# Department Of Defense Usage of FalconView™

**Chris Bailey**
**Sr Research Engineer**
**Georgia Tech Research Institute**

## *Overview*

FalconView™ is a non-proprietary GOTS (Government Off-The-Shelf) application for analyzing and displaying geographical data crucial to the warfighter. Its ease of use and wide variety of applications have made it the system of choice for the warfighter and the standard for data interchange in Iraq and Afghanistan. This paper will outline some of the reasons that FalconView is the software of choice for displaying geographic information within the Department of Defense and how FalconView compares to various COTS (Commercial Off-The-Shelf) GIS programs.

## *History*

Georgia Tech began development of FalconView in 1990 after being contracted by the Air National Guard (ANG) to create a mapping package that would run on a Personal Computer and be easier to use than the existing UNIX based system. Georgia Tech had a history of mapping application development as part of the Micro Fix and the FORSCOM Automated Intelligence Support System (FAISS) programs for the Army. The initial development was performed under an Army Research Lab contract.

The combination of FalconView and the Combat Flight Planning Software (CFPS) which was being developed by the 46th TS and TYBRIN Corp became the Portable Flight Planning Software (PFPS).

**FalconView Milestones**

- 1990 First request from F-16 pilots
- 1993 Initial fielding for F-16 community
- 1994 C-130 moving map and intelligence feeds
- 1995 Initial SOF helicopter support / CHUM towers
- 1996 High resolution imagery / additional overlays
- 1997 Full scale adoption throughout Air Force
- 1998 Initial Navy release
- 1999 Incorporation into PCI-3, ACC standard Intelligence PC based system replacing CIS
- 2000 FalconView for NIMA released
- 2002 US Army release 3.2 as part of AMPS program
- 2003 USSOCOM and US Army Unique 3.3.0 release
- 2004 FV mapping engine chosen as JMPS standard

The initial versions of FalconView were simply a set of routines to display scanned raster maps such as CADRG with simple stick routes drawn on top, but the easy to use software was popular with the end users and more functionality quickly followed. Each new

feature was developed with significant input from the user community and improved with feedback from a group of enthusiastic beta testers. Unlike most other DoD developed applications, the FalconView development team was given very general requirements by the ANG which were fleshed out into a product by the development team and mission planners who used the software for their daily activities.

In the early years the software was distributed to other services from user to user because it made their jobs easier. As the program matured, USSOCOM adopted PFPS and added capabilities such as the Moving Map functionality and helicopter support. In 1997 the Air Force adopted PFPS into the AFMSS program, followed by the first Navy release in 1998 and an Army's release in 2002. Each adopter of the software funds new functionality to the program and expands the capabilities to interact with other systems.

Version 3.2 released in 2002 was a milestone because it added significant third party programmer support to FalconView. As programmers learned how they could extend the functionality of FalconView, a plethora of new applications were developed by other government program offices and even by end users who used Microsoft Visual Basic to automate tasks for their specific needs.

Today FalconView supports a robust set of programmer interfaces which allow diverse applications to fuse their information into a single coherent picture of the user's area of interest. The users know that data produced on FalconView can be shared with other branches of the armed services and coalition partners who have PFPS through the Foreign Military Sales Program.

Because the federal government has funded the development of FalconView, it is a non-proprietary GOTS application and is free of any license fees for government use. This includes the use of the Software Developers Kit (SDK) which documents the interfaces for use by government developers and contractors working on government programs. Finally, there are established end user support structures in place for all services including 24 hour help desks, and System Support Representatives in the field.

## *Ease of Use*

Ease of use is not a discrete quantity that can be measured in a system. There are constant trade offs when mixing ease of use, functionality and flexibility. A tool like MapQuest®, is easier than FalconView within its domain but it obviously lacks the features and flexibility required for aircraft mission-planner and therefore would be very hard or impossible to use in the mission-planning domain. At the other end of the continuum are tools such as ArcView™ or MapInfo® which expose many more options to the user but require a steeper learning curve than FalconView. FalconView's goal has always been to allow a user to be productive with less than a half day of training while providing enough features and flexibility that the experienced user is not limited by the application. Today most FalconView users have never taken a formal training course and they are capable of installing their own software, managing their own map data and performing their day-to-day operations without outside help.

As the DoD moves to a network centric architecture, there is often a belief that a thin-client such as an application running in a web browser, will assure ease of use, but if the functionality is missing in a thin client, the user is stuck with very few options. A thicker client can be easy to use but like any system, it requires significant dedication during the development to get the mix correct. A network architecture cannot assure software usability.

