BMS USER MANUAL

FOREWORD

PURPOSE AND SCOPE

This manual contains information on the Falcon 4 BMS front end, i.e. installation, configuration, user interface, multiplayer etc. Only simulation specific items will be documented in this manual.

The following manuals supplement this manual to establish the complete Falcon BMS 4.36 series:

- TO 1F-16CM/AM-1 BMS (aircraft, avionics, normal procedures and abnormal procedures).

- BMS-Training (documentation to accompany Falcon BMS training missions).

- TO 1F-16CM/AM-34 BMS (weapon systems, support equipment and munitions).

- BMS-Comms & Navigation Manual (how to get the best out of ATC, Radio & Charts).

- BMS-Naval-Ops (Naval Operations from aircraft carrier in BMS).

- Checklists and Cockpit Diagrams (avionics, emergency, non-F-16 pit layouts).

- Airport Approach & Navigation Charts (including KTO AIP).

These documents, with the exception of the TO-BMS1F-16CM-1, are located in the \Docs folder of your Falcon BMS install, along with other supporting documents. The -1 manual can be downloaded from the Falcon BMS wiki: (https://wiki.falcon-bms.com/en/manuals)

All changes in this document coming with 4.36.0 are marked with a **black** line. All changes coming with 4.36.1 are marked with a blue line.

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2. Installation

2.1 System Requirements

2.1.1 Software

In order to install Falcon BMS you must own a valid original Falcon 4.0 licence. Please note BMS will check for the presence of **an installed version of Falcon 4.0 on your hard drive.** It can be either the original 1998 version (there is no need to patch your original version), or the latest GOG Falcon Collection by Tommo, available for purchase on the internet.

2.1.2 Hardware

Throughout its history, Falcon 4 has always demanded fast computer hardware. The same holds true today. With upgraded graphics options like shaders, post-processing, shader rendering effects like light, glass, shadow and weather and enhancements to the avionics sensors (TGP, WPN, TFR & FLIR displays) Falcon BMS continues to require (or at least prefer) the latest computer hardware on the market. The 64-bit executable does manage memory better, but there are more memory requests to manage. Hardware that ran previous Falcon versions comfortably should be able to run Falcon BMS to the same degree.

Flight controls are required to use any flight simulation. To enjoy BMS fully you will need a realistic HOTAS that will allow you to program the F-16 specific functions such as the TMS, DMS and CMS. A head tracking device is advisable as well, although not mandatory.

2.1.3 Operating System

To be able to run BMS you need a 64-bit operating system. At the time of writing this manual Windows 10 x64 is probably the best choice of operating system for BMS. BMS is compatible to Windows 7 and 11. Some users successfully run BMS on Linux platforms. Please check the public forum for more information.
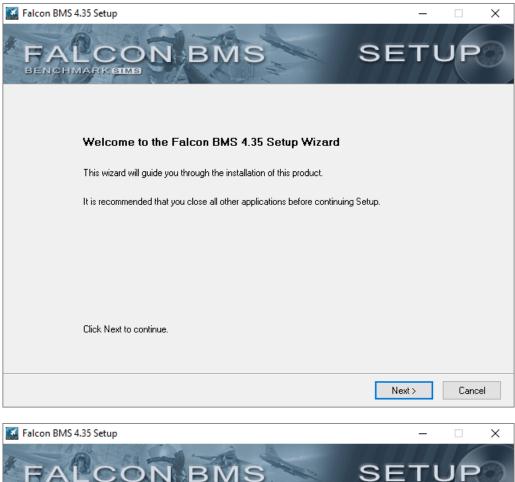
2.2 Installation

Every BMS version is stand-alone and does not need to be installed on top of an earlier version.
All versions of BMS can coexist on the same computer. You do not need to uninstall earlier versions.

2.2.1 Base install

Download Falcon_BMS_4.36_Setup.zip from your preferred mirror and extract the contents to a specific folder on your hard drive. Please note: The *Falcon BMS 4.36 Setup* folder will still be needed after installation for further updates, so it needs to be located in a different place from the *Falcon BMS 4.36* folder. Many users have confused the two folders in the past, or even deleted the *Setup* folder after installation. The important thing is that there must be two different folders: one for Setup/Install content and one for the actual game. Launch *Setup.exe* from the *Setup* folder. The installation will start and may take a few minutes.

> *Note: Pictures are taken in 4.33, 4.34 or 4.35 versions. They are still applicable for the newest version of BMS.*

As always you must accept the Licence agreement to be able to proceed with the installation.
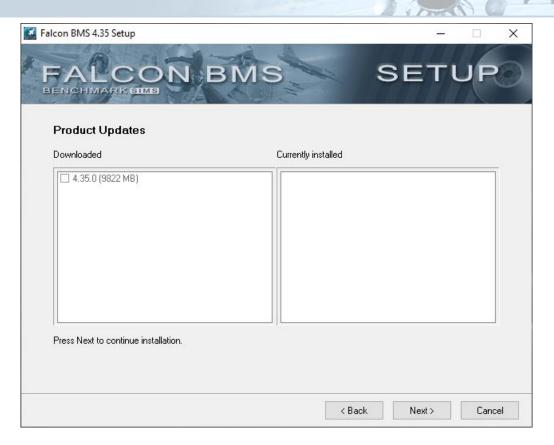
Please note: The Falcon BMS Setup Wizard will automatically check for a valid install of Falcon 4.0. If the Setup Wizard is unable to find a valid Falcon 4.0 install it will display an error message and stop:

The next step is to choose a game installation folder – again ensure it is different from the Setup folder. Please note: you must use only printable ASCII characters in the path or Setup will refuse to proceed.
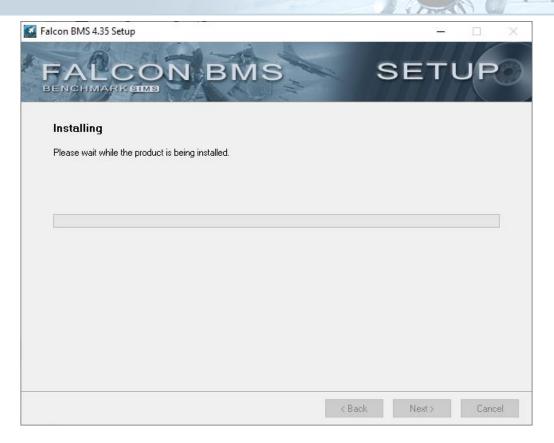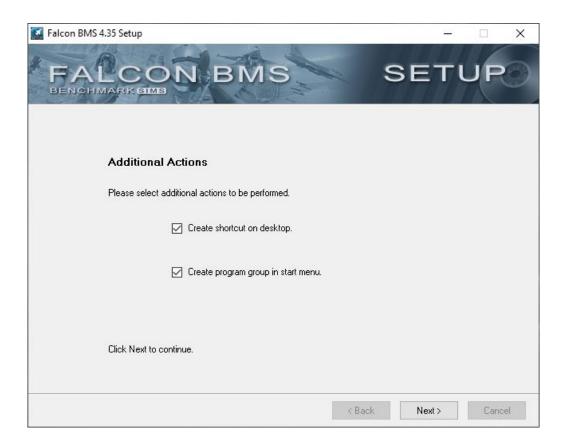
The installation files are ready. Click Next to start installing.
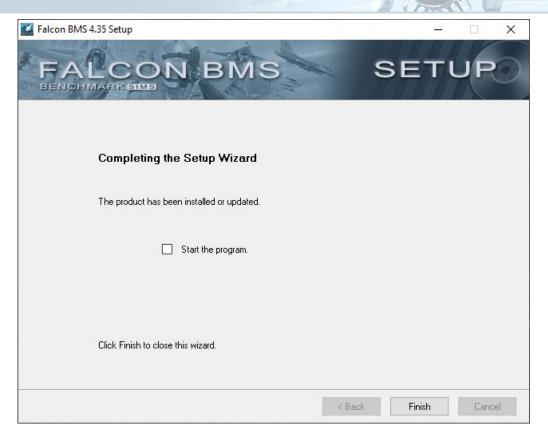
When you update your install, you may have multiple options in this screen.
Since it is the base install only one option is displayed. Check the box and click Next.

The install is in progress and will take a few moments.

When finished you have the option to create shortcuts. Check the boxes as desired and click Next.

Installation is complete.

2.2.2 Restoring older files

Some files can be copied across from your 4.35 install if you wish:
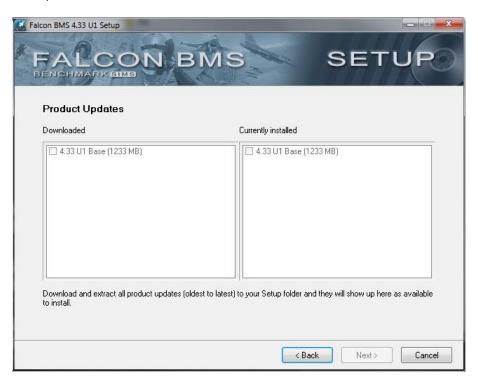
- Logbook can be restored. Please restore only the *pilotcallsign.lbk & pilotcallsign.ini* files in the *\Users\Config* folder.

- TEs **are not** compatible. They need to be converted with Mission Commander to 4.36 format.

- Weather files **are not** compatible, so do not copy across from previous version.

- Third party terrain files **are not** compatible and will need to be updated to the 4.36 structure.

- Older key files can be used, but if you do so you will have to manually add in/change the new 4.36 callbacks. It is therefore strongly advised to start with a new 4.36 key file and customise it as desired.

- axismapping.dat & joystick.cal can be restored from earlier versions.

- RTT server/client.ini can be restored from earlier versions.

- The *Falcon BMS.cfg* file is not compatible and should not be copied. Either use Winmerge to port your configs into the new versions default config or make specific changes from the default settings in the new Falcon BMS User.cfg.

- ACMI and screenshots remain compatible.

- IVC config files **are not** compatible.

- DeviceSorting.txt remains compatible.

2.2.3   Updating BMS

Updates to BMS will be announced on www.benchmarksims.org/forum/. Download the update and run it, pointing to the *Falcon BMS **Setup*** folder. Do NOT save the update to your *Falcon BMS **game*** folder. Once extracted, run the Setup program.

Two columns will be displayed: in the right column are the files currently installed, the left column shows the list of available updates. Click Next to select the version that should be installed. Another click on Next will start the installation of the update.

2.2.4   Launching BMS

The BMS icon will start BMS by initialising the Launcher menu.

To launch BMS click **Launch**.

Configuration opens the BMS config so you can set different options.

Documentation and Manuals opens the *\Docs* folder with Explorer.

IVC Client and **IVC Server** launch the client and server IVC applets respectively.

RTT Client and **RTT Server** launch the client and server RTT. It is the new system to manage display extraction.

Avionics Configurator launches the avionics configuration applet.

Editor launches the BMS editot applet.

Close exits the launcher.

During the launch process a new logo screen will be displayed indicating the current holder of the Falcon 4.0 licence. The UI also clearly states that BMS can ONLY be used for NON-COMMERCIAL purposes.

If the BMS Launcher fails to locate a valid Falcon 4.0 install on your system, BMS will not launch and you will see the error message on page 14. The Falcon 4.0 installation has to remain on your PC for BMS to launch.

Command line parameters can be added to the BMS shortcut. Right-click the BMS icon and click Properties. In the Shortcut tab, the path to the launcher is given in the target box. All command line parameters must be separated from the exe with a space, then add them as they are displayed below. More than one command line parameter can be set.

For instance: "C:\Falcon BMS 4.36\Launcher.exe" –window –nomovie

- -acmi: Will automatically start ACMI recording each time you enter 3D.

- -window: Will start BMS in windowed mode (instead of fullscreen).

- -nomovie: Will suppress playback of all movies, intro and in-game.

- -bandwidth_up <value>: Specifies the desired COMMS bandwidth Upload in kbps (kilobits per second), i.e. 1024 = 1024000 bps. Initial Value is 1024.

- -bw_up <value>:   Same as above.

- -bandwidth_down <value>: Specifies the desired COMMS bandwidth Downloads in kbps, Initial Value is 2048.

- -bw_down <value>:   Same as above.

  Please note: It is advised to use your own values for Upload and Download. Refer to chapter 7 Multiplayer for a method to calculate these values.

- -urview <value>:   If a "Union Reality Gear" headtracker is connected, specify its "FOV" in degrees. Default and max is 160, min is 50 (has not been tested for ages).

- -ef: Enable "eyefly" (See chapter 9.6.3 External views).

2.2.5 Uninstalling BMS

If you wish to remove BMS from your computer **do not delete the *Falcon BMS* (i.e. game) folder** or attempt to use the Windows Control Panel to uninstall the software. If you do you will leave registry entries which will prevent you from reinstalling the software.
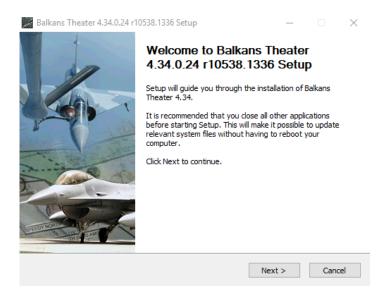
Instead launch Setup.exe from your *Falcon BMS Setup* folder. On the first screen you can choose to **Remove the product from your computer**. Select that option and follow the instructions.

2.2.6   Installing third party terrain

Third party theatres will usually come with their own compressed installer. Users simply follow the instructions in the package to install the theatre. Using Balkan as an example:

Unpack the installer in a temporary folder and launch the executable.

Since most of us have multiple versions of BMS on our computers you must ensure that the theatre version you install is placed in the correct BMS version folder. In this case Balkan is installed into the Falcon *BMS 4.34* folder. The installer detected the correct folder by itself, but it is always worth checking.
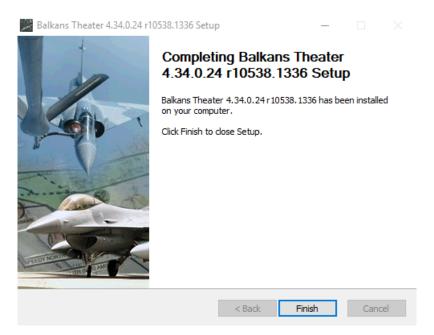
The installer will then create a relevant theatre subfolder named 'Add-On Balkan in the *BMS\Data* game folder.

Please note all third part theatres should have the same subfolder naming structure and always start with Add-On Theatre Name. All specific theatre files must be copied in this Add-On folder.

Once all files have been copied the installer will confirm successful installation. Click the Finish button.

The Theatre Configuration Editor (if supplied) is the same as the BMS Config applet but with options specific for this theatre.

The third-party theatre is now installed but not yet active. Launch BMS and access the Theatre UI screen. Select the newly installed theatre and click OK.

Before doing anything else restart BMS (this step should now be automatic) A BMS restart is mandatory whenever you change a theatre. Documentation related to a third-party theatre should be located in the *\Data\Add-On TheaterName\Docs* folder.

3. Configuration

When first launching BMS a small menu window, the BMS Launcher, will be displayed allowing you to configure your install or launch another application.

To launch the game click on **Launch**. The **Configuration** option will allow you to change many of the options in the Falcon BMS.cfg file in your *User\Config* folder. The third line is a shortcut to the *\Docs* folder.
The next two options launch the **IVC Client** and **IVC Server**, if you need to run them stand-alone (IVC Client is launched automatically when you connect in multiplayer in the UI; IVC Server only needs to be run if you are planning to host IVC). Refer to the IVC section in the BMS Technical manual for more details.
The **RTT Client and RTT Server** link allows you to set up extracted displays for your specific configuration.
The **Avionics Configurator** is used to modify specific F-16 blocks. *Caution: they are set up by default as accurately as current code permits and any changes may result in you not being able to connect to a multiplayer server*. The **Editor** launches the BMS Editor and **Close** obviously closes the Launcher.
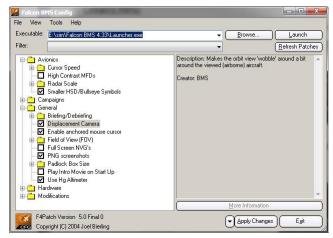
3.1 Falcon BMS Config

When selecting the Configuration option from the Launcher Falcon BMS Config is initialised. It allows users to change settings for Avionics, Campaigns, General, Hardware, Modifications and Multiplayer options.

To enable or disable an option simply check or uncheck it and hit the Apply Changes button when done. The right part of the window lists more detail about the setting.

Many users will probably find all the options they need in this Falcon BMS Config app.

3.2 Config Editor

For more config options open the Falcon BMS.cfg file located in the *\Users\Config* folder with a text editor.

Note: this is for advanced users who know what they are doing and know how to revert changes.
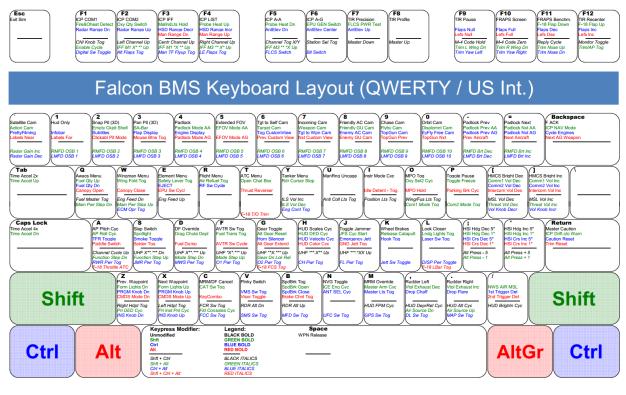
The config file is divided into multiple subsections. The first one is relevant to the changes made through the Falcon BMS Config app. Other sections such as Multiplayer, Weather and Miscellaneous are available.
In these extra sections all config commands are documented in the comment section.
Most of the config commands can be switched on or off with a 1 or 0, e.g.:

> *set g_bACMIRecordMsgOff 1*   disables the ACMI recording message.
> *set g_bACMIRecordMsgOff 0*   enables the ACMI recording message.

See the BMS Technical Manual for an explanation of all the config commands.

3.3 BMS DEFAULT KEYFILE MAP (US Qwerty keyboard)

The following graphics show the layout of the BMS - Full.key file designed for US QWERTY keyboard layouts. It is activated by default for new pilots and can be changed in the SETUP – CONTROLLERS ui. Please refer to the BMS Technical manual for more information. We offer also printouts for QWERTZ and AZERTY keyboard layouts. Check …\Docs\01 Input Devices\01 Keyboard Layouts\… in your BMS root folder.

Falcon BMS Keyboard Layout (QWERTY / US Int.)

(Keyboard layout diagram showing function keys, main keyboard block, modifier keys, UI functions, 3rd party software bindings, Num Block Layout, and Key Combo / Notes.)

Keypress Modifier:
- Unmodified — BLACK BOLD
- Shift — GREEN BOLD
- Ctrl — BLUE BOLD
- Alt — RED BOLD
- Shft + Ctrl — BLACK ITALICS
- Shft + Alt — GREEN ITALICS
- Ctrl + Alt — BLUE ITALICS
- Shft + Ctrl + Alt — RED ITALICS

Legend:
BLACK BOLD / GREEN BOLD / BLUE BOLD / RED BOLD
BLACK ITALICS / GREEN ITALICS / BLUE ITALICS / RED ITALICS

Space — WPN Release

UI Functions:
IVC Broadcast	F1
IVC UI Comms	F2
UI Exit / Abort	Esc
UI Screenshot	Print

3rd Party Software:
TIR Precision	F7	TS PTT	Scrl Lock	FRAPS Video	F9
TIR Profile	F8	TS Broadcast	Num *	FRAPS Screen	F10
TIR Pause	F9	TS Toggle Mike	Shft Num *	FRAPS Benchm.	F11
TIR Recenter	F12	TS Tog Speaker	Ctrl Num *	FRAPS Overlay	F12

Num Block Layout

(Number pad key assignments diagram.)

Key Combo / Notes

Key Combo set to: Alt C

L	-	Load Ckpit Deflts	S	-	Save Ckpit Deflts
P	-	Pilot Model	F	-	Frame Rate
D	-	Score Display	O	-	Online Status
H	-	HUD Rendering	Q	-	Camp Quick Save
R	-	Random Error	J	-	Recenter Joystick
T	-	Reload TrackIR	F1	-	Dev Location
F4	-	Dev Debug	F5	-	Dev Set Scale
F6	-	Dev Scale Down	F7	-	Dev Scale Up
F8	-	Dev Regen	F9	-	Dev Position

Note: Only the first 20 Key Combos are shown here (in order of appearence).

Own Remarks:

Note: This is the layout of an older version of BMS. The layout has been updated meanwhile.

3.4 BMS User Interface Setup

Once in the UI click on SETUP to enter the BMS configuration pages.

3.4.1 Commonly used page areas

Category menu

The Setup is divided into four main categories. This menu will be shown on each category page in the top left corner.

- SIMULATION

- SOUND

- GRAPHICS

- CONTROLLERS

Clicking on one of these buttons will bring you to the specific settings page. Simulation is the default page when entering the setup.

SETTINGS FOR

On each category page below the menu the Pilot's callsign is shown. This is the active pilot currently selected in the LOGBOOK. You can save settings for different pilots separately.

Save & Abort buttons

These buttons are also shown on each category page.

- CANCEL: Returns to main menu without saving.

- APPLY: Saves changes and stays on current page.

- OK: Saves changes and returns to the main menu.

3.4.2   SIMULATION page

The above screenshot shows the default settings

3.4.2.1 Skill Level and Rating

- Skill Level
  You can choose from five pre-defined skill levels: Ace, Veteran, Rookie, Cadet and Recruit. The realism rating shown underneath will change accordingly. Other realism settings will also change depending on your selection.

- Realism Rating
  According to your settings (either individual or by selecting a pre-defined skill level) the realism rating will be adjusted. The range goes from 0 (lowest) to 100 (highest) measured in percent.
  The pre-defined levels have the following ratings:

  - Ace   100%

  - Veteran   80%

  - Rookie   63%

  - Cadet   11%

  - Recruit   6%

These ratings are used to calculate your pilot rating in the Logbook; the higher the setting the higher the score which can be achieved. It affects your score in Instant Action, your Ace Factor and the number of Mission Points you achieve in campaign flights.

Settings for Smart Scaling, Radio Calls Use Bullseye, Display InfoBar, Display Radio Subtitles, User Messages and ACMI File Size will not affect the realism level.

3.4.2.2 Settings affecting realism

- Flight Model
Four flight model selections are available in the UI:

  ➢ Accurate uses the full Advanced Flight Model (AFM).

  ➢ Moderate invokes AFM without lateral asymmetry.

  ➢ Simplified is the original Microprose 'Accurate' Flight Model (OFM).

  ➢ Easy gives you the original 'Simplified' Flight Model.

  Obviously the default and preferred option is the Accurate AFM. The advanced flight model in BMS is believed to be unprecedented in PC flight simulators. It is based on a full physics model for air and ground operations. This is complemented by an implementation of the F-16 flight control system that is a faithful model of the actual system used in current inventory jets.

  Combined, these models create a completely different feel from any prior version of the F-16 in the Falcon franchise (or any other equivalent for that matter). There are a series of articles available on the web by the author of the code for these models and interested readers will find them a fascinating read. For everyone else, jump into the jet and enjoy!

- Air Refuelling
You can select one of three Air Refuelling options: Realistic, Simplified and Easy.

  With the Realistic option you have the highest workload. You need to keep an eye on your speed, height, position and closure rate, all at the same time. Once connected to the boom you must keep your aircraft within the boom envelope limits or the boom will disconnect.

  With the other two modes you can reduce the difficulty level to medium (Simplified) or low (Easy). While it is still your task to get the jet near the tanker the difficulty getting there and staying on the boom is reduced. Throttle or stick inputs are much smoother and the margin of error is much bigger.

- Padlocking
Padlocking can help you keep objects like aircraft, ground units or missiles in sight. You visually padlock (*note: this has nothing to do with a radar lock*) on an object. The object is shown in the centre of the screen with a small green box drawn around it.

  Padlocking max range is 8 nm. All objects within this bubble can be padlocked using the corresponding key commands. Objects with high priority (like incoming missiles) are picked up first, even if they are farther away than other lower priority objects, e.g.: enemy ground units. You have three options:

  ➢ Realistic: Padlock works only if the object is in your Field of View (you must look in the direction of the object).

> ➢ Enhanced: Objects can be locked when in range, no matter in which direction you look.

> ➢ Disabled: Padlocking is disabled.

- **Invulnerability**
  If checked, makes you completely invulnerable. Collisions with objects, the ground, or being hit by weapons cannot harm your jet. It may be useful for specific training, when used with ACMI recording.

- **Unlimited Fuel**
  If checked this option gives you unlimited fuel.

- **Unlimited Chaff & Flares**
  If checked you can drop as many chaff bundles and flares as you want. You are not limited to the specific amount of chaff / flares of the selected airplane.

- **No Collisions**
  If the checkbox is activated collision detection is turned off. This will prevent explosions caused by colliding with objects like buildings, other aircraft or parachutes. This does not apply to the ground which is still lethal if you hit it too hard.

- **No Blackout**
  If this option is checked G forces will have no effect and no GLOC will occur. This is true for both blackouts and red outs.

- **Labels**
  If activated all ground units, ships and airplanes will be shown with the relevant name floating near the object. This makes identification rather easy but will clutter up your screen.

3.4.2.3 Settings not affecting realism

- **Smart Scaling**
  Smart scaling is an option designed to compensate for the fact that we are looking at the 3D Falcon world at a relatively low resolution, with significantly lower visual acuity than in real-life. Even UHD (aka 4K) screens are very limited compared to human vision. Smart scaling is not linear and will increase the size of distant objects more than it will increase the size of close objects.

  Its use is strongly advised as the BMS smart scaling algorithms are based on scientific data from computer sciences studies about perception and the same effects are used in professional simulators.

  A config setting is allowing the user to define the distance from the user POV in nautical miles where smart scaling should begin. This helps correct an issue with smart scaling where objects too close were scaled bigger (for instance flying very close formation or taxiing on the ground, where tyres could be seen sunk in runways because of the scaling effect).

  g_fSmartScalingThreshold defaults to 1.0 which is 1nm. This means that SmartScaling will not begin until the object is 1nm away. You can make this value higher or lower, which will determine at what distance SmartScaling will begin (see the Config Options chapter in the BMS Technical Manual for further details).

The above picture illustrates smart scaling off (top) and on (bottom) at several different visual ranges.

- Radio Calls Use Bullseye
  If checked AWACS uses more realistic bullseye information instead of bearing and range. Note: AWACS will still switch to bearing and range if the target aircraft is within 25 Nm (default) of your aircraft.

- Display InfoBar
  Activating this option will display additional information about the current externally viewed object at the bottom of the screen. This feature can also be toggled with the "ToggleInfoBar" callback in 3D. Neither colour nor type of information displayed can be customised. GS refers to 'Ground Speed', while IAS is an acronym for 'Indicated Air Speed'. This feature only works in external views.

- Display Radio Subtitles
  By activating this feature it is possible to display the radio messages heard in the falcon universe. This feature is selectable in the configuration screen; however it can be momentarily toggled by pressing the 'ToggleSubTitles' key callback. By default a message will be displayed for 10 seconds and up to 10 messages will be displayed at the same time. New messages are added at the bottom of the display and move their way up as older messages are removed.

- User Messages
  When activated, user chat messages will be displayed while in 3d. Otherwise they will be ignored. The chat box is activated with the 'SimOpenChatBox' callback ⎡ **Shift t** ⎤.

- ACMI File Size
  In earlier versions of Falcon BMS you could define the maximum size of an ACMI file. This option is now removed in 4.36. Please refer to the ACMI chapter in this document for further details.

3.4.3   SOUND page

Radio Buttons

You can activate (green light shown) or deactivate the following options:

- Player Voice
  If activated (default) you will hear the pilot's voice when selecting an option in the comms menu while in 3D. It can be deactivated if you prefer (when using Voice Activated Commands for instance).

- UI Radio Chatter
  If activated (default) you will hear all global 3D AI radio calls while you are in the UI (2D map).

- Internal Sounds Outside Cockpit
  This enables or disables cockpit sounds (including Bitchin' Betty) while in external views. This is deactivated by default.

- Mask Breathing Sound
  This enables the Mask Breathing Sound when you enter the cockpit. However, it is possible to disable it either with key file input, or via the Oxygen Regulator panel switch.

Volume Sliders

With the sliders you can adjust the volume of the different sounds.

If a slider is put to the left side the sound is deactivated and will no longer be heard. The further you move the slider to the right, the louder the sound is played. A zigzag line is displayed showing the recommended settings. These are set by default.

- ENGINE INTERNAL
  Sets the volume of the engine heard when in the cockpit. If set too high the engine volume may overpower other important sounds such as Betty or IVC.

- ENGINE EXTERNAL
  Sets the volume of the engine when in external views.

- SIDEWINDER
  Sets the initial state of the MSL volume knob (AUDIO 1 panel) when entering the cockpit unless you have assigned an analogue axis, in which case the knob will always remain at the potentiometer position.

- RWR
  Sets the initial state of the THREAT volume knob (AUDIO 1 panel) when entering the cockpit unless you have assigned an analogue axis, in which case the knob will always remain at the potentiometer position.

- COCKPIT
  Sets the volume of the sound feedback in the cockpit, e.g.: when turning knobs, pressing buttons or using switches. It also controls VMS (Betty) volume.

- COMM1/UHF
  Sets the initial state of the COMM1 / UHF volume knob (AUDIO 1 panel) when entering the cockpit. When entering the cockpit with the Ramp Start option the position of the slider is ignored; the knob will be in the OFF position by default. Assigning an analogue axis to the radio volumes requires a potentiometer with an on/off button at the beginning of the course. That button must be clicked on for the analogue value to register.

- COMM2/VHF
  Same as above but for COMM2 / VHF knob.

- INTERCOM
  Sets the initial state of the INTERCOM volume knob (AUDIO 2 panel) when entering the cockpit unless you have assigned an analogue axis, in which case the knob will always remain at the potentiometer position.

  Unlike the real jet the intercom knob does not control intercom volume in BMS. It is used to control the volume of all sounds normally heard in the pilot's helmet. It allows the user to set the respective individual volumes to a desired 'mix' level and then turn it up or down relative to the rest of the background sounds (those normally not heard in the pilot's headset).

  Please note: COMM1, COMM2, Intercom, (and Trim knobs) now have proper 3D pit animation.

- SOUND EFFECTS
  Sets volume for all external sounds (outside view) except the external engine sound, which has its own slider. For the above sounds you can playback a sample sound for testing purposes by clicking on the speaker symbol. One click activates the sound, the second click deactivates it.

  Note: some sounds (e.g. INTERCOM) may initially play at maximum volume and you will need to move the slider to hear the sound at the correct volume level for the position of the slider.

- **EXTERNAL SOUND IN COCKPIT**
  When in-cockpit with the canopy closed, this slider will lower or boost the volume of external sounds

  Two tick marks are identified on the slider simulating the pilot wearing earplugs or not. In real life pilots tend to wear earplugs to minimise sounds from outside their helmet. Adjust the slider according to your preference:

  - Full Left   Practically mutes external sounds in cockpit (simulates the use of earplugs).

  - Centre   No extra effect (regular helmet without earplugs).

  - Full Right   Boosts (when possible) external sounds when in cockpit.

- **MUSIC**
  Volume of the background music played when in the UI.

- **INTERFACE SOUNDS**
  Sets the volume of the sound feedback when hovering the mouse over a button or slider in the UI.

Tip to adjust the complicated volume sliders:
The best way to set volumes up is the following method:

1. Set your Windows volume and headset/speakers volume as required (external to BMS).
2. Set your UI sound volumes to the default position (BMS UI).
3. Set all volume knobs to mid-range and run the MAL & IND LTS test in the cockpit. While the test is running set the master headset volume you want in BMS with the INTERCOM volume knob.
4. Set your COMM 1, COMM 2, MSL and THREAT volumes as you require them.

The above method gives you more fine control over the in-cockpit volumes rather than have them all at MAX volume, which is often counter-productive.

With the above method you can then decrease Betty sounds for instance with the INTERCOM volume and increase the relevant COMMS volume.

3.4.4   GRAPHICS page

- **Window**
  You can choose how the main window of Falcon BMS should appear. This affects both 2d and 3d.
  The options are:
  - Windowed
  - Borderless
  - Full Screen

- **Adapter**
  This drop-down menu will list all video cards installed in your computer. Select the one which should be used to display the game.

- **Output**
  If Full Screen is set under Window, the Display output (the monitor) on which Falcon BMS should appear. The Dimensions and coordinates of the output are given.

- **Resolution**
  You can select one of the resolutions in the drop-down menu. The resolutions here are the ones which are natively supported by your selected video card. The centred and stretched behaviour only applies when running in Full

  Screen mode. Note: The UI is limited to a resolution of 1024x768. If you do not run BMS in windowed or borderless mode, the UI is stretched to fullscreen.

- **Antialiasing**
You can select the Samples and Quality setting here. BMS simply enumerates the quality settings offered by the driver. BMS MULTISAMPLING is not an absolute setting which is the same on all machines; it is always driver dependent, so test yourself to see the trade-off between quality and frame rate.
For more modern graphics cards you may be better off switching it off in BMS and overriding Anti-Aliasing in AMD Catalyst Control Centre or NVIDIA Control Panel. Anti-aliasing may significantly affect your frame rate, so it is a good idea to experiment with the settings to find what works for you. Lower settings are usually better if you are finding your frame rate is lower than you want, especially at higher resolutions.

- **Vertical Sync**
Attempts to synchronise the frame rate to the refresh rate on your display, to avoid the tearing of images that may occur at higher frame rates, especially noticeable when you turn or pan your view around (using Track IR or similar). In BMS the options are on or off, for other options you will need to switch this off in the BMS UI and force it on in your graphics card control panel. Once again you are advised to test this yourself to find out which setting (BMS UI or driver setting) gives you the experience you are most comfortable with.

- **Triple Buffering**
Triple buffering generates a third frame in the frame buffer instead of just two. This makes sure there is always a frame ready to be displayed. It may help in conjunction with VSync. However, as explained above, you should find out the best setting for your system.

- **Object Detail Slider**
This slider controls the level of detail of various objects, depending on the distance. You have to be pretty close to an object to see its full details, if the slider is at the leftmost position. The further the slider is set to the right, the further the distance at which full details are shown.

| Object Detail level 7 | Object Detail level 1 |

- **HDR Bloom**
This slider controls the intensity of the sun's reflections on various surfaces.

Recommended HDR Bloom setting   Minimum HDR Bloom setting

- **HDR Blur**
  This option controls the intensity of the blur filter used for the HDR effect. Left is less intense and right position is more intense. The suggested setting is identified with a vertical mark.

- **Tree Density**
  With this slider you can control the density of autogen rendered trees. Setting the slider to the rightmost position will render the maximum, the leftmost position will disable autogen trees.
  The suggested setting is identified with a vertical mark.

| Tree Density maximum (rightmost) | Tree Density recommended (default) |

- **Grass Density**
  Same as above, just with grass. The suggested setting is identified with a vertical mark.

- **Pilot Model**
  This option when ticked enables the 3d pilot model by default. You can change that with key file input. By default ALT: c p (i.e. [**ALT** + **c**] followed by [**p**]) will toggle the pilot model on/off.

- **CANOPY CUES**
  Canopy cues give you a clue where you are looking in reference to the cockpit. When you no longer have the cockpit frame in sight you may become disorientated. To prevent this you can either choose Lift Lines, Reflections or both of them. Of course, due to performance issues it can be disabled as well.

  Lift Lines show arrows on the upper part of the canopy which point to the front of the cockpit. Reflections (pilot reflections and scratches in the canopy) can give you also a good clue about 'where your head is'. This is the most realistic choice at a cost of performance.

  - ➢ None   Displays neither Lift Lines nor Reflections.

  - ➢ Lift Line   Displays Lift Lines only.

  - ➢ Reflection   Displays Reflections only.

  - ➢ Both   Displays both at the same time.

Lift Lines

Reflections

- Season
  You can select one of four seasons directly or if it should be weather controlled. In this case it is automatically selected by the date and is depending on latitude.

  ➤ Weather Controlled (default)

  ➤ Summer

  ➤ Fall

  ➤ Winter

  ➤ Spring

  The different seasons are mainly processed through shaders, thus shaders must be activated to change the seasons; otherwise only tiles will change with seasons.

- Preview
  By activating the checkbox you can preview the effect of your recent changes to the graphics settings.

- Video Memory
  Displays the total available video memory on your system as reported by the driver (DedicatedVideoMemory + DedicatedSystemMemory + SharedSystemMemory)

Note: The max anisotropy can be restricted by the Falcon BMS.cfg file setting g_nAnisotropicValue, if needed, by setting it to 0, 2, 4, or 8.

3.4.5   CONTROLLERS page

- **CONTROLLER**
  Here you can select your primary input device. The primary input device is the one which controls the pitch and roll axis of an aircraft. All connected DX devices and the keyboard will be shown here.

  You should select the device you want to control the aircraft with, like your HOTAS or Joystick. Selecting other devices like MFDs or rudder doesn't really make sense.

  If you don't have an input device you can select 'keyboard'. This lets you control the aircraft with the keyboard. However this is not recommended.

  Please note: this will be the only device that plays any force feedback (FFB) effects (if supported).

- **JOYSTICK BUTTONS**
  Falcon will pick up the first 32 buttons on each controller (this is a DirectX limitation), but will only light the buttons in this screen in response to the first eight buttons pressed on the primary flight control device. However the text-readout below the keymappings should work for each button (described later).

  If the mapped device supports FFB it will be enabled by default and you should get immediate feedback (the 'gunfire' effect) on button presses.

- **Testing the axes**
  Falcon will try to auto detect your pitch, roll, yaw (rudder) and throttle axis if such devices are connected to your computer; if it succeeds, the respective bars will turn coloured and will start representing the current value of this axis. Do not worry if no axes are detected, or if Falcon picks up the wrong ones, you can configure this in the advanced controller screen.
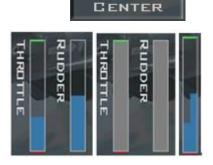
  You can test your primary input devices x- and y-axis and see if they respond correctly. The ball will move according to axis input.

  You can recentre your device by releasing the controller and pressing the CENTER button.

  If available you can also test the Throttle and the Rudder by moving the corresponding axes. If no input device or axis is found the bars will be greyed out. In case of using a dual throttle you see two axis instead of one.

  This is the POV hat symbol. When you move your POV hat the corresponding arrows are highlighted.

- **Set AB**
  You can set detents on your throttle axis to define the positions of the Idle and Afterburner detents (these detents apply to all engines when flying multi-engine aircraft in BMS).

  Just move the throttle to the desired position and do the following:

  ➢ Left-click on SET AB   =   Set Afterburner detent (green).

  ➢ Right-click on SET AB   =   Set Idle detent (red).

  By default no detents are set. Instead the markers are at the top (green) and bottom (red) of the axis. This means basically that no detents are defined. The IDLE detent obviously must be set lower than the AB detent!

  The idle detent is set when using the idle cut off option in the BMS config editor (hardware section).

  When enabled, the idle detent keystroke will be inhibited and the engine will start or shutdown as in the real jet according to the throttle position over the detent: engine start when moving the throttle from CUTOFF to IDLE and engine shutdown when moving the throttle from IDLE to CUTOFF.

  Since 4.36 you can also set the Idle / AB detents for up to 2 engines in game.

Setting up your keyboard and devices

On the right part of the screen you have different options to customise your keyboard assignments and device settings. In what follows we only describe the main features. For a full explanation of customising device and keyboard assignments please refer to the BMS Technical Manual, located in the *Docs* folder.

- Current Key file
  On top of the keyboard mapping area you see the currently loaded key file. By default this is the BMS - Full.key. Make sure you understand the link between this file and your HOTAS programming. Most likely you will program your HOTAS with keystrokes and the keystrokes in the game are dependent on the key file loaded. Both need to match for your HOTAS programming to work as expected.

- The keyboard mapping area
  Here you can find all functions and keyboard assignments contained in the currently loaded key file. You can press any key or controller button and you will see the key command / button number appear on the Input line (below the ADVANCED, SAVE, LOAD buttons) with its description underneath. Pressing a key will also jump the key map list to that key command.

| Input line on key press | Input line on device button press |

- Loading a key file
  If you want to change the key file click on the LOAD button.

  A new window opens and you can select a different file. After clicking on the LOAD button the new keyfile contents and assignments will be displayed in the keyboard mapping area.

  CANCEL closes the window without loading a file.

- Saving a key file
  If you have made changes to your key file you can save the changes by clicking on the SAVE button.

  In the new window you can either overwrite an existing file (a security query is shown) or just enter a different file name and select SAVE. As soon a key file is saved, it will become the new default one.

  CANCEL closes the window without saving a file.

3.4.6   CONTROLLERS page - Advanced options

You can reach this screen by clicking the ADVANCED button located beneath the keymappings.

This window has 4 tabs (categories) named VIEW CONTROL, FLIGHT CONTROL, AVIONICS CONTROL and AUDIO CONTROL. Before these tabs are described in detail, however, some words about analogue axis handling in Falcon BMS are in order.

- **General notes about axis assignment**
  BMS detects the analogue axes from all connected devices. They can be selected from a dropdown menu. You will only be able to map one in-game axis to one 'physical' analogue axis, so if you have already mapped the mouse wheel axis to the view zoom axis, you will not be able to use it to control FOV too!

- Axes Properties

  Axes in Falcon have three properties that may be configured in the UI by the user:

  Note: not all axes have these options.

  ➢ **Dead zone**

  A dead zone is a region around the centre position of the axis in which motion is ignored. The axis always reports '0' in a dead zone. Dead zones are symmetrical around the centre point of an axis.

