

NAVAL AIR TRAINING COMMAND



NAS CORPUS CHRISTI, TEXAS

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FLIGHT TRAINING INSTRUCTION



PRIMARY CONTACT T-34C

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Subject: FLIGHT TRAINING INSTRUCTION, PRIMARY CONTACT, T-34C

1. CNATRA P-330 (Rev. 06-03) PAT, "Flight Training Instruction, Primary Contact, T-34C" is issued for information, standardization of instruction and guidance of all flight instructors and student aviators within the Naval Air Training Command.
2. This publication shall be used as an explanatory aid to the Primary Multi-Service Pilot Training System Flight curriculum. It will be the authority for the execution of all flight procedures and maneuvers therein contained.
3. Recommendations for changes shall be submitted via CNATRA TCR form 1555/19 in accordance with CNATRAINST 1550.6E.
4. CNATRA P-330 (Rev. 09-02) PAT is hereby cancelled and superseded.

R.E.BIRD

Assistant Chief of Staff for
Training and Operations

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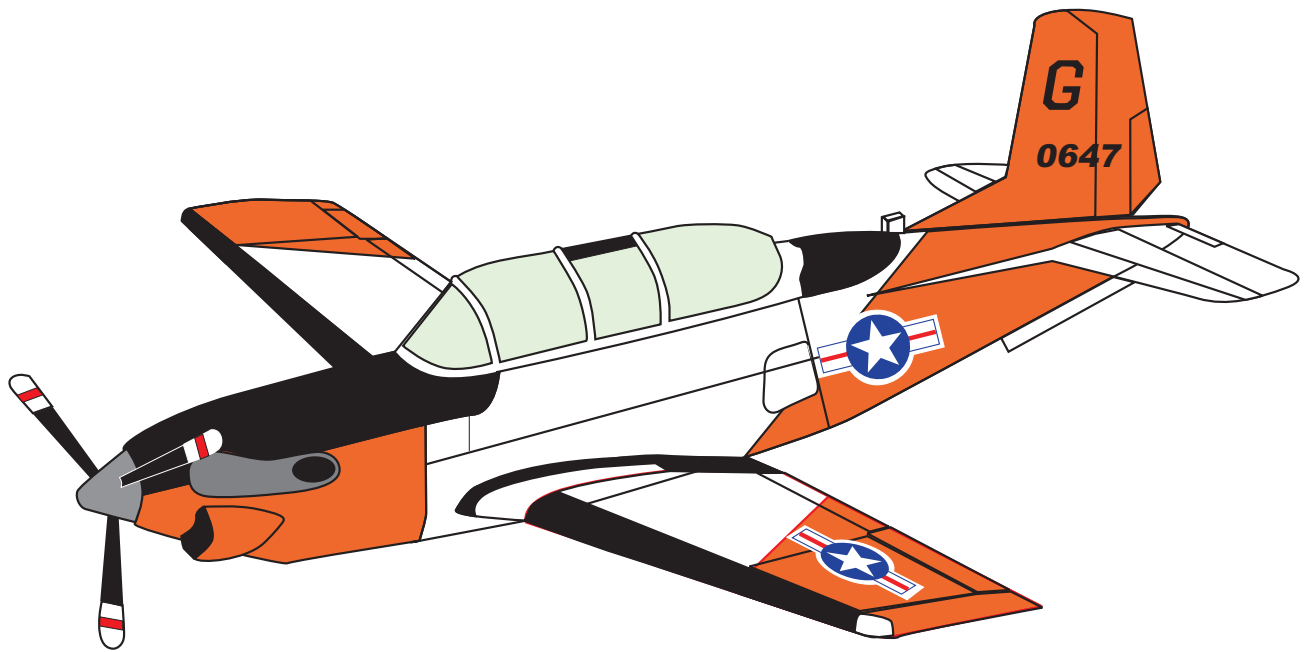
FLIGHT TRAINING INSTRUCTION

FOR

PRIMARY CONTACT

T-34C

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INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

INTRODUCTION

COURSE OBJECTIVE:

Upon completion of this course, the Student Naval Aviator will be able to safely pilot a T-34C including takeoff, aerobatics, and landing phases.

STANDARDS:

Conditions and standards are defined in CNATRAINST 1542.140 (series).

INSTRUCTIONAL PROCEDURES:

1. This is a flight training course and will be conducted in the aircraft and the 2B37 flight simulator.
2. The student will demonstrate a functional knowledge of the material presented through successful completion of the flight maneuvers.

INSTRUCTIONAL REFERENCES:

1. T-34C NATOPS Flight Manual
2. Local Standard Operating Procedures Instruction
3. All new, changed or modified data in this revision is identified by change bars.

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CHAPTER ONE

INTRODUCTION TO T-34C CONTACT

100. INTRODUCTION

This Flight Training Instruction (FTI) is a Naval Air Training Command directive in which the Chief of Naval Air Training (CNATRA) publishes information and instructions relative to all instructors and student naval aviators operating T-34C aircraft in the Primary Phase of training in the Naval Air Training Command. It is very important that the factual material contained herein be thoroughly studied and retained.

The process by which a student is transformed into a skilled naval aviator is both complex and demanding. It can be accomplished only by intensive instruction, in the air as well as in the classroom. Success, for the most part, depends upon the student's attitude, cooperation, and attention to detail. The degree of skill attained by students depends largely upon their ability to understand new material and to work hard. Those students who cannot measure up to the high standards required throughout the various phases of training, because of either their lack of motivation or ability, must and will be attrited.

This FTI does not contain all the information necessary for a student pilot to become a professional aviator. Rather, this instruction provides a focal point and reference manual for all other sources of technical information, outlining and amplifying the flight procedures where necessary. This manual is designed as a training tool and is not meant to establish policy concerning fleet operations. However, every effort has been made to remain in accordance with current fleet procedures and techniques wherever possible and to provide references in NATOPS publications for all applicable areas. It is important to note that the emergency procedures shown are to aid in the topic discussion. For all emergencies, the NATOPS is the final authority. Through this cross-referencing and organization of information, the student pilot should be able to develop a thorough understanding of the manual and flight procedures that form the backbone of an aviation career.

Congratulations on your commencement of primary flight training. Your hard work and determination has earned you the unique opportunity to become part of the most elite team of aviation warriors in the world today. The United States Naval Aviator is a highly trained professional. The tremendous level of skill demanded by the naval air community can only be obtained through total dedication and sustained maximum effort. It is, therefore, imperative that every student naval aviator apply himself or herself completely. Anything less than your best effort is unacceptable. Best of luck in your endeavor to earn your "Wings of Gold."

Terms that would be included ordinarily in a glossary for T-34C Contact training are defined as they are used throughout the text.

101. HISTORY OF CONTACT TRAINING

Naval aviation training has come a long way since 1910 when Lieutenant T. G. Ellyson was ordered to flight instruction to become the first Naval Aviator. Soon thereafter, the U.S. Navy purchased its first airplane, the Curtis Triad, at a cost of \$5,500. Since that time, naval aviation

technology has progressed at a rapid rate. The fleet aircraft of today's Navy are tremendously complex and demanding machines, capable of astonishing performance. Advancements in aviation technology, however, are only part of a much bigger picture. Even the most modern aircraft will most certainly fail to accomplish its mission if piloted by a poorly trained or incompetent aviator. Therefore, a thorough and comprehensive training program is essential to mission accomplishment.

Early aviation pioneers suffered through many "accidents," which became unwanted yet commonplace occurrences. A "good" landing was any one that you could walk away from! Today, the safety record of naval aviation is the best it has ever been. Accidents or "mishaps" are rare, yet do occur. Anything greater than a zero mishap rate is undesirable and mishap-free operation is a goal to continually strive for. Therefore, SAFETY is a primary concern during all aspects of training. There is NO acceptable loss and NO toleration for anything less than total professionalism. This is a goal we can achieve. Your instructors will set an example that you should strive to mirror.

102. SCOPE OF INSTRUCTION

So far as is practical, all information and instructions governing T-34C aircraft procedures and the execution of curriculum maneuvers will be published for inclusion in this manual. Procedures peculiar to Whiting Field (TW-5) and Corpus Christi (TW-4) may be found in the TW-5 Fixed Wing Operating Procedures (FWOP) Manual or TW-4 Standardization Notes/NAS Corpus Christi Course Rules.

1. **LEARNING OBJECTIVES.** The course objective is broken down into Phase (Terminal) Learning Objectives. Terminals are further broken down into Enabling Learning Objectives. These are designed to be smaller, bite-size chunks of the overall objective. The Terminal Objectives are listed in the CNATRA governing instruction.

2. **ENABLING OBJECTIVES, MANEUVERS AND EXERCISES.** Each event in this phase is comprised of various tasks that the student will have to perform. This could be performing a spin on a Contact flight, or reciting an emergency procedure during a lecture, or answering a test question correctly in an end-of-course exam. The Multi-Services Pilot Training System Curriculum, Flight Training Instruction, and Academic Training Instruction break down each of these tasks in detail.

The maneuvers or other items that you will perform on the events may be graded or nongraded. This means that this particular item may or may not be used to compare you to your classmates, or to an arbitrary standard. This does not mean that the instructor may not evaluate a nongraded item. The student is just as responsible, for example, for a demo (nongraded) item as for a review (graded) item. If the instructor determines a blatant lack of preparation for either, an unsatisfactory grade is warranted.

1-2 INTRODUCTION TO T-34C CONTACT

103. CURRICULUM RESOURCES

1. MULTI-SERVICE PILOT TRAINING SYSTEM CURRICULUM

CNATRAINST 1542.140. This little pocket guide is the curriculum outline. It describes what each Student Naval Aviator (SNA) will do in the Primary phase of training. The maneuvers and exercises in the syllabus are described, as well as the standards of performance to be achieved. Each event lists all of the maneuvers to be performed. When there is no task listing in the description of an event, then another publication describes the conduct of that event. For example, although the Multi-Service Pilot Training System (MPTS) Curriculum simply lists Aerodynamics as the event, the Aerodynamics Academic Training Instruction (ATI) lists the material to be covered

2. FLIGHT AND ACADEMIC TRAINING INSTRUCTIONS. These are called "peculiar to aviation training" (PAT) pubs and are produced by CNATRA specifically for each of its curricula. These PAT pubs describe the various maneuvers and exercises the SNA will be required to perform, and list any additional pubs or study material that the student may need to reference for an event. The SNA is responsible for all material listed in these training instructions. Each stage of training has an associated FTI containing the information necessary for a student to complete the primary and intermediate curricula satisfactorily. It is every pilot's responsibility to be thoroughly familiar with the contents of this manual. Strict adherence to the manner of execution of maneuvers, patterns, procedures and instructions herein promulgated is mandatory for all instructors and student naval aviators operating the T-34C aircraft.

3. 1500.4 (TA MANUAL) AND THE AVIATION TRAINING JACKET. CNATRAINST 1500.4 is commonly referred to as the Training Administration (TA) manual. The TA manual is Student Control's guide to handling its students. Normally, those areas of the TA manual for which the SNA is responsible will be outlined to the student upon check in. Such student responsibilities always include obtaining jacket reviews, ensuring Aviation Training Forms (ATF) make their way to the Aviation Training Jacket (ATJ), and updating the calendar card. These responsibilities should not be taken lightly. The responsibility (or lack thereof) that a student displays with these administrative details can be a direct indication of how seriously a student is applying himself/ herself to an aviation training program.

4. AVIATION TRAINING FORMS. These are records of the training events that take place for a student. They also record the instructor's evaluation of student performance. These are permanent, official documents that remain in the SNAs jacket forever. They are never removed or altered by anyone except under very special circumstances listed in the TA manual. Any student who alters or removes an ATF from his or her jacket will be subject to attrition under the provisions of the TA manual.

5. NATOPS PROGRAM. Every student naval aviator becomes familiar with Naval Air Training and Operating Procedures Standardization (NATOPS) early in his or her career. You should be issued a T-34C NATOPS before you start ground school, and a General NATOPS (OPNAVINST 3710.7) should be available to you. The NATOPS program is the responsibility of all who use it. NATOPS only works if everyone is involved. As a student naval aviator, it is your responsibility to originate changes if you find errors or ambiguities in the NATOPS manual. See the squadron NATOPS officer regarding the correct procedure to submit a NATOPS change recommendation.

6. **T-34C NATOPS MANUAL AND POCKET CHECKLIST.** The T-34C NATOPS manual is the definitive instruction on the operation of the aircraft. The Pocket Checklist (PCL) is a convenient pocket sized listing of those items in the NATOPS manual that would be of particular concern while airborne or at a remote location. No student or flight instructor has the authority to deviate from NATOPS without specific written authority except in specific situations. The NATOPS also lists the crew requirements for flying the aircraft. There is a bank of questions in the back of the NATOPS that every aviator should be familiar with. The structure of the T-34C NATOPS is similar to that of every other aircraft in the Navy/ Marine Corps. Both the NATOPS and the PCL list emergency procedures. Some of these procedures are listed in **Boldface** or with asterisks next to them. These items are memory items, and the SNA shall be able to recall and apply any of these procedures correctly to the appropriate aircraft malfunction. In addition to the emergency procedures, a pilot should be able to recall the Landing Checklist from memory. Other than these, every checklist should be performed with the aid of the PCL or appropriate guide. Familiarity with the PCL should be acquired in an attempt to ensure efficient use under potentially arduous situations while airborne.

In Primary Training, there is no room for libraries of publications. T-34C aircrews must be thoroughly familiar with their aircraft. They must study the NATOPS manual in-depth and have a thorough knowledge of it because no opportunity exists to do so while airborne. NATOPS requires the use of checklists. Although a student may become familiar with a checklist, pocket checklists are to be used to ensure no items are missed.

104. ACADEMIC/FLIGHT SUPPORT TRAINING

The terminal objective of flight support training and academics is to provide the SNA with the basic knowledge and skills directly applicable to satisfactory progression in the T-34C aircraft flight training. Upon completion of the academic and flight support activities, the student will be capable of relating these acquired cognitive skills and applying them through simulation and actual flights, thus developing the motor skills and headwork necessary to meet CNATRA standards to complete primary flight training.

105. STANDARDS OF PERFORMANCE

1. **STANDARDIZATION.** Flight instruction must be highly standardized. The syllabi that are currently being used are the result of constant evolution and the techniques taught are lessons learned over the course of many years. The FTI and NATOPS set forth the one standardized way of doing any specific maneuver. Adherence to these standards will be a part of any instructor's evaluation of a student's performance during an event. Occasionally, a student may question a particular instructor's technique, or he may think that an instructor is incorrect. There is no time for protracted discussion or debate in the air. If an instructor's request is unclear to the student, he must request clarification. If, however, the student feels that the instructor's methods or techniques contradict NATOPS or the FTI, he should consult his class advisor on the appropriate way to address the issue. In any event, when the student feels that flight safety is in jeopardy, he is bound to request a Training Time Out to obtain clarification.

The standard flight procedures and techniques employed in the training syllabus are universal to all Navy aircraft, except when slight deviations have been adapted in the interest of flight safety.

Maximum utilization of instructor/aircraft time demands a thorough knowledge of the flight training instructions and referenced publications by both the flight student and instructor. The time designated for the pre-flight briefing is equally limited and demands that both student and instructor have a complete knowledge of the material to be covered in preparation for the flight. Briefing time should be applied to review of previous difficulties, clarification of misunderstandings, and immediate flight planning. It is essential that the instructor and the student have a common understanding of the maneuvers to be flown and employ the same nomenclature in order to take full advantage of the time afforded.

2. **GRADES.** The adage is that if you worry about learning, the grades take care of themselves. The truth is that one should be trying to perform to the best of his or her ability at all times. Grades are designed to do two things: compare performance to a set standard or criterion; and contrast performance of individuals within the same curriculum.

There is little to be gained by sweating over grades. There is much to learn by focusing on the learning objectives for a course. The nature of flight training is such that if one misses a step, it is very difficult to catch up. The syllabus is designed to give the average student sufficient time and opportunity to complete the objectives. When it becomes apparent to an instructor that objectives are not being met, or the student is having difficulty, the student's grades will reflect this. The student should not take grades as a personal affront. The instructor should make every effort not only to critique the student, but also to give the student the information required to perform the exercise or maneuver in an acceptable manner. The best instructors are not those who give the best grades, but those who best prepare the students for their next flight. Students should simply concentrate on correctly performing the maneuvers of the next hop, and meeting the stage and phase objectives. Students who are able to do this are successful in the Naval Air Training Command.

3. **CHECK FLIGHTS.** The student should place no special significance on designated check flights and should not anticipate failure if a superlative performance is not demonstrated. The designated check flight is merely a validation by another instructor of the evaluations other instructors have given the student. If a student fails to meet the accepted standards of progress, the instructor will grade the student's performance unsatisfactory rather than allow him to continue ahead in the syllabus. The check pilot is obligated to judge the student fairly in comparison with accepted standards.

106. THE FLIGHT INSTRUCTOR

The flight instructor is an experienced aviator, trained to provide the student with a sound foundation in the operation of the aircraft. He has undergone a training course similar to the student's, which familiarizes him with the curriculum maneuvers and teaches an effective means of presenting them. This training comes under the heading of standardization. The intent of standardization is to provide the instructor with a logical, effective, and consistent foundation upon which to present any maneuver. This in turn ensures that all students can be judged on the

same basis, each having been exposed to the same material and afforded an equal opportunity to demonstrate his/her abilities. No two instructors will be identical in their techniques and each may vary his/her presentation to fit the needs of the individual student.

In order to teach you to fly the T-34C properly, the instructor must criticize! His/her comments on your performance of the various maneuvers are intended to improve your understanding and technique. All criticism by the instructor is meant to be constructive in character. The instructor's sole intent is to instill confidence and develop you into a qualified naval aviator.

Your flight instructor is a vital part of your training. Nonetheless, you must do your part as well. The one word that you will hear most from your instructor is "**PROCEDURES!**" In order that your time in the aircraft can be devoted to the improvement of maneuver performance, it is imperative that you learn, memorize, and understand the procedural steps required in performing each of the various maneuvers. Then and only then can your instructor's time with you be profitably utilized. The instructor is well trained and qualified to teach his/her student, but his/her success requires the fullest cooperation of the student himself/herself. If you have questions about procedures or concepts, ask them. Again, knowing procedures, both for normal and emergency operations, cannot be overemphasized! They must be over-learned so that they can be recalled in flight, especially during periods of high cockpit workload and stressful situations.

CONTRACT INSTRUCTORS. Simulator instructors are generally civilians, contracted to the Navy to provide simulator flight instruction, and teach academics. These instructors are all experienced military aviators. They are bound by the same instruction as their military counterparts. The simulator event should be treated just as a flight event. Both events require the same dedicated preparation and forethought. The contract instructor (CI) is also responsible for standardization. If you notice a nonstandard maneuver or technique, bring it to the attention of the standardization officer at the squadron.

107. THE STUDENT NAVAL AVIATOR

The qualifications to become a SNA are high. The SNA has been selected for flight training by a screening process that determines his/her superiority over the average American youth with respect to physical condition, intelligence, ability to grasp and retain new ideas, and apparent emotional stability. Superior reasoning ability will enable him/ her to combine these talents into experience that will produce a qualified naval aviator. One critical factor of success, which cannot be accurately evaluated by the normal selection process, is mental attitude. Mental attitude, as much as any other factor, determines the ease or difficulty with which the student progresses through the training syllabus. Under the heading of positive mental attitude come such elements as willingness to conform to military discipline, acceptance of curtailed personal freedom and leisure, and the ability to encounter occasional reverses and still maintain enthusiasm and self-confidence.

Motivation and mental attitude are closely related. The student's motivation greatly affects his or her mental attitude and consequently his or her progress throughout training. The majority of students have had little or no previous aviation experience. Flight training is arduous and places great demands on the student's time and energy. Therefore, motivation plays an important part

in difficult periods. The student who discovers that he or she does not enjoy flying but remains because of prestige or monetary compensation will find that his or her chances of successfully completing the program are poor. The desire to earn those coveted wings of gold and the love of flying provide the highest motivation and the greatest likelihood of success.

With these basic qualities as a foundation, the experience you gain as you progress through each stage of your training will develop the many facets of your skill and judgment. This will allow you to cope with the many and varied problems that may confront you in the handling of your aircraft under all conditions. Although your instructor and other personnel are at your disposal to help solve various problems, your own intelligent analysis, based on acquired knowledge, will generally permit you to arrive at correct and logical conclusions.

The technique of flying is a highly physical attribute and, like many other acts of a physical nature, is mostly a matter of coordination of hands, feet and eyes. As far as controlling the attitude and performance of the aircraft is concerned, the elementary techniques of flying are not at all difficult to master. But, because it is performed in an environment to which you will not be accustomed, you may experience some difficulty adapting to the airborne classroom. With your instructor's patience and your own hard work and alertness, the readjustment required will occur naturally and you will find that the T-34C is one of the most enjoyable classrooms in the world. Every student should remember these guidelines when managing his/her training program.

1. Your flight instructor wants you to learn to be a professional aviator. If in doubt, ask questions and use your flight instructor to help you through problem areas.
2. Preparation is the key to professionalism. Do not be satisfied with only knowing enough to complete the hop. What is being taught in the primary phase has a direct transference to all future training.

Remember one important thing for as long as you fly an aircraft: You must be your own most aggressive critic. This does not mean that you become a mental case in the cockpit, but it does mean that as an aviator beginning the flight training syllabus, you must demonstrate one of the most critical qualities a professional aviator has: self-discipline. This means that you prepare for every hop as if your professional reputation is at stake. Your flights are not contests where someone is keeping score and counting your mistakes. Your flight grades should not be as important as your own honest appraisal of your flight performance. You are expected to come well prepared, but you must expect to make mistakes. Most of these mistakes are forgiven as long as you deal with them professionally, on the spot and learn from them. That is why they call this flight training.

108. TRAINING TIME OUT

CNETINST 1500.20 (series), enclosure (3) defines the conditions under which a Training Time Out (TTO) may be requested. It states in part, "A TTO may be called in any training situation whenever a student or instructor expresses concern for personal safety or a need for clarification of procedures or requirements exists. . . ."

The intent of TTO is to give students and instructors the means to stop a flight if they are not "communicating" or if either party feels they are in an unsafe position. It will not be used to terminate a flight just because you are having a bad day or do not know your procedures. Nevertheless, do not be hesitant to use TTO if you feel the flight conditions warrant it.

109. CREW RESOURCE MANAGEMENT

The "Human Error" factor or inadequate aircrew coordination is the single leading cause factor for Class A mishaps in modern naval aviation. Crew Resource Management (CRM) describes the process of coordinated action among crew members, which enables them to interact effectively while performing mission tasks.

CRM has become an essential element in the Navy's commitment to minimize the contribution of human error to aviation mishaps. The major emphasis on CRM will occur in the intermediate phase of training. Here in primary flight training, our mission precludes us from utilizing the variety of CRM skills to their maximum potential. This is mainly due to the instructor/student relationship adhered to for standardization and training purposes.

1. **Sandbag Syndrome.** The sandbag syndrome is based on a comforting premise that one or more other crew members have the situation under control and are looking out for your best interest. It is mainly experienced at certain times when the instructor pilot has assumed flying duties, such as breaks in training, approaches, enroute transits, etc. This effectively results in the SNA being "along for the ride." It is important to remember that no pilot is above the momentary lapse of judgment or situational awareness that could result in a flight violation or mishap. Do not let this happen to you! As a copilot, your primary responsibility is to support and back up the pilot at the controls.

Stay alert and speak up when necessary. The instructor/student relationship often fosters reluctance on the part of the SNA to confront the Instructor Pilot (IP). But remember, do not let misplaced professional courtesies stand in the way of maintaining safe and efficient flying practices.

2. **"I'm Safe" Checklist.** As a rule, good aircrew coordination begins with the individual crew member. Our situational awareness resources might be lacking before we even set foot in the cockpit. Unfortunately, we do not have external readouts telling ourselves when they are diminished. Therefore, it is important that every pilot conduct a daily personal preflight prior to each flight. "I'M SAFE" is a simple checklist to determine if we are ready and fit to fly. Do not show up for a brief without first conducting a personal preflight.

- I** – Illness (Do you feel well?)
- M** – Medication (Are you feeling any effects of medications taken?)
- S** – Stress (Are there any adverse stresses in your life to distract you?)
- A** – Alcohol (Are you free of all effects of alcohol consumed?)
- F** – Fatigue (Are you well rested?)
- E** – Eating (Did you eat properly before flying?)

110. PHYSICAL/PSYCHOLOGICAL FACTORS

To help you understand something of the physical and psychological factors affecting your training, the remainder of this chapter will be devoted to paraphrasing our flight surgeon's thoughts on the matter.

1. Physical ease and relaxation while flying makes the difference between the pilot flying the plane and the plane flying the pilot. A proper sense of "feel" of the aircraft is essential. Just as a good horseman must be sensitive to the movements of his mount, so must the aviator be sensitive to the movements of the airplane. This innate sense cannot be achieved in any other way than by the proper relaxation of all the body muscles and light touch on the aircraft's controls. The art of being relaxed in an airplane involves an awareness of what your body and mind are doing. A natural reaction to the strange environment or unusual situation is the age-old aviator tendency to "pucker" in a tight situation. Be alert for involuntary tensing of the muscles and you will find you quickly develop that sought-after "feel" and avoid the hard-to-break habit of mechanical flying. An important aspect of developing this sense of "feel" is knowing what you are going to do at all times and be prepared for the next evolution in your flight training. This is nothing more than knowing your PROCEDURES. Remember the panic in your school days when you were handed a test and it suddenly dawned on you that you had not studied, or what you had studied was not on the test?

2. Mental attitude is a very essential element to your relaxation in an aircraft. It affects your nervous system and, if allowed to continue in an unhealthy trend, can result in actual physical incapacitation. Therefore, its significance should be fully appreciated. As with physical handicaps, any mental distraction will also detract from the full use of your required senses. A poor mental attitude will interfere with your ability to concentrate, learn, and apply your knowledge. In turn, a good or positive mental attitude will increase your learning capacity and will make your flight training a pleasure rather than an unpleasant job.

If for any reason you find yourself "flying more, and enjoying it less," whether from some known cause or not, discuss it with your flight instructor or unit leader. Another aid to acquiring a positive mental attitude, after you have satisfied yourself that it is not an outside problem affecting you mentally, is to find some healthy diversion that will get your mind away from the subject of flying for a time. The base as well as the local area offers much in the way of recreational opportunities and diversions.

3. Mental alertness on the pilot's part has a direct bearing upon safety of flight as well as contributing significantly to the learning process. Remember that the training areas utilized are not very large and are used by many aircraft. Being constantly on the alert while flying may save your life and that of one of your squadron mates. Mental laziness is the constant enemy of every aviator. So, as you progress through flight training, plan ahead and try to anticipate all possible contingencies that could affect the operation of your aircraft. Proper planning not only refers to the environment around you but also the aircraft in which you are sitting. Check your engine instruments from time to time to ensure that all is well up front. In other words, train yourself to be alert to all facets of your flight rather than concentrating on the problem of the

moment. You will find yourself surprised at the amount of information your eyes will transmit to your brain during a quick SCAN of your surroundings. Planning ahead will also equip you to take immediate and appropriate action should an emergency occur.

4. Confidence in your aircraft, your instructor, and most importantly yourself, is another essential element of flying. The basic ingredient to acquiring the confidence necessary to professionally pilot an aircraft is knowledge and efficient analytical application of that knowledge. The aircraft you are flying has been engineered to provide you with every safety feature known to the industry. The risks beyond the control of the pilot are minimal. Fire is an extremely rare occurrence. Engines are inherently reliable. In-flight collisions are rarities that are completely avoidable if you stay alert. With the above points in mind, it is readily apparent that the chance of an aviation accident caused by other than incompetence, disobedience or poor judgment is remote. Remember that 70 percent of all fatal accidents are due to 100 percent pilot error. With all this going for you, do not let human frailty or overconfidence develop, particularly while your experience is limited. The instant that a pilot begins to lose that feeling of respect due an aircraft, he has reached a stage when anything can happen and usually does. Good pilots are never caught unprepared in an emergency situation. They know and understand emergency procedures COLD! Humble confidence and perseverance will go a long way in striving for those Wings of Gold.

5. Occasionally physiological problems arise during the course of a flight. Airsickness, fatigue, hypoxia, food poisoning and dehydration can overcome a pilot and result in reduced situational awareness and even complete incapacitation. Pilots must not only recognize these symptoms in themselves but also in other crew members. At any time, the non-affected crew member should be ready to take the controls, and if necessary, fly to a safer environment (i.e., higher altitude, away from other aircraft and clouds) to include termination of the flight. Airsickness is common during early Contact flights and, even though it is not usually incapacitating, it affects judgment and reduces situational awareness. If this occurs, inform your instructor.

111. COCKPIT PROCEDURE TRAINERS/FLIGHT SIMULATORS

Cockpit procedure trainers (CPT) have proven to be a valuable asset in helping students learn the physical attributes necessary to become a good pilot. Before you climb into the T-34C for the first time, you will have practiced the use of checklists and emergency procedures several times. There are three types of procedure trainers available for your use; a static trainer located at your squadron, the 2C42 CPT, and the 2B37 flight simulator. In addition to the syllabus training you will receive in the CPTs, you should utilize the static trainers to practice at every opportunity. Practice will pay off with better grades, self-confidence, and a more professional performance.

2C42/2B37 FLIGHT SIMULATOR. The 2C42/2B37 synthetic flight trainer is specifically designed to give the SNA a device in which to perform cockpit orientation and instrument flight. The simulator may or may not have full motion. The instruments and flight controls in the simulator behave exactly as those in the aircraft. If there is a discrepancy in the device, it is the responsibility of the aircrew (you) to provide maintenance data. Normally this consists of telling the simulator instructor about the problem. Do not be complacent about discrepancies on a flight simulator.

112. THE AIRCRAFT

The first aircraft in your flight to Navy Wings of Gold will be the Beechcraft T-34C "Turbo Mentor." It is an unpressurized two-place, tandem cockpit, low wing, high performance, single engine monoplane equipped with dual controls. Power is provided by a turboprop engine manufactured by Pratt & Whitney Aircraft of Canada, Model PT6A-25, with inverted flight capabilities, providing for a flight envelope with altitudes to 25,000 feet. With few exceptions, both cockpits contain identical controls and instruments. (Refer to T-34C NATOPS, chapter one.)

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CHAPTER TWO

INTRODUCTION TO T-34C AERODYNAMICS

200. INTRODUCTION

Prior to your first flight in the T-34C, there are several fundamental topics that you should review and understand if you are to obtain maximum benefit from your primary training. These topics include not only basic aerodynamics, but also certain principles pertaining to safety of flight. While more complex theories were covered in the classroom during Aviation Indoctrination, the basics are considered to be of sufficient importance to repeat in broad terms at this time. The discussions in this chapter provide student naval aviators with the basic factors of flight before actually beginning to fly.

201. THEORIES OF FLIGHT

1. **Lift And Thrust.** Our discussion will include several basic laws of physics that help to explain how an airplane flies. Sir Isaac Newton is credited with having observed in 1687, ". . . for every action, there is an equal and opposite reaction . . ." This principle applies whenever two objects act upon each other, such as the air and the propeller, or the air and the wing of the airplane. In short, the statement about "action and reaction" tells us how lift and propulsion of airplanes are produced.

The predominant method by which air exerts force on a solid body, such as an airplane's wing, is through pressure. For our purposes, friction can be ignored. In the 1700's, Daniel Bernoulli (a Swiss mathematician) discovered the venturi principle. He found that if the velocity of a fluid (air) is increased at a particular point, the static pressure of the fluid (air) at that point is decreased. The airplane's wing is designed to increase the velocity of the air flowing over the top of the wing as it moves through the air. To do this, the top of the wing is curved, while the bottom is relatively flat. The air flowing over the top travels a little farther (since it is curving) than the air flowing along the flat bottom. This means the air on top must go faster. Hence, the static pressure decreases, resulting in a lower static pressure (as Bernoulli stated) on top of the wing and a relatively higher static pressure below. The pressure differential then pushes the wing up towards the lower pressure area, i.e., LIFT. To increase the lift, the wing is tilted upward in relation to the oncoming air (relative wind) to increase the deflection of air. Relative wind during flight is the direction of the airflow in relation to the wing as it moves through the air. The angle at which the wing meets the relative wind is called the angle of attack.

(Figure 2-1)

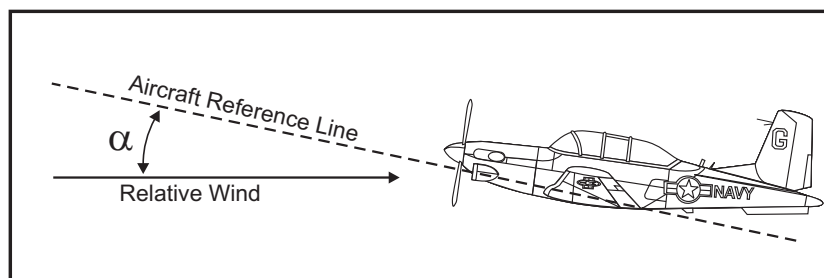


Figure 2-1 Angle of Attack

If the airplane's speed is too slow, the angle of attack required will be so large that the air can no longer follow the upper curvature of the wing. This results in a swirling, turbulent flow of air over the wing and "spoils" the lift. Consequently, the wing stalls. On most types of airplanes, this critical angle of attack is about 15 to 20 degrees.

When the propeller rotates, it provides the force to pull the airplane forward. This forward motion causes the airplane to act on the air to produce lift. The propeller blades, just like a wing, are curved on one side and straight on the other side. Hence, as the engine rotates the propeller, forces similar to those of the wing create "lift" in a forward direction. This is called thrust.

Up to this point, the discussion has related only to the "lifting" force. Before an understanding of how an airplane flies is complete, other forces must be discussed.

2. **GRAVITY.** While the airplane is propelled through the air and sufficient lift is developed to sustain it in flight, there are certain other forces acting at the same time. Every particle of matter, including airplanes, is attracted downward towards the center of the earth by gravitational force. The amount of this force on the airplane is measured in terms of weight. If the airplane is to keep flying, lift must overcome its weight or gravitational force.

3. **DRAG.** Another force that constantly acts on the airplane is drag. Drag is the resistance created by air particles striking and flowing around the airplane when it is moving through the air. Aircraft designers constantly try to streamline wings, fuselages and other components to reduce the rearward force of drag as much as possible. The portion of drag caused by form resistance and skin friction is termed parasite drag, since it is not the result of the production of lift.

A second part of the total drag force is caused by the wing's lift. As the wing deflects air to produce lift, the total lift force is not exactly vertical, but is tilted slightly rearward. This means that it causes some rearward drag force. This drag is called induced drag, and is the price paid to produce lift. The larger the angle of attack, the more the lift force on the wing tilts towards the rear and the larger the induced drag becomes. To give the airplane forward motion, thrust must overcome drag.

In a steady flight condition (no change in speed or flight path), forces that oppose each other are also equal to each other and are always present. That is, lift equals weight, and thrust equals drag.

202. CENTRIFUGAL FORCE

Still yet another force that frequently acts on the airplane is centrifugal force. However, this force occurs only when the airplane is turning or changing the direction (horizontally or vertically) of the flight path. Another of Newton's laws of energy states that "a body at rest tends to remain at rest, and a body in motion tends to remain moving at the same speed and in the same direction . . ." Thus, to make an airplane turn from straight flight, a sideward inward force must act upon it. The tendency of the airplane to keep moving in a straight line and outward from a turn is the result of inertia and it produces centrifugal force. Therefore, some

2-2 INTRODUCTION TO T-34C AERODYNAMICS

impeding force is needed to overcome centrifugal force so that the airplane moves in the desired direction. The lift of the wings provides this counteracting force when the airplane's wings are banked in the desired direction. Refer to the section on Turning Flight later in this chapter.

Since the airplane is in a banked attitude during a properly executed turn, the pilot will feel the centrifugal force by increased seat pressure, rather than the feeling of being forced to the side as is experienced in a rapidly turning automobile. The amount of force (G force) felt by seat pressure depends on the angle of bank. The pilot will, however, be forced to the side of the airplane (as in an automobile) if a turn is improperly made and the airplane is made to slip or skid.

203. YAW FORCES

One other force which affects the aircraft during certain conditions of flight and which will be frequently referred to in the discussions on various flight maneuvers is torque effect or "left turning tendency." It is probably one of the least understood forces that affect an aircraft in flight. Torque effect is the force which causes the airplane to have a tendency to swerve (yaw) to the left, and is created by the clockwise rotation of the engine and the propeller. There are four factors that contribute to this yawing tendency:

1. Torque reaction to the engine and propeller.
2. The propeller's gyroscopic effect.
3. The corkscrewing effect of the propeller slipstream.
4. The asymmetrical loading of the propeller (P-factor).

It is important that pilots understand why these factors contribute to torque effect.

- a. Torque reaction. Torque reaction can be understood by visualizing a rubber band powered model airplane. Wind the rubber band in a manner that will unwind and rotate the propeller in a clockwise direction. If the fuselage is released while the propeller is held the fuselage will rotate in a counterclockwise direction (looking from the rear). The effect of torque reaction is the same in a real propeller-driven airplane except that, instead of the propeller being held by hand, its rotation is resisted by air. This counter-rotational force causes the aircraft to try to roll to the left. In the case of a real airplane, the force is stronger when power is significantly advanced while the aircraft is flying at very slow airspeeds and high power settings.
- b. Gyroscopic precession. The second factor that causes the tendency of an airplane to yaw is the gyroscopic properties of the propeller. Here, we are concerned with gyroscopic precession, which is the resultant action or deflection of a spinning object when a force is applied to the outer rim of its rotational mass. When a force is applied to the object's axis, it is the same as applying the force to the outer rim. If the axis of a spinning gyroscope (propeller in this case) is tilted, the resulting force will be exerted 90° ahead in the direction of rotation and in the same direction as the applied force. Example: As the aircraft nose is raised, the top of the propeller's plane of rotation is

forced aft. This results in an opposite (forward) force 90° further along the prop arc, in the direction of rotation (the right side of the prop). Conversely, as the bottom of the prop arc is forced forward, the left side of the prop precesses aft. That force will be particularly noticeable during takeoff if an abrupt change in attitude is made. The amount of force created by this precession is directly related to the rate at which the propeller axis is changed.

- c. Propeller slipstream. The third factor that causes the airplane's left yawing tendency is the corkscrewing of the propeller slipstream, acting against the side of the fuselage and tail surfaces. The high-speed rotation of an airplane propeller results in a corkscrewing rotation to the slipstream as it moves rearward. At high propeller speeds and low forward speed, as in the initial part of a takeoff, the corkscrewing flow is compact and imposes considerable side forces on the airplane. As the airplane's forward speed increases, the corkscrew motion of the slipstream loosens or elongates, resulting in a straighter flow of air along the side of the fuselage towards the airplane's tail.

When this corkscrewing slipstream strikes the side of the fuselage and the vertical tail surface at airspeeds less than cruising, it produces a yawing motion, which tends to revolve the airplane around its vertical axis. Since in the T-34, propeller rotation is clockwise as viewed from the cockpit, the slipstream strikes the vertical tail surface on the left side, thus pushing the tail to the right and yawing the nose of the airplane to the left.

- d. Asymmetrical loading of the propeller. The fourth factor which causes the left yawing tendency is the asymmetrical loading of the propeller, frequently referred to as P-factor. When an airplane is flying with a high angle of attack (with the propeller axis inclined), the bite of the downward-moving propeller blade is greater than the bite of the upward-moving blade, meeting the oncoming relative wind at a greater angle of attack than the upward-moving blade. Consequently, there is greater thrust on the downward-moving blade on the right side and this force causes the airplane to yaw to the left. At low speeds the yawing tendency caused by P-factor is greater because the airplane is at a high angle of attack. Conversely, as the speed of the airplane is increased and the airplane's angle of attack is reduced, the asymmetrical loading decreases and the turning tendency is decreased.

204. STABILITY AND CONTROL

Most types of naval aircraft have been designed with satisfactory handling qualities in addition to adequate performance. In particular, the T-34C is stable enough to maintain uniform flight conditions, recover from disturbances (such as turbulence), and minimize pilot workload. It has sufficient controllability to achieve the desired performance. However, there are certain conditions of flight which produce the most critical requirements of stability and control. These conditions must be understood and respected to accomplish safe and efficient operation of the aircraft.

1. **Static Stability.** Besides being supported in flight by lift and propelled through the air by thrust, an airplane is free to revolve or move around three axes. These axes may be thought of as axes around which the airplane revolves much like a wheel does. Each axis is perpendicular to the other two and all three intersect at the airplane's center of gravity (CG). The point around which the airplane's weight is evenly distributed or balanced is considered the CG of the airplane. Figure 2-2 depicts the axes about which the aircraft rotates.

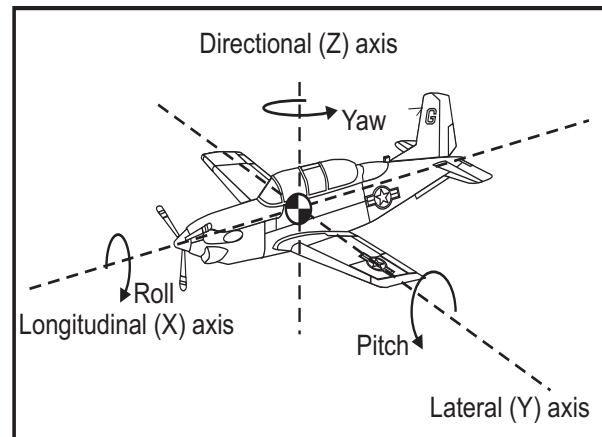


Figure 2-2 Aircraft Reference Axes

If an arrow having no feathered tail is shot from a bow, it will usually wobble or fall end-over-end as it travels, since there is no force produced to bring it back to its original point first travel. The arrow is made stable, however, by adding pieces of feather near the rear of its shaft. Then, when the arrow is shot and begins to wobble, turn, or yaw, the air strikes the tail feathers and turns the arrow back to a straight path. This correction action continues as long as the arrow has sufficient forward motion.

An airplane wing, by itself, is also unstable. It would flip over and continue to flip end-over-end as it flutters to the ground. Like the unstable arrow, the unstable wing needs some kind of "tail feathers" to balance it and keep it on a straight course. Airplanes have their "tail feathers" in the form of horizontal and vertical stabilizers located at the rear of the fuselage.

Again, like the feathered arrow, another most important factor producing directional stability is the weather vane effect created by the fuselage and vertical fin of the airplane. It keeps the airplane headed into the relative wind. If the airplane yaws, or skids, the sudden rush of air against the surface of the fuselage and fin quickly forces the airplane back to its original direction of flight.

If all the upward lift forces on the wing were concentrated in one place there would be established a center of lift, which is called the center of pressure (CP). Rarely, though, are the CP and CG located at the same point. The locations of these centers in relation to each other have a significant effect on the stability of the airplane. If the wing's CP is forward of the airplane's CG, the airplane will always have a tendency to nose up and will have an inherent

tendency to enter a stalled condition. Therefore, most airplanes are designed with their CG located slightly forward of the CP to create a nose-down tendency to pitch downward away from a stalling condition. This provides a safety feature in the characteristics of the airplane. While the airplane is flying within its range of normal speeds, the airflow exerts a downward force on the horizontal stabilizer; thus, at normal cruise speed it offsets the inherent nose-down tendency of the airplane.

Generally, in straight-and-level flight, the wings on each side of the airplane have identical angles of attack and develop equal lift. This laterally balanced condition normally keeps the airplane level. Occasionally though, a gust of air will upset this balance by increasing the lift on one wing, causing the airplane to roll around its longitudinal axis.

The T-34C is designed so that the outer tips of the wings are higher than the wing roots. The upward angle thus formed by the wings is called dihedral. When a gust causes a roll, a sideslip will result. This sideslip causes the relative wind affecting the entire airplane to be from the direction of the slip. When the relative wind comes from the side, the wing into the wind is subject to an increase in angle of attack and develops an increase in lift. The wing away from the wind is subject to a decrease in angle of attack, and develops a decrease in lift. The changes in lift effect a rolling moment tending to raise the windward wing, hence dihedral contributes to a stable roll due to sideslip. The T-34C has positive static stability. That is, it tends to return to the condition for which it has been trimmed.

An aircraft trimmed for steady flight is in a state of equilibrium. In other words, the sum of all the forces and moments is zero. Displacement from this position by some outside force, such as a gust of turbulence, creates an unbalance and causes the aircraft to demonstrate an initial tendency. This tendency will be to (a) return, (b) be displaced further, or (c) remain in the new attitude or position. This initial tendency is known as static stability. If the aircraft tends to move back in the direction of its trimmed attitude, it is said to be statically stable or to have positive static stability. If the aircraft continues to move away from trimmed equilibrium, it is statically unstable or it has negative stability. An aircraft that stays in its displaced attitude, neither moving positively nor negatively, is said to be neutrally stable or neutrally statically stable (Figure 2-3).

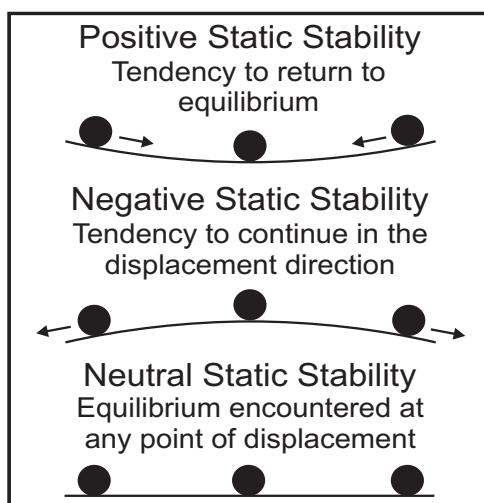


Figure 2-3 Static Stability

2. **Dynamic Stability.** Dynamic stability is the movement of an aircraft with respect to time. If an aircraft has been disturbed from its equilibrium position and the maximum displacement decreases with time, it is said to have positive dynamic stability. If the maximum displacement increases with time, it is said to have negative dynamic stability. If the displacement remains constant with time, it is said to have neutral dynamic stability. Both static and dynamic stability are usually desired in an airplane.

Static stability does not guarantee that an airplane will also be dynamically stable; however, the airplane must first be statically stable before it will oscillate at all and, thus, exhibit any kind of dynamic stability. Possible cases of stability can be summarized in Figure 2-4.

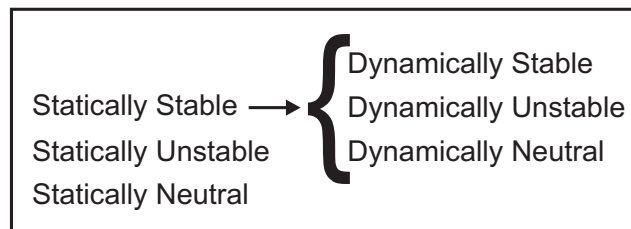


Figure 2-4 Cases of Stability

In addition to positive static stability, the T-34C has positive dynamic stability. Over a period of time, it will tend to return to most conditions for which it was trimmed.

Let us again consider the ball in the saucer shown in Figure 2-3. If you move the ball to the displaced (dotted) position and then let go, it will not go directly to the equilibrium point and stop. Rather, its inertia will carry it well past the bottom and up the other side. As gravity overcomes its inertial acceleration, it rolls back the other way towards the original displacement point until it succumbs again to gravity. This motion could go on indefinitely if there were no friction present between the ball and the dish. Eventually, friction will reduce the momentum of the ball sufficiently so that it finally settles down once again to the bottom of the dish. A pendulum that is pushed to one side and released displays the same action. The resulting motion is an oscillation (movement from one side of the equilibrium point to the other) until friction damps out the motion.

The T-34C aircraft has both positive static and dynamic stability and thus is an "inherently stable" aircraft. The design specifications required the trainer to be capable of aerobatic flight with responsive controls. However, since the T-34C is a primary trainer, it also had to possess the qualities which would be "forgiving" to the early Contact student.

Generally speaking, the longitudinal axis in the T-34C is less stable than the lateral and vertical axes. When trimmed for equilibrium, less force is required to displace the control surfaces, resulting in a rolling moment. It can be stated that the ailerons are sensitive in the T-34C, particularly in high-speed flight.

Your instructor will demonstrate the stability characteristics of the T-34C aircraft by trimming for straight and level balanced flight. He will then place the aircraft in various attitudes and permit the aircraft to return to straight and level balanced flight, demonstrating the necessity and ease of proper use of trim. As discussed earlier in this chapter, the T-34C is capable of equilibrium flight in all airspeeds and configurations that you will encounter. That is, for all changes in power, airspeed, and configurations, the aircraft is able to maintain a "hands-off" straight and level balanced flight condition, but will require a **CHANGE IN TRIM SETTING** for those changes. Further discussion on the use of trim will occur later in this chapter.

An aircraft is said to be trimmed if all moments in pitch, roll, and yaw are equal to zero. The establishment of equilibrium at various conditions of flight is the function of the controls and will be accomplished by pilot effort and trim tabs. Pilot effort is necessary to establish equilibrium conditions and trim tabs will be used to hold the desired conditions (i.e., reduce control pressure).

During training, trim will be of extreme importance and trimming rapidly and properly will become a habit. The necessity to trim the T-34C cannot be overemphasized. When all of the pilot's energy is consumed fighting the controls, little is left over for flying the aircraft and maintaining situational awareness.

3. **Control.** Control is concerned with the maneuverability of the aircraft. Although the T-34C aircraft is "inherently stable" due to its positive and static and dynamic stability, it is not so stable as to inhibit aircraft maneuverability. Since the T-34C is a primary trainer, it was designed to have controls capable of aerobatic flight, yet not so sensitive as to make the aircraft difficult to control or allow aircraft limits to be easily exceeded. Generally speaking, control forces are highest in the directional axis (ailerons). The magnitude of these forces varies depending on the airspeed, trim setting and the amount of deflection. At higher speeds, controls become difficult to deflect due to higher dynamic pressure impinging on the control surfaces. Although the higher dynamic pressure makes the controls more effective, resulting in a greater aircraft reaction for a given control deflection, the forces required to obtain that control deflection are higher. Trim setting affects control forces in that the further the aircraft is flown from its trimmed airspeed, the greater the forces required (in all axes) to maintain balanced flight conditions. These forces serve as physical cues to the pilot that the aircraft has deviated from its trimmed airspeed. The T-34C is capable of equilibrium flight in nearly all airspeeds and configurations that you will encounter. That is, for nearly all changes in power, airspeed, and configurations, the aircraft is able to maintain a hands-off straight and level flight condition, but will require a change in trim setting for those changes.

205. STALLS

In earlier discussions it was shown that an airplane would fly as long as the wing is creating sufficient lift to counteract the load imposed on it. When the lift is completely lost the airplane stalls. Remember that the direct cause of every stall is an excessive angle of attack. There are any numbers of flight maneuvers which may produce an increase in the angle of attack, but the stall does not occur until the angle of attack becomes excessive.

It must be emphasized that the stalling speed of a particular airplane is not a fixed value for all flight situations. However, a given airplane will always stall at the same angle of attack regardless of airspeed, weight, load factor, or density altitude. Each airplane has a particular angle of attack where the airflow separates from the upper surface of the wing and the stall occurs. Each airplane has only one specific angle of attack where the stall occurs. The airplane can be stalled in straight and level flight by flying too slowly. As the airspeed is being decreased, the angle of attack must be increased to retain the lift required for maintaining altitude. The slower the airspeed becomes, the more the angle of attack must be increased. Eventually an angle of attack is reached which will result in the wing not producing enough lift to support the airplane and it will start settling. If the airspeed is reduced further, the airplane will stall since the angle of attack has exceeded the critical angle and the airflow over the wing is disrupted.

In naval aviation, there is great importance assigned to precise control of an aircraft at high angle of attack conditions. Safe operation in carrier aviation demands the ultimate in precision flying at low airspeed. The aerodynamic lift characteristics of an airplane must be fully understood by the student naval aviator as well as the seasoned "fleet pilot" for obvious safety reasons. Additionally, mission requirements and their execution may depend on the pilot's own capabilities and grasp of these basic concepts.

During flight maneuvers, landing approach, takeoff, etc. the airplane will stall **IF THE CRITICAL ANGLE OF ATTACK IS EXCEEDED**. The AIRSPEED at which stall occurs will be determined by weight, load factor, altitude, and configuration, but the stall angle of attack remains unaffected. At any particular altitude, the indicated stall speed is a function of weight and load factor. An increase in altitude will produce a decrease in density and an increase in true airspeed. Also, an increase in altitude will alter compressibility and airflow viscosity, which will cause the indicated stall speeds to increase.

Modern airplanes are characterized by having a large percentage of their maximum gross weight as fuel. Most Navy inventory aircraft carry 25-40 percent of their total gross weight in this manner. Hence, the gross weight and stall speed of the airplane can vary considerably throughout the flight. A general "rule of thumb" is that a 2% change in weight will cause a 1% change in stall speed. Note that for the T-34C, a full load of fuel is only approximately 18% of the aircraft's gross weight. Fuel burnoff will consequently have a diminished effect on stall speed as compared to most naval aircraft in the inventory.

Load factor/centrifugal force. Turning flight and maneuvers produce an effect on stall speed, which is similar to the effect of weight. The stalling speed of an airplane is higher in a level turn than in straight and level flight. This is because centrifugal force is added to the airplane's weight, and the wing must produce sufficient additional lift to counterbalance the load imposed by the combination of centrifugal force and weight. In a turn, the necessary additional lift is acquired by applying back pressure to the elevator control. This increases the wing's angle of attack, and results in increased lift. As stated earlier, the angle of attack must increase as the bank angle increases to counteract the increasing load caused by centrifugal force. If at any time during a turn the angle of attack becomes excessive, the airplane will stall. Thus, the aircraft in a

steady turn still develops lift greater than weight, but experiences increased stall speeds due to load factor increases. However, no appreciable change in load factor or stall speed occurs at bank angles less than 30°.

	Angle of Bank	(°)	0°	15°	30°	45°	60°	75.5°
Level flight	-----							
	Load factor	(G's)	1.00	1.035	1.154	1.414	2.00	4.00

Notice that above 45° angle of bank, the increase in load factor and therefore, stall speed, is quite rapid. This fact emphasizes the need to avoid steep turns at low airspeeds - a flight condition common to stall/spin accidents. (Refer also to NATOPS Vn Diagram.)

It must be reemphasized here that low speed is not necessary to produce a stall. The wing can be brought into an excessive angle of attack at any speed. For example, take the case of an airplane which is in a dive with an airspeed of 200 KIAS, when suddenly the pilot pulls back sharply on the elevator control. Because of gravity and centrifugal force, the airplane could not immediately alter its flight path, but would merely change its angle of attack abruptly from quite low to very high. Since the flight path of the airplane, in relation to the oncoming air, determines the direction of the relative wind, the angle of attack is suddenly increased, and the airplane will quickly reach the stalling angle at a speed much greater than normal stall speed.

The primary purpose of high lift devices (i.e., flaps, slats, and slots) is to increase the coefficient of lift and reduce the stall speed for an airplane. Therefore, flap extension increases the total lift available and reduces the angle of attack for any given lift coefficient. Full flap extension on a T-34C produces approximately a 20% reduction in stall speed.

At this point we should examine the action of the airplane during a stall. In our earlier discussion of pitching (longitudinal) stability, we learned that to balance the airplane aerodynamically, the center of lift is normally located aft of the center of gravity. It was also pointed out that, although this made the airplane inherently "nose heavy," downwash on the horizontal stabilizer counteracted this condition. It can be seen then, that at the point of stall when the upward force of the wing's lift and the downward tail force cease, an unbalanced condition exists. This allows the airplane to pitch down abruptly, rotating about its center of gravity. During this nose down attitude, the angle of attack decreases and the airspeed again increases; hence, the smooth flow of air over the wing begins again, lift returns, and the airplane is again flying. However, considerable altitude may be lost before this cycle is complete.

The associated loss of altitude and control response in the stalled configuration has meant the lives of both students and seasoned naval aviators. A stall never checks anyone's logbook or qualifications before it decides to happen. Therefore, it is important to remember that the stall is not merely a precision maneuver, but an actual situation into which you may inadvertently fly while concentrating on some other aspect of your flying.

CHAPTER THREE

USE AND EFFECT OF CONTROLS

300. INTRODUCTION

This chapter briefly discusses the devices with which the pilot operates the airplane in the air and on the ground and how those devices are to be used effectively. These controls may be grouped into four categories:

1. Primary flight controls.
2. Secondary flight controls.
3. Power controls.
4. Auxiliary controls.

301. PRIMARY FLIGHT CONTROLS

To maneuver an airplane, the pilot must control its movement about its lateral, longitudinal, and vertical axes. This is accomplished by the use of the flight controls (elevators, ailerons, and rudder) which can be deflected from their neutral position into the flow of air as the airplane moves forward through the air. During flight, the flight controls have a natural "live pressure" due to the force of the airflow around them.

With this in mind, the pilot should think not of moving the flight controls, but of exerting force on them against this live pressure or resistance.

1. **Elevators.** The elevators control the movements of the airplane about its lateral axis. They form the rear part of the horizontal stabilizer, are free to be moved up and down by the pilot, and are connected to a control stick in the cockpit by means of cables and pulleys. Applying forward pressure on the stick causes the elevator surfaces to move downward. The flow of air striking the deflected elevator surfaces exerts an upward force, pushing the airplane's tail upward and the nose downward. Conversely, exerting backpressure on the control causes the elevator surfaces to move up, exerting a downward force to push the tail downward and the nose upward.

In effect, the elevators are the angle of attack control. When backpressure is applied on the control, the tail lowers and the nose rises, thus increasing the wing's angle of attack and lift.

2. **Ailerons.** The ailerons control the airplane's movement about its longitudinal axis. There are two ailerons, one at the trailing edge of each wing, near the wingtips. They are movable surfaces hinged to the wing's rear spar and are linked together by cables so that when one aileron is deflected down, the opposite aileron moves up. Contrary to popular belief, the lift on the wings is the force that turns the airplane in flight-not the rudder (Figure 3-1).

To obtain the horizontal component of lift required to pull the airplane in the desired direction of turn, the wings must be banked in that direction. When the pilot applies pressure to the left on

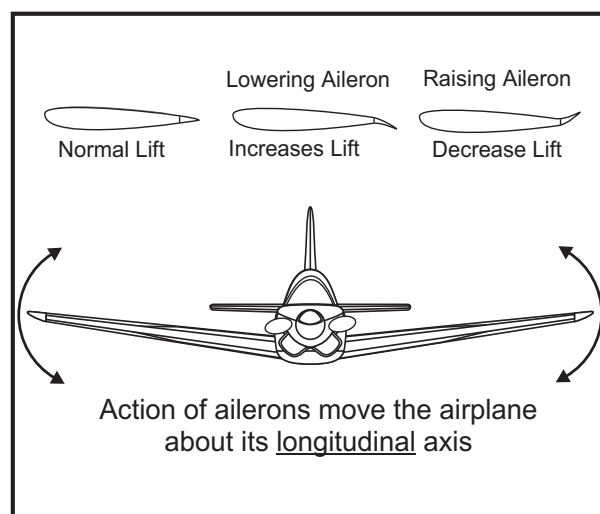


Figure 3-1 Aileron Control

the control stick, the right aileron surface deflects downward and the left aileron deflects upward. The force exerted by the airflow on the deflected surfaces raises the right wing and lowers the left wing. This happens because the downward deflection of the right aileron changes the wing camber and increases the angle of attack and lift on that wing. Simultaneously, the left aileron moves upward and changes the effective camber. This action results in a decreased angle of attack and less lift. Thus, decreased lift on the left wing coupled with increased lift on the right wing causes the airplane to roll and bank to the left.

Since the downward deflected aileron produces more lift, it also produces more drag, while the opposite aileron has less lift and less drag. This added drag attempts to pull or veer the airplane's nose in the direction of the raised wing; that is, it tries to turn the airplane in the direction opposite to that desired. This undesired veering is referred to as adverse yaw. (Figure 3-2).

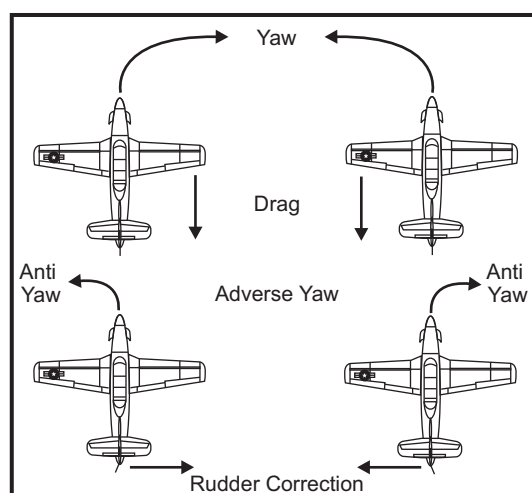


Figure 3-2 Adverse Yaw

3-2 USE AND EFFECT OF CONTROLS

To demonstrate this in flight, an attempt can be made to turn to the right without using the rudder pedals. As right aileron pressure is applied, the airplane rolls into a right bank and tries to turn to the right. But the adverse yaw, or the drag on the downward deflected left aileron, pulls the airplane's nose to the left. The airplane banks, but it turns hesitantly and sideslips. This is undesirable and corrective action should be taken by applying right rudder pressure.

When right rudder pressure is applied simultaneously with right aileron pressure, it keeps the airplane from yawing opposite to the desired direction of turn. In fact, the rudder must be used because the ailerons were used. Therefore, neither of those controls should be used separately when making normal turns.

