



"POWDERKEG" BALKAN THEATRE 1.0

USER'S MANUAL

rev. 10c



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INTRODUCTION

In late 1999, Hasbro Interactive made the fateful decision to end development on the flight simulation Falcon 4.0. The decision, one year after the product was released, and following a series of five patches for the product, was they would no longer continue development. The plans for a new flyable aircraft (rumored to have been the F-15E) set in a new campaign theater (rumored to have been the Balkans) were scrapped and the development team employed in Alameda, CA was dismissed.

The Falcon 4 community was left with a product that had clear potential for future development but, although better than the original release, contained a myriad of troubling bugs and inaccuracies in realism.

During this time a spirited group of people on the www.delphi.com/falcon4 forum started to use hacking and hex editing to provide 3rd party improvements and bug fixes. It rapidly became apparent that a significant percentage of the program's core data could be modified to provide a more realistic environment and fix many of the bugs that had eluded the original development team. Early on the modular nature of the original program and its database style structure indicated an unfulfilled expansion potential. Inroads have been made into adding some of the promised expansion items, such as new theaters, cockpits, other flyable aircraft, and new 3D objects. The new Falcon 4 'electronic battlefield' has the potential to allow us to fly, drive, or sail any vehicles within it. Given enough time, someone will develop the know-how to do so.

As the expansion potential dawned upon the community, patches and enhancements started to be released by the pioneers in the hex editing and hacking community. After a time, and upon realization that to provide some of the more ambitious modifications, teamwork would be needed, the hex editors and hackers began forming into groups. There are now a number of groups working on various aspects of the simulation. **iBeta** initially sponsored a group that included a diverse cross section of people primarily focused on "Realism" fixes. Their charter was to 'fix the data' in Falcon 4. Many of the core members of this original group are now working together as the "**Realism Patch Group**". They continue to focus on bringing the maximum realism to this simulation. Another group, headed by eRAZOR, stated to work on enhancing and fixing the executable core of Falcon 4 in order to bring it up to date with modern PC technology, including a total rewrite of Falcon's graphics engine. The **F4Alliance** are primarily involved with aircraft package development for all the flyable aircraft and are releasing complete aircraft packages that rival the F-16 aircraft in the original release. Their packages include 2D and 3D cockpits, new sounds and video, and patches. The **F4Terrain** group is focused on theater development. The Balkan Theater is their first release and acts as a test bed for development of theater software tool development.



No review of Falcon's history would be complete without mentioning two names, Julian "Codec" Onions and Sylvain Gagnon. Julian has provided most of the essential tools and services to all the groups currently working to improve and develop Falcon 4. Without his help many of the improvements made to date would not have been possible. He has been instrumental in converting the initial hex editing discoveries into useful graphical tools to enable changes to be made by almost anyone. Some of his tools include F4Browse, TACedit, Terrainview, and recently Tlkviewer. I can't stress how important he has been or thank Julian enough for the work he has done. Sylvain, father of the bubble, grandmaster of the patch, is a name known and recognized by anyone that owns Falcon 4.0 and uses the Internet. He supplies expertise to all Falcon development, giving freely of his time and energies.

PRODUCER'S NOTES

When I first got involved in the hex editing back in late 1999 I initially looked at all the work done and tried to find an area where I would not be duplicating efforts by others. Initially I provided some documentary detail to "Rhino" of the Deltahawks, who I believe used some of it in the early Realism patches. However, it became apparent that "Rhino" and crowd were way ahead of me and so I started looking at other areas.

I then made some inroads into the graphics, which made up the User Interface but lacked the skill/time with which to code a useful utility to enable the UI to be changed (although I could change the pilot photo's, UI map etc by hand using the AXE hex editor). One of the areas I looked at was the map display and the small campaign map with it's associated drop down theater selector and started to think about what it would take to add a new theater.

I got hold of Julian, who at this time was also looking at the same thing and together we started to crack open the files that make up the terrain. In parallel, "Tbone" had already started to amend the textures that make up the terrain and had embarked on an ambitious plan to change the entire Korean tile set into something useable in a Middle East theater. A flurry of emails went back and forth between us as we started to unravel the files that make up the terrain. I must admit, again, Julian did most of the work on how to import NASA Digital Elevation Maps (DEMs). I provided the areas I was interested in and discovered, by much manipulation of maps/atlas references (both paper and electronic), that the size of a theater was a $10^{\circ} \times 10^{\circ}$ square. I discovered (although I think some people had already noticed this) that the Falcon 4 representation of Korea was not the same as you get in an atlas, but more on this later. Once we had established the $10^{\circ} \times 10^{\circ}$ theory, I selected 5 areas and chose 2 to start with. One was the Balkans and the other was the Middle East, the latter was handed over to "Tbone" to use with his rapidly expanding desert tile set. At the same time, Julian developed TACedit, as I had envisaged initially placing objects and tiling the terrain simultaneously. Never one to be daunted by a challenge, I took the Balkan terrain and commenced tiling. This rapidly turned into a major task as to tile a completely land covered theater involves hand placing 1,048,576 tiles. Luckily (he laughs), we only had to do some 700,000 as the sea tiles could be placed automatically by a Perl script (another one of Julian's). I suggested that we get the script to place a limited tile set dependant on altitude so you would get grass in the lowlands progressing through to forest, rock



and finally snow as you go higher. I enlisted the help of my LAN Squadron and together we did the coastline with a single set of tiles (there are about six different sets to choose from) after which it became apparent that help would be required.

The F4Terrain eGroup was created and volunteers were asked to help out in tiling. Meanwhile Terrainview had matured from a program where you had to highlight a tile from a list of numbers and then change it's tile value to the one you wanted to a graphical tool where you could drag and drop tiles from a palette. I began to allocate areas to volunteers and after they had finished they would send back their assignments for inclusion into a master file. Slowly at first, areas started to look more natural and realistic. Completed areas started to appear on the allocation spreadsheet I used for this purpose (see figure above). I must mention at this stage that due to a house move I rather neglected the project but luckily Manfred "Schumi" Nelles (a respected tiler at that time) provided many suggestions on how to improve Terrainview so that areas could be tiled more efficiently. He has since become an invaluable member of the project team, dealing with many aspects of the design details. Together with Fred "Baldeagle" Balding, they have provided the packaging and collation of the last Beta and made many other contributions to the effort as a whole. This has enabled me to concentrate purely on the tiling part of the project and

allowed Julian to get involved in some of the more exciting developments we are now seeing within the Falcon 4 community.

We can leave the tiling effort at this stage and look at the placement of objects on the terrain. As stated earlier I had started to relocate the objects in the Korean map to town locations in the theater. This again was a laborious task where I had to get the coordinates for each town over a certain size and manually converting it to a location on the 1024 x 1024 grid in the theater. The objects at this point were not of the correct type. Tobias "Buster" Adam volunteered to take over this part of the project due to the sheer amount of work needed. Since then Tobi has taken on the object placement role and the number and variety of objects in the theater has progressed in leaps and bounds. Again, Manfred has provided a lot of assistance in this regard.

Since I originally produced these notes several new stars have risen on the Balkans Terrain Team forum and I should mention Jerry "Pookie" Davis. He started his Balkans career as a tiler (and very good he is at it too) but since the bulk of the tiling has now finished he has devoted many hundreds of hours to getting theatre specific units into the theatre. He has spearheaded the creation of several new ground and air defence types and since the release of LODEditor (Beta's and release) has created new aircraft, ships and buildings. I won't go into details about these new features here as some are covered in other parts of this document and others are eye candy which you will have to keep a look out for.

In addition I would mention Colin "Cooler" Morrow and Bob Crawford. Colin for his excellent work on the voices used in the game and Bob for his work in the same area and for the witty moral support he has given on the forum.

I could go on at this point like an "Oscar" acceptance speech but I don't like crying (unless I'm really drunk and depressed) so I would also like to thank everybody who has helped out on the project (myself and the team are grateful for any contribution however small) to get it where it is today and that I have enjoyed working with probably the best team of people I have ever come across.

Anyway to sum up we have been working on this project now for over a year and I dread to think of the man-hours that have been put in towards it's completion. Every member of the team involved deserves a large thank you from everyone that uses this product. My thanks are included!

I hope that you enjoy flying this Theater and take advantage of the features we will be adding in the future. Falcon 4 is the best modern combat simulator available and with the projects being developed, will remain that way for years to come.

Chris "Washout" Carter

CO: The Vulture Squadron
F4 Balkan Terrain Team



DOWNLOAD LOCATIONS

This document will form the majority of the first full release's documentation and as such may be released a couple of days prior to the actual theater. Therefore, below is a list of the popular download sites where you should be able to find this theater:

Official Download Sites

- ⤴ <http://balkans.falcon40.com> (USA)
- ⤴ <http://balkans.frugalsworld.com> (UK)

Other sites or mirrors

- ⤴ <http://www.f4freeware.net>
- ⤴ <http://www.f4community.com> (Germany)
- ⤴ <http://www.combatsim.com>
- ⤴ <http://www.dogfighter.com>
- ⤴ <http://www.frugalsworld.com>
- ⤴ <http://www.simhq.com>
- ⤴ <http://www.amvi.it>

SYSTEM REQUIREMENTS

Generally the system requirements for the Balkan Theater are no greater than that used for the Korean Theater in the original game but our **recommended specifications** are listed as follows:

- ^ Pentium III or Celeron processor running at 600mHz or higher
- ^ System bus at 100mHz or higher
- ^ 128 MB minimum of system RAM
- ^ 3D graphics card with 32mb video RAM
- ^ Hard drive with 250 MB free (minimum required for installation and minimum virtual memory, full install for theater to both 108i2 and eFalcon is 500MB!)
- ^ Sound card

The specification is the same as quoted by the Realism Patch Group with additional disk space required for the theater installation. A machine with these specifications or higher will enable you to play the theater adequately with RP5 installed.

Additional memory or faster processors will result in better performance and smoother graphics for your flying experience but the often-debated FPS issues on the forums boil down to this:

Falcon 4's campaign and graphics engine is massively scalable to such an extent that even a 2Ghz processor with the fastest graphics cards available could still choke by turning the graphics details to their highest and the player bubble higher than 3.

This doesn't mean that the engine is flawed in any way. It simply means that the simulation is designed for the future. To run the simulation on less powerful machines you must turn down the graphics detail (Terrain Detail and Density, Object Detail) in Falcon 4. Turning down Object Density or the Player Bubble reduces realism and may have unexpected results.



INSTALLATION INSTRUCTIONS

Warning: This software is provided free of charge and the F4Terrain Balkan Team accepts no responsibility for any damage to hardware or software that may result from its installation or execution. You install this software at your own risk.

This theater is shipped as a single self-installing executable file and should run completely independent of any other modifications you have installed. Other Falcon 4 modifications may (and likely WILL) have an effect on the way the Balkan Theater operates. This theater utilizes vehicles and other entities altered by application of the Realism Patches, for example. If you intend to install the Balkan Theater over a heavily customized Falcon 4 installation you should backup your entire Microprose\Falcon4 directory and it's contents to provide a fallback position in the event of problems. The 'apply' and 'remove' operations of the Balkan Theater patches may produce unexpected results (please use the Fault Reporting Form to help us resolve problems).

The initial installation program remains unchanged. To switch theaters Joel Bierling's brilliant F4Patch program will be used.

VERY IMPORTANT: Make sure you have at least 250Mb free disk space before beginning the installation steps below.

PREPARING FOR INSTALLATION

1. Make a copy of your Microprose\Falcon4\Campaign\Save directory (you may not need to but its good practice just in case).
2. If you have not installed any previous versions of the Balkan Theater then skip straight to the Installation section below.
3. Uninstall the previous version using the "Uninstall Falcon 4 Balkan Theater" shortcut found on the Start Menu.
4. After running the 'Uninstall' check that you do not have a Microprose\Falcon4\terrdata\Balkans directory. If this directory remains delete it.
5. If you have run the 'Uninstall' in Step 3 please check that you do not have any files named "balkans" in the \Microprose\Falcon4\campaign\save directory. If any exist delete them.
6. Make sure that F4Patch version V4.1 is installed and the files expanded during installation. Please consult the installation instructions for F4Patch for information on the expanded installation method.

INSTALLING THE THEATER FILES

1. Run the "Falcon4BalkansTheaterv1.0.exe" from your hard drive.
2. Follow the on-screen instructions provided by the installation wizard.

- The installation wizard includes three installation modes. The selection is made at the start of the installation process. The theater may be installed for 108i2 only, eFalcon V1.10 only, or a dual installation. This allows easy switching of theaters with the executable.

