

Falcon Pro Line 21: Overview, List of Features and Improvements

Jul 29, 2016

Classification: Maint&Ops

F10	F20		F200	F50		F900						F2000						F7X	
	-	-5		-	EX	A/B	C	EX	EASy	DX	LX	-	EX	EASy	DX	LX	S	LXS	
					X							X	X						



2 REASON

EXECUTIVE SUMMARY

Dassault Falcon is pleased to announce the acquisition and availability of the **Dassault Falcon Pro Line 21 avionics upgrade for the F50EX/F2000/F2000EX fleet**. This upgrade implements several new avionics features, capabilities and the most advanced technology to help F50EX/F2000/F2000EX fleet operators optimize the use of their aircraft.

Key features of Falcon Pro Line 21 include:

- Compliance with ATM mandates

- Mitigation of obsolescence issues
- Improved safety and situational awareness,
- Improved navigation capabilities,
- Improved surveillance capabilities,
- Improved communication capabilities,
- Performance enhancements based on operator feedback.



INFORMATION

Falcon Pro Line 21 consists of both software and hardware upgrades proposed through Supplemental Type Certificate (STC) packages. The following is a brief introduction to each option.

1. Pre-requisite

To install Falcon Pro Line 21 (PL21), the aircraft must be equipped with Rockwell Collins Pro Line 4 (PL4) avionics and FMS 6100.

2. Limitation

Falcon Pro Line 21 can be installed with HUD equipped aircraft. Falcon Pro Line 21 certification has not been approved for HUD use on approach.

3. Presentation

Falcon Pro Line 21 is split into the following packages:

1. SBAS GPS (WAAS & EGNOS) - Core Package⁽¹⁾
 - *Improved navigation capabilities*
 - *Pre-requisite for: ADS-B out, FANS 1/A and PL4 to PL21 (LCD+LPV) STCs*
2. PL4 to PL21: LCD Displays w/ FMS 6.1 (LPV)⁽²⁾
 - *Improved safety, situational awareness, improved reliability and navigational capabilities*
 - *Pre-requisite: Pro Line 4 avionics*
3. ADS-B Out
 - *Improved surveillance capabilities*
 - *Compliance with ATM requirements*
 - *Pre-requisite: SBAS GPS (Rockwell Collins STC ST01433WI-D)*

4. XM graphical weather

- *Improved safety and situational awareness*
- *Included in Pro Line 4 to 21 STC as an option (STC ST11041SC or ST11047SC)*

5. Dual Jeppesen Charts

- *Improved safety and situational awareness*
- *Included in Pro Line 4 to 21 STC as an option (ST11041SC or ST11047SC)*

6. FANS 1/A+ ⁽³⁾

- *Improved Communication Capabilities*
- *Pre-requisite: Pro Line 4 to 21 STC (ST11041SC or ST11047SC) and Level D SATCOM*

7. Synthetic Vision System (SVS) ⁽⁴⁾

- *Improved safety and situational awareness*
- *Pre-requisite: Pro Line 4 to 21 STC*

The availability of these packages is described in §4. Certification

⁽¹⁾ The “SBAS GPS (WAAS & EGNOS)” package is defined as the Core package, since it is a pre-requisite for ADS-B Out, PL4 to PL21 and FANS 1/A+. **It is a Rockwell Collins STC.**

