

Boeing 767-300ER Flight Manual.

Zroman (Michael Chang)



Forward:

Thank you for downloading this Freeware Boeing 767-200ER series Jet Aircraft. Enclosed inside this download is one of four planes, all of them with Pratt and Whitney PW-4000 series engines. The other variants can be found on the blog as they appear.

The Boeing 767 is a mid to long range commercial wide-body jet liner developed by Boeing Commercial Airplanes. This was the first wide body twinjet plane that Boeing had ever created (the first Wide body being the Boeing 747). The Airplane features two turbofan engines, manufactured either by General Electric (CF6-80C, CF6-80A), Pratt and Whitney (PW4000, JT9D), Rolls Royce (RB211). The first model produced was the Boeing 767-200 series plane, put into service with United Airlines.

As of April 2012, the 767 has received 1090 orders with 1023 delivered, 837 of these planes are still in service.

This variant is the 767-200ER, consisting of 10 models using four different engine types, (three general electric and one pratt and whitney)

This 767 is a result of collaboration between ZROMAN (FSXP) and Hiroshi Igami (FS2004). The objects and base textures are supplied by Hiroshi, and the animations and flight model are done by Zroman. Sounds were provided by Jerry Ng and the Normal mapping courtesy of Peter Tram. Thanks to everyone who helped.

Please note, the 767-300ER and 767-200ER share many similarities, which is why charts provided below are for the -300ER.

Specifications.