Important: The installation can take 15 minutes or longer (dependant on the speed of your machine) as the terrain is expanded from a single 15Mb file to the 150 – 250Mb required for a full theater. Please allow time for this to happen (a cup of coffee and a stroll around your house is a good thing to do if only to remind yourself that there is a world outside Falcon 4 ☺). Do not under any circumstance shutdown or reboot your computer during the installation process. If you believe the installation has failed or your computer has locked up please do not reboot until your hard drive has not shown any activity for a minimum of ten minutes. A reminder, again, that this is free software that you use at your own risk.

If the theater installation becomes corrupted try the Start menu shortcuts 'Rebuild Balkan Theater – eFalcon' or 'Rebuild Balkan Theater – 108i2', if the terrain files give error messages or corrupt graphics after installation.

THEATER ACTIVATION

After a successful installation, depending on your installation choice, there will be one or two new patches in the "Terrain\Balkan Theater" folder of F4Patch:

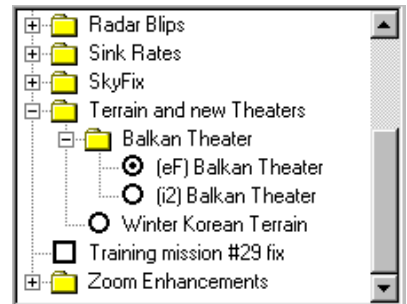
If you have installed the theater only for one executable version, only the appropriate Theater patch will appear. The Balkan Theater patches are compatible with the F4Patch 'Welcome' filters that restrict viewable patches to the selected executable.

With this version of the Balkan Theater we introduce 'one click-theater change'. All required patches are automatically applied with a single click on the Theater patch. This includes the current Realism Patch version, which is required for the Balkan Theater. Note that patches that conflict with the Theater will be automatically removed.

Press the 'Apply Changes' button to activate the new Theater. When applying the theater the first time, F4Patch installs new voices for ATC and additional TACAN channels which takes a few seconds.

For deactivation of the theater just uncheck the main Balkan Theater patch and you have Korea back (if you still want it ☺).

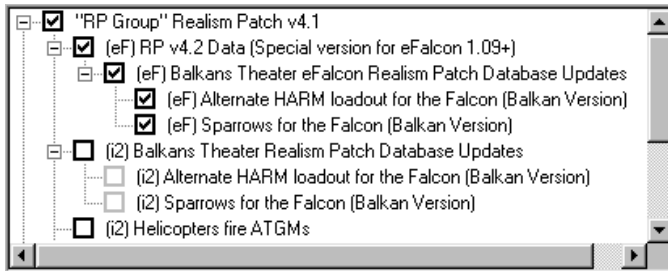
If you want to switch from eFalcon to 108i2 theater version, first unapply the eFalcon version, press "Apply Changes", then apply the i2 version and press "Apply Changes" again.





ADDITIONAL PATCHES

If you want to use the loadout patches (“alternate Harm loadout” and “Sparrows for the Falcon”) with the Balkan Theater, you find them to be applied in the Realism Patch thread as shown in the following picture, again two versions for eFalcon and 108i2:



Please note that the “Balkan Theater Realism Patch Database Updates” patches are applied and unapplied by the main theater patches (eFalcon and 108i2 version, respectively). **Do not** unapply these Database patches, only use the main theater patch, which will unapply all Balkan Theater patches.

KNOWN ISSUES AND COMMON PROBLEMS

Below is a list of known issues we are trying to resolve or common problems. We have workarounds for some of the problems that have occurred with previous Beta releases. If you encounter problems not listed or have other feedback please post it on the Falcon 4 forums at www.frugalsworld.com or www.delphi.com/falcon4/. We will try to help (be patient as we are all volunteers with real life jobs to pay for our Falcon 4 addiction).

- ⤴ Distant Textures Change – Previous versions of the theater had a problem with textures popping into existence as you fly toward them. Fred and Manfred have developed a workaround by reducing the detail used to create the distant textures. Textures will no longer change with changes in distance (like coastal tiles changing into mountains as occurred in previous releases).
Note: This issue is resolved in eFalcon 1.10, so you will get the fully detailed terrain when using that version, 108i2 remains the same. During installation you will now be asked which executable version you are running.
Still possible is that the terrain may undergo radical elevation changes as distance to your aircraft changes. This is a limitation in the way Falcon 4.0 calculates local elevations.
- ⤴ Rivers Run Uphill – This is a fault of the initial tiling run where rivers are only displayed in the middle of textures. If a valley bottom is located at the joint between textures then we have had to place the river on one side of it or the other. Nearly all of these have now been fixed but if you spot any please use the Fault Reporting Form to notify us so that we can fix the river for any future updates. Press CTRL+Z + L and note the X and Y coordinates that you find in the top right screen corner to report the exact location of the terrain anomaly.
- ⤴ TSwitch missing – TSwitch is no longer included. We are now using Joel Bierling's F4Patch program to switch theaters. This is explained in the "Installation Instructions" section of this document.
- ⤴ Distorted Theater Map - looks stretched or distorted – see "Projections / Navigation Inaccuracies" later in this document.



BALKAN THEATER FEATURES

Below is a list of features that are currently included with this version of the theater and below that is a list of features we will be adding dependant on time, will power, and discoveries made by ourselves or other development teams.

VERSION 1.0 FEATURES

- ▲ An accurate Digital Elevation Map (DEM) of the region to a resolution of 1 km (see "Projections / Navigation Inaccuracies")
- ▲ A completely tiled terrain with a landscape that is better than the original Korean theater and much improved from the Beta versions following a lengthy QA procedure
- ▲ New textures and edited originals to provide a more accurate representation of the region
- ▲ Static objects, such as towns, accurately placed according to data available
- ▲ Bridges in their correct places (there are many of these as the surface transport network in the region is denser than Korea)
- ▲ Accurate Military Objects (we have striven to be as accurate as we can but it must be acknowledged that the warring parties aren't that keen on deployment details being known and misinformation will result in placements of objects where they really are not)
- ▲ New weapon systems (see "New Threats and Tactics" for more details)
- ▲ New aircraft (see "New Threats and Tactics" for more details)
- ▲ New Carrier type (see "New Threats and Tactics" for more details)
- ▲ New skins for the aircraft deployed in the region
- ▲ New skins for ground and naval units
- ▲ New TE missions and mini-campaigns
- ▲ Two beta versions of dynamic campaigns
- ▲ Switching of the Campaign\Save directory so that only Balkan missions and campaigns are accessible when the theater is selected
- ▲ New kneemap and mission planning map
- ▲ Dynamic bullseye position, which will change every 24hours under eFalcon's v1.10 to follow the FLOT plus a new bullseye location with 108i2.
- ▲ Balkan PAK map (without black outlines at this stage)
- ▲ Fixed the night lighting on new textures
- ▲ TACAN channels for all airbases present in the region

- ^ Airbases with flat runways so that AI flights can land properly
- ^ New ATC voices in keeping with the theatre
- ^ New voices added for the new aircraft in the theatre
- ^ Some electrical pylons placed in high populated areas
- ^ Some surprise features (look out the window and you may notice them☺)

Note: The new weapon systems and vehicles are not yet RPG tested and approved.

FUTURE FEATURES

- ^ Three fully dynamic campaigns with ongoing ground and air wars set in 1995/1996
- ^ Further fully dynamic future campaigns with new upcoming aircraft like the Eurofighter or Su-37
- ^ New music
- ^ New intro videos for the campaign
- ^ More 3D static object models for local landmarks
- ^ Trees
- ^ New aircraft for NATO countries other than the US
- ^ Naval operations with a Carrier group(s) appropriate to the region
- ^ Carrier operations if they become available (the carriers are already implemented but will remain static as in Korea if you are running 108i2)
- ^ Other features that other third party groups create that are relevant to the Balkans.



NEW THREATS AND TACTICS

To more accurately represent the forces in the region, we have included some new Ground, Air and Naval units (some descriptions have been added whilst the additional objects were still in development so you may not find them in v1.0 dependant on the time we have available).

The following sections deals with those new vehicles and describes their capabilities together with information on how to deal with an encounter and plan your missions accordingly.

The descriptions here are mostly lifted from www.fas.org an excellent site for information on all things military.

AIR DEFENSE

ASPIDE/SKYGUARD AIR DEFENSE SYSTEM

The Italian Aspide, basically a licensed version of the American Sparrow, is similarly employed as both an air-to-air and surface-to-air missile, and in the later role it is launched from both ships and ground platforms. The AIM-7E Sparrow entered service in 1962 and was widely used as a standard for other variants such as the Sky Flash (UK) and Aspide (Italy). Alenia Difesa offers a complete range of systems, including the air to air and surface to air systems based on Aspide missile (Spada, Skyguard, Albatros, and ARAMIS).

The specifications for the missile itself are as follows:

Manufacturer:	Selenia
Date Deployed:	1987
Range:	75 km
Ceiling:	8000 m above the launch point
Speed:	Mach 4 / 4680 km/h
Propulsion:	One SNIA-Viscosa solid-propellant rocket motor
Guidance:	Selenia monopulse semi-active radar homing
Warhead:	72.75 lb. (33 kg) SNIA Difesa e Spazio
Blast/fragmentation:	Doppler proximity- and direct action-fused
Launch Weight:	485 lb. (220 kg) 230 kg
Length:	12 ft, 1.67 in (3.70 m) 3.65 m
Diameter:	8 in (203 mm) 210 mm
Fin Span:	3 ft, 3.4 in (1.00 m) same



For the purpose of the Balkans we have implemented the Skyguard SAM system, which has the following specifications in addition to the missile above:

Capacity discovery radar:	20 km
Number of fire channels:	2
# of ready missiles to the launch:	12
Time reaction arranges:	11 sec
The maximum capacity:	10 km
Minimal capacity:	750 m
The maximum quota:	3.5 km approximately
Guidance system:	homing semi-active
Weight of the missile:	220 kg approximately
Maximum speed of the missile:	650 m/sec
Single-shot hit probability (SSKP):	80%



PRACKA SAM SYSTEM

The Pracka SAM system is effectively a modified BRDM with the launch rails from a MiG21. On these launch rails can be mounted two different missile systems. One is the rather poor performing AA-8 IR Air to Air missile and the other is the very effective AA-11 Archer. Mounting an Air-to-Air missile on a SAM launcher means you had best have knowledge of those two missile systems. The following are descriptions from information provided by the Realism Patch Group with added comments relevant to the missile's new role.



AA-8 Aphid

This missile is very limited in its effectiveness as an air to air weapon. It is a rear aspect Infrared type, so the launcher must fire as you egress its location in order to achieve a good lock. The missile has a range limited to about 1.5 – 2 miles. Its small motor burns rapidly and you can easily out pace or out turn it if engages you from greater distances. The missile is somewhat susceptible to countermeasures so rapid flare deployment and a hard turn into the missile will often defeat it.

AA-11 Archer

This missile, as any Falcon 4 Viper pilot will tell you, is a much more deadly beast. It combines a tremendous acceleration with unparalleled turning performance. This is attained by the use of a 3D thrust-vectoring nozzle and very effective control surfaces. Combined with its large rocket motor, it is able to achieve 50g turns, although sustaining this will reduce its range considerably.

The missile's Infrared seeker has a large gimbal range of 67° and a tracking rate vastly in excess of the Sidewinder. It can be launched from the Pracka at virtually any angle and at short notice giving the SAM operator an almost snapshot ability. A shot can be taken against a departing target to a range of about 2 miles, or more dependant on the speed of the aircraft.

Spoofing with flares, although not impossible, is extremely difficult due to the missile's ability to disregard countermeasures. The missile's Achilles heel, if it has one, is that it is not especially good with ground clutter.

Both missile systems have a rough maximum engagement altitude of 15,000 feet. They become really effective below 5,000 feet. Between these altitudes the AA-11 is the greatest threat while the AA-8 is still fairly easy to avoid. The greatest threat from this system is the total lack of any track or lock warning. Below 5000' feet the AA-11 variant is deadly unless you can defeat it with a combination of flares, reducing your engine temperature and diving to lose yourself amongst the ground clutter.

The forces employing the Pracka will usually locate it near airfields. Although, as NATO found during the Yugoslavian conflicts, these forces like to keep their SAM defenses highly mobile to prevent coordinated SEAD action being taken against them.

When you are engaged by this system it is always best to assume you have been fired upon by the AA-11 variety. You should therefore respond by throttling back, deploying flares and turning into the missile while trying to get below it.

Further information can be obtained by using the Tactical Reference database in Falcon 4.0, section Vehicles – Air Defense.