  ➢ **2. Saturation**

  A saturation zone is a zone of tolerance at the minimum and maximum of an axis. An axis value within this zone is reported as the minimum or maximum value. The purpose of this is to allow for axes (usually of the cheaper ilk) that report values less (or greater) than their maximum (or minimum) value, even if their physical 'throw' is already at the maximum (or minimum). An example might be a throttle slider that just cannot report 100% thrust even at its maximum possible travel. Saturation zones are always symmetrical, that is the zones at the maximum and minimum ends of an axis are of the same size.
  You can set a dead zone or a saturation from a dropdown menu.
  Your options are the same as the dropdown menu for the deadzone: None, Small, Medium and Large.

  ➢ **3. Reverse**

  By activating this option you can reverse an axis. It then reports its minimum value while at its maximum physical travel and vice versa; useful for some configurations such as toebrakes.

➢ Axes Types

  An axis in Falcon can be of two types: 'unipolar' or 'bipolar'. The difference between the two is that a unipolar axis reports values in a non-negative range only, while a bipolar axis reports values symmetrically either side of the 0 value. Because of this, some axes (bipolar ones) may be configured to have dead zone and saturation zones, while others (unipolar ones) may only have a saturation zone.
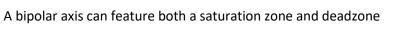
A bipolar axis can feature both a saturation zone and deadzone   A unipolar axis cannot have a deadzone

The throttle has a unipolar axis, while a classical bipolar use case is any of the flight control axes, like pitch.

Of course there is an exception to all this: the mouse wheel axis. As the mouse is per definition a relative device (it is not physically bound to a certain point – desktop size / mouse length-cable / radio-range does not count) the absolute coordinates have to be gathered 'in software', without using DirectX. So, neither dead zone nor saturation settings will apply to any axis mapped to the mouse wheel.

3.4.6.1 VIEW CONTROL Page

This tab controls the views in the Falcon world.

- Field Of View Axis
  This axis moves the field of view inside its specified minimum and maximum values. The initial Field of View is set with the Falcon BMS Config app (General Section) from 40° to 80° (default 60°). You can assign this feature to a keyboard shortcut, an analogue input, or the mouse wheel.

Left is default external FOV, right is maximum external FOV
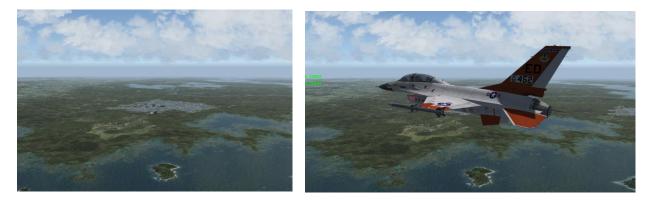
  When using the keyboard you must use the following callbacks: *FOVDecrease*, *FOVDefault* and *FOVIncrease*.

  When using an analogue input simply select it from the drop down menu. If you select an analogue axis the mouse wheel FOV control and keyboard callbacks will no longer work.

When using the mouse wheel you will be able to reset it to its default value by pressing the 3rd mouse button (usually the wheel itself). This axis works both inside and outside of the cockpit. If you have set the TrackIR Z Axis Vector Mode to "FOV Control" the analogue axis is inactive and the mouse wheel and keyboard commands will not work.

- View Zoom Axis
  This axis controls the zoom range when viewing an object. Naturally, it only works while in outside views. If this axis is mapped to the mouse wheel, you will be able to reset the zoom range to a default value (specified by the 3d model currently in focus) by pressing the 3rd mouse button (which is usually the mouse wheel itself).

Left is default external zoom, right is maximum external zoom

- Mousewheel Sensitivity Slider
  This slider lets you set the sensitivity of the mouse wheel axis (provided you have one).

- Mouselook Sensitivity Slider
  By manipulating this slider you can configure the sensitivity of the mouse view, both inside and outside of the cockpit. The further left the slider is, the less sensitive the view will be.

- Dynamic Head Sensitivity Slider
  Various flavours of Falcon have had 'dynamic head positioning' to simulate the pilot's head and body reacting to the forces of flight. In previous versions this was 'hacked in' and simulated. BMS' dynamic head now reacts to the real forces acting on the aircraft which are then are taken into account by the algorithms designed to better simulate the pilot's head and body reacting to those forces. This effect also works with TrackIR users and should not overly 'get in the way'. BMS also features buffeting effects with increased AOA that give a real sense of vibration on the airframe. The dynamic head effect can be either turned off or adjusted via a slider in the UI to give the pilot the choice of how much effect he wants to see. The buffeting effect is always present with the AFM Flight Model and cannot be turned off.

  Full left = off; Middle = normal effect; Full right = effect is doubled.

- Keyboard / POV Hat Panning Sensitivity Slider
  This slider lets you configure the panning speed when keyboard or POV inputs are used. The default sensitivity value is almost on the extreme left.

- Enable Natural Head
  Using this option will provide a more realistic experience when looking back at your six o'clock position as it will take into account the torso movement necessary to do so (valid with and without TIR).

- Clickable 3d Cockpit Default
  This checkbox sets the default mode of the 3D clickable cockpit. The 3D cockpit can be in one of two modes: clickable or pan-able.

  In clickable mode all mouse buttons are active and can be used to activate buttons in the 3D cockpit.

  When the mouse is placed over a hotspot the mouse cursor will appear according to the available functions.

  The left mouse button increments switches up and the right mouse button decrements switches down.

  The mouse wheel will rotate knobs: down will decrement the knob and up will increment the knob position.

  The mouse cursor is anchored to the hotspot position. To leave the hotspot you have to move the mouse slightly more than usual. If the mouse cursor is not on a hotspot position the default X cursor is shown:

  In the Falcon BMS.cfg file you have an option to deactivate this 'mouse cursor over hotspot' behaviour.

  set g_b3DClickableCursorChange 1   // Setting this enables the cursor to let the pilot know he is over a clickable area of the 3D pit

  If the value is set to 0 (zero) the mouse always uses the default cursor and will not anchor to the hotspot position.

  You have also the option to prevent the mouse wheel from turning knobs as described above. In this case (if set to 0) it changes FOV only.

  set g_bMouseWheelKnobs 1   // Allows mouse wheel to turn knobs in 3D pit

  You can also pan the view by pressing (and holding) the right mouse button (when not over a hotspot).

  In pan-able mode moving the mouse pans the view in the cockpit. The mouse buttons remain active but the mouse cursor is invisible until either mouse button is pressed. Cockpit functions can still be clicked as explained above but it is a bit harder to position the mouse over the hotspots.

  You can toggle between these 2 modes by pressing mouse button 4 (provided your mouse has one), or by mapping and pressing the ToggleClickablePitMode command.

  An additional note about the mouse: by default it is not mapped to any analogue in-game axis and the mouse wheel (if available) will send FOV-increase/decrease commands. The middle mouse button (in most cases the mouse wheel when pressed) will reset the FOV to its default value. Once the mouse wheel is mapped to an analogue axis, the middle mouse button will either reset an axis to its default value or just re-centre it.

- **Enable External Mouselook**
  Using this button you can enable mouselook mode in external views. Please note that it is not possible to invert mouse axis direction.

- **Enable Roll-linked NWS**
  This option helps you to steer your aircraft on the ground even if you don't have rudder pedals as an input device. The roll axis controls the steering of the aircraft on the ground.

  Note: if you have assigned a device to the Rudder Axis the Roll-linked NWS is deactivated, even if this option is lit.

- **Enable Custom Axis Shaping**
  This checkbox is a bit oddly placed since it is not really related to view control. By activating it you can tell Falcon BMS to ignore any dead zone and saturation settings and instead read the axis 'shape' from a file supplied by an external application.

- **Enable Force Feedback**
  This button allows you to enable or disable force feedback effects on your flight controller. This button will only light up if Falcon has detected a force feedback joystick as your flight controller, otherwise it will stay dark all the time. If you disable force feedback the joystick should still auto centre, i.e. emulate springs using its actuators, but it should not create any additional effects. The playback of the 'stall' Force Feedback effect is deactivated while the combat autopilot is active.

- **Enable 3D Cockpit TrackIR**
  You have to activate the Natural Point TrackIR software before starting up Falcon! If you fail to do so, the TrackIR related buttons will never light up and you will be unable to change TrackIR related options. Should initialisation fail, then the button will not light up but stay dark instead.

  Please note there are additional TrackIR configuration options in the Falcon BMS config applet. See the TrackIR chapter for a description of these options (currently TrackIR controls external view and TrackIR external view inverted).

  If you did not start the TrackIR software before launching Falcon, it is possible to wake it up once in 3D with the *ReloadTrackIR* callback. By default this is mapped to ALT: c t (i.e. [**ALT** + **c**] followed by [**t**]).

- **Enable TrackIR Vector**
  If enabled the TrackIR runs in 6DOF mode (default), otherwise in 3DOF mode.

- **TrackIR Z Axis Vector Mode**
  You can decide what the TrackIR z-axis should control: Z-Axis or FOV.

  ➢ Z-Axis: controls the natural pilot's head movement on the TrackIR Z-Axis (forward, backward). It has no 'zoom effect'. You can still use the mouse wheel or the keyboard callbacks to change the FOV.

Left: head back (Z-axis)   Right: head forward

> ➢ FOV: the TrackIR Z-Axis (forward, backward) controls the Field of View.
>   It has a 'zoom effect'. Neither mouse wheel nor the keyboard FOV callbacks will work.

Left: head back (FOV)   Right: head forward

Note: the two screenshots on the left were taken at the default (60°) FOV,
but what you will see at this FOV will depend on your screen resolution.

3.4.6.2 FLIGHT, AVIONICS, AUDIO CONTROL tabs – General information

These tabs provide a list of all available in-game axes. Depending of the nature of the axis, each of these axes may have one of the following controls:

- A dropdown box where you can select the physical axis you want to map it to.

- A 'value bar' (located to the right of the axis name) that shows the current value of the analogue axis.

- A dead zone dropdown box with 4 options: 'None', 'Small', 'Medium' and 'Large'.

  ➢ 'None' means exactly that, no dead zone is applied to the physical axis.
  ➢ 'Small' applies a dead zone 1% the size of the physical travel to either side of the '0' point.
  ➢ 'Medium' enlarges that size to 5%.
  ➢ 'Large' applies a 10% dead zone.

- A saturation drop down box that contains 4 options: 'None', 'Small', 'Medium' and 'Large'.

  ➢ 'Small' specifies a saturation zone size of 1% of the physical travel.
  ➢ 'Medium' sets 5%.
  ➢ 'Large' applies 10%.

  Please note: as a consequence of the 'one physical axis per in-game axis' rule, the availability of axes in the list boxes gets smaller the more axes you map. If you want to exchange the mappings of two axes you will have to temporarily map one of them to the keyboard, in order to be able to select it in the other list box.

The changes done in the Advanced Options screen are saved partly in the player options save file (with the extension.pop) and the axismappings.dat file, both of which are located in the *\User\Config* subfolder of your Falcon4 BMS install. Optional axis response curve information is stored in a file called axiscurves.cal.

BMS (actually DirectX) can be a bit unstable when more than one joystick ID is used. In previous versions if one of your joystick IDs failed to initialise before BMS was launched the software would consider that the relevant ID was not available and would change the configuration, overwriting the axismapping.dat and joystick.cal files from the config and making the new automatic configuration permanent. To make matters worse, if there was another joystick ID after the failed one then it would move up the ID list and take over the configuration left empty by the failed hardware. Obviously that messed up your configuration, which would need to be redone, or restored from a backup.

The axismapping.dat and joystick.cal files are now no longer overwritten automatically. When BMS initialises with a missing joystick ID the joystick configuration will still be messed up in that session, but unless you explicitly save the configuration (by changing the ordering and hitting the 'OK' or 'APPLY' button on the UI SETUP screen) you will recover the original configuration when you next start BMS, provided you fix the joystick ID issue that caused the problem of course. So if you realise you have such a problem when you get into BMS do not save the new configuration, exit BMS, fix the joystick issue and restart BMS. Everything should then be working as normal.

If you do make changes in the UI SETUP on purpose, these changes will only overwrite the axismapping.dat and joystick.cal files after the OK or APPLY button has been clicked. Note: these changes are directly applied in the current BMS session (even if you didn't hit OK or APPLY – like closing the UI window); they just aren't saved.

We still advise you to keep a backup of these configuration files, once you have everything set up to your liking. The axismapping.dat, axiscurves.dat and joystick.cal files in the *\User\Config* folder in particular should always be backed up.

3.4.6.3 FLIGHT CONTROL

- Rudder Axis controls the rudder (you cannot assign the mouse wheel to this axis).

- Throttle Axis controls the throttle (you cannot assign the mouse wheel to this axis).

- Right Engine Throttle Axis controls the right engine for multi-engine aircraft; the left engine is controlled by the default throttle axis (you cannot assign the mouse wheel to this axis).

- Trim roll, Trim Pitch and Trim Yaw control the 3 Manual trims (MAN TRIM panel on the left console). They do not control the stick trims, which must be declared through DX or callbacks on your side stick controller (joystick).

- Brake controls the toebrakes. If only single channel toebrakes are present then only the brake axis is declared.

- Right Toe brake controls the second channel toe brake; the default brake axis controls left toebrakes. Often both Brake and Right toe brake axes need to be reversed. Note also that with the new implementation of the JFS accumulator, the toe brakes axis should not suffer AT ALL from any miscalibration. The slightest off centre axis will start depleting the JFS, though.

- Pitch Axis and Roll Axis controls Pitch and Roll usually assigned to your main joystick: the side stick axis.

   Note: Since 4.36 both Throttle axis Pitch / Roll axis can be reversed.

3.4.6.4 AVIONICS CONTROL

- Radar Antenna Elevation controls the elevation of your radar antenna and is usually mapped to the ANT ELEV wheel of your HOTAS.

- Cursor X and Cursor Y are the radar cursors on the throttle.

- Range Knob is the MAN RNG wheel on the throttle.

- HUD Brightness controls the brightness of the HUD (top left ICP wheel). This is one axis that really benefits from an analogue input as it gives you much more control over the HUD brightness, which is often a problem in very bright conditions (like on top of brilliant white clouds).
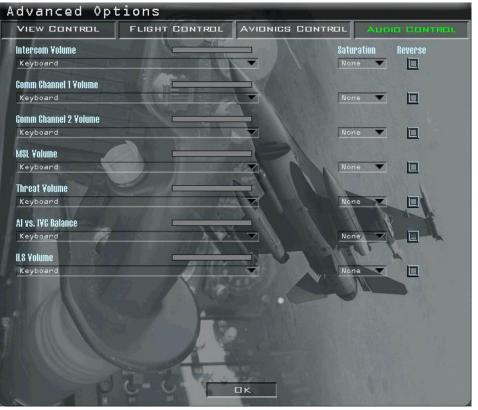
  Please note: if you do you must account for an ON/OFF button on the potentiometer to initially turn the HUD ON/OFF. That button will need to be programmed with the relevant callbacks.

- Reticle Depression controls the manual bombing pipper. It is the top right ICP wheel.

- HMS Brightness controls the brightness of the HMCS (Helmet Mounted Cuing System). It is located on the left auxiliary console under the gear panel.

  Please note: this axis also requires an ON/OFF initialising button to be programmed with relevant callbacks.

- HUD FLIR Image Brightness controls the FLIR on HUD brightness, which is the bottom left ICP wheel.

- HSI Course knob sets the course bug on the HSI. (normally an encoder)

- HSI Heading knob sets the heading bug on the HSI. (normally an encoder)

- Altimeter knob sets the air pressure (either in hPa or inHg, depending on your config settings).

3.4.6.5 AUDIO CONTROL

- Intercom Volume controls the master volume of all sounds normally routed to the pilot's headset. The INTERCOM knob is on the AUDIO 2 panel on the left console.

- Comm Channel 1 & Comm Channel 2 Volume controls the volume heads of both the COMM1 (UHF) and COMM2 (VHF) UFC radios. Both knobs are located on the AUDIO 1 panel on the left console.

  Note: both axes need the ON/OFF initial button to power the respective radios.

- MSL Volume controls the MSL (sidewinder growl) volume (AUDIO 1 panel). *No button required; when assigned to an analogue input the volume will remain set at the potentiometer position whenever you enter the cockpit.*

- Threat Volume controls the RWR volume (AUDIO 1 panel). *No button required; when assigned to an analogue input the volume will remain set at the potentiometer position whenever you enter the cockpit.*

- AI vs. IVC Balance is a volume control that is not present in the real jet. Most of the time it is assigned to the BUP UHF volume control (BUP UHF panel, left console). It is useful in some situations where you want to boost the IVC (human) against the AI volume or vice versa.

- Unlike the real knob, this 4.35 newly implemented volume control does not control the volume of the localizer identification signal as this one is not implemented but the volume of the markers.

4. Weather Control

Weather can be set for TEs and campaign. The menu is accessed through the Weather icon on the UI.

Weather in BMS can be Deterministic, Probabilistic, or based on a Map Model (Fmap).

There are four basic weather types available in BMS: Sunny, Fair, Poor and Inclement.

The WEATHER tab controls how the weather changes from one type to another. With the next 4 tabs the TE designer can control atmosphere (temperature and pressure), turbulence, wind and clouds (visibility, high clouds, low clouds and contrails) for each weather type.

New in 4.35 is the possibility to set the date of flight and get the corresponding time (in Zulu and local time) for the sunrise and sunset which is an important factor of your mission.
By default the date is set for April 15th, 2004. If you want to change that to another day, simply input the relevant date and click the SET DATE button. Don't forget to click the SET DATE button, simply inputting the date does not update the sunrise/sunset times. You should then see the sunrise and sunset time adapted to the correct time in Korea for that day. You can also set the date to 'today'. This is a new feature in 4.36. Based on the date the season is calculated:

The different settings of the different weather models (Probabilistic, Deterministic, Map Model) are described later in this chapter.

4.1 Atmosphere

The ATMOSPHERE tab allows you to set temperatures and local pressure (QNH) at night, dawn and day for each of the 4 weather types. Since 4.36 temperature defaults and the season are now dependent on the latitude of the theatre.

Atmosphere is characterised by temperature, pressure and density of the air mass. As you know they all decrease with altitude up to a certain point at least (explaining what happens above that point is outside the scope of this manual). Atmosphere in BMS follows the ISA standards for the most part: 15°C on ground 1013.2 hPa (Mb) and a dry adiabatic lapse rate of -2°C per 1000 feet and -1Mb by 30 feet of altitude.

Pressure and temperature vary according to time of day and weather type. They reach minima at sunrise and maxima around 4pm. Temperature and pressure both have a further impact on air density which affects flight performance.

- Low pressure / high temperature will decrease performance
- High pressure / low temperature will increase performance

Pressure given in the atmosphere tab is the mean sea level pressure expected for each of the weather types according to time of day (QNH).
It must be dialled in the altimeter pressure window for the altimeter to give the correct altitude. It can be obtained in cockpit via the ATC menu: REQUEST QNH or by listening to the ATIS. An altimeter set on QNH on the ground at a specific airport will give the elevation (height above MSL) of that airport.

Note: Altitude = Height + Elevation

Please note, when using the Map Model, the Atmosphere tab is blanked as all the weather settings are embedded in the Fmap.

4.2 Turbulence

The TURBULENCE tab has been seriously simplified from the many settings we could input previously. Truth was you really need to have a degree in meteorology to be able to set turbulence correctly. Not anymore. All you need now is to adjust the slider between light and severe turbulences for 3 layers:

Troposhere: (surface to about 36000 feet)

Clouds: This slider sets the level of turbulences you may encounter in cloud layers in poor or inclement conditions.

Low level refers to the layer in contact with the ground (surface to 2000 ft) where mechanic turbulence may happen due to friction and convective turbulence may happen because of the different temperature of the ground type from the air (forest, water, plains,...).

4.3 Wind

Independent from the way the weather will change, the wind can be set to deterministic or probabilistic.

When probabilistic the system will randomly assign a wind direction. It provides randomness in runway use as the ATC will choose a suitable runway according to wind direction. The information can be obtained from the ATC or ATIS once in the cockpit.

When set to deterministic the wind blowing from can be set in degrees. The TE designer can set the wind direction and therefore force runway use by the ATC. Please note wind is inputted as always in aviation from the heading it blows. For instance 320° means the wind is blowing from 320°.

Wind speed can be set for all 4 weather types according to time of day.

Wind burst is also controllable with more parameters.

- Interval and duration in seconds are self-explanatory.

- Speed is the speed variation from the nominal setting for that weather type set above in the window.

- Direction is the delta difference from the general wind direction (known in deterministic model, unknown in probabilistic model).

Please note, when using the Map Model, the WIND tab is blanked. All of the wind settings are embedded in the Fmap.

4.4 Clouds

The CLOUD tab controls visibility, high and low cloud and contrail layers. The cloud model has been totally updated in 4.34. Clouds are shared in multiplayer which means that all players should see the same cloud cover throughout the theatre.

The Cumulus coverage slider defines ceilings in octa. The second slider (Congestus/Humilis) changes how dense the cumulus clouds appear. The left position of the slider will create big thick cumulus clouds; the further the slider is placed to the right the more cotton-like the Cumulus cells will look with many smaller scattered cumulus clouds.

Visibility under cloud cover can be set for each weather type with a slider changing from zero (no visibility) to 60 km visibility. Note: all visibility values have been switched to metric since 4.34.

6 types of clouds are now modelled: 3 from the lower atmosphere; Cumulus (fair weather), Stratocumulus (poor conditions) and Nimbostratus (inclement conditions) and 3 from the upper atmosphere: Cirrus (sunny conditions), Cirrocumulus (fair conditions) and Cirrostratus (poor and inclement conditions).

The LOW CLOUD LAYER tab controls the base elevation of the lower clouds while the HIGH CLOUD LAYER tab controls the elevation of the upper cloud layer in the different weather type. This value defines the base of the cloud layer in feet MSL.

The last setting possible to change in this tab is the CONTRAIL LAYER altitude. Contrails are the visible condensation of hot (but cooling) air exhaust at high altitude. They are often a tell-tale visual sign that will give your position away to the enemy. The altitude from which contrails will be generated can be set in the contrail layer box for each of the 4 weather types.
Please note, when using the Map Model, the CLOUD tab is blanked. All of the cloud's settings are embedded in the Fmap.

4.5   Probabilistic weather

The WEATHER tab allows the user to define how the BMS weather changes from one model to another. Options are Probabilistic, Deterministic and Map Model.

Probabilistic type starts with a user defined weather state which will change according to different parameters. The probability of the weather change will follow the set time interval and the percentage of each weather type allowed. This type of weather will induce some randomness but is valid for the entire theatre. There is only a variation with time, not with location.

4.6   Deterministic weather

Deterministic type allows more precise control of when the weather type will change. It starts with an initial weather type running from TE start time to the first shift. The TE designer can define 5 subsequent shifts at specific mission time (day and local time). Minimum time between two shifts is 30 minutes.

It is advised to apply real world logic when shifting weather. Do not shift from sunny to inclement but rather go through the intermediate types (fair and poor) to allow a better transition from one weather type to another type. The transitions in 3D will be much smoother if you do so.

As with probabilistic weather the changes are active for the entire terrain and vary only over time and not location.

When your weather is set up how you want, save it with the SAVE WTH button. The TE needs to be saved first so a TE name exists. Weather is saved in the same \Data\Campaign\Save location as other TE files in a .twx file with the same name as the TE.

Default weather can be saved in a new log profile: nickname.dat. Save a weather profile with the PROFILE S radio button and load profiles with the PROFILE L button.

4.7   Map Model

Map Model has been refined in 4.34.
It still uses the same 4 weather types (Sunny, Fair, Poor and Inclement – for which 4 default Fmaps are available), but unlike Deterministic and Probabilistic models, it allows weather to change not only with time but also location in the BMS theatre.

Select Map Model from the WEATHER tab. Initially the UI will state in red that there is no map loaded. To load a map, simply click on one of the ready-made maps in the list below. As soon as you click the map the UI will load the map and confirm in a small window that the map has been loaded. The loaded map text will turn green and display the name of the map saved.

Default maps are stored in the usual \Data\Campaign\ folder with the extension .fmap.

Once a map is loaded there is no need to save the weather if you intend to fly the mission immediately. If you hit the SAVE WTH button, 2 weather files will be saved alongside your TE:

- A .twx file is the weather file that contains all information on weather not included in the Fmap.

- An .fmap file which is a copy of the loaded map.

With these two weather files the TE can be shared and will load the same initial weather settings.

The weather settings now embedded in the map model include for each cell type (sunny, fair, poor and inclement):

- Weather type.
- Pressure.
- Temperature.
- Wind heading and speed, including wind-aloft parameters.
- Cloud lower layer base altitude.
- Cloud upper layer altitude.
- Cumulus coverage and size.
- Visibility.

As with real air mass and weather cells, the map model can move over the entire BMS theatre.

Previously, this direction and speed was setup directly in the UI. Since 4.34 the move of the airmass is embedded in the Fmap.

Fmaps allow TE creators to generate extremely complex and realistic weather scenarios. You can now transition from a sunny sky with low-lying fog in the morning to a thunderstorm front in the afternoon.

Fmaps can be created with Weather Commander, used mainly for creating artificial weather scenarios which might be suited to a particular mission. On the other hand, the Fmap model will really shine in its new complexity when using real world (Grib) weather data. F4Wx is another application, available via the BMS forum, which is able to convert real-world weather into BMS Fmaps. See the BMS Technical manual for more information on how to create Fmap with these tools.

Please note: when a cell disappears at the extremity of the terrain, it is automatically generated with the same local parameters at the other side making the weather movement perpetual. This feature ensures that the weather over a particular spot can change according to the direction and speed of the map model. An airbase could be in fair weather at time of departure and in inclement weather when the flight is scheduled to land.

BMS recommends use of Map Model weather rather than the deterministic or probabilistic models that may disappear in future updates. BMS ships with a selection of ready-made Fmaps. We hope that more Fmaps will be created alongside TEs and shared within the community.

Maps are shared by the host at multiplayer connection, so every player gets the same weather.

4.8   Weather reports

The briefing page now displays a weather report with predicted weather at take-off and over the target at TOT and at landing.

Always check the VHF ATIS frequency as you near your airbase to get the latest weather and conditions.

WEATHER:			
Conditions@	TAKE OFF:	TARGET AREA:	LANDING:
SITUATION:	Poor	Poor	Poor
WIND:	55deg@ 4kts.	38deg@ 5kts.	55deg@ 4kts.
VISIBILITY:	22km	11km	22km
TEMP:	14deg C.	15deg C.	14deg C.
CLOUD BASE:	6,000 ft MSL base	8,000 ft MSL base	6,000 ft MSL base
CON LAYER:	33,000 ft MSL base	33,000 ft MSL base	33,000 ft MSL base

5. Data Transfer Cartridge

Flight planning is done in briefing rooms and once in the cockpit pilots load the data created during mission planning into the aircraft's systems. This is done with the Data Transfer Cartridge.

The DTC is inserted into the DTU (Data Transfer Unit) and loaded through the DTE MFD page with the LOAD button. Each label on the DTE page will highlight briefly as the corresponding settings are loaded into the jet.

Defining the flight planning is mostly done automatically in the UI but can be modified by the user through the DTC part of the UI. The list of DTC elements you can edit in the UI includes:

- **Precision Target steerpoints** - stored in STPTs 1-24 and 81 to 99

- **Weapon targets** - for Spice bombs (not related to target steerpoints)

- **EWS & Chaff/Flare settings** - burst quantity, burst interval, salvo qty, salvo interval, BINGO, REQJAM

- **MFD setup per Master mode** - A-A, A-G, NAV, DGFT, MSL OVRD

- **UHF frequency presets 1-20**

- **VHF frequency presets 1-20**

- **IFF plan**

- **Bullseye position** – stored in STPT 25

- **LINES -** stored in STPTs 31-54 – 4 groups of 6 STPTs each

- **Pre-planned threats** - stored in STPTs 56-70

- **HARM Threat Tables**

5.1 DTC Operation

After opening a TE or campaign mission, stop the clock. On the right-hand side of the UI map, there is an icon which opens the DTC. There are 5 tabs as seen below. Note that the DTC window can only be opened while you're in a TE or campaign mission and **not** in the TE Editor.

DTC settings are saved automatically (or manually through the DTC icon in the mission editor).

The data saved to the DTC is spread across two different files:

- Pilot relevant information is stored in the callsign.ini file (located in your \User\Config folder).

- Mission specific items are saved in the TEmissionname.ini file (in the \Data\Campaign folder).

5.1.1   Common Buttons

There are 3 common buttons on all the DTC tabs: CLEAR, LOAD and SAVE.

- CLEAR clears the entire callsign.ini file.

- LOAD loads the callsign.ini file.

- SAVE saves any changes you've made to it.

- RESET loads the default DTC settings for that tab.

If you select LOAD, move to a different tab and it appears that the fields (example MFD Modes) did not load, hit the LOAD button again and the fields should populate.

Next to the CLEAR button is a status message. After opening the DTC for the first time, it will say 'Ready'. After loading it will say 'Loaded OK'. A save will show 'Saved OK'.

5.1.2   TARGETS

Since 4.34, the target tab has been split in two:

- Target Steerpoints are used to assign a target identified in the Recon window to a specific steerpoint. The pilot may save these targets as precision steerpoints in STPT 1 to 24 (these are usually the INS flightpath steerpoints), or use another bank independent from the INS steerpoints from STPT 81 to 99.

- Weapon Targets are not related to target steerpoints and are only needed for a limited number of weapon types like SPICE bombs. 100 weapon targets can be saved (see the Spice training mission on how to use them).

The most used feature will be assigning one or two target steerpoints into your INS flight plan (of which one steerpoint is most of the time assigned to a single target). There are two ways the pilot can go about using this feature depending on the pilot's needs and the needs of the mission:

One Pass, Haul Ass

If the mission has only one target (for example a fixed SAM site), generally the (TE) mission builder or the campaign ATO manager will have one TGT-type steerpoint in the flight plan at the target area. Let's assume you are part of a 4-ship assigned to destroy this site. The SAM site has its associated radar (in this case a Fan Song) and a number of TELs (Transporter Erector Launchers) that will be targeted by each member of the flight. Choosing targets using the RECON > TARGET LIST feature makes it easy for each pilot to get an accurate latitude and longitude of their individual target without having to write down the coordinates and reprogram their TGT-type steerpoint in the jet. The following procedures are used to accomplish this.

1. Close the DTC if it is open and then recon the target area. Let's assume that STPT #5 in your flight plan is the TGT-type steerpoint at the SAM site.

2. Select the target you are assigned; in this case the Fan Song B. Use the decrement/increment ◄► arrows to select STPT #5. Press the ACCEPT button to save the exact LAT/LONG of the Fan Song into STPT #5 for your jet. The highest you can select is STPT #24 in the first bank. But you can also assign STPT 81 to 99 if you wish to have extra targets steerpoints outside of your INS flight plan bank.

3. Open the DTC once again. Using ◄► arrows next to the Target Steerpoints text, increment until you hit STPT #5. It should list the target you assigned to it along with the exact coordinates.

4.   Next, to save the assignment hit the SAVE button. Now you have a very precise lat/long of your specific target and no steerpoint reprogramming in the cockpit is required.

Multiple Targets, Multiple Passes

If the mission has more than one target, and/or you are required to make multiple passes on a target, the following technique can be used to assign the targets.

For this example, let's assume you are on a search and destroy mission looking for ground movers and your flight route has a total of 9 steerpoints. Steerpoint 10 is probably the alternate recovery base. Depending on how the TE mission was built or how the ATO went about setting up the steerpoints may vary. The campaign ATO probably set up two TGT-type steer points separated by some distance. We will assume you see some targets in the vicinity of these two steerpoints which leaves you with some options. You may click and drag one or both of your STPTs to get closer to these targets and then use the method described above to reprogram those two steerpoints so they are more accurate. Alternatively, you can leave your two TGT-type steer points alone and assign another steerpoint or two independent of your flight plan (of which the two TGT-type steer points are a part).

You have therefore 2 choices: either you use the steerpoints not assigned to your INS flight plan (11 to 24), or you use the newly implemented target steerpoints (81 to 99).

Obviously the ideal candidate for this scenario is to use the target steerpoints 81 to 99 and leave your INS steerpoints alone.

Once you get to your area of responsibility, you would simply call up whatever steerpoint(s) you assigned and then attack your own target(s). These steerpoints are represented by default on your HSD with a large white cross.

Planning for more precision steerpoints might be useful when you plan to manage all your AI wingmen and direct them to attack your target through the flight/element/wingman communications menu.

Say you are leading a 4-ship and want each wingman to attack two targets; you will therefore need 6 precision steerpoints to direct them to in sequence.

5.1.3 EWS

The Electronic Warfare System allows the pilot to set up his ALE-47 CMDS (Countermeasures Dispenser Set) to meet the threats expected. There are two drop-down menus on the EWS tab. The first is for setting up a Chaff or Flare program and the second is for the specific program in which you are making the assignment.

Remember each chaff/flare program (1-6) may dispense chaff or flares, or both. A good rule of thumb is to program each of the 6 for a specific purpose with maybe even some overlap in case you have a particular program selected designed to counter only a radar threat but then an IR threat suddenly emerges.

For example:

- Program 1 could be a chaff only program designed to counter a radar threat (SAM or AI).
- Program 2 could be designed to counter a radar threat as well as IR missiles that may come your way.
- Program 3 could be used to counter a radar SAM with chaff only.
- Program 4 could be used to counter both a radar SAM and IR SAM threat.
- Program 5 (slap switch) could be used to counter both radar SAM/AI and an IR threat.
- Program 6 could be something like a flare-only air-to-air merge program designed to defeat an IR missile during the visual merge.
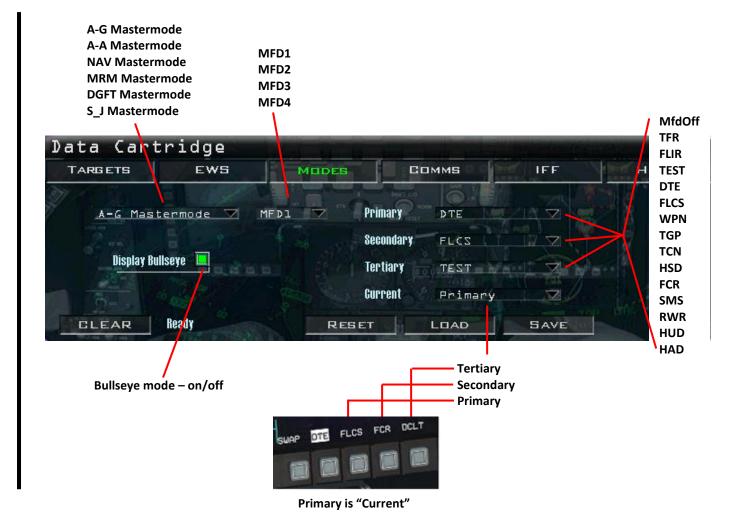
The bottom line is the pilot should come up with programs that meet his needs.

After programming all 6 programs (if desired), hit the SAVE button to write the changes to the callsign.ini file.

5.1.4   MODES

The MODES tab allows the pilot to customise his MFD setup for each Master Mode. To accomplish this follow the steps below or use Weapon Delivery Planner:

1. Choose the master mode from the first drop-down menu, then select which MFD you are configuring. MFD1 is the left MFD and MFD2 is the right MFD. MFDs 3 & 4 are for possible use with non-F-16 cockpits. You don't need to set them when you don't use them.

2. As in the picture below, select each MFD page you want for the Primary, Secondary and Tertiary slots for each master mode and MFD. Most of the labels are self-explanatory. MfdOff is a non-utilised MFD page slot (i.e. blank page). Define which will be displayed first upon master mode selection by setting the "Current" option (Primary, Secondary, Tertiary).

3. Select a different master mode and go back to MFD1 (or you could leave it on MFD2, it does not matter – just make sure you remember to set MFD1) and repeat the process.

4. Program all master modes as desired. Once completely done, hit the SAVE button.

A-G Mastermode
A-A Mastermode
NAV Mastermode
MRM Mastermode
DGFT Mastermode
S_J Mastermode

MFD1
MFD2
MFD3
MFD4

MfdOff
TFR
FLIR
TEST
DTE
FLCS
WPN
TGP
TCN
HSD
FCR
SMS
RWR
HUD
HAD

Bullseye mode – on/off

Tertiary
Secondary
Primary

Primary is "Current"

5.1.5 COMMS

The COMMS tab allows the pilot to set up the UHF and VHF radio presets. A full understanding of the Aircraft Radios section is required to use the COMMS tab to its fullest capabilities.

Working left to right, the 'Band' drop-down menu selects the radio you want to configure: UHF and VHF. The 'Preset #' has numbers 0 through 20 available.

Preset #0 for both UHF and VHF is direct frequency entry if designated as default via 'Default' checkbox. In other words, preset 0 is a placeholder for the radio to set up entered frequency when you enter the 3D world when you also flag preset 0 as the default; put another way, you can put a frequency in preset 0 and make that the default and thereby have the radio pre-tuned to something other than one of the normally selectable presets (i.e. 1-20) as you enter the 3D world. It might be useful for instance if your VFW has its own dedicated Ops frequency (not the new airbase OPS frequency).

In the picture above **Preset** #3 is set to **frequency** 269.5 which by the comm plan is the departure airbase tower frequency.

The '**Default'** checkbox defines which preset will be active after a DTC load (by default it is preset #1 for departure airbase OPS frequency. But the user can change that to any preset.

The '**Frequency'** field allows the pilot to manually type in a valid UHF / VHF frequency to be assigned to a given preset.

The **RESET** button will reset all presets in both bands to their default frequencies.

The **PRINT** button will print your UHF and VHF presets/frequencies to a text file located in your *User**Briefings* folder. The file is independent and named dtc_comm.txt. Unlike the briefing.txt file this file will never be appended.

The **COMM PLAN** button will load the full briefing COMM plan into your DTC comms section which is done by default. But if you have changed the DTC manually and want to revert to the briefed comm plan, just press this button.

The comment window is quite subtle but the area in the screenshot on the previous page may be edited by the user to display more relevant information than the default comments.

It currently says DEP tower but it can be replaced by Yechon tower for instance:

This can be useful for complex communication plans as mentioned in the Aircraft Radios section. After making a text assignment, use the ◄► arrows to select a different preset in order to store the text in memory *before* you hit the PRINT button. If you do not, the text will still say 'No Comment' on your printout.

Here is an example of the briefing.txt file after having printed the COMMS DTC:

```
--------------------------------------------------------
BRIEFING RECORD generated at 12/28/2018 11:11:02.
UHF
===
Preset-#   Frequency   Comment
  1         236.075     Yechon ops
  2         234.500     Yechon ground
  3         269.500     Yechon tower
```

Similar to the other DTC procedures, after changing a frequency or setting a tower click on SAVE.

It should be noted that unless the pilot has a very specific reason or need to change the default frequencies (like for Team vs Team events), it is recommended to use the defaults, especially with a complicated comms plan.

5.1.6   IFF

The IFF tab has been created for 4.34. Advanced knowledge of IFF settings is required before changing the DTC settings. Please refer to the IFF chapter in the BMS Dash-1 for detailed information about how to use the IFF in BMS.

The IFF plan is defined by default by the code but can be defined by the user through the editing of the TEmissionname.iff file. See the BMS Technical manual for the structure of the IFF file.

Either the default IFF plan or the user IFF file will set the DTC automatically. If no IFF file was created, the default will be used. If a specific IFF file exists, it will be used instead.

Basically, the user does not need to create a IFF policy on his/her own. Nevertheless, the option is possible by changing IFF options on the DTC IFF tab.

In case you need to revert to the initial IFF policy plan after some changes, just click on the IFF plan button and the IFF policy from the briefing will be copied back into your DTC file.

Initial codes for Mode 1, 2, 3 are displayed on the left and can be changed as long as valid codes are inputted. Mode 4 default initial key (A or B) can be changed and Modes can be set active or inactive by enabling or disabling the checkbox. Mode C (pressure altitude) and Mode S (eye candy) can be enabled as well.

Events can be set to either POS for Position, TIM for Time, or P/T for both Position and Time as in this example.

Two Position events may be declared. These normally correspond to the PUSH point and the SPLIT point of the flight plan, making three distinct legs of each flight:

1. The take-off to push point: the flight is in friendly territory.

2. The push point to target to split point: usually the ingress in enemy airspace.

3. The split point to landing point: usually the egress over friendly territory.

Position points must be declared in a cardinal direction from a specific steerpoint as seen in the picture above. In the example the first POS event will occur North of STPT 03 (the push point) whereupon the only active mode will be Mode 4.
Up to 12 TIME events may be declared. Each must have a ZULU hour at which the change will be made and again the modes that are set to change with the event. In the picture above, the TIME event will happen at 22:30 and Mode 1 will change to code 30, Mode 3 will change to 5330 and Mode 4 will change to key B.

5.1.7   HARM

With 4.36 a new HARM tab was introduced. Here you can specify which threats should be loaded in the tables (TBL1, TBL2, TBL3) by entering the ALIC codes, pre-define modes and the tertiary table.

If you start BMS for the first time the ALIC codes in all tables are set to '*0000*'. This is because no defaults are set as the threats highly depend on the mission.

Once you enter ALIC codes and populate the tables the codes will remain for the next mission once you save the DTC. The data is stored in your pilot.ini.

You can also set the initial **DELIVERY MODE** (HAS, POS), the initial **POS SUBMODE** (PB, EOM, RUK) and the initial **TER** (tertiary) **TABLE** (TBL1, TBL2, TBL3, TBL0).

The below picture shows a small excerpt of the ALIC codes for the SA-2. A full list can be found in the Dash-34, AGM-88 HARM chapter.

