Neue Technologien und Trends in der
Kabinenkommunikation

Jörg Reitmann
Vice President
Cabin Systems Engineering

AIRBUS

Gliederung

- **Besonderheiten der Kabinenkommunikation**
  - o Kundenforderungen
  - o Technische Randbedingungen

- **Neue Technologien in der Kabinenkommunikation**
  - o CIDS
  - o IFE
  - o A380 NSS

- **Zukünftige Entwicklungen**
  - o Drahtlose Verbindungen innerhalb der Kabine („Wireless Cabin")
  - o Drahtlose Außenanbindung an Terrestrische Netze

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The Cabin Must Allow Differentiation

***Airbus offers ways
to achieve differentiation
across Airbus aircraft family***

Cabin environment

Passenger accommodation

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Cabin Systems Challenges

- Cabin items must: be robust, withstand abuse, be resistant against thievery and vandalism
- No direct multiple redundancy (e.g. no spare seats, no spare display units)
- Passenger expects immediate fix of his/her problem
- Approximately 50% of cabin items are Buyer Furnished Equipment (BFE) and are highly customised.

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Wide consultation on cabin over several years

1998 — Stairs Task Force

1998 — International Survey

天じょうはシンプル
席が横にきれいに並はなくすれた

1999 — Design Competition

1999 — Down-selection

How do I feel about sitting here ?
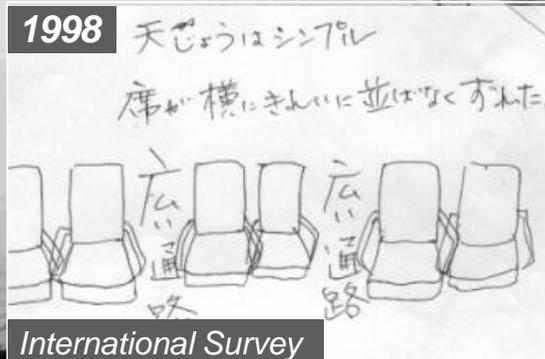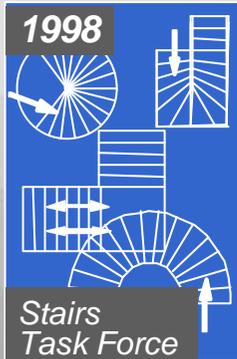
2000 hours of pax interviews, 9 international design teams, 5 major airlines, 3 continents

2000 — Phase 1 Ergonomics

2001 — Phase 2 Ergonomics

2000-2001 — Cabin Research Mock-up

A3 XX — A3 XX — A3 XX
CABIN RESEARCH — CABIN RESEARCH

2000 - — Conceptual Mock-up
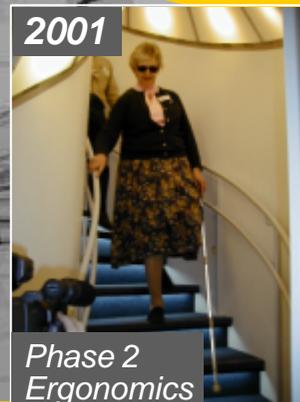
Ergonomics testing, Research MU, more surveys, Industrial Design MU, Conceptual MU

Optimal result
ensured by stakeholders and experts

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Cabin Intercommunication Data System (CIDS)

The digital **Cabin Intercommunication Data System i**s the cabin core system of all Airbus aircraft.

CIDS operates and monitors various passenger and crew functions such as:

- Passenger / Cabin Announcement
- Cabin Temperature Control
- Water / Waste Tank Level Indication
- Cabin Illumination
- Emergency & Evacuation Signalling
- Lavatory Smoke Warning & Indication
- Aircraft Doors & Slides Status
- IFE System Status
- Various Optional Functions