OPTICALLY TRACKING SA-2/3/6'S

During the Gulf War and subsequently in the Balkans conflict reports and intelligence have uncovered a variant of the SA-2 that uses optical tracking to acquire its target.

The missile itself is exactly the same as the radar tracking variants described in the Realism Patch Manual but now includes optical tracking so that the operators will not trigger your RWR until just before launch when the optical lock is transferred to the SAM's radar system.

After launch the missile operates as normal and to defeat them you will need to employ the same tactics described in the Realism Patch Manual.

Some reports credit an optically tracking SA-6 with the downing of an F-117 during Operation Allied Force.

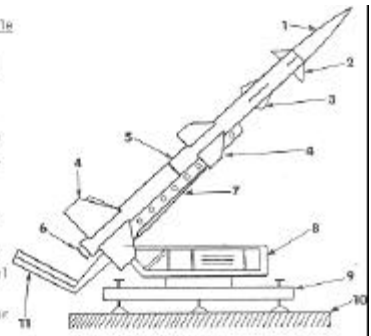
Surface-to-Air-Missile

Parts of a missile:

- 1) Nose cone
- 2) Steering fin
- 3) Antenna
- 4) Stabilizer Pte
- 5) Booster
- 6) Thrust chamber

Parts of a launcher:

- 7) Launcher ramp
- 8) Launcher control panel
- 9) Launcher base
- 10) Launcher pad
- 11) Flare deflector



SIDAM

This is a quad barreled Anti Aircraft Artillery piece with a range of about 2.5 km, although this is only effective under 2 km. Each gun fires 25mm rounds. Very little information is available on this weapon's tracking systems although radar and optical variants have been reported. The platform is expected to operate in a similar manner to the ZSU-23.





AIRCRAFT

MIG-29G (GERMAN VARIANT)

Following the merger of the two German states after the collapse of the Communist block in the early 1990's the United Germany found itself with a number of the former East German MiG29 aircraft.

The aircraft can be deemed as the same for Falcon4 purposes as the MiG-29C variant although it is rumored that the laser rangefinder for the guns has been switched off following safety concerns.

The cockpit has also been modified and will continue to be in order to bring the avionics suite up to Western standards.



SU-33

This naval version of the SU-27 was developed primarily for deployment in the 1990's on the soviet Kuznetsov aircraft carrier. It is also sometimes known as the SU-27K (there was a lot of confusion over SU-27 variant designations as new types were displayed at airshows etc).

The aircraft has the same basic features found in the SU-27 with the same avionics and radar but has tougher under carriage and a slightly lower weapon load to facilitate carrier MTOW requirements. As with most naval aircraft the SU33 has folding wings. The main difference however is the inclusion of horizontal canards mounted on the leading root extensions. This makes the aircraft more maneuverable than it's older counterpart. They also provide extra lift during carrier take-off and landings.



Current estimates indicate that there is only one operational squadron of 20 aircraft but as with all estimates things can change, especially in times of war. Needless to say lookout for this aircraft, especially if an unidentified aircraft carrier makes an appearance.

Please note that the following airplanes aren't yet perfectly implemented. They are based on optimized 3D models and some improved flight models. Future releases will bring further improvements to these aircrafts.

BAE/MCDONNELL DOUGLAS AV8B/GR7 HARRIER

This aircraft, already partially implemented in the Falcon 4 environment, has been updated to include a more detailed 3D and flight model.

Primary function: Attack and destroy surface targets under day and night visual conditions.

Manufacturer: McDonnell Douglas

Propulsion: One Rolls Royce F402-RR-406 or F402-RR-408 turbofan engine

Thrust: F402-RR-406: 21,500 pounds / F402-44-208: 23,400 pounds

Length: 46.3 feet (14.11 meters)

Wing span: 30.3 feet (9.24 meters)

Cruise speed: Subsonic to transonic

Ferry range: 2100 nautical miles (2416.64 miles)

Combat radius: *interdiction:* 454 nautical miles (522.45 miles), *close air support:* 163 nautical miles (187.45 miles) with 30 minutes time on station

Armament: Seven external store stations, comprising six wing stations for AIM-9 Sidewinder and an assortment of air-to-ground weapons, external fuel tanks and AGM-65 Maverick missiles; one centerline station for DECM pod or air-to-ground ordnance. A GAU-12 25MM six-barrel gun pod can be mounted on the centerline and has a 300 round capacity with a lead computing optical sight system (LCOSS) gunsight.

Crew: 1

Introduction date: 12 January 1985, AV-8BII(Plus) introduced in June 1993

Unit Replacement Cost: \$23,700,000



Mission: The mission of the VMA STOV L squadron is to attack and destroy surface and air targets, to escort helicopters, and to conduct other such air operations as may be directed. Specific tasks of the AV-8B HARRIER II include:

- ▲ Conduct close air support using conventional and specific weapons.
- ▲ Conduct deep air support, to include armed reconnaissance and air interdiction, using conventional and specific weapons.



- ▲ Conduct offensive and defensive anti-air warfare. This includes combat air patrol, armed escort missions, and offensive missions against enemy ground-to-air defenses, all within the capabilities of the aircraft.
- ▲ Be able to operate and deliver ordnance at night and to operate under instrument flight conditions.
- ▲ Be able to deploy for extended operations employing aerial refueling.
- ▲ Be able to deploy to and operate from carriers and other suitable seagoing platforms, advanced bases, expeditionary airfields, and remote tactical landing sites.

Features: The AV-8B V/STOL strike aircraft was designed to replace the AV-8A and the A-4M light attack aircraft. The Marine Corps requirement for a V/STOL light attack force has been well documented since the late 1950's. Combining tactical mobility, responsiveness, reduced operating cost and basing flexibility, both afloat and ashore, V/STOL aircraft are particularly well-suited to the special combat and expeditionary requirements of the Marine Corps. The AV-8BII+ features the APG-65 Radar common to the F/A-18, as well as all previous systems and features common to the AV-8BII.

For the purposes of the Balkans theatre the AV8B can be deemed identical to the RAF's GR-7 attack aircraft as both are employed in the same role.

As far as the flight model goes we have not implemented a full VTOL capability as this is actually rarely used except on landing. What we have done is tweak the model to provide a simulated STOL capability.

NORTHROP B2 "SPIRIT" STEALTH BOMBER

The B-2 Spirit is a multi-role bomber capable of delivering both conventional and nuclear munitions. Along with the B-52 and B-1B, the B-2 provides the penetrating flexibility and effectiveness inherent in manned bombers. Its low-observable, or "stealth," characteristics give it the unique ability to penetrate an enemy's most sophisticated defenses and threaten its most valued, and heavily defended, targets. Its capability to penetrate air defenses and threaten effective retaliation will provide an effective deterrent and combat force well into the 21st century.



The blending of low-observable technologies with high aerodynamic efficiency and large payload gives the B-2 important advantages over existing bombers. Its low-observability provides it greater freedom of action at high altitudes, thus increasing its range and providing a better field of view for the aircraft's sensors. Its range without refueling is approximately 6,000 nautical miles (9,600 kilometers).

The B-2's low observability is derived from a combination of reduced infrared, acoustic, electromagnetic, visual and radar signatures. These signatures make it difficult for the sophisticated defensive systems to detect, track and engage the B-2. Many aspects of the low-observability process remain classified; however, the B-2's composite materials, special coatings, and flying-wing design all contribute to its stealth profile.

The B-2 has a crew of two pilots, an aircraft commander in the left seat and mission commander in the right, compared to the B-1B's crew of four and the B-52's crew of five.

The B-2 is intended to deliver gravity nuclear and conventional weapons, including precision-guided standoff weapons. An interim, precision-guided bomb capability called Global Positioning System (GPS) Aided Targeting System/GPS Aided Munition (GATS/GAM) is being tested and evaluated. Future configurations planned for the B-2 include carrying and delivering the Joint Direct Attack Munition (JDAM) and Joint Air-to-Surface Standoff Missile.

B-2s, in a conventional role, staging from Whiteman AFB, MO; Diego Garcia; and Guam can cover the entire world with just one refueling. Six B-2s could execute an operation similar to the 1986 Libya raid but launch from the continental U.S. rather than Europe with a much smaller, more lethal, and more survivable force.

Background

The B-2 development program was initiated in 1981, and the Air Force was granted approval in 1987 to begin procurement of 132 operational B-2 aircraft, principally for strategic bombing missions. With the demise of the Soviet Union, the emphasis of B-2 development was changed to conventional operations and the number was reduced to 20 operational aircraft, plus 1 test aircraft that was not planned to be upgraded to an operational configuration. Production of these aircraft has been concurrent with development and testing.



The first B-2 was publicly displayed on Nov. 22, 1988, when it was rolled out of its hangar at Air Force Plant 42, Palmdale, Calif. Its first flight was July 17, 1989. The B-2 Combined Test Force, Air Force Flight Test Center, Edwards Air Force Base, Calif., is responsible for flight testing the engineering, manufacturing and development aircraft as they are produced. Three of the six developmental aircraft delivered at Edwards are continuing flight testing.

Whiteman AFB, Mo., is the B-2's only operational base. The first aircraft, Spirit of Missouri, was delivered Dec. 17, 1993. Depot maintenance responsibility for the B-2 is performed by Air Force contractor support and is managed at the Oklahoma City Air Logistics Center at Tinker AFB, Okla.

The prime contractor, responsible for overall system design and integration, is Northrop Grumman's Military Aircraft Systems Division. Boeing Military Airplanes Co., Hughes Radar Systems Group and General Electric Aircraft Engine Group are key members of the aircraft contractor team. Another major contractor, responsible for aircrew training devices (weapon system trainer and mission trainer) is Hughes Training Inc. (HTI) - Link Division, formerly known as C.A.E. - Link Flight Simulation Corp. Northrop Grumman and its major subcontractor HTI, are responsible for developing and integrating all aircrew and maintenance training programs.

The Air Force is accepting delivery of production B-2s in three configuration blocks--blocks 10, 20, and 30. Initial delivery will be 6 test aircraft, 10 aircraft in the block 10 configuration, 3 in the block 20 configuration, and 2 in the block 30 configuration.

Block 10 configured aircraft provide limited combat capability with no capability to launch conventional guided weapons. The Block 10 model carries only Mk-84 2,000-pound conventional bombs or gravity nuclear weapons. B-2s in this configuration are located at Whiteman Air Force Base and are used primarily for training.

Block 20 configured aircraft have an interim capability to launch nuclear and conventional munitions, including the GAM guided munition. The Block 20 has been tested with the Mk-84, 2,000-pound, general-purpose bombs and the CBU-87/B Combined Effects Munition cluster bombs (low-altitude, full-bay release).

Block 30 configured aircraft are fully capable and meet the essential employment capabilities defined by the Air Force. The first fully configured Block 30 aircraft, AV-20 Spirit of PENNSYLVANIA, was delivered to the Air Force on 07 August 1997. Compared to the Block 20, the Block 30s have almost double the radar modes along with enhanced terrain-following capability and the ability to deliver additional weapons, including the Joint Direct Attack Munition and the Joint Stand Off Weapon. Other features include incorporation of configuration changes needed to make B-2s conform to the approved radar signature; replacement of the aft decks; installation of remaining defensive avionics functions; and installation of a contrail management system.

All block 10, 20, and test aircraft are to eventually be modified to the objective block 30 configuration. This modification process began in July 1995 and was scheduled to be completed in June 2000. The B-2 fleet was to have 16 combat-coded aircraft by the second quarter of 2000.

Primary function:	Multi-role heavy bomber.
Prime Contractor:	Northrop Grumman Corp.
Contractor Team:	Boeing Military Airplanes Co., General Electric Aircraft Engine Group Hughes Training Inc., Link Division
Power Plant/Manufacturer:	Four General Electric F-118-GE-100 engines
Thrust:	17,300 pounds each engine (7,847 kilograms)
Length:	69 feet (20.9 meters)
Height:	17 feet (5.1 meters)
Wingspan:	172 feet (52.12 meters)
Speed:	High subsonic
Ceiling:	50,000 feet (15,152 meters)
Takeoff Weight (Typical):	336,500 pounds (152,635 kilograms)
Range:	Intercontinental, without fueling
Armament:	Nuclear 16 B61, 16 B83 16 AGM-129 ACM 16 AGM-131 SRAM 2 Conventional 80 MK82, 16 MK84 36 CBU87, 36 CBU89, 36 CBU97 Precision 8 GBU 27, 12 JDAM 8 AGM-154 JSOW 8 AGM-137 TSSAM
Payload:	40,000 pounds (18,000 kilograms)
Crew:	Two pilots
Unit cost:	Approximately \$2.1 billion [average]
Date Deployed:	December 1993
Inventory:	Active force: 21 (planned operational aircraft) ANG: 0; Reserve: 0



SEPECAT JAGUAR

The first prototype, Jaguar A, flew from Istres (Bouches-du-Rhône, France), on 08 September 1968. Difficulties in cooperation, due to the lack of a true main contractor, and changes in the definition delayed the Jaguar entering service until 1972. Originally a program for a trainer aircraft, it ended up as a ground attack aircraft with little in common, either in terms of size or cost, with the model initially foreseen. The French and British versions were not identical, since each country had imposed, for its own models, equipment from domestic sources. In the end, a total of 573 aircraft were ordered. France and Britain purchased 403 to which were added 54, exported to three countries (Oman, Ecuador and Nigeria), and 116 to India of which 70 were produced under license in that country.