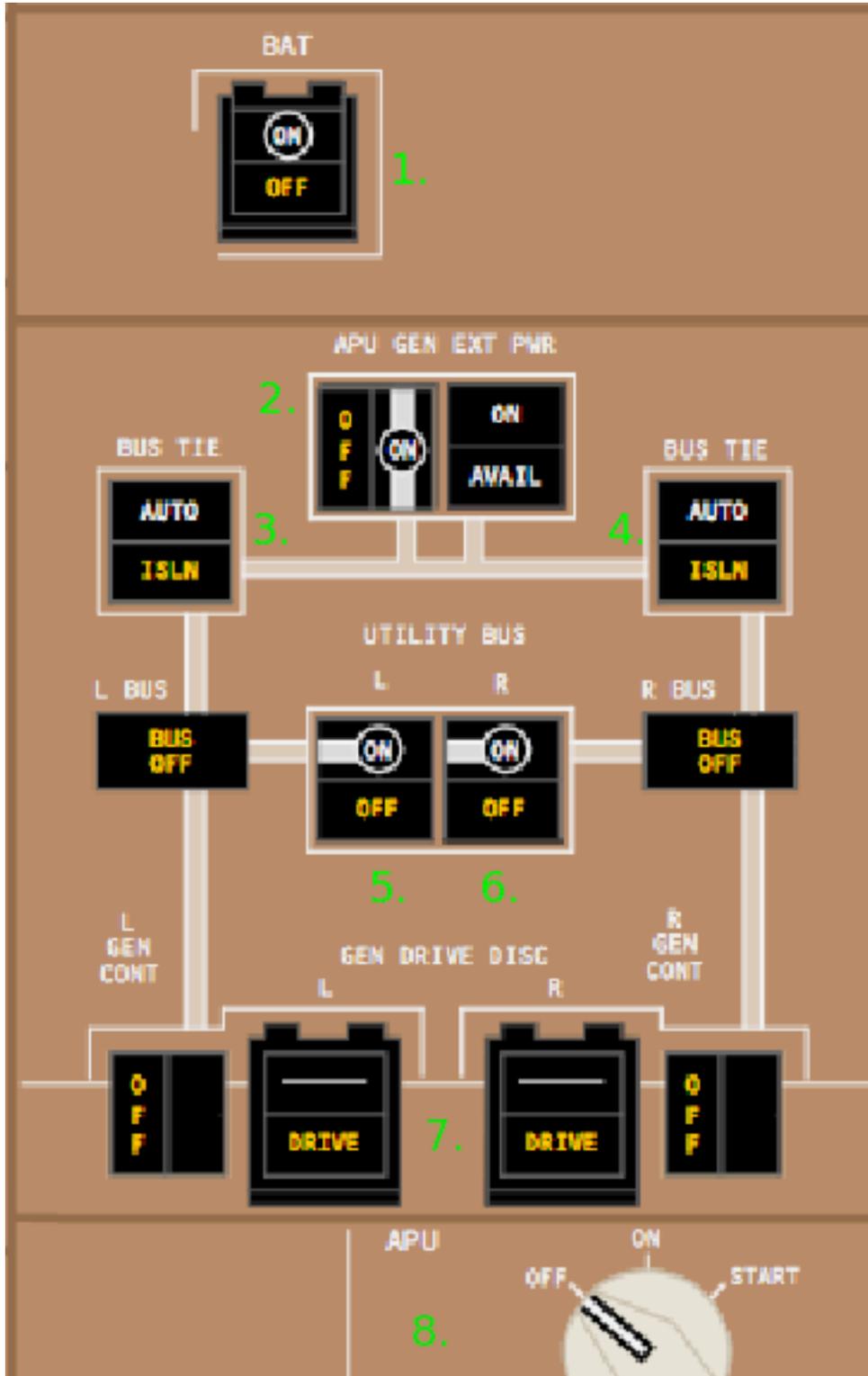
CHARACTERISTICS	UNITS	MODEL 767-300ER			
		SEE NOTE 1			
MAXIMUM DESIGN TAXI WEIGHT	POUNDS	381,000	388,000	401,000	409,000
	KILOGRAMS	172,800	176,000	181,900	185,500
MAXIMUM DESIGN TAKEOFF WEIGHT	POUNDS	380,000	387,000	400,000	407,000
	KILOGRAMS	172,350	175,550	181,450	184,600
MAXIMUM DESIGN LANDING WEIGHT	POUNDS	300,000	300,000	320,000	320,000
	KILOGRAMS	136,100	136,100	145,150	145,150
MAXIMUM DESIGN ZERO FUEL WEIGHT	POUNDS	278,000	278,000	288,000	295,000
	KILOGRAMS	126,100	126,100	130,650	133,800
SPEC OPERATING EMPTY WEIGHT 2	POUNDS	193,843	193,943	195,043	198,443
	KILOGRAMS	87,950	87,950	88,450	90,000
MAX STRUCTURAL PAYLOAD	POUNDS	84,157	84,057	92,957	96,557
	KILOGRAMS	38,150	38,150	42,150	43,800
TYPICAL SEATING CAPACITY	MIXED CLASS	24 FIRST CLASS + 46 BUSINESS + 150 ECONOMY			
	ALL-ECONOMY	FAA EXIT LIMIT 290 3			
MAX CARGO —LOWER DECK	CUBIC FEET	4,030	4,030	4,030	4,030
	CUBIC METERS	114	114	114	114
USABLE FUEL	U.S. GALLONS	24,140	24,140	24,140	24,140
	LITERS	91,370	91,370	91,370	91,370
	POUNDS	161,740	161,740	161,740	161,740
	KILOGRAMS	73,350	73,350	73,350	73,350

- NOTES: 1 TYPICAL ENGINE/WEIGHT CONFIGURATION SHOWN.
SEE TABLE 1.3.1 FOR COMBINATIONS AVAILABLE.
2 TYPICAL OPERATING EMPTY WEIGHT SHOWN. ACTUAL WEIGHT WILL
DEPEND ON SPECIFIC AIRLINE CONFIGURATION.
3 299 WITH MID-CABIN TYPE A DOOR.

2.1.4 GENERAL CHARACTERISTICS MODEL 767-300ER

Start up.

This plane's Start up has been ground down significantly from the original start up procedures, to allow flyers of any level to be able to use this plane. Starting with the plane on any airport apron or runway, you will want to follow the numbers seen below. Start on the Plane's overhead.