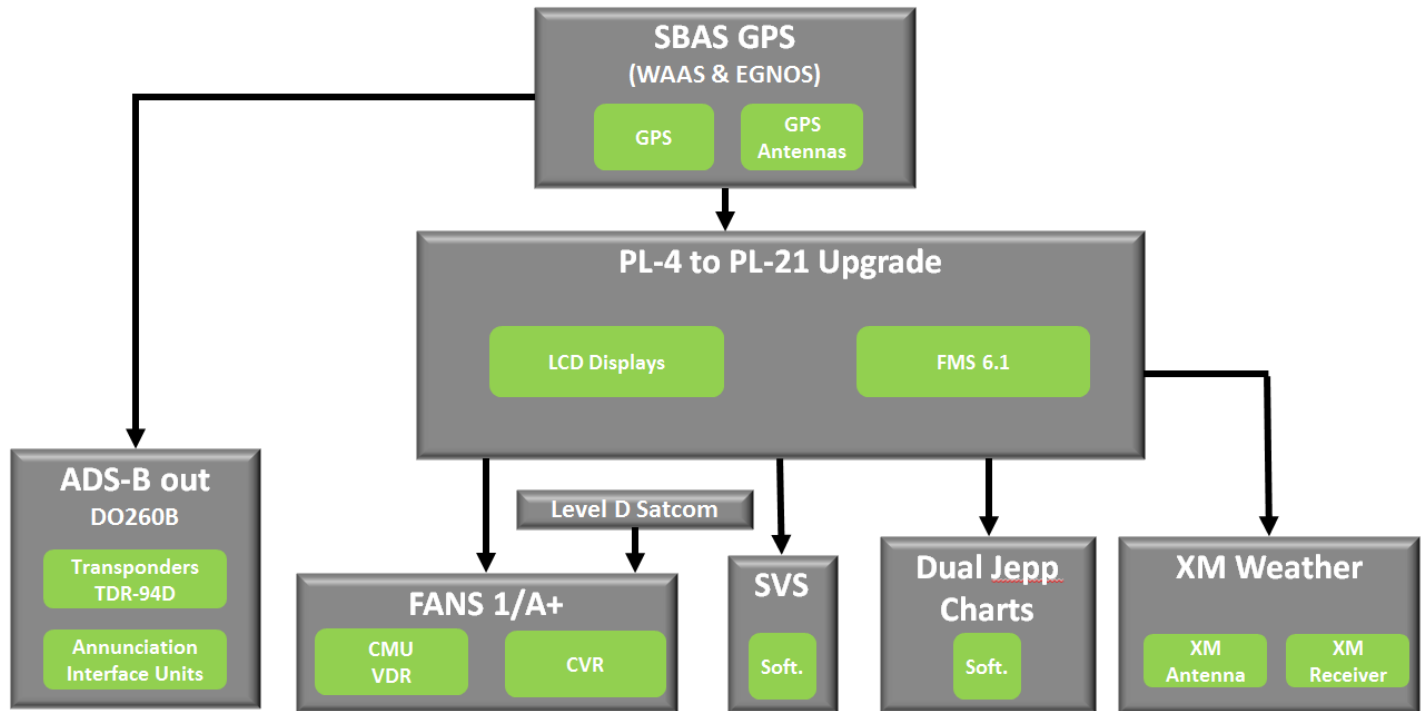
⁽²⁾ This Pro Line 4 to Pro Line 21 Dassault STC installs LCD displays and enables the LPV capability.

⁽³⁾ For FANS 1/A+, the aim is to have it compatible with the different SATCOM solutions available (Aviator 700D, MCS 7120, Aircell Axxess II, amongst others).

⁽⁴⁾ **It is a Rockwell Collins STC.**

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4. Certification

The following table provides:

- STC numbers of certified packages depending on certification authorities (FAA, EASA, ANAC and TCCA)
- Estimated dates of entry into service of Falcon Pro Line 21 packages which are currently in development

Package	Certification			
	FAA	EASA	ANAC	TCCA
SBAS GPS (WAAS & EGNOS)	X RC* STC ST01433WI-D	X STC 10016518	X STC 2009S04-01	X STC SA09-17
LCD Displays w/ FMS 6.1 (LPV) F50EX	X STC ST11041SC	X STC 10045378	Not applied	X STC ST11041SC
LCD Displays w/ FMS 6.1 (LPV) F2000/2000EX	X STC ST11047SC	X STC 10048395	X STC 2015S11-05	X STC ST11047SC
ADS-B Out (DO 260A) F50EX	X STC ST02963NY-D	X STC 10041723	Not applied	X STC ST02963NY-D
ADS-B Out (DO 260B) F50EX	X STC ST02963NY-D	Expected 2H16	Expected 2H16	Expected 2H16
ADS-B Out (DO 260A) F2000/2000EX	STC ST02962NY-D	STC 10041722 for PL4 only	2012S09-03 for PL4 only	ST02962NY for PL4 only
ADS-B Out (DO 260B) F2000/2000EX	STC ST02962NY-D	Expected 2H16 for PL21 only	2012S09-03 for PL21 only	ST02962NY for PL21 only
Dual Jeppesen Charts F50EX	X STC ST11041SC	X STC 10045378	Not applied	X STC ST11041SC
Dual Jeppesen Charts F2000/2000EX	X STC ST11047SC	X STC 10048395	X STC 2015S11-05	X STC ST11047SC
XM graphical weather F50EX	X STC ST11041SC	X STC 10045378	Not applied	X STC ST11041SC
XM graphical weather F2000/2000EX	X STC ST11047SC	X STC 10048395	X STC 2015S11-05	X STC ST11047SC
FANS 1/A+ F50EX	X STC ST04044CH	Expected 1H17	Expected 1H17	Expected 1H17
FANS 1/A+ F2000/2000EX	X STC ST03586NY	Expected 1H17	Expected 1H17	Expected 1H17
SVS F50EX	X RC* STC ST11165SC	Not applied	Not applied	Not applied
SVS F2000/2000EX	X RC* STC ST11162SC	Not applied	Not applied	Not applied

