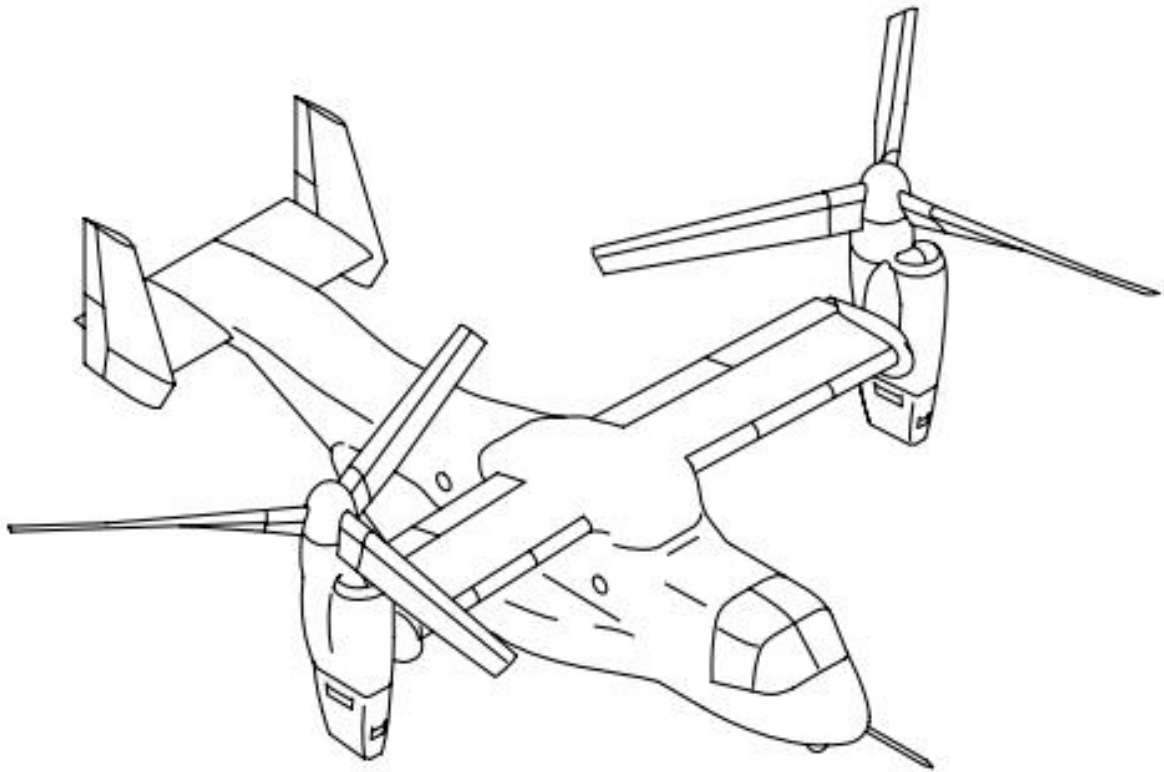


**FSX – P3D
FLIGHT MANUAL
MV-22B
TILTROTOR**

RELEASE 1.0



**MARYADI
INDONESIA**

FOREWORD

I created this addon because I was not satisfied about the quality of todays existing simulations (freeware and payware) of this wonderfull and unique aircraft in FSX/P3D. Then I started to create this add on, after some time, a lot of people give help. I created my own version based on real-world specs, many pictures/videos and even input from people that have hands-on experiance with the real aircraft. With this release I still not satisfied yet, futher update and upgrade will come in future as long as ALLAH SWT still give me a life to continue.

This my first aircraft that available for public and most focus and new experience ever in coding (C++ and XML), flight dynamic, modeling, animation, sound set. As before that I only do texturing and build and airport. Especially focussing on flight dynamics, visual model & special animations, and other things (like the mixed helo/airplane operation) that makes the Osprey such a unique aircraft. I admit: not perfect as well. Limited a.o. by available information, the lack of proper VTOL-operation support in FSX/P3D, and (of course) available time to implement things. I never saw MV22B directly. If I succeeded I will leave that judgement to you.

Read the flight manual, better if understand and complete reading. Even my add on was simulation, but I always try as close as the real aircraft including flight manual. This aircraft very complex and uncommon aircraft, it need to know what inside it, what have, what you should do, or you will confuse and can't do some special feature that this add on have. Flight Manual describes & explains some limitations, what you do on first time, save and load flight, Vortex Ring State, engine overload, and also a lot of the unique V22-Osprey features that are simulated.

This package is "copy-righted freeware" (NOT: public domain), and is made available for your personal use only. Without my explicite permission, it may NOT be sold, modified, re-distributed and/or uploaded to other website in any shape or form. The same applies to files included in this package, created by other developers mentioned in Credits.

And obviously, installing & using this package is at your own risk.

Credits, and thanks to:

1. Jonathan Bleeker. For helping and teaching me in C++ and coding stuff in FSX/P3D.
2. Rob Barendregt. For his VSTOL implementation and other contributions.
3. Bob McElrath, for his gauge map, <http://www.robziemcelrath.com/fs/guides/customdraw>
4. Pilot / copilot 3d model by DICE/EA, <http://tf3dm.com/3d-model/pilot-74764.html>
5. Doug Dawson, for his (included) IPC interface and sound gauges.
6. Nick Needham, for his (included) dust/rotorwash effects.
7. Josh Steward and Letourn as Beta Tester and texture variations
8. Many other users at the FS-Developer website, for their support, beta-testing and willingness to share experiances in FS-design.

For now I didn't have any website, as I work "alone" (in exception for VTOL and advice on programming), I think I can't maintain a website. If there any question, new upgrade/update will inform in fsdeveloper.com on MV22B Osprey showroom forum.

As stated, by itself this addon package is "freeware". But I have spent numerous hours in making this addon, and have spent some money too to create it (like buying a flight manual). So if you want to financially support my (current, and future) FS design effort, I will appreciate that very much.

To make donation please use paypal(maryadi.atc@gmail.com)

Best Regards, and Enjoy

Maryadi
Indonesia

Email: maryadi.atc@gmail.com
User 'Kalong' on www.fsdeveloper.com

**FSX-P3D
MV-22B FLIGHT MANUAL
UPDATES HISTORY**

Update :

1. 28 September 2016.
2. 6 December 2016.
3. 7 January 2017.
4. 16 January 2017.
5. 20 January 2017.
6. 22 February 2017.
7. 23 February 2017 (ROB).
8. 1 March 2017.
9. 5 March 2017.
10. 8 March 2017.