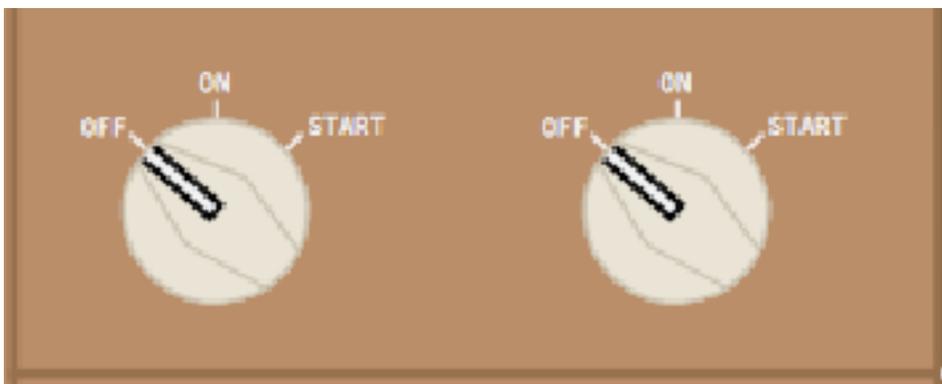


1. Turn on the Plane's battery.
2. Start up the APU generator
3. Turn on the bus ties
4. Turn on the bust ties
5. Turn on the left and right bus (these will supply power to the autopilot)
6. (See above)
7. Start up the generators
8. Turn on the APU.

For all the buttons present, a bright yellow word/light is the sign that that switch is off, the on position is indicated by a white ON.



Next, find the Hydraulic pumps, pressing any of them will flip them all. When the yellow press light is visible, they are off, when the white ON circle is visible, they are on.



Now find your Engine start switches, moving them to the START position and holding it there for five to ten seconds will kick start the engines. It takes thirty seconds for the engines to reach Idle N1.

And there you have it! Your engines should now be spooling up slowly but surely. After this, your plane is taxi ready, however it most certainly is NOT ready for takeoff! Now let's take a look at how to prime the plane for take off.

The FMC

This plane features a default x-plane FMC, which functions simply to enter way points. You should enter any waypoints or flight plans here at this time.



A default FMC

Flaps and Rotation Speeds.

As with any plane, this plane has changing take off V1, VR, and V2 speeds. The chart below should help you pin point that perfect take off speed with relation to your weight. The 767 is designed to take off at these flap detents at these speeds.

FLAPS	WT 1000 LB	A			B			C			D			E		
		V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂
5	420	166	170	175	168	172	176									
	400	161	166	171	163	167	171									
	380	155	161	167	158	162	167	161	164	168						
	360	150	156	163	153	157	162	155	159	163						
	340	144	151	158	147	152	158	150	154	158						
	320	138	145	153	141	147	153	144	148	153	147	150	153			
	300	132	140	148	135	141	148	138	143	148	141	144	148	145	146	149
	280	126	134	143	129	135	143	132	137	143	135	139	143	139	140	143
	260	120	127	138	122	129	138	125	131	138	128	133	138	132	134	138
	240	113	121	133	115	123	133	118	125	133	122	126	133	125	128	133
220	106	114	127	107	115	127	112	118	128	115	120	127	118	122	127	
15	420	160	163	169												
	400	155	158	164												
	380	150	154	160	152	155	160									
	360	145	149	156	147	151	156									
	340	139	144	151	142	146	151	144	147	152						
	320	134	139	147	136	140	147	139	142	147						
	300	128	133	142	131	135	142	133	137	142	137	138	142			
	280	122	128	138	125	129	138	127	131	137	131	133	137	125	127	132
	260	116	122	133	119	123	133	121	125	132	125	127	132			
	240	110	116	127	110	117	127	115	119	127	117	121	127	122	123	127
220	104	109	122	106	111	122	108	113	122	112	115	122	115	117	122	
20	420	159	159	165	156	156	160									
	400	153	154	160	150	150	156									
	380	147	149	155	150	150	156									
	360	142	144	150	144	145	151									
	340	137	140	146	139	140	146	141	142	147						
	320	130	134	142	134	135	142	136	137	142						
	300	125	129	137	128	130	137	130	132	137	133	133	138			
	280	119	123	133	122	125	133	124	126	133	128	128	133			
	260	112	117	128	115	119	128	118	121	128	122	123	128	124	124	128
	240	106	112	123	109	113	123	112	115	123	116	117	123	119	119	123
220	99	105	118	102	107	118	105	109	118	109	111	118	113	113	118	