The first RAF aircraft took to the air in October 1969, and each air force placed orders for 200 aircraft - the RAF opting for 165 single-seat and 35 two-seat aircraft. Deliveries to No 226 OCU, at Lossiemouth, began in 1973. At its peak, the Jaguar equipped 8 front-line and 1 training squadrons, the 14th, 17th, 20th, and 31st squadrons at Bruggen (strike/attack), li (AC) squadron at Laarbruch (reconnaissance), and three Coltishall based squadrons (6th, 41st, and the 54th) and the Lossiemouth based 16th (Reserve) squadron.

A variety of weapons including cluster, freefall, retard, and laser guided bombs, as well as rockets can be carried on the four wing and one fuselage stations. Two 30mm cannon are mounted internally. To mark targets for laser-guided weapons, the aircraft carries the thermal imaging and laser designation (TIALD) pod. For self-defense, overwing Sidewinder infra-red missiles are carried and the aircraft is fitted with a comprehensive suite of electronic countermeasures. Perhaps the Jaguar's most impressive feature is its navigation and attack system. With mission data fed into the computer, all the necessary information for a pinpoint attack is relayed to the head-up display. From the display, the pilot knows exactly where the target is located and precisely when to release his weapons for maximum effect.

The fleet is currently undergoing an upgrade program, and this will see aircraft fitted with new cockpit displays, helmet-mounted sights, the ability to carry the new Advanced Short Range Air-to-Air Missile (ASRAAM) and other system improvements to further extend the life of the aircraft well into the next century.

The Jaguar has a long sleek fuselage with a large swept tail fin and rudder. The fuselage features a long, pointed, chiseled nose, and the body widens at the air intakes rectangular to the exhausts. Relatively short-span swept wings are shoulder-mounted on the fuselage. The internal jet engines, mounted to the rear of the cockpit, have rectangular air intakes either side of the fuselage behind the cockpit, with their top surfaces forming an extension of the wing. The engine exhausts show prominently under the forward portion of the tail. The rear jetpipes are located forward and below the tailplane, which has a marked anhedral. The raised bubble canopy is set

above the sharply-pointed nose. The twin main landing gear of the undercarriage retract into the fuselage.

India acquired the Jaguar strike fighter to meet the IAF's Deep Penetration Strike Aircraft (DPSA) requirement to replace the Canberra and Hunter aircraft. After many years of evaluation and negotiation, the Anglo-French fighter was contracted for, an interim batch of ex-RAF Jaguars being accepted to re-equip No. 14 Squadron. IAF pilots and technicians received conversion training with the RAF and British Aerospace in Lossiemouth, Coltishall and Warton before ferrying the first Jaguars to India in July 1979. These were followed by a batch of U.K. built Jaguars to re-equip No. 5 Squadron even as, HAL prepared for production of the aircraft, its powerplants, avionics, and accessories in India. By the mid-1980s, the Jaguar was in service with the 5th, 14th, 16th and 27th squadrons. The 6th squadron was equipped with the Maritime Jaguar carrying the newer generation Sea Eagle anti-ship sea-skimming missile. The Jaguar strike fighter was equipped with the 'Magic' air-to-air missiles on unique overwing pylons. Also featured were advanced nay-attack systems and the capability to carry formidable loadouts to the far ends of the sub-continent.

Builder team:	Anglo-French co-operation Dassault / BAe
Typical mission:	Close Air Support (CAS), Battlefield Air Interdiction (BAI)
First flight:	March 1969
In-service in the French Air Force :	May 1969
Powerplant:	2 Turbomeca/Rolls-Royce Adour 104 turbofans of 7,305lbs thrust (35.76kN)
Span:	28ft 6 in (8.69m)
Length:	55ft 2.5in (16.83m)
Height:	4.80 m
Weight:	empty / maximum at takeoff: 7.5 t / 15 t
Fuel capacity:	4,200 l internal / 7,800 maximal / In-flight refueling
Max Speed:	Mach 1.35, 990mph (1,593km/h) at 36,000ft (11,000m).
Operational ceiling:	40,000 ft
Accommodation:	GR1B: Pilot only T2: Pilot and pupil in tandem.
Armament:	Two 30mm Aden / DEFA 553 guns Up to 10,000lb (4,500kg) stores including: Matra Magic R550 air-to-air missile AS 30 laser air-to-surface missile laser guided bombs Martel rockets laser-guided bombs.
Special equipment:	Electronic counter measures, photo recon capacity with Omera 40 camera, and gyroscopic guidance



NATO interoperability:	In-flight refueling by NATO aircraft, armament and ammunitions in accordance with NATO standards
Number of units produced:	More than 450
User Countries:	Ecuador France India Nigeria Oman UK
French Air Force inventory:	40 aircraft in 2 squadrons

PANAVIA TORNADO

Designed and built as a collaborative project in the UK, Germany and Italy, the Tornado is in service with all three air forces and the German Navy. Tornado is also in service in Saudi Arabia and Oman. It is a twin-seat, twin-engine, variable geometry aircraft and is supersonic at all altitudes. The design authority for the Tornado is Panavia, the tri-national consortium that comprises British Aerospace, DASA of Germany and the Italian firm Alenia.



The wings of the aircraft are high-mounted, variable, swept-back, and tapered with angular, blunt tips. There are two turbofan engines inside the body. The air intakes are diagonal and box-like alongside the fuselage forward of the wing roots. There are twin exhausts. The fuselage is solid and has a needle nose. The body thickens midsection and tapers to the tail section. There is a bubble cockpit. The tail is tall, swept-back, and has a tapered fin with a curved tip and a step in the leading edge. The flats are large, mid-mounted on the body, swept-back, and tapered with blunt tips.

The Tornado GR1 strike/attack aircraft is capable of carrying a wide range of conventional stores, including the JP233 anti-airfield weapon, the ALARM anti-radar missile, and laser-guided bombs. The reconnaissance version, designated the GR1A, retains the full operational capability of the GR1. The GR1B, equipped with Sea Eagle air-to-surface missiles, undertakes the anti-surface shipping role. For self-defense, the Tornado carries Sidewinder air-to-air missiles and is fitted with twin internal 27mm cannons.

The GR1 originated from a UK Staff Requirement in 1969, calling for a medium-range, low-level, counter-air strike aircraft, with the further capabilities of interdiction and reconnaissance. The Tornado first saw action during the Gulf conflict of 1991, when several were lost as a result of daring ultra-low-level missions to close Iraqi airfields. The proliferation of anti-aircraft defenses in Iraq, Bosnia and elsewhere that the UK might be called on to operate has meant that the standard GR1 is in danger of not being able to fulfil the covert deep penetration operations that it was designed for. Furthermore the advance of air-delivered weapons has meant that strike aircraft need to become ever more sophisticated, especially given the fears of 'collateral damage' or accidentally hitting civilian targets.

The Tornado F3 air defense fighter has an 80% commonality with the Tornado GR1 strike/attack aircraft. The Tornado F3 is optimized for long-range interception, for which it carries four Skyflash radar-guided missiles and four AIM 9-L Sidewinder infra-red homing air-to-air missiles, plus an internally-mounted 27mm Mauser cannon. Tornado F3s are being equipped with the new Joint Tactical Information Distribution System. Operating in conjunction with E-3D Sentry airborne early warning aircraft and other allied fighters, the system gives an unprecedented picture of the air battle, including information obtained by other sensors in other fighters or AEW aircraft. The crew



can thus select its own target and move to within 'kill' distance without using the fighter's own search radar with its position-revealing signature until the very last moment.

The Tornado GR1A is a world leader in the field of all-weather, day and night tactical reconnaissance. The GR1A has no cannons mounted in the forward fuselage. Replacing these are a Sideways Looking Infra-Red system and a Linescan infra-red surveillance system.

Originally intended for use in Central Europe, interdicting Warsaw Pact armored columns and operating in the counter-air role against enemy airfields, the GR1 is now facing a more challenging future, with improved air defenses to face and more difficult targets to engage. A mid-life update (MLU) program was completed by the end of 1998 which, as well as enhancing survivability and operational effectiveness, gave the aircraft the capability to carry advanced weapons such as the anti-armor weapon 'Brimstone' and the stand-off attack missile 'Storm Shadow'. The updated aircraft is designated Tornado GR4. The last of the updates is scheduled for early 2003. The MLU will allow the RAF's Tornados to serve well into the next century until they are eventually replaced by the Future Offensive Air System (FOAS). The airframe's life is to be extended as a result of more advanced technology and this will avoid the necessity of expensive refits or the acquisition of new aircraft.

Both offensive and defensive capabilities will be enhanced on the GR4, including a new Forward-Looking Infra Red (FLIR) system and Night Vision Goggles (NVG), laser designation facilities (to allow the precision bombing that characterized the recent Gulf conflicts), plus a Defensive Aids sub-system to protect the aircraft from Surface to Air Missiles and radar-directed anti-aircraft guns. New avionics improve navigation and flight performance, including the installation of a Global Positioning System. In addition to the existing range of weaponry, such as laser-guided bombs and anti-radar missiles, the GR4 will be able to operate new and development equipment such as the Storm Shadow stand-off attack missile.

The GR4s will all be capable of using the Sea Eagle anti-shiping missile, whereas only the relatively small numbers of Tornado GR1Bs are presently fitted for maritime strike. The actual payload, speed, altitude and other performance characteristics of the GR4 will remain much the same as for the GR1. What will change, however, is the overall capability of the aircraft. The ability - literally - to see in the dark when using FLIR and NVG will permit GR4s to fly at terrain-following height, in close formation, without navigation lights or radar emissions. In effect the GR4 is a more stealthy aircraft, enhancing its chances of covert deep penetration and surviving the mission. It is now an all-weather strike aircraft, an important factor in Europe.

The overall cost of the Tornado MLU is currently estimated to be £850 million. The first delivery was achieved on time on 31 October 1997 and the aircraft formally entered service on 30 September 1998. As of February 1999, 26 GR4s had been delivered to the RAF, from a total number of 142 planned updates. Thirty-two of this number will be training variants, capable of the range of missions that the standard GR4s carry out, but fitted with dual flight controls. Some 26 GR4s will be designated GR4A, being dedicated reconnaissance aircraft equipped with sophisticated equipment built into the airframe. Since only the RAF currently intends operating GR4, the actual MLU work is undertaken within the UK. The RAF at St. Athan in Wales carries out preliminary work and then the main conversion is undertaken at BAe Warton in Lancashire.

Country:	Germany, Italy, and United Kingdom
Manufacturer:	Panavia Aircraft GmbH, Am Söldnermoos 17, 85399 Hallbergmoos, Germany
Crew:	Pilot, WSO
Armament:	Two internal 27-mm Mauser cannon with 180 rounds per gun plus more than 9000 kg of external stores on seven hardpoints, including: Sidewinder, Texas Instruments HARM, Hughes AGM-65 Maverick British Aerospace ALARM, Laser guided bombs like Paveway Bombs up to 450 kg, MW-1 munitions dispenser, Matra Apache Nuclear freefall bombs
Power plant:	2 x Turbo-Union RB199-34R turbofans Thrust: 38,7 kN (8700 lbs.) dry and 66 kN (14480 lbs.) with afterburner
Dimensions:	Length: 16.72 m Height: 5.95 m Span: 13.91 m fully forward, 8,60 m fully swept Wing area: 26.6 m ²
Weights:	Empty weight: approx. 13890 kg Max. external load: over 9000 kg Max. fuel: 4660 kg (5100 kg in RAF and Saudi AF aircraft) Max. take-off weight: approx. 28000 kg
Performance:	Max. speed: 1,452 mph (2,336 km/h) at 36,000 ft (11,000 m) Max. speed: Mach 2.2 at altitude Max. speed with external stores: Mach 0.92 (1110 km/h) Rate of climb: Time to 30000 ft (9150 m) less than 2 min Take-off field length: 900 m or less Landing run: 370 m Ferry range: approx. 3900 km Radius of action: 1390 km (750 NM) with heavy load, hi-lo-lo-hi g-limit (g-Limit): + 7,5
Customers:	The IDS (interdictor-strike) version of Tornado is in service with the Royal Air Force, Luftwaffe, German Navy, Italian Air Force and Royal Saudi Air Force.