**FSX-P3D
MV-22B FLIGHT MANUAL**

TABLE OF CONTENTS

PART I - INSTALLATION

CHAPTER 1 – INSTALLATION AND REQUIREMENTS

CHAPTER 2 – GLOSSARY

PART II - LIMITATIONS

CHAPTER 3 IMPORTANT NEED-TO-KNOW

CHAPTER 4

PART III - AIRCRAFT

CHAPTER 5 GENERAL

CHAPTER 6 AIRCRAFT SYSTEMS

CHAPTER 7 OPERATING LIMITS

PART IV - PERFORMANCE

CHAPTER 8 ENGINE PERFORMANCE

CHAPTER 9 TAKE OFF

CHAPTER 10 CLIMB

CHAPTER 11 RANGE

CHAPTER 12 ENDURANCE

CHAPTER 13 IN-FLIGHT REFUELING

CHAPTER 14 DESCENT

CHAPTER 15 LANDING

PART V - NORMAL PROCEDURES

CHAPTER 16 FLIGHT PREPARATION

CHAPTER 17 FLIGHT CHARACTERISTIC

PART VI – CHECKLISTS AND FLIGHT CREATION

CHAPTER 18 CHECKLISTS, CREATING STANDARD FLIGHTS

PART VII - FAQ

PART VIII - MISCELLANEOUS REMARKS AND SIM CONTROLS

This Documentation is intended to be used in FSX or P3D. Documentation will be updated as necessary without notification. Please see update record.

NOTE

DO NOT USE THIS DOCUMENTATION ON REAL AIRCRAFT.

PART I - INSTALLATION

CHAPTER 1 INSTALLATION AND REQUIREMENTS

This chapter covers FSX and P3D, and will divide in two different sections if future developments would introduce substantial differences.

1.1 Requirements. Make sure you have FSUIPC installed and working on your system (no need for registered FSUIPC). Otherwise the VSTOL function won't work !

1.2 Package. This MV22B simulation is intended for
- FSX-Boxed (fully tested with -SP2 and -Acceleration)
- FSX-SteamEdition
- P3D (fully tested with V3.3)

1.3 Installation. Copy the contents of this zip file to your main .../SimObject/Airplanes folder. Then copy the contents of the the included /Effects folder to your main .../Effects folder.

If applicable: backup (move) an older version of this package from the .../SimObject/Airplanes folder to a temp folder outside the FSX/P3D folder structure.

1.3.1 Default View. There are some differences between FSX and P3D v3 VC-coordinates. This package is optimised for P3D. If you use FSX, the optimal VC Eyepoint (defined in the aircraft.cfg) is:

[Views]
eyepoint = 15.4, 1.9, 0.8
Using a zoomfactor of 0.5 when flying in the VC

CHAPTER 2 GLOSSARY

2.1 All marked text are refer to real flight manual, some abbreviation will explain, some will not.

BFWS	Blade Fold/Wing Stow
CDU	Control Display Unit
CPLD	Coupled
ENAV	External Navigation.
INAV	Internal Navigation.
MFD	Multifunction Display
Ng	Gas generator speed
PFD	Primary Flight Display
SRCH PAT	Search Pattern
STO(L)	Short Takeoff (and Landing)
TCL	Thrust Control Lever
VTO(L)	Vertical Takeoff (and Landing)

PART II - LIMITATIONS

CHAPTER 3 IMPORTANT NEED-TO-KNOW

3.1 Developer and Sim Limitation. To achieve features in this MV22B not supported by the internal FSX/P3D engine, some real features are limited and some are not solved.

3.1.1 "L" key button. The "All lights toggle" command is disabled for use in this aircraft. Use light knobs/switches on overhead panel of the aircraft.

3.1.2 Proprotor animation. The real aircraft has a "gearbox" connecting both engines with both Proprotors, so both Proprotors work with one engine off. Also, spoolup/down is very specific in this aircraft. Since FSX/P3D has no such "gearbox" feature, the developer has made his own Proprotor RPM animation to achieve this.

However, when loading a flight with engines already running while in outside view, the proprotors won't rotate properly.

The same applies if, when flying in outside view, you switch from WindowedMode to FullScreenMode vice versa, during a flight in outside view.

Remedy: Select VC view and then outside view again.

3.1.3 Save-Load flight parameters. The MV-22B has complex aircraft systems, some of which are not supported by the default FSX/P3D program. Another basic restriction of FSX/P3D is, that if you save a flight (for reload later) only a limited set of known FS parameters is saved in the FS saved-flight files.

Example:

the actual (basic FS) exit/door states are NOT saved, so are always loaded with a default position.

In this simulation, some important flight states are saved/reloaded in a private (*.mv22) file, which is stored in the same folder as the standard FS flight files. Like the APU state and the fold/stow position of the propblades/wings.

NOTE

DO NOT save a flight when flying in VTOL/STOL mode. Saving at VTOL/STOL mode is not supported.

3.1.4 SharedCockpit/Multiplayer (SC/MP). In the visual model, the nacelles position of the "remote" MV-22B should be animated correctly in MP operation. Be it with a little "lag", caused by the inherent delay of data transfer via the SC/MP IP-network and FS performance. However, the distributed information (events / variable-states) in SC/MP is quite limited, restricted to some basic functions in FS.

So for many added features unknown to the FS program, like nacelles rotation, APU operation, blade fold / wingstow, etc etc. , FS designers have to use "proxy" functions to simulate them in SC/MP. "Proxy" means: defining an unused, but operational FS function in that aircraft model for other purposes. But only very few "free" FS functions are available for this. Hence we haven't found a good way (yet) to simulate/animate bladefold&wingstow in MP.

Flying in STOL/VTOL and airplane mode are fully multiplayer compatible. FOLD and STOW are not compatible in multiplayer.

3.2 Special Features. Some real MV-22B features have been implemented that may not be liked by a very casual sim-pilot. So they can be switched off if preferred, with the Special Features button (default: ON) located above the Backup Attitude Indicator on the main panel.

3.2.1 Vortex ring state. In VTOL config (nacelles between 83 and 97 degrees) and airspeed < 30 Knots, the aircraft start to roll uncontrollably when V/S gets below 1500 ft/min. To recover (if at sufficient altitude), throttle up and reduce nacelles angle.

3.2.2 Engine limitation. The engines can afford high RPM (> 98% Ng) for max. 60 sec. continuously (real aircraft: 3 sec.) Any longer, and the engines are damaged (now: shutdown).

3.3 Upper/lower conversion limits ("auto-nacelles"). This limits the nacelles angle you can set during conversion from VTOL - APLN mode v.v., depending on current airspeed. Controlled with the AutoNAC button (default: ON) in the Autopilot section.