So once your ATC has given you take off clearance, here's how you run the plane. Arm the Flight Director (the switch on the side) turn on the Vertical Speed to run at 2000 FPM, set the heading hold mode. First thing is to push the throttles up to 70%, allowing them to spool up. At this point, depending on the length of your runway, you can either push to full throttle or to a reduced N1, i.e. 90% or 85.5%. At full throttle, this plane accelerates rather quickly. Once you reach your V1, you are committed to the take off and have to pull of the ground, VR, you start rotating the nose up, V2, you should be off the ground. Once a positive rate is confirmed, raise your gears. At this point, set your autopilot to follow the runway heading until given clearance to fly to your destination. Then, set your HSI navigator to find your flight path and engage the LNAV system. Don't forget to retract the flaps! A flap speed guide is located around the flap indicator, found to the right of the center lower Eicas. It is optional to use the first detent of flaps until 10000 feet.

Once your plane reaches your planned cruising speed below 10000 feet (presumably 240 kts), you can put the plane into the FLCH mode. Naturally, the plane wants to engage a full thrust FLCH, instead, you must pull the throttles to 94% and climb from that rate. Once above 10000 feet, increase the aircrafts speed to 320 kts while retracting the final flap detent if it is still out. Increase the speed in increments of NO MORE than 20 kts in order to avoid interrupting the climb or even descending! Watch your mach number, once it reaches .80, switch from kts to mach.

Controlled Cruise.

At the 767's maximum weight it is typical to pull the plane up to flight level 280 first. There are rules and charts for flying to allow for optimum fuel economy and maximum efficiency. Refer to the below chart.

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
420	%N1	89.8	90.9	92.1	93.5	95.3	97.7					
	MACH	.772	.787	.800	.804	.802	.798					
	KIAS	338	332	324	312	298	284					
	FF/ENG	7229	7061	6950	6871	6889	7067					
400	%N1	88.8	89.9	91.0	92.3	93.9	95.9	99.2				
	MACH	.764	.778	.793	.803	.803	.800	.797				
	KIAS	334	328	321	312	299	285	271				
	FF/ENG	6948	6777	6661	6566	6517	6573	6896				
380	%N1	87.9	88.9	90.0	91.2	92.6	94.3	96.7				
	MACH	.754	.770	.785	.798	.804	.802	.799				
	KIAS	330	324	317	310	299	285	271				
	FF/ENG	6654	6499	6371	6278	6192	6188	6327				
360	%N1	86.8	87.9	88.9	90.1	91.3	92.9	94.8	98.4			
	MACH	.742	.760	.776	.791	.802	.803	.800	.797			
	KIAS	324	319	313	307	298	286	272	259			
	FF/ENG	6352	6217	6090	5992	5898	5842	5868	6137			
340	%N1	85.5	86.8	87.9	88.9	90.1	91.4	93.2	95.8			
	MACH	.725	.749	.766	.781	.796	.804	.802	.799			
	KIAS	316	314	309	302	296	286	273	259			
	FF/ENG	6001	5923	5815	5706	5619	5535	5511	5628			
320	%N1	84.1	85.5	86.7	87.8	88.9	90.1	91.6	93.8	97.5		
	MACH	.703	.733	.754	.771	.786	.800	.804	.801	.798		
	KIAS	306	307	304	298	292	284	273	260	247		
	FF/ENG	5625	5600	5526	5429	5335	5251	5188	5224	5448		
300	%N1	82.6	84.0	85.5	86.6	87.6	88.8	90.0	92.1	94.9	99.3	
	MACH	.683	.711	.740	.759	.775	.791	.802	.803	.800	.797	
	KIAS	297	297	298	293	287	281	273	261	248	236	
	FF/ENG	5269	5236	5222	5149	5055	4972	4894	4880	4982	5266	
280	%N1	80.8	82.4	83.9	85.3	86.4	87.5	88.6	90.4	92.9	96.0	
	MACH	.661	.688	.718	.745	.763	.779	.795	.804	.802	.799	
	KIAS	287	287	288	288	282	276	270	261	249	236	
	FF/ENG	4913	4882	4869	4858	4781	4691	4618	4575	4609	4740	
260	%N1	79.0	80.6	82.2	83.7	85.0	86.1	87.2	88.8	91.0	93.6	97.1
	MACH	.640	.665	.693	.723	.749	.767	.783	.798	.804	.802	.798
	KIAS	277	277	277	278	277	271	265	259	249	237	225
	FF/ENG	4575	4535	4512	4514	4493	4419	4337	4294	4286	4335	4491
240	%N1	77.1	78.6	80.3	81.8	83.3	84.6	85.7	87.2	89.3	91.6	94.2
	MACH	.618	.642	.667	.696	.727	.751	.769	.786	.800	.804	.801
	KIAS	267	267	266	267	268	266	260	254	248	238	226
	FF/ENG	4251	4208	4173	4155	4169	4138	4065	4015	3997	3996	4054
220	%N1	75.2	76.6	78.1	79.8	81.4	82.9	84.1	85.6	87.5	89.6	92.0
	MACH	.596	.618	.642	.668	.697	.729	.753	.771	.787	.800	.804
	KIAS	257	256	256	256	256	257	254	249	243	237	227
	FF/ENG	3930	3894	3850	3820	3813	3831	3789	3740	3718	3700	3703