CIDS Block Diagram (A380-800)
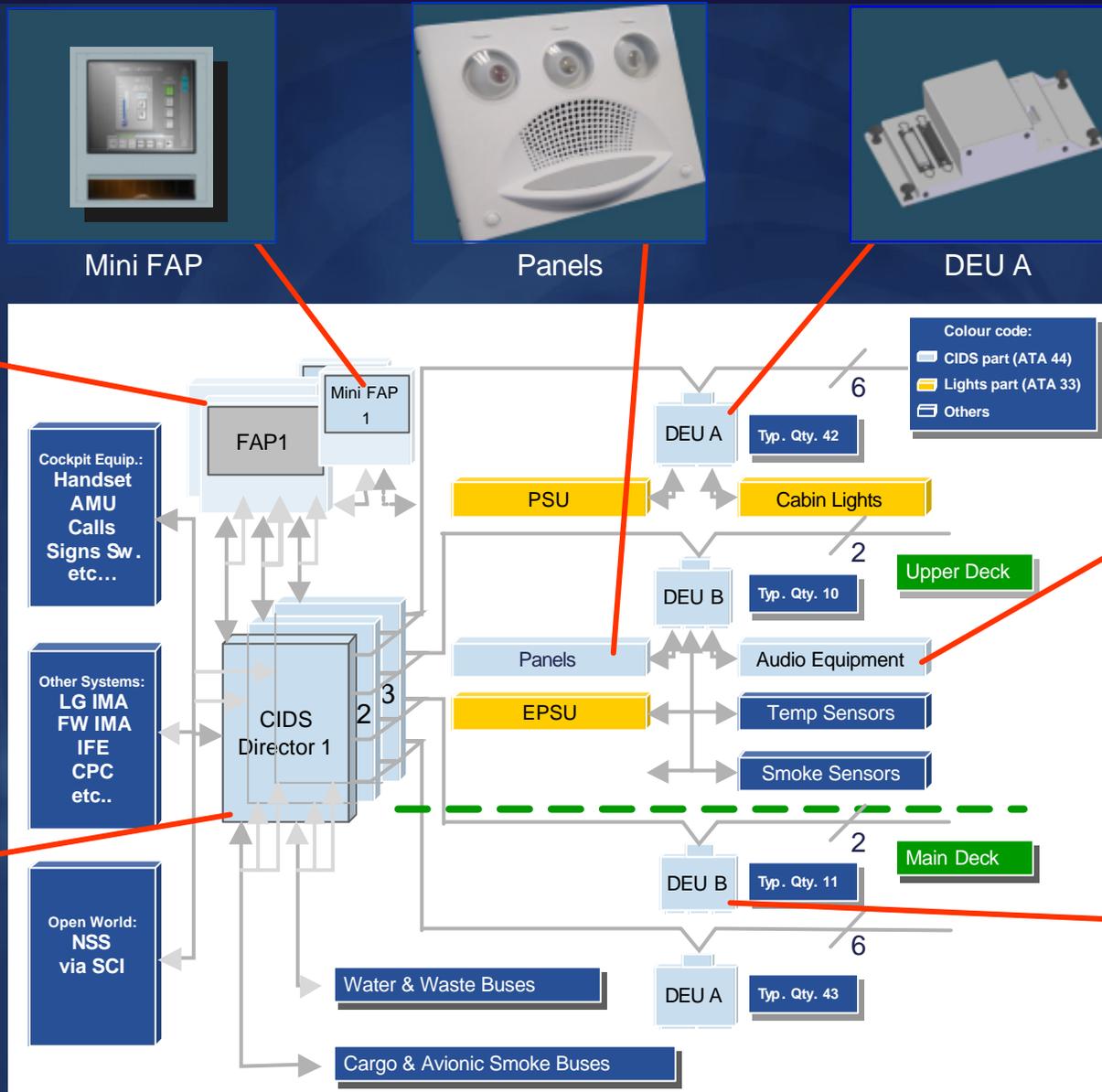
Mini FAP

Panels

DEU A

Flight Attendant Panel

CIDS Director

Audio Equipment

DEU B

Colour code:
- CIDS part (ATA 44)
- Lights part (ATA 33)
- Others

Mini FAP 1

FAP1

Cockpit Equip.:
Handset
AMU
Calls
Signs Sw.
etc…

Other Systems:
LG IMA
FW IMA
IFE
CPC
etc..

Open World:
NSS
via SCI

CIDS Director 1

DEU A — Typ. Qty. 42

6

PSU — Cabin Lights

2

Upper Deck

DEU B — Typ. Qty. 10

Panels — Audio Equipment

EPSU — Temp Sensors

Smoke Sensors

3

2

2

Main Deck

DEU B — Typ. Qty. 11

6

DEU A — Typ. Qty. 43

Water & Waste Buses

Cargo & Avionic Smoke Buses

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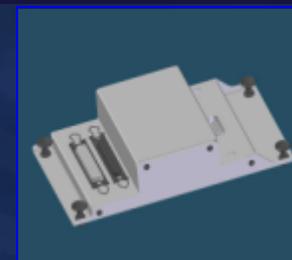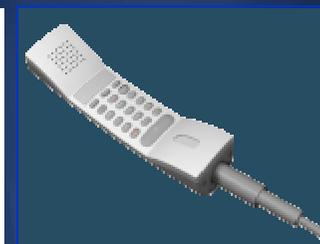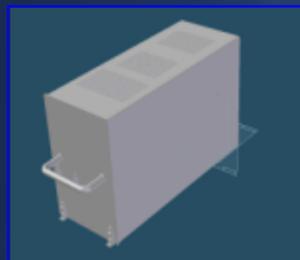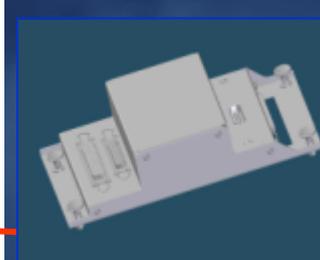
History

1987 Flight attendant panel

Single tube standard illumination

Step dimming: 0 – 25 – 50 – 100 percent

In Service Today: Mood Lights

Cabin Lighting System - Interior Lighting

KID-Systeme is the prime supplier for the whole interior illumination system of the A380 and is developing and integrating this system.

General Illumination:
- Cabin
- Staircase
- Service Area
- Cargo Compartment Illumination
- Info Signs

Emergency Lighting:
- EPSU *)
- Floor Path Marking
- Exit Signs

*) EPSU = Emergency Power Supply Unit

The application of new technologies (LED) allows:

- Customized Lighting Concepts (Low Level Lighting, Colored Lighting, Sunrise & Sunset, Star Light, ...)

- Weight & Energy saving

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Basic A380 IFE System Features

- A basic platform on which systems from a number of suppliers can be installed in a modular fashion

- A centralized system head-end containing all interfaces to other aircraft systems as well as to the Cabin Distribution Network.

- A Cabin Distribution based on a star-wired and redundant fibre-optic network. This permits massive bandwidth throughput and allows future growth in services/features.

- Complete System is powered by SPDBs (Secondary Power Distribution Boxes) and fully controllable by means of remote controlled circuit breakers contained therein.

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Basic A380 IFE System Features

- System is powered by variable frequency (380-800Hz)

- Increased level of In-Seat Integration (common In-seat power Supply and ARINC 485 data network for all powered in-seat components).

- Modularity of components permitting customized flexibility.

- Ethernet interfaces at IFE Head-End (simpler integration into a more Ethernet-based aircraft with more net-based services).

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Basic A380 IFE System Features

- Multiple IFE Control possibilities from IFE and CIDS terminals (Common Cabin Console concept).

- An IFE Architecture/System with the lowest power/weight/LRU and volume figures ever achieved for the highest level of provided functionality

- Aircraft-side Ground Fault Interrupt protection (GFI) via SPDBs.