3.4 Engine Start/Stop. DO NOT use the FS Auto-Start/Auto-Shutdown command to start/stop the engines, but the overhead panel Starter Levers instead. However, if you load a saved flight (with engines On or Off), the Starter Levers will be auto-set in the right position. If the first engine (left or right) is started (i.e. set to FLY position), the FS engine isn't actually started until 30 sec later; although the startup sound suggests otherwise.

This is to allow for proper animated spoolup of the Proprotors. See section 3.1.2 for detail.

3.5 Mouse clickspots. Mouse Clickspots in the VC depend on the clickspot type. In general:

- Buttons are operated with a Left Mouse click.
- Selectors (like: AP AltitudeSelector), multi-position switches (like: APU) and levers (like: Starter levers) are operated with the MouseWheel. Some can also be mouse-dragged (use left click-and-drag); at present however, this dragging is too sensitive. Maybe solved in future.

CHAPTER 4 - Intended to be blank -

PART III - AIRCRAFT

CHAPTER 5 GENERAL

5.1 Dimension.- Intended to be blank -

5.2 Specification.- Intended to be blank -

CHAPTER 6 AIRCRAFT SYSTEMS

6.1. Panel System:

6.1.1. MFD. There are 4 Multi Functional Display's, each having 5 different screens. Each screen has a knob to customize (OFF, NIGHT and DAY). An MFD Screen consists of :

6.1.1.1. PFD. Primary Flight Data. This display contain all basic aircraft instrumentation and some important instrumentation for the need to fly MV-22B.

- Artificial Horizon.
- Indicated Airspeed.
- Altitude Indicator.
- Vertical Speed. It modified vertical speed with warning red line if indicated airspeed below 60 knots. Red line give warning to pilot to avoid vertical speed below 1500 feet/min that can make VRS
- Horizontal Situation Indicator.
- VOR. See 6.1.1.1.1 for detail.

- nacelles indicator. This indicator also visualises (red/green bars) the conversion corridor when in Conv mode; so when AutoNac is Enabled you can only set the nacelles between the two airspeed-dependant upper/lower limits.

- Radio Height. When aircraft below 2500ft of height, radio indicator height will be displayed on yellow color.

- Navigation data. Will displayed if flight using flightplan and autopilot active.



Figure:
PFD screen

6.1.1.1.1 VOR/DME. Very High Frequency Omnidirectional range, use as land base navigation system. Has 2 separate VOR, VOR-1 and VOR-2. Sample for using approach using ENAV See section 18.2.1.

- VOR-1. Input from EICAS, white color indicator gives deviation information. This VOR-1 can be used for ILS approaches.

- VOR-2. Input from EICAS, green color indicator gives deviation information. This VOR-1 can be used for ILS approaches.

VOR Identification and DME distance (if available) is placed in the PFD top-right corner. Top VOR is VOR1, and below it is VOR-2. VOR/DME displayed if no flightplan is active.

6.1.1.2. NAV. Navigational Screen. Contain Map, HSI dan VOR indicator. Some menu are not supported yet.

6.1.1.2.1 MAP. Map display not independ. All change on map display will make change to all 4 screen display. this FSX limitation, Regarding framerates. Map has zoom in/out, center/ decenter position.

Map consist of 2 different map type:

- MAP 1 : Map with Height color
- MAP 2 : Map with blue and black color.
- OFF : no map display

6.1.1.2.2 HSI. Horizontal situation indicator give information about heading, compass rose, wind direction and speed, VOR direction and deviation.

6.1.1.3. FLIR. Available for P3D v3 only. Not supported in FSXA/Steam. Still has limit capabilities can't adjust direction yet and Only forward view only.

6.1.1.4. STAT. The STAT screen has 5 sub screens. The Command function consist of 2 buttons: button UP and button DOWN. (sequential selection, not-repetitive).

6.1.1.4.1. FUEL: Contain fuel status for fuel tank available.

- Right fuel tank places on Right wing,
- Left fuel tank places on Left wing
- Right Auxiliary fuel tank places on right sponsoon
- Left Auxiliary fuel tank on left sponsoon
- Right tip fuel tank place on right afterward sponsoon.
- Center fuel tank place id cargo bay and didn't have functionality due to FSX/P3D limitations. It's used for extended range capability or for aerial air refueling. There is no model and animation yet to use the MV-22B as tanker.

6.1.1.4.2. FCS.
Intended Display only

6.1.1.4.3. ENG. Display engine indication as copy EICAS display. no menu can be use in this screen.

6.1.1.4.4. ICE. Display antiice indicator. Display antiice system in active position ONLY, Not display aircraft detected ice.

6.1.1.4.5. ELECT. Display aircraft electical system. This still in development, no menu can be use in this screen.



Figure:
Blade Fold Wing Stow screen

6.1.1.5. SYST.

Blades FOLD and Wing STOW.

Make sure both engines and propotors are fully stopped.

Operation:

on MFD at SYST Screen, choose [BFWS] to open the new screen. there are 4 options, now 3 available:

FLT READY : has no function yet

FULL STOW : command for wing stow

ROTOR LOCK : rotor lock command

FOLD HORIZ : command for blade fold

in center screen has FLT RDY to FULL STOW check list :

```
-->LOCK ROTOR
-->FOLD BLADES
-->LOWER NACELLES
-->STOW WING
-->SEQUENCE COMPLETE
```

--> arrow sign = active

6.1.1.5.1 FOLD and STOW procedure:

6.1.1.5.1.1 ROTOR LOCK.

Make sure for FOLD and STOW this is active. --> sign will appear. Rotor lock can not be activated, if the propotors still rotate. After rotor lock, FOLD and STOW can commence to next phase.

6.1.1.5.1.2. FOLD HORIZ.

It can fold in whatever nacelles position; if nacelles below 60 degrees it will command nacelles to 60 degrees first. In this position the flight can be saved and reloaded later.

6.1.1.5.1.3 FULL STOW.

After blades have fully folded, this phase can start. Nacelles and flaps are automatically commanded.

6.1.1.5.1.4 after all list done, the --> sign will appear on "sequence complete"

NOTE

- a. if you save a flight when in full Stowed state, this state is set again when you reload the flight.
- b. Fold/Stow isn't animated for the remote aircraft in MultiPlayer operation. See 3.1.4

6.1.1.5.2 UNFOLD procedure :

6.1.1.5.2.1 FULL STOW. To unstow the wings. At some point it will automatically command nacelles to 90 degrees position.

6.1.1.5.2.2 FOLD HORIZ. Unfold blades. If aircraft not from FULL STOW, make sure nacelles above 60 degrees, or command will not respond to unfold.