## *Interoperability*

FalconView began life as a traditional "stovepipe system" but it was valued for its ease of use and functionality over other "stovepipe systems." As more features were added and more communities adopted FalconView, it became obvious that all the communities could not be satisfied by a single monolithic program. Therefore, the interfaces were opened up, first by publishing Interface Control Documents (ICDs) on the data formats and later by creating programmers interfaces to the core software.

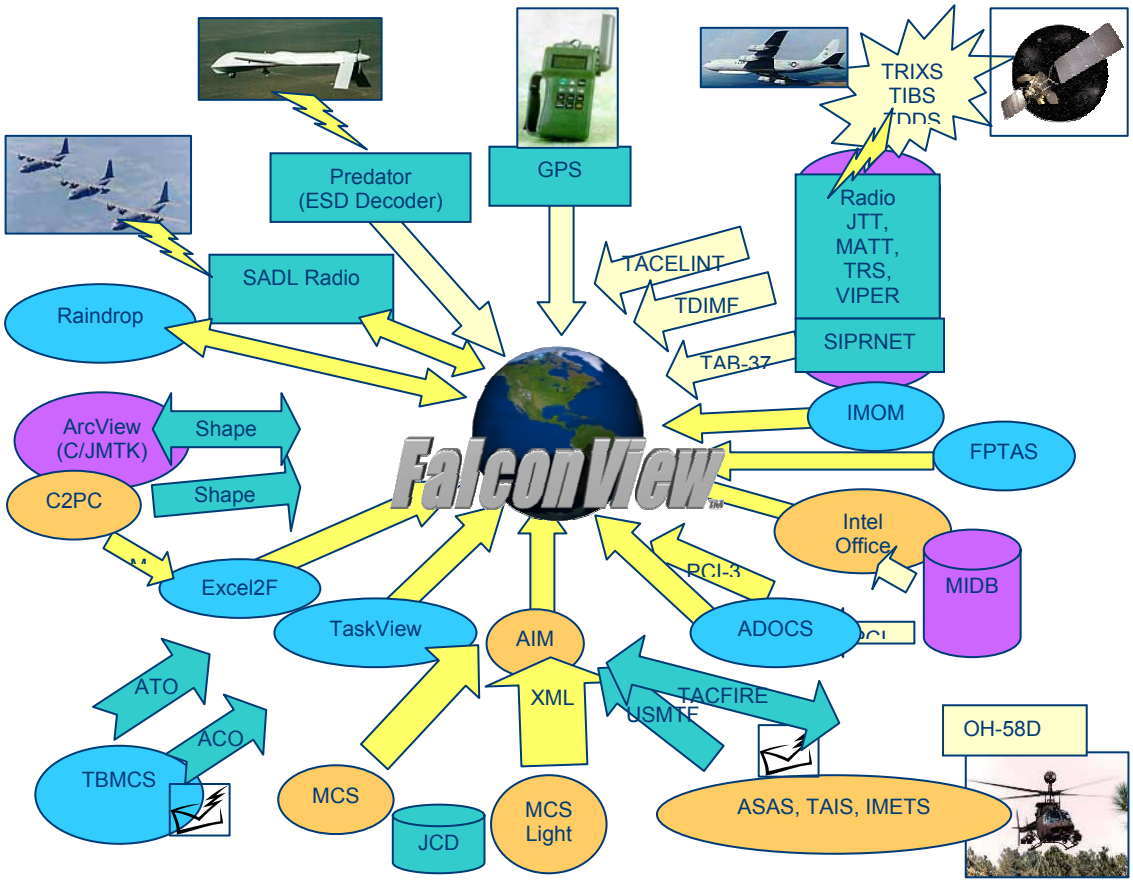


**Figure 1: Some of the systems currently sharing data with FalconView**

Today FalconView has been incorporated into a large number of systems many of which are not part of its initial target audience. It is used in applications as diverse as whale tracking, searching for MIA's in Vietnam, tracking drug runners, and producing the President's daily briefing booklet. The DoD contractor community now has many development groups who have used the Software Developer Kits to integrate FalconView with their applications. There are currently over 450 registered developers and since

there are no license restrictions within the DoD, the actual number of developers is likely much greater.

