FALCON 4 SUPERPAK 2

USER MANUAL

FALCON4 UNIFIED TEAM

USER MANUAL

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USER'S MANUAL

Falcon 4.0 is the intellectual property of Infogrames Inc.

With the "SuperPAK 2" (SP2) patch, your MicroProse Falcon 4.0 combat flight simulator (F4) has vastly improved from the original game. This document should be read in conjunction with the original Falcon 4.0 manual to understand the extent of changes in this version.

For an additional understanding of the changes made to Falcon over the last 2 years and an insight into the ideas behind them, we suggest reading the Realism Patch 5 (RP5) manual - a worthy lecture in terms of air warfare, weapons, weapon systems and air combat tactics and techniques.

This is NOT an official patch release from MicroProse. DO NOT contact G2 Interactive, Hasbro Interactive, Infogrames, or MicroProse for technical support if you are experiencing problems with this patch.

DISCLAIMER: WE ARE NOT RESPONSIBLE FOR ANYTHING THAT GOES WRONG WITH YOUR COMPUTER DUE TO ACTIONS TAKEN BASED ON THIS DOCUMENT OR THIS SOFTWARE. YOU USE THIS SOFTWARE ENTIRELY AT YOUR OWN RISK.

rev. 2a

FAQ - FREQUENTLY ASKED QUESTIONS

- **Help - I can't steer the jet while rolling on the ground!**
  You must enable NWS (nose wheel steering) with [SHIFT-/] *(on international keyboards: the key just to the left of the right shift key).* The same key is also used to cycle hardpoints.

- **When I want to drop a flare I get a bunch of chaffs instead**
  Your EWS Program is pre-set to #1 (chaff-only medium-high SAM evasion). Check p.54

- **How can I fly a plane other than the F-16?**
  When selecting the campaign, click an airbase on the campaign map and choose a squadron using the type of airplane you want to fly. Or create your own TE.

- **I don't want to startup my engine to fly a mission!**
  You don't have to! Select TAXI or TAKEOFF instead of RAMP while starting a mission - or enter it a few minutes after take-off, then you're already airborne!

- **How do I startup the engine when doing a RAMP start?**
  There is a training mission included in this manual. In addition, check out Jagstang's fantastic interactive "SP2 Ramp Start Trainer" in your Falcon 4 folder!

- **Where is the weather?**
  Be sure that you haven't marked "disable clouds" in the graphics setup. You can select a typical weather situation (and choose a Skyfix) in the Setup under the Graphics tab.

- **My A-LOW goes off far too high, around 10,000ft.**
  This is correct. You get a warning when you descend below the MSL altitude (10,000ft by default). You can change this value on the ICP/DED.

- **Radar doesn't seem to work when I'm on the runway.**
  This is correct. Radar only scans when you leave the ground (no weight-on-wheels WOW).

- **Using CCRP bombing mode, bombs aren’t released / I can't reach the release point.**
  Disable the "winds aloft" patch or fly an attack straight into or with the wind.

- **LGBs miss all the time.**
  Turn your laser on! The target must be lased until impact or the LGBs will just go ballistic.

- **Using Master Caution reset doesn't clear the WARN message on the HUD.**
  Use the WARN reset button on the ICP panel [SHFT-CTRL-ALT-w].

- **The autopilot key [a] doesn’t fly the plane.**
  This key only works with Combat and Steerpoint AP settings. With realistic 3-axis autopilot, you must use the two new autopilot switches to decide what the autopilot is going to control.

- **When I fire my AIM-120's there is no smoke trail. Why is that?**
  The correct modeling of the smokeless rocket motor. After a brief exhaust, it burns clean.

- **The new avionics are too complicated for me. I prefer the simpler 1.08 suite.**
  Select "Enhanced" avionics in the Setup>Simulation Tab. "Realistic" chooses the SP2 code.

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THE SUPERPAK MANUAL SERIES

You are currently reading Vol.1 of the Falcon 4 SuperPAK manual series, the "User's Manual". In it, you will learn to employ and operate the new features found in SuperPAK. To enhance your experience and to allow you to take full advantage of this wonderful flight-sim, additional volumes will be released.

Currently, the following volumes are planned:

Vol.1	User's Manual	How to use the new features of SuperPAK
Vol.2	Technical Reference	In-depth technical information for experienced users and SuperPAK developers
Vol.3	Korea Theatre	Background of the current theatre and campaign
Vol.4	Balkans Theatre	The first fully featured theatre for SuperPAK

CHAPTER SUMMARIES

To help you understand the various new features and realism enhancements found in SuperPAK, this User's Manual has been split into a number of chapters:

- The **Welcome** chapter introduces to the Falcon 4 SuperPAK project.
- In **Setup and Configuration**, you learn everything on how to get SuperPAK running.
- **Training missions** help you in getting up-to-date on some major features of SP2.
- The **Avionics** section covers the various enhancements made to the avionics suite.
- Learn more about the engine and take care of Over-G in the **Airframe and Engine** chapter.
- Take care when flying: the **Flight Models** are now much more realistic!
- Some of the main **Weapons** have been vastly improved (GBUs, Mavericks, AIM-120).
- Get connected: Major enhancements were made to **Comms and Multiplayer.**
- **You are not alone** documents changes to the IADS, the pilot AI and the Campaign engine.
- A number of **Special Features** greatly adds to the new experience found in SuperPAK.
- The **Appendix** includes various non-essential tidbits about the SuperPAK.

Chapter

1

Welcome

INTRODUCTION

Welcome to SuperPAK 2: The Falcon 4 Unified Team takes another step forward in creating the ultimate combat flight simulator.

In relation to the original Falcon 4.0 (as released by MicroProse), some of the most notable gameplay improvements found in SuperPAK are:

- Vastly improved gameplay stability
- Fearsome AI behavior
- Superior avionics
- Realistic weapons, weapon systems and flight models (well... as close as it can be!)
- A photorealistic F-16 cockpit (including a separate wide-view option)
- Modeling of electronic warfare (ECM, stand-off jamming, integrated air defense system)
- An improved graphics engine (DX7-compatible, 32bit, anisothropic filtering, fast A2G radar)
- Detailed textures (skins) for many airplanes and weapons
- New wingman commands
- Weather effects (reduced visibility, rain and snow, thunder and flashes, thick clouds)
- Optional engine start-up sequence (Ramp start)
- The ability to fly planes other than the F-16 and an automatic cockpit switcher (free external add-on's bring cockpits for other planes like the F-4, MiG-29, F-18, etc.)
- Basic carrier operations (landing training missions for the F-14 and F-18 are included...)
- 3D sound
- "JetNet", a central game server to find other online pilots
- NEW IN SP2: Vastly improved Multiplayer-Code including DirectPlay Voice
- NEW IN SP2: In-game Theatre Switcher
- NEW IN SP2: Redesigned User Interface
- Countless bugfixes and corrections

This achievement hadn't been possible without the work of a whole bunch of VERY dedicated people. Our thanks go to the folks who dedicated thousands of hours of professional work to build the base for SuperPAK: the Realism Patch Group (Realism Patch 5) and the eTeam (eFalcon 1.10). Thanks to all of you out there!

In addition, none of this would have been possible without the visionary design and outstanding achievement of Gilman Louie and his team at MicroProse - thanks, thanks and thanks again! Last, but not least, we thank G2Interactive and Infogrames Inc., the current holders of the Falcon series' intellectual property, for trusting us and allowing us to build the ultimate combat flight sim - Enjoy SuperPAK!

FOREWORD BY THE PRODUCERS

It's been nearly two years since it all started. It began in early 2000, when eRAZOR wrote the F4DX patch, a DirectX 6 to DirectX 7 DLL proxy that translated DX6 calls and redirected them to their DX7 counterparts. By doing this, he fixed some of the crashes to desktop that caused problems for many player pilots flying the 108i2 exe with DX7. The Falcon community was very impressed with F4DX.

Some time after F4DX was written a guy comes in to IRC and asks a few questions. Knowing what he had done in the recent past, "mirv" didn't hesitate to give him the answers he was searching for. At this point, it wasn't anything yet. It was simply one man trying to make Falcon 4.0 better. This quest started out with improving graphics and frame rates, but almost immediately became much more than that. At this point, they were only two guys - who knew that they would need more help to succeed! Some testers, who were good friends and good pilots, got on board. Then somewhere along the way, the so called "eTeam" picked up some extremely talented programmers: Codec, JJB, Pogo, Marco, Sylvain and <Someone>. and a small group of dedicated beta testers such as Vexx, various members of RPG and the 87th Stray Dogs.

In 2001, eFalcon developed into a project to transform the original Falcon 4.0 into the most realistic simulation it can be. After the individual releases of eFalcon 1.10 and RPG's Realism Patch 5 caused quite a stir, a solution had to be found - the creation of a unified patch, to improve the flight experience and to ease the installation procedures for the various patches. This brought up the idea of a "unified exe", a patch that would combine better avionics and better graphics with improved AI behavior and more realistic campaigns.. In November 2001, this milestone in the Falcon 4 patching history was reached with SuperPAK 1!

With SuperPAK 2, we want to bring Falcon 4 even further. More than three years after the initial release of Falcon 4, we have taken another step forward in our quest for the ultimate combat flight simulation of all times. Here comes SuperPAK 2 - Enjoy!

The Falcon 4 Unified Team
60 Developers, 200 Testers

NEW FEATURES IN SUPERPAK 2

Some of the most notable improvements in SuperPAK 2 are:

- A completely revamped **Multiplayer Engine** including DirectX 8 Comms, allowing direct **pilot-to-pilot voice** communications on separate COM channels in the UI and the game.
- A **unified, complete and theatre-independent database of weapons, weapon systems and aircraft** to allow seamless integration of additional theatres.
- Complete remodeling of the **flight models**, including improved accuracy, the introduction of trailing and leading edge flaps (TEFs and LEFs) with moving 3D surfaces, and the outsourcing of additional flight model data. Not to forget: realistic fuel flows (take care!).
- Tons of improved **3D models** (including a marvelous A-10 "Warthog" and more smoke and contrails on various planes), extensions to the 3D code for **additional switches** (for flaps, dragchutes, opening canopies etc.) and externalization of the 3D cockpit selection code.
- The **integration of a Theater switcher and Weather and Skyfix selectors** into the completely redesigned User Interface.
- Enhanced realism in the photorealistic cockpit, including INS, **Trim and Flaps switches and gauges** - and the addition of a trigger/pickle-dependent **auto ACMI** mode.
- Further enhancements to the **avionics** suite, including ultra-realistic LGB and Maverick (AGM-65) deployment, correct SOI handling and enhanced TGP features.
- Improvements to the Integrated Air Defense Systems **IADS**, including the extension of the data tables to allow further tweaking and the introduction of additional radar status modes.
- Over 40 new **keyboard commands** to take advantage of new features and switches, including special HOTAS commands for enhanced realism (DMS, Pinky switch, Triggers).
- Further bug squashing, memory leak fixing, etc.

A big part of the effort on the SP2 was invested in optimizing the .exe-file, to build a stable foundation for further work with the data parts of Falcon 4. Many new parameters were outsourced to allow future data edits to take full advantage of SuperPAK's advanced features.

Meanwhile, the pursuit continues....

We are anticipating two releases for SuperPAK 2, with one at the end of January and the other at the beginning of March to squash as many bugs as possible. The final exe release at the end of March will also mark the end of Phase One of the SuperPAK project. After that, the team will have several enormous tasks in front of it that will not require exe changes but are still part and parcel to the SuperPAK project:

The next projects will include adding the Theaters that the in-game theater menu will access (We are busy getting all the hooks in the code but will not have time to actually add the Balkans, Iceland, Middle East, Vietnam, Nevada or Afghanistan theaters until after we finish debugging the exe). We have a tremendous back log of new artwork to add, new improvements to the flight models, new corrections to the weapons and vehicle data, new additions to the Tactical Reference, and an extensive collection of manuals.

SUPERPAK AND THE UNIFIED TEAM ON THE WEB

Visit our homepage at **f4ut.frugalsworld.com**
for feedback, SuperPAK news, additional downloads and in-depth articles!

The big success of the SuperPAK series has unfortunately caused server overload and exploding bandwidth costs for our hosting providers. Please check out www.frugalsworld.com and www.f4freeware.net and help us in supporting the community's main forums and file servers.

REPORTING GAME CRASHES

We need your crashlogs to further improve the SuperPAK!

If you experience a "crash to the desktop" in Falcon 4.0 with SuperPAK 2, you will find a file called "crashlog.txt" in your Falcon4 root folder. Please open this file with Notepad and add an exact description of what you were doing where when the game crashed. Include your system specifications and email the crashlog to our team (crashlogs@f4ut.frugalsworld.com). Please do also keep the TE (.tac file in Campaign\Save folder), the campaign save file (.cam file) or the ACMI (if available) in a safe place in case our developers need them to recreate your crash.

The Falconeer

with permission, by D. "Dada" Miller 2001

A bit of wisdom for those who dare
To build our dream sim of the air.
So gather round.
Come gather here
Learn how to please the Falconeer.
This is not for the weak, the bent, the bowed.
This is only for those who know their code.
Code at idle.
Code under stress.
And what's the effect on my F.P.S?
Does the code crash
If I pull some G's?
Or bring my beige box to its knees?
Will my Windows finally seize?
If not, then you're coming near
Starting to please the Falconeer.
Ignore the rants, the raves and bitches,
Just give us all a lot of switches.
This one to pull.
This one to push.
This one for firmness under tush.
Switches to start.
Switches to stop.
A switch so my load won't prematurely drop.
This will take you to the top
And pose you there without a peer
In starting to please the Falconeer.
So make it hard, don't skimp on that.
It should take newbies and squash 'em flat.
Checklists galore
For this work, not play.
Starting the engine should take half a day.
Emergency drills?
That circumstance
Should make even Chuck Yeager crap his pants.
Takeoff denied!
Switch frequencies!
(You forgot to pay your airport fees.)
It's little things such as these
That make it quite clear
You're out to please the Falconeer.
Leave room for improvements, that's certainly key.
One patch a day for sheer ecstasy.
Morning defragging.
Defragging at night.
But still defragging program is not quite right.
So tweak the FM
Tweak the A.I.
Tweak till your tweaker lies down just to cry.
Look up at the sky, you do or you die.
Finally facing your deepest fear,
You might not be pleasing the Falconeer.
The final thing: some room to complain
Is really the most vital part of this game.
I paid for a beta?
This sim sucks.
Is this all I get for my 40 bucks?
The FM's too easy.
The FM's too hard.
Was this thing coded by a blind, deaf, retard?
Abide yourself by the words of this bard
Though an F-16 I've never been near
And you will,
Most certainly,
Be pleasing the Falconeer.

Chapter

2

Install & Configure

SYSTEM REQUIREMENTS FOR FALCON 4 - SUPERPAK 2

Minimum configuration:

- 300 MHz CPU
- 64 MB of RAM (Get more! MORE! It's cheap nowadays and helps SO much!)
- Direct3D capable graphics card with 12 MB video RAM
- Hard drive with 500 MB free (required for installation and minimum virtual memory)
- Sound card (preferably a full duplex card for use with Roger Wilco or Battlecom)
- DirectX 8 or later

Recommended configuration:

- 600 MHz CPU or faster
- 256 MB of RAM (384 or 512 MB would be even better - Falcon alone uses up to 220 MB)
- Direct3D capable graphics card with 32 MB video RAM
- Hard drive with 500 MB free (required for installation and minimum virtual memory)
- Sound card (preferably a full duplex card for use with Roger Wilco or Battlecom)
- DirectX 8 or later

War stories are a mix of real life and Falcon 4.0 events. They give glimpses into the life of fighter pilots to those of us flying in the virtual world that are forever earthbound.

WAR STORY

Anyone find refueling too easy in Falcon 4? Try this!

We were on the way to tanker with 2 F-4s, it was a night intercept, Air to Air refueling mission. I moved from pre-contact to contact position slowly, but it was an unlucky night. I've never remembered such a difficult air refueling. I was saying, "No way, no way". It was dark, very dark, no director lights and nothing. I was sweating.

Finally I loaded the fuel on. After separating from the tanker I went to close formation. Lead called me to the manual uniform channel.

I said, "2" and changed channels. He said, "How do you see me?" I said, "Dark." He said "Raise your visor, it might be better for you when flying at night!"

I wonder if there is another pilot who loaded fuel at night with his visor down.

INSTALLATION

FalconSP2_Installer

You MUST install the SuperPAK onto a clean configuration of Falcon 4 1.08us. Follow the steps noted below for a successful update:

- Make backup copies of your entire Falcon4\config folder, all files ending with the extension '.tac' (Tactical Engagements) found in the Falcon4\campaign\save folder, and the phonebook.dat file in the Falcon4 directory.
  This is to keep your current logbook, campaign, tactical engagements etc.
- Remove your current installation of Falcon 4 using the 'Uninstall' utility found in the MicroProse\Falcon4 submenu on the Start Menu. Delete the Falcon 4 folder manually. Clear temp folder and recycle bin. Reboot your PC.
- Install Falcon 4 from your original retail CD-ROM.
- Update it to 1.08us, the last official patch from MicroProse (a 17 MB file, found in various places on the web: www.simhq.com, www.f4freeware.net, www.frugalsworld.com, etc.)
  Installation instructions for this patch are included in it's distribution package.
- You are now ready to install the SuperPAK!

- Run the SuperPAK Installer and wait a moment while setup starts.
- After a few seconds, a small window as shown to the right appears. Simply click on "**Apply Patch**" to proceed.

- Another progress window will appear ("Applying Patches..."): The installer is now expanding the installation package and copying all necessary files into place. Be patient - this may take a few minutes to finish. Upon successful completion of this step, a window showing an overview of the installed subpatches will be shown (as seen in the screenshot to the right). Click "**OK**" to finish.
  If there are any patches that are not applied or showing errors, then your installation did not complete normally. You should restart from the beginning (clean install).
- Copy the config folder (your logbook), phone book (phonebook.dat), and tactical engagement files (.tac files) that you backed up at the start of the installation back into the same folders they were originally copied from, overwriting the files from the clean installation.
- If you plan to use DirectPlay Voice to talk with fellow pilots in multiplayer games: Run Voicesetup.exe (found inside the main Falcon folder) and set up your microphone.
- Get ready to launch! You can now start your FalconSP.exe!

ADD-ON'S

If you have followed the installation and configuration instructions as noted before, you have completed the installation and configuration of SuperPAK and can start flying.

If you want to install even more goodies, you must use a patching tool called F4Patch (however, these additional packages are NOT required for SuperPAK, but remain purely optional!). The add-ons are not included with SuperPAK and must be downloaded from the Web.

The following add-on's are planned to be released (subject to change):

- F4Patch_Standard_42_SuperPAK
  Additional explosion graphics, improved moon graphics, realistic star data etc.
- F4Patch_Skin_42_SuperPAK
  Improved skins and textures for various airplanes.

To install any of these add-on's, follow these instructions:

1. Unzip the downloaded file into your Falcon folder.
2. Run the extracted exe from your Falcon folder.
3. In the first window to appear, use the Browse button to select the FalconSP.exe.
4. Select ”Expand Package” from the "File" menu.
5. Answer “Yes” to the first prompt asking you if you want to continue expanding the package into a F4Patch directory.
6. If installing an add-on, answer "No" if the next prompt asks about overwriting an existing directory (This will allow F4Patch to merge the new add-on into the existing F4Patch folder).
7. *(If you have started from a clean installation, F4Patch will then ask you if you want a desktop shortcut for F4Patch. Make your selection.)*
8. F4patch has finished the installation process. Click "Exit" to leave F4Patch.
9. Delete the original exe (the one extracted from the zip file) from the Falcon4 folder. A new file, "F4Patch.exe", and the "F4Patch" folder will have been created in your Falcon4 folder.
10. Run F4Patch again, select the patches to be included, hit "Apply changes" and wait for F4Patch to finish the patching process (this may take a few minutes, please be patient).

INSTALLING ADDITIONAL COCKPITS

The official SuperPAK cockpit is installed by the SuperPAK installer. It offers a photo-realistic environment and includes a special wide-view mode [Ctrl-Alt-z/x]. The SuperPAK keystrokes file is specifically designed to take full advantage of this cockpit and it's new features.

The SuperPAK also includes an automatic cockpit switcher. Therefore, you can simply place additional cockpits to fly other planes (that are available on the web) in subfolders under the art/ckptart folder. Rename these subfolders as noted in the "cockpit.txt" file found there - you can use the number or the plane's name (e.g. "MIG29", "F18C" or "889"/"F117").

Check out Aeyes' outstanding work at <fly.to/aeyes>
(including cockpits for the A-10, F-4E, F/A-18C, MiG-29A, SU-27 and C-130H)

CONFIGURING SUPERPAK

1. Run the FalconSP Configuration Editor from the desktop or your Falcon root directory.
2. Set the configuration options under "(SP)FalconSP" item (click to expand): Click an option to read more about it, then check the corresponding box to enable (or disable) it.

Caution: Deselecting the default settings will defeat most enhancements included in SuperPAK!

Setting Advanced

We recommend you **select all of the "Setting Advanced"** (with the exception of the "High Contrast MFDs") to experience the most realistic flight simulation possible. Finish the configuration by clicking "Apply changes". You can then exit F4Patch.

Other settings

You are free to experiment with the other settings. There are, however, a few caveats:

The "Settings General" should look familiar to most experienced Falcon pilots. AWACS support, Dynamic Head positioning, Smart Combat AP, Smart Scaling, and Weather extensions should be considered for selection as they add significantly to the simulation's immersion.

The "Settings Hardware" should only be changed if you are experiencing a problem (graphics stuttering). All settings are set for optimum performance as installed, so selecting any of these options is most likely to reduce performance (as measured by frames per second).

The "Settings Network" are more thoroughly explained in the JetNet section. Refer to that section before changing these settings.

Note for advanced users: You may use Notepad or other text editors to manually edit the falconsp.cfg file (but they must not add any kind of formatting, saving only plain text).

GAME SETTINGS

Choose the SETUP button in the main screen to make the required setup changes.

GRAPHICS SETUP (GRAPHICS TAB)

There are two **required** settings to preserve the realistic weapons functionality:

- **Object Density must be set to 6**.
- **Player Bubble must be set to 3.**

To have the photorealistic cockpit available, you must set your screen resolution to 1024x768.

These settings place higher demands on the CPU. If you find that your frames per second (FPS) in the game drop below 10-15 FPS [Ctrl-z r], lower the following settings:

- *Terrain Texture and Terrain Detail*
- *Object Detail (if set below 5, you won't be able to see your wings from inside the cockpit)*
- *Canopy Cues (enabling Reflections causes a large decrease in FPS on low-end systems)*

AVIONICS SETUP (SIMULATION TAB)

- To get the ultimate cockpit realism, you need to activate SuperPAK's new avionics! Do this by selecting "Realistic" avionics in the Setup/Simulation tab.
- To keep using the classic 1.08 "realistic" avionics suite, select "Enhanced" mode.

The other settings are unchanged. They both offer only very basic modes of radar operation and should only be used by beginners during the first few hours of flying ("Easy" = full 360° radar coverage, "Simplified" = only front radar coverage). Forget about them.

KEYBOARD SETUP (CONTROLLER TAB)

If you **didn't** use the standard keystrokes.key file for your controller/keyboard setup in earlier Falcon 4 versions, you must install the new keystrokes file (See next chapter).

NEW KEYBOARD COMMANDS

Since the last official Falcon 4 release (1.08), a number of additional keystrokes were added to the game. In SuperPAK 2, the following new commands are included.

Separate Keyboard Map and Keystroke Quick Reference PDF are in your Falcon 4 folder.