6.1.1.5.2.3 ROTOR LOCK. Make sure this command deactivated after all UNFOLD and STOW finish. if ROTOR LOCK command active, it will prevent engine from start. starter lever will not give command to start.

NOTE

During the fold / unfold phase, the button will not respond to additional commands untill the phase is finished.



Figure:
CDU-EICAS

6.1.2 CDU Center Display Unit. CDU have 3 main screens.

6.1.2.1 CDU. CDU screen has no functionality by now.

6.1.2.2 STAT. The STAT screen has 5 sub screens. The Command function consist of 2 buttons: button UP and button DOWN. (sequential, non-repetitive).

6.1.2.2.1 FUEL. FUEL screen has additional function compare on MFD. It has a command for fuel probe to extend and retract. Air refueling capability is not simulated yet. It needs additional software to achieve this.

6.1.2.2.1.1 Air Refueling Probe. Command from respective button. Command will loop between:

- PROBE OFF. Fuel probe retract
- PROBE EXTENDED. Fuel probe extended
- STOW. Fuel probe retract

6.1.2.2.2 FCS.

- Intended Display only -

6.1.2.2.3 ENG.

- Intended Display only -

6.1.2.2.4 ICE. ICE screen have button functionality on respective display. ALL MODES, AUTO OFF ON, MANUAL and OVERRIDE function is not simulated yet. Display on ICE system are not all simulated as FSX/P3D limitation plus it complex system.

- PRTR. Proprotor blade deice.

- WING. Structural deice.

- PITOT. Pitot heater.

- ENGINE. Engine deice.

6.2.2.5 ELECT.

- Intended Display only -

6.1.2.3 EICAS. EICAS Display engine reading, propotor, gearbox, oil temperature and hydraulic pressure. Temperature has a defect on due to FSX/P3D and developer limitation capability.

EICAS display has the capability to accept input from your physical keyboard. Just press and hold TAB key during typing/correcting. A string will appear on bottom left as to display what you typing. For now, only digits are supported (use the upper number keys on keyboard). To undo a displayed value, use Backspace key. After typing the value, release the TAB key, and click any of the following:

6.1.2.3.1 COMM1. Input only accept for VOR/ILS frequency only: 118 to 136.975 MHz.

6.1.2.3.2 COMM2 : idem.

6.1.2.3.3 VOR / ILS. VOR-1/ILS on left side and VOR-2/ILS on right side of CDU. There no standby frequency. Input only accept for VOR/ILS frequency only: 108 - 117.95 MHz.

Input VOR1/ILS and VOR2/ILS button also activate which navigation in use with autopilot. Always use VOR1/ILS as primary navigation as only VOR1/ILS has course knob on autopilot panel and has deviation bar on HSI indicator. VOR2/ILS only have direction arrow.

NOTE

VOR1/ILS and VOR2/ILS only work automatic if master autopilot active and navigation system use NAV.

6.1.2.3.4 TACAN CHAN. This feature is not supported yet.

6.1.2.3.5 ALT SET. Altimeter Setting has 2 kind of input, left side input for miliBar and right side for InHg.

6.1.2.3.6 RAD ALT. Radio Altitude input is not supported yet.

6.1.2.3.7 TRANSPONDER: Input using keyboard from 0000-9999 digit.

6.1.3 AUTOPILOT. Autopilot functions are disabled at S/VTOL mode. This to make challenge to user flying MV22B. Developer will trying to minimize all auto mode (opposite in real aviation world and developer achievement), to make user have full control and taking care of his aircraft.

6.1.3.1 Autopilot panel. Not all button available in autopilot panel are supported. All default and basic autopilot needed for flight are available. Button have a light text that will lit green if respective autopilot active. CAP text mean respective button are on active condition. ARM text mean button available and can be activated.

6.1.3.1.1 CPLD. CPLD are autopilot master button, both left and right button have same functionality.

6.1.3.1.2 ENAV / INAV. ENAV stand for External Navigation use VOR, ILS and TACAN. INAV stand for internal Navigation system use GPS only.

6.1.3.1.3 VOR/ILS. VOR/ILS have function as swap button between active navigation with NAV 1 or NAV 2. VOR frequency input see. Section 6.1.2.3

6.1.3.1.4 TACAN. Tacan button not supported yet.

6.1.3.1.5 SRCH PAT. SRCH PAT have function as flight path will give purple line vertical and horizontal. Purple lines only appear if SRCH PAT button active and have VOR/ILS signal

6.1.3.1.6 APPR. APPR button as to activated navigate approach. this not yet full supported, it has function but still need more configure to make it work. (developer never test in autoland mode)

6.1.3.1.7 GPS / WYPT. Navigation using default FSX/P3D flightplan.

6.1.3.1.8 CRS. CRS knob as course selector. This knob only work for NAV1.

6.1.3.1.9 Brightness knob. Brightness knob not supported yet.

6.1.3.1.10 HDG. HDG as heading selector and hold button.

6.1.3.1.11 SPEED. Speed as indicated airspeed selector and hold button.

6.1.3.1.12 ALT. ALT as altitude selector and hold button.

6.1.3.1.13 V/S. V/S as Vertical speed selector. Vertical hold button not yet supported.

6.1.3.1.14 AUTO NAC. When On (CAP), the nacelles are forced to stay within the calculated limits. See figure Conversion corridor

6.1.3.1.15 unmarked button. have no functionality, just refering to real aircraft.

6.1.3.1.16 HVR CPLD. HVR CPLD makes the MV-22B hover at a fixed altitude. This is a very complex system and is not implemented yet.

6.1.3.1.17 REM HVR. REM HVR button has a similar function as HVR CPLD, and is not implemented yet.

6.1.3 Radio COMM. At the dashboard, left/right side of Autopilot. Comm frequency has a wide range of frequencies. There is a knob to change the frequency.

A faster way is to use the Keyboard, to type direct frequency input. Moreover default FSX/P3D has the fastest frequency change option, using ATC dialogue.

6.1.5 OVERHEAD PANEL.

6.1.5.1 Battery. Master Batter Switch on left side Overhead panel. Battery indicator display give information of voltage available by battery. LOW sign will lit if battery below 23.1 volts.

6.1.5.2 APU. APU should be set to Run position when both engines are Off, to ensure electrical power remains at correct level.



Figure:
Autopilot Panel

6.1.5.3 Starter levers. Set to Fly for engine start; set to OFF for engine stop. Even there have CRANK-OFF-START-FLY starter lever not yet supported this. Starter lever only work when voltage above 26 volts. Mean APU or engine generator/alternator must on.