SAM SYSTEM	ALIC CODE	SYMBOL	FCR	ALIC CODE	SYMBOL	EWR	ALIC CODE	SYMBOL
SA2	102	"2"	FAN SONG	202	"2T"	SPOON REST	402	"2A"

Depending on your mission it is possible to enter ALIC codes of interest. The example below shows the codes for the SAM System (*0102*), SAM FCR (*0202*) and the SAM EWR (*0402*) for the SA-2 in TBL1. If you don't want pre-defined ALIC codes in the tables you can fill the fields with 0000 or leave them even blank. Of course you can change the codes during the flight. The fields except 4 digits. But you can also just enter the 3-digit ALIC code. So, there is no need to enter a leading '*0*'.

Note: You can change the ALIC codes and pre-defined modes in WDP also.
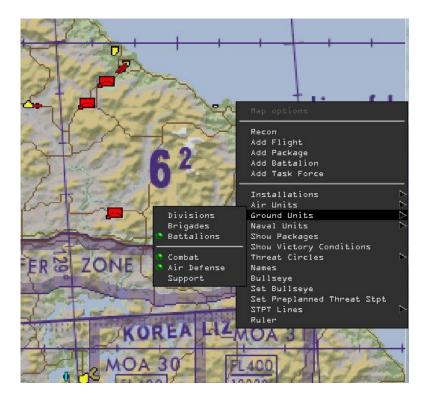
5.1.8   DTC Steerpoints

As the name implies, Preplanned Threats (PPTs) are exactly that – threat systems the pilot plans for during mission planning that could be of harm to him. PPTs are effectively steerpoints with additional information associated with them. This information includes latitude, longitude, elevation, threat system (e.g. 2 for SA-2) and a maximum effective range for that threat in nautical miles.

Since PPTs are steerpoints, the pilot may select a PPT and navigate to it. Up to 15 PPTs can be used at one time and they are stored in steerpoints 56-70. The UI map and DTC are used to store and load PPTs prior to committing to a mission.

How to set up Pre Planned Threats points (PPTs)

1) First, it is important to set up the DTC options (EWS, Comms, etc) the way you want them using the methods described above. After you have done this, you should not have to change them very often.

2) Next, turn on Ground Units ► Air Defences to see what SAM systems are out there that you may want to assign a PPT to. Right-click on the map somewhere and browse to the following:

3) As seen above, several Air Defense systems popped up on the map. The system to the west is an SA-6 system. We will assign it as a PPT. To the northwest is an SA-3 and to the north-northwest is an SA-2. This example will use the SA-6.

4) Right-click on the map in the vicinity of the SA-6 (not directly on it or you won't get the correct menu) and select 'Set Preplanned Threat Stpt'. A blue diamond-looking symbol should appear with the PPT number below it. The picture on the right is a zoomed in view. You will want to zoom in as much as possible and drag the PPT directly over the top of the SA-6.

5) After dragging the PPT over the SAM, right-click on it and choose 'Status'. A box will pop up. This allows you to choose what kind of threat it is, in this case, an SA-6.

6) Select the threat and hit Accept. It will report the threat's radius and lat/long. It will also draw a red range ring (by default) on the UI map and label the PPT icon.

Since 4.34 colour and width of the ring are user configurable via 2 new config settings in BMS config:
g_sPPTRingColor sets the colour of the ring (default red).
g_nPPTRingWidth sets its width (default 1 pixel).

More information about the BMS config options can be found in the BMS Technical manual.

7) If you make a mistake or you want to change this PPT to another threat, just right-click on it and choose Status. Change it to the threat of your choice. Be aware that if you are zoomed out too far and/or you place the threat right on top of the SAM, you may have a little difficulty doing a Recon on it. If you position the cursor just right, you should be able to do a Recon, or just do a Recon very close to it and you should be able to select the SAM from the list. It is recommended that you do a Recon before assigning a PPT to avoid this little hassle.

8) Repeat the above process as necessary for any other threats. Remember you don't have to go crazy and assign every SAM you see with it, but choose the ones that you think will be a factor to you. You only have 15 slots, so use them wisely.

9) You may save the DTC manually to ensure that your PPTs have been saved, but the DTC is automatically saved when you click the FLY button. PPTs will be saved to the callsign.ini file (if you're in the campaign module) or to the TEmissionname.ini (if you're in the TE module) and they will remain there until you overwrite them.

Another benefit of being able to assign PPTs rather than have them automatically appear is that you may assign only one or two PPTs for a given area. For example, let's assume your target is in a populated city that has 6 different SA-2 and 3 SA-3s. Unless you are trying to take them all out (SEAD or DEAD), there is no real need to assign 6 PPTs for all 6 SA-2s and 3 PPTs for all 3 SA-3s. You could use only 2, if the SAMs are in close proximity to each other and avoid an HSD clutter nightmare.

Another capability that can be used to maximise training missions is that you are able to 'make up' threats at a given location even if there are no threats there.
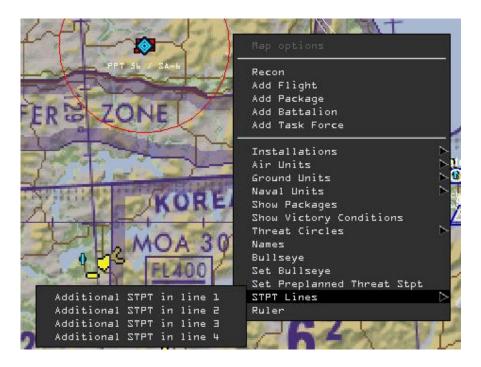
Lines

You also have the ability to draw geographic lines on the UI map which will appear on the HSD. Up to four lines can be drawn on the HSD (LINE1, LINE2, LINE3 and LINE4) using steerpoints 31-54. Each LINE series contains up to 6 steerpoints that can be used to define a forward edge of battle area (FEBA), forward line of troops (FLOT), geographic border or battle container (CAP AOR, kill box, location of friendlies, etc).

The lines in the HSD are dashed lines drawn between the steerpoints. If any of the lines are partially off the HSD, the partial line is displayed.

The following example shows you how:
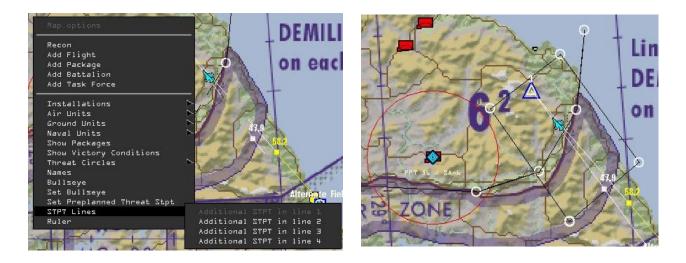
1. Right-click on the UI map at the location you want to start drawing a LINE, select STPT Lines ►
    Additional STPT in line 1. A small white circle will appear.

2. Drag the circle to the desired location. To add another point (and thus make a line), right-click on the circle and choose 'Additional STPT to line'. This second circle will appear exactly on top of the first. Left-click and drag it away and you will see the line drawn between the two. Alternatively, you may also right-click away from the first circle and choose 'Additional STPT in line 1' like the picture above and it will draw another circle with a line attaching the two. As shown below, 'Remove STPT from line' will remove a steer point from a LINE section.

3. After adding all 6 steerpoints to a LINE section, you will see 'Additional STPT in line 1' greyed out. If desired you can create additional LINE sections using the same procedures.

4. Just like the PPTs the LINES steerpoint can be saved manually into the DTC by opening the DTC back up and hitting the Save button, but the DTC will be saved automatically upon clicking the FLY button.

LINES steerpoints are also saved in the callsign.ini file (campaign module) or the TEmissionname.ini (TE module) file and they will remain there until you overwrite them.

Set Bullseye

This is a feature which allows the pilot to move the bullseye to a location that is useful to him. To move the bullseye, simply right-click on the area where you want to move it to, select 'Set Bullseye' and then 'confirm'.

A pilot may move the bullseye in a multiplayer session before take-off and the position change will propagate visually on all clients in the session (if they have the Bullseye option enabled) as well as in each pilot's navigation system. It is good practice to make sure everyone is aware that bullseye has been moved and can see the changes for themselves in the UI, so that pilots have the correct location in their head when they hear bullseye calls during the flight.

5.2   What about Multiplayer?
How can these features be used in MP?

Since the pilot has the ability to save an .ini file associated with his TE mission, using the data in multiplayer is a piece of cake. All the pilot has to do is send each pilot the TEmissionname.ini file that will be used. Each pilot saves the .ini file into the *\Data\Campaign* directory. It is not necessary for each pilot to have a copy of the actual TE mission. The code is smart enough to recognize the name of the TE and will load the .ini file associated with it.

The following are the procedures for using the TGT STPTs/LINES/PPTs in MP if the mission builder desires all pilots to have the same information:

5.2.1   For Tactical Engagements

1. Build your TE as normal. Within the TE editor, place your PPTs, Lines and Bullseye position and click once on the DTC icon to save the DTC (the icon does not open the DTC window in the mission editor but simply saves the DTC). Previously it wasn't possible to set DTC items such as STPTs, LINES and Bullseye position straight from the TE editor. The TE needed to be saved and entered as if you were going to fly it before placing the steerpoints on the map. This is no longer necessary.

2. Saving the DTC will write an .ini file that has the same name as the TE. So if you saved your TE as '4shipOCA', the associated .ini file will be called '4shipOCA.ini'. It is saved to the *\Data\Campaign* directory.

3. Distribute this file to the pilots flying. They will need to save the file into the same directory.

4. Upon entering the TE module, all pilots should see the same TGT STPTs/LINES/PPTs.

5. Each pilot may subsequently manipulate the information in the UI (add threats, additional lines, or target STPTs), but only he will see those changes.

5.2.2   For Campaign Missions

1. Open the campaign module and stop the clock. Build TGT STPTs/LINES/PPTs as described above.

2. Upon completion, open the DTC and hit the Save button. This will write the information to the callsign.ini file. Upon entering the 3d world, the pilot will see the data on the HSD.

Unfortunately, due to technical reasons, each pilot will have to create/build the data they want to see in the cockpit in the campaign screen right before committing to 3D, since it is not possible to share it like with TEs.

6. Multiplayer

The BMS learning curve is very steep when flying solo but it's nothing compared to multiplayer.

Flying in multiplayer with your peers is the pinnacle of any flight simulation. It opens new doors that you will probably never want to close again. Very often seasoned solo pilots will feel like rookies again at first in a multiplayer arena, but the experience is so much more rewarding.

6.1 Prerequisites

Besides a stable (and fast) internet connection you will most likely need to open ports to allow BMS to work through it. Please refer to your router, firewall or ISP documentation on how to open up or forward ports.

- ➢ BMS needs **UDP** ports 2934 and 2935 to be opened/forwarded.
- ➢ IVC needs **UDP** ports 9987 to 9989 to be opened/forwarded.

These are the default ports which can be changed by config option *g_nServerPort*. Multiplayer games need a host and at least one client, but multiple clients can connect if the host has sufficient bandwidth to manage them. When the host can manage unlimited connections over time we refer to it as a server, which can be joined for online events that may last multiple days. In these cases measuring your upload speed and ping time to the location of the server might also be required to ensure server stability and a smooth online experience.

These tests can be performed online for free, for example at https://www.speedtest.net/. You will usually want to select the nearest server location to the BMS server you intend to use to get a representative result.

See below on how to estimate the value for upload and download according to your speedtest result.

If bandwidth (upload usually) is not sufficient or ports are not forwarded correctly problems will start to occur in multiplayer; users may fail to see correct position updates, IDM updates, flight controls or even get pauses during the MP game. These problems happen less frequently with more recent MP code revisions and typically faster internet connections available today, but given the multinational nature of the Falcon community and the distances involved they can still happen.

6.2 Connection requirements

For a connection between two computers to succeed the following settings must be the same on both computers:

- Same BMS version.
- Same Active theatre (e.g.: KTO Theater).
- Either IPv4 **or** IPv6 addresses being used, as you cannot mix IPv6 with IPv4 addresses (see below).
- In some scenarios the host may impose specific settings to its clients. These options are defined in the Multiplayer settings section of the Falcon BMS.cfg file. To be able to connect, clients have to comply with these settings (see BMS Technical manual for an explanation of MP dependant config options).
- BMS features anti-cheat protection intended for large server multiplayer events. The host can activate the anti-cheat code with the Falcon BMS.cfg option: *set g_bRequireSameAcdataMP*. The option can be set to 1 (true) and 0 (false). By default this option is set to 0. When set to 1, the host compares the contents of the MISDATA and ACDATA folders and will refuse connection if they are not the same.

6.3 COMMS / Phone book

Multiplayer is initialised with the COMMS button in the UI. When clicked, the COMMS window opens:

- Server Name
  This is a text string that you can choose as a way to remember this particular host. Normally this would be the host system name, or the name of the player who is hosting a game that you would like to join.

- Connect to IP Address
  This is the routable IP address of the host system to which you would like to connect. This address must be routable from your system. Typically this is the WAN address of the router of the remote player or server who will host your game. It is possible to use a non-routable address such as one on your local LAN if you are not using the internet for connectivity.

  BMS 4.34 introduced support for IPv6 addresses as some ISPs have started to phase out IPv4 addresses. If one player uses IPv6, all must use IPv6 as you cannot mix IPv6 with IPv4 addresses.

  In the comms-menu you can now define both IP and port for the server to connect to or the port of the session you're hosting, as well as IVC port. Defining the port is optional. Without it, the defaults will be used. The default game server port can be set in Falcon BMS.cfg using 'g_nServerPort'. If defined, it will overrule the default 2934, 2935 ports.

  Note: Since entering the complicated IPv6 addresses via the UI is tedious and error-prone, keep in mind you can manually edit the phonebook.ini with any text editor. Also you can copy paste any IP into the address field by using Ctrl + V.

- Download & Upload Bandwidth
  Connection bandwidth has been split in two separate bandwidth settings for Download and Upload. These values are used to help manage network traffic on your connection to avoid flooding, while keeping the throughput as high as practical.

  Bandwidth settings are used in two places: locally, you use it to limit what you send to the server and other clients; remotely, other clients (and especially the server) will use it to limit what they send to

you. These defaults are only a "hint" to tell BMS how much bandwidth you *physically* have available. The new network stack will figure out what it can/should/has to use all by itself.

Here are guidelines on how to input Bandwidth settings:

- o Each client (as well as the server) should pick his/her *own* personal setting, the clients do *not* need to match up.

- o Each individual download and upload rate should be roughly 80-90% of your measured internet connection speed. Why 80-90%? You may need spare bandwidth for IVC or TeamSpeak, or someone else using up bandwidth watching IP TV or whatever; only *you* know how much spare bandwidth you'd like to reserve.

Example:

Run a speedtest (https://www.speedtest.net/) and note your results (note them in kbps, usually the tests default to Mbps; just multiply by 1024 or find the settings section and select kbps to begin with)

Enter 80-90% of your measured download value (in kb/s) in the Download Bandwidth box, then 80-90% of your measured upload value (in kb/s) in the Upload Bandwidth box.

Once set you will not need to touch them again, unless your internet connection speed changes. If you have a fast enough internet connection that bandwidth really isn't an issue you can probably use the same values for other entries in your phone book, but if in doubt test first as explained above.

- Dedicated Voice Server IP
This field holds the IP address of the voice server that you will use for IVC in this game. It can also be either IPv4 or IPv6 with or without a port. The IVC server listens to both IPv4 and IPv6 at the same time. If you connect as a client to an IVC server that is not running on your computer, input the IP address of the IVC server. It may be the same as the host IP address if someone is hosting both the game and IVC on the same PC. You can also use Strg + V to paste any IP.

If you are hosting the voice server on your local system (flight PC), you should enter 127.0.0.1 here. Leaving this field blank with no valid IP address or hostname will result in no IVC communication. In 4.36 the maximum number of clients that can connect to a single IVC-server session has been set to 96. The default IVC server port can be set using command line parameter '-p <NNNN>', while 'NNNN' = the first port #. If set, don't forget to forward ports port NNNN, port NNNN+1 and port NNNN+2.

- Dedicated IVC Password
Some voice server hosts may set a password to access their server. If required, enter the password in this field to allow you to connect.

- IVC Enabled
Turns integrated voice comms on/off (default is on). Please refer to the IVC section in the BMS Technical manual for more detail on the Integrated Voice Comms system.

- IVC Automatic Gain Control
Attempts to adjust input volume automatically for the microphone you have connected and are using for the IVC system (default is on).

If you are using TeamSpeak or other voice comms software they often have AGC (TeamSpeak calls it Automatic Voice Gain Control) enabled by default too, which will probably interfere with AGC in IVC.

If you notice your IVC volume getting quieter (or louder) without any input from you this could be the reason. Turn Automatic Voice Gain Control in TeamSpeak off, for example, to avoid this.

- Portforwarding with non-default ports

  For the router/firewall you need to forward to your game-pc:

  - game server: port defined by 'g_nServerPort', port+1
  - IVC server: port defined by command line parameter '-p <NNNN>', port+1 and port+2

- Host a game

  The "Connect to IP-address"-field in the comms menu is used for connecting to a server or hosting an MP-session

  - Game IPv4: 0.0.0.0:port
  - IVC IPv4: 127.0.0.1:port
  If no port is defined you can omit the ':port'.

  - Game ipv6: [::]:port
  - IVC IPv6: [::]:port
  If the port is not defined you can omit the square brackets [].

- Connect to a server
  - Game IPv4: yyy.yyy.yyy.yyy:port
  - IVC IPv4: yyy.yyy.yyy.yyy:port
    This is the IP and port on which the server hosts. If no port is defined you can omit the ':port'.

  - Game IPv6: [xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx]:port
  - IVC IPv6: [xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx]:port
    If port is not defined you can omit the square brackets [].

- Using the Comms/Phonebook
  When all data fields have been filled with relevant information the connection details can be saved with the SAVE button to avoid you having to enter them again (unless the hosts IP address changes). Once saved, the entry will need to be selected from the list on the left before you click on CONNECT.

  New configurations can be created with the NEW button; entries can be deleted with the DELETE button. The connection entries are saved in the phonebkn.ini file in the *\Users\Config* folder.

6.4   Connecting as a client

Let's document an example of connecting as a client. Your partner will host BMS and IVC on his own IP address which he transmitted to you: 82.152.23.64. He told you that IVC has no dedicated password.

Once in the UI click on the COMMS button to open the phonebook window.

The phonebook is empty so we will have to fill in all the connection details:

In the Server Name input the name of the host: VD server (any name will do).

Input 82.152.23.64 in the 'Connect to IP Address' box or paste it via Ctrl + V.

Input the IP address again in the 'Dedicated IVC Server' box. If you enter a wrong IP for IVC it will probably crash requiring a full BMS and IVC restart, so double-check your entries to avoid frustration.

Leave the 'Dedicated IVC Password' box blank as there is no password.

Ensure both 'IVC Enabled' and 'IVC Automatic Gain Control' are on/lit (they are by default).

You did a speedtest and the results you received were 191.11 Mbps download and 19.25 Mbps upload. As documented above, multiply these values by 1024 and round the values to 80-90%. Input your calculated bandwidth values in the respective Download (160000) and Upload (16000) boxes. Note the numbers in brackets are for this example only.

If you want to save that entry, click the SAVE button **before** you click on CONNECT. A new entry will be created with the name 'VD server'. Then select the newly created entry in the phonebook on the left and the details will automatically appear in the relevant boxes. Now click CONNECT.

After a few moments a small window saying Connection established will appear. If something is not correct (ports not open, wrong IP address entered, different active theatre, or different BMS version) another window will open stating that the connection has failed. In that case check your settings before trying again.
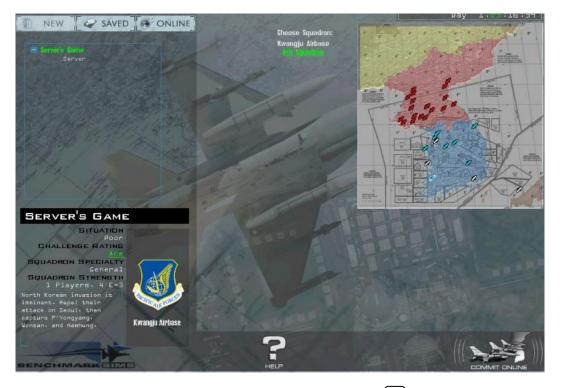
Once connection is established click on OK then the COMM button on the UI to open the "first chat" window. There you will see the online participants and their connection details. Each user present can type a message.

The IVC client applet will automatically start and voice communication will be possible with F1 or F2 Push To Talk shortcuts:

- F1 is the TEAM frequency and will be heard by anyone on the same frequency in the UI and in 3D if tuned to UFC UHF preset #14 (339.750 MHz by default).

- F2 is a UI only frequency and will be heard by anyone in the UI. F2 can't be heard in the cockpit, so should be used to avoid distracting anyone in 3D when checking in, planning missions, etc.

Usually first chat is where a voice communication check is performed on F2 to ensure everyone has IVC setup correctly and can hear each other. The host can then launch the TE or Campaign mission and tell you to join when he/she is ready. While doing so the host leaves the chat room, so it is normal to see him/her disappear. When they call you in simply select Tactical Engagement or Campaign or Instant Action, according to which type of game was planned, then select the ONLINE tab.

You should see the online game. Click on it until it turns green, then click the COMMIT ONLINE button in the bottom right corner of the screen.

The RULES OF ENGAGEMENT window will then pop up.

In the top part (blue) the game name, password and number of maximum players are displayed. The green text is just for your information. To be able to join the server - if specified - you have to enter a password. Or in different words: If the host requires a password and you leave this field blank, you don't get into the mission.

In the yellow part you have in the upper part some drop down lists for Flight Model, Air Refueling and Padlocking. On the left side (AUTHORIZED) it shows you what minimum required settings are host controlled, thus mandatory for participation. On the right side (CURRENT) you can adjust your personal settings. You can be above or the same level of minimum requirement but not below. You won't be able to join.

In the lower part are the PWD TEAM 1 to 7 text fields. Since 4.36 it is possible to set passwords for up to 7 teams. Before joining you should make sure to enter the right password in the correct teams text field. These are required, if the host askes for a specific password for a team. You can join a team when no password is specified. In other cases you need the correct password for a team to be able to join.

In the green box as a client you can only influence the right column (your settings). The left column shows the host authorised settings. In the example picture above the server does not allow invulnerability and the box is red, indicating that you must change the setting in order to be able to join. You can either unselect invulnerability by clicking on the red box and then clicking OK, or just click on the COMPLY button to accept the authorised settings and join the game. The server sets

> *Note: Also since 4.36 the authorized / current settings for Avionics, Weapon Effects and*
> *Autopilot have been removed.*

Your game will then receive units and data from the host and you will be connected to the online session.

6.5   Hosting a session

Hosting will be different depending on whether you host IVC, or join a remote IVC server.
In this example we will host both BMS and IVC. The principles for hosting BMS and joining an IVC server are a mix of both the examples illustrated here.

Before launching BMS you must start IVC Server on your computer. Simply select **IVC Server** from the Launcher menu and a CMD window will open. That's it; you don't need to do anything else. Minimise it if you prefer.

Launch BMS as usual and click on the COMMS button in the UI.

To host a game the 'Connect to IP Address' box must be "0.0.0.0". The bandwidth values should not change from your usual settings, but you need to have enough bandwidth available to realistically host the number of clients that will connect to you. Ensure both IVC boxes are checked.

In the 'Dedicated IVC Server' box enter IP address 127.0.0.1 (localhost) to point it to the IVC Server already running on your computer. No password is required as we did not set one up. If you want to save that entry, click the SAVE button, then select the newly created entry. Click on CONNECT. If all settings were input correctly the Connection established window will be displayed; click OK .

Connecting as a client or host to an active MP session in the UI will be indicated by a blinking COMMS button. Click the COMMs button to enter first chat. You can now instruct your clients to connect to your server.

When they connect to your session they will appear in the CHAT window. You may see a P2P or CS suffix next to the name of your clients:
CS (Client/Server): the client sends and receives its data only to and from the server, which in turn is responsible for forwarding data sent by one client to all the other clients.
P2P (Peer to Peer): each client can send and receive relevant data to and from each other directly, without the need to route additional traffic through the server. The usual "client/server" traffic is still being sent/received.

P2P is *always* preferred; CS is a fall-back for connectivity/visibility only purposes. There is no need to force CS; BMS will set CS automatically for individual connections, if necessary.

Use 'F2' to make IVC checks and when everyone is accounted for select Tactical Engagement or Campaign or Dogfight or Instant Action and set up the mission as you would offline, except the COMMIT button is now replaced by COMMIT ONLINE.

The RULES OF ENGAGEMENT window will pop up and you as host must now set the authorised settings. In this case you manage the left column. Upon clicking OK the TE etc. will be ready, you can stop the clock and then call your clients in to join you.

6.5.1 Hosting Scenarios

These are three of the more common scenarios for making network connections with IVC support. Others are possible. In some cases, it *may* be possible to mix WAN and LAN clients on the same host but this is router/NAT implementation dependent and there is no guarantee that this will work for you.

1. Pilots are using a separate dedicated IVC server and the pilot with the most bandwidth / fastest machine is game host. All pilots enter the host's IP in the 'Connect to IP Address' field and the voice server IP or hostname in the 'Dedicated IVC Server' field and then click CONNECT.

2. Separate voice comms server not available – one pilot is hosting voice comms and another is hosting the actual mission. The pilot hosting voice comms should be the initial game host. He starts the IVC Server locally before entering the game. Then at the COMMS screen he puts '0.0.0.0' in the 'Connect to IP Address' field and '127.0.0.1' in the 'Dedicated IVC Server' field and clicks CONNECT.

   All other pilots put his IP address in the 'Connect to IP Address' and 'Dedicated IVC Server' fields. Once all pilots are in first chat the mission host sets up the TE/Dogfight/Campaign and the other pilots join.

3. Separate voice comms server not available – one pilot is hosting both IVC and the actual mission (not recommended for large missions with lots of clients unless the host has a smoking fast machine and lots of bandwidth). The host starts the voice server locally before entering the game. Then at the COMMS screen he enters '0.0.0.0' in the 'Connect to IP Address' field and '127.0.0.1' in the 'Dedicated IVC Server' field.

   All remaining pilots input the host's IP address in the 'Connect to IP Address' and 'Dedicated IVC Server' fields and connect. This host also brings up the TE/Dogfight/Campaign mission and pilots join.

6.6 Hosting larger events

Larger online events or TvT (Team versus Team) servers usually need specific rules of their own because of the high volume of participants:

- Usually the host (dedicated server) needs to be in 3D in a discrete place while clients connect in and out of the server.

- If campaign scenarios are used, it is preferable to have the campaigns dedicated to the TvT event. An unstable campaign can be responsible for many problems.

- The organising party should ensure that all clients connecting have suitable connections, have performed their speed tests, abide by the download/upload calculations documented in chapter 7.4 and have the relevant ports opened (chapter 7.1).

- There is no need for the organising party to force CS through outdated config options. BMS defaults work better and are preferred.

As a reminder:

CS means Client/Server: the client sends and receives its data only to and from the server, which in turn is responsible for forwarding data send by one client to the other clients. This is less efficient and timely.

P2P means Peer to Peer: each client can send and receive data to and from each other directly, without the need to route the traffic through the server (of course, there still is "client/server" traffic anyway whenever necessary).

P2P is always preferred; CS is a fall-back for connectivity/visibility only purposes, there is no need to force CS. BMS will set CS automatically for individual connections if necessary.

You may think that CS requires less upload bandwidth from clients, because they only send to the server, but this is incorrect as the server does not magically multiply messages. If a client needs to send data to N other clients, it will send out N messages, regardless of whether they are routed through the server (CS), or whether they are sent out to the other clients directly (P2P).

Do not force CS, use the default settings in BMS.

7. Flying Different Aircraft

Please note there are no new flyable aircraft in BMS 4.36.

Falcon BMS is first and foremost an F-16 flight simulator, but there are a few other flyable aircraft too. The user needs to understand that although external 3D models and even cockpits may be available the avionics will always be based on F-16 ones. Flying aircraft other than the F-16 will always be a compromise and will never as accurate or realistic.

Some aircraft have external models and cockpits, e.g.: Mirage 2000, F/A-18 Hornet, A-10 Warthog, F-15 Eagle, F-15E Strike Eagle, Tornado, F-4 Phantom and AV-8B Harrier. The AV-8B is unique because it also features a bespoke V/STOL advanced flight model.

Remaining available aircraft have only the 3D model and no cockpit enabled. The default F-16 pit is displayed.

7.1 Managing two engines

As the F-16 is single engine and many other aircraft have two engines, BMS has throttle controls for the second engine. It can be declared via the ADVANCED CONTROLLER SETUP in the UI (see chapter 3 - Configuration).

Each engine has its own thrust, fuel flow, damage modelling etc. Be advised that adverse yaw and roll are also modelled when there is asymmetric thrust! When flying a two engine aircraft the upper left corner of the screen will display rpm of both engines. When the right throttle axis is not declared the throttle axis controls both engines together.

If you chose to manage the engine with the keyboard you will have to select left engine or right engine, or toggle engines with a keystroke to be able to manage them.

7.2 Managing Specific Flight Controls

Specific aircraft require specific controls and that may not be present in the F-16 cockpit management flow. These controls must be managed through specific key callbacks found in the 'keyboard flight control & other cockpit callbacks section in the 'BMS – Full' key file. You will find the required callbacks to manually manage flaps, thrust reversers, nozzle positions for VTOL aircraft, naval operation specific callbacks, formation lights, par brakes, etc.

Some flight controls, handles or displays or specific aircraft functions may not be available in the F-16 avionics but are required when flying other types of aircraft. The most obvious ones are the flaps and slats (LEF) that are completely automatic in the F-16 thanks to the FLCS. The F-16 cockpit does not have a Flaps and Slats indicator.

That will be a problem when flying other aircraft requiring manual controls of the flaps and slats. To overcome this issue the status of the flaps and slats will be displayed as green text in the top left corner of the main screen. When it is not displayed it's because the aircraft you selected does not need it (the F/A-18 for instance has automatic flaps and slats controls like the F-16).

Other controls will be displayed as well depending on the aircraft you fly: nozzle positions for the V/STOL Harrier for instance.

7.3 Available Aircraft and Specifics

7.3.1 F-16

One of the biggest changes in 4.33 regarding aircraft was the complete re-organisation of the F-16 models. The database was completely re-structured and the F-16 features corresponded to specific blocks. Most of the F-16 blocks have their own entry in the database and each version features its own 3D cockpit, 3D model, engine (General Electric on blocks 30, 40 and 50 and Pratt & Whitney on 32, 42 and 52 models) with their respective intakes, avionics suite, weapon capabilities etc.
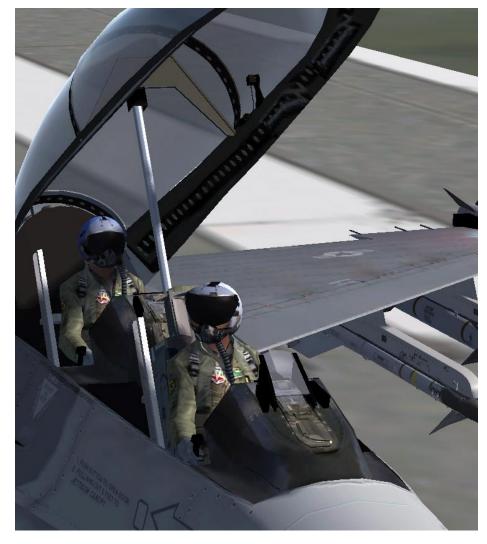
Earlier blocks 15 and 25 and USAF aggressors also exist.

Within these blocks F-16C single seat as well as F-16D dual seats are implemented (though only the front seats of B/D models are implemented).

Specific country versions also have their own entry in the database and sport their own specifics.

Korean blocks 32 and 52, Hellenic Air Force block 52+ with or without conformal fuel tanks, MLUs from various EPAF countries, Israeli versions (block 15 Netz to F16-I Sufa), Egyptian (52+) and Jordanian (MLUs).

The F-16 3D models were updated in 4.33 with many more features such as new pilots, canopies, speedbrakes and animations, air refuelling door animation, wing flex animation, HMCS sensors, GE or PW engines, small or large intakes, correct pylons, new tail strobe, HUD repeater for relevant D models, Para brake tail for the MLUs, etc.

The texture sizes were increased and each model features licence plates, ensuring that each aircraft in a 4-ship can have different registration and/or serials.

The licence plate is completely transparent for the user as it is done in the DDS textures.

7.3.2　F/A-18 Hornet

The F/A-18 is the backbone of BMS Naval operations for the BLUEFOR. Although the avionics is still mostly F-16 related, the aircraft features many specific features:

- Accurate 3D model
- Accurate cockpit model
- Specific F/A-18 features
- Flight model with G limiters
- Fully Carrier Ops capable

The F/A-18 is documented in detail in the BMS Naval Ops document in your \Docs\04 Other Aircraft\ folder. The Ramp Start PDF can also be found in the \Docs\04 Other Aircraft\01 F-18 folder.

BMS also features 3 training missions for Carrier Operations with the F/A-18 Hornet; they are also documented in the Carrier Ops manual.

Please note, the IFF in the F/A-18C works fine but cockpit hotspots haven't been implemented. You must activate IFF with callbacks (thus keystrokes). 4.35 also broke the landing light switch, use callbacks.
Please note also, the E and F Super Hornet models in the database use the C and D classic cockpits, respectively.

7.3.3   Mirage 2000 (All versions)

The Mirage has many aficionados within the community because it is an aircraft flown by many different airforces: France, Greece, Taiwan and many Middle Eastern airforces. The Mirage 2000 series is thus a very popular aircraft in third party theatres: EMF, ITO etc.

BMS 4.32 was already very complete regarding the Mirage 2000. Multiple versions were implemented: Mirage 2000C (RDI), Mirage 2000-5F, Mirage 2000-EGM (Greek), Mirage 2000N & Mirage 2000D.
The M2000-5F & M2000C have new 3D models and PDLCT and ATLIS pods were implemented where appropriate.

The Mirage 2000 versions have high quality dedicated 3D cockpits and dedicated flight models (AFM); less detailed than the F-16 perhaps, though not too far away from the real aircraft performance. For more details refer to the \Docs\04 Other Aircraft\03 Mirage-2000 folder.

7.3.4   A-10A/C

The A-10 is an old flyable aircraft in BMS (some may remember it was even the first flyable aircraft after the F-16). It was used as a test bed for the NFBW flight model module.
BMS 4.32 only had the A-10A. 4.33 introduced the A-10C with different weapon loads but unfortunately the C cockpit with its modern avionics much closer to the F-16 has yet to be made. At this time both A and C models use the high quality clickable A-10A 3D cockpit documented in the \Docs\04 Other Aircraft\02 A-10 folder.
A ramp start document is also available at the same location.

7.3.5   AV-8B & AV-8B+ Harrier

The Harrier features a complete high-quality clickable 3D cockpit. It was created to illustrate the new V/STOL flight model (AFM). Callbacks were also created to orient the nozzles for V/STOL management. See the *AFIncExhaust* and *AFDecExhaust* in the keyboard flight controls section of the BMS – Full.key file. They increment or decrement the nozzle positions by 10°. As with the other flyable aircraft in BMS the Docs folder contains a PDF explaining the 3D cockpit.

The aircraft received some love in BMS 4.35 and is now available in two models with specific skins and matching avionics. The AV-8B is radar less but should have a FLIR (which unfortunately has been deactivated in 4.35). The AV-8B+ features an on-board radar and as such is able to launch AIM-120 amraams.
Beside the radar difference, both aircraft are similar in BMS. Their flight models were revised to allow better interaction with the new LHD USS WASP and racks and weapon loadouts were also revised in BMS 4.35.

A cockpit layout document is available in the *Docs\04 Other Aircraft\04 Harrier* folder. Ramp start is quite close to the F-16 procedure (you know why).

3D Cockpit known issues:

- IFF is not correctly implemented.
- SMS page is porked.
- VSTOL master mode light is missing
- Formation lights knob do not work in the cockpit (it is the master light switch). They do work on the 3D models, just use the relevant callbacks.
- the 4.35 implementation for anti-skid and taxi/landing light has unfortunately not been implemented in the Harrier cockpit.
- the 4 Gear lights on the cockpit remains red (the bottom one normally for the main gear has been replaced by the hook light, which is working fine) have been replaced by the green GEAR mnemonic on the right of the UFC.
- Some of the harrier hotspots do not follow the left/right click logic explained in chapter #9

Other known issues when flying the harrier are:
Absence of Water ingestion system providing more thrust absence of "STO STOP" and "HOVER STOP" positions for the nozzles. These are specific nozzle positions settings defined according to gross weight and atmospheric conditions.
Their lack of implementation clearly is a consequence of the F-16 avionic suite being used for other BMS aircraft. STO STOP can be considered as 50-60° nozzle and can be implemented by a quick succession of 5x the *AFIncExhaust* callback or through HOTAS programming.

The Harrier is a fun aircraft to fly but requires some knowledge about V/STOL. The aircraft is not able to sustain hover when fully loaded. That is the reason it is not a full VTOL aircraft (Vertical Take Off and Landing) but a V/STOL (Vertical/Short Take Off and Landing). The max Gross weight for vertical operation seems to be in the 25-26000 Lbs.
You should plan for a rolling take-off when loaded and try vertical landing when returning home with empty stores and less fuel. You may obviously perform conventional take-offs and landings as well.
The Harrier can obviously be used in naval operations in BMS but destroyer platforms are not suitable for Harrier ops. You can only land on the aircraft carriers and the new LHD-1 WASP.
See Naval ops dedicated WASP and Harrier chapters and training missions for further information.

There are four types of take-offs possible with the Harrier:

- VTO (Vertical Take-Off);
- STO (Short Take-Off);
- RVTO (Rolling Vertical Take-Off);
- CTO (Conventional Take-Off).

The chosen method will depend on the runway available and your gross weight. The real Harrier has a water ingestion system that provides more power at take-off (and landing), allowing the jet to perform VTO and STO with a heavier load. This is not implemented in BMS and therefore the take-offs are always dry (as opposed to wet when using water).

With a combat laden jet you should plan a short take-off (STO). Vertical take-off (VTO) is only possible with a gross weight under 25/26000 Lbs. The same is true for landing. Do not try a vertical landing with a heavily loaded jet and consider that MLW (Maximum Landing Weight is 26000Lbs, just like in reality.

In the following example, we will demonstrate a runway short take off with a medium load and vertical recovery once fuel and weapons are depleted. Proper naval operations are demonstrated in the Naval OPS manual.

There are two modes for flaps operations: STOL mode will manage the flaps automatically according to gear position and Cruise will automatically manage flaps according to airspeed. When the gear is lowered the aircraft automatically enters the V/STOL master mode. Unfortunately this is not indicated anymore in the 4.35 harrier cockpit.

To perform a short take-off, rotate the nozzle to 50° and check flaps set to STOL mode. Engage NWS and advance the throttle to the stop while maintaining wheel brakes. At brake release the aircraft will start rolling and will need a very limited runway length to lift off. Pull on the stick as soon as airspeed appears on the HUD airspeed scale and maintain an AOA < 15°. Maintain wings level in the initial climb and let the aircraft climb to a safe altitude of about 2000 feet before starting the transition to wing borne flight. Raise the gear in the climb. According to the flaps mode the flaps will retract with the gear (STOL mode) or with airspeed (cruise mode).

The accelerating transition is a term used to describe transition from jetborne/semi-jetborne flight to wing-borne flight. A slight climb should be maintained throughout the transition manoeuvre. During this transition AOA should not exceed 15°. As you maintain your climb in the accelerating transition gradually rotate the nozzle aft. Once wing borne flight is achieved you can reduce the throttle and perform your after take-off checklists.

Landing the Harrier vertically on the ground is a fine art in BMS and requires a lot of practice. This is best practised in BMS at the new MCAS Iwakuni airbase in japan as the airbase offers specific markings for V/STOL landing.
The procedure is started downwind from the landing point at approximately 250 kts gear down, flaps set to STOL, nozzle set at 20% and AOA speed of 8-10°.

Approaching the 180° turn to the landing point the nozzles are rotated to 60° and AOA speed set at 10-12°.

The decelerating transition to a hover will start ½ Nm from the touchdown point ideally at an altitude of 310 feet AGL. The idea is to reach hover attitude around 150 feet above the touchdown point.

During the decelerating transition adjust flight path with stick and control AOA with the throttle or nozzle. Please note the nozzles are vertical at 80° due to the Harrier chord line. The nozzles rotate up to 120° providing rearward thrust from 90° setting. To reach the hover point abeam the touchdown point rotates the nozzle to 80°, minimise sideslip, ensure no more than 15° AOA and strive for 0° AOB (Angle of bank) until less than 30 kts. Increase power to maintain a shallow glideslope up to 150 feet above the touchdown point. Keep your power up or you may lose stability control in BMS.

Approaching the landing site select ground references and monitor rate of closure. Once below 30 kts flare slightly to stop forward motion. Placing the nozzles to 90-100° greatly helps stopping forward motion in BMS but revert back to 80° quickly or you will find yourself flying backwards.

Once in the hover your height is controlled by very tiny throttle adjustments. Any brutal power change will result in a catastrophic landing. Maintain your position over the landing site using your ground references.

Vertical landing is initiated from hover by very slowly decreasing the throttle and adjusting attitude and roll as necessary to maintain drift. Maintain a slow rate of descent until the wheels touch the ground. Once on terra firma immediately retard throttle to idle, apply brakes and rotates the nozzles aft.

As mentioned above, MCAS Iwakuni is the perfect place to train shipborne procedure on a deck that does not move. a STOL runway is available South West of the airbase and VTOL pads (deck markings) are available East of the main runway.
Once you master the technique on the ground, you may try on the newly implemented LHD-1 USS WASP.
A 4.35 training mission was created for this purpose, refer to the naval ops manual located in your "Docs\04 Other Aircraft" folder.