*RC : Rockwell Collins

5. Downtime and Implementation on the Aircraft

4.1 Downtime

The following table provides you with the estimated number of calendar days required to comply with Falcon Pro Line 21 packages.

These estimates are for informational purposes only. Actual downtime may vary according to the aircraft configuration, scope of other work being performed at the same time, and combination of packages being installed. Access to a given zone will be potentially used for the installation of several packages. Your Authorized Service Center will be able to provide a detailed quotation for the retrofit of your Aircraft.

Package	Installation conditions	Estimated downtime
SBAS GPS (WAAS & EGNOS)	Defined as baseline	3 days
LCD Displays w/ FMS 6.1 (LPV)	Simultaneously with baseline	28 days
	Separately	30 days
ADS-B Out	Simultaneously with baseline	5 days
	Separately	15 days
Dual Jeppesen Charts	-	3 days
XM graphical weather	Access provided by '2C Check'	4 days
	Separately	6 days
FANS 1/A+	Simultaneously with baseline	10 days
	Separately	18 days
SVS	Simultaneously with baseline	3 days
	Separately	5 days

4.2 Implementation on the Aircraft

4.2.1 "SBAS GPS (WAAS & EGNOS)" Core package

This package consists in the installation of mainly:

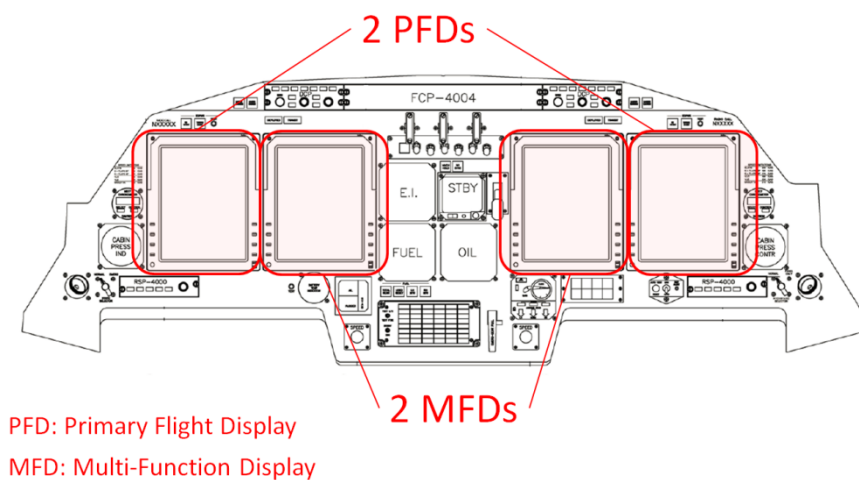
- Two SBAS GPS,
- Two GPS antennas,
- Wiring between GPS antenna and SBAS GPS

4.2.2 “LCD Displays w/ FMS 6.1 (LPV)” package

I. Overview

This package consists in the upgrade from Pro Line 4 to Pro Line 21 avionics via the installation of mainly:

- Four LCD displays (AFD-3010E)
- FMS computers
- Control Panels



II. HUD Limitation

The ProLine 21 system installed via this STC is not compatible with the existing HUD (heads-up display).

As stated in the AFMS: “If a HUD system is installed, the HUD cannot be used and must be in the stowed position.”

