

## FLYING THE PMDG 737-700 “SOUTHWEST STYLE”

### Background

Southwest Airlines is a very successful airline which pioneered “low-cost” flying in the USA<sup>1</sup>. They eschewed hubs, flying lots of direct flights between popular city pairs, and kept operational costs low by flying one type of aircraft – the Boeing 737. This single-type philosophy has served them well, with the ability to put any pilot with any aircraft – so well that they only recently retired the -200 series in 2005.

When Boeing designed the 737NG, with its high level of automation and glass cockpit, Southwest expressed concerns that the new PFD/ND displays and symbology would require extensive “differences” training for the pilots as they transitioned to the NG, as well as requiring two sets of procedures – one for the NGs with glass, and another for the older airplanes. Since this would drive up costs, they asked Boeing to provide an alternate display mode, called the EFIS/MAP. In this mode, the glass panels provide replicas of the “steam” gauges, so the instrument scan is unchanged from the earlier models. For the same reasons, SWA orders their -700s without VNAV (if you look at cockpit photos of SWA birds, you’ll see the Autothrottle switch present but the VNAV button missing).

The end result for the SWA pilot is that while they do have an autoflight system with full pitch, roll, and yaw controls, the thrust is controlled by the pilot no matter what the autopilot may be doing. This changes the way the aircraft is flown somewhat, particularly in the climb, descent, and approach.

### The Basics

Not having autothrottles or VNAV changes the way we’ll fly the airplane. This document will take you through the changes you’ll need to make in your flying habits to compensate for the differences.

### Getting the EFIS/MAP display

You must have the -800/900 package for the EFIS/Map option to be available. From the PMDG Styles Menu, select the EFIS/MAP option. Alternatively, you may select Southwest Airlines from the airline list.

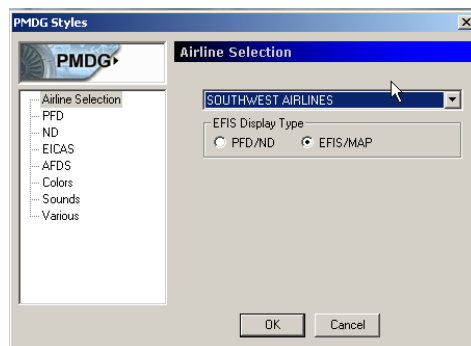


Figure 1 - Setting up for the EFIS/MAP Display

1. For more info on Southwest Airlines history consult [http://www.southwest.com/about\\_swa/press/bibliography.html](http://www.southwest.com/about_swa/press/bibliography.html)



Figure 2 - The EFIS/MAP display

## Smoothness Is The Key

When you are flying without autothrottles, you have to be much more engaged in the process, and be constantly thinking ahead to manage the thrust needed for the next phase of flight. You should strive to make smooth changes and small adjustments to give your passengers the best experience.

## Preflight, Start, and Taxi

Use normal procedures for these phases of the flight. You may elect to perform a reduced thrust takeoff, but all climbs are performed at full thrust. Figure 3 shows the FMC setup for a reduced thrust takeoff.

## Before Takeoff

All normal steps are taken, except (of course) you will not arm the autothrottles.

## Takeoff

After the normal before takeoff checks (RECALL, Start Switches to CONT, etc) are complete, as you roll onto the runway, advance the throttles smoothly to 40% N1. Once they are stabilized, advance the power smoothly to the setting indicated on the EICAS. While the engine controllers will prevent you from an overspeed, do not put the throttles fully forward – you’ll need to increase the power in the climb. Press TO/GA as you would normally so that the flight director will give you proper cues for takeoff.



Figure 3 - Setting up for a reduced thrust takeoff

## Initial Climb and Departure

As you climb out and are ready to engage the autopilot, set the MCP speed to 250 knots, and select the roll mode you need (HDG or LNAV) and use LVL CHG. When the autopilot is engaged, the airplane will pitch to maintain the set speed. Your job is to manage the thrust, increasing it to keep it at the limit, but be prepared to pull it back if you need to level off before reaching 10,000! A setting of 60-70% will hold 250 knots in clean configuration in level flight at lower altitudes.