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Data Distribution Architecture
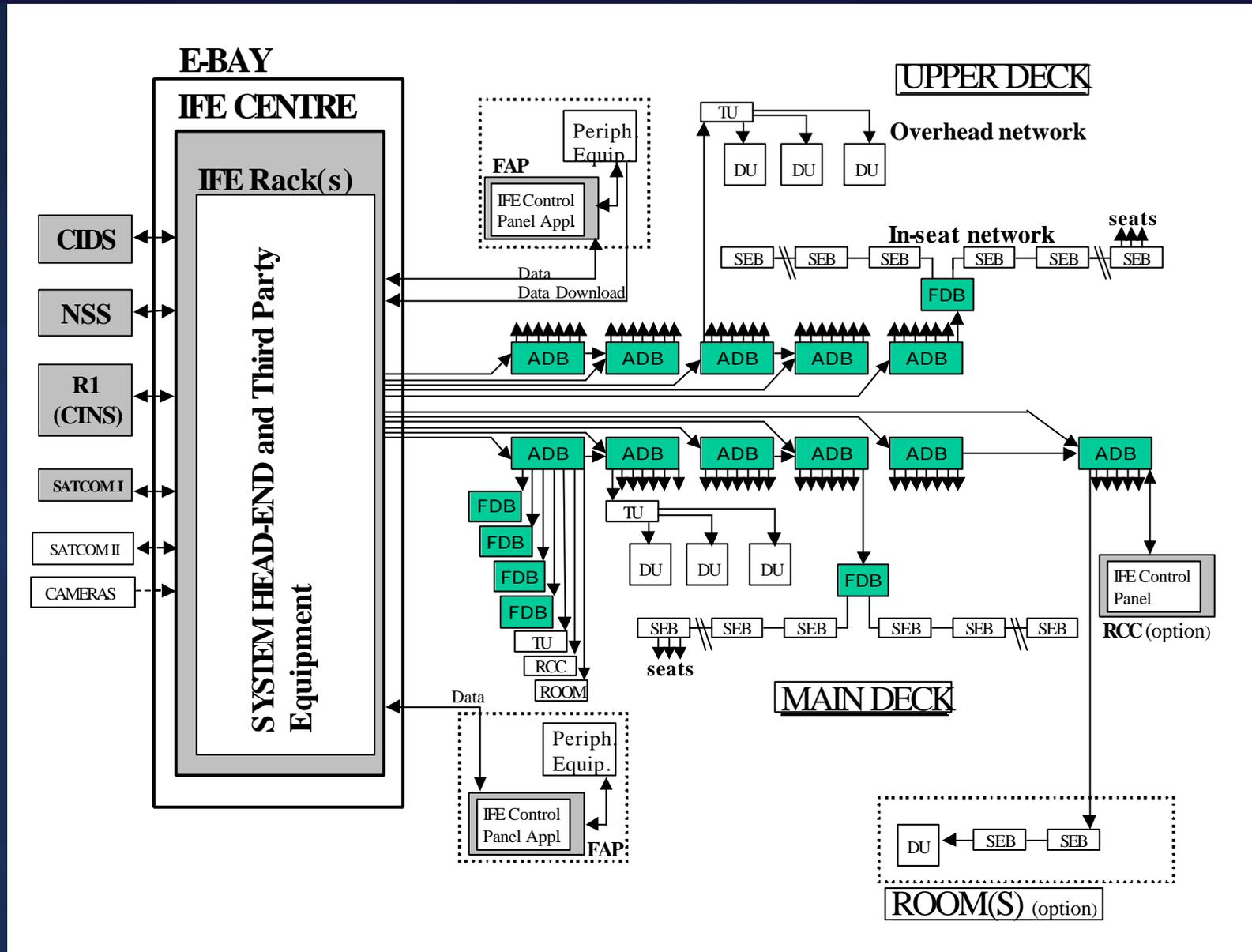
System Integration and why it is IFE

- All Seat Systems are connected to IFE and can be remotely controlled
- IFE becomes part of power distribution and consumption management
- IFE will have an interface to next generation Galleys

IFE
SEB

PC Power
Seat actuator
Reading light
Massage
Seat doors
Environmental control
Mood light

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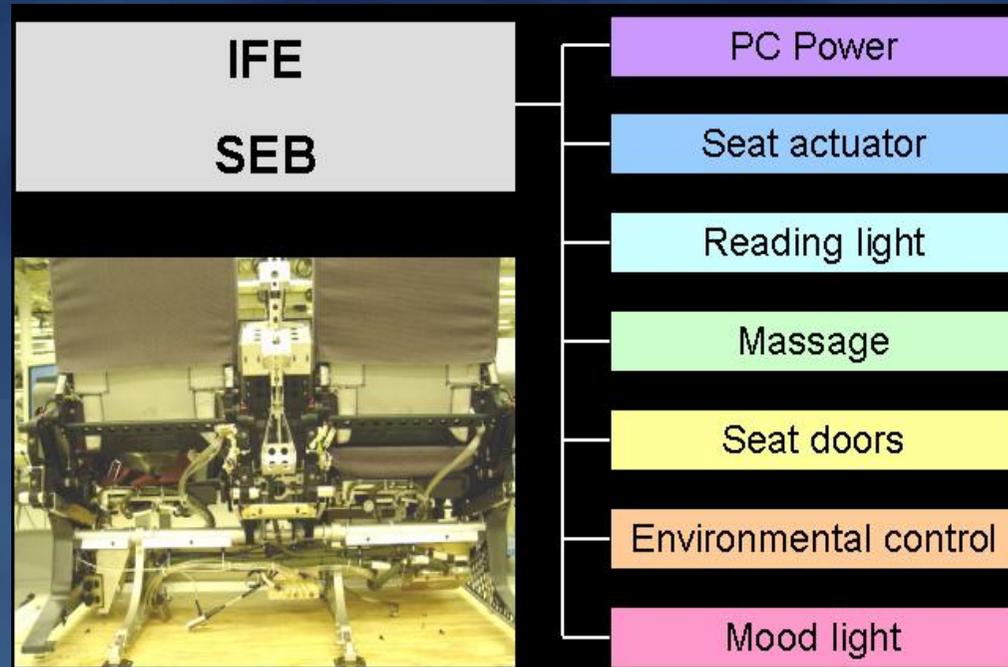
Aircraft Integration of IFE
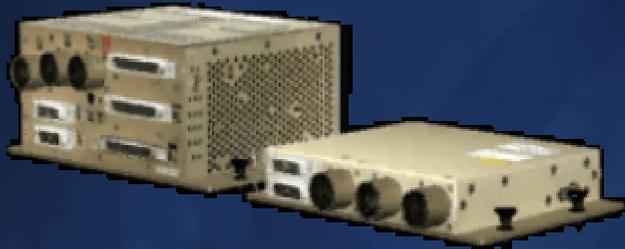
Current and
3rd Generation Seatbox

Attendant operated
IFE-control screen

Passenger IFE
navigation / operation
by remote control

Advantages:
- Improved Passenger legroom
- less wiring and weight

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A380 NSS / OIS architecture

PMAT

shared terminals:

IFE Server

SCI 1
CDAM
SCI 2

Avionics Domain

A429 bus

TBC

TWLU **CWLU**

Airframer domain

Airline domain

Pax domain

ACR router

firewall

IP (wireless) connectivity to the ground

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A380 NSS / OIS Function Mapping

Green box (left):
- DLCS
- CMS
- ACMS
- PDCS
- Shared Data Base
- Logbook
- AIRN@V
- MEL
- AOC 1 / 2
- W&Preset
- Refuel