The following list shows a few of the programs, which are using these developer interfaces:

- FPTAS – Calculates areas where enemy man-pad would likely be positioned to get a clear shot at an aircraft take off or landing
- FBCB2 overlay in FalconView – Allows Army aviation to share FBCB2 blue force tracking on FalconView on a kneeboard computer
- Multi-predator – Displays the location of multiple predator tracks in real time on FalconView
- C130 EW trainer – Uses FalconView to lay down training threats which then become simulated for on board training.
- Oilstock Overlay – Used by DIA to view intel data in Oilstock format on FalconView
- Dynamic-Debrief tool –User developed tool to synchronize multiple GPS playback with video capture.
- TopScene – Gives 2D feedback of 3D display on FalconView
- Environment Processor (EP™) - Evans & Sutherland's interactive 3D visualization to FalconView
- PCDS – Personal Computer Debriefing System displays output on FalconView
- Pioneer UAV, Navy Swarm UAV – Planning and display of UAV positions
- SADL Link – displays data sent across a SADL radio to a kneeboard computer

But there is more to interoperability than just being able to pull or push data from one system to another. The users need to obtain information from the data, which requires the ability to view the data in a familiar context. The data must be timely and if it requires a separate analyst to massage the data, then it is very often not used or not available in time. FalconView's ease of use enables the warfighter to perform the types of analysis that have traditionally only been available to the one computer expert in the back room.

The Air Force Combat Support Office was charged with creating a suite of tools to integrate the wide variety of data sources available to the Combined Air Operations Center (CAOC) in a single program. In their first version they chose to use a powerful COTS GIS package that could perform ad-hoc analysis of the data. The problem they found was that the system required a dedicated operator with enough training on the software to make use of its power. Their next version of tools leveraged FalconView and while some of the flexibility may have been lost, the system can be used by a much wider audience. Today, both sets of tools are available, one for the advanced operator and one for the typical user.

## *GIS Functionality*

A Geospatial Information Systems is a software system which combines a geographic display (a map) with a database which allows queries based on the geography. A

simplistic GIS system might allow a user to collect and plot the locations of all Starbuck Coffee Houses and all Krispy Kreme doughnut shops and be able to do queries such as find all the places where a Starbucks and Krispy Kreme are within 1 mile of each other.

There are obvious military applications for GIS systems for instance:

- Find all the sensitive (non-combat structures) near a target of interest
- Find areas where a route passes within a danger zone
- Analyze a drop-zone to ensure the terrain is suitable

FalconView is not a general purpose GIS tool but uses GIS techniques under the covers to perform similar analysis without adding complexity for the user. The user rarely knows or cares what algorithms are being used internal to the application.

## OGC Standards

Recently the OpenGIS Consortium (OGC) has produced a number of standards which attempt to create a minimum level of interoperability among web-based GIS systems. As these standards are adopted by more systems, it becomes possible to automate the exchange information between OGC compliant systems. The DoD has been slower than the commercial world at adopting these standards but its recent focus on Network Centric Warfare is changing that.

The OGC standards define two basic types of services Web Feature Services (WFS) and Web Mapping Services (WMS). Web Mapping Services allows a client to perform a query to a server and get back a picture (JPG or PNG) of an area of interest with desired data. Web Feature Services allow a client to perform a query and get back an XML description of the features in the area of interest. The OGC also defines the schema of the XML used to make the query and to return the results. This is known as Geospatial Markup Language (GML).

Currently the OGC standards are fairly new and many venders support them to provide a minimal level of interoperability. Venders like ESRI support OGC standards but encourage developers to use their richer set of (non OGC compliant) interfaces for clients who want greater performance or flexibility. These interfaces typically use open web standards for the low level protocols such as XML, SOAP and WSDL but there is no commonality at higher levels. FalconView currently does not have a funded requirement that requires OGC interfaces but the internal architecture would support the addition of these interfaces if a new feature needed them.

## Web Based Interfaces

Portable Flight Planning Software users have traditionally not had access to robust networks in the field or in flight. This has made most network centric functionality impractical. As the network infrastructure has evolved some of the technology has become more appealing. Time sensitive data such as threat and blue-force positions are currently readily available on FalconView through the SIPRNET, JWICS or through

satellite radios. The next step will be to get and publish data through WMS and WFS services or by integrating technology such as ArcSDE and ArcIMS into FalconView.

A likely architecture would use ArcSDE as a backend in FalconView and enabling queries to ArcIMS servers to fetch information such as weather or target information. This would allow users to keep static data, such as charts and imagery, local for fast access and query for data of temporal significance. It would allow users to continue to use their variety of tools available today while leveraging the growing number of networked services.