3. **Rudder.** The rudder controls movement of the airplane about its vertical axis. This is the motion called yaw. Like the other primary control surfaces, the rudder is a movable surface hinged to the vertical stabilizer. Two rudder pedals control movement of the rudder-left and right. Its action is very much like that of the elevators, except that it moves in a different plane; the rudder deflects from side to side instead of up and down. When the rudder is deflected to one side, it protrudes into the airflow, causing a horizontal force to be exerted in the opposite direction. This pushes the tail of the airplane in that direction and yaws the nose in the desired direction. When rudder is used for steering during ground taxiing, the propeller slipstream provides the force to yaw or turn the airplane in the desired direction. (The T-34C does NOT have a steerable nosewheel.)

As mentioned earlier, the primary purpose of the rudder in flight is to counteract the effect of adverse yaw and to help provide directional control of the airplane. In flight, the rudder does not turn the airplane; instead, the force of the horizontal component of wing lift turns the airplane when the wings are banked. As in the demonstration of turning by use of ailerons alone, this can be verified by flying straight and level and then, after taking the hands off the control stick, trying to turn to the right by applying right rudder pressure only. At first it may seem to work pretty well. The airplane will turn to the right, but it will also skid to the left (a skid in a turn is an unbalanced flight condition caused by insufficient angle of bank for a given radius of turn). Since the airplane possesses inherent stability, it will tend to stop the skid by banking itself to the right.

If the pilot were now to neutralize the rudder, only a shallow banking turn would result. However, inasmuch as the purpose of this demonstration is to make a turn using only the rudder, continue to hold right rudder pressure. Since the airplane is slightly banked to the right, the rudder will force the nose of the airplane downward to the right. The reason for this is that yawing is the only movement the rudder can produce. As a result, the nose yaws downward, the airspeed increases, and the airplane starts losing altitude. At the same time, the airplane, being stable, attempts to stop the increased skidding by banking more steeply. The more steeply it banks, the more the nose is yawed downward by the right rudder action. The net result of holding rudder alone is a descending spiral unless back elevator pressure is applied. Thus, it can be seen that rudder alone cannot produce a balanced turn. Coordinated application of aileron, rudder, and elevator pressure will produce a balanced flight condition.

4. **Primary Control Application.** The following will always be true in controlled flight, regardless of the airplane's attitude in relation to the earth:

- a. When backpressure is applied to the elevator control, the airplane's nose rises in relation to the pilot.
- b. When forward pressure is applied to the elevator control, the airplane's nose lowers in relation to the pilot.
- c. When right pressure is applied to the aileron control, the airplane's right wing lowers in relation to the pilot.
- d. When left pressure is applied to the aileron control, the airplane's left wing lowers in relation to the pilot.
- e. When pressure is applied to the right rudder pedal, the airplane's nose moves to the right in relation to the pilot.
- f. When pressure is applied to the left rudder pedal, the airplane's nose moves to the left in relation to the pilot.

5. **Performance.** Most basic airwork problems result from the student's inability to see and control the aircraft's attitude properly. Only when the student has mastered attitude control can he/she progress to making proper corrections. Remember this simple formula:

$$\text{POWER} + \text{ATTITUDE} = \text{PERFORMANCE}$$

The preceding explanations should prevent the beginning pilot from thinking in terms of "up" or "down" in respect to the earth, which is only a relative state to the pilot. It will also make understanding of the functions of the controls much easier, particularly when performing steep banked turns and the more advanced maneuvers. Consequently, the pilot must be able to properly determine the control application required to place the airplane in any attitude or flight condition that is desired.

Coordinated use of ALL controls is extremely important in any turn. Applying aileron pressure is necessary to place the airplane in the desired angle of bank, while simultaneous application of rudder pressure is required to counteract the resultant adverse yaw. During a turn, the angle of attack must be increased by application of elevator pressure because more lift is required than when in straight-and-level flight. The steeper the turn, the more back elevator pressure is needed.

After the bank and turn are established, the airplane may continue in a constant turn when all pressure on the ailerons and rudder is released, or it may require some opposite aileron to prevent the bank angle from increasing. It may also require continued aileron pressure in the direction of turn to prevent returning to the wings-level attitude. This will be discussed in more detail in the chapter on Flight Procedures.

After learning how the airplane will react when the flight controls are used, the pilot must learn how to use them properly. Rough and erratic usage of all or any one of the controls will cause the airplane to react accordingly; therefore, the pilot must form the habit of applying pressures smoothly and evenly.

The amount of force the airflow exerts on the control surface is governed by the airspeed and the degree that the surface is moved out of its neutral or streamlined position. Since the airspeed will not be the same in all maneuvers, the amount of control surface movement is of little importance. However, it is important that the pilot maneuver the airplane by applying sufficient control pressures to obtain a desired result, regardless of how far the control surfaces are actually moved.

The pilot's feet should rest comfortably against the rudder pedals. Both heels should support the weight of the feet on the cockpit floor with the ball of each foot touching the individual rudder pedals. The legs and feet should not be tense; they must be relaxed just as when driving an automobile. The pedals should be adjusted so that the pilot with full throw of the rudder still has a slight flex in the knee.

When using the rudder pedals, pressure should be applied smoothly and evenly by pressing with the ball of one foot just as when using the brakes of an automobile. The rudder pedals are interconnected and act in opposite directions; when pressure is applied to one pedal, pressure on the other must be relaxed proportionally. When the rudder pedal must be moved significantly, heavy pressure changes should be made by applying the pressure with the ball of the foot while the heels slide along the cockpit floor. Remember, the ball of each foot must rest comfortably on the rudder pedals so that even slight pressure changes can be felt. Care must be taken NOT to apply any brake pressure inadvertently (i.e., when in the landing pattern).

During flight, it is the pressure the pilot exerts on the control stick and rudder pedals that causes the airplane to move about its axes. When a control surface is moved out of its streamlined position (even slightly), the air flowing past it will exert a force against it and will try to return it to its streamlined position. It is this force that the pilot feels as pressure on the control stick and the rudder pedals.

302. SECONDARY FLIGHT CONTROLS - TRIM DEVICES

The secondary flight controls are the trim tabs. They are used for trimming and balancing the airplane in flight and to reduce the force required of the pilot in actuating the primary flight control surfaces. These tabs are really small airfoils attached to, or recessed into, the trailing edge of the primary control surfaces. When an airplane's flight conditions (attitude, power, airspeed, loading, and configuration) are changed, the control pressures required to maintain the new flight conditions are affected by the resulting changes in aerodynamic forces. To relieve the pilot of this tiring effort, the T-34C is equipped with trim tabs with which to trim the airplane for balanced flight.

A trim tab is a small, adjustable hinged surface, located on the trailing edge of the aileron, rudder, or elevator control surface. It is used to maintain the flight surfaces in balance in

straight-and-level flight and during other prolonged flight conditions without the pilot having to hold pressure on the controls. This is accomplished by deflecting the tab in the direction opposite to that in which the primary control surface must be held. The force of the airflow striking the tab causes the main control surface to be deflected to a position that will correct the unbalanced condition of the airplane.

The trim tab controls are located on the left console in each cockpit. To apply a trim force, the trim wheel must be moved in the desired direction. The position in which the trim tab is set can be referenced by glancing at the trim indicators located at the trim wheel. However, the trim is adjusted to whatever is required to relieve the control pressures. For this reason, the trim tabs are referred to as "labor-saving devices."

The general sequence for trimming the aircraft is rudder, elevator, and aileron.

1. **Rudder Trim.** Rudder trim is usually set first, because a correction for yaw will precipitate the need to change the trim setting for pitch and roll. Additionally, most pilots have difficulty maintaining balanced flight (keeping the ball in the center) with rudder pressure for an extended period. Thus, if rudder were trimmed last, both nose and wing would have to be retrimmed to some extent. Initial trim applications will generally be large adjustments, which require additional "fine tuning."

Trimming the rudder is more difficult, since you are wearing heavy boots and it is harder to "feel" pressure on the pedals. Never stiff-leg both rudder pedals by forcibly holding your feet against them. This may happen when the pilot is tense or excited. Try to rest your feet lightly on the pedals when checking the BALANCE BALL for coordinated flight. For example, if the ball is out to the right, the nose is actually out to the left and you are in a skid. Smoothly apply right rudder pressure to regain balanced flight. Then smoothly apply right rudder trim until you relieve the rudder pressure you are holding. If you have trimmed properly, the ball should stay in the center and you should be in coordinated flight. Eventually you will be able to "feel" if you are flying straight. An easy way to remember which way to trim the rudder is to "**STEP ON THE BALL.**"

2. **Elevator Trim.** To trim nose attitude, first move the stick to position the nose for the attitude that you desire in relationship to the horizon. Then relieve the pressure you must maintain on the stick by moving the elevator trim. If you must hold forward pressure on the stick, slowly roll the elevator trim wheel forward (it is very sensitive) until the pressure is relieved and the nose remains at the attitude which you desire. If you must hold back on the stick to hold the desired attitude, slowly roll back the elevator trim wheel until you relieve the pressure you must maintain on the stick. Always use a light grip on the stick so as to "feel" the pressure. "Fingertip control" is the key to smooth flying. The T-34C is virtually impossible to fly with a tight grip on the stick unless proper and constant trim is utilized.

3. **Aileron Trim.** Always make sure the rudder and elevator are trimmed properly before you attempt to trim with the aileron trim tab. Aileron trim is only necessary if, after the rudder is trimmed, the aircraft tends to roll to one side. If this is the case, level the wings with the stick, and relieve the side pressure you must apply to the stick to maintain wings level by rolling the

aileron trim tab in the direction you are applying stick pressure. For example, if you must hold in right stick (the aircraft wants to roll left), roll the aileron trim wheel to the right. Generally speaking, once the aileron trim is "fine-tuned," you may not have to retrim the ailerons for the remainder of the flight.

4. Trim Requirements-Rudder/ Elevator

Acceleration.....LEFT/DOWN

Power Addition.....RIGHT/DOWN

Deceleration.....RIGHT/UP

Power Reduction.....LEFT/UP

The trim diagram (Figure 3-3) should help you understand which way to trim when airspeed and power changes occur. However, the trim requirements must be committed to memory before your first flight, because you will not have the time to stop and think through the trim diagram. The center of the diagram represents equilibrium for whatever level flight condition you are trying to maintain. When airspeed is increased (with power unchanged), we see from the trim diagram that left rudder trim is needed and down elevator trim is needed. If power is unchanged and airspeed is reduced, we see from the trim diagram that right rudder trim and up elevator trim is needed. If airspeed is constant and power is increased, then right rudder trim and down elevator trim is needed. If power is reduced with airspeed constant, then left rudder trim and up elevator trim is necessary.

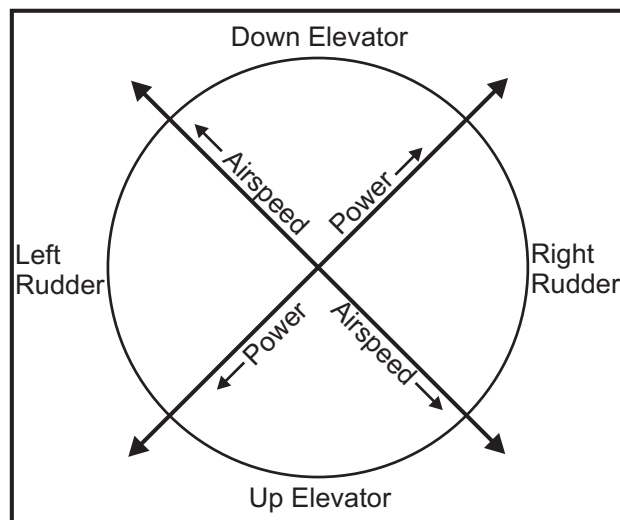


Figure 3-3 Trim Diagram

The four trim requirements outlined in this section are basic rules. However, many situations during a flight combine two of the "rules" simultaneously. For example, when initiating a 120-KIAS climb from normal cruise (150 KIAS, level), you will add power, raise the nose and decelerate. In this case, right rudder trim is required for both the power addition and deceleration. However, the elevator trim will be nose UP, because deceleration requires a greater amount of nose up trim than the addition of power will require nose down. The resultant or net force is trimmed for equilibrium. More on this later.....

303. POWER CONTROLS

The power controls are the power control lever, condition lever, and emergency power lever. These controls are located on a quadrant on the left side in each cockpit. They permit the pilot to adjust the power output of the engine within its operating limitations.

1. **Power Control Lever.** The PCL controls the power output of the engine. This power, transmitted through the propeller, produces thrust. As discussed in the previous chapter, this thrust will propel the aircraft through the air, developing lift. When sufficient power is combined with the appropriate angle of attack, the desired performance is obtained.

Moving the PCL forward increases power; moving it aft decreases power. If a constant airspeed is maintained with adjustments in the attitude relative to the horizon, a variation in power will control the gain or loss of altitude. This concept of control establishes a basic fundamental of the mechanics of any powered flight.

The PCL should be operated firmly but smoothly. You will learn to set the desired power with your peripheral vision and then go back and fine-tune the power as required for a particular maneuver. Occasionally check to see that the desired power setting is still in fact set. Some T-34C PCLs have a tendency to slip if the PCL friction is not sufficient.

2. **Condition Lever.** The power generated by the engine is converted to a usable force (thrust) by the propeller. The propeller on the T-34C is a constant-speed, full feathering, reversible pitch propeller. The condition lever controls fuel on and off, feather, and propeller RPM, and is mechanically interconnected between cockpits. Moving the condition lever aft towards a spring detent will reduce propeller RPM to minimum governed RPM. Further movement aft past the detent to a positive stop will cause the prop to feather. This mechanical stop can be released by the pilot in either cockpit by pushing a spring-loaded lever (stop lever). When the stop lever is simultaneously pushed forward while pulling the condition lever aft, fuel cutoff position may be selected to secure the engine. The stop will automatically reset when the condition lever is moved forward out of the fuel cutoff position. The condition lever travel range/positions are placarded on the quadrant and will be full forward to all normal operations.

3. **Emergency Power Lever.** In the event the pneumatic function of the fuel control unit becomes inoperable, the manual fuel control system will provide the capability to restore power with the Emergency Power Lever (EPL). When engaged, the EPL will provide a direct mechanical linkage to the bellows and fuel-metering pin in the Fuel Control Unit (FCU), effectively bypassing the pneumatic function while scheduling fuel to the engine. Basic principles of operation are as follows:

- a. Operation of the EPL requires lifting it up to move it forward and out of the disconnect detent. Moving it back into the disconnect position requires pulling aft and pushing down on the lever.
- b. The EPL does not have the same range of travel that the PCL possesses. In other words, forward movement of the EPL will achieve MAX ALLOWABLE power sooner than a corresponding application of the PCL.

3-8 USE AND EFFECT OF CONTROLS

- c. Do not perform rapid accelerations with the EPL. Due to the nature of the manual fuel control system, proper fuel/air ratios are not readily achieved with rapid power application. The turbine must spool up (accelerate) as fuel is introduced, particularly on the low end of the power range.
- d. Normal operation of the landing gear warning system is provided except that when BOTH the EPL and PCL are forward of the 75% switch at the same time, the gear horn and light will function when the gear is up. This mode functions as an alert to the pilot that both power systems are engaged. For a more detailed discussion of the Manual Fuel Control system and EPL, refer to the T-34C NATOPS Manual.

304. AUXILIARY CONTROLS

The auxiliary flight controls consist of the landing gear and flaps.

1. **Flaps.** Flaps are high lift devices used to increase the maximum lift coefficient during low speed flight. The T-34C employs electrically operated slot-type wing flaps. The flaps are applied to the trailing edge of both wings near the root. The deflected flap segment is moved aft along a set of tracks which increases the chord and therefore, the camber. Additionally, the wing area is increased; all of which contribute to an increase in lift and a decrease in the stall speed.

In the T-34C, the flaps are electrically operated by a flap lever located on the left side in each cockpit. Lifting the lever "UP" raises the flaps; moving the lever "DOWN" lowers them. Moving the lever to the "OFF" (center) position, will stop the flaps at any intermediate position. Otherwise, they will continue to move until full UP or DOWN travel is reached. At this time, the limit switch shuts off the flap motor whether or not the lever is moved to OFF. In primary training, no intermediate positions are used. The flaps will always be in either the full UP or full DOWN position. The flap position indicator is labeled in terms of percent extension. No emergency extension system is provided for operation of flaps in the event of an electrical failure.

2. **Landing Gear.** The T-34C employs electrically operated, fully retractable tricycle landing gear. In order to provide satisfactory maneuvering capabilities, a free castering nose wheel is used with limit stops 30° either side of center. The landing gear handles are on the left front console in both cockpits and mechanically linked to one another. Either handle will electrically operate the landing gear system. The main wheels retract inboard into the wings and the nose wheel retracts aft into the nose wheelwell. Fairing doors, operated by gear movement, fully cover the landing gear when retracted. The main gear inboard doors open during the gear extension and close again when the gear are fully extended. All gears are actuated by a single D.C. motor and gear mechanism located under the front cockpit, and raise and lower through a push-pull rod to each main gear side brace and nose gear drag brace. Individual uplocks, actuated by the retraction system, lock the gear positively in the retracted position. Mechanical downlocks lock the gear in the extended position. A downlock is not provided for the nose gear, since the over center pivot of the linkage provides a geometric locking effect when fully extended. A safety switch on the right main strut prevents accidental gear retraction on the ground. In flight, the gear may be manually extended in an emergency. There is no provision to manually retract the landing gear.

CAUTION

Do not cycle the landing gear when it is in transit. The motor should stop before selecting the opposite direction of travel. Otherwise, you may damage the motor and drive mechanism.

Three position indicators adjacent to the gear handle are located in both cockpits. Each indicator shows cross-hatching (barber pole) if the related gear is in any unlocked condition or whenever the electrical system is not energized. The word "UP" appears if the gear is up and locked; and a "wheel" shows on each indicator when the related gear is down and locked. The gear position circuit breaker, placarded POSN, is located on the landing gear section of the front cockpit circuit breaker panel.

In addition to the gear position indicators, an audio-visual warning system is installed to provide indications of any abnormal or unsafe gear position. A flashing red "WHEELS" light on the instrument panel, a light in the gear handle, a warning horn, and an audio tone (1000 Hz) warns the pilot that one or more of the following conditions exists:

- a. The flaps have been extended (regardless of amount) prior to extending the landing gear.
- b. The power lever has been retarded below approximately 75% N_1 with the gear not extended or when the aircraft is on the ground with the gear handle placed in the UP position.
- c. The EPL has been retarded below approximately 75% N_1 (with PCL at idle), with the gear not extended .
- d. Both the PCL and EPL are simultaneously advanced beyond the 75% switch with the gear up.

During extended power-off operations with the gear up, depressing the "WARNING HORN SILENCE" button adjacent to the landing gear handle will silence the warning horn. The "WHEELS" light will continue to flash. However, whenever the flaps are down (and the gear is up), the warning horn cannot be silenced.

WARNING

Do not silence the aural warnings when commencing an approach for landing by any method other than extending the landing gear.

An Inboard Landing Gear Door Position Indicator system has been retrofitted on many of the aircraft. The purpose is to indicate, via annunciators (located on both cockpit panels between the WHEELS annunciator light and the MASTER CAUTION annunciator), when the inboard landing gear doors are not in the closed and locked position when the landing gear is not in transit (i.e., fully up or down). Refer to the T-34C NATOPS Manual Chapter Two for further discussion.

3. **Emergency Landing Gear System.** The emergency handcrank is in the front cockpit located on the right side panel. Engaging the crank drives the normal gear actuation system through a flexible shaft. Approximately 41 turns of the handle are required to fully extend the gear.

The handcrank clutch knob must be pushed down to engage the system after having first pulled the PWR and CONT circuit breakers. The drive shaft is a flexible cable and is designed and stressed only for extension and should not be used to retract the gear. The gear may be extended manually for demonstration purposes.

CAUTION

The handcrank must be disengaged from the drive shaft after extending the gear manually; otherwise, subsequent operation of the gear electrically will cause the crank to spin rapidly, possibly injuring personnel and damaging the system.

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CHAPTER FOUR

FUNDAMENTAL FLIGHT CONCEPTS

400. INTRODUCTION

This section discusses and explains the fundamental flight maneuvers upon which all flying tasks and techniques are based. In learning to fly, as in any learning process, fundamentals must be mastered before the more advanced phases can be learned.

401. FUNDAMENTAL FLIGHT MANEUVERS

Maneuvering of the airplane is generally divided into four flight fundamentals:

1. Straight and level flight,
2. Turns,
3. Climbs, and
4. Descents.

All controlled flight consists of any one or a combination of these basic maneuvers. Proper control of an airplane's attitude is the result of the pilot knowing when and how much to change the attitude, and then smoothly changing the attitude by the required amount. When flying by reference to objects outside the airplane, the effects of the pilot's control application on the airplane's flight attitude can be seen by observing the relationship of the position of some portion of the airplane to the outside references.

At first, control of the airplane is a matter of consciously fixing the relationship of a specific reference point on the airplane to the horizon. As basic flight skills are developed through experience and training, the pilot will acquire a continuous awareness of these relationships without conscious effort. The reference points will be used almost subconsciously in varying degrees to determine the attitude of the airplane during all maneuvers.

In establishing the reference points, the airplane should be placed approximately in the desired attitude, and then a specific point should be selected. No two pilots see this relationship exactly the same. The apparent position of reference points will depend on each pilot's seat height and lateral position, and/or the pilot's eye level and line of sight. It is imperative that the student utilize the same seat position on each flight so that the reference points remain the same.

402. INTEGRATED FLIGHT INSTRUCTION

In introducing the basic flight maneuvers, the "integrated flight instruction" method will be used. This means that each flight maneuver will be performed by using both outside visual references and the flight instruments.

When pilots use this technique, they achieve a more precise and competent overall piloting ability. It results in less difficulty in holding desired altitudes, controlling airspeed during takeoffs, climbs, descents, and landing approaches, and in maintaining headings in the traffic pattern, as well as on cross-country flights.

The use of integrated flight instruction does not, and is not intended to, prepare pilots for flight in instrument weather conditions. It does, however, provide an excellent foundation for flight during Basic Instrument (BI) and Radio Instrument (RI) stages of training, and will result in the pilot becoming a more accurate, competent, and safe pilot.

A sharp lookout for other aircraft must be maintained at all times, particularly when using instrument references, to avoid the possibility of collision with other aircraft. Frequently, other aircraft are unnoticed until they suddenly appear within the limited area of the pilot's vision. Consequently, it is imperative that the pilot not only divide attention between controlling the airplane by outside visual references and flight instruments, but also be observant of other aircraft. For visual flight, the pilot's scan should be directed outside the cockpit at least 80% to 90% of the time!

403. ATTITUDE FLYING

Airplane control is composed of four components:

1. **Pitch control:** Pitch control is the control of the airplane (longitudinal axis) about its lateral axis by applying elevator pressure to raise or lower the nose, usually in relation to the horizon.
2. **Bank control:** Bank control is the control of the airplane (lateral axis) about its longitudinal axis by use of the ailerons to attain the desired angle of bank in relation to the horizon.
3. **Yaw control:** Yaw control is the control of the aircraft (longitudinal axis) about its vertical axis by use of the rudder.
4. **Power control:** Power control is the control of power or thrust by use of the PCL to establish or maintain desired airspeeds in coordination with the attitude changes.

The attitude indicator (attitude gyro), heading indicator (Radio Magnetic Indicator (RMI)), altimeter, vertical speed indicator, and airspeed indicator are the instruments used as references for control of the airplane.

- a. The attitude indicator shows directly both the pitch and bank attitude of the airplane.
- b. The heading indicator shows directly the airplane's direction of flight.
- c. The altimeter indicates the airplane's altitude and, indirectly, the need for a pitch change.

4-2 FUNDAMENTAL FLIGHT CONCEPTS

- d. The vertical speed indicator shows the rate of climb or descent.
- e. The airspeed indicator shows the results of power and/or pitch changes in the airplane's speed.

The outside visual references used in controlling the airplane include the airplane's nose and wingtips to show both the airplane's pitch attitude and flight direction with the wings and frame of the windscreen showing the angle of bank.

404. "SEE AND AVOID" DOCTRINE

Simply stated, the "See and Avoid" Doctrine is a pilot's best defense against a midair collision. The "Big Sky, Little Airplane" theory is the key ingredient in the recipe for a midair collision. The causal factor most often noted in aircraft accident reports involving midair collisions is, "failure of the pilot to see and avoid the other aircraft." In most cases, at least one of the pilots involved could have seen the other in time to avoid contact if he had been using his eyes properly.

Statistics taken from the April 1983 AOPA Air Foundation Safety Report reveal some interesting points concerning midair collisions. Nearly all midair collisions occur during daylight hours, in good VMC weather conditions. Most midairs occur within five miles of an airport, in the areas of greatest traffic concentration, and usually on warm, weekend days. Most midairs also involve maneuvers that are classified as crossing or overtaking. Very rarely were head-on collisions reported.

It was also noteworthy to find that the closing speed (rate at which two aircraft approach each other) in a crossing or overtaking maneuver is often relatively slow, usually much slower than the airspeed of either aircraft involved. Again, that is because the majority of midair collisions are the result of a faster aircraft overtaking and striking a slower one.

The report also revealed some interesting information regarding the vulnerabilities of the human eye and how its limitations contribute to midair collisions.

The eye, and consequently vision, is vulnerable to just about everything: dust, fatigue, emotion, germs, fallen eyelashes, age, optical illusions and alcoholic content. In flight, our vision is affected by atmospheric conditions, windscreen distortion, too much or too little oxygen, acceleration, glare, heat, lighting and aircraft design. Most importantly, the eye is vulnerable to the vagaries of the mind. We "see" and identify only what the mind lets us see. For example, a daydreaming pilot staring into space sees no approaching traffic and is a number one candidate for a midair collision.

A constant problem source to the pilot (though he is probably never aware of it) is the time required for "accommodation." Our eyes automatically accommodate for (or focus on) near and far objects. But the change from something up close, like a dark panel two feet away, to a well-lighted landmark or an aircraft target a mile or so away, takes one to two seconds or longer for eye accommodation. That can be a long time when you consider that you need 10 seconds to avoid a midair collision.

Another focusing problem occurs on drab, colorless days above a haze or cloud layer when no distinct horizon is visible. If there is little or nothing to focus on, we do not focus at all. We experience something known as "empty-field myopia;" we stare but see nothing, not even opposing traffic. In general, the threat of a midair collision can be avoided by scanning both 60° to the left and right horizontally and 10° up and down. Figure 4-1 illustrates the minimum scan range for the T-34C.

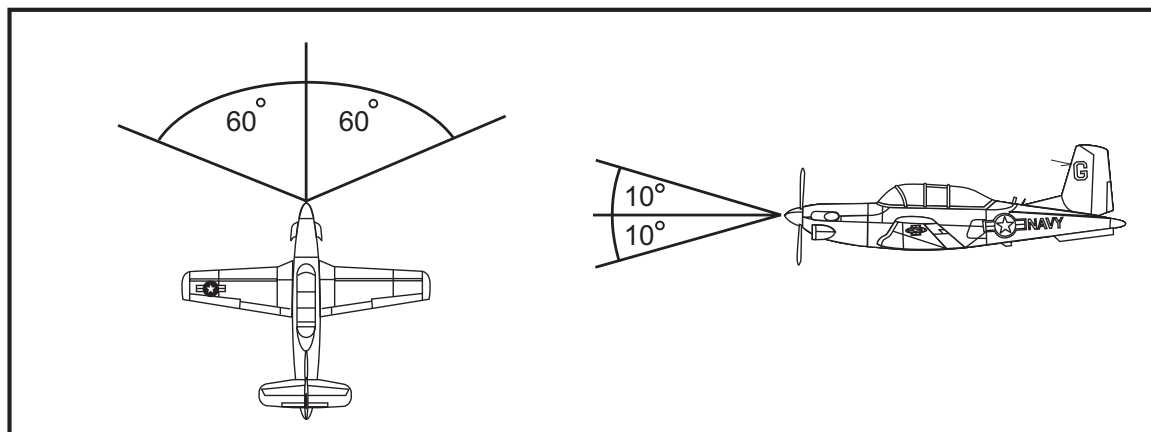


Figure 4-1 Outside Scan

The effects of "binocular vision" have been studied by the National Transportation Safety Board (NTSB) during investigations of midair collisions. The board concluded that this is also a causal factor. To actually accept what we see, we need to receive cues from both eyes. If an object is visible to one eye, but hidden from the other by a windscreen post or other obstruction, the total image is blurred and not always accepted by the mind.

Another inherent eye problem is that of narrow field of vision. Although our eyes accept light rays from an arc of nearly 200° , they are limited to a relatively narrow area (approximately 10-15 degrees) in which they can actually focus on and classify an object. Though we can perceive movement in the periphery, we cannot identify what is there. We tend not to believe what we see out of the corner of our eyes. This often leads to "tunnel vision."

That limitation is compounded by the fact that at a distance, an aircraft on a collision course will appear to be motionless. It will remain in a seemingly stationary position, without appearing either to move or to grow in size for a relatively long time, and then suddenly bloom into a huge mass filling the canopy. This is known as "blossom effect." We need motion or contrast to attract our eyes' attention. A large bug smear or dirty spot on the windscreen can hide a converging plane until it is too close to be avoided.

In addition to built-in problems, the eye is also severely limited by environment. Optical properties of the atmosphere alter the appearance of traffic, particularly on hazy days. "Limited visibility" actually means "limited vision." You may be legally Visual Flight Rules (VFR) when you have three miles, but at that distance, on a hazy day, opposing traffic is not easy to detect. At a range closer than three miles—even though detectable—opposing traffic may not be avoidable.

4-4 FUNDAMENTAL FLIGHT CONCEPTS

Lighting also affects our vision. Glare, usually worse on a sunny day over a cloud deck or during flight directly into the sun, makes objects hard to see and scanning uncomfortable. Also, a well-lighted object will have a high degree of contrast and be easy to detect, while one with low contrast at the same distance may be impossible to see. For instance, when the sun is behind you, an opposing aircraft will stand out clearly, but when you are looking into the sun, and your traffic is "backlighted," it is a different story.

A contrast problem exists when trying to see an airplane against a cluttered background. If an aircraft is between you and terrain that is varied in color or heavily dotted with buildings, it will blend into the background until quite close.

So what can we do to overcome the vulnerabilities of the eye? The most important thing is to develop a scan that is both comfortable and workable for your own airplane. In normal flight, the threat of a midair collision is greatly diminished by scanning an area 60° either side of center and 10° up and down. Refer again to Figure 4-1. This does not mean that the rest of the area should be ignored.

Many times the threat of an impending midair collision is evident early enough for the aircrew to discuss the threat and coordinate a decision regarding deviation from the flight path to avoid it. However, this will not always be the case. The other aircraft may be sighted at a point which will prevent discussion with, or even notification of, the other crewmember. This would require immediate action! In such a situation, students are expected to take the controls and/or initiate a deviation in either bank, pitch or power (or combination of these) to displace the aircraft from its current flight path in order to avoid the collision. This concept holds true even if the deviation involves either high positive or negative "G" loads. Avoiding the collision takes priority over preventing an overstress! This situation should be addressed during the NATOPS preflight briefing.

Naval Aircraft Collision Warning System (NACWS) can enhance a pilot's visual scan by detecting several aircraft up to 20 NM. Depending upon the mode selected, a series of traffic advisory symbols (see T-34C NATOPS) may appear, enabling earlier visual detection of possible conflicting traffic. In this way the NACWS effectively complements but does not replace the VFR scan, which remains the pilot's primary means to see and avoid conflicting traffic.

405. FLIGHT INSTRUMENTS

Of the basic skills required for flight, instrument interpretation requires the most thorough study and analysis. It begins with your understanding of each instrument's construction and operating principles. Then you must apply this knowledge to the performance of the aircraft you are flying, the particular maneuvers to be executed, the scan and control techniques, and the flight conditions in which you are operating. For each maneuver, you will learn what performance to expect and the combination of items that you must interpret in order to control aircraft attitude during the maneuver.

For flight that is not restricted to cockpit references for setting aircraft attitudes, the following flight instruments will comprise the group to be used as "crosscheck" or performance instruments in succeeding chapters:

1. Attitude Gyro
2. Altimeter
3. Vertical Speed Indicator (VSI)
4. Airspeed Indicator
5. Radio Magnetic Indicator (RMI)
6. Turn and Bank Indicator (Turn needle and ball)

NOTE

For a complete discussion of these instruments, refer to the Instruments FTI, Chapter One and NATOPS Section I.

406. SCAN PATTERN

The tool that all pilots must employ to guard against midair collisions is an efficient scan pattern. Division of attention, or scanning, is the "awareness" that a pilot must possess in order to fly his/her aircraft effectively. It is quite obvious that you must:

1. Look outside the airplane to see where you are going.
2. Look at the aircraft with respect to the horizon to check and maintain a desired attitude.
3. Look inside the aircraft at the instrument panel to check for proper power settings, flight instrument readings and for any signs of engine malfunction.

Combined with the diversified attention involved in the fundamental control of the aircraft is the concern that must be devoted to flight safety-avoiding other aircraft. Behind the proper division-of-attention techniques, which you learn in training, lies the foundation for the mandatory alertness of the military pilot.

It might seem that the task of having to be aware of so many events and circumstances at the same time is impossible. However, the ability to do so is an integral part of your flight training and is developed more or less naturally. Of course, as in any endeavor, its development is expedited by a conscientious effort to learn.

In order to divide your attention, your development of an efficient scan pattern will offer the most efficient means by which you can readily ascertain required information and not dwell on any one item with subsequent failure to notice other equally important details.

A scan pattern is a means, or procedure, by which you can observe everything you need to see by starting at one point, moving visually about the aircraft, checking all applicable items systematically and thoroughly and completing the pattern at the starting point. A scan pattern may be started anywhere, but it must be complete and continuous.

What we refer to as the integrated scan involves combining contact flying and flight instruments through a systematic pattern. The task of scanning in contact flying (VMC) involves division of attention between the external and internal environment, setting attitudes with the nose and wings in relation to the horizon and cross-checking them against the instruments in the cockpit. The following scan pattern is a workable example. Figure 4-2, Integrated Scan Patterns, on the next page, gives a pictorial representation of two of the views-outside the cockpit and the Attitude Gyro-that you will use to orient yourself in the air. Figure 4-2 will also be referred to in discussing various basic maneuvers.

1. Outside the cockpit:

- a. Attitude and area - Nose in proper relation to horizon and geographical references for heading and position.
- b. Area - Airspace between nose and left wing clear of hazards.
- c. Attitude - Left wing in proper relation to horizon.

2. Inside the cockpit:

- a. Attitude - Check wings level with RMI and correct nose position with the altimeter and VSI.
- b. Performance - Check airspeed indicator and power setting.

3. Outside the cockpit:

- a. Attitude and area - Nose in proper relation to horizon and geographical references for heading and position.
- b. Attitude - Right wing in proper relation to horizon.

As a beginner, you may crosscheck rapidly by "looking" without knowing exactly what you are looking for, but with increasing familiarity with the maneuvers and experience with the support instruments, you will learn:

What to look for,

When to look for it, and

What response is required.

As proficiency increases, you will scan primarily from habit by adjusting your scanning rate and sequence to the demands of the situation. The scan requirements will vary from maneuver to maneuver, so initially the scanning process will seem new and somewhat unnatural. It cannot be overemphasized, however, that your level of success in flight training will vary proportionately with your ability to force yourself to develop and maintain a correct and expeditious scan pattern.

The entire pattern should take very little time and no one item should fix your attention at the exclusion of another. Meanwhile, corrections have been initiated for any errors detected and the next scan over the pattern will enable you to further correct or perfect your condition of flight.


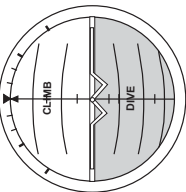

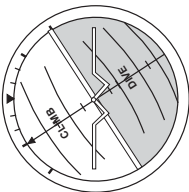

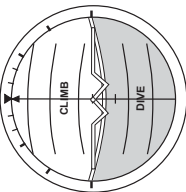

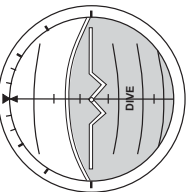

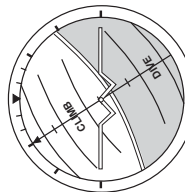
MANUEVER	PRIMARY Relation to Horizon	SECONDARY Attitude Gyro	CROSS CHECKS		PERFORMANCE	ADDITIONAL
			Nose	Wing		
STRAIGHT AND LEVEL			Altimeter VSI	RMI	Airspeed	Turn Needle/ Balance Ball Engine Instruments
URNS			Altimeter VSI	AOB Indexer	Airspeed RMI	Turn Needle/ Balance Ball Engine Instruments
STRAIGHT CLIMB			Airspeed	RMI	Altimeter	Turn Needle/ Balance Ball Engine Instruments
STRAIGHT DESCENT			Airspeed	RMI	Altimeter	Turn Needle/ Balance Ball Engine Instruments
TURNING CLIMB			Airspeed	AOB Indexer	Altimeter RMI	Turn Needle/ Balance Ball Engine Instruments

Figure 4-2 Integrated Scan Patterns

There are other methods of scanning, some of which may be more effective for you than the preceding type. Figures 4-3 and 4-4 illustrate other frequently utilized outside scan patterns.

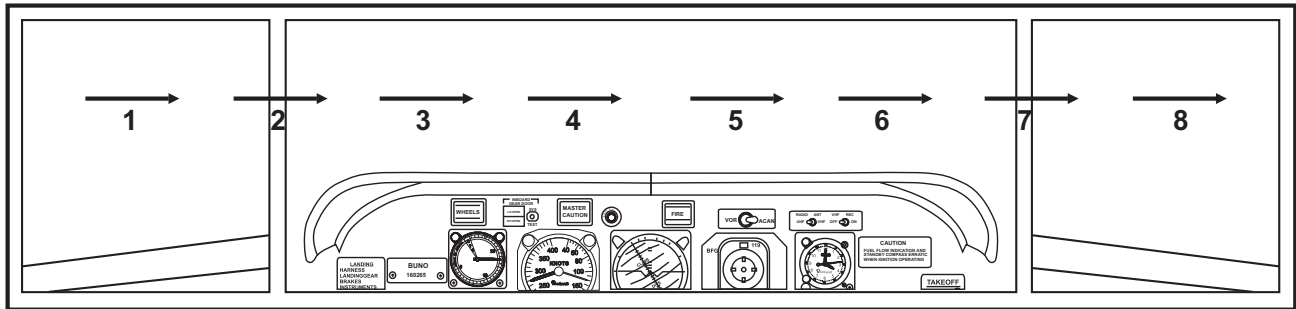


Figure 4-3 Side-to-Side Scanning Method

Start at the far left of your visual area and make a methodical sweep to the right, pausing in each block of viewing area to focus your eyes. At the end of the scan, return to the panel.

An equally effective scan pattern is the front-to-side method illustrated in Figure 4-4. In this pattern, start in the center block of your visual field (center of front windscreen), move to left focusing in each block, then, after reaching the last block on the left, swing quickly back to the center block and repeat the performance to the right. There are no real advantages or disadvantages of one method over the other. Use the technique that works best for you.

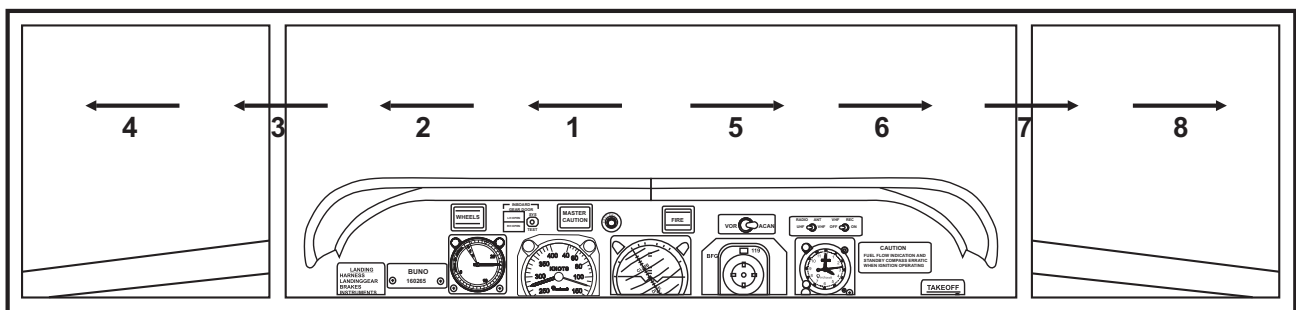


Figure 4-4 Front-to-Side Scanning Method

In order to establish an efficient and useful scan in flight, one also has to establish a good internal (instrument) scan and learn to give each instrument its proper share of time. The amount of time spent scanning outside the cockpit in relationship to inside depends on cockpit workload and traffic density.

Remember, while you are looking at the instruments, the nose attitude and wing position may become erratic, and while you look at the nose position and correct it, the instrument readings may vary. You cannot afford to gaze at any one item for any length of time or the pattern will be broken (this is referred to as "fixating"). Instead, scan each position, initiate corrections, and then check those corrections when you return to that position in the scan pattern. Be alert! Look around! Remember that under you is a blind spot. Never assume that others see you!

407. TURNS

The turn is the most complex of all the basic flight maneuvers. During the turn, coordinated use of all three flight controls is required. Although there are other important considerations, the first requirement for the turn is that balanced flight be maintained.

You will recall that when an airplane is flying straight and level, the total lift is acting perpendicular to the wings and to the earth. As the airplane is banked into a turn, the lift then becomes the resultant of two components. One, the vertical component, continues to act perpendicular to the earth and opposes gravity. The other, the horizontal component, acts parallel to the earth's surface and opposes centrifugal force caused by the turn. These two lift components act at right angles to each other, causing the resultant lifting force to act perpendicular to the banked wings of the airplane. It is this lifting force that actually turns the airplane, not the rudder, as misinformed pilots might believe. These facts are illustrated in Figure 4-5.

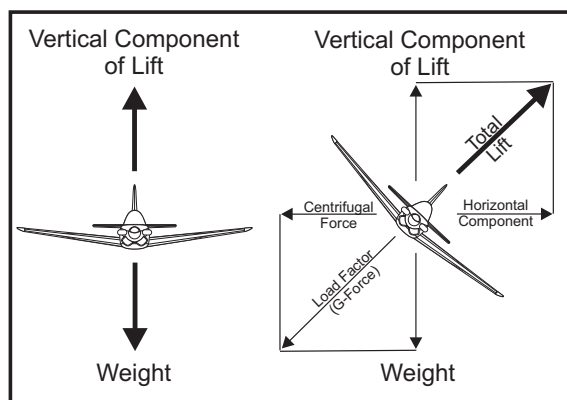


Figure 4-5 Turn-Bank Lift Vectors

When applying aileron to bank the airplane, the depressed or lowered aileron (on the rising wing) produces a greater drag than the raised aileron (on the lowering wing). This increased aileron drag, which is called adverse yaw, tends to yaw the airplane towards the rising wing, or opposite to the desired direction of turn, while the banking action is taking effect. To counteract the yawing tendency, rudder pressure must be applied simultaneously in the desired direction of turn. This produces a coordinated turn.

After the bank has been established in a theoretically perfect turn in smooth air, all pressure on the aileron control may be relaxed. The airplane will remain at the bank selected with no further tendency to yaw since there is no longer a deflection of the ailerons. As a result, pressure may also be relaxed on the rudder pedals, and the rudder allowed to streamline itself with the direction of the air passing it. If pressure is maintained on the rudder after the turn is established, the airplane will tend to skid to the outside of the turn. If a definite effort is made to center the rudder rather than let it streamline itself to the turn, it is probable that some opposite rudder pressure will be exerted inadvertently. This would tend to force the airplane to yaw opposite its original turning path. As a result, the airplane would tend to slip to the inside of the turn. The ball in the turn indicator will be displaced off-center whenever the airplane is skidding or slipping.

In all turns in which a constant altitude is to be maintained, it is necessary to increase the angle of attack by applying back elevator pressure. This is required because the lift produced to equal the weight of the airplane and the centrifugal force caused by the turn must be obtained from the wing to maintain altitude. The force of lift must be further increased as the turn steepens and the centrifugal force builds up, but must be slowly decreased as the airplane is being rolled back to level flight when completing the turn.

To stop the turn, the wings must be returned to laterally level flight by the use of the ailerons, and the resulting adverse yaw (now acting in the same direction as the turn), must be overcome by the coordinated application of rudder. The yaw effect will often be more apparent when rolling out of a turn than rolling into a turn, due to the higher angle of attack and wing loading which exists when the rollout is started.

To understand the relationship between airspeed, bank, and radius of turn, it must be recalled that the rate of turn at any given airspeed depends on the amount of sideward force causing the turn; that is, the horizontal component. The horizontal lift component varies in proportion to the amount of bank. Thus, the rate of turn at a given airspeed increases as the angle of bank is increased. On the other hand, when a turn is made at a higher airspeed for a given bank angle, the centrifugal force created by the turn becomes greater, causing the turning rate to become slower with an increase in radius of turn. It can be seen, then, that at a given angle of bank, a higher airspeed will make the radius of the turn larger because the airplane will be turning at a slower rate.

The inherent positive stability of the T-34C wing has an effect on the manner in which it turns. Turns in the T-34C may be divided into three types: shallow, moderate, and steep.

Briefly, if a shallow angle of bank turn is established and the controls released, the aircraft tends to return to level flight. This may not always occur, because friction in the control surface rigging may cause a very slight control deflection. In a moderately banked turn, if the aileron and rudder pressures are released, the aircraft will tend to stay at the established angle of bank. In a steep angle of bank turn, the aircraft will tend to steepen its bank. The actual amount of angle of bank for each type is undefined and varies with changes in airspeed and configuration.

Figure 4-6 illustrates the explanation of the airplane's overbanking tendency during a steep turn; as the radius of the turn becomes smaller, a significant difference develops between the speed of the inside wing and the speed of the outside wing. The wing on the outside of the turn travels a longer circuit than the inside wing, yet both complete their respective circuits in the same length of time. Therefore, the outside wing must travel faster than the inside wing and as a result it develops more lift. This creates a slight differential between the lift of the inside and outside wings and tends to further increase the bank.

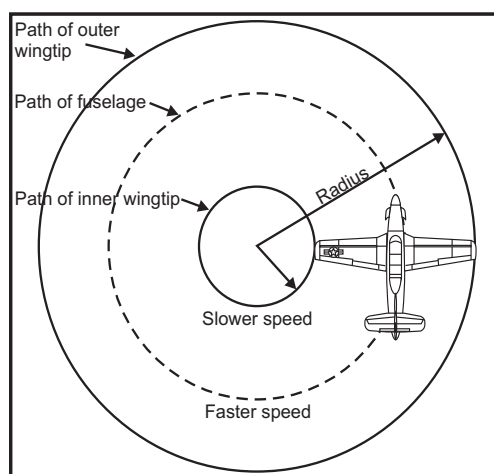


Figure 4-6 Overbanking Tendency

When changing from a shallow bank to a moderate bank, the lift of the outside wing is greater than that of the inside wing. However, in this situation the force created exactly balances the force of the inherent lateral stability of the airplane, so that at a given speed, no aileron pressure is required to maintain that bank. However, as the radius decreases further when the bank progresses from a moderate bank to a steep bank, the lift differential overbalances the lateral stability, and counteractive (opposite) pressure on the ailerons is necessary to keep the bank from steepening.

The pilot's posture while seated in the airplane, particularly during turns, since it will be very important in all maneuvers, affects the alignment of outside visual references. At the beginning the student may lean to the side when rolling into the turn in an attempt to remain upright in relation to the ground rather than "ride" with the airplane. This tendency must be corrected at the outset if the student is to learn to properly use visual references.

As in all maneuvering, the pilot should form the habit of ensuring that the area towards which a turn is to be made is clear of other aircraft. If nearby aircraft are not detected before lowering the wing, it may be too late to avoid a collision.

As soon as the airplane rolls from the wings-level attitude, the nose should also start to move along the horizon, increasing its rate of travel proportionately as the bank is increased. Any variation from this will be indicative of the particular control that is being misused. The following variations provide excellent guides:

1. If the nose starts to move before the bank starts, rudder is being applied too soon.
2. If the bank starts before the nose starts turning, or the nose moves in the opposite direction, the rudder is being used too late.
3. If the nose moves up or down when entering a bank, excessive or insufficient back elevator pressure is being applied.

During all turns, the ailerons and rudder are used to correct minor variations just as they are in straight-and-level flight. However, during very steep turns, considerably more back elevator pressure and trim is required to maintain altitude than in shallow and moderate turns, and additional power may be needed to maintain a safe airspeed. Frequently, there is a tendency for the airplane's nose to lower, resulting in a loss of altitude.

To recover from an unintentional nose-low attitude during a steep turn, the pilot should first reduce the angle of bank with coordinated aileron and rudder pressure. Then back elevator pressure should be used to raise the airplane's nose to the desired pitch attitude. After accomplishing this, the desired angle of bank can be reestablished. Attempting to raise the nose first by increasing back elevator pressure will usually cause a tight descending spiral, and could lead to overstressing the airplane or stall.

408. THE ONE-THIRD RULE

Since the airplane will continue turning as long as there is any bank, the rollout must be started before reaching the desired heading. The amount required to lead the heading will depend on the rate of turn and the rate at which the rollout will be made; however, a good rule of thumb is to start the rollout one-third the number of degrees of angle of bank in use. Example: If a 30° angle of bank turn was being used, the rollout would be started 10° prior to the desired heading. As the wings become level, the control pressures should be gradually and smoothly released so that the controls are neutralized as the airplane assumes straight-and-level flight. As the rollout is being completed, attention should be given to outside visual references as well as the attitude indicator and heading indicator to determine that the wings are being leveled precisely and the turn stopped.

409. BALANCED FLIGHT

Balanced flight basically exists when the aircraft is neither in a slip nor a skid as it progresses along a flight path. With respect to balanced flight, there are two principles of control application:

1. Any control deflection will result in an attitude change until the control is returned to neutral.
2. There is a definite aerodynamic interrelationship between the rudder and aileron to maintain balanced flight.

For an aircraft to be in a balanced flight condition, the controls must be applied so that the longitudinal axis lies in the plane of forward motion. The utilization of either the rudder or the ailerons, independent of one another, will result in a condition of unbalanced flight. The "turn and bank" indicator has a free-rolling ball, which indicates an unbalanced condition by moving away from the center position in the direction of the slip or skid. The pilot can also recognize this condition by an awareness of a sensation of side motion. The side motion causes a tendency to lean in the direction of the slip or skid. This unbalanced condition can be corrected by the proper application of the rudder, ailerons, or both.

1. **Skid.** A skid occurs when the aircraft slides sideways away from the center of a turn. It is caused by too much rudder pressure in relation to the angle of bank used. In other words, if you try to force the aircraft to turn faster without increasing its degree of bank, the aircraft will skid sideways away from its radius of turn. In a turn, the rudder must follow the flight path of the aircraft. If excessive pressure is maintained on the rudder after the turn is established, a skid will result.

A skid may also occur when you are flying in a level flight attitude if the nose of the aircraft is permitted to move sideways along the horizon when the wings are level. This condition would occur when excessive rudder pressures are applied or when the aircraft is improperly trimmed. A skidded turn can develop into a dangerous situation when in close proximity to the ground. Essentially, what occurs is the wing on the inside of a turn is moving slower than the outside wing. Since the slower wing develops less lift during a skid, this compounds the reduction in lift, eventually developing into a stall of one wing. The result: unintentional inverted flight! Figure 4-7 shows both conditions.

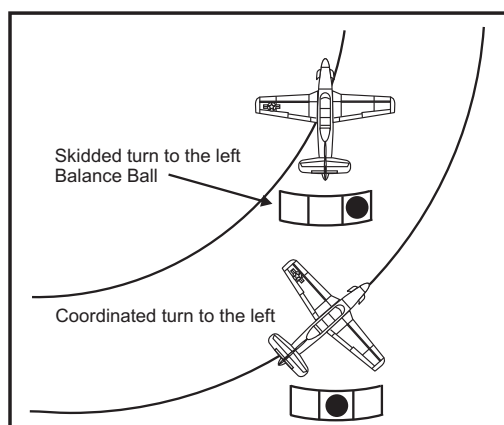


Figure 4-7 Skidded vs Coordinated Turn

2. **Slip.** A slip occurs when the aircraft slides sideways towards the center of the turn. It is caused by an insufficient amount of rudder in relation to the amount of aileron and the angle of bank used. If you roll into a turn without using coordinated rudder and aileron, or if you hold rudder against the turn after it has been established, the aircraft will slide sideways towards its center of turn. A slip may also occur in straight and level flight if one wing is allowed to drag; that is, flying with one wing low, while holding the nose of the aircraft straight by the use of the rudder pressure. In this case, the aircraft slips downward towards the earth's surface and loses altitude. An intentional slip is not a dangerous maneuver. The slip is an acceptable method to safely dissipate excess altitude under certain conditions discussed later in this manual. Any inadvertent tendency to fly in an out-of-balanced flight (either a slip or skid) is **NOT** an acceptable practice.

The flight paths for a coordinated turn and a slipping turn are depicted in Figure 4-8. During a turn, balanced flight is maintained by causing the aircraft to move in a curve at a rate which is in direct proportion to the degree of bank. The angle of bank is established by the coordinated application of ailerons and rudder. The amount of rudder required to establish a turn is

dependent upon the rate at which the angle of bank is established. In other words, rolling into a turn rapidly requires more rudder than rolling into the same turn slowly. This interrelationship is absolute and should be thoroughly understood.

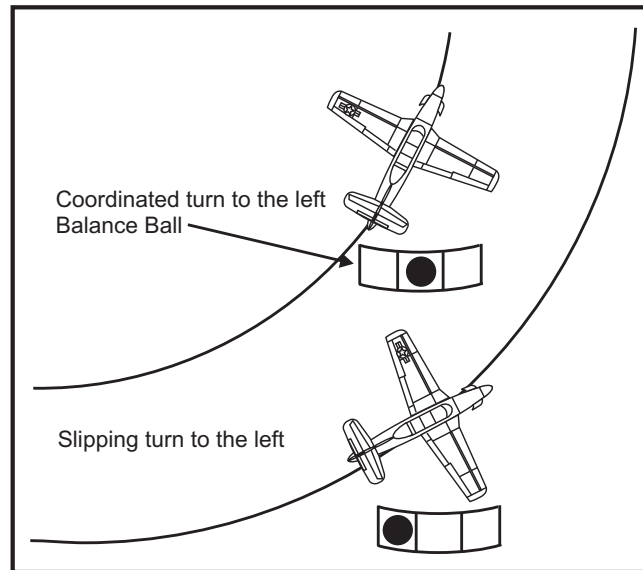


Figure 4-8 Coordinated vs Slip Turn

The overlapping function of the controls provides a safety factor in the control of the aircraft. It is quite possible to fly the plane without the use of one or more controls. For example, suppose that the elevators failed to operate properly. It is possible to control the position of the nose by the use of power. As the power is increased, the nose will rise; as the power is decreased, the nose will drop.

It is also possible to bank the airplane and to turn it without the use of the ailerons. Using only the rudder, the plane can be turned in any desired direction. This use of the rudder will cause the aircraft to yaw or skid in the direction in which the rudder is applied. During the yawing motion, the outside wing moves faster through the air than the inside wing. This increases the lift of the outside wing, causing it to rise, thus producing a bank in the direction in which the rudder is applied. A turn can also be accomplished by using only the ailerons. In this instance, the aircraft will have a tendency to slip before it begins to turn.

The foregoing discussion was given to show the advantage of the overlapping functions of the controls. It must be emphasized, however, that smooth and balanced flight can only be achieved through the proper coordination of all controls. Make it easy on yourself; trim your aircraft.

410. WIND EFFECTS AND CRAB CORRECTIONS

Inasmuch as an aircraft flies in an air mass, any movement of this air mass affects the course of the aircraft. In other words, the path of the aircraft over the ground will be determined not only by the direction in which it is headed, but also by the direction and velocity of the air mass movement. In perfectly still air, for example, the nose of the aircraft points exactly in the same

direction as its path over the ground or, to put it another way, the path of the aircraft through the air and its path over the ground coincide. However, you will notice the aircraft does not always follow a course over the ground in the same direction the nose is pointed.

You have been or will be, at one time or another, flying parallel to a road or section line. The longitudinal axis of the aircraft is aligned perfectly with this road or section line and you are flying a straight and level course. Suddenly, you realize that the aircraft is getting closer to the road or has actually crossed it, without any turn having been made. This would indicate to you that the air in which you are flying is moving in a direction which has caused the aircraft to cross the road at some angle.

Suppose you were flying along straight and level and the wind was blowing 30 knots from a direction 90° to your left. At the end of one hour, the body of air in which you were flying would have moved 30 miles to your right. Since the aircraft was in the body of air, and moving with it, you and the aircraft would also have drifted 30 miles to your right in one hour. Of course, in relation to the air mass itself, you would have moved forward only, but in relation to the ground, you would have moved forward and 30 miles sideways. This effect of the movement of the air on the track of the aircraft is known as drift. The difference between the actual heading of the aircraft and its track over the ground is called the angle of drift. Drift must be compensated for, in order to cause the aircraft to maintain a desired track over the ground. The proper way to correct the drift when you are flying in straight and level flight and wish to follow a desired ground track, is to make a shallow balanced turn into the wind. When you seem to have the drifting effect neutralized or stopped, return to straight and level flight. The aircraft is now pointed into the wind slightly. This causes the aircraft to fly into the wind at the rate that the wind is trying to move it sideways. Since the effect of drift has now been neutralized, the aircraft will fly a straight and selected ground track. The nose of the aircraft, however, is not pointed in the direction of the ground track. This is known as drift correction, and is usually referred to as "crabbing" because the aircraft is moving sideways in relation to the ground. (Figure 4-9).

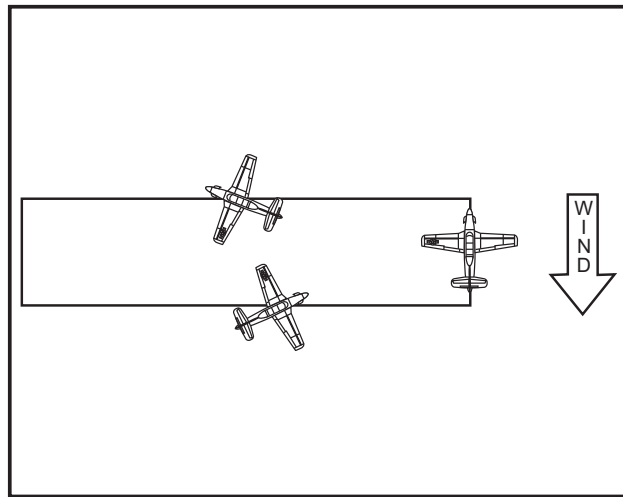


Figure 4-9 "Crabbing" Flight Path

411. CLIMBING FLIGHT

For an automobile to go uphill at the same speed as that being maintained on a level road, the driver must "step on the gas"; that is, power must be increased. This is because it takes more work to pull the car's weight up the hill and to maintain the same speed at which the car was moving along the level road. If the driver did not increase the power, the automobile might still climb up the incline, but it would gradually slow down to a speed slower than that at which it was moving on the level road.

Similarly, an airplane can climb at the cruise power setting with a sacrifice of speed, or it can, within certain limits, climb with added power and no sacrifice in speed. Thus, there is a definite relationship between power, attitude, and airspeed.

When transitioning from level flight to a climb, the forces acting on the airplane go through definite changes. After the addition of power, an increase in lift occurs when back pressure is applied to the elevator control. This initial change is a result of the increase in the angle of attack, which occurs when the airplane's pitch attitude is being raised. This results in a climbing attitude. When the inclined flight path and the climb speed are established, the angle of attack and the corresponding lift again stabilize.

As the airspeed decreases to the climb speed, the downward force of the air striking the horizontal stabilizer becomes less, creating a longitudinally unbalanced condition that produces a tendency for the airplane to nose down. To overcome this tendency and maintain a constant climb attitude, additional back pressure must be applied to the elevator control.

The primary factor which affects an airplane's ability to climb is the amount of excess power available; that is, the power available above that which is required for straight-and-level flight.

During the climb, lift will increase with the flight path, so that it is not directly opposing gravity to support the airplane's weight. With the flight path inclined, the lift is partially acting rearward.

This adverse or retarding lift is termed induced drag. This adds to the total drag. Since weight is always acting perpendicular to the earth's surface and drag is acting in a direction opposite to the airplane's flight path during a climb, it is necessary for thrust to offset both drag and gravity.

As the aircraft continues to climb at a constant angle of attack, torque will drop off as air density decreases. The volume of air entering the induction system gradually decreases, resulting in a pressure reduction within the combustion chamber. Consequently, power decreases. The PCL must be continually advanced to maintain constant power.

412. CLIMBING TURNS

In developing skills to perform climbing turns, the following factors should be considered:

1. With a constant power setting, the same pitch attitude and airspeed cannot be maintained in a bank as in a straight climb, due to the decrease in effective lift during a turn.
2. The degree of bank should be neither too steep nor too shallow. Too steep a bank intensifies the effect mentioned above. If too shallow, the angle of bank may be difficult to maintain because of the inherent stability of the airplane.
3. A constant airspeed, a constant rate of turn, and a constant angle of bank must be stressed. The coordination of all controls is likewise a primary factor to be stressed and developed.
4. The airplane will have a greater tendency towards nose-heaviness than in normal straight climb, due to the decrease in effective lift that is the case in all turns.
5. As in all maneuvers, attention should be diverted from the airplane's nose and divided among all references equally.