ACR router

A429 bus TBC

Light green box (center):

« right side OMS »

Cabin doc.
- CCOM
- cabin emergency check-list

- AOC 2 / 2 E-mail Contact manager
- FCOM MEL CDL ...
- EFF/FFU Nav. charts Weather maps
- Take off perfos. Landing perfos. In-Flight perfos. Weight & balance
- Toolbox Acronym ICAO converter

Yellow box (center-right):

- Cabin Services
  - Service reporting
  - Cabin inventory
  - Trolley management

- Crew Services
  - Cabin crew management
  - Crew training course ware
  - Commercial check-list
  - Hand-over report
  - Dictionary
  - Cooking instructions

- Crew Ground Connectivity
  - E-mail
  - Internet

- PAX Management
  - PAX information list
  - PAX counting

- Telemedicine

Blue box (right):

- PAX Ground Connectivity
  - E-mail
  - Internet
  - Goods ordering & credit card validation
  - Connecting flights information
  - Flight reservation

- Cabin Services
  - Intranet (on-board content)
  - Meal ordering
  - PAX survey / feedback

IP (wireless) connectivity to the ground

Airline TBD

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Development for Cabin Systems

Market Characteristics:

-Airlines will follow the rapid technological changes of the consumer market

-Passenger will use their own Personal Electronic Devices (PED)

-New communication standards will emerge (e.g.WiMAX)

-Lower Costs for systems and services demanded by customers

-Access to onboard content without satellite

Development Targets

-Closer to COTS (Commercial Off The Shelf) equipment

-Shorter development time

-Cheaper

-Automate the selection of the cheapest communication service

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Usage Trends and Passenger Expectations

- Current Situation:
    - o 6.1B emails sent each day
    - o 1.2 B SMS messages sent each day
    - o GSM/GPRS, UMTS phones
    - o Users want the same level of connectivity on board as on the ground
- New technologies support permanent and mobile connectivity
    - o PDA, Bluetooth, GSM/GPRS, UMTS
    - o Laptop and wireless Ethernet
- Future Expectations:
    - o WiMAX (IEEE 802.16)
    - o Ultra Wideband (UWB)
    - o Universal Wireless Backbone System

Source: Frost and Sullivan

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Potential Communication Functions

Satcom

DBS TV & HS data

VDR/HF DL

Crew Station

Cockpit Terminals

Avionics

Servers

IFE

TWLUs

Gatelink

Passenger Terminals
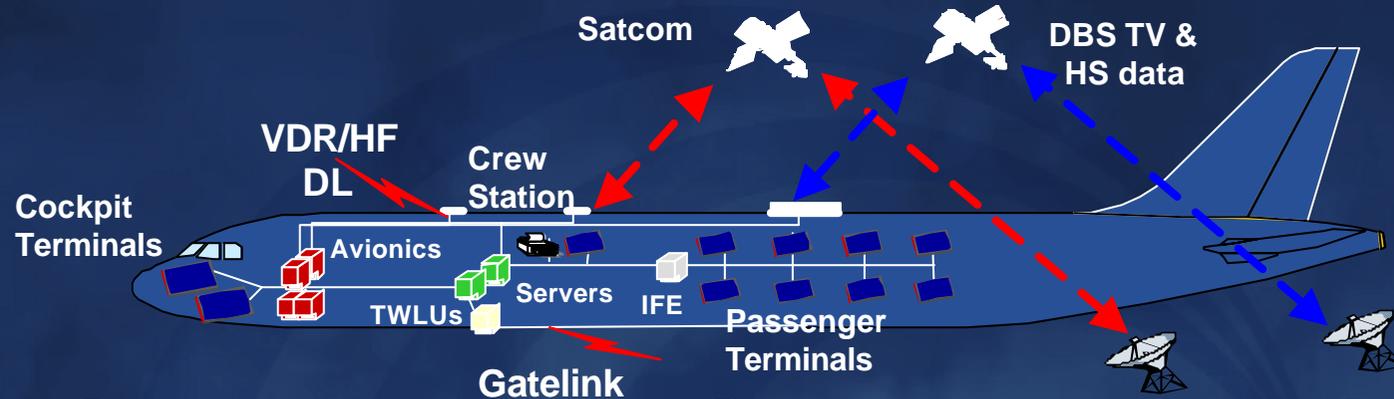
Flight Operations (cockpit crew)
- A/C Documentation
- Electronic Logbook
- Weight & Balance
- Performance Data
- Operational Checklists
- Access to Flight Information services (Weather, NOTAM…)
- Charts and Maps
- Crew e-mail
- Airlines specific applications...

Cargo
- Cargo monitoring...

Passengers
- e-Mail
- Internet / Intranet
- News / Sports
- Live Television
- e-commerce….

Cabin Crew
- PAX data base
- Crew e-Mail
- Cabin E - Logbook
- A/C Documentation
- Credit Card validation
- Cabin inventory
- Quality monitoring
- Reservation...

Maintenance
- Maintenance documentation (TSM, AMM)
- Maintenance improvements (tools)
- A/C condition monitoring
- Electronic logbook
- Data loading
- E-mail
- Operational s/w and data bases storage
- FOQA download
- Equipment List ….