4.2.3 “ADS-B Out” package

This DO 260B package consists in the installation of mainly:

- Two transponders performing ADS-B out functionality,
- Two annunciator interface units

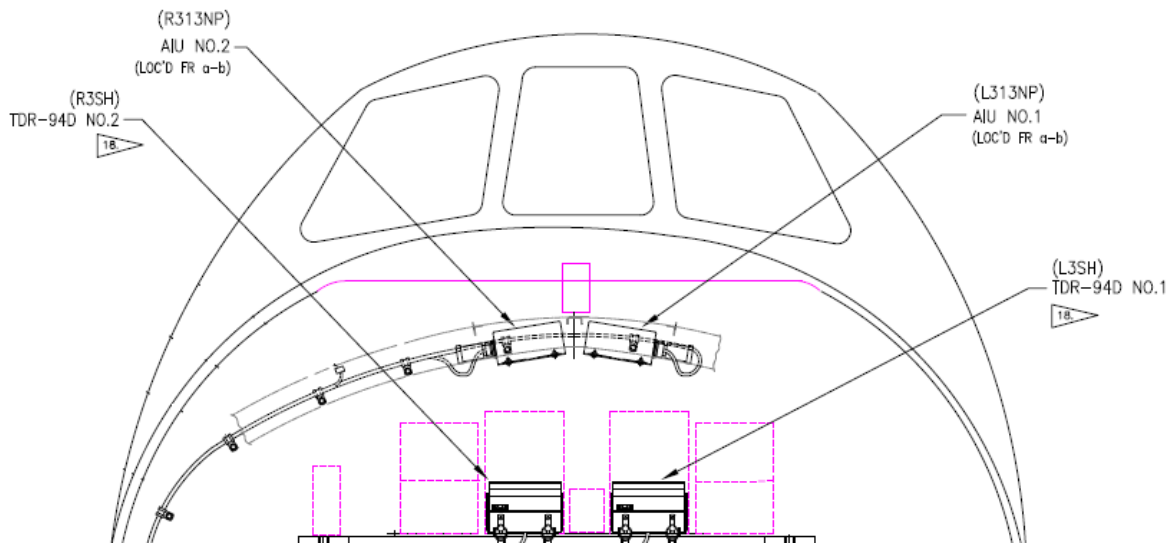


Diagram of a F50EX
Wiring work needed (layout not contractual)

4.2.4 "XM Weather" package

This package requires the LCD displays including FMS 6.1 (option 2).

This package consists in the installation of the XM Satellite Weather System (Antenna and Receiver).

4.2.5 “Dual Jeppesen Charts” package

This package requires the LCD displays including FMS 6.1 (option 2).

This package consists in the installation of the Dual Jeppesen Charts.

4.2.6 "FANS 1/A+" package

This package requires the LCD Displays w/ FMS 6.1 (LPV) (option 2).

The FANS 1/A+ cert also requires a Level-D SATCOM and a dedicated VHF antenna.

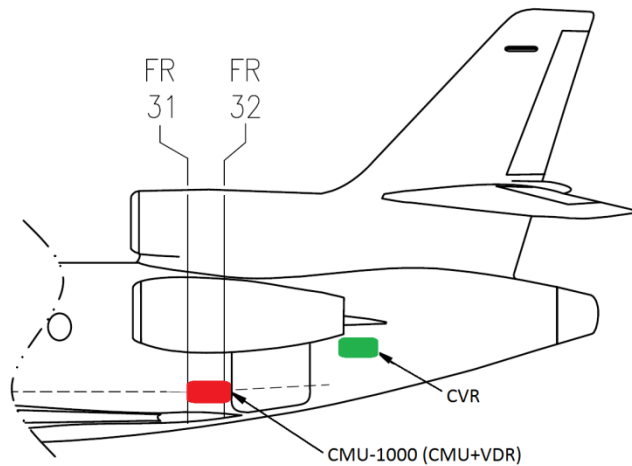
The work scope consists in:

- The replacement of the CVR (cockpit voice recorder) capable of recording data messages
- Installation of CMU-1000 (Communication Management Unit and VDR combined) which is a communications router that supports data link and AFIS services as well as VHF data radio capability.