All of the factors that affect the airplane during level (constant altitude) turns will affect it during climbing turns or any other turning maneuver. It will be noted that because of the low airspeed, aileron drag (adverse yaw) will have a more prominent effect than it did in straight-and-level flight and more rudder pressure will have to be blended with aileron pressure to keep the airplane in coordinated flight during changes in bank angle. Additional elevator deflection and trim will also have to be used to compensate for centrifugal force and loss of vertical lift, and to keep the pitch attitude constant.

During climbing turns, the loss of vertical lift becomes greater as the angle of bank is increased, so shallow turns must be used to maintain a sufficient rate of climb. If a medium or steep banked turn is used, the airplane will not climb sufficiently.

413. DESCENDING FLIGHT

When the power is reduced during straight and level flight, the thrust needed to balance the airplane's drag is no longer adequate. Due to the unbalanced condition, the drag causes a momentary reduction in airspeed. This decrease in speed, in turn, results in a corresponding

decrease in the wing's lift. The weight of the airplane now exceeds the force of lift so the resulting flight path is downward, with the force of gravity providing the "a" portion of the forward thrust. In effect, the airplane is actually going "downhill."

As in entering a climb, the forces acting on an airplane again go through definite changes when transitioning from level cruising flight to a descent. When forward pressure is applied to the elevator control or the airplane's pitch attitude is allowed to lower, the wing's angle of attack is decreased, the lift is reduced, and the flight path starts downward. The initial reduction of the lift, which starts the airplane downward, is momentary. When the flight path stabilizes, the angle of attack and lift stabilize.

414. THE P.A.T. PRINCIPLE

For corrections and to execute many maneuvers you must:

1. Reset power
2. Adjust the nose attitude
3. Retrim for the new attitude

The mechanics of the transitions will be performed in a specific sequence:

1. **P** ower
2. **A** ttitude
3. **T** rim

Although power and attitude change are almost simultaneous, lead with PCL movement. For example, consider the transition to an enroute descent. Reduce power from normal cruise to the descent power setting, scanning the nose attitude. As the power is retarded, lower the nose towards a descending attitude. Finally, trim the aircraft.

NOTE

The power may not be exactly the descent power setting, since it was initially reduced using peripheral vision. Power is then reset to exactly the descent power setting after completing P.A.T. Remember - Power, Attitude, Trim; reset Power, reset Attitude, reset Trim.

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CHAPTER FIVE

GROUND PROCEDURES

500. INTRODUCTION

This chapter discusses the basic procedures and techniques essential to the safe operation of the airplane on the ground prior to and after a flight. This includes the major points of ensuring that the airplane is in an airworthy condition, starting and stopping the engine and taxiing the airplane to and from the line area and the runway.

In the line area, there is usually considerable activity - aircraft may be operating at high power settings, taxiing in and out of the area, taking off and landing on nearby runways; fuel trucks and people may be moving about the aircraft. Consequently, constant vigilance must be exercised at all times while performing ground operations.

The propeller is the most dangerous part of the airplane, since under certain light conditions, it is difficult to see a revolving propeller. This may give the illusion that it is not there. As a result, the files of Aviation Safety Offices contain many cases that read, "Victim walked into a rotating propeller."

While approaching the airplane, the pilot should note the presence of obstructions and articles such as fire extinguishers, fueling or maintenance equipment or chocks that could be a hazard when taxiing the airplane.

The accomplishment of a safe, productive flight begins with a careful visual inspection before the pilot enters the airplane. In addition, a planned routine of starting, Taxiing, Runup and Before-Takeoff Checklists will assure that the airplane is operating properly while there is still an opportunity to correct any discrepancy which may appear. When well organized, these checks can be made quickly and soon will become a matter of habit; the airplane will become familiar and anything unfamiliar will alert the pilot that something is not as it should be.

The use of appropriate checklists to inspect and start the airplane, as well as for other ground checks and procedures, is mandatory. Checklists are guidelines for use to ensure that all necessary items are checked in a logical sequence. The beginning pilot should not get the idea that a checklist is merely a crutch for poor memory - even the most experienced professional pilots never attempt to fly without an appropriate checklist. The NATOPS Manual for each model of aircraft flown by the Navy contains all appropriate checklists for that aircraft.

501. CONTACT 1001

1. Description. N/A

2. General. Prior to your first flight, there are several fundamental topics that you, as a student aviator, must be aware of and understand if you are to obtain maximum benefit from your primary training. Make your initial appearance, and each succeeding appearance before your instructor, a good one. Bear in mind that military courtesy and discipline are important factors in your training and will continue to be so as long as you are a member of the military service.

You will be required to wear your flight gear to this event, since it will be inspected by your instructor. Your flight gear should include the following items:

- a. Flight suit
- b. Flight boots
- c. Flight gloves
- d. Helmet
- e. Dog tags (two worn around the neck)
- f. Kneeboard and checklists
- g. NATOPS Pocket Checklist

Additionally, an oxygen mask and survival gear will be required. Your instructor will show you where these are issued. You will be required to obtain these prior to each flight (IAW local procedures).

3. **Procedures.** Discuss with the instructor all of the preflight/postflight items listed under Contact in the MPTS Curriculum.

4. **Common Errors**

Failure to know Preflight/Postflight procedures.

502. PREFLIGHT PLANNING/BRIEFING

Prior to each flight, you will be scheduled for a brief (discussion) for that flight with your instructor. The Instructor Pilot (Pilot in Command) is responsible to perform and/or delegate preflight planning for the flight (i.e., weight and balance, fuel planning, obtaining weather brief, and filing flight plan as necessary). You will assist as directed, reporting results and noting any discrepancies. In later stages of training, you will be tasked with increasing responsibilities with preflight planning. During the brief, the instructor will expect you to know the procedures for the maneuver to be flown, along with any "discuss" items listed in the Multi-Service Pilot Training System Curriculum. He will also brief the conduct of the flight in accordance with the NATOPS briefing guide found on the back of the NATOPS Pocket Checklist. Appendix B provides more details for each area of that brief. You are encouraged to ask questions. **Do not go flying with an unanswered question on your mind.**

1. **Emergency Procedures/Discussed Items**

The MPTS Curriculum lists all maneuvers and items to be discussed for each flight. You should be prepared to answer in depth any item listed under discussion. Ensure that you refer to any and all available resources when you are studying a particular item. For example, the FTI, T-34C NATOPS Manual, Aeronautical Information Manual (AIM) and many ground school texts all contain information germane to your studies. Your instructor may quiz you on each discussion/demonstration and introduction item for that flight. Additionally, he/she may ask you

5-2 GROUND PROCEDURES

about any maneuver previously introduced or any subject general in nature to the T-34C (systems, limitations, etc.). The MPTS Curriculum also has a listing of all emergency procedures to be discussed for each flight. Section V of the T-34C NATOPS Manual lists these procedures.

2. **Headwork, Procedures, and Basic Airwork**

- a. **Headwork** - The ability to understand and grasp the meaning of instructions, demonstrations, and explanations; the facility of remembering instructions from day to day, the ability to plan a series or sequence of maneuvers or actions, the ability to foresee and avoid possible difficulties and the ability to remain alert and spatially oriented.

Headwork is the instructor's evaluation of the student's situational awareness (SA), and his or her ability to effectively manage the aircrew responsibilities. An example of a measure of headwork is whether the student remembers to "aviate, navigate, communicate" in the correct order. Another measure of headwork is whether the student is able to effectively communicate his or her SA. Headwork is purely a subjective item, and the student should never question the instructor's assessment of his or her headwork.

- b. **Procedures** - The demonstrated knowledge of the sequential actions required to perform the curriculum maneuvers and actions. Procedures is simply an instructor's evaluation of the SNA's ability to recall and/or apply the correct procedures to any situation. This may include emergency procedures, or such things as Instrument, Gas and Position (IGP) reports. It may also include compliance to course rules or squadron SOP. Procedures is a fairly straightforward item. Grades other than average are normally given only in exceptional cases where students are not able to recite or apply basic procedures correctly, or when a student demonstrates unusually high competence (strive to be in the latter category).
- c. **Basic Airwork** - Demonstrated technique and mastery of the power and flight controls to obtain the desired attitude, heading, airspeed and altitude consistently through a range of maneuvers.

503. **PREFLIGHT INSPECTION**

1. **Description.** N/A

2. **General.** The pilot who accepts an airplane for flight is in effect the commanding officer of that plane and is responsible for the efficient operation and safety of the aircraft, its equipment and its crew. Prior to every flight, a thorough preflight inspection must be performed.

A poor preflight may easily result in an embarrassing, if not dangerous, situation. Any pilot who thinks that there is a possibility that a discrepancy exists which would make the aircraft unsafe for flight should "down" the plane, inform maintenance of the trouble, and write a thorough and

comprehensive description of the trouble on the Maintenance Action Form (MAF).

Each pilot, in signing the aircraft acceptance form ("A-Sheet") prior to the flight, acknowledges acceptance of the aircraft in a satisfactory, safe-for-flight condition. He should always keep in mind that mistakes are sometimes made even by the most competent mechanics. The pilot must, therefore, make his inspection accordingly. **Under no circumstances is a pilot required to accept an airplane unless it is satisfactory for flight operations in all respects.**

Regardless of the number of items you check on a preflight, you will forget something unless you follow a systematic pattern each time. For this reason, the Preflight procedure published in NATOPS shall be used by all pilots.

3. **Procedures.** As you approach your aircraft, notice its position and the position of adjacent aircraft in relation to the yellow parking spots. An aircraft parked too far off the spots may have insufficient taxi clearance. Also note the position of fire bottles and other obstructions in relation to the path of your aircraft as you leave the chocks. Although a signalman will taxi you out, you have the final responsibility to see that the aircraft clears all obstructions. Climb up on the port wing, place your helmet on the starboard canopy rail and connect your radio cords and oxygen hose. You are now ready to commence the preflight inspection in accordance with section III of the T-34C NATOPS and will be expected to know nomenclature for all visible aircraft and engine components. Notify the other crew member of any problem areas discovered during the preflight inspection and if any corrective action has been taken/initiated, if necessary.

4. **Common Errors**

- a. Taking too much time. Do not rush, but by the same token, move along.
- b. Pushing/pulling on the trim tabs, static wicks. Check, using only a slight amount of pressure.

504. **"STRAPPING IN"**

1. **Description.** N/A

2. **General.** Upon completion of the preflight inspection, your instructor will show you how to enter the cockpit (take care not to step on the canopy rail). Don your parachute, fasten and adjust the harness to ensure a snug fit.

Each time you fly, your seat position should be the same. The seat adjustment lever is located on the starboard side of the seat. When sitting straight in the seat, line up the front edge of the instrument glare shield with the upper part of the instrument panel, so that the warning lights are just visible. If not, lower the seat to obtain the proper clearance. Once the seat is properly adjusted, secure the shoulder harness and lap belt. Adjust the rudder pedals so that you can get full forward throw of either pedal with the corresponding brake fully depressed without locking your knees.

505. PRESTART CHECKLIST

1. **Description.** N/A
2. **General.** The checklists will be conducted in the challenge-action-response format. This means that you state the challenge, take the required action, and then make the appropriate response. These items comprise a systematic check of the cockpit, starting from the left and working around the cockpit to the right.

NOTE

If the noise level is high in the line area, close your canopy slightly so you do not have to shout.

3. **Procedures.** The checklist will be conducted in accordance with NATOPS.
4. **NACWS Ground Test Operation**

During the Pre-Taxi Checklist the pilot tests six basic NACWS items to ensure normal operation in the air. These include:

- a. Pictorial Display. Check that all characters are present.
- b. Altitude reads within plus or minus 125 feet of barometric altitude.
- c. Heading is plus or minus five degrees from that indicated on the RMI.
- d. Distance Measuring Equipment (DME) is working.
- e. Twelve traffic advisory tones in a two-second period.
- f. The "CWS Test Passed" message is broadcast over ICS.

5. Common Errors

- a. Missing items on checklist
- b. Taking too much time/rushing checklist

506. STARTING PROCEDURE

1. **Description.** N/A
2. **General.** After completion of the Prestart Checklist, ensure the prop area is clear and that a plane captain with a fire extinguisher is stationed forward of the wing. While holding the

brakes, start the sweep second hand on the clock. Next, switch the starter to "ON" (check voltage for minimum of 10 volts, ignition light on, fuel pressure light out, oil pressure indicated and monitor N_1 .)

When N_1 reaches 12%, move the condition lever out of the FUEL OFF position to the "feather" (FTHR) position. Monitor Interstage Turbine Temperature (ITT) and N_1 for start indications (light off). Periodically scan the lineman in case of a fire indication. A rise in ITT should be indicated within ten seconds and should not exceed 925° for more than two seconds on light off. Secure the starter switch when N_1 reaches 60% RPM. Check the oil pressure for 40 psi minimum and check N_1 for 62-65%.

NOTE

Idle RPM (N_1) as low as 60% is acceptable, but should be reported to Maintenance after the flight. Idle RPM above 65% (or below 60%) is a downing discrepancy.

CAUTION

Do not introduce fuel before N_1 reaches 12% or if N_1 begins to decrease. Start attempts with a weak battery are likely to cause over-temperature damage to the engine. Use a Ground Power Unit (GPU) if the starter is unable to produce at least 12% N_1 under battery power.

If a GPU was used, signal the plane captain to disconnect it. Place the condition lever to full increase (INCR) and indicate a normal start to the plane captain by giving a "thumbs-up." Check the generator annunciator light out and voltmeter indicating 27.0 - 29.5 volts; reset the generator only if the annunciator light remains on. Turn the inverter switch to number 2 then number 1, checking the inverter annunciator light out in both positions. Remain on number 1 inverter.

When ready to taxi out of the chocks (wait for the attitude gyro "OFF" flag to disappear), hold the brakes, release the parking brake by pushing the parking brake knob in, then signal the plane captain to remove the chocks. When given the "release brakes" signal, smoothly release brake pressure and allow the aircraft to move ahead slowly. When signaled, apply the brakes for a brake check, then pass control of the aircraft to the instructor to complete a brake check and follow the plane captain's signals for positioning the aircraft. Your instructor will then pass control of the aircraft back to you and you will complete the Pre-Taxi Checklist (TW-5) or taxi to the pre-taxi area (TW-4).

NOTES

1. Beta should not be used in close proximity to ground personnel.
2. Watch lineman while chocks are being removed.

3. Common Errors

- a. Failure to place condition lever in "FEATHER," instead placing it beyond.
- b. Failure to give thumbs-up to plane captain after good start.
- c. Fixating on one instrument (i.e., oil pressure) thereby failing to monitor all aspects of the start sequence.
- d. Failure to ensure positive change of controls during brake checks.
- e. Failure to adhere to lineman's signals.

507. TAXIING

1. **Description.** Taxiing is the controlled movement of the aircraft on the ground under its own power. Speed is controlled by the PCL; direction is controlled by rudder, augmented as necessary by brakes.

2. **General.** Since an airplane must be moved under its own power between the line area and the runway, the pilot must thoroughly understand Taxi procedures and be proficient in maintaining positive control of the direction and speed of movement on the ground. In addition, the pilot must be alert and visually check the location of everything along the taxi path.

An awareness of other aircraft which are taking off, landing, or taxiing, is essential to safety. Persons, "yellow gear," fuel trucks and fire bottles are among some of the most common hazards associated with an airport. When taxiing, the pilot must continually scan the entire forward area from wingtip to wingtip. **If at any time there is doubt about wingtip clearance, stop until the situation is resolved!!**

NOTE

Ultimate responsibility for the safe operation of an aircraft lies with the pilot!!

It is difficult to set any rule for a safe taxi speed. What is safe under some conditions may be hazardous another time. The primary requirement for safe taxiing is SAFE, POSITIVE CONTROL of the aircraft. A general "rule of thumb" is to taxi no faster than a person can walk when within the line area and no faster than a person can trot when outside the line area. Local course rules may determine right-of-way rules, but if ever in doubt - **STOP!**

Prior to taxiing, check the immediate area clear of personnel and obstructions. Also check the taxiway clear in both directions for other aircraft, fuel trucks, etc. Keep your left hand on the PCL and your right hand on the stick when taxiing. To initiate the taxi, slowly release the brakes, selecting BETA range as necessary to control taxi speed. On rare occasions, power in excess of idle may be required; most likely this will occur when taxiing uphill into the wind. Downwind or downhill taxiing will generally require full BETA in order to taxi at a safe speed. Use brakes as necessary to slow down during cases such as these.

Prior to any turns, slow the aircraft down. Otherwise the turn radius will be exaggerated. Excessive speeds in a turn may cause a hazardous situation. An uncontrollable swerve and possibly a ground loop is a real possibility. Very sharp turns or fast turns exert excessive strain on tires and landing gear.

When taxiing at normal speeds during no-wind conditions, the aileron and elevator have little or no effect on directional control. The rudder is the primary directional control to taxi. Steering with the pedals is possible by slipstream forces acting on the empennage (tail). When taxiing crosswind, the aircraft has a normal tendency to "weathervane" or "weathercock" into the wind.

This is caused by the wind striking the tail surface, which has a long moment arm from the center of the turn radius. The wind forces the tail of the aircraft downwind, which turns the nose into the wind. Deflecting the aileron into the wind will help to minimize this tendency by spilling the air from under the wing.

Initially, taxiing the T-34C may be a humbling experience. It will take coordinated use of power, BETA, rudder, and moderate brake pressure to properly maintain directional control and speed simultaneously. The feet should be positioned with the arches placed on the rudder pedals and the toes near but not quite touching the brake portion of the pedals. This permits the simultaneous application of rudder and brake whenever needed. Avoid tensing the feet and riding the brakes. The brakes are used primarily to stop the airplane, slow it down and augment the turn as necessary. When applying the brakes, use a smooth, even application. When initiating forward movement, power slightly greater than idle may be required. To turn in confined quarters, additional power may also be necessary, as you will need the inboard brake to shorten the turn radius.

A normal turn is initiated by applying full rudder in the direction of turn augmenting with brake as necessary. Lead the rollout with opposite rudder and corresponding brake. Stop the aircraft using BETA and brakes. Return the PCL to IDLE after coming to a complete stop. On wet surfaces, braking action will be poor; therefore, extreme care should be used to avoid locking one brake. If, at any time, brake action is not effective, maintain directional control with rudders and remaining brake. Use BETA to aid in deceleration, signal for chocks and follow the NATOPS Emergency procedures.

Taxiways have a single, yellow line painted down the middle. Taxi with the nose wheel on this line. This will ensure a safe taxi clearance from fixed objects such as buildings. However, total responsibility for obstruction clearance still rests with the pilot.

NOTE

During all taxi operations, aircraft in the line area shall use the appropriate yellow line.

Runup areas will be in accordance with local course rules. Taxi into the runup area and stop the aircraft with the nose wheel pointed straight ahead. The runup will normally be made in accordance with local course rules.

5-8 GROUND PROCEDURES

3. Common Errors

- a. Riding the brakes.
- b. Not applying full rudder to turn.
- c. Not leading rollout (with opposite rudder).
- d. Not placing PCL to IDLE when aircraft has stopped.

508. TAXI SIGNALS**1. Description.** N/A

2. General. In addition to learning taxiing techniques, all pilots must memorize the standard hand signals used by plane captains in the line area. Refer to the NATOPS Manual part VII, chapter 19, for the appropriate hand signals.

509. GROUND RUNUP CHECKLIST**1. Description.** N/A

2. General. Engine checks are performed prior to each flight to determine the relative condition of the engine. These checks do not guarantee proper operation. They merely check for some of the more frequent causes of engine malfunction.

3. Procedures. The checklist will be conducted in accordance with NATOPS.

CAUTIONS

In event of inadvertent engine shutdown during the feather check, do not advance the condition lever. Forward movement of the condition lever immediately after engine shutdown can result in severe engine over-temperature damage. The pilot shall monitor engine instruments for normal shutdown and perform Abnormal ITT During Shutdown procedure if required.

Selection of feather with the PCL in Beta range may result in over-temperature and/or flameout. Indications of this condition include rising ITT and decreasing N_1 (towards 40%) and decreasing fuel flow. In event of inadvertent selection of feather with PCL in Beta range, the pilot shall perform the "EMERGENCY ENGINE SHUTDOWN" procedure.

4. Common Errors

- a. Omitting items from the checklist.
- b. "Looking but not seeing" - calling an item checked/set when in fact it is not.

510. TAKEOFF CHECKLIST

1. **Description.** N/A
2. **General.** Check and report each item on the Takeoff Checklist to your instructor while in the runup area. The importance of the Takeoff Checklist as a safety factor cannot be overemphasized. You will occasionally hear of pilots who take off with improper trim tab settings or other circumstances that contribute to accidents. This is invariably due to carelessness and haste in completing the checklist.
3. **Procedures.** Complete the checklist in accordance with NATOPS.
4. **Common Errors**

Omitting items from checklist.

511. POSTLANDING CHECKLIST

1. **Description.** N/A
2. **General.** Once clear of the duty runway, switch to Ground Control in accordance with local course rules and complete the Postlanding Checklist. It is important not to get anxious during the landing rollout. Do not start the checklist until clear of the duty runway.
3. **Procedures.** After clearing the runway, switch to Ground Control and complete the checklist in accordance with NATOPS.
4. **Common Errors**
 - a. Switching to Ground Control or Starting Checklist prior to clearing duty runway.
 - b. Omitting items on checklist.
 - c. Forgetting to note the land time.

512. ENGINE SHUTDOWN CHECKLIST

1. **Description.** N/A
2. **General.** Once clear of the duty runway, taxi in accordance with course rules to the appropriate spot. Once the aircraft is stopped, focus your attention to the side of the aircraft that the lineman is on. This will allow you to detect movement of the aircraft, especially at night. Maintain the PCL at idle until the plane captain has signaled the chocks are in place. Then, acknowledge the plane captain and perform the Engine Shutdown Checklist in accordance with NATOPS.
3. **Procedures** (in accordance with NATOPS)

4. Common Errors

- a. Starting checklist prior to acknowledging plane captain.
- b. Securing strobe lights/battery prior to prop stopping.

513. POSTFLIGHT CHECKS

1. **Description.** Checks conducted upon leaving the aircraft.
2. **General.** This inspection is designed to discover airborne damage or any discrepancies so that the necessary maintenance work may be performed promptly, with little or no delay of the aircraft going out on the next flight.
3. **Procedures.** (in accordance with NATOPS)
4. **Common Errors**
 - a. Failing to perform walk-around inspection
 - b. Omitting items from the checklist

514. ALDIS LAMP SIGNALS

Aircraft with radio failure should observe the tower for light signals to obtain clearance to taxi, takeoff, land, etc. Acknowledge signals in the daytime by movement of ailerons or rudder on the ground and by rocking wings in the air. Acknowledge signals at night by flashing aircraft lights. Aldis lamp signals (Figure 5-1) from an airport traffic control light gun have meanings as indicated. For additional information concerning lost communication procedures, refer to the local course rules manual

COLOR AND TYPE OF SIGNAL	ON THE GROUND	IN FLIGHT
STEADY GREEN	CLEARED TO TAKEOFF	CLEARED TO LAND
FLASHING GREEN	CLEARED TO TAXI	RETURN FOR LANDING (followed by steady green at the proper time)
STEADY RED	STOP	GIVE WAY TO OTHER AIRCRAFT AND CONTINUE CIRCLING
FLASHING RED	TAXI CLEAR OF RUNWAY	DO NOT LAND
FLASHING WHITE	RETURN TO STARTING POINT ON AIRPORT	NOT USED INFLIGHT
ALTERNATING RED AND GREEN	GENERAL WARNING SIGNAL. EXERCISE EXTREME CAUTION	GENERAL WARNING SIGNAL. EXERCISE EXTREME CAUTION
RED PYROTECHNIC	NOT USED ON THE GROUND	NOTWITHSTANDING ANY PREVIOUS INSTRUCTIONS, DO NOT LAND. WAVE OFF IMMEDIATELY!

Figure 5-1 Aldis Lamp Signals

CHAPTER SIX

FLIGHT PROCEDURES

600. INTRODUCTION

This chapter discusses the basic procedures and techniques that you will practice at the beginning of your contact training. These basics will form the foundation of your ability to fly the aircraft and to later perform advanced maneuvers. You will learn to takeoff, fly straight and level, turn, climb and descend and even to stall and spin the aircraft. While some of these maneuvers, such as Straight-and-Level Flight, may seem simple, they all require strict adherence to the procedures contained in this chapter. In order to successfully learn to accomplish these maneuvers in the small amount of time that you will be airborne, it is essential that you commit these procedures to memory prior to strapping into the aircraft. If you do not know the procedures on the ground, you will not be able to perform them in the air. Some procedures, such as the Spin, require extra care and preparation due to the dynamic and possibly disorienting nature of the maneuver.

601. CONTACT FLIGHT TERMINOLOGY

FAST CRUISE	170 KIAS (clean) Power as required (approx. 750-800 ft-lbs.)
NORMAL CRUISE	150 KIAS (clean) Power as required (approx. 600-650 ft-lbs.)
SLOW CRUISE	120 KIAS (clean) Power as required (approx. 450-500 ft-lbs.)
NORMAL CLIMB	120 KIAS (clean) Max allowable power (1015 ft-lbs/695°C) Attitude: cowl seam on horizon
ENROUTE DESCENT	Normal cruise airspeed, 150 KIAS Power 300 ft-lbs.
FAST CRUISE ENROUTE DESCENT	Fast cruise airspeed, 170 KIAS Power 300 ft-lbs
DOWNWIND CONFIGURATION	100 KIAS, gear down, flaps up Power as required (500-550 ft-lbs.) Landing lights ON
LANDING APPROACH CONFIGURATION (LAC)	90 KIAS, gear down, flaps down Power as required (approx. 600 ft-lbs.) Landing lights ON

MAX ALLOWABLE POWER

Torque set to 1015 ft-lbs.,
monitor ITT so as not to exceed 695° C
Prop RPM 2200±25

WINGTIP DISTANCES

One wingtip	–wingtip
$\frac{3}{4}$ wingtip	–outboard aileron hinge
$\frac{2}{3}$ wingtip	–middle aileron hinges
$\frac{1}{2}$ wingtip	–fuel cap
$\frac{1}{3}$ wingtip	–fuel cell access panel inboard of fuel cap
$\frac{1}{4}$ wingtip	–between wing root and fuel access panel (also the double row of rivets)

602. INSTRUMENT, GAS AND POSITION REPORTS

Instrument, fuel (gas) and position (IGP) reports will be performed at least every 15-20 minutes during all flights. The student will check all engine instruments for normal indications, the purpose of which is the early detection of any engine malfunction. The fuel quantity in each tank is checked in order to detect excessive fuel consumption or uneven fuel flow. Determine your position by reference to checkpoints on the ground, preferably a paved runway. It is of vital importance that the student be aware of his or her position at all times during the flight. If unsure of prominent landmarks during early stage Contact flights, ask your instructor to point them out.

The following is an example of the IGP report:

"Engine instruments normal, fuel is 250 lbs. left tank, 250 lbs. right tank and our position is _____."

603. ASSUMING CONTROL OF THE AIRCRAFT

It is critical to flight safety that a pilot be at the controls of the aircraft at all times. A misunderstanding between two pilots as to who is actively controlling the aircraft could become a causal factor in a mishap. Therefore, you must be knowledgeable of the procedures involved in transferring controls. Throughout your flying career, you will fly with many pilots of various experience levels and backgrounds. To avoid miscommunication, all pilots transfer the controls the same way, regardless of platform.

Either pilot may initiate a change in control of the aircraft. It shall be accomplished by means of a positive three-way exchange using the word "controls."

NOTE

Do not use the words "it," "aircraft," or "command" to refer to the controls.

6-2 FLIGHT PROCEDURES

For example, the instructor may initiate by telling you over the ICS, "I have the controls." You will then acknowledge by saying over the ICS, "You have the controls." You will then take your hands and feet off the controls and your instructor will confirm he has control by saying, "I have the controls."

When your instructor wants you to take control, he will say, "You have the controls," whereupon you will take control and acknowledge by saying over the ICS, "I have the controls." Your instructor will complete the three-way exchange with, "You have the controls."

Stay on the controls and keep flying the aircraft until you are told to do otherwise. Never be in doubt as to who is doing the flying. Always fly as if you are flying solo unless you know that the instructor has control. The important thing is that a "demand and reply" series of responses is used so that there is no question as to who is flying.

604. COMMUNICATIONS

Proper radio communication techniques are extremely important to safety when operating in controlled airspace or the vicinity of other aircraft. You should read and learn the basic communication terminology/procedures explained in Appendix A. These procedures will be used throughout your aviation career. Appendix C contains information on the NATOPS briefing required before every flight.

605. NORMAL TAKEOFF

1. **Description.** Takeoff is the movement of the aircraft from its starting point on the runway until it leaves the ground in controlled flight.
2. **General.** Since the takeoff requires both ground and in-flight operation, you must learn to use the controls during the transition from ground movement to airborne flight with maximum smoothness and coordination. Skill in blending these functions will improve your ability to control the airplane's direction of movement on and from the runway. The takeoff itself, although a relatively simple maneuver, often presents the most hazardous part of a flight. Accident statistics show that takeoff accidents, although slightly less frequently occurring, are much more tragic than landing accidents.

Takeoffs should always be made as nearly into the wind as practical. The airplane depends on airspeed in order to fly. A headwind provides some of that airspeed, even with the airplane motionless, by reason of wind flowing over the wings. The aircraft's groundspeed will be less with a headwind and greater with a tailwind. Not only is a lower groundspeed safer, it reduces wear and stress on the landing gear and results in a shorter ground roll. Therefore, much less space is required to develop the minimum lift necessary for takeoff and climb.

Although the takeoff and climb process is one continuous maneuver, it will be divided into three separate steps for purposes of explanation:

- a. **Takeoff roll** - That portion of the Takeoff procedure during which the airplane is accelerated from a standstill to an airspeed that provides sufficient lift for it to become airborne.
- b. **Liftoff** - The act of becoming airborne as a result of the wings lifting the airplane off the ground or the pilot rotating the nose up, increasing the angle of attack to start a climb.
- c. **Initial climb after becoming airborne** - Initial climb begins when the airplane leaves the ground and a pitch attitude has been established to climb away from the takeoff area. Normally, initial climb is considered complete when the airplane has reached a safe maneuvering altitude and the departure from the airport commences in accordance with the local course rules.

The use of maximum allowable power, even though it may appear that conditions do not require it, is used for every takeoff. There is little or no advantage in using reduced power. Reduced power would be the equivalent of starting the takeoff at a point well down the runway. Reduced power not only lengthens the takeoff roll but also increases wear on the tires.

The PCL should always be advanced smoothly and continuously to prevent any sudden swerving. An abrupt application of power may cause the airplane to yaw sharply to the left because of the torque and propeller slipstream.

Initially, no pressures on the elevator control are necessary beyond those needed to steady it. Applying unnecessary pressure will only aggravate the takeoff and prevent the pilot from recognizing when pressure is actually needed to establish the takeoff attitude.

As speed is gained (approximately 30 - 40 knots), the elevator control will tend to assume a neutral position if the airplane is correctly trimmed. At the same time, directional control should be maintained with smooth, prompt, positive rudder corrections throughout the takeoff roll. The effects of torque or P-factor at the initial speeds tend to pull the nose to the left. The pilot must use whatever rudder pressure is needed to correct for these effects or for existing wind conditions to keep the nose of the airplane headed straight down the runway. The use of brakes for steering purposes is to be avoided, since they will cause slower acceleration, lengthen the takeoff distance, and possibly result in severe swerving.

While the speed of the takeoff roll increases, more and more pressure will be felt on the flight controls, particularly the elevators and rudder. Since the tail surfaces receive the full effect of the propeller slipstream, they become effective first. As the speed increases, all of the flight controls will gradually become effective enough to maneuver the airplane about its three axes. It is at this point (approximately 50 knots) in the taxi-to-flight transition that the airplane is being flown more than taxied. As this occurs, progressively smaller rudder deflections are needed to maintain direction.

The feel of resistance to the movements of the controls, as well as the airplane's reaction to such movements, are the only real indicators of the degree of control attained. This feel of resistance is not a measure of the airplane's speed, but rather of its controllability. To determine the degree of controllability, the pilot must be conscious of the reaction of the airplane to the control pressures and immediately adjust the pressures as needed to control the airplane.

Since a good takeoff depends on the proper takeoff attitude, it is important to know how this attitude appears and how it is attained. The ideal takeoff attitude is one which requires only minimum pitch adjustments shortly after the airplane lifts off to attain the speed for the desired rate of climb.

When all the flight controls become effective during the takeoff roll (approximately 80 knots) back elevator pressure should be applied gradually to raise the nose wheel slightly off the runway, thus establishing the takeoff or liftoff attitude. This is often referred to as "rotating." The wings must be kept level by applying aileron pressure as necessary. Coordinate right rudder as necessary during rotation. Left yaw should be compensated by right rudder - not aileron. Pilots of propeller driven aircraft are usually required to input a certain amount of right rudder to offset gyroscopic slip-stream (the swirling air from the prop hitting the left side of the horizontal stabilizer) and other factors during the takeoff roll to hold centerline. The other force holding the aircraft on centerline is the friction between the tires and the runway. At rotation, this friction is lost and P-factor adds to the left nose yaw tendency of the aircraft. As the nose yaws left, the tendency is to apply right wing down to counter and maintain centerline. What is really needed is right rudder at rotation to maintain wings level, centerline, and balanced flight (centered ball).

The airplane should be allowed to fly off the ground while in this normal takeoff attitude (approximately 80-85 knots). Forcing it into the air by applying excessive back pressure would only result in an excessively high pitch attitude and may actually delay the takeoff. As discussed earlier, excessive and rapid changes in pitch attitude result in proportionate changes in the effects of torque, thus making the airplane more difficult to control.

Although the airplane can be forced into the air, this is considered an unsafe practice and must be avoided under normal circumstances. If the airplane is forced to leave the ground by using too much back pressure before adequate flying speed is attained, the wing's angle of attack may be excessive, causing the airplane to settle back to the runway or even to stall. On the other hand, if sufficient back elevator pressure is not held to maintain the correct takeoff attitude after becoming airborne, or the nose is allowed to lower excessively, the airplane may also settle back to the runway. This would occur because the angle of attack is decreased and lift diminished to the degree where it will not support the airplane. It is important, then, to hold the attitude constant after rotation or liftoff.

Even as the airplane leaves the ground, you must be concerned with maintaining straight flight as well as holding the proper pitch attitude. Upon liftoff, the airplane should be flying at an attitude which will allow it to accelerate to 120 KIAS.

NOTE

More efficient climbs may be required for obstacle clearance or specific requirements. V_x is the best angle of climb (75 KIAS).
 V_y is the best rate of climb (100 KIAS).

If the airplane has been properly trimmed, some back pressure may be required on the elevator control to hold this attitude until proper climb speed is established. On the other hand, relaxation of any back pressure may result in the airplane settling, even to the extent that it contacts the runway.

The airplane will pick up speed rapidly after it becomes airborne. However, only after it is certain the airplane will remain airborne and a safe landing can no longer be made should the landing gear be retracted. Check first that the fuel caps are secured with no streaming fuel. Check the airspeed below 120 KIAS and raise the gear. Check for three "UP" indications.

Since the power on the initial climb is fixed at the takeoff power setting, the airspeed must be controlled by making slight pitch adjustments using the elevators. However, do not stare at the airspeed indicator when making these slight pitch changes. Instead, watch the attitude of the airplane in relation to the horizon. It is better to first make the necessary pitch change and hold the new attitude momentarily, and then glance at the airspeed indicator as a check to see if the new attitude is correct. Due to inertia, the airplane will not accelerate or decelerate immediately as the pitch is changed. If the pitch attitude has been over or under corrected, the airspeed indicator will show (belatedly) airspeed that is more or less than that desired. When this occurs, the cross-checking and appropriate pitch-changing process must be repeated until the desired climbing attitude is established. When the correct pitch attitude has been attained, it should be held constant while cross-checking it against the horizon and other outside visual references. The airspeed indicator should be used only as a check to determine if the attitude is correct. Be smooth with attitude adjustments.

3. Procedures

- a. Approaching the holdshort line (approximately 200 feet prior) switch to Tower frequency.
- b. When appropriate, and in accordance with the SOP, call the tower for clearance. Prior to making this call, listen carefully to avoid cutting out other transmissions. Instructions to "Taxi into position and hold" or "Hold short" must be read back. Clearance for takeoff will be acknowledged with, "Call sign, cleared for takeoff." Note the wind and, upon receiving takeoff clearance, taxi into the takeoff position in accordance with local course rules.
- c. Crossing the holdshort line, complete the Takeoff Checklist (noting time), and report it over the ICS.
- d. When properly aligned on the runway (with nose wheel centered and brakes held) and

cleared for takeoff, add power to 500 ft–lbs. and check the engine and flight instruments. Report, "Instruments checked."

NOTE

This is a last chance check to ensure the engine is operating normally. Perform this check silently (report its completion only). ICS transmissions on the runway are not required unless something abnormal is observed.

- e. Select a reference point. Position the stick in neutral. Release the brakes, dropping your heels to the deck so that the toes or balls of the feet are on the rudder portions - not on the brake portions. Maintain directional control using rudder pressure as you smoothly advance the PCL to maximum allowable (approximately 3 seconds).

NOTE

Select a reference point directly ahead (runway centerline, trees, buildings, etc.) and keep the nose pointed towards this reference. Remember, torque effect and P-factor will tend to pull the nose to the left; therefore, right rudder pressure will be necessary to maintain proper directional control. Detect small heading changes quickly and make immediate, but smooth, rudder corrections.

- f. At approximately 80 knots, smoothly apply backstick pressure and position the nose to the takeoff attitude (cowl seam slightly below the horizon). Maintain this attitude and allow the aircraft to fly itself off the deck at 80-85 knots.
- g. Once airborne, recheck the attitude (the cowling should be approximately even with the horizon). When a safe landing can no longer be made on the runway, check fuel caps for streaming fuel and airspeed below 120 KIAS. Retract the landing gear and check for three "UP" indications, light out in the gear handle and that the inboard gear door indicator lights are out. Report: "Fuel caps secure, three up and locked" over the ICS.
- h. Approaching 120 KIAS, set the 120-KIAS climbing attitude (cowl seam on the horizon) and climb out in accordance with local course rules. Retrim as necessary.

4. Common Errors

- a. Failure to maintain directional control on takeoff roll through improper use of rudder.
- b. Not assuming the takeoff attitude at approximately 80 knots.
- c. Not relaxing backstick pressure as necessary to maintain takeoff attitude, hence over-rotating.
- d. Pulling aircraft off the deck prematurely or over-controlling.

- e. Swerving or skipping on takeoff roll due to improper or lack of crosswind correction.
- f. Applying insufficient right rudder on liftoff and attempting to correct with right wing low.
- g. Failure to trim left rudder, nose down after gear are retracted and airspeed increases.
- h. Failure to ensure three "UP" indications and light out in the gear handle.

606. CROSSWIND TAKEOFF

1. **Description.** N/A

2. **General.** The technique used during the initial takeoff roll in a crosswind is the same as that used in a normal takeoff, except that aileron control must be **held INTO** the wind. This raises the aileron on the upwind wing to counteract the lifting force of the crosswind and prevents that wing from rising.

As the airplane is taxied into takeoff position, mentally note the winds as called by tower (also check the windsock and other indicators) so that the presence of a crosswind may be recognized and anticipated. Aileron should be held into the wind as the takeoff roll is started. As the airspeed increases and the ailerons become more effective, adjust the aileron inputs to maintain the wings level.

While keeping the wings level with aileron, directional control will be maintained with rudder. Normally, a crosswind takeoff will require downwind rudder pressure, since the aircraft will tend to weathervane into the wind. Torque or P-factor, which yaws the aircraft to the left, may be sufficient to counteract the weather-vaning tendency caused by a crosswind from the right. On the other hand, it may also aggravate the tendency to swerve left when the crosswind is from the left.

Firmly rotate the aircraft off the runway when flying speed is reached to avoid sides-slipping and damage to the tires. Once the aircraft has become airborne, initial drift correction is made by turning into the wind with a shallow bank, then rolling wings level to maintain runway centerline.

607. DEPARTURE

1. **Description.** N/A

2. **General.** See local Standard Operating Procedures or Course Rules.

3. **Procedures.** See local Standard Operating Procedures or Course Rules.

608. STRAIGHT AND LEVEL FLIGHT

1. **Description.** Maintain a constant altitude, airspeed and heading using the horizon as the primary reference.
2. **General.** Straight and level flight is a balanced flight condition while maintaining a constant heading and altitude. It is flown at a constant airspeed, most commonly at normal cruise. Keeping the aircraft in straight and level flight will be a matter of maintaining a good scan, quick interpretation of errors, and constant control adjustments.

A scan pattern is a systematic and thorough procedure for both controlling your own aircraft and seeing and avoiding other aircraft. Your scan pattern will involve dividing your attention between the outside environment and the cockpit instruments. Though experienced pilots may utilize scan patterns that vary immensely, you should learn and practice the integrated scan pattern discussed in paragraph 406. With experience, you may vary this scan to fit your needs and ability.

The pitch attitude for level flight (constant altitude) is usually obtained by selecting some portion of the airplane's nose as a reference point, then keeping that point in a fixed position relative to the horizon. In the T-34C, the horizon should intercept the canopy approximately one-half the way up the windscreen for normal cruise. That position should be cross-checked against the altimeter to determine whether or not the pitch attitude is correct. If altitude is being gained or lost, the pitch attitude should be readjusted in relation to the horizon and then the altimeter rechecked to determine if altitude is being maintained. The application of forward or back pressure on the stick is used to control this attitude (Figure 6-1).

Pitch information obtained from the attitude indicator also will show the position of the nose relative to the horizon and will indicate whether or not elevator pressure is necessary to change the pitch attitude to return to level flight.

a. **To achieve straight flight (constant heading)**

- i. **VISUAL:** The pilot selects two or more outside visual reference points directly ahead of the airplane (such as fields, towns, lakes, or distant clouds, to form points along an imaginary line) and keeps the airplane's nose headed along that line. Roads and section lines on the ground also offer excellent references. A straight flight can be maintained by flying parallel or perpendicular to them.

Straight flight (constant wings level attitude) may also be accomplished by visually checking the relationship of the airplane's wingtips with the horizon. Both wingtips should be equidistant below the horizon, and any necessary adjustments should be made with the ailerons, noting the relationship of control pressure and the airplane's attitude.

- ii. **INSTRUMENT:** An occasional check of the heading indicator should be made to determine that the airplane is actually maintaining flight in a constant direction.

- iii. **CORRECTIONS:** Whenever an error in heading is noted, first stop the error and stabilize, then correct back to proper heading. A correction to return to a desired heading should be made by establishing an angle of bank using the integrated scan and maintaining it until approaching the particular heading desired. As a rule of thumb, the angle of bank used for heading corrections should not exceed the number of degrees you want to turn. Lead the rollout on heading by the "one-third rule," (i.e., by the number of degrees equal to one-third the angle of bank). This lead in rollout will preclude turning beyond the desired heading.

Continually observing the wingtips has advantages other than being a positive check for leveling the wings. It also helps divert the pilot's attention from the airplane's nose, prevents a fixed stare, and automatically expands the radius of visual scanning. In straight-and-level flight the wingtips can be used for both estimating the airplane's angle of bank, and to a lesser degree, its pitch attitude.

In balanced flight, any time the wings are banked, even though very slightly, the airplane will turn. Thus, close attention should be given to the wing position and attitude indicator to detect small indications of bank, and to the heading indicator to note any change of direction.

When the wings are approximately level, straight flight could be maintained by simply exerting the necessary forces on the rudder in the desired direction. However, the practice of using rudder alone is not a "normal" method of aircraft control and may make precise control of the airplane difficult.

Straight-and-level flight requires almost no application of control pressure if the airplane is properly trimmed and the air is smooth. For that reason, the pilot must not form the habit of moving the controls unnecessarily.

When practicing this fundamental flight maneuver, the pilot should trim the airplane so it will fly straight and level without assistance. This is called "hands-off flight." The trim controls, when correctly used, are aids to smooth and precise flying. Improper trim technique usually results in flying that is physically tiring, particularly in prolonged straight-and-level flight. By using the trim tabs to relieve all control pressures, the pilot will find that it is much easier to hold a given altitude and heading. The airplane should be trimmed by first applying control pressure to establish the desired attitude, and then adjusting the trim so that the airplane will maintain that attitude without control pressure in "hands-off flight."

Your instructor will introduce straight-and-level flight in normal cruise.

b. **Corrections In Straight-And-Level Flight**

There are several methods for correcting a deviation from desired altitude/airspeed when maintaining level flight. These consist of a power correction, or a power and attitude correction with a continual need for retrimming.

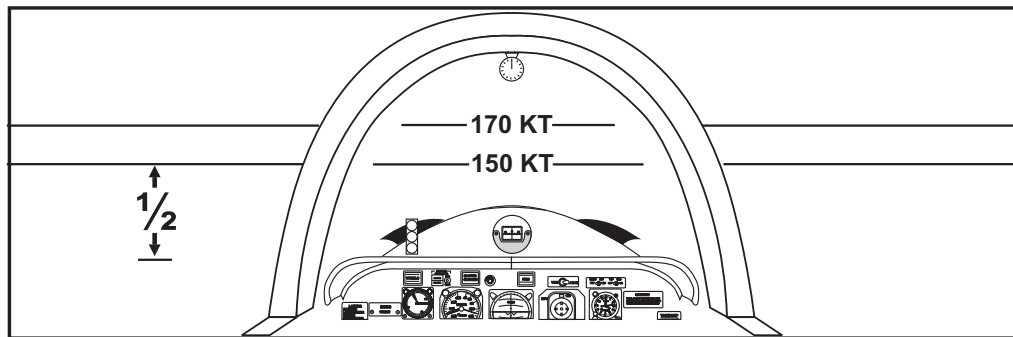


Figure 6-1 Straight and Level Flight Attitude

- i. **Off airspeed/on altitude.** If you note that the altitude is being maintained, but the airspeed is slow or fast, a power adjustment is necessary, since power controls airspeed in level flight. Remember each torque setting given in this manual is a suggested starting point. Once the appropriate power setting has been changed, a change in the pitch may be required to maintain the attitude for level flight and, as always, retrim.
 - ii. **Off airspeed/off altitude.** If you have a high airspeed and a loss of altitude or a low airspeed and a gain in altitude, it is the result of not maintaining the proper nose attitude. Stop the loss or gain by resetting the level flight attitude, then correct by trading the excess altitude or airspeed to return to the desired altitude and airspeed. RETRIM.
 - iii. **On airspeed/off altitude.** If you note that you are 100 feet high, yet the airspeed is correct, correct to altitude by reducing the power slightly and allow the nose attitude to lower just slightly so the aircraft will descend back to the desired altitude. Once returned to altitude, reset normal cruise power setting and retrim.
3. **Procedures**
- a. Maintain balanced flight. Trim.
 - b. Set the nose position for straight and level by visually bisecting the windscreen with the horizon. Crosscheck the altimeter and VSI. Trim.
 - c. Set the wing position for straight and level flight by setting the wingtips equidistant below the horizon. Crosscheck the RMI. Trim.
 - d. Continue a working scan and if an error is recognized, make proper corrections.
 - e. If an error in altitude is noted on the altimeter, stop the error by adjusting the nose attitude. Then, using coordinated power and stick pressure, adjust back to desired altitude. Retrim.

- f. If an error is noted in heading, stop the drift on the RMI by leveling the wings. Turn back towards the desired heading, never using a greater angle of bank than the number of degrees off heading. Retrim.

4. Common Errors

- a. Over-controlling: Making control movements too great for the amount of correction necessary.
- b. Not recognizing a wing low or nose attitude too high or too low.
- c. Fixating. Not maintaining a good scan.
- e. Not retrimming.

609. BASIC TRANSITIONS

1. **Description.** The basic transitions are used to enter a climb or descent from normal or fast cruise and to level off in normal or fast cruise from a climb or descent. Climbs of greater than 1000 feet will be done at 120 KIAS. Clearing turns are required for climbs and descents greater than 1000 feet.

2. **General.** Use the P.A.T. principle in making all transitions. As soon as the nose attitude is changed upon entering a climb or descent, the airspeed indicator becomes the nose attitude crosscheck instrument. The nose attitude must be held constant until the airspeed indicates the necessity for a change.

The nose attitude change will then be accomplished on the horizon. Note the progress of the altimeter and vertical speed indicator as performance instruments.

The RMI remains the attitude crosscheck instrument for the wings as long as the aircraft is maintaining a constant heading.

As soon as the nose is placed in the level flight attitude on the horizon upon leveling off from a climb or descent, the altimeter and vertical speed indicator become the nose attitude crosscheck instruments.

NOTES

1. In order to remain clear of clouds and other aircraft, and to maintain geographic orientation during the climb or descent, use clearing turns for all climbs and descents greater than 1000 feet when not under positive radar control. A recommended procedure for clearing turns is to use 15° angle of bank between reversal headings 30° either side of the base heading. As you transition to level flight, stop the clearing turns on a heading that will take you most directly into the working area.

2. Torque will decrease with an increase in altitude, and increase with a decrease in altitude. Therefore, continue to adjust the PCL throughout the transition to ensure the desired torque setting is maintained. Do not exceed engine operating limitations.

3. Procedures

Cruise to Climb. Using the P.A.T. principle:

- a. **Power** - Smoothly add power to max allowable.
- b. **Attitude** - Simultaneously raise the nose and place the exhaust stacks on the horizon (approximately 12 - 15 degrees nose up). (Figure 6-2) Commence clearing turns as appropriate.

NOTE

Climbs of 1000 feet or less will be done at max allowable power and cruise airspeed (150 or 170 KIAS). Climbs of 1000 feet or more will be done at 120 KIAS, accompanied by clearing turns.

- c. **Trim** - RIGHT and UP for the climb, power addition and deceleration.
- d. Approaching 120 KIAS, lower the nose to the appropriate attitude. (Figure 6-3)
- e. Retrim.
- f. Maintain max allowable power as you climb.

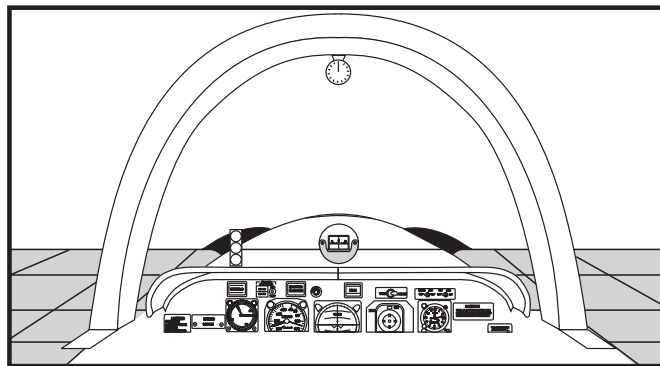


Figure 6-2 Exhaust Stacks on Horizon

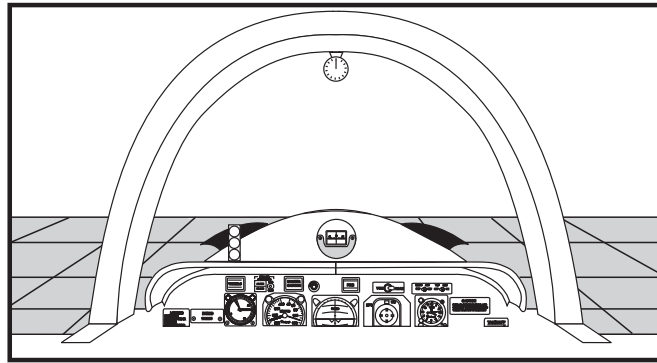


Figure 6-3 Cowling Seam on Horizon (6-8)°

Climb to Cruise

- a. 200 feet prior to level-off altitude, lower the nose TOWARDS the level flight attitude as the aircraft accelerates and climbs.
- b. Trim: LEFT AND DOWN for the acceleration.
- c. Approaching normal/fast cruise airspeed, use the P.A.T. principle:
 - i. **Power:** Reduce to normal cruise (600-650 ft-lbs.) or fast cruise (750-800 ft-lbs).
 - ii. **Attitude:** Level flight
 - iii. **Trim:** LEFT (for power reduction) and fine-tune the elevator trim as necessary.

NOTES

1. Insufficient acceleration trim will result in being high on level-off and considerably off heading.
2. For climbs at normal/fast cruise (150-170 KIAS), begin lowering nose towards level attitude 50 feet prior to level-off altitude.

Cruise to an Enroute Descent

NOTE

Power settings will be 300 foot-pounds for all descents. When your instructor introduces the enroute descent, notice the position of the nose in relation to the horizon. You are learning to fly by attitude; a constant nose position will maintain a steadier airspeed. For descent attitudes, refer to figures 6-4 and 6-5.

- a. Use the P.A.T. principle:
 - i. **Power:** reduce to 300 ft-lbs. torque.
 - ii. **Attitude:** nose down to maintain airspeed.
 - iii. **Trim:** LEFT and UP (once airspeed is stable).
- b. Perform clearing turns (if required).

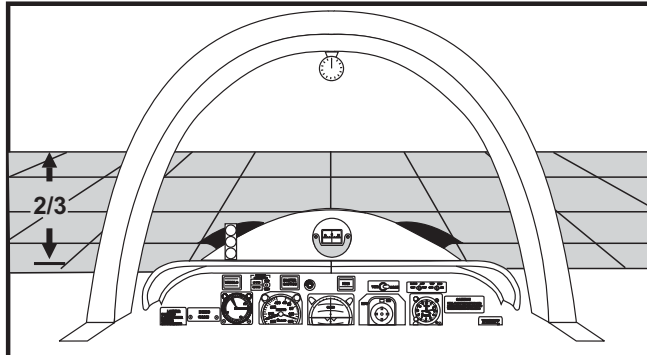


Figure 6-4 Enroute Descents - 150 Knots

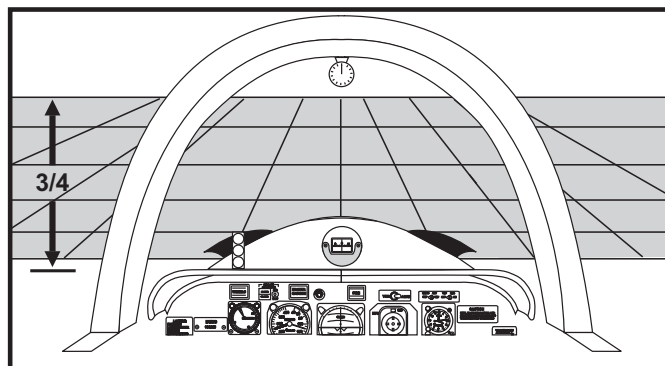


Figure 6-5 Enroute Descent - 170 Knots

Enroute Descents to Cruise

- a. 100 feet prior to level off altitude, use the P.A.T. principle:
 - i. **Power:** to normal cruise (600-650 ft-lbs.) or fast cruise (750-800 ft-lbs.) as appropriate.
 - ii. **Attitude** - Raised to level flight.
 - iii. **Trim** - RIGHT and DOWN to maintain airspeed.

4. Common Errors

a. Cruise to a Climb

- i. Not concentrating on horizon and remaining scan. Use your peripheral vision.
- ii. Not trimming as airspeed slows.
- iii. Overcorrecting nose attitude for airspeed error. If the aircraft is off airspeed, check torque at max allowable, readjust the nose and retrim.
- iv. Not performing clearing turns (when required).

b. Climb to Cruise

- i. Lowering the nose to the level flight attitude immediately instead of TOWARDS the level flight attitude. Remember, the airspeed is still slow.
- ii. Not trimming during the transition.

c. Cruise to an Enroute Descent

- i. Rushing.
- ii. Not trimming properly.
- iii. Not performing clearing turns (when required).
- iv. Not setting/holding sufficient nose down, thereby getting slow.

d. Enroute Descent to Cruise

- i. Moving nose first. Remember P.A.T.
- ii. Under-trimming the nose and continuing in a descent.

610. CONSTANT ANGLE OF BANK TURNS

1. **Description.** Turn the aircraft using a constant angle of bank to an assigned heading while maintaining altitude and airspeed.

2. **General.** When you perform constant angle of bank turns (CABT), your instructor will state the desired angle of bank and rollout heading. Before commencing any turn, look in the direction of the turn to ascertain that the area is clear of clouds or other aircraft. If clear, commence the turn. Throughout this maneuver, a rapid and consistent scan pattern is a necessity.

During the turn, continue to check the area clear, check the aircraft attitude with the horizon, then crosscheck the nose attitude with the altimeter and VSI and the angle of bank with the attitude gyro. Correct the visual attitude as necessary, while periodically cross-checking the RMI for turn progress and the airspeed for power required.

To prevent turning beyond the desired heading, it is necessary to anticipate or lead this new heading by using the one-third rule. This rule will be used during all turns to specified headings.

3. Procedures

- a. Clear the area.
- b. Roll into an estimated angle of bank on the horizon; add slight rudder in direction of turn to maintain a centered ball, then crosscheck that angle of bank on the attitude gyro throughout the turn.
- c. Adjust power and nose attitude as necessary and retrim for the correct altitude and airspeed, (P.A.T.).
- d. Roll out of the turn on the desired heading by leading the turn with the one-third rule.
- e. Reset straight and level and retrim.

4. Common Errors

- a. Inattention to performance, (i.e., maintaining altitude but not adding any power to maintain airspeed). Power + Attitude = Performance
- b. Not maintaining a constant angle of bank.
- c. Losing altitude in steep turns.
- d. Lack of trim.
- e. Not clearing the area prior to and during the turn.

611. TURN PATTERN

1. **Description.** The turn pattern (TP) is a series of constant angle of bank turns while maintaining altitude and airspeed.

2. **General.** The TP is started in normal cruise on a cardinal heading (north, south, east, and west). The TP consists of two 15° angle of bank turns in opposite directions for 30° of heading change, two 30° angle of bank turns in opposite directions for 90° of heading change, and two 45° angle of bank turns in opposite directions for 180° of heading change. A smooth reversal is made going from one turn into another, eliminating a straight and level leg. (Figure 6-4).

Throughout the pattern, check the area clear, check the aircraft attitude with the horizon, and then crosscheck the nose attitude with the altimeter-VSI and the angle of bank with the attitude gyro. Correct the visual attitude as necessary. Crosscheck your instruments by periodically scanning the RMI for turn progress and the airspeed for power required. Note that the absence of a wing attitude crosscheck instrument (other than the gyro) allows you to scan the RMI frequently for turn performance and thus keeps you from overshooting headings.

The 15° angle of bank turn will require little backstick pressure or additional power. For the 30° and 45° angle of bank turns, it will be necessary to raise the nose slightly to increase the angle of attack in order to compensate for the loss of vertical lift as the bank steepens. Additional power

will be required to maintain airspeed. To avoid overshooting the rollout headings, lead the rollout heading by a number of degrees equal to one-third the angle of bank. (For a 15° angle of bank turn, lead the rollout by 5°, etc.) Strive for smooth reversals between turns.

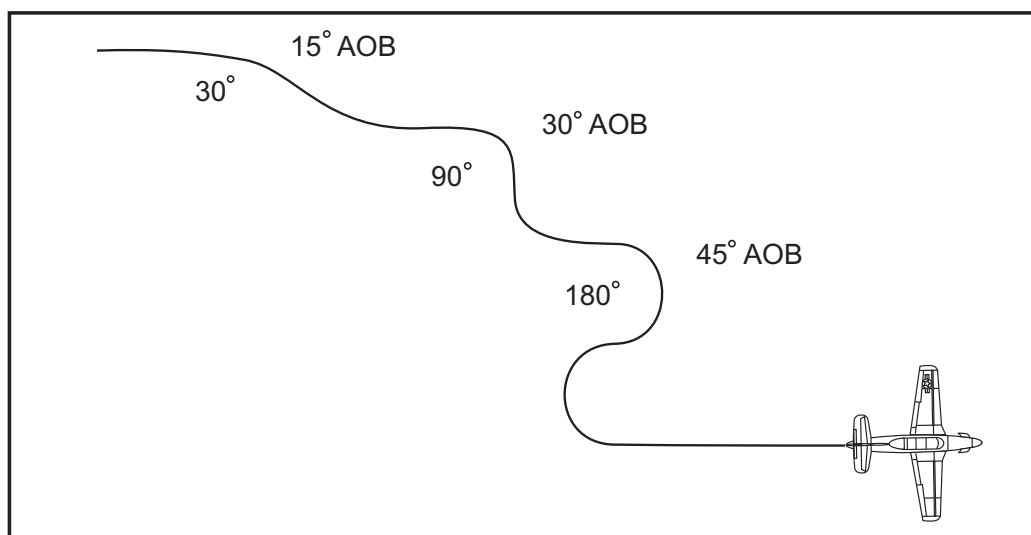


Figure 6-6 Turn Pattern

Trim the aircraft as necessary throughout the pattern. Remember, as the reversal or rollout occurs, the nose must be lowered back to the level attitude, and since it has been trimmed "up" during the turn, the nose will require forward stick pressure to lower it. Remember to use the P.A.T. principle.

