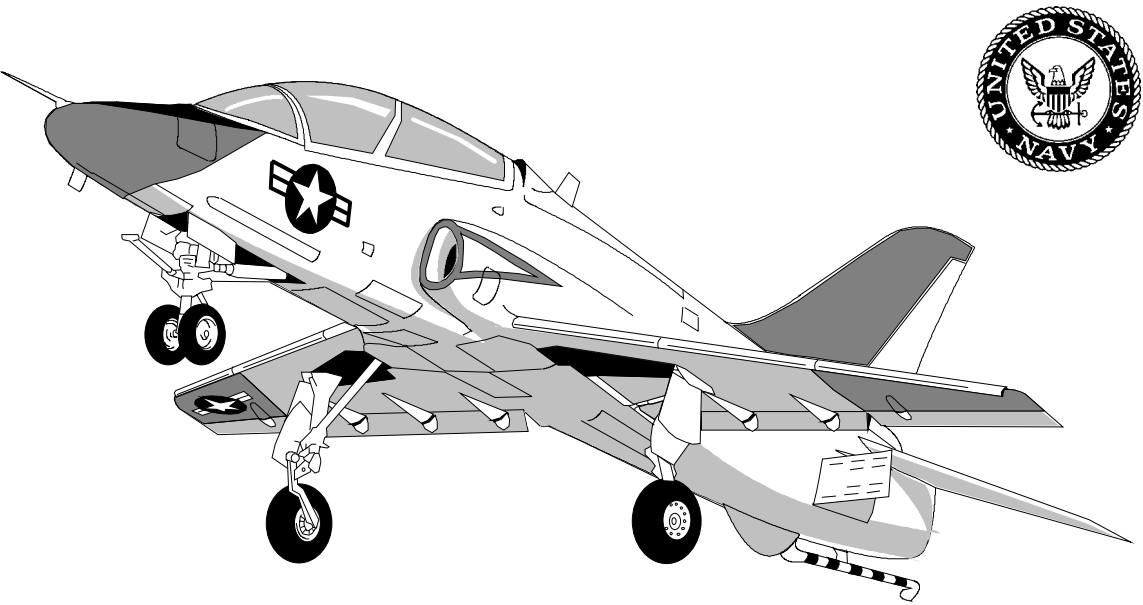


T-45C Goshawk Training & Deck Landing Information for Dino Cattaneo's Freeware FSX T-45C Goshawk


NAVY
253
"GREAT PILOTS
ARE MADE
NOT BORN..."

CHAPTER II

OPERATIONAL REQUIREMENTS, PROCEDURES AND LIMITATIONS

200. Introduction. Carrier qualification requirements are directed by reference (b), COMNAVAIRFOR Instructions, NATRACOM Curricula and Flight Training Instructions. This instruction focuses on the requirements, procedures and limitations that are used to train Student Naval Aviators, Jet Transition Aviators, NATRACOM LSOs, CQ Instructors and other pilots undergoing undergraduate Carrier Qualification.

201. Waiver Authority. Under unusual circumstances a waiver of the restrictions and limitations imposed by this and other CNATRA instructions may be desired. Except where specific waiver authority is delegated within this instruction, waivers must be approved by the Chief of Naval Air Training (CNATRA) and the CO of the carrier.

202. Authorized Personnel. The following personnel are authorized for fixed wing CQ or rotary wing DLQ:

a. Student naval aviators.

b. LSOs receiving initial or refresher training.

c. Instructors Under Training.

d. Helicopter SAR Detachment's initial or refresher training.

e. Other personnel when approved by the Chief of Naval Air Training or higher authority.

203. General Instructions and Standard Operating Procedures

a. FCLP. All Strike SNA/Naval Aviators (NAs) shall be field qualified IAW ref (b) using the Improved Fresnel Lens Optical Landing System (IFLOLS). The controlling LSO shall be responsible for changing the Basic Angle as required for FCLPs. In order to standardize field lens settings, all NATRACOM LSOs shall use a field lens setting of 3.25.

b. CNATRA Carrier Qualification (CQ) Requirements

(1) CQ operations for student naval aviators shall be in accordance with the Naval Air Training Command curriculum. Hot seat evolutions are authorized. SNAs shall have an arrested landing prior to being considered for a hot seat evolution.

(2) Other Naval Aviators such as Instructors Under Training (IUTs), Lead/Safes and foreign military pilots, should receive instruction and qualification based upon previous flight experience and applicable instructions.

c. Pilot Performance. The performance of pilots during carrier qualification must be closely observed. Instructors and instructors under training may be controlled by any NATRACOM qualified LSO. The authority to certify a pilot as "qualified" rests with the controlling LSO; however, disqualification may be directed by the controlling LSO, TRAWING LSO, CNATRA LSO, or the Commanding Officer of the carrier. Non-fleet experienced IUTs shall not be controlled by an unfamiliar LSO at the ship. Squadron LSOs shall be assigned a class of SNAs and be responsible for conducting and debriefing the majority of his/her classes, FCLP periods, and act as controlling LSO aboard ship for his/her class. The cognizant TRAWING LSO or the CNATRA LSO shall act as controlling LSO in the unlikely event that the squadron LSO is not aboard when his/her class arrives.

d. LSO Qualification. TRAWINGs shall have qualified LSOs on board during the period of CQ. LSOs shall be qualified in accordance with ref (b), ref (h), and this instruction. An appropriate number of LSOs for each type aircraft shall be provided by each squadron involved with CQ. Landing Signal Enlistedmen (LSEs) for helicopter qualification shall be provided by the carrier.

e. LSO Facilities and Equipment. The Improved Fresnel Lens Optical Landing System (IFLOLS) shall be used for all fixed wing carrier qualifications. In case of an IFLOLS casualty, a Manually Operated Visual Landing Aid System (MOVLAS) "Talk Down" may be used to recover aircraft. MOVLAS shall not be used to conduct NATRACOM CQ.

f. Lead/Safe Pilots. Lead/Safe pilots are responsible for the conduct and safety of the flight to and from the carrier. The Lead/Safe pilot shall advise and update the Air Boss if conditions do not warrant commencement or continuation of CQ operations. Prior to entering the CQ pattern, he shall return the flight to a shore station if, in his opinion, weather conditions, flight fuel status, or in-flight emergencies so require. Once the flight enters the CQ pattern, primary responsibility for the safety of the flight lies with Commanding Officer of the training carrier. Lead/Safe pilots shall continue to monitor student fuel states and position in the CQ pattern, primarily upwind, and advise the Air Boss if an unsafe situation develops. When the flight leaves the CQ pattern, the responsibility for safety of flight once again lies with the Lead/Safe pilot. Except in an emergency situation, Lead/Safe pilots shall limit the size of their flights to four aircraft.

g. Lead/Safe Requirements. To perform the duties of a NATRACOM Lead/Safe, a pilot must possess good judgment and operational carrier experience. Only fleet carrier experienced aviators with 150 or more arrested landings shall be used as Lead/Safe pilots. Lead/ Safe requirements for SNA CQ shall be as follows:

(1) Lead/Safe pilots shall be current in accordance with Table II-1.

(2) A single ship weather reconnaissance (RECCE) shall launch as required prior to the first student launch of the day. This weather RECCE should normally function as a Lead/Safe after the arrival of student aircraft.

(3) CQ Pattern lead safe requirements.

(a) 1-3 SNA: One Lead/Safe required.
4-6 SNA: Two Lead/Safes required.

(b) A third safety pilot shall launch to arrive overhead the ship 30 to 45 minutes (as required by the ship) after the first scheduled student ramp time.

204. General SNA Operating Limits and Emergency Procedures

a. Brief time should be scheduled 2.5 hours prior to take off for SNAs. After the second CQ flight brief, SNAs may be scheduled to brief less than 2.5 hours prior to take off as necessary.

b. A maximum of 3 1/2 hours total flight time (to commence at take-off and terminate with engine shut down) is permitted during any one carrier qualification flight. SNA crew rest aboard CV is 10 hours from debrief to brief vice the 12 hours required when shore based.

c. A maximum of 5 hours total flight time is permitted during any one day.

d. A maximum of two carrier qualification flights with three man ups per day is permitted.

e. CNATRA limits SNAs to six arrestments per day. The CNATRA LSO may authorize SNAs to a maximum of 10 arrestments in 1 day. IUTs are limited to 10 arrestments per day. For CQ current instructors, there is no operational limit.

f. For CQ: Case II penetrations to the ship are authorized under the following conditions:

(1) Penetration shall be led by a qualified Lead/Safe.

(2) Penetration shall be performed with no more than two aircraft in a flight.

(3) Cloud tops shall not be in excess of 15,000 feet.

(4) Minimum ceiling of 1500 feet and minimum visibility 5 NM in the carrier control zone. Weather requirements at the ship can be waived by the CV Commanding Officer with CNATRA's concurrence to no lower than 1000/5 with the following restrictions:

i. The maximum number of aircraft in the pattern is reduced from six to four.
ii. If weather prohibits two lead safes from operating within sight of the ship, the maximum number of aircraft in the pattern is reduced to three.
iii. The spin pattern is closed.
iv. Lead safe aircraft may not operate below 1000 feet.

(5) SNAs shall not be launched into the carrier pattern with less than bingo plus 300 lbs.

(6) SNAs shall not be launched to home base with less than bingo for that field plus 600 lbs. If a student is diverted with less than bingo plus 600 lbs, a lead safe shall be directed to escort the SNA to the divert field.

205. Carrier Landing Requirements

a. CNATRA carrier landing requirements are shown in table II-1 below. (R

Table II-1

Carrier Landing Requirements

	Notes	T&G Trap
SNA	1,2,3,4	4/10
IUT	1,5	2/6
LSO IUT	1,5	2/10
Qualified Pilot Currency (LSO/Lead Safe)	6,7	Refer to ref (b)

NOTES:
(1) If a student becomes critically low on fuel, tower may postpone one of the two initial touch and goes and trap the SNA to avoid bingo. Student shall then be given remaining touch and goes (T/Gs) if required after refueling.
(2) Partially qualified SNAs not having a trap that same day require a touch and go before their next trap.
(3) FCLP Currency for SNA - FCLP warmup is required if more than 2 days have elapsed between the CQ field qualification and the first carrier landing. FCLP warmup required every 2 days thereafter. A touch and go or trap at the ship constitutes the applicable warmup requirement.
(4) After the completion of six arrested landings and upon the recommendation of the controlling LSO, the CNATRA LSO may approve up to a maximum of ten arrested landings in 1 day for initial CQ.
(5) Non-fleet experienced IUT/IP shall receive FCLP within 3 days of CQ. Fleet experienced IUT/IP should FCLP within 5 days of CQ. The CNATRA LSO may approve up to a ten day delay between FCLP and IUT/IP CQ.
(6) Pilots shall have a trap within 14 days to be current. Prior to achieving currency, lead safe duties may be performed if an FCLP has been flown within 10 days. Lead Safes/LSO's who have a trap within 59 days may fly with a NATOPS qualified pilot in their back seat for essential transportation to/from the ship, or for mission essential duties such as standardization check flights. For Lead Safes/LSO's who do not have a trap within 59 days, refer to reference (b).
(7) Refresher qualification - Pilots must refresh if they have not trapped within the last 14 days. Required number of refresher landings are prescribed by ref (b) and shall be preceded by an FCLP period within the preceding 10 days. If greater than 12 months has passed since last trap, refer to the IUT requirement.

b. Pilots who are carrier qualified in either model of the T-45 may be carrier qualified in another model by completing the following requirements:

(1) Log 15 hours in model

(2) Complete a CQ simulator

(3) Complete 4 FCLP periods

(4) Complete 6 arrested landings

c. For pilots who are carrier qualified in both models of the T-45, FCLP landings may be flown in either model and shall satisfy CQ preparation requirements for both models. Additionally, carrier landings in either model shall satisfy currency requirements for both models.

206. Weather Minimums. NATRACOM weather minimums are shown in table II-2 below. Fleet CQ weather minimums are as directed by references (a) and (b) and applicable COMNAVAIRFOR instructions.

Table II-2

CNATRA Weather Limits

	Point of Departure	En route	CV	Bingo	Divert
SNA	VFR (2)	VFR on Top (4) (below 15,000)	1500/5 (1) (3) (6) (7)	VFR (5)	IFR
IUT/LSO	IFR	IFR	700/3 (7)	TACAN Mins (5)	IFR

NOTES:

(1) A definite horizon is required for student CQ training and is defined as "an obvious line delineating sky and water."

(2) Student solo flight may be launched for an on top rendezvous with weather between 500-2 and VFR with the expressed consent of the squadron commanding officer or combined CQ Det OIC.

(3) SNA shall land prior to sunset. 30 minutes prior to sunset, all SNA's shall remain on deck at the CV(N) or be directed to divert.

(4) Flight leaders are prohibited from leading a division formation into IMC conditions with students as wingmen except in emergency situations.

(5) Student bingo field shall be VFR (the airfield should be accepting visual approaches). Instructor Bingo WX shall not be less than TACAN circling mins.

(6) Weather requirements at the ship can be waived by the CV Commanding Officer with CNATRA's concurrence to no lower than 1000/5 with a maximum of four aircraft in the pattern. If this waiver is granted, the following conditions apply:

a. The spin pattern is closed.

b. Lead Safes shall operate no lower than 1000'. If conditions prohibit 2 lead safes from operating within sight of the carrier, the maximum number of aircraft in the pattern is reduced to 3.

(7) Case III operations are not authorized for SNA's. Due to the lack of PALS and CILS in the T-45 aircraft, case III operations should not be conducted unless required to launch and recover aircraft from the beach.

207. Wind and Deck Limitations for Fixed Wing Aircraft. CNATRA wind and deck limitations for fixed wing aircraft are shown in the Table II-3 below.

Table II-3

Wind and Deck Limitations for Fixed Wing Aircraft

	Wind Over Deck			Deck Pitch
	Max CQ (1)	Optimum	Min CQ (2)	
SNA	35kt	25kt	20kt	5ft Ramp Movement
IUT GTF L/S	35kt	25kt	20kt	6ft Ramp Movement

NOTES:

(1) The maximum crosswind component for all CQ is 7 knots.

(2) Consult applicable Aircraft Recovery Bulletins (ARBs).

208. Bingo Considerations and Limitations. CNATRA bingo considerations and fuel states are listed in Tables II-4 through II-7 below. Sufficient fuel for flight to an alternate field that satisfies alternate criteria listed in ref (d) shall be added to the bingo states if Visual Flight Rules (VFR) conditions do not exist at the bingo field. Instrument Flight Rules (IFR) bingo fuel figures shall be used when weather at the primary bingo requires an instrument approach (not for SNAs). BINGO FUEL IS AN EMERGENCY SITUATION. Aircraft reaching this state shall immediately report "bingo," squawk 7700 and shall normally be diverted to the bingo airfield, unless well established in the groove, hook down, and under LSO control. In this case only, an approach may be continued with immediate bingo departure if not arrested (trapped). In all cases a Lead/Safe pilot shall be dispatched to escort student pilots on a bingo. SNAs who are bingoed shall commence the bingo profile and shall not be told to join on a Lead/Safe. Once the SNA is well established on his bingo profile, the escorting Lead/Safe will join the SNA and assume the lead. The intent is to avoid a circling join up which wastes precious fuel once bingo fuel has been reached by the SNA.

a. If NATRACOM aircraft are below bingo, the Commanding Officer of the carrier shall decide whether to have the aircraft bingo with available fuel, remain in the pattern, or set up for a controlled ejection.

b. Flight from the carrier to the bingo field may be made under Instrument Meteorological Conditions (IMC) by students, IUTs, and instructors, provided the flight is conducted in accordance with air traffic control procedures.

c. Maximum Bingo range for CNATRA CQ is 120 miles.

d. Operations at distances over 90 NM allows limited time for aircraft entering the pattern to perform two T/Gs and one trap prior to reaching student bingo fuel states. Any delays encountered once aircraft have "Charlied" must be closely monitored to avoid multiple student bingos. Postponing one touch and go should be considered if any delays are anticipated.

e. Lead/Safe pilots shall use STUDENT bingo fuel requirements while operating as a Lead/Safe. Once student bingo fuel is reached, the Lead/Safe should be trapped or diverted. Lead/Safes should not perform Lead/Safe duties when their aircraft is below SNA bingo as this does not allow sufficient fuel margin to effect flight leader join ups, etcetera, and return to the divert airfield. Lead/Safes shall update fuel states with Air Boss every 15 minutes and inform the Air Boss when they are approaching the SNA bingo fuel state. Once alleviated of their Lead/Safe

responsibilities by the Air Boss, they shall use NATOPS bingo. The pilot is responsible for arriving on deck with applicable NATOPS requirements.

f. Arresting Gear must be rigged and in battery at the bingo field. A T-45 Training Qualified LSO shall be on station any time SNA's are conducting CQ operations.

Table II-4
T-45 SNA BINGO FUEL REQUIREMENTS

NO WIND

Distance (NM)	Clean	Gear Down/ Flaps Down	Holddown Gear Down/Flaps Up
20	.7	.9	.8
30	.7	1.1	.9
40	.8	1.3	1.0
50	.9	1.5	1.1
60	.9	1.7	1.2
70	1.0	1.9	1.3
80	1.0	2.1	1.4
90	1.1	2.3	1.5
100	1.2	2.5	1.6
110	1.2	2.7	1.7
120 (max)	1.3	2.9	1.8
130	1.3	N/A	1.9
140	1.4	N/A	2.1

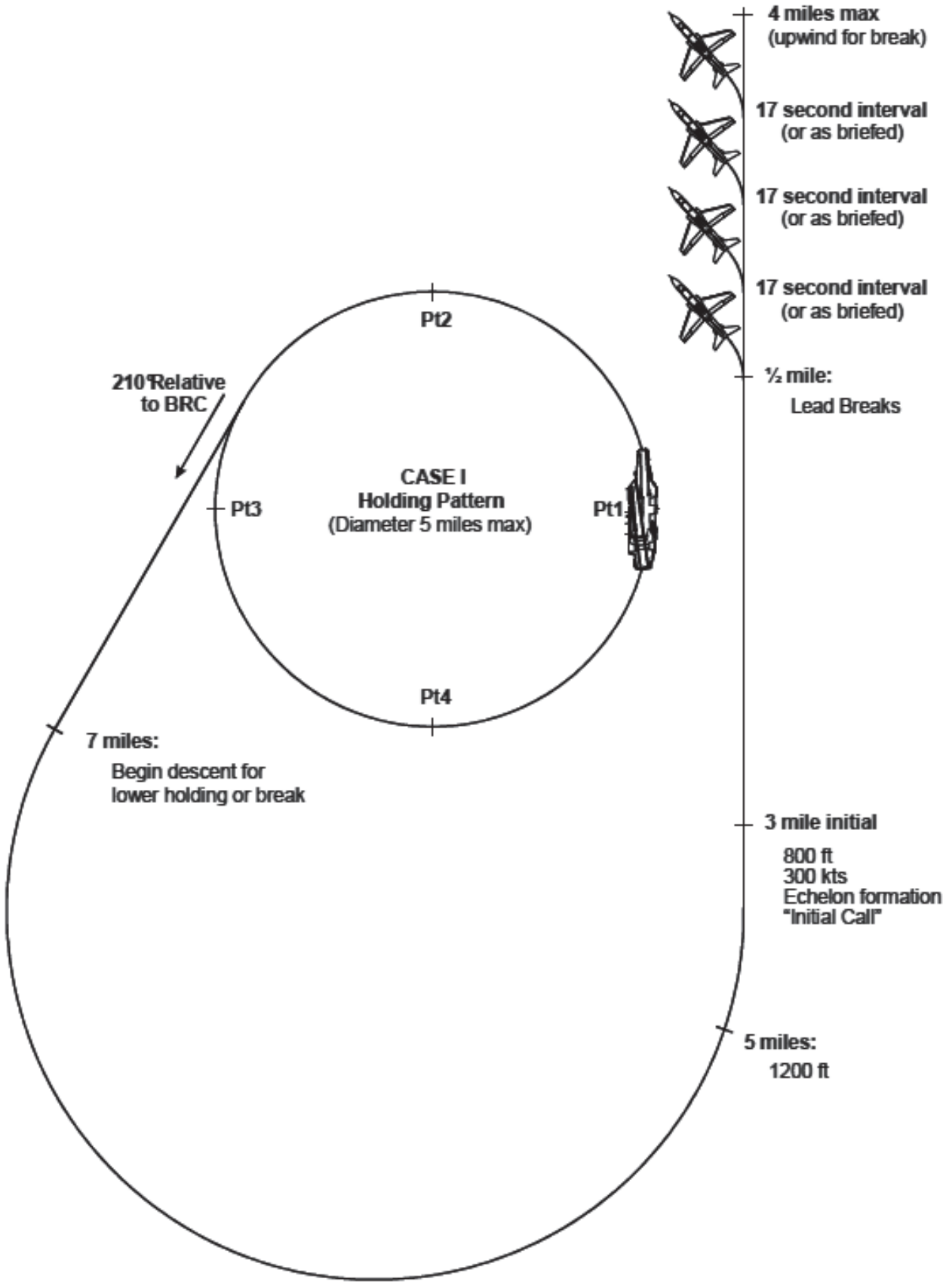
NOTE:
(1) These fuel figures based on 550# reserve overhead bingo field.
(2) Based on sea level figures of 250 KTS. Bingo aircraft shall climb to altitude, and follow NATOPS bingo profiles as closely as possible.
(3) Add 300# for IFR or night, or if the weather is questionable.