A second paradigm for web access to data would be to allow a networked update of large data sets. Traditionally chart currency has been achieved by the National Geospatial-intelligence Agency (NGA) producing chart update CDs which are mailed to users who insert the CD and use FalconView to copy updated data over any that was out of data. As connectivity improves these updates could be automatically download similar to the way most computers receive new virus signatures today.

## *Comparing C/JMTK with FalconView*

C/JMTK and FalconView do have some overlapping functionality but there are also a number of complimentary technologies in both. C/JMTK is a "toolkit", it is not an application. If you install C/JMTK on your computer there is no "exe' to run. It provides a number of software modules which can be integrated into a program to provide mapping functionality. FalconView is an application with a number of modules designed specifically for use within the FalconView application.

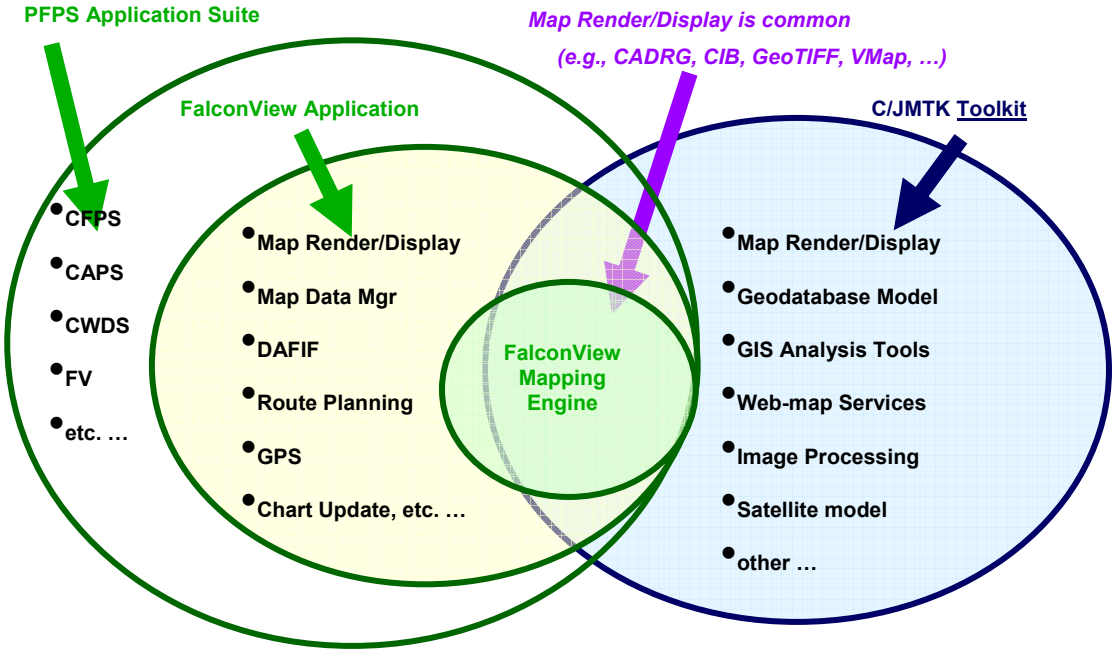


**Figure 2: C/JMTK and FalconView functionality (based on a diagram by Paul Brown of MITRE)**

Figure 2 shows the relationship of some of the components of PFPS, FalconView and C/JMTK. Most of the overlap of FalconView and C/JMTK falls in the area of the FalconView Mapping Engine. The Mapping Engine is a set of COM components used in FalconView and JMPS for rendering map information as a background. Traditionally this data has been scanned paper maps (CADRG) or satellite imagery (CIB). It also supports Vector Product Format data (VMAP, DNC), and commercial standards such as GeoTIFF and MrSID data. C/JMTK can also display these formats of data. FalconView has traditionally been more focused on raster data and C/JMTK on vector data and both have some areas that are stronger than that of others.

Outside the overlap regions is functionality such as robust route planning, large scale web-based map services, DAFIF, and CHUM handling. Incorporating C/JMTK functionality into the FalconView application and the packaging FalconView functionality for use in C/JMTK would enhance both products.

## *Conclusions*

It makes sense to leverage all of the best technologies available to the DoD where one size does not fit all. FalconView meets much of the DoD's user's needs as a system which is easy to use, yet flexible and extensible enough to provide the functionality demanded by a mission critical application.

Open web standards are making it easier to share data among systems. The transformation of systems to these new standards is making system level interoperability practical but there is still application level work required in each problem domain. Leveraging the technology available in FalconView and C/JMTK will allow this transformation to progress quickly while continuing to provide tools that the warfighter knows how to use.