AFAileronTrimLeft	Aileron trim left	Shift-LeftArrow
AFAileronTrimRight	Aileron trim right	Shift-RightArrow
SimRightAPSwitch	Ckpit- Autopilot Pitch Switch	Ctrl-2
SimLeftAPSwitch	Ckpit-Autopilot Roll Switch	Ctrl-1
SimAVTRSwitch*	Ckpit-AVTR Switch	Alt-f
AFDragChute*	Ckpit-Deploy Drag Chute	Shift-d
SimAPOverride	Ckpit-Disconnect autopilot temporarily	Ctrl-3
SimGndJettEnable*	Ckpit-Ground Jettison enable	Alt-j
SimINSDec*	Ckpit-INS Dec	Ctrl-Alt-F7
SimINSInc*	Ckpit-INS Inc	Ctrl-Alt-F8
SimInstrumentLight	Ckpit-Instrument lights	Shift-Ctrl-l
CkptNormalView	Ckpit-Normal View	Ctrl-Alt-z (left of x!)
AFCanopyToggle*	Ckpit-Open/Close canopy	Shift-Ctrl-c
SimMainPowerDec	Ckpit-Power Main Dec	Ctrl-Alt-F1
SimMainPowerInc	Ckpit-Power Main Inc	Ctrl-Alt-F2
SimSeatArm	Ckpit-SeatArm	Shift-e
CkptWideView	Ckpit-Wide view	Ctrl-Alt-x
OTW900View	Ckpit-Ghost MFD view	Ctrl-Alt-c
SimDLPower	Datalink power switch	Shift-Alt-F7
SimHUDBrightnessDown	Decrease HUD brightness	(not assigned)
TimeAccelerateDec	Decrease time acceleration	Shift-Capslock
SimDecAirSource	Decrement the air source switch	Shift-Ctrl-F3
SimDecFuelSwitch	Decrement the fuel display switch	Shift-Ctrl-F2
SimDecFuelPump	Decrement the fuel pump switch	Shift-Ctrl-F6
AFAlternateGear	Deploy the landing gear manually (to retract a manually deployed gear)	Alt-g
SimDMSDown*	DMS Down	Shift-Num2
OTWStepMFD1*	DMS Left	Shift-Num4
OTWStepMFD2*	DMS Right	Shift-Num6
SimDMSUp*	DMS Up	Shift-Num8
SimEWSChaffPower	EWS-Chaff Power	Ctrl-Alt-F3
SimEWSFlarePower	EWS-Flare Power	Ctrl-Alt-F4

SimEWSJammerPower	EWS-Jammer Power	Ctrl-Alt-F5
SimEWSPGMDec	EWS-PGM Dec	Shift-z
SimEWSPGMInc	EWS-PGM Inc	Shift-x
SimEWSProgDec	EWS-Program decrease	Shift-q
SimEWSProginc	EWS-Program increase	Shift-w
SimEWSRWRPower	EWS-RWR Power	Ctrl-Alt-F6
SimFCCPower	FCC power switch (HSD)	Shift-Alt-F10
SimFCRPower	Fire Control Radar power	Shift-Alt-F5
AFDecFlap*	Flaps-Decrease	Ctrl-F11
AFDecLEF*	Flaps-Decrease LEF	Alt-F11
AFIncFlap*	Flaps-Increase	Ctrl-F12
AFIncLEF*	Flaps-Increase LEF	Alt-F12
SimLEFLockSwitch*	Flaps-Lock LEFs	Ctrl-5
AFFullLEF*	Flaps-Set LEF to Full	Alt-F10
AFNoLEF*	Flaps-Set LEF to Null	Alt-F9
AFFullFlap*	Flaps-Set to Full	Ctrl-F10
AFNoFlap*	Flaps-Set to Null	Ctrl-F9
SimGPSPower	GPS power switch	Shift-Alt-F6
SimCursorEnable*	HOTAS-Cursor enable	Shift-n
SimTriggerFirstDetent*	HOTAS-First Trigger Detent	Ctrl-/
SimPinkySwitch*	HOTAS-Pinky Switch	Alt-v
SimTriggerSecondDetent*	HOTAS-Second Trigger Detent	Alt-/
SimHUDPower	HUD power	Shift-Alt-F2
SimRetDn*	HUD-ManBombRet Down	Ctrl-]
SimRetUp*	HUD-ManBomBRet Up	Ctrl-[
SimICPZERO	ICP 0 button	Ctrl Num0
SimICPTHREE	ICP 3 button	Ctrl-Num3
SimICPSIX	ICP 6 button	Ctrl-Num6
SimICPEIGHT	ICP 8 button	Ctrl-Num8
SimICPNINE	ICP 9 button	Ctrl-Num9
SimICPDEDDOWN	ICP DCS switch Down	Ctrl-PgDn
SimICPCLEAR	ICP DCS switch Return	Ctrl-Insert
SimICPDEDSEQ	ICP DCS switch Sequence	Ctrl-Home
SimICPDEDUP	ICP DCS switch Up	Ctrl-PgUp
SimICPIFF	ICP IFF button	Ctrl-Num7
SimICPLIST	ICP LIST button	Ctrl-Num8
SimICPResetDED	ICP Reset button	Ctrl-End

SimHUDBrightnessUp	Increase HUD brightness	(not assigned)
TimeAccelerateInc	Increase time acceleration	Shift-Tab
SimIncAirSource	Increment the air source switch	Shift-Ctrl-F4
SimIncFuelSwitch	Increment the fuel display switch	Shift-Ctrl-F1
SimIncFuelPump	Increment the fuel pump switch	Shift-Ctrl-F5
SimTISLPower	Laser power	Shift-Alt-F11
SimLeftHptPower	Left Hardpoint power	Shift-Alt-F8
SimExtlAntiColl*	Lights-Extl Anti Coll	Ctrl-Alt-F10
SimExtlPower*	Lights-Extl Power	Ctrl-Alt-F9
SimExtlSteady*	Lights-Extl Steady	Ctrl-Alt-F12
SimExtlWing*	Lights-Extl Wing	Ctrl-Alt-F11
SimMalIndLights*	Lights-Test	Ctrl-t
SimMAPPower	MAP power	Shift-Alt-F3
SimMFDPower	MFD power switch	Shift-Alt-F1
SimFuelDoorToggle	Open/Close the refueling door	Shift-r
SimRFSwitch	Radar-RF Inhibit	Shift-Alt-r
AFAlternateGearReset	Reset alternate gear (to retract a manually deployed gear)	Ctrl-Shift-g
AFResetTrim	Reset trim to default	Ctrl-Alt-r
SimWarnReset	Reset warn	Shift-Ctrl-Alt-w
SimRightHptPower	Right Hardpoint power	Shift-Alt-F9
AFRudderTrimLeft	Rudder trim left	Alt-LeftArrow
AFRudderTrimRight	Rudder trim right	Alt-RightArrow
OTWToggleAeroDisplay*	Sim-Aerodynamic Debug	Not assigned
SimSMSPower	SMS power switch	Shift-Alt-F4
SimStepComm1VolumeDown*	Sound-Com1 Volume Down	Ctrl-Alt-[
SimStepComm1VolumeUp*	Sound-Com1 Volume Up	Ctrl-Alt-]
SimStepComm2VolumeDown*	Sound-Com2 Volume Down	Shift-Ctrl-Alt-[
SimStepComm2VolumeUp*	Sound-Com2 Volume Up	Shift-Ctrl-]
SimStepMissileVolumeDown*	Sound-Missile Volume Down	Shift-Ctrl-[
SimStepMissileVolumeUp*	Sound-Missile Volume Up	Shift-Ctrl-]
SimStepThreatVolumeDown*	Sound-Threat Volume Down	Shift-Alt-[
SimStepThreatVolumeUp*	Sound-Threat Volume Up	Shift-Alt-]
SimJfsStart	Start the JFS	Shift-j
SimEpuToggle	Step through EPU settings	Alt-e
SimReticleSwitch	Switch on the manual bombing reticle	Shift-Ctrl-m
SimRALTOFF	Switch radar altimeter to off	Alt-a
SimRALTON	Switch radar altimeter to on	Ctrl-a

SimRALTSTDBY	Switch radar altimeter to standby	Shift-a
SimThrottleIdleDetent	Throttle to Idle Cutoff	Alt-I
SimTMSDown	TMS-Down	Ctrl-DownArrow
SimTMSLeft	TMS-Left	Ctrl-LeftArrow
SimTMSRight	TMS-Right	Ctrl-RightArrow
SimTMSUp	TMS-Up	Ctrl-UpArrow
SimToggleFlir	Toggle FLIR HUD display	Shift-Alt-f
SimHookToggle	Toggle hook	Ctrl-k
AFElevatorTrimDown	Trim pitch down	Alt-DownArrow
AFElevatorTrimUp	Trim pitch up	Alt-UpArrow
SimTrimAPDisc*	Trim-AP Disc	Ctrl-4
SimTrimNoseDown*	Trim-Manual nose down	Shift-Alt-Num-End
SimTrimNoseUp*	Trim-Manual nose up	Shift-Alt-Num-Home
SimTrimRollLeft*	Trim-Manual roll left	Shift-Alt-Num-Delete
SimTrimRollRight*	Trim-Manual roll right	Shift-Alt-Num-PageDown
SimTrimYawLeft*	Trim-Manual yaw Left	Shift-Alt-Num-Insert
SimTrimYawRight*	Trim-Manual yaw right	Shift-Alt-Num-PageUp
SimLandingLightToggle	Turn on/off the landing light	Shift-Alt-l
SimParkingBrakeToggle	Turn on/off the parking brake	Alt-p
SimLaserArmToggle	Turn on/off the targeting laser	Alt-l
SimToggleMasterFuel	Turn the master fuel switch on/off	Shift-Ctrl-F7
SimToggleTFR	Turn the TFR system on/off	Ctrl-Shift-a
SimUFCPower	UFC/DED/ICP power switch	Shift-Alt-F12
OTW900View*	View-cockpit Ghost MFD Zoom	Ctrl-Alt-c
SimInhibitVMS	VMS Inhibit	Ctrl-v
SimTransmitCom1*	Voice-Transmit Com1	Alt-1
SimTransmitCom2*	Voice-Transmit Com2	Alt-2
SimToggleMissileBoreSlave	Wpn-Missile Bore/Slave	Ctrl-u
SimToggleMissileTDBPUncage	Wpn-Missile TD/BP	Alt-u
SimToggleMissileSpotScan	Wpn-Sidewinder Spot/Scan	Shift-u
SimToggleMissileCage	Wpn-Sidewinder-Cage/Uncage	u

* = new in SuperPAK 2

ACTIVATING THE NEW MAPPING FILE

As listed above, there are over fifty new keyboard commands available. However, do not despair - nearly all of the new commands are also directly accessible by using the mouse in the SuperPAK default cockpit. Many of the additional keystrokes have only been added to allow users with programmable input devices to take full advantage of SuperPAK.

The installer will place a new keystrokes file called "keystrokes.key" (including all these new commands) in your "Falcon4/Config" subfolder. To activate it, select the "Controller" tab in the Falcon Setup screen, click "Load", select "keystrokes.key" in the resulting file list and click "Load" to activate it.

The " SP2_Keyboard-Map.pdf " found in the Falcon 4 folder is a keyboard layout map of this keyfile, similar to the keyboard chart found in the original Falcon 4.0 retail package. In addition, there is also a new quick reference included ("SP2_Keyboard-Reference.pdf ").

For ease of use, we strongly suggest using the new keystroke file "keystrokes.key" in its entirety and reprogramming your HOTAS to your needs! If you feel that this will be more time than you care to invest, then you can manually add the new key definitions to your existing .key file:

MODIFYING THE KEY MAPPING FILE

If you don't want to use the included keystrokes.key file and choose to apply the new keyboard shortcuts to your existing keyboard mapping file, the following documentation describes how the key file in Falcon 4.0 works and how to reprogram it directly using a text editor.

We still suggest using the new keystroke file "keystrokes.key" in its entirety and reprogramming your HOTAS to your needs!

How to add new keyboard shortcuts to your existing keyboard mapping

You can find all the new commands available in SuperPAK in the aforementioned "keystrokes.key" file. To add these shortcuts to your existing .key file, copy the shortcuts line per line (each command takes one line) from the new keystrokes.key to your old .key file by using a text editor.

After pasting the new commands into your .key file, you will need to start Falcon 4.0 and use the key remapper in the controller setup of Falcon to program the keys to the new commands.

There have been reports that sometimes Falcon 4.0 will scramble the keyfile if you try to program the keys in the key programmer. The safest thing to do when making modifications to the keystrokes.key file is to always "save as" and rename the file after modifying it in

The steps are as follows:

1. Make a backup of your current .key file located in the \falcon4\config folder.
2. Open your current .key file with Notepad.
3. Open the new SuperPAK keystrokes.key file with Notepad and highlight the first new command line (re: table on p. 19-21). Copy it to the clipboard [Ctrl-c]. All commands consist of ONE line!
   Example: ***SimToggleMissileCage -1 0 0X16 0 0 0 1 "Wpn-Sidewinder-Cage/Uncage"***
4. Switch to your original .key file and, using the names between the "" of the line (NOT the beginning of the line), determine the alphabetical order to insert the command line into. Use your mouse to select the beginning of the line you want to insert at in your .key file. With the cursor at that position, press [Ctrl-v] and the command line will be pasted.
5. Now check if the command is not yet used in your existing keyfile: Search for the hex code associated with the command's shortcut ("***0X16 0"*** *in the example above. The "0X16" stands for the associated key, and the following "0" for the modifier (none here, 1 is SHIFT, 2 is ALT, 3 is CTRL etc.))*.
6. If the code is found in another command, the shortcut is already in use. You must therefore replace the code section between the command and it's description (***-1 0 0X16 0 0 0 1*** in our example) with a value of ***-1 0 0XFFFFFFFF 0 0 0 1*** . This will clear the shortcut and you can manually re-program a new shortcut later by using the Falcon Setup > Controller tab.
7. Repeat these steps until all new commands are in your .key file.
8. Once they are all copied, you will want to save the .key file to the falcon4\config folder, start F4, go to the controller setup screen in F4 setup and reload your .key file. Program unassociated commands (those where you had to delete the code section) to whatever keystrokes your heart desires.

HOTAS SETUP

To allow for maximum realism in HOTAS programming, a number of additional keystrokes have been added to simulate proper HOTAS button operations.

2-STAGE TRIGGER

The original HOTAS trigger is a two-detent switch. Squeezing the trigger to the first detent [Ctrl-/ (the key left of the right shift key)] starts operation of the AVTR (if the AVTR switch is in the AUTO position) and provides consent for laser fire (if selected and armed).

Squeezing the trigger to the second detent [Alt-/] continues operation of the AVTR (and consent for laser fire) and, if the gun is selected, fires the gun.

If the AVTR switch is in the AUTO position, camera operation continues for 30 seconds after the trigger is released.

MSL STEP BUTTON (NWS)

This button [SHF-/ (the key left of the right shift key)] is mode dependent:

- On the ground, it enables the Nose Wheel Steering (NWS) used to taxi around.
- In Air-to-Air modes, depressing MSL STEP selects the next available missile of the currently selected type.
- In Air-to-Ground modes, depressing MSL STEP switches through bombing modes (CCRP, CCIP, and DTOS).

PINKY SWITCH

This key [Alt-v] toggles the FOV (field-of-view) in various radar and weapon views:

SOI / Mode	View
FCR (TWS mode)	NORM, EXP
FCR (GM mode)	NORM, EXP, DBS1, DBS2
FCR (SEA and GMT modes)	NORM, EXP
WPN (AGM-65D)	WIDE / NARROW FOV
TGP (LGB/GBU)	WIDE / NARROW / EXP FOV

TARGET MANAGEMENT SWITCH

Special keyboard commands are available to partially simulate the operation of the target management switch (TMS) on the HOTAS: [Ctrl-Up], [Ctrl-Right] and [Ctrl-Down] allow easy target designation and quick Air-to-Air radar submode switching.

Depending on the current radar mode, the TMS works as follows:

RCR (N/I)

RWS: Command SAM (=Designate Target)
TWS: Designate Target
ACM: Boresight Scan

A2G: Designate Target

RWS: Command TWS
TWS: Step Bug
ACM: 30 x 20 Scan

RWS: STT->SAM->Search
TWS: STT->Search->RWS
ACM: 10 x 60

A2G: Drop Target Tracking

DISPLAY MANAGEMENT SWITCH

After setting up the preferred MFDs on mission start-up using the OSBs, use the Display Management Switch (DMS) to quickly access these pages or to move the SOI between the HUD and the MFDs.

Depending on the current radar mode, the DMS works as follows:

Move SOI to HUD
(if possible)
[Num-Shift-8]

Cycle through left MFDs [Num-Shift-4]

Cycle through right MFDs [Num-Shift-6]

Switch SOI between MFDs [Num-Shift-2]

COUNTERMEASURES MANAGEMENT SWITCH

CMS information and operation is classified. We can assume that it controls ECM and Flare/Chaff operations. Therefore, the following setup is suggested:

Run selected
EWS program
[SHF-x]

Decrease
EWS program
[SHF-q]

Increase
EWS program
[SHF-w]

Toggle
Jammer
[J]

CURSOR ENABLE SWITCH

The Cursor Enable Switch [Shift-n] on the TQS is the Z-axis of the slewing cursors used to move the radar or the weapon video view. Depressing the CURSOR/ENABLE switch with an AIM-9L/M, AIM-120, or AGM-65 selected changes the BORE/SLAVE option.

For AIM-9L/M and AIM-120, the BORE/SLAVE option is changed only as long as the switch is held depressed. For the AGM-65, a permanent change of BORE/SLAVE (PRE/VIS/BORE) occurs when depressed.

Chapter
3

Training Missions

TRAINING

The training missions are an easy introduction to some of the most important new features in SuperPAK. They give you a calm and peaceful training environment where you can learn about the new avionics and other exciting new options. After these missions, you will be well prepared for the heat of the battle in a tactical engagement or a campaign mission!

MISSION SP01: RAMP START / ENGINE STARTUP

When committing to a mission, you have a new option in addition to TAXI and TAKE-OFF: Choosing RAMP puts you in the cold jet with all systems turned off. It's your job to get this baby running! To have enough time to power up the avionics, align the INS and start the engine, you must commit at least 12 minutes before takeoff.

Capitalized letters in brackets (A) denote the cockpit panel where the switch can be found, as noted on the drawing below. Text in grey denotes additional information and checks that are not mandatory for successful startup. And check out the interactive "SP2 Ramp Start Trainer" in the Falcon 4 folder!

The first step is to prepare the jet for engine startup:

- (C) Set the parking brake - we don't want the jet to roll off once the engine is running!
- (B) Set the switch on the ELEC panel to MAIN PWR to power the systems.
  (D) This activates various warning lights- ignore them for now: ELEC SYS, SEC ON and SEAT NOT ARMED on the warning panel, HYD OIL ON on the right eyebrow panel.
- (B) Go to the external lights panel, set the master switch to NORM and turn anti-collision lights to ON. Switch the position lights on Wing Trail and Fuselage to BRT and set them to FLASH.
- (B) Set MASTER FUEL to ON and ENG FEED to NORM.
- (B) Check that the EPU switch is set to NORMAL
- (E) Check that the Fuel Readout Switch (FUEL QTY SEL) is set to NORM
- (G) Set the AIR SOURCE to NORM

Now the engine can be started:

- Move your throttle to idle.
- (B) Set the JFS to START2. You can now hear the engine spinning up.
- (D) While the engine starts, the RPM needle begins to move. As soon as it goes over 20%, advance the throttle to 50% and...
- (C) ...toggle the idle detent switch on the throttle. The engine RPM will now increase to the current throttle setting (e.g. 70%).
- (B) Check that the JFS has switched itself OFF.
- The HYD OIL warning light should have switched off between 25% and 70% RPM

With the engine running at idle, power up the avionics:

- (G) Turn on FCC, SMS, UFC, MFD, GPS and DL.
- (G) Set the INS to ALIGN NORM. The gyroscopes will begin to spin up. The INS will be fully aligned after about 8 minutes.
- (F) Power on the left and right hardpoints, turn on the FCR and set RDR ALT to STBY.
- (F) Enable the flight path marker by setting the ATT/FPM switch from OFF to FPM.
- (D) Turn on the HUD using the SYM knob (press multiple times to increase brightness).
- (D) Observe the INS status in the DED: The first line shows status and remaining time, starting at "0.0/99". It will be fully aligned when the status reaches "10.0".
- (E) Check that no flags are shown anymore on the ADI, VVI or AOA displays
- (A) Check that TRIM is reset.
- (B) Adjust audio volumes for COMM1, COMM2, MSL and THREAT audio.
- (C) Power the EWS: Set THREAT WARN AUX, EWS PWR, EWS JMR, EWS CHAFF, EWS FLARES to ON. Then switch EWS MODE to MAN. Arm the ejection seat.
- (G) Once INS is fully aligned, enable it by switching to NAV on the avionics power panel.
- (F) Set RDR ALT to ON.
- (C) Switch the landing lights ON and the PARKING BRAKE to OFF
- (D) Enable nose-wheel steering, NWS [Shift-/ (the key left of the right SHIFT)], to taxi..

You're ready to go! Just wait for your take-off time, the tower will call you.
You can check the current time by pressing the "6-TIME" button on the UFC.

MISSION SP10: INSTRUMENT LANDING

Now for a REAL instrument landing! Use the instructions from the original Falcon 4.0 training mission 10 to learn the basics of instrument landing. Then come back and select our version of this training mission: You'll find yourself in the middle of a rainfront with *very* limited visibility!

Watch your instruments and do not rely on outside cues. White-out and loss of orientation can occur. Do not fly extreme turns and always watch your altitude!

The TACAN channel for Kunsan is 101X.

MISSION SP11: CARRIER OPERATIONS

While carrier missions aren't fully implemented (no tower comms), you now land on a carrier and take-off from it. The single most important thing to know is: Always extend the landing hook [Ctrl-k] before touch-down! (*As 3D models aren't updated yet, the hook can only be heard extending, but not seen from the outside.)*

Two training missions are available:

- Clear weather approach in a F-14
- Bad weather landing in a F-18

After a successful landing, retract the arrestor hook [Ctrl-k] and taxi into a parking position. You can also taxi to the beginning of the start ramp and relaunch for another landing attempt.

You can also fly campaign missions from a carrier if one is positioned in the theatre: after selecting a campaign, look for an airbase symbol just off the coast. Click this "airbase" and continue the campaign. You will now fly for a carrier based squadron.

MISSION SP24: AGM-65 MAVERICK MISSILE

Load the default Falcon 4 training mission 24 to practice the new deployment procedures.

Use the following procedure to properly set up your cockpit:

- When the mission begins, set the Master Arm switch [Shift-m] to ARM (so you can fire) and select A-G [NumKP-/] as your master mode (because you want to attack ground targets)
- Select the FCR page in your left MFD and the SMS page in your right MFD (using the OSBs 12/13/14)
- On the SMS page, switch to the AGM-65 missile (OSB 6) and power it up (OSB 7)
- Switch to the WPN page on the right MFD (OSBs 12/13/14).
- On the FCR page (in your left MFD), set your radar mode [F2] as required (GM/GMT)

Now you can choose your target area:

- Still on the radar screen, slew the radar cursor over your target [Cursor keys] and designate it [NumKP-0].
- The SOI (Sensor of Interest) now changes to the right MFD.

Finally, it's time to ready the missile and launch it:

- Uncage [u] the missile (this removes the protective lens cover from the AGM-65). You can now see the target area that you designated before.
- Slew the video cursor [Cursor keys] (use EXP mode [Shift-v or OSB 3] for zoom view) and lock it onto the final target [NumKP-0].
- Check weapon range
- Pickle to launch the missile [Space]

Repeat these four steps for each additional missile that you want to fire into the target area. If you want to attack a target further away, undesignate the current target [NumKP-.] and return to search mode.

The pictures on the right depict the 3 stages of the WPN view: caged (no video available yet - uncage the missile!), uncaged (slew with cursor to target) and locked (target has been designated).

MISSION SP25: LASER-GUIDED BOMBS

Load the default Falcon 4 training mission 25 to train the new deployment procedures.

With SuperPAK 2, Falcon 4 finally features a realistic Targeting Pod (TGP). Therefore, the operation of Laser Guided Bombs (LGBs) has changed considerably.

Use the following procedure to set up your cockpit properly:

- When the mission begins, set both the Master Arm switch [Shift-m] and the Laser Arm switch [Alt-L] to ARM.
- Select A-G [NumKP-/] as your master mode (because you want to attack ground targets).
- Select the FCR page in your left MFD and the SMS page in your right MFD
  (using the OSBs 12/13/14).
- On the SMS page, switch to the GBU (OSB 6). *GBU is the US designation for LGBs.*
- Switch the right MFD to TGP (*not* WPN!) mode (using the OSBs 12/13/14). You will now see the FLIR video from the targeting pod. *Do also check if the laser is armed: a large "L" should be visible in the lower right part of the image.*
- On the FCR page (in your left MFD), set your radar mode [F2] as required (GM/GMT).

Now you can choose your target area:

- Still on the radar screen of the FCR page, slew the radar cursor over your target [Cursor keys] and designate it [NumKP-0]. The SOI (Sensor of Interest) now changes to the right MFD with the WPN view / FLIR video.
- Slew the laser around [Cursor keys] and designate your target [NumKP-0].
  Use the TGP's zooming capability [Shift-v] to get a better view. You can also undesignate a wrongfully selected target [NumKP-.] while still keeping a ground lock on the area. This allows you to precisely select the correct target.
- Do a CCRP bomb release.
- Check if the laser is firing: the "L" in the lower right corner of the WPN view should start flashing as soon as the impact timer meets the Laser timer value (8 seconds before impact)

You can also manually lase your target by holding down the first trigger detent [Ctrl-/] (you will see the "L" flashing whenever the laser fires). This will override auto lasing - you must therefore keep lasing until weapon impact.

Chapter

4

Avionics

AVIONICS

This section covers the upgrades to F4's avionics. Most of the changes only function if the Avionics variable in the Falcon Settings screen is set to '***Realistic***'. Using Realistic Avionics adds tremendous functionality and means that the cockpit

workload is much closer to a real F-16C.

If you are a beginner in Falcon 4.0 and find yourself overwhelmed by the complexity of the realistic avionics, switch to "simple" avionics for your first steps.

OVERVIEW

The SuperPAK offers a number of significant improvements to the Falcon 4.0 original avionics. The changes to the different subsystems are documented on the following pages. They include:

1. The Integrated Control Panel (ICP) with it's Data Entry Display (DED). This is the primary interface to configure the Flight Control Computer (FCC).
2. The Multi-Function Displays (MFD) are two small monitor screens positioned on the front panel of the cockpit. They display information about various avionics and aircraft systems.
3. The Heads-Up Display (HUD), projecting vital information directly onto the windshield.
4. The APG-68 Radar System, the "eyes and ears" of the F-16.
5. The Autopilot, an important navigation aid.
6. The Electronic Warfare System, supporting and automating countermeasure operations such as jammer activation or chaff and flare deployment.
7. The Fault and Warning System, giving the pilot a quick overview of the current jet status.
8. Various switches around the cockpit, supporting special functions and additional features.

INTEGRATED CONTROL PANEL (ICP)

The Integrated Control Panel (ICP) is the primary interface to the aircraft's systems. The Data Entry Display (DED) tracks system status, Fire Control Computer (FCC) settings, and facilitates data entry. The side-consoles are back up systems in the event the ICP fails.

BACKUP SWITCH

In the event of a primary system failure, the BACKUP switch on the AUX COMM panel is used to divert control from the ICP to backup controls. When switched to backup, the TACAN channels and other systems are accessed through the AUX COMM panel. When the BACKUP switch is restored to the UFC position, the settings from the ICP override any entries made using the AUX COMM panel. See your original Falcon 4 manual for more information.

MASTER MODES

The master modes simultaneously set several functions and configure the cockpit and it's display devices for a particular mission activity. There are two types of master modes. The first set is for weapon delivery:

- Air-to-Air (A-A)

- Air-to-Ground (A-G)

- Dogfight (DGFT)
- Missile Override (MSL OVRD)

Air-to-Air [Shift-Num-0] and Air-to-Ground [Shift-Num-.] master modes are selected using the appropriately labeled buttons on the ICP. The DGFT [d] and MSL OVRD [m] override master modes are selected from switches on the throttle grip or via the keyboard. They can only be exited by pressing the cancel button [c]!

The other master modes are:

- Navigation (NAV) is the default mode and is automatically selected when no other MASTER mode is selected.
- Selective Jettison (S-J) may be accessed from either MFD using the Stores Management System (SMS) page.
- Emergency Jettison (E-J) is shown while the Emergency Jettison button is pressed.

OVERRIDE MODES

COMM1, COMM2, IFF, LIST and F-ACK buttons are *Override* modes. Pressing any of these buttons usually provides immediate access to the functions of the corresponding button. *Override* modes are a toggle function. Return to the previous mode by pressing the same *Override* button a second time.

The RESET function is a special *Override* mode that brings up the Communication, Navigation, Identification (CNI) page from any mode or display combination. It is accessed using the Data Command Switch (DCS).

ICP FUNCTIONS AND USAGE

The numbered keypad (numbers 0-9) are the *Secondary* buttons. They are labeled with a four-letter abbreviation if they directly access a subpage. They are used as a normal numeric keypad for data entry on subpages with data entry options.

Scratchpad

Two asterisks surround the data entry section of the DED known as the *Scratchpad*. Wherever you see two asterisks, you're allowed to make manual input using the *Secondary* buttons (there are a few exceptions).

To change a value, such as the TACAN channel as an example, access the appropriate page (such as the T-ILS page) and type in your new channel. You'll notice that the text between the asterisks will be drawn with light text on a dark background when starting to input data. After pushing the Enter button (ENTR), the input is checked for validity. If valid, the system will use the new settings and clear the *Scratchpad*. If the input is not valid (entering a nonexistent TACAN channel), the DED will flash. Your input is not set until ENTR is pressed.