DASSAULT MIRAGE 2000

The Mirage 2000 is very similar to the Mirage III/5 and 50, though it is not a variant of the Mirage III/5 or 50 but an entirely new aircraft with advanced interceptor controls. In its secondary ground-attack role, the Mirage 2000 carries laser guided missiles rockets and bombs. There is a two-seat version of this aircraft, the 2000 N (Penetration) which has nuclear standoff capability.



The wings are low-mounted delta with clipped tips. There is one turbofan engine mounted in the fuselage. There are semicircular air intakes alongside the fuselage forward of the wings. There is a large, single exhaust that protrudes past the tail. The fuselage is tube-shaped with a pointed nose and a bubble canopy. There are no tail flats. The fin is swept-back and tapered with a clipped tip.

The Mirage 2000-5 is a multi-role, single seater or two seater fighter. It differs from its predecessors mainly in its avionics, its new multiple target air-to-ground and air-to-air firing procedures linked to the use of RDY radar, and its new visualization and control system. As a multi-role combat aircraft with versatile air-to-air mission capabilities, the Mirage 2000-5 integrates the state-of-the-art of the know-how based on the experience gained from the previous Mirage 2000 versions (Mirage 2000 DA, Mirage 2000 E, Mirage 2000 D) and is designed for the most-advanced armaments.

The Mirage 2000 D, derived from the Mirage 2000 N operated by the French Air Force, is a two-seater air-to-ground attack aircraft. The Mirage 2000 D tactical penetration two-seater fighter carries air-to-ground high precision weapons which can be fired at a safe distance, by day or by night. Its navigation and attack system enable it to fly in any weather conditions, hugging the terrain at a very low altitude. Beyond the nuclear-weapons capabilities adopted for the Mirage 2000 N, the Mirage 2000 D armament includes laser-guided weapons, low-drag bombs, and the aircraft can also carry the APACHE cruise missile. The Mirage 2000 D geometrical characteristics and the main performance data are the same as those of the Mirage 2000-5.

	<i>Mirage 2000C</i>	<i>Mirage 2000D</i>
Country of Origin:	France	
Builder team:	Dassault Aviation, SNECMA, Thomson-CSF	
First flight:	March, 1978	February, 1991
In-service French Air Force:	Summer 1983	Spring 1993
Crew:	One	Two
Role:	Interceptor	All weather night and day missions such as Battlefield Air Interdiction (BAI)
Major operational capabilities		Automated terrain following at very high speed and very low altitude All-weather night and day bombing capability High precision all weather day/night bombing with Thomson-CSF PDL-CT
Length:	50 ft, 3 in (14.36 m)	
Span:	29 ft, 5 in (9.13 m)	
Height:	5.30 meters	
Empty Weight:	7,600 kg	
Maximum Weight:	16,500 kg	
Maximal armament weight:	5,900 kg	6,200 kg (9 store stations)
Power plant / Thrust:	SNECMA M 53 P2 jet engine / 9.7 t with afterburner	
Maximum Speed:	Mach 1,2 [low altitude], Mach 2,2 [high altitude]	
Rate of Climb:	17,000 m/min	
Ceiling:	Above 50,000 ft / 16,500 m	
Combat Radius:	800 nm (1,475 km) w/ 4 250-kg bombs 1,000 nm (1,850 km) w/ two 1,700-liter drop tanks 1,800 nm (3,335 km) max fuel w/ two 1,700-liter and one 1,300-liter drop tanks	
In-Flight Refueling:	Yes	
Fuel capacity:	3,950 l internal 8,000 l maximal in-flight refueling	3,1 t internal 6,2 t maximal In-flight refueling
Sensors:	RDI radar (interceptor), RWR, Advanced bombsight	
Drop Tanks:	1700 l drop tank (1358 kg of fuel for 188 nm of range), 1300 l drop tank (1038 kg of fuel) for 144 nm of range	



Armament:	Cannon: 2 GIAT DEFA 554 de 30 mm	
Air-air missiles:	MICA, Magic 2, Super 530F, Super 530D Sky Flash.	
Air-ground bombs:	BGL 1000, BM400, BAP 100	
Air-ground missiles:	Durandal, Belouga, Armat, Apache, Scalp, AS30L, AM39, ASMP	
Typical Loads:	2 AM.39 Exocet, 1 1300 l drop Tank (855 nm) 1 1300 l drop tank, 2 ARMAT, 2 R.550 Magic (885 nm) 1 1300 l drop tank, 2R.500 Magic, 2 R.530D (885 nm) 4 Belouga, 2 1700 l drop tank, 2 R.550 Magic (1094 nm) 18 EU2 250 kg bombs (756 nm)	
Special equipment:	Thomson-CSF RDI radar (pulse doppler), look down-shoot down capacity, integrated electronic counter-measures, fly-by-wire, automatic pilot, inertial guidance system	Fly-by-wire system, 2 inertial navigation systems, Thomson-CSF Antilope 5 terrain following radar, Icare digital map, integrated GPS, integrated countermeasures, laser designation pod with thermal camera (PDL-CT)
NATO interoperability:	Protected radio communications, identification friend or foe, in-flight refueling by NATO aircraft, armament and ammunitions in accordance with NATO standards	
Number of units produced:	526 (all types included)	
User Countries:	Egypt, France, Greece, India, Peru, Qatar, Taiwan, United Arab Emirates	

G4 SUPER GALEB

Super Galeb G-4 is a tandem - seat low-wing single-engine trainer/ground attack aircraft designed for modern basic/advanced training and ground support. It is a highly modified derivative of the Galeb G-2, which is currently used as a trainer. The Galeb's wings are low-mounted and slightly tapered. The fuel tanks are generally mounted at the square tips on the Galeb, though not on the Super Galeb. There is one turbojet engine inside body. There are semicircular air intakes alongside the body extending from the rear of, and below, the canopy. The fuselage is rounded, tapered to the rear, and has a round nose. The aircraft has a bubble canopy. The rear of canopy is flush with the dorsal spine. The tail flats low-mounted on the tail fin, equally tapered with square tips. The fin is swept-back and tapered with a blunt tip.



Crew:	2
Weaponry :	23mm cannon 4 hardpoints
Engine:	Rolls-Royce Viper 632-46 turbojet
Engine power (dry):	4000lbs 17.8kN
Top speed:	565mph 910km/h
Payload:	4525lbs 2050kg
Length:	40' 2" 12.25m
Height:	14' 1" 4.3m
Wingspan:	32' 5" 9.88m
Weight (empty):	7000lbs 3175kg
Weight (max T-O):	13,900lbs 6300kg



AVIOANE J-22 ORAO (EAGLE)

The Orao is a twin-engine, turbojet, high-wing aircraft intended for performing tactical assault missions within the zone of the front and also in the enemy rear. It is manufactured in single-seater (J-22) and two-seater (NJ-22) versions and as a single-seater (IJ-22) and two-seater (INJ-22) reconnaissance plane, though the latter's engine does not include an afterburner. The wing is trapezoidal, swept-back, having a low thickness ratio with pronounced strakes (hybrid wings). The propulsion system consists of two single-shaft Rolls-Royce turbojet engines in the Viper family. The engines are located side by side, in the rear section of the fuselage.



Following the Yugoslav aircraft industry's success in the 1970's with the G-2 Galeb [Sea Gull] and J-1 Jastreb [Hawk] airplanes, attention turned to designing a more up-to-date combat aircraft to replace the F-84 Thunderjet in supporting the fleet of Jastreb light assault planes. Romania, intending to replace older models of the MiG-17, soon joined the new effort in 1970. The joint program was given the name YUROM (YUgoslavia-ROMania).

The program called for a transonic twin-engine plane, intended for support of units at the front and for assault operations, that would be simple to operate and easy to maintain. A secondary role was envisaged as a fighter-interceptor in combating helicopters, transport planes, and fighter-bombers. The series 600 Viper engines of Rolls-Royce were chosen for the power plant.

The prototypes took off for the first time, one in Yugoslavia and the other in Romania, on 31 October 1974. The Yugoslav aircraft was christened the Orao, while in Romania the plane was given the designation IAR-93. In series production the plane was designated the J-22, with NJ-22 for the two-seater version.

For self-defense of the aircraft the arsenal of weapons has been bolstered with short-range air-to-air missiles with infrared homing, which are installed on two new armament lines on the wingtips, each with a carrying capacity of 100 kg. The assortment of weapons has also been broadened with laser, antiradar, and anti-ship missiles and short-range air-to-air projectiles. Armament includes two twin-barrel GS-23L 23-mm cannon with 200 rounds each. The maximum weapon-carrying capacity is 2,800 kg.

Length - Wingspan - Height: 42 ft 8 in (13.02 m) - 30 ft 6 in (9.3 m) - 14 ft 10 in (4.52 m)

Weight (Empty): 12,676 lb. / 5,750 kg

Weight (Max T/O): 24,030 lb. / 10,900 kg

Max Speed / Range: 702 mph / 712 nm

Powerplant: two Viper Mk 632-47 w/ afterburner

Thrust: 8,000 lb., 10,000 lb. w/ afterburner

Armament : five hardpoints (6,173 lb): bombs, rockets
two 23mm twin GSh-23L cannon

MI-8/17 (HIP A/H)

The MI-8 HIP is a multi-role transport helicopter capable of carrying troops or supplies as well as conducting armed attacks with rockets and guns. It is often used to resupply guerrillas, insert detachments or provide close air support to attacking units. Designed as a transport helicopter, the Mi-8 proved a multi-purpose machine. The cable external suspension, equipped with the weight-measuring device, makes it possible to carry large size cargoes weighing up to three tons. If required, it became both combat, rescue and artillery observation helicopter.



The large, five-blade main rotor is mounted over the engine at the body midsection, while a weapon-carrying platform is mounted at the lower body midsection. External stores are mounted on weapons racks on each side of the fuselage. The HIP C has four external hardpoints; the HIP E, HIP H, have six; other variants have none. Not all available munitions are employed at one time, mission dictates weapon configuration. Twin turboshaft engines are mounted on top of the fuselage with two round air intakes just above the cockpit and rounded exhaust ports aft. The Mi-8 is capable of single-engine flight in the event of loss of power by one engine (depending on aircraft mission weight) because of an engine load sharing system. If one engine fails, the other engine's output is automatically increased to allow continued flight. The fuselage consists of a long, bus-like body with a rounded nose and glassed-in cockpit. Interior seats are removable for cargo carrying. The rear clamshell doors open, an internal winch facilitates loading of heavy freight. Floor has tie down rings throughout. The aircraft carries a rescue hoist capable to 150 kg, and a cargo sling system capable to 3,000 kg. Two fuel pods are offset and mounted low on the body, which features an upswept rear section and tricycle landing gear. The tail boom tapers to the small, swept-back, and tapered fin with rotor on top right or left, with small flats mounted forward of the fin.

The first Mi-8 flew in January of 1960, and by 1985, more than 1500 Mi-8 were built. Mil Moscow helicopter plant joint stock company is the major designer and producer of military transport, civil transport, heavy-lift, multi-role helicopters. Mil is associated with the Rostov and Kazan production enterprises. Kazan is the oldest helicopter manufacturing plant in Russia and makes Mi-8 and Mi-17 helicopters. The Mi-8 was exported to Czechoslovakia, Algeria, East Germany, Hungary, Bolivia, Poland, Bulgaria, Yugoslavia, Finland, and Ethiopia.

Mi-8MT/MTV/MTB-171-17: The HIP H is an upgraded medium assault/ transport version. The designation Mi-17 is for export.