Descent and Approach.

This part of the flight is simple enough. Once given clearance to descend, simply set your altitude and engage the FLCH descend mode. There are specific speeds assigned per altitude for a flaps up holding pattern, shown below.

Performance Inflight -
All Engine

DO NOT USE FOR FLIGHT

767-300/CF6-80C2B6F
FAA

767 Flight Crew Operations Manual

Category C & D Brake

**Holding
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
420	%N1	68.8	71.5	76.1	80.3	84.3	88.6	93.3		
	KIAS	259	259	259	259	259	259	261		
	FF/ENG	6500	6440	6380	6340	6340	6430	6550		
400	%N1	67.4	70.1	74.7	78.9	83.0	87.3	91.8		
	KIAS	252	252	252	252	252	252	255		
	FF/ENG	6200	6130	6080	6030	6010	6090	6190		
380	%N1	66.1	68.8	73.1	77.5	81.7	85.9	90.3	96.1	
	KIAS	246	246	246	246	246	246	248	263	
	FF/ENG	5900	5830	5770	5720	5700	5750	5840	6380	
360	%N1	64.5	67.3	71.5	76.0	80.4	84.5	88.8	94.0	
	KIAS	239	239	239	239	239	239	241	244	
	FF/ENG	5610	5530	5470	5410	5380	5410	5490	5710	
340	%N1	62.8	65.8	69.8	74.4	78.8	82.9	87.3	92.1	
	KIAS	231	231	231	231	231	231	233	236	
	FF/ENG	5320	5230	5160	5110	5070	5080	5150	5280	
320	%N1	61.0	64.2	68.2	72.7	77.1	81.3	85.7	90.3	
	KIAS	225	225	225	225	225	225	226	229	
	FF/ENG	5040	4950	4870	4810	4770	4760	4810	4910	
300	%N1	59.3	62.3	66.6	70.8	75.3	79.7	83.9	88.5	96.2
	KIAS	220	220	220	220	220	220	220	221	236
	FF/ENG	4760	4680	4580	4520	4480	4450	4480	4570	5190
280	%N1	57.6	60.4	64.9	68.9	73.6	77.9	82.1	86.6	93.5
	KIAS	215	215	215	215	215	215	215	215	216
	FF/ENG	4490	4410	4310	4240	4190	4170	4170	4220	4510
260	%N1	55.8	58.6	63.0	67.0	71.6	76.0	80.2	84.6	91.0
	KIAS	210	210	210	210	210	210	210	210	210
	FF/ENG	4230	4150	4040	3970	3920	3900	3870	3900	4090
240	%N1	54.1	56.6	60.8	65.1	69.3	74.0	78.3	82.6	88.7
	KIAS	204	204	204	204	204	204	204	204	204
	FF/ENG	3960	3890	3780	3700	3650	3620	3590	3600	3740
220	%N1	52.3	54.7	58.7	63.2	67.2	71.9	76.2	80.5	86.5
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	3700	3630	3530	3450	3380	3350	3310	3330	3420

This table includes 5% additional fuel for holding in a racetrack pattern.

Final Approach.