NOTE

APU must turning off when inflight

6.1.5.4 Fuel Control lever. The Fuel control lever is placed between the two starter levers, and should normally be On (down).

6.1.5.5 Door panel. To open/close the main and ramp doors. Use the center switch to extend the ramp door fully down.

6.1.5.6 Light Switch

6.1.5.6.1 Primary Lighting. Consist of:

- Beacon light. Switch OFF-BRIGHT
- Strobe light. Switch OFF-BRIGHT
- Navigation light. Switch OFF-BRIGHT

6.1.5.6.2 Lighting. Consist of:

- Instrument light. Switch OFF-BRIGHT
- Cockpit light. Disabled at the moment

6.1.5.6.3 Rotor Tip Light. Placed in rear far left side of overhead panel. Consist of:

- Light mode. Light switch NORMAL/OFF
- Blade mode. Light toggle TOP – OFF – BOTTOM

To enable the bladetip light, set light mode to NORMAL and blade mode to TOP or BOTTOM

6.1.6 Center Console.

6.1.6.1 Flapslever. This simulates the flaperons as in the real MV-22B.

6.1.6.1.1 Auto Flap. auto-mode (position A), flaps are auto-commanded (in CONV/VTOL mode) depending on nacelles position and airspeed.

6.1.6.1.2 Manual Flap. In manual-mode (position 0,10,20,40):

- In APLN mode, you can freely set flaps to position 0,10, 20, 40, either via this lever, or standard flaps keys.
- In CONV mode, flaps are limited to position 0 or 40.
- In VTOL mode, flaps are always forced to position 73.

CHAPTER 7. OPERATING LIMITS

7.1 VTOL

7.1.1 MTOW. Max takeoff weight at VTOL mode : 52.000 lbs at sealevel. This is altitude-dependant, and decreases with altitude.

7.1.2 MAX VTOL Altitude. Max altitude for VTOL operation: 5500 ft.

7.2 STOL

7.2.1 MTOW. Max takeoff weight at STOL mode: 60.000 lbs at sealevel.

7.2.2 Nacelles Setting. Normal nacelles setting for STOL: 60 degrees (normal) or 75 degrees (Tactical).

Required runway length for STO: depending on Nacelles angle, thrust and weight. Minimum: 20 ft.

PART IV - PERFORMANCE

CHAPTER 8 ENGINE PERFORMANCE

8.1 The aircraft is powered by two Rolls-Royce Corporation AE1107C turboshaft engines. One engine is mounted in each of the wingtip nacelles.

CHAPTER 9 TAKE OFF. Intended to be blank -

CHAPTER 10 CLIMB. Intended to be blank -

CHAPTER 11 RANGE. Intended to be blank -

CHAPTER 12 ENDURANCE. Intended to be blank -

CHAPTER 13 IN-FLIGHT REFUELING

13.1 Capability to do in-flight refueling is not supported yet. It supports animation only. Aerial refueling capability have not supported yet.

CHAPTER 14 DESCENT. Intended to be blank -

CHAPTER 15 LANDING. Intended to be blank -

PART V - NORMAL PROCEDURES

15.1 Engine start.

- Set the APU to Run.
- Make sure props are Unlocked (so wings unstowed, blades unfolded)
- Set both StarterLevers to Fly position

15.2 Engine failure. The real MV22B can fly (in emergency operation, with degraded performance) with only one engine running. Via a gearbox, that drives both left and right propotor. This addon simulates this, so visually both propotors rotate when only one engine is running.

Fly with One engine running must landing on STOL Mode, never do in VTOL mode. When on cruise flight, fly with one engine running still can do with degradation performance. Maintain speed around 170 kts or keep engine indication on green (tested fly at altitude 16000 feet)

NOTE

Normal CONV/VTOL operation, both engines must be running normally. With engine failed (both or 1 engine) is prohibited to do auto-rotation.

Figure
Overhead panel



CHAPTER 16 FLIGHT PREPARATION. Intended to be blank

CHAPTER 17 FLIGHT CHARACTERISTIC

17.1 Flight modes. The MV22B can be in any of three flight mode:

- APLN: normal flight (nacelles angle 0)
- CONV: Conversion mode / STOL (nacelles between 0 and 83 degrees)
- VTOL: (nacelles between 83 and 97 degrees)

PART VI – CHECKLISTS AND FLIGHT CREATION

18.1 These Checklist are general checklists that need to correspond with aircraft state (see section 18.2).

1. Battery – ON
2. APU - RUN/ENG check APU display is RUN
3. AVIONIC POWER (Mast Avionic) – ON
4. Turn ON ALL PFD/MFD/CDU Display. Not used PFD/MFD display can remain OFF
5. At STOW state, unfold wing and blade:
 - a. Observe no obstacle/ obstruction – CLEAR
 - b. MFD-SYST-BFWS- FULL STOW – UNCHECKED
 - c. MFD-SYST-BFWS- FOLD HORIZ – UNCHECKED
 - d. MFD-SYST-BFWS-Proprotor – unchecked
6. Check Fuel availability
7. Start Engines:
 - a. Set CDU on EICAS display or set MFD on STAT-ENG display

- b. Parking brake ON
- c. Check aircraft in clear from obstruction/obstacle
- d. Move one starter Lever to FLY position. Start can be done from engine 1 or 2.
- e. Proprotor – ROTATE
- f. EICAS-NG – gaining % RPM after 30 sec
- g. respective engine. Wait RPM stabilize at 70-72 %
- h. Switch respective FADEC (Engine Generator Switch) – ON
- i. Move other starter Lever to FLY position – Check NG RPM
- j. RPM stabilize at 70-72% Switch respective FADEC (Engine Generator Switch) – ON

8. Disengage APU – CRANK Position

VTOL

9. Check MTOW for VTOL
10. Check take off Area- CLEAR from obstacle
11. Check windspeed and direction – headwind / into the wind
12. Check nacelles position degrees – always try to get head wind
13. Take off VTOL – observe NG indication (see section 3.2.4)

STOL

14. Check MTOW for STOL
15. Observe obstacle – CLEAR PATH
16. Nacelles: as required, depending on available runway. Normally: 60 or 75 degrees.