Data Command Switch (DCS)

The Data Command Switch (DCS) is the four-way switch below the ICP. Its four labeled positions and corresponding functions are:

Label	*Direction*	*Function*
RTN	Left	Reset
UP	Up	Cycle through the editable options forward
SEQ	Right	Cycle through subpages and options
DOWN	Down	Cycle through the editable options backwards

CLEAR button

This button will clear the last two data entries. If pushed twice, the entire input is cleared.

Communication, Navigation, and Identification (CNI) Page

The Communication, Navigation, and Identification (CNI) page is the default page displayed on the DED after powering up the Up Front Control panel (UFC). The CNI page displays information about your communications channel, steerpoint, IFF response, and TACAN channel settings. The active communications channel is written on the 1st row of the DED. To change from UHF to VHF, push the COMM2 button, return to the CNI page, and VHF will be displayed on the first line. The UP/DOWN function of the switch will cycle the symbol between the communications channels. Then use the PREV or NEXT button to change your channel.

Wherever you see that small up/down arrow symbol, you can change the data using your PREV/NEXT buttons.

- Toggling the DCS into the SEQ position will show wind information.
- The HACK clock (see below) is displayed on the CNI page when it is running.
- Observe that there is a small up/down arrow symbol beside your steerpoint. This indicates the steerpoint can be changed using the PREV and NEXT buttons on the ICP. If you've selected AUTO steerpoint (see below), you'll see an "A" next to your steerpoint number.

IMPORTANT NOTE: You must RETURN to the CNI page after accessing any page using a *Secondary* button. For example, after pressing MARK to access the Mark page, the sequence to change to the Steerpoint page would be:

- Press RTN (<CTRL><Shift>R)
- Press STPT (<CTRL>KP4)

Pushing the THREE Button while at the CNI page will bring you to the DLINK page. You can also access this page through the LIST page.

Instrument Landing System page (ILS or 1 button)

The T-ILS Button has the FCC enter into one of two modes. Instrument Landing System (ILS) mode is entered if the Instrument mode (INSTR MODE) switch (beside the HSI) is in the appropriate position (TCN/ILS or NAV/ILS).

- The FCC defaults to NAV mode when the INSTR MODE is set to NAV or TCN.
- Input any new TACAN channel using the *Secondary* buttons. A valid channel must be between 1 and 126. To cycle through the TACAN BAND, input 0 into your *Scratchpad* and

push ENTR. The DED readout shows your active TACAN channel. The FREQ readout shows a bogus ILS frequency if your TACAN channel is set to an airbase.

- Use the SEQ button to toggle the TACAN domain.
- The CRS readout shows your selected HSI course.

Altitude Low page (ALOW or 2 button)

ALOW 2N Increment or decrement the low altitude alarm using the *Secondary* buttons. By default, your Minimum Safe Level (MSL) floor is set to 10,000ft. Should the aircraft enter that area during a descent "Bitchin' Betty" will call out "Altitude" twice.

NOTE:

- The MSL floor setting is RALT independent!
- Terrain Following Advisory (TF ADV) is not implemented at this time.

Steerpoint page (STPT or 4 button)

STPT 4W Provides the GPS coordinates of the selected steerpoint. Choose the steerpoint to be displayed on the DED with the PREV/NEXT buttons. Pushing any of the *Secondary* buttons will change to the Destination (DEST) page (see below). Press RTN to return to CNI page (required before accessing any other page).

Use the SEQ function to cycle between AUTO and MANUAL options. If you've selected AUTO, your steerpoint will cycle automatically to the next when you're within 2 miles of the currently selected steerpoint. AutoSteerpoint only works when the FCC is not in A-G mode.

Cruise page (CRUS or 5 button)

There are 4 sub pages:

RNG

Shows the current waypoint, how much fuel you will approximately have when you reach it, and wind information.

HOME

Shows the same info as the RNG page plus the optimum cruise altitude for your HOME waypoint.

EDR (Endurance)

Shows your current wapoint, how much time left until you reach your bingo level (see below) plus optimum cruise altitude, and wind information.

TOS

Shows your current waypoint, system (or, if running, HACK) time (see below), time left until reaching the current waypoint, estimated waypoint arrival time, and the required (approximate) ground speed to reach the waypoint on time.

Push either the SEQ button, or a *Secondary* button (1-9 only) to cycle through the pages.

Press RTN to return to CNI page (required before accessing any other page).

TIME page (6 button)

Shows the current system time. Also contains a stopwatch that can be started/stopped using the PREV/NEXT buttons. Push NEXT once to start it, a second time to freeze it (while the timer is still running in the background), and a third time to update the display again. Use the PREV button to clear the HACK clock. If the HACK time is running, it will show up on the CNI and the CRUS TOS pages. For example, there is a given station time on a BARCAP mission. When arriving at the first BARCAP steerpoint, start the HACK time. This will give an indication of time on station as it runs. Then wait until the HACK time has almost exceeded the station time, then cross reference destination time on station with your ETA. As an example, by Falcon4 default a full 15 minutes is required in the BARCAP area, so a safe bet is to let HACK time run a minute or two over, then apply a little more power to meet the speed/time requirements to get to the next NAV steerpoint.

MARK page (7 button)

Shows info on the MARK points. Press RTN to return to CNI page (required before accessing any other page).

FIX page (8 button)

Permits selection of sensors to update INS position (N/I).

A-CAL page (9 button)

Used to update system altitude and/or INS position (N/I).

Identify Friend or Foe (IFF)

Displays some info about your IFF settings. IFF is not implemented.

LIST page

Access additional pages:

Destination page (DEST)

Displays the GPS coordinates of the selected steerpoint (see STPT page above). Use the *PREV* or *NEXT* button to change the selected steerpoint. The waypoint coordinates may be changed using the *Secondary* buttons. Enter the GPS coordinates of the new waypoint destination and press *ENTR* to implement the change.

Up to two Offset Aimpoints (OA) may be entered for the target waypoint (target waypoint needs to be the active waypoint). Use the sequence button to cycle between the two OAs, enter the GPS coordinates, and press ENTR to set.
NOTE: There will always be an error shown for the coordinates you are entering. This is not a bug, but the way F4 calculates coordinates in game.

BINGO page

Sets the BINGO Fuel warning level. It can be set using the *Secondary* buttons. Push the ENTR button to implement the changed warning level.

Visual Initial Point page (VIP)

Set location information for the Visual Initial Point (VIP). Enter a Visual Initial Waypoint for the target waypoint (the target waypoint needs to be the active waypoint).

Navigation page (NAV)

Displays and controls FCC NAV Filter operation and some GPS functions. Not implemented.

Manual Gun Funnel Adjustment page (MAN)

Set the manual ballistics for the gun using the DED scratchpad. Valid data entries change the size of the gun funnel to match the wingspan of known threats. The default is 35 feet, an effective setting for small to medium fighters (e.g. MiG-29).

Aircraft	*Span (ft)*
A-10	58
F-111	48
F-14	51
F-15	43
F-16	31
F-18	38
F-4	39
F-5	27
MiG-21	24
MiG-23	37
MiG-25	46
MiG-29	36
MiG-31	46
Su-24	44
Su-25	51
Su-27	42

Inertial Navigation System page (INS)

The first line of the INS page displays the align time/status, RDY mnemonic, and steerpoint . The other lines display your current GPS coordinates, heading and groundspeed.

Electronic Warfare System page (EWS)

Control page for the Electronic Warfare System. Toggling the REQJAM option to ON automatically turns the radar jammer on when the RWR system detects a radar spike.

Set the warning level for expendables by toggling BINGO to ON, then manually set chaff and flare low warning levels. When setting the BINGO option to ON, Bitchin' Betty will call out "Low" when your chaff/flare level reaches the alarm level set. REQJAM and BINGO options are toggled with any of the *Secondary* buttons.

If you want to create your own chaff/flare programs, use the SEQ button to access the programming mode (*you need to set the EWS mode switch to STBY before*). There, the PREV/NEXT button switches between the four different default programs. Use Burst Quantity (BQ) to determine the number of chaff and/or flares to release when Burst Interval (BI) is reached. Use Salvo Quantity (SQ) to decide how many times the Burst Quantity should be released when the Salvo Interval (SI) is reached. For example:

EWS	CHAFF PGM
BQ	2
BI	0.500
SQ	3
SI	1.5

The above program will release 2 chaff packets within an interval of 0.5 seconds when a missile launch is detected (This is called one iteration). After 1.5 seconds, the program is repeated using a 0.5 second interval between the release of chaff. The whole loop will be called 3 times (While this useful, it can empty your expendables quite quickly).

Don't forget to switch EWS mode to STBY to enable access to the program mode! Your programs are saved in your cockpit settings by pressing [ALT-c], then [s].

NOTE: The chaff and flare programs are only initiated when the MODE switch on the EWS panel is set to SEMI or AUTO.

Master Mode page (MODE)

The current master mode may be changed through this page should the master mode buttons on the ICP become inoperative. Use the SEQ button to choose the mode you want to change to, then press the 0 button to select it (You can only choose between A-A and A-G master modes). The active mode is drawn color inverted. Pushing 0 on a selected mode will change the FCC into NAV mode.

Visual Reference Point page (VRP)

Set location information for Visual Reference Point (VRP). Enter a VRP for the target waypoint (Target waypoint needs to be the active waypoint).

Interrogation page (INTG)

Check or set AIFF modes and code for interrogation (N/I).

Data Link page (DLNK)

Display data link target information (N/I).

Miscellaneous page (MISC)

Gives you access to miscellaneous subpages:

Correction page (CORR)

Allows checking/input of the correction co-efficient for the HUD, CTVS, CAMERA and left and right hardpoints (N/I).

Magnetic Variation page (MAGV)

Displays the actual magnetic variation of the aircraft's location. This value is displayed on the DED. This info would be used to correct the INS for positional errors in the real aircraft (N/I).

Operational Flight Program page (OFP)

The Operational Flight Program (OFP) page shows the program numbers for the UFC, FCR, MFDs, FCC, SMS and DTE (N/I).

Inertial Navigation System Memory page (INSM)

This is the place where INS parameters like drift errors, maintenance data and manufacturer codes are stored (N/I).

Laser page (LASR)

Page for setting the targeting pod laser pulse code (N/I) and lasing timer (default setting: lasing begins 8 seconds before impact).

Global Positioning System page (GPS)

Displays information about the GPS system (N/I).

DRNG page

Set manual correction to a consistent A-G miss distance (N/I).

BULL page

Select Bullseye mode (toggle with ICP button 0).

If selected, Bullseye information is displayed. If the aircraft is further than 99 miles away from Bullseye, the Bullseye circle is empty. Otherwise the actual distance is displayed. When the target is in STT, the Cursor-Bullseye readout changes to Target-Bullseye distance/bearing.

If not selected (default), an aircraft reference symbol is displayed in the FCR and HSD screens. It's bearing/distance readout depends on current master mode:

A-A: Bearing to the collision point (with a locked target only)

A-G: Air-2-Ground bearing

NAV: Bearing to current system waypoint

In this screenshot (right), the current system waypoint is the one fully right. Therefore, the vertical line in the aircraft reference symbol is also shifted to the right, displaying the bearing to this current waypoint.

WPT page

Info and settings for Harpoon missile operation (N/I).

HARM page

Verify/modify HARM threat table data (N/I).

MULTI-FUNCTION DISPLAY (MFD)

MFD BASICS

The Multi-Function Displays (MFD) are two small monitor screens positioned on the front panel of the cockpit. They display information about various avionics and aircraft systems. As their name implies, they can have different functions set by the pilot according to his or her requirements.

Twenty Option Selection Buttons (OSBs) surround each MFD. Each button on the MFD may have a label (shown on the display next to it) to indicate its current function. The type of function assigned to each button position is generally consistent across all displays and falls into one of the following categories:

Buttons 1 to 5

Usually control the format of the display or its sub-modes. For example, changing the radar mode (which changes the appropriate display), or changing the position of the HSD are typically controlled by these buttons.

Buttons 6 to 10 and 16 to 20

Normally concerned with options for a specific mode or sub-mode. Changing the radar range, scan beam width or controlling some aspect of a sub-mode (such as boresight versus slave targeting mode).

Buttons 11 and 15

Regardless of mode, these special buttons usually are assigned the same function. Button 15 is labeled [SWAP] and exchanges the displays of the two MFDs. Button 11 is labeled [DCLT] and de-clutters the display if that function is supported by the current mode. The Stores Management System (SMS) page is unique with button 11 labeled as S-J to give quick access to the Selective Jettison function.

Buttons 12, 13, and 14

These are three quick access modes. The primary selection is highlighted to indicate the current display mode. The other two are optional secondary selections. Change modes by pressing the appropriate OSB. In the real F-16 a joystick button can be programmed to cycle between primary and secondary selections. This enables a pilot to set-up his/ her three favorite modes on each MFD for each master mode and quickly cycle between them.

SELECTING DISPLAY MODES

Pressing the currently selected primary mode button brings up the MENU page showing all major modes. Selecting one of the other modes will load that mode into this position (It is advisable to set up the MFDs for each master mode on mission start). You can use the DMS keyboard shortcuts [Shift-Num-4/6] to cycle through the preset MFD pages on the MFD being SOI (switch SOI using [Shift-Num-2]).

Example 1 : Primary and secondary displays are set as follows: With OSB 12 selected (FCR), BLANK on OSB 13 and TEST on OSB 14 (as SEEN RIGHT), we can directly access the MENU page by pressing OSB 12 because FCR already is the primary ("currently selected") mode.
We can also get the menu page by pressing button 13 or 14 twice: The first press promotes a page from secondary to primary mode, changing the display to that mode (here: BLANK or TEST). The second press is just like the case mentioned before, except that the mode selected from the MODE menu will be assigned to the selected page (OSB 13 or 14).

Example 2 : We have FCR (OSB 12 primary), BLANK (OSB 13) and TEST (OSB 14), but need to change to FCR (OSB 12), HSD (OBS 13 primary) and TEST (OSB 14):

Press OSB 13 (BLANK) once to select it as primary (display changes to BLANK display), then press OSB 13 again to bring up the MENU page for OSB 13. When we now select HSD (using OSB 7), it will be loaded into the slot at button 13. The MFD now looks as desired.

Configuring Master Modes

The settings of the OSB 12, OSB 13, and OSB 14 buttons are master mode specific, meaning that different OSB display configurations can be assigned to each of the five master modes (NAV, A-A, A-G, MSL, DGFT). These configurations will be remembered when you switch back to that master mode. For instance, if you press the A-A button on the ICP to enter the Air-to-Air master mode, the MFDs reconfigure to the last set modes for that master mode. So if you make a change in range, scan width, radar mode, etc. while in A-A mode, switch back to NAV for a moment and then switch back to A-A mode, the MFDs will show the same settings as before.

The current cockpit configuration can be saved by pressing [Alt-c], then [S]. This will save ALL settings in your HUD, DED and MFDs. Use [Alt-c], then [L] to reload.

The two extra MFDs available in the upper half of HUD-only view [1] do not offer these features.

MENU

The MENU page is the top-level page. All other MFD pages are be accessed from this page. Pressing the highlighted OSB 12, 13, or 14 (the one in primary mode) will switch to this page. The OSBs on this page access other primary MFD pages or apply a function.

OSB 1 BLANK	Access blank MFD page
OSB 2 HUD	Mirror HUD display
OSB 3 RWR	Mirror RWR display
OSB 4 RCCE	Access Reconnaissance Pod page when loaded on a hardpoint
OSB 5 RESET MENU	Access the Reset page
OSB 6 SMS	Access Stores Management page
OSB 7 HSD	Access the Horizontal Situation Display page
OSB 8 DTE	Access Data Loading page (N/I)
OSB 9 TEST	Access Test pages
OSB 10 FLCS	Access the FLCS page
OSB 11 DCLT	Declutter display (if in supported mode)
OSB 12 <mode 1>	Direct access mode (FCR on this screen)
OSB 13 <mode 2>	Direct access mode (HSD on this screen)
OSB 14 <mode 3>	Direct access mode (TEST on this screen)
OSB 15 SWAP	Swap left and right MFD displays
OSB 16 FLIR	Access FLIR display
OSB 17 TFR	Access TFR on the MFD
OSB 18 WPN	Access Weapon Display page
OSB 19 TGP	Access Targeting Pod page
OSB 20 FCR	Access Fire Control Radar page

NOTE: It is not possible for both MFDs to display the same data simultaneously and therefore some MFD combinations are not possible. When attempting to display something currently displayed on the other MFD in either primary or secondary buttons, the item will be 'stolen' from the MFD and replaced with a blank setting.

HORIZONTAL SITUATION DISPLAY (HSD)

The Horizontal Situation Display is a 'God's eye' view of the airspace and relevant ground based objects where the aircraft is currently located. It shows your current position together with a collection of other relevant features, such as Bullseye, waypoints, SEAD threats, wingmen location, and radar information.

SEAD threats are shown based on the known data that is available at take-off time. If a JSTAR aircraft is active, you will receive updates on this information every 30 seconds for the immediate surrounding area.

Wingman positional data may be shown on the HSD. This requires both data links (ownship's and wingman's) to be powered up and working. All wingmen will be displayed on the HSD with their number and altitude. If they bug a target, it will be indicated together with a number and the bugged target altitude. These displays may be suppressed (see below).

The HSD has three modes, two of which are implemented in SuperPAK:

HSD Mode 1: Base Page

The Base page is the default view.

OSB 1 - CEN/DEP

In Depressed (DEP) mode, the display view shows your aircraft (ownship) offset from the center. Your aircraft's position is depressed two-thirds down the display to dedicate a larger percentage of the display to your forward quadrants. The display covers a minimum viewable range of 15 miles and a maximum of 240 miles. Three range rings appear in this view and divide the display into four quarters of viewable range (rings at 5 miles, 10 miles, and 15 miles at minimum range). DEP is the default mode.

In Centered (CEN) mode, the display view centers the ownship on the MFD. Two range rings appear in this view and divide the display into equal thirds distance (rings at 5 miles and 10 miles at minimum range). The minimum range is 10 miles and the maximum range is 160 miles in this view. This mode can be used as a means to zoom the display slightly since you can get a 10-mile picture.

OSB 2 - DCPL/CPL

In the default decoupled (DCPL) mode, OSBs 19 and 20 adjust the range displays on the HSD. When in Coupled (CPL) mode, the range is not adjustable, but follows the range of the radar display.

For example: if the radar range is set to 40 miles, the HSD will be set to 40 miles when in CEN mode, and 60 miles in DEP mode.

OSB 3 - NORM/EXP

Toggles expanded view modes (only if HSD is SOI)

OSB 5 - CNTL

When pressed once, this button takes the MFD display to the control (configuration) page. In this mode various display options may be set (see next page). Pressing the CNTL button again returns you to the base page.

OSB 7 - FRZ

This button freezes the HSD at the current world position and orientation of the ownship (see picture below). The aircraft now moves with the world position fixed on the MFD (ownship is free to fly around and off the HSD) instead of the world moving with reference to the aircraft. Pressing the FRZ button again unfreezes the HSD's world position.

OSB 19 - (Down symbol)

Pressing this button decreases the current HSD view range. No symbol is drawn if the mode does not allow range modification, or if the range is already at minimum.

OSB 20 - (Up symbol)

This button increases the current HSD range view. No symbol is drawn if the mode does not allow range modification, or if the range is already at maximum.

HSD Mode 2: Control Page

The Control page accesses the configuration of the HSD. The buttons are highlighted when their function is available or active (RINGS toggled on OSB 10 is shown below right).

OSB 1 FCR	Displays the ghost radar cursors and the radar scan volume of the Fire Control Radar (FCR).
OSB 2 PRE	Displays preplanned targets. SEAD targets include range rings.
OSB 3 AIFF	Display IFF responses from other aircraft, showing friendly and unknown targets.
OSB 5 CNTL	Exits Control mode
OSB 6-9 / LINE1-4	Toggles line drawings 1-4 on the display (currently FLOT/FEBA (Line 1) is the only line drawing)
OSB 10 RINGS	Toggles the display of the range rings
OSB 11 DCLT	Declutter display (if in supported mode)
OSB 12 <mode 1>	Direct access mode (FCR on this screen)
OSB 13 <mode 2>	Direct access mode (BLANK on this screen)
OSB 14 <mode 3>	Direct access mode (TEST on this screen)
OSB 15 SWAP	Swap left and right MFD displays
OSB 16 ADLNK	Toggles the display of data link air information, including wingman position and wingman bugged targets.
OSB 17 GDLNK	Toggles display of data link ground information. This includes data link mark points and data link SEAD threats.
OSB 18-20 NAV1-3	Toggle the display of NAV routes 1 through 3. Only NAV1, the default route, has any information.

HSD Cursor

If the HSD is SOI, you can move the cursor and designate items:

- Designating a waypoint selects it as the currently active waypoint.
- Designating a pre-planned thread will show it's range ring (if not yet visible).

Moving the cursor to the top or bottom of the display will cause the HSD range to bump.
If coupled with the Radar, it will decouple.

Symbols

As in the F-16C Block 50/52 MLU upgrade, Falcon now features color MFDs, drastically improving pilot's Situational Awareness. The colors of the symbols on the HSD are:

CYAN:

- Own ship, representing your aircraft
- Radar search volume
- Bullseye location and data
- Wingmen positional information (including wingman number and current altitude in thousands of feet)

YELLOW:

- Your own bugged target
- Wingmen bugged targets
- Pre-planned SEAD threat ranges (when you are outside lethal range)

WHITE:

- Navigation routes
- Range rings
- Cursors
- North pointer

RED:

- Pre planned SEAD threat range (when you are inside lethal range)

Color MFDs can be de-selected in the Falcon SP Configuration Editor.

TEST (TEST) PAGES

These pages show various Built-In Tests (BIT). Page one and two display the master list of faults encountered during a flight. Each fault encounter logs the following:

1. Fault type. This is the first mnemonic that's appears on the F-ACK list.
2. Test number that failed.
3. Number of failures.
4. Time of the first fault. The time is relative in minutes and seconds since startup.

Two pseudo-faults are recorded; the take-off time (TOF), and landing time (LAND). Pressing the CLR button will clear the fault list. A maximum of 17 faults (including the two pseudo-faults) may be recorded. Subsequent faults are not recorded, unless they are duplicates.

PAGE 1

OSB 1 BIT1	Indicates BIT 1 tests. Pressing this button changes to the BIT 2 page.
OSB 3 CLR	Clears the Master Fault List (MFL) if displayed
OSB 6 MFDS	MFD Self Test (N/I)
OSB 7 RALT	Radar Altimeter test (N/I)
OSB 8 TGP	Targeting Pod test (N/I)
OSB 9 FINS	Fixed Imaging Navigation Set (N/I)
OSB 10 TFR	Terrain Following Radar Test (N/I)
OSB 16 RSU	Rate Sensor Unit (N/I)
OSB 17 INS	Inertial Navigation System test (N/I)
OSB 18 SMS	Store Management System test (N/I)
OSB 19 FCR	Fire Control Radar test (N/I)
OSB 20 DTE	Data Test Loading (N/I)

PAGE 2

This page contains additional built-in tests.

OSB 1 BIT2	Indicates that these are the BIT 2 tests. Pressing this button will change to the BIT 1 page.
OSB 3 CLR	Clear fault list (N/I)
OSB 6 IFF1	IFF1 Self Test (N/I)
OSB 7 IFF2	IFF2 test (N/I)
OSB 8 IFF3	IFF3 test (N/I)
OSB 9 IFFC	IFF Mode C test (N/I)
OSB 10 TCN	TACAN Test (N/I)
OSB 19 TISL	Target Identification Set, Laser (N/I)
OSB 20 UFC	Up-Front Controls (N/I)

RESET PAGE

The reset page allows various symbology and lighting levels to be reset.

OSB 1 BLANK	Switches off the MFD display
OSB 5 RESET MENU	Return to main menu page
OSB 6 SBC DAY RESET	Reset day symbology to default value (N/I)
OSB 7 SBC NIGHT RESET	Reset night visibility symbol data (N/I)
OSB 8 SBC DFLT RESET	Reset default symbology visibility settings (N/I)
OSB 9 SBC DAY SET	Set the SBC daylight settings (N/I)
OSB 10 SBC NIGHT SET	Set the SBC nighttime settings (N/I)
OSB 18 NVIS OVRD	Night visibility override mode (N/I)
OSB 19 PROG DCLT RESET	Programmed declutter reset (N/I)
OSB 20 MSMD RESET	Master mode initialization data reset (N/I)

FIRE CONTROL RADAR (FCR) PAGE

The FCR page displays all the radar modes. There are eight main radar modes, each with sub modes. OSB buttons 1-5 select the current radar sub mode. The currently selected major mode is shown at OSB 1.

The radar will start up in OFF mode. In this mode the screen displays limited information and no radar specific selections are possible. Only the generic OSBs 11-15 are active. To turn the radar ON, power must be applied to the radar system, using the avionics power switches (This can not be done through the MFD). When power is applied, the radar goes through a self-test, then enters the Stand-By (STBY) mode. In this mode, the radar is inactive and the radar dish is stowed. Pressing OSB 1 (STBY) will take you to the radar sub-mode menu page. This will continue to display the current radar picture if any, but allow selection of a different sub mode. The ground radar options are displayed down the right side, and the air radar modes down the left side. The options are:

OSB 1	Menu page (select a different mode)
OSB 2	Shows the current sub-mode
OSB 3 NRM	Toggle expansion of the area of interest
OSB 4 OVRD	Override will stop the radar emitting in any of the modes. It will become highlighted when selected, and pressing it again will allow the radar to start scanning again.
OSB 5 CTRL	Control page (displays the radar parameters to be modified)
OSB 6 GM	Ground Map radar
OSB 7 GMT	Ground Moving Target radar
OSB 8 SEA	Sea Mode radar
OSB 9 BCN	Beacon mode (N/I)
OSB 10 STBY	STBY mode
OSB 11 DCLT	Declutter display (if in supported mode)
OSB 12 <mode 1>	Direct access mode (FCR on this screen)
OSB 13 <mode 2>	Direct access mode (BLANK on this screen)
OSB 14 <mode 3>	Direct access mode (TEST on this screen)
OSB 15 SWAP	Swap left and right MFD displays
OSB 17	Set radar bar scans
OSB 18	Set radar scan azimuth
OSB 19	Decrease range scale
OSB 20	Increase range scale

The Declutter (DCLT) button works in both A-A and A-G modes. Decluttering removes much of the text and some of the less critical symbols to allow concentration on the main picture. Many OSB button labels are removed in this mode (but the buttons still function). Pressing DCLT again restores the display. The A-A and A-G modes have individual decluttered states that are retained in computer memory as long as the FCC is powered. The real F-16 has a menu to select symbols and labels to be removed when declutter is toggled. This functionality is not present.

Control (CTRL) Page

Pressing OSB 5 on the FCR MFD pages accesses the FCR Control page. This allows fine-tuning of the radar parameters. The current radar display is overlaid with the control options, in positions 6-10 and 16-20. They are:

OSB 6 CHAN	Radar channel in use (cycle four possible channels).
OSB 18 TGT HIS	Number of target histories shown, selecting a lower number of target histories will show fewer low intensity returns in A-A radar modes (cycle 1 to 4 histories).
OSB 20 MTR HIGH	Moving target recognition. Toggles target minimum speed processed and recognized by the system. Low and High speeds may be chosen (N/I).