Country of Origin:	Russia
Builder:	Mil
Date of Introduction:	1967
Role:	Armed assault-transport
Similar Aircraft:	Puma, Mi-2 Hoplite, Super Frelon



Blades:	Main rotor: 5 / Tail rotor: 3
Rotor diameter:	Main Rotor: 21.3 m [70 ft] / Tail Rotor: 3.9 m
Length:	Length (rotors turning): 25.2 m Length (fuselage): 18.2m [61 ft]
Height:	18 ft 6 in (5.65 m)
Width:	2.5 m
Cargo Compartment:	Floor Length: 5.3 m / Width: 2.3 m / Height: 1.8 m
Weight:	Maximum Gross: 12'000 kg Normal Takeoff: 11'100 kg Empty: 6,990 kg
Engine:	2 TV2-117, 1482 hp each
Maximum speed:	230-250 km/h
Cruising speed:	122 kts (140 mph; 225 km/h)
Range:	Maximum Load: 350 km, Normal Load: 460 km With Aux. fuel tanks: 950 km
Fuel:	Internal: 445 liters Internal Aux. Tank: 915 liters ea. External Fuel Tank: 745 liters in port tank, 680 liters in starboard tank
Service Ceiling:	Service: 4,500 meters Hover (out of ground effect): 800 meters Hover (in ground effect): 1,900 meters
Vertical Climb Rate:	9 m/s
Standard Payload:	HIP C: 24 troops, or 3'000 kg internal or external loads on 4x hardpoints. HIP E: 24 troops, or 4'000 kg internal or 3,000 kg external on 6x hardpoints. HIP J/K: antennas on aft section of fuselage.
Armament:	HIP E mounts a flexible 12.7-mm machinegun in the nose 2x 7.62-mm or 1x 12.7-mm MG 4-6 x AT-2C Swatter or AT-3 Sagger ATGMs 4-6x- 57-mm rocket pods (16 each) 2x 80-mm rocket pods (20 each) 4x 250-kg bombs 2x 500-kg bombs 2x 12.7-mm MG pod 2x Twin 23-mm gun pods Loaded combat troops can fire personal weapons through windows from inside cabin.

Survivability/Countermeasures:	Main and tail rotor blades electrically deiced. Infrared jammer, chaff and flares.
Avionics:	The Mi-8 is equipped with instruments and avionics allowing operation in day, night, and instrument meteorological conditions.
Crew:	3 (2x pilots, 1x flight engineer)
Cost:	\$3,200,000 (new) / \$900,000 (1991 used),
User Countries	At least 54 countries (Armenia, Azerbaijan, Afghanistan, Algeria, Angola, Belarus, Bulgaria, Cambodia, CIS, Croatia, Cuba, Czech Republic, Egypt, Germany, Guyana, Hungary, Iran, Iraq, Madagascar, Mongolia, Mozambique, Nicaragua, North Yemen, People's Republic of China, Slovakia, South Yemen, Sudan, Syria, Ukraine, Vietnam, Yugoslavia, Zambia)



NAVAL VESSELS

KUZNETSOV AIRCRAFT CARRIER

The 67,500-ton Kremlin class aircraft carrier supports strategic missile carrying submarines, surface ships and maritime missile-carrying aircraft of the Russian fleet. The ship is capable of engaging surface, subsurface and airborne targets. Superficially similar to American carriers, the design is in fact "defensive" in support of SSBN bastions. The lack of catapults precludes launching aircraft with heavy strike loads, and the air superiority orientation of the air wing is apparent.



The flight deck area is 14,700 square meters and aircraft take-off is assisted by a bow ski-jump angled at 12 degrees in lieu of steam catapults. The flight deck is equipped with arrestor wires. Two starboard lifts carry the aircraft from the hangar to the flight deck. The ship has the capacity to support 16 Yakovlev Yak-41M (Freestyle) and 12 Sukhoi Su-27K (Flanker) fixed wing aircraft and a range of helicopters including four Kamov Ka-27-LD (Helix), 18 Kamov Ka-27 PLO, and two Ka-27-S. The ship has a Granit anti-ship missile system equipped with 12 surface to surface missile launchers. The air defense gun and missile system includes the Klinok air defense missile system with 24 vertical launchers and 192 anti-air missiles. The system defends the ship against anti-ship missiles, aircraft, unmanned aerial vehicles and surface ships. The ship is equipped with an Udav-1 integrated anti-submarine system with 60 anti-submarine rockets.

Originally designated 'Black-Com-2' class (Black Sea Combatant 2), then subsequently the 'Kremlin' class, and finally re-designated 'Kuznetsov' class, these ships were sometimes also referred to as the 'Brezhnev' class. Initially Western analysts anticipated that the ships would have a Combined Nuclear And Steam (CONAS) propulsion plant similar to the Kirov battle cruiser and the SSV-33 support/command ship. However the class was in fact conventionally propelled with oil-fired boilers.

Western intelligence first detected preparations for the construction of the first ship in late 1979. The first public view of this ship came with the leak of the "Morrison Photos," which were the first real public look at overhead satellite imagery.

Designer:	Nevskoye Planning and Design Bureau
Builder:	Nikolayev South
Displacement (tons):	43,000 tons light 53,000-55,000 tons standard 66,600-67,500 tons full load
Speed (kts):	32 knots

Dimensions(m):	302.3-306.45 meters long overall 270.0-281.0 meters long at waterline 35.4-38.0 meters beam 72.0-73.0 meters width overall 9.14-11.0 meters draft
Propulsion:	2x 50'000 hp gas turbines; 8 boilers; 4 fixed pitch props, turbogenerators 9 x 1500 kW, diesel gen. 6 x 1500 kW
Range:	3'850 nm/32 kts
Endurance:	45 days
Crew:	1960 + 626 air group + 40 flag, 3857 rooms
Airwing:	16x Yak-141 12x aircraft SU-27k or MIG-29k 4x Helicopter KA-27LD32 18x KA-27PLO 2xKA-27S
Missiles:	12 Granit (SS-N-19) SA Klinok ADAM system (24 launchers, 192 vertical launch missiles; rate of fire: 1 missile per 3 sec) SA Kashtan ADGM system (256 AD missiles, 48'000 cartridges; range: 0.5- 1.5 km)
Guns:	8 x 6 AK-630 gattling AA (6x30 mm; 6'000 rounds/m/mount, 24000 cartridges)
Electronics:	Combat Information Center Aviation Combat Information Center Communications suite including satellite communications MR-710 Fregat-MA/Top Plate 3D Air/Surface Search 2 MR-320M Topaz/Strut Pair 2D Air/Surface Search 3 Palm Frond Navigation 4 MR-360 Podkat/Cross Sword SA-N-9 Fire Control 8 3P37/Hot Flash SA-N-11 Fire Control Fly Trap B Aircraft Control Zvezda-2 search and attack sonar [medium and low frequency bands] MGK-345 Bronza/Ox Yoke hull mounted Sonars
Other:	UDAV-1 ASW RL (60 rockets; R: 3'000 m)

WEAPONS

BL-755 CLUSTER BOMB

Offensive, support, and attack aircraft carry the BL755 Cluster Bomb. Weighing 600lb, each bomb carries 147 small bomblets that scatter over an area on release. A dual-role weapon, it entered RAF service in 1972. It is designed to provide a high 'kill' probability against a range of hard and soft targets.

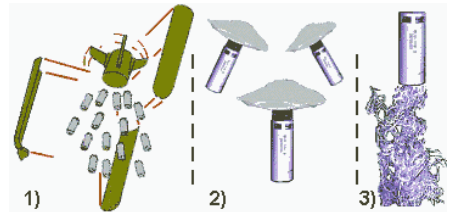


When the BL755 is dropped, the primary strike is armed. After a set interval the initial cartridge is fired, which produces the gas pressure to blow off the two-part body skins and then fires the main cartridge. Each bomblet is 5.87" (0.15m) as it is fired. This extends to 24.69" (0.62m) complete with extending nose probe and retarding parachute.

Manufacturer: Hunting Engineering. **Length:** 8' 0.5" (2.45m)

CBU-94 "BLACKOUT BOMB"

The CBU-94 is a special-purpose munition for attacking electrical power infrastructure. Although very little is known about this highly classified weapon, reportedly it functions by dispensing a number of submunitions which in turn disperse large numbers of chemically treated carbon graphite filaments which short-circuit electrical power distribution equipment such as transformers and switching stations. The weapon is sometimes referred to as a "soft bomb" since its effects are largely confined to the targeted electrical power facility, with minimal risk of collateral damage.



The CBU-94 detonates over its target and disperses huge numbers of fine carbon filaments, each far smaller than the crude wire spools used in the gulf war. The filaments are only a few hundredths of an inch thick and can float in the air like a dense cloud. When the carbon fiber filaments dispensed from the BLU-114/B submunition contact transformers and other high voltage equipment, a short circuit occurs and an arc is often created when the current flows through the fiber, which is vaporized. The graphite, which is a conductor of electric current, is probably coated with other materials to enhance these effects. At the spot where the electric field is strongest, a discharge is initiated, and electrons rapidly form an ionized channel that conducts electricity. At this stage current can flow and an arc forms. This causes instantaneous local melting of a certain amount of the material at the surface of the two conductors. If the current involved is strong enough, these arcs can cause injury or start a fire. Fires can also be started by overheated equipment or by conductors that carry too much current. Extremely high-energy arcs can cause an explosion that sends fragmented metal flying in all directions.

Deployment of this weapon is exactly the same as any other cluster bomb.

SKYFLASH (RAF SARHM)

Skyflash is a medium-range radar-guided air-to-air missile. Designed to operate in severe electronic countermeasure conditions, the Skyflash is the RAF's major air defense weapon. Four are carried by the Tornado F3 under the fuselage. The Skyflash was a development of the AIM-7E2 Sparrow, retaining its aerodynamics, with a cruciform of delta control wings mounted on the mid-point of the cylindrical body. It also features a compatible cruciform of delta stabilizing surfaces at the tail. The weapon entered RAF service in 1978, originally for use by the Phantom.



Manufacturer:	British Aerospace
Date Deployed:	1978
Range:	28 miles (45 km)
Speed:	Mach 4
Propulsion:	One Aerojet Mk52 Mod 2 or Rocketdyne Mk38 Mod 4 solid-propellant rocket motor
Guidance:	Marconi XJ521 monopulse Semi-Active Radar Homing
Warhead:	87 lb. (39.5-kg) HE fragmentation with contact, delay action uses.
Launch Weight:	425 pounds (192.8 kg)
Length:	12 ft, 1 in (3.68 m)
Diameter:	8 in (0.203 m)
Fin Span:	3 ft, 4 in (1.02 m)



THE CAMPAIGNS

This version of the Balkan Theater includes the 'Balance of Power' campaign in a beta state. The campaign engine of Falcon 4 is highly sophisticated and needs much more research in order to have all data files set up correctly. The next theater update, scheduled Q3 2001, will include three campaigns.

Future versions of the Balkans will include three fully dynamic campaigns. These campaigns are based in 1996, just before or just after the Dayton Peace Accord was signed. These are "what if" scenarios so they are not historically accurate from a political/strategic point of view. They will be accurate when dealing with the aircraft, ships, and ground vehicles that were available at the time. It should be noted here that the addition of a new 3D modeling tool has allowed some NATO aircraft outside of the US inventory to be added. It is our plan to add more as either ourselves or other groups make them available.

Throughout all three campaigns NATO will operate up to three carrier groups with the CVN-70 USS Carl Vinson, CVN-71 USS Theodore Roosevelt, and the CVN-76 Ronald Reagan available for deployment in the region.

Due to the size of video files we have decided not to include the campaign introduction videos at this point.

OPERATION POWDERKEG

It is April 1995 and the civil war in the Former Republic of Yugoslavia has been raging since 1991. The main aggressor in this conflict appears to be Serbia who is actively trying to gain control of as much of the region as possible under the pretence of reuniting the fractured Yugoslavian Republic.

So far the Croatian and Bosnian forces are holding the Serbs just inside their own borders following an earlier repulsed invasion attempt. The Serbs have reacted by leaving a scorched earth policy during their retreat essentially emptying the land of any remaining civilians and habitation.

NATO to date has moved it's forces into Italy on a "high alert" status to carry out any UN/NATO mandates that are decided upon. That decision has now been made and the time for action has come.

Following reports and investigations into war atrocities NATO has had to act in order to bring the conflict to a close and prevent further aggression from Serbia. Surprisingly the UN has agreed to the removal/capture of the Serbian leadership after making the mistake of leaving Saddam Hussein in power in Iraq. This means rolling the Serbian forces back to and capturing Beograd (Belgrade).

Support has been strong from those neighboring countries that now fear that they will be the next targets. Russia however has made several vocal oppositions to this strategy in the UN and

intelligence indicates that they have been selling military equipment into Serbia contrary to a UN/NATO embargo. Whether Russia will assist the Serb leadership more directly is uncertain.

Most allied flights will originate in Italy and refuel over the Adriatic before carrying out their missions, who will be in support of the NATO bolstered forces advancing into Serbia. Squadrons maybe relocated into the region if considered tactically important to do so.

Intelligence suggests that the Serbian forces are expecting this move and their IADS is fully operational following some Croatian Airforce attacks. This would also indicate that the forces may not be as badly equipped as first thought.