3. Procedures

- a. Establish the aircraft straight and level on a cardinal heading, base altitude and normal cruise.
- b. Clear the area. Turn for 30° of heading change using a 15° angle of bank. Clear the area (in the other direction) then reverse the turn, leading by the one-third rule for 30° of heading change using a 15° angle of bank.
- c. Clear the area. Reverse the turn leading by the one-third rule and turn for 90° of heading change using a 30° angle of bank. Maintain altitude and airspeed with power and nose attitude; retrim. Clear the area (other direction) then reverse the turn using the one-third rule for 90° of heading change using a 30° angle of bank. Remember to adjust nose attitude as necessary to maintain airspeed and altitude while rolling through wings level.
- d. Clear the area. Reverse the turn leading by the one-third rule and turn for 180° of heading change using a 45° angle of bank. Adjust power and nose attitude to maintain altitude and airspeed; trim. Clear the area (other direction) then reverse the turn leading by the one-third rule; hold slight forward stick pressure to prevent ballooning as you roll through the wings level. Reestablish the attitude to maintain altitude; turn for 180° of heading change using a 45° angle of bank.

- e. Roll out on the original heading using the one-third rule and holding slight forward stick pressure to prevent ballooning.
- f. Reset power to the normal cruise power setting (as required), reset attitude and retrim for straight and level.

4. Common Errors

- a. Applying the control pressures too rapidly and abruptly, or using too much backstick pressure before it is actually needed. Remember the aircraft is flown through a medium-banked turn before it reaches a steeper turn.
- b. Not holding the nose attitude steady. In order to determine the appropriate corrections, you must first establish a steady attitude and allow the instruments to stabilize.
- c. Staring at the nose and consequently applying control corrections too late. Divide your attention. Scan your instruments, never fixating on any one instrument. **Anticipate** the need for additional power and nose up. Do not wait until you are low or slow.
- d. Gaining altitude in reversals. Not lowering nose as the wings pass the level flight attitude, usually due to fixating on the RMI instead of scanning the horizon.
- e. Not clearing the area before and during all turns.

612. LEVEL SPEED CHANGE

1. **Description.** Level speed changes (LSC) are taught to familiarize you with the various trim adjustments required with changes in airspeed, power setting, and aircraft configuration.
2. **General.** The LSC maneuver will be commenced on any assigned heading. The sequence is flown from normal cruise (150 KIAS) to the downwind configuration (100 KIAS), to the landing approach configuration (90 KIAS), and then to fast cruise (170 KIAS). Because of the numerous tasks associated with these transitions, a good outside visual scan pattern cannot be overemphasized. You will experience changes in aircraft attitudes and control pressures during each transition. These attitudes will be utilized throughout your primary training and the stick pressures will be relieved through proper trim technique. Your instructor will require you to fly the aircraft at various angles of bank in the downwind and landing approach configurations to experience the way in which the aircraft handles at these slower than normal airspeeds. Angle of bank in both the downwind and landing approach configurations will not exceed 30°. During these turns, additional power must be applied to maintain airspeed with attitude adjustment to maintain altitude. During later stage flights, the approach turn stall will normally be done while in the landing approach configuration.

3. Procedures

- a. Reduce power to 300 ft-lbs., check airspeed below 150 KIAS and lower the landing gear. Approaching 100 KIAS adjust power to approximately 500-550 ft-lbs. to maintain airspeed. Initially, left rudder will be required for the power reduction, then right and up trim as the aircraft decelerates towards 100 KIAS.
- b. When on airspeed, altitude, and heading, perform the Landing Checklist down to flaps.
- c. Perform turns as prescribed by the instructor.
- d. Reduce power by 100 ft-lbs., check airspeed below 120 KIAS and lower full flaps.
- e. Approaching 90 KIAS, adjust power to approximately 600 ft-lbs. to maintain airspeed.
- f. Trim will be right rudder and up elevator. Check flaps full down and report, "Gear down, flaps down, Landing Checklist complete."
- g. Perform turns as prescribed by the instructor.
- h. Advance power to maximum allowable, check airspeed below 120 KIAS and raise the gear and flaps. Turn landing lights off. Approaching 170 KIAS, reduce the power to 750-800 ft-lbs. With the initial power advancement, right rudder is required, but as the aircraft accelerates, trim will be left rudder, down elevator.

4. Common Errors

- a. Failure to properly trim rudder pressures, resulting in poor heading control.
- b. Commencing the Landing Checklist in the middle of a transition, resulting in poor basic airwork.
- c. Failure to maintain proper nose attitudes associated with configuration.
- d. Failure to properly trim elevator pressure, resulting in poor altitude control.
- e. Neglecting the landing lights.

613. STALLS

1. **Description.** Stalls are taught to develop your ability to recognize a complete stall or an approaching stall and to recover correctly with a minimum loss of altitude.

2. **General.** You will learn to recognize the approaching stall or complete stall through a combination of the senses of sight, sound and feel.

- a. Vision is useful in detecting a stall condition by noting the attitude of the airplane. This sense can be fully relied on only when the stall is the result of an unusual attitude of the airplane. However, since the airplane can also be stalled from a normal attitude, vision in this instance would be of little help in detecting the approaching stall.

- b. Hearing is also helpful in sensing a stall condition, since the tone level and intensity of sounds incident to flight decrease as the airspeed decreases. The reduction of the noise made by the air flowing along the canopy as airspeed decreases is also quite noticeable, and when the stall is almost complete, vibration and its incident noises often increase greatly.
- c. Kinesthesia, or the sensing of change in direction or speed of motion, is probably the most important and the best indicator to the trained and experienced pilot. If this sensitivity is properly developed, it will warn of a decrease in speed or the beginning of a settling or "mushing" of the airplane.
- d. The feeling of control pressures is also very important. As speed is reduced, the "live" resistance to pressures on the controls becomes progressively less. Pressures exerted on the controls tend to become movements of the control surfaces, and the lag between those movements and the response of the airplane becomes greater, until in a complete stall all controls can be moved with almost no resistance, and with little immediate effect on the airplane. Rudder shakers will normally occur 5-10 knots prior to the stall, with airframe buffet occurring almost immediately thereafter.

Before performing any stall maneuver, the THREE Cs must be completed. The first C is CONFIGURATION. Put the aircraft in the appropriate configuration. The second C is CHECKLIST. Complete the following STALL CHECKLIST and, if on a dual flight, report it item by item to your instructor!

- a. Bilges - "Clear of loose objects, control lock stowed (in 2 places)."
- b. Restraint harness - "Locked and tight."
- c. Autoignition - "On, AUTO IGN light, ON."
- d. Engine instruments - "Checked." (for normal indications)
- e. Report - "Stall Checklist complete."

The third C is CLEARING TURNS. All stalls will be preceded by clearing turns for a minimum of 180° utilizing a 30° angle of bank in the landing configuration and a 45° angle of bank clean. The clearing turn may consist of one turn for a minimum of 180° or two 90° turns in opposite directions. Turning stalls will be performed in the direction of the last 90° of the clearing turn. Recovery from all stall or spin maneuvers must be complete and level flight achieved above 5000 feet AGL.

Stalls will be preceded by the rudder shakers and recovery will be initiated as the nose pitches down (full stall). When practicing stalls, you will take the aircraft to a full stall before initiating recovery. This is done, not to foster a complacent attitude towards stalls, but to build skill and confidence in the recovery technique. Obviously, if a stall warning (i.e., rudder shakers) is encountered at any time other than during stall practice, you will initiate recovery immediately.

3. Common Errors

- a. Not completing the three Cs prior to every stall.
- b. Leaving the autoignition on after concluding all of your stall maneuvers.

614. SLOW FLIGHT/MINIMUM CONTROL MANEUVERS (SFMCM)

1. **Description.** The slow flight maneuvers are designed to develop your ability to fly the aircraft in a near-stalled condition.
2. **General.** This maneuver will be demonstrated by the instructor and then flown by the student. Every properly executed takeoff and landing you make requires you to operate the aircraft at low airspeed. During training, students are taught "flight at minimum controllable airspeed" so they may learn the effect that airspeed has on aircraft performance and controllability.

Listed below are some of the objectives for teaching flight at minimum controllable airspeed:

- a. The student will be able to recognize that the aircraft is approaching or has attained a critically low airspeed.
- b. The student will be able to control the aircraft at airspeeds just above stall.
- c. To increase the confidence of the pilot in his ability to operate the aircraft throughout its full range of controllability. There is more training value to the maneuver than just showing how slow the airplane can be flown. For example, the following items will be demonstrated and taught:
 - i. Airplane attitude at minimum controllable airspeed.
 - ii. Power required versus airspeed produced.
 - iii. Trim needed.
 - iv. Control effectiveness.
 - v. Radius of turn and rate of turn compared to degree of bank.
 - vi. Stall as a result of level turn.
 - vii. Adverse yaw.
 - viii. "Minimum controllable airspeed." This is not a set figure. It will vary with aircraft weight, configuration, and power setting. It is best described as a speed just above stall or a point at which a further reduction in airspeed, or an increase in angle of attack or weight, will cause an immediate physical indication of a stall. The physical indication would be rudder shakers ($26.5 \pm \frac{1}{4}$ units AOA), pitch down of the nose, rolling to right or left, or reaching the limit of up elevator travel.

The instructor should provide a basis for comparison of control pressures and rates of response. While in cruise flight at cruise airspeed, the student should use rudder, aileron and elevator and note the pressure applied and the response rate. Transition to the landing approach configuration.

Then, while maintaining heading and altitude, reduce power to 400 ft-lbs., slowing the aircraft to 25-26 units AOA. As speed is reduced, a change in pitch attitude is needed in order to maintain altitude. There will be a point at which pitch change alone does not increase lift to the point that altitude can be maintained. Power must be added (approximately 475-500 ft-lbs.)

When properly trimmed and on airspeed, the student should recognize that the aircraft is close to operating limits; sight, sound and feel give the clues. The pitch attitude of the nose, the angle of the wingtips in reference to the horizon, the sound of the engine compared to the lack of wind noise, and the lessened resistance to control pressures and the need of elevator and rudder trim, all indicate to the pilot that the aircraft is at a low airspeed.

Now apply aileron, elevator, and rudder pressures and note the response. Everything still affects the aircraft the same way, except that greater control movement is needed to produce the same rates of response that were obtained at cruise speed. Now roll smoothly in a medium banked turn. This is done to show that the aircraft is maneuverable even at low airspeed. The medium bank results in a high rate (small radius) of turn at this low airspeed and an increase in angle of attack. It will seem that the aircraft is almost pivoting over a point on the ground. Notice that a steep bank is not needed in order to obtain a high rate of turn when operating at low airspeeds.

The turn made at medium bank is also used to demonstrate that a level turn does increase stall speed (and AOA) and, unless power is added, a stall will occur soon after the turn is established. When the first indication of stall is felt, recognize the stall indication, and gently recover by rolling out of the turn (add power if necessary). To complete the maneuver, perform a level acceleration to normal cruise.

3. Procedures

- a. **CONFIGURATION:** Trim the aircraft for 90 KIAS level flight in the landing approach configuration. Turn landing lights on.
- b. **CHECKLIST:** Perform the Stall Checklist aloud to your instructor.
- c. **CLEARING TURN:** Conduct a level clearing turn for a minimum of 180°.
- d. Reduce power to 400 ft-lbs. torque. Maintain altitude. Retrim.
- e. Reset power to stabilize aircraft at 25-26 units AOA (approximately 475-500 ft-lbs.) and retrim. Rudder shakers (stall warning) will activate at $26\frac{1}{2} \pm \frac{1}{4}$ units AOA. Anticipate full deflection of rudder trim.

- f. Slow Flight Characteristics:
 - i. Apply aileron, elevator, and rudder pressures and note the response.
 - ii. Roll into shallow angle of bank turns while maintaining altitude. Note the reduced effectiveness of the ailerons.
 - iii. Execute a turn without rudder. Note adverse yaw. Try a coordinated turn.
- g. Power Application
 - i. Level the wings and hold assigned altitude.
 - ii. Apply max allowable power while maintaining nose attitude. AOA will decrease due to propwash and acceleration.
 - iii. Below 120 KIAS, retract the gear and flaps. Turn landing lights off. Do not retract the flaps if the airspeed is below 90 KIAS.
 - iv. Accelerate to normal cruise on an assigned altitude.
 - v. Retrim.
 - vi. Turn autoignition off.

CAUTION

Rapid divergence to incipient stall/spin may occur if caution is not observed in returning to 25-26 units AOA prior to full stall.

NOTE

Due to the length of time required to execute the above maneuvers, exercise good judgment as to the necessity of additional clearing turns between maneuvers.

4. Common Errors

- a. Abrupt control movements.
- b. Failure to clear area during maneuver.
- c. Failure to maintain altitude.
- d. Failure to use adequate trim.

615. POWER-OFF STALL (POS)

- 1. **Description.** Stall the aircraft in a power-off condition to demonstrate the proper recovery when no power is available.

2. **General.** This stall might occur while you are descending in an actual or simulated emergency or in any power-off situation when airspeed is not controlled. Recovery is made with power off so that you will become proficient in recovering from a stall without power.

Enter this stall maneuver smoothly and without rushing to avoid over-controlling. The entry glide simulates an actual flight condition and also provides a "measure" for the student pilot to use in establishing the proper recovery attitude. Since the recovery is effected without power, you cannot rely on thrust to "pull" you out of the stalled condition. You must utilize the force of gravity to enable the aircraft to regain flying speed.

3. Procedures

- a. **CONFIGURATION:** Position the aircraft at an appropriate altitude; in slow cruise and the clean configuration.
- b. **CHECKLIST:** Perform the Stall Checklist aloud to your instructor.
- c. **CLEARING TURN:** Commence clearing turn using 45° angle of bank.
- d. Roll wings level, then reduce the PCL to 200 ft-lbs. and adjust the nose attitude to maintain altitude. Approaching 100 KIAS, set the 100-KIAS glide attitude (horizon bisecting the windscreen). Retrim.
- e. Once established in a 100-KIAS descent, smoothly raise the nose to a position 12-15 degrees above the normal cruise attitude by visually placing the exhaust stacks on the horizon. Maintain this attitude with the wings level and the aircraft in balanced flight. As the airspeed diminishes it will be necessary to increase backstick pressure gradually in order to maintain nose attitude. Maintain heading with rudder. The stall is recognized by airframe buffet and the nose pitching down slightly.
- f. At the stall, decrease the angle of attack by releasing backstick pressure and allow the nose to fall slightly below the 100-KIAS gliding attitude. Stop any rolling tendency with rudder pressure applied opposite to the direction of roll and, as soon as aileron effectiveness has been regained, smoothly level the wings with coordinated rudder and ailerons. Hold the recovery attitude in balanced flight to permit the airspeed to build up and as airspeed approaches 100 KIAS, raise the nose to resume the 100-KIAS power-off attitude. The maneuver is complete when reestablished in the 100-KIAS glide.

4. Common Errors

- a. Lowering the nose too far, resulting in excessive loss of altitude.
- b. Not trimming for 100-KIAS glide.
- c. Not maintaining altitude during the clearing turn.
- d. Early recovery resulting in secondary stall.

616. APPROACH TURN STALL

1. **Description.** Stall the aircraft while simulating a landing approach and recover safely with a minimum loss of altitude.
2. **General.** The approach turn stall (ATS) may occur during an approach to landing. This stall is a good illustration of what can happen when a pilot is concentrating on reaching the runway and continues to raise his nose to stretch a power-off glide, rather than adding power to make the runway. This stall is practiced so that the pilot will learn to recognize the approaching stall and the complete stall, and to recover with a minimum loss of altitude.

NOTE

Stalls should be practiced to the maximum extent to build confidence and proficiency. In all cases, however, departure from controlled flight shall be avoided. Instructional time should be used to practice successful recovery techniques rather than test the student's ability to recover from uncontrolled flight. It is stressed that during an actual approach, a waveoff should be executed at the onset of rudder shakers, as the aircraft will be approximately 100-200 feet AGL rolling final.

WARNING

Rapid divergence to extremely disorienting post-stall gyrations and incipient spin may occur if improper control inputs are applied. If steady-state spin is entered at 7000 feet, the crew will have less than 15 seconds to recover before the 5000 feet bailout decision altitude is reached.

3. Procedures**NOTE**

The approach turn stall may be performed before the completion of the LSC maneuver while in the landing approach configuration.

- a. **CONFIGURATION:** Position the aircraft so that the stall will be entered and recovered at/above 6500 feet AGL; 90 KIAS, level flight, gear and flaps down, Landing Checklist completed.
- b. **CHECKLIST:** Perform the Stall Checklist aloud to your instructor.
- c. **CLEARING TURN:** Roll into a 30° angle of bank clearing turn (in either direction) for a minimum of 180° (or two 90° turns), maintaining airspeed and altitude.
- d. Roll out of the clearing turn, reduce power to 300 ft-lbs., and set the 90-KIAS descending attitude (horizon $\frac{2}{3}$ of the way up the canopy). Trim left rudder, nose up.

- e. When comfortably established, smoothly roll into 30° angle of bank, simulating an approach turn. (Turn in same direction as last 90° of clearing turn.)
- f. When comfortably established, raise the nose, placing the lower exhaust stack on the horizon (12-15 on the attitude gyro) and simultaneously reduce power to 200 ft-lbs. of torque. Increase backstick pressure as the airspeed decays.
- g. Hold this attitude until the aircraft stalls.

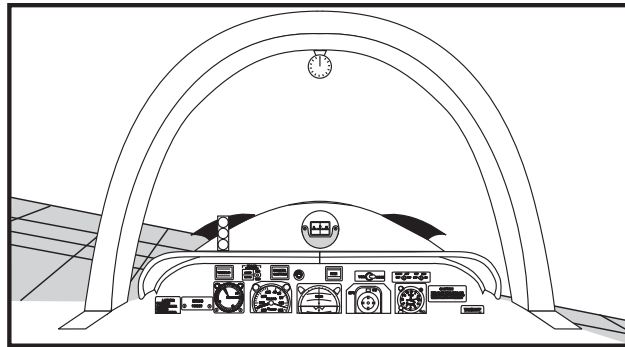


Figure 6-7 ATS Entry Attitude

- h. Recover:
 - i. Relax backstick pressure slightly to decrease the angle of attack (nose no lower than horizon bisecting windscreen).
 - ii. Simultaneously, Roll wings level PCL full forward and add right rudder as necessary to counter torque. (Do NOT cycle rudders in an attempt to maintain balanced flight.)
 - iii. Wings level - raise the nose to positive climbing attitude; cowl seam just above the horizon, so as to stop loss of altitude. Check that the ball is centered.
 - iv. Maintain nose attitude and ensure the aircraft is climbing. When the airspeed stops accelerating, slightly lower the nose and continue the acceleration to 90 KIAS. Retrim.
 - vi. Once established at 90 KIAS, reduce power to 1015 ft-lbs.
 - vii. Level off at the next 500-foot interval.
 - viii. Maintain 90 KIAS (approximately 600 ft-lbs.) and level flight. Retrim.
 - ix. Return to normal/fast cruise when directed by your instructor, utilizing max allowable power. Turn landing lights and autoignition off.

4. Common Errors

- a. Failure to hold the nose in the landing attitude, thus delaying or not obtaining a stalled condition, (i.e., letting the nose fall through).
- b. Failure to maintain angle of bank during the entry. The aircraft will have a tendency to continue rolling past 30° angle of bank. In addition, with increasing angle of bank, the nose will have a tendency to drop.
- c. Releasing instead of relaxing backstick pressure, or applying forward stick pressure on recovery, thus resulting in a nose low attitude and excessive altitude loss.
- d. Not relaxing backstick pressure enough, causing the aircraft to remain stalled.
- e. Cycling rudders in an attempt to keep the ball centered before flying speed is attained.
- f. Delay in raising the nose to the recovery attitude to stop the altitude loss.
- g. Allowing aircraft to accelerate to 90 KIAS before a climb is established.
- h. Failure to add sufficient power on recovery.

617. SKIDDED TURN STALL

1. **Description.** This maneuver demonstrates the excessive loss of altitude and the unusual characteristics of a stall in unbalanced flight. This maneuver will not be performed by the student.

2. **General.** The Skidded Turn Stall (STS) may occur in either a right or left, power-on or power-off landing approach. One possible scenario occurs in a turn to final during an emergency landing pattern approach while appropriately configured for the landing site. If above the ELP profile, a slip will be required to position the aircraft back on profile. However, improper slip inputs can result in a skid and possible stall at an altitude from which safe recovery is impossible.

Another possible scenario occurs in a turn to final during an ELP approach appropriately configured for the landing site. If below profile, the student may incorrectly attempt to use excessive rudder to turn the aircraft and raise the nose slightly to stretch the glide. Again, this may very easily result in a stall at low altitude from which a safe recovery is impossible. This stall occurs at a much higher airspeed than a stall in balanced flight. A stall that occurs in unbalanced flight is also accompanied by a pronounced roll.

This demonstration will illustrate how quickly and unexpectedly an inverted attitude may result. This inverted attitude, plus the fact that the stall is most likely to occur very near the ground, should impress to the student the importance of avoiding this situation. To avoid improper slip inputs, students shall report, "____ wing down, top rudder", prior to slip entry.

3. Procedures

- a. **CONFIGURATION:** Position the aircraft at or above 8,000 feet AGL; 100 KIAS, level flight, gear down, flaps up, Landing Checklist complete.
- b. **CHECKLIST:** Perform the Stall Checklist aloud.

- c. **CLEARING TURN:** Perform clearing turns with the last 90° of turn to the right.
 - i. At the beginning of the last 90° of turn, reduce the PCL to 300 ft-lbs. of torque and transition to a 100-KIAS descent.
 - ii. At the completion of the clearing turn, apply full right rudder while using left aileron to maintain 30° angle of bank to demonstrate the characteristics of a full skid. Simultaneously raise the nose while reducing the PCL to 200 ft-lbs. Increase control pressures as airspeed is reduced.
 - iii. After the aircraft stalls, recover IAW NATOPS Out-of-Control Recovery Procedures.
 - iv. Ensure 150 KIAS is not exceeded throughout the maneuver.

618. SLIP

1. **Description.** A slip is an out-of-balance flight condition used to increase the sink rate and lose excess altitude while maintaining a constant airspeed and a specific track over the ground.

2. **General.** A slip occurs when the aircraft slides sideways towards the center of the turn. It is caused by an insufficient amount of rudder in relation to the amount of aileron and the angle of bank used. If you roll into a turn without using coordinated rudder and aileron, or if you hold rudder against the turn after it has been established, the aircraft will slide sideways towards its center of turn. A slip may also occur in straight-and-level flight if one wing is allowed to drag; that is, flying with one wing low, and holding the nose of the aircraft straight by the use of rudder pressure. In this case, the aircraft slips downward towards the earth's surface and loses altitude. In a full slip, the rate of descent may be in excess of 2000 feet per minute.

3. Procedures

- a. Although the slip can be flown at any airspeed or configuration, it will be demonstrated and introduced at altitude simulating the slip to high key at 100 KIAS with flaps down, and gear up.

NOTE

Caution must be exercised, since stall speed is increased in this out-of-balance flight condition.

- b. To initiate a slip from wings level, lower one wing while applying opposite (top) rudder pressure. Select a reference point on the horizon and adjust rudder pressure and/or angle of bank to maintain the desired groundtrack.
- c. To initiate a slip while in a turn, lower the inboard wing while increasing opposite (top) rudder pressure. It will be necessary to vary the angle of bank and rudder pressure to maintain the desired track over the ground.
- d. Monitor airspeed closely, adjust nose attitude as necessary to maintain 100 KIAS. Monitor the VSI and note increased rate of descent.

NOTE

The low-fuel warning light for the low-wing tank may illuminate regardless of fuel state.

- e. To recover from the slip, smoothly roll the wings towards level while reducing rudder pressure. Remember, the slip must be taken out with enough altitude remaining to slow the rate of descent and ensure positive control of the aircraft during the final moments of any maneuver in which it is used.

4. Common Errors

- a. Improper application of rudder, resulting in a skid.
- b. Poor airspeed control. Remember, nose attitude still controls airspeed.
- c. Not varying angle of bank or rudder pressure to maintain desired track over ground.
- d. Rough entry and recovery control applications.

619. SPIN

1. **Description.** Aggravate a stall until the aircraft begins a nose low autorotation. Concentrate on cockpit indications during the spin. Once spin indications have been verified, execute recovery procedure. When rotation stops and assured of flying speed, commence a smooth pullout.

2. **General.** Spins are taught primarily to increase your confidence in yourself and the aircraft and improve your orientation in unusual attitudes. In this respect, spins are an excellent introduction to aerobatics. Practice them to the left and right. A spin is very easy to perform and recovery can be just as easily effected. This maneuver places no excessive loads or stresses on the aircraft when properly executed.

We practice spins for the same reason we practice stalls. Stalls and spins are not normal flight maneuvers, but they can occur during flight and only through practice can they be recognized rapidly, and recovered from instinctively and reflexively by making the mechanical flight control inputs necessary for recovery.

Spins are generally performed only for air shows and training, but in WWI spins were used to descend through a cloud layer safely. With no flight instruments, early aviators who tried to fly through the clouds could easily get vertigo and enter a spiral dive with rapidly increasing airspeed that (when exceeding V_{ne}) resulted in destruction of the plane and the aviator. A solution was to enter a spin, descend down through the clouds, and hope you had enough altitude and visibility after breaking out to recover safely. With technology and instrumentation, this maneuver was no longer needed to descend through a cloud layer.

An airplane is a compromise between stability and maneuverability. Modern civilian general aviation and transport planes are designed with stability in mind, and although not spin-proof, are usually difficult to spin and even very few modern trainers are certified for spins. Military

aircraft, however, especially fighters and attack aircraft, are designed with maneuverability and performance paramount. High performance planes have poor stall characteristics and can depart from controlled flight readily and violently during high G and high AOA maneuvering. A departure usually begins with a stall and can then involve a pitch-up, nose slice, pitch-roll coupling, pitch-yaw coupling or some other type of post-stall gyration, resulting in a spin type out-of-control situation. To successfully recover, the pilot has to immediately assess what is going on in what may be an extremely disorienting situation. He then has to make a mechanical series of flight control inputs and hope the plane will respond. If he is able to regain controlled flight, he has to recover without exceeding aircraft limitations. If not, he has to be able to recognize it quickly and make a very rapid decision to jettison the airplane and try his luck with his parachute.

For these reasons, spin training is started early in a naval aviator's primary flight training. Spins are confidence builders for a student. They build confidence in his or her own ability to maintain orientation and reflexively apply proper recovery controls; and they build his or her confidence in the ability of the airplane to respond to specific flight control inputs and regain normal flight. Even in our relatively docile training plane, an incipient spin can develop with improper or heavy-handed flight control inputs during stall training or aerobatic maneuvers. Students are demonstrated a skidded turn stall, which is basically a spin type post-stall gyration. A snap roll, such as you see in air shows, is simply a spin while flying horizontally performed by abruptly pulling backstick to stall the wing and kicking rudder in the direction of the desired roll. Instructors Under Training perform a progressive spin and control release spin to more fully investigate the spin characteristics of the T-34C because they will be doing a lot of intentional spins (and perhaps some unintentional ones!) during their tour in the training command. We teach spins for all these reasons and more — one additional reason being that they are fun!

Now that we have discussed spins in general, let us talk about how the T-34C performs in spins. The following pertains to erect spins in clean configuration at idle power.

NOTE

Spins shall be practiced in the clean configuration. In the event of an unintentional spin with gear and flaps down, they shall be retracted immediately to effect recovery and to prevent possible damage by exceeding their speed limitations.

- a. **Spin Entry.** At the stall, positive pilot action is required to effect spin entry by application of pro-spin controls. At the stall, smoothly apply full rudder in direction of desired spin and full backstick with neutral aileron. The controls must be held fully against the stops or the maneuver will not develop into a spin, but will be a spiral with rapidly increasing airspeed. The steady state spin should be fully developed after two turns.
- b. **Nose Attitude.** During the spin the nose will be approximately 45° nose down. During the first several turns, the nose attitude may pitch up and down slightly. During spin tests at NAVAIRTESTCEN, test pilots found that aileron inputs mainly affected these nose pitch

- oscillations with no other significant change to the spin characteristics from lateral stick inputs. With stick into the spin, the oscillations continued for about five turns. Stick opposite the spin resulted in the pitch oscillations damping out within three turns.
- c. **Spin Rate.** The spin rate varies with direction of spin, power setting, configuration, and center of gravity. Spins to the left average about 120° per second with right spins being slightly faster at about 150° per second.
 - d. **Rate of Descent.** In a steady state spin, the rate of descent will be about 9000 to 12,000 feet per minute, depending on power setting. This is about 375 to 500 feet per turn. At idle power the rates will be at the lower values. At these high rates of descent, the altimeter may lag by as much as 1000 feet.
 - e. **Cockpit Indications.** Erect steady state spins typically indicate 80 to 100 KIAS, 30 units AOA, turn needle fully deflected in the direction of spin, and master caution and low fuel annunciator lights may illuminate. The turn and slip indicator is mounted approximately on the spin axis of the airplane at the lower center of the instrument panel. The ball gives no useful information about the spin direction, as it remains basically centered. In the event of disorientation or lack of visual cues, the only reliable instrument that indicates spin direction is the turn needle.
 - f. **Spin Recovery.** The recovery from a spin requires a mechanical input of flight controls to specific positions. To recover the T-34C from an erect spin apply full rudder opposite the spin direction, stick forward of neutral, and neutral ailerons. The control inputs should be brisk and the T-34C responds best to an almost simultaneous application of opposite rudder and stick forward of neutral. The rate of rotation will speed up slightly after anti-spin controls are applied, but recovery should occur within one to two additional turns after recovery is initiated. The airplane will then be in a steep nose-down dive and controls should be neutralized and the plane flown out of the ensuing dive in a timely manner to avoid excessive airspeed, but also avoiding secondary stall or excessive Gs. The NATOPS Manual warns that abrupt aft stick movement near accelerated stall speeds is prohibited due to the possibility of structural damage, therefore spin control inputs should be smoothly applied. Stick Position. Although the rudder is the principal recovery control, the control which requires the most critical positioning is the elevator. The stick must be positioned "FORWARD OF NEUTRAL." Note that this is not "slightly" or "just" forward of neutral. The importance of this longitudinal stick position was determined during NAVAIRTESTCEN spin tests when it was found that an inadvertent aft stick position of only ½ inch behind neutral increased the recovery to as many as six turns. Because of this it is much better to have the stick too far forward than too far aft, and we stress the proper longitudinal stick position is "forward of neutral."
 - g. **If Spin Does Not Recover.** If a recovery from an erect spin does not occur within two turns after applying recovery inputs, verify cockpit indications of AOA, airspeed and turn needle for a steady-state spin. Verify full rudder applied opposite direction of turn needle and stick forward of neutral (no aileron). If no indication of recovery

is evident, adding maximum (allowable) power while maintaining proper spin recovery controls will enhance recovery from an erect steady spin in either direction. Spin recoveries using anti-spin controls and power will not appreciably increase rate of descent while maintaining a stalled AOA; however, significant altitude loss and airspeed increase will result on spin recovery. Power application to recover from spins should be used in emergency situations only. Upon recovery, controls should be neutralized expeditiously and power reduced to idle to minimize altitude loss and rapid airspeed buildup.

3. Inverted Spins

WARNING

Intentional inverted spins are PROHIBITED.

Inverted spins are difficult to achieve and easily recoverable. Pro-spin controls (full rudder deflection and full forward stick) must be applied following an inverted stall to induce a spin. The inverted spin characteristics are quite similar to erect spin characteristics with the exception of angle of attack and normal acceleration. The angle of attack indicates two to three units AOA, airspeed will indicate zero and the load factor will be approximately -1.0 "G." Due to the unusual aircraft attitude required to enter an inverted spin and the initial spin gyrations, inverted spin direction is easily misinterpreted by the pilot when relying on outside reference alone. The cockpit turn needle deflects fully in the direction of spin, erect or inverted, and is the only reliable indicator of spin direction. To recover from an inverted spin refer to the T-34C NATOPS Manual, section V, OUT-OF-CONTROL RECOVERY.

4. Miscellaneous

As good as the spin characteristics of the T-34C are, do not take the aircraft for granted. Always be prepared to bail out if necessary. If a spin just will not recover after ensuring recovery controls are properly applied and power is increased, it is time to bail out. Do not waste time when you have made your bailout decision. If you have not recovered by 5000 feet (remember the 1000 foot lag on the altimeter) and you decide to bail out at that altitude, you are extremely time limited as the aircraft will impact the ground in about 30 seconds. Observations during the KIWI bailout trainer show it takes 12 to 15 seconds to get out of the aircraft and that would put you clearing the aircraft at about 2500 feet. Bail out to the outside of the spin (opposite the turn needle deflection) towards the trailing edge of the wing. If you end up sitting or lying on the wing and the lack of airflow does not sweep you clear of the aircraft, do not crawl 15 feet to the wingtip. Rather, go two feet to the trailing edge to get in the relative airflow that should separate you from the aircraft. This may happen due to the high AOA creating a dead space of undisturbed air on top of the wing.

Overall, the T-34C is a good spinning aircraft. Know the capabilities, limitations, and proper NATOPS recovery procedures for the aircraft for spins and out-of-control situations, and the spin training you receive during your training command tour will be fun and rewarding for both instructors and students.

5. Procedures

a. Spin Entry

- i. **CONFIGURATION:** Establish and trim the aircraft in normal cruise. Trim will remain constant throughout the maneuver. Start the maneuver at an altitude so that the spin itself is entered at a minimum altitude of 9000 feet AGL.
- ii. **CHECKLIST:** Perform the Stall Checklist aloud to your instructor.
- iii. **CLEARING TURN:** Commence a clearing turn using 45° angle of bank. Since considerable altitude will be lost in the spin, be sure that the area below is clear of other aircraft or clouds.
- iv. Roll out of the clearing turn, reducing the power setting to 200 ft–lbs.
- v. Check the wings level and smoothly raise the nose (on the attitude gyro) to approximately 30° above the horizon, and then set PCL to idle.
- vi. At the rudder shakers, lead the stall with a slight amount of rudder in the desired direction of spin. Spins will be conducted in same direction as the last half of the clearing turn.
- vii. When the aircraft stalls (recognized by the nose pitching down), smoothly apply full rudder in the direction of spin and full backstick. Do not use aileron in the entry or during the spin.
- viii. At spin entry, scan inside the cockpit to verify sufficient altitude for recovery, stalled AOA, airspeed stabilized 80 to 100 KIAS and turn needle fully deflected in direction of spin, respectively.

b. Spin Recovery

- i. After verifying spin indications, initiate the recovery from the spin by first applying full rudder opposite to the direction of rotation. Follow immediately with positive forward stick to a position forward of neutral. Do not use ailerons! A common error is unintentionally placing the stick in neutral or slightly aft of neutral.

NOTE

At spin entry, the instructor pilot shall scan inside cockpit to verify stalled AOA, airspeed approaching 80-100 KIAS, turn needle fully deflected in direction of spin and proper pro-spin inputs. Upon application of anti-spin inputs, instructor will verify proper anti-spin inputs inside the cockpit.

- ii. Hold the controls in this position until the rotation stops, then;
 - (1) Neutralize the controls.
 - (2) Check power to idle.
 - (3) Level the wings by reference to the horizon.
 - (4) Commence a smooth pullout. Ensure a minimum of 120 KIAS and do not exceed 4.5 "Gs" or 24 units AOA.
- iii. Continue the pullout until the nose is positioned to the level flight attitude. Recover with a minimum loss of altitude; emphasis is on smooth control movements.
- iv. Check the oil pressure for a minimum of 40 psi.
- v. Add power to the normal cruise power setting.
- vi. Check and report the oil pressure.
- vii. Check the gyro and RMI for precession, and slave if necessary.
- viii. Secure the autoignition.

NOTE

During a spin, left and right fuel caution lights may illuminate regardless of fuel state. Propeller RPM may decrease below normal operating RPM.

WARNING

Erect spins with the propeller feathered are prohibited. Due to reduced airflow, spin recovery may NOT be possible with the propeller fully feathered. If propeller-feathering action is noted during a spin, initiate recovery immediately.

6. Common Errors

- a. Not reducing the power setting to 200 ft-lbs. after rolling wings level from the clearing turn.
- b. Becoming disoriented and not initiating recovery.
- c. Not neutralizing the controls as the rotation stops.

- d. Commencing the pullout too rapidly and/or too early, resulting in a secondary stall.
- e. Not checking the oil pressure, late in adding power when level, and not reporting oil pressure to the instructor.
- f. Unintentionally placing the stick in the wrong position, either too far forward or aft. Unintentionally placing the stick in neutral or slightly aft of neutral.

620. INTENTIONAL FEATHER WHILE AIRBORNE

1. **Description.** The propeller will be feathered while airborne to demonstrate the actual feathering characteristics compared with the simulated condition. This maneuver will not be performed by the student.

2. **General.** In order to extend the aircraft glide during an actual engine failure (with torque less than 205 ft-lbs.), the propeller may be feathered. This increases the blade angle to a maximum pitch of +87.5°, streamlining the propeller and thereby increasing glide range.

At 100 KIAS, the propeller will continue to turn at approximately 200-300 RPM irrespective of engine operation. Throughout this maneuver, you must maintain a minimum of 5000 feet AGL over a hard surface runway.

3. Procedure

- a. Simulate feather. Trim the aircraft for 100-KIAS glide (torque at 205 ft-lbs.).
- b. Note the rate of descent and nose attitude.
- c. Reduce the PCL to idle. Note the deceleration and increased rate of descent.
- d. Place the condition lever to feather. Note the acceleration effect and decreased rate of descent.
- e. Return the condition lever to full increase. Note the time it takes for the propeller to return to governing range, and deceleration at flat pitch.
- f. The maneuver is complete once the propeller is in normal operating range.

4. Common Errors. N/A

CHAPTER SEVEN

LANDING PROCEDURES

700. INTRODUCTION

This chapter discusses the procedures and operations required for the T-34C to enter, land, and depart the landing pattern.

701. LANDING PATTERN

The landing pattern is a geometric racetrack-shaped course flown so that an approach and landing may be executed in a systematic sequence. The landing line, the upwind leg, and the parallel downwind leg form the sides of the racetrack pattern. These lines are joined together by the upwind turn and by the approach turn at the downwind end of the pattern. For purposes of clarity in this instruction, the landing pattern will be subdivided into three parts: the pattern, approach, and landing.

702. LANDING PATTERN TERMINOLOGY

1. Visual Wing References

- | | |
|------------------------------------|--|
| a. Wingtip distance: | Wingtip bisecting the intended point. |
| b. $\frac{3}{4}$ Wingtip distance: | Outboard aileron hinge bisecting the intended point. |
| c. $\frac{2}{3}$ Wingtip distance: | Middle aileron hinge bisecting the intended point. |
| d. $\frac{1}{2}$ Wingtip distance: | Fuel cap bisecting the intended point. |
| e. $\frac{1}{3}$ Wingtip distance: | Fuel access panel inboard of fuel cap bisecting the intended point. |
| f. $\frac{1}{4}$ Wingtip distance: | A point bisecting the wing root and the fuel access panel (also double row of rivets). |

2. **Initial Point.** A point over the ground at the appropriate distance from the runway as specified by the local SOP. At this point the aircraft shall be:

- a. wings level.
- b. at break altitude.
- c. airspeed in accordance with local SOP.

3. **Break.** An overhead transition from cruise to the downwind configuration. The break is basically a LSC conducted simultaneously with a constant angle of bank turn.

4. **Break Altitude.** Consult local SOP or Course Rules.

5. **Pattern Interval.** Determine the number of aircraft and visually acquire each aircraft to determine the proper interval. You have "interval" when any of the following conditions occur:
- a. The aircraft ahead of you is abeam or behind your wingtip AND has completed at least 90° of turn.
 - b. The aircraft ahead has departed in accordance with course rules or simulated Low Altitude Power Loss from the Pattern (LAPL(P)).
 - c. At a tower-controlled field, the above conditions are met, AND you are cleared by the controller.
 - d. At Navy Corpus: If the preceding aircraft is a full stop, the proper interval is 45° behind your wingtip.

NOTE

For AOA approaches (either you or the preceding aircraft), your instructor will judge the proper interval for the crosswind turn.

6. **Upwind.** The extended runway centerline past the departure end.
7. **Downwind.** That portion of the racetrack pattern offset from the runway in the opposite direction of landing.
8. **Crosswind Turn.** The turn between upwind and downwind.
9. **Abeam.** The position in the racetrack pattern abeam the intended point of landing at pattern altitude.
10. **180° Position.** The position in the racetrack pattern opposite the intended rollout point.
11. **90° Position.** The bisector between the 180 and intended rollout point. The aircraft should be 450 feet AGL and perpendicular to the runway. Airspeed is dependent on the type of approach. (Civil equivalent: BASE LEG)
12. **Final.** The extended centerline of the runway with 1200-1500 feet of straightaway at an altitude between 100 and 150 feet AGL. Airspeed is dependent on the type of approach.
13. **Intended Point of Landing.** This is the point on the runway where you intend to touch down. Many outlying fields have a box painted on the runway to assist in referencing the position for landing. Touchdowns should be made on centerline at the intended point of landing to 500 feet past that point. If a crash truck, wheels watch, runway duty officer, etc. is positioned at the approach end of the duty runway, do not touch down prior to them. TW-4 exception: Refer to local Course Rules for operations at Aransas County Airport. TW-5 exception: Touch down prior to the RDO cart at NAS Whiting Field is allowed.

14. **Landing Line.** This is the extended runway centerline. It is a line over which the aircraft should track in the final straightaway and landing.

15. **Wind Line.** This is an imaginary line parallel to the wind direction extending through the intended point of landing. It may or may not coincide with the landing line. If the landing line and wind line do not coincide with each other, a crosswind exists.

16. **Departure Interval.** You are number one for departure when above 300 feet AGL, flaps up, and the aircraft upwind has:

- a. Begun his crosswind turn.
- b. Raised his gear to depart.
- c. Conducted a simulated LAPL(P).

NOTE

In order to depart, you do not have to be number one with interval, but you must be number one upwind. There is a difference!

NOTE

Navy Corpus aircraft consult local course rules for departures from the downwind when applicable.

703. OUTLYING FIELD ENTRY

1. **Description.** The outlying field entry (OFE) is a series of uniform procedures by which aircraft enter the landing pattern.

2. **General.** The following procedures are utilized because of the vast number of aircraft requiring landings. Since numerous (5-10) aircraft may be using the same outlying field (OLF) simultaneously, it is absolutely necessary that each aircraft conform to the same systematic pattern and standard operating procedures for safety and efficiency.

3. Procedures

- a. Determine the duty runway.
- b. Fly to establish the aircraft at the appropriate initial point. The initial point is a point over the ground at the appropriate distance from the runway as specified by SOP. At this point the aircraft shall be:
 - i. on extended runway centerline and on runway heading. (Reference the RMI!)
 - ii. wings level.

- iii. at break altitude (see local SOP).
- iv. airspeed in accordance with local SOP.
- c. When at the initial point, make the appropriate radio call.
- d. Fly from the initial point towards the runway maintaining altitude and airspeed, visually locate pattern traffic and obtain wind information.

4. Common Errors

- a. Not selecting the appropriate outlying field channel.
- b. Not positioning the aircraft for the correct runway.
- c. Incorrect voice report.
- d. Not properly established at initial point.
- e. Not establishing the proper break interval.
- f. Continuing inbound for the break without two-way communications with the RDO.

704. THE BREAK

1. **Description.** The outlying field break is a series of procedures to transition the aircraft from fast cruise configuration to the downwind configuration and position the aircraft on the downwind leg. (Figure 7-1).
2. **General.** The following procedures will prepare the aircraft for landing at a field.
3. **Procedures**
 - a. Establish the proper interval. Consult your local course rules for proper intervals for other types of aircraft.
 - b. With interval, execute the break in accordance with local SOP.
 - c. Roll into a 30° AOB (TW-5)/45° AOB (TW-4) turn and maintain altitude.
 - d. Reduce power to 300 ft-lbs. torque.
 - e. Verbally confirm airspeed below 150 KIAS on ICS prior to the pilot at the controls lowering the landing gear.

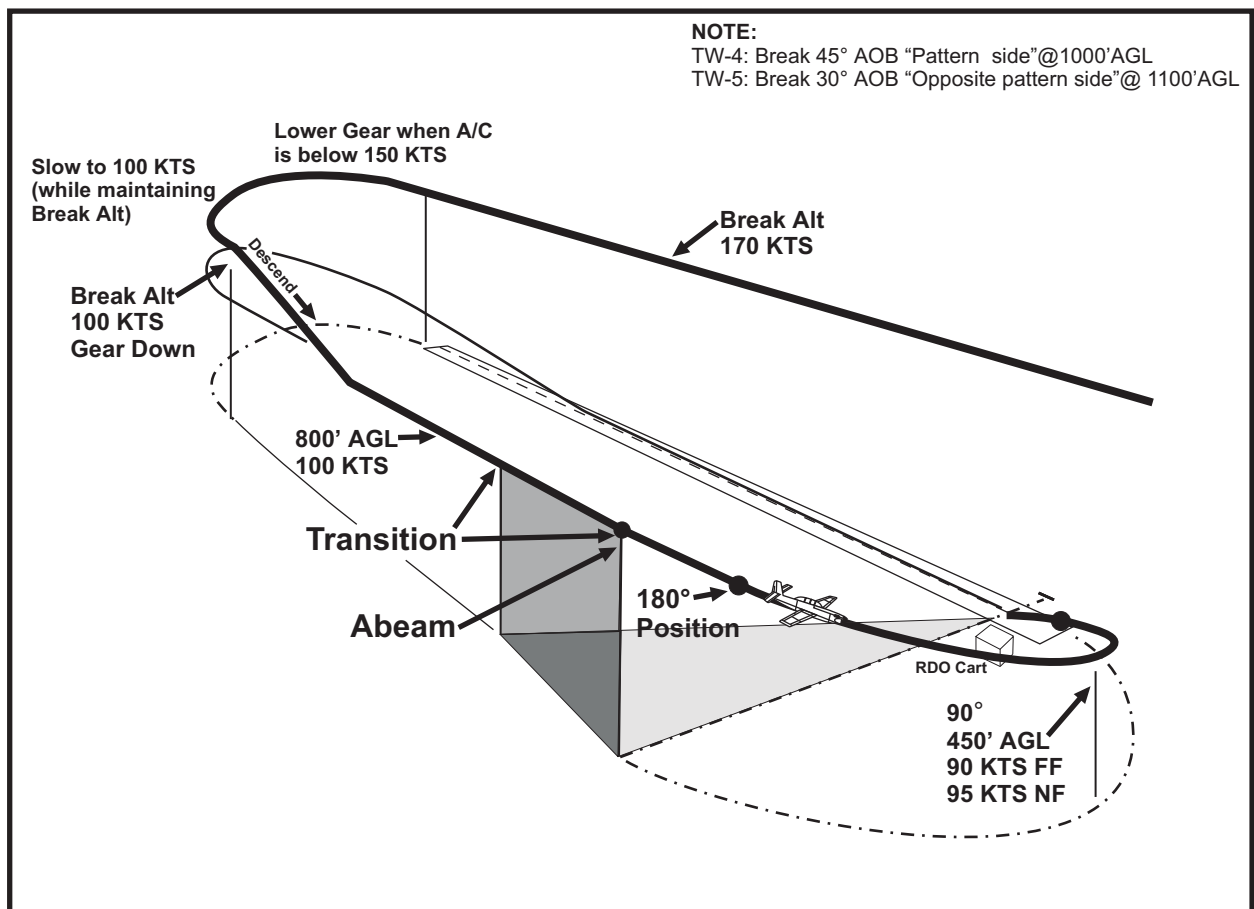


Figure 7-1 "The Break"

- f. Halfway through the break turn, adjust the angle of bank to establish a $\frac{3}{4}$ wingtip distance on downwind.
- g. Slow to 100 KIAS, maintaining break altitude, trimming right rudder and up elevator for deceleration.
- h. Approaching 100 KIAS, lower the nose and descend at 100 KIAS to pattern altitude.
- i. Level off at pattern altitude using the P.A.T. principle:

Power:	Approximately 500-550 ft-lbs. torque
Attitude:	Stop the descent by initially setting a slightly nose-up attitude immediately followed by the 100 knot level flight attitude.
Trim:	Retrim.
- j. Once you are wings-level on downwind, conduct the Landing Checklist down to the flaps. Report it aloud to your instructor.

4. Common Errors

- a. Not establishing proper interval.
- b. Poor attitude/altitude control in turn.
- c. Not trimming right/up.
- d. Not maintaining break altitude until reaching 100 KIAS.
- e. Not maintaining pattern altitude after descent from break altitude (i.e., settling below pattern altitude).

705. LANDING PATTERN

1. Description. N/A

2. **General.** The pattern is the portion that commences with the break, or the takeoff following a touch-and-go or waveoff, and ends at the commencement of the approach turn. (Figure 7-2). The following limits will be observed in the pattern:

- a. MAX 30° angle of bank.
- b. One hundred knots upwind with flaps up, crosswind, and downwind.
- c. Crosswind turn shall not be initiated below 300 feet AGL.

Interval permitting, the entire pattern can be flown in as little as 3½ minutes. There is not time for confusion or disorganization. Inability to fly a safe, consistent landing pattern has been the pitfall of more student naval aviators than all other failures combined. The cockpit workloads are high, but an in-depth understanding of what is to be accomplished and how to get it done will enable you to consistently shoot good passes. Remember, you are only as good as your last pass.

The following paragraphs are sequenced to fly you through the entire landing pattern and its options. These procedures and techniques have worked for thousands of SNAs. They will work for you.

706. APPROACH

1. **Description.** Make a descending 180° balanced turn to final in the full-flap or no-flap configuration.

Control: AIRSPEED with NOSE ATTITUDE

RATE of DESCENT with POWER

2. **General.** The approach is the portion that commences at the 180° position and ends with a landing, touch-and-go, or waveoff. This type of approach develops the student's judgment and ability to control airspeed with nose attitude and rate of descent with power, while tracking a

7-6 LANDING PROCEDURES

prescribed pattern over the ground under varying wind conditions. It develops consistency in landing the aircraft on or near the intended point of landing.

NOTE

Pattern interval will be established in the break or crosswind turn and will NOT be corrected by variance of the approach from the 180 to final. If proper interval cannot be maintained, WAVE OFF.

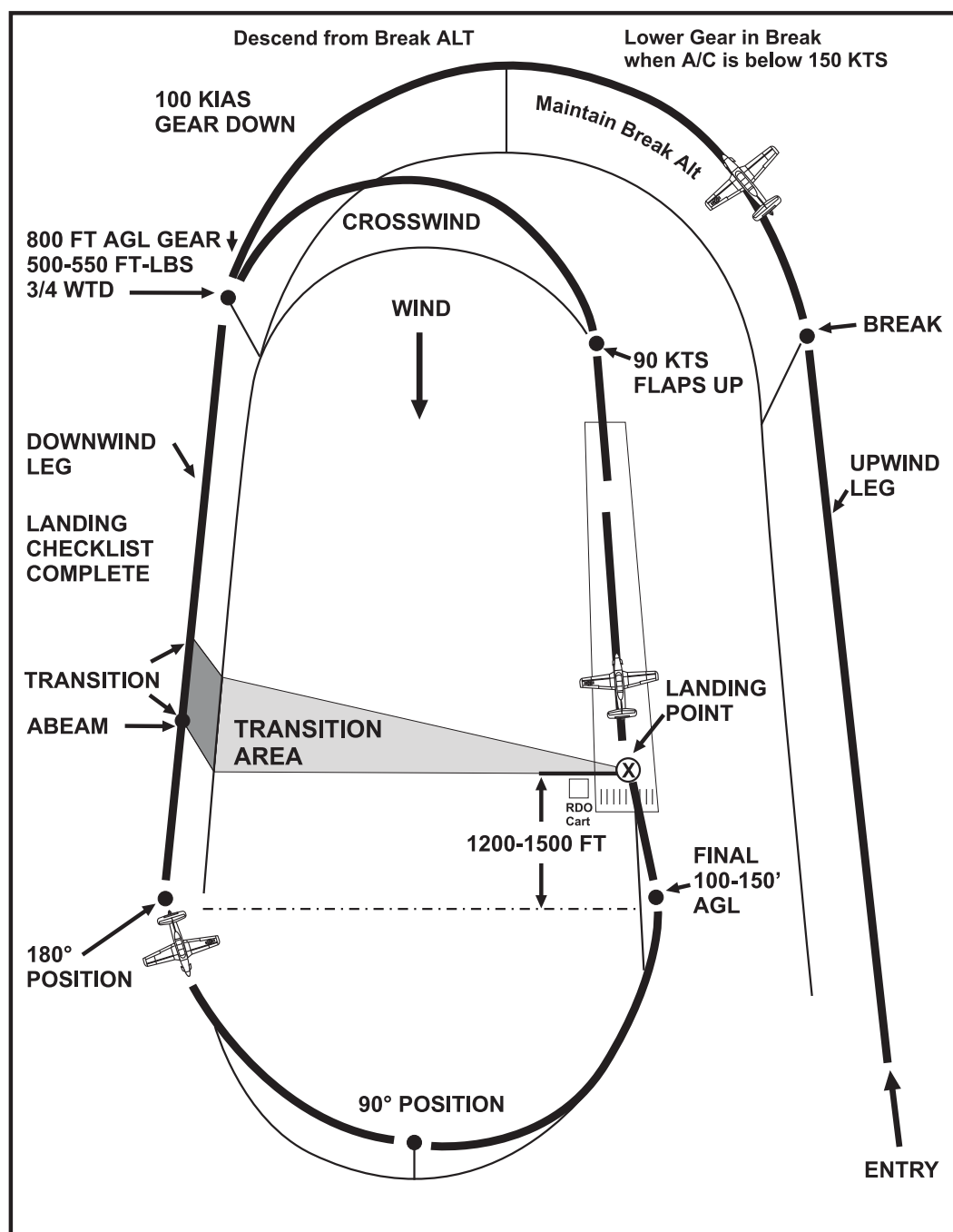


Figure 7-2 Landing Pattern

- a. **Downwind.** The downwind leg is flown at pattern altitude, at $\frac{3}{4}$ wingtip distance from the landing line at 100 KIAS using approximately 500-550 ft-lbs. of torque. (Checklist will be performed prior to the 180.) When established on the downwind leg, perform the Landing Checklist. (Figure 7-3).

CHALLENGE	ACTION	REPLY
1. "Harness"	Lock harness	"LOCKED"
2. "Landing Gear"	Check for 3 down and locked	"DOWN AND LOCKED"
3. "Brakes"	Check parking brake off and brakes pumped firm	"PARKING BRAKE OFF, BRAKES PUMPED FIRM"
4. "Instruments"	Check engine instruments for proper indications	"CHECKED"
5. "Landing Lights"	Turn landing lights on	
Hold flaps until the appropriate location in the landing pattern.		
6. "Flaps"	Put flaps down (if desired) and make visual confirmation	"GEAR DOWN, FLAPS DOWN/UP, LANDING CHECKS COMPLETE"

Figure 7-3 Landing Checklist

NOTE

In perfectly calm wind conditions, the downwind heading (reciprocal of runway heading) will maintain the proper spacing once a $\frac{3}{4}$ WTD has been established. However, this is not true when a crosswind exists. If there is a crosswind, the aircraft will have to be angled (crabbed) sufficiently into the wind to prevent drifting into or away from the runway. It is not uncommon to have to alter the downwind heading as much as 15° to maintain proper spacing abeam the runway.

- b. **Transition.** Initiate the transition early enough to arrive at the 180 in the proper configuration in a trimmed condition. Transition by reducing power smoothly to approximately 300 ft-lbs. torque (275 ft-lbs. NF), lower flaps (if required), and trim left rudder and up elevator for the power reduction.

NOTE

Wind conditions must be considered when determining when to transition. During perfectly calm wind conditions, the transition should begin at the abeam position.

- c. **The 180.** This is the position on the downwind leg from which the approach turn is commenced, and is typically the point opposite the intended rollout point. Upon reaching the 180, commence the approach turn by simultaneously lowering the nose to the 90 KIAS (95 KIAS for NF) approach attitude and smoothly turning toward the

90° position. Due to the transition power reduction, lowering the nose is necessary so as not to slow below 90 KIAS (95 KIAS NF).

The pitch attitude of the aircraft in a full-flap approach is lower than in a no-flap approach. The no-flap approach will typically require a slightly steeper angle of bank and further power reduction to achieve the proper racetrack pattern checkpoints. Never exceed 30° AOB. Maintain balanced flight. Retrim as necessary. Do not skid nor slip the aircraft through the turn. One of the most important concepts to understand is that every approach must be started from the same relative position.

The runway is a landmark. Pilots are encouraged to look at it frequently. Also, objects on the ground should be used as pattern checkpoints so as to fly the same consistent path over the ground regardless of wind. When ground checkpoints around the pattern are available, they can be used in getting to the final checkpoint, the runway. The more experience you have, the more you look out the canopy to compensate for abnormal conditions before you get out of position. It is rather hard to fly the same path over the ground unless you look at the ground.

After starting the approach turn:

- i. Give appropriate 180 call in accordance with SOP.
- ii. Then check and report on the ICS, "Gear down, flaps up/down, Landing Checklist complete."

Vary the angle of bank and adjust the nose attitude/rate of descent as necessary to arrive at a proper 90° position. Use ground checkpoints.

- d. **The 90.** The 90° position is a fixed position at the midpoint of the approach turn at which the aircraft's heading is 90° from the runway heading. The aircraft should pass through this position at 90 KIAS FF/95 KIAS NF and 450 feet AGL. (Figure 7-4).

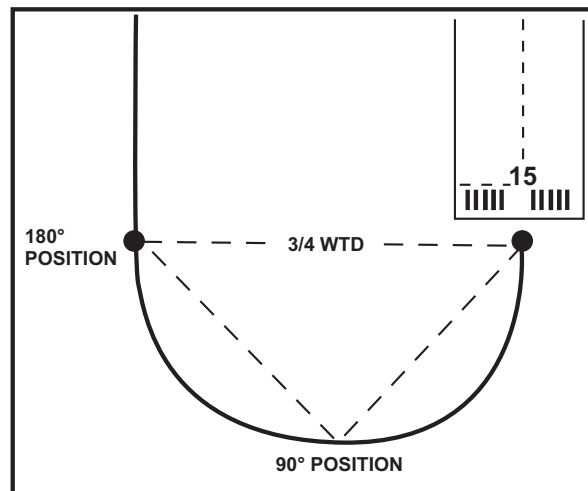


Figure 7-4 90° Position

Continue to fly the aircraft from the 90° position and anticipate a rate of turn which will enable you to intercept the extended centerline with 85 KIAS FF/95 KIAS NF, 1200-1500 feet of straightaway, 100-150 feet AGL, and wings level. Check and report on the ICS, "Gear down, paddles checked." (If no paddles are available, report "negative paddles.")

The need for corrections in the approach must be recognized as soon as possible and the actual corrections must be small to avoid over correction. Although power controls the rate of descent and the nose attitude controls the airspeed, it must be remembered that the combination of attitude (nose and wing) and power work together to produce aircraft performance. Any change in attitude (nose or wing) to maintain the proper glidepath will require a corresponding change in power. No written outline can effectively state all possible errors in a landing approach. The correctional techniques that are utilized to correct for deviations from the desired altitude/airspeed are those learned on your first flight. Remember, the combination of attitude and power work together to produce aircraft performance.

- e. **The "final" (straightaway or groove)** is that final portion of the landing approach, beginning at a point 1200-1500 feet from the intended point of landing at an altitude of 100-150 feet AGL where the aircraft is first aligned, wings-level and ends with the landing transition. The length of the straightaway should provide 10-12 seconds prior to landing. (Figure 7-5).

The entire pattern to this point is designed to position the aircraft to intercept the cone that is the glideslope groove. The rate of descent must be adjusted and readjusted in order to achieve and maintain a constant rate of descent, but also to stabilize the glideslope "picture." Power required will vary with wind conditions.

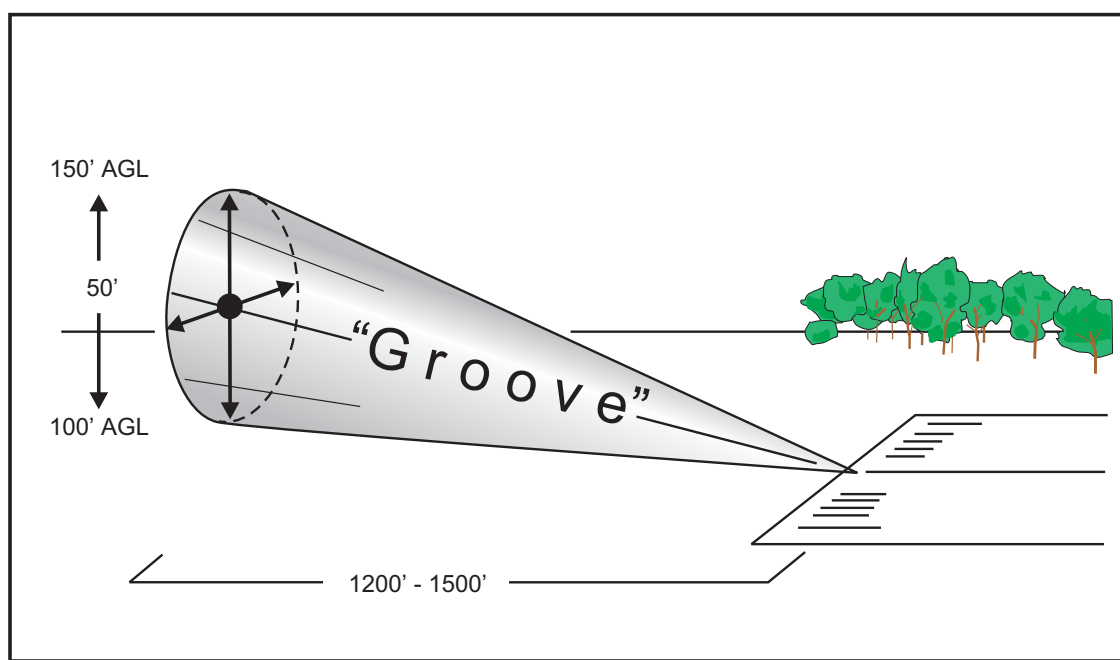


Figure 7-5 The "Groove"

The secret to a good approach is to solve lineup problems early. After rolling out on straightaway, if the centerline is not between your legs, correct immediately and positively. Following this correction, continue to scan lineup, making small corrections as necessary. Do not ease yourself to centerline, or a counter-correction will have to be made close to the touchdown point of the runway.