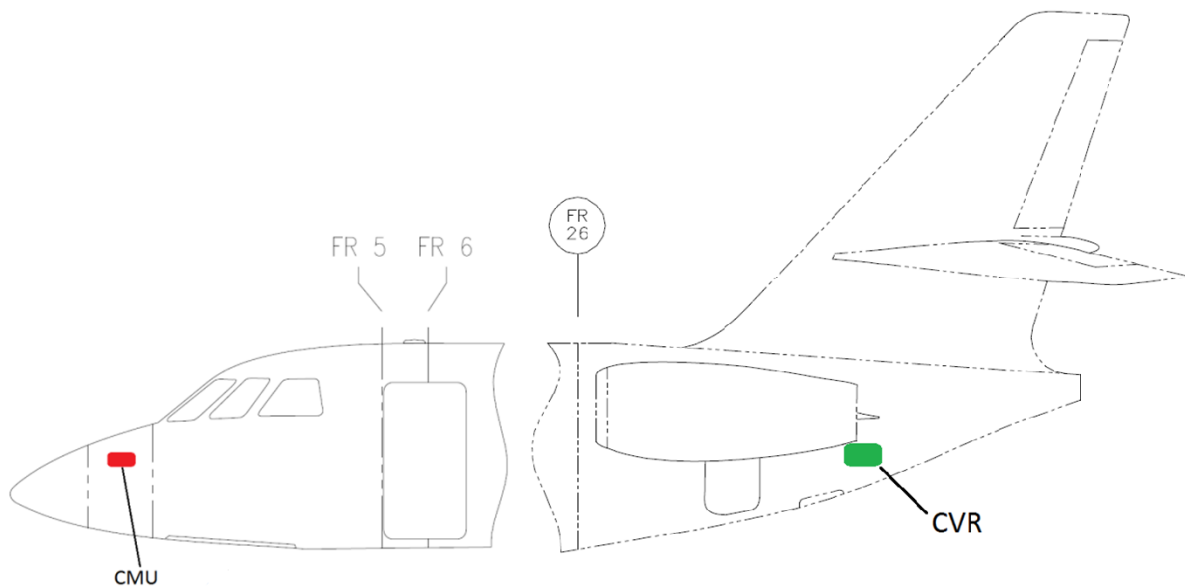
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- Replacement of the cockpit area microphone and aircraft personality module
Downtime for this work is approximately 15 days.



*Diagram of a F50EX
Wiring work needed (layout not contractual)*



*Diagram of a F2000
Wiring work needed (layout not contractual)*

4.2.7 “Synthetic Vision System (SVS)” package

This package requires the PL4 to PL21 STC: LCD displays including FMS 6.1 (option 2). This package consists in the installation of the SVS.

5. Schedule, Tooling

5.1 Schedule

Contact Dassault Aircraft Services, Dassault Falcon Services or your Authorized Service Center to quote the installation.

5.2 Tooling

Please see the individual STC documentation for any special tooling/test equipment required

6. Documentation

The supplemental flight documentation is included in the following documents:

- Supplemental AFM for ADS-B Out,
- Supplemental AFM for the LCD Displays with FMS 6.1 (LPV),
- Supplemental AFM for FANS 1/A+.

Each supplemental AFM handles limitations, emergency procedures, abnormal procedures, normal procedures, performance and systems topics.

The maintenance documentation is included in Instructions for Continued Airworthiness documents, which deal with maintenance instructions for equipment involved in the Falcon Pro Line 21 packages such as:

- SBAS GPS and its antennas,
- ADS-B Out transponders,
- AFD-3010E LCD Displays,
- Control panels,
- FMS computers,
- Communication management unit

7. Ordering

Please contact your service center to order packages of Falcon Pro Line 21.

8. More information

For more information please contact STC@falconjet.com or visit us at www.dassaultfalcon.com/STC

9. Training

- New Flight Manual Supplements are included in the STC packages.
- Operational documentation is being created to give pilots an insight about the systems installed via STCs and how to operate them.
- The necessity for full simulator training is being evaluated.
- LOA assistance is available for flight departments

10. Support

Technical support is available from Dassault Falcon Jet and Dassault Aviation at: commandcenter@falconjet.com or commandcenter@dassault-aviation.com

11. Annex

“SBAS GPS (WAAS & EGNOS)” Core package

Improved navigation capabilities

This package consists in the installation of the SBAS GPS (WAAS & EGNOS).