AIRBORNE

17. Observe aircraft attitude – LEVEL
18. Observe obstacle – CLEAR from obstacle
19. Observe engine RPM% - GREEN
20. Landing Gear - UP
21. Gain speed and gradually rotate nacelles forward –

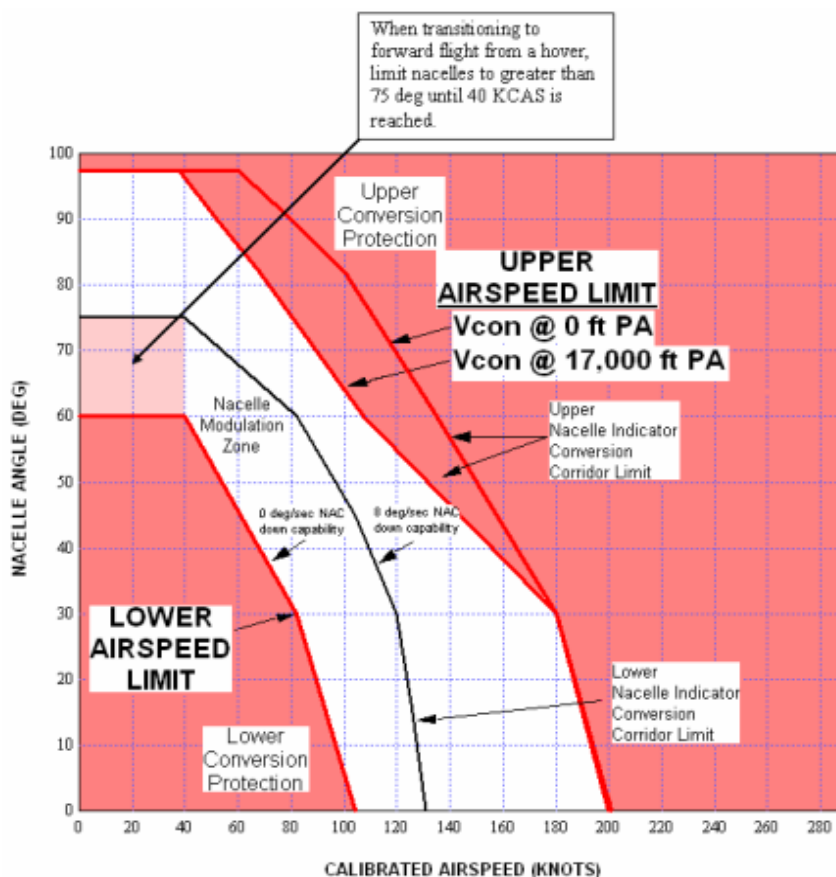


Figure:
Conversion Corridor

- observe conversion corridor indication in the PFD.
22. Gain altitude –observe vertical speed at 1000 ft/min
 23. Above 130 knots nacelles can rotate to 0 degrees

NOTE

Keep in mind the aircraft Gross Weight.
Different weights give different effect on lift
resulting from aircraft speed.

CLIMB

24. Default autopilot climb is set to 1000ft/min, observe vertical speed indicator.
25. navigation course - SET

CRUISE

26. Max cruise altitude – 17000ft
27. Best cruise Indicated airspeed – 180 knots

DESCENT

28. Default rate of descent – 1000ft/min
29. Keep indicated airspeed below 200 knots

CONVERSION

30. Max speed conversion 200 knots (see figure conversion corridor)
31. Best start conversion at 150-170 knots, below 5000 ft Radio Altitude

VTOL

32. Observe landing spot to be make.
33. Observe windspeed and direction – head wind / into the wind.

34. Observe obstacle – CLEAR
35. Adjust speed and nacelles angle – observe conversion corridor indication in the PFD.

NOTE

From indicated airspeed 170 knots to 0 kts/hover, conversion needs around 1800 meters length. Result length also depend on wind speed and direction, nacelles angle and thrust.

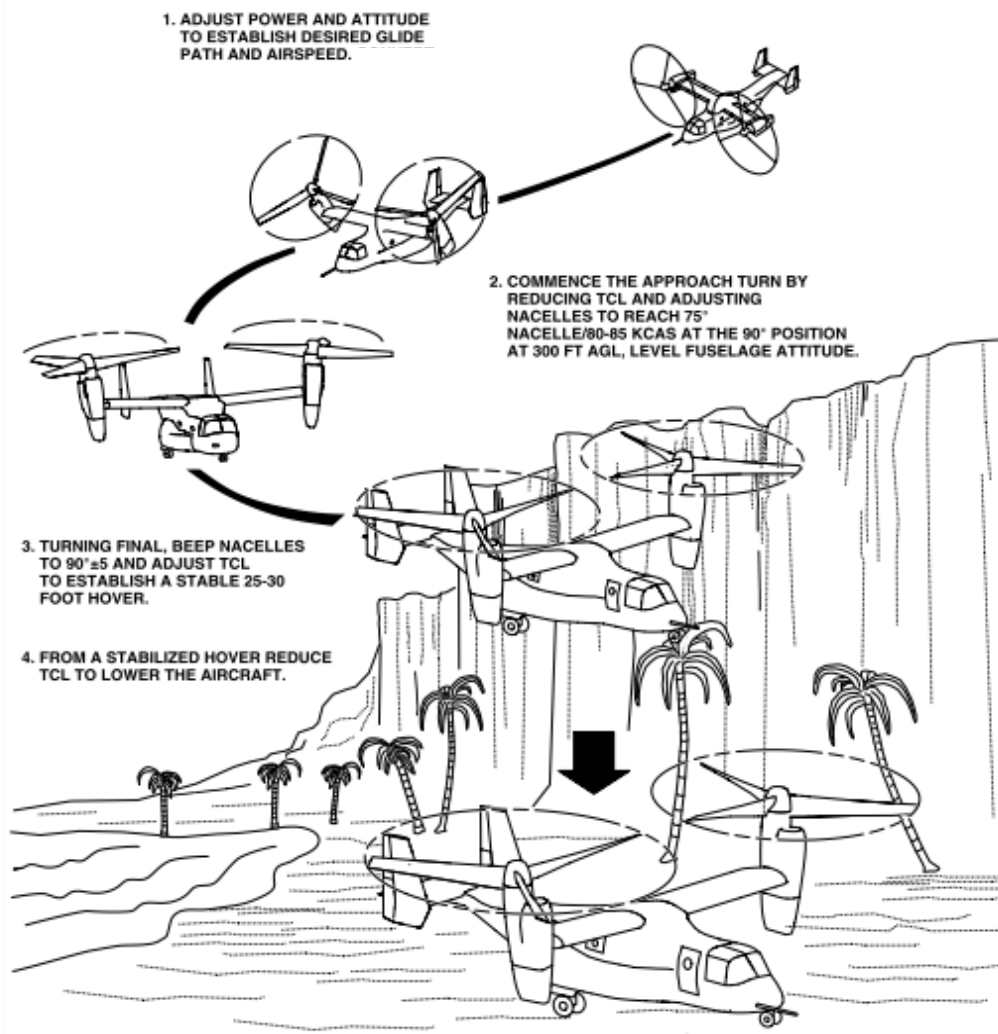
36. Landing Gear– EXTENDED
37. Observe vertical speed – not more than -1500 ft/min
38. Avoid landing in cross wind conditions
39. Below 200 ft Radio Altitude - vertical speed not more than -400 ft/min

NOTE

When landing in VTOL with nacelles not 90 degrees, after touchdown immediate close the throttle to avoid aircraft movement on ground.