Table II-5
T-45 LEAD/SAFE, IUT, LSO BINGO FUEL REQUIREMENTS

Distance (NM)	Clean	Gear Down/ Flaps Down	Holddown Gear Down/Flaps Up
20	.4	.6	.5
30	.5	.8	.6
40	.6	1.0	.7
50	.6	1.2	.8
60	.7	1.4	.9
70	.7	1.6	1.0
80	.8	1.8	1.1
90	.8	2.0	1.2
100	.9	2.2	1.4
110	1.0	2.4	1.5
120	1.0	2.6	1.6
130	1.1	2.8	1.7
140	1.1	N/A	1.8

NOTE:
(1) These fuel figures are based on sea level cruise, 300# reserve overhead bingo field.

CNATRA CQ CASE 1 HOLDING PATTERN AND BREAK ENTRY



(3) Break Entry and Subsequent Lead Holding Assignment. All flights shall report 3 miles and proceed as directed. Figure II-3 depicts Case I Lead/Safe departure procedures following break entry into the pattern.

(a) T-45 Flights. T-45 leads shall enter at 300 knots and break at 1/2 to 1 mile; fuel permitting the lead shall then execute a touch and go, accelerate and clean-up maintaining 500 feet up wind to 7 NM and climb overhead to assigned altitude as described above. Under normal circumstances, the leads shall be assigned the following altitudes after student drop-off:

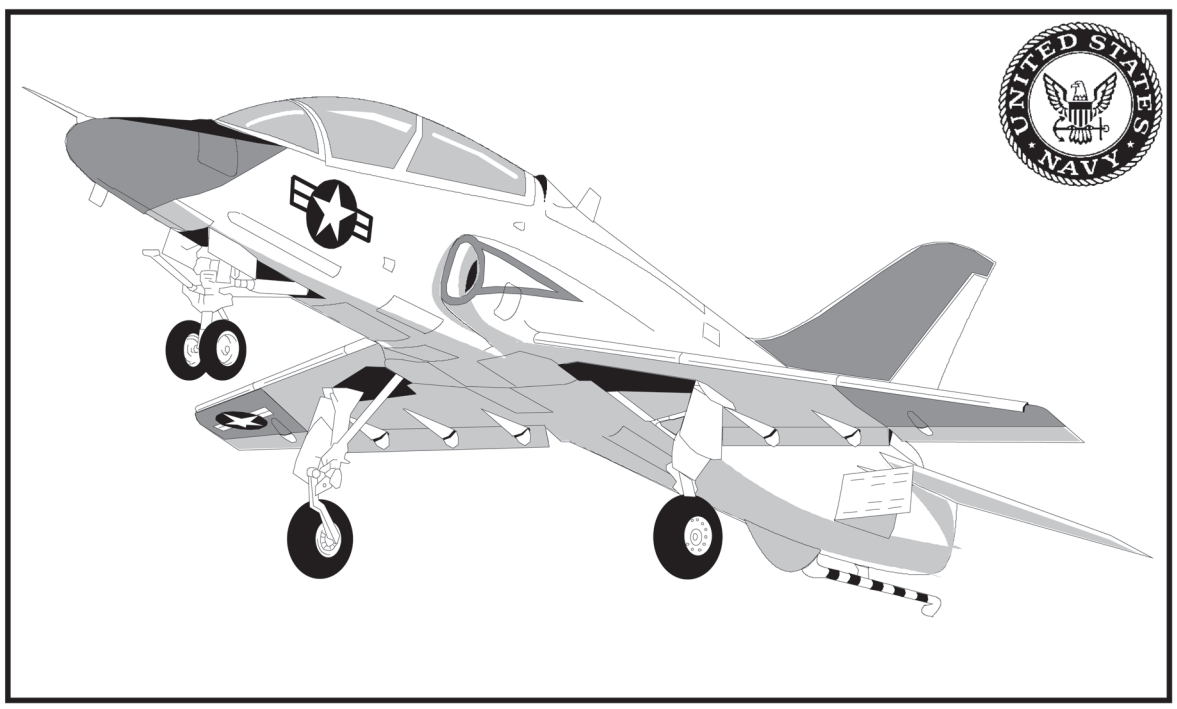
2000, 3000, and 4000.

NOTE: If weather dictates, Tower may hold a maximum of two Lead/Safe singles at the same altitude. Tower shall assign one of the Leads as primary "hawk." The second A/C shall fly loose wing until told to assume "primary hawk" or divert.

b. Case II, Controlled Descent-Visual Approach. This approach shall be utilized when the ceiling is less than 3000 feet but not less than 1500 feet (1000 feet for IUT or IP refresher). Close control shall be utilized until the flight is inside 10NM and reports the ship in sight.

c. If IMC is encountered, the Lead/Safe shall bring each SNA down individually, while his remaining SNAs continue to marshal as assigned. Penetration shall not be made unless the pattern is clear. After dropping off the SNA, Lead/Safe shall either (1) receive vectors to pick up the remaining SNA/s, (2) recover, or (3) depart on the BRC for re-marshaling. Aircraft shall penetrate to 1200 feet until reaching 10 NM from the carrier. At this point, clearance to descend to 800 feet is authorized. At no time shall a flight be cleared below 800 feet. When within 10NM with the ship in sight, flights shall report "see you." At this time, the flight shall be instructed to switch to tower and proceed as in Case I. If a flight does not have the ship in sight at 5 miles, both aircraft shall be vectored to VMC on top for holding/divert. If two-way radio communications are lost after commencing the approach, maintain last assigned altitude and continue inbound on the CV-1 approach squawking 7600. If ship is not in sight at 5 NM, mark overhead and proceed outbound 360 degrees relative to the final bearing. After 5 NM, climb on divert/bingo profile.

d. Case III, Controlled Descent-Approach. This approach shall be utilized in accordance with reference (a) when the ceiling is less than 1000 feet and/or the visibility is less than 5 miles. Only fleet experienced pilots shall be authorized to approach the ship during Case III conditions. Weather minimums for experienced pilots is 700/3 or TACAN minimums.



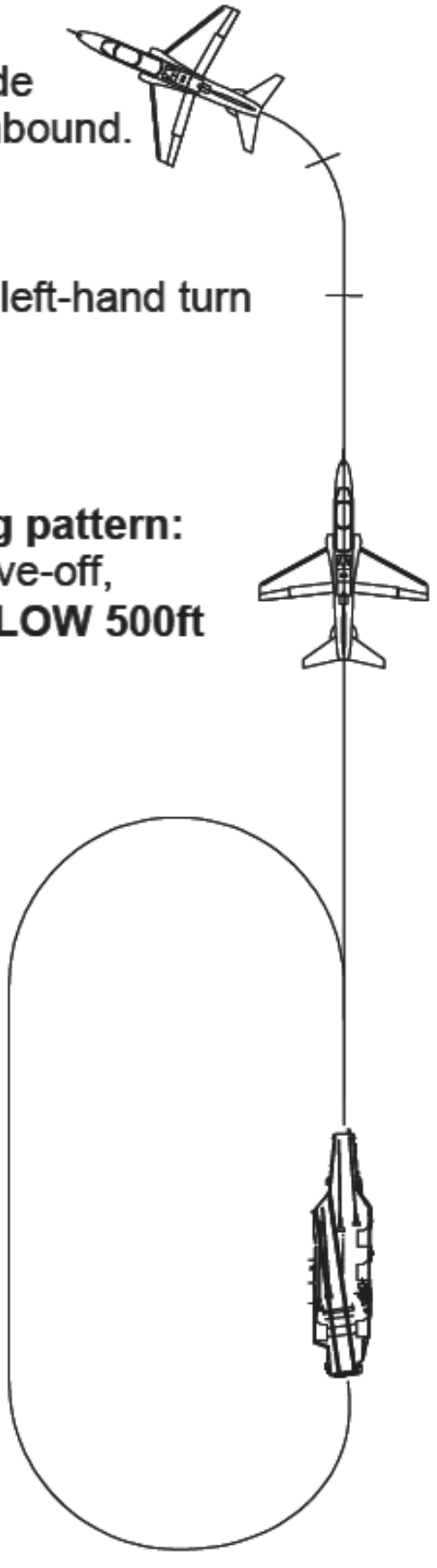
LEAD SAFE DEPARTURES AFTER BREAK

10miles:
Be at assigned altitude
prior to proceeding inbound.

7miles:
Commence climbing left-hand turn
to assigned altitude..

Figure II-3

T-45 Lead Departure from landing pattern:
After executing touch-and-go or wave-off,
clean up and fly upwind **AT OR BELOW 500ft**
until 7 miles.



216. Training Carrier Departure Procedures. To provide a safe, orderly flow of traffic departing the carrier, the following procedures are established as standard for NATRACOM aircraft during carrier qualifications. Figure II-4 depicts Case I SNA departure procedures after CQ completion.

aa. All CNATRA aircraft that are directed to depart the landing pattern from the catapult during Case I and Case II operations shall execute a clearing turn. Clearing turns will only be executed after a positive climb rate is established. Clearing turns shall be made using a 20 degree angle of bank turn for 20 degrees of heading change. Once wings level after the clearing turn, gear and flaps may be retracted. The aircraft will level off at 500 feet AGL and the turn will be reversed once the aircraft is clean using a 20 degree angle of bank turn to parallel the BRC.

a. Students are permitted to return to home base single ship. If departing for an unfamiliar field, a Lead/Safe escort is required and the following procedures shall be used: (1) After completion of carrier qualification and refueling as necessary, the tower shall designate a Lead/Safe to join on and shall inform the student of the Lead/Safe altitude and position. (2) After launch, the student shall proceed straight ahead to 7 miles at 500 feet where a left turn shall be made back toward the training carrier and a climb commenced to rendezvous with the Lead/Safe at the assigned altitude. The Lead Safe shall keep the student informed of his progress in the circle, if necessary. (3) After completion of rendezvous, the flight shall be switched to departure frequency once clear of the overhead stack. FOR THE PURPOSES OF THESE PROCEDURES, AN UNFAMILIAR FIELD IS DEFINED AS ONE FOR WHICH A DETAILED COURSE RULES BRIEF HAS NOT BEEN GIVEN (e.g., MacDill AFB when operating in the Key West OPAREA).

b. Case II departures for SNA's. After completion of carrier qualifications and refueling as necessary, the tower shall provide departure information, designate a Lead/Safe pilot to join on and inform the student of the Lead/Safe position and altitude. After launch, continue straight ahead at 500 feet to 7 miles where a turn shall be made in the shortest direction on the 10 NM arc to intercept the departure radial. A TACAN rendezvous shall be effected VFR ON TOP on the departure radial at a distance of angels plus five miles. Students shall report, "Airborne," "Arcing," and "Outbound." After completion of rendezvous, the flight shall be switched to the appropriate controlling agency.

c. Bingo Aircraft. Aircraft which reach bingo fuel state shall immediately bingo. When instructed, bingo aircraft shall clean up as directed by the Air Officer, commence a climb, then turn to the bingo heading and return to the bingo field at optimum bingo profile in accordance with type aircraft operating parameters (Note - students must be briefed to comply with the bingo profile, but should remain heads up and not risk midair collision with another A/C during their departure). Student Bingo fuel requirements are predicated on a sea level bingo, enabling a student bingo to be flown at any altitude. A Lead/Safe shall be designated by the Air Officer to join and escort the bingo. When entry into Class "A" airspace is necessary, the bingo aircraft shall notify CATCC of the desired altitude. CATCC shall then direct the bingo aircraft to contact center and notify Air Traffic Control (ATC) of desired bingo altitude. When operating and communicating with an ATC facility, the term "Emergency Fuel" shall be used in lieu of the term bingo.

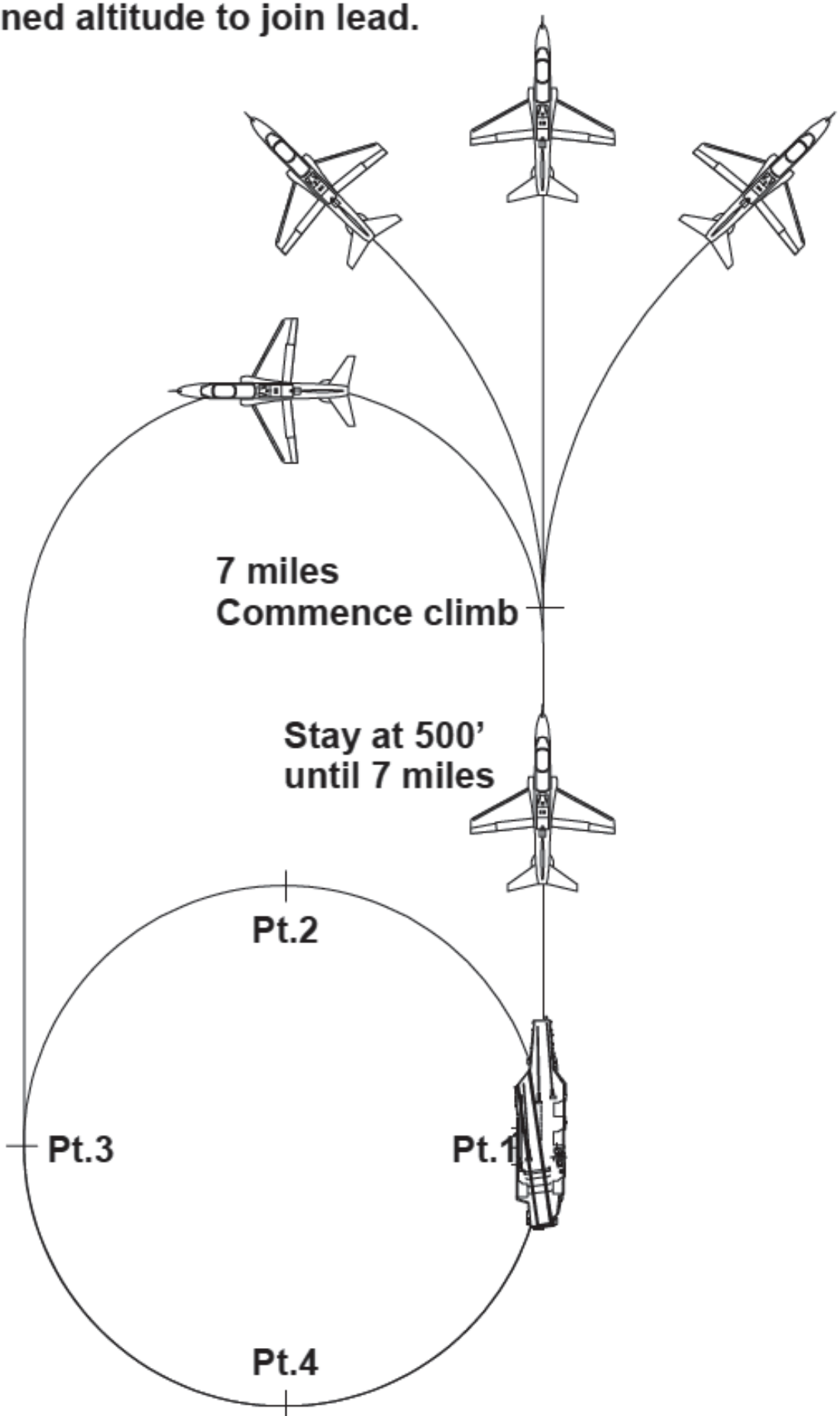
d. Helicopters. After completion of deck qualifications, the flight shall join on the flight leader in the port or starboard holding pattern, as directed, and depart. Helicopter CASE I and CASE II departures shall be provided with departure instructions and pigeons by the tower.

e. Identification Friend or Foe (system) (IFF)/Selective Identification Feature (SIF). Squawk IFF/SIF codes as assigned.

CASE 1 SNA DEPARTURE

If diverted to unfamiliar field, SNA's turn back to ship at assigned altitude to join lead.

If steer to familiar field, depart *single ship*.



T-45A/C
CARRIER QUALIFICATION BRIEFING GUIDE

The following items will be briefed by the flight lead for all TS CQ-25X/ADV-17X flights. The brief will be conducted 2.5 hours prior to scheduled takeoff time.

1. Flight Call Sign

2. Lineup

3. Walk, Man-up, Takeoff, and "Charlie" Times

4. Weather
   a. Departure
   b. En route
   c. Ship
   d. Divert field
   e. Bingo field

5. Fuel Requirements

6. Communication Plan

7. Preflight. Perform normal preflight paying extra attention to the following items:
   a. Carrierization card in A.D.B. (Empty Wt)
   b. Tire pressure
   c. Launch bar
   d. Holdback assembly
   e. Landing gear - proper servicing, security
   f. Tailhook – security, greased
   g. Tailhook snubber pressure - 950 psi plus or minus 50 psi
   h. Cockpit
      (1) Instruments secure - both c/p
      (2) No loose gear, minimum pubs/gear in cockpit.
      (3) Check cat grip
      (4) Rear cockpit - Harness locked; "Soloized."