7.3.6 F-15 Eagle

There are many F-15 models in the database. 4.33 introduced updates for the Japanese F-15J and DJ with Aggressor skins as well as the F-15K (Korean) and F-15I (Israeli) based on the F-15E Strike Eagle model.

The F-15 A/C/D/J and DJ Eagles have a non-clickable 3D cockpit while the Strike Eagles (F-15E/K and I) have a clickable 3D cockpit which is only 90% finished.

All F-15s have dedicated OFM flight models and 3D models featuring variable geometry intakes. The F-15 flaps will retract if a player exceeds 250 knots. If the flaps switch is left down the flaps will also deploy again when the airspeed decreases below 250 knots. The F-15 speed brake will automatically retract if 25° AOA is exceeded. If the speed brake is left deployed, it will extend out again when the aircraft is under 25° AOA.

7.3.7 Tornado

The Panavia Tornado was a new aircraft for BMS 4.33. Its 3D model was completely remade with variable geometry wings, spoilers, flaps and slats and thrust reversers. Multiples versions are implemented in the database: Italian ECR & IDS, Luftwaffe ECR & IDS and RAF GR4 and ADV. All feature a fully clickable 3D cockpit.

The tornado has automatic wing sweep, but manual flaps and speed brake controls. The wings cannot be swept fully aft when the flaps are 12°. The aircraft must be in a clean configuration.

7.3.8 JA-37 Viggen

The Viggen was also added to 4.33 as a flyable model. The aircraft features a high quality 3D cockpit model and OFM, but accurate flight model.

7.3.9 Other lower quality flyable aircraft

The following aircraft are flyable but do not have as many features as the previous aircraft. Most of them have very rough 3D cockpits and basic OFMs, nowhere near their real counterparts. They include:

- F-4 Phantoms (all versions)

- MiG-29

- Worth mentioning as well is the SU-33 and the J-15, now flyable from the new Russian Kuznetsov and Chinese Liaoning carriers. They have a highly detailed 3D model but no dedicated cockpit yet (it still uses the F-16 cockpit at the moment). They both feature a dedicated AFM with flight control system, including AOA limiter and override for Cobra through the stick paddle.

8. 3D cockpit & Views

This chapter is not meant to be a complete description of all available cockpit functions. Please refer to the Dash-1 for detailed explanations. If you are interested in the technical details about how to setup e.g. FOV, Custom Views etc., please refer to the Views chapter of the BMS Technical manual.

8.1 Cockpit interaction

This chapter describes how to interact with the controls. F-16 cockpits all have the same basic functionality. Cockpits other than F-16 may behave differently from what is described here.

There are different types of buttons in a F-16 cockpit: push buttons, 2 position switches, 3 position switches, press and hold pushbuttons, rotary buttons, encoders, volume control heads, etc. Considering the fact that all these different buttons can be interacted with the keyboard, programmable joystick devices (via DirectX or key presses), mouse, touchscreens, or even real switches we needed to standardise the use of sim control inputs.

Interacting with keyboard is easy enough. You just use the relevant callback and most of the time that will suffice. The trick here is indeed to find the relevant callback. Please simply refer to the key file and their associated keyboard layout.

But interacting with keyboard is far from being the most intuitive method. Most of you will want to use the mouse to interact with the cockpit, except for the functions you have mapped to your HOTAS. Most of nowadays mice feature at least 2 buttons and a mouse wheel. The left mouse button will be referenced as left-click and the right mouse button will be references as a right-click.

8.1.1 Hotspots

A hotspot is an area around a specific cockpit control (a switch, a push button, an encoder or a rotary switch) where the mouse is active and relevant to that particular button.

The mouse cursor in the cockpit is a yellow X by default (left picture). When it floats over a hotspot it turns green, indicating the presence of the hotspot. The form of the cursor also changes, indicating what kind of behaviour the mouse will induce. A green cross (rotated 45° from the yellow X) illustrates a mouse button requirement (centre picture) and a green double round arrow indicates the possibility of mouse wheel use (right picture).

Mouse interaction depends on button type. Since 4.36 it is possible to invert the move / step up & down behaviour of mouse inputs. Some users might that find more intuitive. Please refer to the Technical Manual.

Short press buttons are simple; just left-click on the hotspot area (your yellow mouse cursor turns green). These are for instance MFD, ICP buttons and most of the pushbuttons not requiring a long press in the F-16 cockpit. The action is immediate as soon as the button is pressed.

2 or 3 position switches are equally simple. A left-click moves the switch up and a right-click moves the switch position down. In the case of a two position switch like the AR door illustrated above (centre), a left-click will move the switch to OPEN and a right-click will move the switch back to CLOSE to close the AR door.

A special case is the **MPO switch** which will toggle position with a right- or left-click. It's a left/right oriented switch and the up/down convention was confusing in this specific case. Besides in the real jet it's a press and hold feature and not something you can do with the mouse as your hands are really required on the sidestick when you need to activate that switch (refer to the Dash-1 for more information about the purpose of the MPO switch).

Encoders, Rotary buttons and volume controls are implemented in the same way in the BMS cockpit. When the mouse is placed over such a hotspot, the green double rounded arrow will be displayed. A left-click will move the button up; a right-click will move the button down.
Also, mouse-wheel default behaviour (Field of View) will be inhibited, so moving the mouse wheel up will turn the button clockwise and down will turn it anti-clockwise.
Examples of such buttons include: the COMMS volume knobs, the ENG FEED knob, the HSI CRS encoders, etc.

The **MAN TRIM wheels** can be moved only with left or right-clicks; the mouse wheel has no effect on them. Hovering above these wheels displays the mouse cursor as a green cross though, clearly indicating that the mouse wheel is not active for these hotspots.

The **HSI CRS and HDG encoders** also have modifiable behaviour: the speed of rotation can be set via callbacks (you can increment by 1° or by 5°) for mouse clicks, and the mouse wheel speed can be modified according to the *g_nKnobAccelerationDelta* config line in the Falcon BMS.cfg file. Please refer to the Technical Manual.

Special push buttons (long press or press and release). Some push buttons have different behaviour according to the way they are used. Some may have different functions if they are pressed and released or if they are pressed for a longer time (the Handoff TWP button for instance). Others have a function remaining active while the button is kept depressed (like the MAL & IND LTS button).

The first kind is rather easy to emulate with the mouse, just keep the mouse depressed the time required for the button action to become active. The second kind is a bit trickier because it may require a longer time depressed and during that time the view may be panned and the mouse may not be hovering over the hotspot anymore

A typical example for that is the MAL and IND light pushbutton. While depressed all the lights and sounds in the cockpit are tested and of course you have to sweep the cockpit visually to check all lights are in working order. Doing so will cause the mouse to move from the hotspot. The button will keep its depressed state however and the MAL & IND test will continue, even if you release the mouse button. When that happens, to cancel the button action you simply have to left-click the button again.
Note: about keyboard behaviour for cockpit builders, this must be programmed as a press and release function of the button – see the Technical manual.

8.1.2 BMS Crew Entertainment

You can control the software Winamp when in 3d. In order to do so you must activate it by setting *g_bPilotEntertainment* from 0 to 1 in you config file. You can also set the initial volume. Please refer to the Technical Manual for more details.

In the cockpit you can enter the BMS Crew Entertainment via the ICP by pressing LIST – M-SEL 0 – M-SEL 0.

This opens the DED page where you can see the track number, the interpret, song title and the volume. There are multiple ways to interact with Winamp:

1. Keyboard callbacks / DX Assignments
   There are a couple of keyboard callbacks:
WinAmpNextTrack	Next Track	DCS Up (1)
WinAmpPreviousTrack	Previous Track	DCS Down (2)
WinAmpStartPlayback	Start Playback	
WinAmpStopPlayback	Stop Playback	
WinAmpTogglePlayback	Toggle Playback	
WinAmpTogglePause	Toggle Pause	DCS SEQ (3)
WinAmpVolumeDown	Volume Down by1	
WinAmpVolumeUp	Volume Up by1	

   See section"**6.07   WINAMP**" in your key file (note: These not available in Basic profiles). They have no assigned keys by default. The above callbacks work also when assigning them via DX to one of your input devices. You don't need to be on the BMS Crew Entertainment page.
2. ICP / DED
   You can control Winamp via the ICP when you are on the BMS Crew Entertainment page:

Note: In previous versions you could control the Volume (0=mute – 255=100%) via the PREV/NEXT rocker. This doesn't work anymore. The above callbacks work fine though.

You can leave the entertainment system DED page by pressing DCS RTN (4). This brings you to the CNI page and the ICP controls resume to default.

8.2 View Panning & SNAP Views

The primary use of the 3D cockpit is panning the views either with TIR or mouse or keyboards, if you prefer Snap view, you may use the 2 key and move the view around with the regular keys. Both cockpits are the same, it is just the view system that changes (3 has pan views and 2 has snap views)

8.2.1 3D Cockpit (Pan): "*3*"

- TrackIR
  This is the preferred option. If you declared a TrackIR, or equivalent head/eye tracking device, it will exclusively pan the view around and the mouse or keyboard will have no effect on panning.

- Mouselook
  The mouse can also be used to pan the view.
  Obviously if you move the views with the mouse you can't control cockpit buttons at the same time. For mouse panning to work, the *Clickable 3D Cockpit Default* (Setup > Controller > Advanced in the UI) option must be deactivated. If it is activated (green checkbox) you can't pan the view with the mouse. Even when mouse look is active, if you click and hold the right mouse button, you can still interact with buttons and knobs.

- Keystrokes

  You can use the following keys to pan views (if TrackIR is inactive):

  - View Up: *SHIFT KP8*

  - View Down: *SHIFT KP2*

  - View Left: *SHIFT KP4*

  - View Right: *SHIFT KP6*

  - View Up Right, View Up Left, View Down Left & View Down Right: no default assignment

  Note: View Reset (OTWViewReset) SHIFT KP5 only works in external views.

- POV Hat

  If you have a device with a Point Of View (POV) hat this can be used for view panning as well. This is the default behaviour of a POV hat unless altered to other functions.

- Mouselook with wheel button pressed

  When the mouse wheel button is held you can move your head up / down, left / right and forward / backward. This only works if TrackIR is disabled and the 3d cockpit supports 6DoF. Mouse head translation only works in 3d pit Pan view; it does not work in 3d pit Snap view, padlock or other views. When the mouse wheel button is depressed and held you have the following options:

  - Mouse movement left / right   =   Pilot Head Movement left / right

  - Mouse movement fwd / bwd   =   Pilot Head Movement forward / backward

  - Mouse wheel up / down   =   Pilot Head Movement up / down

8.2.2   3D Cockpit (Snap): "*2*"

- TrackIR and Mouselook do not work in the Snap pit. You can control the SNAP views only with the keyboard and POV hat.

- POV hat: Same behaviour as in the 3D cockpit (Pan) paragraph.

- Keystrokes: Same behaviour as in the 3D cockpit (Pan) paragraph.
  Move the view right with *SHIFT KP8*, left with *SHIFT KP4* etc.

Please understand that the key given here are from the default key files. If you loaded a different key file, the key active on your install might be different!

8.3   Field of View (FOV)

You can adjust the field of view in the default 3D cockpit (*3*). The Snapview 3D cockpit (*2*) doesn't react to FOV changes. Field of view changes allow you to have a better general view of the full cockpit and therefore increasing the perception of speed at low level, or allow you to look closely at your instruments in the virtual cockpit. How to customize FOV settings is described in the Technical Manual.

Changing the FOV can be done via mouse, callbacks or TrackIR. Each of the options is mutually exclusive with the others:

- TrackIR
  You can use TrackIR to change the FOV in game. All you need to do is to set the *TrackIR Z Axis Vector Mode* to FOV. Please refer to the Setup section for more details. You can adjust the FOV with your TrackIR smoothly. The default FOV Increment has no effect here.

- Keyboard Callbacks
  The following functions are available:

  ➢ FOVIncrease: *SHIFT KP+* (Increases FOV by the number of degrees set by FOV Increment).

  ➢ FOVDecrease: *SHIFT KP-* (Decreases FOV by the number of degrees set by FOV Increment).

  ➢ FOVDefault: *SHIFT KP ENTER* (Sets FOV to the value defined in Falcon BMS.cfg).

  ➢ FOVToggle: *L* (Toggles the FOV between default and 20° - hardcoded, cannot change).

- Mouse Scroll Wheel and Middle Mouse Button
  You can use the scroll wheel and middle mouse button in Falcon. By default, the wheel will control the FOV increase and decrease functions and the middle mouse button (or scroll wheel click) will set the FOV to the default value defined in the Falcon BMS.cfg.

- Field Of View Axis
  You can also assign an axis to change the FOV. It will not work if *TrackIR Z Axis Vector Mode* is set to FOV.

8.4 Internal Views

8.4.1 HUD Only (*1*)

The HUD Only view provides a fixed view out of the front of your aircraft. No cockpit frame is visible. Other instruments are not shown. Fixed view means you cannot pan around to change the view angle.

Unlike older Falcon versions this view does not feature the possibility to display MFDs. HUD rendering can be disabled (see Toggle HUD Rendering later on) to have a completely free front view.

8.4.2 Snap (old 2D) Cockpit (*2*)

This is the 3D cockpit with sticky snapviews we discussed before.
Although incorrect, many still use the term '2D' cockpit, even though it is no longer the case.

8.4.3   3D Cockpit (Pan) (*3*)

This is the default cockpit view of BMS we documented earlier.
There are actually 2 ways to display the cockpit. The default view focuses on the HUD, a second press on *3* shifts the view down a bit to give a better view of the MFDs and ICP. You cannot toggle back to the HUD focus view though, you need to exit the 3D cockpit view and come back to it.

8.4.4   Toggle Empty Cockpit Shell (*SHIFT 2*)

Instead of the full cockpit you can also display a simple cockpit frame. No consoles or instruments are shown in this view (except the HUD).
This is useful for those with a full cockpit simulator at home who prefer
to look at their cockpit instruments.

It does not help with performance though as instruments are still being rendered in the background.
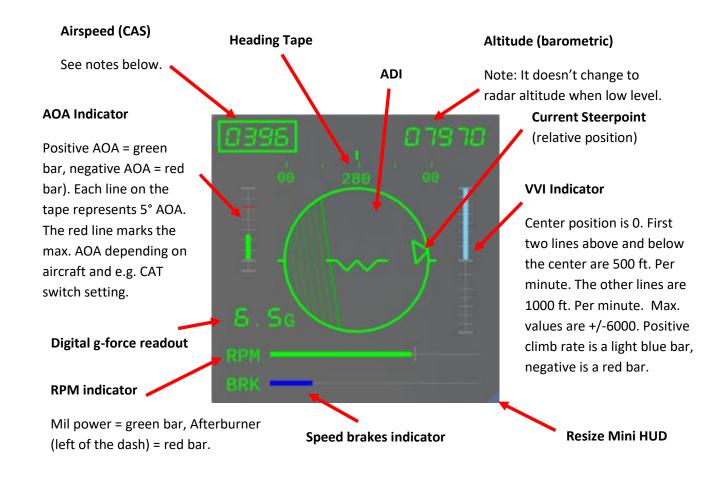
The HUD rendering can be disabled (see Toggle HUD Rendering later on).

8.4.5   Toggle Mini HUD (*SHIFT 3*)

The mini HUD helps you to maintain situational awareness if the cockpit frame and thus the main instruments including HUD are not in your sight. It provides some useful information, e.g. altitude, speed, heading and attitude. This allows you to keep your aircraft stable even though the main cockpit instruments are not visible.

4.36 introduces a new mini HUD and replaces the old SA bar. On first startup a pretty tiny mini HUD will be shown in the top left corner of your screen. You can change its position by left clicking anywhere into the window. You can also resize the window by dragging the blue triangle in the bottom right corner. The window position will be stored in …\User\Config\3DUiSettings.ini and remembered for the next flight. For more information check the Technical Manual.

Airspeed (CAS)

See notes below.

AOA Indicator

Positive AOA = green bar, negative AOA = red bar). Each line on the tape represents 5° AOA. The red line marks the max. AOA depending on aircraft and e.g. CAT switch setting.

Heading Tape

ADI

Altitude (barometric)

Note: It doesn't change to radar altitude when low level.

Current Steerpoint (relative position)

VVI Indicator

Center position is 0. First two lines above and below the center are 500 ft. Per minute. The other lines are 1000 ft. Per minute. Max. values are +/-6000. Positive climb rate is a light blue bar, negative is a red bar.

Digital g-force readout

RPM indicator

Mil power = green bar, Afterburner (left of the dash) = red bar.

Speed brakes indicator

Resize Mini HUD

The green box around the airspeed represents an indication when your jet is in the relevant corner speed zone. It is from max. corner speed (dependent on the aircraft you fly) to max. corner speed minus 20%. The box gradually changes its color from very dark red to solid bright red when you are outside this corner speed zone. At very low speeds the box starts flashing green / red.

A red cross starts flashing to war you that you are about to crash into the ground.

> *Note: The mini HUD can only be displayed in the Pan (3D) pit and the Empty Cockpit Shell. Keyboard commands are not working when the mouse cursor is hovering above the mini HUD. DX commands work though.*

8.4.6   Padlock (*4*)

Padlock view helps you to keep other objects in sight (as long as they are within visible range). Once padlock is used this object stays in the middle of the screen all the time, hence you don't lose sight of it. When an object is padlocked you can't control POV anymore.

If you need an immediate quick look to the front or the rear of your jet you can use Glance forward / backward commands (see later). If the object doesn't need to stay in focus anymore you can cancel padlock view by invoking any other view or just return to the Pan (3D) cockpit.

You can only visually padlock objects which are nearby and visual (clouds and terrain will now break padlock). By default the maximum padlock distance is 8 Nm. If you have locked a target on your radar you can padlock this object at a distance further than 8 Nm.

- Padlock Realism Settings
  You can choose from three different padlock realism settings in the SETUP > SIMULATION tab.

  ➢ **Disabled**: no padlocking is possible.

  ➢ **Realistic**: objects **in your current 3D pit field of view** and not obscured by aircraft structure can be padlocked.

  ➢ **Enhanced**: objects that **are anywhere around your jet** and aren't obscured by structural elements of your own jet can be padlocked.

- Padlock Preferences
  Padlock operates in three different preference modes:

  ➢ None: No preference   =   Padlock   *4*

  ➢ A-A: Air to air objects preference   =   Padlock Mode = AA   *SHIFT 4*

  ➢ A-G: Air to ground objects preference   =   Padlock Mode = AG   *ALT 4*

  Note: Aircraft on the ground will be treated as A-G objects.

  If there is no preference specified (*4*), then the game tries to make a good choice for you based on several factors. The net result is this:

  ➢ If you are in NAV master mode and there is a runway in your FOV it will be padlocked first.

  ➢ If there is a missile in visual range and it is guiding on you it will be padlocked before anything else, regardless of other preferences (the only exception is runways as noted above).

  ➢ If you are in an A-G ordnance mode, including gun strafe, or the FCR is in A-G mode, then padlock will focus on ground targets (if any are available).

> ➢ If all the above rules are not satisfied, padlock will revert to air to air targets within visual range.

- Padlock Priorities
  Below you will find lists of the padlock preferences. The 'list' of candidates is dynamic, meaning each time you call for a change into padlock or to switch padlocked object the relative importance of candidates is re-evaluated.

  If you are already in padlock mode and call for a change of padlocked target, then priority is seeded with the present padlocked object and the next most or next least high priority target (depending on whether you asked for 'next' or 'prev') relative to your present padlocked object is selected.

  > ➢ For A-G the ordering list is:
  >   1) any missile guiding on you (also blue on blue situations)
  >   2) any ground object you may have locked
  >   3) any vehicle targeting you
  >   4) any enemy vehicle on your radar
  >   5) any enemy vehicle
  >   6) any runway
  >   7) friendly vehicles on your radar
  >   8) friendly vehicles
  >   9) ground features
  >   10) anything not mentioned elsewhere in the list
  >   11) missiles not guiding on you

  > ➢ For A-A the ordering list is:
  >   1) any missile guiding on you (also blue on blue situations)
  >   2) your locked air target
  >   3) any aircraft attacking you (including terminal phases of BVR intercept potentially)
  >   4) enemy aircraft on your radar
  >   5) enemy fighters
  >   6) enemy fighter/bombers and bombers
  >   7) other enemy aircraft
  >   8) friendly aircraft on your radar
  >   9) friendly fighters
  >   10) friendly fighter/bombers and bombers
  >   11) other friendly aircraft
  >   12) anything else including missiles not guiding on you

  > ➢ For NAV master mode or ILS override mode the ordering list is:
  >   1) any runway in sight.
  >   *If there is no runway in sight (and only then) next priorities are the same as A-A:*
  >   2) any missile guiding on you (also blue on blue situations)
  >   3) your locked air target
  >   4) any aircraft attacking you (including terminal phases of BVR intercept potentially)
  >   5) enemy aircraft on your radar
  >   6) enemy fighters
  >   7) enemy fighter/bombers and bombers
  >   8) other enemy aircraft
  >   9) friendly aircraft on your radar
  >   10) friendly fighters

11) friendly fighter/bombers and bombers

12) other friendly aircraft

13) anything else including missiles not guiding on you

Note: When two objects of the same priority are in padlock range, the closest will be padlocked.

- Padlock controls

Padlock next	=		Padlock previous	-
Padlock next AA	*SHIFT =*		Padlock prev AA	*SHIFT -*
Padlock next AG	*CTL =*		Padlock prev AG	*CTL -*

The Next/Prev callbacks as illustrated above can also be used to enter padlock mode directly.

- Padlock Colours

The colours shown depend on the realism settings.

Enhanced mode just offers a green box around the padlocked object, which appears immediately. The boxes stay as long the view is focused onto this object.

Realistic is a little different:
First the coloured box disappears after a couple of seconds.
Second when you padlock an object a yellow box is shown first (left top picture).
After approx. 2 seconds it turns green (right top picture) until it disappears after a short period of time.

If you step through different objects the earlier padlocked object has still the green box while the new object has a yellow one. After approx. 2 seconds the yellow box turns green.

8.4.7 Glance Forward / Glance Backward: (*SHIFT KP9 / SHIFT KP3*)

The Glance Forward / Backward functions are extremely helpful when padlock is used.
When padlocking an object your view can't be changed as long as padlock is active. To give you a chance to see what is happening in front or behind your aircraft you can use the glance forward / backward functions.

Glance forward and backward are invoked via keystrokes. A hold keypress is required.
Once either of the functions is invoked the view starts to move to the front or the back of the aircraft. Once the front or back end position is reached it stays in this position as long the keys are held.

8.4.8   Extended FOV (EFOV) (*5*)

EFOV is identical to the HUD only view at first glance. What makes the difference is that it offers a feature to keep padlocked targets in sight. When padlock criteria are met, a small box appears at the bottom of the screen showing the padlock view.
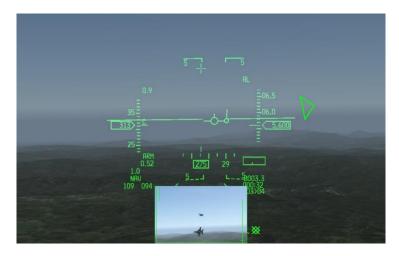
In Enhanced padlock mode you can padlock objects anywhere around your jet. This may not work in realistic mode occasionally. However, you still have the opportunity to padlock objects in the Pan (3D) cockpit and then switch to the EFOV view.

> Pressing "*5*" does not imply a special preference.
>
> Padlock EFOV Mode=AA "*SHIFT 5*" sets A-A preference.
>
> Padlock EFOV Mode=AG "*ALT 5*" sets A-G preference.

The priorities and preferences are identical to the ones described for Padlock above.

8.4.9   Custom Views in 3d

You can add some 3d Pit custom snap views. How this can be done is described in the Technical Manual, chapter 8. E.g. you can define your own snap view for ICP like shown here:

The following callbacks are available to switch between the different custom views:

- OTWToggleCustom3dPitView: *CTL 6*: Toggles between custom view on and off.

- OTWNextCustom3dPitView: *ALT 7:* Switches to the next custom view.

- OTWPrevCustom3dPitView: *ALT 6:* Switches to the previous custom view.

   Note: How to create your own Custom Views is explained in the Technical Manual.

8.5 External Views

8.5.1 General notes

The different views are not necessarily limited to your own aircraft. You have several options to step through all kind of objects: aircraft, ground units (including naval vessels), weapons (yours and those coming at you).

If you set the focus to a specific object other than your own aircraft this object will be shown in the different camera views such as Satellite, Chase or Incoming view.

You can step through different objects with the Next Aircraft "*ALT=*" and Previous Aircraft "*ALT -*" commands.

> *Note: This does not work in all views.*

8.5.2 Point of View:

Point of view (POV) works in both internal and external views. You have several options to change the POV. These do not work in all views but it is pretty obvious when it does not.

	Keystrokes:	POV Hat:
Rotate View Up	*SHIFT KP8*	POV Hat Up
Rotate View Down	*SHIFT KP2*	POV Hat Down
Rotate View Left	*SHIFT KP4*	POV Hat Left
Rotate View Right	*SHIFT KP6*	POV Hat Right
	Mouse:	Track-IR:
Rotate View Up	Move Mouse Forward	Tilt Head Up
Rotate View Down	Move Mouse Backward	Tilt Head Down
Rotate View Left	Move Mouse Left	Turn Head Left
Rotate View Right	Move Mouse Right	Turn Head Right

If you use TrackIR then keystroke, mouse and POV inputs won't work
(unless the LOS between your TrackIR emitter/receiver is broken).

To use the mouse you either have to activate mouselook (see 3D Cockpit section) or press and hold the right mouse button and move the mouse accordingly.

POV Hat and Keystroke inputs also work in external views. To use the mouse just go to the SETUP > CONTROLLERS > ADVANCED > VIEW CONTROL page and activate 'Enable external mouselook'.

If you want to control external views with your TrackIR you have to launch the Falcon BMS Config Editor and open …Hardware/TrackIR Settings/. Activate the box next to 'TrackIR Controls External View'.

8.5.3 Zoom Level:

You can adjust the zoom level only in external views. Zoom has no effect in internal views.
To change the zoom level you can either apply a zoom axis in the Setup menu or use the keystrokes.
If a zoom axis is assigned the keystroke functions become ineffective.

<u>Keystrokes:</u>

Zoom In	*SHIFT KP1*
Zoom Out	*SHIFT KP7*
Zoom Default	*SHIFT KP5*

8.5.4 Satellite Camera (`) *(the key left of 1)*

The Satellite Camera shows a top down view with the focus object in the centre.
You can change the POV, Zoom and FOV level but you can't move the POV below the horizontal line of the shown object.

8.5.5 Action Camera (SHIFT `) (the key left of 1, shifted)

The Action Camera is a compilation of different camera views. The Action Camera will step through all kinds of objects nearby and show them with different camera views like satellite, orbit, chase, incoming, flyby etc.
The view changes every 8 seconds but is user configurable through the *set g_nActionCameraTimer* config line.
See the BMS technical manual for further information.
Depending on the view you can change the POV, Zoom and FOV level and step through the objects with the Next / Previous Aircraft commands.

8.5.6   Target-To-Self Camera (*6*)

This is the view from an object (Enemy aircraft, weapon, ground unit or naval vessel) looking towards your jet. While the object stays in the foreground your own jet is centred on the screen. You can step through different targets by pressing "*6*" again or by using next / prev aircraft functions.

8.5.7   Target Camera (*SHIFT 6*)

This is the opposite of the Target-to-Self camera. While your jet is in the foreground the target object stays in the centre of the screen.

8.5.8   Incoming Camera (7)

You see the weapon in the foreground and the object tracked by the weapon in the centre of the screen. Obviously this only works if weapons are in the air and are tracking a target.

By default, you see weapons (SAMs or AAA) shot at your own aircraft. However, it is possible to set the focus on another object (ground unit, aircraft) and see weapons on their way to the tracked target. This works both for A-A and A-G weapons. If no weapon is shot at the focused target, or your own aircraft, nothing will happen.

You can step through all weapons shot at the object by pressing "7" again.

8.5.9   Weapon Camera "SHIFT 7"

You see the weapon in the foreground and the object tracked by the weapon in the centre of the screen. Obviously this only works if missiles are in the air and are tracking a target.

By default, you see weapons (A-G or A-A) released by your own aircraft. However, it is possible to set the focus on another object (ground unit, aircraft) and see the weapons released by them on their way to the tracked target. This works both for A-A and A-G units. If no weapons are shot by the focused object, nothing happens.

You can step through all weapons shot by the object by pressing "*SHIFT 7*" again.

8.5.10 Target-to-Weapon Camera   (*CTL 7*)

This view shows the weapon(s) released or shot by your aircraft in relation to the target you have fired upon. The weapon is centred while the target is in the foreground.

You can step through all weapons by hitting "*CTL 7*" repeatedly.

> *Note: Only weapons fired by you are shown here. If no weapon is released, nothing will happen.*
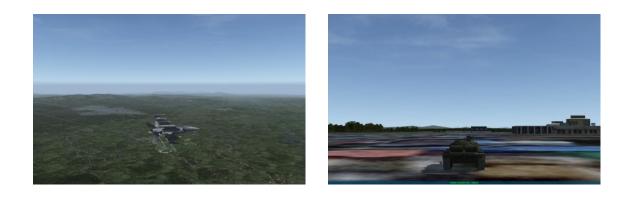
8.5.11 Aircraft & Ground Unit Cameras

Friendly Aircraft Camera   *8*

Friendly Ground Unit Camera   *SHIFT 8*

Enemy Aircraft Camera   *CTL 8*

Enemy Ground Unit Camera   *ALT 8*

These camera views are all mentioned together as they are obviously doing almost the same thing. The difference is just the kind of object shown. You can step through the objects in the area nearby using the above keystrokes. In addition it is possible to step through next / previous objects by using "*ALT =*" (Previous Aircraft) and "*ALT -*" (Next Aircraft) commands.

> *Note: naval vessels and aircraft on the ground will be treated as ground units.*

8.5.12 Chase Camera (*9*)

The chase camera places the view directly behind the focused object. Even if the object (e.g. an aircraft) turns the view will stay behind it. You can step through other aircraft nearby with Prev / Next Aircraft commands. You can change FOV and Zoom levels.

> *Note: changing the POV with the mouse isn't possible. The object stays in the centre of the screen.*

8.5.13 Flyby Camera (*SHIFT 9*)

The Flyby camera places a fixed view in front of an object and lets it pass by. When the object has passed, the view switches to Chase camera. You cannot control POV and Zoom levels; only FOV is possible. The object stays in the centre of the screen.

8.5.14 TopGun Camera (*CTL 9*)

Next TopGun View "*ALT 0* "
Prev TopGun View "*ALT 9* "

TopGun views are fixed views around an aircraft. "*CTL 9*" toggles the TopGun Camera on and off, while the next / prev TopGun view functions step through the different views.

The 4 default TopGun views are shown below. These views can be user defined. See the Technical manual for further information.

8.5.15 Orbit Camera: (*0*)

This view allows a free, flexible camera view around an object. You can change POV in all directions.

The view angle stays constant while the object turns. You can step through other aircraft nearby with Prev / Next Aircraft commands. You can change FOV and Zoom levels.

The object stays in the centre of the screen.

8.5.16 Toggle Displacement Camera (*SHIFT 0*)

Activating this option makes the camera 'float' around the currently viewed (flying) aircraft while in orbit view mode. It simulates the relative motion of the airborne vehicle.

This feature needs to be enabled in the Falcon BMS.cfg file. Once this is done, you can toggle it temporarily by pressing the above keypress.

8.5.17 Toggle EyeFly (Free Cam)   (*CTL 0*)

EyeFly is a free camera. To get it to work you first have to add -ef to your BMS Launcher.exe shortcut, **"C:\Falcon BMS 4.34\Launcher.exe" –ef**.

In game it is activated via the above keystroke. It toggles EyeFly on and off.

The free cam is controlled via the mouse. External mouselook must be activated in the SETUP > CONTROLLERS > ADVANCED > VIEW CONTROL tab.

In 4.36 we reworked the EyeFly controls:

- W – Fwd | A – Left | S – Back |D – Right
- Q / Z keys for up and down
- The Mouse controls view panning
- Mouse Wheel controls sensitivity

Control sensitivity can be set in the Falcon BMS.cfg:

g_fEyeFlySpeedFactor   // controls the forward (mouse scroll wheel), default 1000.0f

g_fEyeFlyTranslateFactor   // controls the up/down/left/right/forward/backward speed, default 500.0f

g_fEyeFlyViewAngleFactor   // controls the sensitivity of the mouse viewing angles, default 1.0f

Eyefly provides interesting view perspectives.

8.6   Text Overlays

Note: This chapter was moved from the BMS Technical Manual (Chapter 8) to BMS Manual.

8.6.1   Infobar (CTL 1)

In external views an infobar is shown on the bottom of the screen. It contains information about the object (aircraft, naval vessel, ground unit or weapon) the view is focused on. The infobar is displayed by default. It depends on your settings in the UI Simulation tab. You can also toggle it on and off by pressing "*Ctrl 1*".

Note: If you toggle the infobar in 3D your last setting when leaving the 3D world will be applied to the UI setting as well. For example, if the infobar was activated in the UI before the flight and in 3D you turn it off and exit the sim the UI setting will be deactivated then. Depending on the focused object the infobar contains different information.

Aircraft will have information about callsign (Own AC = Pilots callsign - friendly aircraft = Callsign - Enemy aircraft = Type of aircraft), heading, altitude, speed, RPM, Gs and AOA.

For Ground Units only Friendly or Enemy Ground Unit Camera messages are displayed.

8.6.2   Radio Subtitles (CTL 2)

By activating this feature it is possible to display the radio messages subtitles.
This feature is exclusively activated/deactivated in the configuration screen; however it can be momentarily toggled by pressing the "ToggleSubTitles" key. Please note that audible messages may 'lag' behind the displayed ones

Messages will be displayed for 10 seconds and up to 10 messages will be displayed at the same time. As more messages are displayed the more recent ones are added at the bottom of the display and move their way up as the older messages get removed. You can configure both the 'time to live' (TTL) and the maximum number of displayed messages by editing the *g_nSubTitleTTL* and *g_nNumberOfSubTitles* options in the Falcon BMS.cfg file. See the BMS Technical Manual for more information.

Messages are displayed in different colours, which indicate the radio channel where they originated from. The colours are user editable through config options lines and are explained later in this manual.

In 4.36 we introduced the possibility to show the radio subtitles within the new ImGui feature. How that works is described in the Technical Manual.

```
[01:56:08] Goblin 2-1 F-16 15 miles South 2000 inbound for Free landing
[01:56:13] Good morning Goblin 2-1 Gunsan Approach continue inbound for straight in approach runway 3-6 welcome back
```

8.6.3 Flap Display (CTL 3)

When flying aircraft that do not have automatic FLAPS (LEF & TEF) the position of the flaps will be displayed in the top right corner of the screen by default. You can toggle these OFF and ON with the relevant keystroke.

Flaps 26 LEFs 85

8.6.4 Engine Display (CTL 4)

When flying aircraft multi-engine aircraft each engine RPM will be displayed in the top right corner of the screen. You can toggle these OFF and ON with the relevant keystroke.

Both Engines rpm 0.91 rpm2 0.91

Show Score (ALT c : d)

This function shows you the score in Dogfight module or a Tactical Engagement.
In a TE you get points if you destroy specific targets (if Victory Conditions have been set by TE creator). In Dogfight you get points for shooting down other aircraft.

Game Over		Sierra Hotel	
USA	0	Crimson	0
DPRK	0	Shark	0

Score in Tactical Engagement   Score in Dogfight

8.6.5 Frame Rate (ALT c : f)

If activated the frame rate overlay will be displayed in the upper left corner of the screen.

```
FPS: 101.5,   9.85 ms, Mem 85.92 MB, Cmd 2521
Sim: 111.4,   8.98 ms (Draw 8.98, Expt 1.07, Wait 0.00)
Ren: 252.3,   3.96 ms (Exec 3.89, Prsnt 0.07, Res 0.0026)
```

- •   FPS: The number of frames per second presented to the monitor and the duration of a frame.
- •   Sim: Theoretical FPS of the simulation thread based on its duration.
- •   Ren: Theoretical FPS of the render thread based on its duration.

- Cmd: The number of draw calls/commands created by the current scene. If this number is high, performance will be lower.
- Expt: Duration of the RTT export. This, added to the Sim duration roughly equals the overall FPS duration.

If you want e.g. 120 FPS, then SIM, REN and FPS must be above 120 FPS. It is limited by the slowest running part. If e.g. REN is only running at 50 FPS, you will never have more than 50 FPS overall.

Usually, your FPS will be a bit smaller than SIM and REN because there is still a synchronous part running between when SIM and REN are finished and until the frame is actually presented on screen. This includes things like the RTT export and virtual universe update.

8.6.6   Online Status (ALT c : o)

If activated, you can see a list of all users who are currently connected to the server in the top left corner of the screen. The number in the bracket is the consecutive numbering. The Host of an online game is always number one. The second part shows the pilot's callsign as defined in the Logbook.

The third part, which is also set within brackets, shows the current status of the pilot. We have different status massages which are as follows:

- (UI): A pilot has connected to the server <u>and</u> the online game <u>and</u> is currently in the UI.
- (UI>3D): A pilot is entering the 3D world.
- (3D): A pilot is in the 3D world <u>and</u> in the cockpit.
- (3D>dead): A pilot has either ejected <u>or</u> his jet has crashed / exploded.

We have also some subtitles in relation to online status changes:

\<Callsign>**: (is committing now)**
\<Callsign> **joined as** \<FlightCallsign&SlotNumber> **at** \<FalconTime>
\<Callsign> **exited from** \<FlightCallsign&SlotNumber> **at** \<FalconTime>

> *Note: The "exited from" message does NOT appear if a pilot has ejected or has been killed. You also get no message if a pilot enters a server (from desktop to UI) or leaves the server (from UI to desktop).*

The OnlinePlayersDisplay 3D overlay also includes live network connection information:

- incoming bw in kbps
- outgoing bw in kbps
- ping in ms
- bandwidth limit (if applicable)

The info is not calculated by BMS, but directly taken from the transport layer, i.e. it is accurate.

If you notice no "LIMITED" indication during game play (in brackets at the end of the line), all is fine. In case a client has insufficient bandwidth for a smooth mp experience the "LIMITED" overlay will occur, indicating that BMS msg sending is now hitting the client limits.

Also note that once "LIMITED" is shown, the ping times reported for these clients will also increase. This is an artefact of the RakNet congestion control, as hitting the BW limit simply means that messages queue up and take a while to be processed. Unfortunately, this is true for the ping measuring round trip messages as well. So you will only see the actual physical ping time as long as you don't hit the hard BW limit on any given connection.

> *Note: We have a new config option g_bOnlinePlayersDisplayDefault (default OFF/0) which specifies whether the OnlinePlayersDisplay overlay should be ON or OFF by default when entering 3D.*

8.7   Other View Features

We have a couple of other views related functions which will be described here.

8.7.1   Labels

When labels are activated all aircraft, ground units, naval vessels and released weapons like A-A missiles or bombs (but not gun shots) are tagged with their name and their distance to your own jet (slant range). The labels float near the object. Labels are not shown on static objects like buildings or bridges.

Before you can use labels in 3D you have to activate them on the SETUP > SIMULATION tab.

You can toggle near and far labels temporarily with these functions:

   Labels Near: "*ALT ^*"   Labels Far "*ALT 1*"

The keystrokes toggle labels on/off. You get corresponding status messages (subtitles) on the left side of the screen if activated.
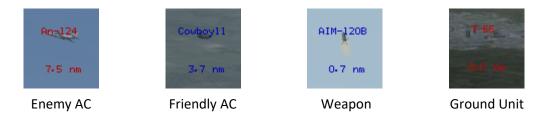
> *Note: far labels can only be displayed if near labels have been already activated.*

The difference between the two is that objects shown with near labels are within potential engagement range, while far labels show objects outside engagement range. Or in other words: everything shown with near labels should be taken care of as they may become a possible threat or target.

Labels have different colours as shown in the following table:

Mode	Identifying Colours
Dogfight	Red = Crimson, Blue = Shark, White = USA / Eagle, Orange = Tiger
TE / Campaign / Instant Action	Blue = Friendly, Red = Enemy

Enemy aircraft, all ground units and all weapons will be labelled with the name of the object.
Friendly aircraft will be labelled with their callsign. Ownship will be labelled with pilots callsign.

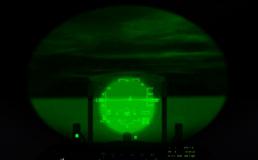| Enemy AC | Friendly AC | Weapon | Ground Unit |

8.7.2   Nightvision (*n*)

When flying sorties at night the helmet mounted Night Vision Goggles (NVGs) can help you to see even in dark conditions. By default only a part of the screen shows the NVG image. This is to simulate the real life NVG gimbals. However, the shape of the gimbals is dependent of your screen resolution. It should be a circle only, but the more widescreen the resolution is, the more it becomes an oval.

You can also operate night vision in full screen mode. To activate Full Screen NVGs launch the Falcon BMS Config Editor and open the General section. Activate the box next to "Full Screen NVGs".

The right image shows the default NVG view. The left image shows the full screen option.

8.7.3   Helmet Visor (*ALT v*)

This toggles the helmet visor up / down for better readability of the HUD in bright conditions.
The view is darkened a bit. The tint is configurable in 3dckpt.dat file via visor_tint_color.

Left image shows the regular view with the helmet visor up. The right image shows the visor down.

8.7.4   Redout / Blackout

This simulates the effect of G forces on the pilot's body. When pulling positive Gs the blood flows from the head to the lower parts of the body. If you do so for a significant amount of time the view gets greyed out and the field of view narrowed until a point when vision is completely lost. This is what we call a blackout. The longer the pilot is under high positive g-force, the more the vision is influenced.

A redout is the opposite; under negative g-force conditions the blood tends to flow towards the head which leads to a red haze.