Note: Only TGT HIS is functional. Other OSBs display labels change when pressed but have no other effect.

STORES MANAGEMENT SYSTEM (SMS) PAGE

The SMS page shows the details of the stores management system. There are several possible modes of display on this, of which only some are implemented in this version.

Inventory (INV)

This is the default view when in NAV master mode. It shows the stores currently loaded on the jet. In the real jet, you can manipulate the stores from this page, changing the number and types of munitions. This is not implemented in this version. The only purpose for this is if you might need to take a backup jet rather than your assigned one.

Weapon details

This is the default SMS view in any weapon delivery master mode. It shows details associated with the currently selected weapon.

OSB 1	Display current master mode (A-A, A-G, MSL, DGFT or GUN). Pressing this button in A-A or A-G will toggle the GUN mode.
OSB 2	Display current submode (when applicable). Only applies to GUN, A-G and DGFT. The sub-mode options are: A-G: CCIP, CCRP, DTOS, LADD, MAN • DGFT/A-A (in any of the A-A Gun modes) • GUN: STRF (if in A-G mode)
OSB 4 INV	Access the inventory page
OSB 5 CNTL	Access the control page
OSB 6	Select hardpoint
OSB 7 PROF	Switch preplanned bombing profile
OSB 8	Single / Pair weapon release [Alt-; / ´]
OSB 9	Modify release spacing [Ctrl-; / ´]
OSB 10	Modify ripple count [Shift-; / ´]
OSB 18 NSTL	Select Nose, Tail or NSTL (NoSeTaiL) bombing profile (as set in CNTL page)

Weapons Control page

Used to edit the details of the bombing profile that was selected in OSB 7 (PROF) on the main SMS view. Allows adjusting of weapon delivery parameters like arming delay, burst height and release angle for different weapon types:

OSB 5 CNTL	Return to the previous page (weapon detail)
OSB 10 REL ANG	Set the release angle for tossing deliveries. This value is used by the FCC to calculate the bomb loft and bomb release cues.
OSB 15-20	Modify the selected bombing profile (Arming delay and Burst Altitude), according to weapon category:
OSB 20 CAT1	Arming delay for impact-fused weapons
OSB 19 CAT2	Arming delay and burst altitude (CBU) for altitude-fused weapons
OSB 18 CAT3	Fuse time and desired burst altitude for time-fused weapons (N/I)
OSB 17 CAT4	Two fuss times and desired burst altitude for Rockeye weapons (N/I)

The two bombing profiles store FCC Submode, Pair or Single, Ripple spacing, Release Pulses and Nose/Tail/NSTL profiles.

Selective Jettison

Toggle Selective Jettison by selecting OSB 11 when in SMS mode. This brings up a display that allows you to select which hardpoint weapons to jettison. You may move back to normal mode by pressing OSB 11 again. Once selected, the hardpoints to be jettisoned are saved. This allows pre-selection of what is to be jettisoned.
To selectively jettison your stores, press the "pickle" button while in the S-J page.

Emergency Jettison

This page looks similar to Selective Jettison. It is only displayed while the Emergency Jettison button is pressed down.

Pressing the Emergency Jettison button for about a second will jettison all Air-2-Ground weapons.

TERRAIN FOLLOWING RADAR (TFR) PAGE

The Terrain Following Radar setup is displayed, controlled, and enabled from this page. This system is not fully implemented. The basics work, but a correct implementation of all the LANTIRN pod features isn't available. The OSB buttons have the following functions:

OSB 1	Current mode
OSB 2	Selects ride type (Hard/Soft/Smooth) which determines how aggressively the terrain is followed and how many G's the Autopilot is allowed to pull to avoid terrain
OSB 4 ON	Toggle On/Off to enable or disable the TFR system
OSB 5 CHN1	Current radar channel (N/I)
OSB 6 1000	Set 1000' terrain clearance
OSB 7 500	Set 500' terrain clearance
OSB 8 300	Set 300' terrain clearance
OSB 9 200	Set 200' terrain clearance
OSB 10 VLC	Set very low clearance (only over sea, or extremely flat land)
OSB 11 DCLT	Declutter display (if in supported mode)
OSB 12 <mode 1>	Direct access mode (FCR on this screen)
OSB 13 <mode 2>	Direct access mode (BLANK on this screen)
OSB 14 <mode 3>	Direct access mode (TEST on this screen)
OSB 15 SWAP	Swap left and right MFD displays
OSB 16 ECCM	Emission Control Mode (N/I)
OSB 17 WX	Weather mode settings (rainy or clear conditions) (N/I)
OSB 18 STBY	Select standby mode
OSB 19 LPI	Low probability of intercept mode (TFR radar only scans forward and less often)
OSB 20 NORM	Selects normal mode

TARGETING POD (TGP) PAGE

This page shows the FLIR image from the targeting pod.

OSB 3	Select field of view (FOV)
OSB 6	Select display polarity (N/I)

WEAPON (WPN) PAGE

Displays images from weapons with a seeker head, such as the AGM-65 "Maverick". When selected, a black screen is shown first. You must then uncage [u] the missile to remove the missile's seeker lens cover and display the image.

OSB 3	Select field of view (FOV)
OSB 20	Select SLAVE/BORE mode

FORWARD LOOKING INFRARED (FLIR) PAGE

Only partially implemented, it displays the Forward Looking InfraRed sensor parameters. The FLIR page allows some adjustment of the FLIR image so it can be aligned with the real world when the FLIR is switched on. Field of Vision and pitch reference lines may currently be changed. The FLIR image can also be displayed on the HUD [Shift-h].

FLIGHT CONTROL SYSTEM (FLCS) PAGE

Displays the status of the Fly-by-Wire system. (N/I)

DATA TERMINAL ENTRY (DTE) PAGE

Data cartridge loading page (N/I)

APG-68 RADAR SYSTEM

SYMBOLOGY

The radar MFDs have been improved to reflect improved realism and enhancements to the HUD and the Non-Cooperative Target Recognition.

In Range While Search (**RWS**), the ASEC is displayed with the same mechanics as the HUD, as is the LOSE cue which flashes opposite the targets altitude if the radar is in Single Target Track mode (STT):

Track While Scan (**TWS**) mode now allows expanding the field of view around either the bugged target, or the cursor position if no target is bugged. This draws a 4nm box around the selected position and expands the view by 4:1. This enables you to split out targets flying in close formation. No special radar modes are used here. It is simply magnifying the existing display. If no target is bugged, the expansion box can be slewed around the screen with the radar cursor keys. The box expands to the correct size based on the radar screen display range.

Using OSB3 toggles between the Expanded (EXP) and Normal (NRML) views. EXP will flash when the function is enabled.

Also note these following changes:

- Track Files are now displayed as hollow polygons.
- Track Files display a tail if an AMRAAM has been fired at it. The tail flashes when the missile goes active.
- At the calculated impact time, an X is imposed over the Track file. This happens regardless of actual impact or not. The X is steady for 5 seconds before it flashes and disappears. If the radar lock is lost due to impact and target disintegration, Track Files vanish as usual.
- The radar will not scan while the aircraft is on the ground.

AZIMUTH STEP

The Azimuth scan width step can be changed between 60 and 30 degrees using the radar cursor: Slewing it to one side of the display toggles an Azimuth step change and the radar cursor moves back in range on the MFD.

LONG RANGE SCAN (LRS)

A new mode called LRS is available. This is Long Range Scan, almost identical to RWS. The exceptions are that LRS is intended for identifying big targets at long range. Therefore, the scan rate is slower, and the chance of detection slightly higher. It is intended for use at range of 80nm (but will work at any range).

ACM MODES

ACM submodes are only accessible by cycling through the long-range radar modes (However, direct access is still possible through keyboard shortcuts [Ctrl-F5/F6/F7] or by switching to dogfight master mode [d], [c] to cancel).

HEADS UP DISPLAY (HUD)

HUD FEATURES

- A roll cue is displayed in normal mode and shows your roll angle up to 45º. This roll indicator is only displayed when the FPM is visible (switched on) and the system is not in AG or DGFT master mode.
- A bank indicator is displayed when FPM is visible (switched on), the system is in AG master mode, the gear is down and the scales switch is set to VV/VAH.
- The AOA indexer lights only work when the gear is down
- When the landing gear is down, a -2.5o ladder bar appears. As well as showing the approximate best descent angle, it is another visual cue that you are in landing mode. in addition, Calibrated Airspeed is displayed (regardless of switch position).
- The heading cue on the heading tape has changed: In ILS master mode, it's a "V"; in NAV mode, it's an inverted triangle
- If the HUD is SOI, a star (★) is displayed in the HUD's top left corner.
- *In the HUD-only view [1], all MFDs can now be turned off (g_bNoMFDsIn1View)*

SWITCHES

HUD power switch

Use the SYN dial on the UFC to toggle the HUD on and off [Shift-Ctrl-Alt-b].

Drift C/O switch

The Drift C/O switch [Ctrl-PageDown] on the UFC centers the FPM in the center of the HUD. Without it, the FPM is off to one side depending on the prevailing winds. During take-off and landing, you usually switch to normal mode, which means you see the effect the wind has on your flight path. Once in the air, you no longer need to worry about the wind, so you use that switch to center the HUD ladder and fpm for better visibility.

HUD CONTROL PANEL

This panel in the right auxiliary console determines how the HUD displays information:

Scales Switch [Shift-Ctrl-Alt-s]

Off	Digital readouts for velocity and altitude
VAH	All scales except vertical velocity
AH	All scales

Flight path Marker Switch [Shift-Ctrl-Alt-f]

FPM	Flight Path marker
ATT/FPM	Flight Path marker and attitude reference bars

DED Data Switch [Shift-Ctrl-Alt-d]

PFL	Pilot Fault List
DED	Data Entry Display

Manual Bombing Switch [Shift-Ctrl-m]

STBY PRI	Backup reticle
DEPR RET	Manual Bombing reticle

Velocity Switch [Shift-Ctrl-Alt-v]

GND SPD	Ground Speed
TAS	True Air Speed
CAS	Calibrated Air speed

Altitude Switch [Shift-Ctrl-Alt-a]

ALT RADAR	Radar Altitude Above Ground Level (AGL)
BARO	Mean Altitude Above Sea Level (MSL)
AUTO	Radar altitude while below 1500 feet AGL / MSL when higher than 1500 feet AGL,

Brightness Control Switch [Shift-Ctrl-Alt-b]

DAY	Full brightness
AUTO	Auto brightness
NIGHT	Half brightness

RADAR ALTIMETER DISPLAY

The HUD symbology has been changed to match the RALT changes. The altitude is displayed rounded to the nearest tens of feet (571' becomes 570'). An "AR" or "R" is displayed below the altitude tape depending on the position of the altitude scales switch. This reflects radar altitude when the Radar-Altimeter has been turned on. Below the altitude readout is the low altitude alarm (ALOW) setting. Should the aircraft descend below the ALOW setting the AL readout starts flashing. If the landing gear is retracted Bitchin' Betty will call out "Altitude, Altitude". With the gear extended, the readout still flashes, but without the cockpit voice warning. The RALT readout box will flash if the Radar Altimeter fails.

MANUAL BOMBING MODE

In a situation where the FCC has become inoperable due to damage, switching to the manual bomb delivery reticle may be a viable option to complete an A2G attack (The standby reticle is available even when the HUD fails). Similar to a WWII aiming device, the reticle has three modes: Off, Primary (Normal) and Standby (Backup).

- Enable the reticle from the A/G MFD by depressing OSB2 and selecting MAN in the list.
- Toggle modes between OFF, STDBY and PRI using the switch [SHIFT-CTRL-m] on the HUD control panel.
- Move the reticle on the HUD using the DEPR RET wheel found on the ICP [Ctrl-[/]].

NEW HUD WARNINGS

TRP FUEL

This indication shows that the fuel in the external tanks is not accessible. Check the fuel transfer switch positions or make appropriate adjustments in the flight plan to increase the effective range. The normal cause of this is incorrect setting of the Air Source control. If the external tanks are not pressurized then fuel will not transfer correctly. This cue will appear when all the following conditions are met:

- More than 500 lbs. of fuel in the external tanks
- Internal fuel is 500 lbs. or more below capacity
- The fuel display selector is in NORM position
- Fuel flow is less than 1800 pph
- Air refueling has not happened in the last 90 seconds

ALIGN

While the INS is spinning up, ALIGN is displayed in the HUD. As soon as the INS is ready, the ALIGN flashes for a few seconds before disappearing.

LOSE

A LOSE cue will appear on the HUD when an AIM-120 is in flight, and the FCC calculates that the missile no longer has the ability to intercept the target. At this point LOSE will flash on the HUD, and the timer cue will change from an A (Autonomous) or T (Targeting) prefix to an L (Lose).

HOJ

The HOJ (Home on Jam) symbol will appear if the target of an AIM-120 missile is using ECM. The AIM-120 will switch off its active seeker in favor of a passive home on jam capability.

AUTOPILOT

There are two switches that control the Autopilot (AP) operation, the ROLL [CTRL-1] and the PITCH [CTRL-2] switch.

The PITCH switch engages the AP. The PITCH switch must be in the ALT HOLD or ATT position for the AP to be active. The AP system tracks your current altitude in the ALT HOLD position or your current attitude in the ATT position.

Switch: Position	ROLL: HDG SEL	ROLL: ATT HOLD	ROLL: STRG SEL
PITCH: ALT HOLD **AP holds current Altitude**	**Follow HSI heading**	**Hold roll angle and altitude**	**Follow course to next waypoint**
PITCH: OFF	**AP OFF**	**AP OFF**	**AP OFF**
PITCH: ATT HOLD **AP holds current Attitude (pitch)**	**AP OFF**	**Hold roll and pitch angle**	**AP OFF**

To make manual inputs at any time during AP operation, use the paddle switch [CTRL-3]

The Autopilot can only be engaged when the following conditions are met:

- Refueling door is closed
- Landing gear is up
- No FLCS Fault
- Aircraft attitude must be within +/-60 degrees of trim flight
- Altitude < 40,000 feet
- Speed is less than .95 Mach

ATTITUDE HOLD

The attitude hold mode is available in either pitch or roll when the pitch and roll mode switches are placed in the ATT HOLD position. Once ATT HOLD is engaged, the aircraft will be held within +/-0.5 degrees in pitch and +/-1 degree in roll. To do a roll and/or pitch correction, use the Autopilot Override. The Autopilot Override (paddle switch [CTRL-3]) will decouple all autopilot inputs while it is depressed. Upon release of the Autopilot Override, the autopilot hold modes capture the reference at release and the heading select guides the aircraft towards the selected HSI heading.

HEADING SELECT

To use this mode, switch to the HDG SEL position on the ROLL switch. The autopilot system uses the heading error signal from the HSI to command the necessary bank angle (up to 30 degrees) to capture the heading that has been set on the HSI. The aircraft will automatically turn through the smallest angle to any heading selected by the pilot, and will maintain that heading within +/-1 degree. To use your current heading, adjust the heading select knob on the HSI to align the heading marker (Captain's bars) to the aircraft heading. Then engage HDG SEL.

ALTITUDE HOLD

Upon engagement of the ALT HOLD position on the PITCH switch, the autopilot system receives an altitude error and altitude rate signal referenced to the conditions existing at the time of selection. The autopilot will control to within +/-100' with bank angles less than +/-30 degrees.

WAR STORY

How sensitive are the F-16 controls? Perhaps this will help illustrate it.

It was my second sortie with the F-16 Falcon after 1000 hours F-4 Phantom time. The mission was a contact mission and the subject was aerobatics. As usual for a Split-S, the instructor began by saying, "OK, roll the F-16 inverted."

I knew it was easy just to roll inverted. I applied normal stick pressure for an F-4, but the F-16 rolled about 720 degrees. Whoa!

ELECTRONIC WARFARE SYSTEM

The EWS allows for automatic countermeasures upon missile launch detection by the RWR. This includes the release of pre-programmed sequences of Flares and/or Chaff and the ability to turn on the Jammer automatically.

The EWS is controlled by a number of switches on the main EWS panel found on the left-hand front panel.

MODE

Select the EWS main mode [SHIFT-z/x]:

- **OFF**: The system is switched off completely. No Flare/Chaff release is possible.
- **STBY**: To manually re-program one of the default programs through the ICP, switch the EWS to standby mode.
- **MAN**: To manually launch the selected Flare/Chaff program.
- **SEMI**: When a radar spike is detected by the RWR, Betty calls out "Jammer" to ask you if you want to turn the Jammer on (*only* if the REQJMR Option in the ICP is set to ON). If so, turn it on manually.
  When a missile launch is detected by the RWR, Chaff/Flares are automatically released according to the currently selected program on the PRGM switch.
- **AUTO**: When a radar spike is detected by the RWR, the Jammer is turned on automatically (*only* if the REQJMR Option in the ICP is set to ON).
  When a missile launch is detected by the RWR, Chaff/Flares are released automatically according to the currently selected PRGM.

PRGM

The program selector [Shift-q/w] controls which one of four pre-programmed counter-measure programs will be used in SEMI and AUTO mode. The default program is #1, a *chaff-only* sequence for medium and high altitude SAM evasion.

The pilot can choose between 4 different programs, each optimized for a certain task. By default, the 4 programs are defined as follows (*Check the ICP-EWS section on page 49 for a detailed explanation on how the programs work)*:

Program #1 - High-Med Altitude SAM Evasion

This program is optimized to deal with RDR launches from SAMS and SARH missiles. The 3 Chaff drop every 2 seconds gives the pilot a maneuver time between salvos to jink and change heading.

Chaff	BQ: 3	Flare	BQ: 0
	BI: 0 .5		BI: 0
	SQ: 3		SQ: 0
	SI: 2		SI: 0

Program #2 - Merge program against enemy with IR missiles

This is optimized to deal with the Archer-HMS combo. At the first turn, the Pilot dispenses this program (6 flares in 6 seconds per press, as suggested in the RP manual)

Chaff	BQ: 1	Flare	BQ: 4
	BI : 0.5		BI: 0.25
	SQ: 3		SQ: 2
	SI : 3		SI: 1

Program #3 - Popup AG sequence, Chaff only

To confuse enemy radar, as the ingressing fighter begins his pull-up into the SAM envelopes this program dumps 8 bundles of chaff.

Chaff	BQ: 2	Flare	BQ: 0
	BI : 0.5		BI: 0
	SQ: 4		SQ: 0
	SI : 3		SI: 0

Program #4 - Popup AG sequence, Chaff-Flare

With the possibility of SA7 or SA8 over the target area, this sequence adds in the protective measure of 6 flares.

Chaff	BQ: 2	Flare	BQ: 2
	BI : 0.5		BI: 0.5
	SQ: 4		SQ: 3
	SI : 3		SI: 3

The EWS system is closely related to the ICP. The pilot can change each program as he/ she likes. To do so, the pilot accesses the “LIST” page, switches to the “EWS” selection and enters the Chaff and Flare program pages. The pilot can change the various values from there (*see the ICP-EWS section on page 30*). Remember: To manually re-program the default programs the MODE switch of the EWS must be in STBY MODE.

RWR

This switch controls whether or not the EWS system receives RWR data. Switch it to ON to use SEMI and AUTO modes - otherwise the EWS doesn't get launch warnings from the RWR.

JMR

SEMI and AUTO Jammer operations only work if this switch is set to the ON position.

Chaff / Flare

Chaff and Flares are only released in SEMI or AUTO when these switches are in the ON position. Manual Chaff/Flare program release does not depend on the state of these switches.

Chaff / Flare release keys

If the avionics are setup as "Realistic", pressing the keystrokes for manual Chaff or Flare release will instead start the selected program.

Manual release of single Chaffs/Flares is not possible. If you really want to release single chaffs or flares, you must reprogram your EWS programs accordingly.

VMS Calls

New VMS ("Bitchin' Betty") calls are "Chaff/Flare", "Chaff/Flare LOW", and "Chaff/Flare OUT".

FAULT AND WARNING SYSTEM

There are two types of indications that the pilot can get from this system: warnings and cautions.

Note: The Voice Management System (Bitchin' Betty) is disabled when on the ground.

WARNINGS AND WARNING LIGHTS

Warning lights are attached to the glare shield, and are red in color. The "T/O LDG CFG" (Take-Off Landing Configuration) light is a warning light. If the pilot flies slower then 190 kts, descending at more than 250 ft/min, and is below 10,000 ft. with gear up, this warning light illuminates. A typical warning consist of a "WARN" indication on the HUD when a light is illuminated. Five beeps followed by "Warning, warning!" from the VMS (Betty) follows 1.5 seconds after a warning light illuminates.

There are two ways to clear a warning:

- Use the WARN RESET switch located on the ICP. The "WARN" indication in the HUD will be removed, and the VMS will stop. However, the warning light will remain on.
- Change the situation that caused the warning. In the above example, accelerate to a speed above 190 kts, descend slower, or lower the landing gear. The HUD "WARN" indication will be removed, the warning light will extinguish, and Betty will quit shouting.

This is the same with all warning lights. Clear by getting out of the condition that caused the warning (if possible), or use the WARN reset switch.

CAUTIONS AND CAUTION LIGHTS

Cautions work basically the same as Warnings, but the Master Caution light illuminates instead of the HUD "WARN" indication. Seven seconds after the caution light illuminates, Betty calls "Caution, caution". Pressing the Master Caution button during the seven-second interval avoids the VMS call. Removing the condition causing the warning will clear the warning.

Example: selecting CAT I when the aircraft is limited to CAT III will generate a Master Caution, a Betty call and a Stores Config caution light. Changing the switch back to CAT III will extinguish the caution lights and there will be no VMS messages. Also after expending all A-G ordnance, the Master Caution and Stores Config lights will be on and Betty calls. This is because CAT III isn't necessary any longer, as no A-G ordnance hangs under the pylons anymore. Simply switch back to CAT I to solve the problem!

PILOT FAULT DISPLAY

The Pilot Fault Display (PFD) is located just above the caution lights panel on the right auxiliary console. This display is accessed via the F-ACK button on the left side of the glare shield. If the button is pressed and there are no system faults then "No FAULTS, ALL SYS OK" will be displayed. Pushing the F-ACK button a second time will turn the display off.

When the "AVIONICS FAULT" caution light is illuminated the pilot will get a Pilot Fault List (PFL) and Master Caution will illuminate as it does for all cautions. Pushing the F-ACK button will bring up the first fault the system detected. Use the F-ACK button to cycle through all system faults *(You can also click directly on the PFD to switch through the messages)*. When the last fault in the list has been displayed, another push on the F-ACK button will turn the display off. The "AVIONICS FAULT" light will be turned off once the pilot has cycled through all faults.

The PFL can also be accessed through the DED: If the DED Data switch is set to PFL data, the F-ACK button steps through the individual faults, just like the PFD display.

WARN RESET

The Warning Reset switch [SHIFT-CTRL-ALT-w] is located on your UFC and is used to acknowledge warning indications when they appear on your HUD. For example, should a warning indication for Bingo Fuel occur, the Master Caution light illuminates and "WARN" is displayed in your HUD. Pressing the Master Caution button [CTRL-c] will reset the warning system and extinguish the Master Caution light, but will not remove the "WARN" indication on the HUD. Use the Warn Reset switch to reset and remove that indication. The Warn Reset resets the MaxG readout the pilot sees on the HUD to 1.

INERTIAL NAVIGATION SYSTEM

The INS uses gyroscopes and other electronic tracking systems to detect acceleration and deceleration of the airplane. With this data, the INS computes the aircraft's position in latitude and longitude. As the INS is aligned on the ground before take-off, it's accuracy declines on long flights. In modern jets, the INS is coupled with the GPS to gain additional precision.

In SuperPAK 2, INS is partially implemented:

- When doing a ramp start, the INS must be aligned. (Full alignment takes 8 minutes, but INS will be useable after 90 seconds of alignment).
- Wrongly entered INS coordinates will result in waypoint offset (coordinates are automatically preset upon start - but can be changed manually through the DED)
- The INS drifts if GPS is turned off (HUD waypoint and HSD stuff drifts). Drift depends on alignment time. The longer aligned, the smaller the drift will be: With full alignment, INS drifts 1 NM per hour, with minimum alignment, INS drifts 10% more.
- The jet may not be moved during alignment, or alignment will stop (it continues once the jet stops again). If the plane moves faster than 60kts on ground and in Align mode, INS has to be shut down before it can be aligned again.
- Pitchladder and Headingtape numbers aren't shown when the INS is powered off or not aligned

HOW TO USE THE INS

- To align the INS, the UFC must be turned on. Then, switch the INS knob on the right panel to ALIGN NORM [Ctrl-Alt-F7/F8]. Alignment will now begin.
- The alignment status is shown in the HUD and on the INS DED page:
  - During alignment, ALIGN is displayed in the HUD and flashes after full alignment.
  - On the DED, the 1st line shows RDY as soon as the INS is useable (after 90 seconds). When the INS is fully aligned (after about 8 minutes), this RDY indicator will flash.

- The timer on the INS DED page will count on after 8 minutes, but status won't go below 10.
- If coordinates are entered in the DED after 2 minutes of alignment, alignment starts anew.
- Should you have a total power loss in flight or switch the INS to OFF, turn the INS knob to IN FLT ALIGN. The INS will then use GPS information to re-align itself

OTHER SWITCHES

AVIONICS POWER

The main power switch on the left console needs to be set to BATT for engine startup and to MAIN PWR when the engine is running [CTRL-ALT-F1/F2]

The other power switches are on the right side panels:

	[SHIFT-ALT-F6...F12]
FCC	Fire Control Computer HSD display on the MFD
SMS	Stores Management System
MFD	Main MFD
UFC	Up Front Controls, DED, and ICP
MAP	Unknown (N/I)
DL	Data link (required to datalink wingman positional data and JSTAR updates)
GPS	GPS power
INS	Inertial Navigation System - Inflight/Aligned: NAV - Ramp/Aligning: ALIGN NORM

FCR	Fire Control Radar, powers up the radar systems [SHIFT-ALT-F5]
LEFT/RIGHT HDPT	Powers the fuselage hardpoints (normally targeting or navigation pods) [SHIFT-ALT-F3/F4]

RADAR ALTIMETER (RALT)

This is a three-position power switch. Positions are OFF, STANDBY, and ON. Only the ON position provides A-LOW warnings. The altimeter takes time to cool down before it functions.

In realistic avionics, the RALT will only work if the aircraft's parameters are within following limits:

Altitude (ft)	Roll (+/-)	Pitch (+/-)
< 3000	60°	30°
> 3000 <= 5000	30°	30°
> 5000 <= 10000	25°	25°
>10000 <= 25000	15°	15°
>25000 <= 50000	10°	10°

PARKING BRAKE

The parking brake switch [ALT-p] applies the brakes permanently. As its name implies, it is used to park the aircraft. The parking brake may be released with the parking brake switch or by applying 83% or greater engine RPM.