8. Ground Procedures
   a. Marshal (normally in chocks)
   b. Radio checks (check appropriate channelization)
   c. Taxi (bumpier due to carrier pressure)
   d. Alignment

9. En Route
   a. Take off and departure - IFR/VFR clearance/Rdv
   b. En route to ship
   c. Check in with Marshal giving line-up, qual number, low fuel state and "ANGELS."
   d. Hold as assigned.
   e. Smash light-off/antiskid-off/hook bypass switch-carrier/SAHRS-DG

10. Fuel Management
    a. Individual pilot responsibility

b. Note bingo distance, bearing, and fuel required.
c. Holddown: Bingo + 300 lbs
d. Maximum trap weight 13,360 lbs

11. Approaches to the Ship
a. Case I (wx 3000/5)
(1) Flight will descend from holding IAW CV NATOPS/CNATRA CQ OP plan.
(2) Be at 1200 feet at 7 NM, descend to the initial: 800 feet at 3 NM. Flight lead will call "3 miles."
(3) Concentrate on good formation.
(4) Lead breaks 10 seconds or not later than 1/2 NM upwind, two uses a 10-second interval, three/four use 15-second intervals (17 seconds if interval is hook down).
(5) Spin procedures: initiate at the bow, climb to 1200 feet, and remain within 3 NM and reenter for the break. Call "spin 90."
b. Case II (wx 1500/5. Tops not above 15,000 feet).
(1) Marshal as assigned; angels + 15 = DME
(2) Students may penetrate in section only on an instructor's wing. Lead may break up the division for individual holding.
(3) 250 knot descent, S/B out, 4-6000 FPM.
(4) Lead will call "platform" at 5000 feet (approximately 20 NM) and shallow rate of descent to 2000 FPM (minute to live rule).
(5) If not VFR or ship is not in sight at 800 feet and 5 NM, climb straight ahead on the BRC to visual conditions on top of cloud layer.
(6) Ship in sight - call "see you" and switch tower. Enter normal break; 800 feet, 300 KTS.

12. Carrier Pattern
a. Pilot controlled pattern
b. Break
(1) 800 feet AGL 300 KTS with each succeeding A/C at a 15-second interval (20 seconds if hook down)
(2) Level break on the instruments.
(3) Descend to 600 feet when downwind.
c. Downwind
(1) Landing checks - harness locked, anti-skid off, anti-smash light off, and hook up/down
(2) AOA check
(3) Report abeam with qual number, gear, flaps full, fuel state, qual number. Qual number only will be reported on subsequent passes.
d. Approach Turn
(1) Abeam position. Lead should set proper distance abeam (1 to 1.1 NM).
(2) Turn abeam LSO platform.
(3) 90-degree position: 450 feet AGL.
(4) 45-degree position: 325 - 375 feet AGL.
(5) Cross wake at 300 - 350 feet AGL.
(6) Do not look for ball early.
(7) Ball acquisition - check VSI and adjust (500-600 FPM).
(8) Radar altimeter no lower than 300 feet without a ball.
(9) Fly the numbers - will appear close and steep.
e. Glideslope
(1) Work for good start.
(2) Call the ball: side number, Goshawk ball, fuel state, and qual number.
(3) Meatball, lineup, angle of attack
(4) Fly the ball all the way to touchdown. Landing should be a surprise. MRT and S/B retracted upon touchdown.
(5) Stress lineup with recorrections to touchdown.
(6) Do not spot the deck.
(7) Never accept a low ball.

f. Waveoffs
(1) Mandatory.
(2) Straight ahead (up the angle) unless otherwise directed.
(3) Do not over rotate - hold 17 units AOA/landing attitude.

g. T/G or Bolter
(1) MRT, S/B in, rotate, and climb.
(2) Turn to parallel BRC (10 degrees to the right).
(3) If necessary, ask for interval.
(4) First aircraft to the bow has priority.

h. Downwind
(1) Turn with interval at 7 o'clock hook down/9 o'clock hook up.
(2) Fly instruments - scan altitude, heading, and abeam distance.
(3) Reciprocal of BRC, 1 - 1.1 NM abeam.

13. Deck Procedures

a. Arrestment
(1) Fly the ball to touchdown - be surprised.
(2) MRT speed brakes in on touchdown - do not reduce power until engine is at MRT and aircraft stops (no cuts).
(3) Yellow shirt director at 1 o'clock - watch signals (off brakes, pull back, raise hook).

b. Leaving landing area
(1) Use NWS.
(2) Follow taxi director – exactly, discuss signals.
(3) Foul line, slippery deck.

c. Taxi to JBD
(1) Route and placement of director.
(2) Notify tower if fuel is at or below hold down. If anticipating a delay that will put you below hold down, notify the tower.
(3) Take-off checklist prior to crossing JBD (full flaps, 3-1/2 degrees nose up trim, BARO altimeter should read 60 feet).
(4) Weight board/signals (500-lb increments).
(5) Stop and notify tower if you lose sight of your director or you are unsure who your director is.

d. Catapult procedures
(1) Watch the director.
(2) Taxi slowly. Extend launch bar when directed. Use high gain NWS only when directed (+/- 20 degrees, low gain not available). Brake as directed.
(3) Taxi slowly into holdback - avoid push back.
(4) Tension/signal
a MRT - Retract Launch bar when signaled. Use cat grip/check gauges/instruments.
b Heels on deck - Off brakes!
c Wipe out controls (including rudder).
d Head against seat.
e Salute Cat Officer.
(5) Suspend
a Prior to salute - shake head "no" and broadcast, "Suspend, suspend!"
b After salute - same, but be ready to go.
c Remain at MRT until Cat Officer moves in front of A/C with "throttle back" signal.
(6) Catapult techniques
a Hold stick lightly - allow it to come back aft during the stroke, then set 8-10 degrees attitude as A/C becomes airborne.
b Scan ADI, AOA, airspeed. Do not over or under rotate. Elevator trim will rotate the A/C to the proper climbing attitude. AOA will initially be approximately 19 units but will accelerate to 17 units quickly. Check heading, BRC, airspeed, and interval. Lower hook if required.
(7) Catapult malfunctions
a Cold/soft shot.
b Broken holdback.
c Hangfire.

14. Refueling Procedures
    a. Locations.
    b. Push Back procedures.
    c. Signals for chocks and chains.
    d. Canopy closed.
    e. Purple shirt refueling signals.
    f. Cut signal at 3000 lbs (or as directed by Air Boss).
    g. Call "side number, up and ready (gross weight)."
    h. Mask on prior to being broken down.

15. Aircraft Man-up
    a. Cold start/Flight deck
        (1) Location of A/C (obtained from flight deck control, escort required).
        (2) Pre-flight - same as before.
        (3) Beware of intakes, exhausts and props!
        (4) Avoid landing area if ops in progress.
        (5) Same start, checks, etcetera. (Start on yellow shirt signal only.)
        (6) No hook check if tail over water until A/C pulls forward.
        (7) Call "side number, up and ready, gross weight."
    b. Hot switches
        (1) A/C chocked and chained.
        (2) Seat safed and parking brake set.
        (3) Throttle friction on.
        (4) Leave all electrical equipment on.
        (5) Unstrap, lengthen lap straps, seat up, and rudder peddles outward.
        (6) Open canopy on signal, ensure intake screen in place.
        (7) Debrief oncoming pilot.

16. Normal Departure Procedures
    a. Case I
        (1) Straight ahead at 500 feet to 7 NM at 300 KIAS or as directed by tower. All Rdvs will be at 250 KTs/within 5 NM.
        (2) Turn shortest direction to field and climb. Stay away from overhead marshal stack (remain outside of 10 NM).
        (3) Contact departure when directed.
    b. Case II
        (1) Straight ahead at 500 feet to 7 NM at 300 KIAS or as directed by departure.
        (2) At 7 NM, turn in appropriate direction onto the 10 NM arc and intercept the departure radial outbound.
        (3) If joining other aircraft, execute TACAN rendezvous (VFR on top) on departure radial at a distance of angels plus 15 miles.
        (4) All aircraft shall report airborne, arcing, and outbound. Remain VMC established outbound on departure radial.

17. Bingo Procedures
    a. Be prepared to bingo.
    b. Update bingo info as provided by tower.
    c. Notify tower when at bingo - don't wait to be asked. This is an Emergency Procedure!
    d. Immediately turn to bingo heading and clean up (including hook).
    e. Reselect SLV mode and cross check with the wet compass.
    f. Accel to 307 KIAS - level.
    g. Commence MRT climb to pre-determined altitude (as per PCL Bingo Chart).
    h. Don't wait for safety pilot to join.
    i. Switch to departure and tune in bingo TACAN. Squawk 7700.
    j. Go IMC if necessary to preserve profile.
    k. Discuss coordination with Approach Control (emergency fuel).
    l. Discuss recoveries - downwind or base leg entry, VFR straight-in, min fuel GCA.
    m. Heads up for other A/C.

n. Land on speed.
o. Remember carrier tire pressure.
p. Check hook up, anti-skid on and anti-collision lights on.

18. Emergencies/Safety of flight
a. Takeoff abort.
b. NORDO - fly A/C first, check fittings and switches.
(1) Fly normal pattern; watch for cut lights; waveoff if directed. Succeeding cut lights are calls for power.
(2) Clean up; proceed to 7 NM at 500 feet; climb overhead ship (1500 feet or VMC), expect to be joined by (or join) lead safe.
(3) If bingo fuel - BINGO!
(4) Require immediate landing: landing light. Emergency only. LSO will use cut lights to roger ball.
c. Loss of NAVAIDS.
d. Lost Plane.
e. Lost sight/inadvertent IMC.
f. Down plane/SAR.
g. Bird strike.
h. Midair.
i. Brake failure.
(1) Airborne - probable steer and short field arrest.
(2) On deck - drop hook and transmit to tower.
j. Landing gear malfunctions, probable steer.
k. Flameout - airborne and during cat shot.
l. Blown tire.
m. Hydraulic failure - discuss dirty bingo.
n. Launch bar light/Launch bar down airborne.
o. Accel light.
p. Brake Pressure light.
q. System failure.
r. Low altitude ejection (clean and dirty).

18. Miscellaneous
a. NATOPS and other QOD
b. Yellow sheets - "A" for ship ops, log traps, cats, T/Gs, bolters, field landing.
c. Hop isn't over after last trap. (Final cat shot, formation, field landing etc.); ensure hook up after final CAT.
d. Reputation is earned around the ship - be professional and alert.

1. Dimensions:

Wing Span	30 ft 10 inch
Height	13 ft 6 inch
Length	39 ft 4 inch
Hook-to-eye	12.0 ft

2. Aircraft Weight:

Basic	10,403 lbs
Total fuel	3,012 lbs
Max trap fuel	2,947 lbs
Max trap gross weight	13,360 lbs

3. Fuel Statistics:

Carqual pump	3,012 lbs
Fuel per pass	150 lbs
Divert fuel (above Bingo)	600 lbs
Fuel flow on deck	600 lbs/hr
Bingo fuel (see Chapter II)	

4. Shipboard Operational Considerations:
   a. No barricades
   b. Full flap landing
   c. Full flap takeoff
   d. Catapult and trap at full fuel
   e. Canopy wind speed limitation 35 kts. With wind in excess of 20 kts, it is recommended that the nose of the aircraft be pointed into the wind if possible.
   f. Full time nose wheel steering except with the launch bar down.
   g. Self starting
   h. On board oxygen system (OBOGS)
   i. On catapult launch with the aircraft at MRT, the catapult officer will give the launch bar retract signal.
   j. Tie down requirements as follows:
      (1) Normal weather, 6 chains
      (2) Moderate wind to 60 kts, 12 chains
      (3) Heavy weather, 18 chains
   k. Anti-skid off for carrier operations
   l. Pump to full bag of gas after 1st trap for bingo considerations. Hot refueling limit is 2800 lbs.

CQ PLANNING FACTORS

Overhead Holding

- Air Boss has overhead up to 5.5K for holding. Boss must ensure Air Operations does not bring aircraft into his airspace without first notifying the Boss.
- If the Air Boss needs higher than 5.5K, then it must be coordinated with Air Operations.
- Holding altitudes under tower control are 1.5, 2.5, 3.5, 4.5, 5.5.
- When aircraft spin, the Boss shall give them a heads up call that aircraft are holding at 1.5 (or lowest Lead).
- If two aircraft must be held at the same altitude due to WX, etcetera, one should be assigned one mile trail with the forward aircraft utilized as the primary hawk. If preferable, the aircraft may also be joined up, the lead being the primary hawk.

Leads

- Students in a non-bingo, non-emergency can go home themselves to a familiar field if they have bingo fuel for that field plus 600 lbs.
- Students shall be pumped 600 lbs for T-45 above bingo **FOR THE FIELD TO WHICH THEY ARE BEING LAUNCHED** when launched home.

Weather

- The minimum weather to have NATRACOM CQ at the ship is 1500/5; can be waived by ship's commanding officer with CNATRA's concurrence to 1000/5.
- Max CQ wind is 35 KTS.
- Downwind recovery should only be used in an emergency.
- T-45s can be worked to 120 miles from the bingo field.
- The winds must be within 7-knot crosswind component.
- The first aircraft launched to the ship for the day shall be a single lead and shall be the WX recce. The weather recce should be trapped and heavy pumped, then used as a lead safe.

SAR

- One SAR helicopter shall be airborne and a second aircraft shall be in a 30-minute alert status during all carrier air operations.

Hot Seat Evolutions

- Students shall have an arrested landing prior to being considered for a hot seat evolution.

Items to Watch

- The upwind pattern must be continuously watched as students will cut each other out. The Boss and Leads should keep track of who is in the pattern. While six aircraft are allowed in the pattern at one time, fewer aircraft in the pattern reduces fuel consumption per pass and aids in keeping SNA aircraft within sight of the tower. Four aircraft airborne in the pattern at one time is considered optimum for CNATRA CQ.

- It is not desirable to spin divisions of SNA's. Tower should hold the CATS when a division is charlied to allow the division lead the opportunity to break at .5 to 1 NM upwind.

- The Boss must watch the students in the break for loss of altitude. It is not uncommon to see students descending toward the water out of the break.

- Students have to be watched on deck to make sure they are following their directors. Flight directors should be briefed that students may not understand or follow their directions.

- All cat shots must be watched closely, especially the first shot for each student.

- Lead/Safe fuel states must be monitored closely.

- Ensure students on a bingo clean up and turn towards bingo field promptly.

- Keep aircraft in the spin pattern advised of the lowest holding Lead/Safe to avoid mid air potential.

T-45 BLOWN TIRE CONSIDERATIONS

The following items **at a minimum**, shall be briefed prior to attempting to recover a T-45 with a blown tire.

1. Field Arrestment

(a) Confirm blown tire(s), flap setting, hook position, fuel state, Hyd 1 pressure, anti-skid off. Confirm all emergency procedures complete.

(b) Winds & runway: ensure crosswind on good tire side. If > 5 kts on blown tire side, a tailwind recovery may be preferred.

(c) Arresting gear and lens location.

(d) Approach and pattern.

(e) LSO talkdown voice calls.

(f) Touchdown procedures (MRT, S/B's in, positive rotation) and importance of rudder inputs (full rudder opposite blown tire).

(g) Bolter procedures.

(h) Wave-off procedures.

(i) Arrestment.

(j) Loss of control/ejection.

2. Ship

(a) Confirm blown tire(s), flap setting, hook position, fuel state, Hyd 1 pressure, anti-skid off. Confirm all emergency procedures complete.

(b) WOD (from ARB's, nominally 20-35 kts).

(c) Pattern and approach.

(d) Importance of glideslope control.

(e) LSO voice calls.

(f) Touchdown procedures (MRT, S/B's in, positive rotation) and importance of rudder inputs (full rudder opposite blown tire).

(g) Bolter procedures.

(h) Wave-off procedures.

(i) Arrestment.

(j) Loss of control/ejection.

NATRACOM CQ AIRCRAFT INFORMATION

T-45A/C GOSHAWK

1. Dimensions:

Wing Span	30 ft 10 inch
Height	13 ft 6 inch
Length	39 ft 4 inch
Hook-to-eye	12.0 ft

2. Aircraft Weight:

Basic	10,403 lbs
Total fuel	3,012 lbs
Max trap fuel	2,947 lbs
Max trap gross weight	13,360 lbs

3. Fuel Statistics:

Carqual pump	3,012 lbs
Fuel per pass	150 lbs
Divert fuel (above Bingo)	600 lbs
Fuel flow on deck	600 lbs/hr
Bingo fuel (see Chapter II)	

4. Shipboard Operational Considerations:
   a. No barricades
   b. Full flap landing
   c. Full flap takeoff
   d. Catapult and trap at full fuel

PRESTART CHECKS

1. Batt 1 & Batt 2 .....ON
2. Batt 1.....OFF, (>24v), ON
3. Batt 2.....OFF, (>24v), ON
4. Seat.....ADJUSTED
5. Master Alert ..... OUT
6. Fire Light..... OUT
7. Paddle Switch.....PRESS
8. Warning Lts. OIL PRESS, HYD FL .....OXYGEN, GENERATOR
9. Caution Lts.....CANOPY, HYD1/2 LP PUMP, F PRESS AC INV NWS
10. Advisory Lts.....SKID, NWS

"ICS check, Lights, Tones"

11. Hyd/Brake ZERO/ZERO/1250
12. Gear Pos Lts..... GREEN
13. Flap Pos Lts..... AGREE
14. AOA .....NO FLAG
15. UHF FWD/AFT MIX .....SET
16. FUEL QUANTITY ..... CHECK

STARTING ENGINE

1. GTS Button ..... PRESS (GTS LT <20sec)
2. Engine Switch ..... START (READY LT <15SEC)
3. Throttle..... IDLE @15-20%
4. Monitor.....LT Out<15sec OIL PRESS LT OUT – 18% EGT 350-450C (550+20) RDY/GTS/GEN OUT – 45% (<61%) RPM 52% W/IN 30SEC
5. Voltmeter ..... CHECK (27-29v)
6. HUD/MFD/Radio/TCN/VOR ...ON
7. IFF.....STBY
8. OBOGS/Anti-G..... ON-TEST
9. OBOGS Flow/Mask.....ON
10. ECS Selector Switch ..... NORMAL

POSTSTART

"Clearance on Request"

1. Throttle..... Advance to 70%
2. HYD 2...RESET (All HYD@3000)
3. Fuel Control .....Manual (<5% Dec/ M FUEL Light)
4. Fuel Control .....NORM
5. Throttle.....IDLE (55±2%)
6. Menu/BIT/Mant

"No exceedances or overflows"

7. Menu/Data/Acft

"GPS 4 SATs/Align Countdown"

If alignment no down – Verify A/C Wypt zero correct (if not fix)
When heading info displayed…

8. Paddle Switch.....PRESS
9. C Aug Lt.....CHECK ON
10. C Aug Sw..... RESET (Lt Out) Ck Rudder Trim@ 12o'clock)
11. C Aug Sw .....ALL (Lt ON) (C AUG Lt Out w/in 120sec)

ATIS/Copy Clearance

12. Ck Trim (include STBY).... 2-3 NU
13. Aileron Trim.....CHECK
14. Stby Att Gyro .....ERECT
15. Altimeter.....SET
16. ADI.....Pitch Set/Compare
17. BIT Display .....CHECK
18. RADALT.....BIT/GOOD TONE
19. LAW.....SET 200ft
20. BINGO .....SET
21. Waypoints.....PROGRAM
22. Rudder Trim..(C AUG out) ...CHK
23. Nav Source (HYBD) ..... SET
24. Flight Controls..... Full Throw
25. NWS.....DISENGAGED

4 Down (Hook, Bar, Flaps, Boards)

HANDS OUT

3 Up (Flaps @ Half)

"Canopy" .....DOWN

TAXI

1. Parking Brake .....RELEASE
2. Brakes.....CHECK
3. Parking Brake .....SET

FINAL CHECK – HANDS OUT

4. Parking Brake .....RELEASE
5. NWS.....LT ON
6. Instruments .....CHECK

TIGER BASE: "…out of chocks"

Marshall – Clnc, ATIS, NAV, Inst, T/O

INSTRUMENT CHECK

1. Nav Equip.... CK/VERIFY WYPTS
2. VOR/TCN ..... SET/LOCK
3. Cockpit Lts ..... SET
4. Airspeed/VSI.....CK PRIM/STBY
5. ADI.....AS DESIRED
6. Altimeter.. SET, CK PRI/SBY/AFT
7. Wet Compass.....FREE
8. HUD/HSI/ ADI.....CK HDGS
9. Turn Needle Ball .....CK ON/TAXI