Rolling wings level while aligning the airplane with the runway centerline, the nose attitude should be maintained and a slight reduction in power may be necessary to compensate for the increase in lift. Slight adjustments in pitch, changes of nose attitude, and power may be necessary to maintain the descent attitude while gradually decelerating. When the nose attitude and airspeed have been stabilized, the airplane should be retrimmed to relieve the pressures being held on the controls. Do not slow below 80/90 KIAS until commencing the landing transition.

The straightaway portion of the approach has some very closely defined dimensions and these enable the pilot to establish constant visual checkpoints. The dimensions are depicted below (Figure 7-6).

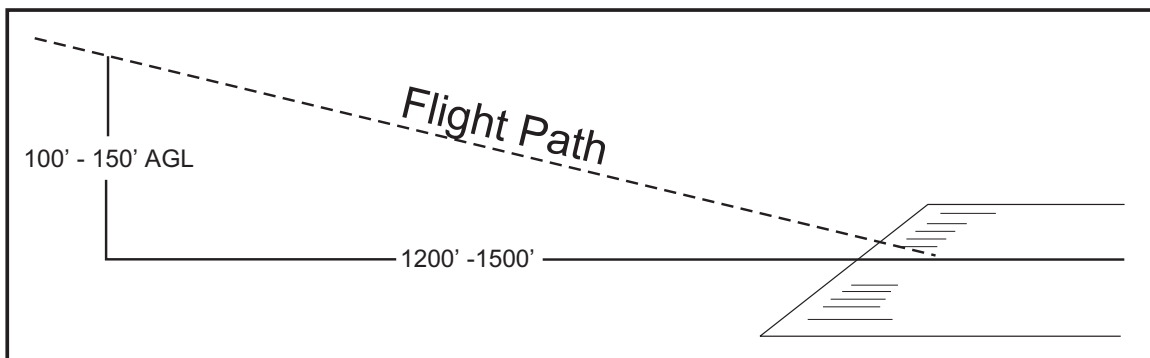


Figure 7-6 The "Straightaway"

To maintain a constant glideslope, it is necessary to maintain a fairly constant airspeed and rate of descent. Given that the aircraft has a constant attitude for each airspeed, power, and configuration combination, we will be able to reference the nose position to glideslope and intended point of landing. (Figure 7-7).

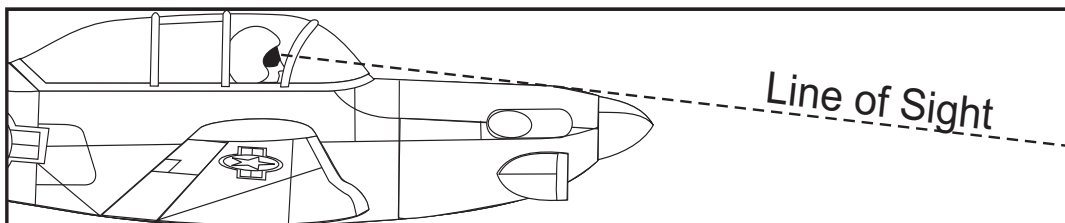


Figure 7-7 Line of Sight

Mentally superimpose our symbolic aircraft on the glideslope and you should see that by maintaining airspeed (meticulously) and a constant sight picture of the touchdown zone, you will maintain a constant rate of descent to land in a predictable area of the runway.

If your airspeed is "locked on" and the intended point of landing appears to be running away from you, your aircraft is falling below the desired glideslope. Add power, raise the nose to maintain airspeed and fly back up to the glideslope. Anticipate a slight power reduction when back on glideslope and lower the nose to the approach attitude to reestablish the rate of descent.

Conversely, if the intended point of landing disappears beneath the nose and airspeed is "locked on," you have flown above the glideslope and need to reduce power. Lower the nose, thereby increasing the rate of descent while maintaining airspeed. Anticipate a slight power addition once reestablished on glideslope and readjust the nose attitude to "set" the desired rate of descent (Figure 7-8).

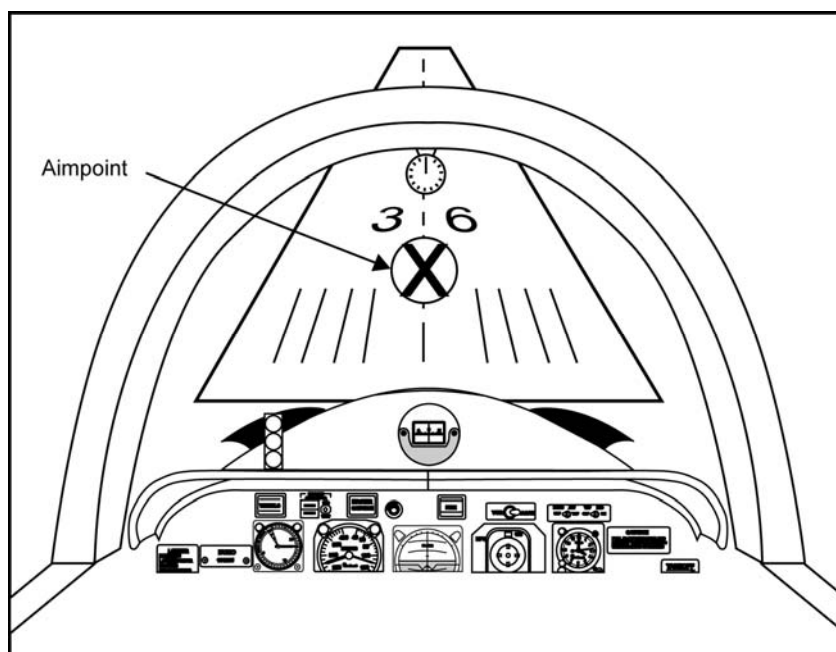


Figure 7-8 Aimpoint

Balanced flight must be maintained throughout the approach. An unbalanced flight condition increases the stalling speed, gives an erroneous impression of the flight path of the aircraft, and may cause difficulty during the subsequent landing transition, touchdown, and/or landing rollout. Fly the aircraft smoothly; avoid sudden or erratic control movements. Remember, good basic airwork and proper trim are mandatory in the approach. The proper amount of rudder and up elevator trim will enable the aircraft to "fly itself" with very little control pressure. The key to a good landing is a good approach.

- f. There are three general areas to consider in flying a good approach.
- i. **SCAN.** A rapid integrated scan pattern is a necessity. The exterior cues of the "picture" and landing area alignment, and the internal cues of tactile sensation and inner ear ("seat-of-the-pants"), must be "scanned" and integrated with instrument readings for an accurate total appraisal of the pilot's present situation. An anticipation of trends and early correction can then be made.
 - ii. **FUNNEL EFFECT.** Because of the cone shape of the straightaway/groove large corrections must be made while far out, and small corrections as touchdown is approached.
 - iii. **COUNTER-CORRECTION.** For every correction that is made, there will be a counter-correction necessary to achieve stability. The overall goal is to achieve stability of attitude and rate of descent, and cross the runway at a precise altitude on the centerline of the landing area. Stability of the above factors must not be construed to mean that power and controls are necessarily stable. Smoothness comes from recognizing errors early, through a rapid scan, and being able to make a small correction before the aircraft deviates far from optimum.

The glideslope (altitude) is controlled primarily with power, and the attitude/airspeed primarily with the stick, but it cannot be overemphasized that there must be a coordinated use of both in any correction. In analyzing a situation, there are two basic elements to be considered: speed (either fast or slow) and altitude (either high or low). There are many possible combinations of these elements, which will compound the error analysis and correction. The following is a list of the most common deviations and corrections to ensure the "perfect approach." (Figure 7-9).

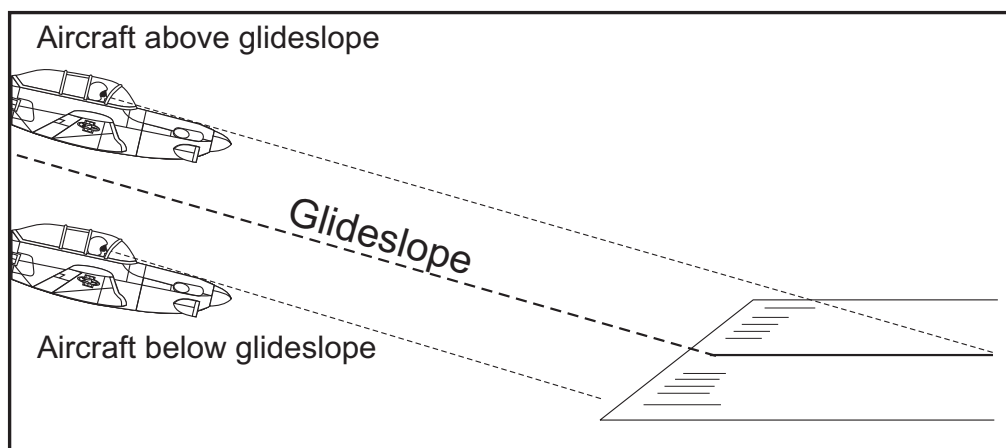


Figure 7-9 Glideslope Corrections

- (a) **HIGH** - To correct a high situation, reduce power slightly and lower the nose to maintain airspeed with nose attitude. Power should be reduced,

because it is probably why the aircraft got high in the first place. Do not reduce power excessively. DO NOT attempt to correct for being high once over the runway. Attempting to do so will result in a hard landing, which could cause structural damage to the aircraft.

- (b) **LOW** - NEVER accept being low. To correct a low situation add power and raise the nose to maintain airspeed. The nose attitude correction is vital. Attitude must be adjusted if the correction is to be timely. Adding power alone will merely accelerate the aircraft.
- (c) **FAST** - To correct, reduce power slightly while simultaneously applying slight backpressure on the stick. Readjust power when the aircraft decelerates to the proper airspeed.
- (d) **SLOW** - To correct, add power and apply forward pressure to the stick to increase airspeed. Reduce power and readjust nose attitude when the aircraft reaches the proper airspeed.

4. Procedures

a. Downwind leg

- i. Perform Landing Checklist up to flaps prior to the abeam.
- ii. Maintain proper downwind, parallel runway at $\frac{3}{4}$ wingtip distance, pattern altitude, and 100 knots, using approximately 500-550 ft–lbs. of torque. TRIM.

b. Transition (prior to the 180° position)

- i. Power reduced to approximately 300 ft–lbs. torque (275 NF).
- ii. Flaps full down/or remain up for a no-flap approach.
- iii. Trim left rudder for the power reduction and up elevator.

c. 180° Position

- i. Opposite the intended rollout position, simultaneously lower the nose to the 90/95-KIAS approach attitude and smoothly turn towards the 90° position.
- ii. Make appropriate UHF radio transmission.
- iii. Make necessary corrections throughout the approach using power to control rate of descent and nose attitude to control airspeed.
- iv. Retrim the aircraft throughout the approach.
- v. Check and report the Landing Checklist complete over the ICS. This should be one prior to the 90° position.
- vi. Vary AOB and power as necessary to arrive at a proper 90° position; 90/95 KIAS, 450 feet AGL, perpendicular to the runway.

- vii. Intercept the extended centerline with 85/95 KIAS, 1200-1500 feet of straight away and 100-150 feet AGL, wings level.
- d. **Final**
 - i. Maintain pitch attitude while making a slight power reduction.
 - ii. Gradual deceleration.
 - iii. Maintain runway centerline.
 - iv. Locate windsock to determine wind direction and velocity.
 - v. TW4 report "gear down, paddles checked/negative paddles" over ICS. TW5 report "gear down and locked, lights checked" over ICS.
 - vi. Do not slow below 80-90 KIAS until commencing the landing transition.

5. Common Errors

- a. Not flying all checkpoints.
- b. Not maintaining the appropriate airspeed and altitude profile at the 90° and on final.
- c. Spotting the deck.

707. LANDINGS

1. **Description.** Land smoothly on the main-mounts at the intended point of landing on runway centerline.

2. General

- a. **Landing Transition.** The landing transition is a slow, smooth transition from a normal approach attitude to a landing attitude. The landing attitude has approximately the same nose-high attitude as that for normal takeoffs. When approaching touchdown, what appears to be approximately 5 to 10 feet above the ground, the transition should be started and should be a continuous process until the airplane touches down on the ground.

As the airplane reaches the height above the ground where a timely change can be made into the proper landing attitude, smoothly reduce the PCL towards idle while gradually applying backstick pressure to slowly increase the nose attitude and angle of attack. This will cause the airplane's nose to gradually rise towards the desired landing attitude. The angle of attack should be increased at a rate that will allow the airplane to continue to settle slowly as forward speed decreases.

- b. **No-Flap Landing.** When the angle of attack is increased, the lift is momentarily increased, thereby decreasing the rate of descent. Since power normally is reduced to idle during the transition, the airspeed will also gradually decrease. This, in turn, causes lift to decrease again; it must be controlled by raising the nose and further increasing the angle of attack. During the transition, then, the airspeed is being

decreased to touchdown speed while the lift is being controlled so the airplane will settle gently onto the landing surface. Backstick pressure will need to be increased as the airspeed decays. The transition should be executed at a rate such that the proper landing attitude and the proper touchdown airspeed are attained simultaneously just as the wheels contact the landing surface.

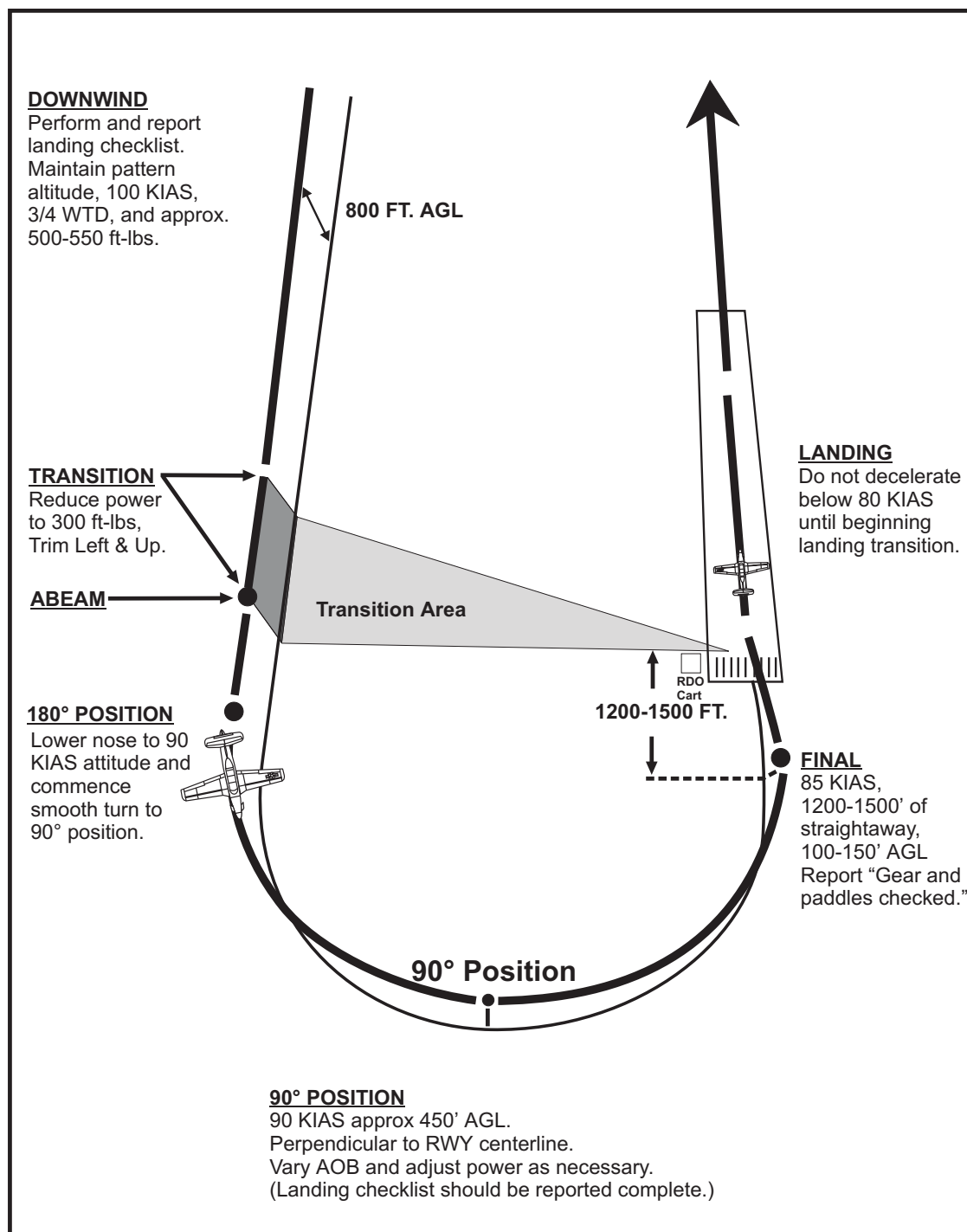


Figure 7-10 Full Flap Landing

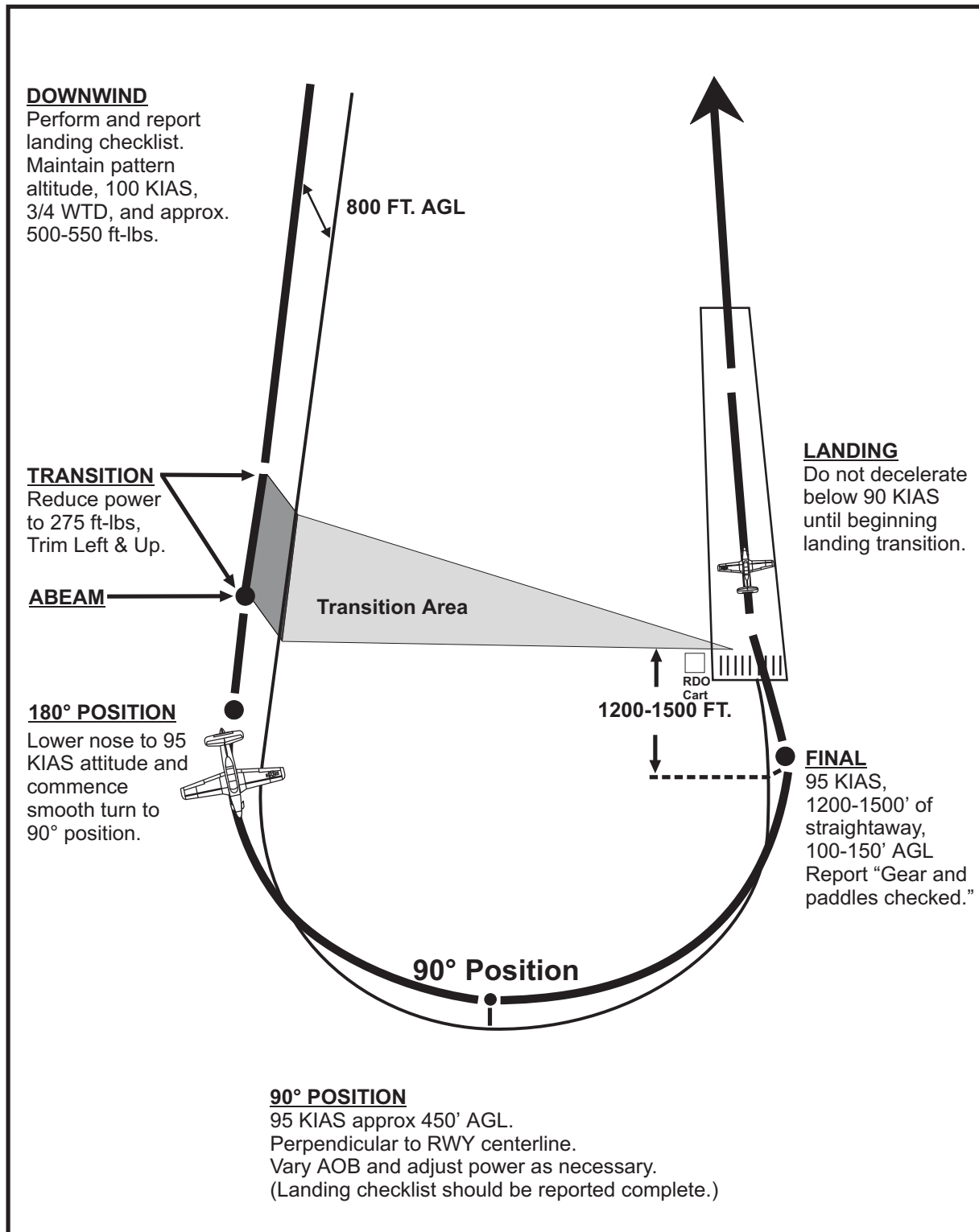


Figure 7-11 No-Flap Landing

The rate at which the landing transitional flare is executed depends on the airplane's height above the ground, the rate of descent, and the pitch attitude. A transition started excessively high must be executed more slowly than one from a lower height to allow the airplane to descend to the ground while the proper landing attitude is being established. The rate of flaring must also be proportional to the rate of closure with the ground; that is, when the airplane appears to be descending very slowly, the increase in pitch attitude must be made at a correspondingly slow rate.

The rate of upward movement of the nose depends on the conditions of flight, the height of the aircraft above the ground, and the rate of descent at the moment the landing transition is initiated. A high transition must be executed more slowly than one from a lower height so that the altitude may be dissipated. Apply backstick pressure proportionately to the apparent upward movement of the ground. When the ground appears to be coming up very slowly, raise the nose slowly.

If you misjudge the apparent upward movement of the ground and think it is coming faster than it is, you may raise the nose too rapidly, causing the aircraft not only to stop descending, but actually to start climbing. This sudden climb during the transition is known as "ballooning." Ballooning presents a dangerous situation, because your height above the ground is being increased and your aircraft may be approaching a stalled condition. Any time you balloon excessively, apply full power smoothly and execute a waveoff.

When the ground stops coming up towards you, the rate at which you have raised the nose has been too rapid, and you will be too high above the runway. To compensate for this, stop the nose movement and maintain a constant nose attitude until the aircraft again starts descending, and then continue with the transition. This technique should be used, however, only when you have adequate flying speed. If you have reached the landing attitude and are still well above the ground, do not wait for the aircraft to start descending again. Execute a waveoff. Remember that when a landing attitude is attained, the aircraft is rapidly approaching a stall (because the airspeed is decreasing and the critical angle of attack is being approached), even though you are no longer raising the nose.

If the nose of an aircraft is lowered, the lift is decreased momentarily as the nose attitude is changed. If you lower the nose of the aircraft in the landing transition when fairly close to the runway to increase the rate of descent, the momentary decrease in positive lift may be so great that the aircraft will land hard on the nosewheel, which may collapse. You should execute a waveoff instead of lowering the nose in the landing transition; this is an indication that you may be too high above the ground and approaching an immediate stall.

NOTE

If at any time during the landing approach you experience rudder shakers, execute a waveoff.

- c. **Touchdown.** The touchdown is the setting of the aircraft gently onto the runway from a landing attitude. As the aircraft settles, the landing attitude must be maintained with backstick as necessary. If the landing attitude is not maintained, the nosewheel will contact the ground with or before the main gear and the aircraft will probably bounce back into the air. If the aircraft is flown onto the ground with excessive speed in a flat attitude, the same thing will occur. These situations call for immediate pilot action. A very hard or high bounce has only one remedy — application of full power to execute a waveoff. A moderate skip or bounce can usually be corrected by raising the nose to the landing attitude and re-landing the aircraft. Failure to take any corrective action or the use of improper technique such as chasing the nose will result in a "porpoise." A porpoise is a condition where the aircraft oscillates in successive bounces, which usually results in an eventual severe nose-wheel-first landing with probable damage to the nose gear, and possible propeller strike of the runway. If a porpoised landing develops, immediately execute waveoff procedures. Examples of unsafe landings are hard landings resulting in a bounce and a flat or nose-first landing leading to a porpoised landing.

The landing transition and touchdown should be made with the PCL approaching idle, and the airplane at an airspeed approximately 10 percent above stall, so that the airplane will touch down on the main gear. As the airplane settles, the proper landing attitude must be attained by application of whatever back elevator pressure is necessary.

Some pilots may try to force or fly the airplane onto the ground without establishing proper landing attitude. It is paradoxical that the way to make an ideal landing is to try to hold the airplane's wheels a few inches off the ground as long as possible with the elevators. In most cases, when the wheels are within about two or three feet of the ground, the airplane will still be settling too fast for a gentle touchdown; therefore, this descent must be retarded by further back pressure on the elevators. Since the airplane is already close to its stalling speed and is settling, this added back pressure will only slow up the settling instead of stopping it. At the same time, though, it will result in the airplane touching the ground in the proper landing attitude.

The T-34C should contact the ground in a nose-high attitude, with the main wheels touching down first. After the main wheels make initial contact with the ground, back pressure on the elevator control should be held to maintain a positive angle of attack until it is certain that the aircraft is on the deck. Then back pressure may be gradually relaxed to allow the nosewheel to gently settle onto the runway. This will cause a low angle of attack on the wings to prevent floating or skipping, and will allow the full weight of the airplane to rest on the wheels for better braking action. The airplane should never be "flown on" the runway with excess speed.

It is extremely important that the touchdown occur with the airplane's longitudinal axis exactly parallel to the direction in which the airplane is moving along the runway. Failure to accomplish this not only imposes severe side loads on the landing gear, but imparts groundlooping (swerving) tendencies.

To avoid these side stresses or a ground loop, the pilot must never allow the airplane to touch down while in a crab or while drifting.

- d. **Landing Roll-out.** The landing roll-out is a very important phase of the landing, because directional control must be maintained during the roll-out. The roll-out is not completed until normal taxi speed is reached, the aircraft is brought to a stop, or the aircraft becomes airborne for touch-and-go landings.

To properly execute this phase of a landing, you must understand what factors may influence the maneuverability of the aircraft after the landing has been made and use sound judgment in applying corrections. Some of these factors are the center of gravity, strong crosswinds and/or gusty winds, and a low oleo strut or tire inflation. Special precautions will have to be taken for crosswinds any time the winds are gusty.

Any time there is a change in direction, centrifugal force will cause the center of gravity of the aircraft to be moved outward and away from the direction of the turn. If the turn is severe, centrifugal force may move the center of gravity far enough to cause the outside wing to strike the ground. For this reason, swerves should be avoided whenever possible. Remain on the runway centerline until a safe taxi speed is reached prior to turning off the runway for a full-stop landing.

While considering the dominant factors which affect the landing roll-out, it is important to analyze what controls are available to counteract them and what effect they have on the aircraft. The three controls that can control the aircraft on the ground are the rudder, brakes, and ailerons. The PCL is not used to aid the pilot in directional control. Adding power after a swerve has developed may aggravate the condition, because of the effect of torque, thereby increasing the severity and possibly resulting in a ground loop.

Ensure your heels are on the deck and use only rudders to control direction. Since you will be rolling fast, only small rudder corrections need be applied. The rudder serves the same purpose on the ground as it does in the air (it controls the yawing of the airplane). The effectiveness of the rudder, however, is dependent on the airflow which, of course, depends on the speed of the airplane. As the speed decreases and the nosewheel has been lowered to the ground, the nosewheel provides more positive directional control.

The brakes of an airplane serve the same primary purpose as do the brakes of an automobile (that is, to reduce speed on the ground). In airplanes, however, they may also be used as an aid in directional control when more positive control is required than can be obtained with rudder alone.

To use brakes, the pilot should slide the toes or feet up from the rudder pedals to the brake pedals. If rudder pressure is being held at the time braking action is needed, that pressure should not be released as the feet or toes are being slid up to the brake pedals, because control may be lost before the brakes can be applied.

During the ground roll, the airplane's direction of movement may be changed by carefully applying pressure on one brake or uneven pressures on each brake in the desired direction. Caution must be exercised, however, when applying brakes to avoid over-controlling. Brakes should not be used until full throw of the rudder no longer provides the necessary control forces.

The ailerons also serve the same purpose on the ground as they do in the air (they change the lift and drag components of the wings). During the after-landing roll they should be used to keep the wings level in much the same way they were used in flight. If a wing starts to rise, aileron control should be applied towards that wing to lower it. The amount required will depend on speed because, as the forward speed of the airplane decreases, the ailerons will become less effective. Techniques for using ailerons in crosswind conditions are explained further in the section on crosswind landing.

- i. **Full-Stop Landing.** In order to execute a full stop, lower the nosewheel to the deck, and bring the PCL smoothly into full BETA. Maximum effectiveness of reverse thrust occurs with higher airspeeds. Therefore, BETA will precede braking action. A single smooth application of brakes is generally used to fully stop the aircraft. The amount of brake pressure applied is commensurate with forward speed and runway remaining for turnoff. If a long runway (5000 feet or more) is being utilized for a full stop, the speed of the airplane should normally be allowed to dissipate through friction and drag. Gradual deceleration saves on tires and brakes.
- ii. **Touch-and-Go Landing.** When making touch-and-go landings, utilize the P.A.T. principle by smoothly applying the power to full forward. Remember that right rudder pressure will be required as the engine spools up. As power becomes available following engine spool-up, raise the nose to the takeoff attitude and allow the aircraft to smoothly take off. Climb out at 90 KIAS (full flap)/ 100 KIAS (no flap) and trim for balanced flight. When safely airborne (90 KIAS with a positive rate of climb) reset 1015 ft-lbs., raise the flaps and accelerate to 100 KIAS (if required) while maintaining the same climb attitude. Retrim the aircraft and continue climbing at 100 KIAS. When number one with interval, make a crosswind call on the UHF (as required) and commence a turn to the downwind leg using a maximum of 30° AOB. Fifty feet prior to pattern altitude, begin the transition to level off at pattern altitude by reducing power to approximately 500-550 ft-lbs. of torque, then lowering the nose to maintain 100 KIAS and trim.

3. Procedures

a. Landing Transition to Touchdown

- i. Approaching touchdown, smoothly reduce PCL towards idle.

- ii. Coordinate gradual backstick pressure to land smoothly on the mainmounts in a nose-high attitude.
 - b. **Roll-out**
 - i. Smoothly lower the nose to the ground.
 - ii. Maintain directional control using rudders only.
 - c. **Full-Stop Landing**
 - i. Smoothly move the PCL to full BETA for deceleration.
 - ii. Augment rudder with light brake pressure only when full rudder deflection is inadequate.
 - iii. Use even brake pressure to continue deceleration to taxi speed.
 - iv. At taxi speed turn off the runway in accordance with SOP.
 - d. **Touch-and-Go Landing**
 - i. Move PCL to full forward. As power becomes available following engine spool-up, apply right rudder and raise the nose to the takeoff attitude.
 - ii. Execute a normal takeoff, climb out at 90/100 KIAS.
 - iii. Retrim.
 - iv. When safely airborne (90 KIAS with a positive rate of climb) reset 1015 ft-lbs., raise the flaps and accelerate to 100 KIAS (if required) while maintaining the same climb attitude.
 - v. Retrim in the 100-KIAS climb attitude.
 - vi. Number one with interval, make crosswind call on the UHF (if required).
 - vii. Turn crosswind using a maximum of 30° AOB.
 - viii. Fifty feet prior to pattern altitude, transition to level flight by:
 - (a) Reducing power to 500-550 ft-lbs. torque.
 - (b) Lowering nose to maintain 100 KIAS downwind.
 - (c) Retrim.
4. **Common Errors**
- a. Uncoordinated transition with power reduction and nose attitude, resulting in a rapid or late flare.
 - b. Landing prior to the wheels watch, RDO, etc.
 - c. Floating, ballooning, bouncing and full-stall landings.
 - d. Excessive sink rate due to excessive power reduction (possibly caused by the flat pitch of the prop at lower power otherwise known as the "bucket.")

- e. Not checking the paddles and landing gear after intercepting the landing line.
- f. Not executing a waveoff for **any** unsafe condition.

708. CROSSWIND APPROACH

1. **Description.** Compensate for crosswinds in the landing approach with power and angle of bank to maintain the normal track over the ground.

2. General

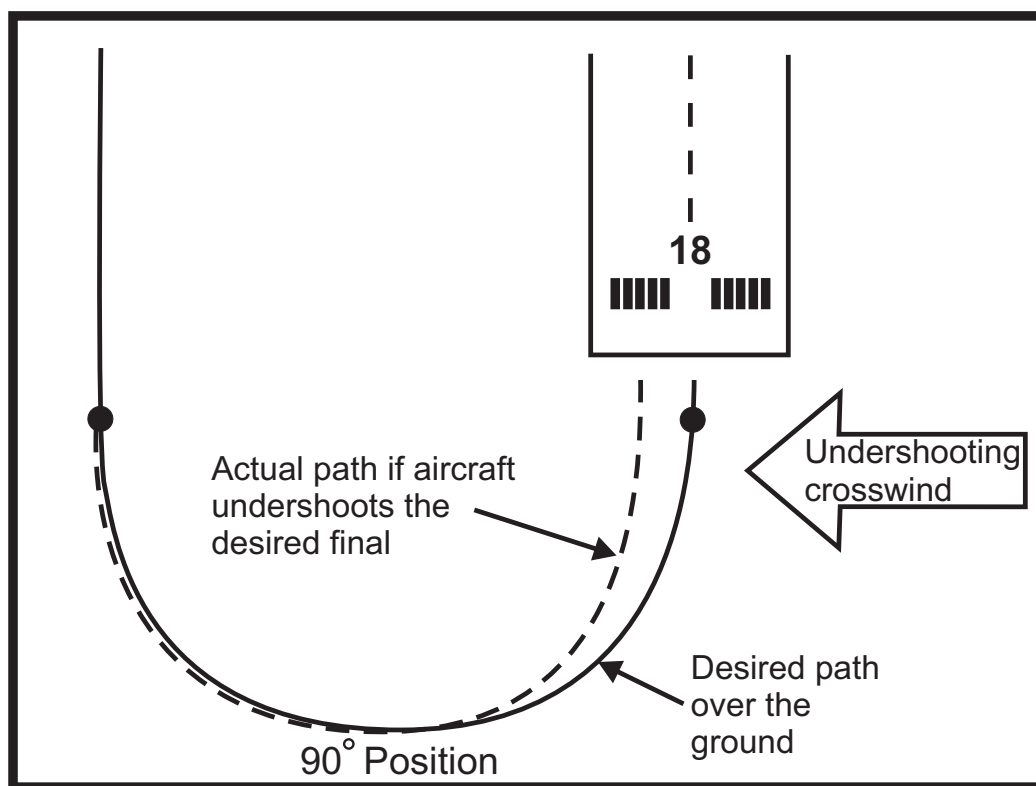
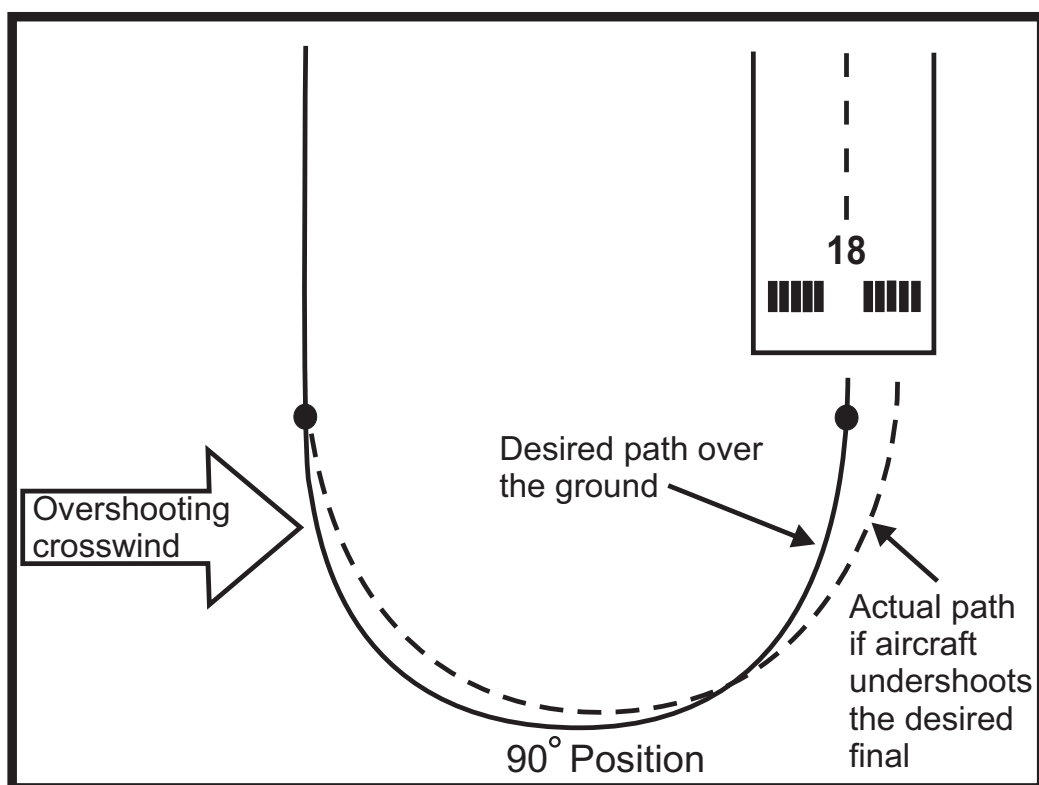
- a. **Background.** Many runways or landing areas are such that landings must be made while the wind is blowing across rather than parallel to the landing direction; therefore, all pilots should be prepared to cope with these situations when they arise. The same basic principles and factors involved in a normal approach and landing apply to a crosswind approach and landing. Only the additional techniques required for correcting for wind drift are discussed here.

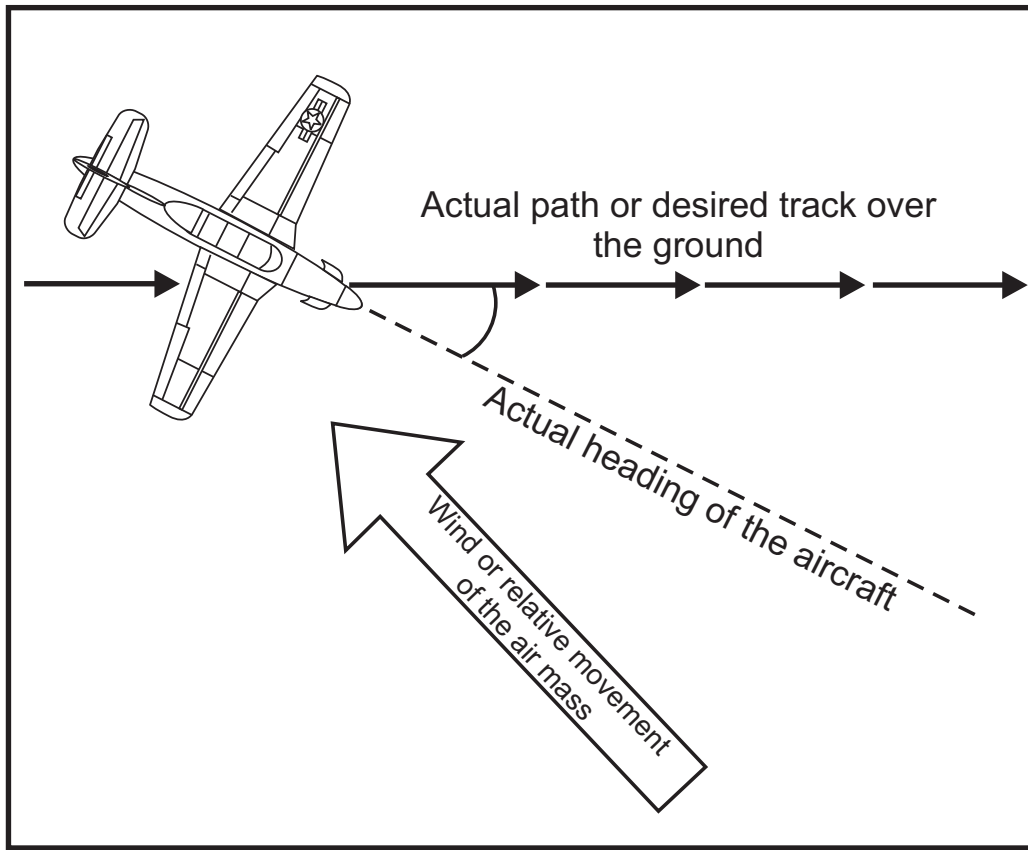
There are two usual methods of accomplishing a crosswind approach and landing the crab method, and the wing-low method. Although the crab method may be easier for the pilot to maintain during final approach, it requires a high degree of judgment and timing in removing the crab immediately prior to touchdown to avoid side loads on the landing gear. The wing-low method is recommended in most cases, although a combination of both methods may be used later in your career. Only the wing-low method will be utilized during your landings in the T-34C.

- b. **Execution.** The power setting and angle of bank used at the start of the approach are compatible with an "average" condition. This "average" condition is a day when the wind is 5-10 knots and nearly parallel to the landing line. Under these conditions, the initial approach turn will utilize 15-20 degrees of bank and the power setting will be reduced in small increments in order to maintain the prescribed glideslope. However, as wind conditions vary, it will be necessary during the approach to vary the angle of bank, power setting, or both in order to arrive at the landing line with 1200-1500 feet of straightaway, 100-150 feet of altitude and the proper airspeed.

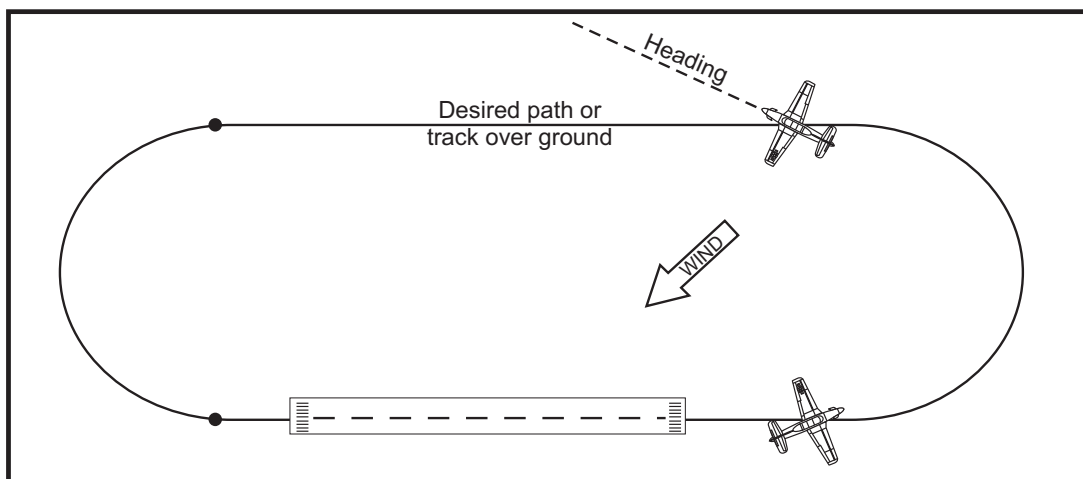
Prevailing crosswinds are normally broken down into two categories according to how they will affect the aircraft on the landing approach. They are referred to as either "overshooting" or "undershooting" crosswinds. The "overshooting crosswind" will cause the aircraft to fly a track outside the normal path over ground on final. The "undershooting crosswind" will cause the aircraft to fly a track inside the normal path over the ground on final. (Figures 7-12 and 7-13).

In order to maintain a particular track or desired path over ground, it will be necessary to "crab" or head into the wind slightly.

**Figure 7-12 Undershooting Crosswind****Figure 7-13 Overshooting Crosswind**

**Figure 7-14 Crabbing Technique**

Therefore, when climbing out upwind or flying downwind, to maintain the desired path over ground, you must crab into the wind slightly (Figure 7-14). Remember, you should arrive at the same "180° position." To do so you must crab to fly the desired path over ground prior to the 180° position (Figure 7-15).

**Figure 7-15 Desired path**

To adjust the angle of bank through the approach, use the 90-degree position as a reference in order to fly a normal pattern.

- c. For an overshooting crosswind, the angle of bank used from the 180° position to the 90° position will be less than normal. Conversely, from the 90° position to final, more angle of bank will be used. The reason for this is that initially the wind will be "helping" the aircraft travel towards final and less "turn" will be necessary. Past the 90° position, the wind will tend to displace the aircraft outside the desired path over ground. Higher angle of bank here will "turn" the aircraft back towards the desired path over ground. In an overshooting condition, power reductions through the approach have to be greater to achieve the proper rate of descent relative to the rate of closure to the landing line.
- d. For an undershooting crosswind, the angle of bank used from the 180° position to the 90° position will be higher than normal. Since the wind will appear to slow the rate at which the aircraft travels towards final, it will require more "turn" to fly towards final initially. Past the 90° the aircraft will be heading in the opposite direction, and the wind will appear to displace the aircraft back towards the 180°. Less "turn" or angle of bank here should overcome this tendency to drift inside the desired path over ground. Here it is critical to have patience to establish the aircraft with 1200-1500 feet of straightaway rather than aiming for the end of the runway. In an undershooting condition, power reductions through the approach have to be made at a slower rate to achieve the proper rate of descent relative to the rate of closure to the landing line. Remember, fly the same path over ground.

The principles stated for flying the crosswind approach are not hard-and-fast rules. Adjust your power and angle of bank as necessary to fly the normal racetrack pattern. Rapid changes in wind direction and velocity are often associated with crosswind conditions. Any time you go low, add power, and adjust nose attitude for airspeed control. Any time you are uncomfortable, WAVE OFF.

3. Procedures

- a. Maintain proper $\frac{3}{4}$ wingtip distance downwind with crab.
- b. Adjust power and AOB to fly normal approach.
 - i. Overshooting crosswind
 - (a) Power settings may be lower than normal after the 180° position due to a faster ground speed requiring a higher rate of descent.
 - (b) AOB will be shallow during first part of approach and will steepen approaching the 90° position. Adjust AOB as necessary (30° AOB maximum) to intercept landing line.

- ii. Undershooting crosswind
 - (a) Power settings may be higher than normal after the 180° position due to a slower ground speed requiring a reduced rate of descent
 - (b) AOB will be steeper during first part of approach and will shallow approaching the 90° position. Adjust AOB as necessary (30° AOB maximum) to intercept landing line.
4. **Common Errors**
- a. Not recognizing when a crosswind exists.
 - b. Not establishing proper technique quickly enough.

709. CROSSWIND LANDING

1. **Description.** Compensate for crosswinds and land smoothly on the main mount at the intended point of landing on runway centerline.
2. **General.** There are several ways of executing a crosswind landing. However, only one is utilized in the primary flight training program - the wing-low, top rudder, or slip method. The wing-low, top rudder method will compensate for wind from any direction. It permits you to keep the longitudinal axis aligned with the runway throughout the final straightaway, landing transition, touchdown, and roll-out. This allows you to utilize the same visual reference for the landing transition, since it is very similar to the normal landing transition, and provides an automatic crosswind correction during the landing transition, touchdown and landing.

Generally, the landing transition can be made as in a normal landing approach, but the application of a crosswind correction must be continued as necessary to prevent drifting.

Since the airspeed decreases as the flare progresses, the flight controls gradually become less effective; as a result, the crosswind correction being held would become inadequate. When using the wing-low method then, it is necessary to gradually increase the deflection of the rudder and ailerons to maintain the proper amount of drift correction.

Do not level the wings; keep the upwind wing down throughout the flare. If the wings are leveled, the airplane will begin drifting and the touchdown will occur while drifting. Remember, the primary objective is to land the airplane without subjecting it to any side loads, which result from touching down while drifting, and to prevent ground looping while the landing is being accomplished.

Upon intercepting the landing line, level the wings and hold the aircraft in balanced flight with its longitudinal axis aligned with the landing line. Quickly observe the magnitude of the drift and immediately establish the proper drift correction by lowering the upwind wing to stop the drift. At the same time, coordinate opposite (top) rudder to keep the nose of the

aircraft straight down the runway. The degree to which the upwind wing is lowered and the amount of opposite rudder pressure applied are governed by the amount of drift present. If there is a strong crosswind, the wing must be lowered further than if a light crosswind is encountered.

If the wing-low method is used, the crosswind (aileron into the wind and opposite rudder) should be maintained throughout the flare, and the touchdown made on the upwind main wheel. Think of flaring on one wheel.

During gusty or high wind conditions, prompt adjustments must be made in the crosswind correction to assure that the airplane does not drift as it touches down.

As the aircraft settles onto the runway in a landing attitude, the actual touchdown will be made on only one of the main wheels. As the forward momentum decreases, the weight of the aircraft will cause the other main wheel to settle onto the runway.

During gusty or high wind conditions, extreme caution should be used to make certain that the aircraft is not drifting and/or crabbing. A crab or drift is a condition that occurs when a touchdown is executed while the longitudinal axis of the aircraft is not aligned with the landing track. Since the aircraft is actually traveling sideways in relation to the ground, it will be given a tipping moment in the direction that the aircraft is traveling. Touchdown in a crab or drift will also cause the aircraft to turn away from the intended landing path. This turn is called **a swerve**. Any time a swerve develops, centrifugal force will be created commensurate to the speed of the swerve. It is dangerous to land in a crab or drift because control of the aircraft may be lost momentarily, thus exposing you to other adverse landing factors. Maintain the crosswind correction to minimize the weather vaning tendencies of the aircraft and lower the nose gently onto the runway. Use rudder as necessary to maintain directional control.

Particularly during the landing roll, special attention must be given to maintaining directional control with rudders while maintaining the crosswind aileron inputs. While the airplane is decelerating during the landing roll, more and more aileron must be applied to keep the upwind wing from rising. Since the airplane is slowing down, there is less airflow around the ailerons and they become less effective. At the same time, the relative wind is becoming more of a crosswind and exerting a greater lifting force on the upwind wing. Consequently, when the airplane is coming to a stop the aileron control must be held fully towards the wind.

When making a touch-and-go landing hold the nosewheel on the deck and apply upwind aileron to maintain a wings-level attitude. Initiate positive (firm) rotation when flying speed is reached to avoid sideslipping. Initial drift correction is made by turning into the wind with a shallow bank to counteract drift, then rolling wings-level. On the climbout, it will be necessary to "crab" the aircraft into the wind to maintain runway heading. The crab must also be used on the downwind parallel the runway.

When landing, in order to remain on the desired approach path, the aircraft must slip back into the wind at the same rate that the wind is trying to move it away from the landing line. The wing-low attitude must be maintained as long as the crosswind is apparent. If the effect of the crosswind is reduced, this crosswind correction must also be reduced or the aircraft will begin slipping too much into the wind and away from its flight path. The crosswind landing approach is not a set angle of bank and rudder pressure. Several factors will change as the aircraft makes its final descent towards the runway, such as airspeed, turbulence (associated with thermal heating or from nearby buildings), power and wind velocity and magnitude. The wind will most likely change as the aircraft crosses the tree line and then again near the surface of the runway. With all these factors changing rapidly, the pilot must constantly react to the conditions and maintain runway centerline with the longitudinal axis of the aircraft aligned with the runway.

On the straightaway and throughout the landing, keep the longitudinal axis aligned with the landing line regardless of the amount of crosswind correction being used. Sit straight in the cockpit. Do not lean away from or towards the low wing. Remember, the fundamental concept behind the wing-low drift correction method is to counteract the drift and keep the longitudinal axis aligned with the landing line.

3. Procedures

- a. Maintain crosswind correction through the landing transition.
- b. Increase aileron pressure as necessary to land the aircraft with zero side motion.
- c. Landing will be made on the upwind mount first.
- d. Maintain crosswind corrections to minimize weather vaning and lower the nose gently to the runway.
- e. Full-stop landing may require increased corrections as the airplane decelerates.
- f. For touch-and-go landings:
 - i. Hold in crosswind controls throughout ground roll.
 - ii. Firmly rotate the aircraft to the takeoff attitude.

4. Common Errors

- a. Landing with any side motion.
- b. Landing in a crab.
- c. Not holding in corrections while on the runway.
- d. Not crabbing upwind, causing a drift from runway centerline.

710. WAVEOFF (GO-AROUND)

1. **Description.** The waveoff is a set of standard procedures used to effect the safe discontinuation of an approach.

2. **General.** Frequently, during your landing practice, you will have to discontinue an approach for reasons of safety and execute a waveoff. A waveoff may be initiated by the pilot, or may be directed by an external source (RDO, wheels watch, waveoff lights (TW-4), flare, IP, tower, another aircraft, etc.). The reason for an externally directed waveoff may not be apparent to the pilot, but the waveoff is mandatory unless a greater emergency exists.

Although a landing approach may be aborted at any point in the pattern, a waveoff will usually be executed during the approach turn, in the straightaway, or during the landing transition. Of course, the sooner a poor landing condition is recognized and the waveoff executed, the safer it will be. If at any time your approach does not feel comfortable or you are too close to the aircraft in front of you, "take it around." You should not wait until the last second to make a decision. Keep in mind that a waveoff is not an emergency procedure unless it is executed too late. A pilot who recognizes a poor approach situation (i.e., overshooting the runway) and executes a proper waveoff well before getting into a dangerous situation (i.e., steep angle of bank to get back to the runway) is demonstrating maturity and good judgment and will never be criticized by fellow aviators. Be alert for a waveoff given by wheels watch (shooting a flare or waving paddles overhead). Once you have initiated a waveoff, do not change your mind and attempt to land.

Examples of an unsafe approach are unsafe altitude, unsafe airspeed, overshooting approach, drifting or crabbing prior to touchdown, and high transitions that will lead to a bounced landing. The sooner a poor landing condition is recognized and the waveoff executed, the safer it will be.

Conflicts in the traffic pattern and insufficient separation during the landing approach are usually solved by establishing proper interval in the break or upwind prior to the crosswind turn; however, the following guidelines should be followed.

There should be at least 90° of approach turn between you and the aircraft ahead. If you roll out in the straightaway before the aircraft has landed, an immediate waveoff shall be initiated. Do not delay your waveoff in hopes that the situation will correct itself. During operations at outlying fields where Practice Precautionary Emergency Landing (PPEL), PPEL in the pattern, and touch-and-go is in progress simultaneously, pilots must be constantly alert for traffic conflicts. All PPEL traffic at joint-operation fields have the right-of-way over normal touch-and-go traffic.

As a pilot in the touch-and-go pattern at a field where PPELs are in progress, be prepared to wave off as early as possible to avoid conflict with PPEL traffic.

3. **Procedures**

- a. Advance PCL to full forward.
- b. Simultaneously level the wings (if conditions permit), and center the ball.
- c. Raise the nose to climbing attitude and climb at 90 KIAS FF, 100 KIAS NF. Retrim.

NOTE

When the aircraft is under control, make a UHF transmission that you are waving off.

- d. If flaps were lowered, when safely airborne, at or above 90 KIAS, with a positive rate of climb, reduce PCL to 1015 ft-lbs., raise the flaps and then accelerate to 100 KIAS. Retrim.
- e. Adjust your flight path, moving to either side of the runway if necessary, to avoid conflicting traffic and to keep aircraft on the runway in sight. Comply with any instructions given to you from the tower/RDO. If the waveoff was performed on final or during the landing transition with no other aircraft on the runway, the waveoff may be performed directly over the runway (unless prohibited by SOP).

NOTE

Waveoff shall continue to follow ground track to avoid traffic and comply with local course rules.

- f. With interval, call crosswind to re-enter downwind or depart the pattern.

4. Common Errors

- a. Failure to initiate waveoff early enough.
- b. Failure to advance PCL to full forward.
- c. Failure to establish aircraft in a positive rate of climb.
- d. Failure to maintain 100 KIAS.
- e. Forgetting to raise the flaps.
- f. Transmitting waveoff call prior to having aircraft under control.
- g. Failure to maintain solid lookout doctrine and keep other aircraft in the pattern in sight.

711. OUTLYING FIELD DEPARTURE

1. **Description.** The outlying field departure (OFD) is a series of uniform procedures by which aircraft depart the pattern.

2. **General.** Departure from outlying fields shall be conducted in accordance with local course rules. You are number one for departure when above 300 feet AGL, flaps up, and the aircraft upwind has:

- a. Begun his crosswind turn.
- b. Raised his gear to depart.
- c. Conducted simulated low altitude power loss from the pattern.

NOTE

In order to depart, you do not have to be number one with interval, but you must be number one upwind. There is a difference!

3. Procedures

- a. Ensure you are number one upwind.
- b. Aircraft shall be above 300 feet AGL with flaps up.
- c. Transmit departure call, "(Field name), crash/RDO/tower, (call sign), number one upwind, departing."
- d. Add power to max allowable (if it had been reduced previously to level off.)
- e. Check airspeed below 120 KIAS.
- f. Raise landing gear and turn landing lights off.
- g. Climb to departure altitude (in most cases, this will be the pattern altitude), level off, then accelerate to 170 KIAS.
- h. Climb when clear of pattern.
- i. Comply with SOP/Course Rules for departure.

4. Common Errors

- a. Not ensuring you are number one.
- b. Forgetting departure call.
- c. Not raising gear.
- d. Raising gear above 120 KIAS.
- e. Climbing through pattern altitude, i.e., no level-off.
- f. Not retrimming.
- g. Deviating from course rules.

712. VFR WIDE OR STRAIGHT-IN APPROACH

1. **Description.** A wide or straight-in approach may be used at either military or civil airfields when use of the "break" (or "overhead" at civil fields) would be precluded or impractical due to weather, traffic, or local procedures. These type approaches may also be used in conjunction with certain emergencies (i.e., in-flight damage).

2. **General.** Every wide or straight-in approach will be different, depending on altitude and aircraft position relative to the runway. These factors may be influenced by weather, traffic, approach and/or tower controllers, etc. The pilot must use his/her judgment and experience to adjust the aircraft's flight path and/or configuration to safely and efficiently execute the approach and landing.

3. **Miscellaneous.** It is necessary to become familiar with and understand certain terms used in aviation not common to naval aviation. Since the racetrack landing pattern is peculiar to naval aviation, a pilot may encounter the more common "box" pattern at a non-Navy field or any time a non-break entry is made to any field (i.e., visual approach, instrument approach, etc.).

Figure 7-16 illustrates the typical box pattern and its terminology. Base leg should always be referred to as "left base" or "right base," depending on the direction on the turn to final (i.e., a left base would mean a left turn to final).

NOTE

There is not an FAA or military standard for the length of the "final" leg. Fly the base leg deep enough so as to allow you to fly the aircraft to a 1200-1500 feet straightaway at 100-150 feet AGL.

4. Procedures

- a. Establish contact with ATC to communicate your request and/or intentions. If at a tower-controlled field, contact tower when instructed to by Approach Control or prior to entering the Airport Traffic Area.
- b. Fly the aircraft in fast cruise at an appropriate altitude to a position approximately 2-3 miles from the runway on an extended runway centerline or extended base leg.
- c. Transition to the landing approach configuration by slowing below 150 KIAS, lowering the landing gear and completing the Landing Checklist. This should be done no later than base leg (if used) or a one-mile final. Lower/hold flaps as appropriate.
- d. If requested, make the appropriate radio call to the tower or RDO (i.e., "Report 2-mile final"). If at a tower-controlled field, obtain landing clearance prior to landing and report landing gear down and locked. Check the winds!
- e. Fly to intercept a standard glideslope at 85/95 KIAS, 1200-1500 feet of straightaway and 100-150 feet AGL, wings level.
- f. Continue the approach and landing as in paragraphs 706 and 707.

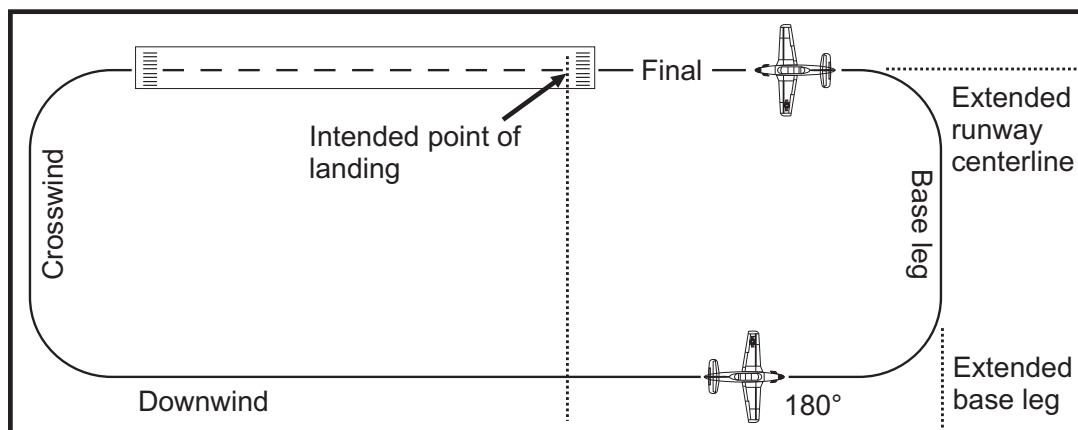


Figure 7-16 The "Box Pattern"

5. Common Errors

- a. Not establishing radio contact with ATC soon enough.
- b. Transitioning to the landing configuration too late.
- c. Not making requested report to the tower.
- d. Landing without a clearance.
- e. Descending too early, resulting in a low, power-on approach.