LANDING LIGHT

Toggles the landing/taxi light on or off [CTRL-ALT-l].

EXTERIOR LIGHTNING

Used to toggle the jet's position and anti-collision lights.

MASTER	Set to NORM [Ctrl-Alt-F9]
ANTI COLLISION	Toggle the anti-collision light (on the tail) [Ctrl-Alt-F10]
POSITION	Switch to BRT to turn on the position lights [Ctrl-Alt-F11] on the wings and choose FLASH or STEADY [Ctrl-Alt-F12].

INTERIOR COCKPIT FLOOD LIGHTING RHEOSTAT

This rheostat on the right console controls the interior flood lighting of the cockpit. *Please note that enabling this causes a framerate hit.*

KNEEPAD

SEAT ARM SWITCH

This switch [SHIFT-e] can be found on the left front of the ACES II Ejection seat, just below the pilot's kneepad and the landing gear handle. When the switch is in the UP (SAFE) position, the seat is NOT armed and the SEAT NOT ARMED caution light will illuminate. Ejection is NOT possible. Moving the switch down (ARMED) allows normal operation of the ejection seat. Changing the seat from ARM to SAFE will illuminate the caution light and a Master Caution will be displayed.

TAIL HOOK SWITCH

For carrier landings, the aircraft's tailhook must be deployed [CTRL-k]. Upon landing, the hook catches one of several arresting wires stretched across the landing deck of the carrier, bringing the plane to a stop.
The hook cannot be visually seen, as the 3D models aren't updated yet.

ALTERNATE GEAR DEPLOY / RESET

If hydraulics fail, this handle [ALT-g] engages the alternate gear deployment. The center white button [CTRL-SHIFT-g] resets the alt gear deployment and re-enables normal hydraulic gear deployment.

SPEED BRAKES

In the air and with the gear retracted, the speed brake operates through its full range. However, if the landing gear is lowered, the speed brake opening is limited to 43°. If necessary, the pilot can override this limitation by holding the speed brake actuator in the "open" position [Shift-b].

On the ground, there is no need to hold the key in the open position after the nose wheel is on the ground. The speed brake will remain in the position the pilot set before.

DRAG CHUTE

Some planes like the F-4 or the SU-27 will feature drag chutes to slow the plane after landing. Use a cockpit switch (if available) or [Shift-d] to deploy the chute when you have slowed to about 160 kts (do not deploy while faster - it may get detached!). After slowing down, press the switch a second time to detach the chute (before turning from the runway onto the taxiway).

The standard USAF F-16C in SuperPAK 2 does NOT feature a drag chute!

LASER ARM

Found just below the RF Switch, the Laser Arm switch [ALT-l] turns on the Forward Looking InfraRed (FLIR) pod's targeting laser. Laser Guided Bombs (LGB) require that the laser illuminates the target until impact. Should the laser stop illuminating the target, or should the lock be broken during the LGB's time of flight (TOF), the weapons will follow a ballistic trajectory. LGBs can be assigned new targets while in flight.

RF SWITCH

The RF switch [SHIFT-ALT-r] is located on the left side of the cockpit, just above the Laser Arm switch. This switch is used to cut radar emissions quickly and completely. When entering into enemy territory with the desire to be undetected (perhaps using Terrain Following Radar navigation or just NOE ingressing) use this switch. This switch has three positions:

- NORM: Normal operation
- QUIET: Radar emissions reduced, and the AGP-68 radar is put into Standby
- SILENT: ALL radar emissions are silenced (i.e. no RADAR, no CARA (RALT), and no TFR, the system will indicate a TF failure and generate a TF FAIL light and WARN indication)

GROUND JETTISON ENABLE SWITCH

Enables [Alt-j] stores jettison while still on the ground (in case of Emergency).

EMERGENCY JETTISON BUTTON

Pressing this button [Ctrl-j] for more than one second will jettison all Air-2-Ground weapons (Air-2-Air missiles will stay onboard). *While the Emergency Jettison button is hold, the Emergency Jettison page will be displayed in the MFD.*

STORES CONFIG SWITCH

This switch [SHIFT-c] toggles the stores configuration. Also known as the CAT switch, it restores maneuverability to the aircraft after the loadout is released or jettisoned.

TRIM PANEL

Use the manual trim knobs to correct problems with airplane stability (e.g. after being hit by AAA or SAM). The gauges show the level of currently applied trim [Shift-Alt-NumInsert/Home/PageUp/Delete/End/PageDown]. TRIM/AP DISC switch: Set to DISC to disable trim through the stick or autopilot [Ctrl-4].

FLIGHT CONTROL

As the F-16's flaps are controlled by the FLCS, no pilot input is needed. However, if the FLCS is damaged, you can manually access the flaps by using the FLT CONTROL panel:

LE FLAPS [Ctrl-5]	AUTO: Leading edge flaps controlled by the FLCS LOCK: LEFs locked in current position

MANUAL FLAPS

On aircraft equipped with manual flaps, normal (trailing) flaps and leading edge flaps (LEFs) can be operated by using appropriate cockpit panels (if available) or by using keyboard shortcuts to set the flaps to zero (null), extend them fully or decrease/increase their angle:

	Set to Zero	Extend Fully	Decrease	Increase
Flaps	[Ctrl-F9]	[Ctrl-F10]	[Ctrl-F11]	[Ctrl-F12]
Leading Edge Flaps	[Alt-F9]	[Alt-F10]	[Alt-F11]	[Alt-F12]

AVTR SWITCH

The Airborne Videotape Recorder is used to record ACMIs:

- Switching to ON starts recording.
- Switching to AUTO [Alt-f] enables automatic recording. In this mode, the AVTR starts recording whenever the 1st trigger detent or the pickle button are pressed. It then keeps recording for at least 30 seconds or until recording is stopped [f].

AUDIO VOLUME

Use the knob on the main AUDIO panel to regulate the sound volume of the missile seeker heads (MSL), the threat warnings (THREAT) and the two (voice) comms channels.

Audio	Vol. -	Vol. +
MSL	Shift-Ctrl-[	Shift-Ctrl-]
THREAT	Shift-Alt-[	Shift-Alt-]
COMM 1	Ctrl-Alt-[	Ctrl-Alt-]
COMM 2	Shift-Ctrl-Alt-[	Shift-Ctrl-Alt-]

TEST PANEL

Set the Test switch from NORM to TEST to check malfunction and indicator lights [Ctrl-t]. *Left mouse to turn on, right to turn off.*

Chapter

5

Airframe & Engine

AIRFRAME

AIRFRAME OVERSTRESS

Extreme levels of airframe overstress or overspeed during flight will damage the hardpoints. Damaged stations will not be able to release weapons.

Noise inside the airframe will warn you of increased airframe stress.

FUEL

The F-16 Fuel system is based on the Forward/ Right Left/Aft layout. The fuel is divided into two systems, the F/R and L/A, and is fed from both systems to the engine. In this way balance is maintained and the aircraft does not become too nose or tail heavy or have a tendency to roll.

The fuel storage system is composed of the following:

- Two Reservoir tanks, these hold 480lbs of fuel each and feed the engine directly. One reservoir is for the F/R and the other L/A system.
- Forward and aft fuel tanks hold the bulk of the internal fuel. They feed into the appropriate reservoir tanks.
- The wing tanks which feed the forward and aft tanks, the left wing tank feeding the aft main tank, and the right feeding the forward tank. These tanks hold 550lbs of fuel each.
- External tanks feed into the wing main tanks. The wing externals feed into the appropriate wing tank, and the centerline feed into both. Capacity is dependent on the tank size loaded.

The fuel is transferred from the reservoirs to the engine. There are fuel pumps that are normally activated to aid the transfer, but the main transfer mechanism is gravity and siphoning between tanks. The fuel then goes through the Fuel Flow Proportioner (FFP). It adjusts flow rates from the two systems to maintain the balance of fuel between F/R and L/A systems to maintain the aircraft's center of gravity. Should the FFP fail (it is part of the '**A'** hydraulic system) then erratic distribution may occur leading to a center of gravity imbalance.

The fuel then goes through the main fuel valve to the engine (where it burns!). The amount of fuel in the F/R and L/A is shown on the fuel gauge. More important is the ratio of the fuel in the tanks. If the difference is too large, a center of gravity imbalance will occur. Attention to the fuel gauge indicators is important beyond just assessing remaining fuel.

The **fuel readout knob** has 6 settings - which alter what is shown on the gauge. In all positions except TEST, the digits in the display show the total fuel [Shift-Ctrl-F1/F2].

The positions have the following functions:

- TEST: Digits should show 6000lbs of fuel, and both dial indicators should point to 2000lbs.
- NORM: One gauge indicates the F/R amount, and the other the L/A quantity of internal fuel (total amount stored in reservoirs, Fwd/Aft tanks and internal wing tanks for each system).
- RESV: Shows the amounts in the Fwd/Aft reservoirs.
- INT WING: Shows the amount of fuel in the Right/Left internal wing tanks.
- EXT WING: Shows the amount of fuel stored in any external wing tanks.
- EXT CENTER: Shows the amount of fuel stored in any centerline tanks.

The normal fuel transfer procedure from external to internal is to transfer fuel from the centerline tank first, then from the external wing tanks. However, this may be overridden by setting the **fuel transfer switch** to WING FIRST.

The left console has the protected **fuel master switch**. This controls the main fuel valve. In the off position, no fuel will get to the engine.

*The next switch, **tank inerting**, is not implemented.*

Next to it is the **fuel pumps control switch**. This has 4 positions [Shift-Ctrl-F5/F6]:

- OFF: All fuel pumps are off. Fuel will still transfer using gravity and siphon feeds, but you will encounter problems in negative G maneuvers with the engine being fuel starved.
- NORM: Normal position - all fuel pumps on.
- AFT: Fuel is transferred from the L/A system only .
- FWD: Fuel is transferred from the F/R system only.

These last two positions allow a fuel imbalance to be corrected manually.

The switch for the **aerial refueling door** [SHIFT-r] opens and closes the air-refueling door. The air-refueling door must be opened before attempting in-flight refueling.

Finally, there is the **air source control switch** on the right console. This controls pressurization of the cockpit and the fuel tanks. The external fuel tanks require pressurizing to allow the transfer system to work.

This knob has four settings [Shift-Ctrl-F3/F4]:

- OFF: no air control.
- NORM: normal position for pressurizing the cockpit and the external fuel tanks.
- DUMP: dumps cockpit pressure, but still pressurizes the external fuel tanks.
- RAM: external tanks are not pressurized.

The external tanks are pressurized when switch is in the NORM or DUMP. In other positions the tanks are not pressurized and external fuel flow will not occur. If this happens for too long, you may get a FUEL TRAPPED warning on the HUD indicating fuel flow problems.

WAR STORY

A certain real F-16 pilot known to many of us, was cruising along at 25,000ft one day, getting ready for the days work. He began to feel a little cold, and the air temperature up there is usually a little on the cool side. So reaching over to the side panel for the heater rheostat, he attempted to turn up the cockpit temperature. Unfortunately, he selected the Air Source knob instead of heater, and succeeded in turning up the 'temperature' to DUMP position. So, all air pressure is immediately dumped from the cockpit. This is equivalent to ascending from 10,000ft to 25,000ft VERY quickly. To make matters worse, the natural reaction is "Oops – I better fix that" or thoughts to that effect. So he turned the knob back to NORM. This re-pressurized the cockpit to 10,000ft equivalent.

So, in the space of a few seconds, he'd made the trip from 10,000ft, to 25,000ft and back again. Now if that isn't a workout for the ear, nose and throat, I don't know what is. As he said afterwards, "It's good I didn't have a head cold!"

ENGINE

DEFINITIONS AND TERMINOLOGY

The jet engine system in the F-16 consists of several engines actually. There is the main engine, and a small jet engine known as the **Jet Fuel Starter** (JFS) [SHIFT-J]. This engine is used to bootstrap the main engine to life by spinning up the main engine to an adequate RPM where the fuel can be fed and ignited. What spins up the JFS engine to a point where it can light? Hydraulic power, stored in two hydraulic pressure accumulators, is used to accomplish this.

When you start the JFS, hydraulic accumulators discharge through the JFS to spin it up to starting speed. Once running, the JFS can then start the main engine. The JFS accumulators are a one-shot process. Once the accumulators are discharged (one JFS start attempt), they must be recharged before another attempt can be made. Running the engine at greater than 12% RPM about one minute is enough to charge the accumulators.

WAR STORY

If you discharge the JFS accumulators on the ground and the JFS fails to start for any reason (like you had the switches wrong), the normal method for a restart is to get the crew chief to pump up the hydraulic reservoir by hand. This is done through an external port. As this procedure is time consuming and takes several hundred ‘pumps’ to achieve, you end up with one sweaty and annoyed crew chief. You will probably be late for your take-off slot too.

It is not especially recommended as a method to win the heart of your crew chief or the respect of your fellow pilots, tapping their feet in their jets. It will probably also cost you a case or two of beer. In the air your options are more limited.

Power to move the control surfaces and other parts is supplied through the ‘ **A**’ and ‘**B**’ hydraulic systems. These are pressurized from pumps driven by the main engine.

When all other systems fail, and the aircraft is in the air, the **Emergency Power Unit** (EPU) starts up automatically. The EPU has ten (10) minutes of fuel, total. When the engine is offline, the secondary hydraulic system, Hydraulic B, fails. The primary hydraulic system, Hydraulic A, fails when the EPU shuts down. None of the aircraft control surfaces function when both systems are down. This is a good time to leave the cockpit.

If the EPU switch is in the NORMAL position during flight, the EPU will start and run automatically. In the OFF position, the EPU doesn't run. In the ON position, the EPU runs regardless of the main engine status. The EPU can be set manually [ALT-e].

Switching the EPU to ON has no noticeable effect if the engine RPM is above 80%, as it will simply derive power from the main engine. However, as soon as RPM drops below 80%, the EPU will start to burn EPU fuel.

The throttle on the F-16 has various stops where the normal sliding motion stops (called detents). The throttle must either be lifted or an interlock lever pulled to move it further. One of these detent settings stops the throttle before it moves into afterburner position, so the pilot has feedback that he is about to go into afterburner. There is another position at the other end of the throttle travel that stops the throttle from moving below the idle setting to the cut-off setting (which avoids accidental shutdowns). In the F-16, a small lever must be engaged to move the throttle below idle and shut down the engine: Use the **throttle idle detent** [ALT-i] to cut-off the fuel flow to the engine.

One of the preflight checks is to check the throttle travel and confirm that the detents are working correctly.

WAR STORY

Although the detents normally stop accidental movement of the throttle into a wrong position, you can imagine that during the heat of battle or training, that your actions may not always be as precise and collected as you might like.

A certain pilot flying F-16s during a Fox-2 training flight, chopped his throttle back a little too vigorously, and managed to jump it back beyond the Idle setting to the cutoff setting.

Now while this is an excellent way to reduce the heat signature of your engine, it does have problems of its own, as you can imagine.

FUNCTIONS AND USAGE

To shut down the engine

- Set throttle position to idle.
- Engage the idle detent switch [ALT-i]. This is equivalent to pressing the lever that allows the throttle to travel fully back, and then pulling back the throttle.
- Engine will now spool down (to 0% on the ground or between 5%-10% in the air, depending on speed).

In flight, the EPU will start and run automatically as soon as the rpm drops below 80% (The EPU has a 10 minute fuel supply to power flight systems, then a total flight control system failure will happen).

The Hydraulic B system will fail as soon as the engine is shut down. The most important effect of this is that the landing gear cannot be lowered normally. Instead you'll have to use the Alternate Gear Extension [ALT-g] to lower the gear. You will not be able to retract it unless the main engine is restarted. To retract after an engine restart, toggle the Alternate Gear Reset switch [SHIFT-CTRL-g] to reset the system.

To start the jet engine

- Set throttle position to idle.
- Start the Jet Fuel Starter [SHIFT-J]. Engine will spool up to a maximum of 25% rpm.
- When the RPMs are greater than 20% advance the throttle above idle.
- Press the idle detent switch [ALT-i].

Engine should now start and spool up to over 70%. The JFS will automatically disengage when the engine RPM gets above 50%.

DETAILS

The JFS will fail to start the main engine if the aircraft is higher than 20,000 ft barometric or moving at greater than 400 Knots. There is an increasing probability of failure at higher altitudes or speed. Unfortunately, the JFS accumulator will still discharge during an attempted restart! Once discharged, the JFS accumulator will not function without recharging the pressure accumulators. If at sufficient altitude, diving the aircraft to get 12% or better RPM on the inlet turbine will recharge the JFS accumulators in about one minute.

When the '**B'** hydraulic system fails the following systems will fail:

- landing gear
- nose wheel steering
- drag chute system
- gun
- air refueling
- wheel brakes
- JFS recharge

When the '**A'** hydraulic system fails the following systems will fail:

- speed brakes
- fuel flow proportioner

All other systems are served by both A and B.

WAR STORY

This is an example of how to get yourself into an unrecoverable situation. It happened while testing out the F4 engine restart code.

A nice day for a training mission, flying nice and high, around 30,000ft so that shutting down the engine would leave plenty of room to try restarts and other procedures.

Throttle to idle, Idle detent selected. The engine spools down nicely to about 7%. A quick check of the gauges shows EPU fuel slowly decreasing, Hydraulic B system down, Hydraulic A working. Everything is looking good. Now to test a few other things. Deploy the landing gear, a quick check before hand that we are less than 300knots, good. Gear fails to deploy – check. That is correct the **B** system is down. So, switch to Alternate Gear select. The gear drops correctly, and won't retract. Ok – the test is over, time to get back.

I set Throttle to Idle, engage the JFS. I hear the sound of the accumulators discharging but the RPM remain static. Hmmm – what went wrong? Speeds ok, but the Altimeter is reading 26,000ft! Damn – that's the problem. OK – but at 26,000ft I might be able to dive and recharge the accumulators. However, if I do that, I'm going to be traveling at 400+ knots, which will wreck the landing gear, which I can't retract.

OK – I'm now officially screwed! I need the engine to retract the gear, but I can't start the engine without breaking the gear. A dead stick landing is the only option left. This is not going to look good on my record!

START-UP SEQUENCE

When you select to start from the hanger by clicking RAMP start in the mission loader screen, the game will start with the F-16 in its powered off, cold state. The jet therefore needs to have a full preflight sequence before being ready to take off. Currently twelve (12) minutes are allowed to preflight the aircraft, start the engine, and taxi to the runway. The AI aircraft, and players using Combat AP, will do this automatically. Check out Training Mission SP01: Ramp Start / engine startup for a complete walk-through! There is also an appropriate check-list included at the end of the manual.

When you start at the ramp and hear the jet power up without having touched anything yet, you are probably hearing your wingman's engine. They are very keen to get started and light up as soon as they can! It may be your own jet if you selected Combat Autopilot in which case it will preflight your jet for you.

ELECTRICAL SYSTEMS

The F-16 has several electrical systems and generators. The main sources of electrical power are in rough preference of use:

- Main Generator
- Standby Generator
- Emergency Power Unit (EPU)
- Battery

The main generator is powered by the engine and is sufficient to power all the aircraft's systems. The standby generator is powered by the main engine and has adequate output to power most of the essential systems. The emergency power unit is an independent system that can provide power in the absence of the main generators. The batteries provide minimal power to certain systems only.

Attached to each generator is a power bus, which is designed to allow degrading of the power systems. These are:

- Battery bus
- Emergency power bus
- Essential power bus
- Non essential power bus

Thus, the main generator provides power to all busses, the standby generator provides power to all but the non-essential power bus, and so on. Without the engine, both the standby and main generators are inoperative, which is why the EPU is an independent system used for power during an engine failure.

LIGHTS

There are numerous lights associated with the electrical system. The main one is the ELEC SYS caution light. This illuminates when there are any electrical problems identified and is a cue to check for other problems. There are two lights on the electrical panel, showing the status of the main and standby generator. These are illuminated when there is a problem with the generators. FLCS RLY and TO FLCS indicate problems with power to the FLCS. This usually indicates that the FLCS is not getting power from all possible power sources (The FLCS gets power from every system as it is the most critical system in flight). The battery light illuminates when there is a problem charging the batteries, or problems with the battery voltage. The EPU has two lights to show that it is working (in addition to the main EPU run light): The first one is an AIR light that indicates that the EPU is running. The other one, labeled HYDRAZINE, indicates that the EPU is consuming Hydrazine fuel (rather than running off engine pressure). This means there are less than ten (10) minutes of reserve power!

WAR STORY

The F-5 has twin engines and fire warning lights for each of them. When the temperature in the engine goes out of control, the FIRE light comes on. You never see this in normal life, and you never want to see it either. It is a serious emergency when it happens.

It has CAPS:

- Throttle-idle
- Throttle-off if FIRE light remains on
- Eject-if fire remains

It was a cloudy day but we knew that above 10,000 feet it would be clear. A 2 vs. 2 DACT ride was my favorite those days. We took off in formation and came out of the clouds. Lead sent us to line abreast, 1.5 NM. The jet was trimmed up, and everything was ok. I was checking leads 6 visually, but I remembered the instructors comment, "If everything feels ok, there is something wrong, so check everything again."

I looked inside the cockpit. Saw a red light. Looked outside again, and said to myself, "Wait a second, did I see a red light there?" I looked inside again, there it was - LEFT FIRE.

I did the CAPS: throttle to idle – the light stayed on, throttle off - the light went out. I shut down the left engine quickly and started to turn back. I called on radio "Knock it off #2, left engine fire, shut down engine, turning back"

The light was off, so I sat back and relaxed. I had one more engine, and everything looked fine. I checked the TACAN, 45nm to go. I did a descent calculation, put fpm to descent. "Whoa that was my unlucky day" I said to myself with a smiling face, while I checked off the checklist items. Coming down to 10,000 feet. I started to fly on instrument because of the IMC.

The RIGHT FIRE light blinked once. I said, "Oh no!" I was so full of adrenaline, I knew I must calm down. It blinked again and I stared, "God no, you have got to be kidding me." I began to lose my self-confidence. Had I misjudged the fire light and shut down wrong engine?

"No it can't be!" I said to myself. I started to pull the right throttle back. The light turned off at %85 RPM. On single engine with limited thrust, I glided down to the runway. I landed with no problem but without the utility hydraulics.

"Phew – a good day after all." I thought.

After inspection it turned it out that the light circuit had a problem. The FIRE lights were false. Some people thought it was funny. I almost bailed out. I never got the joke.

Chapter

6

Weapons

WEAPON SYSTEMS

GUN

The EEGS display levels have been further expanded to reflect increased realism:

- The funnel disappears when firing and reappears shortly after firing stops.
- If the SCOR button on the MFD is enabled, FEDS bullet markers replace the funnel while firing (only if no target is locked and the Master Arm switch is set to either to SIM or ARM).
- If a target is locked, a level V director piper appears, giving a true "death dot" in a stabilized situation against a target on a predictable flight path.

TARGETING POD

The AN/AAQ-14 Targeting Pod contains a high-resolution, forward-looking infrared sensor (which displays an infrared image of the target to the pilot), a laser designator-rangefinder for precise delivery of laser-guided munitions, a missile boresight correlator for automatic lock-on of AGM-65D imaging infrared Maverick missiles, and software for automatic target tracking. These features simplify the functions of target detection, recognition and attack and permit pilots of single-seat fighters to attack targets with precision-guided weapons on a single pass.

With SuperPAK 2, operating the TGP has become much more realistic than in previous versions:

- The Targeting Pod image in now shown in the TGP page. Therefore, the SMS page shows only SMS inventory.
- As soon as right hardpoint power is turned on, the pod begins to cool. This will take 7-15 minutes. During cooling, "NOT TIMED OUT" will be displayed on the TGP page.
- FOV adjusted to real world values (6° in Wide View, 1.7° in Narrow View). EXP mode modeled, providing 2:1 expansion over narrow view. The box around the crosshair is the narrow FOV indicator. The Pinky switch toggles FOV.

Targeting Pod AN/AAQ-14

- If the TGP is SOI and not ground stabilized, it will use the Radar slewing speed. If it is ground stabilized, it will use it's own (slower) slewing speed.
- Less jumpy cursors when designating (only jumping to the closest target, not to a randomly one). Real pod would track based on contrast - In Falcon 4, tracking is based on range.

- The laser will only fire if armed (LASER ARM switch!). It keeps firing until 4 seconds after impact. OVRD (OSB 4) inhibits the laser from firing.
- If the laser hasn't been fired manually (1st trigger detent) and a bomb is in the air, the laser will automatically fire at the target using the LASER ST TIME entered on the UFC (MISC page 5) if the calculated impact time is greater than the entered time. LASER ST TIME can be 176 seconds at maximum. Using manual lasing overrides this setting - the laser will not lase automatically anymore during this bomb drop!
- Laser status displayed: Steady L means laser armed, flashing L means Laser is firing.
- Time to Impact displayed.
- Laser and passive ranging added: The TGP image shows the range to target. When the laser is firing, an L is displayed in front of the readout. Without the laser firing , a T is displayed meaning that the range value is coming from the targeting pod itself.
- RALT readout is displayed (if allowed).
- TMS-Left toggles display polarity between BHOT and WHOT (N/I)

LASER-GUIDED BOMBS

The major changes to the use of Guided-Bomb Units (GBUs) relates to the changes in the TGP usage as described above. In addition, the following features are new in SuperPAK 2:

- GBUs now have normal parameters just ordinary bombs. They can be rippled or dropped in pairs. They can also have an arming delay.
- When the laser is lasing, GBUs drop where the TGP crosshair points to. Therefore, the target doesn't need to be locked.
- Seeker head gimbal limit adjusted to 18 degrees instead of 45 degrees

AGM-65 "MAVERICK"

With SuperPAK 2, various enhancements have been made to the operation of the AGM-65:

- Mavericks need to be powered before they can display an image. Power is either applied through the PWR Button (OSB 7) on the SMS page, or with STBY (OSB 7) on the WPN page (will then change to OPER). They take about 5 seconds to cool down. During cooling "NOT TIMED OUT" will be displayed.
- To see the image from the Maverick's seeker head on the MFD, change to the WPN page. Then, each time a AGM-65 is selected, it needs to be uncaged in order to receive an image from the seeker head (This simulates removing of the seeker cover).
- The box around the crosshair is the narrow FOV indicator. The pinky switch toggles FOV.
- RALT readout displayed (if allowed)
- TMS Left toggles display polarity between HOC and COH (N/I)

In addition, Submodes have been modeled (not all complete yet):

- PRE for preplanned targets: Radar will start in GM, the Maverick is slaved to the radar. Once designated, a steering line is displayed (same as CCRP)
- VIS for visual targeting: Missile starts in Boresight, Radar is in AGR. Predesignate, the seeker position indicator is a square, postdesignate it's a circle.
- BORE is the same as VIS

AIM-9

The AIM-9 Caged and Uncaged modes have changed.