TAKEOFF CHECK

1. Control Aug.....ALL, LIGHT OUT
2. Anti-Skid ..... ON, LIGHT ON
3. Flaps/Slats .....HALF, SLATS OUT
4. TRIM..... 0, 0, 2-3NU
5. Canopy ..Clsd,Lckd,Lt Out, Arrows
6. Harness .....CONNECTED

I'm attached 8 points, pins removed ready to go hot in the front

I'm attached 8 points, pins removed ready to go hot in the back

7. Seats ..... ARM

"Hot in the Front - Hot in the Back"

Call for Taxi
Complete prior to Switching Tower
Clearance, **A**tis, **N**av set, **I**nst &**T/O**

BEFORE HOLDSHORT

1. Pitot Heat..... ON
2. IFF ..... NORM
3. Taxi Lt ..... ON
4. Strobes ..... ON
5. VCR..... ON
6. BIT Page.....CHECK

Call for Takeoff (#1 @ holdshort)
"Groove clr, winds are.. T/O Ck comp

RPM CHECKS

OAT (Deg F)	Min N2 RPM
Above 50	97%
37 to 50	96%
21 to 36	95%
9 to 20	94%
-5 to 8	93%

LIFT OFF SPEEDS

Weight/Fuel	Half	Full Flap
11,000/ 0.5	113	99
12,000/ 1.5	119	104
13,000/ 2.5	124	108
14,000/ 3.0	127	111

10,000FT – 15MIN check

1. Flt Eng Instruments.....CHECK
2. Cabin Press .....CHECK
3. Fuel State .....CHECK
4. LAW..... Ck set @ 5000'
5. Location/ Navaid Set .....CHECK

PRE-STALL/AERO CHECK

1. Harness ..... AS DESIRED
2. FOD.....SECURE
3. Map Case .....SECURE
4. Fuel State .....CHECK
5. AREA .....CLEAR

DESCENT/ PEN CHECK

1. Defog & C/P Temp..... AS REQ
2. Master ARM ..... SAFE
3. Control Aug ..... ALL
4. Weather/Field Cond.....CHECK
5. NAVAIDS ..... TUNED/ID
6. Stby Att/Alt..... ERECT/SET
7. LAW..... SET
8. MFDs/HUD ..... SET & X-CHECK
9. Fuel State .....CHECK
10. Marker BCN ..... AS DESIRED
11. IFF .....CHECK
12. Approach CLNC Time .....IF REQ

Descent/Penetration checks complete

MISSED APPROACH

1. TACAN .....AS REQUIRED
2. NAV Source .....VERIFY
3. Course.....VERIFY
4. RADALT.....RESET

LANDING APPCH SPEED

Weight/Fuel	Full	Half	NF
11,000/ 0.5	114	132	151
11,500/ 1.0	116	135	154
12,000/ 1.5	119	138	157
12,500/ 2.0	121	141	161
13,000/ 2.5	124	143	164

LANDING CHECK

1. Gear.....DOWN
2. Flaps/Slats .FULL/HLF/UP/DOWN
3. Hook ..... UP/DOWN
4. Harness.....LOCKED/UNLOCKED
5. Speedbrakes ..... OUT/IN
6. Anti-skid .... ON(LT) /OFF(NO LT)
7. On Speed is .....XXX Kts

"Landing Checklist Complete"

ROLLOUT SPEEDS

Distance Remaining.....	Target Speed
5000'	100KTS
4000'	80KTS
3000'	60KTS

AFTER LANDING

"Ready to safe the seat"

1. Seats ..... SAFE
2. Boards .....IN
3. Flaps/Slats .....UP
4. Pitot Heat .....OFF
5. IFF.....OFF
6. Taxi Lt..... AS DESIRED
7. Strobes .....OFF
8. VTR .....OFF
9. BIT Status ..... NOTE
10. Menu/BIT/MANT.....

"no exceedance or overflows"

11. IFF/NAV/HUD .....OFF

Except Radios

Call for Taxi
"Post Landing Checks complete"
BASE: "…1XX, in and up/down"

12. Unstrap (when cleared)

BEFORE ENGINE SHUTDOWN

1. Parking Brake .....SET
2. NWS .....OFF
3. Menu/Bit/GINA PWR .....OFF
4. MFDs/Radios .....OFF
5. OBOGS Flow.....OFF
6. OBOGS/Anti-G .....OFF
7. Idle RPM..... w/in ±2%

"All of my equipment is off, I'm clear of the canopy after shutdown"

8. Throttle.....OFF
9. Canopy (45sec delay).....UP
10. Fuel Shutoff Handle.....PULL
11. All Remaining Switches .....OFF
12. Batteries .....OFF

POWER SETTING

300 Kts	1800pph
250 Kts	1400pph
200 Kts	1100pph
150 HF Dirty	2400pph
150 FF Dirty	2600pph
On Speed SB in	
HF	1800pph
FF	2100pph
On Speed SB out	
HF	2600pph
FF	2900pph

PENETTATIONS

250Kts Clean	500pph
	2500fpm
	2nm/1000'
250Kts SB	500pph
	6000fpm
	1nm/1000'

Max Glide Range
IDLE (500pph) 180kts
12-13 units 3-4nm/1000'

Facilities		TCN	VOR	LOC
McCain	NMM	56		109.7
Meridian	MEI	117	117.0	110.1
Kewanee	EWA	85	113.8	
Tuscaloosa	TCL	125	117.8	
Brookwood	OKW	47	111.0	
Semmes	SJI	100		
Bigbee	IGB	109	116.2	
Colombus	CBM	99	115.2	109.3
Jackson	JAN	73	112.6	110.5
P-cola NAS	NPA	119		
P-cola Reg	PNS			111.1
Saufley	NUN		108.8	
Maxwell	MXF	97		109.3
Sidon	SQS	94	114.7	

T-45 Freqs

1.	NMM Clearance	274.8
2.	NMM Ground	336.4
3.	NMM Launch	360.2
4.	MEI Departure	343.7
5.	Memphis Center	263.0
6.	Area 1	289.9
7.	Area 2/3	285.2
8.	ATL Center	270.25
9.	ATL Center	352.8
10.	Pine Hill MOA	280.1
11.	IR-044	362.6
12.	NMM SFA	325.2
13.	NMM SFA	328.4
14.	MEI APP West	276.4
15.	NMM Land	340.2
16.	NJW Tower	279.2
17.	MEI APP East	374.9
18.	MEI APP South	269.6
19.	AREA 4	282.1
20.	R4404(P)	227.825
21.	MEI Tower	257.8
22.	TAC 22	225.85
23.	TAC 23	377.25
24.	TAC 24	237.8
25.	TAC 25	201.35
26.	TAC 26	279.45
27.	TAC 27	299.25
28.	TAC 28	316.4
29.	Eagle Base	356.1
30.	NMM ATIS	273.2

GCA Gouge

AOB: 30° Base, 20° Dogleg, 10° Final
Dirty Up
W/in 10nm & 30 radials rwy hdg
200kts Clean – 1100pph
HF 150kts – 2400pph
O/S – w/in 30° Final Course
HF, SB in – 1800pph
FF, SB in – 2100pph
Pop SB on Glideslope for half G/S ROD
Add 5 clicks nose down trim

AEROBATICS	KIAS	PWR(acft)
SPLIT-S	180	IDLE
AILERON ROLL	300	89%
BARREL-ROLL	350	92%
WINGOVER	300	89%
LOOP	380	96%
IMMELMANN	380	96%
CUBAN-8	380	96%

KNMM Stuff

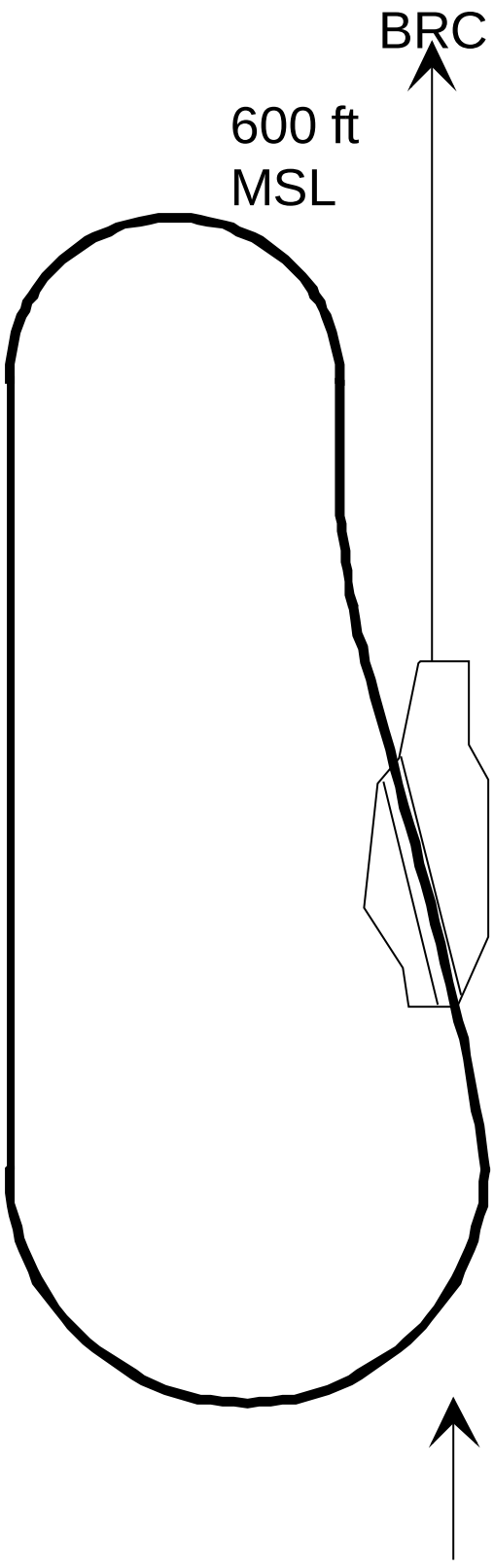
FOGGY NMM 007/10
HORNE NMM 273/10
SONI NMM 315/10
PIGMY NMM 328/28
MEI MSA 2700FT
VT-9 PH 679-2330

MANUAL FREQ

FSS	255.4
VT9 BASE	348.0
GUNSHY	325.8
CBM APP	226.0
PCOLA APP	270.8
SHER TWR	340.2
SHER GND	336.4

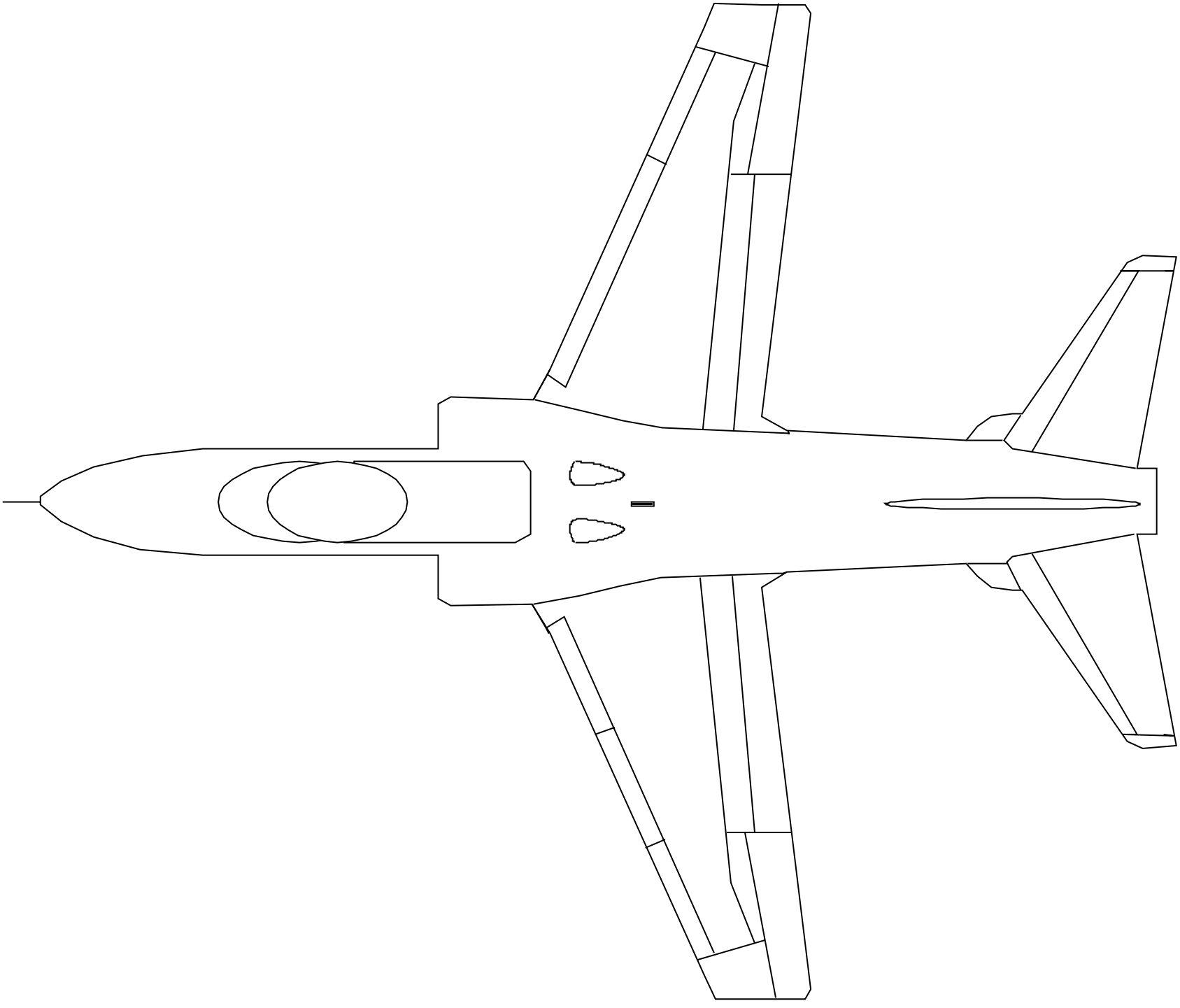
Dest WX	Alternate Weather		
0-0 up to but not. Pub mins	3000-3 or better		
Pub Mins up to but not incl 3000-3 (single pilot absol mins 200-1/2)	Non Precision	Precision	
		ILS	PAR
	Pub mins plus 300-1	Pub mins plus 200-1/2	Pub mins plus 200-1/2

T-45C Goshawk

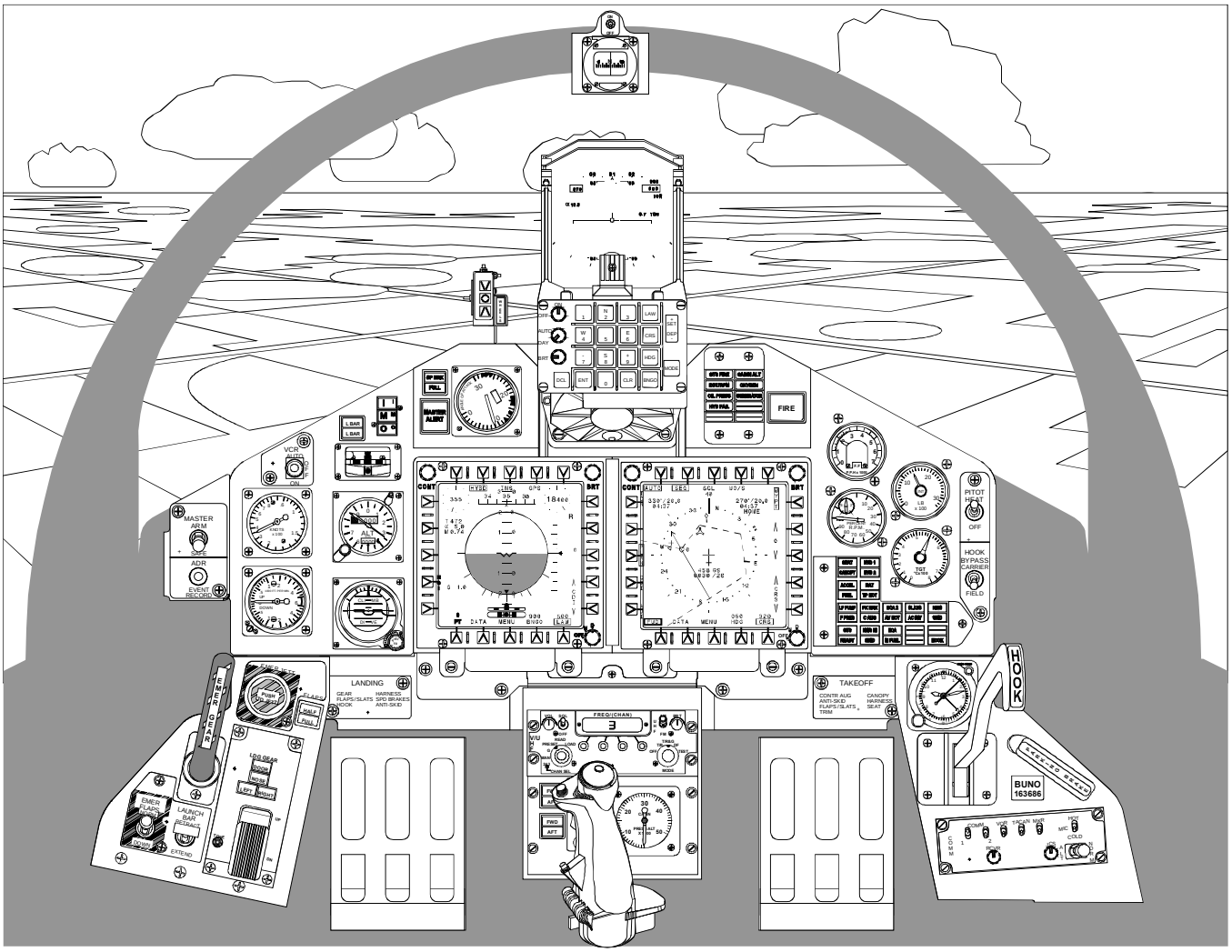


Approach Waveoff

WAVEOFF AND BOLTER PATTERN



T-45C — FLAMEOUT - INSTRUMENT INDICATIONS



T-45C — NORMAL - INSTRUMENT INDICATIONS

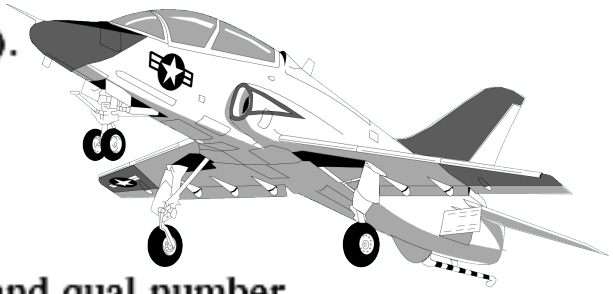
Carrier Pattern

a. Pilot controlled pattern

b. Break
   (1) 800 feet AGL 300 KTS with each succeeding A/C at a 15-second interval (20 seconds if hook down)
   (2) Level break on the instruments.
   (3) Descend to 600 feet when downwind.

c. Downwind
   (1) Landing checks - harness locked, anti-skid off, anti-smash light off, and hook up/down
   (2) AOA check
   (3) Report abeam with qual number, gear, flaps full, fuel state, qual number. Qual number only will be reported on subsequent passes.

d. Approach Turn
   (1) Abeam position. Lead should set proper distance abeam (1 to 1.1 NM).
   (2) Turn abeam LSO platform.
   (3) 90-degree position: 450 feet AGL.
   (4) 45-degree position: 325 - 375 feet AGL.
   (5) Cross wake at 300 - 350 feet AGL.
   (6) Do not look for ball early.
   (7) Ball acquisition - check VSI and adjust (500-600 FPM).
   (8) Radar altimeter no lower than 300 feet without a ball.
   (9) Fly the numbers - will appear close and steep.



e. Glideslope
   (1) Work for good start.
   (2) Call the ball: side number, Goshawk ball, fuel state, and qual number.
   (3) Meatball, lineup, angle of attack
   (4) Fly the ball all the way to touchdown. Landing should be a surprise. MRT and S/B retracted upon touchdown.
   (5) Stress lineup with recorrections to touchdown.
   (6) Do not spot the deck.
   (7) Never accept a low ball.