4.36 introduces a new concept of Redout and Blackout. No pilot has its full G tolerance potential right from the beginning. Once in the air you must adjust your body to higher G manoeuvres with a proper AGSM (Anti-G Straining Maneuver) Warm up exercise. This is a set of maneuvers that the pilots use in real life to be physically and mentally prepared for the G demand on the body. This is to avoid GLOC (G induced loss of consciousness). As in RL, your G tolerance depletes over time and your body becomes fatigued when pulling high Gs.

- **G-Tolerance:**
  G-tolerance can be thought of as the ultimate G level that can be maintained over a short period of time that still allows the pilot to employ the jet safely and effectively.

- **G-Endurance:**
  G-endurance, the max G level that can be maintained over a longer period, is perhaps more important; especially considering the F-16's capability to sustain high G.

- **G-Warm-Up:**
  In order to get your G tolerance to its best potential you must perform a G war up procedure. This shall be done prior entering possible combat scenarios.
  The G warm up consists of flying turns in the 3-5 G region to train the body. The more you train in this area the longer your body will remember the warmup. Without a proper warm up procedure the resistance of the pilot's body will be limited thus affected by Redout / Blackout much faster.

- **Fatigue:**
  The pilot's G tolerance depletes progressively after some time. For example, a 45 seconds warmup in the 3-5 G region will provide full G capability for 20 minutes. After 20 minutes a new warm up should be done.
  The longer you pull high Gs in combat (above 7G) the quicker the effect of the warm up will be depleted. After a certain amount of time above 7G, the G Load resistance of the pilot is equivalent to the one with no warm up.

- **G-Warmup exercises:**
  - ➢ With a smooth application of G (as in a tactical turn), perform a 4 - 5 G turn for 90º (level to climbing).
  - ➢ Reestablish airspeed and perform another 90º (air-to-ground)/180º (air-to-air) turn. Turn initially with 5 - 7 G's and then let off to a minimum of 3 - 4 G's during the last 90º as energy bleeds off. Again, use this opportunity to establish your awareness for operating in the increased-G environment while practicing the anti-G straining maneuver.
  - ➢ If aircraft limits or energy limits preclude completing the above at the prescribed G, then turns should be performed so as not to exceed aircraft limits.

The G tolerance warm up is deactivated in Instant Action and Dogfight modules. In TE and Campaign it is set by the "*g_bEnableGtraining*" option (default true) in Falcon BMS.cfg (MP Settings section -> host controlled in MP).

8.7.5 HUD Colour *(*ALT h)

This is not really a view feature as such, but it should also be mentioned.

Using the keystroke you can step through various HUD colours with different intensities. Altogether you have 16 options here to choose from.

Although not realistic it can help you to increase the contrast in specific lightning conditions.
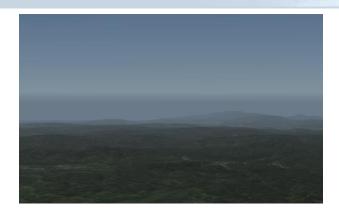
> *Note: this also affects the colour of some overlay messages like 'Screenshot saved as', joining or exiting pilot messages etc. Displays and radio subtitles are not affected.*

8.7.6 Toggle HUD Rendering (alt c : h)

> *Note: Moved from BMS Technical Manual (Chapter 8) to BMS Manual.*

A new callback (OTWToggleHUDRendering) has been added, which will toggle rendering the HUD. It works only in the HUD only, Snap (2D) Pit, Pan (3D) Pit, Empty Cockpit Shell and EFOV views. The Cockpit Display Extraction (external window rendering) is not affected by this.

| HUD only w/o HUD rendering | Pan (3D) Pit w/o HUD rendering |

8.7.7   Pilot Model & New multipage kneeboard (ALT C:P)

The Pilot Model, which is basically a body and legs model, can be displayed in the 3d cockpit by either activating the checkbox in the SETUP - GRAPHICS page (pilot model is on by default when entering 3d) or by key comb ALT c: p (i.e. [ALT + c] followed by [p]) which toggles the pilot model on/off when in cockpit. The latter one can be useful if the view to parts of the cockpit is partially obscured.

- Toggle Pilot Model on/off "*ALT C: P*"
- Left Kneeboard - Inc "*Ctrl Insert*"
- Right Kneeboard - Inc "*Ctrl PgUp*"

The pilot model now features left & right kneepads which consist of 16 pages each. This is new from previous version of BMS where the kneeboard pages could not be toggled.
You can scroll through the pages either via hotspots (left click, right click, mousewheel) or by using the keyboard callbacks *SimRightKneePadInc*, *SimRightKneePadDec*, *SimLeftKneePadInc* and *SimLeftKneePadDec* (Dec callbacks have no key assignments by default). There are two hotspots per kneeboard: One smaller one in the upper right corner and one bigger one in the centre of the kneeboard.

You can set the pages with the Weapon Delivery Planner. How that works is described in the BMS Technical Manual. However, if you do not use WDP at all there is a set of default pages ready for use featuring normal checklists on the left knee and KTO maps, navigation data and RWR tables on the right knee.

9.   User Interface

9.1   Instant action

If you need a quick fix of single player aerial combat select INSTANT ACTION. The left part of the screen offers some options:

- The start time can be set at any hour of the day or night. Please note, it is local time, unlike all other places in BMS UI/

- If Fighter Sweep is selected from the MISSION section Instant Action will be mainly Air to Air; in Moving Mud it will be Air to Ground. Both options are self-exclusive.

- The WAVE section allows setting the level of the Artificial Intelligence the user will fight against: Recruit/Cadet/Rookie/Veteran and Ace. Obviously it goes from easiest to hardest.

- The AIR DEFENSES section activates SAMs and/or AAA. If enabled they will fire in both A-A and A-G scenarios.

The geographic area of Instant Action can be selected by dragging the green square on the map with the mouse.

Once all options have been set, simply select the COMMIT button to enter the cockpit in flight in the thick of the action.

The aircraft will be the KF-16 block 52 with various and mixed loadouts depending on the chosen A-A or A-G scenario.

The stores are not realistic but provide a mix, allowing the users to use as many weapons systems as possible. They are unlimited but the user has no control on store selection prior to flying. For instance a Moving Mud scenario will initialise with one AGM-88, one CBU, LANTIRN NVP and TGP pods, one GBU and one Maverick.

Obviously the threat will also change according to the chosen scenario. Ground units will be present in the green square if the Moving Mud option was chosen; different waves of aircraft (bombers and fighters) will be present when the Fighter Sweep option is selected.

Please note Invincibility is not turned on by default and if desired can be activated in the SETUP part of the UI.

When Instant Action ends a debrief screen will be displayed with all events from the flight and your total score, depending on your realism rating in the SETUP part of the UI.

9.2 Dogfight

The DOGFIGHT module provides the user with SP or MP head-to-head aerial combat. Up to 4 teams of humans or AI can fight for the highest score.

3 scenarios are available by default: Furball, Match Play and Team Furball. Once you have created your own scenarios they will be available from the menu as well. In Furball you are on your own against everyone else. Match Play introduces cooperation with more than one aircraft within a team. Team Furball is one team against other teams, each fighting for their side.
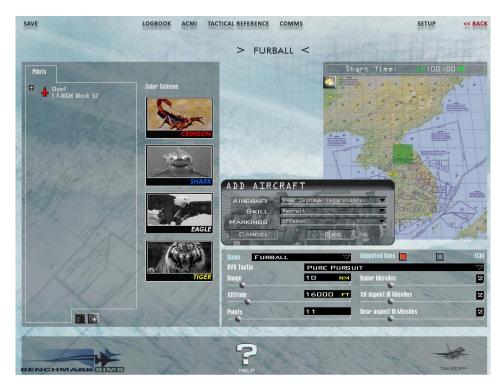
Remember that to communicate with your wingman you need to be on the same frequency. Since there is no briefing in Dogfight, the assigned VHF frequency for flights is preset #15. Make sure you are set to that frequency before issuing any orders.

Please note changing the weather is now possible in the Dogfight menu. Dogfighting with clouds allows you to use them as cover or for IR deception tactics, but with Track IR, turning clouds really impact your immersion and ability to keep tally on your opponent. Now you can deactivate the clouds if you desire.

Select an option then click the COMMIT button on the bottom right of the screen.

9.2.1 Furball

To setup a Furball you must add aircraft to the list by clicking the add aircraft icon. A window will pop up where you can choose the type of aircraft, its skill level and its team (Crimson, Shark, Eagle or Tiger). Unlike the original Falcon, the aircraft are not painted according to their team colours. The location of the Furball can also be selected by dragging the green square on the map. Time of day can be set as well by changing the start time.

In Furball you get points for each kill, but lose points when you crash, eject or are damaged. The Points slider determines the score the participant must reach to win the Furball. Once a participant (AI or human) reaches the set number of points, the Furball ends. When one aircraft is destroyed it is regenerated with a new weapon load just outside the Furball and the Sierra Hotel window is updated with the current points.

The Range slider sets how far from the Furball the participant will enter. Altitude sets the initial altitude of the engagement. The AAM loadout can be set to prioritise BVR engagements, dogfights or both. ECM and unlimited guns are options you can toggle on or off.

Once you are happy with the Furball settings you can save it with the SAVE button on the top left of the screen or hit the TAKEOFF button to start the Furball.

9.2.2 Match Play

The setting options are the same for Match Play. The difference is that 4 teams can be created and the player can join any team. Each team will start the engagement together in one of the 4 geographic quadrants separated by the distance set in the Range slider. To win a match, your team must win the number of sets selected with the Points slider.

Every time one team kills all the aircraft in the opposing teams, that team scores a point, the teams are reset to their starting positions and weapons loadouts replenished for a new fight. If you are killed in the middle of a fight, you cannot re-enter until the next match begins.

Once a Match Play dogfight begins, no new pilots can join in (unlike in Furball or Team Furball). If you exit the simulation, you cannot rejoin.

BVR tactics is a new drop-down menu to setup and practise complex BVR tactics in Match Play. It is not applicable in Furball or Team Furball. The AI will now be able to execute these complex tactics competently, unlike in previous versions of BMS.

After a match is over, everyone returns to the DOGFIGHT screen and the events list is displayed.

Before launching Match Play you can change aircraft or pilots within a team by right-clicking on an aircraft. A submenu will be displayed letting you change aircraft, the pilot rating for AI or delete the aircraft from the team. The setup can be saved with the SAVE button as with Furball.

9.2.3 Team Furball

Team Furball is the same as Match Play but the points are counted as in Furball. You do not have to destroy the whole opposing team to score, but points are accumulated when you destroy an aircraft of any team. Points are assigned within a team. The winning team is the team that reaches the points set in the slider first.

Points are thus assigned in the same way as in Furball but you will also lose points when you kill a team mate. Unlike Match Play, when you are killed you are respawned immediately with a full weapon load.

Within all DOGFIGHT setups you always have access to the LOGBOOK, ACMI, TACTICAL REFERENCE and COMMS menus.

To set up online Dogfights simply initiate a host (or join as a client) with the COMMS menu and join the DOGFIGHT section. In most cases you can join any team by right-clicking on an aircraft. The AI pilot rating will then be replaced by your human callsign. A further right-click on a human callsign will allow you to display their logbook to check his/her ratings.

9.3   Tactical Engagement

Unless you mostly fly Campaign, TACTICAL ENGAGEMENT is where you will spend most of your time in the User Interface. It's where individual missions (also called TEs) are created and initialised. Tactical Engagement defaults to the TRAINING missions tab. Other tabs are SAVED and ONLINE. The button on the bottom labelled TE BUILDER launches the TE editor, used to create missions.

Reminder: 4.35 TEs are not compatible with 4.36 due to Database changes. And 4.35 training missions are not compatible with the new 4.36 due to the database having been updated. 4.35 training missions have been converted. TEs can be converted with Mission Commander.

9.3.1   TRAINING missions

BMS training missions cannot be edited by the user. They have the extension .trn and are located in the *Data\Campaign* folder.

An accompanying BMS-Training manual is located in the *Docs* folder and should be used together with the training missions. Each training mission has a dedicated chapter detailing the whole training flight step by step, in the same way the original Falcon 4.0 Flight Handbook documented training missions.

To launch a training mission, simply select it and click the COMMIT button on the bottom right corner of the UI. Refer to the BMS-Training.pdf document for further information about the training syllabus.

9.3.2   ONLINE TEs

The ONLINE TEs tab is where MP missions will be initiated. Once COMMS have been established between host and client(s) the host's mission will be available on the ONLINE tab and can be launched just like any other TE. If COMMS was not initiated prior to selecting the ONLINE tab, then the COMMS window will popup prompting you to connect.

9.3.3   SAVED TEs

The middle tab is used to load, modify or create TEs. As with the training tab, a list of TEs will be displayed. Unlike the training missions the TEs can be modified by the users with the EDIT button. We will come back to that later in this chapter.

TEs use the .tac extension and are saved in the *Data\Campaign* folder along with supporting files. They often have an .ini file which is the DTC data, a .twx weather file or an .fmap if the TE has a new weather map and perhaps a .iff file for IFF setups. All files have the same name, only the extensions are different.

TEs can be shared amongst users. For TEs to work correctly when shared, all the files must be copied to the *Data\Campaign* folder. They can't be renamed unless all files are renamed. It is not advisable to do so as part of the DTC may be lost unless the first line of the .ini file, which has the same name as the TE, is also updated.

The DELETE button is obviously used to delete a TE from the list.

The TE BUILDER button loads an empty TE based on the te_new.tac template, which is the base for a TE created from scratch. We will come back to that later on as well.

9.3.4   Launching an existing TE

To select a TE simply click once on its name. The TE name will turn green and more information will be displayed in the right part of the TE window. Most TEs can be flown on any side, so you must first ensure you select your assigned side in the top right window under the CHOOSE TEAM heading. Please note, BMS defaults to 7 teams. Simply click the flag of the side you wish to fly for, unless it's already selected. As you can see the terrain is divided into multiple colours (as many as they are different teams) and each flag is outlined with the same team colour.

The bottom right window gives more information about the selected TEs. Some comments may be displayed, depending on the TE creator. All TEs can be flow MP or Solo. When no humans are available the AI takes over.

Please note the flag in the bottom right section confirms your team choice.

To launch the TE click on the COMMIT icon to go to the MISSION SCHEDULE page.

The MISSION SCHEDULE window is divided into 5 parts.

The clock

TEs have a running clock, now in both ZULU and Local Times. It is a good habit to always stop the clock whenever you enter a TE. The reason is that things may happen in 3D (virtual world) while you are spending time in 2D (the user interface) briefing. If you plan to ramp start and spent 10 minutes briefing before launching the TE then your ramp start time might be seriously shortened (depending on how much spare time was built-in to the TE when it was created).

To stop the clock, simply click on the ▼ next to the time of day and select Stop. If you are the Host of a multiplayer session it is strongly recommended that you select HALT to stop the clock for everyone.

You can also accelerate time, up to x64 if required, though it is usually advised not to go above x16 time compression as AI actions in 3D cannot always be relied upon at higher rates.

Flight line-up

The left section lists all the allied flights in the mission; the selected flight is listed in green. The aircraft icons below constitute the selected flight. Players can join any flight in any position by first selecting the flight and then selecting an aircraft icon until their logbook name is displayed under the chosen aircraft.

The flights are divided into columns: Priority, Take-off time (now ZULU), Role, Package number and Status. As you can see the F-16s in this TE take off at 0540 & 0543 ZULU time. The current TE time is 0524z, already within the 18 minutes normally set for ramp start, hence the need to stop the clock as soon as possible.

Package is an important aspect as IDM (data-link) will usually only be available within the same package.
In this case both F-16 flights are part of the same package; as you can see they share a common 3706 package number.

Map Option Icons:
The right icon column allows specific map options to be activated. The first (top) one allows you to switch the map to full screen. The second one opens a small help window. The flag is not active in this scenario but in the TE Builder would allow you to change teams. The icon with two aircraft allows you to add a new package in the TE if you click on the map afterwards. These last two options are outside the scope of using an existing TE.

The next three icons allow you to zoom out (-) or zoom in (+) on the map and centre the map on the current flight route. The mouse wheel will also zoom in and out when the mouse pointer is placed on the map.

The next group of icons allows you to display the altitude plots, the DTC and the weather options.

There are two Altitude Plots available: Linear and Log. Both provide the same result but have different scales. Use the Log Altitude Plot as it is easier to see the altitude difference between steerpoints. If you use the linear view you may have to scroll vertically to see all the altitudes because of the fixed linear scale.

The Altitude Plot also gives the total route distance (not taking into account the CAP patrol time (triangular shape)) and the time required for the flight (taking into account the CAP patrol time).

The DTC icon allows you to set the DTC correctly for this flight. Most options may already have been set by the TE designer but the user can customise things to their personal preference. For instance specific targets may be set as target steerpoints for A-G missions.

The COMM plan and IFF policy are automatically loaded into the DTC.
In the example (right) we can check that the tower frequency has been pre-programmed correctly: from the COMMS tab, select UHF Preset 3, and check that it has been correctly assigned to Gunsan tower 292.3 MHz.

For complete documentation about how to set up the DTC please refer back to Chapter 6 of this manual.

The Setup Weather icon is used to set the weather for TEs and is usually already set by the TE designer. Weather briefings can be obtained from other sources such as third party software like WDP, or through the briefing page which we will document later. For a full explanation of the weather screens, please refer back to Chapter 5 of this manual.

Mission Builder Tools

The bottom section of the MISSION SCHEDULE has 6 more icons: Air Tasking Order, Order of Battle, Flight plan, Briefing, Loadout and Takeoff.

- ATO

  The Air Tasking Order lists all friendly flights fragged for this mission. When first opened it might not show all flights but checking the bottom option 'Show all packages' fixes that.

  Each package arranged by tasking can be opened up if a **+** is displayed in front of it, showing information (aircraft type, tasking, callsign, take-off time, squadron) for all flights within the package.

  By checking the right checkbox (TOT) the flight plan of each flight within the package will be displayed in black on the mission map.

  The ATO is mostly used when building missions, as it allows you to manage different flights. We will come back to it later. When briefing a TE it is mostly used to check tasking, routes and help coordination with other flights or package, AI or humans.

  From the ATO window you can manage packages or specific flights. To manage a package or a flight right-click on its line.

  A submenu will open with Package or Flight specific options:

  ➢ **Recon:** will spot the flight in the Recon view if already underway.

  ➢ **Show Flights** (package): will open the window listing the flights in the package. They are listed in the ATO as well but from here you can change settings such as Package Priority, Takeoff Time and Time on Target. You can also manage individual flights.

  ➢ **Delete:** allows the user to delete the flight, or the whole package.

  ➢ **Add Flight:** (flight) is an option that is visible when clicking on a package flight and lets you add a further flight into the selected package.

  ➢ **Add Package:** (flight) allows you to add a complete package, on the same level as the other packages.

  ➢ **Status:** (flight) displays the squadron status.

  ➢ **Join:** (flight) is for the user to join that flight but is not necessary in TEs as the user already selected a flight previously.

- OOB

  The Order of Battle is a list of all assets from all the teams in the Tactical Engagement. The assets are listed by teams (flags) and Air, Sea, Land and Installations.

  To browse through assets, expand the list with the **+** sign and collapse the list with the **–** sign. If you right-click on an asset the usual submenu will be displayed allowing further options, mainly for TE designing.

  The INFO button on the bottom of the OOB will display further information about the selected asset and the FIND button will jump directly to the selected asset on the UI map. Certain information may only be available for team/allied/friendly units, or units that have been identified by other assets, such as JSTARS or other flights.

- FLIGHTPLAN

  Reviewing your flight plan is a good idea before flying a mission. The flight plan window lists the selected flight package number and the current flight: Fury1. Any other flight can be selected with the drop down menu but we will concentrate on our own.

  Each steerpoint can be reviewed with ◄►. In this case STPT 3 was selected, which is the first target point (actually the first CAP point).

  The information listed below is relevant to the chosen steerpoint:

  ➢ **TOS**: Time over Steerpoint in UTC (Falcon) time.

  ➢ **ALT**: the planned altitude at the steerpoint.

  ➢ **TAS**: the True airspeed at the steerpoint.

  ➢ **CAS**: the planned Calibrated airspeed at the steerpoint.

  ➢ **Formation**: the flight formation on that steerpoint leg.

  ➢ **Enroute**: Sets the planned action of the flight enroute to the steerpoint (most of the time NAV).

  ➢ **Action**: Sets the steerpoint action point. In this case the action for steerpoint 3 is CAP.

  ➢ **Descent/Climb**: this line is only displayed if there was a change of altitude from the previous steerpoint. The change of altitude can be immediate (upon leaving the previous steerpoint) or delayed (the change of altitude will be completed just before arriving at the selected steerpoint).

  ➢ **Patrol Duration**: According to the steerpoint action a patrol timer may be displayed. The timer will define the time the flight needs to stay on the action assignment (in this case CAP). As there are 2 CAP points (STPTs 3 & 4) the 1 hour patrol time will be spent flying back and forth between the 2 steerpoints. The time at STPT 4 will not take into account the patrol time, but just the time needed to fly from STPT 3 to 4. The time at the next nav point (STPT 5) will account for the time to fly from STPT 4 to 5 and the patrol time however.

Whenever there are ◄► on the right it means the information can be changed by the user. When an open padlock is displayed it means the data is not locked; when the green closed lock is displayed it means the data is locked and must be unlocked first before being changed. This is useful to lock a target time to ensure effective coordination with other flights for time sensitive scenarios.
A feature often unknown is that if a left click on the padlock locks/unlocks that steerpoint only, a right click on the padlock locks/unlocks ALL STEERPOINTS at once. It is very useful when editing flight times.

Obviously when a TOS is locked, changing the other steerpoint times will change the required airspeed between steerpoints and vice versa. These changes can be done up to a certain point.

If the situation becomes impossible to achieve (because of a too high or too low airspeed, or another timing problem) the problematic leg of the flight plan will turn red and the problematic data will be surrounded in red in the flight plan window, making it easy for the user to identify and attempt to solve the issue.

The first steerpoint is always the take-off steerpoint. The altitude and speed will be zero. The last steerpoint is the alternate landing site and the penultimate steerpoint is the landing steerpoint.
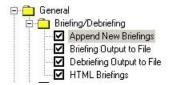
If there is no alternate planned the last steerpoint is the landing steerpoint. Sometimes the landing steerpoint is red, usually because the steerpoint is not perfectly placed on the airbase. The take-off, landing and alternate airbases must be listed in the option box of the flight plan window.

- • <u>BRIEFING</u>
  The briefing is a summary of all relevant information about the selected flight. It has been extensively updated to take advantage of new BMS features. It can be printed by clicking on the PRINT button in the top right corner. The print is done to a text file, Briefing.txt, located in the *User\Briefings* folder, which in turn can be sent to your printer.

  The Falcon BMS Config app has different options used to manage the briefings:

  - ➢ **Append New Briefings** will add the last briefing content to the Briefing.txt file, rather than overwriting the old content. That way you will have all your briefings by date in the briefing.txt. If the option is not selected the Briefing.txt file will only contain the last printed briefing in it.

  - ➢ **Briefing Output to File** is the master option to enable the PRINT button in the UI.

  - ➢ **Debriefing Output to File** when checked creates a debrief.txt file in the same folder. That file is automatically appended with subsequent debriefings, with the latest debrief at the bottom. This output is very useful when you want to share the result of a mission with a squad or other users.

  - ➢ The **HTML Briefing** option outputs the briefing format in .html for better formatting and sharing.

Please note the .html briefings are not in the same file. Each briefing has its own file named with the day and time of the mission. The briefing lists your mission task, the package elements, a list of all steerpoints with information, the Comm Ladder, the IFF policy, the ordnance for each aircraft within your package, the weather briefing at take-off, target and at landing (which can be different according to the loaded weather map), the support flights available and emergency procedures.

BRIEFING

PRINT ✕

12	Refuel	--	--	--	--	20.0M	Descend delayed	Wedge	Tanker station area
13	Land	--	--	--	--	--	--	Wedge	Land (Alternate)

COMM LADDER:

AGENCY:	CALLSIGN:	UHF [CHNL]:	VHF [CHNL]:	NOTES:
INTRA-FLIGHT:	Gamble1	274.625 MHz	141.950 MHz	Flight Management Comms
GUARD:	None	243.000 MHz	121.500 MHz	Distress / Emergency
COMMON:	None	339.750 MHz [14]	119.500 MHz [13]	Advisory / UNICOM
BASE OPS:	None	317.800 MHz [1]	--	Homeplate Operations
CHECK-IN:	Dragnet6	370.450 MHz	--	AWACS: Global Check-In
TACTICAL:	Dragnet6	300.125 MHz	--	AWACS: Package Comms
TANKER / AAR:	Copper5 (TCN: 062Y)	231.850 MHz	--	Boom Operator
DEP ATIS:	Gimpo ATIS	--	126.350 MHz	Departure Airbase
DEP GROUND:	Gimpo Ground	236.700 MHz [2]	--	Departure Airbase
DEP TOWER:	Gimpo Tower	240.900 MHz [3]	118.050 MHz [3]	Departure Airbase
DEP DEPARTURE:	Gimpo Departure	363.800 MHz [4]	--	Departure Airbase
ARR ATIS:	Gimpo ATIS	--	126.350 MHz	Recovery Airbase
ARR APPROACH:	Gimpo Approach	363.800 MHz [4]	--	Recovery Airbase
ARR TOWER:	Gimpo Tower	240.900 MHz [3]	118.050 MHz [3]	Recovery Airbase
ARR GROUND:	Gimpo Ground	236.700 MHz [2]	--	Recovery Airbase
ALT ATIS:	R103 ATIS	--	--	Alternate Airbase
ALT APPROACH:	R103 Approach	236.600 MHz [10]	--	Alternate Airbase
ALT TOWER:	R103 Tower	236.600 MHz [10]	122.600 MHz [11]	Alternate Airbase
ALT GROUND:	R103 Ground	236.600 MHz [10]	--	Alternate Airbase

IFF

GENERAL:

Initial STAT Settings:	Modes Active: M124	Codes:	M1: 60 M2: 2630 M3: 4530
M4 Validity Time (Until):	Key A: Day2 00:00z		Key B: Day3 00:00z
IFF Policy:	M1: per team	M2: per aircraft	M3: per aircraft
Code Change Setting:	POS/TIM		

TIME EVENTS:

	Rot/day:	04:00z	05:00z	06:00z	07:00z	08:00z	09:00z	10:00z	11:00z	12:00z	13:00z	14:00z	15:00z
M1:	24	43	33	21	22	13	61	72	22	51	63	30	13
M3:	24	4704	6254	5354	4554	6104	2054	0654	3604	1504	3204	1504	2430
M4:	1	A	A	A	A	A	A	A	A	A	A	A	A

POS EVENTS:

Ingress: M4 / NOF4	Egress: M124 / SOF9

More information about the new feature can be found in the relevant chapter of the Dash-1 manual for IFF and the new BMS Comms and Nav book for the new Comm plan.

- LOADOUT
You can review the aircraft loadout by clicking this icon. The arming screen will be displayed. The view of the aircraft can be moved and zoomed with the controls on the right. The loadout can be changed for the whole flight if all aircraft are selected (pilot boxes in green) or individually by unselecting (pilot box in grey) the others.

If the flight is still on the ground the Take Off time (Z) is displayed in green. Up to 2 minutes prior take-off time the loadout can be changed by the user. Past take-off time it will be replaced by a red IN FLIGHT and the loadout can no longer be changed.

4.36 introduces some useful fixes for e.g. multiplayer 24/7 events. In the past it was not possible to change the loadout if the flight was already deaggregated (spawned in 3d) and less than 4 (TE) or 10 (Campaign) minutes prior T/O time. This is now possible if the following conditions are met, even if the server is already in 3d:

➢ Not less than 2 minutes prior take-off time
➢ No human of that flight in 3d

Weapons are loaded from the list. The content of the list depends on the drop down menu on the left of the screen. Users can display **A-A**, **A-G**, **Other** (fuel tanks, pods, etc.) or **All** stores. When **Loadout** is selected only the stores currently on the aircraft are displayed in the list.

Only ordnance relevant to the selected aircraft will be displayed. If you cannot find a specific weapon or a pod it means that aircraft cannot carry it. To load a weapon, select the relevant list from the drop down menu and scroll the list until you see the desired weapon.

Any station able to carry the store will be identified with a light blue circle. The number of circles gives the number of stores that can be carried on that station. If the circle is khaki it means that station is already loaded with another store. When more than 3 stores can be carried the circles double (internal and external circle).

Relevant pylons to interface the store with the aircraft will be automatically loaded as you add stores. For instance if you select the BDU-33 training bombs a single bomb will load on the regular pylon, 1 to 3 bombs will load on a TER (Triple Ejector Rack) and more than 3 bombs will load on a SUU-20 dispenser. Unfortunately the 4 rockets on the SUU-20 are not loaded.

AIM-120B	HGH	2	● ○ ○ ○ ○ ●
AIM-9X	HGH		○ ○ ○ ○ ○ ○
AGM-65G	HGH	2	● ○ ○ ●
370 Gal Tank	HGH	2	● ●
AN/ALQ-131(V)	HGH	1	○ ● ○

The chosen loadout is dependent on the mission and the final decision is left to the user. Normally stations 4 and 6 are loaded with fuel tanks, leaving stations 3 and 7 for A-G stores (or A-A depending on the mission) and stations 1, 2, 8 and 9 usually carry A-A stores. Station 5, which is the centreline, is usually used either for an ECM pod or a fuel tank, depending on the block and mission you are flying.

When choosing a loadout the user must take into consideration the asymmetrical drag different weight stores will create. When stores are not symmetrical, roll trim will be required to maintain level flight. If the asymmetrical condition is significant, a notch or two of yaw (rudder) trim may also be required. Yaw trim can only be made with the YAW trim knob on the MAN TRIM panel.

Weights, limits and indexes are given in the bottom right part of the Loadout screen. Gross weight is the sum of the clean weight + munitions weight + fuel weight and must remain under the Max weight for that aircraft.

Fuel weights can be adjusted with the slider and will now be saved with the TE.

```
Clean Wt   : 19500
Munitions  : 7820
Fuel ————————● 12194
Gross Wt   : 39514
    Max Wt : 42300
Drag Factor : 218.0
Max G Limit : 5.5
Min G Limit : -2.0
   MAX KIAS : 550
   MAX Mach : 0.95
   Load CAT : III
LGB Laser Code 1511
```

Loadout configuration will also limit your load factor between a maximum positive G and a minimum negative G value. Stores may also have a maximum speed limit which is given in KIAS and Mach. These limits will change according to weapons carried. Failure to respect these limits in flight may damage stores, causing problems like fusing issues for bombs, hung status for missiles, SMS stations degrading or even failing. Category I or III will also be stated according to loadout.

This section of the loadout screen corresponds to the use of the weapon graphics in the real Dash-2 manual. The values given here will simplify the stores limitation by giving you the limits relevant to the current loadout.

The LGB Laser Code is the code for any laser guided weapons you are carrying. It was introduced in 4.33 and is explained in the BMS-Training manual (LGB chapter) and TO-BMS1F-16CM-34-1-1 (Targeting Pod chapter). For the weapon to guide, both the weapon code and laser code set in the UFC must match.

To set a specific code click on the green 4-digit code until it's selected; enter a new code between 1511 and 1788 then click the SET CODE button. You need to do this for each aircraft if you want to use different laser codes before take-off. Weapon codes cannot be changed once the flight has departed (except the GBU-54 Laser JDAM which can be reprogrammed in flight).

The bottom of the arming screen has multiple buttons: (unless the flight has already departed, then only cancel is available)

- ➢ **SAVE AS** allows users to save their own configuration. A SAVE WEAPON LOADOUT window will be displayed. Add your own name and click SAVE.

- ➢ **LOAD** allows the user to load ready-made configurations for specific tasking. The LOAD WEAPON LOADOUT window will be displayed. Configurations are named according to tasking and weapon load. Select one and hit LOAD.

- ➢ **RESTORE** switches the loadout back to the saved TE status.

- ➢ **CLEAR** will empty all stores & pylons (internal fuel will remain fully loaded).

- ➢ **CHANGE SKIN** selects other skin sets (if available) for that aircraft.

CAUTION: when you change the skin set for one aircraft, all other aircraft in the TE will also change their skin set!

- ➢ **CANCEL** will close the LOADOUT screen without saving any changes.

- ➢ **OK** will save the loadout and close the arming screen.

- ➢ **SET CODE** is the button to confirm laser code changes.

- • TAKEOFF
  When you are ready to go flying click the TAKEOFF button to commit to 3D. Hitting TAKEOFF always saves the DTC prior to flying, but it is advised to at least review and save the DTC prior to flying.
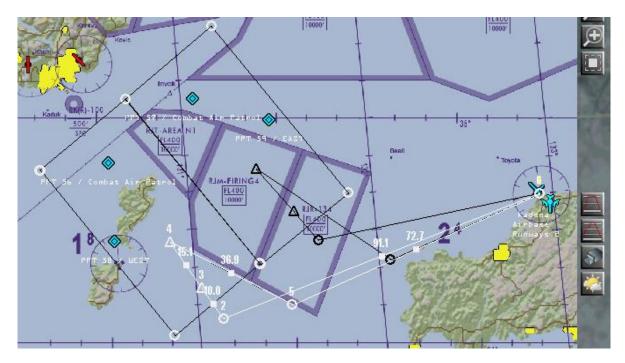
The Map

The main section of the TACTICAL ENGAGEMENT UI is the TE map. The map can be zoomed with the mouse wheel and once zoomed it can be panned by dragging the map with the mouse.

The selected flight's route is displayed in white. Other flight's routes may be shown in black according to the ATO options.

Any routing can be changed by the user by dragging a steerpoint to another location. If the middle point (solid square) is selected and dragged to another location an extra steerpoint will be created.

Right-clicking on any steerpoint opens a submenu for Steerpoint management. You can **Recon** the steerpoint, **Lock Time** and **Airspeed**, change the **Climb Mode** to switch altitude changes from delayed or immediate. Users can also change **Formation**, check current **Enroute Action** and change it (**Action**). Basically the submenu is a shortcut to the possibilities of the Flight Plan window. Steerpoints can be added or deleted with the last two options.

Other options are available if the user right-clicks the map at any location.

- Installations
  Different installations can be displayed as icons on the map. The icons will be coloured according to their side.

  ➢ **Air Fields** option will display airbases and airstrips.

  ➢ **Air Defences** will display known fixed SAM sites and air defines Radar.

> ➢ **Army** will display Army camps.

> ➢ **CCC** will display Command, Communication and Control centres.

> ➢ **Political** will display towns and villages.

> ➢ **Infrastructure** will display bridges.

> ➢ **Logistics** will display ports and depots.

> ➢ **War Production** will display factories and power plants and the new windfarms.

> ➢ **Nav Beacons** will display the non-collocated VORTAC stations on the map.

> ➢ **Other** will display various installations including the training ranges.

Once the desired icons are displayed on the map the user can easily manage them by right-clicking the icon and using the options of the submenu like Recon, Add a Flight with the selected point as target, Add a Package etc.

- Air Units
  Friendly **Squadron**, **Fighter**, **Attack**, **Bomber**, **Support**, **Helicopter** and **Unknown** will display detected aircraft of the relevant category on the map.

  Note: only detected units will be drawn on the map.
  Unknown units will be displayed as a triangle pointing towards their direction of flight.

  Detection of air units will obviously be increased if an AWACS is airborne. If no AWACS is airborne detection is by active friendly assets on the map.

  Placing the mouse cursor over an air unit will display an info box with further information about the flight depending on which side it is:

> ➢ For the red air side: quantity and type of aircraft, range and bearing from Bullseye, altitude, speed and heading and if they are deaggreated or not.
> ➢ For the blue air side: all of the above plus their UHF and VHF frequencies. (L) means Local. (A) means Agged.

  Units not directly influencing the outcome of the mission may be considered as a single entity by the code. They are said to be *agged (aggregated)*.

  Once the flight becomes more important in the TE scenario it will then be de-aggregated into its component units. The flight will then be said *deagged*. The ability to display detected air units on the map makes human AWACS possible in TE and Campaign scenarios.

- Ground Units
  Detected ground units can be drawn on the map as **Divisions**, **Brigades** or **Battalions**. **Combat**, **Air**

Defence and **Support** units can also be selected. Each unit will be displayed on the map with their specific icons (if spotted – i.e. their location is known).

- Naval Units
  Combat and/or **Supply** naval units can be displayed on the map with their respective icons.

- Show Packages
  Allows you to see a package icon on the map where other friendly packages are operating. Right-clicking the icon displays the usual submenu, allowing you to see the flights within the package.
  This is very useful if you want the UHF frequency of other friendly flights operating in the same area.

- Show Victory Conditions
  Some TEs have victory conditions (see the section on Creating a TE). If this is the case Show Victory Conditions will display an icon relevant to the mission goal.

- Show Threat Circles
  Opens a submenu with 4 different types of threat circles to display: **None**, **Air Defence Systems - Low altitude**, **Air Defence Systems - High altitude** (pink circles), **Average Radar Coverage - Low altitude** and **Average Radar Coverage - High altitude** (blue circles).

  Note: the circle colours are not side dependant but type dependant (blue for radar and pink for air defences).
  These threat circles are left over from the original Falcon 4.0 and are much less reliable nowadays. In the interim BMS created the ability to use PPTs (pre-planned threat steerpoints) which are a better way to indicate threats (on the map and on your HSD in the aircraft). In a TE these old threat circles are practically useless. In a Campaign they might provide some information about possible SAM sites, but the information they provide is neither fully accurate nor complete. The threat circles also cause CTDs on 128x128 terrains.

- Show Object Labels
  Add text information for all icons drawn on the map. This option is useful for the names of the icons or more specifically for airborne assets as their flight information remains displayed.

  In flight UHF and VHF frequencies have been added for friendly units. Since 4.36 the A/A TCN is shown for Tanker flights as well.

- Show Bullseye
  Display the Bullseye grid on the map. The Bullseye is a reference point that can be moved to any location on the map. Its location is saved as Steerpoint 25 in the DTC by default. All pilots in the same TE have the same bullseye location and it therefore becomes a convenient way to locate any assets from that known reference point. The system used for localisation is to give a bearing and a range **from** the bullseye. In the picture above the ROKAF F-5 flight is 128° from the bullseye at a range of 179 Nm.

- Set Bullseye

  The TE creator usually sets the bullseye when designing the mission but users can move the bullseye to any other location before flying. Right-click on the map where you want to place the bullseye and select the Set Bullseye option. To avoid inadvertent bullseye moving you have to confirm the change.

- Set Preplanned Threat Stpt

  When selecting this option a PPT will be placed on the map at the cursor position and stored in the DTC. PPTs start at STPT #56 and are incremented to #70 for a total of 15 PPTs. Once placed on the map the user can label the PPT by clicking on its icon and selecting the relevant type from the drop down menu. SAM and AAA systems can be selected and will draw a red threat circle around the PPT, indicating the weapon engagement zone (WEZ). PPTs can also be tactical points (CAP, RV, FAC, etc) or navigation points (Airbases, Radio Nav stations, navigation fixes, airspace, etc.)

- Set STPT Lines

  Marking airspace can be useful in some scenarios. In this mission both F-16 CAP boxes have been marked with lines.

  These lines are created with the Set STPT Lines option and will also appear in the HSD. Users connect up line steerpoints to create lines.

  The STPT lines steerpoints are from #31 to #54 (up to 6 steerpoints per line = 4 lines) and they are stored in the DTC like any other steerpoint.

  To place a line on the map, right-click where you want the line to start, then select **Set STPT Lines > Additional STPT in line 1** (if you are setting the first line). The menu will close and a round white steerpoint will be placed at the cursor position. Move the cursor to the next point of the line and repeat the operation. A second steerpoint will be placed and a white line will join both steerpoints. Repeat again until your line or box is complete, or you reach the 6 steerpoint per line limit, in which case you can simply add additional points as Line 2, 3, or 4.

- Ruler

  When selected, a ruler of 20 Nm is displayed on the map. The Ruler can be dragged around the map with a left-click and hold on the centre white square. The triangles at each end of the ruler can also be dragged with a left-click to alter their position and relative placement. The number above the centre square represents the length of the line in Nm. The numbers above the triangle indicate the bearing from the centre point of the ruler.

9.3.5 Flying a TE workflow

Now that all options have been explained here is a basic workflow when flying a ready-made TE.

Once the TE files have been placed in the *Data\Campaign* folder, BMS can be launched and the TE selected. If the TE is flown in MP, COMMS must be initialised first; then the host can launch the TE and clients can join.

Note: in multiplayer only the host needs to have the .tac and weather (.twx and .fmap) files as necessary data will be sent to all clients when they connect. The .ini file (DTC data) should be in each client's *Data\Campaign* folder though, or they will not see PPTs, Lines etc.

Upon entering the TE the clock should be stopped, or the host should select the HALT option in multiplayer. Each pilot selects a seat in a flight by clicking on the relevant aircraft icon. Depending on the mission goal specific icons may be selected on the map through the right-click submenu:

- E.g. **Ground Units > Battalions > Air Defences** for an up to date snapshot of known enemy air defences.

- **Show Bullseye** is always worth checking before flying, especially if it has been moved.

- If the mission is an air-to-ground strike it might be worth enabling the related target type symbol (display **Infrastructure** if you are tasked to strike a bridge for instance).

The BRIEFING button should be selected to display an overview of the flight. Useful information on the Briefing page includes the flight Callsign, which is not obvious anywhere else in the UI, except the LOADOUT screen. The Comm plan became a critical part of the briefing as you really need to ensure you can communicate with the other flights during your mission. Especially the other AI flights like the Tankers.
Also the weather brief and the alternate landing site should be noted.