## Climb above 10,000

Consult the FMC CLB page to see the programmed climb speed and dial up the MCP speed to match as you pass 10,000 feet. Continue to monitor the thrust level, advancing the throttles to keep N1 at the programmed setting. Somewhere around FL260 you'll need to adjust the MCP SPD to the target Mach number.

## Leveling off for the cruise

As you reach the cruise altitude, and the airplane enters the ALT ACQ and then ALT HOLD mode, allow the airplane to accelerate to the cruise speed and then reduce the thrust slowly to maintain that speed. Thrust settings of 85%-93% are normal for cruising at FL350 or higher.



Figure 4 - The CLB page - note the target speed (295/.765M)



Figure 5 - Level in cruise



## Managing the descent

Even though you don't have a VNAV autopilot mode, the autoflight system can still calculate the required descent path, and YOU can fly it without much difficulty. To be sure the path is correctly calculated, you need to enter all speed and altitude restrictions in the LEGS page as soon as you get them. Then, the DES page will give you appropriate rates of descent, and it's predicated on an idle thrust descent at the given airspeed. For the descent to 10,000, I recommend using the VS mode, pulling the throttles to idle and setting the VS to match what you see on the DES page in order to make the next crossing restriction. Once below 10,000, managing your airspeed is usually more important than the rate of descent, so use LVL CHG at that point, pulling the throttles to idle for max descent rate and adding thrust to reduce descent rate. You need to stay focused during this phase and the approach as you may have multiple descents and segments of level flight. Your goal should be to not let the airspeed vary from your target by more than ten knots, and then as you become more proficient, shoot for keeping it within five knots.



Figure 6 - Initial descent using VS pitch mode - thrust controls airspeed



Figure 7 - Descent on arrival using LVL CHG - thrust controls vertical speed

## Precision Approaches

The airplane will fly the ILS and track the glideslope just fine, though autoland is not possible without autothrottles. Use the throttle to maintain the appropriate airspeed, remembering you want to be stabilized (on the glidepath, in the landing configuration, at your target airspeed) as you descend through 1000 feet AGL. I usually reduce speed to 200 during the intercept, then 180 with flaps 1 or 5 as I approach the final approach fix. When I am one and a half dots low on the glideslope, I drop the gear, pull the throttles to idle, set the speed bug at  $V_{ref} + 5$ , and extend the flaps using the flap maneuvering speeds on the airspeed indicator. I find that 58-65% N1 will maintain the target speed in the landing configuration.



Figure 8 - Slowing to final approach speed



Figure 9 - Stable approach at 1000 feet

## Non-Precision Approaches

Non precision approaches are best flown in VS mode, by selecting the next altitude in the MCP and using 800-1000 FPM descents at 160 knots with flaps 15. For the final descent from the Minimum Descent Altitude to the runway, you may be able to use the vertical deviation indicator on the map as a sanity check to your visual landing. It's very important that you code the altitudes of your approach fixes into the LEGS page so that the FMS can calculate the proper vertical path.

## Landings

At 50 feet, smoothly pull the throttles to idle, and then into reverse as the wheels touch down. Fly the nose down to the runway. Stow the reversers as you decelerate through 60 knots.



Figure 10 - Path deviation indicator circled on map display

## Missed Approaches/Go-Around

Aside from you needing to bring the throttles forward, not much is different in this maneuver. Press TO/GA to give you proper flight director cues, advance the throttles, retract the flaps to 15, and raise the gear. Keep your pitch up around 15 degrees and once you are climbing, treat it like a takeoff, lowering the nose and retracting the flaps as required. Remember to reduce the thrust as you level off and not exceed speed restrictions.

## Practice Makes Perfect

Good luck with your future flights. I suggest you practice these techniques flying offline before putting them to the test on a VATSIM fly-in. Don't be afraid to re-engage the autothrottles and VNAV and watch to see how the system manages thrust and pitch attitudes when it's all automatic. Then go and try and duplicate it yourself. You'll soon master the process and be ready to fly "Southwest Style"!