Caged

The performance of the missile varies in Caged Mode depending on the mode and whether the radar is locked on target or not.

- Slave mode with Radar Lock: The missile seeker will be slaved to the radar. The missile's seeker (diamond in the HUD) will look at the same spot as the radar locked target. The seeker gimbal limit is approximately 30 degrees.
- No Radar Lock or Boresight mode: The missile seeker will look directly forward. The seeker diamond will be placed in the middle of the HUD.
- Scan and Spot modes: Scan mode provides a larger FOV for the seeker head to detect targets. Spot mode requires the pilot to place the diamond on the target.
- Threshold Detection (TD) and By-Pass (BP) modes provide auto-uncage capability. When the IR signature detected by the seeker head (direction the seeker head is looking indicated by the diamond) rises above a preset level (potentially a target or a large heat source), in TD mode, the seeker head will uncage automatically.

Uncaged

While uncaged, the seeker diamond is displayed twice as large. A new tone is heard when the AIM-9 has obtained a lock while uncaged.

There are two possible conditions in Uncaged Mode dependent on whether the seeker is tracking a target or not (Spot, Scan, TD or BP, Bore or Slave do not affect an uncaged seeker head):

1. **Tracking**: The missile seeker will track (follow) the target. (You will hear a pulsating high pitch tone a.k.a. grumble). The gimbal limit is now approximately 40 degrees horizontal.
2. **Not Tracking**: The missile seeker will tumble randomly around since it's not able to track anything and may fall off the HUD.

Use of Caged/Uncage modes

There are two ways to shoot the 'heater', with radar lock and without:

With radar lock (preferred):

- Wait for a good tone (high pitch tracking tone).
- Uncage the missile (optional, but it's a good habit since it will increase the gimbal limit from 30 to 40 degrees). Nevertheless, the missile will be uncaged at launch.
- If the missile is uncaged, check that the diamond tracks the target.
- Check the Dynamic Launch Zone (DLZ).
- Shoot!

Without radar lock:

- Maneuver the jet so the missile seeker diamond is directly over the target.
- Uncage the missile (not necessary since missile will auto-uncage, but if the target is lost by the seeker head just before launch it would be a wasted shot).
- Wait for a good tracking tone and confirm the diamond is following the target.
- Judge whether the aspect/range is OK for the missile (since you don't have a DLZ)
- Shoot!

If you don't hear a tracking tone even although a target is being tracked, check that the MSL Volume isn't turned down (in the AUDIO panel).

AIM-120

The Dynamic Launch Zone (DLZ) is a feature of the AIM-120 software in the MicroProse release of Falcon 4, displaying minimum and maximum ranges for launching an AARAAM, giving the pilot parameters for an optimal shot. The Allowable Steering Error Cue (ASEC) in Falcon 4.0 (which was displayed rigidly) had been modeled after the Block30 model F-16C. Now the real Block 50 model has an ASEC that breathes between 262mm and 12mm, and is a function of missile kinematics and LINE OF SIGHT to target (LOS). Locking up a target from rear aspect beyond 15 or so miles will therefore give the pilot the smallest ASEC display on the HUD. If that target then turns towards you, the ASEC expands accordingly. As the target nears maximum track rate for the AIM-120 by closing to extremely close quarters, the ASEC will shrink again. When the target is in the maneuver zone and missile LOS limits, the ASEC flashes.

If a missile's time of flight exceeds the calculated impact, LOSE will be displayed in the center of the HUD. LOSE will accordingly disappear if the target returns to range within the time of flight and impact calculations. During the display of the LOSE cue, the time of flight countdown will change from the T to an L.

Non-data-link launching is now modeled the same way as in Jane's F/A-18. Selecting BORE will command the missile to be launched without a data-link from the F-16's FCR. The missile will track the first target it finds in its FOV (indicated in the HUD's center by the AIM-120 diamond).

Also modeled is the AIM-120's ability to turn off its own radar in favor of a Home On Jam (HOJ) capability: If a target is jamming your radar, the AIM-120 can home on this signal. HOJ will then be displayed on the HUD.

Five radio calls accompany firing the AMRAAM.

- "MADDOG" Shooting with no radar target
- "FOX3 CLOSE" Firing in close quarters [<5miles]
- "FOX3 MEDIUM" Firing medium range shot [5-15miles]
- "FOX3 LONG" Firing long range shot [>15miles]
- "PITBULL" The AIM-120 is now active and autonomous

The AIM-120 may now be selected while in Dogfight override master mode by using OSB 6.

The AIM-120 MFD page includes OSBs for activating telemetry (TM) and missile data link channel selection (ID). Telemetry (OSB 18) is a test setting and has no modeled function. The missile data link channel selection (channels 1-4), toggled by OSB 17, is used to deconflict multiple AMRAAM launches. Although channels can be cycled, the full function is not modeled.

Chapter

7

Comms & Multiplayer

NEW RADIO COMMANDS

COMMAND	DESCRIPTION	CHANGE
Tower Commands		
Abort Approach	I am aborting this approach.	New command for SP2

"Inbound", "Request Landing", "Declaring An Emergency and "Abort Approach" are only available when the player's aircraft is airborne. "Request Taxi "is only available on the ground.

AWACS Commands		
Request Help	Send assistance from nearby flights, if available.	Now receives a response and action from AWACS in SP2
Request Rescue Chopper	Request rescue chopper.	Speech activated for SP2
Vector To Carrier Group	Vector to Carrier Group.	New command for SP2

All AWACS commands, except "Request Rescue Chopper", are only available when an AWACS flight is in the air and active. If an AWACS gets active while you're flying, you will hear the radio call "Sunrise".

Combat Management 1		
Attack Targets	Attack targets in group designated.	New speech for SP2
Go Shooter (Wingman only)	You attack; I will provide cover.	Speech activated for SP2
Go Cover (Wingman only)	I will attack; you provide cover.	Speech activated for SP2
Combat Management 2		
Drop Stores	Jettison external stores.	New command for SP2
Form Wing (Wingman only)	Re-form wingman formation	New speech for SP2
Split Wing (Wingman only)	Split off from wingman formation	New speech for SP2
Mission Management		
Take The Lead	Take over as lead	Speech activated for SP2
Say Weapons	Report weapon status	Replies added for SP1

COMMAND	DESCRIPTION	CHANGE
Formation Management 1		
Switch side	Toggle formation side Left/Right	New speech for SP2
Break Right	Perform 90 degree break to your right.	Speech activated for SP2
Break Left	Perform 90 degree break to your left	Speech activated for SP2
Go Higher	Increase relative Altitude	Activated for SP2
Go Lower	Decrease relative Altitude	Activated for SP2
Flex	Orbit current position	Speech activated for SP2
Formation Management 2		
Go Fluid	Go "Fluid" formation	Activated for SP2
Formation Management 3		
Go Vic	Go "Vic" formation	Activated for SP2
Go Line Astern	Go "Line Astern" formation	New command for SP2
Go Finger Four	Go "Finger Four" formation	Activated for SP2
Go Echelon Left	Go "Echelon Left" formation	Activated for SP2
Go Echelon Right	Go "Echelon Right" formation	Activated for SP2
Go Diamond	Go "Diamond" formation	New command for SP2

THE MULTIPLAYER EXPERIENCE

Ace of the skies, bored by the AI? Face real competition! There is nothing more fun in Falcon 4 than a multiplayer game with human partners or opponents. Get ready for a totally new experience!

SuperPAK 2 features the long awaited new Multiplayer-Code, offering maximum stability, minimal lag and optimum bandwidth usage. In addition, DirectPlay Voice comms puts in-game voice communication into Falcon (no need for additional voice software like Roger Wilco or Battlecom).

With the new multiplayer code come a number of changes in the proper procedure to setup and participate in a multiplayer game.

CONFIGURING BANDWIDTH USAGE

It is now a MUST to **set your real bandwidth** in the User Interface! This means that you need to select the bandwidth corresponding to your network speed when setting up a connection.

If you can't find your real bandwidth (i.e. 512 kb), use the commandline option "-bandwidth 512". When you use this option, it will overwrite what you selected in the User interface, so it doesn't matter what you set there.

You should always connect with your lowest available bandwidth - doesn't matter if host or client! Take a "pessimistic" approach, not an "optimistic" one. This means if you have an asymmetric connection like 128 kb upstream and 512 kb downstream, you must always set the bandwidth to the lower setting (128 kb).

If you want to setup a Falcon multiplayer game and host an online game, it is very important that you have **enough bandwidth** to support all clients. As host, you should offer at least 33.6 kb for each client connected to the game, e.g. 128 kb for four players (Caution: The host is the one who sets up the Campaign or the Tactical Engagement - not the one who set 0.0.0.0 in his IP!)

VOICE COMMS

Falcon 4 SuperPAK 2 features DirectX 8 Directplay Voice. Therefore, DirectX 8 or later must be installed on your system (Check out www.microsoft.com/directx). In addition, you must once initialize your microphone by running Voicesetup.exe (in the main Falcon folder).

Real-time voice communication between players does greatly enhance the online gameplay experience in Falcon 4. You can now use "real" radio to communicate with other players!

If you want to use voice comms, go into the FalconSP configuration editor and enable it (Go to *// use voicecom* and *set g_bvoicecom 1* if editing manually).

Communicating in the User Interface

In the User Interface, use the keys "F1" and "F2" to activate radio comms on two different channels (hold the appropriate key while talking - it acts like a transmit button on a radio):

- Channel 1: Guard (Other team members in the UI or the 3D world)
- Channel 2: Everybody who is in UI

Communicating in the 3D world

Once flying in the 3D world, the keys used to transmit are the ones defined in the keystrokes.key file and will radio on whatever channel COM1 or COM2 is set to on the UFC. The audio volume of each channel can be adjusted by using the knobs on the audio panel in the cockpit.

The available frequencies in the 3D world are similar to those in the original Falcon 4.0:

- Flight — Other flight members who have at least one radio set to flight
- Package — Other package members who have at least one channel set to package
- Guard — Other team members will hear (even though there is no radio set on guard)
- Broadcast — Everybody connected to the server (doesn't matter if in 3D or User Interface)
- Tower — Others who have the same takeoff base and at least one radio set to tower.

To change frequency, select COM1 or COM2 from the ICP. Then use [Alt-z] to switch channels.

Setting up a Campaign

When a host starts a new campaign, the clock stops and the priorities setup screen appears. This allows the host to configure the campaign as desired from the beginning on. **The important thing is that clients must wait with joining until the host has set the campaign priorities!**

Dedicated Server mode

Using the option "(SP) MP Server mode" in the FalconSP Config Editor, you can put FalconSP into a dedicated Multiplayer Server mode (which is comparable to the known "-time" commandline option).

Using the sub-option "(SP) MP Host all units", the server will have the full CPU load of all aggregated and deaggregated units and the network traffic they afford. This option is designed to be useful for a fast CPU server with a high bandwidth hosting many players with low bandwidth connections. *WARNING: This sub-option has not yet been fully tested and should be handled with care. Use at your own risk.*

Dedicated Voice Server

If you want to host large multiplayer games with more than a few players, it is a good idea to set up a separate voice server (Use the voiceserver.exe to setup a dedicated voice host). This host will use mixing techniques to reduce bandwidth load to the clients to max 3.2 kb no matter how many players.

To use a voiceserver, the clients need to point to the host's IP address by setting the *g_strvoicehostip* variable in the config file (i.e. *set g_strvoicehostip "130.123.33.23"*)

A mixing server requires some CPU power so it's not recommended to run the voiceserver.exe while playing Falcon on the same computer. In this case, just run Falcon normally - the Falcon built-in host will act as a forwarding server which doesn't require that much CPU power.

Router/Firewall Issues

If you have a router or firewall, make sure to open the ports that DirectPlay Voice requires! The voice comms itself use ports 2936 and 2937, but DirectPlay Voice opens some additional ports while enumerating your TCP devices.

Technical background

With the new MP code, position updates are sent in a client-server manner and not peer-to-peer anymore (The host now sends all updates about all the planes). This seriously cuts down client bandwidth use and makes MP more fluid and less laggy. The disadvantage is that the host now needs more bandwidth than in the old code. There are also still problems with MP (not related to the position updates): Old bugs such as non-synchronizing clocks in the UI and no time acceleration when people commit are unfortunately still there. So don't expect super MP yet, but if you have a host with sufficient bandwidth (e.g. 128kb for 4 players, 256 kb for 8 players), then you should be able to have fluid games with a higher number of players than before. The new MP code was successfully tested with 10 players.

JETNET - ONLINE GAME BROWSER

WHAT IS IT?

JetNet is an in-game browser that helps you find other Falcon pilots from around the globe, to fly together online over the Internet!
It shows you a list of Falcon SuperPAK multi-player games to easily allow one to set up or connect to a game. The game browser is built into SuperPAK's GUI and is very similar to what you might find in Counter-Strike, Quake 3, UT and other games. JetNet is also fully Game Spy compatible.

HOW DOES IT WORK?

When the JetNet uplink is enabled and the game is set up, Falcon sends a heartbeat to the master server (*check our homepage for the current IP*) which maintains an up-to-date list of games. Upon a client's request, this list is sent from the master, and the client can then select a server to join.

JOINING AS A CLIENT

- Go to the COMMS menu, click JetNet and select the bandwidth available to you. Then click "Connect". Now the JetNet window will pop up.
- Click the Refresh button to get an updated list of game servers. *Click other tabs to filter by type (Favorites is not functional).*
- Highlight a server and click Play.
- Next, you'll see the window "Communication Established" pop-up and the browser window will disappear.
- Go to the appropriate tab of the game you joined (DF, TE or Campaign) and click the 'Online' tab. After a few seconds, the current online game of the selected server will appear. Select the game and join the fun!
- *Please be patient while joining an online game! Depending on your Internet connection, setting up can take a while (transmitting an online campaign can easily take a few minutes!). Please don't abort too early and don't jump from game to game - otherwise you will probably end up ruining someone else's flights!*

SETTING UP A SERVER

To set up a server and host a game, enable the JetNet uplink in the FalconSP.cfg file (To simply join as a client, the uplink doesn't need to be enabled).

It is a good idea to edit FalconSP.cfg with any plain text editor like Notepad and change the default name of "Another Falcon Server" to something a little more meaningful so it will be easy for people you know to join. For example: "259th Hawks Campaign Server" or "Bob's Funhouse" or something similar will help your squad mates find your games in the inevitable long list of "Another Falcon Server". You can also change where the server is located physically (put the state or country) and who the admin is if desired.

Now you must set up an Internet game by connecting to IP 0.0.0.0. (This is no different than setting up a Falcon 4.0 game). After connecting, you'll be in the lobby of your own game. Your Falcon will now send a heartbeat - but the server will not yet be in the master list, because there is no specific game set up yet (i.e., Dogfight, TE, or Campaign). Once you have set up a game, it will be appear in the master server list. Now you have your game up and others can join!

Note: JetNet has no means of protecting games. This means that ANYONE can join your server's comms lobby without any authentication. You can however, password protect the TE, DF, or Campaign mission to prevent people from joining. But even when someone joins only your comms, it uses a little of your bandwidth, not a lot, but some. If you wish for your game to be completely private, disable the JetNet uplink in the falconsp.cfg file and play by IP (Internet connection) address only.

WAR STORY

We were holding a night CAP over the Bosnia-Serbia border during allied operations in 1999. Since Serbs were firing their missiles without lock in order not to be noticed by HARM shooters , we were trying to establish unpredictable random flight path CAP patterns. I was able to see the flashing bombs far away on the ground and the missiles raising up to the sky just like Christmas celebrations. We had our beacons OFF and exterior lights in DIM and STEADY. Suddenly, I saw a light coming towards me from 3 o'clock position. It was staying constant on the canopy - which meant that "it's really coming after ME!". I got excited with the adrenaline pumping through my vessels, took a hard turn to bring it into BEAM position while dispensing chaff at the same time. But it was still coming right towards me!

Then I realized that it was just my right wingtip formation light.

Chapter

8

Flight Models

FLIGHT MODELS

This section is designed to:

- Familiarize you with the new features of the SP2 flight models.
- Give you the basic knowledge necessary to successfully fly the aircraft in SP2.

This QUICK START guide is a concise introduction and does not supersede the necessity of reading the forthcoming complete flight manual upon final release after the bug fixing period.

INTRODUCTION

Falcon 4UT SP2 brings significant changes to the flying aircraft in the Falcon 4.0 simulation. While the original MicroProse F-16 flight model was a good representation of the F-16, the other flight models ranged from adequate to subpar for the AI aircraft to fly and to complete missions. Once human players were allowed to fly other aircraft, the shortcomings became even more obvious. The typical data file problems encountered:

- One low aspect ratio wing type (F-16) for every aircraft (fighter, attack, bomber, cargo)
- F-16 modified turbofan thrust curve for each aircraft
- Improper fuel flow (too high or too low)
- Wrong thrust numbers (too high or too low)

In essence, it was obvious that the data files were generic and intended to get the AI flying only. This is not to fault the original work, but it is necessary to understand the need for improvement.

The flight models in SP2 are an incredible leap forward and bring added dimensions of "realism" to flying in the Falcon 4 virtual battlefield. The SP2 pilot will immediately experience the difference from the F-16 to the B-52. Each aircraft now has a distinct "feel" and the new flight models demand better piloting skills and better tactics.

FEATURES

What the FM team accomplished is simply amazing for a home PC simulation. While graphical changes are often the first noticed, after a few minutes flying in SP2 the profound changes will be obvious. What the SP2 pilot enjoys now is the end result of a long process of putting together aircraft piece by piece. This process began by researching wing data:

WINGS

The Flight Model team spent hundreds of hours researching and then making new wings for the SP2 flight models. The team acquired information on multiple wing types through NASA, NACA, Freedom of Information Act (FOIA), Journals, Libraries, and web sites. The end result is that the FM team found data on the F-16, F-15, F-18, A-10, F-4, MIG-29, F-111, F-5, YF-102, 60 degree Delta, MIG-21, X-5 (45 degree sweep), C-130, Monoplane, Boeing 767, and other wings. These wings were incorporated into the flight models and were matched as best as possible to the aircraft type and wing aspect ratio.

An important feature now present because of the new wing data is the transonic drag rise. For most fighters, both old and new, there are three regions that the pilot flies in: subsonic, transonic, and supersonic. The subsonic region is generally considered to be between Mach 0.0 and Mach 0.6. The transonic region is considered to be between Mach 0.7 and Mach 1.2. The supersonic region is considered to be Mach 1.2+. What the pilot needs to understand is that as an aircraft accelerates from subsonic speed and approaches the Mach 1 barrier, he enters the transonic region where one particular drag, wave drag, increases substantially. Once through the transonic region, the drag coefficient begins to decrease, though never back to the lower subsonic values.

Before SP2, this curve was not completely present. The drag coefficient on the F-16 model had a strong increase in the transonic region, but it never decreased once into the supersonic region. The drag coefficient continued a sharp increase all the way to Mach 2.5. In contrast, the SP2 fighter wings reflect the drag coefficient curve correctly with the drag coefficient decreasing once past the transonic region due to the decrease in wave drag (see fig. 1).

The transonic drag rise is important to note particularly for older fighter aircraft and any fighter that is low on thrust to weight ratio. There are techniques that a pilot can use to get through the transonic region quickly to achieve a better acceleration to top speed. One technique is to best climb (normally maintaining Mach 0.8) to 40, 000 feet and then to do a zero g pushover in afterburner. This zero g pushover should bottom out around 30,000 ft and into a slight climb to the desired altitude and speed (see fig. 2).

The transonic drag increase is also the reason why many fighters cannot break the Mach 1 barrier when carrying multiple bombs and fuel tanks. These additional drag producers combine to create a wall of drag that is nearly impossible to push through. Even high powered fighters like the F-16 experience this problem with high drag index loadouts like six CBU-52's, four missiles, two 370 gallon fuel tanks, and one ECM pod.

ENGINES

The engines in SP2 are considerably improved as well over the 108i2 originals. In the original MPS flight model for the F-16, the thrust for an afterburning turbofan engine was used, but modified in various ways to incorporate RAM drag and to match the F-16 energy curve (Ps curve). This same thrust chart was the basis for all the other flight models as well. Because of all the specific “tweaking” to the original thrust model and the lack of other engine type thrust curves, the FM team went back to the beginning and started from scratch on the engines.

Fig. 3. Pratt & Whitney F100-PW-229 afterburning turbofan courtesy of Jack Mattingly

The team assembled data on the various engines types (afterburning turbofan/jet, turbojet, high bypass turbofan, turboprop, etc.). Each type of engine has a specific thrust curve and this curve was duplicated and matched to each aircraft depending on that aircraft's engine type. The team then compiled the published output performance numbers for each engine.

On some engines the FM team had the exact thrust numbers and curves (like the F-18's F404 engine in afterburner). On other engines (particularly OPFOR aircraft) the output thrust numbers were scaled to the appropriate engine thrust curve. Since most published output numbers are for uninstalled “gross” thrust, the FM team used a standard installation loss equation to simulate installation thrust loss as well.

The end results are aircraft with engines that perform in the manner real world aircraft engines perform. The SP2 pilot will need to take this information into account as well when flying. Since most pilots will be flying fighters, the example thrust curve below represents an advanced fighter engine similar to the engines used in fighter aircraft:

Fig.4: Notional afterburning turbofan engine thrust curve reprinted from "Aircraft Design: A Conceptual Approach", by Daniel P. Raymer, Copyright C 1999. Used by permission of the author.

The top line is the Sea Level thrust curve. Notice how the thrust starts at 30,000 lbs. and then dips slightly through Mach 0.1 – Mach 0.4. The thrust then increases through to Mach 2+. SP2 models this same type of thrust curve for afterburning turbofan engines.

ENGINE SPOOL RATE

Each engine has a particular time it takes to spool up and down from idle to full power. SP2 now allows for different engine spool rates. Data was found for the various types of engines and added to each aircraft. Typical spool rates are:

- Afterburning Turbofans (1995 - Present): 2-4 seconds
- Afterburning Turbofans (1970 - 1995): 4-8 seconds
- Afterburning Turbofans (1955 - 1970): 6-10 seconds
- High Bypass Turbofans (1970 -Present): 6-8 seconds
- Turbojets (1950 - 1970): 8-12 seconds

On some of the older turbojet aircraft like the J-5 or Mig-19, these engine spool rates are much slower than the typical modern turbofan. These new rates are another factor the SP2 pilot must take into account when flying and fighting.

FUEL FLOW (TSFC)

Along with the new thrust curves and matching output numbers the FM team researched and implemented the standard Thrust Specific Fuel Consumption (TSFC) numbers. Each engine has a particular efficiency in how much thrust it provides per how much fuel it consumes. These values vary significantly depending on the type of engine, the age of the design, and the power setting. Modern engines are more efficient per pound of thrust than older ones, while high bypass turbofans are more efficient than regular afterburning turbofans at subsonic to low transonic speeds.

The FM team found TSFC values for nearly every engine in SP2. For the few that did not have published TSFC values, the team took a similar engine TSFC values and used those. This particular change will have a profound effect upon mission performance. As one former F-15C pilot commented on flying in real life, “I quickly got fuel religion.” In SP2, “fuel religion” is a must as well. Let me quote again this former F15C pilot:

“I always had sense of how much gas something was going to cost ... If I turn with this guy, it is going to cost me XXXX pounds of fuel... Can I afford it? Or, would it be better to burn YYYY pounds of fuel running?”

For many, this particular area is going to be the single biggest immersion producing factor with the new flight models.

As a quick tip, knowledge of the thrust curve comes into play again when discussing fuel flow. Notice on the thrust curve chart (fig. 4) that thrust decreases as the aircraft gains altitude. Since fuel consumption is “Thrust Specific” this means that you have a much lower fuel flow at 20,000 feet than at the same speed at Sea Level. This type of knowledge is helpful in determining what type of profile to fly.

As a representative example of what the TSFC changes will mean for the SP2 pilot, here is a comparison between the 108i2 F-16 and the SP2 F-16 fuel flow for military and afterburner throttle settings at Sea Level:

Fig. 5: Fuel Flow Comparison

These fuel flows are the reason why most mission profiles are High/Low/Low/High: You will get the best endurance by performing a best climb to altitude and then cruising the majority of the mission at altitude.

The SP2 engines and TSFC values bring added realism to piloting in the simulation. No longer can a pilot ignore the questions of distance and fuel usage. This will also mean that tankers will play a significant role in the SP2 campaigns.

FLAP SETTINGS

A great new addition in SP2 are the various manual and automatic flap settings. Because of the many different lifting devices on modern aircraft, there are many possible combinations of settings. Currently SP2 models:

Leading Edge Flaps (LEFs) / Slats

These devices are found on the front of the wing and can be set in the following manner:

- No Device (most older aircraft)
- Manual (pilot deploys/retracts)
- AOA related (LEF deploys/retracts automatically according to the angle of attack of the wing)
- Mach related (LEF deploys/retracts automatically at a designated Mach speed)
- TEF related (LEF deploys/retracts automatically when the TEF is deployed)
- Takeoff Setting (LEF default at takeoff)
- Stages (how many stages the LEF deploys through)
- Max Angle (the maximum angle the surface can deflect)
- Rate (the rate in degrees per second the surface can move)

Trailing Edge Flaps (TEFs)

These devices are found on the back of the wing and can be set in the following manner:

- No device (rare)
- Manual (pilot deploys/retracts)
- AOA related (TEF deploys/retracts automatically according to the angle of attack of the wing)
- Mach related (TEF deploys/retracts automatically at a designated Mach speed)
- Takeoff Setting (TEF default at takeoff)
- Stages (how many stages the TEF deploys through)
- Max Angle (the maximum angle the surface can deflect)
- Rate (the rate in degrees per second the surface can move)
- Flapperon (surface is both a flap and aileron, or both are separate)
- Gear Relative (surface deployment linked to landing gear position or separate from it)

Obviously, it is important to note which aircraft have manual settings since these aircraft require the pilot to raise and lower the surfaces. A table showing LEF and TEF settings for each aircraft is available on the following page.

The keystrokes to move the LEFs and TEFs are:

	Set to Zero	Extend Fully	Decrease	Increase
Flaps	[Ctrl-F9]	[Ctrl-F10]	[Ctrl-F11]	[Ctrl-F12]
Leading Edge Flaps	[Alt-F9]	[Alt-F10]	[Alt-F11]	[Alt-F12]

To view the current flap position with manual flaps, find set g_bShowFlaps and set it to “1” instead of “0” in the “falconsp.cfg” file found in the main Falcon4 directory. This will put a flap position display in the upper left corner of the screen that is always on during flight. This is a temporary measure until cockpits and 3D models are designed that take advantage of the SP2 coding for flap position.

Another feature to help the pilot is an added flap sound that plays when the LEFs/TEFs are manually set. The sound plays when first entering the cockpit as the flaps lower to takeoff position, and when the pilot manually deploys or retracts the surfaces.