STOL

40. Make approach like conventional aircraft
41. Observe landing path
42. Observe speed – 170 knots
43. Observe altitude – as DESIRED
44. Rotate nacelles – as REQUIRED
45. Landing Gear– as REQUIRED
46. At final approach
 - a. Nacelles - 60 degrees
 - b. Speed – 50-80 kts, depending on weight
 - c. Vertical speed - as REQUIRED
47. Land with main gear first.



TAXI

48. nacelles - as REQUIRED
49. speed - as REQUIRED

SHUTDOWN

50. parking - as DESIRED
51. set starter levers – OFF
52. FADEC – TURN OFF
53. APU - as REQUIRED

FOLD/STOW

54. Observe Proprotor – Fully stopped
55. APU – CRANK
56. Proprotor – LOCK
57. FOLD Horiz – CHECK
58. FULL STOW – CHECK
59. Nacelles - CHECK
60. SEQUENCE COMPLETED - CHECK

18.2 VOR / ILS Navigation. To use 2 VOR/ILS as navigation should follow this procedure(not mandatory).

18.2.1 APPR using NAV 1 and Nav 2. Use Navigation for approach using VOR on NAV1 and ILS on NAV2:

1. set frequency on VOR 1 as VOR receipt. Then set course (CRS knob) to heading path to intercepting ILS. Use approach chart for real experience
2. set frequency VOR 2 as ILS receipt. Set course ILS path.
3. set autopilot ON = CAP
4. NAV = CAP
5. VOR/ILS = NAV 1.
6. set srch path = CAP
7. set course of target ILS using VOR course knob. mean use VOR1 or VOR 2 as search course/heading to the ILS
8. after get signal from ILS target (make it 10 Nm from threshold or see ILS DME) switch to NAV 2 as active navigation
9. APPR button = CAP
10. Disengage immediately after runway insight and start rotate nacelles to make STOL or VTOL.

NOTE

ILS has lateral and longitudinal range (long and narrow), only in range ILS reception will active. Always learn ILS path (heading) to get correct reception and guidance.

18.2.2 APPR using heading and NAV1 or Nav2. Using combine heading and nav as ILS approach (Localiser and Glideslope):

1. Start the procedure, flying on AP.
2. HeadingHold On, and the HeadingSelector at a heading that deviates 20 – 50 degrees from the ILS Localiser heading.

3. And make sure that this heading takes you to a point where it crosses the Localiser about 10 – 15 nmiles out.
4. AltHold On, flying at 2500 – 3000 ft above the ground.
5. At an airspeed of 180 – 200 knots (APLN mode of course).
6. Set the CRS for the NAV radio (usually NAV1, but could be NAV2) with the ILS, equal to the Localiser heading of the ILS.
7. At DME 20, activate ApprHold. Nothing happens yet (HH and AH remain On.)
8. When the Localiser becomes Active (so a bit before you intercept the Localiser), HeadingHold is auto-switched off and the AP intercepts and tracks the Localiser. This is at DME 10 – 15.
9. When the Glideslope needle becomes Active (you are flying "into" the Glideslope) , AltHold is auto-switched off, and the AP intercepts and tracks the Glideslope.

APPR navigation can be use as autoland, but with Auto nacelles ON, in some height AP will disengage as nacelles going up. moreover, using autoland will lead to long roll on runway, not suitable for VTOL on final segment.

NOTE

Use autoland in MV22B are prohibited in any condition.

18.3 Create flights. For aircraft systems emulation, this MV-22B uses both standard FSX/P3D and proprietary systems. To make sure all aircraft systems are in a defined state, it is advised to create a few default MV-22B flight, to be used for future flight load.

18.3.1 Create MV22B flight as HOT flight.

1. Start/create a flight, best with a default 2-engine jet aircraft (like the Boeing 737), in any scenery.
2. Make sure both engines are running normally (at idle), the aircraft is on a parking-spot/runway with the ParkingBrakes set, and Autopilot disabled.
3. From the Aircraft menu, load a MV-22B version, and let this stabilise.
4. Select the VC (if not selected already), and check/set the following systems in the VC overhead section:
 - a. APU: set it to RUN/ENGA position. The button should display RUN.
 - b. Battery: the On/Off button should display ON. If not, click it On. The Voltage should display 24 Volt or so.
 - c. Ramp/Door: the button should display CLOSE
 - d. Engine Control section:
 - 1) left FADEC (Generator1 switch) button should display ON; if not, click it.
 - 2) Center Avionic Power (Avionics switch) switch should display ON; if not, click it.
 - 3) Right FADEC (Generator2 switch) button should display ON; if not, click it.
 - 4) Left Starterlever should be in FLY position.
 - 5) Right Starterlever should be in FLY position.
 - 6) Lever marked Fuel Control between the Starterlevers (tooltip says: FuelControlSwitch (open)) should be up/forward.
5. In the basic VC, all 4 MFD's should be displayed.
 - a. The selected screen per MFD is default (not saved/reloaded)

- b. The most left/right MFD's should be set to PFD screen; the Nacelles angle indicator (top-left on the PFD screen) should display value 60 or more.
 - c. The Off/Night/Day switch per MFD is set to Day position (not saved/reloaded)
 - d. In the Autopilot section, the CPLD button should not be lit.
 - e. In the Autopilot section, the AUTONAC button should display CAP (not saved/reloaded).
 - f. The SpecialFeatureEnabled button should display ON (not saved/reloaded).
 - g. In the main, center CDU:
 - 1) By default, the Off/Night/Day switch is set to Day position (not saved/reloaded).
 - 2) By default, the EICAS screen is selected (not saved/reloaded).
 - 3) ALL engine/pressure/hydraulics display segments should be lit green.
 - h. Landing gear:
 - 1) All three buttons (Nose/Left/Right) should be lit green.
 - 2) The LandingGear lever should be down.
 - i. FlapsLever: by default, should be in AUTO position (not saved/reloaded).
 - j. Park Brake lever: should be in Pulled position.
6. Goto Spotplane view, and visually observe that:
 - a. Both propellers are rotating.
 - b. Both nacelles are rotated to 60 degrees or more.
 7. Set the VC view to your preference. Best view:
 - a. From co-pilot seat (default)
 - b. Zoom factor set to 0.30 - 0.50 (whatever you prefer)
 8. Saved this flight, and check if it loads Ok:
 - a. Exit FSX/P3D.
 - b. Start FSX/P3D again, and load this saved flight.
 - c. Check if every is set/saved as above.
 - d. If not (like: APU is not in RUN position: reload this flight again via the Flight-Load-Select menu; now it should be OK.
 9. This procedure can be done too when in flight. APLN mode only !, so nacelles at 0 degrees.