Happy Landings!  
(Cloud 9 Los Angeles Scenery shown here)

# SimSouthwest Quick Reference Checklist for PMDG 737 NG

## —Flight Planning / Dispatch—

FLIGHT PLAN .....OBTAINED/FILED  
PASSENGER/CARGO ..... WEIGHTS SET  
FUEL .....CALCULATED AND ORDERED  
WEATHER BRIEFING .....OBTAINED  
NOTAMS ..... CHECKED AND NOTED  
CHARTS .....READY FOR USE

## —Aircraft Acceptance—

EXTERIOR INSPECTION .....COMPLETED  
FUEL ..... LOADED AND VERIFIED  
DOORS/STAIRS .....READY FOR BOARDING

## —Cockpit Acceptance—

PARKING BRAKE ..... SET  
BATTERY ..... ON  
ELECTRIC HYDRAULIC PUMPS .....OFF  
LANDING GEAR ..... DOWN  
START LEVERS ..... IDLE, THEN CUTOFF  
OVERHEAD FUEL VALVE LIGHTS ..... ILLUMINATED  
GROUND POWER ..... ON  
FIRE WARNING SYSTEMS ..... TESTED  
CAB/UTIL ..... ON  
IFE/PASS ..... ON  
EMERGENCY EXITS ..... ARMED  
SIGNS ..... BOTH ON  
RECIRCULATION FAN ..... AUTO  
ENGINE BLEEDS ..... OFF  
PASSENGER BOARDING ..... COMMENCE

## —APU Start—

APU SWITCH ..... START  
APU EGT ..... RISE AND STABILIZE  
APU GEN LIGHTS ..... ILLUMINATED  
APU GENERATORS ..... ON  
APU BLEED ..... ON  
DUCT PRESSURE ..... PRESSURE L AND R

## —Overhead Setup—

FLIGHT CONTROL PANEL .....CHECK  
YAW DAMPER ..... ON  
FUEL SYSTEM PANEL .....CHECK  
FUEL PUMPS ..... ON AS REQUIRED  
ELECTRICAL PANEL .....CHECK  
EQUIPMENT COOLING ..... NORMAL, LIGHTS OFF  
WINDOW HEAT ..... ON  
PROBE HEAT ..... OFF  
ANTI-ICE ..... OFF  
HYDRAULICS PANEL .....CHECK  
SYSTEM A SWITCHES ..... ON  
SYSTEM B SWITCHES ..... ON  
ELECTRIC LOW PRESSURE LIGHTS ..... OFF  
AIR CONDITIONING PANEL .....CHECKED  
LEFT PACK ..... AUTO  
ISOLATION VALVE ..... OPEN  
RIGHT PACK ..... AUTO  
PRESSURIZATION PANEL .....CHECK  
FLIGHT ALTITUDE ..... SET FOR CRUISE  
LANDING ALTITUDE ..... SET FOR DESTINATION  
EXTERIOR LIGHTING ..... AS REQUIRED  
IGNITION ..... L OR R

## —FMC Initialization—

ROUTE CLEARANCE .....OBTAINED  
FMC VERSION .....CHECKED  
NAVDATA .....CHECKED  
POSITION INIT ..... SET  
DEPARTURE ..... RWY/SID SET

ROUTE .....ENTERED/RECALLED  
LEGS ..... CHECKED FOR CORRECTNESS  
PERF INIT ..... COMPLETED  
N1 LIMIT ..... SET FOR TAKEOFF  
TAKEOFF ..... FLAPS AND V SPEEDS SET  
TAKEOFF ..... PRE-FLT COMPLETE  
CLIMB PAGE ..... SET FOR DEPARTURE

## —Main Panel Setup—

### EFIS

MINIMUMS ..... AS DESIRED  
FLIGHT PATH VECTOR ..... AS DESIRED  
ALTIMETER ..... SET LOCAL  
VOR/ADF POINTERS ..... AS DESIRED  
MODE SELECTOR ..... MAP  
CENTER SWITCH ..... AS DESIRED  
RANGE SELECTOR ..... AS DESIRED