Airbus In-Flight Communication – Global scope

BGAN: Broadband Global Area Network

Satcom

BGAN

Ku-Band

Crew Stations

Avionic Server

Cabin Network

Gate Link

VHF HF

GMS GPRS

Airport

Mobile Service Provider

Airline

Ground Operation Center

Ground network

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Security

Cockpit ▷|◁ Cabin ⟹ Passenger Domain
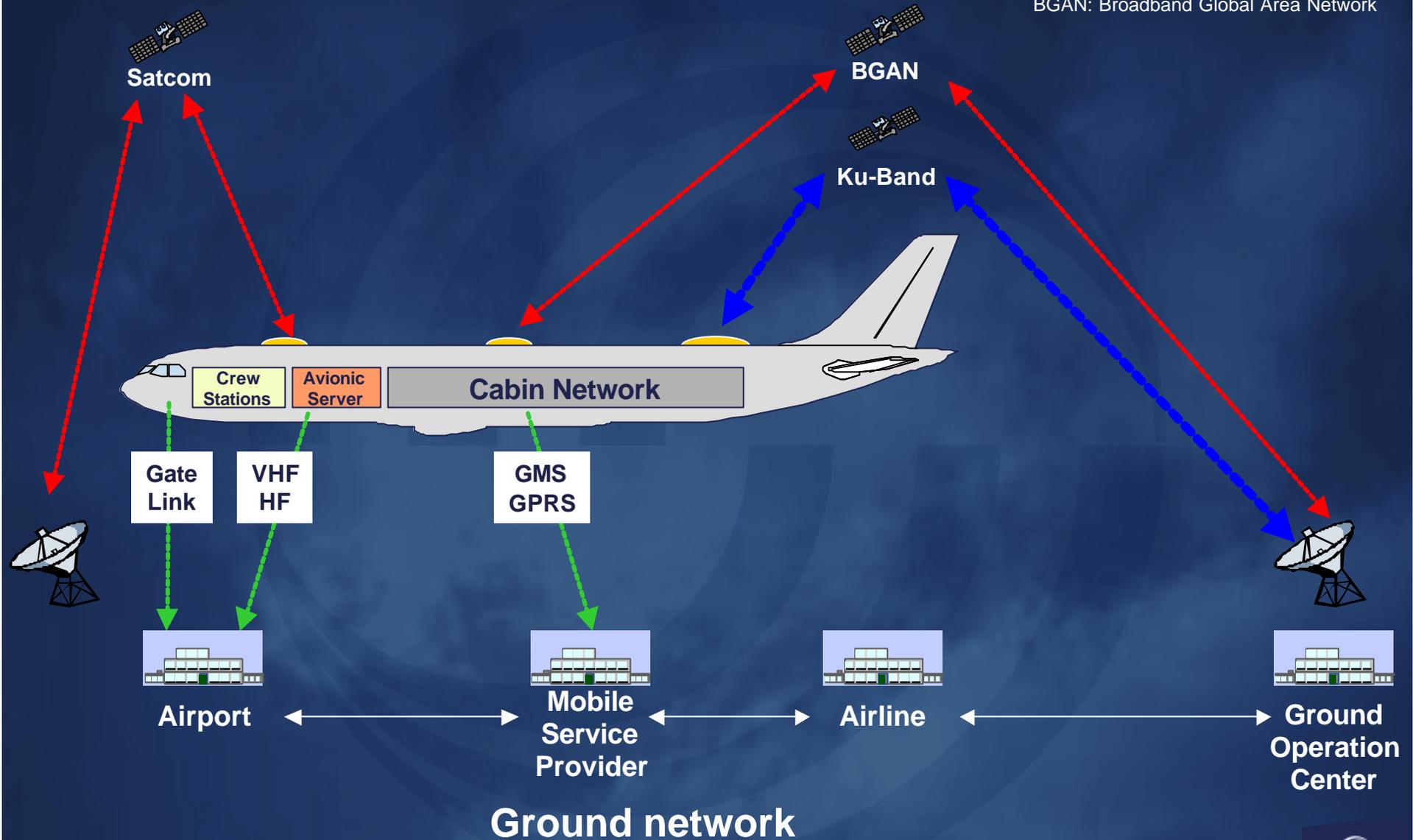
Cockpit
- ATM (Air Traffic Management)
- Maintenance
- Data Loading
- ...

Cabin
- Messaging
- E-mails
- GSM
- ...

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Channel Resource Assignment and Coordination

Standards	Max data rate per channel	Channels simultaneously available
WLAN 802.11b,g (f=2.4 GHz)	**11/54 Mbit per channel**	**3 independent channels available**
WLAN 802.11a (f=5.x GHz)	**54 Mbit per channel**	**12 independent channels available**
WLAN 802.11n (under standardisation)	**320 Mbit per channel**	**12 independent channels (tbc)**
UWB* (802.15.3a) (under standardisation)	**448 Mbit per channel**	**10-12 independent channels**

*UWB – Ultra Wideband Band

OBJECTIVE: Universal Wireless Backbone System (UWBS)

Benefits: - Flexible Configuration

- Scalable Capacity

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Wireless Antenna Solutions

CWLU Cabin Wireless LAN Unit

==== Leaky Line technology antenna TBC

WACS Wireless Airport Communication System

▲ Outside antenna

Cabin package

WACS package

Leaky Line Technology:

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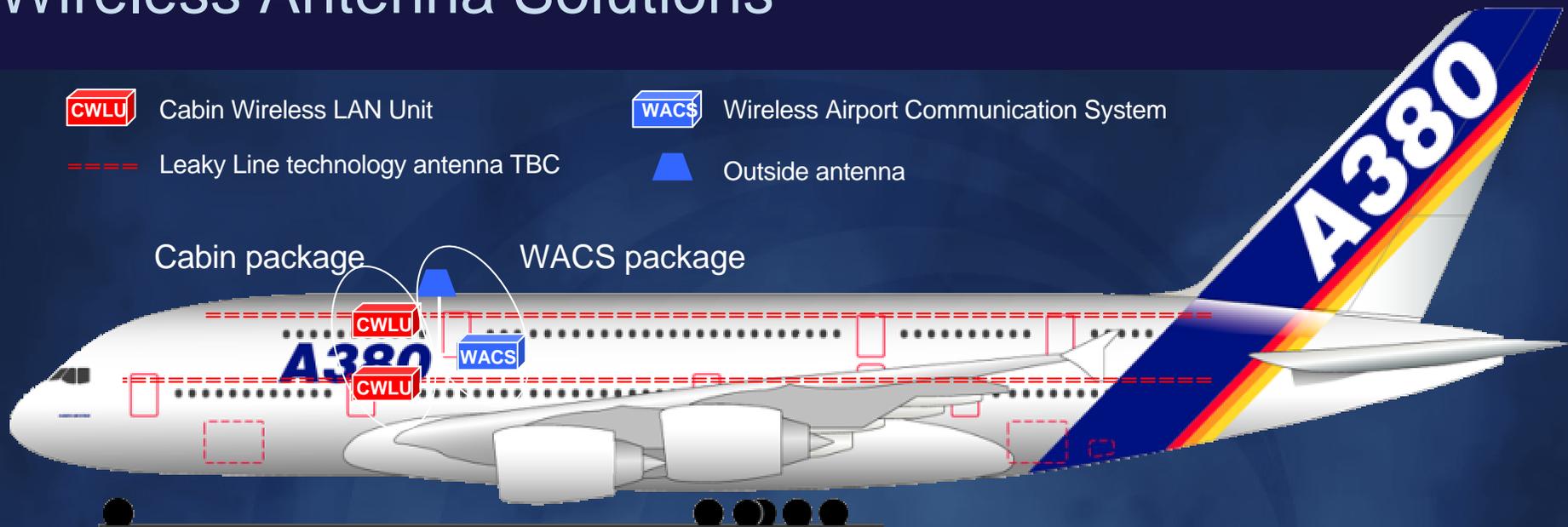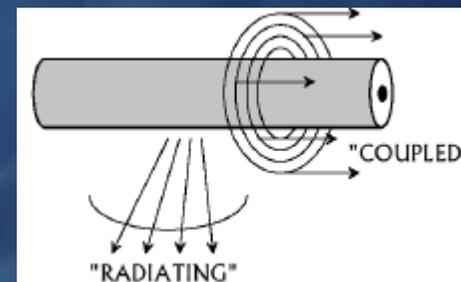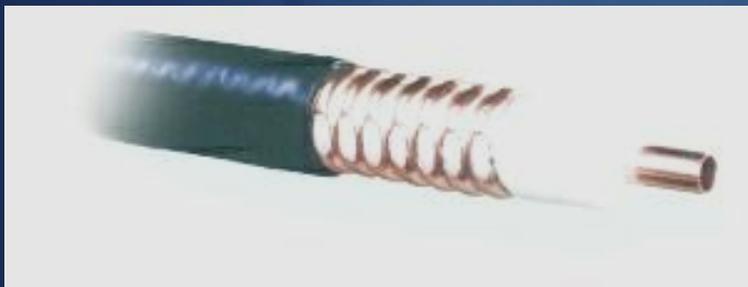
Mobiles on aircraft (OMTS onboard mobile telephone system)
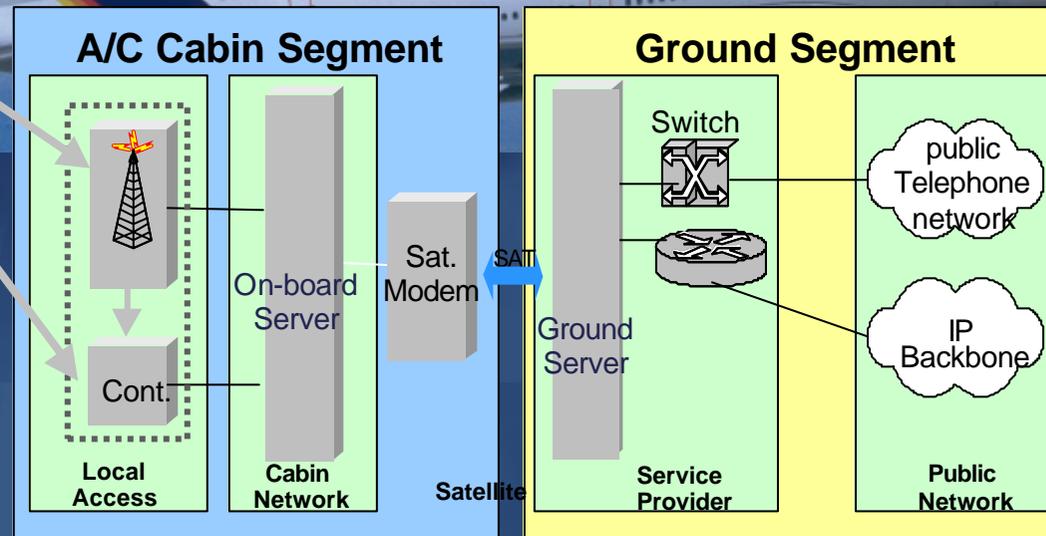
- **Passenger can use his own telephone & number like in foreign countries**
- **Connection from aircraft over sat-link to the ground**
- **Bill will come from passengers mobile home operator**
- **Data functions (for mobile phone applications SMS, WAP*, WEB, VPN*…)**
- **Control of all mobiles on board**
- **Monitoring and control functions (from aircraft & ground)**

WAP – wireless application protocol

VPN – virtual private network

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Satellite Services

L-Band

e.g. Inmarsat

Ku-Band

USA

Asia

EU

- Original avionic/maritime network for mobile platforms
- Full worldwide coverage assured

- Original purpose: TV / radio for end users on fixed (terrestrial) platforms
- Coverage over oceans not yet extended

L-Band (Inmarsat) and Ku-Band

L-Band
Tx: 1,5265...1,5605 GHz
Radio BW: 34 MHz

64 kB/s (Swift 64)

432 kB/s (BGAN)

Pros:
- Designed for mobile platforms
- Established in the the avionic market
- Worldwide coverage
- Small antenna (low cost for A/c drag)

Cons:
- Smaller radio BW (lower data rates)
- BGAN satellites EIS in 2006

Ku-Band
Tx: 14,0...14,5 GHz
Radio BW: 500 MHz

2000 kB/s

Pros:
- Higher radio BW (high data rates)
- Low cost for data transfer
- Large no. of satellites over congested areas

Cons:
- Satellite spacing 2°...3° requires big antenna for precise focusing (high cost for A/c drag)
- Directional antenna requires exact satellite tracking
- Lack of coverage e.g. over oceans
- Business case yet to be proved