Arresting Gear

Fresnel Lens

Catapult #3 & #4

LSO Platform

Elevator #4

Foul Deck Line

Catapult #2

Catapult #1

Centerline

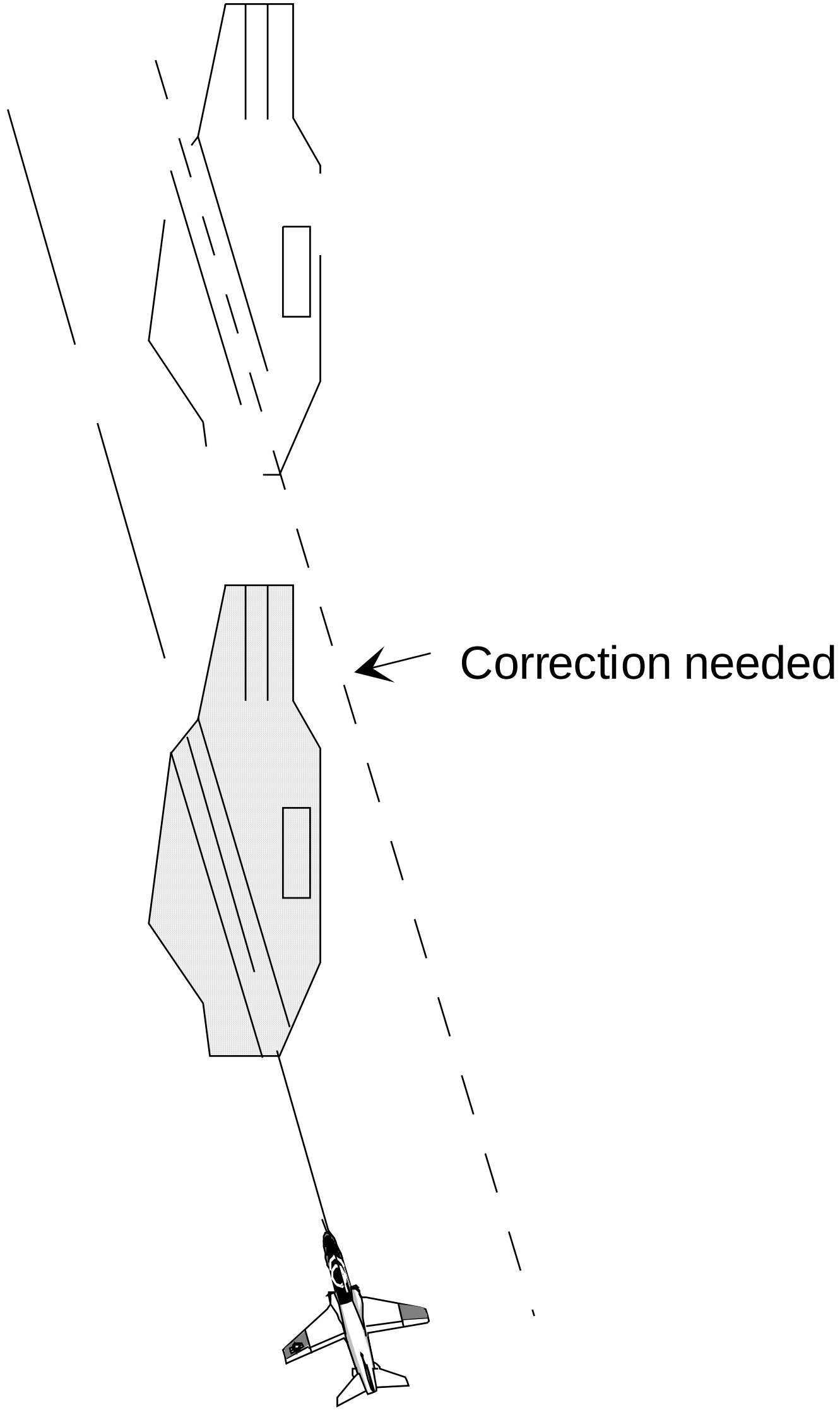
Elevator #3

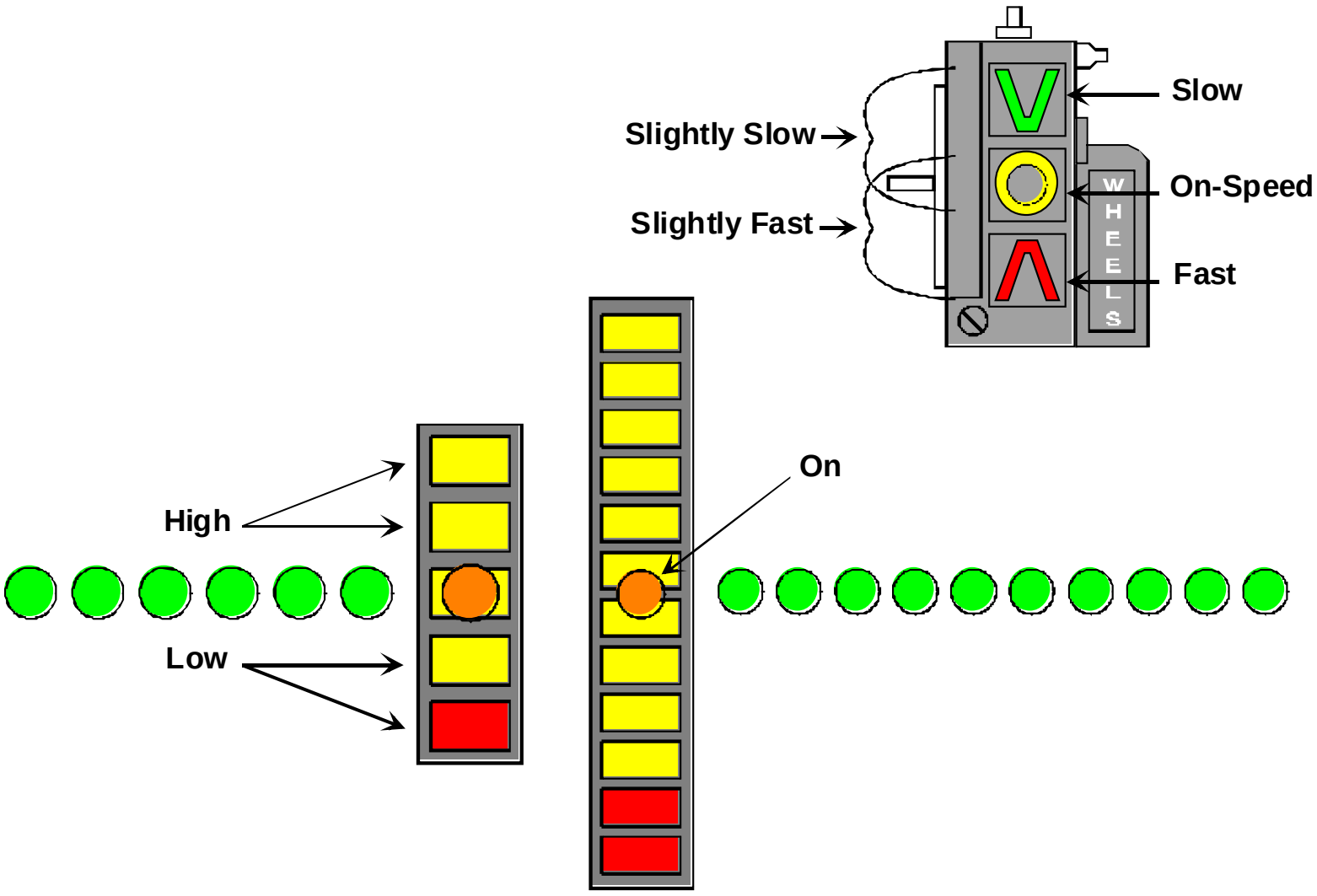
Elevator #2

Elevator #1

Hatch to Flight Deck Control (Outboard)

CARRIER DECK ARRANGEMENT - USS KITTY HAWK

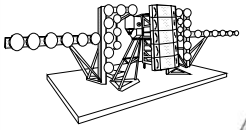

Correction needed



GLIDESLOPE INDICATIONS

Goshawk T-45C

TURN DOWNWIND
Interval's Hook Down, 7 o'clock

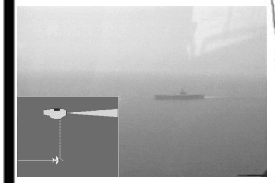


BREAK
On Interval or No Earlier Than 1 nm
Wingman: 15 sec Interval

DOWNWIND
600 ft On-Speed
Airspeed Check
Landing Checks
Trimmed Up

TOUCH & GO/BOLTER
Climb, Turn to Parallel BRC

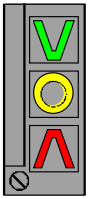
INITIAL
3 nm Astern
800 ft
250-300 KIAS



.9 - 1.1 nm

ABEAM CALL

BALL CALL



ABEAM
600 ft
Establish
VSI: 200-300 fpm
27-30° AOB

"Flying the ball" properly all the way down to an OK three-wire landing on the deck of an aircraft carrier is what separates Navy pilots from all other pilots. However, before you will be allowed to recover aboard an aircraft carrier, you will need to demonstrate safe and consistent landings during field carrier landing practice (FCLP). The pattern you will fly at the field is almost exactly the same as the one for the ship. Through repetition in the simulator and in the aircraft, you will establish a feel for properly correcting approach deviations and because your performance during FCLPs will normally mirror your performance at the ship, you want to do the best you can during FCLPs. Mastery of landings during FCLP will lead to an efficient transition to carrier landings, making your carrier qualification hops at the ship an enjoyable experience.

LANDING APPCH

Weight/Fuel	Full Flap
11,000/ 0.5	114 KIAS
11,500/ 1.0	116
12,000/ 1.5	119
12,500/ 2.0	121
13,000/ 2.5	124

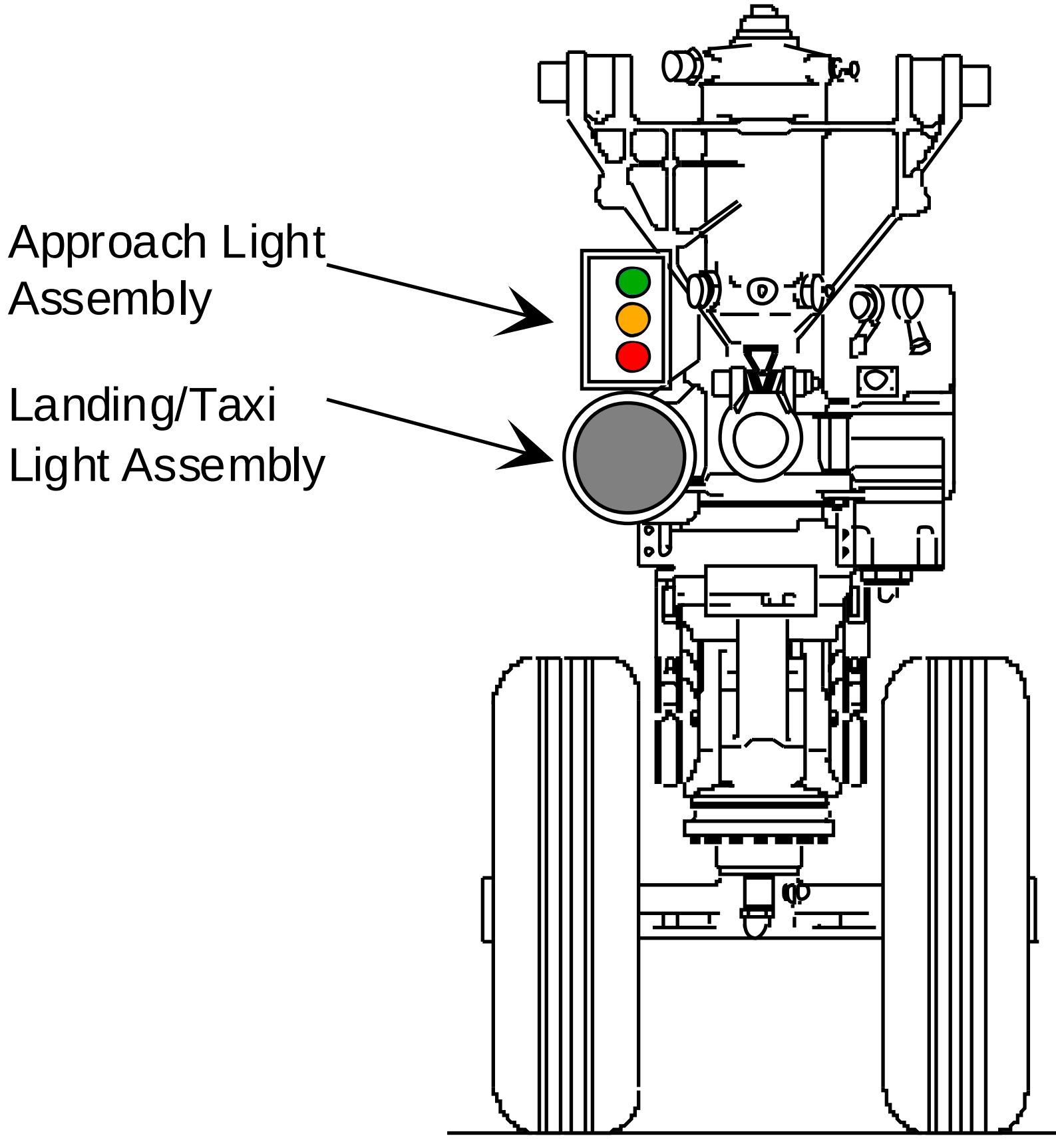
45
325-375ft

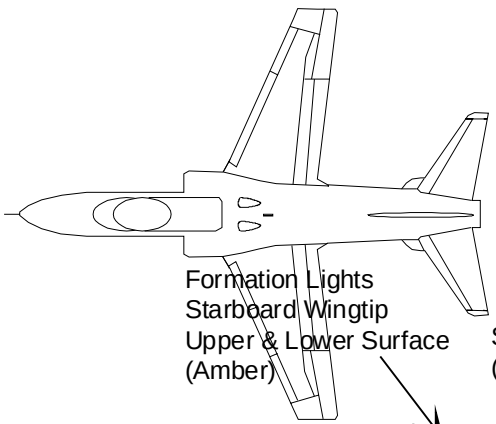
45°

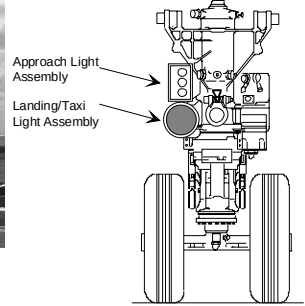
90
450 ft
27-30° AOB
VSI: 500 fpm

90°

Carrier Landing Pattern


Approach Light Assembly
Landing/Taxi Light Assembly





Formation Lights Starboard Wingtip Upper & Lower Surface (Amber)

Strobe (White)

Anti-Collision Light (Red)

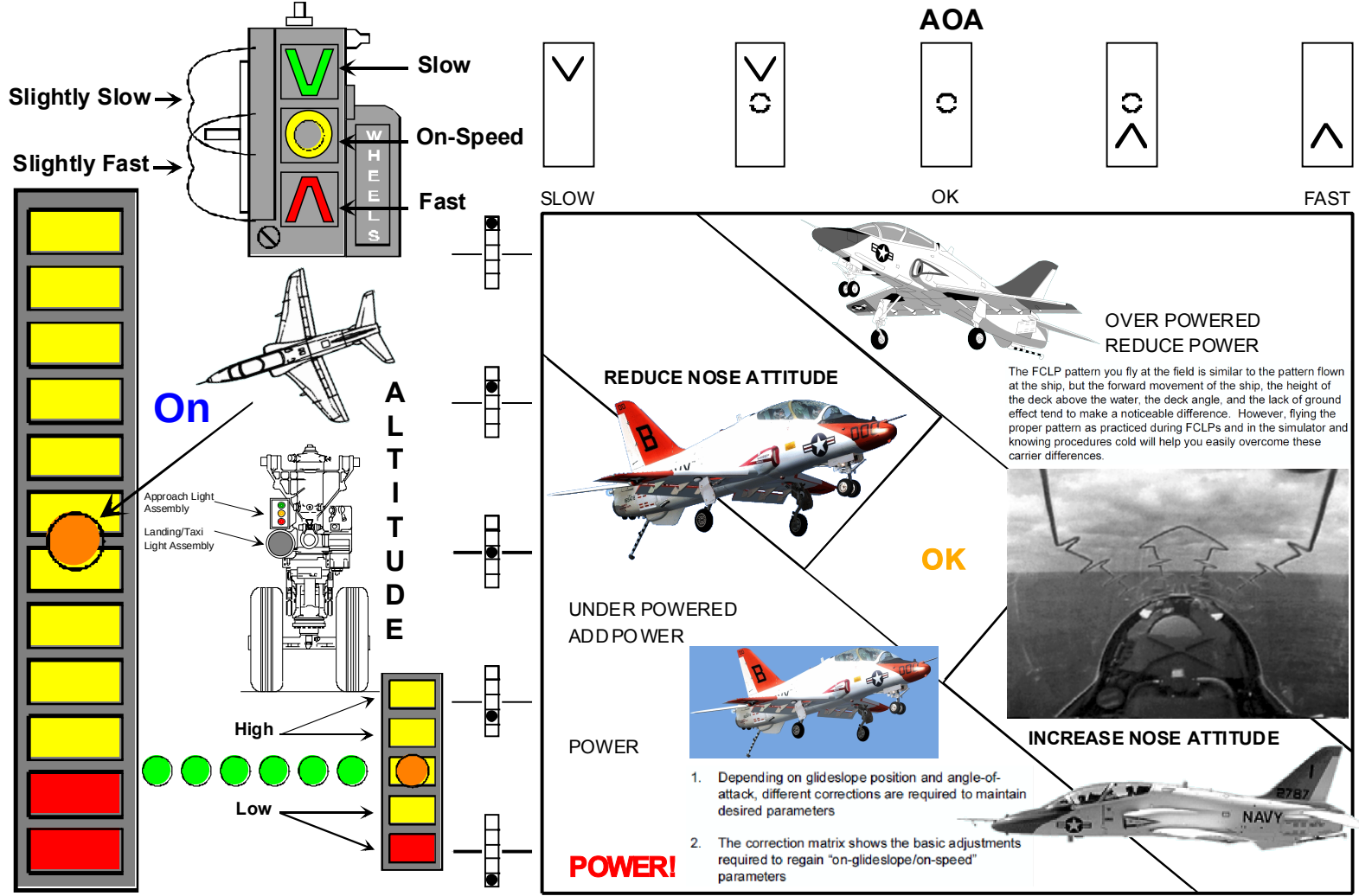
Tail Navigation Light (White)