### MCP

COURSE .....SET IF NEEDED  
FLIGHT DIRECTOR ..... ON  
AUTOTHROTTLE .....OFF  
HEADING ..... RWY HEADING  
ALTITUDE ..... SET FOR INITIAL CLEARANCE  
AUTOPILOTS ..... OFF  
PFD ..... NO FLAGS  
AUTOBRAKE ..... RTO  
ENGINE INSTRUMENTS ..... CHECK

### RADIOS

COMM RADIOS ..... SET  
NAV RADIOS ..... SET  
ADF ..... SET  
TRANSPONDER ..... SET, OFF

### CENTER PEDESTAL

SPEED BRAKE ..... DOWN  
THRUST LEVERS ..... IDLE  
ENGINE START LEVERS ..... CUTOFF  
STABILIZER TRIM ..... SET

## —Pushback and Start—

PASSENGER BOARDING ..... COMPLETE  
PASSENGER DOORS ..... CLOSED AND LOCKED  
CLEARANCE FOR PUSH ..... OBTAINED  
THROTTLES ..... IDLE  
START LEVERS ..... OFF  
PACKS ..... OFF  
APU ..... RUNNING  
BLEED AIR PRESSURE ..... CHECKED  
FUEL PUMPS ..... ON  
ANTI-COLLISION LIGHT ..... ON  
PARKING BRAKE ..... RELEASED  
PUSHBACK ..... COMPLETE  
PARKING BRAKE ..... SET  
GROUND CREW ..... READY FOR START  
#2 STARTER ..... GROUND  
#2 N2 ..... 20%  
#2 START LEVER ..... IDLE  
#2 EGT ..... MONITORED  
#2 STARTER ..... AUTO-OFF  
#1 STARTER ..... GROUND  
#1 N2 ..... 20%  
#1 START LEVER ..... IDLE  
#1 EGT ..... MONITORED  
#1 STARTER ..... AUTO-OFF



**—After Starting—**

ENGINE GENERATORS ..... ON  
PROBE HEAT ..... ON/TESTED  
ANTI-ICE ..... AS REQUIRED  
ENGINE BLEEDS ..... ON  
PACKS ..... AUTO  
ISOLATION VALVE ..... AUTO  
APU BLEED ..... OFF  
APU SWITCH ..... AS REQUIRED  
EXTERNAL LIGHTS ..... AS REQUIRED  
MASTER CAUTION LIGHT ..... OFF  
RECALL ..... CHECKED CLEAR

**—Taxi—**

TAXI CLEARANCE ..... OBTAINED  
GROUND CREW ..... SALUTE OBTAINED  
TAXI SPEED ..... <20  
BRAKES ..... CHECKED

**—Before Takeoff—**

MASTER CAUTION LIGHT ..... OFF  
RECALL ..... CHECKED CLEAR  
FLIGHT CONTROLS ..... CHECKED  
FLAPS ..... SET  
TRIM ..... CHECKED  
FLIGHT DIRECTOR ..... ON  
TAKEOFF BRIEFING ..... COMPLETE  
-----THE LINE-----  
TAKEOFF CLEARANCE ..... OBTAINED  
STROBE LIGHTS ..... ON  
WING LIGHTS ..... ON  
LANDING LIGHTS ..... ON  
RUNWAY TURNOFF LIGHTS ..... ON  
ENGINE START SWITCHES ..... CONT  
TRANSPONDER ..... TA/RA

**—Takeoff—**

HEADING BUG ..... ALIGNED WITH RUNWAY  
THROTTLES ..... TO 40% N1  
TOGA ..... ENGAGED  
THROTTLES ..... SET TAKEOFF POWER  
BRAKES ..... RELEASED

**—After Takeoff—**

POSITIVE CLIMB ..... GEAR UP  
400 FT ..... ROLL MODE SELECTED  
..... CLIMB SPEED V2+20  
800 FT ..... REDUCE PITCH  
..... SPEED 220/230  
..... RETRACT FLAPS ON SCHEDULE  
1000 FEET ..... ENGAGE AUTOPILOT  
3000 FEET ..... SPEED TO 250  
..... GEAR OFF  
..... AUTO BRAKES OFF  
..... ENG STARTERS OFF