Like with any other plane, this plane can be landed at either full flaps or flaps 25. See below for a VREF chart.

LANDING CHARTS

767-300 Minimum Maneuvering and Vref

MINIMUM MANEUVERING AND LANDING FLAP MANEUVERING SPEEDS (LFMS) 767-300

WEIGHT	FLAPS						
	0	1	5	15	20	25	30
400	257	214	195	190	187	166	172
396	256	213	194	189	186	166	171
392	255	212	193	188	185	165	170
388	253	211	192	187	184	164	169
384	251	209	191	186	183	163	168
380	249	207	190	185	182	162	166
376	248	206	189	184	181	161	165
372	247	205	188	183	180	160	164
368	246	204	187	182	179	159	163
364	245	203	186	181	178	158	161
360	243	201	184	179	177	157	159
356	242	200	183	178	176	157	158
352	241	199	182	177	175	156	157
348	240	198	181	176	174	155	155
344	238	197	180	175	173	154	153
340	236	195	179	174	172	153	151
336	235	194	178	173	171	152	149
332	233	193	177	172	170	151	148
328	231	191	176	171	169	150	147
324	229	189	175	170	167	149	146
320	227	187	173	168	165	148	145
316	226	186	172	167	164	147	145
312	225	185	171	166	163	146	144
308	223	184	170	165	162	145	143
304	221	183	168	164	160	144	142
300	219	181	166	162	158	143	141
296	218	180	165	161	157	142	140
292	216	179	164	160	156	141	139
288	214	177	163	159	155	140	138
284	212	175	161	158	154	139	137
280	210	173	159	156	152	138	136
276	209	172	158	155	151	137	136
272	207	171	157	154	150	136	135
268	205	169	156	153	149	135	134
264	203	167	155	151	147	134	132
260	201	165	153	149	145	132	130
256	199	164	152	148	144	131	129
252	197	163	151	147	143	130	129
248	195	161	149	146	141	129	128
244	193	159	147	145	139	128	128
240	191	157	145	143	137	127	127

Speeds above heavy line are above max structural landing weight.

Speeds within shaded area are above max extended flaps landing weight.

Wind Corrections:

- The Flaps 30 Landing Flap Maneuvering Speed (LFMS) is the equivalent of Vref or REF in the Flight Manual.
- Target Speeds - Add 1/2 the steady headwind component plus the full gust value to the LFMS. Total addition should not exceed 20 knots. Minimum target speed is LFMS + 5.

SYSTEM DESCRIPTIONS

Now although most of the systems on this plane are well known to the world, we feel it necessary to show you exactly how certain ones work.

Let's start with the Primary flight display.



The 767's PFD is a little different than most. For starters, the pink crossbars only show when following LNAV flights. On the left side, the regular speed indicator is replaced by a Fast/Slow indicator. A small pink bug will move from side to side there, indicating whether or not you are moving faster or slower. It does NOT however, indicate your airspeed. In the real plane, the largest diamond would represent your target speed, but sadly, we can't emulate that.

Note the three white lines located at the top of the PFD. These indicate various active autopilot functions. Green symbols represent active modes while white symbols represent armed modes

In the first column (farthest left, green):

- FLCH
- A/T

In the Second Column (shown in green):

- ALT
- V/S
- VNAV
- G/S

In the Second Column (shown in white):

- G/S
- VNAV

In the third column (shown in green):

- HDG
- LNAV

In the Third Column (shown in white):

- LNAV

In the Fourth Column (shown in green):

- CMD, to represent the Autopilot being on
- FD, to represent the Flight director being on.

Flap system

The flaps of the 767 are a simple thing. The inboard flaps are double slotted fowlers while the out board ones are single slotted fowlers. We have decided, in this model, to include the detailed flap track mechanisms hidden under the flap canoes. The actual angles for the flaps are 1, 8, 15, 20, 27 and 36.

In all honesty, this plane shouldn't be too hard to fly, as long as you follow the procedures presented.

Other features:

The plane features many sliders and ground services, controlled by the slider buttons

To activate the sliders:

Shift+F1 through F7

On mac computers, you need to hit SHIFT+fn (function) + F1 through F7 in order to activate the sliders. Ground services appear after the respective doors have been opened.

~Zroman.