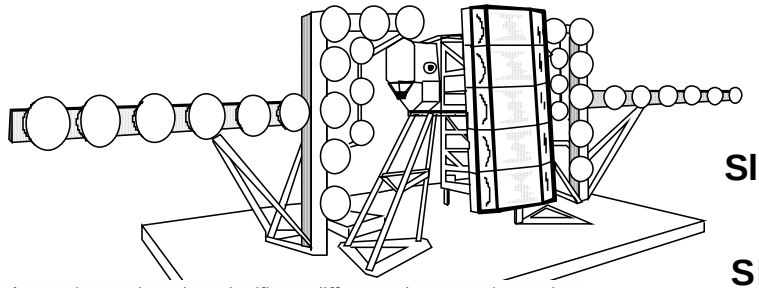
Starboard Navigation Light (Green)

Formation Lights Port Wingtip Upper & Lower Surface (Amber)

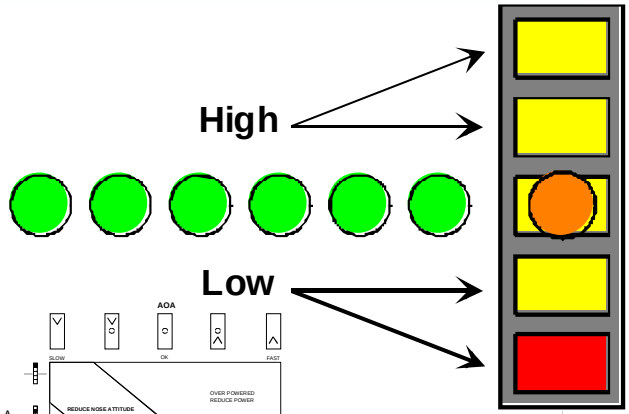
Anti-Collision Light (Red)

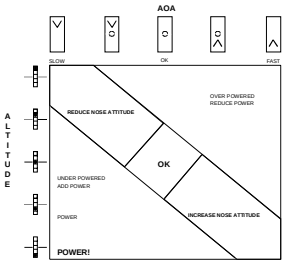
Port Navigation Light (Red)


AOA
Slightly Slow
Slightly Fast
Slow
On-Speed
Fast
WHEELS
SLOW
OK
FAST
On
ALTITUDE
Approach Light Assembly
Landing/Taxi Light Assembly
High
Low
REDUCE NOSE ATTITUDE
OVER POWERED
REDUCE POWER
The FCLP pattern you fly at the field is similar to the pattern flown at the ship, but the forward movement of the ship, the height of the deck above the water, the deck angle, and the lack of ground effect tend to make a noticeable difference. However, flying the proper pattern as practiced during FCLPs and in the simulator and knowing procedures cold will help you easily overcome these carrier differences.
OK
UNDER POWERED
ADD POWER
POWER
INCREASE NOSE ATTITUDE
1. Depending on glideslope position and angle-of-attack, different corrections are required to maintain desired parameters
2. The correction matrix shows the basic adjustments required to regain "on-glideslope/on-speed" parameters
POWER!
NAVY

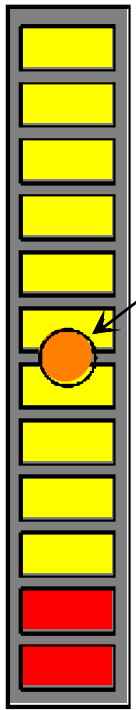


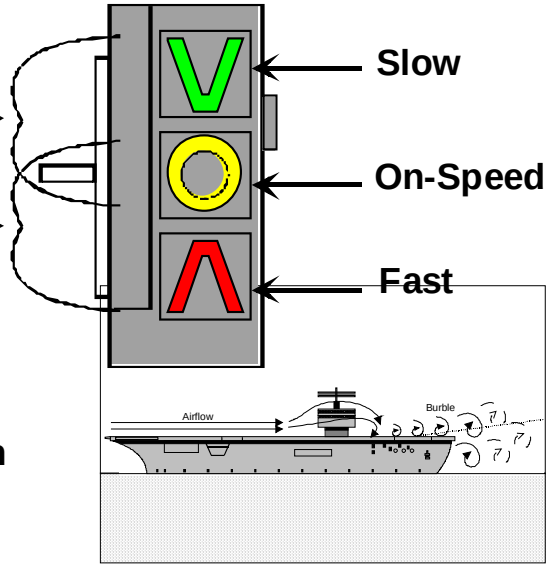
As you know, there is a significant difference between day and night flying. At night during FCLP, you will not have reference to the horizon and other peripheral cues that you were able to use during the day. Even though you will not be doing night landings on the carrier before you are assigned to the Fleet Replacement Squadron (FRS), the additional practice you get performing night FCLPs now will enhance your instrument scan.



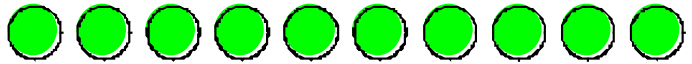


The goal of every Naval officer who is selected for jet pilot training is to become a tactical carrier pilot. Carrier pilots are the best because they must be the best: the carrier environment will not tolerate anything less. Landing and launching aircraft, moving equipment, and personnel in a relatively small area requires precise coordination for safe operation. Handling aircraft on a flight deck is more complicated than at the field due to the high winds across the deck, the proximity of the deck edge, and the ship's movement. Successful and safe operations in and around the carrier depend on a coordinated team effort in which all team members do their job properly. There is no excuse for not knowing and not using correct procedures around the ship, and there are no exceptions to this rule!





On



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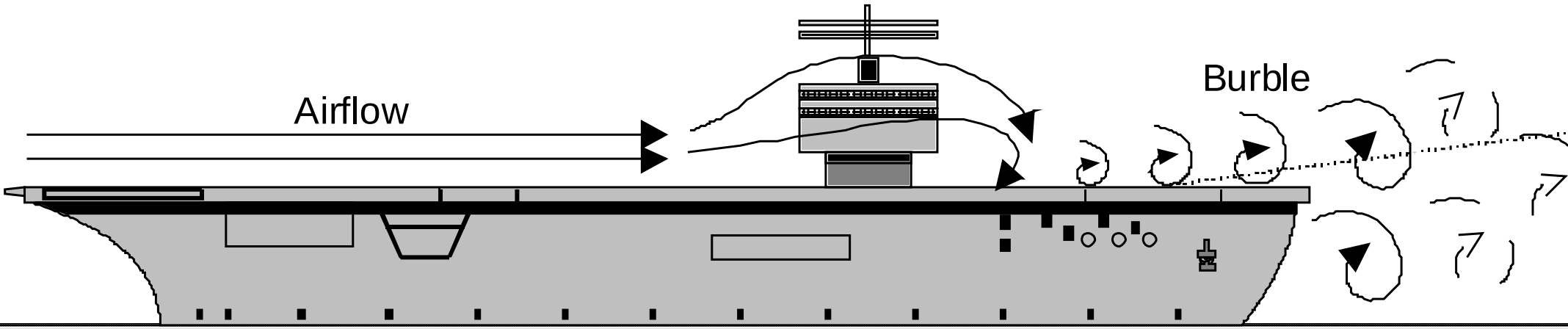
BURBLE



INTERIOR PREFLIGHT

WINDSCREEN/CANOPY ..... CHKED

MDC FIRING PIN……REMOVED
SEAT PIN……REMOVED
GUST LOCK ..... STOWED
EJECTION SEAT .....INSPECTED
(1) SAFE/ARM .....SAFE
(2) EMERGENCY RESTRAINT RELEASE .... DOWN &LOCKED
(3) EMERG O2.....OFF
(4) EMERG O2 PRESS .. 1800-2500#
(5) LEG REST .....PROP ROUTE
(6) ELT/OXYGEN LANYARDS..... CONNECTED
(7) CAT MAN VALVE..... ..... SECURE /PIN INSTALLED
(8) TOP LATCH .....FLUSH
(9) ELECTRONIC SEQ.....BLACK
(10) CHUTE W/DRAW LINE .....SECURED

STRAPPING IN

THROTTLE.....OFF
LDG HANDLE .....DOWN
PRAKING BK ..... SET
RUDDER PEDALS ..... ADJ
NO BINDING
O2 & G-SUIT HOSES .. CONNECTED
KOCHS / LEG RES .....SECURE/ADJ

INTERIOR CHECK

OBOGS FLOW.....OFF
OBOGS/ANTI-G .....OFF
FUEL SHUTOFF .. DOWN&LOCKED
CONTR AUG.....SBI
IGNITION..... NORM
ENGINE .....ON
FUEL CONTROL ..... NORM
RUDDER TRIM.....NEU
STBY STAB TRIM .....GUARDED
THROTTLE FRICTION .....OFF
THROTTLE.....OFF
EXT LIGHT MASTER ..... AS REQ
FLAPS/SLATS .....UP
ANTI-SKID.....ON
ARMAMENT .....OFF/SAFE
EMERG FLAP ..... NORM
EMERG GEAR .....IN
LDG HANDLE ..... DOWN
UHF/VHF 1 .....OFF
LAUNCH BAR .....RETRACTED
HUD .....OFF
AOA IND/INDEX.....OFF/FLAG
VSI .....ZERO
ADI.....MARKED
SAHRS.....OFF
SAHRS LAT.....27°
CABIN ALT .....CHECK
RADALT .....OFF
G-METER ..... RESET
CLOCK.....SET/RUNNING
HOOK ..... CORRESPONDS
A-COLL/STROBE ..... A-COLL
INT LIGHTS.....AS DESIRED
COMM PANEL .....AS DESIRED
UHF/VHF 2 .....OFF
VOR.....OFF
TACAN .....OFF
IFF .....OFF
COCKPIT A/C...NORM/AS DESIRED
BATT.....OFF
AC RESET ..... CNTR
GEN.....ON
NAV TRNG SWTs.....NORM
HOOK BYPASS.....AS REQ
EXT LIGHTS.....AS REQ
PITOT HTR .....OFF

AFT COCKPIT INT CHECK

1ST 8 STEPS COMP PRI TO ENG START
EJECT SELECT.....AS REQ
SEAT LIGHT SWT.....NORM
ENG SWT.....ON
STBY STAB TRIM ..... GUARDED
FUEL CONTROL .....NORM
ANTI-SKID .....ON
EMERG FLAP.....NORM
FLAPS/SLATS..... UP

OBOGS FLOW.....OFF
RUDDER TRIM .....NEU
EMERG GEAR.....STOWED
LDG HANDLE.....DOWN
UHF/VHF 1 .....OFF
MSTR ARM OVRD .....NORM
RTCL .....OFF
AOAIND/INDEX ..... OFF/FLAG
VSI..... ZERO
ADI ..... MARKED
CABIN ALT .....CHKED
RADALT .....OFF
G-METER ..... RESET
CLOCK.....SET/RUNNING
HOOK ..... UP
INT LIGHTS.....AS DESIRED
COMM PANEL .....AS DESIRED
UHF/VHF 2 .....OFF
VOR.....OFF
TACAN .....OFF
AC RESET ..... CNTR
GEN.....ON
VCR.....OFF
VCR MOD ..... SECURE

PRESTART CHECK

BATT ..... ON
BATT 1 OFF 24-29VOLTS
BATT 1 ..... ON
BATT 2 OFF 24-29VOLTS
BATT 2 ..... ON
SEAT..... ADJUSTED
ICS ..... CHKED
FUEL QTY..... FULL/3000#
MSTR ALERT..... OUT
ADVISORY PANEL ..... ANTI-SKID
FIRE WARNING ..... OUT
WARNING LIGHTS ..... 4 RED
CAUTION LIGHTS..... 6 AMBER
LT/TONE/AOA IND..... CHKED
HYD 1& 2 PRESS ..... ZERO
BRAKE PRESS 1250MIN
FLAP IND ..... CORRESPONDS
GEAR POSIT LIGHTS ..... 3 GREEN
COMM/NAV XFER..... AS DESIRED
AOA ..... NO OFF FLAG
CANOPY..... AS DESIRED

ENGINE START

GTS START SIGNAL
GTS START
BUTTON ..... PRESS MOMENT
GTS LIGHT WITHIN 20 SEC
ENG START SWT ..... START
ROTATION LIGHT WITHIN 15 SEC
THROTTLE*(15-18%RPM)* ..... IDLE
LIGHT OFF WITHIN 15 SEC
OIL PRESS LIGHT OUT 18%
GEN, GTS , ROTATION OUT 45%
MAX EGT 550C
EGT STABLE AT ..... 450°C
RPM STABLE AT ..... 52%+-2
VOLTS 27-29VDC
SAHRS..... SLV
HUD ..... ON/SET BRT
RADALT ..... ON/SET 200'
UHF/VHF 1& 2..... ON
VOR ..... ON
TACAN..... ON
IFF..... STBY
OBOGS/ANTI-G SWT ..... ON

POST START

RUN UP SIGNAL
THROTTLE..... > SLOWLY TO 70%
FUEL CONTROL ..... MANUAL
RPM < 6% /ADVISORY LIGHT ON
FUEL CONTROL ..... NORM
LIGHT OUT->RPM
HYD 2 ..... RESET
HYD 2 PRESS..... 3000PSI
THROTTLE..... IDLE

POSITIVE BLEED VALVE CLOSURE
RPM > 3% / EGT<50°C
ADI/HSI NO OFF FLAGS
EGT/RPM..... 400-450°C/55%+-2
CONT AUG BIT ..... PERFORM
(1) PADDLE SWTMOMENT PRESS
CONT AUG LIGHT ON
(2) CONT AUG..... RESET >SBI
CONT AUG LIGHT OUT
(3) CONT AUG..... ALL
CONT AUG LIGHT ON 120SEC MAX

PERFORM NEXT 4 STEPS DURING CONT AUG BIT
ATIS ..... RECORD(UHF BTN 30)
ALTIMETER..... SET
CLNC ..... COPY(UHF BTN 29)
SQUAWK ..... SET

RUDDER TRIM ..... CHKED/NEU
STAB/STBY TRIM ..... CHKED/SET
2 - 3 °NOSE ↑
AILERON TRIM..... CHKED/NEU
STANDBY GYRO ..... ERECT
OBOGS BIT ..... TEST
02 MASK ..... ON / FLOW
ANTI-G..... TEST
GIVE THUMBS UP TO PC
FLIGHT CONT ..... FREE/FULL
NWS ..... ENGAGE
S/B ..... EXT
2 ADVISORY LITES ON
FLAP/SLAT ..... FULL/DOWN
HOOK..... DOWN
WARNING LIGHT ON
LAUNCH BAR..... EXT
ADVISORY LIGHT ON
HANDS UP FOR CHECKER
S/B ..... RETRACT
2 ADVISORY LIGHTS OUT
FLAPS/SLATS..... RETRACT ½
CHK IND FOR ½ FLAPS
HOOK..... UP
WARNING LIGHT OUT IN 6 SEC
LAUNCH BAR..... RETRACT
ADVISORY LIGHT OUT
PARKING BRAKE ..... RELEASE
BRAKE CHECK
PRAKING BRAKE ..... SET
HANDS UP FOR FINAL CHECKER

TAXI

PRAKING BRAKE ..... RELEASE
NWS ..... CHK
FLT INST ..... CHK/SET
CALL OUT OF CHOCKS UHF BTN 1
CALL FOR TAXI UHF BTN 2
PITOT HTR ..... AS REQ

INST CHECKLIST

COMM/NAV EQP ..... CHKED/SET
NAV ..... SET
LOCAL
NQI - 125X
LRD - 121X/117.4
CKPIT LGTING ..... SET
VSI ..... ZERO
MACH/ASP IND ..... ZERO
ADI ..... SET
ALTMETER ..... CHKED/SET
CLOCK ..... SET/RUNNING
STBY COMPASS ..... FREE
HUD/HSI/ADI ..... MARK HEADINGS
NO OFF FLAGS
TURN NEEDLE ..... CHKED

TAKEOFF CHECKLIST

CONT AUG ..... ALL
ANTI-SKID ..... ON
FLAP/SLATS ..... ½
TRIM ..... SET
(1) RUDDER/AILERON ..... 0/0°
(2) STAB ..... 2 -3°↑
CANOPY ..... CLOSED&LOCKED
LIGHT OUT !!!
HARNESS ..... CONN/LOCKED
SEAT ..... ARMED
CALL FOR TAKEOFF (UHF BTN 3)
IFF ..... NORM
STROBE ..... ON
T/O TIME ..... NOTE
PITOT HEAT ..... ON

INST TAKEOFF

LINED UP WITH R/W CENTER LINE
LAST CHANCE TURN NEEDLE CHECK
HSI/ADI/SAHRS ..... ALIGNED./SLV
WITHIN 10° OF R/W
IFF ..... NORM
PITOT HEAT ..... ON

MRT CHECK

THROTTLE ..... MRT
ACCLERATION 645 ℃ FOR 20 SEC
MAX THEN 600 ℃- 104%RPM
ANTI-SKID LIGHT ..... ON
WARN/CAUT LIGHTS ..... OUT
FLT CONT ..... FREE
HYD 1 & 2 ..... NORM
3000PSI
VOLTS 27-29VDC
ENG INST ..... CHKED
OAT ℃ ..... N2 MIN RPM
> +50 ℉ 97%
+37 °- +50 ℉ 96%
+21 °- 36 ℉ 95%
+9 °- +20 ℉ 94%
-5 °- +8 ℉ 93%
-15 °- -6 ℉ 92%

LIFT OFF SPEEDS T-45C

Weight/	Fuel	Half	Full Flap
11,000/	0.5	113	99
12,000/	1.5	119	104
13,000/	2.5	124	108
14,000/	3.0	127	111

LANDING APPCH SPEED

Weight/Fuel	Full	Half	NF
11,000/ 0.5	114	132	151
11,500/ 1.0	116	135	154
12,000/ 1.5	119	138	157
12,500/ 2.0	121	141	161
13,000/ 2.5	124	143	164

10,000FT/15 MIN REPORT

ALL INSTRUMENTS ..... CHKED
CABIN ALT ..... CHKED
FUEL STATE ..... NOTE #s
HYD 1 & 2 ..... NORM
VOLTS ..... NORM

DESCENT/PENETRATION

ARMAMENT PANEL ..... OFF/SAFE
CONT AUG ..... ALL
DEFOG/COCKPIT TEMP ..... AS REQ
ATIS ..... CHKED
NAVAIDS ..... TUNED/ID
SAHRS ..... CHKED/ALIGNED
ALTIMETER ..... SET
RADALT ..... SET/(5000/*platform)*
FUEL ..... NOTE #s
HYD 1& 2 ..... NORM
VOLTMETER ..... NORM

LANDING CHECKLIST

GEAR ..... DOWN/LOCKED
FLAPS/SLATS ..... AS REQ\
HOOK ..... AS REQ
HARNESS ..... LOCKED
SPEED B/KS ..... AS REQ
ANTI-SKID ..... AS REQ
BRAKE PRESS LIGHTS ..... OUT
AOA/ON SPD ..... NOTE SPD

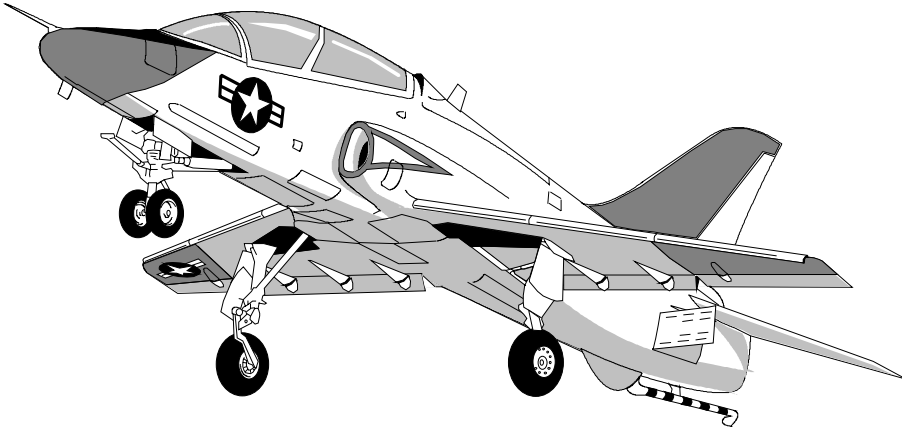
	F/F	½ F	NF
1000	116	134	153
2000	121	140	160
3000	127	145	167