The next step would be to check your loadout to ensure that the stores carried are suitable for the mission goal. The LOADOUT screen also provides store limits the pilots should commit to memory before flying. If the mission uses laser guided munitions laser codes should be set and checked accordingly. When changing anything in the LOADOUT screen ensure you click OK so your changes are saved before exiting.

In an Air to Ground mission you should Recon the target. It will increase your chance of success and allows each flight member to assign his own precision target steerpoint. Right-click on the target icon on the map and select **Recon**.

The TARGET LIST and the RECON windows will open. The target list can be expanded to see all known features within the target complex. Choose one of them (or select the one you have been assigned) and the RECON window will then centre on that specific feature. The view to the target can be rotated with the left and right arrows around the compass on the right of the recon screen. By rotating the compass to your inbound to target heading you can have a pretty accurate view of what to expect on the bombing run, weather-permitting (and/or take screenshots if you are briefing a flight with humans in multiplayer). You can also zoom in or out.

The top left of the RECON screen lists the GPS coordinates and elevation of the target. That information can be transferred to the DTC by selecting a target steerpoint with ◄► to the right of the DESIGNATE AS TGT STPT # box and confirming with ACCEPT. From that moment the coordinates of the flight plan steerpoint will be replaced with the more precise coordinates of the target. This can be checked by opening the DTC screen and confirming that the Target Steerpoint has the relevant coordinates instead of the not set message.

In the TARGET LIST window you can also assign targets to your AI wingman (AIRCRAFT). Select the number in flight and assign a target from the list. You should select the correct target waypoint (WP) before. All wingmen can have a different target. If you don't specify a target it will default to "target at will".

While you have the Data Cartridge window open you may check mission specific DTC settings. The comm plan, for example, is now saved automatically to the DTC and presets are assigned to departure, arrival and alternate airbase ops, ground, tower and approach/departure frequencies. You may still change Radio presets if you like, but that is not necessary and not recommended. If you do, try to select an open frequency (a preset not assigned to a Comm plan frequency – usually between UHF 16 and 20).

Basically the recommended steps are just to ensure the DTC has the comm plan loaded correctly and check/ choose which frequency will be active upon DTC load (identified by the green Default checkbox – In this case Gunsan Ground: Preset #2). Close the DTC screen with the SAVE button. That will ensure the DTC is saved.

The last stop before flying would be the weather office. If the weather briefing wasn't enough, you can enter the weather pages and check more information about the weather. Most specifically the deterministic wind which will give you the departure runway at the airbase.

Once you are ready (or once all your teammates report ready) you can commit to 3D by clicking on the TAKEOFF button. The clock will resume and may accelerate once all players have committed to 3D if the take-off time is a long time ahead.

4 options will be displayed (all players should select the same option):

- **Ramp** starts with a cold jet. The user will have to execute the full start-up procedures. The time left before take-off time (TOT) is 20 minutes, though you will probably need considerably less if your jet has the newer EGI.

- **Taxiway** on the taxiway with an operational jet 5 minutes before TOT.

- **Runway** lined up on the runway with a fully operational jet at TOT.

- **Cancel** returns to the UI.

9.3.6   Creating TEs from scratch

In this chapter we will design a MP Air-to-Ground TE from scratch using the MISSION BUILDER and external tools built for BMS.

Teams setup

Team declaration is made by clicking on the TEAMS button. Flags, colours, names, pilots and air defence skills can be assigned to each team in the TE. Since 4.35 7 teams share the Korea territory alongside the real geopolitical Korean borders. Team territory can be changed by selecting the team and the brush icon and painting new map occupancy. Since the 7 teams are now assigned by default, it is not possible to add a NEW team unless you first delete one team.

Note: Set the desired skill level of pilots/ADA operators here right from the start. If this is not done, the skill level for units will default to rookie for all teams.

The Timeline and Victory Conditions

TEs by default start Day1 at 0000 ZULU Time and end at Day 20 0000z. It is interesting to vary the time of the TE to avoid having all TEs starting at 0000z (0900Lt). Adjust the current mission time to 0420z in the top right clock of the Mission Builder screen. That will give us plenty of time for Ramp Start. Before starting to build the TE you may have to adjust the start time and time limit in the Victory Conditions section of the TE builder. That is done with the START TIME (Day1, 0400z) and TIME LIMIT boxes (Day2, 0100z).
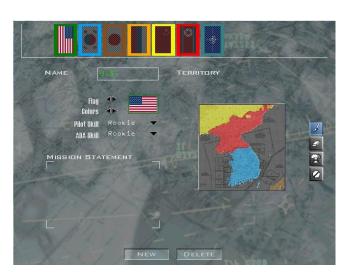
Regular TEs do not really need victory conditions although they can be added for each team of the TE. If required they can be added from the VICTORY CONDITIONS screen by clicking NEW and then ASSIGN. The small map is the same as the TE map and can be zoomed in or out to display installations. Just click on the target on the map to make it part of the victory condition.

You can **Occupy** (move ground troops to), or **Degrade** (damage the objective to a certain %), or **Destroy** a specific feature within the chosen objective. When selecting **Destroy** the Target List window will pop up and you will have to select a feature. You can then assign a certain amount of points granted for that specific victory condition. When you choose **Degrade** you must assign a certain % operability of the objective to get the victory condition points. (60% operability as in the picture means 40% destroyed)

The TE designer should draw a timeline of events in the TE. It might be superfluous for simple TEs but for larger COMAO with time sensitive objectives and intercepting opposing forces it will be a great help as the TE is being designed.

The Plan

A good TE starts with a good plan. A plan consists of an objective and a means to reach that objective according to certain factors. The objective is the target; the means to attack it are the packages and the way the flights will be organised to achieve the objective. The factors include the weather and the organisation of the opposing forces.

Of course a TE designer must plan the TE for both sides. He must set the blue force's objective and arrange the TE accordingly so the blue side can reach that objective, but he must also plan for the red side to counter the goal of the blue side or reach their own objective during the same timeframe.

The TE should be able to be flown in many different ways. It can be human versus AI (co-op), human versus human (force on force), or a mixture of the two (human and AI vs. human and AI).

Weather can also be considered in the initial plan. Weather plays a huge tactical role and may define the way the objective will be met. There is no point attacking a target at low altitude in bad weather at night if the aircraft have no TFR; and not all F-16 in the database can load the LANTIRN navigation suite. Attacking a target in bad weather with a weapon that requires clear line of sight to the target, like a LGB is similarly not a good option. Weather will therefore limit the choices available to the TE designer.

> *Please note: sunset and sunrise times can now be set in the Weather tab when a specific date is set.*

The Mission Builder

This section is where most of the TE design is performed. The map is initially blank and comparable to the blank page syndrome some writers may feel. Here is one way to overcome this and get started:

1. **Select the target**
    By that time you certainly have a suitable target. For the sake of an example our main target will be an underground factory located near Koksan airbase. The initial plan for this TE also calls for the destruction of the nearby Tach'ung-ni (previously Soktam-Ni) radar station. The main target being a hardened bunker factory prompts the need for a penetration weapon, the radar station is a medium to soft target.

2. **Select the airbase**
    We will use Gunsan airbase as home plate for this TE. Let's place a few squadrons there. Placing squadrons beforehand is not really necessary for the completion of the TE. If you don't, the squadrons will be placed as NEW when you create the flight's package. For the sake of the exercise we will place a US F-16CM block 50 and a Korean F-16 block 52 squadron at Gunsan airbase.
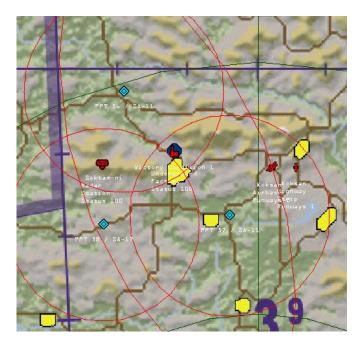
Make sure the US (green) side is selected by clicking on the flag button until the US flag ▦ is displayed, then activate the squadron button ▦ and click on Gunsan airbase. The add squadron

window will popup. Select the aircraft type from the drop down menu and confirm Gunsan airbase is selected. Click OK and repeat the process for the other squadron.
As you noted, with the new team organisation, USAF airbase in South Korea are coloured green whereas ROKAF airbases are coloured blue.

3. **Place PPTs for OPFOR Air Defences**
That may sound unconventional, but it is a great way to have a SAM coverage idea before placing any actual air defines units. As a TE designer you want to challenge the route of the blue forces or defend a target area with specific SAM sites or mobile units. In this case the high altitude airspace of North Korea is defended with a couple of SA-10 batteries that will force the blue side to ingress at mid to low altitude. The target low airspace will be defended by SA-11 and SA-17 batteries. Their range is more limited but the weapon systems are very lethal. By placing PPTs and assigning threat types their engagement range will be displayed, helping the TE designer choose the best route and tactics for the blue side.

The blank page syndrome is over. You know what to do next: add the main package.
But before doing that let's think about what we need.

- The main target needs heavy weapons. A 2-ship will suffice.

- The secondary target needs soft weapons and a 2-ship should also be enough.

- The target area is well defended with modern SAMs, so we will need a SEAD flight with at least 4 missiles (2-ship) HTS equipped. That means block 50 models.

- It is not planned yet but red air will be present, so a 4-ship escort flight will be required.

- The whole strike package will have to fight its way in under the umbrella of SA-10 coverage so the profile will mostly be High-Low/Med-High. Weather is not a factor as it is FAIR weather so we do not really need TFR. TGP will be very useful though.

- Place the mouse cursor over the target area, right-click the map and select ADD PACKAGE. You can also use the PACKAGE button. A blank ADD PACKAGE window will open. Start by setting TAKEOFF or TIME ON TARGET. You cannot set both; you must choose to lock one and adjust the other. In this case, I the take-off time was selected locked and set at 0520z. Click on the grey open padlock right of TAKEOFF. The lock will turn green and you can now adjust the time with ◄►. We are now ready to add the flights in the package.

Note: it's important to know exactly what you need here because you can't alter packages once created within the Mission Builder. We can do it later with Mission Commander though.
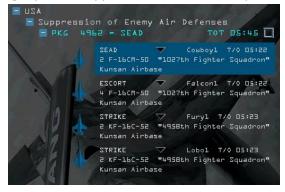
Click NEW and the ADD FLIGHT window will open. Select F-16CM Block 50 for the SEAD flight, 2-ship. The squadron and airbase are automatically assigned as we placed the relevant squadron beforehand. If we had not done it we would now choose a new squadron and select Gunsan airbase. Skill is set to Ace as we took care of that in the TEAM page. If we hadn't it would default to Rookie and we've have to change it. Click OK and repeat the same process for the other 3 flights. First create two flights of 2 Korean block 52s and then create 4-ship block 50 for Escort with target pointing to one of the Strike flights. Double check each time to ensure your package creation is correct. If you clicked on the target when adding the package the Strike target of the first flight will be assigned by default to the Underground Factory. The target for the second Strike flight will default to the Underground Factory as well so select Soktam-Ni Radar station from the drop down list. A package is made up of a maximum of 5 different flights that will all be able to share IDM in flight (if set up correctly).

Ensure all is correct and click OK. Please note package creation is different in an online campaign (covered later).

The route for the package is created and identical for the 4 flights. We will now adjust the flight plans.

Open the ATO ![icon], check the **Show all packages** button, click **+** next to USA, SEAD and the PKG and all 4 flights will appear. By selecting one flight in the ATO the corresponding flight plan will appear in white on the map.

There are a few considerations to take into account when creating large packages. The role of the flights usually determines the flow of the mission. Obviously you won't send the SEAD flight in after the strikers. The idea is for the SEAD flight to sanitise the target area for the strikers. Same is true about the place of the Escort flight. Normally an Escort flight protects a specific flight assigned as its target. In this case since the Escort will be flown by human pilots it is considered Force Protection and therefore will try to protect the whole package.

Take-off time is an issue as well. You cannot have 4 flights and a total of 10 aircraft taking off at the same time from the same airbase. Ideally flights must be spaced at 2 minute intervals for take-off. A push point is advised; it is a timed steerpoint preceded by a holding or package rendezvous point. This was completely redone in 4.33 and further refined in 4.34. The holding point is where the package will meet after take-off. Each flight will hold until they need to leave the holding point at a specific time to overfly the next steerpoint at their planned PUSH time. The principles of the holding/push point ensure that any delays during departure can be absorbed and the package will re-establish the correct flow and timing of the route. Most automated flight plans now have steerpoint #3 as the holding point (6 minutes) and steerpoint #4 as the push points. Be careful when you manage timing or when you need to delete steerpoints, deleting steerpoints under #4 might create timing issues.

The SEAD flight must coordinate their attack with the TOT (Time over Target) of the Strike flight or destroy the SAMs before the strikers enter their engagement zones. That is one of the reasons why a timeline is important. Alternatively the strikers may hold in a safe area until cleared in by the SEAD flight.

The Escort may sweep the area or establish a CAP near the target area (TARCAP) depending on the briefing. TEs designed for humans must allow flexibility for the human lead to brief. That way the mission may be flown multiple times, allowing the users to try different tactics.

Air refuelling may be required for fuel, or for training. In that case the TE designer must decide if pre-strike refuelling or post-strike refuelling is better and allow sufficient time for the whole package to refuel, then add a refuel waypoint to the INS flight plan of relevant flights for the tanker frequency to be assigned to a preset and listed on those flights' briefings. (and account the time needed for the whole flight to perform the AAR)

In this case the SEAD flight will go first, followed by the Escort flight and then the 2 Strike flights. A common push point will be created. The TOT will be coordinated between flights with a 2 minute window. Post-strike refuel should not be necessary and the package will recover visually at home plate.
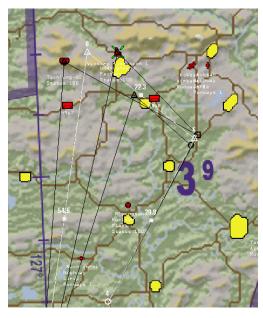
The route of the 4 flights must be similar. We will adjust the route of each flight separately, while keeping some common steerpoints. It is advised to use significant waypoints when adjusting the route. That will make it easy to establish the same steerpoints from one flight to another, but it also makes it easier for the flights to check their steerpoints visually, or with their sensors.

We don't have INS drift, but we can get battle damaged and it helps SA nevertheless. We will adjust the route first and then review each flight plan and assign timing and action points.

Steerpoint 2 for the package is the Gunsan north exit point: JEWEL. The holding point will be steerpoint 3, located on the newly created Incheon Vortac 85X. Steerpoint 4 will be the PUSH point over the small village of Yongp'a-dong, 38 Nm NNW of Incheon. At 480 kts GS 38 Nm is covered in about 4 minutes 45 seconds. Steerpoint 5 will be the Strike IP at Suemal village. The target points are obvious for the 2 Strike flights. The targets for the SEAD and Escort flights can stay vague for now.

The exit from the target will be to the left towards steerpoint 7 at P'yungyang-Ni Village, which is common again for the whole package. And finally steerpoint 8 will be over water about 13 Nm abeam Gunsan to let the flight leads decide their recovery procedures.

One last point to check for the 4 flights is to assign the same alternate. By default Seosan airbase was chosen but Gimpo is better as it is closer to the FLOT line.

By clicking the radio button right of the package TOT, all flight's plans are drawn on the map. The selected flight is white and the others are black. Note the green cross is the victory condition assigned to this TE for the green team (USA). For the red coloured team, that cross would be red.

We now need to adjust flight plan timings and action at each steerpoint for the 4 flights. Keep the ATO open and select the SEAD flight. Open the flight plan by clicking on any white steerpoint or the flight plan icon.

Steerpoint 1 is take-off. There is nothing to change here as it is the first flight to take off at 0522z.

Steerpoint 2 is the exit point at JEWEL where the flight must be in formation. The details will be the same for all flights. Assign an altitude of 5000 feet rather than the default high level. It is best to let the flights form up while staying level. The climb to high altitude will be performed enroute to steerpoint 3. Altitude deconfliction may be ensured by stacking the flights 500 or 1000 feet apart over steerpoint 2, although they are normally deconflicted in time (due to the 2 minute take off interval). Do not mind formation as we will manage that one later on. Action is Nav for all flights.

Steerpoint 3 is the package holding point. This is where the package will hold until all flights report as fragged and will push on time. You must ensure each flight has enough time to get there, so plan enough holding time to absorb any departure delays. If we consider 1 minute legs and 4 minutes full holding, taking 8 minutes usually is enough. In this case it's very important to stack the flight 1000 feet apart for deconfliction as the whole package will be in the same area holding over the same fix. Since the SEAD flight is the first to arrive there, they will have the highest altitude, FL250. Assign Action as Holding Point and Patrol duration of 8 minutes. Adapt the patrol time for all flights to separate them at PUSH point according to the TE mission goal but stack them 1000 feet lower according to their arrival time (first arrives highest, last arrives lowest).

Steerpoint 4 is the push point. It's so called because the flights will have to overfly this steerpoint at their push time. To meet their Push point on time, flights will have to depart their holding point on time as well. Assign

Push to Action and set altitude accordingly. As said above the flight time at 480 kts between hold and push will be 4 minutes 45 seconds. Subtracting that to the push time gives the Hold Out time (or Leave RV time).

Steerpoint 5 is the package IP. The SEAD flight will start their SEAD duties enroute to Steerpoint 5 and will continue to do so until the strikers are safely out of the target area. Assign altitude accordingly. Note that strike flights in this example by default have IP assigned to steerpoint 6. To make all flights have IP on steerpoint 5, delete the original steerpoint 5 for strike flights.

Steerpoint 6 is the target point. For the SEAD flight the settings are the same as steerpoint 5.

Steerpoint 7 is the egress point; NAV action for all.

Steerpoint 8 is set with an altitude of 6000 feet delayed descent.

Steerpoint 9 is the landing point and steerpoint 10 is the alternate at Gimpo for all 4 flights. Both steerpoints must have the relevant airbase assigned as landing point otherwise the steerpoint will turn red.

If a steerpoint leg turns red the Mission Builder is telling you there is a speed or timing (or fuel) problem. You must take action to fix that issue before continuing your planning.

We must now repeat the whole process for the other three flights. The procedure is the same but do ensure that the take-off time is spaced by two minutes and pay special attention at the push point to separate the flights correctly for their inbound leg to target.

Take off for the Escort flight is 0524, the first Strike flight is 0526 and the second Strike flight 0528.

You can set all take off times at the same time from the flight plan window by selecting steerpoint 1 and then using the Flight drop down menu to select each flight in turn and set their respective take off times in sequence. This option is very handy when you need to change the same setting at specific steerpoints for all different flights within the same package.

Now may be a good time to save your TE. Click the SAVE button in the top menu and give it an appropriate name. Remember to save your work often, using incremental numbers in case you make a mistake and want to go back to a previous version.

We can then leave the flights separated by two minutes until the holding point and use the holding timer at steerpoint 3 to set proper separation using the push time. In this case the SEAD flight has a holding time of 8 minutes and a TOS of 054935z at push point. Ensure the Escort pushes 30 seconds later and the Strike flights 2

after that, separated by a further 30 seconds. TOS at push point then are:

> 054935z for the SEAD flight.
> 055005z for the Escort flight.
> 055205z for the Strike flight attacking the Radar station.
> 055235z for the Strike flight attacking the underground factory.

These holding timers also set the TOT for the two Strike flights: 055855z for the radar and 055840z for the factory. Since both targets are separated the desired effect is an almost simultaneous strike. Lock both Strike TOS by clicking on the padlock until it closes and turns green.
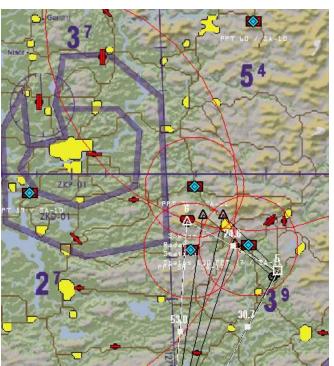
The Strike flight TOS determines the time the Escort and the SEAD flights will have to cover the target area.

Unfortunately if these flights are manned by AI there is no way we can make them stick in the target area with their current steerpoint action.

We could assign the Escort flight to CAP and assign a patrol time for steerpoint 5 and 6, but we cannot assign a HARMCAP patrol time to the SEAD flight. Luckily these will be manned by humans in this scenario.
If AI manned them we would have to hope they sanitised the area before leaving.

Finally ensure the timings are different on the remaining steerpoints, especially steerpoint 8, which will determine the landing times. Aim for 2 minutes separation at steerpoint 8 and then check corresponding times at landing.

If flights are very close to each other at any route steerpoint you can leave it as is and separate the flights in altitude. It will mostly be the case at steerpoint 7.

We have not set the altitude of the target area steerpoints yet. That is on purpose as we first need to set the red SAMs that will determine the altitude we want the package to fly at. It is a very important aspect as the TE designer can impose specific tactics according to SAM coverage. Many virtual pilots will tend to attack from high altitude because it is easier and safer. Protecting the target area with long range high altitude SAMs like the SA-10 will force them to go lower but will impact SEAD and Escort flight duties. It is your choice you have to make.

I often place a SA-10 far away from the target area but with its WEZ still above the target. That way the target is protected but the SA-10 will not always be in a position to fire at the package. The higher they fly the more chances they have of being engaged. That will leave them with medium and low altitude to use. That airspace is then defended by the shorter range SAMs at the target, which is the SEAD flight's task to deal with. Failure in that task may certainly be a mission abort condition.

Let's place the red SAMs. Click the FLAG button to select DPRK then the Add Battalion button.

Click the map where you want the first SAM to be placed (remember we placed PPT earlier as guide). The ADD BATTALION window opens. We want to place SA-10, SA-11 and SA-17. All these systems are Russian and not DPRK units. Select SOVIET from the EQUIPMENT drop down menu and then select Air Defence - SA-11 (9K37M1) from the UNIT TYPE menu. The Roster states that a SA-11 battalion is made of 6 SA-11 vehicles, 2 support trucks, 1 SnowDrift radar, 1 BMP (with SA14 Shorad), 1 ACRV and 6 2T7M (loading cranes). Since each SA-11 vehicle is independent it is going to be way too much for the SEAD flight to deal with but we will address that later with Mission Commander.

Click OK and repeat the process for the second SA-11 unit, the SA-17 unit and the 2 SA-10 units that we planned.

Units will always default to roads; keep that in mind when planning the position of your PPTs in earlier stages. You can now adjust PPT position so they are perfectly on top of the newly placed SAM units.

Let's now place the air opposition. Add a MiG-29S Fulcrum-C squadron at Sunan airbase, a MiG-23ML Flogger-G squadron at Kalma and a MiG-25 Foxbat one at Ongjin. The Red side flag should still be selected and you know where the Add Squadron button is.
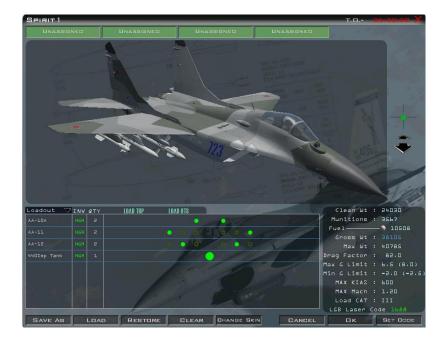
The MiG-29's will protect the North Korean capital; the MiG-23's and MiG-25's will try to intercept the Strike flights at different times during the mission. When planning the opposition it is also important to get a good balance, not so much about the number of aircraft but rather the number of missiles.

Let's make the CAP flight. Select the Add Flight button and click on the map west of PyongYang. Select the MiG-29 variant you added as a squadron; 4 ship and BARCAP duties. They are Ace and start at Take-off.

Obviously we want to have the MiGs on station when the strike package enters the target area, so the Escort flight can engage them. The Green side will be at IP around 0553z. So with a patrol time of 30 minutes the MiG CAP points can be around 0540z to 0610z. Open the ATO and select **Show all packages**. Expand DPRK and the DCA flight. The MiG-29 flight plan will be displayed on the map. You can adjust steerpoint placement it if required.

Open the flight plan window and right click the padlock to unlocking all TOS at once. Then adjust the first CAP point time to 0540z and check that the patrol duration is set to 30 minutes. Usually at least one steerpoint is locked in time: either the take-off or the target point. If we shift time with a locked TOS in the flight plan one of the legs will turn red. That is the reason we need to unlock all times before changing the steerpoint timers.

Open the loadout screen with and load the MiG-29 with A-A weapons. The deadliest OPFOR missiles are the AA-12, similar to the AIM-120. Load them accordingly. You must always think about the audience of your TE and keep it well balanced. I often load a mix of missiles and rarely use a full load of AA-12 unless I really want to wipe out the Escort flight. In this case 2 AA-12, 2 AA-10A and 2 AA-11 will be a real threat for the Escort and SEAD flight.

Let's now place the MIG-23 flight from Kalma, trying to intercept one of the inbound green Strike flights from the East. Select the radar station strike flight from the ATO and note the TOS at STPT 4 (0552z) and 5 (0556z). The middle of that leg is a square and the flight should be there around 0554z. That will be set as the intercept point for the MiG-23 flight. Check the red side flag and Add Flight are still selected. Click on the map as close as possible to the mid-section of the green Strike flight leg. In the ADD FLIGHT window select MIG-23, Intercept, 2-ship Kalma airbase and assign target to Blade4 flight.

As before the flight timing will not be correct, so unlock steerpoint times and select the intercept (target point). Set TOS there at 0554z and let the other TOS adjust. Decrease the MiG-23 flight's altitude to low level. The striker may be concerned about high altitude threat and may not have their radar set for low altitude search.

Varying the altitude of the OPFOR can be very challenging for the COMAO. Select the arming screen and load up the MiG-23 accordingly. Here I used 2 AA-8 (R-60) and 2 AA-7A (R-23R).

The MiG-25 flight will be used to provide some action on the egress part of the blue flights. This is trickier to organise because post target the flights may not be on their TOS. We have two possibilities here: we can use the intercept type again, but this time on the second Strike flight and hope for the best, or we make the MiG-25 ambush CAP the egress area of the blue force. I'll take my chances and use the intercept option.

The Underground Factory Strike flight will overfly steerpoint 7 at 0605z. That will be the target of the MiG-25 flight. Since they fly very fast and their airbase is only 45Nm away they will be on scene very fast. Just move their steerpoint 2 further south so they intercept from the South-West. This time make them fly very high. As always unlock all TOS and set their intercept point around the blue force steerpoint 7 with a TOS of 0605z. Arm them accordingly.

It is time to save the mission again. Save often. You are never safe from a problem and it would be a shame to have to restart the whole process.

We now can set the weapons for the blue flights and we still need to set their altitude correctly according to the expected target threats.

Arming is easy. The SEAD flight will need ARMs (AGM-88 + HTS) and A-A for protection, the Escort will need A-A missiles (5 AIM-120 and 1 AIM-9 for instance) and the strikers will need relevant A-G stores for their targets. The radar station can be attacked with retarded GP bombs for low altitude profile and the hardened factory will need penetration weapons such as the GBU-31(v)3/B JDAM. All flights will have 2 wing bags and a centreline ECM pod for the USAF birds (Koreans have an internal jammer). Both Strike flights will ingress low but the hardened factory flight will have to pop up to deliver the IAMs. Open the ATO, select each flight separately and load them as above.

Open the flight plan window and set altitude for the radar station striker flights to 500 feet at steerpoint 4, 5, 6 and 7. And 700 feet for the hardened target flight. If the strike flights were AI the altitude at the hardened

target should be slightly above to avoid the weapon frag pattern. Make that 2000 feet. It's not that important for humans as they will pop up anyway.

Managing the altitude of both the SEAD flight and the Escort flight is trickier because they need all the altitude they can get, but the higher they fly the more they expose themselves to the far away SA-10. Mid altitude is required in this case. So let's make the SEAD flight own the airspace between FL150 and FL180 and the Escort flight own the airspace between FL190 and FL230, or higher if they dare or need to. Assign altitudes accordingly between steerpoints 4 and 7.

The first step of the TE design is almost complete. Just cover the friendly territory with a Patriot SAM to protect the package once they return over friendly territory. Place it at the Northern point above Seosan. Placing allied air defences is the same method used for the red side, but you first need to ensure that the green side flag is selected.

We can also place support units such as AWACS and Tankers. Place a squadron of E-3A Sentry at Iwami and then right-click the area around Jungwon airbase and select ADD FLIGHT. Set E-3A Sentry AWACS as aircraft, AEW/ABCCC as role, 1 aircraft. Ensure the squadron at Iwami is selected and start at target. Since the patrol time of these aircraft is so long, we do not want to wait till the AWACS is on station. It has been pre-positioned in its orbit.

The flight plan will appear on the map. You can adjust the steerpoint, ensuring its route remains well clear of any red air. If we wanted to provide a HAVCAP for the AWACS, we should also have used the ADD PACKAGE option and created multiple flights of F-15 alongside the AWACS to cover its patrol time.

Bullseye needs to be placed appropriately. Its placement will depend on the mission. In this case the best spot for Bullseye is the target area. Right-click the map between the two targets and select the option **Set Bullseye**. You must confirm the new position to avoid unwanted bullseye position change. From that moment the **Show Bullseye** option will display the Bullseye at the new location.

> *Note: The ability to save the DTC from within the TE editor was introduced in 4.33. Previously we had to save the TE, launch it as if we were going to fly it, place the PPTs and lines and save the DTC, because the DTC icon was missing from the Mission Builder screen. This was fixed in 4.33 and the TE designer can now set up and save the DTC after having saved the TE at least once.*

Next adjust the PPTs we created earlier on the actual SAM positions and place a LINE at the FLOT as explained in earlier chapters of this manual. To populate the HSD in flight I also like to place navigation PPTs. I'll set a Rendezvous PPT at STPT 3, a PUSH PPT at STPT 4 and two navigation fixes around Gunsan: JEWEL and VIPIR. Save the DTC by clicking the save DTC icon.
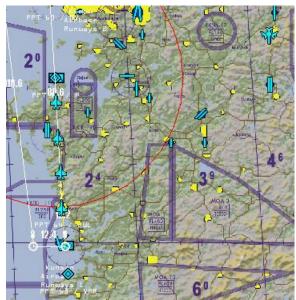
Test running the TE

Once the first step in the TE build is complete I like to test run the TE from the UI with just the AI assigned. It is not fully representative of what will happen in the real TE with players in 3D but at least it lets you check basic timing.

After having saved your TE one last time, exit the TE builder with the BACK button, select your TE from the SAVED tab and click the COMMIT button in the bottom right of the UI.

Set time to x64 until the first flight takes off and then decrease time acceleration to x8 or x4. Monitor the departure and the nicely spaced flight enroute to the holding point. The AWACS is already on station.

Continue fast forwarding the TE at medium speed and check the actions of the red AI flights, most especially if the interception works.

If all goes according to plan you can move to the next step of TE design.

Mission Commander

The options in the UI Mission Builder interface are quite limited. We now have a third party tool, however, that allows much more flexibility for mission design (amongst many other cool features). The tool is named Mission Commander and it is available from www.weapondeliveryplanner.nl. We will not document all MC features as it would be a manual on its own, just the few specific features we will need for our TE design scenario.

Exit The TE builder in BMS and load the TE .tac file with Mission Commander.

My first step using MC is always to change the default F-16 callsigns. I'm done with Cowboys, Furies and Falcons. Select the **Units** tab on the top tab list and then click the **Flights** button on the left button list. That will just display the flights. You can further fine-tune the results by selecting the countries and/or types.

Nr	Name	Type	Squad Patch	Callsign	Flag	Info	Home	Elements
7	F-16CM-50 - Fighter	Flight - SEAD		Cowboy 1		Package: 4962	1027th Kunsan Airbase	2 Aircraft
9	F-16CM-50 - Fighter	Flight - ESCORT		Falcon 1		Package: 4962	1027th Kunsan Airbase	4 Aircraft
12	KF-16C-52 - Fighter	Flight - STRIKE		Fury 1		Package: 4962	4958th Kunsan Airbase	2 Aircraft
16	KF-16C-52 - Fighter	Flight - STRIKE		Lobo 1		Package: 4962	4958th Kunsan Airbase	2 Aircraft

Double click the first flight and the flight window will open. The callsign is displayed in the Callsign drop down menu. Expand the menu and select a callsign of your choice. I chose Dart as it's suitable for a SEAD flight throwing HARM missiles. You can also assign a callsign number, for instance if you assign 2 the flight will be known as Dart2 rather than the default Cowboy1. Just bear in mind that since 4.34, changing the callsign of a flight also changes its assigned frequency as the new radio code ties a unique frequency to specific callsigns.

While we are here let us change the formation for all steerpoints to SPREAD. This is easily done in MC by selecting Spread in the **All Formations** drop down menu (top right corner of the window). This is much quicker and more efficient than the UI where we have to change that at every steerpoint.

Many other options are very useful on this page: **Shift Times** for instance is a great tool to correct timing issues. You can also add or decrease the number of aircraft in the flight and even change the AC type if you made mistakes when creating the package in the UI. That is something you can't do in BMS unless you delete the package and start from scratch. Exit the Flight window with the **Apply** button at the bottom right. Repeat the same process for the other 3 F-16 flights.

The red forces air defences also need adjusting. In the UI, when you place an air defines battalion on the map, it may default to specific roles depending on where they are placed. Most of the time if they are placed near high value targets, they will set their role to 'Air Defence' which is usually what the TE designer wants. But when the battalions are placed further away from strategic targets very often their role is set to 'Reserve'. That is not good as a reserve battalion will be enjoying their R&R and will not be ready to engage air targets swiftly.

Another aspect we need to fix is the composition of the SAM battalions. The number of vehicles is often too much for a simple SEAD flight to deal with. As we said earlier the SA-11 battalion has 6 mobile launchers, each sporting their own radar and acquisition units. A bit too much considering the SEAD flight is a 2-ship armed with 4 missiles. We will therefore remove a number of SAM vehicles from the active battalions to balance things out.

Select the **Battalions** button and ensure you have the DPRK side selected from the Country drop down menu. The SA-10, 11 and 17 battalions will appear. Select one of the SAM battalions so the relevant window opens.

As you can see the Orders are RESERVE and that is not good. Change that with the drop-down menu to AIRDEFENSE and ensure you do the same for all the air defines battalions you placed on the map.

The number of vehicles is changed by clicking on the **Act** column of the Roster. The clicks are incremental so click until 1 is displayed if you want a single vehicle of that type. Ensure you set the Platoon Cmdr to zero and keep only 1 Battalion Cmdr vehicle for this mission (Always keep at least 1 battalion Cmdr present or the full battalion may not fire at all). The battalion will be down to one launcher but remember there are 2 SA-11 and 1 SA-17 battalions. So even with only one launcher each, they will present a high threat for the SEAD flight to deal with. Since they have 4 HARMs that will leave them one spare missile they may choose to spend on one of the 2 SA-10s. When done, exit the window with the **Apply** button and do the same for the reminder of the air defines battalions in the TE.

Before quitting Mission Commander ensure you save the mission with the **Save** button displayed at the top right.
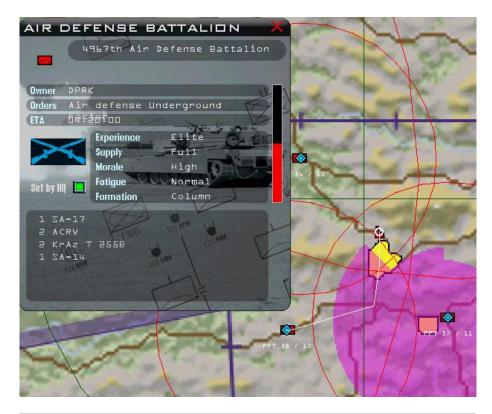
As said above, Mission Commander is much more powerful that the brief glimpse we have seen here. Use it as often as required and you will discover many more cool features.

Re-launch BMS and let's check the MC changes. To further edit your TE select it in the SAVED TE list and click the EDIT button. You will notice straight away from the ATO windows that the flight callsigns have changed. You may check the SAM battalions as well but rest assured that their vehicle numbers and their roles have been updated accordingly.

If you want to add a bit more surprise to the mission you may instruct one of the SAM battalions to move. Let's imagine we want to simulate bad intel and move the SA-17 battalion to the hardened factory target and instruct it to defend the site. Left-click the SA-17 battalion on the map in the UI. A few seconds later its route will appear as a white line with a white circle at its end.

Drag the circle to where you want the battalion to move and see the route changing, following Korean roads. Do not move the PPT as this simulates bad intelligence perfectly. If you go back to Mission Commander you will notice the added steerpoints of the SA-17 battalion and their ETA at each steerpoint.

Wpt	Action	North	East	Speed	Arrive	Depart
0	NOTHING	38,41.330	127,06.105	0	1, 04:20:00	1, 04:20:00
1	MOVEUNOPPOSED	38,41.330	127,06.105	0	1, 04:20:00	1, 04:20:00
2	MOVEUNOPPOSED	38,43.485	127,15.899	0	1, 06:39:21	1, 06:39:21
3	MOVEUNOPPOSED	38,47.257	127,16.816	0	1, 07:19:59	1, 07:19:59
4	MOVEUNOPPOSED	38,49.952	127,16.978	0	1, 07:50:58	1, 07:50:58

Weather

The weather can be an important tactical aspect as it may change from homeplate to target. Weather at target will dictate the tactics available as much as the air defines situation will. It is up to you to use the new weather functionalities and the weather chapter in the BMS Technical manual will guide you to create new Fmaps. In this mission we will set a simple weather system as the mission is already challenging enough.

Open the weather screen with the ![icon] icon. Irrelevant to this TE, but worth noting is that now you can set a specific date and the sunrise and sunset times will adapt accordingly.

Set the weather model to deterministic and current weather to FAIR. The shifts can be left default as they will happen after the time limit of the mission.

Atmosphere and Turbulence tabs may remain as default but change the Wind to deterministic so we can assign RWY 36 as the active runway at Gunsan. Set wind from 330°.

Fair weather is an interesting model because you can add a fair amount of good weather cumulus from the CLOUD tab. Set the cumulus coverage slider to 3/8 and their Congestus/Humilis slider to a quarter of the range. The Low Cloud layer altitude can be set as well for the fair weather model. It is 5000 feet by default, which is perfectly suitable for this mission.

Save the weather model with the SAVE WTH button. You can exit the weather screen.

Documenting your TE

Depending on how your TE might be used you may want to provide a minimum of documentation with your files. It's unfortunately an aspect of TE creation that is often overlooked. It takes time, but if your TE is meant to be shared with other people it is well worth doing. If no documentation is provided then users will probably miss important aspects of your TE and your hard work will not be justified.

A basic documentation package will provide at least a briefing to layout the mission goal, package composition, number of seats available (Humans/AI), difficulty of the mission, intel about red air and air defences and of course weather. There are multiple ways to do this. All but one must be done with third party applications.

The only thing you can do in the UI regarding the mission goal of your TE is to use the mission statement box in the TEAMS screen. Please note you can add different mission statement for each team.
 You must end your mission description text with a carriage return until your text highlights in dark green; if you don't the statement will not be saved. It's an old Falcon bug that hasn't been fixed yet.
The mission description will then be available from the SAVED TE selection menu depending on the chosen team.

The rest of the documentation must be done with external tools.

A mass briefing document may be handy for flight leads to brief their flight accordingly.

As a TE designer you do not want flight leads to open your mission with the TE editor and discover all your tricks, but if you don't provide mission documentation that is exactly what they will do as it is their only source of information. A quick PDF or PowerPoint presentation is perfect. You decide how interesting you want to make it.

Another way to do it, not mutually exclusive with the above, is to create a datacard for each flight with Weapon Delivery Planner. WDP is part of the same software suite as Mission Commander and is available from the same website. It is just as important a tool for BMS.

WDP allows flight datacard creation with a minimum of hassle, which you can even send to your pilot's kneeboards if you use the pilot model in the cockpit in 4.34. WDP also provides a full weather briefing, coordination cards for COMAO missions and many more flight planning items to use.

It takes a bit of time to set up all this, but it will provide the cherry on the cake of your TE work. Your package will be at a professional level, which is what this community is after.

