

A close-up, low-angle view of a Boeing airplane's wing and engine, showing the leading edge of the wing and the large engine nacelle. The background is a bright, hazy sky.

ATC Datalink on Boeing Airplanes

Datalink Performance Monitoring Seminar
March 2013

Brad Cornell

FANS-1

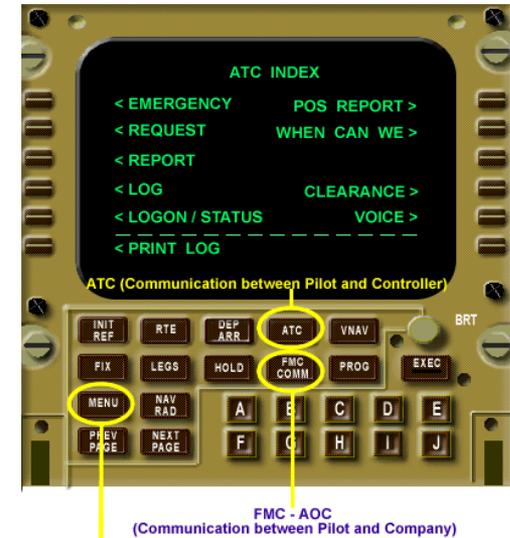
- FANS-1 introduced on 747-400 in 1995
- Now available as standard or optional on all recent Boeing production airplanes
 - 747-400 and 747-8 (also limited retrofit on -300)
 - 777 all models
 - 757/767 with Pegasus FMC
 - 737 from -300 on
 - 787
 - MD-11 and MD-90 with Pegasus FMC
 - 717
 - Also C-17A
- Uplink delay detection (so-called “FANS-1/A+”) on 787, 777, 757/767, 737 and 747-8
- GPS is a requirement for FANS (for UTC time accuracy)
- RNP4 certified for all FANS-1 installations
- Available subnetworks (VHF/POA, VDL2, SATCOM, HFDDL) dependent on what the operator has installed
 - AEIT to be run on specific radio/CMU complement
- On some MCDU-based airplanes, a different MCDU/faceplate has to be installed for the ATC key

FANS-1 Evolution

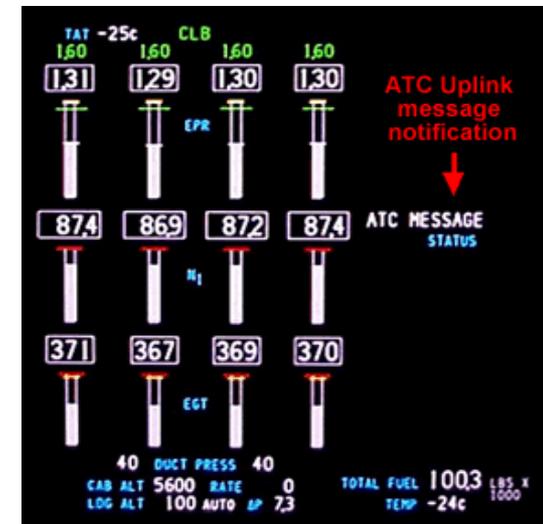
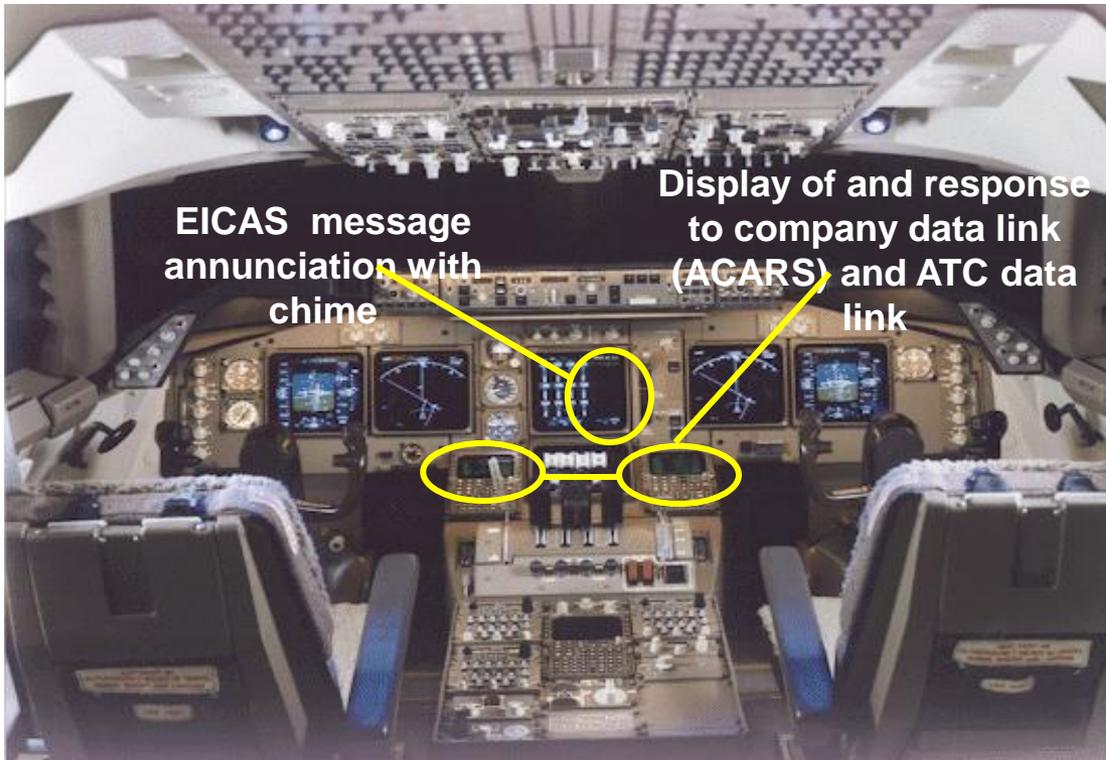
- Originally certified to DO-219/ARINC 745/ARINC 622 and ATS Systems Requirements & Objectives document (ATS SR&O)
 - 60-second one-way, 120-second two-way 95%ile requirement
- 787 and 747-8 now certified as RCP-compliant
 - DO-258A (Interop) and DO-306 (SPR)
 - Documented in ATS Capabilities document
- Functionality has also evolved
 - 10 loadable uplinks on 747-400, 15 on 757/767/777 and 25 on 787/747-8
 - Addition of uplink delay detection
 - Use of large format display on 777 and 787
 - Use of separate datablock
 - Use of glareshield-mounted response buttons
 - Dial feedback
 - Conditional clearance monitoring
 - Loading to other systems than just FMC
- Expectation that additional capabilities are required to allow crew to gain full benefits of datalink