In this first SP2 release, the following aircraft have manual surfaces:

Aircraft	LEF	TEF	TEF Takeoff Setting
A-10	AOA	MAN	7
A-50	MAN	MAN	30
AN-2	NONE	MAN	25
AN-24	MAN	MAN	20
B-1B	AUTO/TEF	MAN	50
B-52	NONE	MAN	30
C-130	NONE	MAN	30
E-3	NONE	MAN	50
EA-6B	MAN	MAN	30
F-4E/G	AOA	MAN	10
F-5	MAN	MAN	20
F-15C/E	NONE	MAN	15
IL-28	NONE	MAN	30
IL-76	MAN	MAN	30
IL-78	MAN	MAN	30
J-5	NONE	MAN	10
J-7	NONE	MAN	25
KC-10	MAN	MAN	50
KC-135	NONE	MAN	50
MiG-19	NONE	MAN	20
MiG-21	NONE	MAN	25
SU-25	AUTO/TEF	MAN	20
TU-16/16N	NONE	MAN	30
TU-95	NONE	MAN	30

Other aircraft will have different variations of automatic settings.

ROLL RATES

The roll rates on many aircraft are revised to reflect the various classes of aircraft. For fighters, there was some roll rate data available on the F-16, F-15 and F-22 aircraft. These values helped define how the roll rate charts should look. The numbers were then made into a template and used to fit other fighter aircraft where no data was present.

Fighters

The average fighter roll rate in SP2 is 300 dps at Mach 0.6. Some aircraft are higher and some are lower depending on data provided and a good generic figure. The figure is based on a test pilot's recommendation and agreement with the other pilots in the SP2 group and the testing community.

Attack/Fighter-Bomber

In absence of hard data, attack/fighter-bomber type aircraft were given roll rates anywhere between 120-220 dps depending on the aircraft.

Cargo/Heavy Bombers

For the heavy aircraft like the KC-10, KC-135, B-52 and others, SP2 had access to some real life pilots of heavy aircraft for the military and civilian world. These pilots gave input and helped adjust the roll rates until satisfactory performance was reflected in the simulation. The typical heavy aircraft is set to 60 dps max at Mach 0.6.

It is important to realize that roll rates decrease as angle of attack increases and as speed decreases. When a fighter aircraft starts to pull near 20+ angle of attack, there is a noticeable decrease in roll rate. To get the roll rate back, the pilot must “unload” the aircraft by easing the back pressure on the stick and allowing the AOA to decrease.

AIRCRAFT MOMENTUM (ROLL, PITCH, YAW)

With the F-16 being a fly-by-wire (FBW) aircraft, much of what non-FBW aircraft experience is dampened or removed by the flight control system. With the ability to fly other aircraft came the need to model more of the momentum/inertia of each aircraft along the three axes. SP2 allows for these changes and each aircraft has some minor changes to the axes. Using roll as an example, a pilot will notice on some aircraft more of a need to give opposite stick to stop the roll at the precise point desired. The momentum of the wing is not countered by the FCS and it is up to the pilot to stop the momentum.

ROLL COUPLING

Roll coupling is the tendency of an aircraft to roll in the direction of the rudder input. This is normally dampened significantly by FBW systems, but most aircraft have light to moderate roll coupling. SP2 pilots will now experience a slight tendency to roll when the rudder is used.

GUN POSITION

From the A-10 to the MiG-29, SP2 pilots will notice that each aircraft gun now fires from the correct location on the aircraft.

SMOKE, CONTRAILS, WINGTIP VORTEXES

There are some new visual effects that the SP2 pilot will notice. Though these do not directly affect the flight models, they were set by the FM team in the data files. There are now two types of smoke currently modeled. The first type of smoke is the typical lighter engine smoke seen behind most older fighter aircraft like the F-4 Phantom II. The second type of smoke is a darker, thicker smoke that is found behind very early model jet aircraft and heavy bombers. Both smokes have a visual detection penalty, with the lighter smoke being least and the darker smoke being most.

Fig. 6. KC-10 contrails

Also new is the ability to set how many engines the aircraft has and the location from where the smoke comes. The smoke positions are set correctly for each aircraft engine location. Setting the engine location also set the contrail position in the correct location.

Often seen in pictures during hard turning maneuvers or during very humid days, wingtip vortexes are now a reality for many aircraft in SP2. These vortexes come off the outer tips of the aircraft wings and last only a few moments before dissipating. The current vortex model has vortexes appear between Sea Level and 10,000 feet. The aircraft must also be at 15+ degrees AOA and pulling a minimum of 4 g's.

DRAG CHUTE

There are many aircraft that use a drag chute to assist in slowing down upon landing. SP2 gives the pilot this feature as well. The drag chute can be in one of four states: stowed, deployed, trailing, and released. To deploy the drag chute, press [Shift-D]. To detach it after deployment, press [Shift-D] a second time.

- *The F-16C does NOT have a drag chute.*
- *The drag chute will tear off if deployed above 170 knots!*

PYLON AND STORE DRAG VALUES

After the new wings and engines were added, some performance problems appeared for aircraft when loaded with pylons and stores. The FM team discovered that the drag values for pylons and stores were wrong and too high. Some examples:

Store	108i2 Drag Value	SP2 Drag Value
AIM-9M	0.0012	0.0007
AA-10C	0.0048	0.0010
CBU-52	0.0048	0.0014
330 Gal Tank	0.0084	0.0019
Weapon Rack (TER)	0.0069	0.0017

While small values like these may not seem like very much, when added together on a typical loadout, the resulting drag differential is dramatic. Using the figures above, on a typical loadout of 4 AIM-9M missiles, 6 CBU-52's cluster munitions, and one 330 gallon centerline tank, the original 108i2 values give 0.0558 extra drag. The new SP2 values give 0.0165! This is a 0.0393 difference in drag. To put this in perspective, the drag coefficient for the entire F-15C at zero AOA / Mach 0.2 is 0.0215.

Through the help of a team member involved in aircraft simulation, and through Daniel Raymer's book, new drag values were determined for all pylons and stores. The end result is that aircraft with stores can come as close as 0.1 Mach to their performance charts for matching drag indexes.

FUEL VALUES FOR CAMPAIGN UNITS

To take into account the new engines and fuel flow rates, the fuel values in each aircraft unit were changed to match the particular aircraft engine and TSFC. This allows for the Campaign and Tactical Engagement modules to properly give fuel tanks when distance requires it.

KNOWN ISSUES

Like any simulation, there are areas where things could be better. Below is a listing of some of those areas.

Generic Wings.

While every aircraft has a new and better wing, not every aircraft has its proper unique wing. This means that some aircraft, while much better than before, are still not going to perform exactly as they should in every flight region. When faced with a lack of data, the issue became improvement and moving closer to more realistic flight behavior. The question was “does this move the aircraft closer to better and more realistic flight behavior?” So for example, when data was lacking for the B-52's high aspect wing, it was better to give it a generic higher aspect wing than a generic lower aspect wing like a fighter. Until the FM team gets the proper data for each unique wing, these were considered necessary concessions.

Generic Engines.

As with the wing data, exact engine thrust data is very hard to find. When specific thrust data was not available, the aircraft was given the proper generic thrust curve for the particular class/type of engine and scaled to the published output numbers. This again is a step toward more realistic behavior since the aircraft engines are now following a proper curve for the engine type. It is better to have the high bypass turbofan on the KC-10 on a generic high bypass turbofan curve than to have it on a afterburning turbofan curve like a fighter. As more data is found, changes will be made to reflect that data.

RAM Drag

Currently, most of the idle thrust values are set to zero. Ideally, the idle thrust table should reflect the proper RAM drag for each engine and aircraft inlet. The amount of work necessary to determine proper RAM drag has pushed its implementation back until a later point. The effect of not having the proper RAM drag values in idle thrust means that aircraft will not decelerate as quickly as they should. The FM team hopes to incorporate RAM drag before the final bug fix period is over. As of this writing, only the F-16 aircraft has the proper RAM drag.

TSFC Values

Thrust Specific Fuel Consumption values do change over airspeed and altitude. To reflect this properly would have required a large amount of code work. It was considered best to use the single published values for MIL and AB power alone. This means that the fuel usage will be a little higher than it should be in some flight regions.

Flaps

The broad range of aircraft simulated in Falcon 4 brings with it a broad range of lifting devices. Some aircraft, like the F-18C, have LEFs and TEFs that deploy over both an AOA and Mach region. This would have required building a table into the data file for the simulation to read for the proper scheduling of these devices. Because of the complexity of this issue and the small amount of time, this was not done. This means that some aircraft will not have their lifting devices deploy as they do in the real world.

Stall Model

One particular glaring omission in Falcon 4.0 from the beginning is the lack of a true stall model. The FM team tried hard to work out a stall model, but complexity and lack of time caused this to not get done. This means that angle of attack stall and slow speed stall are not modeled correctly. Aircraft will still fly in attitudes and speed ranges that they should not.

CONCLUSION

This introduction to the flight models showcases the vast amount of improvement that SP2 brings to Falcon 4.0. From new wings, engines, flaps, etc., SP2 takes Falcon 4.0 one giant step forward in realism and immersion. The virtual battlefield has just become even more exciting to fly and fight in.

Enjoy!

Tom "Saint" Launder and The Flight Model Team

Chapter

9

Special Features

SKYFIXES

When Falcon 4 was originally published, many people didn't like the default color tones in the 3D world (like the grey sky and yellow haze). Soon, modifications of these color schematics (known as "skyfixes") appeared and varied according to the individual tastes and realism.

SuperPAK 2 helps you in finding your preferred skyfix: Select the Graphics tab from the Setup menu and click the Skyfix button. You can now select a skyfix and preview it at different daytimes. Make your selection and enjoy the improved colors on your next flight!

WEATHER

SuperPAK 2 features integrated weather effects! While in the mission briefing, select the Graphics tab from the Setup menu and click the Weather button. You can then select a weather pattern and view a simulated "radar" picture of the weather situation in the theatre.

If you choose the DEFAULT selection, Falcon will continue using the weather that was saved in your mission the last time you saved it. If you choose RANDOM, Falcon will select one of the weather patterns for you. BLUE SKY is the default Falcon sky (without any clouds).

Do not forget to leave clouds enabled in the Simulation tab of the Setup menu. Clouds can easily be afforded on mid- to high-end machines (3D card, CPU >500 Mhz)

EFFECTS OF WEATHER

Selecting a certain weather pattern can have various influences on your mission:

- Depending on the wind direction, the tower selects the runway heading to be used.
- Crosswinds create difficult landings
- Cloud coverage makes target acquisition troublesome
- White-out conditions inside clouds can endanger your situational awareness
- Low visibility in heavy rain or snow can cause misjudgment of altitude and attitude
- Thunder and flashes irritate and distract

If you are losing orientation, always concentrate on your instruments. They know better than you what your position is!

TREES

In SuperPAK 2, many objectives are now populated with trees to give you a better sense of height and speed while flying low (NOE).

However, the trees can cause quite a large frame rate hit on lower end systems. Therefore, they are optional. So if your framerate is too low, you can simply eliminate the trees using the "Disable trees" option in the "Advanced Settings" tab of the FalconSP Config Editor.

PADLOCK VIEW

The padlock view [4] has been optimized in SuperPAK2. The "overstretched-neck" syndrome was eliminated. Targets outside visual range aren't tracked anymore.

If you don't want to use the new padlock method, you can return to the 1.08US algorithm by disabling the "New padlock" option in the "Settings General" tab of the FalconSP Config Editor.

EJECTING CREWS

The number of crew members ejecting from a hit airplane now corresponds to the number of crew members on board.

E.g. shooting down a TU-16 will result in four ejections from the plane, giving four parachutes:

SCREENSHOTS

- In-game screenshots will be saved as BMP files in the *falcon4/pictures* subfolder.
- Using [PrintScreen], you can also take screenshots from the User Interface. These will be saved as TGA files.

SHIPS

Ships are implemented in this version of Falcon. They will move through their planned waypoints, or if no waypoints are set, will stay at a dock if one is available (else they move in a racetrack pattern). Ships can fire missiles and guns as appropriate, and will fire them on the move. The ships have a new sound and leave wake trails when moving.

CARRIER OPERATIONS

Check-out the training missions for easy access to carrier operations.

TAKE-OFF

Missions begin with the aircraft located at the center of the aircraft carrier's deck. Depending on fuel and weapons load, you may need to turn your aircraft around and taxi to the end of the carrier. Once at the end of the carrier, point your nose to the front of the aircraft carrier, lock the brakes, push the throttle up to full afterburner, release the brakes, and takeoff. Raise the gear [g] as soon as the aircraft is airborne to gain additional velocity. If the mission includes wingmen, they will start in the air above the carrier. Ask them to rejoin the flight once you are airborne.

NAVIGATION

Follow the waypoints back to home plate. The carrier will likely have moved since your take-off, so do some searching to find it. You can also request "Vector to Carrier Group" from AWACS, as the carriers now feature dynamically allocated TACAN (like the refueling tankers do).

LANDING

For a successful approach, align the aircraft behind the carrier. Lower the landing gear [g] and the tail hook [CTRL-k]. Set the AOA and throttle so the FPM is located on the end of the carrier's deck. Once within several hundred feet of the end of the carrier deck, increase the throttle and/or pull back slightly to move your FPM to the middle of the carrier's deck. Keep in mind that the heavy-duty landing gear typically found on carrier aircraft is not modeled, so set down gently. Mission accomplished!

PLANNING SCREEN

Various changes have been made to the planning screens.

AWACS VIEW

Configuring the *g_bAWACSSupport* variable to '1' using the FalconSP Configuration Editor allows the planning screen to be used a somewhat like an AWACS view. Extra details about each flight are displayed, showing the number of aircraft in each group, including altitude, Bullseye position and velocity.

PRINTING THE BRIEFING

Select the new Print button on the briefing and debriefing screen to print a text representation to the default connected printer.

THEATERS

SuperPAK 2 features in-game theater switching: Just access the THEATER setup screen from the main menu to switch theatres!

Note: Theatres for SuperPAK 2 will be released in the coming weeks (including the Balkans).

Theaters bigger than the default size (MicroProse 1.08 us) are supported. In addition to bigger sizes, some optional data can be tagged to the theater definition files to specify their latitude and longitude information.

Support for more complex terrain tiles is also included. A flag set in the theater definition file will switch from 2 byte to 4 byte tile identifiers, allowing more than the current 64,000 total possible far tiles.

Chapter

10

You are not alone

INTEGRATED AIR DEFENSE SYSTEM (IADS)

The IADS has undergone further improvements: The air defense battalions now have correctly modeled search radar, featuring additional radar modes (There are no new radar symbols, but new data and exe edits enable the radar to simulate search and track modes). The six radar modes used are: Off - Search1 - Search2 - Search3 - Acquire - Guide.

This is because in reality, a battalion (e.g. a SA-6 site) does not only use its straight flush radar system. Instead, it will be supported by EW, search and acquisition radar, height finders, illuminators and tracking radar. Some of these radar needs to have either tracking or detection of the target before the next radar can try to acquire it. An air defense system must be in Guide Mode (Mode 5) to be able to launch and support a missile.

E.g. the acquisition radar might need the height information from the height finder before it can attempt an acquisition or the illuminator needs to get accurate position information from the acquisition radar before it can attempt a lock.

These different radar will show up on the RWR with different symbols and sounds to simulate the whole chain of events.

A radar will always start in search mode 1. It needs a minimum interval of 2 seconds to step to the next mode. To change modes, either "detection" (the radar can see either a jammer or a radar track) or "track" (means the radar can see a radar track) must be achieved.

- To step through search modes (from 1 to 2 to 3 to acquire to guide), detection is needed.
  - To go from search 1 to 2, the radar must have been in search 1 for the time entered in Timetosearch1 and range needs to be less than *Rangetosearch2*.
  - To go from search 2 to 3, the radar must have been in search 2 for the time entered in Timetosearch2 and range needs to be less than *Rangetosearch3*.
  - To go from search 3 to acquire, the radar must have been in search 3 for the time entered in Timetosearch3 and range needs to be less than *Rangetoacquire*.
- To go from acquire to guide mode, the radar must have been in acquire for the time entered in *Timetoacquire* and range needs to be less than *Rangetoguide*. In addition, the radar must have both detection and tracking (so it won't be able to go to guide mode if being jammed).
- If the radar is not able to burn through the jammer for the time entered in *Timetocoast*, then it will return to search3.
- If the radar is in guide mode and tracking is lost due to jamming or chaff, it returns to acquire.

PILOT ARTIFICIAL INTELLIGENCE (AI)

SuperPAK 2 is based on the improvements made to the pilot AI in previous patches. The famous Air-2-Ground AI from SP1 was further tweaked and improved, and the not-so-famous Air-2-Air AI has undergone a major overhaul to live up to the standards of SuperPAK 2.

Still, the AI isn't yet perfect... expect further refinements in SP2a (available spring 2002). Feedback is always welcome!

The following outline concentrates on the vast improvements done to the A2A AI.

AIR-2-AIR TACTICS

First of all, each flight in SP2 now reacts as a flight and not as singletons. The flight lead will therefore choose one of 18 profiles based on his mission, his skill level, his aircraft type and the enemy's aircraft type (Some randomness is also factored in). The flight will then execute this (simulated pre-briefed) profile as long as at least one pilot in the element has situational awareness of the enemy flight.

The profiles themselves range from droning straight and level into the threat, to complex air-2-air combat tactics. In general the following guidelines are used in an A2A engagement:

Superior weapons ("our flight has longer range missiles than the bad guys")

If the flight is on an aggressive mission like a Sweep, Intercept or Escort mission, they attempt to stay together and will not react defensively by dragging (unless they are very highly threatened).

If they are on a non-aggressive mission (OCA, SEAD), they will also press on and launch their longer range missiles. They will kick (turn away a bit) though since they are not looking for a flight. If they are getting too close and are threatened, they will attempt to run rather then end up in a turning flight.

Inferior weapons

The nature of this situation requires us to do some fancy stuff or we will die! (Well, unless our tactic is to outnumber the enemy so we could just drone in and overwhelm the enemy by sheer numbers). These fancy tactics are used in the current code.

Based on their skill, the flight will execute some tactics that should confuse the enemy's targeting and drag out some of the enemy's long range missiles: The initial aim is to stay alive until we get within a range where we can deploy our own weapons.

The flight stays together in pairs, but usually splits up in two elements. The pairs themselves only split in rare cases (like if a wingie is defending against a missile launch), but will attempt to rejoin if split.

In general the flight will attempt to use one element as bade and one element will try to get in untargeted. One way to do that is to have one pair notch right and one pair notch left and that way force the enemy to choice which pair to engage or split up. If the enemy choices a pair he will also sandwich himself, as the targeted (spiked) element will start dragging and the untargeted element will do a hot pursuit.

The other tactics coded include lead trail, altitude stacks, beam deploys narrow and wide azimuth splits and some other unnamed fancy maneuvers profiles...

The skill level and the flights mission type determines how smart they react and how forced they are to keep moving forward.

Available Tactics

The tactical profiles used by the A2A AI are based on the following determinators:

- Timing (i.e. notch for 20 sec)
- Spike inventory (who is spiked how often in the flight)
- Hot nose inventory (who in the flight is hot nosed how often by their target)
- Targeted inventory (who in the flight is targeting a target)
- Supporting a missile

The maneuvers available to the AI to execute his tactics are based on individual steps. The determinators mentioned above are used to determine what steps to execute.

E.g. Step 1 (pump for 20 seconds), Step 2 (notch for 20 seconds), go back to Step 1...and so on.

The following maneuvers are available for the AI pilots:

- BvrFollowWaypoints
- BvrFlyFormation
- BvrSingleSideOffset
- BvrPince
- BvrPursuit
- BvrPump
- BvrCrank
- BvrCrankRight
- BvrCrankLeft
- BvrNotch, (in the shortest direction)
- BvrNotchRight
- BvrNotchRightHigh
- BvrNotchLeft
- BvrNotchLeftHigh
- Bvrchainsaw (crank, pump when the active missile is pitbull)

In addition, an important element has been added: If the flight or element lead gets killed, they stop giving orders to their wingmen (...). Sometimes, this loss-of-command can result in some confusion of the surviving flight members. Leaderless, they might run back home or try to just continue enroute.

Remember: Survival is one of the most valued tactics. Therefore, don't be astonished if some enemies will just turn and run instead of attacking you. While a rookie might fly right into the lion's den, smarter AI pilots might just try to turn and outrun your missile if fired upon. However, they might well return later and try to sneak upon you from below...

Check six!

CAMPAIGN ENGINE

One of the highlights of Falcon 4.0 is the campaign engine. This makes the real difference between Falcon and other simulations on the market. The campaign system in Falcon is very complex, as it tries to simulate a whole war. Many aspects of the campaign system are not overtly apparent to the player but are running in the background. Only after examining the source code one can imagine how complicated and exceptional this simulation's engine really is.

The key parts of the campaign engine are:

- Modeling the structure of orders (Order of Battle from Brigades to Battalions).
- Generating useful air and ground tasks, depending on the current status of war.
- Evaluating the current 'tide' of war (whether a team should have "initiative" or should concentrate on defense).
- Modeling a complete supply system.

What a campaign designer wants is a well-balanced campaign. The difficulty is that the aspects mentioned above are highly interdependent and generate, from a mathematical point of view, a very complicated nonlinear dynamic system. There is some mathematical theory to examine such dynamic systems, for instance chaos and catastrophic theory, but the campaigns in Falcon 4 are simply too complicated for a useful application of those theories. Therefore, to investigate the behavior of campaigns, one has to restrict investigations to simple trial and error methods.

For Falcon 4 SuperPAK 2, considerable efforts were spent to improve the campaign behavior, make campaigns more realistic, and eliminate some very obvious bugs. The following sections explain some of these changes. Nearly all changes are configurable, so if one doesn't like them, they can simply be turned off.

SuperPAK 2 installs a new "falcon4.aii" file that enables the improved campaign engine. It is therefore not necessary to manually add the configuration options described below!

WHAT HAS CHANGED?

The changes and improvements deal with the following aspects of campaigns:

- Removing bugs
- Campaign timings
- Production and supply system
- Hit rates and production rates
- General impact of player performance
- Generation of initiative points
- Other aspects

As the items of this list are connected to each other, it is simply not possible to go ahead point for point without referring to other points, but this will attempt to be a well-structured overview.

As already mentioned, nearly all changes are configurable. Contrary to many other changes made for SP2, many of the configuration variables for campaigns are located in the "*falcon4.aii*" file located in your \Campaign\Save folder, not in the "*falconsp.cfg*" file found in the Falcon root directory. This way, as every theater now has it's own \Campaign\Save folder, each campaign can be configured dependent on the active theater.

REMOVING BUGS

Several bugs were squashed: The most significant was the "no-fly" penalty levied against players who don't fly during a campaign: There is a routine in the code that reduces the player's rating if two game hours pass without a mission flown. This player rating is very important and is used for the calculation of hit probabilities for your troops in campaign. In Falcon v1.08us and earlier, due to a simple sign-error in a logical expression, this routine was called every hour, *independently* whether the player had flown a mission or not. This generally lead to bad player ratings and low hit probabilities for your troops. It was one of the reasons why it was so hard to win a campaign.

This "player rating" bug is now corrected. Additionally, the time interval for calling this routine can be set by a configuration variable. For instance, if you set **g_nNoPlayerPlay 12** in the "falconsp.cfg" file, it will take twelve hours before a player's rating is reduced because of non-flying (The default value is two hours).

CAMPAIGN TIMINGS

We have introduced two new configuration variables that enable the control of important timing aspects for the actions in the campaign. These variables are "*ActionRate*" and "*ActionTimeOut*", and are located in the "*falcon4.aii*" file. *ActionTimeOut* controls the maximum time, in hours, an offensive action can last. The default value is 24 (hours). *ActionRate* controls the minimum time a campaign action lasts be it defensive, consolidation, minor or major offensive. The default value is 8 (hours). A more rapid change of the campaign status will result if these variables are changed to

ActionRate = 2

ActionTimeOut = 12

in the *falcon4.aii* file under the [Campaign] header. This will lead to shorter offensive and consolidation actions and will give you a more "colorful" campaign.

PRODUCTION AND SUPPLY SYSTEM

The supply system in Falcon 4 is very sophisticated. The production of replacement equipment and supplies is based on the number of factories and their capacity (set in the data rate). The production of fuel is based on the number and capacity of refineries. The more factories a team has and the better their production rates, the bigger the stream of supplies and replacements a team has available. Power stations will affect production as well, when the variable *g_bPowerGrid* is set to 1 in the "*falconsp.cfg*" file. Destruction of factories, refineries, or power stations near by factories (i.e. supplying them power) can therefore significantly reduce the enemy's ability to sustain the war.

Unfortunately, prior to SP2, the production and supply system has had a lot of shortcomings, bugs and questionable algorithms that rendered the whole system unrealistic. Here are some examples:

- An offensive team received an offensive bonus and could produce four times (!) the replacement aircraft or tanks that the defensive side could produce. This is even if they have the same number of factories with the same capacity. This has the absolutely unrealistic effect of making it extremely difficult to weaken the strength of an offensive team. There existed another offensive bonus that delivered 1000 additional replacements whenever a team went offensive. The result was the well-known "Wall of MiGs".
- The supply of units with replacements is governed by their needs. In a loop, every unit reports its particular needs for replacements and receives this request times a factor, which should ensure that, in aggregate, the total number of replacements is never more than the number of replacement units available. Within this loop was a "type bonus" which lead to the situation where a Ground Attack unit got six times (!) of his normal replacement rate (air squadrons only got twice the normal rate). The problem was that the program didn't check whether the pool of replacements was already exhausted. Whether it is reasonable to favor offensive units in such a dramatic way, this bug provided an offensive team could get more replacements than actually produced (remember that the production of the offensive team was already four times the normal production rate). The consequence in the campaign was an even stronger Wall of MiGs.

In SuperPAK 2, these gross inconsistencies can be corrected: The variable "*StartOffBonusRepl*" can determine the extent of additional replacements a team gets when it goes offensive (default value was 1000). The similar variables "*StartOffBonusSup*" and "*StartOffBonusFuel*" do the same thing with the additional level of supplies and fuel delivered to an offensive team as they begin their push (default values were 5000 for both).

The variable "*NoActionBonusProd*" switches off the 4X replacements bonus for the offensive team: if set to 1, they have the same number of factories with the same capacity.

The variable "*NoTypeBonusRepl*" controls a whole new procedure for supplying units with replacements. Setting it to 1 has several advantages. It removes the bonus for attacking units. It absolutely guarantees that units can not get more replacements than previously produced or available through airlift. A distinction is now also made between ground vehicles and airplanes; you can therefore fine tune the distribution of replacements as aircraft or ground vehicles. The variable "*RelSquadBonus*" does this last job.

These goodies are enabled through the following variables under the [Campaign] header in your *falcon4.aii* file:

StartOffBonusRepl = 150

StartOffBonusSup = 2000

StartOffBonusFuel = 2000

NoActionBonusProd = 1

NoTypeBonusRepl = 1

RelSquadBonus = 4

In addition, there is another important improvement to the supply system: When aircraft return to their base after a mission, unused ordinance and fuel are put back into squadron stores. Prior to SP2, these unused ordinance was simply lost.