CHAPTER EIGHT

EMERGENCY PROCEDURES

800. INTRODUCTION

This chapter forms the basis of your T-34C Emergency Procedures Training. A complete and thorough knowledge of the procedures in this chapter is essential for students who wish to progress to their solo flight. The memorization and proficient execution of these procedures will prove to be one of the greatest challenges to you during Primary Training. Remember, however, the single most important factor in the execution of any emergency procedure is to first maintain control of the aircraft. After the aircraft is under control you must then determine the precise nature of the problem. It is only at this point that you can execute the applicable emergency procedure and determine the appropriate landing criteria. No matter how well you know your procedures, if you lose control of the aircraft or misdiagnose the nature of the malfunction, you will not be successful in handling the emergency. Make sure that you are in control of the aircraft and understand what the problem is before you attempt to apply a solution.

1. **Description.** N/A

2. **General.** It is conceivable that during any flight evolution, an engine or system malfunction may occur either while on the ground or in flight. These malfunctions can range from system failures to complete power losses. All emergencies or malfunctions will be handled in accordance with NATOPS procedures, utilizing aircrew coordination skills. Power losses fall into two main categories:

- a. Those that occur without warning.
- b. Those that present ample warning.

The first step in any emergency is to maintain control of the aircraft. Do not assume the Instructor Pilot is flying until he/she has verbally taken the controls. The second step is to correctly analyze the situation and announce the malfunction. Lastly, take the appropriate corrective action. Instructors should pre-brief certain items regarding who will fly during an emergency and what kind of assistance will be required from the pilot not at the controls.

The instant failure generally occurs due to fuel starvation and, dependent upon altitude, may require immediate response. Impending engine problems may be prefaced by loss of oil pressure, excessive ITT, fluctuating N_1 or prop RPM, vibrations, etc. These may be classified as deferred emergencies requiring action to prevent catastrophic failure. This chapter will show the actions to be taken by the pilot in the event that the engine fails to operate as designed.

The Emergency Landing Pattern (ELP) will be utilized for both the impending engine failure and the immediate power loss. A different set of procedures will be required to execute the Precautionary Emergency Landing (PEL), High Altitude Power Loss (HAPL) and Low Altitude Power Loss (LAPL). However, the ELP profile will be flown for all three of the

above conditions. Since precise control of the aircraft and sound judgment are necessary to effect a safe landing, a review of factors influencing track over the ground may be in order.

3. **Procedures.** Review appropriate emergency procedures.
4. **Common Errors.** N/A

801. ABORTED TAKEOFF DEMONSTRATION

1. **Description.** This maneuver demonstrates the characteristics and length of runway required for an aborted takeoff.
2. **General.** An aborted takeoff may be required during any takeoff. Examples of reasons for aborting a takeoff include blown tire(s), streaming fuel, fire light, chip light, fluctuating oil pressure, rapidly rising ITT or bird strike. Any situation which appears abnormal or unsafe during takeoff shall necessitate an abort.
3. **Procedures**
 - a. Call tower for takeoff, stating intentions.
 - b. Position aircraft on runway for a normal takeoff.
 - c. When properly aligned on the runway (and cleared for aborted takeoff), add power to 500 foot-pounds and check instruments.
 - d. Release brakes, advance PCL to 1015 ft-lbs., and commence normal takeoff roll.
 - e. Before 1500 feet of takeoff roll and prior to 60 KIAS, initiate the Aborting Takeoff procedure as described in the NATOPS Manual.
 - f. Maneuver is complete when the aircraft has achieved a safe taxi speed.
 - g. Taxi clear of runway, or commence takeoff from present position, as required.

802. EMERGENCY LANDING PATTERN

1. **Description.** The profile of the ELP is a 360-degree overhead pattern designed to position the aircraft for landing when no power is available or the possibility of a power loss exists. The pattern may be conducted to a prepared surface (runway or established grass strip) or to an unprepared surface such as a farmer's field. For the unprepared surface, the final landing will be made with the gear up and flaps down.
2. **General.** The complete ELP profile will be flown for PEL and HAPL. PEL(P) and LAPL(P)/LAPL will intercept the Profile somewhere after high key. The following description and procedures cover the ELP pattern inclusively. Further procedures that are specific to PEL and HAPL/LAPL are covered in the appropriate section.

The aircraft will enter the ELP Profile at 2500 feet AGL aligned with the landing direction and ¼ wingtip distance abeam the intended point of landing with the landing environment in sight. The following definitions apply to the ELP profile (Figure 8-1).

8-2 EMERGENCY PROCEDURES

EMERGENCY LANDING PATTERN (ELP)

CHECK POINT	ALTITUDE	AIRSPEED	PPEL CONFIG	HAPL CONFIG	POSITION
1. High Key	2500 feet AGL	100 KIAS	Gear DOWN Flaps UP	*Gear UP Flaps DOWN	–¼ WTD abeam intended point of landing –runway heading/ aligned with landing direction –wings level
2. Crosswind	Approx. 2000 feet AGL	100 KIAS	Gear DOWN Flaps UP	Gear UP Flaps DOWN	Crossing the landing line
3. Low Key	Approx. 1200 feet AGL	100 KIAS	Gear DOWN Flaps UP	Gear UP Flaps DOWN	⅔ WTD abeam intended point of landing
4. 90°	600 – 800 feet AGL	100 KIAS	Gear DOWN Flaps DOWN **	Gear UP Flaps DOWN	Perpendicular to landing line; halfway between low key and final
5. Final		90/95 KIAS		As appropriate	
(*) Gear will be down and flaps up at high and low key for the HAPL/LAPL if conducted to a prepared surface. Flaps will be lowered no sooner than low key (when the field is made).					
(**) For the PPEL, the flaps will be lowered when the field is made but no sooner than low key. If below altitude, get back on the profile prior to lowering the flaps.					

Figure 8-1 ELP

NOTE

The intended point of landing is within the first one-third of runway or field (on centerline if applicable).

The most important factor in the ELP is to fly your checkpoints (altitude, airspeed, heading and position over the ground) (Figure 8-2). This is accomplished through a good VFR scan. Check outside to reference the aircraft's position. The aircraft's position may be off as a result of poor planning, imprecise basic airwork, or current wind conditions. Check inside for airspeed, altitude, heading, and engine instruments. Make all corrections smoothly and expeditiously.

An important consideration when choosing the landing site and direction is the wind conditions. While landing "into" the wind is an important goal, a larger/longer landing site should not be sacrificed just to be perfectly aligned with the wind (generally, a headwind component is the goal). Attempt to set up the ELP to take advantage of headwinds and maximize landing distance. Lessons learned from T-34C forced landings have emphasized that once in ground effect, the T-34C will continue to fly (float in ground effect) for a good distance while the excess energy is being dissipated.

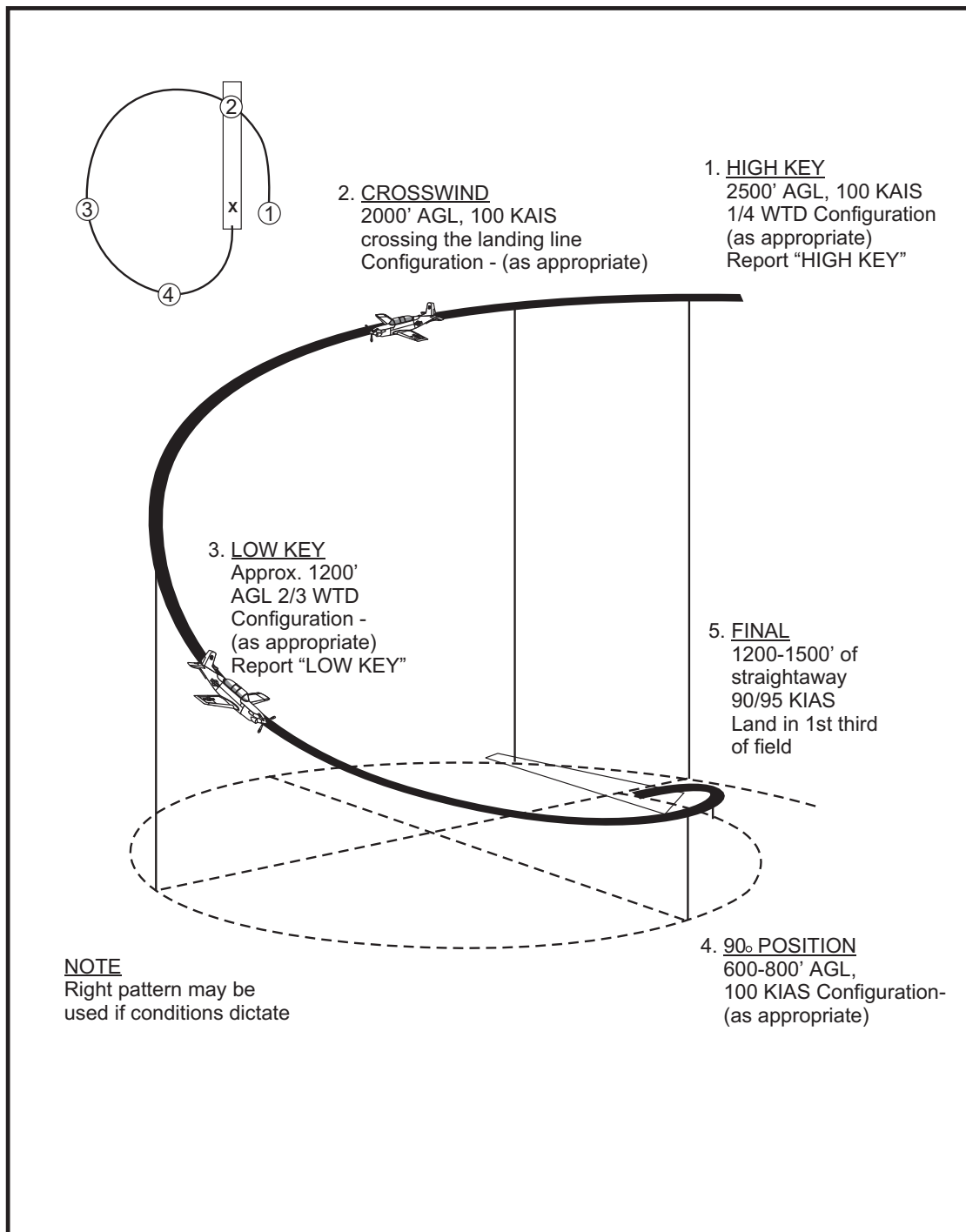


Figure 8-2 Emergency Landing Pattern

3. Procedures

- a. Position the aircraft at high key, 2500 feet AGL, 100 KIAS, wings level, aligned with the landing direction and 1/4 wingtip distance abeam the intended point of landing in the appropriate configuration. Turn, using angle of bank as necessary

8-4 EMERGENCY PROCEDURES

(approx. 10-15 degrees in calm wind), towards crosswind position. Maintain 100 KIAS and make appropriate voice call.

NOTE

An improper setup or existing winds may require you to vary the angle of bank to arrive at proper low key. Retrim as necessary to maintain 100 KIAS.

- b. Check for approximately 2000 feet AGL when the aircraft is crossing the landing line.
- c. Arrive at low key, momentarily level the wings and check for $\frac{2}{3}$ wingtip distance abeam the intended point of landing, altitude approximately 1200 feet AGL and 100 KIAS. Make the appropriate voice call.
- d. Fly towards the 90° position (maintaining 100 KIAS).
- e. Once at the 90° position, decelerate towards 90 KIAS (95 KIAS if making a no-flap landing).
- f. Fly to intercept a 1200-foot straightaway final. Maintain 90/95 KIAS airspeed. Plan to land within the first one-third of the field/runway.

The specifics for each emergency requiring an ELP will be found in the sections pertaining to those particular emergencies.

4. Common Errors

- a. Failure to properly position for high key.
- b. Turning too tightly from high key towards low key, resulting in a high and tight low key.
- c. Not maintaining airspeed in the ELP.
- d. Not flying checkpoints.
- e. Making improper corrections (or none at all).
- f. Not trimming the aircraft throughout the pattern.
- g. Not taking crosswinds into account.

803. HIGH ALTITUDE POWER LOSS

1. **Description.** The **SIMULATED** High Altitude Power Loss (HAPL) will be initiated above 2500 feet AGL by the instructor reducing power to idle and informing the student he has a simulated power loss. The HAPL may occur at any airspeed and configuration. Fly to intercept the ELP profile while simultaneously executing the appropriate procedures.
2. **General.** Power losses may be caused by engine seizure, flameout, or malfunction of the pneumatic sensing system of the fuel control unit resulting in a "rollback." In the last case, the pilot may restore power by utilizing the Emergency Power Lever (see paragraph 808) enabling him to execute a PEL at a paved field. However, if power cannot be restored, execution of the HAPL procedures will be required when above 2500 feet AGL.

The **SIMULATED** High Altitude Power Loss will closely resemble the actual characteristics of the aircraft with a "dead" engine and feathered propeller. The glide ratio and rate of descent will be very similar to the actual engine failure, as well as the nose attitude required for the 100-knot power-off glide.

An alert pilot is constantly on the lookout for suitable landing fields in the event of an actual emergency. Naturally, the best landing site is an established airfield. This should be your first consideration during any emergency. The next best substitute is a hard-packed, long (5000 feet or more) and smooth field with no obstructions (trees, power lines, etc.) on the approach end, but these fields are not always readily available. You must be prepared to select the best field and, if you have been conducting your gas and position reports, this should not be a difficult task. Cultivated fields are usually good as are plowed fields when landing with the furrows. Try to avoid small, rough fields containing boulders, ditches, trees, cattle, trailers or other obstructions. When nothing is available, altitude permitting, you will have to bail out. Remember that your bailout option expires at 1200 feet AGL (low key). If bailout is not possible or feasible, and there is no field available, landing on the tops of trees and settling down is your last recourse. If no field is available and you are near a large body of water, ditching near shore is preferable to landing in the trees. In all cases, however, good headwork will make the difference between success and failure.

Always be aware of the direction and velocity of the wind if possible. Wind direction may be determined by several methods. Other than a windsock or tetrahedron at an established field, the best indication of the wind is blowing smoke. If smoke rises for a short distance and then abruptly flares out close to the earth in a straight line parallel to the ground, the velocity near the surface will be fairly high. Blowing dust is another good indicator. If you are unable to determine the wind direction or velocity, use your last known wind or duty runway from your departure airport.

NOTE

Distractions resulting from excessive troubleshooting or time-consuming attempts to regain power during the execution of the ELP may cause substantial deviation from the standard pattern, precluding a safe landing at the selected site.

STUDY AND KNOW the emergency procedures for engine fires, power losses, bailout, etc. in the T-34C NATOPS FLIGHT MANUAL.

3. **Procedures.** When informed that there has been a simulated power loss, carry out the following procedures:

- a. Flying speed - MAINTAIN (100 KIAS minimum). If fast, smoothly raise the nose to trade excess airspeed for altitude. If you are at 100 KIAS or below, expeditiously lower the nose to maintain 100 KIAS.
- b. Landing gear and flaps - UP. Clean up aircraft by raising the gear and flaps, if necessary, and report "aircraft clean" to your instructor.
- c. Engine instruments - CHECK. Report actual N_1 to your instructor. The instructor will reply with a simulated condition of:
 - i. N_1 at 0% - indicating a "frozen engine."
 - ii. N_1 decreasing to as low as 10-12% - indicating a "flameout."
 - iii. N_1 below flight idle, above 40% - indicating a "rollback."

NOTE

N_1 and ITT are the instruments that will enable you to analyze the problem most quickly. Check the torquemeter. If indications are indicative of a rollback, execute the Rollback procedure IAW the T-34C NATOPS.

- d. Simulate Condition lever - FEATHER. The instructor will simulate feather by advancing the power to 205 ft-lbs. torque to simulate actual aircraft performance with a dead engine and a feathered propeller.
- e. Landing site - SELECT. LOOK for the best available field and report your intended landing site to your instructor.

NOTE

Use a paved field if one is available. Determine the wind direction and your landing direction. Fly the aircraft as necessary to enter the ELP as you complete the remaining steps.

- f. Harness - LOCKED. Check and report harness locked.
- g. Airstart - PERFORM. If conditions warrant and above 1500 feet AGL, perform a simulated airstart in accordance with NATOPS. Place your hand on each control/switch as you report it to the instructor, but do not move any item.

CAUTION

If an airstart is attempted and unsuccessful, sufficient battery power may not be available to lower the flaps or gear electrically.

If airstart is not attempted or is unsuccessful:

- h. No landing site available and altitude permits - BAIL OUT.

If forced landing is to be continued:

- i. Condition lever - FUEL OFF.
- j. Emergency Fuel Shutoff Handle - PULL
- k. MAYDAY (UHF), 7700 (transponder) - BROADCAST.
- l. Maneuver the aircraft to the high key position.

NOTE

Maintain 100 KIAS maneuvering to high key. To dissipate excess altitude to arrive at a proper high key, use "S" turns, slip or a combination of the two. You may also lower the flaps early (unpaved field) or the gear early (paved field only) if necessary. Do not become so totally absorbed in the Airstart procedures that you do not fly the aircraft to a safe landing. Continually scan altitude, airspeed and position as you fly the ELP profile. If the gear/flaps were not previously used to dissipate altitude, lower either the gear or flaps at high key (depending on what type field at which you are landing), altitude permitting, and RETRIM. If low at high key, it may be necessary to hold the gear/flaps (or retract them if previously lowered) until back on altitude within the ELP profile. If holding the gear/flaps, report it to the instructor.

- m. Gear and Flaps - AS REQUIRED. Conduct the Landing Checklist and report it to your instructor.
- n. Canopy - EMERGENCY OPEN.
- o. Battery Switch - OFF.

Fly the ELP profile as follows (Figure 8-1):

- i. Report high key to your instructor (and crash or tower as appropriate with local course rules).

- ii. Commence turn towards the crosswind position and then to low key. (No wind condition, using 10-15 degrees angle of bank.) Adjust angle of bank to arrive at a proper low key on altitude and airspeed. Report low key to your instructor (and crash or tower as appropriate with local course rules). Momentarily level your wings to check your $\frac{2}{3}$ wingtip distance abeam the approach end of the landing field.

NOTE

If making a gear-down approach to a paved field, lower full flaps (wind and emergency permitting) when the field is made but no earlier than low key.

- iii. Commence the landing approach. Fly the aircraft deep enough so as to arrive with at least a 1200-foot straightaway. Altitude at the 90° position should be approximately 600-800 feet AGL. Adjust the nose to decelerate towards 90 KIAS from the 90 to final (95 KIAS if making a no-flap landing). Maintain 90/95 KIAS on final until commencing the landing transition. If the emergency approach should result in a high final to the landing site, it may be necessary to slip the aircraft to increase sink rate and dissipate altitude.
- iv. On final, report: "Canopy blown, battery off."
- v. **Waveoff.** This will be taken by the instructor and must be completed by 300 feet AGL (500 feet, TW-5) or at any time it is evident that the aircraft is approaching a point from which a safe landing cannot be made.

NOTE

On later stage flights, the instructor may initiate this simulated emergency in close proximity to a paved field. If a paved field is selected, the pattern is flown with gear down. If able, lower the gear prior to high key so that sufficient time is available to hand crank the landing gear down in the event of an electrical failure. After lowering the gear, conduct the Landing Checklist, reporting each item to the instructor. The flaps will be lowered when the field is made. A no-flap landing may be executed in the event of gusty or crosswind conditions. In this case, the airspeed on final will be 95 KIAS until commencing the landing transition. Report the Landing Checklist complete.

4. Common Errors

- a. Failure to establish 100-knot glide, TRIMMED.
- b. Failure to use proper procedures for power loss conditions.
- c. Failure to maneuver aircraft towards high key while conducting procedures.

- d. Failure to complete Landing Checklist.
- e. Not using "S" turns, slip, or lowering flaps to dissipate excess altitude.
- f. Not judging wind conditions or compensating for drift in order to arrive at high key headed in desired direction of landing.
- g. Failure to allow for field elevation.
- h. Excessive angle of bank turning from high key towards low key.
- i. Failure to maintain 100 KIAS off high key.
- j. Failure to level wings at low key to check low key position.
- k. Turning too tightly off low key.
- l. Not flying to a proper 90° position.
- m. Not using paved field when available.

804. LOW ALTITUDE POWER LOSS

1. **Description.** The simulated Low Altitude Power Loss (LAPL) will be initiated between 800 and 2500 feet AGL by the instructor reducing power to idle and informing the student he has a simulated power loss (if below 1000 feet AGL, the instructor will set 205 ft–lbs.).
2. **General.** A simulated LAPL (below 2500 feet) may be initiated by the instructor at any time during the flight when the aircraft is between 800 feet and 2500 feet AGL. This may also be conducted in any airspeed and configuration. The first few times should be initiated from cruise, however. The primary concern of the pilot in this situation is to maintain flying speed initially. Once the aircraft is under control, the pilot will maneuver towards the best suitable landing site while simultaneously conducting the necessary procedures to prepare the aircraft for landing. Time and altitude permitting, the pilot should attempt to accomplish as many of the listed procedures as possible. If power loss should occur at a very low altitude priority shall be given to accomplishing the first six steps. This will require immediate reaction and steps may be performed concurrently, such as selecting and turning towards a landing site while performing other critical steps.

NOTE

You must consider the option to bail out. If a landing site is not available and an airstart is not possible, you should bail out while sufficient altitude remains.

CAUTION

If an actual engine failure occurs and power cannot be restored by the ELP, the decision to feather the propeller must be made rapidly. N_1 and ITT will enable you to analyze the problem most quickly. The sink rate is dramatically increased with the propeller unfeathered, severely reducing the glide range.

3. **Procedures.** When informed that there has been a simulated power loss, carry out the following procedures:

- a. Flying speed - MAINTAIN (100 KIAS minimum). If fast, smoothly raise the nose to trade excess airspeed for altitude. If you are at 100 KIAS or below, expeditiously lower the nose to maintain 100 KIAS.
- b. Landing gear and flaps - UP. Clean up aircraft by raising the gear and flaps, if necessary, and report "aircraft clean" to your instructor.
- c. Engine instruments - CHECK. Report actual N_1 to your instructor. The instructor will reply with a simulated condition of:
 - i. N_1 at 0% - indicating a "frozen engine."
 - ii. N_1 approximately 12% - indicating a "flameout."
 - iii. N_1 approximately 40% - indicating a "rollback."

NOTE

N_1 and ITT are the instruments that will enable you to analyze the problem most quickly. Check the torquemeter. If indications are indicative of a rollback, execute the rollback procedure IAW the T-34C NATOPS.

- d. Simulate condition lever - FEATHER. The instructor will simulate feather by advancing the power to 205 ft-lbs. torque to simulate actual aircraft performance with a dead engine and a feathered propeller.
- e. Landing Site - SELECT. **LOOK** for the best available field and report your intended landing site to your instructor.
- f. Harness - LOCKED. Check and report harness locked.

NOTE

Deciding where to enter the ELP is a function of aircraft position and altitude. If the situation allows, enter as closely as possible to high key. However, you may have to enter at low key, the 90 or even as late as final. With an actual power loss at very low altitude, you may have no viable recourse other than to land straight ahead. It is much better to make a controlled landing in the treetops than to stall the aircraft trying to make an unreachable field.

- g. Airstart - PERFORM. If conditions warrant and above 1500 feet AGL, perform a simulated airstart in accordance with NATOPS. Place your hand on each control/switch as you report it to the instructor, but do not move any item.

CAUTION

If an airstart is attempted and unsuccessful, sufficient battery power may not be available to lower the flaps or gear electrically.

If airstart is not attempted or is unsuccessful:

- h. No landing site available and altitude permits - BAIL OUT.

If forced landing is to be continued:

- i. Condition lever - fuel off.
- j. Emergency fuel shutoff handle - PULL.
- k. MAYDAY (UHF), 7700 (transponder) - BROADCAST.
- l. Enter ELP at or below high key.
- m. Gear and Flaps - AS REQUIRED. Conduct the Landing Checklist and report it to your instructor. Once the field is made, lower the flaps and conduct the Landing Checklist. If conducted to a hard-surfaced field, lower the gear when the field is made. Then lower the flaps (to reduce the stall speed) prior to touchdown, winds permitting.
- n. Canopy - EMERGENCY OPEN. Remember that with the prop feathered (simulated or real), the aircraft will have a tendency to float considerably, compared to a normal landing transition. The canopy, once opened, will create some drag, increasing the rate of descent slightly. Plan accordingly.
- o. Battery Switch - OFF

4. Common Errors

- a. Failure to establish and maintain a 100-knot glide.
- b. Failure to analyze engine condition and use proper procedures for the power loss situation.
- c. Failure to clean up aircraft.
- d. Lowering gear instead of flaps when landing in unprepared field.
- e. Slow selection of field.
- f. Failure to lower flaps when field is made.
- g. Failure to use a slip when high during approach and on final.
- h. Excessive airspeed on final.

805. LOW ALTITUDE POWER LOSS FROM THE PATTERN

1. **Description.** The simulated LAPL in the pattern (LAPL(P)) will be initiated above 800 feet AGL by the instructor reducing the power to 205 ft-lbs. torque and informing the student there is a simulated power loss.

8-12 EMERGENCY PROCEDURES

2. **General.** The power loss on takeoff will require immediate reaction to prevent catastrophic results. About the only recourse for the pilot in this situation is to land straight ahead, changing direction only to avoid major obstacles. Do not try to turn back to the runway from which you departed. Making a crash landing straight ahead with the aircraft under control affords a much higher likelihood of survival than an uncontrolled crash. Depending upon your altitude, you may be able to reach an off-duty runway if it is forward of the wings. On entry to any airfield, an alert pilot will take notice of the options available in the event a failure occurs ANYWHERE in the pattern. Obviously, the most critical area is that from takeoff until commencing the crosswind turn. Thereafter, your options will greatly improve, as an off-duty runway will probably be within gliding distance IF THE FIRST SIX PROCEDURES OF THE LAPL ARE EXECUTED.

A simulated LAPL(P) will be initiated by the instructor once above 800 feet AGL. The first step in the procedure is to obtain safe flying speed. If in a climb with the gear and/or flaps down, the aircraft will rapidly decelerate towards stall speed. Immediate forward stick is required while you simultaneously assess the engine difficulty. If a rollback condition exists, the EPL may be used to restore power. If not, feather the prop.

WARNING

It is not recommended to delay feathering the propeller in the landing configuration below landing pattern altitude.

Raise the gear and flaps while you are setting up for the landing site. Check your harness locked prior to landing. Time and altitude permitting, disconnect the fuel source by placing the condition lever to fuel "OFF" and pulling the T-handle. Lower the flaps whenever the landing site is made. Now all that remains is to get out a MAYDAY report, blow the canopy and secure the battery. The entire evolution should take only a matter of seconds to complete. Any longer, and the pilot's chance of survival are greatly diminished in an actual situation.

3. **Procedures.** When informed you have a simulated power loss in the pattern immediately carry out the following procedures. Configure the aircraft as appropriate. Perform additional LAPL procedures as time permits.

- a. Flying speed - MAINTAIN (100 KIAS minimum). If fast, smoothly raise the nose to trade excess airspeed for altitude. If you are at 100 KIAS or below, expeditiously lower the nose to maintain 100 KIAS.
- b. Landing gear and flaps - UP. Clean up aircraft by raising the gear and flaps, if necessary, and report "aircraft clean" to your instructor.
- c. Engine instruments - CHECK. Report actual N_1 to your instructor. The instructor will reply with a simulated condition of:
 - i. N_1 at 0% - indicating a "frozen engine."
 - ii. N_1 approximately 12% - indicating a "flameout."
 - iii. N_1 approximately 40% - indicating a "rollback."

- d. Simulate condition lever - FEATHER. The instructor will simulate feather by advancing the power to 205 ft-lbs. torque to simulate actual aircraft performance with a dead engine and a feathered propeller.
- e. Landing Site - SELECT. **LOOK** for the best available field and report your intended landing site to your instructor.
- f. Harness - LOCKED. Check and report harness locked.

WARNING

If on the upwind or early in the crosswind turn, do not try to turn back to the runway from which you just departed. Making a forced landing straight ahead with the aircraft under control affords a much higher likelihood of survival than an uncontrolled crash.

NOTE

Depending upon your altitude you may be able to reach an off-duty runway if it is forward of the wings.

4. Common Errors

- a. Not lowering the nose to maintain safe flying airspeed - 100 KIAS.
- b. Not feathering prop (simulated).
- c. Not cleaning aircraft.
- d. Failure to lower flaps when field is made.
- e. Poor field selections.
- f. Failure to intercept ELP Profile when possible.
- g. Getting too verbose with "MAYDAY" call. Fly the aircraft; be brief with the call.

806. PRACTICE PRECAUTIONARY EMERGENCY LANDING

1. **Description.** Utilize the PEL procedure to ensure that a safe landing at a paved field can be made if indications of an impending engine failure should occur. A PEL will be performed any time engine reliability is questionable or there are indications of impending engine failure.
2. **General.** The procedures for the PPEL are basically the same as the actual PEL. The PPEL will be initiated by the instructor informing the student of a simulated condition requiring that a PEL be performed. Indications of an impending failure or power loss could be excessive vibration, smoke or fumes, chip detector annunciator light, fuel leaks or siphoning, prop malfunction or any other condition listed in NATOPS Chapter Five requiring that you land as soon as possible due to impending engine/airframe problems.

Unlike the total power loss situations, **POWER IS AVAILABLE** and should be used to reach high key, low key, and the runway at a paved field. Utilize maximum power (1015 ft-lbs.) if the emergency is not related to the oil system or strong engine vibrations; if related, use 850 ft-lbs. torque. Climb at 120 KIAS. Realize that power may cease at any time, anticipating forward stick to maintain flying speed should this occur. As stated earlier in this chapter, the precautionary emergency landing will utilize the ELP profile (Figure 8-1).

3. Procedures

- a. **TURN** towards the nearest paved field.

NOTE

For PPEL, turn towards the nearest manned outlying field designated for PPEL. Realize that for actual conditions, you would land at the best suitable field commensurate with altitude and gliding distance.

- b. **CLIMB** if not within dead engine gliding distance of high key. Utilize maximum power (1015 ft-lbs.) if the emergency is not related to the oil system or strong engine vibrations; if related, use 850 ft-lbs. torque and 120 KIAS airspeed.

NOTES

1. 120 KIAS climb is used to afford increased forward visibility in the training environment. For actual emergencies, airspeeds as low as 100 KIAS may be used to increase rate of climb.
 2. If weather conditions preclude a climb to within dead engine gliding position, leave the power at 850 ft-lbs. or 1015 ft-lbs. (whichever is applicable), and accelerate, remaining clear of clouds until at a position from which you can descend and/or decelerate to enter the ELP. Once a high key is "made," reduce power to 205 ft-lbs. and maintain altitude as the airspeed bleeds off to 100 KIAS. Approaching 100 KIAS, lower the nose to maintain 100 KIAS. Anticipate forward stick to maintain 100 KIAS should the engine lose total power. When climbing to a point within dead engine gliding distance, do not lose sight of your field by turning the aircraft away from it.
- c. Landing Gear and Flaps - **UP**. **CLEAN** up the aircraft (Check gear and flaps retracted. Report "aircraft clean").
 - d. Aircraft and Engine Instruments - **CHECK**. Check the cockpit systematically to determine the nature of the problem, and for any secondary indications. Try to ascertain the cause and functional status of the aircraft.

- e. **DETERMINE** the duty runway at your landing site.
- f. **DELIVER** a simulated voice report over the ICS to the instructor. Include the aircraft identification, situation, position and intentions (ISPI). Preface the call with "PAN-PAN, PAN-PAN, PAN-PAN." The instructor will make the appropriate radio call to enter the outlying field as required by local course rules.
- g. **REDUCE** power to 205 ft-lbs. torque and retrim for the 100-knot descent once sufficient altitude is achieved to make the field.

NOTE

Use the experience and judgment gained in practicing the HAPL to position the aircraft for the 100-knot descent into high key. Depending upon which direction you are flying from, the "final" into the high key may be of different lengths. Plan your approach so that you have some sort of "final" to set up for a good high key.

If excess altitude was gained during the climb, lower the gear early, slip or "S" turn to increase rate of descent.

- h. **LOWER** the landing gear prior to high key (if not previously lowered to dissipate excess altitude).

NOTE

If the gear must be lowered manually (due to fumes, electrical failure, etc.), begin in sufficient time to hand crank the gear prior to high key.

- i. **REPORT** each item of the Landing Checklist to the instructor (once gear is lowered).

NOTE

If approaching high key in 100-knot glide and you determine that you are below profile, add power to maximum allowable, raise the nose and climb at 100 KIAS to regain profile.

- j. At **HIGH KEY**: Turn towards the crosswind position using angle of bank as necessary (10-15 degrees under calm wind conditions). Maintain 100 KIAS. Make appropriate radio call.
- k. At **LOW KEY**: Vary the angle of bank as necessary so as to arrive at a $\frac{2}{3}$ wingtip distance abeam the intended point of landing (this $\frac{2}{3}$ WTD is valid only if at the proper altitude). Level the wings momentarily to accurately check your position abeam. Perform the low key voice report as required by local course rules.

- l. **CONTINUE** the turn towards the 90-degree position. Vary angle of bank as necessary to arrive at a proper 90-degree position (600-800 feet AGL, 100 KIAS).
- m. **LOWER** full flaps (winds and emergency permitting) when the field is made (but no sooner than low key).

NOTE

If the aircraft is below profile between high key and the 90° position, add power to max allowable to regain altitude. After the 90° position, use momentary power as required. Once on the profile again, reduce power to 205 ft-lbs. and lower flaps.

If the aircraft is above profile between high key and the 90° position, a slip is the preferable method of losing excess altitude. After the 90° position, a slip and/or a power reduction may be used at the pilot's discretion.

- n. Check and report, "Gear down, flaps up/down, Landing Checklist complete."
- o. **DECELERATE** towards 90 KIAS FF/95 KIAS NF from the 90° to final. Maintain 90/95 KIAS on final until commencing the landing transition.
- p. Upon rolling wings level on final, TW4 report "gear down, paddles checked/negative paddles" over ICS. TW5 report "gear down and locked, lights checked" over ICS.
- q. Reduce power to idle for the transition to touchdown at the intended point of landing.

NOTES

1. Touchdown is made on the main gear, then the nosewheel is gently lowered as in a normal landing. The descent to final will generally be at a greater rate than for normal touch-and-go. Adjust nose attitude and power in the flare to transition to a normal landing. If making a full stop, apply BETA and braking commensurate with runway remaining. Should insufficient runway remaining preclude a full stop before going off the runway, execute a waveoff if in the pilot's judgment the engine will continue to develop sufficient power to obtain a low key position for another attempt. If the pilot feels that the engine is not reliable for another attempt, utilize NATOPS ABORTED TAKEOFF PROCEDURES.

If at a tower-controlled field, clearance to land must be obtained from the tower prior to landing.

PPEL/PEL traffic has priority (to land) over touch-and-go traffic. Touch and-go traffic will wave off if in conflict with PPEL/PEL traffic.

2. When executing a PEL with the EPL, exercise caution in power application to prevent a compressor stall. BETA shall not be used with the EPL engaged. The Emergency Power Lever is only used for actual emergencies while in the emergency landing pattern.

4. Common Errors

- a. Not turning towards the nearest paved field prior to starting a climb. Remember, the first step is to TURN towards THE NEAREST PAVED FIELD.
- b. Poor judgment and planning to arrive at high key (including climbing excessively, thereby delaying entry into the ELP).
- c. Late or insufficient power additions to keep the aircraft in the ELP profile, i.e., "driving around the pattern" with 400-500 ft-lbs. of torque. Whenever low in a PEL, use power immediately and judiciously. Remember, the engine may give you only a second or two burst of power; so use power whenever you are low in a PEL.
- d. Holding the flaps instead of adding power when the aircraft is below the ELP profile.
- e. Excessive angle of bank off high key, resulting in a high and close low key.

807. PRECAUTIONARY EMERGENCY LANDING FROM THE PATTERN

1. **Description.** Utilize PEL procedure if indications of an impending engine failure occur while in the landing pattern.
2. **General.** The same indications of an impending engine failure as discussed in the PPEL may occur in the landing pattern. This maneuver affords the opportunity for the student to practice intercepting the ELP at low key.

The PPEL in the pattern will be initiated at or above 500 feet AGL by the instructor informing the student that he has a simulated condition requiring that a practice PEL be performed. (Example: "You have a simulated chip light.") At this time, the student would execute the appropriate procedures.

NOTE

This simulated PEL should not be initiated until proper interval with both PPEL(P) and touch-and-go traffic is obtained.

3. Procedures

- a. **TURN** towards the nearest suitable runway. Your first consideration is an off-duty runway. If the pattern is extended and/or the winds are calm, the nearest suitable runway may be the reciprocal of the runway the aircraft just departed. The instructor will then direct which runway will be used. Practice PELs in the pattern must conform with local course rules. The instructor will make the appropriate call to the Tower/RDO/crash crew.

- b. **CLIMB** at 100 KIAS, utilizing maximum allowable power (for the emergency).

NOTE

Anticipate immediate forward stick to maintain 100 KIAS should total engine power be lost.

- c. Land gear and flaps - UP. **CLEAN** up the aircraft. Check airspeed below 120 KIAS and raise the gear and (if necessary) the flaps. Turn the landing lights OFF and report "aircraft clean" to your instructor.
- d. Aircraft and engine instruments - **CHECK**. Conduct a systematic check of the aircraft for secondary indications.
- e. **DETERMINE** - Verify the intended runway with the instructor.
- f. **DELIVER** the appropriate simulated radio report to your instructor. (For an actual emergency, notify the tower/RDO of your situation/intentions on the UHF radio.)
- g. Continue the climb until within dead engine gliding distance of a low key position; then **REDUCE** power to 205 ft-lbs., lower the nose to the 100-knot glide attitude and retrim.
- h. **LOWER** the landing gear, **REPORT** the Landing Checklist and retrim for 100 KIAS. Turn the landing lights on.
- i. Arrive at low key with proper altitude and $\frac{2}{3}$ wingtip distance.
- j. Make the appropriate radio call at low key.
- k. Complete the maneuver as in the last half of the PEL.

NOTE

Any time the aircraft is below profile, add power to maximum (for as long as necessary to regain proper altitude). After the 90° position, use momentary power as required to regain profile.

4. **Common Errors**

- a. Excessive angle of bank, resulting in a close and high low key position.
- b. Not maintaining 100 KIAS in the climb.
- c. Failure to use power when low throughout the pattern.
- d. Overclimbing to low key, resulting in excessive altitude precluding a safe descent profile to landing.
- e. Failure to complete the Landing Checklist prior to low key.

808. EMERGENCY POWER LEVER**1. Description.** N/A

2. General. The manual fuel control system consists of a cockpit control, which provides the pilot with direct mechanical linkage to the bellows and the fuel metering pin in the FCU. The manual fuel system is a backup system only and is used in the event of a malfunction in the pneumatic section of the FCU. When engaged, the system will bypass all pneumatic failure modes that result in minimum fuel flow and/or lack of engine response to PCL movement. Movement of the EPL towards max mechanically depresses the bellows to schedule more fuel to the engine. This system relies on torque tube pretension to reduce power as the EPL is moved towards the idle range. When using the EPL, normal operation of the landing gear warning system is provided. If loss of power occurs due to a malfunction of the FCU, power may be restored using the EPL. No automatic fuel scheduling is incorporated, and fuel metered to the engine is a direct function of the lever position. Idle RPM, when required, should be maintained above 65% by the pilot to eliminate the lack of EPL response in the idle range, and improve engine response. The manual fuel control system bypasses the protective devices, relying on pneumatic bleed air as the operational parameter for the fuel topping function of the primary governor. Failure of the FCU at high power cannot be corrected with the EPL.

Reduced fuel flow (rollback) is typical of a fuel control unit pneumatic sensing system malfunction. However, a rollback can also be caused by a hydro (fuel) sensing system malfunction associated with a rare generator failure that fails with extreme heat. The Emergency Power Lever (EPL) may not be effective in this case. The close proximity of the FCU to the extreme heat created by the generator can cause the fuel within the FCU to vapor lock and inhibit fuel flow through the FCU.

NOTE

With gear up, normal operation of the gear warning system occurs when the PCL and the EPL are retarded below 75% N_1 .

Additionally, the warning system will activate (with gear up) when both the PCL and EPL are forward of the 75% switch.

3. Procedures**a. EPL Activation**

- i. Condition lever - full increase.
- ii. EPL - Out of detent; slowly advance to desired power setting.
- iii. PCL - Idle.

- b. EPL Normal Use.** Utilize smoothly in the same manner as the PCL with considerations/limitations as set forth under GENERAL above. The use of the EPL will only be practiced at altitude. It will **NOT** be used for training purposes in either the normal or emergency landing patterns.

CAUTION

1. Compressor stall, vibrations and overtemp are probable with rapid accelerations of the EPL, particularly at the low end of the power spectrum.
 2. During an actual rollback, if power is restored with the EPL, exercise caution not to excessively reduce power in the final landing transition, as sink rate will drastically increase at low power.
- c. Deactivation
- i. PCL - advance to power setting above EPL.
 - ii. EPL - disconnect.
4. **Common Errors**
- a. Failure to check condition lever to full increase.
 - b. Failure to operate the EPL smoothly on activation.
 - c. Failure to monitor power settings during changes in altitude.
 - d. Using the PCL for operation of the manual fuel system after EPL is engaged.

809. EMERGENCY VOICE REPORTS

Emergency voice reports will be made in the Identification, Situation, Position, and Intention (ISPI) format.

In a non-radar environment, emergency reports of an immediate or serious nature are preceded by the word "MAYDAY." Emergency voice reports of a delayed or less serious nature are preceded by the word "PAN-PAN." Repeating either word (as applicable) three times is the widely accepted method of clearing the frequency for an emergency voice report. An example of an emergency voice report of an engine failure in a non-radar environment is as follows: "MAYDAY! MAYDAY! MAYDAY! [Call sign], engine failure, seven miles northeast of Brewton at 3500 feet. Intend to land in a farmer's field to the southwest."

In a radar environment, standard procedure for a distressed or urgent situation is to declare an emergency. An example of an emergency voice report of an engine failure in a radar environment is as follows: "[Call sign] is declaring an emergency. Streaming fuel, 10 miles north of Corpus at 5000 feet. Executing emergency landing at T. P. McCampbell."

Regardless of radar condition, expect to inform ATC of fuel remaining in hours and minutes (e.g., 1+00) and the number of people on board after delivery of ISPI information.

810. ICS FAILURE**1. Description.** N/A

2. General. The most important consideration in any ICS failure situation is positive control of the aircraft. Good headwork and procedural knowledge may enable you to regain use of the ICS. Failing that, you should return to base as soon as practical if the situation warrants. Communication is possible by shouting (slowing the aircraft will help) or by passing notes. Under no circumstances should you assume that the instructor has taken control of the aircraft without positive confirmation of that fact.

NOTE

It is possible to communicate between cockpits with an ICS failure by using the UHF radio.

3. Procedures

- a. Check all cords, switches and connections for proper position/condition.
- b. Check volume knob on the audio panel. Ensure it is full volume.
- c. Attempt communication on hot mike with audio panel mixer switches.
- d. Shout or pass notes as necessary.
- e. If unable to communicate verbally and the pilot in the front cockpit wishes to be relieved, he shall pat the top of his helmet and point to the other pilot. The pilot taking control of the aircraft will shake the stick to signify assuming control. The pilot in the front cockpit will then raise his hands above his shoulders to confirm he has relinquished control.
- f. If the pilot in the rear cockpit wishes to take command of the aircraft, he will shake the stick with a firm, positive motion. At this time the pilot in the front cockpit will relinquish the control of the aircraft and raise his hands above his shoulders. Once again the pilot in the rear cockpit will shake the stick with a firm, positive motion to verify that he has control of the aircraft.
- g. Use of the front cockpit mirrors may aid in communication between cockpits.

4. Common Errors

- a. Improper switch settings.
- b. Disconnected cords.

CHAPTER NINE

SOLO FLIGHT - CONTACT 4401

900. INTRODUCTION

For most students, the Contact 4390 will be the most demanding task undertaken to date in their aviation career. While the safe-for-solo check is certainly challenging, successful completion is a rewarding, confidence-building experience.

901. THE SOLO FLIGHT

1. Preflight Preparation

- a. **Physical preparation.** Make sure your body is well rested. The average sleep requirement is eight hours during each 24-hour period. However, needs will vary with each individual. Lack of sleep means a lack of awareness. You should have learned your procedures all along, so do not try to "cram" the night before. Get a good rest. If you have received your training properly, all that is necessary to prepare for the check flight is a review. Make sure that your body is well nourished. If you eat a well-balanced diet regularly, you will have a sufficient energy supply. Do not depend on a coffee and donut breakfast, or a coke and candy bar lunch. As always, avoid self-medication if you are sick. Do not hesitate to see the flight surgeon. He is well aware of an aviator's needs, for the flight surgeon has gone through a special flight training regimen himself. If you are ill, you do not belong in a cockpit.
- b. **Mental Preparation.** You must know your Standard Operating and Emergency procedures before the flight. Since you have passed your check flight, you have demonstrated that you can safely operate the aircraft without assistance. However, you must be even more prepared for the solo, as there will not be an instructor to bail you out of critical situations. Study those procedures, especially those requiring immediate action. Prior to the solo, plan your flight in order to make efficient use of the limited time available. Review the course rules for the area in which you plan to operate. Pay particular attention to location of fields that may be utilized in the event of an emergency. You should also ensure that you have the proper flight equipment (I.D. tags, etc.) and checklists in your possession. (The wearing of ear protection on the flight line is mandatory.) Prior to leaving the FDO's desk, you should find out which fields are available for solo operations, their status and operating hours. Ask the flight duty officer if he has any information that may pertain to your flight. And if you have any final questions, do not hesitate to ask.
- c. **Ground Procedures.** You will be assigned an aircraft for which you are solely responsible once signing the "A" sheet. Inspect all the gripes on the aircraft carefully. Once again, if you have any questions do not be afraid to ask. Take note of any repeat gripes of a serious nature. Do not accept the aircraft for flight if there are any outstanding gripes which must be corrected. Maintenance Control retains the yellow copy of the MAF in the book to indicate that required action on previous gripes have

been corrected and signed off by a maintenance supervisor. The pink copy of the MAF is retained in the book, indicating that maintenance is outstanding, but the aircraft is certified for flight. This is referred to as an "outstanding" gripe.

- d. **Preflight.** Conduct a thorough and complete preflight. If you note any discrepancies, call a troubleshooter. Do not just ask a lineman. He is not qualified to make any judgments as to airworthiness. If any doubt exists, check with a flight instructor. Before you depart on any solo it is of utmost importance to secure the rear cockpit.
- e. **Securing the rear cockpit.** Secure the rear cockpit in accordance with NATOPS and the Solo Flight Checklist located in the rear cockpit. Ensure that the parachute is facing forward to prevent pin damage and that the parachute straps and harness are fastened and secured with the inertial reel locked. Be certain that the parachute cannot fall forward during flight and jam the controls. Check all cockpit lights off and all switches off. Ensure that the battery switch is on and that inverter #2 is selected. Check all circuit breakers set. Check for loose objects and finally close and lock the rear canopy.
- f. **Start, taxi, and runup.** It is recommended that you read the checklists out loud as if your instructor were with you. This will reduce your chances of omitting an item on the checklist. While taxiing, keep your head "on a swivel." You are solely responsible for the safety of the aircraft and a good "See-and-Avoid" doctrine is imperative, both on the ground and in the air. You also need to pay attention to radio transmissions, especially those that begin with your call sign. If problems should arise during the runup phase, do not hesitate to ask the FDO/ODO for assistance. You should know the areas available (hot spots) for minor repairs in case you have to avail yourself of these.

2. **Takeoff and Flight.** Prior to taking the active, ensure you have clearance to do so. Read back the appropriate response as required. Even before this, you should have already thought out the Takeoff and Departure procedures to ensure a smooth evolution.

Remember, you will be by yourself for the first time, and naturally you will be a little more relaxed and start hearing more than you have before. So, if you start hearing noises, pause for a few seconds and look for a cause. Is the canopy fully closed; is something loose in the cockpit? Check your gauges. Check the aircraft configuration again. Aircraft performance in hot weather is not up to standard at times. If you feel the aircraft is not performing as it should, check to see if the gear and flaps are up before making any conclusions. If you have any doubts, return the aircraft to the duty runway.

- a. **Restrictions.** You may not make a full-stop landing at an OLF unless directed by the RDO, or if weather or an emergency makes it necessary. If you must make a full-stop landing at an OLF, remember that you are responsible for the aircraft until either you return it to home field, or you are relieved of responsibility by a maintenance or instructor pilot. Ensure you are properly chocked before shutting down. Perform a proper postflight before leaving the aircraft and close the canopy if rain is anticipated.

- Once you have properly taken care of your aircraft, call the FDO commercial collect or DSN and advise them of your situation. Be sure to use a fireguard for restarting the aircraft. Solos may not practice spins, stalls, simulated engine failures, PPEs, or any maneuver which has not been previously introduced. Solo launch time is no earlier than sunrise with RDO on station. Solo recovery is no later than 30 minutes prior to official sunset.
- b. **High work.** Conform to local course rules and remain oriented. It is recommended that you practice high work in sight of an easily identifiable landmark. Check between maneuvers to see where you are and perform gas/position reports to yourself while operating in the working area. You should be monitoring the area common frequency, as well as the guard frequency in the event of a solo recall. Take time to practice maneuvers which you need to perfect. Keep your scan moving outside for other aircraft in the same operating area.
 - c. **Operations at Outlying Fields.** Ensure that you know the radio frequency and pattern altitude of the OLF you are about to enter. Utilize the Proper Entry and Communications procedures for the OLF. Know the proper pattern direction and use extra care in establishing interval. You should also keep track of your flight time and number of landings accomplished at the OLF. When it is time to depart, follow applicable course rules and check your gear up.
 - d. **Emergencies.** In all emergencies, the first consideration is to fly the aircraft. Then, determine the situation and your course of action in accordance with NATOPS. Should the emergency you are experiencing require a forced landing, it is imperative that you level your wings prior to impact to avoid a possible "cartwheeling" condition. Lastly, communicate and let others know your situation.
 - i. **Lost aircraft.** If you get lost, admit it and try to communicate using all available channels and NAV aids. Be prepared to give a long count (i.e., 1-2-3-4-5-6-7- 8-9-10-9-8-7-6-5-4-3-2-1) or short count (i.e., 1-2-3-4-5-4-3-2-1) in the event of a lost plane search. Land at a suitable airfield before you run out of gas. The best policy is to remain oriented and do not get lost. If you actually get lost, it will be necessary for you to use your own initiative and good judgment. Every situation will be different; therefore, it is impossible to establish a criterion that will apply to every set of circumstances. However, the following items, known as the five "Cs" will generally apply: CONFESS, CLIMB, COMMUNICATE, CONSERVE, AND COMPLY.
 - (a) **CONFESS** - Admit that your are lost and need some form of assistance.
 - (b) **CLIMB** - Ceiling and visibility permitting, climb to improve radio reception and forward visibility.
 - (c) **COMMUNICATE** - Request assistance on the area working frequency from an instructor pilot or advice from your FDO/ODO. If unable, try calling Approach Control frequency with a PAN report and request vectors to homefield. If unable to receive any reply, switch radio and try again on GUARD frequency. A sample PAN report follows: "PAN-PAN, PAN-PAN, PAN-PAN, [Call sign] is lost, request vectors to homefield."

If ATC replies, they will ask you to squawk a certain code on your transponder. They may also ask you to provide other information in order to give you a vector (heading) to home field. If it appears that clouds will be on your vectored flight path, advise Approach and circle while maintaining VFR.

- (d) **CONSERVE** - Operate the aircraft (when straight and level) at maximum endurance power setting of 420 ft-lbs. torque.
- (e) **COMPLY** - With instructions received from another dual aircraft, Approach, or your base. Many prominent landmarks are available in and around your working areas to give clues as to your general whereabouts. If you find yourself lost, the important thing to remember is this: Do not fly about aimlessly. Be calm and develop a plan using your good judgment and established procedures. If you still cannot identify your position after having gone through the five "Cs," look for any established landing field. Before landing at a strange field, circle it at a safe altitude and locate all obstacles and hazards. Determine the wind direction and duty runway and try to get a rough estimation of runway length and width. If there is a tower at the field, try to contact Approach or Tower on GUARD prior to landing. Once you are ready to land, make a normal traffic pattern. Remember that the field elevation may be considerably different from that of your home field. Use your best estimation and adjust accordingly. Once on deck, notify your base of the situation.

During foul weather, maintain a visual reference to the ground. **DO NOT FLY ABOVE AN OVERCAST.** If you happen to blunder above a cloud layer, try to find a hole in the clouds and let down VFR. If letdown is impossible and no other instructions have been received (five "Cs"), bailout is a consideration. Do not wait until fuel exhaustion, but do not be in a hurry to "throw in the towel" either. Be calm and exercise good headwork. Prior planning and preparation will prevent an incident such as those described above.

- ii. **Lost communications.** Should you experience lost communications, you may have just one bad channel. Try calling tower, ground, approach, or area common. Also, try setting in the manual frequencies. If this fails, utilize the lost comm procedures as described in the SOP. Remember, during Lost Comm YOU are responsible for safe separation, so watch for other aircraft and remain VFR. Be sure to make all voice reports in the blind and rock your wings approaching the break. On final, double-check the Landing Checklist complete and for a green light from the tower. (Know what all of the light signals mean as they can and will be given to you.) Make a full-stop landing and clear the duty runway when safe.
- iii. **PEL.** Should a PEL be necessary, execute one without hesitation at the nearest paved field. If the PEL is made to a short runway, be prepared to use Abort procedures to stop once the landing is made.

- iv. **Emergency orbit pattern (Delta pattern).** Be familiar with the procedures for the emergency orbit pattern in accordance with local course rules. Once established in the pattern, you may contact the FDO/ODO and ask for assistance if needed. If you need advice to solve an aircraft malfunction, choose one person to be your advisor and have everyone else go through him. Utilize NATOPS as required.
 - v. **Unintentional Instrument Flight.** Instrument conditions are to be avoided at all times in Contact. If actual instrument flight is encountered, immediately level your wings on the attitude gyro and time for 30 seconds. If not VFR at the end of 30 seconds, attempt to regain visual flight conditions by making a shallow turn (15° of bank) for 180°.
3. **Conclusion.** Lastly, enjoy your solo. This is your hop and it is designed to give you confidence in yourself and your abilities. Know and use the standard operating procedures that you have been taught. This hop will be a valuable and enjoyable step towards your becoming a competent naval aviator.

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CHAPTER TEN

INTRODUCTION TO AEROBATICS

1000. INTRODUCTION

This stage of your flight training is primarily devoted to the performance of aerobatic maneuvers and the further refinement of the maneuvers previously introduced.

Aerobatic flight training is essential to your development as an effective military pilot. Experience gained through aerobatic training will increase your confidence and enhance your understanding of practical aerodynamics. Your coordination, timing, and ability to maintain spatial orientation will improve as you learn by flying the aircraft through the various aerobatic maneuvers.

The ability to perform aerobatic maneuvers skillfully is in large part due to an innate "sense of feel" which is developed through practical experience. Mechanical execution of the procedures alone will not produce the desired results. The pilot must continually analyze and make control adjustments based upon a constant flow of visual, tactile, and even aural feedback.

Increased demands will be made upon your airwork as you improve your consistency and precision in the landing pattern. You will also perform angle of attack (AOA) approaches for the purpose of introducing landing procedures which are used exclusively in fixed wing Naval Carrier Aviation and to some degree in the USAF.

Aerobatic flight training is as challenging as it is exciting. Study this instruction thoroughly. The better you prepare yourself on the ground, the quicker you will begin to develop your "sense of feel" while in the air. Careful study and preparation will ensure that you receive the maximum benefit from this training while maintaining the highest possible level of flight safety.

1001. RULES AND PRECAUTIONS FOR AEROBATIC FLIGHT

Due to their unique nature, there are certain rules and precautions you must observe prior to performing any aerobatic maneuver. FRRs and local SOP will prescribe restrictions governing the airspace within which you may perform aerobatic maneuvers. Ensure that you are thoroughly familiar with these regulations. Strict compliance is mandatory.

1002. AEROBATIC CRUISE

All aerobatic maneuvers will be from aerobatic cruise. This is defined as trimmed and balanced flight utilizing the maximum allowable power setting (1015 ft-bs.). Transition to aerobatic cruise by increasing power to maximum allowable and trimming for straight and level balanced flight. This will normally result in an indicated airspeed between 180 and 190 KIAS. Once the aircraft is trimmed for aerobatic cruise, leave the trim tabs where they are and do not adjust them while performing the various aerobatic maneuvers. Remember that one of the basic reasons that aerobatic training is performed is so that you may develop a "sense of feel" under constantly changing attitudes and airspeeds. The use of trim tabs would defeat this objective by altering the feel of the controls.

1003. AEROBATIC CHECKLIST

Prior to performing any aerobatic maneuver or series of the same maneuver, complete the Aerobatic Checklist. This will assure you that your aircraft is prepared for aerobatic flight. The checklist is as follows:

1. **Bilges** - "Clear of loose objects, control lock stowed (in two places)"
2. **Restraint harness** - "Locked and tight."
3. **Autoignition** - "On, AUTO IGN light, ON."
4. **Engine instruments** - "Checked" (for normal indications).
5. **Report** - "Aerobatic Checklist complete."

Ensure that all loose items (checklists, charts, pubs, clips, water bottles, etc.) are secure in either the map case or a zipped pocket. Your inertial reel should be locked and the harness tight (waist and shoulder straps). The control lock should be visually checked to ensure that it is secured in both places. Check that the autoignition light actually illuminates and make a mental note to secure it once all aerobatic maneuvers and/or stalls are complete. Take the time to check each instrument for normal indications. Additionally adjust the friction knob so that sufficient pressure is applied to prevent the PCL from slipping during high G maneuvers. Taking the time and effort to do your Aerobatic Checklist correctly can prevent some unwelcome surprises.

1004. SECTION LINES AND GROUND REFERENCE POINTS

The maneuver descriptions and procedures of the various aerobatic maneuvers often refer to section lines and ground reference points. Understanding how to select and utilize these geographical references will greatly enhance your ability to remain oriented during the various aerobatic maneuvers.

Much of the area you will fly over is rural farm land (Whiting) or beachline/waterways (Corpus Christi). The lines which separate one "section" of land from another is called a "section line." These lines commonly run north/south or east/west in long, straight lines and are easily identified from the air. During the various maneuvers, these section lines are utilized as a reference to maintain directional control. Since some maneuvers involve a reversal in the direction of flight, it becomes necessary to select a line which extends both in front of and behind you. Highways, utility cuts or even beachlines may also be utilized, provided they are linear and of sufficient length.

Maneuvers such as the Barrel Roll or Wingover require the use of a ground reference point which is 90° from your initial heading. Ensure that the points which you select are prominent and easily seen, remembering that you will have to relocate them rapidly as you are passing through unusual attitudes. The rate at which you must scan while performing the maneuvers does not allow the time to search for a hard-to-see reference point.

1005. CLEARING TURNS

During aerobatic flight, attitude, altitude and direction of flight change rapidly. You must therefore exercise extreme caution by ensuring the immediate area is clear of other aircraft and that no danger of midair collision exists. A clearing turn, as the name implies, allows you to clear the area in which you are operating. A clearing turn shall be executed after the Aerobatic Checklist and immediately prior to the performance of any aerobatic maneuver. Utilize a minimum of 45° angle of bank and turn for a minimum of 180° of heading change. Two 90° turns in opposite directions will suffice. The direction of the last clearing turn shall be in the direction in which the maneuver will be performed. Throughout the turn, check the area thoroughly for other aircraft. Continue the turn until you have the desired airspeed and sufficient ground references to maintain orientation during the maneuver. Remember 180° of turn is a minimum, not an absolute.

If the number of section lines or ground references is limited, then a teardrop maneuver is an effective means of performing the clearing turn while positioning the aircraft for the next maneuver. This may be performed by turning to place the nose approximately 45° from the section line, timing for 10-15 seconds, and then turning back to the reciprocal of the original heading.

1. Common Errors

- a. Failure to plan or execute the clearing turn(s) so that the chosen ground references are properly positioned to allow for adequate orientation during the subsequent maneuver.
- b. Not "clearing" the area sufficiently during the turn.
- c. Poor basic airwork during the clearing turn(s), resulting in the aircraft not being at the correct altitude and/or airspeed to commence the planned maneuver in a timely fashion.
- d. Failure to execute the maneuver within the cleared airspace.

1006. ALTITUDE LIMITATIONS

Commence each aerobatic maneuver from an altitude which is sufficient to allow a return to straight and level flight above 5000 feet AGL. You must also exercise caution to ensure that you do not exceed the maximum altitude permitted for your particular operating area. If performed correctly, all of the maneuvers (except the Aileron Roll) require approximately 1500 feet of vertical airspace. Use this figure while planning your entry altitude, keeping in mind that the minimum recommended altitude for bailout during out-of-control flight is also 5000 feet AGL.