Boeing 747 Operation

- Pilot interaction through MCDU
 - ATC key
- Alert on EICAS
- Chime
- Other MCDU-based airplanes (737, 767,...) similar

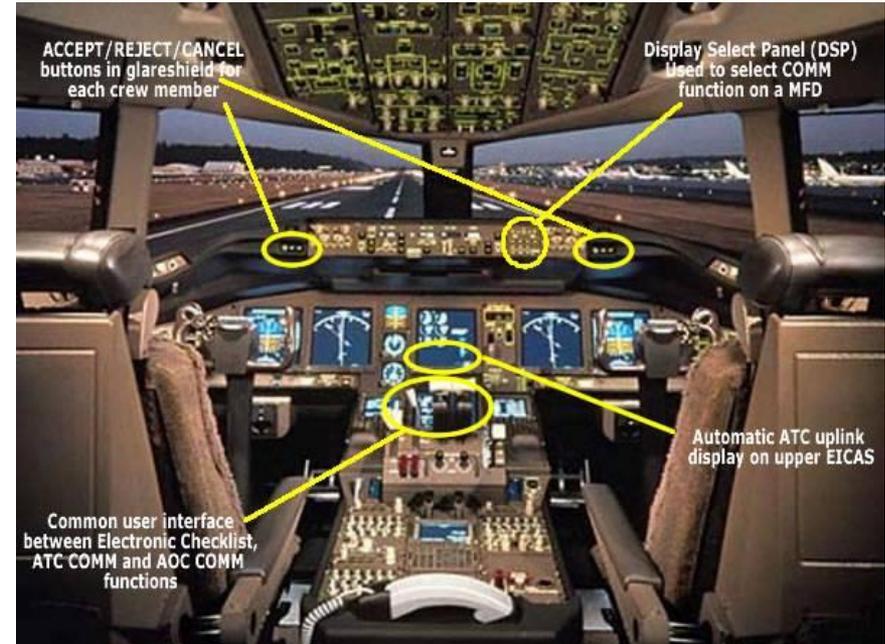


General - AOC (Communication between Pilot and Company e.g. ACARS)
 Menu key on MCDU and then ACARS prompt



Boeing 777 Operation

- Crew operation via MFD and cursor
 - Data entry on MCDU
- Data block on EICAS
- EICAS alert
- Chime
- Glareshield buttons
 - ACCEPT/CANCEL/REJECT
- Dial feedback on uplinks (e.g. MCP altitude for CLIMB TO AND MAINTAIN)



ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
ALTITUDE REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	LOGON/STATUS	POSITION REPORT
CLEARANCE REQUEST		FREE TEXT MESSAGE
		EXIT MENU

TAT +11c CLB 1322 1322

1.014 1.014

59.1 59.1

540 540

CLIMB TO AND MAINTAIN FL350

ACCEPT 0008z REJECT

TOTAL FUEL 188.6 LBS X 1000
TEMP +14c

*ATC

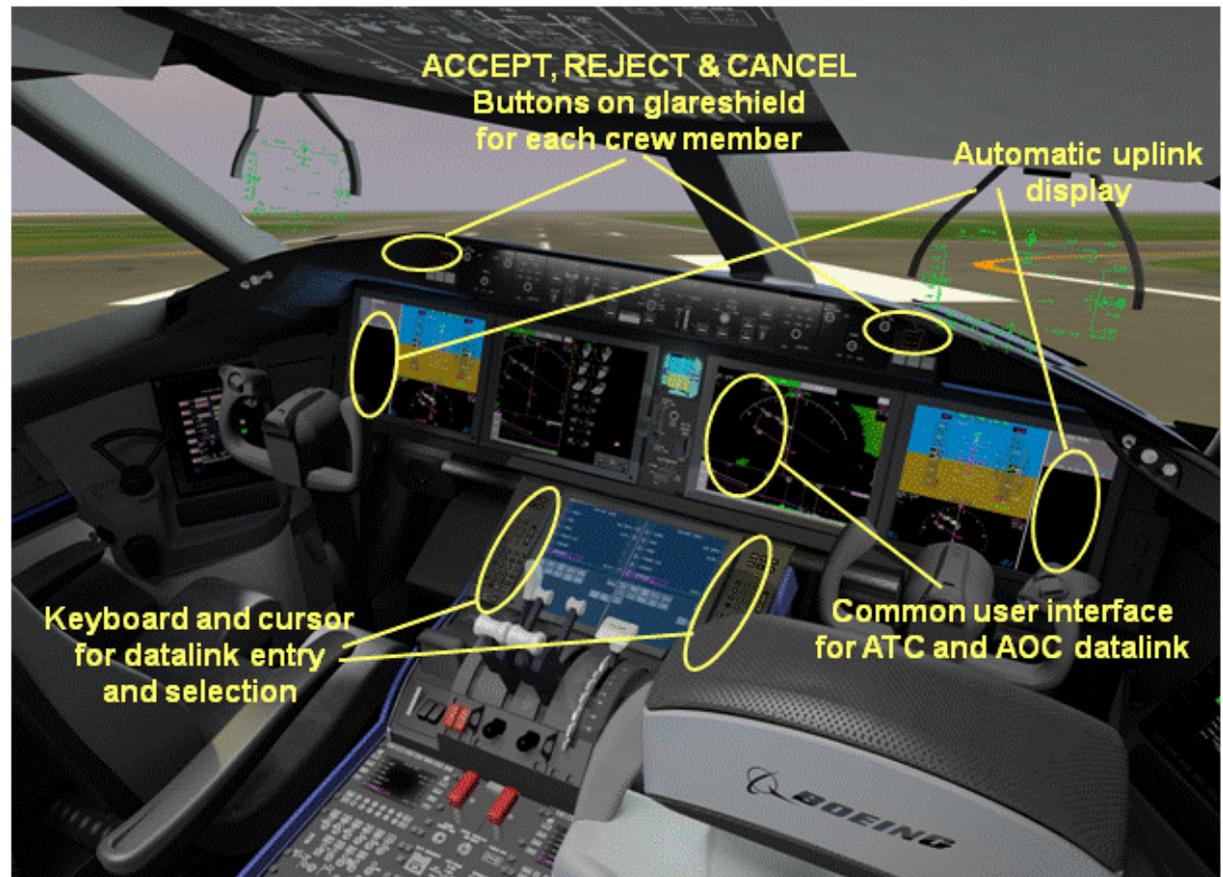
ATC Message Notification and Display

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
0011z	ATC UPLINK	
CLIMB TO AND MAINTAIN 10200M (33465FT), REPORT LEAVING 9600M (31496FT),		
DISPLAY REPORT	PRINT	CANCEL

Boeing 787 Operation

- Builds on 777 operation
- Same cursor operation
- Datablocks now located in primary view, dual, and larger
- MFD pages based on 777 but laid out for new larger displays
- Common operation