Page 1 — DATACARD

ATIS Civil: RKJK INFO: B 010425LT ILS RWY36 TRL140 330/10KT 9999 OVC070 10/0 Q989

Airbase	TCN	UHF	VHF	Elv	RWY	ILS
DEP Kunsan	75 X	292.30	126.50	10	36	110.30
ARR Kunsan	75 X	292.30	126.50	10	18	110.30
ALTN Kimpo	83 X	240.90	118.05	96	14R	110.10

Pos	Name	IDM	TCN	TO	LND	CONF-LSR	Mode 2/3
1 Lead		3-1	14Y			0	
2 Wing		3-2	24Y			0	
3 Element		3-3	77Y			0	
4 Wing		3-4	87Y			0	

Callsign Pack 4962	Aircraft Type	UHF	VHF	IDM	TCN	Task
Dart 2	2 F-16CM-50	6	#1	XMT 10	12Y	SEAD
Snake 1	4 F-16CM-50	6	#2	XMT 20	13Y	ESCORT
Gamble 1	2 KF-16C-52	6	#3	XMT 30	14Y	STRIKE
Blade 4	2 KF-16C-52	6	#4	XMT 40	15Y	STRIKE

STPT	Action	TOS	HDG	Dist	Mach / GS	Alt	Min.Fuel	Form
1	TakeOff	05:26:00	---	---	---	10	9300	Spread
2	Nav	05:28:23	356	15.2	.62 / 375	22000	9100	Spread
3	Timing	05:40:07-47:48	357	80.6	.67 / 410	22000	7900	Spread
4	Push	05:52:30	344	37.6	.73 / 480	700	7100	Spread
5	Nav	05:56:20	028	30.7	.73 / 480	700	6500	Spread
6	Strike	05:58:40	316	18.7	.73 / 480	700	6200	Spread
7	Split	06:05:35	192	55.3	.72 / 475	700	5000	Spread
8	Nav	06:20:24	173	118.5	.74 / 480	6000	3300	Spread
9	Land	06:21:57	092	12.4	.73 / 480	10	3000	Spread
10	Land	---	005	98.7	---	---	1000	---
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Page 2 — DATACARD

1265334	Callsign Gamble 1	Package 4962	Mission VD433_underfact

			TO Spec 13°/Mil	int Fuel 7162
A-A	3x A120B 1x A-9LM	Gross Wgt 40037	Rotation 156	TO Fuel 11994
A-G	2x GB31B	Drag ind 173	Refusal 178	Set Fuel
ECM		ALOW	Mil Power 97 %	JOKER
Tanks	2x TK370	MSL	Mil Climb 385/0.82	BINGO

TGT:
Primary	Underground Factory	Secondary	
DMPI	Underground Fact	DMPI	
Lat&Long	N38,50.017 / E127,17.021 - 1109'	Lat&Long	

EWS = THR: 1 = | 2 = | 3 = | 4 = | 5 = | 6 =

Weapon Profile 1: AG INV PROF1 CCRP — Fuze NSTL — SGL/PAIR SGL — NS/ AD SG/ TL RELANG PA — AD — RP — HB — SPACING — SMS 0 — FT RP REL AGL — B. CODE 0

Weapon Profile 2: AG INV PROF2 CCRP — Fuze NSTL — SGL/PAIR SGL — NS/ AD SG/ TL RELANG PA — AD — RP — HB — SPACING — SMS 0 — FT RP REL AGL — B. CODE 0

Delivery:
None	VIP / VRP	OA1	OA2	PUP	Pull Hdg
TBRG					Climb
RNG					Pull Dwn
ELV					Turn
Ingress Alt		Rel Height			Attack hdg
Ingress Spd		Rel Spd			TGT in HUD

Support:
	AC Type	TACAN	UHF	LOC	Notes:
Tanker 1					
Tanker 2					
AWACS	Eyeball6 - E-3			140 / 148	04:21 - 09:28
JSTAR					
FAC					

Class	MTR	FR	MAR	DR	DOR
ROE					

Sharing your TE

If you plan to share your work with other pilots you must ensure you provide the following files from the *\Data\Campaign* folder:

- TAC file (TE mission)

- INI file (DTC)

- TWX file (Weather)

- FMAP (Map Model advanced weather file)

- IFF (IFF policy)

- And all the documents related to mission (briefing, flight datacards, weather briefing etc)

  Please note: copy and paste the files while BMS is not running (or restart BMS after placing the files) or some of them may not be read.

9.4 Campaign

9.4.1 Starting a campaign

There are several campaign scenarios available in the BMS theatres; each one will present a different challenge by pre-setting the unit strength and position for both sides. We will start with Rolling Fire in the Korea standard theatre and run through a "quick start" to get you into the fight with default values.

After clicking on the selection box, you will be presented with a short movie (if you have the ffdshow video codec installed). If you do not care to watch the news today, hit ESC to skip it.
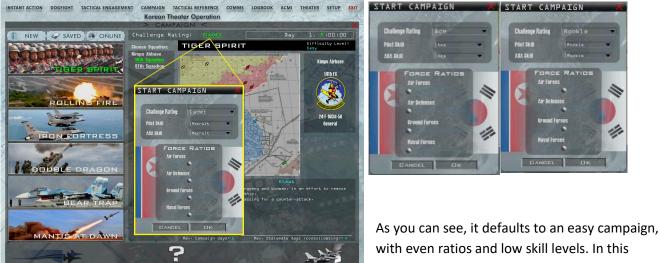
*Note: ffdshow is not included in the installer. BMS currently does **not** install any codecs at all; they need to be installed manually if you want the videos to play.*

> *Tip: For stability, always exit and restart BMS after changing theatres*

Now you can choose from many bases and several squadrons - bases and squadrons have different F-16 types and may be either RoK or US. On the map, blue bases are Korean, white are US. Don't stress about it now, you can change your squadron from the Air Tasking Order (ATO) after the campaign starts.

Let's take a look at the "challenge" adjustment pictured here:

As you can see, it defaults to an easy campaign, with even ratios and low skill levels. In this world, you are a superstar! Feel free to try this flavour and come back for a spicier version when you get bored.

There are presets as shown below, or you can adjust the mix to your taste. Moving a slider to the left gives the DPRK the edge, to the right favours the RoK/US. OK, hit COMMIT and crank it up!

We hear tanks rolling over our heads and now we are in the campaign (with the clock stopped). Let's look at the screen below:

This is the PRIORITIES option box that can be recalled any time, by clicking on the **P** (highlighted in blue above).

Also notice I've highlighted the **Set by HQ** (Yellow box) option, which is selected and the war clock is stopped at 0000z of day 1. We'll talk more about the importance of these later, but for now click OK.

Click OK to start the campaign and you will notice it takes a few seconds for the Air Command (HQ) to set the missions or FRAGs for all of the squadrons. Soon the 14th FS has a full list of missions, so stop the clock while we look at the MISSION SCHEDULE screen. To stop the clock, click the **x 1▼** and select **Stop**.

Tip: Stopping the clock allows you to do your pre-flight checks without losing your mission. Your flight will leave with or without you. In some large multiplayer events, the clock is out of your control.

Above, we see the list of flights available, the call sign of the selected flight and the flight plan with alternate airfields. Notice you do not have a wingman yet; when you click your seat one will be assigned to you.

Looking closer at the FRAG ORDER, we see the Priority, Take-off Time, Mission Type, Package number and Status. You can click on each of the flights to see their flight plans and size (2 or 4 aircraft).
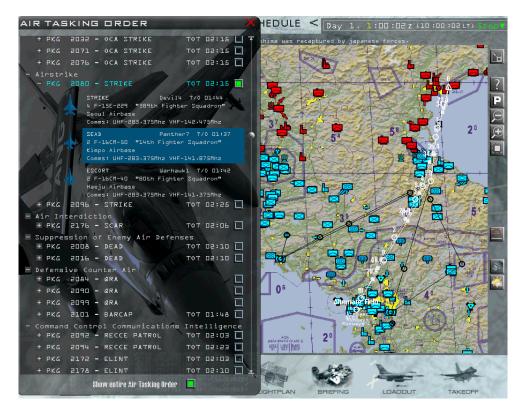
- **Priority:** Arbitrary – just used for sorting the list.

- **Take-off Time:** You should leave enough time to adjust your loadout and flight path, if necessary – an hour is recommended to allow for proper BMS operation.

- **Role:** The type of mission. See 11.4.6.1 for more information.

- **Package:** If this is part of a multi-ship package, you can find references to the other package flights in the ATO.

- **Status:** Status of "Briefing" means you can *usually* join the flight, adjust load-outs and flight plans and recon any targets before it leaves.

This flight leaves in 30 minutes, so we still have a chance to change weapons or the flight path. We could accept our orders and fly off to glory and medals… or, being a free-agent of sorts, we could explore other options from other squadrons. Yeah, let's do that!

The Air Tasking Order (ATO)

Clicking the ATO icon brings up this screen showing our flight only. If we click the **Show all packages** box at the bottom, we can see the entire plan for the day.

Now that is more like it, there is a lot going on today! We are looking at package 2080, an Airstrike North of Kalma. This is neat; there are 3 flights with 8 aircraft in total, and I can fly any of them (the Seoul folks fly Eagles, so I would have to get checked out on that bird first). Luckily the 2 other flights are F-16. They leave from 3 different airbases and play different roles in the mission.

I have checked the box to the right of the package name and it shows me the flight paths of all the elements of this package. I want in on this action!

I'll **right**-click on Panther7 and click **Join**.

And now I have selected the package at Gimpo – but what is missing? No flight plan and no me!
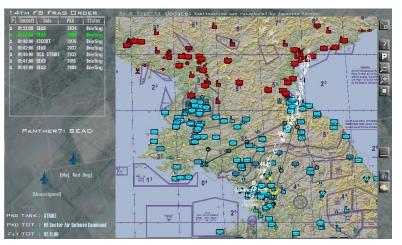
I need to click the flight in the FRAG ORDER and click the Lead seat to finish the transaction.

Tip:
Always click your Frag and click your seat when changes are made to the flight path! In multiplayer, all pilots in the flight should do this to ensure proper DTC operation. If something does not match, click on another flight and back into yours and usually that should solve the issue.

Now you can see I'm in the lead and our flight path is visible. If you clicked the box to the right of the package number, you could see the flight paths for the Eagles from Seoul and the Escort from Haeju.

We will meet them at the Push Point – STPT 4.

And so it is time to do our pre-flight briefing; let's see what we are expected to do on this flight.

If I click the target steerpoint (STPT 6), we see that our tasking is to provide SEAD for the strike package that will strike the North East Sector air defence command bunker. (The F-15 will execute the strike with big punch weapons. We are tasked to protect them from SAMs and AAA.

The Briefing

OK, now click the BRIEFING icon and we can walk-through that:

- **Mission:** Obvious – Note the Time on Target – in large packages it is important to "fly the caret" to ensure you have the support you need, when you need it!

- **Situation:** Some important items here are the targets – you need to match your loadout to the targets assigned (if you decide to change it).

- **Package Elements:** Your playmates on this mission. Make a note of the order flights are listed in the package – this will determine their IDM series. It is good practice to keep (at least) the Lead of each flight in your IDM – in this case I would fill the right column of your IDM with 11 and 31 (we are 21/22). Also note the Push time – this is when your support will meet you at steerpoint 4 – BE ON TIME!

- **Threat Analysis:** VERY IMPORTANT! It is early in the campaign, so Air and SAM threats are everywhere. Consider marking threats with pre-planned threat points (PPTs) to increase your SA.

- **Steerpoints:** Your flight plan.

- **Comm Ladder**: Your radio frequencies and presets for this flight, make a note of these or you may not be able to communicate with your flight and package. ATC will normally tell you what frequency to tune, but presets help reduce your cockpit workload.

- **IFF**: Your "squawk" codes for this mission; make sure your DTC is saved with this information and note the MODE 4 key setting and changeover time. If your mission goes into the next day, you must ensure your key has changed. Refer to the IFF section of the Dash-1 for more information. Please note all times are ZULU unless otherwise specified.

- **Ordnance:** How HQ has loaded your aircraft – 2 AGM-88. The briefing loadout also shows the "chin" (inlet) station equipment (TGPs or HARM Tracking System [HTS] pods are mounted here). If there is enough time before take-off, you can enter the LOADOUT screen to change your Air-to-Air weapons, drop tanks, ECM pods, and inlet station equipment.

- **Weather:** The weather can be different over your target and your airbase – CHECK BOTH! Important points here:

  - **Situation** – if it is bad weather, LGBs and AGM-65s are not a good choice.

  - **Wind** – used to predict active runway heading (though ATC will tell you when you 'Request Taxi').

  - **Visibility** – obvious

  - **Cloud Base** – How low must you fly to get clear line of sight (LoS) for the Maverick seeker or TGP.

  - **Con Layer** – This is where you start "marking"; contrails make you more visible to the enemy.

- **Support, Rules of Engagement, Emergency Procedures:** Review these for information on your AWACS, Tankers, and alternate airfields.

The Arming screen

We better look at our loadout and "shake the weapons" during our walk-around.

You can see that the loading crew has equipped us with AGM-88 HARM missiles and the AN/ASQ213 HTS pod on the left chin pylon. You can click the **Loadout ▼** drop down box to change A-A, A-G, or Other (tanks, jammer, etc.) ordnance and add to the SNIPER pod if you feel it is necessary to identify targets better (both AA and AG)

If we were using laser guided bombs, we could change our bomb laser codes here.

Verify that the time at the top is sufficient to allow changes. (green clock allows plenty of time, red clock means your limit time is near and red 'In Flight' means changes are not possible anymore. This usually happens 2 minutes before take-off time in BMS if no human pilot is in 3d in this flight. See Loadout in the Tactical Engagement chapter for more details.

One last thing before we strap in, we should check and set our Data Transfer Cartridge (DTC).

The DTC icon is on the lower right and clicking it brings us to the TARGETS tab. In this case, being tasked with SEAD we do not have a precise target steerpoint. But in case of a strike mission, you might have done a **Recon** on the target and assigned a precision steerpoint, in that case it would be shown here.

We should also click COMMS. Clicking COMM PLAN will preload the DTC with your comm. ladder (it is by default). We should set our default UHF to Preset 1 (Ground Ops) and our VHF to the Intra-flight channel assigned to our flight (e.g.: VHF 15 for the 1st flight in a package) in the comm. ladder.

In the IFF tab, you can click the IFF Plan button to program your transponder codes (although they should already be setup by default).

The "Click Dance"

Well, at least that is what I call it. Before hitting the TAKEOFF icon, click the flight in the FRAG list, then click your seat in the flight and save your DTC. Failure to do the "dance" can result in loss of any changes you may

have made to loadouts, flight paths, PPTs and target assignments. You may also want to save the Campaign, in case you want to try this mission again with different tactics.

The Debrief

Upon coming back to the User Interface after your flight you will be presented a Debrief screen.
Mission results are always a bit weird. For instance it might say that a flight never arrived to their target although they destroyed it. That happens when standoff weapons are used and the flight not really overfly the target steerpoint.
Mission type may have a few factors to be met for rating a mission success. For instance a Barcap mission with a station time at CAP of 30 minutes needs to record these 30 minutes to rate the mission as a success, regardless of how many enemy aircraft your flight took out. So choose your mission type wisely.
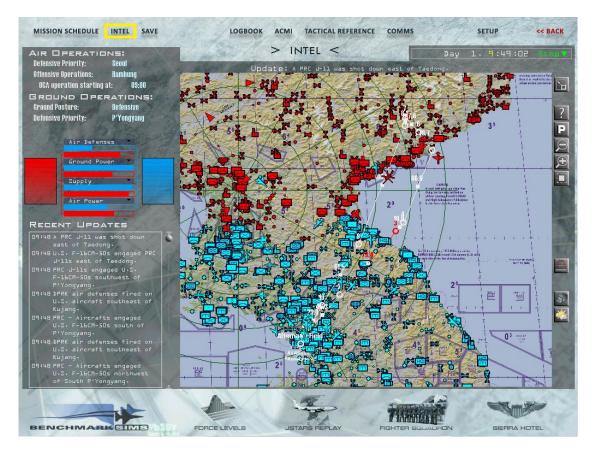
Try to stay in the habit of meeting your scheduled Time over Target; you will be supported better within your package and those relying on you will be more successful.

So what is the big deal about mission ratings? Well, Mission Success and Excellent pilot ratings are fed into the campaign engine to dynamically adjust the state of the war. One mission may not cause North Korea to surrender, but if we keep it up the momentum spreads, morale stays high and the AI perform better. Your mission rating includes your wingman; if your flight all RTB safely, with targets hit, great! If your flight suffers losses, your rating suffers.

Intel
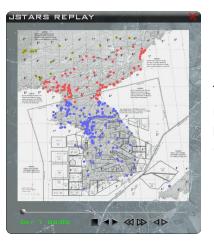
OK, the crew chief is putting your bird to bed, let's go into Ops and see how the war is going.
Clicking the INTEL icon brings up the current state of the war:

The Ground Posture is Defensive – do not be concerned yet, the war is less than 2 hours old. They outnumber us in… well, everything – but given time we should make progress.

Check the recent updates to see if any units have surrendered - lost battalions, task forces, etc. are major initiative points!

It is early, but to see what the force trends show click the FORCE LEVELS button on the bottom left. We should already see a slight downward slope to their Air Defences in less than 2 hours – AD should be the first to go so we can fight over their soil.

Now click the JSTARS REPLAY.

This will show movement and attrition of ground forces on both sides. The replay is not very long right now (1 hour), so check back often. This is your best indication of how the FLOT is moving, where troops from each side are "in contact" and where each side is massing troops for a possible breakout.

Your squadron statistics are interesting - in the first hour they have flown 10 missions, lost 1 aircraft, killed 11, killed 72 ground units and 3 stationary targets (our factory strike).

Morale is high and the rating is EXCELLENT!

So that is the state of the war today, news flashes roll across the top throughout the war.

Save your campaign often so you can pick up where you left off. If you want speed it up a little, remember to use maximum **x16** speed, or campaign issues can result. If you are on a particularly long and boring mission (what I call the "long drive to work") consider using x2 or x4 time compression. While this is not available in most multiplayer events, it can be helpful in getting several missions logged in a short evening. Do not be a spectator; the campaign will sense your absence and your side will begin to suffer. It is war, not your fish tank.

OK Lieutenant, you are on your own; you can take it from here and become a legend in the skies.

9.4.2   Priorities

Welcome back Captain (I assume you have been promoted by now), you have shown great skill in battle and now want to learn more about how "HQ" decides the orders for today. As a veteran of several campaign missions you should be ready to move up to veteran-level understanding of the campaign engine.

Let's take your knowledge up a few steps, so you can help nudge the air war in different directions using Priorities. Priorities are the easy way to give input to the HQ "Frag Machine" and make it run a smarter campaign.

Why would we want to adjust priorities?

War evolves in mission types and geographical focus over time. Early on in the conflict we need to concentrate on killing things that kill us (enemy fighters, air defences and command/control [C&C] units that direct them). Later we will shift to killing things that kill our troops; after that we hit factories and power plants to weaken their resolve to continue the fight. That is a simple war doctrine; you may have a different variation you would like to try.

If you accept the default priorities, you run a high risk that:

- You will lose aircraft to ill-advised and "suicidal" missions.

- Air assets that are chasing after low value targets (e.g.: naval patrol boats, textile mills, baby formula plants) could be taking out air defences, C&C, airbases, fighters, etc.

- A bridge you destroy now has to be repaired when your troops get moving – you may want to decide which infrastructure should be hit and when.

When to adjust priorities?

Priorities are easy to adjust, but you need to have a sense of when the tempo should change in the war. Do we have air superiority? Are enemy air defences blind or destroyed? Are troops moving into our territory, putting our airfields at risk? Try to anticipate the needs of the ground war, because eventually the ground units must win it for us.

How to adjust priorities?

We have 3 tabs with sliders:

The first tab adjusts targets
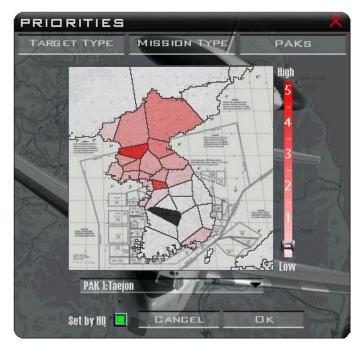
As mentioned above, early in the war you may want to give more attention to things that kill you. Sliding the dot to the left will set a target type to the lowest setting; to the right is the highest.

Mission Types come next

- **Offensive Counter Air** – Strikes on airbases, radars, C&C, helicopter bases, etc.

- **SAM Suppression** – Attacks against SAMs, AAA, etc.

- **Air Interdiction and Close Air Support** – Attacks against ground units and emplacements (CAS in proximity to friendly troops).

- **Strategic Strikes** – Attacks against production, power, nuclear, fuel, research facilities, bridges...

- **Anti-shipping** – Targets offensive (Destroyers, Carriers, Patrol boat, etc.) and support vessels (Tankers, Freighters, etc.).

- **Defensive Counter Air** – Combat Air Patrols (CAP) that include BARCAP, TARCAP, HAVCAP.

- **Reconnaissance** – Includes U-2 and helicopter recon patrols. These missions will "spot" enemy units on the map for a period of time after they fly over them.

PAK (route Package)

The war theatre is divided into sections that can be prioritised from 0 to 5; the shading indicates the current priority. If you click on a region the name will appear below the map. These names are the same as the "Posture" reports in the upper left of the INTEL screen. In the map to the left, P'Yongyang and Seoul are set high. If you remember the INTEL above, P'Yongyang was the goal of Air Offensive Operations and Seoul was the Defensive Priority.

These are the default settings for Rolling Fire and I can only assume Pusan (SE corner of S Korea) is medium high due to the concentration of troops there. I doubt that Japan is a threat in this conflict.

Tip: After adjusting Priorities, scan the ATO and delete/abort packages that are not aligned with your new plan. This will free up assets for you and your high-value missions.

Ok Captain, that is the Veteran-level route to Strategic Command. The next step, to Ace, means unchecking the **Set by HQ** button and I am not sure we want to go there yet. Doing that means you accept responsibility for creating a vast number of packages that do not concern you, like: Airlift to keep bases and troops supplied, Tankers, AWACS, JSTARS and their HAVCAP Escorts, recon, etc. We can still go into how to frag a flight, so you can "roll your own" when needed.

9.4.3   Creating a Package

You have the ability to create your own special missions to support the war effort. These packages can be one you intend to fly, or they can be 100% AI flown. Once created they will fly, with or without you, so be prepared.

Pick your Target
You need to consider several factors before adding your package:

1.   Threats – Do I have a good idea what I will fly over and into to accomplish this mission? Are there air defences I can't see on the map yet? Are there enemy CAPs and Alert Scrambles that may ambush me?

2.   How long is the flight? Do I have AA Refuelling or runways I can refuel at?

3.   Can the supporting flights get to the "PUSH Point" without fuel, threat, or weather issues?

4.   Can the supporting flights get home OK? You are responsible for your assets, do not waste them!

5.   Do I have the skill to accomplish the mission? Making a low-level run on the Admiral Kuznetsov carrier group with Mavericks requires a delicate balance of skill and crazy to pull it off.

Consider your Package
After researching your threats and route limitations, you need to decide what is needed to support you:
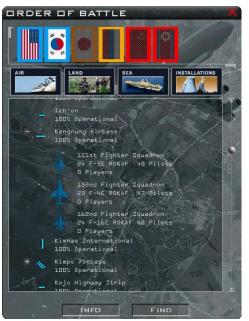
1.   SEAD Escort – a flight to protect the package from SAMs along the route.

2.   Fighter Escort – a flight to protect the package from air threats along the route.

3.   ECM – are there Jammer aircraft available in your theatre (EF-111 or EA-6B or F/A-18G Growler)?

4.   AAR – are refuelling tankers on station before you need them?

5.   Are AWACS available within radio range of my flight plan?

As we begin to build our package, we may find that other aircraft are not available, because HQ has assigned them to other FRAGs. Building a package in the early days of the campaign can be hit or miss, so be prepared for some frustration.

> *Tip: Package creation is different from solo to MP for code reasons. In a MP environment the host controls flights creation and multi mission packages cannot be created from the client side. A client can only create a single flight package with the ADD PACKAGE button. The ADD package window will close after adding the first flight.*
> *In a MP campaign the following flights in a package must be added to the newly created package by going into the ATO, finding the package you just created, right-clicking on the package line and selecting SHOW FLIGHT. The package window will then be displayed again and the next flight can be added in the same package with the NEW button.*

Squadrons available to the war effort can be found in the Order of Battle (OOB), so let's look at that now:

Pressing the OOB icon brings up the window to the left.

In this picture, I have selected the US and RoK flags to include both countries' airbases and then expanded Gangneung Airbase.

As you can see, there is a squadron of F-5s, F-4s, and KF-16s.
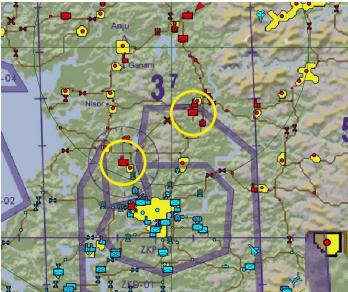
If I right-click on the 162nd FS and click status, I can see they are a general role squadron (can do both A-A and A-G), they have full inventory and seem ready for a mission.

If I clicked **JOIN** the squadron I would be taken to their airbase and would view their frag – they have a few missions scheduled today, but others would likely be available for you.

Tip: F-4s and F-5s are under-utilized by HQ; do not overlook them to support your needs!

What if you still cannot find planes available? Check the ATO and see if a scheduled flight can be deleted and those airframes can be made available for you. Let's try making (fragging) a flight:

To protect packages heading north, we want kill SA-2 battalions north of the FLOT.

Other flights from our base will be striking SAMs north of these units at 1036LT, so we will get strike these before they get in range (about 1025LT). We should plan on having an escort in case the MiGs come to spoil our plans. That should do it for this package.

Right-click on SAM icon and select **Add Package**.

1. Set Time on Target to 10:25LT, you will have to learn ZULU time which is 9 hours before local time in Korea, so 01:25Z
2. Hit NEW.
3. Fill in AIRCRAFT type, ROLE, SIZE, SQUADRON & skill in the newly opened window
4. Hit OK.

If you get this, try a different aircraft or a different squadron nearby.
That means that all aircraft of this squadron have already been assigned.

Tip: It is common practice to use the Take-off Time rather than
Time on Target. Setting the Take-off for an hour later allows a
better chance of getting an aircraft loaded and ready!

Now we need to add an Escort flight; if we add it to our
package it will be available for IDM linkage.

Click NEW again and find an available escort.

I was able to get a 4-ship from our squadron to join us, so we
are good-to-go!

We need to look at our loadout, it
gave us AGM-88s and an HTS.
That looks good to me.

We should be in-and-out quickly;
we will be back to Officer's Club
before our beer gets warm.

Tip: Be careful using AI
flights as TARCAP as they
will stay on station only
until their patrol time is
met. If you are late, you'll
have no cover; if you
strike the target and
leave, they will stay
behind (and possibly die),
instead of egressing with
you.

So there you have it, we have a custom mission ready-to-fly. If you like having this much control, stick around
for the ACE briefing that is available to new squadron commanders.

9.4.4   Commanding a Squadron

Welcome back Major, it is time to prepare you for Squadron Command assignment. In this section we will discuss why and how to take a squadron away from HQ control and assume full control of the assets.

Let's get started!

Why control a squadron?

By now, you may be frustrated by the lack of aircraft available for your missions. While this situation can improve later in the campaign, you want it now! When you have control of the squadron, HQ will "leave you alone" to do your own thing, so your squadron's aircraft and pilots are available for YOUR tasking.

Many BMS virtual squadrons will run a campaign as a weekly flight activity. To ensure you have enough "seats" for your members, you may have to control multiple squadrons. For these situations, try to find an airbase with 2 or more squadrons co-located, so packages can ramp and marshal easily.

Why wouldn't I want total control? Well, as mentioned before, HQ "keeps the lights on" by scheduling resupply flights, tanker support, AWACS/JSTAR, and Recon missions. Additionally HQ needs adequate fighter support assets to provide HAVCAPs for these flights, or they could be shot down. Nothing will lose the campaign faster than troops without ammo, flights without C&C and squadrons running out of missiles and bombs.

How to control a squadron?

This is the easy part, follow along…

Find the squadron you want in the OOB – we will go back to the 14th Fighter Squadron at Gimpo Intl Airport. Find Gimpo and expand it, click on the 14th to highlight it, right-click and click **Status**.

As you can see, we have 24 aircraft still available (more may be resupplied in the future), so we can work with this. Do not pick a squadron that is low on airframes or pilots.

Click the Green **Set by HQ** button so it goes blank.

Now click JOIN to be moved to that squadron.

Congratulations, welcome to your new command, hope you like your office, sir!

Hey, wait! There are 8 flights in my frag, 1 is enroute.

Yes, just because you took over, does not mean the war stops! We have to clean them out.

There are two ways to do this, advance the campaign in **x16** until they have all flown and landed (you risk losing airframes this way), or click on each flight, remove the weapons, find it in the ATO and delete it. If a flight is inbound to a target you can abort the package to recall them. Here is how:

We will abort package 2345, a SEAD flight in support of an OCA mission. We need to abort the entire package or we will leave the OCA and ESCORT flights vulnerable to SAMs

Find the flight in the ATO (notice it is grey because it has left).

Right-click on the Package number and select **Show Flights**.

Tip: This procedure can also be used to remove unwanted or suicidal Strike missions.

Click ABORT and the package should return home (remember to start the clock momentarily to process the action).

The other flights can be deleted by finding them in the ATO, right-clicking on the Package line and selecting **Delete**.

This is our FRAG Order now! I left the 2 SEAD missions because they were part of larger packages

Ok, now you should have aircraft available for your tasking. The ones landing will need some time to be "turned around" by the ground crew and made ready in your inventory.

9.4.5 Multiplayer Considerations

Well done Colonel, you are mastering the ACE material, how about adding in some human interaction?

Multiplayer campaigns come in two general categories, Human versus AI, or Human vs. Human. The techniques are the same, but in Human vs. Human events the host sets the controls.

Human versus AI

This is the execution of a campaign where several players will take control of one side (usually the US/RoK in KTO) and battle against an AI DPRK. Here are some things to consider when running this simulation:

1. Mission control – as mentioned earlier ensure you have enough aircraft to facilitate your guests. You will lose aircraft during the campaign, so plan in advance and manage your assets well. This may involve having Rules of Engagement (RoE) that will call for "mission abort" if faced with a large enemy air presence. Also, consider your chance of losses to surface and naval threats. If in doubt… RTB!

2. Stop the clock – when each person joins, the clock will begin running. Always be mindful of the clock, or your mission may leave without you. Most squadrons have Standard Operating Procedures (SOPs) which check players into the lobby first, do IVC checks, do a general mission brief and then enter into the Online Campaign, announcing "call sign in, clock stopped" on TeamSpeak or over IVC.

3. Consider joining via a support squadron (AWACS, C-17, AAR, etc.) first and then join the flights in order. The Lead joins the flight and calls #2 to "Join on me" followed by 3 and 4. If you jump into a seat prematurely, you may have to leave BMS and re-enter before someone can take your spot. Orderly entry avoids this. To join on a player – right-click their callsign in the COMMS tab and select **Join**.

4. Consider setting up the flights prior to the event start. This allows an opportunity to do a general brief ("Tonight we are striking Haeju Airbase; there are 2 Strike seats, 2 SEAD Escort and 4 Escort. Which flight do you want?")

5. As mentioned above, take turns in the LOADOUT screen to avoid lost changes. Always ask flight members to check their loadout in the BRIEFING screen prior to flight.

6. Use the sliders mentioned above to build a worthy adversary – having several experienced pilots trouncing Rookie-level DPRK pilots is not going to test your ability much.

7. Squadrons with a separate server should create a "server flight" that is safe and will run longer than the missions tonight. When all briefings and loadout changes are complete, save the campaign and prepare to FLY. The server flight should commit to FLY first and then the others can do the "click dance" and go. When everyone commits, the clock will run at x16 until 4:00 before the first human take-off time in the package for commit to TAXI or 20:00 before for RAMP). When creating the packages, consider that the last flight will sit in "splash screen" with a slow clock until this time before they enter the jet. If a squadron member is observing or providing human AWACS in the 2D screen, they must select **x16** when everyone else commits to 3D, or all clocks will be slow.

8. "Hey, you're in my seat!" – This is a frequent exclamation in multiplayer events. After your flight ends, you are in the splash screen while the ACMI is processing, so you leave the room (it was a long flight, if you get my meaning!). While you are away, your ACMI finishes and you now have the debrief screen. If someone frags a flight from this squadron you are going to end up in the Lead seat, his or her seat. Soon you will hear: "Hey, you're in my seat!" When you finish a flight, try to stay around until the ACMI is done, take a quick screenshot of the debrief information, join another flight (AWACS, Transport, etc.), or exit BMS (restarting BMS is a good habit anyway between missions). This procedure applies to both Human vs. Human and Human vs. AI events that are continuously running.

9. Some sites host an "always-on" campaign that you can join and fly with others. In these campaigns the clock is always running and you have no control. You should consult the RoE and SOPs of the server for operational parameters. Generally, the above procedure for creating a package is used on these sites. Since you will be creating a flight 1 hour before departure, you will need to roll back the take-off time when everyone is ready to fly.

    To roll back a flight, find the package in the ATO:

    - Right-click on the Package line and select **Show Flights**.

    - Ensure all flights in the package have the same take-off time (sometimes Escorts are fragged several minutes before the strikers).

    - Click the Lock next to TAKEOFF (if not already selected).

    - Click the minute digits to highlight them and then decrease the time to the desired value. Click OK to accept.

    - Verify that the TO times are correct in the FRAG Order.

    - Ask all pilots to "do the Click Dance" as mentioned above.

Human vs. Human

Ah, the real test of an airman – compete against an adversary that thinks like you, acts like you and may be a little bit better than you. In human vs. human events the server rules are closely monitored and the loadouts may even be limited to set up a greater test of skill. In these events you are at a big disadvantage flying alone (if you are even allowed to fly alone), so start making friends or join a virtual squadron.

The procedures above still apply, but you may have some differences:

1. It may involve a theatre not in the stock BMS install. No worries, you are up to the challenge.

2. It may be a "take the flag" type event – One side will attack a target, the other will defend it. This format is usually constructed more like a TE and less like a campaign, because it does not need a dynamic AI engine to run the ground war.

3. RoEs may make some airbases off-limits to attack – this allows world-wide participants to enter the arena around-the-clock and not be denied a base to launch from.

4. DTC frequencies may be different – usually each side has their own IVC server to avoid inappropriate monitoring by the other side. The event's sponsor will cover this in the RoEs or SOPs.

5. Enemy troops are usually invisible to you unless "spotted" by your troops or fellow pilots. Get used to fragging and flying within the "fog of war".

6. There may be players suppling human AWACS support through a common tactical channel. In some events AI AWACS is not available and visual ID is needed before engaging anything.

7. Learn to frag and ramp quickly (these events are usually RAMP start only) – you may need to scramble for an enemy attack on your troops. Here you still frag the flight at T+1 hour but roll it back to the minimum time needed to start your cold dark jet. Remember to set COMMS, PPTs and check loadouts, or you may be rushing for nothing.

8. If someone frags a flight and leaves it, or gets disconnected, be a good sport and abort the flight. These events usually forbid fragging an AI wingman, so if your buddy gets disconnected – tell his jet to RTB. If he was flight lead, you may have to RTB quickly and abort the flight. Check the RoEs.

9. Remember, you will be limited in the number of aircraft and arms for the event – do not waste them on solo AI planes flying stupidly into a wall of smart humans!

9.4.6   KTO Campaign objectives, Mission Types and Success Factors

List of standard BMS Campaigns and their Objectives

RED/BLUE victory conditions and stalemate bounds:

- **TIGER SPIRIT**
  - ➢ **RoK/US** wins if Kalma and P'yongyang, Onch'ang-ni, Hamju, Huich'on, Kaechon and Taehung are controlled in less than 5 campaign days, or…
  - ➢ **RoK/US** wins if Kalma and P'yongyang are controlled in less than 5 campaign days and DPRK strength is less than $1/10^{th}$ that of Allies forces.
  - ➢ **DPRK** wins if either Kalma or P'yongyang are controlled in less than 5 campaign days and DPRK maintains 1:1 force ratio.
  - ➢ If none of these conditions are met in 5 days then the outcome will be a stalemate.

- **ROLLING FIRE**

- ➢ **RoK/US** wins if Kalma and P'yongyang are controlled in less than 30 campaign days.

- ➢ **DPRK** wins if Seoul and Pusan are controlled in less than 30 campaign days.

- ➢ If none of these conditions are met in 30 days then the outcome will be a peace treaty.

- ➢ If no major objective is captured in 20 days then the outcome will be a stalemate.

- **IRON FORTRESS**
  - ➢ **RoK/US** wins if Pusan and Seoul are controlled in less than 5 campaign days.
  - ➢ **DPRK** wins if Seoul and Pusan are controlled in less than 5 campaign days.
  - ➢ If none of these conditions are met in 5 days then the outcome will be a peace treaty.

- **DOUBLE DRAGON (4.34 campaign)**

  - ➢ **RoK/US/DPRK** wins if P'yongyang, Kalma, Koksan and Changyon is captured in less than 10 campaign days and PRC strength is less than 1/10th that of Allies forces.
  - ➢ **DPRK** wins independently if DPRK forces own P'yongyang, Kalma, Koksan, Changyon, Chongjin and Tan-tung.
  - ➢ **PRC** wins if P'yongyang, Kaesong, Koksan and either Changyon or Kalma are controlled in less than 15 campaign days and PRC maintains 1:1 force ratio.
  - ➢ If none of these conditions are met in 20 days then the outcome will be a stalemate.

- **BEAR TRAP (4.34 campaign)**

  - ➢ **RoK** wins if Pusan, Sokcho and Pohang are controlled in less than 8 campaign days.
  - ➢ **CIS** wins if not pushed backed from South Korea within 8 campaign days.

- **MANTIS AT DAWN (4.34 campaign)**

  - ➢ **BLUEFORCE** wins if Cheongju is controlled in less than 5 campaign days.
  - ➢ **REDFORCE** wins if Cheongju stays controlled within 5 campaign days.

- TVT Campaign

The TVT campaign is a special campaign with a specific terrain and will not be readily visible from the Campaign tab of the UI. To activate it you must switch the Theatre from KTO to TVT.
In the UI, select the Theatre tab and select Korea TvT, click OK and BMS will auto shut down.
(A restart of BMS is always mandatory after a theatre change).

After the restart BMS will not display the regular KTO terrain but the specific TvT map. Select the campaign tab as usual and you will have access to the specific Team Vs Team BMS campaign.

The TvT campaign has 4 teams:

➤ YELFOR (North team).

➤ GREFOR (South team).

➤ CIS (reserved and server dedicated).

➤ NATO (the purpose of the NATO team is to prevent both the YELFOR and GREFOR from trespassing the prohibited sea airspace. These areas are guarded by NATO naval forces that will engage any trespassing aircraft from both YELFOR and GREFOR teams).

YELFOR/GREFOR victory conditions and stalemate bounds:

➤ YELFOR wins if Chuncheon is controlled in less than 65 campaign days.

➤ GREFOR wins if Hoeyang is controlled in less than 65 campaign days.

➤ If none of these conditions are met in 65 days, then the outcome will be a peace treaty.

➤ If no major objective is captured in 40 days, then the outcome will be a stalemate

There are two campaign "types" available in the SAVE tab of the campaign:

➤ TvT Coop Event - multiplayer dedicated with two teams at war (Team vs Team) with AI (A-A and A-G) tasking available.

➤ TvT Official Event - multiplayer dedicated with two teams at war (Team vs Team) with only BARCAP AI available.
This scenario is dedicated and optimised for large MP events.

List of Mission types and their success factors

- **DCA:** Defensive Counter Air. DCA missions are meant to protect friendly assets in a particular area. DCA flight plans have two CAP points and a patrol time. To ensure success you must stay on station and prevent friendly assets in and around your AOR (Area of Responsibility) from being attacked by OPFOR. The main problem with DCA is knowing which asset to defend with a war going on around you.

- **BARCAP (or CAP):** Barrier CAP. A standard CAP (combat air patrol) where your flights will protect a geographical area from enemy aircraft. Arrive on time at the first CAP point and stay in the CAP for the assigned patrol time for mission success (usually 30 minutes but that depends on the flight plan).
If you have to leave early for whatever reason you must request relief from the AWACS. Try not to fly too far from your CAP point and set a commit criterion of 25 Nm. The difference between CAP and DCA is that CAP is not tied to specific assets so it is easier to get success with survival and CAP time, even if you did not shoot any OPFOR aircraft down.

- **HAVCAP:** High Value CAP. Same as CAP but mission success is tied to the survival of the high value asset you are tasked to protect. CAP patrol time is usually longer with HAVCAP (defaults to 1 hour).

- **TARCAP:** Target CAP. Same as CAP but you are protecting a specific target area (usually while other aircraft strike it). You must ensure the strikers survive their attack.

- **AMBUSHCAP:** Same as CAP but you are hiding from the OPFOR, usually behind a mountain at low altitude.

- **SWEEP:** Aggressive Air to Air flight that has no patrol time but 3 target steerpoints where you will attack and destroy as many OPFOR aircraft as possible without friendly losses in your flight. You must shoot down at least one enemy and survive for success.

- **INTERCEPT:** This Air to Air flight has a very specific target that must be intercepted and destroyed around the target steerpoint. Mission success is tied to the failure of the intercepted aircraft mission. An abort by them is considered as success for you. This mission can unfortunately fail if another unit downed your target before you could.

- **ESCORT:** Your flight must protect a package from OPFOR aircraft. You will meet with your target package and fly with them (usually in front of them to ensure they are not attacked by enemy aircraft). The trick with Escort is to find a good compromise between commit criteria and staying with the package. Enemy forces will try to drag you away from your target, so other enemy flights can destroy them while you are not there to protect them. For mission success the target package must not sustain any loss.

- **DEAD:** Destruction of Enemy Air Defences. As the title implies you must destroy as many specific radars and/or launchers as possible at the target steerpoints. That is the old SEAD STRIKE tasking from 4.32.

- **SEAD:** Suppression of Enemy Air Defences. This time you do not have to destroy specific ADA, but usually protect a strike package from enemy air defences. It is the old SEAD ESCORT tasking. Mission success is tied to the strike package sustaining no losses.

- **OCA STRIKE:** Offensive Counter Air Strike missions are targeted specifically against airbases or search radars. The purpose of OCA strikes is to help gain aerial supremacy by destroying assets on the ground. Mission success is tied to target damage of at least 30% (target must be under 70% operational status after the strike).

- **STRIKE:** Genuine Air to Ground strike mission against a variety of specific targets. Decrease operational status of the assigned target by 30% at least to ensure success (target must be under 70% operational status after the strike).

- **DEEP STRIKE:** Same as STRIKE but deep behind enemy lines. Success conditions are the same as Strike.

- **FAC(A):** Forward Air Controller (Aircraft) mission. Although the F-16 is not the best platform for FAC duties it is quite possible to direct strike flights in MP with the TGP and Laser Spot Tracker capabilities. You can now even illuminate and guide other flights' LGB weapons. When tasked with FAC duties you must assist in the destruction of as many enemy ground units as possible around the 2 target steerpoints. This tasking is best flown in MP.

- **ON CALL CAS:** On Call Close Air Support. You are tasked to patrol an area (respect the patrol time) and standby for specific targets that will be transmitted to you by friendly assets (usually a FAC). The way the AI transmit target coordinates is tricky to follow and this type of mission is best flown in MP with a human FAC(A). To ensure success you must destroy as many targets as possible.