The SBAS GPS provides increased position accuracy and removes the GPS RAIM FDE checking requirement (for US registered airplanes). Such increased accuracy allows airplanes to rely on GPS for most of the flight maneuvers, including precision approaches in airports.

The SBAS GPS is a pre-requisite for the following package(s):

- ADS-B Out,
- LPV
- FANS 1/A+.

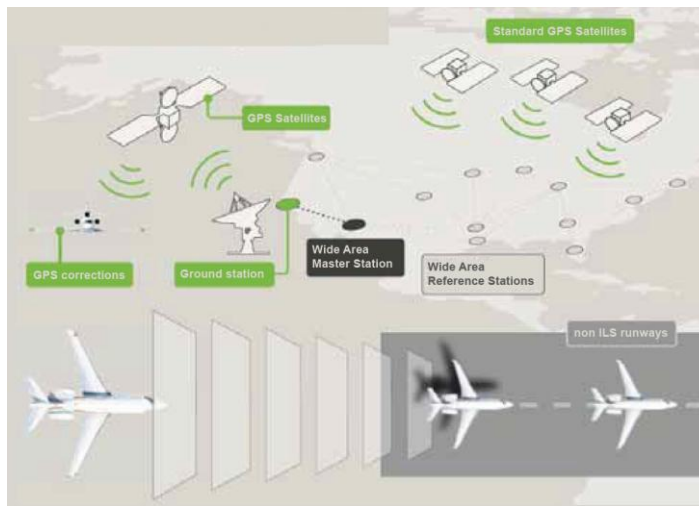
“LCD Displays w/ FMS 6.1 (LPV)” package

Improved navigation capabilities

LPV is one of the most important features of FMS 6.1.

LPV significantly increases the number of accessible airports, especially in adverse weather conditions.

This feature offers new lines on minimums on RNAV approaches, with typically lower MDA/DA than those which may be associated with LNAV/VNAV.



The capability proposed is compatible with the Wide Area Augmentation System (WAAS), as well as the European Geo Navigation Overlay System (EGNOS) and is expected to be also compatible with other future Space-based Augmentation Systems (SBAS).



As of today, more than 3500 LPV approaches are published in the USA and much more are on the way. Similar approaches are also being published in Europe (France, Switzerland, UK, Germany ...), since EGNOS Service of Life was declared operational (2011).

Falcon Pro Line 21 provides a unique design, intended to maximize commonality with ILS or

RNAV approaches and therefore eases pilots transition to this new type of approach.

After LPV feature, the other FMS 6.1 features are the following:

- **Vectors-to-Final Approaches**, which reduces crew workload in busy terminal environment
- **“Circle-to-Land” Procedures**, which reduces the crew workload in a busy terminal environment by allowing the pilot to automatically conduct a circle-to-land maneuver
- **Multiple RNAV Approaches to the Same Runway End**, which increases availability of approaches per runway without need for customization of the Navigation Database

This package also installs adaptive flight displays AFD-3010E (LCDs) with the FMS 6.1. LCD displays exhibit advantages that Cathode Ray Tube (CRT) displays cannot match. In fact, CRT displays are soon to become obsolete while LCDs are taking over the market. First, LCD displays increase safety by increasing situational awareness through dynamic visual displays (video display capability) and XM graphical weather. Having such valuable information on the primary flight display reduces the workload on the pilot. These LCDs are also lighter and require less maintenance which reduces the cost of ownership compared to the CRTs. They are also easily installed on an aircraft thus reducing the downtime.



Source: Rockwell Collins

“ADS-B Out” package

- *Improved surveillance capabilities*
- *Compliance with ATM requirements*
- *Compliance with mandate*

This package is fundamental to the future Air Traffic Management (ATM), as a further step after Elementary and Enhanced Surveillance.

This package provides the aircraft position and intent broadcast from the onboard transponder to ADS-B receivers on the ground.