CLEAR OF RUNWAY

SEAT ..... SAFE
S/B ..... RETRACTED
FLAPS/SLATS ..... UP
TRIM ..... ZERO
NAV/IFF ..... OFF
HUD ..... OFF
PITOT HEAT ..... OFF
RADALT ..... OFF
STROBE LIGHT ..... OFF
LDG/TAXI LIGHT ..... OFF

ENGINE SHUTDOWN

PARKING BRAKE ..... SET
CALL STRIKE BASE RETURNED
RADIOS ..... OFF
VCR ..... OFF
OBOGS ..... OFF
OBOGS/ANTI-G ..... OFF
SAHRS ..... OFF
IDLE RPM ..... CHK WITHIN 2%
THROTTLE ..... OFF
IDLE 2 MIN
ENG START ..... OFF
AFTER 45 SEC
BATT ..... OFF
ALL REMAINING SWTS ..... OFF



Engine Systems (NATOPS 2.1)

5527 lbs.	Thrust rating of engine
112.4 +/- 1%	N1 rpm above which the EGT/RPM warning light illuminates
104%	Maximum N2 rpm at MRT
104%	Maximum N2 rpm for transient accelerations
100%	Maximum continuous N2 rpm
95%	N2 rpm not to be exceeded in manual fuel control in order to prevent N1 overspeed below 20,000 ft.
90%	N2 rpm not to be exceeded in manual fuel control in order to prevent N1 overspeed above 20,000 ft.
72%	approach idle, minimum rpm gear down and no weight on wheels
61 +/- 4%	% rpm at which bleed valve closes during initial engine acceleration
55 +/- 2%	idle rpm range on standard day
52%	idle rpm which should be obtained within 30 sec after selecting IDLE
45%	rpm at which ignition is turned off
45%	rpm at which GTS automatically shuts down
45%	approximate rpm at which bleed valve opens during initial engine shutdown
45%	rpm at which ROTATION and GTS advisory lights are extinguished
20%	rpm above which ATS start valve is inhibited from opening
15%	minimum N2 rpm required for engine start
3%	approximate increase in idle rpm after compressor bleed valve closes
2%	maximum shift in idle rpm between poststart and engine shutdown checks
1%	increase allowed idle rpm for each 1,500’ altitude
650 +/- 8°C	EGT above which the EGT/RPM warning light illuminates
645°C	maximum EGT for transient accelerations
600°C	maximum EGT at MRT
550°C	maximum continuous EGT limit
550°C	maximum EGT during ground start
600°C	maximum EGT during air start
450°C	maximum EGT at idle
300°C	firewire temperature required for FIRE warning light to illuminate
150°C	firewire temperature required for TAILPIPE HOT warning light to illuminate
50°C	approximate decrease in EGT after compressor bleed valve closes
50°C	maximum overshoot above 600°C during airstart (10 sec max)
20°C	maximum overshoot above 550°C during ground start (10 sec max)
30min.	maximum time limit at MRT
30min.	minimum interval after three GTS start attempts
3min.	minimum interval between each GTS start attempt
60sec.	Time bleed valve remains open after GTS assisted airstart using manual fuel
45sec.	Maximum time ignition system can remain on
45sec.	Time that firewire must remain below 300°C for FIRE warning light to go out
30sec.	Time allowed for GTS to reach GTS idle before automatic shutdown
30sec.	Time ignition system remains on after GTS button release during airstart
28sec.	Maximum allowable time for GTS advisory light to illuminate while in flight
20sec.	Maximum time for EGT to remain above 600°C during transient accelerations
20sec.	Maximum allowable time for GTS advisory light to illuminate at sea level
15sec.	Maximum allowable time for ROTATION advisory light to illuminate
15sec.	Maximum allowable time engine light-off after moving throttle to idle
10sec.	Maximum time for EGT to remain normal limit during ground start/airstart
35psi	pressure below which the LP PRESS caution light illuminates
10psi	oil pressure differential below which the OIL PRESS caution light illuminates after 10 sec. Delay.
75gph	additional fuel allowed for acceleration by shot of fuel solenoid below 7200'msl
1.2	capacity of engine oil tank and systems in US pints
1.6	unusable or trapped oil in engine oil system in US Pints
1.8	maximum consumption rate of engine oil in pints per hour
12-joule	power rating of two dc ignition plugs
___-___ knots	airspeed range for in-flight GTS start attempts
24V	minimum voltage for engine start
_____' MSL	maximum altitude for in-flight GTS start attempts

9500 +/-' MSL	shot of fuel solenoid closes as aircraft climbs through this altitude
7700 +/-' MSL	shot of fuel solenoid opens as aircraft descends through this altitude
F405-RR-401	Model number of Rolls Royce engine
15,512	N2 rpm at 100%
100	the ROTATION advisory light illuminates when N1 rpm reaches tins in the correct direction. Ignition begins too.
18	Number of fuel nozzles in engine
5	number of high pressure (N2) compressor stages
2	number of low pressure (N1) compressor stages

Bypass air from the N1 compressor 1. Cools the engine, 2. Provides increased thrust, 3. Provides noise Reduction

T/F Under manual fuel control the compressor bleed valve remains closed at all engine speeds except during airstarts. (TRUE)

5th stage compressor bleed air supplies 1. Environmental system, 2. OBOGS, 3. G-suit, 4. Fuel tank pressurization

Steam ingestion bleed valve provides increased bleed air flow when 1. Weight on wheels, 2. 70% N2, and 3. LAUNCH BAR not retracted

the ACCEL caution light illuminates when 1. Steam ingestion bleed valve not in commanded position (2sec delay), 2. shot of fuel solenoid failure

the engine accessory gearbox drives 1. Hydraulic pumps, 2. DC generator, 3. LP fuel pump, 4. HP fuel pump, 5. Engine oil pumps, and 6. N2 tach-generator

_____ in the FCU dampens throttle valve response during rapid throttle movements. (Acceleration Switch)

_____ maintains constant pressure drop across throttle valve compensating for airspeed and altitude changes. (Servo Pressure control).

The _____ in the FCU trims basic fuel flow in response to ECA (Solenoid (Fuel Trim))

The _____ automatically prevents overspeed/overtemp conditions by monitoring N1 and two thermocouples behind the N1 turbine. (Engine Control Amplifier)

The _____ meters a fuel supply to the fuel spray nozzles during the start cycle. (Sub Idle Fuel Control Unit)

T/F The ECA contains two identical lanes, and after engine start, the lane with the lowest fuel flow setting takes priority. (TRUE)

Engine operation in manual fuel control is similar to normal except 2. Airstarts require throttle modulation, 2. Idle rpm up to 5% lower, 3. Slower engine acceleration without dashpot, 4. Bleed valve closed at all engine speeds except 60 sec on airstart, and 5. N2 must remain below 95/90% below/above 20,000' MSL

With weight on wheels, ignition is provided when 1. GTS button pressed and released, 2. ENGINE switch set to START, and 3. ROTATION is on.

When airborne, ignition is provided when 1. GTS button is pressed and for 30 sec after release, 2. ENGINE Switch set to START, and 3. ROTATION is ON.

The ignition switch has two positions 1. ISOLATE- de-energizes engine and GTS ignition system, 2. NORMAL

Fuel System (NATOPS 2. 2)

443 gal	total fuel capacity in gallons
427 gal	total usable fuel capacity in gallons
223 gal	Capacity of wing tank in gallons
220 gal	capacity of fuselage tank in gallons
11 gal	amount of unusable or trapped fuel in gallons
3012 lbs.	Total fuel capacity in pounds (JP-5)
2904 lbs.	Total usable fuel capacity in pounds (JP-5)
400 lbs.	Capacity of collector tank in pounds.
350 lbs.	Approximate fuel quantity remaining with FUEL LOW caution light illuminated
73 lbs.	Approximate amount of trapped fuel in pounds
300-400 gph	idle fuel flow in gallons per hour
180 gpm	maximum refueling rate in gallons per minute
24 gpm	defueling rate at 11 psi suction
30 sec.	Capacity of Negative G compartment
30 sec.	Time period I seconds fuel boost pumps continue to operate after GEN failure to conserve battery power
10 sec.	Delay in illuminating FUEL LOW caution light to avoid nuisance flickering
50 psi	maximum refueling pressure
9.5 psi	pressure at which dual datum relief valve opens to relieve an over pressure condition

6 psi	pressure of engine bleed air supplied for fuel tank pressurization (Above ambient press.)
4.0 psi	pressure at which dual datum relief valve opens when REFUEL switch set or arresting hook is down
3 psi	low air pressure sense switch causes FUEL PRESS caution light illuminates (A/C 163647 and up)
2 psi	fuel tank air pressure below which the FUEL PRESS caution light illuminates

Boost pumps automatically turn on 1. During GTS operation, 2. When N2 > 42%, GEN is on, and ENGINE switch is on.

Two fuel boost pumps are installed in the _____. (Negative G compartment)

The FUEL PRESS caution light illuminates when 1. There is insufficient differential pressure across a boost pump (such as an inoperative pump), or 2. The fuel tank air pressure regulator drops below 3 psi.

T/F Opening the fuel shutoff valve disables GST ignition in addition to securing fuel (TRUE)

The fuel flow transmitter is powered by _____ bus and measures fuel flow prior to the _____ pump. (28V Essential Services, LP Fuel Pump)

T/F The FUEL advisory light and the INLET FUEL caution light are inoperative except during the Light test. (TRUE)

T/F the FUEL LOW caution light is triggered by a float switch in the negative G compartment, and is not linked to the fuel quantity indicator. (TRUE, NATOPS 2.2.2.5)

Fuel tanks are vented to atmosphere through a _____ valve and a _____ valve/orifice. (pressure relief, bleed).

T/F Pressure refueling requires electrical power on the aircraft. (TRUE)

Hydraulic Systems (NATOPS 2.5)

3600 psi	pressure relief valve opens in power supply package (PSP)
3000 psi	normal hydraulic pressure
1500-3000 psi	normal RAT operating range
2200 psi	pressure reserved by wheel brake/emergency flap accumulator if HYD 1 loses pressure
2000 psi	pressure at which HYD 2 PRESS caution light extinguishes
1800 psi	pressure required to close hyd 2 bypass valve and retract RAT if deployed
1660 +/- 110psi	pressure at which HYD 2 PRESS caution light illuminates
1500 +/- 100psi	pressure at which RAT deploys
1600 psi	pressure at which priority valve in PSP reopens to provide power for general services
1500 psi	pressure at which proirity valve in PSP closes to isolate flight controls from general services
1300 psi or >	required nitrogen preload pressure for wheel brake/emergency flap accumulator
725 psi	pressure at which HYD 1 PRESS caution light extinguishes
700 psi	pressure at RAT retracts as HYD 2 pressure is lost (aerodynamic load permitting)
600 +- 50psi	pressure at which HYD 1 PRESS caution light illuminates
45%	N2 rpm required to use HYD 2 Reset button
42%	N2 rpm below which HYD 2 bypass valve is energized open to reduce engine loads on start
10x	number of full brake applications provided by brake/emergency flap accumulator

three requirments for HYD FAIL warning light 1.HYD 1 pressure below 600 +/- 50psi 2. HYD 2 press below 1660 +/- 110psi, and 3. Emergency system pressure less than 600 +/- 50psi

Eight hydraulic devices in general services category 1. Flaps, 2. Slats, 3. Speed brakes, 4. Landing gear, 5. nose wheel steering, 6. Arresting hook, 7. Launch bar, 8. Wheel brakes

_____ ensure adequate base pressure to resist pump cavitation under all flight conditions (nitrogen pressurized resevoirs)

the power supply package consists of _____ , _____ , _____. (check valves, pressure relief valve, priority valve)

Flight Controls and Trim System (NATOPS 2.6)

20 +/-0.5°	maximum rudder surface deflection
+6.6° to -15°	maximum travel of stabilator leading edge due to stick movement
+3° to -8°	maximum travel of stabilator leading edge due to trim movement alone
+/- 15.5°	maximum aileron deflection with gear down
+/- 12.5°	maximum aileron deflection with gear up
+/- 9°	maximum aileron trim deflection with gear down
+/- 6°	maximum aileron trim deflection with gear up
2°/sec	approximate trim rate

120 sec maximum time required for CONTROL AUG BIT test

T/F the artificial feel for the stabilator is provided by the spring cartridge (FALSE, a spring cartridge and inertial weight)

T/F because the standby stabilator trim is powered by the 28 VDC gen bus, in the event of a generator failure, activating the standby trim system will have no effect on the main stabilator trim (FALSE, raising the guard cover over the standby trim switch disengages the main trim motor regardless of the 28 VDC generator bus status)

T/F the stabilator position indicator shows stabilator trim position only with zero force on the stick (TRUE)

T/F rudder trim is available only with control augmentation system activated (TRUE)

The control augmentation system performs four functions 1. Yaw dampening, 2. Turn coordination, 3. SBI interconnect, and 4. Rudder trim.

T/F yaw dampening and turn coordination are not available above 217 knots (TRUE)

T/F turn coordination is available in any flap configuration (FALSE, only with 1/2 or full)

T/F the SBI operates without any movement of the control stick (TRUE)

The CONTR AUG BIT requires 1. Weight on wheels, 2. Less than 80 knots airspeed, 3. FLAPS/SLATS up

Conditions for CONTR AUG caution light illuminates when 1. CONTR AUG system degraded, 2. BIT test in progress, 3. Paddle switch has been depressed

FLAP/SLAT System (NATOPS 2.7)

217 Maximum airspeed for Slats

200 Maximum airspeed for flap extension

50° approximate full flap deflection in degrees

25° approximate 1/2 flap deflection in degrees

T/F assuming sufficient pressure is available, use of emergency flap extension will drive flaps to full down regardless of flap lever (TRUE)

T/F if the brake pressure valve indicates 2200psi or less, activating the emergency flap lever will have no effect (TRUE)

T/F if HYD 1 fails while slats are fully extended, air flow pressure will drive them to the retract position as hydraulic pressure bleeds down (FALSE)

The SLATS caution light is illuminated if 1. Slats not in selected position, 2. Split slats, 3. Slats selected above 217 knots

SPEED BRAKE System (NATOPS 2.8)

380 knots speed at which speed brakes blow back begins

340 knots speed above which speed brakes may not fully extend

60° full speed brake deflection

LANDING GEAR System (NATOPS 2.9)

200 knots maximum gear extension/retraction speed

15 sec approximate landing gear extension time

10 sec approximate landing gear retraction time

2.2-2.5” main landing gear oleo limits

3.25” approximate nose gear oleo exposed (NATOPS)

7/8-1 7/8” approximate main landing gear oleo exposed (NATOPS)

The main landing gear are _____ type units. (Trailing arm suspension)

The _____ caution light is illuminated whenever the landing gear doors are not up and locked (DOOR)

T/F the light in the gear handle will illuminate in the DOWN position if the gear is down and locked, and the gear doors are not up and locked.
(FALSE, gear door status doesn’t matter when the handle is down)

T/F The light in the gear handle will illuminate in the UP position if the gear is down and locked, and the gear doors are ot up and locked.
(TRUE, gear door status does matter when the handle is in the up Position)

Conditions for WHEELS warning light illumination 1. LDG gear handle is not set to DOWN position,
2. N2 rpm below 95% and either, -
3a. altitude is less than 7200’ msl with airspeed below 170 knots, OR
3b. SLATS/FLAPS lever not in up position.

T/F when lowering the gear with the EMER GEAR handle, all of the gear doors remain open (FALSE, 28 VDC services bus powers the emergency nose landing gear door actuator bringing the nose gear doors to a near closed position.)

NOSE WHEEL STEERING System (NATOPS 2.10)

65° maximum nose wheel deflection with high gain
20° maximum nose wheel deflection with LAUNCH BAR in EXTEND and NWS button depressed
12° maximum nose wheel deflection with low gain
10 knots maximum taxi speed with high gain NWS

Nose wheel steering is powered off the _____ bus and the HYD 1 system (28VDC Essential Services)
T/F On landing, the NWS system is engaged with weight on wheels from just one main gear and nose wheel, and will remain engaged with weight on only one main gear (TRUE)
T/F In order to use NWS with LAUNCH BAR in Extend, the NWS button must be depressed (TRUE)
The NOSE WHEEL STR caution light is illuminated if 1. Nose wheel moves away from commanded pedal position, 2. If there is an internal system failure (including HYD 1 failure), 3. When the system has been paddled off.
T/F No landing gear will retract until the nose gear is centered (TRUE)
The paddle switch 1. Disengages NWS, 2. Deactivates control augmentation causing the NOSE WHL STR and CONTR AUG caution lights to illuminate when the aircraft is on the ground
T/F the NSE WHL STR advisory light is iluminted anytime the NWS system is energized (FALSE, only shows on high gain)

WHEEL BRAKES/ANTI-SKID System (NATOPS 2.11)

2200psi pressure reserved by wheel brake/emergency flap accumulator if HYD 1 loses pressure
180 +/-20psi minimum pressure to illuminate BRAKE PRESSURE indicators lights
150psi pressure at which BRAKE PRESSURE lights are extinguished
30 knots minimum required wheel speed for anti-skid to operate while accelerating
10-13 knots minimum wheel speed for anti-skid to operate while decelerating
10 number of full brake applications provided by brake/emergency flap accumulator
324°F temperature at which fusible plugs in main gear wheels are designed to release tire press.