**—Departure—**

AUTOPILOT ROLL ..... AS REQUIRED  
AUTOPILOT PITCH ..... LVL CHG  
MCP ALTITUDE ..... SET AS REQUIRED  
THRUST ..... SET AS NEEDED

**—Climb—**

10,000 FEET ..... SEAT BELT SIGNS OFF  
..... LIGHTS OFF AS APPROPRIATE  
..... ADJUST CLIMB SPEED  
TRANSITION ALT ..... ALTIMETER SET TO STD  
THRUST ..... SET AS NEEDED

**—Cruise—**

THRUST ..... SET AS NEEDED  
ARRIVAL PROCEDURE ..... SELECTED  
LEGS PAGE ..... CHECKED FOR CONSISTENCY  
DESCENT PROFILE ..... VERIFIED  
DESTINATION WEATHER ..... UPDATED

**—Descent—**

SPEED ..... MONITORED  
PITCH MODE ..... VS ABOVE 10,000  
..... LVL CHG BELOW 10,000  
TRANSITION ALT ..... ALTIMETER SET TO LOCAL  
10,000 FEET ..... SEAT BELTS SIGN ON  
..... LIGHTS ON AS APPROPRIATE

**—Arrival—**

DESTINATION RUNWAY ..... SELECTED  
APPROACH ..... IN FMC AS REQUIRED  
FMC INIT REF PAGE ..... VREF SELECTED

**—Approach—**

APPROACH ..... SELECTED AND BRIEFED  
NAV RADIOS ..... SET FOR APPROACH  
APPROACHING INTERCEPT ..... SPEED 180  
..... FLAPS 5  
AUTOBRAKE ..... SET  
AUTOSPOILERS ..... ARMED  
ENGINE START SWITCHES ..... CONT  
APPROACHING FAF ..... GEAR DOWN  
..... FLAPS SET FOR LANDING  
..... SPEED VREF +5

**—After Landing—**

SPEED BRAKE LEVER ..... UP  
FLAPS ..... UP  
PROBE HEAT ..... OFF  
ENGINE START SWITCHES ..... OFF  
LANDING LIGHTS ..... OFF  
TAXI LIGHTS ..... AS REQUIRED  
STROBE LIGHTS ..... OFF  
FLIGHT DIRECTOR ..... OFF  
TRANSPONDER ..... SBY  
APU ..... START IF NEEDED

**—Shutdown/Secure—**

BRAKES ..... ON  
START LEVERS ..... CUTOFF  
GROUND POWER ..... ON  
DOORS/STAIRS ..... OPEN  
FUEL PUMPS ..... OFF  
CAB/UTIL ..... OFF  
IFE/PASS ..... OFF  
SIGNS ..... OFF  
WINDOW HEAT ..... OFF  
PROBE HEAT ..... OFF  
ELECTRIC HYDRAULICS ..... OFF  
ALL BLEEDS ..... OFF  
ISOLATION VALVE ..... CLOSED  
RECIRC FAN ..... AUTO  
EXTERNAL LIGHTING ..... OFF  
EMERGENCY EXIT LIGHTS ..... OFF  
BATTERY ..... OFF  
GROUND POWER ..... OFF

**—Missed Approach—**

TOGA ..... ACTIVATED  
FLAPS ..... 15  
THRUST ..... SET AND MONITORED  
PITCH ..... TOWARD 15 DEGREES  
POSITIVE CLIMB ..... GEAR UP  
400 FT ..... ROLL MODE SELECTED  
..... CLIMB SPEED V2+20  
800 FT ..... REDUCE PITCH  
..... SPEED 220/230  
..... RETRACT FLAPS ON SCHEDULE  
1000 FEET ..... ENGAGE AUTOPILOT  
3000 FEET ..... SPEED TO 250  
..... GEAR OFF  
..... AUTO BRAKES OFF  
..... ENG STARTERS OFF