FLT # ANA123 TAIL # N7E701	
DATE 00 JAN 00 UTC TIME 00:00:00z ELAPSED TIME 01:45	1307
ATC COMM	
1307 z	FROM KZAK
CLIMB TO AND MAINTAIN FL350, REPORT LEAVING FL330, REPORT LEVEL FL350	
ACCEPT	REJECT



- FANS-2 is the Boeing name for an installation comprising:
 - FANS-1 datalink (ADS and CPDLC)
 - ATN datalink (CPDLC per the Link2000+ requirements)
 - Both FANS-1 and ATN integrated with FMC (loading of route uplinks)
 - Seamless transfers between ATN and FANS-1 connections
- FANS-2 available on:
 - 747-8 now
 - 787 from late 2013
- 777 will get FANS-1 + Link 2000+ (FANS-2 but without route loading for ATN CPDLC) in late 2013
- All other models will need to install a CMU with ATN/Link2000+ to obtain this functionality and satisfy the mandate (EC 29/2009)
 - Not possible to enable both FMC-based FANS-1 and CMU-based ATN due to different operation/HMI/Etc.

FANS-1 and ATN Displays in FANS-2

- CPDLC uses the same displays for FANS-1 and ATN
 - Unavailable options (for the smaller Link2000+ message set) are cyaned out
- Common training/documentation

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234z ROUTE REQUEST		
◆ DIRECT TO:	<input type="text"/>	
◆ ROUTE 1	◆ ROUTE 2	
◆ HEADING:	<input type="text"/> TRU	
◆ TRACK:	<input type="text"/> TRU	
◆ DEP / ARR:	<input type="text"/>	
◆ WEATHER DEVIATION UP TO:	<input type="text"/> NM	EITHER SIDE
◆ OFFSET:	<input type="text"/> NM	EITHER SIDE
<input type="checkbox"/> OFFSET AT:	<input type="text"/>	
<input type="checkbox"/> AT PILOTS DISCRETION		
<input type="checkbox"/> DUE TO WEATHER		
<input type="checkbox"/> DUE TO AIRCRAFT PERFORMANCE		
<input type="checkbox"/> MAINTAIN OWN SEPARATION AND VMC		
FREE TEXT:	<input type="text"/>	
<input type="text"/>		
SEND	PRINT	RESET
RETURN	EXIT	
SCRATCH PAD		

← FANS-1

ATN →

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234z ROUTE REQUEST		
◆ DIRECT TO:	<input type="text"/>	
◆ ROUTE 1	◆ ROUTE 2	
◆ HEADING:	<input type="text"/>	
◆ TRACK:	<input type="text"/>	
◆ DEP / ARR:	<input type="text"/>	
◆ WEATHER DEVIATION UP TO:	<input type="text"/> NM	
◆ OFFSET:	<input type="text"/> NM	
<input type="checkbox"/> OFFSET AT:	<input type="text"/>	
<input type="checkbox"/> AT PILOTS DISCRETION		
<input type="checkbox"/> DUE TO WEATHER		
<input type="checkbox"/> DUE TO AIRCRAFT PERFORMANCE		
<input type="checkbox"/> MAINTAIN OWN SEPARATION AND VMC		
FREE TEXT:	<input type="text"/>	
<input type="text"/>		
SEND	PRINT	RESET
RETURN	EXIT	
SCRATCH PAD		

Boeing's Plan for NextGen and SESAR

		2011	2012	2013	2014	2015	2016	2017	2018	2019	>2020	
787	Forward Fit	FANS-1			FANS-2							FANS-3
	Retrofit	FANS-1			FANS-2							FANS-3
777	Forward Fit	FANS-1			FANS-1 + LINK2000+							FANS-3
	Retrofit	FANS-1			FANS-1 + LINK2000+							FANS-3
747	Forward Fit	FANS-1	FANS-2									FANS-3
	Retrofit	FANS-1										
757 767	Forward Fit	FANS-1										
	Retrofit	FANS-1										
737 EU Domestic OPS	Forward Fit	CMU LINK2000+									FANS-3	
	Retrofit						CMU LINK2000+					FANS-3
737	Forward Fit	FANS-1										
	Retrofit	FANS-1										
717 MD90 MD10 MD11	Forward Fit											
	Retrofit	FANS-1										

1. FANS-1 and CMU LINK2000+ are mutually exclusive. Only one can be installed/enabled due to differences in HMI and host system.
2. FANS-2 (integrated) is FANS-1 + LINK2000+
3. FANS-3 (integrated) is FANS-1 + SC214
4. 737 will not have FANS-2. Most customers have selected non-integrated CMU LINK2000+.
5. 777 will not have integrated LINK2000+. ANSPs do not require integration.

Questions?