BALANCE OF POWER

It is May 1996 and the Serbs have broken the Dayton peace accord between the various parties in the civil war following the break up of Yugoslavia. In a lightning strike, they have managed to overwhelm Croatia and Bosnia and are now consolidating their position. A concerted effort by diplomatic means to get the Serbs to withdraw has fallen on deaf ears and more alarmingly troops and armor are now amassing near the Slovenian border.

NATO has decided to hear the pleas of the Croats and Bosnians and following a request from the Slovenian government are preparing to restore the status quo that existed when the peace agreement was signed.

Most F16 missions will largely involve the aiding of NATO forces in the region and the suppression of Serbia's IADS. Other aircraft will be providing specialist strike and air cover. AWACS and tanker flights are currently operating over the Adriatic to support NATO aircraft and two US carrier groups are also stationed there.

UNDER SIEGE

Intelligence has suggested that Serbia, after amassing forces along it's border, invaded the small country of Albania. The Serb leadership has stated that Albania has been sponsoring the Kosovo Liberation Army. They further state the only way they can prevent further unrest is to annex Albania. Albania has requested that NATO help them in their time of need.

NATO has decided that the Serbs policy of systematic and brutal clearance of civilians from captured territory cannot be tolerated. The orders are to repel the invasion and push the Serbs back from the borders twenty miles to provide a buffer zone against further aggression.

Russia has not given it's blessing to NATO's actions as they see the Serb invasion of Albania as legitimate self-defense. The Russians believe Albania's annexation would help stabilize the region.

Tensions in the UN are high and Russia has stated that it may send aid to the Serbs for their cause even if that means openly opposing the NATO forces in the region.



DESIGN NOTES

GOALS

The goal of the Balkan Theater project is to deliver a free, downloadable add-on to the original Falcon 4 game, which enables a player or players to fly TEs and Campaigns in the former Yugoslavian states. The add-on will, upon full release, include the following features:

- ▲ Terrain as accurate as that modeled in the Korean Theater using a 1km resolution DEM downloaded from a NASA GIS site (I did look into acquiring higher resolution DEMs but they are only available for quite large sums of money, which wouldn't be justified given the greater accuracy)
- ▲ Textures placed with as much, if not more, accuracy than the Korean Theater using more hand placement to cut down on the repetitiveness noticeable in the Korean Theater
- ▲ Limited number of new textures to provide more variation and accuracy in the landscape. (One of the reasons the Balkan Theater was chosen was that as a "temperate" climatic area most of the same textures can be used between the Korean and Balkan theaters)
- ▲ Objects placed on the landscape and linked so as to provide a ground war as active as that supplied in the Korean Theater
- ▲ New static objects more in keeping with the architecture in the region including some more recognizable buildings such as the Coliseum in Rome.
- ▲ To replicate the Integrated Air Defense System existing in the Balkan states with as much accuracy as possible
- ▲ Fully operational dynamic campaigns using both the air and ground wars
- ▲ Include new TEs to help Falcon 4 pilots get used to flying in the new theater
- ▲ Use a simple executable installation program
- ▲ Theater switching using Joel Bierling's excellent F4Patch program or a drop down menu from within Falcon 4.0
- ▲ Include new Skins for aircraft, ground vehicles, and ships appropriate to the region

A number of features are to be included in later releases dependent on the Terrain Team's and other developer's discoveries in the Falcon 4 world. Our wish list currently is:

- ^ New weapons and ground vehicles relevant to the region.
- ^ A fully operational naval simulation to enable ships to move in the theater and participate in campaign operations.
- ^ A fully operational US/NATO carrier group enabling Naval aircraft, such as the F-14 and F/A-18, to be launched and recovered as part of the campaigns
- ^ New NATO aircraft such as Tornado, Mirage, Galebs, Raphale, etc.
- ^ New ground vehicles in keeping with the forces deployed in the region
- ^ New airfield objects



THEATER CHOICE

Below is list of Pros and Cons for the five theaters initially considered:

<i>Theater Name</i>	<i>Pros</i>	<i>Cons</i>
Balkans/Italy	Well known area Microprose's next choice Few new textures req'd Good sources of info	New aircraft needed No naval ops in Falcon 4
Gulf War	Well recognized area Good sources of info	Done to death New aircraft needed Long development (new textures needed), Long tiling effort (little sea), No naval ops in Falcon 4
India/Pakistan	Excellent mountains Few new textures needed	New aircraft needed Long tiling effort (no sea)
Cold War Germany	Well known area Good info available Good simulation as most military hardware was originally designed for this potential conflict Massive potential ground war	New aircraft needed Not very current Projection difficulties
Scandinavia/Baltic	Very moody atmosphere (see EF2000) Excellent mountains	Large amount of new textures needed New aircraft needed No naval ops in Falcon 4 Projection difficulties
Ethiopia/Eritrea	Varied terrain types Few if any new aircraft needed	Not well known New textures needed No naval ops in Falcon 4

As 'Tbone' had already begun the development of the Middle East Theater and since Microprose had already decided that their next Falcon 4 add-on would be an F15E simulation in the Balkans, we concluded that the Balkans would be the best choice for a new theater. It allowed other potential developments such as a naval battles to be included if and when others, working on the simulation, implement this aspect of Falcon 4.

HISTORY OF THE BALKAN THEATER

Historically the region has been politically unstable for centuries but a major conflict began when the various states making up the Yugoslavian federation spilt from the central administration and began a bloody period of civil war. Added to this there are quite large and diverse, religious and ethnic groups, with their own agendas, whose geography doesn't match the political boundaries in the region. This makes for a very confusing and volatile situation.

Anybody who hasn't heard of the troubles in the region in the past decade must be very isolated indeed.

NATO's involvement in the civil conflict began due to the disturbing reports of war crimes being committed against the civilian populations and the fear of an escalation of the conflicts into surrounding countries. The involvement of NATO and the UN was less than glorious as there was no clear understanding at the beginning of the war of who were the main aggressors. The warring factions manipulated the media and NATO/UN officials for their own ends.

THE CONFLICT

The conflict can really be divided into two actions when viewed from a NATO perspective. The first is the bitter civil war where the old Yugoslavian coalition disintegrated and various member states tried to gain disputed regions from each other. This resulted in NATO action, following the allegations of ethnic cleansing and continued military targeting of civilians. NATO first employed a "no fly zone" policy in the region. However, when the combatants refused to discuss settlements diplomatically and continued to kill indiscriminately amongst the civilian population, NATO started air strikes to convince the forces in the region to adopt a different stance and restart diplomatic negotiations.

The second action was taken after the various countries had signed an agreement of territory administration. This concerned the Kosovo region's attempt to become an autonomous state (still part of Serbia at that time). Slobodan Milosovich (already on shaky moral ground due to his actions during the Yugoslavian civil war) reacted viciously to this agreement and ordered a retaliatory occupation of Kosovo by his armed forces. In fairness, the Kosovons did provoke this response knowing that NATO was watching.

In the end, NATO decided that rather than let the situation deteriorate to the levels seen during the previous conflict, they would step in immediately. Following failed diplomatic attempts to halt Milosovich's actions, NATO embarked on an air campaign to attempt to control the Serb leadership. On the ground, to prevent tit-for-tat retribution attacks by either side, the intent was to occupy Kosovo.

The actual events outlined above are very brief and much more could be written about all sides involved in the conflicts. The campaigns included with Version 1.0 of the Balkans are based just prior or just after the 1996 Dayton Peace Accord.



THEATER INFORMATION

THEATER AREA

Setting reasonable limits for the allowable size of a theater, at the time of conception, meant we had to position the theater to allow the following (Subsequently this limit was removed by the efforts of Snake_Man and Julian):

- ▲ As many Italian airbases as possible (including Aviano, a major Italian base used by NATO, that was not in the first alpha build)
- ▲ An area of land between Italy and the Balkans for a potential ground invasion to take place (This makes the enabling of a naval invasion unnecessary but the capability can be added later as the naval side of campaigns is enabled)
- ▲ As much of Serbia as possible including Beograd
- ▲ A good portion of the industrial northern regions of Italy

Unfortunately, to include all these criteria, Kosovo is only partially represented in the theater. To create a full Kosovon campaign, including much more of Albania, it would have been necessary to add Greece and other surrounding countries. This would have the effect of pulling the theater away from Aviano in the north. Although the Kosovo crisis was well publicized, it really only involved Kosovo, NATO, and Serbia. It lasted weeks rather than years.

We took the decision to design the theater around the earlier civil wars.

This has the following advantages:

- ▲ The number of countries that can be involved increases.
- ▲ The conflict situation at that time was extremely volatile and provides much scope for changing of sides by the participants as certain criteria are reached. Alliances can be forged and broken by the actions of the forces in the region.
- ▲ Most of Italy can be included to provide a decent target for a Balkan's state retaliation if desired. This provides a sort of bi-polar situation.

It subsequently transpired that although Aviano airbase was included it was so close to the northern edge of the map you could look over the "edge of the world" on approach. It was decided that we should shift the theater North by about 50km to properly represent the Aviano area. This also had the advantage of including some of the Alps, which shield your view of the "edge of the world" and allowed a larger land area for a ground war to take place.

AIRBASE TACAN CHANNELS

<i>Airport</i>	TACAN
Amendola Airport	053X
Ampugnano Airport	038X
Asiago Airport	049X
Aviano Airbase	110X
Banja Luka Airport	055X
Batajnica Airport	056X
Beograd Airport	069X
Berat Airbase	032X
Bihac Airport	059X
Bologna Airport	058X
Bolzano Airport	116X
Brindisi-Casale Airport	078X
Capodichino Airport	031X
Catania Fontanarossa	057X
Cerklje Airport	060X
Cervia Airport	082X
Ciampino Airport	044X
Crotone Airport	061X
Dubrovnic International	100X
Elbasan Airbase	033X
Falconara Airport	034X
Fiumicino Intl. Airport	095X
Forli Airport	062X
Frosinone Airfield	028X
Ginolisa Airport	063X
Gioia del colle	026X
Gjirokaster Airport	064X
Gramsh Airport	065X
Grazzanise Airport	121X
Grosseto Airport	027X
Grottaglie Airport	114X
Guidonia Airport	066X
Ioannina Airport	085X
Istrana Airport	054X
Ivangrad Airport	104X



Kefallinia Airport	047X
Korce North Airbase	070X
Kovin Airbase	037X
Kraljevo Airbase	039X
Kukes Airbase	040X
Lamezia Terme Airport	071X
Latina Airport	048X
Lecce Airport	074X
Lepa Glava Airport	072X
Ljubljana Airport	073X
Maribor Airport	079X
Matera Airport	081X
Mattarello AP	084X
Mifol Airport	089X
Mostar Airport	096X
Nagykanisza Airbase	123X
Ocseny Airport	090X
Ohrid Airport	118X
Osijek Airport	120X
Padova Airport	092X
Palermo Airport	076X
Palese Macchie Airport	098X
Pantelleria Airport	107X
Pecs East AP	093X
Peretola Airport	051X
Perugia Airport	030X
Pescara Airport	105X
Podgorica Airbase	077X
Portoroz Airport	097X
Practica di mare Airport	086X
Preveza Airport	101X
Pula Airport	067X
Ravenna Airport	102X
Reggio Calabria Airport	046X
Rijeka Airport	119X
Rimini Airport	108X
Rivolto Airport	036X
Roma Urbe Airport	106X
Ronchi dei legionari AP	088X

San Pancrazio Airport	109X
Sarajevo International	113X
Satorhely Airbase	111X
Shkoder Airbase	035X
Sigonella Airport	052X
Sjenica Airport	112X
Slovenj Gradec Airport	115X
Sombor Airport	117X
Split Airport	103X
Szeged Airport	050X
Taszar Airbase	122X
Tirane International AP	094X
Tirane Rinas Airport	091X
Tivat Airport	029X
Trapani Birgi Airport	087X
Treviso Airbase	043X
Tuzla Airport	068X
Udbina Airport	042X
Varazdin Airport	041X
Venezia Tessera Airport	099X
Vicenca Airport	080X
Zadar Airport	075X
Zagreb Airport	083X
Zakinthos Airport	045X



PROJECTION/NAVIGATION INACCURACIES

One observation that appeared shortly after the original release of Falcon 4 in December 1998 was that the terrain and map supplied with it did not appear to fit exactly with other map references available. This is a problem we were aware of from the earliest development stages of the theater. It is a result of the earth being nearly spherical and the Falcon terrain engine being flat.

If you look at a map of the planet in an atlas you are not looking at a true representation of the landscape. In order to lay a spherical object onto a flat piece of paper distortions have to be made. There are many different ways of doing this and these provide what are known as projections when transferred to flat paper. Any good atlas should contain more information on this subject if you wish to delve further.