Sound judgment applies in choosing an altitude from which to commence each particular maneuver. Generally, the higher you can begin without exceeding your maximum altitude is the most logical choice. As your experience increases, you should manage your altitudes in order to control your energy states more effectively, thus increasing efficiency within the same allotted time and available fuel.

1007. OPERATING LIMITATIONS

Aerodynamic, acceleration and aerobatic flight limitations are contained in chapter four of the T-34C NATOPS Manual. You are required to know and operate the aircraft within these limitations. In the event that you inadvertently overstress the aircraft, you should discontinue aerobatics immediately and execute the IN-FLIGHT DAMAGE procedures in accordance with NATOPS. Immediately after your return, you must "down" the plane so that the airframe can be inspected for damage prior to the next flight.

1008. INVERTED AND ZERO G FLIGHT LIMITATIONS

The maximum inverted flight time is 15 seconds. Inverted flight above 220 KIAS is prohibited. The maximum zero G flight time is transient.

Zero G flight is associated with a "floating" sensation. This is usually a result of relaxing too much or all of the backstick pressure and is often referred to as "unloading the aircraft." If the maneuvers are performed correctly, you will not experience this condition.

1009. G-INDUCED LOSS OF CONSCIOUSNESS

G-induced loss of consciousness (G-LOC) is a fainting episode caused by gravity-induced physiological stresses on the human body. The most commonly experienced G-forces are encountered by pilots during positive acceleration maneuvers (such as pulling out of a dive or turning at high angles of bank). This type of positive G-force (+Gz) is directed from head to foot, and therefore imparts a feeling of being pressed into the seat.

The ultimate effect of these forces on the human body is a tendency for blood to pool both in the lower abdomen and the extremities. This pooling effect dramatically reduces the volume of blood available to the eyes and brain, thereby critically reducing the oxygen available to sustain vision and conscious brain function. The typical G-LOC sequence of progression is as follows:

1. Grayout — peripheral vision is progressively impaired.
2. Blackout — vision is lost completely.
3. Loss of consciousness.

Once G-LOC actually occurs, it typically lasts from 15-30 seconds. Once consciousness is regained, the individual usually exhibits a period of uncontrolled muscle spasms followed by disorientation or a "dream-like" state which can last from a few seconds to several minutes. Some pilots have described post G-LOC feelings of detachment, apathy and temporal distortion. Amnesia of the entire episode is a common occurrence. Impairment of piloting skills may last for as long as 30 minutes.

Navy and Air Force investigators have identified G-LOC as a probable causal factor in numerous Class A mishaps. The Air Force estimates that at least 12% of all Tac-Air pilots have experienced actual G-LOC at least once. G-loading capability in the T-34C is comparable to most tactical jets, and therefore can easily cause G-LOC among the inexperienced or unprepared

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pilot. Most T-34C G-LOC episodes occur during rapid G-loading of 3 to 5 G's over 2 to 5 second intervals. Pilots can prepare themselves for the physical stress of rapid accelerations and therefore prevent G-LOC by taking certain precautions:

1. Learn and utilize the proper Anti-G Straining Maneuver (AGSM), more commonly called the "HICK Maneuver." There are two components to the recommended AGSM:
 - a. The first component is a continuous and maximum contraction (if necessary) of all skeletal muscles including the arms, legs, chest, and abdominal muscles. This tensing of the skeletal muscles restricts blood flow in the G-dependent areas of the body and thereby assists in the retention of blood in the thoracic region (including the heart) and the brain.
 - b. The second component of the AGSM involves repeated closing of the respiratory tract at 2.5 to 3.0-second intervals. Its purpose is to counter the downward G force by expanding the lungs and increasing the chest pressure, thereby forcing blood to flow from the heart to the brain.

The respiratory tract is an open breathing system which starts at the nose and mouth and ends deep in the lungs. It can be completely closed off at several different points, the most effective of which is the glottis. Closing the glottis (which is located behind the "Adam's Apple") yields the highest increase of chest pressure. The glottis can be closed off by saying the word "HICK" and catching it about $\frac{3}{4}$ of the way through the word ("Hiii-"). This should be done after a deep inspiration, followed by forcefully closing the glottis as you say "HICK." Bear down for 2.5 to 3.0 seconds, then rapidly exhale by finishing the word HICK ("-ka"). This is immediately followed by the next deep inhalation, repeating the cycle until the G-loading is discontinued.

The exhalation and inhalation phase should last for no more than 0.5 to 1.0 second. Since the blood pressure falls dramatically during this phase, its duration must be kept to a minimum.

WARNING

Do not hold your respiratory straining too long (more than five seconds) since this will prevent the blood from returning to the heart properly and may result in loss of consciousness.

Anticipate the onset of high G forces whenever possible. Skeletal muscles should be tensed prior to the onset, coupled with the "HICK" respiratory cycle as the G-loading increases. Initiating the AGSM too early can inhibit the body's natural cardiovascular reflex responses, while beginning too late creates a deficit situation which may be difficult to overcome.

NOTE

If properly performed, the AGSM should provide adequate protection against G-LOC while performing the various aerobic maneuvers. If you experience difficulty, or are in doubt as to whether or not you are executing the maneuver correctly, see your squadron flight surgeon or wing Aeromedical Safety Officer.

2. Inter-cockpit communication between aircrew is imperative. Both individuals must rely on the other not to apply high G forces without first giving prior warning. Historically within the T-34C community, poor crew communication has been a major causal factor in G-LOC episodes.
3. Be prepared physically.
 - a. Avoid flying if ill or extremely fatigued.
 - b. Maintain an adequate fluid intake and do not skip meals.
 - c. Stay in shape. The optimum fitness program for increasing G-tolerance is a combination of moderate weight training and cardiovascular aerobic exercise (running, walking, swimming, etc.) 2-3 times weekly. Avoid excessive long distance running (more than 25 miles per week) or overly intense weight training. These will typically result in lower blood pressure and heart rate which may decrease G-tolerance.
4. A "G-warmup sequence" is recommended for any pilot who anticipates performing high G maneuvers. This may be accomplished by performing the following procedures:
 - a. Transition to aerobatic cruise and complete the Aerobatic Checklist. Notify the other crewmember that you are going to commence the G-warmup sequence.
 - b. Clear the area. Initiate three-second verbal countdown. On "1," apply the AGSM and on "0," smoothly roll into a 60° AOB turn at 2 G's for 90° of heading change. Maintain altitude with nose attitude. Continue to perform the AGSM until step 4 is completed.
 - c. Clear the area. Using the one-third rule, reverse the turn for 90° of heading change at 60° AOB and 2 G's. Maintain altitude with nose attitude.
 - d. Clear the area. Using the one-third rule, reverse the turn for 90° of heading change at 90° AOB and 2.5 to 3.0 G's. Maintain altitude with nose attitude.

1010. VFR UNUSUAL ATTITUDES

1. **Description.** Refer to T-34C NATOPS Flight Manual Section IV for discussion of, and procedures for, UNUSUAL ATTITUDE RECOVERY.
2. **General.** The diverse and demanding missions performed by military aircraft often require maneuvers which involve unusual attitudes. An effective military pilot must therefore be trained to quickly recognize and then safely recover from unusual attitudes. This must often be accomplished while relying almost exclusively upon the interpretation of visual cues from outside the cockpit. In this stage of training you will perform the procedures for recovery from various unusual attitudes utilizing what is primarily a scan of visual references located outside the cockpit.

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WARNING

When experiencing an unusual attitude associated with inverted attitude, the aircrew may feel the push-pull effect of going from negative to positive G forces. The aircrew needs to be aware of the range of these G forces and execute the AGSM to provide adequate protection from G-LOC. Starting the AGSM prior to the onset of Gs is of the utmost importance.

3. Procedures

- a. The instructor will transition to AEROBATIC CRUISE, complete the AEROBATIC CHECKLIST and perform a CLEARING TURN.
- b. The instructor will then smoothly maneuver the aircraft so as to place it in an unusual attitude.
- c. Once directed by the instructor, assume the controls and recover the aircraft in accordance with the NATOPS Unusual Attitude Recovery procedures. Recovery shall be accomplished by 5000 feet AGL.

4. Common Errors

- a. Not rolling aircraft upright first.
- b. Pulling through like a Split-S.

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**CHAPTER ELEVEN
AEROBATIC MANEUVERS**

1100. INTRODUCTION

This chapter provides procedures and descriptions of all of the T-34C aerobatic maneuvers that you will accomplish in Primary Training. Strive to accomplish the maneuvers with the highest degree of skill and precision possible. Later, in cruise formation training, you will be conducting some mild aerobatic maneuvers in formation. Those maneuvers will rely on the skills you develop now to precisely maneuver your aircraft in three dimensions.

1101. LOOP

1. **Description.** The Loop is a 360° turn in the vertical plane. During the Loop the aircraft is rotated at a constant rate of pitch about its lateral axis (Figure 11-1).

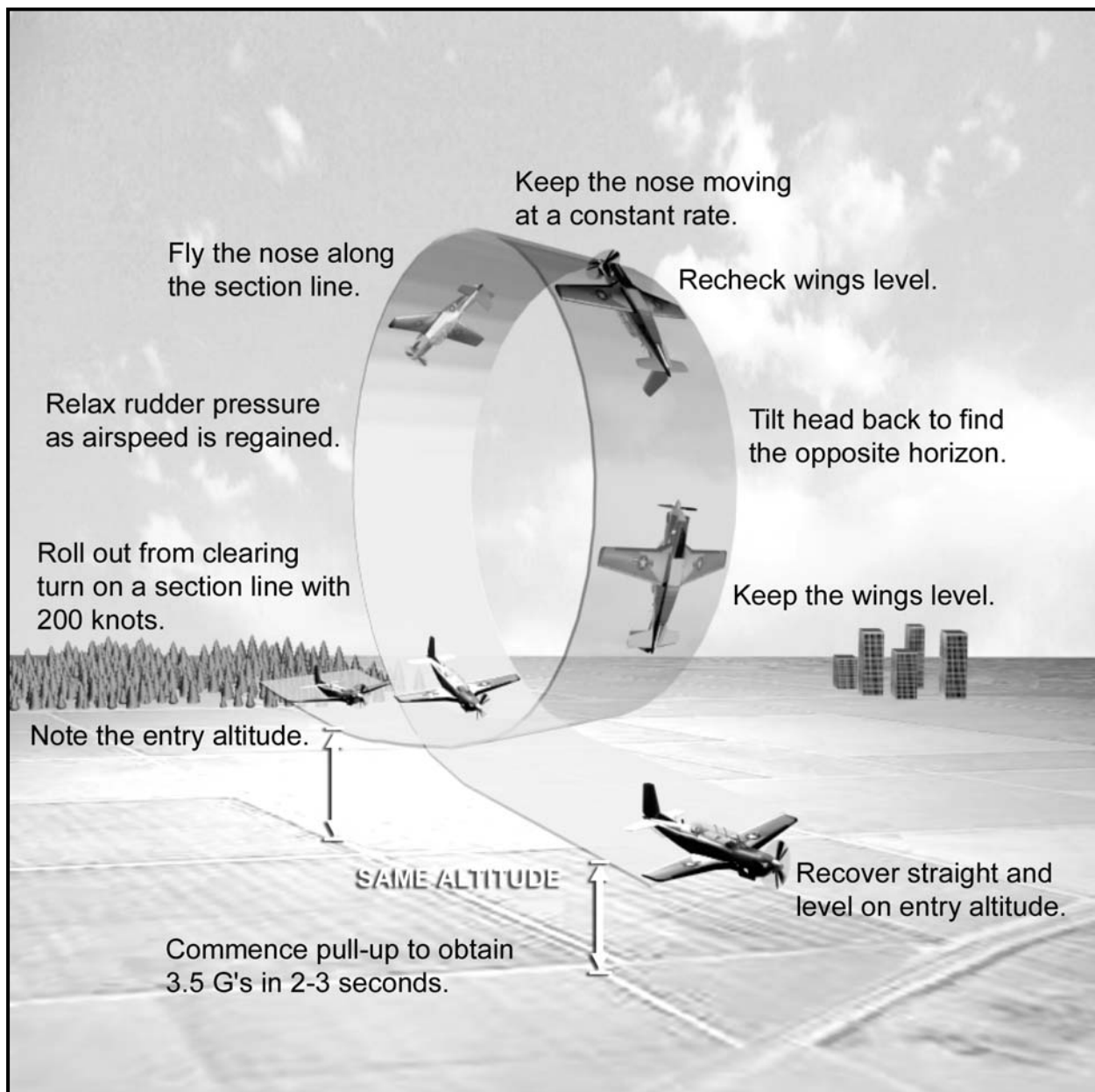


Figure 11-1 Loop

2. **General.** The Loop is one of the most rudimentary aerobatic maneuvers, yet one which requires skill and practice to consistently perform well. Since the Loop is executed in a single plane, the elevator is the principle control surface utilized. The nose pitch rate should be

11-2 AEROBATIC MANUEVERS

constant, but the aft stick force required to obtain this will vary with airspeed and "G" loading. Directional control is maintained by adjusting rudder input as the airspeed varies, thereby maintaining balanced flight. Aileron is used only in making corrections to maintain the wings parallel with the horizon throughout the entire maneuver.

When the Loop is performed correctly, positive "G" loading and constant nose pitch movement should be maintained throughout the maneuver. As airspeed varies, the resulting transcribed arc will also vary in radius, therefore backstick pressure will vary in order to maintain constant nose pitch movement. The result will produce a Loop that has an egg-shaped appearance when viewed on the horizon. Remember to select a long, well defined section line which extends behind as well as in front of you.

3. Procedures

- a. **CONFIGURATION:** Transition to aerobatic cruise. **CHECKLIST:** Complete the aerobatic checklist. **CLEARING TURN:** Commence a clearing turn. During the last 90° of turn, lower the nose slightly and accelerate to 200 KIAS. Roll out of the clearing turn on or parallel to a section line with 200 KIAS. The increased airspeed will require a slight amount of left rudder to maintain balanced flight.
- b. Recheck the wings level and clear the airspace above you. Just prior to entry, check and report the entry altitude over the ICS. Commence the AGSM and immediately start a smooth straight pull up accelerating to 3.5 Gs within two to three seconds. Do not use the aileron.
- c. Recheck the wings level as the nose passes through the horizon. Adjust stick pressure as necessary to keep the nose moving at a constant rate. Increase right rudder pressure as airspeed decreases.
- d. Shortly after passing the vertical position, tilt your head back and visually locate the opposite horizon. Correct with aileron as necessary to maintain the wings parallel to the horizon. Check the nose in relation to the section line and correct directional deviations as necessary by adjusting the rudder input.
- e. Airspeed will reach its slowest point at the top of the Loop. The greatest amount of right rudder input will therefore be required at this point in order to maintain balanced flight. The amount of aft stick force required to maintain a constant nose pitch rate will have decreased significantly from the initial pull-up. Maintain positive "G" loading and wings parallel to the horizon.
- f. Allow the nose to fall through the opposite horizon, adjusting the amount of aft stick pressure to maintain a constant pitch rate. Fly the aircraft's nose along the section line, relaxing right rudder pressure as airspeed is quickly regained.
- g. Continue to relax right rudder pressure as the airspeed increases in the dive and smoothly increase aft stick pressure as necessary to maintain a constant pitch rate. The recovery will again require approximately 3.5 Gs, so remember to resume the

AGSM. Quickly scan the altimeter during recovery in order to return to straight and level flight at approximately the same altitude, airspeed and heading from which the maneuver was initiated.

4. Common Errors

- a. Failure to check and report the altitude prior to entry. It is hard to recover on the same altitude when you do not know what it is.
- b. Poor directional control caused by failure to maintain balanced flight with the proper amount of right rudder as airspeed is lost and then regained. Poor rudder control is easily detected by checking the alignment of the nose and the section line. Remember that the required rudder input varies as airspeed varies. Almost constant rudder adjustment will be required during the maneuver.
- c. Poor directional control caused by failure to keep the wings parallel to the horizon throughout the maneuver. The most common tendency by far is to pull the stick slightly to the right when pulling the nose up during the 3.5 G entry. Keep the stick centered longitudinally as the entry input is made. Check and correct the wing attitude often.
- d. Poor execution of the initial pull-up with respect to G loading and/or timing. Remember, 3.5 Gs in two to three seconds. Scan the accelerometer. Excessive G-loading and/or loading the aircraft too quickly will cause an excessively rapid deceleration, and may result in overstress. Insufficient G-loading, or taking too long to obtain the correct acceleration, will deplete the aircraft's energy state, resulting in a stalled or near-stalled condition when approaching the inverted position.
- e. Relaxing too much backstick pressure while passing through the inverted position at the top of the Loop. This will result in a "floating" sensation. Remember to maintain some positive G-loading throughout the entire maneuver. Conversely, failure to relax sufficient backstick pressure over the top will result in excessive angle of attack and rudder shakers. If this occurs, relax the backstick pressure slightly.
- f. Failure to initiate the pull-out soon enough during the second half of the Loop. This results in excessive airspeed and recovery below the initial altitude.

1102. WINGOVER

1. **Description.** The Wingover is a 180° reversal in the direction of flight accomplished by combining a smooth climbing turn for 90° with a smooth diving turn for 90°. Recovery should be on the same altitude and approximately the same airspeed at which the maneuver was started (Figure 11-2).

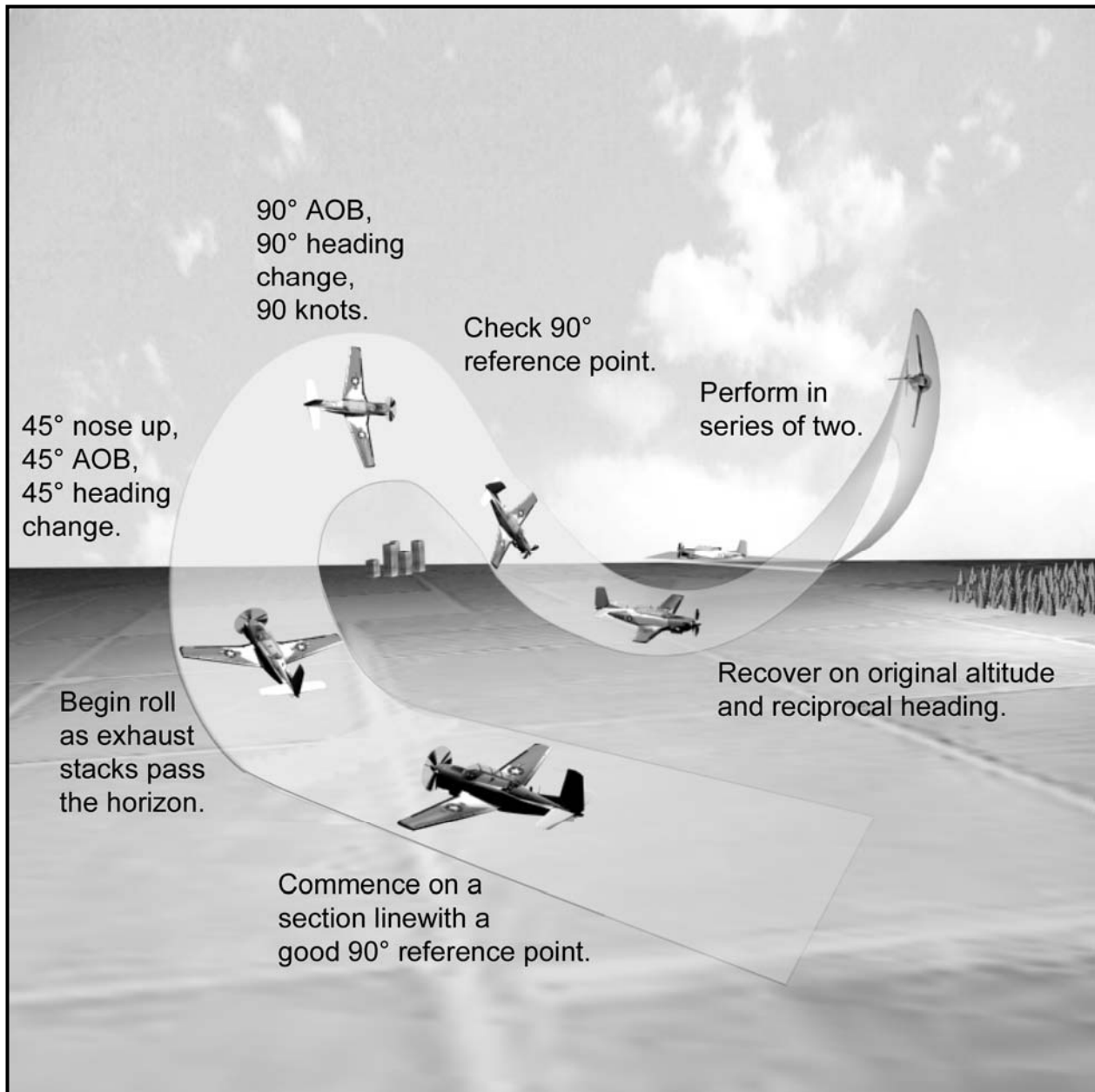


Figure 11-2 Wingover

2. **General.** The Wingover will develop your ability to smoothly control the aircraft in balanced flight through constantly changing attitudes and airspeeds. It is a slow and gentle maneuver when properly executed. No abrupt control movements are necessary. The maneuver may be initiated in either direction and is always performed in a series of two. You should therefore complete the series on the same heading that the first Wingover was initiated. Flying the maneuver in series will enable you to develop a "feel" for the changing control pressures and the rhythm of the maneuver. Successive Wingovers, when continued without interruption, serve as clearing turns for the next series.

When your instructor first demonstrates the Wingover, it is of primary importance that you acquire a mental picture of the path through which the aircraft is flying. Notice the appearance of the nose and the wings in relation to the ground and the horizon at various points during the maneuver. Once you are able to visualize this, the Wingover is merely a matter of flying the aircraft in balanced flight through this pattern. Since you are learning to fly the aircraft in a predetermined pattern, keep your scan primarily outside of the cockpit. Use your instruments only for an occasional reference to crosscheck your sensory impressions.

The rate of roll should be constant throughout the maneuver. The nose should always move at a constant rate in relation to the horizon as it describes arcs, first above and then below the horizon. Remember that in turns to the right, torque and slipstream effect must be offset with a greater amount of rudder input than in turns to the left. Proper performance of the maneuver demands smooth coordination of control pressures to maintain balanced flight. The rate of pitch and roll during the Wingover is relatively slow, therefore the resultant increased G-loading is relatively slight. It should not be necessary to exceed 2.0 Gs at any time during the maneuver.

3. Procedures

- a. **CONFIGURATION:** Transition to aerobatic cruise. **CHECKLIST:** Complete the Aerobatic Checklist. **CLEARING TURN:** Commence a clearing turn and roll out on or parallel to a section line. Pick a prominent reference point on the horizon 90° to either side of the nose, in the direction you intend to perform the maneuver.
- b. Recheck the wings level and clear the airspace above you. Just prior to entry, check and report the entry altitude over the ICS. Commence the maneuver by smoothly raising the nose while keeping the wings level. As the exhaust stacks pass the horizon, start a roll towards the 90° checkpoint. Control the pitch and roll rate so as to reach 45° nose up and 45° AOB simultaneously. The aircraft's heading should also have changed approximately 45° at this point.
- c. Continue to roll towards 90° AOB as the nose inscribes an arcing path downward towards the horizon. Maintain orientation by concentrating on your outside reference points. Control the pitch and roll rate so as to arrive at 90° AOB with the nose aligned with the 90° reference point. Airspeed should be approximately 90 KIAS at this point. Do not exceed 90° AOB.

- d. Allow the nose to fall through the horizon, then commence the recovery by smoothly rolling and pulling out of the diving turn. After approximately 135° of turn, the nose will be approximately 45° below the horizon and the angle of bank should again be 45°. Scan the section line for longitudinal alignment and the horizon for pitch and roll rates. Crosscheck the altimeter. Control the pitch and roll rate so as to recover on the original altitude and reciprocal heading.

NOTE

When the maneuver is completed at the same altitude it was initiated, there is a tendency to gain about 10 KIAS.

- e. Repeat steps b through d, performing the second Wingover in the opposite direction. Upon completion of the series, the aircraft should once again be established in level balanced flight, on the original heading and altitude.

4. Common Errors

- a. Rushing the maneuver. Remember, the Wingover is a relatively slow and gentle maneuver.
- b. Failure to obtain 45° nose up and 45° AOB simultaneously. This is usually caused by an excessive roll rate and/or insufficient backstick pressure during the initial pull-up. Once the AOB exceeds 45°, it is difficult to raise the nose any higher. This type of error will result in excessive airspeed (i.e., greater than 90 KIAS) at the 90° checkpoint. After the exhaust stack passes the horizon, keep the roll rate slow and constant. As the aircraft rolls, smoothly increase the backstick pressure so as to obtain 45° nose up simultaneously with 45° AOB. The required backstick pressure reaches a maximum at approximately this point. You must then continue to roll towards the 90° checkpoint at a constant rate while beginning to relax the backstick pressure. By the time you reach 90° AOB you should only have enough backstick to keep from feeling light in your seat (i.e., slight positive G-loading).
- c. Exceeding or not fully reaching 90° AOB.
- d. Holding excessive backstick pressure at the 90° checkpoint, thereby "pulling" the nose through and obtaining the reciprocal heading too early during the recovery. Conversely, releasing all of the backstick pressure, thereby inducing a zero or negative G state.
- e. Poor timing of the roll and pitch rate during recovery. The wings should come level simultaneously as the nose reaches the level flight attitude.
- f. Commencing the second Wingover in the series off airspeed, heading, altitude, etc. Expeditiously make the necessary corrections prior to initiation of the next Wingover. There is no point in practicing the maneuver if the entry parameters are incorrect.

1103. BARREL ROLL

1. **Description.** The Barrel Roll is a maneuver in which the aircraft is rolled 360° about an imaginary point which bears 45° off the nose of the aircraft (Figure 11-3).

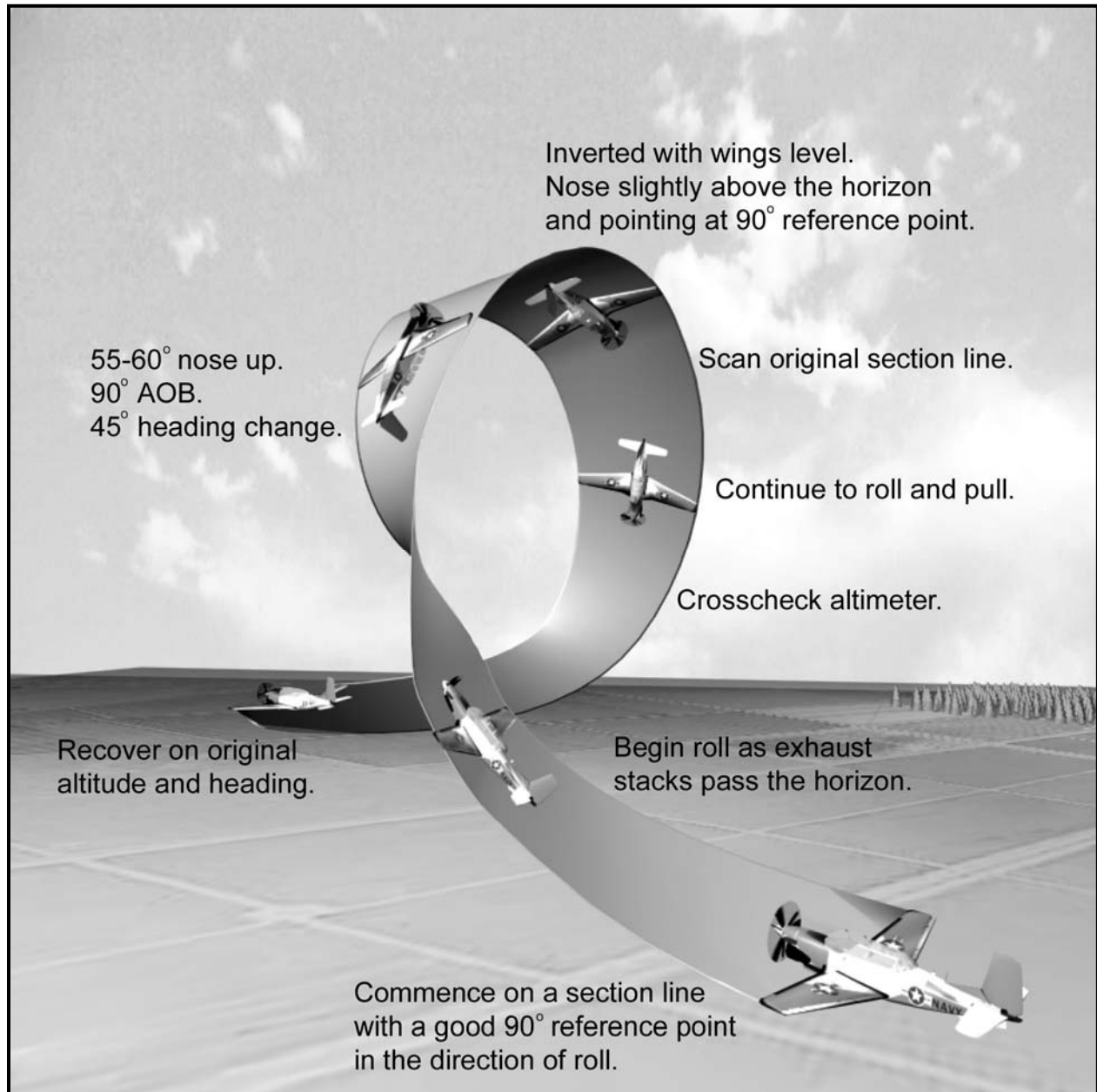


Figure 11-3 Barrel Roll

2. **General.** The Barrel Roll will help develop your confidence, coordination and "sense of feel" while flying the aircraft through rapidly changing attitudes and airspeeds. Since attitude, heading, etc. change so rapidly, this is an excellent maneuver for developing your ability to maintain orientation.

3. **Procedures**

- a. **CONFIGURATION:** Transition to aerobatic cruise. **CHECKLIST:** Complete the Aerobatic Checklist. **CLEARING TURN:** Commence a clearing turn and roll out on or parallel to a section line. Pick a prominent reference point on the horizon 90° to either side of the nose, in the direction you intend to perform the maneuver.
- b. Recheck the wings level and clear the airspace above you. Just prior to entry, check and report the entry altitude over the ICS. Commence the maneuver by smoothly raising the nose while keeping the wings level. As the exhaust stacks pass the horizon, roll and pull so that the nose travels around in an arcing path towards the selected 90° checkpoint. After 45° of turn, the angle of bank should be 90° and the nose will be at its highest point during the maneuver (approximately 55-60 degrees above the horizon).
- c. Continue rolling the aircraft at a constant rate until in a wings level, inverted attitude, heading directly at the 90° reference point on the horizon. Your nose should be slightly above the horizon and the airspeed between 90 and 100 KIAS. Fly the aircraft through the inverted position and continue rolling at a constant rate, completing the maneuver on the original heading and altitude at aerobatic cruise airspeed. Maintain a positive "G" load throughout the maneuver. If performed properly, 2.0 Gs should not be exceeded at any time during the maneuver.
- d. The nose should appear to make an arcing path about the imaginary point on the horizon 45° from your original heading. The last half of the arc will, therefore, be the same distance below the horizon that the first half is above the horizon. Remember, as the airspeed decreases towards the top of the maneuver, it will be necessary to increase the deflection of the ailerons, rudder, and elevator to maintain a constant rate of pitch and roll. Conversely, as the airspeed increases towards the bottom of the maneuver it will be necessary to decrease the deflection of the ailerons, rudder, and elevator to maintain a constant rate of pitch and roll. Notice that this roll is started as a climbing turn, which then becomes a continuous roll at a constant rate.
- e. Maintain orientation throughout the maneuver by concentrating on your reference points. Maintain a constant rate of roll and nose movement. Inscribing a small arc above the horizon in the first half of the maneuver and a larger arc below the horizon in the last half will result in too great an airspeed at the completion of the maneuver or unnecessarily high "G" forces to recover on airspeed. During the roll out to the original heading, adjusting the backstick pressure will enable you to recover on altitude and at aerobatic cruise airspeed.

4. Common Errors

- a. Failure to raise the nose high enough during the first 45° of turn. Generally, this will result in a correspondingly nose low attitude and proportionally high airspeed when recovery is made.
- b. Improperly coordinating the rate of roll with the rate of pitch. An insufficient roll rate will result in an overshoot of the intended recovery heading while an excessive roll rate will result in an undershoot. A common tendency is to allow the roll rate to accelerate after passing the inverted position.
- c. Failure to maintain balanced flight. Too much or too little rudder will produce essentially the same results as too fast or too slow a rate of roll, respectively.
- d. Failing to scan ahead for the reference point and/or section line and thereby losing orientation.

1104. AILERON ROLL

1. **Description.** The Aileron Roll is a 360° roll about the longitudinal axis of the aircraft (Figure 11-4).

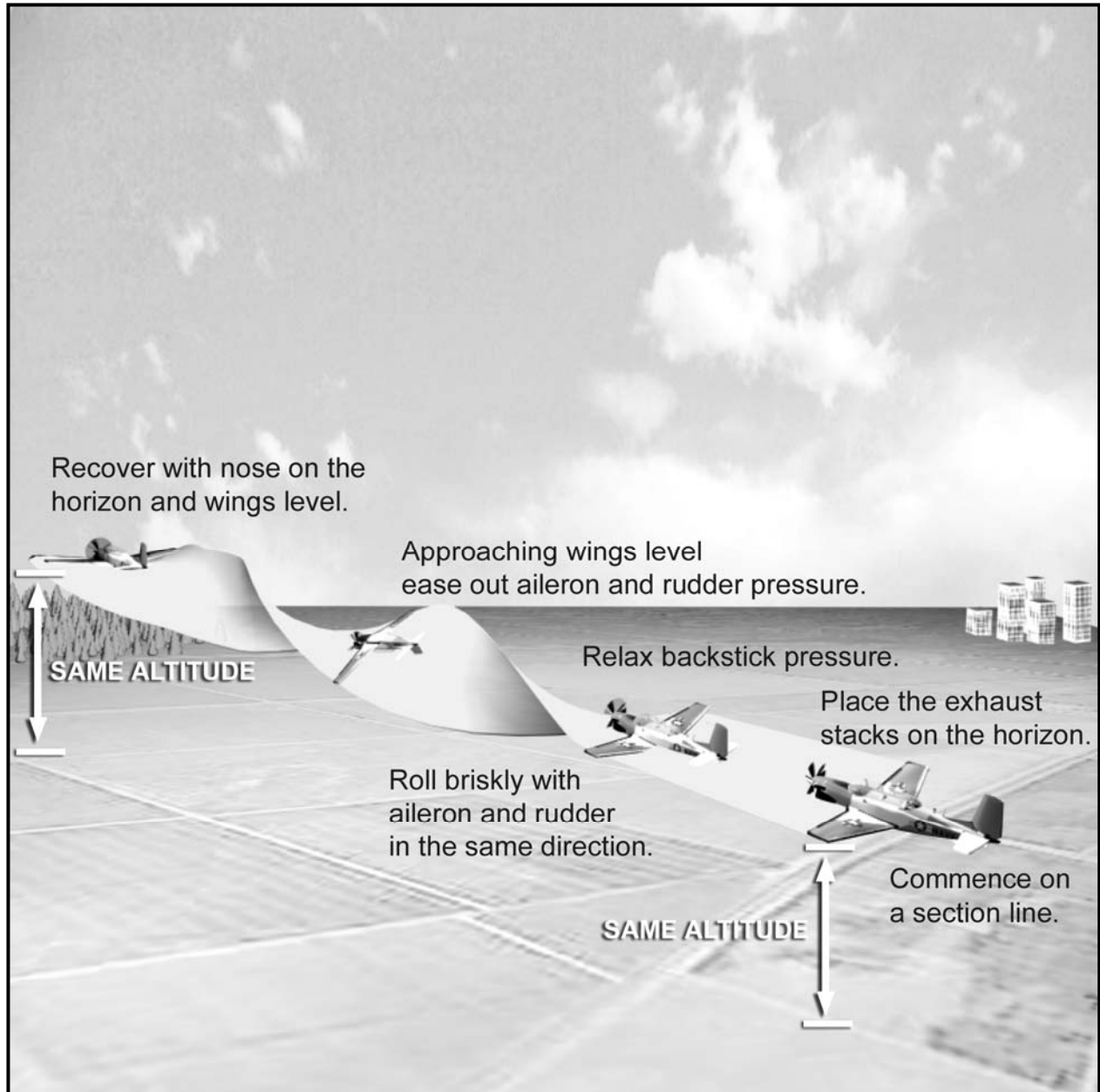


Figure 11-4 Aileron Roll

2. **General.** Plan your clearing turn so as to roll out on a good section line or with the nose aimed at a prominent reference point. When performing the maneuver make your control inputs smooth, brisk and positive.

3. **Procedures**

- a. **CONFIGURATION:** Transition to aerobatic cruise. **CHECKLIST:** Complete the Aerobatic Checklist. **CLEARING TURN:** Commence a clearing turn and roll out with the required ground references.
- b. Commence the maneuver by smoothly raising the nose to place the exhaust stacks on the horizon while keeping the wings level. Stop nose movement by relaxing backstick pressure.
- c. Roll briskly in either direction by applying lateral stick deflection and rudder in the same direction. The amount of stick deflection will determine your rate of roll. If the rate of roll is too slow, the nose will fall below the horizon and a rolling pullout will result.
- d. As you approach the wings level attitude, ease out aileron and rudder pressure to recover with the wings level and the nose attitude reset for level flight.

4. **Common Errors**

- a. Failure to relax the back stick pressure prior to rolling. Backstick pressure is required only to set the initial nose high attitude. Failure to relax the backstick pressure will cause the nose to follow an arcing path rather than having the aircraft roll about its longitudinal axis. It will also cause the nose to drop rapidly while passing the inverted position.
- b. Delaying initiation of the roll once the nose high attitude is set. This causes excessive airspeed decay, which results in a sluggish roll performance.
- c. Failure to input sufficient rudder in the direction of roll. The high roll rates required for the Aileron Roll generate considerable adverse yaw. This must be compensated for with sufficient rudder in order to maintain balanced flight.

1105. SPLIT-S

1. **Description.** The Split-S maneuver combines the first half of an Aileron Roll with the last half of a Loop (Figure 11-5).

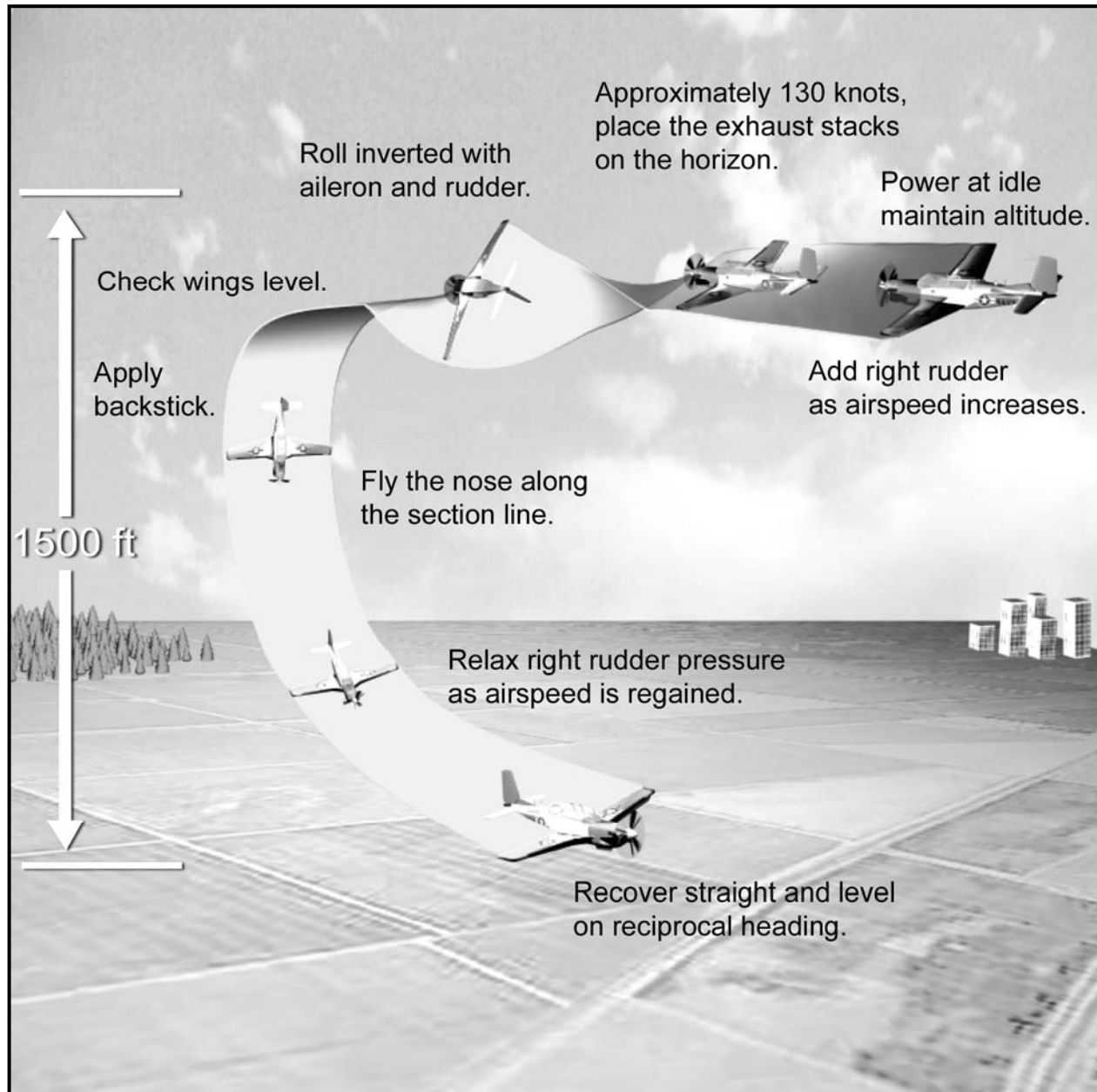


Figure 11-5 Split-S

NOTE

Student solos are strictly prohibited from performing the Split-S, Immelmann Combination Maneuver, and intentional sustained inverted flight maneuvers. Failure to comply with this safety related restriction is considered sufficient grounds for attrition from flight training.

2. **General.** The Split-S provides a means of rapidly converting the potential energy of altitude into airspeed while reversing the direction of flight. Once the pull is commenced from the inverted position, airspeed builds rapidly and altitude is quickly lost. If performed correctly, the altitude loss should be approximately 1500 feet. Remember to select a long, well defined section line which extends behind as well as in front of you.

3. **Procedures**

- a. **CONFIGURATION:** Transition to aerobatic cruise. **CHECKLIST:** Complete the Aerobatic Checklist. **CLEARING TURN:** Commence a clearing turn. After rolling out of the clearing turn, reduce power to idle and maintain altitude while slowing to 130 KIAS. Increase right rudder pressure as the aircraft decelerates in order to maintain balanced flight.
- b. Raise the nose to place the exhaust stacks on the horizon, relax the backstick pressure and roll in either direction using aileron and rudder to the inverted position.
- c. Once inverted, neutralize the ailerons and apply slight forward stick pressure to momentarily maintain straight and level flight. Quickly verify that the wings are level by referencing the horizon and correct as necessary. Apply back stick pressure, pulling the nose through the horizon and flying the aircraft along the section line as in the last half of the Loop. Decrease right rudder pressure as the aircraft accelerates to recovery airspeed.
- d. Check oil pressure within normal limits. Reset aerobatic cruise power and report the oil pressure over the ICS.

4. **Common Errors**

- a. Failure to maintain altitude and/or balanced flight during the deceleration.
- b. Delaying roll initiation, airspeed decay causes difficult lateral control.
- c. Failure to obtain, check and/or correct wings level prior to the pull-out. This results in disorientation and a rolling pull-out.
- d. Pulling too much backstick before sufficient airspeed has been gained resulting in a near-stalled AOA.

1106. ONE-HALF CUBAN EIGHT

1. **Description.** The One-Half Cuban Eight combines the first 210° of a Loop, a half roll to the upright position, and a 45° diving pull out to level flight on the original altitude and reciprocal heading (Figure 11-6).

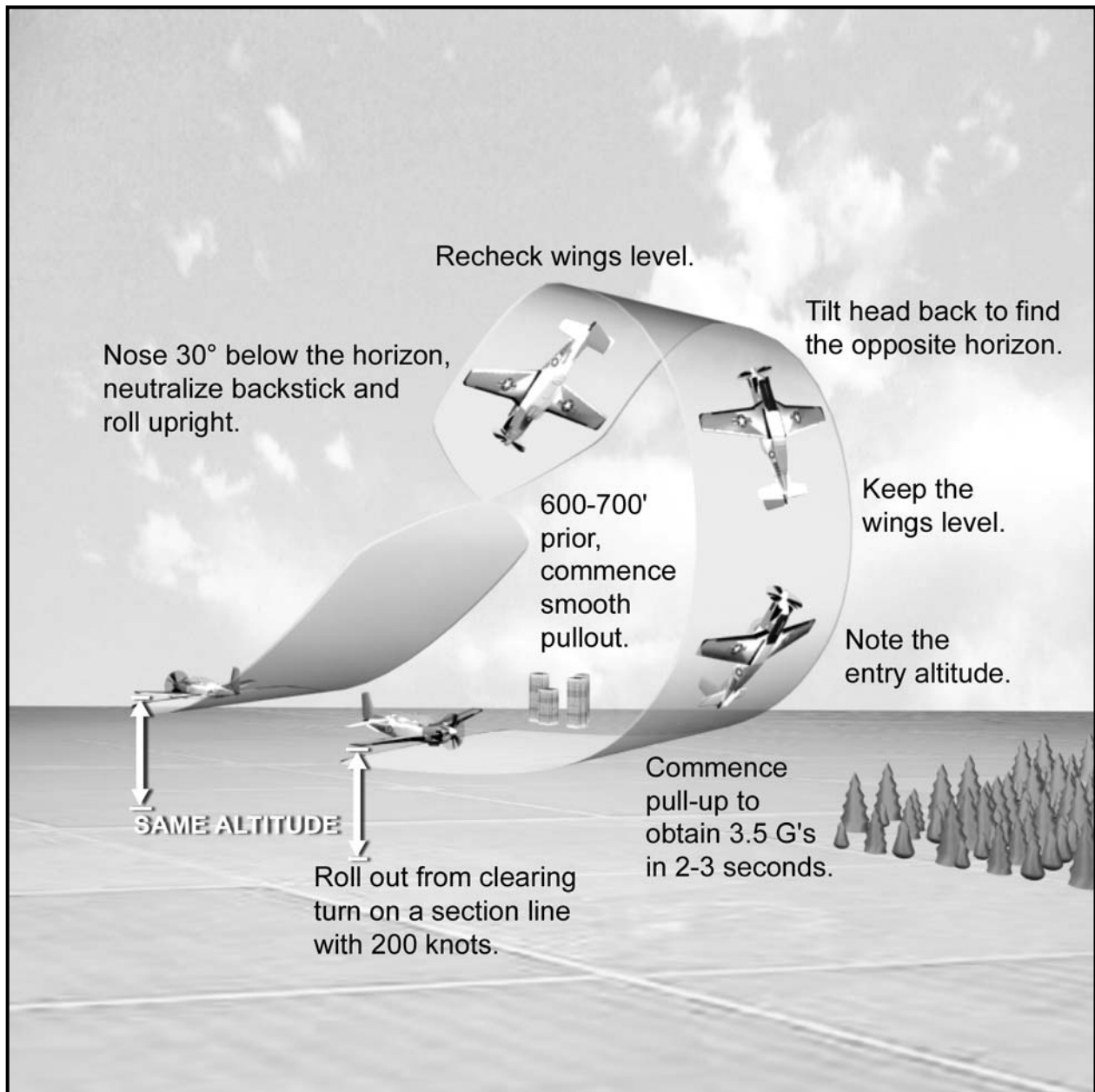


Figure 11-6 One-half Cuban Eight

2. **General.** This maneuver offers a quick means of reversing the direction of flight while preserving the original altitude and airspeed. Remember to select a long, well defined section line which extends behind as well as in front of you.

3. Procedures

- a. **CONFIGURATION:** Transition to aerobatic cruise. **CHECKLIST:** Complete the Aerobatic Checklist. **CLEARING TURN:** Commence a clearing turn. During the last 90° of turn, lower the nose slightly and accelerate to 200 KIAS. Roll out of the clearing turn on or parallel to a section line with 200 KIAS. The increased airspeed will require a slight amount of left rudder to maintain balanced flight.
- b. Recheck the wings level and clear the airspace above you. Just prior to entry, check and report the entry altitude over the ICS. Commence the AGSM and immediately start a smooth straight pull-up, accelerating to 3.5 Gs within two to three seconds. Do not use the aileron.
- c. Recheck the wings level as the nose passes through the horizon. Adjust stick pressure as necessary to keep the nose moving at a constant rate. Increase right rudder pressure as airspeed decreases.
- d. Shortly after passing the vertical position, tilt your head back and visually locate the opposite horizon. Correct with aileron as necessary to maintain the wings parallel to the horizon. Check the nose in relation to the section line and correct directional deviations as necessary by adjusting the rudder input.
- e. Airspeed will reach its slowest point at the top of the Loop. The greatest amount of right rudder input will therefore be required at this point in order to maintain balanced flight. The amount of aft stick force required to maintain a constant nose pitch rate will have decreased significantly from the initial pull-up. Maintain positive G-loading and wings parallel to the horizon.
- f. Allow the nose to fall through the opposite horizon, adjusting the amount of aft stick pressure to maintain a constant pitch rate. As the nose approaches a point 30° below the opposite horizon, slow the nose movement by releasing backstick pressure and commence a roll in either direction, using aileron and rudder. During the roll, it will take slight forward stick pressure as the aircraft passes wings vertical to hold the heading and allow the nose to continue pitching downward to a position 45° below the horizon.
- g. Commence a smooth pullout to straight and level balanced flight 600-700 feet prior to the original entry altitude. Recover on the original altitude and reciprocal heading.

4. Common Errors

- a. Same common errors as the first half of a Loop.
- b. Improper forward stick application during roll resulting in less than the desired 45° nose down attitude.
- c. Failure to initiate the pull-out 600-700 feet prior.

1107. IMMELMANN

1. **Description.** The Immelmann combines the first half of a Loop followed by a half-roll to the wings level attitude. It achieves a 180° change of direction of flight and a gain in altitude of approximately 1500 feet (Figure 11-7).

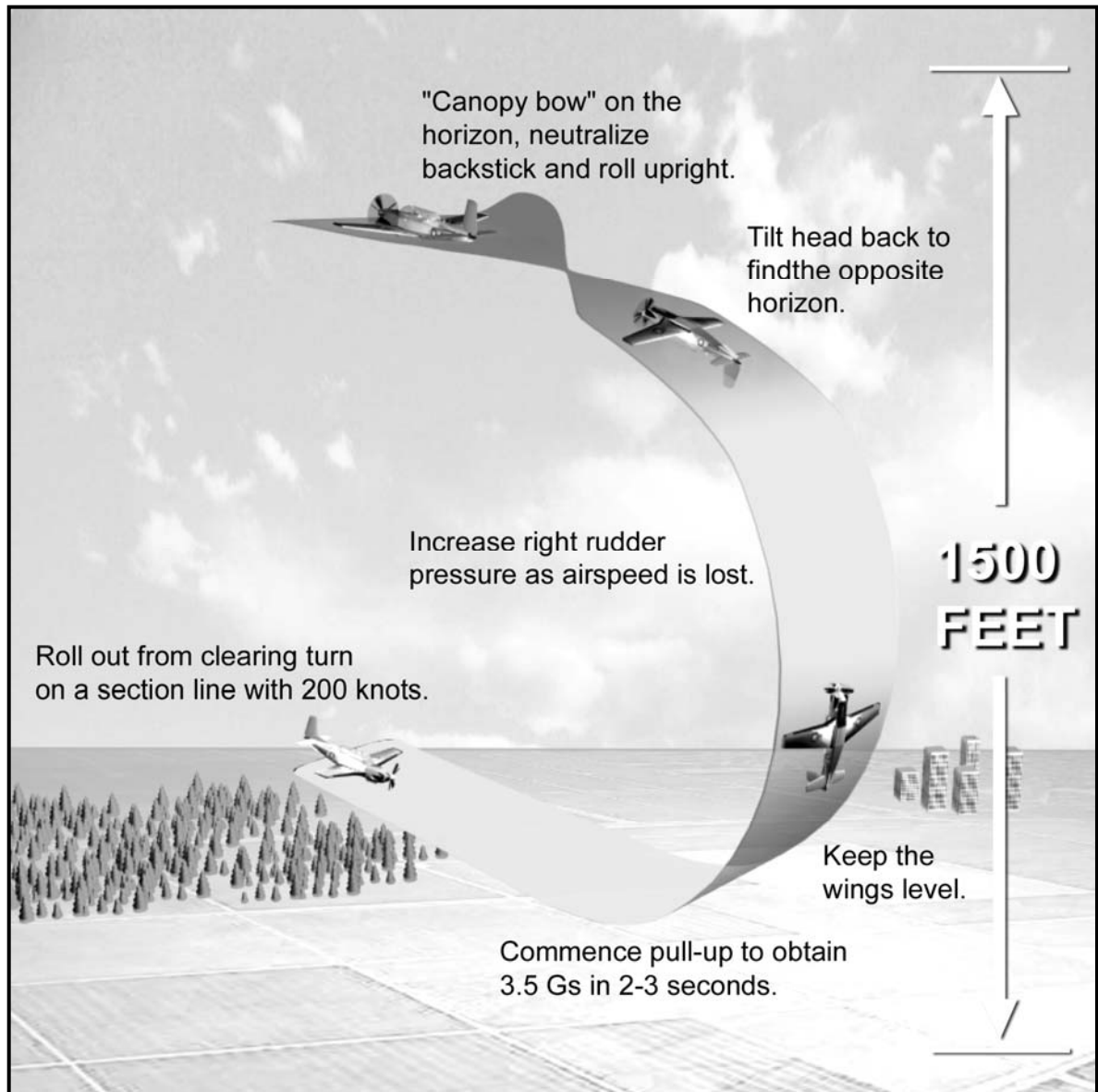


Figure 11-7 Immelmann

2. **General.** This maneuver offers a quick means of reversing the direction of flight while trading excess airspeed for increased altitude. Remember to select a long, well defined section line which extends behind as well as in front of you.

3. **Procedures**

- a. **CONFIGURATION:** Transition to aerobatic cruise. **CHECKLIST:** Complete the Aerobatic Checklist. **CLEARING TURN:** Commence a clearing turn. During the last 90° of turn, lower the nose slightly and accelerate to 200 KIAS. Roll out of the clearing turn on or parallel to a section line with 200 KIAS. The increased airspeed will require a slight amount of left rudder to maintain balanced flight.
- b. Recheck the wings level and clear the airspace above you. Just prior to entry, check and report the entry altitude over the ICS. Commence the AGSM and immediately start a smooth straight pull-up, accelerating to 3.5 Gs within 2 - 3 seconds. Do not use the aileron.
- c. Recheck the wings level as the nose passes through the horizon. Adjust stick pressure as necessary to keep the nose moving at a constant rate. Increase right rudder pressure as airspeed decreases.
- d. Shortly after passing the vertical position, tilt your head back and visually locate the opposite horizon. Correct with aileron as necessary to maintain the wings parallel to the horizon. Check the nose in relation to the section line and correct directional deviations as necessary by adjusting the rudder input.
- e. As the nose approaches a point 20° above the opposite horizon ("canopy bow" on the horizon,) slow the rate of nose movement by neutralizing backstick pressure. Commence a roll in either direction to the upright position using aileron and rudder. Anticipate the need for slight forward stick pressure as the aircraft passes 90° of roll.
- f. The maneuver is complete when the aircraft is once again in the level flight attitude on the reciprocal heading. The airspeed should be approximately 100 KIAS. The nose attitude will therefore be slightly high.

4. **Common Errors**

- a. Same common errors as the first half of a Loop.
- b. Commencing the roll to upright attitude either too early or too late.
- c. Utilizing improper rudder and/or poorly coordinated rudder inputs during the roll.

1108. COMBINATION MANEUVER

1. **Description.** A Combination Maneuver is nothing more than combining a series of aerobatic maneuvers into a single evolution. A maximum of FOUR maneuvers may be "linked" together.

2. **General.** The aerobatic training you receive is NOT intended to prepare you for the airshow circuit. As previously discussed, aerobatic training IS taught to allow you to make the aircraft perform precise and controlled maneuvers, flying the aircraft throughout more of its envelope.

By combining maneuvers, you will need to plan ahead to the second maneuver while completing the first half. As always, maintain a constant and vigilant scan, especially during the maneuvers.

Energy management should be a part of the discussion so as to plan maneuvers to maximize airspeed/altitude, while staying within assigned airspace. This should be a major consideration for which maneuvers are linked together and in what order.

Example: One-Half Cuban Eight - Barrell Roll - Immelmann - Split-S

3. **Procedures.** Perform all maneuvers IAW the procedures previously set forth for the maneuvers you intend to fly. The SNA shall pre-plan his/her Combination Maneuvers and thoroughly brief his/her intentions to the IP during the pre-flight briefing. While modifications are authorized during the flight, the intent is that impromptu and non-briefed Combination Maneuvers NOT be accomplished.

1109. INVERTED FLIGHT

1. **Description.** The Inverted Flight maneuver is the intentional flying of the T-34C in the inverted wings level attitude for a maximum of 15 seconds (IAW NATOPS limits). Review T-34C NATOPS regarding inverted flight.

2. **General.** Inverted flight is a natural part of many aerobatic maneuvers you will perform during this stage (Loops, Barrel Rolls, etc.). While students will never intentionally fly inverted as a separate maneuver, this demonstration will give you the experience and confidence to handle the T-34C throughout a full range of pitch attitudes. This demonstration will acquaint you with the inverted flight attitude (nose high-not level), feelings of sustained negative G's (normally -1 G), and proper entry and exit control inputs.

It is imperative that you tighten your restraint harness to the maximum extent possible (without cutting off your circulation.). The reason being that regardless of how tight you think your belts are, once inverted and stabilized, you will have the sensation of being pulled from the aircraft. You will stretch to the limits of your belts and may feel like you are "hanging in the straps." First, RELAX; you are not going anywhere. Second, notice the nose attitude. The T-34C inverted has a relatively high nose attitude in order to maintain level flight.

Reference points that may be used to keep the aircraft from changing altitude while inverted are:

1. Front Cockpit = OAT gauge on or about even with the horizon.
2. Rear Cockpit = The middle canopy bow on or about even with the horizon.

Your instructor will be pointing out this attitude as well as watching the oil pressure and clock to remain within limits. Ensure the rudder pedals are within reach in this attitude. Since you will not be flying this maneuver, you can crank the rudder pedals towards you.

NOTE

This is a "demonstrate only" maneuver and shall not be performed by the student.

3. Procedures

- a. **CONFIGURATION:** Establish the aircraft at 150 KIAS in the clean configuration. **CHECKLIST:** Perform the Aerobatic Checklist. **CLEARING TURN:** Perform a clearing turn and roll out on a suitable section line
- b. Raise the nose to place the exhaust stacks on the horizon and roll the aircraft in either direction using rudder and aileron to the inverted position. Once inverted neutralize aileron and rudder and utilize slight forward stick pressure to maintain altitude. Immediately note the clock sweep second hand and check the oil pressure. Return to normal flight immediately if oil pressure is not in the normal range.
- c. Prior to 15 seconds inverted, utilize coordinated aileron and rudder to roll the aircraft back to the upright flight attitude. Recheck the oil pressure in the normal range.

4. Common Errors

- a. Failure to maintain straight-and-level flight while inverted.
- b. Poor coordination of control inputs during the roll to the inverted and/or upright positions.

CHAPTER TWELVE

ANGLE OF ATTACK APPROACHES

1200. INTRODUCTION

This chapter contains procedures to conduct AOA approaches. The AOA approach is typically used by carrier based airplanes to perform a precision approach to the carrier. The Air Force advanced jet trainer (T-38) also utilizes an AOA system to land even though the landing is conducted on a long runway and not on an aircraft carrier. Similarly, in the T-34C you will be conducting an AOA approach to an actual runway. The skills learned by conducting AOA approaches in the T-34C will, however, be used as a building block for advanced jet training.

1201. ANGLE OF ATTACK APPROACHES

1. **Description.** The AOA approach is a descending 180° balanced turn to final followed by a normal landing. During the approach, the optimum AOA is maintained by controlling nose attitude, and rate of descent is controlled by power adjustment.

2. **General.** You are introduced to angle of attack approaches for two primary reasons. One is to simply broaden your exposure to different aspects of aviation. Additionally, AOA landings are commonplace in jet and multi-engine aircraft and are virtually mandatory when used with a visual glideslope indicator during carrier landings. Should you end up flying jets or multi-engine aircraft, your exposure to AOA approaches in the T-34C should be beneficial.

AOA is displayed both by the AOA gauge, located on the instrument panel, and on the AOA indexer, located on the glare shield. The gauge provides continuous AOA readout. When the gear is down, the indexer displays one or two of three illuminated symbols. Depending on which symbols are illuminated, the indexer tells you if you are flying at optimum, higher than optimum, or less than optimum AOA. Refer to the T-34C NATOPS Manual for further discussion of the AOA system.