- **PRE-PLAN CAS:** Close Air Support mission against known ground units. The FAC is not needed. Destroy as many vehicles in the target battalion as possible to ensure mission success. Please note the flight plan will place two target steerpoints. The target is supposedly around these two steerpoints, usually moving on roads. Mission can unfortunately fail if your target was destroyed by other units.

- **CAS:** Same as Pre-Planned CAS.

- **AI:** Air Interdiction missions to prevent reinforcements reaching the front line. There is no specific target assigned between the two target steerpoints and your flight is free to hunt down reinforcement and logistics units (actually any unit will do). To ensure success you must destroy as many targets as possible.

- **RECCE:** Reconnaissance. Usually pre-strike recon mission against a specific target. Your aircraft will be loaded with the LOW ALT camera and you must photograph the target. Mission will be rated as success if you fly closer than 2 Nm (slant range) from target. Please note anything higher than 12000 feet is more than 2 Nm slant range. Fly low level at the target.

- **BDA:** Bomb Damage Assessment. Same as reconnaissance but post-strike to evaluate the strike effectiveness. Mission success conditions are the same as for recon flights.

- **TASMO:** Tactical Air Support for Maritime Operations. Damage as many naval targets as possible at the attack steerpoint.

- **RECCE PATROL:** Same as Recce but with two target steerpoints. Mission is aimed to search for enemy ground vehicles in the assigned area. You must photograph the target with the LOW ALT camera. See RECCE for details. Mainly used for choppers (which are not flyable by humans).

- **Patrol:** Same as RECCE Patrol but the task is to photograph naval units. See above for details.

- **TRAINING:** is a Training flight without specific objectives. Just bring the jet back for mission success.

9.5   Tactical Reference

The purpose of this section is to provide as much information as possible on allied and enemy aircraft, vehicles, and weapons. 4.35 reordered the items but content is still not updated.

The Tactical Reference in its current state has 6 main categories with 7 subcategories each with the potential to add more if needed in the future:

- Aircraft: Fighters
                  Multi-Role
                  Attack
                  Bombers
                  Helicopters
                  C3IRSEW (Early Warning, Command and Electronic Warfare)
                  Support

- Vehicles: Tanks
                  IFVs / APCs (troop transport)
                  Artillery
                  SAMs (Surface to Air missiles)
                  AAA (Anti-Aircraft Artillery)

Rdr Sys / CP (Radar & Tracking Systems)

Support

- Vessels: Carriers

    Cruisers

    Frigates

    Destroyers

    Submarines

    Other

    Support

- Missiles: Air to Air Infrared missiles

    Air to Air Radar missiles

    Anti-Surface missiles (ASMs)

    Anti-Radiation missiles (ARMs)

    Other Air to Ground missiles (AGMs)

    Surface to Air missiles (SAMs)

    Surface to Surface missiles (SSMs)

- Bombs

    General Purpose bombs (GP)

    Laser Guided Bombs (LGBs)

    GPS weapons

    Cluster Bomb Units (CBUs)

    Incendiary bombs

    Anti-Runway weapon

    Other

- Stores

    Fuel tanks

    Recon pods

    ECM pods

    CM pods

    Targeting pods

    Rocket/Gun pods

    Others

Until the tactical reference content is updated Teesquare has created a very useful document, available on the BMS forum, called THE VAULT, which is a collection of information on weapons used in the battlefields of the BMS world.

9.6 Comms

The COMMs menu is used to initiate Multiplayer connection. Please see the Multiplayer chapter in this manual.

9.7 Logbook

The logbook is where all your pilots' records are saved. Some users value their logbook dearly as it may have been created initially in 1998 when Falcon 4.0 was released and been used in many different Falcon versions since then. The logbook file is callsign.lbk located in the *\Users\Config* folder and can be saved and ported to new Falcon installs.

The default logbook is Joe "Viper" Pilot.

Click NEW to create a new entry and type a callsign and a pilot name in the relevant boxes. You can choose a password to protect your logbook entry and a voice for that pilot (that will be the voice heard in cockpit for the radio comms if the Player Voice option is activated in the SETUP SOUND tab).

CLEAR erases all pilot information, including career statistics and is used to start with a fresh logbook as well.

CANCEL exits the logbook screen without saving any changes and OK exits the logbook and saves the changes.

9.7.1   Career

Fresh logbooks start at the rank of lieutenant and according to your mission points you may be promoted up to Brigadier General. Usually when you get there you fly a desk with an F-16 model on it and not the real F-16 anymore, so do not seek promotion too much! Here are the conditions for promotions:

- 1st Lt – 150 points.

- Capt – 300 points.

- Major – 800 points and one campaign won.

- Lt Col – 1600 points one campaign won and no campaign losses.

- Col – 3200 points one campaign won and no campaign losses.

- Gen – 6400 points.

The career box holds some valuable pilot information, such as the date the logbook was created and the number of flight hours accumulated from all the BMS modules (Dogfight, Instant Action, TE and Campaign). unfortunately Training does not count.

The Ace factor depends on your online combat versus other humans. If you do not fly online against other humans your Ace factor will remain at 1.0.

Each campaign mission adds some points to the pilot statistics and the total score is displayed in the career section. The last mission score is also displayed. Scores are calculated with many different factors and influenced by your realism rating in SETUP. A realism rating of 100% (Ace) will multiply your score by 1. Anything under 100 will actually decrease your mission score (%) as it will multiply it by a decimal (e.g.: 0.8 for 80% realism rating). You do not get points for TE unfortunately.

9.7.2   Campaign

The campaign section holds information about the pilot's campaign statistics:

- **Campaign 1/0/0** represents the number of campaigns Won/Lost/Stalemate.

- **Mission** is the number of missions flown in campaign. You must join the package and re-enter friendly airspace to get credits for the mission. If you quit by selecting **(D) Discard mission** you won't get credit.

- **Rating** is a number between 1 and 5 that influences (amongst other factors) the medal awards.

- **Kill Ratio** indicates the ratio of kills against the number of times you have been killed.

- **Online** is the same as kill ratio, but specifically against human players in online campaigns.

- **Consecutive** represents the number of consecutive successful missions. If you reach 100 consecutive missions you are awarded the Longevity medal.

- **A-A Kills** is the number of Air to Air kills in campaigns. It is also the first number of your kill ratio.

- **A-G Kills** is the number of Air to Ground vehicle kills in campaigns.

- **Static** is the number of static targets destroyed in campaigns.

- **Naval** is the number of naval targets destroyed in campaigns.

- **Death** is the number of times you have been killed. It is also the second part of the kill ratio.

- **Frat kills** is the number of friendlies you have unfortunately killed.

9.7.3   Medals & Dogfight

You may obtain a medal if your campaign mission went flawlessly, e.g.: the primary target was destroyed; you and your wingmen landed safely with no friendly fire incidents.

> *Note: medals are only awarded in Campaign.*

Criteria to gain a medal include:

- Enemy Air, Naval, Ground units and fixed targets destroyed - the first two count more.

- Realism rating given in the SETUP screen and your campaign rating from the logbook.

- Campaign difficulty and mission complexity.

The easiest medal to get is the Air Medal, followed by the Distinguished Flying Cross and the Silver Star. The hardest medal to get is the Air Force Cross. Two extra medals are awarded: the Air Force Longevity medal is awarded after 100 consecutive campaign missions and the Korean Campaign medal is awarded after completion of an original Korea Campaign.

Whenever you are awarded a medal it is displayed in the Medals section of your logbook. If you receive the same medal again you will get bronze oak leaves displayed on the medal ribbon. When you have 5 bronze oak leaves they are replaced by a silver oak leaf.

The statistics for the dogfight module measure the pilot's performances in the Dogfight arena. The number of games played is displayed and categorized with victory /defeat and kill ratio each time for offline and online.

9.7.4   Pilot Pictures & Squadron Patch

The pilot picture and squadron patch can be selected from the current list, or users can create their own images. Pilot image is personal but nowadays most virtual squadrons already have their own squadron patch included by default. If not images can be added in the *\User\Patches* folder. Pilot images must be added in the *\User\Pictures* folder. Images must be 96 x 96 pixels in TGA format (16-bits/pixel & without RLE compression). Transparency is pure magenta: RGB: 255/0/255.

The Personal Data section can be used to type personal information you may want to share with people looking your logbook up. Just type your text in the box.

9.8   ACMI

The User Interface features a module for ACMI viewing. ACMI stands for Air Combat Manoeuvring Instrumentation. It is a great learning tool that allows users to review their flight during debriefing.

There are several ways to start an ACMI recording:

- Command line parameter "-acmi" (automatically starts ACMI recording once you enter 3D and stops it when leaving 3D)
- Keystroke shortcut 'F' (toggle between ACMI recording On / Off)
- Mouse in 3D Pit or discrete keystrokes for each switch position (AVTR switch ON / OFF / AUTO) ON manually starts the tape / OFF manually stops the tape / AUTO manually record X seconds whenever the trigger or pickle button is pressed (X is default 30 seconds but can be defined by g_fAVTRSeconds in Falcon BMS.cfg)

9.8.1   ACMI File Format and Conversion

Once you start recording while in 3d a file with the extension '.flt' is stored in your local …\User\Acmi… folder. When you leave the 3d world the initial '.flt' file is converted to a replay file with the extension '.vhs'. This happens on the fly between leaving 3d and entering the debriefing screen. Depending on the Scenario (e.g. heavy Campaign vs. small TE) and duration of the flight it might take a while. In case of a CTD the conversion from '.flt' to '.vhs' will start once BMS is fired up the next time.

The ACMI conversion has been greatly improved, so you get from 3D to briefing much more quickly. 1 GB just takes around 5 seconds now. There is no need for any 3rd party conversion tools anymore. Also, the recording start logic was fixed so we only start a '.flt' file when in 3D. The previous code had a nasty propensity to spit out tiny '.flt' files (about 1KB) while in the menus if the game was launched with -acmi.
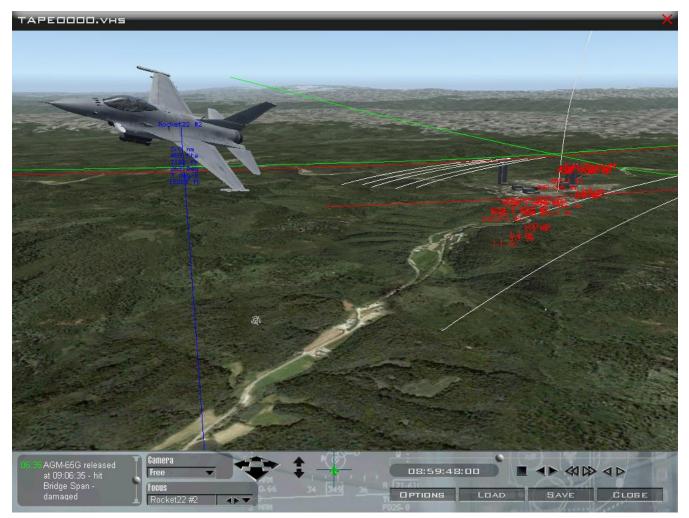
9.8.2   ACMI File Size

With 4.36 the option of changing the ACMI file size has been removed from the UI (Setup – Simulation).

The maximum file size for the initial recording format '.flt' is now hardcoded to 2.5 GB. If the saved ACMI file is bigger than that (which should not happen often, if at all) a subsequent ACMI file will be recorded. Default file naming is incremental from TAPE0000.vhs. Btw., each gigabyte of '.flt' file size turns into about 1.5 gigabyte of '.vhs' file size.

9.8.3   ACMI Viewer

Selecting ACMI from the UI will open a window where you can select the ACMI to review. Once selected the ACMI screen will be displayed.
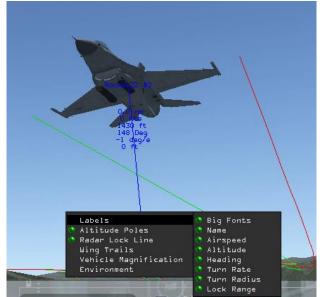
The ACMI viewer is separated into different sections. The biggest part is the 3D view which will respond to the options set in the ACMI controls section, which is the bottom part of the ACMI screen.

The event list on the left describes all events in the flight in sequence.

- View controls allow you to change POV: Internal, Orbit, Chase, Satellite, Isometric, Free & Tracking:

  - **Internal** is a HUD view with Airspeed, Heading and Altitude displayed. The views cannot be changed, but the user can select other aircraft HUD views by changing the focus aircraft box.

  - **Orbit** is an external view that can be rotated and zoomed. It is centred on the focus aircraft.

  - **Chase** shows the aircraft from behind. The view can only be zoomed in or out. It cannot be rotated.

  - **Satellite** gives a Gods'eye view on the focus aircraft from straight above. Zoom controls are enabled and rotation as well but limited to view from above.

  - **Isometric** provides a ¾ oblique view granting good perspective. Zoom and rotation controls are enabled.

> ➤ **Free** disconnect the view from the focus aircraft. You can therefore set a spot in space and manage the view from there looking at your aircraft. You can pan the view around, increase and decrease altitude and rotate your point of origin. This view is perfect at KOTAR during a range flight, when placed at the target looking at the attack axis of the flight.

> ➤ **Tracking** displays a view relative to the focus aircraft and another object selected in the TRACK box. Only zoom controls are activated.

- The **Focus** box is the reference object on which the view above will centre. It can be an aircraft, a missile, bombs or any object present in the event list.

- The View Controls will be displayed according to the selected view in the **Camera** drop down menu. The views are managed with the mouse. Once activated view changes can be accelerated by moving the mouse away from the view control graphics.

- The VCR controls allow you to run the tape at different speeds or image by image, forward and back. Falcon time is displayed. A timeline with a cursor position is also displayed. The VCR can be moved to a specific point on the timeline by dragging the round reference point to the desired spot on the timeline.

- The OPTIONS button opens a small selection menu to manage ACMI options:

> ➤ **Labels** can be displayed in small or large fonts. Name, Airspeed in Kts, Altitude in feet above MSL, Heading in degrees, Turn Rate in degrees per second, Turn Radius in feet and Lock Range can be toggled on or off.

> ➤ **Altitude Poles** are reference lines drawn from the aircraft to the ground.

> ➤ **Radar Lock Line** draws coloured lines illustrating radar locks between aircraft.

> ➤ **Wing Trails** draw a red line on the port wingtip and a green line on the starboard wingtip. The length of the trail can be set to
None, Short, Medium, Long and Maximum. Wing trails are very useful to judge aircraft evolution.

> ➤ **Vehicle Magnification** allows the object to be increased in size from 1 to 16 times.

> ➤ **Environment** allows ACMI to ignore or respect the time of day, the weather and shadows. In some night or bad weather conditions ACMI can be difficult to review without deactivating these options to improve visibility.

- The Acmi can be saved and loaded with the SAVE and LOAD buttons. To exit the ACMI screen, select the CLOSE button or click the red closing cross at the top right of the ACMI screen.

9.8.4   Screenshots

In addition to ACMI recording the user can take screenshots of the action with the relevant keystrokes. Screenshots can be with text (screenshot) or without text on the screen (pretty screenshot).

The images are stored in .jpg or .png format according to the setting in the Falcon BMS Config app. They are saved in the *User\Pictures* folder. Default naming is Date Hour (e.g.: YYYY-MM-DD_HHMMSS.png).

9.8.5   Alternative ACMI viewer

The ACMI viewer in Falcon is very old and view control is not always intuitive. The data provided may lack in some aspects but is still the most accurate around.

Tacview is third party software available for free (regular version) which works very well with BMS. Tacview can easily convert .vhs files to .acmi (Tacview format) and will save a lot of space doing so. It offers more intuitive controls and additional features over and above the built-in ACMI viewer.

Tacview is available at: http://tacview.strasoftware.com

Tacview Pro is not free but BMS users don't really need the Pro version and therefore we can make you aware of the free version of Tacview for BMS use.

Since 4.36.1 there is a native support for Tacview recordings. Note that this is still experimental. Files are saved in the <timestamp>.zip.acmi format. You can revert to the old .vhs format by adding in Falcon BMS User.cfg: *set g_bTacviewAcmi 0*.
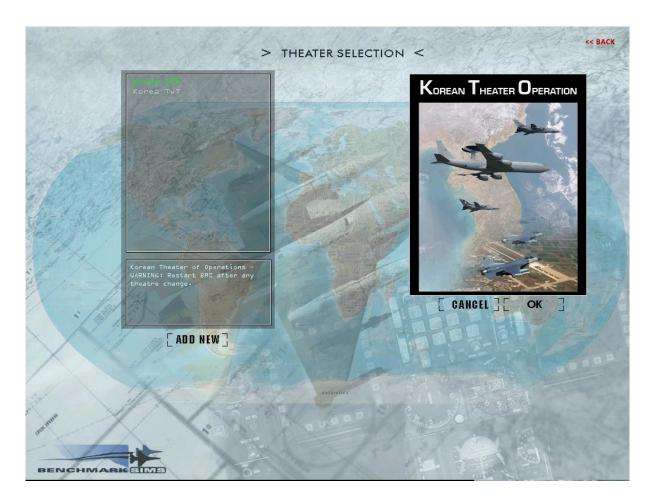
Native Tacview allows replays to contain lots of new info. Take a flight and see what you find!

9.9   Theatre

This section allows you to switch BMS theatres. BMS ships with Korea and Korea TvT "Team versus Team", which is the official BMS online campaign event. Other third-party theatres will no doubt become available in due course.

Please see the Installation chapter in this manual for specific information on theatre installation.

The box on the left lists all theatres currently installed in BMS. The green one is the active theatre. To switch theatres, simply select one and click OK. Upon selecting a new theatre, BMS will auto shut down. If not, manual restart is mandatory.

9.10 Setup

The SETUP section is documented in Chapter 3.4 of this manual.

9.11 Exit

This button exits Falcon BMS back to windows. The credits will be displayed before quitting. Credits can be bypassed with an additional click on EXIT.

10.   Artificial Intelligence

Here you can learn about significant changes regarding AI behaviour.

10.1 BMS 4.36 AI changes

10.1.1 Ground Attack improvements

AI behaviour is completely rewritten. The AI is now able to perform dedicated tactics for all weapons with proper guidance support when necessary. Attack patterns have been revised.

- AI can now fly proper HI-LO, Pop-up, HIGH and LOW attack profiles.
- AG attack profiles depending on weather situation. Attack minimum ceiling is dependent on weather: 5000 ft for Lasing / TV (depending also on cloud density in FAIR), 3000 ft for dumb bombs (depending on cloud density for popup / HI LO)
- Upgraded communications (Tactical / Flight)
- Fix AI Cluster burst altitude set up (was a fixed value before whatever terrain elevation!)
- Fix AI not releasing bombs despite being in parameters, improved smoothing of bombing runs
- Fix AI always being short for dumb bombs
- Fix release point according to Bomb spacing (was responsible of releasing too late)
- AI able to set up HARM with proper FLEX parameters
- AI is now able to fly at 500 ft above terrain when ordered with the new command menu "GO deck", following leader or during LOW / POPUP attacks profiles.
- Target Selection & AG mission defensive routines
- Dedicated tactics for every weapons with proper guidance support when necessary

10.1.2 New target assignments

You can now select individual targets for each wingman for Strike and OCA missions. This can be done in the UI. If you open the Target List you can assign different targets to your AI wingman. You can also set the target waypoint (WP). If you don't assign a target they default to "Target at will".

10.1.3 New JTAC

Implemented a new JTAC agency to allow JTAC operations. JTAC is available only for CAS/ ON CALL CAS/ PRE PLAN CAS / AI / INTERDICTION missions if a friendly unit of type HQ / RECON / INFANTRY / AIRMOBILE / MARINE OPS / MECH is within 6 NM from an enemy unit (that is within 10 NM of a target waypoint).

10.1.4 New / Revised comms

- "Attack target": AI will attack the designated target and will rejoin after a successful pass
- "Weapons free": AI will engage the pre-planned target until no more weapon left or a "Rejoin" command is issued
- New formation "stack up" / "level" / "stack down" / "God Deck" commands"
- "Set Bingo": AI will take over the human Bingo setting. Joker is Bingo plus 500 pounds.

10.1.5 Improved flight characteristics

- Upgraded AI ground avoidance
- WVR capabilities. Dogfights are much tougher now. Incoming missiles detection improvements.
- Roll control, AOA management, Separation routines, Fuel Management routines
- revised patterns for all kind of weapons
- Improve AI low flying capabilities for all phases of the flight.
- use correct radar AA mode (RWS/TWS/TWS soft lock/RWS SAM /RWS/STT) depending on situation (you will learn the hard way what that means.)

10.2 BMS 4.35 AI changes

10.2.1 SAMs

SAM tactics have again been upgraded and radar operators will better use their search and fire control radars to make the life of SEAD and DEAD flights more realistic. SAM operators, at least some of them manning multi targets radar are now able to fire at incoming missiles.

10.2.2 Ships

If ships in 4.34 hardly reacted to threats, 4.35 ships are firing back at their aggressors and might as well engage the incoming vampires.

10.3 BMS 4.34 AI changes

10.3.1 New ATC

4.34 introduced a completely new ATC code. This is fully documented in the BMS Comms and NAV book located in your *Docs* folder.

10.3.2 New Awacs

The AWACS AI has also been completely rewritten and it too is documented in the BMS Comms and NAV book in your *Docs* folder.

10.3.3 New BVR capabilities
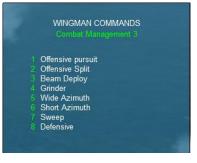
AI pilot behaviour in BVR engagements have been made much more realistic. AI pilots now apply complex BVR tactics and are much more challenging opponents, especially at higher skill levels. Some of us may have a real shock if we don't raise our game 😊

The Dogfight module has been updated with additional tactic scenarios to offer training experience on some specific manoeuvres (refer to the Dogfight module in the previous chapter of this manual).

The AI skill levels will determine the BVR capability of the AI. The default setting corresponds to VETERAN skill level. The choice of tactics applied, execution of the tactic, missile engagement behaviour and missile evasion behaviour are now dependant on the chosen AI skill level (in dogfight, campaign and TE scenarios). The more skilled the AI are, the less mistakes they will make and the sharper you will need to be to make it back in one piece.

The AI radio menu BVR commands which never really worked properly before are now perfectly usable and the AI wingmen will respond to the flight lead orders, applying the ordered tactics.
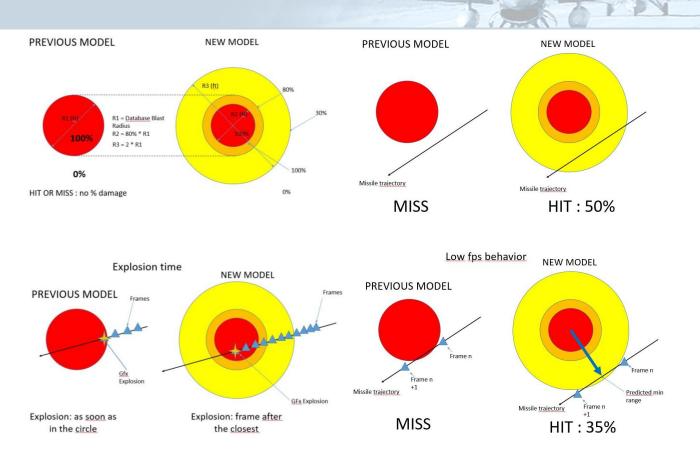
The opposition will react accordingly, according to their set skill level.

10.3.4 AA and AG missiles in BMS

Missile mechanisation has been updated in 4.34. It's not exclusive to SAMs, but the same updates were done for all missiles (including air to air). Missiles now have a proximity fuse.

Before 4.34 missiles were either hit or miss. You survived, or you were hit, exploded and out of commission. With the new damage model and failures more manageable from the cockpit, 4.34 needed more occasions for degraded operations. Missile behaviour was changed to provide the possibility of damaging aircraft rather than just destroying them every time they were hit. The following graphics illustrate the comparison from the old model (left side) and the new model (right side).

You thus have now more chances to survive a missile hit, but also bear in mind bigger missiles will yield bigger damage, and some of these SAMs are quite big, so stay sharp!

10.3.5 Various Ai enhancements

Mission timing management, through better use of push points and holdings (right picture shows AI holding) have been refined in 4.34, making the AI rarely arrive late at a steerpoint.

Previously, AI who were late were using afterburner and soon became low on fuel during a mission. Now AI are able to skip waypoints, if necessary, to try to remain on TOS.

AI pilots now flare correctly on landing and aero-brake properly after touchdown.

10.4 BMS 4.33 AI changes

10.4.1 Take-off changes

- AI will pick the runway which is long enough to take off from. This depends on the type and weight of the AC. If such a runway is not available, the flight is cancelled.

- If a flight is late at take-off it will pick the other runway to bypass the take-off queue if possible.

- There are 3 different types of take-off for heavy/large, slow/small aircraft and fighters. The differences are in initial climb and the moment it turns to STPT 2.
  Traffic congestion according to different aircraft class should now be better and faster.

- Heavies will climb out with a high pitch so that the airspeed doesn't increase and all energy is used for the climb. When reaching 1000 feet AGL the AI will pitch the nose down and start to speed up. Flaps will be retracted and if the speed is above minimum clean speed the AI will proceed to the next steerpoint.

- Slow aircraft will start to accelerate at 500 ft AGL and when all flaps are retracted and minimum clean speed is reached they will turn to the next steerpoint.

- Fighters will keep their nose low and immediately start to speed up. When reaching the minimum speed and 500 ft AGL AI fighters will turn to the next steerpoint. This also means that fighter aircraft will be ready to fight as soon as they get airborne.

10.4.2 Departure changes

- During climb the AI will now keep a set speed +/- margin for timing. At higher levels this will be a Mach number. Besides being realistic this ensures the AI can actually climb to cruise level.

- AI leads will climb with 98% power to ensure their wingmen can rejoin and keep up. If the lead is slowing down below minimum speed it will use afterburner to make sure it does not fly at the backside of the power curve and fall to the ground.

10.4.3 Approach changes

- How the AI flies the approach concerning speed and gear/speed brake selection has been updated.
  AI flies a lot smoother (you can stay in formation now) and slowly reduces speed on final. This means there is no longer a huge speed change at 500 ft AGL.

- The go-around has been changed/fixed. AI used to fly extremely low or even crash when going around. Now the AI climbs straight out until 1500' AGL then turns downwind for another approach.
  AI will go around if there are humans in the take-off/landing queue, unless they are under 50 feet on final approach. At that point they are committed to landing and have priority.

10.4.4 Landing changes:

- Before 4.33 all AI were touching down on the runway numbers; this was not correct. The PAPI and ILS touchdown points have been adjusted for all airbases. As a consequence the AI will now touchdown at different locations according to their aircraft class and weather conditions.

- Heavies will follow the 3° glide slope from the PAPI or the ILS and touch down on the 2 larger touchdown markers 1000 feet after runway threshold. Doing so they will not fly through the runway lights as before.

- In good weather fighters will aim to touch down just behind the threshold. This value is set between -600' and -400' which lets the AI fighter touch down just on the runway numbers (the offset is done in the FMs as aiLandingOffset). It is therefore correct for them to have a LOW indication on the PAPI just prior to touchdown.

- The use of this aimpoint is also dependant on the weather. With bad weather even the fighters will fly the ILS approach and will therefore aim for the touchdown markers 1000 feet from the threshold.

- Fighters will fly a visual approach and touch down on the runway numbers in sunny and fair weather and will fly an ILS approach and land on the touchdown markers in poor and inclement weather.

  Note: these changes are very important for theatre makers as they will need to adapt their data accordingly. Failure to do so will increase the chance of AI landing short and crashing into the approach lights.

- After landing the AI will not perform hard braking and roll slowly to the end of the runway. To expedite landing procedures they will only use wheelbrakes at the end of the runway if needed.

- AI will deploy full speedbrakes on the landing roll (if not already fully open), unless their speed is slower than the minAirbrakeSpeed. The tornado will use this for example, if reversers are used the speedbrakes should remain closed or else they get blown off.

- AI will deploy drag chutes depending on aircraft type and runway length and speed. For AC which have a drag chute a runway length has been set. If the runway length is shorter than this value the chute will be deployed after a short time delay. As with the speed brake and reverser, the chute also has a speed at which it will be released/dropped. This does not mean that you will see a drag chute being deployed at each landing. Even if an AC does have a drag chute, it is not always needed or used.

- AI will deploy thrust reversers if included in the model. Reversers will open up after touchdown and will close again at a set speed. Humans can also use the thrust reverser with the new callback if the aircraft they are flying feature thrust reversers.

10.4.5 AI BINGO adjustments

When reaching Bingo fuel the AI is now able to take proper action and not crash as was the case in 4.32.

- If the leader is human the AI will wait for lead's command before doing anything regarding BINGO, except tell you about their low fuel state.

- If the leader is another AI, the AI wingmen will try to find a tanker to refuel. It may form back up with its lead after refuelling if the range between the aircraft is less than 40 Nm. If he can't rejoin his flight the AI will RTB and land safely.

- If no tanker is available the AI will RTB but will remain able to defend itself until it starts its landing procedures. Before, the AI after switching to RTB mode was unable to defend itself on the way home as it was already in landing mode.

- When the AI reach a fuel state considered as running on fumes it will jettison all stores and land at the closest airfield.

- Unlike 4.32 the AI should now be able to bring back its aircraft, even with a fuel emergency.

10.5 BMS 4.32 AI changes

10.5.1 AI Refueller

This chapter is not new and was introduced with 4.32

All AI aircraft loitering were capped to altitudes between 5k and 20k MSL. Since tankers normally hover above the top of this cap range if they got into a loiter mode they would often appear to dive sharply. The loiter altitude range top cap is now 26,000 feet MSL, which should remove this issue.

Default tanker altitude was set pretty low... absent any other orders they sought to fly around at 10k MSL. This too could apparently make the tanker suddenly drop like a rock. Default altitude is now 22k MSL but other changes make it a lot less likely that this default will ever be needed (in theory).

Tankers are ONLY open for business when they are shuttling between their two target waypoints. If you call one for fuel before he reaches his first target waypoint or after he departs his track station for the flight to his home base you will hear the 'unable' response. If you are doing TE design or ATO adjustment, make sure that you set tanker Time-on-Target at the first target waypoint anchor and his station time so that your tactical flights get what they need when they need it.

Tankers de-aggregated in the 3D world will now fly a two minute holding pattern, anchored on their first target waypoint when there are no receivers in their refuel queue. At typical speed/altitude for tanker flight plans this is probably a 15-18nm oval from apex to apex. As a result the tanker should be closer (most of the time) to that first target waypoint where he will anchor in the holding pattern until receivers come along; at which point he will fly the full track pattern.

A significant change from older Falcon versions is that the tanker target waypoints define the complete extent of the refuel track that they will fly. In other words, the first target point is where he anchors for holding while waiting for receivers and the second target waypoint is the exact location that he will turn inbound to the first target point again when he's flying the full track length.

Tankers in 2D world do NOT fly anchor holding patterns; they simply go from target waypoint to target waypoint back and forth. This is required presently to make 2D refuelling work it seems.

Since the aggregated tanker flies the full track length all the time in the 2D world, it is possible that when he de-aggregates for your flight that he is not in the holding pattern. If he has no receivers in tow he will try to enter the hold if you do not get there and ask for fuel before he reaches the anchor turn point. This may be useful to you, depending on the geometry: it may be more efficient to fly an intercept on the tanker's anchor point and only call him for fuel once he enters the hold. Certainly if you join and call for fuel as he turns outbound from the anchor point you will have the longest straight and level segment of his track to try and grab fuel before he turns again.

Note: don't place tanker target waypoints closer than the length of the typical two minute holding oval (no less than 25nm separation of target waypoints is recommended for safety). If you do put the target waypoints close together, the tanker will likely get confused.

The default flight plan for tankers has been changed. Previously the flight plan would use LoiterTurnDistance (seems to be '25' for default Korea) from the falcon.aii file. The units for this are grid, which in Falcon4 world means roughly a half mile per unit. Thus target point to target point ended up around 13nm; from the above

implications you will note that this is a Bad Thing™, so the code was changed to consult a new falcon.aii file variable called TankerTrackLength. This var has a default of 100 grids for a net track length of just over 50nm.

> *Note: this default is in the code, if you want to override it then add that var to the data file for your theatre. 50 Nm was suggested as a decent default tanker track length by active duty USAF personnel. Both the campaign ATO generator and the TE editor use this default for planning tanker flights.*

The altitude that the tanker flies at is determined by two factors:

1. When there are no receivers in the queue, the altitude set as part of the tanker flight plan is used (the only exception to this would be for loitering, in which case the flight plan altitude is used unless it is greater than 26k MSL, in which case 26k MSL is used, or less than 5k MSL, in which case 5k MSL is used).

2. When receivers are in the queue, the altitude used is the one supplied by the flight plan, or the one specified by the setting in the aircraft .dat file; whichever of those two values is lower is the one selected. This allows for lower working altitudes for aircraft like A-10's that are loaded for bear and have a hard time making refuel altitudes and speeds normally used by F-16's.

One special note about track length: it is sometimes useful to assign tankers to ferry missions where you want them to fly a long path with receivers in tow, able to take fuel at any and all times along the way. If you set the tanker target waypoint separation to 100nm or longer the tanker will skip holding at his anchor point and assume this is a ferry mission, so he flies the entire track length for as long as station time remains. In this case, I recommend you set appropriate station time to cover just the duration of the flight between the two target waypoints. While not strictly necessary to make it exact, by making the duration at least the time it takes to transit and setting the tanker's enroute speed to the same speed as receivers take fuel you can ensure that he flies the full route intended.
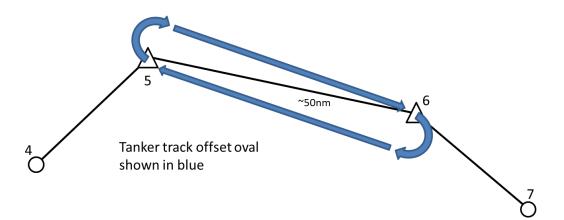
One quick point about station time: as the end of station time approaches, the tanker is not required to reach the second target waypoint before departing for the next higher numbered waypoint in his flight plan. That is, if he's halfway between target waypoint 3 and target waypoint 4, heading for either one and his station time expires, he will turn immediately for waypoint 5 and be closed for business at that time. This isn't a bug, it is deliberate, but you should be able to accommodate that with proper flight planning (read: worst case is he turns to 5 direct from #3... if that path overflies a SAM ring it's the TE designer's fault when the tanker is lost!)

There are a few points of additional advice for TE mission designers that may help get the most out of adding a tanker to the plan.

Set the two target waypoints to the same altitude value. While you can set them high and have the tanker conserve fuel for its own station time, usable fuel load isn't typically a problem for the KC-10 or the KC-135. Thus I'd recommend 22k MSL for the altitude; this is the typical refuel altitude for F-16's.

As for speed setting at target waypoints, the ATP-56B NATO AAR operations document seems to indicate that 275 KCAS is a fairly typical speed. Again, you will want to set this same speed for both target waypoints for best effect.

The actual over the ground track for the tanker as it flies between the target waypoints is sort of oval shaped.

Tanker track offset oval
shown in blue

~50nm

What happens is that the steerpoints are used as the aimpoint for the long straight and level portions of the track. When the tanker reaches one of these, he initiates the turn. This turn is approximately 180 degrees and ends up with the tanker aimed at the reciprocal target waypoint. If you think about it, what this means is that as the tanker completes the 180, he aims at the next waypoint, but not from the waypoint he just reached, he's offset by one turn diameter to the side.

This means that his over the ground track to the waypoint is to one side of the ground track that joins the two target waypoints directly one to the other. Furthermore, it means that as he reaches the next steerpoint he does so with the previous steerpoint just a little to one side of his own nose-to-tail axis line.

Now, the AI being pretty simple always turns the shortest way to the next waypoint. If you draw this out on paper you will see that it means that the tanker always ends up turning the same way at each target waypoint. Furthermore, the direction of that turn, left or right is directly influenced by the direction that he reaches the first target waypoint when he is inbound from the preceding waypoint.

Hopefully as a result of knowing this, TE designers can more effectively place target waypoints for tankers to get the effect they want and receivers can predict ahead of time which way tankers will turn as they perform both holding patterns and full track length traversals.

10.5.2 Tanker Radio Calls

There are relatively few radio calls that you will hear from the tanker. This section presents a list of those and the meanings for them.

1. **Unable**: this means that the tanker is not yet on station or has left his station (RTB). In the case that the tanker is not yet on station, if you call again later he may reply one of the things below if he is reached his station. In the case that he is already RTB, all you will ever hear from him is "unable". Your flight is NOT queued when you hear "unable" and will not be unless you hear something other than "unable".

2. **Vector to tanker**: this means the tanker is on station but you are not close enough. Get your flight within 10nm of the tanker and call again. I recommend that all jets you want to refuel in your flight be within 10nm of the tanker when you call again to ensure they all get queued properly.

3. Thirsty-11 **cleared to pre-contact**: this means you as Thirsty-11 and the flight you are in are queued and the tanker expects you to join and take fuel. There is no need to call again or for any other players in your flight to call for fuel again at this point... the whole flight is queued and you should all just follow quick-flow formation procedures.

4. **Cleared to contact position**: this happens in two possible situations:

   I.   When you have already heard cleared to pre-contact and have successfully closed to that position and stabilised there (i.e. you are at the pre-contact position more or less stationary relative to the tanker; the boomer wants to see that you are stable and in control and not likely to ram him).

   II. When there is a jet ahead of you on the boom, he tops off and clears and you are presently at the on-deck position and stable.

5. **Roger**: this means you are queued. This can happen if you call and there is at least one jet from another flight ahead of you, or if you are already in the queue. I do not recommend hitting y-1 a lot once you hear #3 above for your flight, but should you happen to do that, the roger confirms that you are in line.

10.5.3 AI Behaviour around the Tanker

This chapter is not new and was introduced with 4.32

Before 4.32 the AI would get within *g_fAIRefuelRange* nautical miles (default 10nm) of the waypoint that has the refuel action and then immediately call for fuel. Most of the time this worked because the default tanker track length was 13nm and most TE designers would put the receiver refuel waypoint on or between the tankers' station waypoints. However, basic math tells you that this won't work if the tanker is now flying with receivers in tow and is at the far end of the default racetrack pattern that is 50nm long (tanker had better be deagged when sim vehicles call for fuel or Bad Stuff™ happens).

4.32 behaviour: at *g_fAIRefuelRange* nm from the refuel action waypoint, the AI will start looking for the tanker assigned for the flight. Two possible results can happen at this point: the tanker is in range and the AI calls for fuel or, the tanker is "far" and the AI will close.

The range for the AI to call for fuel is now set to one third of *g_fAIRefuelRange*. By default this means the tanker must be deagged and within ~3.5nm away before the AI will do the equivalent of y-1 "request fuel" call.

In almost all cases the AI will not be within 3.5nm of the tanker when it starts looking 10nm short of its refuel waypoint (again assuming default for *g_fAIRefuelRange* value, the code just divides that cfg value by 3 for this one). As a result, most of the time what the AI does is figure out where the tanker is and it flies a baseline intercept on the tanker to close to one third of the *g_fAIRefuelRange*; then it calls for fuel.

When receivers call for fuel they must now be within *g_fAIRefuelRange* to successfully make it onto the queue for fuel. Yes, the AI waits until one third of that range but I figure players are not going to be as precise so you have a (default) 10nm radius to call instead.

If you call and the tanker is not on station (meaning specifically that it has not started to shuttle between the two "target" waypoints assigned to its flight plan which is also to say it has passed the first of those at least one time), then you will hear "unable" as the response.

If you call for fuel outside a 10nm (default) radius of the tanker, then he will ignore you completely. However, if there is an AWACS in the TE/Campaign it will take pity on you and reply for the tanker with a vector to tanker call. So please don't be surprised: if you call y-1 for "Request fuel" and hear "Vector to tanker camel 1-1 bearing 030 15 miles tacan channel 29Y" this is not a bug – you are simply calling from too far out, use the vector to help you get closer and call again when you are in range.

Finally, when the AI flight completes the refuel evolution it will slide out and down towards a position 1nm abreast of and 1000' down from the tanker's position. As it approaches this point, the lead AI will change waypoint to the next point after the one designated for the refuel action. This is a change because previously there was some significant chance that they would fly back to the refuel waypoint instead before moving on. You may not see the impact for this but in terms of timing for TE mission planners at least you know what to expect now.

In case you are wondering, players must clear the tanker to at least one half nautical mile range after refuelling before you can call for fuel and rejoin the queue. Especially around a busy tanker the exit corridor that the AI uses (right and down from post fuel observation) is recommended.

One other comment about TE planning and tanker flight plans in particular. The AI will perform a pretty reasonable looking intercept. However, if you have heavily laden receiver jets (set for ground attack or what-have-you) then you will need to consider their reasonable top speed at MIL throttle settings for the assigned refuel altitude. Put another way, don't have tankers flying their transit to station (for receivers timed to arrive as the tanker arrives on station) or anchor orbits at break neck speed; doing that will simply make the receivers work harder and be less time efficient about tanker rendezvous. Something in the 250-280kt range for transit or station loiter ought to give receivers an opportunity to generate reasonable overtake.

11.   Bibliography

- BMS 4.32, 4.33, 4.34 & 4.35 Manuals

- BMS 2.0 Manual & Technical Manual

- Realism Patch 5 Manual

- Original Falcon 4.0 Manual

- Falcon 4.0 Strategy guide

- BMS Dev articles, forum

12.   Acknowledgements

As always, such a venture cannot be possible with the work of a single person. This manual is the result of a team effort provided by many actively involved with BMS; they know who they are. I'd like to thank them all for making this ungrateful task possible.

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