When landing gear is retracted, landing gear door open pressure is applied to the _____ cylinder. Which in turn applies force to the parking brake lever to actuate the brake control valve (DE-SPIN)
Conditions for anti-skid to operate 1. Landing gear down, 2. Weight on wheels, and 3. Speed above 30 knots while accelerating or 10-13 knots deceleration
T/F the anti-skid system releases brake pressure if brake pedals are depressed while airborne to prevent touchdown with locked brakes. (TRUE)
the ANTI-SKID caution light is illuminated if 1. System malfunction is detected, 2. Prolonged full pressure dump lasting greater then 2 seconds, 3. No wheel spin detected 3 seconds after weight on wheels (reverts to normal braking)
T/F engaging the parking brake with anti-skid energized will eventually deplete brake accumulator pressure (TRUE)
T/F selecting anti-skid in either cockpit will energize the anti-skid system (FALSE, both cockpits must have it selected)
The PARKING BRAKE caution light is illuminated if the throttle is advanced beyond intermediate position (60-70%) and the parking brake is engaged.
Conditions for ANTI-SKID advisory light illumination 1. Anti-skid switches in both cockpits must be ON, and 2. Landing gear DOWN

LAUNCH BAR System (NATOPS 2.12)

10 sec. Time allowed for launch bar to retract following launch before warning tone sounds
The green L BAR indicator light is illuminated when launch bar is extended with the switch set to EXTEND
The red L BAR indicator light is illuminated when 1. Launch bar is not retracted, 2. No weight on wheels, 3. gear down and not locked
T/F with a launch bar retraction failure, raising the gear is not possible. (FALSE)
T/F the weight on wheels switch inhibits launch bar switch from remaining in extend position when airborne (TRUE)

ARRESTING HOOK System (NATOPS 2.13)

950psi +/-50 pressure of arresting hook nitrogen preload
300 knots airspeed above which HOOK warning light may illuminate due to airloads

6 sec approximate hook transit time up
1.5 sec approximate hook transit time down
the HOOK warning light is illuminated when HOOK handle does not correspond to hook position
T/F moving the HOOK handle to the down position hydraulically releases the up latch assembly and switches a hydraulic selector valve to remove HYD 1 pressure (FALSE, it mechanically moves both)

BOARDING System (NATOPS 2.14)

T/F both pull-out footsteps can be retracted from inside the cockpit (FALSE, front only)

CANOPY System (NATOPS 2.15)

95% rpm above which caution tone sounds with CANOPY caution light illuminated
45 knots maximum side winds allowed for canopy to remain open
4” free travel range of MDC firing handle

EJECTION SEAT System (NATOPS 2.16)

18,000’ MSL altitude at which drogue bridles are released during Mode 5 ejection sequence
0.5 sec backup delay initiator between seats
0.4 sec interseat sequencing system delay
30-60 lbs. Force required to initiate ejection
60-70% rpm above which SEAT UNARMED caution light will illuminate

ENVIROMENTAL CONTROL System (NATOPS 2.18)

150°f temperature at which AVIONIC HOT caution light illuminates with weight on wheels
5 sec time in seconds between each rotary valve movement in oxygen concentrator
60/40 approximate airflow split between ventilation and defog with airflow knob in normal
T/F in the event of complete electrical power loss, air conditioning and pressurization will remain on (TRUE, the PRSOV IPRSOV valves deenergize to the open position)
The ram air inlet and outlet valves are open when 1. Air flow know is in the off position 2.W-O-W
T/F the AVIONIC HOT caution light is only operative on the ground (TRUE)
Conditions that will cause CABIN ALT warning light to illuminate 1. Air conditioning failure causes overpressure to the CAU compressor 2. The CAU compressor outlet temperature rises above 500°f, 3. The CAU turbine inlet temperature rises above 250°f cabin pressure failure only when cabin altitude is above 24,500' +/- 500'

ON-BOARD OXYGEN GENERATING System (NATOPS 2.19)

5 sec time in seconds between each rotary valve movement in oxygen concentrator
250°f temperature at which overheat temperature sensor illuminates OXYGEN Warning light
40000' MSL altitude above which full 4.0 psi cabin pressure is obtained
35000' MSL cabin altitude above which oxygen is supplied at full pressure
35000' cabin altitude above which oxygen is supplied at increased pressure
24500 +/-500' cabin alt above which CABIN ALT warning light will illuminate
9500' MSL altitude above which a low oxygen concentration will cause OBOGS to shutdown
5000' MSL altitude at which pressurization begins
2 G number of G's at which anti-g suit inflation begins
6 G number of G's at which anti-g suit reaches maximum inflation
1800-2500 psi acceptable pressure range for emergency oxygen bottle
6.5 psi maximum pressure of anti-g suit inflation
4.8 psi cabin pressure required to open safety relief valve
4.psi maximum cabin pressure allowed by discharge valves
-0.5 psi pressure below which safety and inward relief valve opens
4-20 min approximate duration that emergency oxygen supply provides in minutes
three situations that will cause OBOGS automatic shutoff 1. A system malfunction 2. Low oxygen concentration and altitude over 9500' and, 3. Bleed air temp above 250°f or 4. Whenever the OBOGS/ANTI-G switch is off
T/F Once started, the emergency oxygen supply cannot be shutoff and restarted (FALSE)

FLIGHT INSTRUMENTS (NATOPS 2.20)

5° degrees of deviation indicated by increments on the CDI for VOR and TACAN
1 1/4° degrees of deviation indicated by increments on the CDI for ILS
9 min 2 1/4' standby gyro provides valid attitude data for minimum of __ after power loss
3 min 3" standby gyro provides valid attitude data for minimum of __after power loss
399.9 nm maximum range that can be displayed on H.S.I. range indicator

30 number of preset channels available
000 H.S.I. course required for VOR/ILS self test
180 H.S.I. course required for TACAN self test
315 +/- 2.5° heading No. 1 points to during VOR/ILS self test
180 +/-2.5° heading No. 2 points to during TACAN self test
108.10-111.95 MHz (odd) ILS frequency range
108.0-117.95 MHz VOR frequency Range
_____-173.975 MHz VHF frequency Range

Static inputs are provided to 1. Mach/airspeed indicators, 2. Barometric altimeters, 3. VSI's 4. OBOGS, 5. SADS

T/F The Mach indicator is corrected of temperature and pressure (TRUE)

T/F the forward and rear mach/airspeed indicators contains an airspeed switches set for 170 and 217 knots respectively to signal appropriate cautions and warnings (TRUE)

the SAHRS system provides only heading information to the H.S.I.

the SAHRS system provides only roll information to the yaw damper control (YDC)

The SAHRS system provides attitude information to the 1. ADI, 2. HUD, and 3. ADR

T/F The ILS needles come into view on the ADI whenever a valid ILS frequency is tuned (FALSE, ILS must be selected on NAV/COMM control transfer panel)

T/F The turn indicator on the ADI will be available in the event of a GEN failure (FALSE)

T/F the number 1 green needle corresponds to VOR and number 2 white needle to TACAN (TRUE)

T/F When T/R&G is selected on the COMM radio, both 121.5 and 243.0 MHz are monitored (FALSE, only the GUARD freq in the selected band)

ANGLE-OF-ATTACK System (NATOPS 2.21)

25.5-28 units AOA Range for Stall
21.5 units AOA at which rudder shakers activate
>18 units AOA range for upper green chevron (V)(Slow)
17 1/2 -18 units AOA range for upper green chevron and amber donut (VO) (slightly slow)
17 units optimum AOA, on speed
16-16 1/2 units AOA range for lower red chevron and amber donut (□O)(slightly fast)
< 16 units AOA range for lower red chevron (□)(fast)
14 units AOA for best angle of climb and max endurance (holding), ~195-210 knots
12 units AOA for best rate of climb and max range (Bingo)

T/F the AOA indexer lights illuminate with weight off wheels and the gear handle down (FALSE, need three gear down AND LOCKED)

T/F discrepancies are possible between rear cockpit AOA indicator and rear cockpit indexer lights (TRUE)

RADAR ALTIMETER System (NATOPS 2.22)

5,000' AGL maximum altitude displayed on radar altimeter
100 +/- 10' altitude indicted during the BIT check
40° maximum pitch or bank angle for radar altimeter effectiveness
AN/APN-194 Radar altimeter designation

T/F the low altitude warning system (LAWS) can be set in either cockpit, but the headset warning tone will only be triggered by the front cockpit radar altimeter. (TRUE)

T-45 Goshawk

The T-45A aircraft, the Navy version of the British Aerospace Hawk aircraft, is used for intermediate and advanced portions of the Navy pilot training program for jet carrier aviation and tactical strike missions. The latest version of the aircraft, known as the T-45C, includes a digital cockpit. The T-45 replaces the T-2 Buckeye trainer and the TA-4 trainer with an integrated training system that includes the T-45 Goshawk aircraft, operations and instrument fighter simulators, academics, and training integration system. The T-45 Goshawk replaced the TA-4J Skyhawk in the Advanced Jet Training Program and replaces the T-2 Buckeye in the Intermediate Jet Pilot Training Program. The Goshawk Training System combines academic, simulation, and flight phases into an integrated computer-based training approach that greatly improves training efficiency and safety.

The primary mission of the T-45 is to provide Navy strike flight training. The aircraft provides the capability to train student naval aviators for high performance jet aircraft and to qualify students for a standard instrument rating and initial carrier qualification. In addition, the aircraft supports training in fundamental tactical skills, emphasizing the development of habit patterns, self confidence, and judgment required for safe and efficient transition to fleet aircraft with advanced technology weapon systems.

The T-45 Training System (T-45TS) is the first totally integrated undergraduate jet pilot training system. It consists of five elements: instructional programs using computer-assisted techniques; advanced flight simulators; the T-45 aircraft; a Training Integration System (TIS); and contractor logistics support package. The training system elements build upon each other to teach pilot skills progressively and logically.

All required flight training knowledge and basic aviation skills are taught in electronic classrooms and with computer-assisted instruction using sophisticated animation techniques. These skills are then refined in high fidelity simulators where students practice T-45 cockpit procedures, and instrument and visual flight techniques. Validation of these skills then occurs rapidly and safely in the T-45A aircraft. The TIS coordinates and tracks all training activities, including the scheduling of instructors, equipment and students. It tracks students' progress and maintains their records while analyzing the training activities. Contractor logistics support is an integral part of the T45TS, with Boeing Aircraft Company providing the maintenance of all system elements (air and ground) as well as all logistic support.

The T-45A Goshawk is powered by a single Rolls-Royce/Turbomeca Adour turbofan engine, producing a sea level static thrust of 5527 pounds. The wing is low mounted and moderately swept, with full span leading edge slats and double slotted trailing edge flaps. The single vertical stabilizer and horizontal stabilator are both of swept design, with the vertical stabilizer integrating a mechanically powered rudder and control augmentation system for all speed flight. Speed

brakes are mounted on the aft fuselage just forward of the stabilator. All control surfaces, with the exception of the rudder, are hydraulically powered.

Two wing pylons permit carriage and delivery of a variety of training weapons, including Mk-76 practice bombs. Five external stores stations accommodate a wide variety of weapons, including a 30mm gun pod as one of the alternates on the fuselage centerline station. The cockpit is air conditioned and pressurized, accommodating two aircrew in a tandem seating arrangement. The instructor is in a raised position behind the student, both under a large single-piece, sideway-opening canopy, providing excellent visibility. Each cockpit is fitted with the Martin-Baker Navy Aircrew Common Ejection Seat (NACES) affording safe escape from zero airspeed and zero altitude. Maximum weight for the T-45A is approximately 15,000 pounds. The aircraft is capable of achieving an airspeed of 0.85 Mach at 30,000 feet in level flight.

While construction was fairly conventional, every effort was devoted to improving the reliability and maintainability of the new trainer through appropriate selection of operating system design and components and their installation.

History

Selected as the basis for the airplane portion of the Navy's VTXTS jet training system, the British Aerospace Hawk is well established as the Royal Air Force's (RAF) principal jet trainer, and has also found a similar niche with other countries' air forces. One of several multipurpose trainer/light ground attack aircraft developed in various European countries during the seventies, it was found adaptable to the U.S. Navy's training role, including carrier operations, with a minimum of aerodynamic modification -- a tribute to the excellent characteristics of the basic design.

The Hawk's beginnings go back to the late sixties when Hawker Siddeley (one of the predecessor companies of today's British Aerospace) began design studies for a prospective new RAF jet trainer suitable for basic/advanced training and also for strike/weapon delivery mission type training. The RAF settled on its final requirements in 1970 and Hawker Siddeley's final HS-1182 design proposal was the winner of the subsequent competition. In the spring of 1972, development and a total of 176 airplanes were ordered.

The first Hawk made its initial flight on 21 August 1974, flying at that year's Farnborough show in early September. Subsequent aircraft joined the flight development program which resulted in minor modifications--enlargement of the ventral fins being one of the more obvious changes -- by the time the Hawk T.1s went into RAF training squadron service in late 1976. Assignment to the tactical weapons unit followed in 1978.

Meanwhile, one extra Hawk had been registered for company use as G-Hawk, while the Mk 50 series export Hawk found customers in various parts of the world. Finland was the first foreign purchaser, with plans for production there. Active NavAir interest in the Hawk as one candidate for possible replacement of T-2s and TA-4s in the Training Command began in 1977 as part of a general study of what could be accomplished through various alternatives, including new development as well as derivatives of the newly-developed European advanced jet trainers.

In 1978, the US Navy initiated the VTXTS Advanced Trainer program to replace the existing T-2 Buckeye and TA-4 Skyhawk advanced jet trainers. Industry responses to the Navy request for proposals (RFP) included several existing and new aircraft configurations. A team from McDonnell Douglas and British Aerospace proposed both a modification of the existing British Hawk land-based configuration and a new trainer. The VTX contract was awarded to the McDonnell Douglas and British Aerospace team in November 1981. The Boeing (formerly McDonnell Douglas) T-45 Goshawk evolved from the Hawk design. With this proposal selected as the winner, another British Aerospace design has found its place in Naval Aviation alongside the already well-known Harrier.

Conversion of the Hawk land-based aircraft to a naval trainer with carrier capabilities involved considerable research and development. In addition to the necessary strengthening of landing gear components and the inclusion of arresting gear, development work was required in numerous areas that were critical for carrier-based operations. Some areas of concern included the handling qualities, engine response characteristics, and stall characteristics of the T-45.

In 1988, following extensive preliminary flight-test evaluations by the Navy at the Patuxent River Naval Air Station in Maryland, the Navy cited several major deficiencies in the T-45. The deficiencies included high approach speed, slow engine thrust response, and longitudinal and lateral stability deficiencies. McDonnell Douglas and British Aerospace developed candidate solutions and recommended approaches to resolve these issues.

The stall characteristics of the initial T-45 configuration were judged to be unacceptable by the Navy on the basis of a severe wing-drop behavior at the stall and high approach speeds (aggravated by the increased weight required to strengthen the airframe for carrier operations). During the Navy’s flight evaluations, the wing drop was so severe that uncommanded roll motions often exceeded 90 deg. The T-45 Program subsequently adopted a wing redesign, which incorporated wing leading-edge slats. The slats virtually eliminated the wing-drop tendency and lowered the carrier-approach speed to a more acceptable value.

Flight-test experience with the British Hawk aircraft had indicated that the aircraft was very reluctant to spin and that attempts to intentionally spin the aircraft usually resulted in a spiral with rapidly increasing airspeed. Flight tests of the T-45 subsequently verified that during spin attempts, airspeed rapidly increased, and stabilized spins could not be obtained. As a result of this spin resistant behavior, the T-45 is not used for spin training (The T-2 and TA-4 had been used for spin training).

Inlet Performance Flight-test experience with the T-45 has demonstrated that the aircraft sometimes experiences undesirable propulsion system characteristics during certain maneuvers. In particular, the aircraft engine has experienced self-clearing “pop” stalls, pop surges, and occasional locked-in surges during simulated air-combat maneuvers and recovery maneuvers from aircraft (wing) stalls.

Upgrades

The T-45C is known as Cockpit-21 because its cockpit has been reconfigured with multifunctional displays. Its head-

up displays have also been upgraded. The digitally modified T-45C is a step up in technology from the analog cockpit associated with the T-45A jet trainer, first flown in 1988. This change to Cockpit-21 is more like the configurations of present tactical fighter aircraft. In contrast to the dated analog system, Cockpit-21 has two multi-function displays providing navigation, weapon delivery, aircraft performance and communications data. Not only will the T-45C upgrade enhance the Navy's ability to train future F/A-18 Hornet, AV-8B Harrier and other aircraft carrier pilots, but it will also shorten training time.

Procurement of the T-45C (digital configuration) is scheduled for 15 aircraft per year with associated ground training systems and support until 2003, for a total of 187 aircraft and 17 simulators. Eighty-two T-45As and 16 T-45Cs had been accepted by the Navy through calendar year 1998. The T-45Cs, which began delivery in December 1997, are based at NAS Meridian, Mississippi, and training in the T-45C began in August 1998. All T-45As will be retrofitted to the digital configuration starting in FY 2004. In the long run, the Navy projects savings of more than $400 million by completing the acquisition and delivery of new T-45's by the year 2002 instead of 2005.

Logistics support is provided by Contractor Logistics Support Package (CLSP) with the Boeing Company, with Boeing providing the maintenance of all system elements, as well as all other logistic support. Principal subcontractors are British Aerospace for the airframe, Rolls-Royce for the engine and Hughes Training Inc. for the simulators.

The three major deficiencies of concern to aircrew that remain from the T-45 Full Scale Development (FSD) days ('89-'94) are probably ground handling, engine surge, and environmental control system fogging and icing. Blown tires on the catapult came to light once the aircraft began flying students operationally in '94. Not surprisingly, these fall into the number one, two, three and eight most desired items to be fixed from the Operator's Advisory Group (OAG) '99 list.

T-45 students have suffered at least 16 incidents of blown tires on the catapult that have ultimately resulted in two Class A mishaps, including one fatality. Preceding an August '98 mishap, TRACOM experienced a blown tire incident roughly once every other Carrier Qualification (CQ) detachment. The T-45 project office tested a toe-bar modification (a small metal bar across the rudder pedal used as a proper position toe guide) in September '98, which has been partially responsible for significantly reducing the incidents of blown tires on the catapult. Since the toe-bar modification was installed, the T-45 experienced one more blown tire incident on the catapult. The toe-bar modification was helpful in reducing the incidents of blown tires, but due to its ergonomic shortcomings, is certainly not the long term solution.

The T-45 has been plagued with poor ground handling characteristics since its inception. Five of the ten Goshawk Class-A mishaps occurred during ground handling operations. While all of the mishaps had other complicating factors, the basic ground handling characteristics are the underlying cause that make incidents such as blown tires into a major emergency, vice the minor emergency it would be in any tactical fleet aircraft. Under normal, benign landing conditions the aircraft has a tendency to cause Pilot Induced Oscillations (PIO) on landing rollout, particularly when the jet is light. Numerous factors, identified by a joint Navy-McDonnell Douglas team formed in 1994, contribute to the undesirable characteristics.

The T-45 fleet is experiencing a growing looseness or freeplay in the stabilator due to wear in the various linkages of the longitudinal flight control system. The stabilator is free to rotate as much as 0.25o independent of commands from the pilot's longitudinal stick input. Engineers predict that with sufficiently large freeplay, the stabilator will encounter destructive flutter at high dynamic pressures within the NATOPS envelope. NAVAIR flutter engineers have however, through analysis, cleared the T-45 to fly the entire NATOPS envelope up to 0.25o of freeplay and to the limits of 350 KIAS, 0.7 IMN and 4 g's up to 0.30o freeplay. For freeplay values greater than 0.30o, the jet is not cleared to fly.

An excessive amount of water enters the Goshawk cockpit through the ECS system in the forms of liquid, fog, snow and ice. Ice chunks frequently navigate the defog ducts and impact the pilot's visor. Water also falls from the eye vents onto the consoles, potentially promoting corrosion. A multiphase program to identify the cause(s) and develop solutions began in the fall of 98. Phase I testing discovered that a pressure relief valve opened unexpectedly following a pressure build up in the water separator and coalescer sock. This phenomenon was associated with throttle transients or ECS controller changes, which resulted in a mild burst of airflow, ice and fog through the eye-vents/defog ducts, but the cause of the pressure build up was not understood. Additionally, temperature and flow oscillations were observed that appeared unrelated to any pilot activity. Phase II ground testing (June '99) identified a low frequency rumble in the ECS system that had not been seen previously. Some of the proposed solutions include; modified temperature selector to permit more precise control of the temperature, a coalescer ice screen to prevent ice from forming in the coalescer, and a modified vent demist valve to reduce the moisture in the system. These and other potential modifications will produce a long-term solution to ECS fog and ice in the T-45.

NGS (Navigation Guidance System) the Standard Heading Attitude Reference System (SAHRS) used in the T-45A as the primary attitude source has had an unacceptably high failure rate, and the vendor has ceased support for it. BAE/Marconi has developed NGS as a form, fit and function replacement.

In 1997 the project office conducted extensive tests with the baseline engine and a modified higher-bypass engine to see if the bypass ratio would improve the engine stall margin. The result was that the bypass did not improve the engine stall resistance sufficiently to go forward with production. PMA-273 continued the effort to reduce the engine's susceptibility to surges an 18 month flight test program, beginning fall 2000 that initially modified the way the Fuel Control Unit (FCU) schedules fuel to the engine, then follows up with tests of a modified engine inlet. T-45 test pilots and engineers evaluated the modifications for their efficacy at reducing engine surges and their effect on general engine handling qualities.