The AOA system in the T-34C is calibrated in units of AOA, not degrees. An adjustment is automatically made to the readout based on whether the flaps are up or down. Because of this, optimum AOA of 20 units remains the same, regardless of configuration.

The question you may ask at this point is, "What is meant by optimum AOA and why is it 20 units?" To help answer this question, consider a situation where you are flying at a constant AOA on final for a landing. Depending on your configuration (flaps up or down, aircraft weight and power setting), this constant AOA will result in a certain airspeed on final. Configuration and weight will also fix stall speed. This is all building up to the fact that for a given AOA, stall speed is a constant percentage lower than the airspeed associated with that AOA. At optimum AOA of 20 units, stall speed is approximately 35% lower than this airspeed.

For instance, at 4300 lbs, flaps down, maintaining 20 units, your airspeed will be about 85 KIAS and your stall speed about 55 KIAS. $85 \text{ KIAS} - 35\% \text{ of } 85 = 55 \text{ KIAS}$. Or, for a 3500 lb. airplane, airspeed would be about 77 KIAS and stall speed about 50 KIAS. Again, $77 \text{ KIAS} - 35\% \text{ of } 77 = 50 \text{ KIAS}$.

As you can see, flying an approach at optimum AOA gives you an adequate safety margin (approach airspeed above stall speed), while keeping your approach and landing speed low.

3. Procedures

- a. AOA approaches will normally be flown after one or more touch-and-go landings. After a touch-and-go, climb out at 90 KIAS (leave the flaps down) for full-flap AOA or 100 KIAS (flaps up) for no-flap AOA. Climb to pattern altitude.
- b. Your instructor will judge interval for the crosswind turn. During the turn notify other aircraft in the pattern, if performing a full-flap AOA, that you will be conducting an AOA approach.
- c. Level off at pattern altitude and 100 KIAS by reducing power to 650-700 ft-lbs. (approx. 550 ft-lbs. NF).
- d. Approaching the upwind numbers, reduce power to 300 ft-lbs. and slow to 20 units AOA (approximately 80 KIAS FF/95 KIAS NF). If flaps are down, a deceleration to 20 units AOA is all that is required. If flaps are up, reduce power to 300 ft-lbs. and lower the flaps (check airspeed below 120 KIAS) if performing a FF approach. Slow to 20 units AOA. Carefully adjust power to approximately 500 ft-lbs. to maintain pattern altitude and adjust nose attitude to maintain optimum AOA; 20 units on the gauge and an amber donut, "O" on the indexer. Maintain 20 units and a $\frac{3}{4}$ wingtip distance on downwind.
- e. Perform the Landing Checklist prior to abeam position.
- f. Abeam the intended point of landing reduce power to approximately 300 ft-lbs. (275 ft-lbs. NF), lower the nose slightly to maintain 20 units and commence the turn at the 180° position. Your pattern over the ground should be the same as in previous landings, but your airspeed will be constant at about 80 KIAS (95 KIAS NF). You will probably need less angle of bank at the lower airspeed. Using the same angle of bank as in a normal approach would result in too tight a turn.
- g. During the approach, scan the AOA indexer, the intended point of landing and the altimeter. Adjust power and attitude as necessary to maintain the proper rate of descent and 20 units. If the green "slow" chevron ("V") lights up, your AOA is higher than optimum and your airspeed is too slow. To correct, lower the nose slightly. The chevron points in the direction the nose needs to go. Too low a nose

- attitude results in illumination of the red "fast" chevron, indicating less than optimum AOA and excessive airspeed. In this case, the correct response is to raise the nose. Again, all nose attitude adjustments must be coordinated with power to control altitude/rate of descent.
- h. Rate of descent should be constant. Vary the angle of bank and power as necessary to arrive at the proper 90° position (20 units AOA, 450 feet AGL, perpendicular to the runway). Maintain 20 units AOA through the rest of the turn to final. When you are established on final with 1200-1500 feet of straightaway, maintain 20 units AOA until just prior to the intended point of landing. Transition to a normal flared touchdown at the intended point of landing.

NOTE

The intent of this training is to do an AOA approach to a normal flared landing, not an AOA approach to an AOA landing!

4. Common Errors

- a. Excessive nose attitude corrections. Scanning the indexer will indicate if you are not at optimum AOA. A glance at the gauge will show how far from optimum. Correct only as much as necessary.
- b. Failure to coordinate power and attitude changes. Keep in mind that power affects AOA attitude. Remember to control AOA with attitude and rate of descent with power.
- c. Using the same angle of bank as utilized in the higher airspeed full-flap landings.

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CHAPTER THIRTEEN

INTRODUCTION TO NIGHT CONTACT

1300. INTRODUCTION

You are now ready to enter one of the most interesting stages of your flight training - NIGHT CONTACT. There is no reason for you to approach it with any more apprehension than you did the transition from day to night driving in an automobile. In fact, you will find much in common between the two experiences. Just as you did not try to drive at night until you had perfected your skill in handling an automobile in the daylight, you now come to night flying with an improved feel of the airplane and the ability to make your airplane do precisely what you want it to do. You will further these same qualities under the conditions of restricted vision present at night.

Your first night flight is not intended to teach you all there is to know about night flying, but to familiarize you with the fundamentals. You will come to realize that there are differences in night flying, but that a careful study of these differences will make flying at night fully as safe as in the daytime.

Good night flying, like good night driving, requires increased care. You will have to identify obstructions and other aircraft, not by entire outline, but by such small identifying features as a few colored lights. This is not difficult if you leave the ground well prepared for the conditions you will meet, and if you remain constantly alert. Once you are in the air, clear of all ground obstructions, the only possible obstruction remaining will be other aircraft. Obviously it is essential that you know the location of other aircraft.

1301. NIGHT FLYING PHYSIOLOGY

1. **Night Vision.** You will remember from lectures on flight physiology that the eye uses different parts for night vision than for day vision. Because of the difference in function of the rods and cones, technique must be changed in order to spot objects at night: Do not stare at a spot, but scan the vicinity of the sky in which you believe the object to be located.

The eyes must be adapted for night vision; the pupils must dilate and the rods must be brought into full use. It takes approximately 30 minutes for the eyes to become completely adapted, and only 10 seconds for all adaptation to be lost in bright light. Adaptation may be accomplished by total darkness or by gradually approaching darkness such as normal daylight to sunset to night.

2. **Vertigo.** Vertigo, in aviation, is a feeling of dizziness and disorientation caused by doubt in visual interpretation of your attitude. This feeling is often experienced at night from lack of a well-defined horizon. The period immediately after takeoff, leaving a well lighted runway and entering complete darkness, brings on this feeling of disorientation. Trust and use your attitude gyro.

3. **Moving and Stationary Lights.** Often you will not be able to see anything of the aircraft ahead except its tail light or strobe lights. In such cases, it will be difficult to judge distance,

since the only criterion for judgment will be changing intensity at changing distance; therefore, you will have to check its movement in relation to known references to ascertain relative movement. Ordinarily, you can judge distance and relative motion by the distance between two lights on the same aircraft. You will undoubtedly experience some difficulty in discerning moving lights from fixed lights or stars. This can be further complicated by the autokinetic effect, the apparent motion of stationary objects. Again, this may be overcome by using known references for comparison.

1302. PERSONAL PREPARATION

Briefs for all night flights will be given prior to commencing syllabus night operations. Ensure that you eat a good meal prior to attending the brief. There are many times when the night's flight operations will be lengthy, so ensure that your body is properly fueled.

Students are expected to know Emergency procedures thoroughly prior to the brief and will be quizzed on them by the Instructor Pilot. If you are uncertain about anything concerning the night's flight, get it cleared up during the brief by asking your instructor. If you are not absolutely certain about all Night procedures and Emergency procedures, make sure you are certain before you leave the briefing room.

In addition to the normal flight equipment required for day flight operations, the following equipment is required for all night flights:

1. Flashlight with clear and red lenses.
2. Clear visor installed in your helmet (prior to the brief).

CHAPTER FOURTEEN

NIGHT GROUND PROCEDURES

1400. INTRODUCTION

This chapter provides the basic procedures and techniques essential to the safe operation of the airplane on the ground at night. These procedures cover night operations both before and after flight.

1401. PREFLIGHT PROCEDURES

The night preflight will include all items checked on day preflight with the following additions:

1. Check operation of all interior lights in both cockpits during the cockpit safety check by checking the following switches ON (both cockpits) prior to turning on the battery.
 - a. Instrument lights - rheostats full clockwise.
 - b. Console and flood lights - rheostats full clockwise.
 - c. Utility light - rheostat full clockwise. The utility light will be positioned in the forward receptacle just aft of the emergency canopy open handle.
 - d. Circuit breaker panel light switch - ON.
2. With the battery on, complete a check of all exterior lights by turning ON the following switches:
 - a. Landing lights.
 - b. Navigation lights (BRIGHT and DIM position).
 - c. Strobe lights.
 - d. External landing gear indicator lights ("peanut lights") (will automatically activate with battery ON). Conduct a walk-around of the aircraft to ensure operation of all exterior lights. Ensure any discrepancies are corrected prior to flight. A clear lens flashlight shall be used during night preflight inspection.

1402. LIGHT SIGNALS

The student must have a precise knowledge of all light signals to safely conduct night operations. NATOPS contains the required ground handling signals.

1403. START

The start will be accomplished in the same manner as daylight operations except that the NAV lights switch will be in the BRIGHT position and the STROBE lights will be OFF. Cockpit lights will dim during start, so it is recommended you turn the INST POST lights FULL

BRIGHT before starting. After start, continue to dim the INST POST lights and LEDs as your eyes become adjusted to the darkness. When the pilot is ready for the start, he will signal the lineman by rotating the flashlight at the lineman or if ambient light permits, use appropriate hand signals for clearance to start. The lineman will repeat the signal with his wand or appropriate hand signal and will man the fire extinguisher for the start.

Upon completion of the start, signal the lineman to remove the chocks by moving the flashlight alternately from shoulder to shoulder and hold the brakes while the chocks are removed. The lineman will taxi the aircraft out of the chocks for a normal brake check using his wands.

NOTE

In the line area, where adequate light is available, hand signals may be used as in daylight operations. However, when lighting is not adequate, hand signals must be passed as light signals (see NATOPS for ground handling signals).

1404. TAXI

The Pre-taxi Checklist shall be completed and clearance from Ground Control received prior to taxi in accordance with NATOPS and local SOP. All taxiing will be conducted in accordance with current course rules. Caution must be exercised to prevent excessive taxi speeds caused by lack of outside references and depth perception. Landing lights should be used during all night taxi evolutions in areas not adequately illuminated. Consideration will be given to courteous use of lights to avoid the disorientation of other aircraft, ground support, and tower personnel. Taxi is only permitted on lighted, authorized taxiways (see SOP). If there is any doubt as to your position on the field or any confusion caused by light signals, STOP! Do not continue until reoriented. Turn landing lights off while conducting Pre-taxi and Runup Checklists or if a delay is encountered at the hold short line awaiting takeoff.

1405. NIGHT FIELD LIGHTING

1. **BLUE LIGHTS:** Blue lights mark all taxiways. There should be blue lights on both sides of the taxiway.
2. **WHITE LIGHTS:** White lights mark the boundaries of the duty runway.
3. **GREEN LIGHTS:** Green lights mark the threshold of the duty runway.
4. **RED LIGHTS:** Red lights mark all obstructions on the airfield.
5. **ROTATING BEACON:** There is a rotating white and green beacon located at fields that are open for night operations. A military airfield's white light will be split by a three degree void. This will give the impression that there are two separate, closely timed flashes of light. A civilian airport has a solid white light and can be easily distinguished from a military field.

14-2 NIGHT GROUND PROCEDURES

6. **TETRAHEDRON:** A wind tetrahedron points in the direction of the wind and is lighted with red lights along the left rear and side of the tetrahedron and green lights on the right rear, side and top of the tetrahedron.

7. **WIND TEE:** A lighted wind tee is located in the grass area immediately west of the control tower at NAS Corpus. The wind tee is free-swinging and outlined in green lights.

1406. ENGINE RUNUP

Taxi to the appropriate runup area for the duty runway and night ops. (See current SOP). Complete the Runup/Takeoff Checklist as in daytime ops. Taxi to the holdshort line in accordance with local course rules.

1407. INBOUND TAXI PROCEDURES

1. Landing traffic will turn off only on lighted taxiways. (See current SOP for any exceptions.)
2. Landing lights may be left on and used as an aid in landing rollout and for taxi back to the line at pilot's discretion.
3. When clear of the duty runway, switch to Ground Control and complete Post-Landing Checklist (strobe lights will be turned off).
4. Make the appropriate call to Ground Control for taxi.
5. Taxi via the most direct route to the appropriate line. Inbound Taxi procedures are the same as Outbound Taxi procedures. (TW-5: See current SOP for inbound taxi routes.)

1408. ENGINE SHUTDOWN

1. Engine shutdown will be conducted in accordance with NATOPS and the current SOP.
2. Engine Shutdown Checklist will not be started until the plane captain signals chocks are in place.
3. The navigation lights will remain on bright until the propeller has come to a complete stop.

1409. POSTFLIGHT INSPECTION

1. All aircraft will be postflighted following each flight in accordance with NATOPS.
2. Set all cockpit rheostats to "OFF."
3. Turn off the utility light and return it to the aft receptacle.

4. Turn all dimmed lights back to the full bright position (UHF radio, TACAN/VOR, transponder, electrical and avionics Take Command lights).
5. Complete a thorough postflight inspection utilizing a white-lens flashlight.
6. The postflight is not complete until the checklists are completed in proper sequence, the yellow sheet has been signed off, and any aircraft discrepancies written up.

CHAPTER FIFTEEN

NIGHT CONTACT FLIGHT PROCEDURES

1500. INTRODUCTION

This chapter provides the basic procedures and techniques required to conduct night flight operations. While these procedures form a basis, the expanded procedures for each Training Air Wing may be varied. Consult your most current Standard Operating Procedure for further amplification.

1501. TAKEOFF PROCEDURES

1. All takeoffs will be conducted in accordance with NATOPS and the current SOP.
2. Call for takeoff clearance IAW local SOP/Course Rules.
3. Once takeoff clearance has been issued, position on the duty runway. Crossing the holdshort line, complete the Takeoff Checklist. Position the aircraft on the runway centerline. Commence Takeoff procedures IAW daytime operations.
4. Direct the instructor to check fuel cap security with a flashlight prior to landing gear retraction.

NOTE

Anticipate a flashing Master Caution/LNDG LT annunciator light when raising the gear with the landing lights on.

1502. HOMEFIELD DEPARTURE

Comply with tower instructions and make departure in accordance with local SOP.

1503. LANDING PATTERN

Entry to touch-and-go fields will be in accordance with the current SOP/Course Rules. Break procedures will remain the same as day operations. After the break or crosswind turn, roll out with a $\frac{3}{4}$ wingtip distance on the downwind leg.

At night, the wingtip distance remains the same as in the day. Crosscheck the RMI for the reciprocal heading of the duty runway to assist in maintaining wingtip distance abeam. Crosscheck the attitude gyro to maintain wings level in the downwind leg.

Abeam your intended point of landing, transition the aircraft by setting 300/275 ft-lbs. torque, lowering full flaps (if required) and trimming left rudder and up elevator. At the 180° position, start the approach turn and make the appropriate radio call in accordance with local SOP.

The landing lights will be used in accordance with local Course Rules.

The approach and landing at night are the same as in the daytime. Your 90° position and final checkpoints remain the same. Vary the angle of bank and adjust power as necessary to fly from the 90° to intercept the landing line with 1200-1500 feet of straightaway, 100-150 feet of actual altitude, and 85/95 KIAS. Maintain 85/95 KIAS until the landing transition. Do not slow below 80/90 KIAS until commencing the landing transition.

The intended point of landing at night is on runway centerline, 500-1000 feet up the runway from the green threshold lights. Avoid fixating on the intended point of landing. A waveoff should be executed if you cannot touch down in the first one-third of the runway or if lined up extremely right or left of runway centerline.

Initiating the landing transition, smoothly and continuously reduce the PCL to idle and control your rate of descent with a smooth, continuous flare until touchdown. It is imperative that you focus on the end of the runway vice directly over the nose. "Spotting the deck" may result in a hard landing. Remember, at night, peripheral cues are greatly reduced requiring a continuous scan.

After touchdown on the main gear, smoothly lower the nose to the deck. Smoothly apply power to full forward; following engine spool-up, raise the nose to the takeoff attitude. Make a normal takeoff by maintaining directional control with rudders and climb out at 90 KIAS FF, 100 KIAS NF. When safely airborne and 90 KIAS, reset the power, raise the flaps, and maintain 100 KIAS in the climbing attitude. Make heading corrections as necessary to maintain runway centerline as you proceed upwind. When the proper interval has been established on the aircraft ahead and you are cleared downwind by the tower (at controlled fields only), you may begin your crosswind turn utilizing a maximum of 30° angle of bank. Look both left and right to make sure that no one is entering the pattern and that you are actually the number one aircraft upwind. If the preceding aircraft is full-stop, wait until it is 45° behind the wingtip.

Touch-and-go landings may be conducted with or without landing lights at the IP's discretion; however, students should have the opportunity to practice both types of approaches. Remember, the external landing gear indicator lights will not be easily visible to the RDO or wheels watch with the landing lights on.

NOTE

Due to lack of ground reference points at night, attention should be given to the effects of crosswinds throughout the landing patterns.

1504. WAVEOFF

If you take a waveoff for any reason during an approach, execute the normal Waveoff procedures. Waveoff procedures are the same as during day operation. Maintain 100 KIAS and climb IAW SOP/Course Rules. Turn downwind with proper interval (or as directed by the tower).

15-2 NIGHT CONTACT FLIGHT PROCEDURES

If you are given a waveoff prior to the 180° position, make a waveoff in a racetrack pattern in accordance with local SOP. Fly up the side of the runway dictated by local Course Rules or as tower directs. Take interval in the pattern when you can safely do so. Remember, you are under tower control at homefield. If you are unable to comply with directions given by the tower, let them know.

It is mandatory to execute a waveoff under any of the following conditions:

1. Flare or waveoff lights from the RDO or wheels watch.
2. Red light from the tower.
3. Verbal command from the IP, RDO, crash crew, or the tower.
4. No clearance received from the tower for a touch-and-go or full-stop landing.
5. Unable to touch down safely on the first one-third of runway.

It is the prerogative of the pilot to initiate a waveoff at any point in the approach when he/she feels uncomfortable.

1505. HOMEFIELD ARRIVALS

Check current SOP.

1506. HOMEFIELD BREAK

The Night Break procedures are basically the same as Day procedures in accordance with local SOP. Adjust inbound course to provide approximately two miles of straightaway for the duty runway. At the approach end of the runway (abeam the numbers), call tower for clearance to break. Break direction will always be in accordance with current SOP.

1. **Executing the Break.** Proper interval is the same as during daylight operations. The only exception is when the preceding aircraft is full-stop, then the interval is 45° behind the wingtip. At NAS Corpus, proper interval is 45° behind your wingtip at all times.

2. Downwind

- a. Slow to 100 KIAS, descend to pattern altitude.
- b. Complete the Landing Checklist.
- c. Continue the approach IAW daytime ops. Be precise and fly to the appropriate checkpoints; depth perception at night is degraded, so it will be more difficult to judge height/distance.

1507. LANDING

1. Call tower for landing clearance at the abeam position.
2. After touchdown, slow aircraft to a comfortable speed prior to selecting an exit taxiway. If you cannot safely make the turnoff, proceed to the next lighted taxiway. Use the yellow painted taxi lines to assist you in locating the taxiways.
3. Do not perform the After-Landing Checklist until clear of the duty runway.

CHAPTER SIXTEEN

NIGHT EMERGENCY PROCEDURES

1600. INTRODUCTION

The Emergency procedures for the T-34C are outlined in the T-34C NATOPS Manual and the T-34C NATOPS Pocket Checklist and are applicable for day and night operations. Refer also to Chapter Eight of this FTI; Daytime Emergency procedures apply to Night Contact. This section on emergency procedures will discuss the additional considerations to existing emergency procedures.

1601. ENGINE FAILURES

While engine failures are rare and usually occur only if flameout or fuel flow fails, considerations must be made for them when operating at night.

1. **Engine Failure at or above 2000 feet AGL.** If an engine failure occurs at altitude, attempt an engine restart if applicable. If the restart is not attempted or is unsuccessful, and a lighted runway is not immediately available, abandoning the aircraft (BAILOUT) is highly recommended. Refer to the NATOPS Flight Manual, section V or the NATOPS Pocket Checklist.
2. **Engine Failure below 2000 feet AGL.** If the engine fails below 2000 feet AGL (minimum recommended night bailout altitude), abandoning the aircraft is not recommended. If a lighted runway is not immediately available, NATOPS does not specify what action should be taken. Therefore, expeditious headwork will dictate what action should be taken. If the engine failure occurs close to 2000 feet AGL, a decision to bail out should be made quickly to allow sufficient time for egress. In any case, **DO NOT SECURE THE BATTERY.**

NOTE

Remember, airspeed can be exchanged for altitude.

1602. VISUAL AIRCRAFT-TO-AIRCRAFT SIGNALS

In the event of lost communications, it is necessary to have standard visual aircraft-to-aircraft signals.

1. **"FOLLOW ME"** - If another aircraft joins on you, turns its external lights off and on several times, and then continues ahead of you, this means "follow me."
2. **"CONTINUE ON COURSE"** - While following another aircraft as described above, it turns its external lights off and on several times and breaks away sharply to the RIGHT, this means "continue on course."
3. **"ORBIT THIS POSITION"** - If the aircraft you are following turns its external lights on and off several times and then breaks sharply to the LEFT, this means "orbit this position." Establish an orbit and remain there until the aircraft again joins up and signals to follow.

4. **"I MUST LAND IMMEDIATELY"** - If it becomes necessary to make an immediate landing and you have no radios, signal to the aircraft that joins up with you by using your flashlight. With a lighted flashlight pointed directly towards the other aircraft, rotate the light in a circular motion similar to your signal to the lineman for start.

1603. NIGHT PRECAUTIONARY EMERGENCY LANDING

The night PPEL is flown with the same checkpoints and airspeeds as the day PPEL (see NATOPS and Chapter Eight). Aircraft will fly to high key at 2500 feet AGL, $\frac{1}{4}$ wingtip distance abeam the intended point of landing (the first one-third of the runway).

At high key, make your voice report and turn towards low key using angle of bank as necessary, passing over the runway at approximately 2000 feet AGL. At low key, 1200 feet AGL, momentarily level your wings on the attitude gyro and check for a $\frac{2}{3}$ wingtip distance (the middle aileron hinge). Ensure landing lights are on by low key. Landing lights will be used for all night PPEL training. Report low key in accordance with course rules. Turn towards the 90° position and proceed with your PPEL procedures as in the daytime.

1604. ELECTRICAL POWER FAILURE

Electrical power is of great importance at night because of the need for interior and exterior lighting, two-way communications, navigational equipment, flight instruments, and landing gear and flaps. An aircraft with no electrical power is virtually invisible at night. In this case, it is only the pilot who can maintain his own aircraft separation. For our purposes, we will discuss only two types of electrical failure: generator failure and complete electrical failure.

1. **Generator Failure.** If the generator becomes inoperative, the indications will be a flashing master caution light, a generator annunciator light, an ammeter discharging, a voltmeter reading 24 volts or less, and a slight dimming of cockpit lights when the voltage drops from 28 volts to below 24 volts. Perform the appropriate NATOPS procedures. If you are unable to reset the generator, then the primary consideration is to conserve battery power. The following procedures shall apply to the appropriate situation.

- a. **Landing Pattern.** If unable to reset the generator while in the landing pattern, call for a full stop, stating difficulty and the next time around the pattern, execute a full-stop landing.

NOTE

Remember that with the exterior lights off, only the pilot can maintain aircraft separation. You will be invisible to other aircraft. Also, with both battery and generator off, your pitot static instruments (airspeed indicator, altimeter, VSI) and wet compass will still function. Engine instruments that will also function are ITT, N_1 , and prop RPM. The attitude gyro, caution panel, RMI, turn and bank, torque, fuel flow, fuel quantity, oil pressure and oil temperature indicators will not operate.

16-2 NIGHT EMERGENCY PROCEDURES

2. **Complete Electrical Failure.** An immediate failure of the entire electrical system is rare. Most complete electrical failures occur due to a generator failure and the subsequent exhaustion of battery power.

Landing Pattern. If a complete electrical failure occurs in the landing pattern, recheck gear handle down and make your next approach to a full-stop landing. Be sure to maintain proper interval. Without exterior lighting, only the pilot can maintain aircraft separation. Be sure to taxi clear of the duty runway on a lighted taxiway, shut down the aircraft and stand by with your flashlight to mark your position for emergency crews and taxiing aircraft. Do not taxi without lights; shut down your aircraft when clear of the duty runway.

NOTE

The torquemeter is inoperative with a complete electrical failure. At 100 KIAS and the gear down, a VSI indication of 1000-1200 FPM rate of descent will equate to approximately 205 ft-lbs. of torque.

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APPENDIX A
GLOSSARY OF TERMS

A100. GLOSSARY - N/A

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APPENDIX B

COMMUNICATIONS

B100. INTRODUCTION

Radio communications are a critical link in the air traffic control system. The link can be a strong bond between aircrew and controller, but it can be broken with surprising speed, leading to disastrous results. The most important aspect of aircrew-controller communications is understanding. The controller must understand what you want to do before he can properly carry out his control duties. Similarly, you must know exactly what he wants you to do. Although brevity is important, concise phraseology may not always be adequate. Use whatever words are necessary to state your message. It cannot be stressed enough that communication plays a vital role in the flight evolution. With experience, it should become second nature.

B101. COMMUNICATION TECHNIQUE

There are several techniques to consider when using aircraft radios:

1. First, pause and listen before you transmit. If you hear others talking, the keying of your transmitter will be futile. You will probably jam the frequency, causing them to repeat their call. If you have changed frequencies, allow your receiver time to tune, then listen and make sure the frequency is clear before you begin your transmission. Also, do not transmit during an exchange between the controller and another aircraft. For example, if the controller asks another aircraft a question, you should wait until the other aircraft has answered before transmitting.
2. Think before keying your transmitter. Know what you want to say. If it is a lengthy transmission such as a flight plan, write it down. Avoid saying "and" prior to each transmission.
3. The microphone should be positioned very close to your lips. After pressing the mike button, a slight pause may be necessary to be sure the first word is transmitted. Speak in a normal conversational tone. When the operating environment requires oxygen usage, your microphone is incorporated in the oxygen mask (also ensure microphone is close to your lips).
4. After your call, release the button and wait a few seconds before calling again. The controller may be jotting down your call sign, looking for your flight plan, transmitting on a different frequency, or switching his transmitter to your frequency.
5. Be alert to the sounds, or lack of sounds, in your receiver. Check your volume and frequency setting. Check your equipment to ensure that your microphone is not stuck in the transmit position. Frequency blockage can, and has, occurred for extended periods of time because of unintentional transmitter operation. This situation is referred to as a "stuck mike." Avoid revealing your innermost thoughts during this time.
6. Be sure that you are within the performance range of station equipment. UHF radios are limited to "line-of-sight" communications. Remember that as altitude increases, radio range increases. The approximate range of your radio can be determined by using the range chart located in the Meteorology section of your Flight Information Handbook (reproduced as Figure 1).

For example, an aircraft at 5000 feet will have an approximate radio range of 50 nautical miles to a ground station.

7. Know what to expect. As you progress through each flight you should know what is expected to happen. In order to do this, you and controllers will make certain transmissions. If you know what is to be said ahead of time, responding correctly will be much easier. Use the proper formats and terminology to assist you in making brief and concise transmissions. Good phraseology enhances safety and is the mark of a true professional.

NOTE

Active ELT signals can interfere with normal communications. If an ELT is broadcasting on Guard, temporarily switch the UHF to "MAIN" (vice "BOTH"). Wait a few minutes and re-select "BOTH." Repeat as necessary.

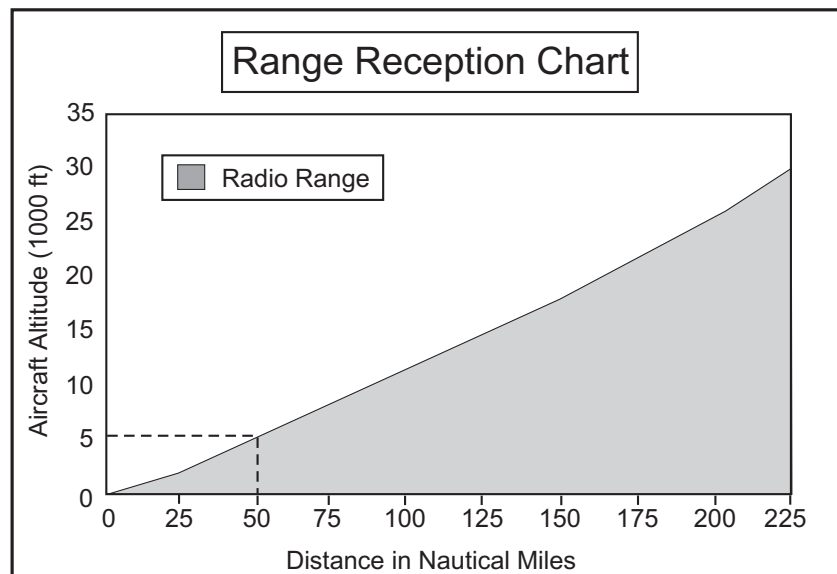


Figure 1

B102. CALL SIGNS

1. **Ground Station Call Signs.** When calling a ground station, you should begin with the name of the facility being called, followed by the type of facility being called; for example:

Clearance Delivery	"Clearance Delivery"
Ground Control	"North Ground," "Navy Corpus Ground"
Airport Traffic Control Tower	"North Tower," "Navy Corpus Tower"
Radar Departure Control	"Pensacola Departure," "Corpus Departure"
Radar or Nonradar Approach	"Pensacola Approach," "Corpus Approach"
FAA Air Route Traffic Control Center	"Jacksonville Center," "Houston Center"
FAA Flight Service Station (FSS)	"Pensacola Radio," "San Angelo Radio"
USAF Pilot to Metro Service (PMSV)	"Eglin Metro," "Kelly Metro"

B-2 COMMUNICATIONS

2. **Aircraft Call Signs.** Improper or abbreviated call signs can result in a pilot's executing a clearance intended for another aircraft. As an example, assume that a controller issues an approach clearance to an aircraft at the bottom of a holding stack and an aircraft with a similar call sign (at the top of the stack) acknowledges the clearance with the last two or three numbers of his call sign. If the aircraft at the bottom of the stack did not hear the clearance and failed to intervene, flight safety would be affected. This kind of "human" error can strike swiftly and is extremely difficult to rectify. You must be certain that aircraft identification is complete and clear before taking action on an ATC clearance. FAA personnel will not abbreviate call signs of aircraft having authorized call signs. FAA may initiate abbreviated call signs of other aircraft by using a prefix and the last three digits or letters of the aircraft identification after communications are established. Controllers, when aware of similar or identical call signs, will take action to minimize errors by emphasizing certain numbers or letters, by repeating the entire call sign, or by repeating the prefix.

B103. VERBALIZATION

1. Time

The 24-hour clock system is used in radio-telephone transmissions. The hour is indicated by the first two figures and the minutes by the last two figures. FAA uses Greenwich Mean Time (GMT), Coordinated Universal Time (UTC) or Zulu ("Z") for all operations.

Example: 0000 ZERO ZERO ZERO ZERO

Example: 0920 ZERO NINER TWO ZERO

Time may be stated in minutes only (two figures) in radio-telephone communications when no misunderstanding is likely to occur. When two figures are used, the current hour (within 60 minutes) is understood to be the time being referenced.

Example: "Mobile Radio, [Call sign], low-level, entering Victor Romeo One Zero Two Zero at Point Alpha at Four Three, exit Point Foxtrot."

"Four Three" is understood to mean 43 minutes past the current hour. If the call was made at 0935 local time, the aircraft will enter the low-level route at 0943 local.

Current time in use at a station is stated in the nearest quarter minute in order that pilots may use this information for time checks or to set their clocks. Fractions of quarter minutes less than eight seconds are stated as the preceding quarter minute; fractions of quarter minutes of eight seconds or more are stated as the succeeding quarter minute.

Example: 0929:05 TIME: ZERO NINER TWO NINER STRAIGHT UP 0929:10
TIME: ZERO NINER TWO NINER AND ONE QUARTER

2. Figures

Digits indicating hundreds and thousands in round numbers, such as ceiling heights and upper wind levels up to 9999, shall be spoken as follows:

Example: 500 FIVE HUNDRED

4500 FOUR THOUSAND FIVE HUNDRED

Numbers above 9999 shall be spoken by separating the digits preceding the word "thousand."

Example: 10,000 ONE ZERO THOUSAND

13,400 ONE THREE THOUSAND FOUR HUNDRED

All other numbers shall be transmitted by pronouncing each digit.

Example: 10 ONE ZERO

When a radio frequency contains a decimal point, the decimal point is spoken as "point" or "decimal."

Example: 322.1 THREE TWO TWO POINT ONE

322.1 THREE TWO TWO DECIMAL ONE

3. Altitudes and Flight Levels

Up to but not including 18,000 feet MSL (FL180), state the separate digits of the thousands, plus the hundreds, if appropriate.

Example: 12,000 ONE TWO THOUSAND

12,500 ONE TWO THOUSAND FIVE HUNDRED

At and above 18,000 feet MSL (FL180), state the words "flight level" followed by the separate digits of the flight level.

Example: 19,000 FLIGHT LEVEL ONE NINER ZERO

Feet in MSL (Mean Sea Level) is understood in altitudes; therefore it is not necessary to say "feet."

4. Directions

State the three digits of all magnetic courses, bearings, headings, or wind directions. All are assumed to be magnetic. The word "true" must be added when it applies.

Example: (magnetic course) 005 ZERO ZERO FIVE
(true course) 050 ZERO FIVE ZERO TRUE
(magnetic bearing) 360 THREE SIX ZERO
(magnetic heading) 100 ONE ZERO ZERO
(wind direction) 220 TWO TWO ZERO

5. Speeds

State the separate digits of the speed followed by the word "knots." The controller may omit the "knots" when ordering a speed adjustment: "Reduce/increase speed to one five zero."

Example: 250 TWO FIVE ZERO KNOTS

185 ONE EIGHT FIVE KNOTS

95 NINER FIVE KNOTS

6. Phonetic Alphabet

The International Civil Aviation Organization (ICAO) phonetic alphabet (Figure 2) is used by FAA personnel when communications conditions are such that the information cannot be readily received without their use. Air traffic control facilities may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency.

Pilots should use the phonetic alphabet when identifying their aircraft during initial contact with air traffic control facilities. Additionally, use the phonetic equivalents for single letters and to spell out groups of letters or difficult words during adverse communications conditions.

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
A	• —	Alfa	(AL-FAH)
B	— • • •	Bravo	BRAH(-VOH)
C	— • — •	Charlie	(CHAR-LEE) or (SHAR-LEE)
D	— • •	Delta	(DELL-TAH)
E	•	Echo	(ECK-OH)
F	• • — •	Foxtrot	(FOKS-TROT)
G	— — •	Golf	(GOLF)
H	• • • •	Hotel	(HOH-TEL)
I	• •	India	(IN-DEE-AH)
J	• — — —	Juliett	(JEW-LEE-ETT)
K	— • —	Kilo	(KEY-LOH)
L	• — • •	Lima	(LEE-MAH)
M	— —	Mike	(MIKE)
N	— •	November	(NO-VEM-BER)
O	— — —	Oscar	(OSS-CAH)
P	• — — •	Papa	(PAH-PAH)
Q	— — • —	Quebec	(KEH-BECK)
R	• — •	Romeo	(ROW-ME-OH)
S	• • •	Sierra	(SEE-AIR-RAH)
T	—	Tango	(TANG-GO)
U	• • —	Uniform	(YOU-NEE-FORM) or (OO-NEE-FORM)
V	• • • —	Victor	(VIK-TAH)
W	• — —	Whiskey	(WISS-KEY)
X	— • • —	Xray	(ECKS-RAY)
Y	— • — —	Yankee	(YANG-KEY)
Z	— — • •	Zulu	(ZOO-LOO)
1	• — — — —	One	(WUN)
2	• • — — —	Two	(TOO)
3	• • • — —	Three	(TREE)
4	• • • • —	Four	(FOW-ER)
5	• • • • •	Five	(FIFE)
6	— • • • •	Six	(SIX)
7	— — • • •	Seven	(SEV-EN)
8	— — — • •	Eight	(AIT)
9	— — — — •	Nine	(NIN-ER)
0	— — — — —	Zero	(ZEE-RO)

7. Common Terms

English is the international aviation language. Through the years, aviators and controllers have developed what is, at times, their own language. Several terms have been modified to fit the aviation environment. Here is a list of common aviation terms you will use throughout your career.

ACKNOWLEDGE

Let me know that you have received and understood my message

EXAMPLE: "[Call sign], _____ APPROACH, execute an immediate right turn heading 180, vector for traffic, acknowledge."

ADVISE INTENTIONS

Tell me what you plan to do.

EXAMPLE: "[Call sign], _____ TOWER, advise intentions after touch-and-go."

AFFIRMATIVE

Yes.

ALTITUDE RESTRICTION

An altitude or altitudes stated in the order flown which are to be maintained until reaching a specific point or time.

AT PILOT'S DISCRETION

ATC has offered the pilot the option of complying with the instruction whenever he/she wishes.

EXAMPLE: "[Call sign], _____ CENTER, descend at pilot's discretion and maintain one six thousand."

CLEARANCE LIMIT

The fix, point, or location to which an aircraft is cleared when issued an ATC clearance.

EXAMPLE: "[Call sign] is cleared to Navy Pensacola."

CLEARANCE ON REQUEST

Used by Clearance Delivery to inform the pilot that his clearance is being processed by ATC.

EXAMPLE: "[Call sign], _____ CLEARANCE, your clearance is on request."

CLEARED AS FILED

Means the aircraft is cleared to proceed in accordance with the route of flight filed in the flight plan. This clearance does not include the altitude, SID, or SID transition.

(also **CLEARED VIA FLIGHT PLAN ROUTE**)

EXAMPLE: "[Call sign] is cleared to Navy Pensacola as filed (flight plan route). . ."

CLEARED	<p>ATC authorization for an aircraft to perform a specific procedure (Approach, Land, Takeoff, etc.).</p> <p>EXAMPLE: "[Call sign], _____ TOWER, cleared to land RWY 14."</p>
CLIMB UNRESTRICTED	<p>Rate of climb to an assigned altitude is not restricted and/or published altitude restrictions on a SID are no longer applicable; however, the remaining items of the SID are binding.</p> <p>EXAMPLE: "[Call sign], _____ DEPARTURE, climb unrestricted to one one thousand."</p>
CONCUR	<p>I agree with you.</p>
CONTACT	<p>Establish communications with (followed by the name of the facility, and, if appropriate, the frequency to be used).</p> <p>EXAMPLE: "[Call sign], _____ CENTER, contact Pensacola Approach now on 270.8."</p>
CORRECTION	<p>An error has been made in the transmission and the correct version follows.</p> <p>EXAMPLE: "_____ CENTER, [Call sign], leaving niner thousand, correction eight thousand, for three thousand."</p>
CROSS (FIX) AT/ABOVE OR BELOW	<p>An altitude restriction at a specified fix is required.</p>
DISCRETE FREQUENCY	<p>A separate radio frequency for use in direct pilot controller communications.</p>
DISREGARD	<p>Cancel my last message.</p>
EXECUTE	<p>Perform a task.</p> <p>EXAMPLE: "[Call sign], _____ TOWER, execute missed approach."</p>
EXPECT	<p>Used under certain conditions to inform a pilot that an altitude/additional clearance will be provided later.</p> <p>EXAMPLE: "[Call sign], _____ DEPARTURE, expect seven thousand at Victoria."</p>
EXPECT FURTHER CLEARANCE	<p>The time or place at which it is (TIME)/EFC expected that additional clearance will be issued to an aircraft. This pertains to route as well as altitude.</p>

EXPEDITE	<p>To execute promptly.</p> <p>EXAMPLE: "[Call sign], _____ TOWER, expedite clearing runway."</p>
FLY HEADING (DEGREES)	<p>Informs pilot of heading he should fly.</p> <p>EXAMPLE: "[Call sign], _____ APPROACH, fly heading 290."</p>
GLIDESLOPE/PATH	<p>Used by ATC to inform an aircraft making a precision approach of its vertical elevation relative to descent profile.</p> <p>EXAMPLE: "[Call sign], above glidepath, correcting slowly."</p>
GO AHEAD	<p>Proceed with your message.</p> <p>EXAMPLE: "[Call sign], _____ CLEARANCE DELIVERY, I have your clearance. Advise ready to copy?" "[Call sign], go ahead."</p>
GUARD	<p>Guard frequency (243.0 MHz) is the universal emergency UHF frequency.</p>
GO AROUND	<p>Instructions for a pilot to discontinue his approach to landing.</p> <p>EXAMPLE: "[Call sign], _____ TOWER, obstruction on runway, go around."</p>
HAND-OFF	<p>An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications will be transferred.</p>
HOW DO YOU HEAR/READ	<p>A question relating to the quality of the transmission or to determine how well the transmission is being received.</p> <p>EXAMPLE: "[Call sign], _____ DEPARTURE, how do you hear (read)?"</p>
IDENT	<p>Request for a pilot to activate the aircraft transponder identification feature. This will help the controller to confirm an aircraft identity. (No verbal response necessary.)</p> <p>EXAMPLE: "[Call sign], _____ CENTER, ident."</p>
IMMEDIATE	<p>Used by ATC when such action is required to avoid a hazardous situation.</p> <p>EXAMPLE: "[Call sign], _____ DEPARTURE, immediate right turn heading 180."</p>

INOPERATIVE	Used to describe a piece of equipment which has ceased to function properly; e.g., an inoperative TACAN.
INTERCEPT	To meet or cross. EXAMPLE: "[Call sign], _____ DEPARTURE, intercept the Crestview 230 radial and proceed inbound."
LAST ASSIGNED	Last clearance assigned by ATC and acknowledged by the pilot.
LEAVING	To depart an altitude/flight level at which you were level. EXAMPLE: "_____ APPROACH, [Call sign], leaving one zero thousand for six thousand."
MAINTAIN	Concerning altitude/flight level, the term means to remain at the altitude/flight level specified. The phrase "climb and" or "descend and" normally precedes "maintain" and the altitude assignment. EXAMPLE: "[Call sign], _____ APPROACH, descend and maintain two thousand two hundred." EXAMPLE: "Maintain VFR."
NOTE: Concerning other ATC instructions, the term is used in its literal sense.	
NEGATIVE CONTACT	Previous issued traffic is not in sight. EXAMPLE: "[Call sign], _____ APPROACH, you have T-47 traffic at your 12 o'clock at one mile, one six thousand." "[Call sign], negative contact."
MILITARY OPERATIONS AREA/MOA	Airspace assignment of defined vertical and lateral dimensions to separate certain military training activities from IFR traffic.
MISSED APPROACH	A maneuver conducted by the pilot when an approach cannot be completed to a landing.
NEGATIVE	"No" or "Permission not granted" or "That is not correct."
NEGATIVE CONTACT	Previous issued traffic is not insight. EXAMPLE: "[Call sign], _____ APPROACH, you have T-47 traffic at your 12 o'clock at one mile, one six thousand." "[Call sign], negative contact."

NEGATIVE INFORMATION	Used by pilots to inform ATC that they have not received runway and wind information from ATIS. EXAMPLE: "_____ GROUND, [Call sign], taxi, negative information."
NO JOY	You were unable to contact ATC on a particular frequency.
NORDO	A contraction meaning "no radio." It is used to describe aircraft that have lost radio communication capability.
OUT	When said at the end of a transmission means: My transmission is ended; I expect no response. Should be used when it may not be apparent that no response is expected.
OVER	When said at the end of a transmission means: My transmission is ended, I expect a response. Should be used when it may not be apparent that a response is expected.
PASSING	Climbing or descending through an altitude/flight level. EXAMPLE: "_____ CENTER, [Call sign], passing eight thousand."
RECYCLE	Reset your transponder. Indicates that ATC is not properly receiving your IFF. EXAMPLE: "[Call sign], _____ CENTER, recycle transponder, Code 2321."
READ BACK	Repeat the message back to me. EXAMPLE: "[Call sign] is cleared . . . Departure 314.0, read back."
REPORT	Used to instruct pilots to advise ATC of specified information. EXAMPLE: "[Call sign], _____ APPROACH, report PENSI."
REQUEST	To ask for. EXAMPLE: "_____ APPROACH, [Call sign], request TACAN 13R approach to a full stop."
ROGER	I understand (not yes); acknowledges information. EXAMPLE: "[Call sign], _____ CENTER, surveillance radar is down at Navy Pensacola." "[Call sign], roger."
SAY AGAIN	Used to request a repeat of the last transmission.

SAY ALTITUDE

Used by ATC to ascertain an aircraft's specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet.

EXAMPLE: "[Call sign], _____ DEPARTURE, say altitude." "[Call sign], passing eight thousand two hundred."

SAY HEADING

Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft.

EXAMPLE: "[Call sign], _____ APPROACH, say heading."

SEARCH AND RESCUE/SAR
SQUAWK

Service which seeks missing aircraft.

Activate specific modes/codes functions on the aircraft transponder. (No verbal response necessary unless you did not hear all four digits that were specified and want to confirm them.)

EXAMPLE: "[Call sign], _____ CENTER, squawk code two-one-zero-zero."

Example Codes: Emergency squawk 7700 Lost Comm 7600 VFR squawk 1200

STAND BY

The controller or aircrew must pause for a few seconds, usually to attend to other duties of higher priority. Also means to "wait."

SWITCHING

A response to an ATC request to contact a new agency on a discrete frequency followed by reading back the frequency.

EXAMPLE: "[Call sign], _____ CENTER, contact JAX Center now on 351.9." "[Call sign], switching 351.9

TRAFFIC IN SIGHT

I have visual contact with other air traffic.

EXAMPLE: "[Call sign], _____ DEPARTURE, traffic at your 12 o'clock and two miles, three thousand, type unknown." "[Call sign], traffic in sight."

UNABLE	Indicates inability to comply with a specific instruction, request, or clearance. EXAMPLE: "_____ APPROACH, [Call sign], unable to execute the ILS approach."
VECTOR	Heading issued to an aircraft to provide navigational guidance by radar. EXAMPLE: "[Call sign], _____ CENTER, turn left 090, vector for traffic."
VERIFY	Request confirmation of information. EXAMPLE: "Verify assigned altitude."
WILCO	I have received your message, understand it and will comply." EXAMPLE: "[Call sign], _____ GROUND, taxi runway 13L." "[Call sign], wilco."

8. Basic Formats

Adherence to the following guidelines will assist you in the application of proper radio communication techniques:

- a. The format for contacting an agency is always, "Agency called, aircraft identification, message."

If at a loss for the "right" words, remember: WHO you are, WHERE you are, and WHAT you want.

- b. When instructed to squawk or ident on your IFF, no verbal response is necessary unless confusion exists.

Example: "[Call sign], _____ DEPARTURE, squawk 0622." (Dial Code 0622 in aircraft's IFF transponder.)

Example: "[Call sign], _____ DEPARTURE, IDENT." (Momentarily select the ident position on the transponder.)

- c. When advised to "contact" a new controlling agency, acknowledge with "switching" and repeat the specific frequency.

Example: "[Call sign], _____ DEPARTURE, contact Houston Center on 322.4." "[Call sign], switching 322.4."

If unable to contact the new agency on the frequency given, return to the transferring agency and state, "No joy." The transferring agency will give you an alternate frequency to reattempt contact.

- d. Always report leaving an altitude. Unless requested, it is not necessary to report reaching an altitude.

Example: "[Call sign], _____ CENTER, climb and maintain FL210."
"[Call sign], leaving FL180 for FL210."

- e. When in a climb and instructed to climb to a new altitude (i.e., other than that issued in your clearance), you should acknowledge the new altitude.

Example: (you are passing 6000 for 9000 and Departure says):
"[Call sign], _____ DEPARTURE, climb and maintain 13,000."
"[Call sign], climbing to 13,000."

- f. When instructed to "report" a specific point or time of information, report only the item requested.

Example: "[Call sign], _____ APPROACH, report ROMEK."
"[Call sign], WILCO." (Upon reaching ROMEK): "_____
APPROACH, [Call sign], ROMEK."

Example: "[Call sign], _____ CENTER, say altitude passing."
"[Call sign], passing 5500."

- g. "Roger" nice-to-know information.

Example: "[Call sign], your clearance is on request."
"[Call sign], roger."

Example: "[Call sign], _____ DEPARTURE, radar contact."
"[Call sign], roger."

- h. "Wilco" instructions or commands which do not require a readback. You may wilco several commands with a single wilco.

Example: "[Call sign], proceed direct to MARYS, report reaching."
"[Call sign], wilco." (Covers two commands: 1) proceed MARYS and 2) Report MARYS.)

or

"[Call sign], proceeding direct to MARYS, wilco." (Wilco covers the command not repeated; i.e., report IAF.)

- i. Mandatory readbacks include: headings, altimeter settings, leaving an altitude, and frequency assignments.

Example: "[Call sign], PENSACOLA DEPARTURE, turn left heading 180, descend and maintain one six thousand, altimeter 30.02."
"[Call sign], left 180, leaving FL210 for one six thousand, altimeter 30.02."

- j. Always acknowledge call-ups to your aircraft call sign. If you do not respond, the controller has no way of knowing whether you received the information or have experienced radio failure.

Summary

We have covered some of the techniques and terminology used during communications with ground controlling agencies. Proper utilization of this basic knowledge will enhance your abilities to successfully operate in the aviation environment in a professional manner.

APPENDIX C

THE NATOPS BRIEF

C100. AN OVERVIEW

The NATOPS Briefing Guide is a general purpose format used to discuss the majority of contingencies or emergency considerations that might arise in the course of a normal flight. Use of the NATOPS brief is not unique to the T-34C aircraft or to the Naval Air Training Command, but finds application in every aspect of naval aviation.

Preparing the Brief. The content of the brief includes those details relevant to communications, weather, navigation/flight planning and aircraft emergencies that are necessary for the safe and orderly conduct of a particular flight. Use the published briefing guide to organize the information you want to convey and amplify it as required.

No briefing is intended to be all-inclusive. Briefings should be tailored to the mission at hand; i.e., a briefing for a Formation hop would involve much additional detail that would not be relevant to a Contact briefing. Additionally, those missions that intend to take the aircraft into IMC weather would include crew coordination specifics that would not be covered in a Contact briefing except as a matter of contingency.

Crew Coordination. A fresh buzzword in naval aviation recently popularized because of the number of incidents or mishaps that have occurred without it and which could have easily been avoided with a little more of it. A professionally prepared NATOPS brief is step one toward maximum crew coordination and efficient mission completion.

Use of Standard Operating Procedures. Reference to Standard Operating Procedures or published regulations is highly encouraged during NATOPS briefings to avoid lengthy dissertations, provided that all members of the flight are thoroughly familiar with the procedures. NATOPS itself is founded on the premise of training and operations standardization for maximum combat readiness.

Any questions? An often overlooked, but perhaps most important, segment of the NATOPS briefing period which should be included in the conclusion of every brief. Use this period to clarify SOP or other details that may be pertinent to the assigned mission. The members of the flight that are being briefed should hold questions until the conclusion of the brief to the greatest extent possible. The enclosed pages are provided as an example or guide in preparing a NATOPS brief for Contact operations. It is admittedly wordy and intended for use with local Standard Operating Procedures.

The T-34C aircraft is inherently reliable. The odds of any one of these contingencies arising are slim, but with a proper NATOPS brief, you will be prepared to respond confidently and correctly should such a situation actually occur.

C101. THE BRIEFING

The brief should serve several functions. First, the brief should serve to inform all crewmembers about elements critical to safe mission completion. A briefing guide shall be used to prompt the briefer, but all items in the briefing guide will not apply to every mission. Items that do not apply may be passed over without mention. Those items which will be handled routinely in accordance with a published instruction may be briefed as such. Of particular importance to the student naval aviator in this portion of the brief is the sequence of events or route of flight. Leave nothing to unspoken assumption; the instructor pilot expects his or her students to ask questions.

Just as important to dissemination of information in briefing is the delineation of cockpit responsibilities. This function is the cornerstone of crew coordination. Put some serious thought into how tasks will actually be performed in normal and emergency conditions, then brief them as such. All crewmembers are responsible for ensuring that the flight conforms to existing limitations. Where the pilot in command does not specify stricter limits, existing SOP or NATOPS always applies.

Another function of the brief is for the pilot in command to determine whether or not his crew is ready to fly. In the training command, the instructor pilot will evaluate a student's motivation and degree of readiness by checking the student's knowledge against standards established in the Multi-Services Pilot Training System Curriculum.

For all flights, each student being graded shall check existing and forecast weather, and furnish the instructor with a grading sheet. The student shall bring a Multi-Services Pilot Training System Curriculum, NATOPS Pocket Checklist, and all required charts and pubs to the brief. The flight shall be conducted as briefed. When circumstances require a change in plans, the pilot in command is responsible for updating the brief. When any crewmember is unclear with regard to any changes in plans, it is his or her responsibility to resolve any questions.

C102. SAMPLE NATOPS BRIEFING GUIDE**NOTE**

This is just a sampling of many common NATOPS briefing items. This should NOT be construed as the single source for your study pertaining to the NATOPS brief. Many items are site specific (i.e., TW-5 vs. TW-4). Refer to local operating guidelines.

Communications

1. **Frequencies.** Brief the frequencies expected to be used on the ground and in flight during departure, enroute, and arrival.
2. **Radio Procedures and Discipline.** The person in control of the aircraft will initiate radio communications with the controlling agencies or respond to the appropriate radio calls. We will

C-2 THE NATOPS BRIEF

reply promptly to ATC calls for other air traffic with "traffic in sight" or "negative contact." Keep all calls short, concise and professional.

3. **Change of Control of Aircraft**

- a. There will be a positive 3-way change of control of the aircraft using the word "controls" vice "it" or "aircraft": "I have the controls" acknowledged with a return response, "Roger, you have the controls," "Roger, I have the controls." (challenge/response/confirmation).
- b. If the stick is bumped for any reason, **do not** assume that control is being transferred, but continue to fly the aircraft until told otherwise. If there is any doubt as to who has control, ask your fellow crewmember and be prepared to maintain or assume control until the confusion is resolved.

4. **Navigational Aids**

- a. In Contact we rely primarily on ground reference and landmark association to navigate to/from the training areas.
- b. As a backup tool, we may use appropriate GPS, TACAN, or VOR to assist us in determining our position relative to homefield.

5. **Identification.** Our call sign will be (see appropriate squadron SOPs). We will be alert for other aircraft with similar call signs and ensure that we resolve any confusion by announcing our call sign clearly. We will squawk the appropriate code (IAW Course Rules/ SOP).

6. **Lookout procedures.** All pilots maintain a positive lookout doctrine, see and avoid. Call out traffic using the clock system, high or low, factor or no factor.

Weather

1. **Local Area**

- a. The current weather is (**specify ceiling/visibility**) which is (**above/below**) our weather minimum for departure.
- b. Our selected training area must be VMC for us to conduct Contact flights and we must have ground visual reference to perform spins or approach turn stalls and skidded turn stalls. Current PIREPS are indicating _____.

2. **Local Area and Destination Forecast.**

- a. The weather for the training area and homefield is forecast to be _____.
- b. Our minimum acceptable weather forecast is _____.

3. **Weather at Alternate.**

The designated alternate airfields are presently _____.

The weather there is forecasted to be _____.

Navigational And Flight Planning

1. **Climbout.** Climbout will be in accordance with local course rules to our selected training area, deviating as necessary to maintain adequate cloud clearances.

2. **Mission Planning, including Fuel/Oxygen Management.** (Example)

- a. We will transit to the working area, begin with the high work maneuvers (TP/ATS/SPIN), then simulated HAPLs and LAPLs as initiated by the IP.
- b. We will accept the aircraft for flight with greater than XXX lbs./side. Bingo fuel will be determined by expected length of the flight and forecasted weather conditions.
- c. We must have at least 1000 psi oxygen pressure to accept the aircraft.
- d. We will monitor and manage our fuel with instrument, gas and position reports given at least every 15-20 minutes.

3. **Penetration.** Generally not applicable to Contact flights. If an IMC descent is required, the IP will descend with IFR clearance from ATC.

4. **Approach.** If the weather at homefield degrades below 1000/3 or Approach Control directs instrument recoveries, the instructor will fly an instrument approach and the SNA will assume the duties of copilot:

- a. Maintain VFR "see and avoid" lookout when not in clouds.
- b. Back up IP as he requests for DME, altitude, or landing gear alerts.
- c. Search for visual contact with runway landing environment.
- d. Alert IP with "airport in sight" and clock code direction.

5. **Recovery.** Planned recovery will be VFR via the course rules for our working area. We will obtain current ATIS.

Emergencies

1. **Aborts**

- a. If we **abort in the chocks**, another aircraft will be issued and we will alert the FDO/ODO. Example of areas that may cause aborts:

- i. Preflight problems.
 - ii. Battery below 18 volts, Gs in excess of +4.5/-2.3, oxygen 1000 psi.
 - iii. Pre-taxi problems.
 - (a) If we **abort on takeoff**, we will stop the aircraft on the remaining runway centerline by lowering the nosewheel, using max beta and smoothly increase pressure on the brake pedals.
 - (b) If we **depart the runway**, we will continue our abort with the appropriate NATOPS procedures. After aircraft evacuation we will meet well clear of the aircraft.
 - (c) If we **abort shortly after liftoff**, we will turn downwind and climb to pattern low key, notifying Tower of our intentions to execute a pattern PEL.
2. **Divert Fields.** The divert fields for today's mission are _____.
3. **Minimum and Emergency Fuel**
 - a. Minimum fuel is when we are at a fuel state that will not allow us to accept undue delay enroute to our destination. ATC may be notified; however, they may not necessarily grant any preferential assistance. Minimum fuel is not considered an emergency.
 - b. We will declare an emergency when we have reached a fuel state that will result in our landing with less than acceptable fuel quantity. Emergency fuel is considered an emergency; ATC will provide preferential assistance.
4. **Waveoff Pattern**
 - a. **Execution of the waveoff is mandatory for all students** when directed by RDO, Tower, Wheels Watch, or the IP. Waveoffs will be conducted per local procedures.
 - b. **Homefield waveoff** per local course rules.
 - c. **OLF waveoff** procedurally similar except maintain safe separation from other aircraft, climb to pattern altitude and turn downwind when you have proper interval per local procedures.
5. **Radio Failure/ICS Failure.** A confirmed radio failure will be handled per the procedures outlined in the FWOP/Course Rules and sound judgment on the part of the pilot in command. If VFR, remain VFR and do not proceed into questionable or marginal VFR weather. Discuss ICS failure procedures and procedure for positive change of control.

- a. **Landing Pattern.** Major troubleshooting of radio/ICS systems and resetting of transponders will not be performed in the landing pattern. Make normal calls "in the blind," exercise extreme caution, and perform a full-stop landing. Taxi clear of the runway on the first available taxiway/off-duty runway once the aircraft has decelerated to safe ground taxi speed.
 - b. **Training Area.** After troubleshooting confirms the radio has failed and assuming VFR weather at homefield:
 - i. Squawk 7600.
 - ii. Change UHF channels to Approach/Tower and make radio calls "in the blind."
 - iii. Consider using the VHF or PRC-90.
 - iv. Make homefield entry per local Lost Comm procedures.
6. **Loss of Visual Contact with Flight.** If a Formation flight, refer to local operations.
7. **Downed Pilot and Aircraft.**
 - a. If we are the first on the scene of an aircraft mishap, we will assume on-scene command of the accident site until properly relieved, we reach a bingo fuel state or have any emergency of our own. We will guide in the SAR aircraft, assessing the status of the crew and aircraft, and directing the SAR effort as outlined by the published On-Scene Commander Checklist.
 - b. Discuss basic responsibilities of each crewmember.
8. **Aircraft Emergencies and System Failures.** Will be handled per NATOPS procedures. In a broad sense, EPs are categorized into immediate action or deferred PEL type emergencies.
 - a. **Simulated emergencies** will be prefaced with the word "simulated."
 - b. **Power losses** must be quickly analyzed to determine whether prop feathering is appropriate. For example, we will try not to confuse the occurrence of a "rollback" or compressor stall as a flameout or frozen turbine. This is sometimes briefed as "no fast hands in the cockpit," designed to remind the crew that a wrong action may actually make matters worse.
 - c. **Fire warning lights** will be confirmed with secondary indications prior to engine shutdown.
9. **Bailout.** Occurrences that would warrant bailout must be compared against actual altitude, noting that we can **trade excess airspeed for altitude**:
 - a. Engine failure without a landing site.
 - b. Airborne fires that will not extinguish.
 - c. Uncontrolled flight below 5000 feet AGL (spins/ATS, etc.).
 - d. Midair collision with severe damage and uncontrollable aircraft.
 - e. Minimum recommended altitudes are: 1200 feet AGL Day VMC 2000 feet AGL Night or IMC 5000 feet AGL Out-of-control.

- f. Consider the optional items if time permits and dive opposite the turn needle if the aircraft is spinning or developing a spin.
- 10. The flight leader will inspect all flight members for the proper flight equipment. Review Training Time Out policy.
- 11. ANY QUESTIONS?

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