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Service Coverage

Proposed Ku-Band coverage
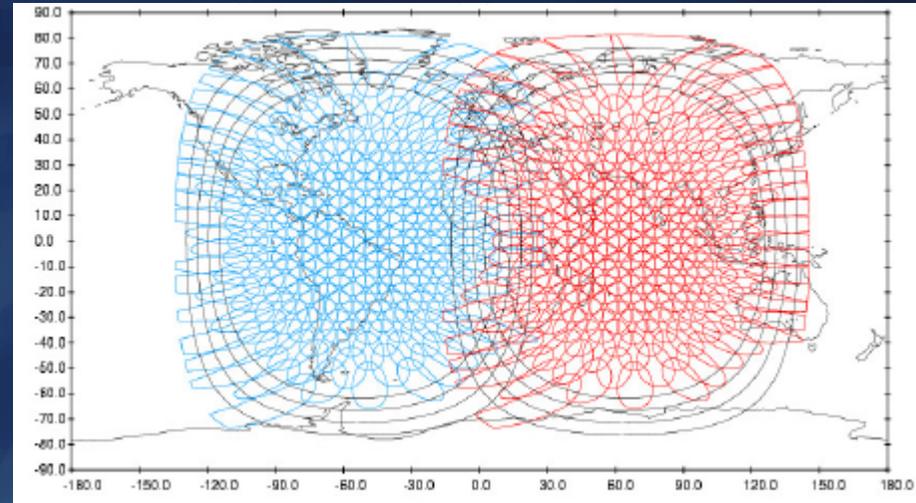
**INMARSAT BGAN**
2 satellite configuration
Narrow Spot Beams
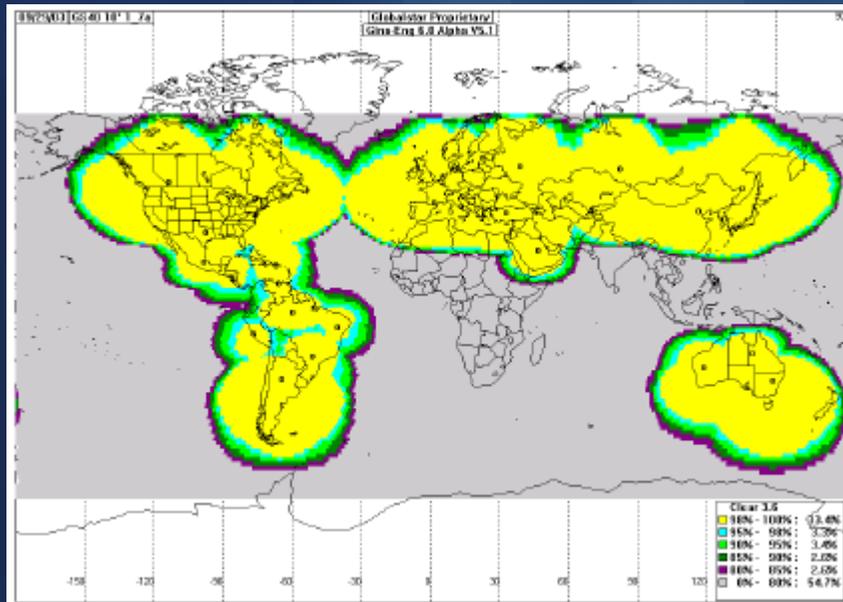
Globalstar: Does not Reflect
Actual Service Offered

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Inmarsat BGAN

BGAN Ground Stations
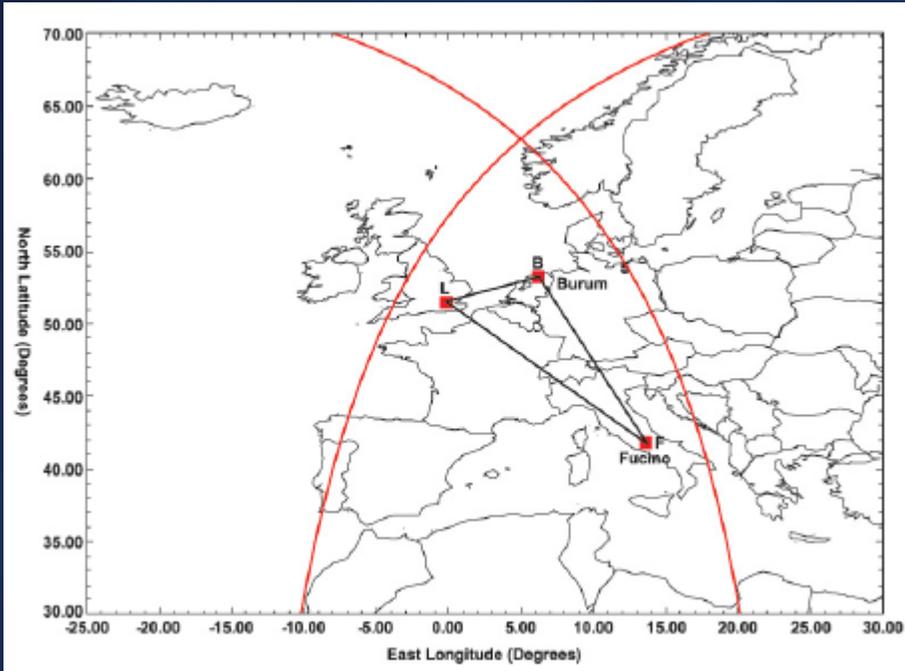
L-Band
GEO Satellites

Burum

Fucino
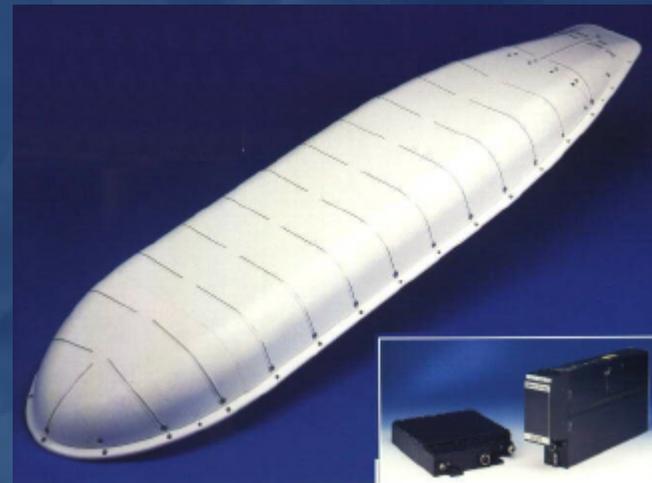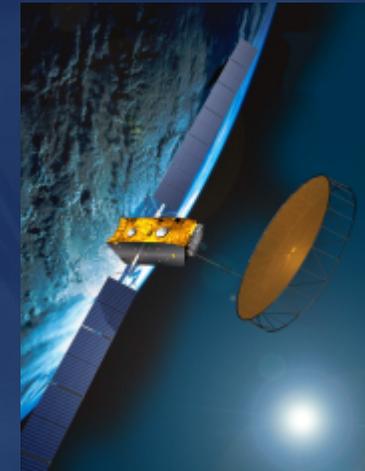
Globalstar