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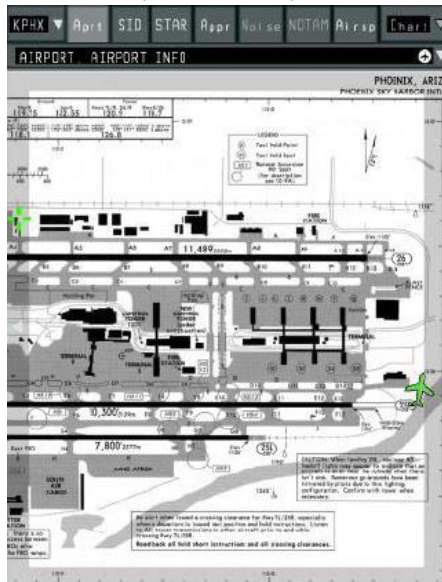
This package allows a better use of the airspace, provides routing advantages for ADS-B equipped aircraft.

On airspace not covered by radar, the ADS-B infrastructure allows to improve the ATC surveillance capability, therefore allowing reduced separation between aircraft. ADS-B infrastructure is already fully implemented in the US. ADS-B infrastructure is also being deployed in Europe.

For further details, please refer to FSA 34-50-006.

“Dual Jeppesen Charts” package

Improved safety & situational awareness



This package introduces redundancy for the use of the electronic Jeppesen charts: the charts database is stored in each DU, bringing the number of data sources up from one to four.

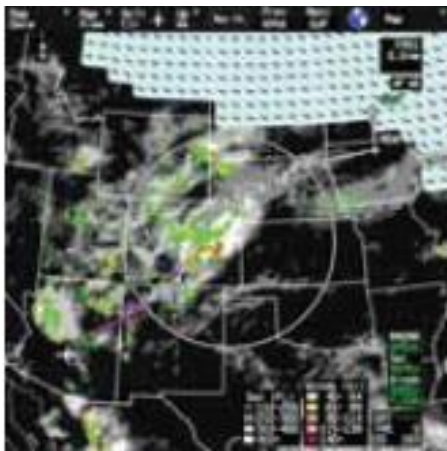
As a consequence, the probability of losing access to this function and having to revert to back-up charts is significantly reduced.

This package improves the situational awareness by displaying Jeppesen airport maps and approach charts with SIDs, STARs, NOTAMs, Noise procedure and Airspace.

This package supports Paperless Terminal Approach Charts and Airport Maps requirement.

“XM graphical weather” package

Improved safety & situational awareness



This package provides uplinked graphical weather information broadcast by XM® (Weather Information Network).

XM's advanced digital satellite broadcast infrastructure provides the optimum method of transmitting the XM WX satellite weather data to aircraft flying anywhere within the contiguous United States and coastal waters. XM's advanced technology allows for dependable reception of the XM signals in any weather conditions and features affordable, unlimited use subscription plans and wide ranging display options.

The XM Weather provides the flight crew with superior weather information to optimize the route according to operational constraints in terms of comfort, safety, fuel consumption and arrival time.