HIT RATES AND PRODUCTION RATES

Hit rates in Falcon 4 are generally based on the hit probabilities of the weapons versus a specific target type. Much effort has been spent to develop realistic hit probabilities for these weapons. When an aircraft fires a missile (for instance an AIM-9M), the hit probability of this weapon is 40% against high flying aircraft, but there is also an aircraft specific bonus (The concept behind this bonus is that there is a difference whether an F-16 or an F-4 fires the missile). If the missile is shot by an F-16, the hit probability increases by another 40%. Conversely, there is an aircraft specific defensive bonus (representing the maneuverability of the aircraft). If the missile is shot against a Mig-21, hit probability is reduced by 25%, so the actual hit probability of an AIM-9M fired by an F-16 against a Mig-21 is 55% in a 2D world fight (a.k.a. the statistical battle world).

The same principle applies for air to ground missiles. The only difference is that ground vehicles have no defensive bonus. Because of this, hit probabilities against ground targets were too high. Setting the variable "*CampBugFixes*" to 1 in your *falcon4.aii* under the header [Campaign] will

eliminate the aircraft specific bonus against ground targets. The same variable also make guns against ground targets less effective (these guns were heavily overmodeled because hit probabilities were calculated according to the method described above *for each shell*, ignoring the fact that these are not independent events).

In the original Falcon 4 1.08us, calculated hit probabilities were divided by 6 for air to air engagements and by a factor of 3 for air to ground attacks. This was necessary because otherwise loss rates would have been much too high and both teams would have lost nearly all their aircraft after only a few campaign hours. The reasons for this are very high and unrealistic sortie-rates, a much too aggressive AI (compared to reality), and over modeled detection capabilities. The sortie-rates can be adjusted by the variable "*g_npercentage_available_aircraft*" in the *falconsp.cfg* file.

New correction factors for hit probabilities were also required and changed from 6 and 3 to 3.5 and 1.5. If it appears that these values are too high or too low, they can be adjusted by the two variables "*2DHitChanceAir*" and "*2DHitChanceGround*" in your *falcon4.aii* file under the header [Campaign].

For a well-balanced campaign hit probabilities should be considered in conjunction with production and supply rates. Therefore production rates are configurable also. The variable "*DataRateModRepl*" determines the production rates for replacements (airplanes and ground vehicles). The default value is 1 (normal rate). The variable "*DataRateModSup*" determines production rates for supplies and fuel. The default value is 1.5 (50% higher than normal rates because there are no production type bonuses if the variable "*NoActionBonusProd*" is set to 1).

Both variables are found in the [Campaign] section of your *falcon4.aii* file.

Adjusting hit probabilities and production rates enables some interesting strategic options. For example, if you moderately increase both hit probabilities and production rates, the supply system becomes relatively more important. In this campaign destroying factories will turn out to be a very promising strategy. Building different styles of campaigns, by adjusting all the new variables, will become as challenging and interesting as building TEs.

GENERAL IMPACT OF PLAYER PERFORMANCE

What should be the effect of player performance in campaign? Currently player performance has a very strong impact through several effects. The most important ones are:

- Hit chance modification through players rating. Player rating varies between +20 and -20. Hit probabilities are corrected by the following factor: (players rating + 20)/20. So, if you have a rating of -10, hit probabilities of your troops are multiplied by 0.5. If your rating is 10, hit probabilities of your troops increase by 50%. We believe this is the right way to model the influence of player performance. If one supposes that the player is a representative pilot of his team it seems natural to link the hit probability of the other pilots to the performance of the player.
  Imagine what tremendous influence removing the player performance bug (see Removing bugs section) has had.

- The number of shots depends on player rating.
- Initiative points, which are described in more detail in the next subsection.

GENERATION OF INITIATIVE POINTS

Judging the particular situation of war and determining whether a team should have “initiative” or should concentrate on defense instead is a key aspect of the whole campaign engine. This judging is done in Falcon 4 by so called initiative points.

In Falcon v1.08us, a team could only go to a major offensive if it had more than 60 initiative points (Initiative points can vary between 0 and 100). Initiative points are calculated through:

1. Starting values at the beginning of a campaign and “event-files” inside the campaign (*.tri files). Campaign builders can set these trigger events.
2. When an object is captured, the overrunning team gets 5 points; the previous object owner looses five points.
3. Killing a battalion transfers one point.
4. There was an automatic adoption of initiative points:
   - If a team’s initiative was less than 40 points (which was required to begin a minor offensive), this team got two points every update.
   - If the team was between 40 and 60 points we lost two points.
   - If the offensive team had more than 60 initiative points nothing happened.

   This asymmetric setting could lead to strange results: When the opposing team was on the offensive (more than 60 points), there were very limited opportunities for the defending team to increase their initiative points (because generally only the offensive team captures something, see point 2). So if the defensive team’s air force was very successful and eventually had much stronger forces than the enemy did, the defensive team could not go on the offensive because it lacked the necessary initiative points! The only possibility to swing the ‘tide of the war’ was a trigger file event (this being somewhat arbitrary) or exceptional player performance.
5. Player performance (in particular the player rating) is used to modify initiative points. This was implemented in a somewhat problematical way, similar to the Initiative = Initiative + f(rating) formula. Considering the fourth method (see above), there was a cumulative effect from being on the offensive. This meant that flying a successful or failed mission *only once* led to cumulative effects in initiative points.

In SuperPAK 2, the first three mechanisms were left unchanged, but 4 and 5 were optimized:

Our basic assumption was that the initiative of a team should be mainly governed (apart from player performance) by the relative status of the team in the war. A measure for this is the relative strength of the teams. So the automatic calculation of initiative points for each team should converge to this relative strength (and not arbitrarily to 40 or not at all converging as in the old version). This would prevent the possibility (as mentioned above) that a defensive team never goes on the offensive even when it has more vehicles (because the air force was very successful) and a better strategic position.

The player's performance can be similarly applied as above. The mechanism to incorporate the player's contribution is critical and should target a long term value that is effected by the player's ongoing contribution. Therefore, simple formulas like Initiative = 0.5*Initiative + 0.5*relative_strength will not have the desired cumulative effect. However, if the player is *consistently* flying successful missions, initiative points should converge to a number greater than the relative strength. This is what is intended - so if he is flying only one mission, the effect on initiative is only temporary (The same applies for poor mission performance).

In SP2, Initiative points for both teams exactly sum to 100. A team can now go to a minor offensive when initiative is greater than 50 and on a major offensive when initiative is greater than 55. In calculating the relative strength of the teams, both air and ground forces, as well as relative losses are taken into account. If a team is on the offensive and its initiative falls below 40 (for instance because of heavy losses), the offensive breaks down and we reach consolidation.

There are many advantages to these improvements:

- One mission does not have any permanent effects on the war.
- There are no asymmetries in acquiring automatic initiative points between offensive and defensive teams.
- There are no inconsistencies between the allies and enemies initiative points summing to 100.
- Without player input, it is the relative strength of the teams which determines long-term initiative points and therefore the evolution of the campaign.

With this new initiative point system the transition from defensive to offensive states and vice versa should be smoother, more understandable, and better grounded in the actual status of each team in the war.

You can set this new initiative point system in effect by putting *NewInitiativePoints* = 1 in the [Campaign] section of your *falcon4.aii* file.

OTHER CONSIDERATIONS

There are many other aspects in Falcon 4 that have direct or indirect effects on campaign behavior:

- For example, the new flight models with new fuel flow rates will have a significant impact on the campaign because the air tasking manager uses fuel rate calculations for generating missions and weapon loadouts (more auxiliary fuel tanks will therefore be carried). Tanker availability is now of higher importance, too.
- New terrain masking capabilities and improved, realistic detection algorithms influence the success of strike missions.
- New types of airplanes could have a strong impact also (because one of the big weaknesses of North Korean's air force is the lack of a "real" air to ground capable fighter).

A further aspect is airbase relocation. You can now determine the time it takes to make the relocated squadron flight ready. The relevant variable is "*g_nRelocationWait*" in the *falconsp.cfg* file. The default value is 3. Helicopter squadrons are ready more rapidly (the default value divided by three, one hour by default) and are now relocated even if the air (army) base is destroyed.

A new feature is the capability to easily change campaign priorities before the air task manager creates missions. The campaign priority window appears when a new campaign is started and the clock is stopped. This allows you to preset your campaign priorities to influence the type of missions that are generated by the computer. After closing the priority window, click on the "OK" button to start the campaign.

REMAINING ISSUES

Blue superpower

Selecting the new campaign changes available in SuperPAK 2 makes it easier to win the war from the blue side. The removal of the player rating bug (see section “Removing Bugs”) is the main reasons for this. This bug has been in the code since the beginning of Falcon 4, so the standard campaigns were tuned under flawed conditions. Without this bug it turns out that the forces of North Korea are too weak to be a real challenge for the US Air Force.

This is perfectly realistic. Every other outcome would be suspicious. The problem is that some people will now find it too easy. How to resolve this problem?

1. Shift the force ratio sliders more to the left at the start of a new campaign.
2. Wait until someone makes new campaigns with stronger opponents. This may happen very soon. Perhaps the Balkan Theatre campaigns will be balanced for this realistic campaign engine.
3. Make the forces of North Korea stronger. Use the TacEdit utility to add squadrons for the north. Particularly important are units with strong air to ground capability, for instance Mi-24 squadrons, and the addition of more modern air to air fighters.
4. Play the campaigns from the red side for a real challenge.

Mission Generation

Another weak point is mission generation:

- Sometimes, generated air missions are not very intelligent ("suicide missions").
- From time to time, the behavior of ground troops is questionable.

One might therefore wish for a feature to design missions and to be able to order ground troops.

CONCLUSION

Although there are some remaining problems and a remaining wish list, the campaign engine of Falcon 4 SuperPAK 2 is certainly the best you can get in a current game!

Chapter
11

Appendix

CREDITS

With the SP2a release in early spring, an updated manual will be published including full credits.

The following people helped substantially in the production of SuperPAK:

Art: Christian 'Ripper' Thomsen, Jerry 'Pookie' Davis

Cockpit: Paul 'Jagstang' Joy, Patrice 'Skypat' Basquin

Coding: Joel 'Jackal' Bierling, Manfred 'Schumi' Nelles, Alfred Stiassny, Martin 'Pogo' Ingold, Sylvain 'Bugsquasher' Gagnon, Julian 'Codec' Onions, 'Rik'

Flight Models: Tom 'Saint' Launder, Andre 'Raptor One' Joseph, Bennie Broughton, Instar, TAF, Georg, Firebird, Coradan, Chris Carter, Davor, Ratty, Animal, Spieg, Randall, Chuck Boothe, Paul Poulsen, Craig Homer, Greg Lewis, MIX

Realism: Michael 'Superman' Kent, Shawn 'Viper' Agne

Theater: Manfred 'Schumi' Nelles, Chris 'Washout' Carter

Weapon Loadout: Lloyd 'Hunter' Cole, Sim 'Gunner' Taylor

Additional Development: Albert 'Recker' Yung, Bob 'Snowman' Crawford, Bryn 'Horseman' MacDonald, Chuck Boothe, Colin 'Cooler' Morrow, Fred 'Baldeagle' Balding, Martin 'Terrapin' Gerner, Marv De Beque, Obi Offiah, Rob 'Vexx' Yurystowski, Rufus Parson, Sang-Hyuk Yune, Stephen 'HotDogOne' French, Tim 'Nighthawk' Admire, Tobias 'Buster' Adam.

Checklists: Olivier 'Red dog' Beaumont

Documentation: Thomas 'Tom2' Wälti

Public Relations: Kurt 'Froglips' Giesselman, Mark 'Frugal' Bush

SuperPAK logo and UI artwork: Terry Bailey

User Interface: Ivo 'Widowmaker' Schäperclaus

Web site: Daniel 'BrownSnake' Fahlén

Beta Testing: The over 200 members of the Falcon 4.0 SuperPAK beta test team (A full list of all members will be published on our website at f4ut.frugalsworld.com).

Multiplayer Beta Testing: The nearly 50 online pilots from the AMVI, Freebirds, 87th, 185th, 388th and 404th Virtual Fighter squadrons. Fabio 'Spieg' Incagli for leading the MP beta testing, Greg 'Pony' Herbert for offering his 24h online server.

As mentioned in the introduction: none of this would have been possible without the work done by the Realism Patch Group, who created the Realism patch 5, and the eTeam, who brought us eFalcon 1.10. Check the respective manuals for full credits!

Special thanks to the **Hellenic Air Force Pilots** (BL 50/52)

Special thanks to **Jane's Information Group** (Jane's FA-18, Jane's F-15)

Thanks to the pilots, operational and retired, who told us what we could ask, and gave us detailed information on what they could.

DISCLAIMER

Due to changes in the data structure and new features in SP2, F4UT have made some edits to the RP5 data files. These were made without the permission of RPG or any consultation from the RPG. As a result SP2 cannot be considered RP5 compatible and F4UT make no claims of compatibility, integration, or performance of RPG work. RPG feel that their permission should have been sought but in the interests of improving relations agree to let the matter end here.

KNOWN ISSUES

Nobody is perfect. While much improved in relation to the original Falcon 4, SuperPAK still has its share of bugs and issues. Some are known, others are still undetected. Meet us in major forums (www.frugalsworld.com, forums.delphiforums.com/Falcon4) and help improve SuperPAK by giving us your feedback!

Erratic stuttering while flying

This issue only hits some users and can even be observed on high-end systems. To resolve this issue (or at least lessen the stuttering), there are several steps to try:

- Optimize your system: Make sure that enough RAM is available, defragment your hard disk, update the drivers of graphics and sound cards, close unneeded applications.
- Disable "Display trees" in the "Settings Advanced" inside the FalconSP Config Editor.
- If the stuttering worsens with subsequent missions, exit Falcon 4 and restart it.
- Disable 3Dnow/ISSE in the Advanced Graphics Setup.
  Test lower settings in the Graphics Setup.
- Try the different hardware options available in the FalconSP Configuration Editor.
- Disable 3D Sound and/or enable the old sound algorithm.

Graphics problems (Radar garbled, Text on HUD and MFD unreadable etc.)

- On nVidia cards:
  - Disable FSAA and anisothropic filtering.
  - Reset the texel alignement slider: Right click on a free part of Desktop > Properties > Settings > Advanced > Tab "name of your graphics card" (e.g. 3D Blaster GeForce 256) > Additional properties > Direct3D settings > More Direct3D > Texel Alignment. Reset the slider (to the mark just left of the middle). Click 4x OK to save. Reboot.
- If you have a GeForce 2 MX graphics card: select the "Direct3D HAL" (not "Direct3D T&L HAL") as Video Card and disable FSAA (the MX series aren't made for that).
- Try a different sort of drivers for your graphics card, like the older 7.97 for nVidia cards (Be sure to delete all files from the previous driver by using a tool like NVMAX).

The intro movies are stuttering badly

- Disable 3D Sound and/or enable the old sound algorithm in the FalconSP Config Editor.
- Check the audio playback settings of your system (Start > Control Panel > Multimedia).

Long waiting time or getting stuck on the standby screen after the mission

- Try pressing ESC or TAB if you are really stuck.
- However, if you were recording ACMIs during the mission, it may take some time for Falcon 4 to return you to the User Interface. This is because Falcon has to analyze the mission and write it to disk (so you can review the ACMI later).
  Users have reportedly waited up to 10 minutes until a long ACMI was written to disk.

When there are fire/smoke/moon/sun graphics near the edge of the screen, I get a strange effect where there are big colored triangles displayed instead of the original graphics

- The graphics engine sometimes has trouble correctly displaying GIF's (Sun, Moon, Explosions) touching the edge of the screen. Since a totally new engine is being worked on, the issue should hopefully soon be resolved.

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RADAR, JAMMING, ECM

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- www.jedefense.com
- radar-www.nrl.navy.mil/Areas/Warloc

MLU

- www.voodoo.cz/falcon
- home.wanadoo.nl/tcc/rnlaf/mlu_back.html

F16 BLOCK 50/52 INFORMATION

- www.f16korea.com
- www.fas.org
- www.f-16.net

EXE VERSION CHANGES

SUPERPAK 2

Tons of new features, Hundreds of bugfixes... A full "history.txt" will be available from our website in the near future. There was simply no time left to catch up with the developers.

SUPERPAK 1

This is the "combined exe", eFalcon 1.10 and RP5. It therefore doesn't offer any major new features - but many bug and CTD fixes ;-)

Adaptation of RP5 exe features

- GCI (Ground Controlled Interception): Target detection, Target spotting
- Pilot's Air-2-Ground AI: Target selection, Weapon use, Missile evasion, Flight path
- RWR (Radar Warning Receiver): Improved RWR information, better HARM use
- SEAD Escorts: regained situational awareness, improved situation handling
- Air Tasking Order (ATO): Nighttime tasking, enroute waypoints
- Integrated Air Defense systems (IADS): Correct radar mode switching of systems

Various

- Further improvements to A2G AI (Target selection, ground awareness)
- AI flight performance improved
- Adjusted ripple spacing
- Improved HTS (Better coupling with RWR)

THE AGREEMENT

THE FALCON 4.0 SUPERPAK PROJECT

Purpose: To generate an agreement between G2 Interactive Inc. (the current license holder of all Falcon 4 intellectual property) and the Falcon 4 community of developers which results in G2 Interactive allowing continued community-based development of Falcon 4.0 in such a way that the work of the RPG, eTeam, F4Alliance, F4Terrain, and other meaningful independent teams are brought into a single Falcon 4.0 version patch.

General Statement: G2 accepts that no amount of time from any individual will be required. Time management and use of any person's free time will be at their own discretion. The management team of this newly organized FALCON 4 UNIFIED TEAM (F4UT) will determine if a persons position or work needs to be removed.

The new patch will be called the Falcon 4.0 SuperPAK

Motivation for G2 to allow this

1. All development work done by the F4UT will be signed over by each developer for use by G2 in their for-profit endeavors. Signing over Intellectual Property claims will be done via a release form and is required as part of the membership/signup process.

2. Additionally, all persons using the source code must also sign an NDA as part of membership and signup. This NDA, as provided by G2, will state that each user of the source code agrees to share it only with G2 authorized persons.

3. Certain high-priority features as required by G2 Interactive must be addressed and developed first. These will likely be the same features that the community has been working on anyway, so this should be a win-win for all concerned. Examples of such features will be:

a. The total merger of all possible and reasonable community based modifications (data, functionality, cockpits, terrains, etc.) within the 1.10 executable code base:

i. All possible eTeam exe edits and Sylvain Gagnon's AI exe edits, as determined by the management team, will be included.

ii. All possible and reasonable Cockpits, terrains, etc will be included

iii. All possible and reasonable eTeam Source Code features and functions will be included

b. Completion of the multiplayer client/server code that the eTeam had to drop just before the 1.10 release, and fixing of Jet-net as necessary (Should Jet-net lie in the domain which is covered by signed members of this team). Should Jet-net not be made readily available to G2 by eRazor, his decision will be respected, and every reasonable effort will be made to create a new Jet-Net like code which will manage the peer to peer game matching.

c. DirectX 8.0a compatibility and new features (offloading to GPU, T&L, increased poly capability, etc.) to the extent that such skills exist within the team

d. Other features as agreed upon in the negotiation such as:

i. Major features/fixes available in the 1.08i2 version of the MicroProse code that haven't yet made it into the eTeam 1.10 version. (As put forth by G2 in a list format) .

ii. In game, easy and fully integrated Terrain/campaign switching

iii. An expanded configuration interface where new/modified features can be turned off/on based on user preference.

iv. All possible and reasonable Hooks for additional aircraft, HUDs, avionics, and other aircraft systems

v. All features desired by the F4UT Management Team for the second Falcon4SuperPAK released patch (not the first combination-only patch) must be submitted to G2 within 14 days of the completion of this agreement. This list must be a short, concise list of desired features that can be accomplished, along with G2's required features, in the minimum time allotted by this agreement (120 days). Should both the initial list of G2's priority features as well as F4UT's desired list of features be completed with time remaining, F4UT's management team may then submit a second round of requested features to G2 that can be incorporated in the second patch or a subsequent third patch if all parties agree. All new features beyond the initial lists are subject to veto by G2. However, should time remain and G2 be amenable to a new feature list, it may approve them in a line item fashion.

vi. EFalcon terrain features (color pallet, far tiles, etc.)

Motivation for the F4 community developers and testers to sign on and join the new team

1. The F4UT will have the right to continue the development process that they have already committed so much of their time and devotion to.

2. The F4UT will have the right to choose and develop features of their choosing and desire in addition to the features agreed upon with G2 (with G2s approval of the feature)

3. The F4UT will have the opportunity to place old feelings aside, to come together as one in the community, and to continue to contribute positively to the best flight simulation available.

4. The F4UT will have the chance to bolster up and help a burgeoning new flight sim company in their endeavor to build a new age of flight Sims.

Other Deal points

* In order to establish some momentum and success, the new Falcon4 UNIFIED TEAM (F4UT) agrees to create, as their first release, a simple combination of eTeam features from the 1.10 exe and Sylvain Gagnon's exe modifications, well tested and integrated - no major new development. This will allow the team to gain a foothold and not be drawn down by a long, complex development cycle. This, of course, will also return the community to a happy place. It will show then that the F4UT is keeping their eye on the ball and they are going in the next logical direction. This will also allow the F4UT and G2 to gauge the success of this operation and to better predict how long subsequent releases might take

* The sole arbitrator in feature disputes will be G2. In other words, any features not agreed upon in this initial negotiation must be submitted to G2 for final decision before any development on said feature is begun.

* A management team will be formed to handle feature set decisions as well as parsing out development/testing tasks. The management team will consist of approximately 1 (one) member from each of the old community teams and one neutral party for the purpose of tie breaking during management team votes. A total of 5 voting members and 5 non-voting alternates will make up the entirety of the 10-person management team. In cases where consensus cannot be reached on details of this project, the 5th voting member, (known as the tie breaker), will cast his tie breaking vote. All issues resolved by this voting mechanism and not achieved by consensus will be accepted and respected by all members of the Management team.

* A development team will be formed and managed by the F4UT management team - only those people who directly contribute to development (either Source Code or data) will be a member of this team. All contributors of code enhancements and data enhancements will have to first sign a copyright release. Furthermore, any handling the source code specifically will additionally require the need to sign an NDA relating to that source code.

* A separate testing team will be formed and managed by the F4UT management team as well.

* The F4SuperPAK, developed by this community effort and copyright controlled by G2, must be allowed to be available free to the community for internet download. This is irrespective of any for-profit endeavors potentially also done by G2 with the code or any of its components.

* The management team will compile a short, concise list of their desired new features and present them to G2 for line-item approval. This list must be consistent with being doable within the minimum time frame allotted in this arrangement (120 days) and must also take into consideration the fact that G2's required features will be completed first. Furthermore, in so far as no other requirements and priorities of this agreement are overlooked, the F4UT management team has the full right to determine how to implement the currently existing features and the full right to fix bugs to any of those features as needed.

* A G2I representative will be involved in the management team, but will not have voting rights for day to day decisions - G2I will be available for advice, counsel, and direction setting, and to relay G2's position in ongoing development decisions. G2I will not try to overly affect the new teams

operations, but as the custodian for the Falcon 4.0 IP, G2 will have complete veto power on any new feature requests. Upon execution of this contract, G2 must approve any additional features not agreed to up-front.

* The F4UT management team will make all day-to-day decisions, but G2 will have veto authority on any decision to include a new feature not previously agreed upon. This authority will be used only when necessary and as a last and final resort.

* No new features should be forced upon the new team by G2 other than those features agreed to at the start of this process

* The team will have a finite life span. When G2 has determined that any future development by the community would compete with their forthcoming products, the new community team will be allowed to finalize their current release, but will close down operations shortly thereafter - at least 30 days notice will be granted prior to final release. And no less than 90 days will be assured from the time of the projects inception. So a total of 120 days minimum is guaranteed for this "SuperPAK" project. It should be at G2's sole discretion to grant any continued development or additional time from that point on.

* During the finite life span of the newly formed "Falcon4 Unified Team", F4UT has the right to also continue development on all tools that may require the use of F4 source code in their development (such as TacEdit and F4Browse as examples).

* Even beyond the aforementioned 120-day minimum development time, G2 will permit no less than 60 additional days for the sole purpose of fixing bugs in any feature already approved and already functioning in the executable portion of the F4SuperPAK . This automatically includes all Crashes to Desktop (CTDs) and any other bugs that may exist in otherwise implemented and approved features. The F4UT (The SuperPAK team) respects that this is not a loophole for continued development of features that did not get implemented prior to the closure of programming once the aforementioned 30-days notice was complete. These 60 days do, however, begin after the end of the 30-day notice period.

* The new team will not attempt to develop aircraft or scenarios that might be in competition with the future FV product features that G2 has already announced: no Taiwan theatre, no F-15 aircraft, etc. Other than that, all features are possible (if they meet the design principles documented below)

* If G2 should ever use any of the code made by this team in a for-profit capacity, the authors of SuperPAK who come from this community effort may not be held liable for any results of their work and are not in any way required to fix the bugs or provide continued support on their code.

DESIGN PRINCIPLES for the FALCON4 UNIFIED TEAM

The "Design Principles" will guide the team's actions during the course of development. These principles should be referenced when establishing priorities, selecting features, and arbitrating disagreements. They are as follows:

1. The changes will not add any instability to Falcon 4.0

2. The data and functionality changes must reflect "real world values".

3. Real world values must be supported by non-classified military or civilian documentation.

4. The changes will not adversely affect gameplay

Note 1 - The "real world" in Falcon 4.0 terms is a hypothetical battlefield in the current or near future timeframe that involves US, ROK, DPRK, Chinese, and Russian forces. All modifications to the objects and capabilities of Falcon 4.0 will be made with these force capabilities in mind. Other aircraft/theatres/weapons should be incorporated as available, but the standard version of the Falcon 4.0 SuperPAK will be offered with the default standard Falcon 4.0 default Korean scenario in mind. All other equipment, theatres, weapons, etc. should be integrated, but user-selectable either from the in-game interface or through pre-game configuration panels.

Note 2 - Although the F-16C has additional capabilities beyond what the USAF employs, the F4UT agrees to keep strict USAF specifications, as well as the specifications set forth by the other theatre combatants. When other countries aircraft/capabilities are to be incorporated (example: F-16 MLUs or blocks that are of foreign military configurations), these can be integrated, but incorporated as non-default options that can be user-selectable.

Note 3 - One of F4UTs principals must be that of documentation for their choices of realism. A most sacred guiding principle must be to support all changes with recognized military and civilian sources. Sources must be submitted to all members of the F4UT's management team and G2, verified, and re-verified as necessary.

NOTES

NOTES

THE SAGA CONTINUES