18.3.2 Create flight as READY to fly.

1. Use Hot flight as base. Make sure aircraft on the ground.
2. Shutdown both engine.
3. Keep nacelles at 90 degree.
4. Turn off all display screens
5. Turn off avionic power and FADEC, no text lit on button.
6. Shutdown APU if it running by turn switch to crank position.
7. set door open/close as you wish.
8. Turn off battery
9. Saved this flight.
10. Nacelles can be rotated to 0 degrees and saved it as parking mode flight.

18.3.3 Create flight as Parking Remain Over Night (RON)

1. Use Hot flight as base. Make sure aircraft on the ground.
2. Shutdown both engine.
3. Keep nacelles at 90 degree.
4. Go to [BFWS] display to get fold menu (See section 6.1.1.5) and fold the blade only.
5. Rotate nacelles to 0 degrees
6. Turn off all display screens
7. Turn off avionic power and FADEC, no text lit on button.
8. Shutdown APU if it running by turn switch to crank position.

9. set door open/close as you wish.
10. Turn off battery
11. Saved this flight.

18.3.4 Create a fully Cold&Dark flight:

1. Set the right Starterlever to OFF, and wait until it's NG value in the CDU/EICAS screen is 0.
2. In Spotplane view, the propellers should still rotate normally (gearbox function).
3. Set the left Starterlever to OFF, and wait until it's NG value in the CDU/EICAS screen is 0.
4. In Spotplane view, wait until the propellers have fully stopped rotating.
5. Observe that the left/right FADEC (Generator switches) indicate FAIL.
6. And (optionally):
7. In any MFD, select the SYST screen and then the BFWS sub-screen.
8. Click the [Rotor Lock] button; in the screen, an arrow should appear in front of LOCK ROTOR.
9. Click the [Fold Horiz] button; if not already in that position, the nacelles should be auto-rotated to 90 degrees.
10. When blades are fully folded, the screen display an arrow in front of FOLD BLADES.
11. Click the [Full Stow] button; the wings should be folding now, and half-way, the nacelles are auto-rotated to 0 degrees.
12. When the wingstow is completed, flaps are lowered and all lines in the screen should be marked with an arrow. And (optionally, for a really full Cold&Dark):
 - a. Click both FADEC's (generators) OFF.
 - b. Click InterimPower (avionics) OFF.
 - c. Click MasterBattery switch OFF
 - d. Set APU to CRANK position.
13. If all OK, save this V22 flight as C&D V22 flight.
14. Check our saved flight:
 - a. Exit FSX/P3D.
 - b. Start FSX/P3D again, and load this saved flight.
 - c. Check if every is set/saved as above.

18.3.5 To start up the MV22B from a C&D saved flight again, do everything in reversed order (depending on the options you used for C&D flight saving).

PART VII - FAQ

To be specified.

PART VIII: Miscellaneous Remarks and SIM controls.

1. From Beta-4 onwards, this MV-22 simulation supports one-engine operation even in VSTOL mode. Meaning that you can do VSTOL (with degraded performance of course) with only the left or right engine running. Which was the whole purpose of the "gearbox" concept in a Tiltrotor aircraft.

2. Engine PropPitch is auto-controlled. So if you have a proppitch lever on a flight control device, make sure it's in a position where it doesn't "jitter".

3. The MV-22B TCL is simulated with the standard FS Throttle function.

4. Nacelles operation.

By default, the nacelles are controlled with "AileronTrim" commands. This means that the nacelles can be fully controlled contiguously between 0 and 97, with a 1-degree accuracy.

That is: within the limits of the conversion corridor(when AutoNac is Enabled), and the min. nacelles position of 60 degrees on the ground.

You can control "AileronTrim" with keyboardkeys / controller buttons assigned to FS functions "Aileron Trim (left)" and "Aileron Trim (right)" .

When assigning controller buttons, set Repeat on.

Note that the max. change-rate of the MV-22B nacelles is 8 degrees/sec.

So they won't move faster, even if the repetition rate of the AileronTrim keys/buttons dictates faster changes.

Alternatively, you can control the nacelles with a free controller axis lever or thumbwheel axis, assigned to the FS "Spoiler Axis" function.

To enable this option: in the panel.cfg, [Vcockpit00] section, remove the two // characters in line

```
//gauge05=rcb-gauges!NacellesFollowSpoiler, 0,0
```

NOTE

- Make sure this controller axis is calibrated properly, so it varies SpoilerAxis over the full range (0 to 100%)
- The response of the nacelles to SpoilerAxis position is quadratic; meaning that at high nacelles angles sensitivity is much higher, to allow precise control of the nacelles around 90 degrees.
- Unlike AileronTrim (which is not a true FS Axis value, just a variable with 100 discrete positions), a controller axis lever/thumbwheel position might not reflect the actual position of the nacelles, since the physical lever/thumbwheel can not be forced to the actual position of the nacelles. Example: if you are on the ground and move the SpoilerAxis to the 0 position, the nacelles are still forced to min. 60 degrees.

5. Flight load issue.

On **some** PCs, the aircraft isn't initialised properly when loading an existing (saved) MV-22B flight the first time after starting FSX/P3D.

This initialisation problem might be related to specific PC performance, Windows version or even FSX/P3D version. Unsure yet.

You can detect a wrong initialisation, if some aircraft systems are not initialised as they were saved.

Like:

- The APU switch is in CRANK position, while it was saved in RUN position.
- The wings show up as unfolded, while they were saved in a fully folded state.

Remedy: load the flight a second time, via the Flight-Load-Select menu; now it should be OK.

NOTE: use Flight-Load, NOT Flight-Reset (this won't work).

6. Gear warning.

When you fly below 100 ft RadioAltitude without landing gear extended, a tone warning is given (in VirtualCockpit mode).

7. Using the AP FlightDirector (AP INAV mode) .

In this simulation, the purple FlightDirector needles in the PFD represent the deviation from a tracked ILS Localiser and Glideslope..

Note that when way-above the Glideslope, the horizontal needle is suppressed.