Falcon 4 is no different to an atlas in this respect, as the DEM data obtained from NASA is a data set obtained from satellite surveys of the planet. They are therefore held spherically and to use them in Falcon 4, which uses a flat terrain, we need to distort them.

As both the Korean and Balkan theaters are Northern Hemisphere areas the spherical projection has to be stretched in order to make it flat and fit a square. This results in distances between objects at the top of the theater being larger than they are in real life. There is no real workaround for this without making Falcon 4's world spherical or part of a sphere, which would involve a complete rewrite of the terrain engine.

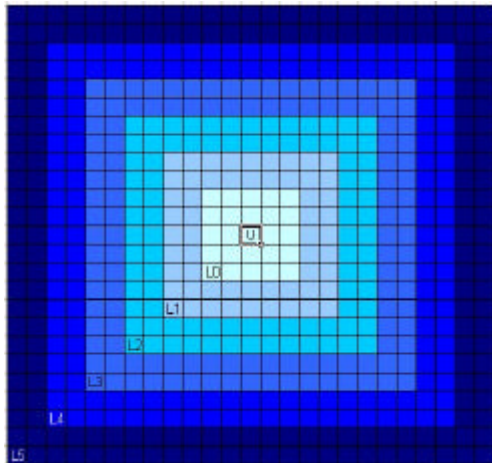
THE TERRAIN – (L2’S AND ALL THAT)

What follows is a brief explanation of how the Falcon 4 simulation models terrain.

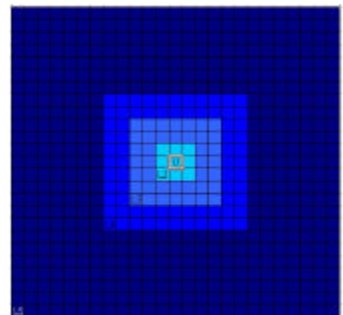
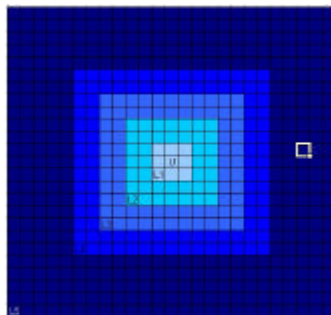
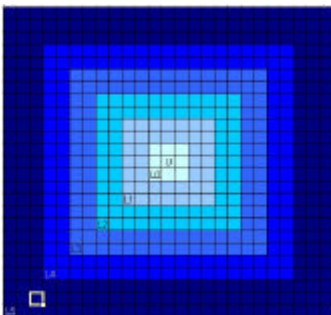
Essentially the terrain is made up of six files named theater.I0, theater.I1, theater.I2, and so on, up to theater.I5. Each of these files contains essentially a data table containing a point identifier to provide a location and then a number of fields to define that point. The fields define attributes such as altitude, texture offset used and three other attributes related to the way the terrain is displayed and the mist/haze.

There are an increasing number of data points in each file with the I5 having the least and the I0 the most. The theory is that the I0 displays closest to your aircraft and progresses out to the distant I5. This principal is shown in the figure to the right that shows a plan view with your F16 marked as “U”.

The increase in data points as you get towards L0 means that the terrain is going to be more detailed the closer a point is to your aircraft. The textures used for each L file are also more detailed and larger. This gives a realistic representation of the landscape with less detail in the distance and more in the foreground. (More on textures later).



The amount of each layer (L) file displayed is dependant on altitude so if you were in the center of the diagram and started to climb, the boxes would start to reduce from the center outwards (see figures below). Progressively, the inner/more detailed layers get smaller and are replaced by the L5 until that is all that remains in view. You can see the opposite effect by flying as high as the aircraft will allow then pointing straight to the ground and letting it fall earthwards.





TEXTURES

Having discussed the concepts behind the files that make up the terrain layer files, the next items are the textures placed on the landscape.

There are two distinct types of textures dependant on the "I" file that uses them. The first set are plain .PCX graphics files which are held in \terrdata\theater\textures\texture.zip . The textures located here are used to populate the L0, L1 and L2 files. There is a set of textures for each L file with the most detailed (and largest) being for the L0 and getting smaller and less detailed for the L1 and L2.

The textures for the L3, L4 and L5 files are held in the fartiles.raw file. These are constructed by taking 4 adjoining textures from the L2 and pasting them together to form one tile for the L3. The L3 tiles are then combined to make the L4 tiles and so on for the L5.

TILING

During the initial investigation into the terrain file structure it became rapidly apparent that most information relating to the terrain is held in map files using a 1024x1024 grid. These files include the theater.L2, theater.mea, theater.thr and the TAC files, which hold the static object locations. It was decided that the theater.L2 would be the sensible file to tile as it provide the smallest number of tiles to place without using the fartiles.raw as a palette. Even using this file it can be seen that to tile a 1024 x 1024 landlocked theater (such as India/Pakistan) would require the hand placing of 1,048,576 textures. Tiling the L2 allows all the other L files to be generated automatically which cuts the amount of data to download to 10mb rather than the 130mb+ which makes up a theater.

Microprose used a 3rd party program to generate their theater, which essentially takes a DEM, places a satellite image of the area over it. The image is then chopped up into 1,048,576 individual textures, algorithms are run on those textures to reduce their number, and by finding matching terrain types the data reduced to a level manageable by Falcon 4. This still resulted in a terrain with some 1700 textures but this is manageable and falls within the 2 byte index that fartiles.raw uses.

The package that Microprose uses is expensive, so to speed up the process of tiling we first used a single tile for land and a single tile for sea. The sea tiles were placed automatically wherever the altitude for a tile was 0. We further refined the algorithm in order to place tiles according to altitude so that the terrain used grassland tiles for low altitude and progressed through forest then rock to snow as altitude increased. This gave us a "banded" terrain and helps the tiling team in placing the right set of tiles. The coastline was then added to provide a more natural transition from sea to land.

Julian helped further by finding some GIS overlays showing roads, railways, rivers, cities, etc. that he imported into Terrainview. The overlays had the advantage of providing a standard filter for roads, rivers, etc. that tilers could then follow. An auto-tiling facility was added to places tiles according to the overlays.

The auto-tiling features of Terrainview still leaves a huge amount of work in order to get the right tile types placed and to provide a realistic representation of what is actually there. The Balkan Theater took a year to tile even though it is only 60-70% land! It is finished now and the other important areas of the theater's development can be finalized, such as object placement and campaign generation.

OBJECT PLACEMENT

The landscape is less than half the equation. For something to happen within the simulation it needs to be populated.

Objects basically fall into two categories static and mobile.

- ▲ Static objects are defined as buildings, bridges and other objects that do not move. They are located in a "TAC" file and are linked together to form a hierarchical structure. For example, you can have a "Rome" object for the City itself then as children of that object place Rome Bridge, Rome Office, Rome Coliseum, etc. The links between these objects define how the ground war operates and provide targets for ground vehicles to capture.
- ▲ Mobile objects define the placement of ground units and aircraft squadrons. In the next release we will expand on this and explain the operation of units within the theater.

Initially objects were placed by hand, which involved taking the `te_new.tac` file from Korea and manually moving objects to new locations in the Balkans using TACedit. The first objects to be located were towns and cities, which were placed by finding the LAT/LONG coordinates of the towns from Microsoft's Encarta Atlas and then converting these to a 1024 x 1024 grid position in the Balkan Theater. After this some bulk processing of the TAC was carried out to convert these objects into towns rather than the random object type that was initially used. Airfields were then placed with appropriate size and runway orientation, different from those provided in the Korean Theater.

As the tiling progressed repeated refinements were made to more accurately place objects to match the tile types used on the landscape. This eliminated, where possible, buildings being placed in the sea. This process was carried out while the building types were changed away from the defaults and additional structures were added to provide "populated" towns and cities.



VERSION HISTORY

Since development of the theater commenced we have released a number of Betas both internally for testing purposes and externally to keep interest in the project alive and to get feedback from the Falcon 4 community. I would like to thank those who have downloaded and provided feedback to us, you have been a valuable source for finding bugs and shaping the directions we have taken in creating this theater.

VERSIONS AND HIGHLIGHTS

Pre-Alpha – 20 March 2000

- ▲ Banded Terrain
- ▲ Coastline 80% Tiled

Alpha 1.0 – 12 April 2000

- ▲ Banded Terrain
- ▲ Major Italian Lakes Tiled
- ▲ Snowline 10% Tiled
- ▲ Modifications in L2 now replicated into other L* files
- ▲ L3-5 (Fartiles.raw) problems solved, now matches L2
- ▲ New Campaign\Save directory included

Beta 1 – 2 May 2000

- ▲ Internal release

Beta 2 – 15 May 2000

- ▲ Internal Release

Beta 3 – 22 May 2000

- ▲ Terrain 45% Tiled
- ▲ TEs now available
- ▲ Object Placement Underway (Major Airfields now in Place)

Beta 4 – 12 June 2000

- ▲ Internal Release

Beta 5 – 26 June 2000

- ▲ Terrain 55% Tiled
- ▲ New Tiles for Rocks/Mountains/Highways and Snow
- ▲ New TEs in addition to those under Beta 3
- ▲ Object Placement progressing (Major Towns, Airfields, and Factories)
- ▲ Objects being matched to tiling progress

Beta 5a

- ▲ Internal Release

Beta 5b

- ▲ Internal Release

Beta 5c – 5 October 2000

- ▲ Terrain 70% Tiled
- ▲ Mini Campaign TE included
- ▲ More objects placed with better diversification.
- ▲ New Pie loader screen

Beta 6 – 14 January 2001

- ▲ Terrain 100% Tiled
- ▲ 1 Air-to-Air Campaign
- ▲ Many more objects placed
- ▲ Still more new textures and edited originals to provide a more accurate representation of the region
- ▲ Accurate Military Objects
- ▲ New weapons systems
- ▲ New skins for the aircraft deployed in the region
- ▲ New TE missions
- ▲ Switching of the Campaign\Save directory so that only Balkan missions and campaigns are accessible when the theater is selected
- ▲ New kneemap and mission planning map



Version 1.0 – June 2001

- ▲ Dynamic bullseye position, which will change every 24hours under eRAZOR's 1.0799 and later executables to follow the FLOT
- ▲ Balkan PAK map
- ▲ Fixed the night lighting on new textures
- ▲ Corrected TACAN channels for known airbases
- ▲ Airbases with flat runways so that AI flights can land properly
- ▲ New ATC voices in keeping with the theatre
- ▲ New voices added for the new aircraft in the theatre

CREDITS

These are the individuals who have given up their free time towards the development of this theater for no other reward than to be able to play the end result and share it with others. The members of the team are from all over the world and this represents a truly international effort.

If we have missed anybody, please accept our deepest apologies. If your name is misspelled or you have a "callsign" that is not listed then please let us know so that we can amend it. The list is organized into meaningful tasks. Some names will appear more than once.

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 Manfred "Schumi" Nelles

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 Chera Bekker
 Chris "Washout" Carter
 Contiero "Josc" Giovanni
 Darren "Merlin" Sadler
 Dieter "Joxer" Blancquaert
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 Erik "Owl" de Klerk
 Francesco "Mix" Missarino
 Fred "Baldeagle" Balding
 Gayle "Beartrax" Galbraith
 Gregor "Madman" Papez
 James "Rellick" Lumsden
 James "Warlock" Farmer
 Jason "Jaguar" Howlett
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 Thomas "Tom2" Waelti
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 Bob "Snowman" Crawford
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 Milenka Jekovec
 Manuela Anastasiou
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 Masayuki "Jappo" Hojo
 Matevz "White Angel" Jekovec
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 Paul "Too Easy" Poulson
 Rick "Drummer" Centeno
 Roberto Grasso
 Scott "Seaghost" Eddy
 Snakeman
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 Steve "Ironklad" Klastrup
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F14Magic

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Fernando "Goose" Salles

Dr Stop

Shinobi "H20"

Damir "Slat" Gulesich

Beta testing

Everybody listed here has contributed in some way towards Beta testing over the last year and a half. In addition are many other individuals and groups (including Virtual Squadrons and real aircrew and pilots actually based in the region) who have helped enormously in ironing out problems and generally providing feedback on what the theatre should look like.

From the Balkans Terrain Team we thank you all it would not be the same product without you.

Special thanks goes to all those partners of the team who have seen little of their loved ones over the development period as they have indulged in their passion for this simulation.

Thanks also go to those people from the original hex editing community who eased a crowbar into the lid of the box that is Falcon 4. You know who you are and you should be applauded for your efforts.