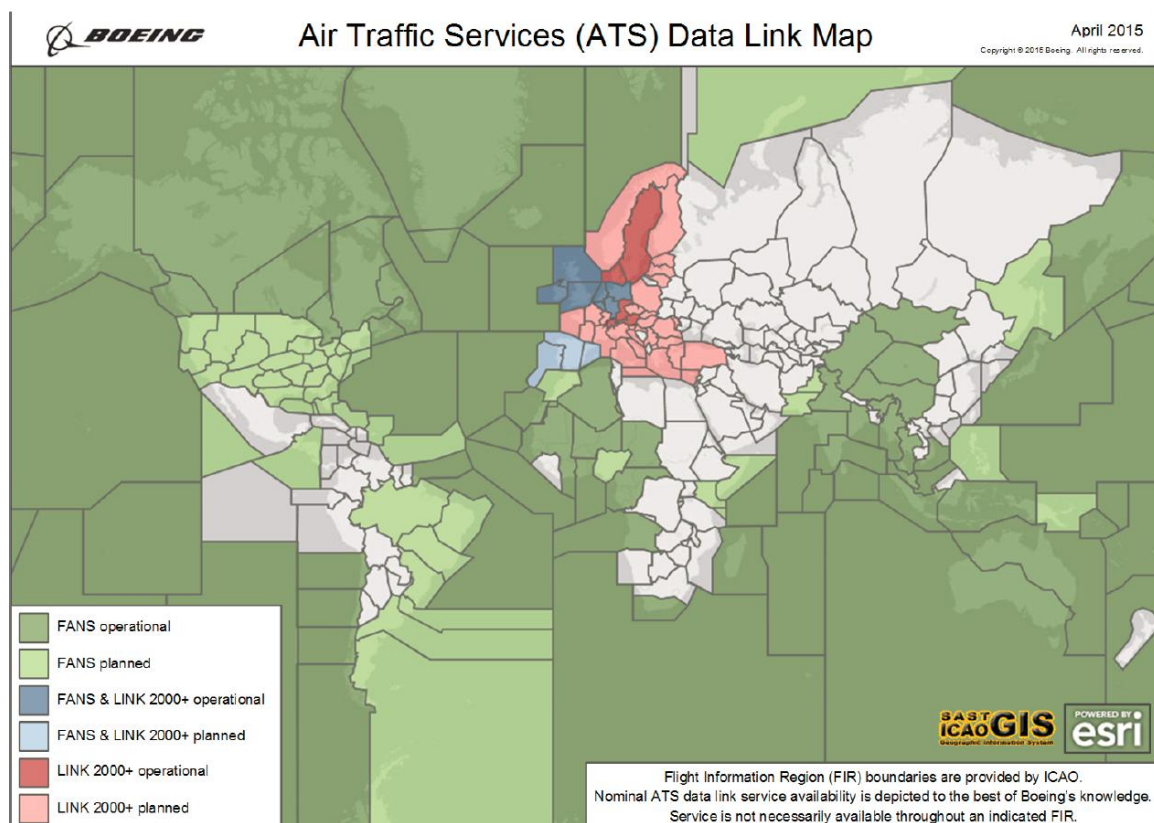
Information is automatically updated and stored and then is always available for display.

“FANS 1/A+” package

- Improved communication capabilities
- Compliance with mandate

FANS 1/A+ was initially designed to improve communication and surveillance over remote areas taking benefit of data communications over SatCom networks.

The related services are available in most oceanic airspaces worldwide, and may also support routing benefits (eg. over North Atlantic).



FANS 1/A worldwide availability

This package introduces new ATC data communication capabilities on remote and oceanic routes, supporting both CPDLC and ADS-C services available in FANS 1/A+.

While CPDLC allows the crew communicating with ATC through formatted data link messages as a substitute to VHF and HF standard voice communications, the ADS-C allows the aircraft sending automated reports as required by the ATC. These reports include information related to the aircraft position, velocity and intent as well as weather conditions.

They can typically be contracted by the ATC when flying over remote areas, while the aircraft is no longer under radar coverage and are a substitute to standard position reports through HF.



To perform these functionalities, this package consists in the installation of the new CMU-1000.



The CMU-1000 is an airborne communications router that supports data link service access between aircraft data link applications and their corresponding ground service providers (AOC, CPDLC, ADS-C).

Access to the ground network is performed by the following links:

- Satellite communications (SATCOM)
- Very High Frequency (VHF)

This unit also has a VHF data radio (VDR) embedded.

“Synthetic Vision System (SVS)” package

Improved safety and situational awareness

The SVS allows the crew to navigate in low visibility via a virtual landscape image that provides the topology of the surrounding area. This technology relies on a database of information from which the images are generated and displayed on the primary flight display of the pilot. It increases safety, as terrain can now be known regardless of the weather outside and time of the day.



ANNEX: list of acronyms

ABOC	Automatic Bleed Override Controller
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AFD	Adaptive Flight Display
AFM	Airplane Flight Manual
AOC	Aeronautical Operational Communication
ATC	Air Traffic Control
ATM	Air Traffic Management
CMU	Communication Management Unit
CPDLC	Controller Pilot Data Link Communication
CVR	Cockpit Voice Recorder
DL	FMS Data Loader
DU	Display Unit
EGNOS	European Geostationary Navigation Overlay Service
FANS	Future Air Navigation System
FMS	Flight Management System
LPV	Localizer Performance with Vertical guidance
MFD	Multi Functional Display
NZ	FMS Navigation Computer
RAIM	Receiver Autonomous Integrity Monitoring
SBAS GPS	Satellite Based Augmentation System GPS
STC	Supplemental Type Certificate
TOLD	Take Off and Landing Distance
VDR	VHF Data Radio
WAAS	Wide Area Augmentation System