L-Band

LEO Satellites

Single Globalstar channel = 9.6 Kbps

24 Gateways

2 Control Centers

48 Satellites
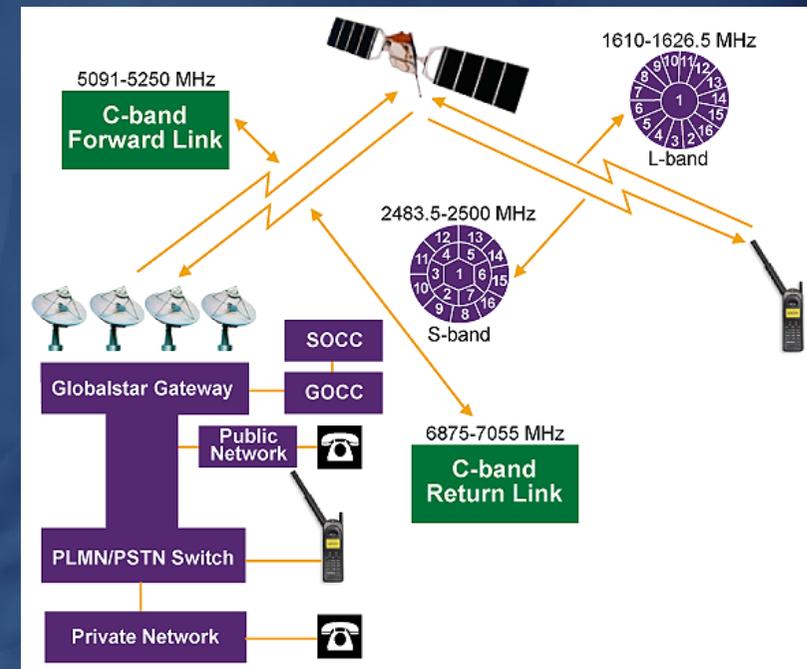
Aircraft TV systems

	TV Band	Number of channels	Coverage	Entry in service	Other data connectivity
Airshow	Ku	32	CONUS, EU, ME (Pacific also foreseen)	TW550 In service (Bizjets, VIPs) Developing TW560 for QTR: Jun'06	No (Researching?)
ITAN	Ku	24 (depending on regions)	CONUS only Developing multiregional functionality (EU, ME, PA?)	In service on Song fleet (B757)	Researching? (only return link Ku)
LiveTV	Ku	24+2	CONUS only	In service on JetBlue, Frontier, WestJet	No
AirTV	S	TBD	Worldwide Regional?	Q1 2006	Yes (Return Link with Inmarsat L-band)
Airia	L	1 – 2	Worldwide	TBD Test on BBJ Nov'03	No

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Airshow System (Tailwind 560)
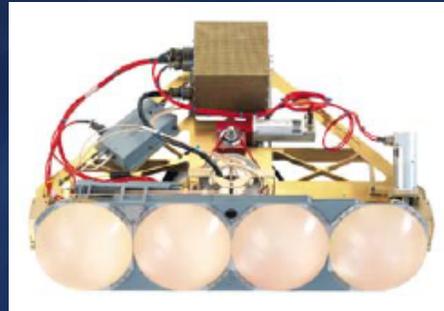
- **DBS Antenna Unit (DAU) and radome**

- **System Signal Processor (SSP)**

- **Configuration Data Module (CDM)**

- **CPIF – Control, Power and IF Multiplexer Unit (up to 4 RDU8's) + CDM**

- **RDU8 - Receiver Decoder Unit (8 channels)**

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LiveTV system

An

PCU

Complete IFE system!

(2x) MRM

SEB

VDU

Components of the system:
- Antenna
- MRM - Multi-Channel Receiver Modulator
- SEB - Seat Electronics Box
- VDU - Video Display Unit
- PCU - Passenger Control Unit
- Optional: headphones

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TV Antennas

Airshow Antenna
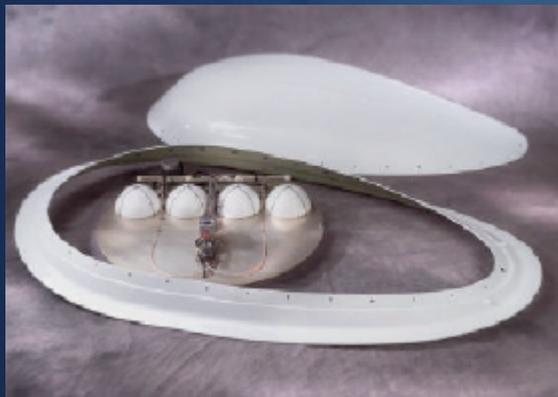
ITAN TV Antenna
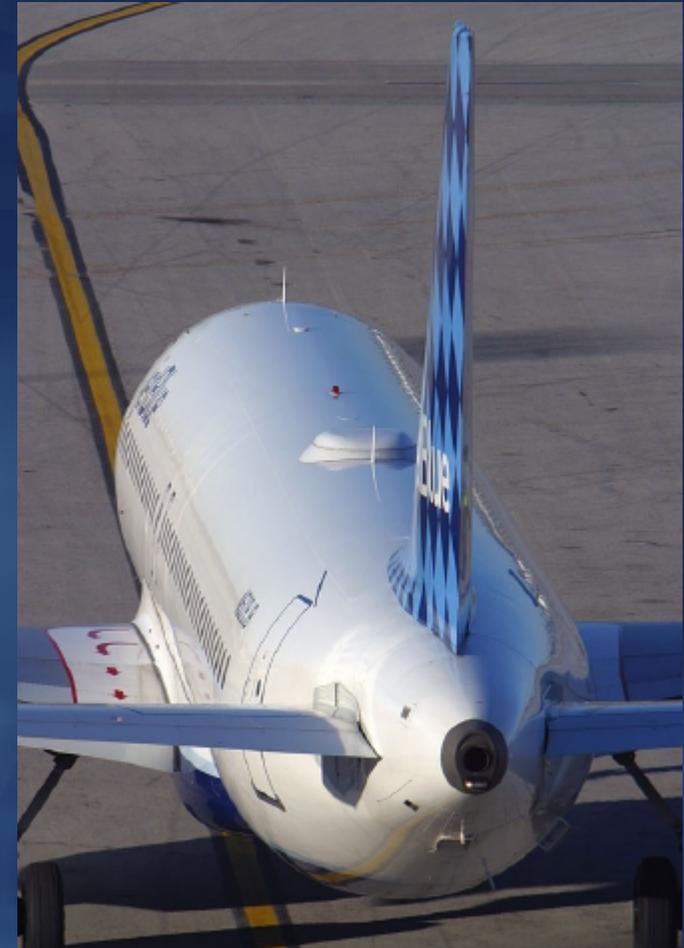
Live TV installed on JetBlue

SATCOM   1740 x 430 x 120

AIR - TV   2489 x 830 x 116.6

LIVE -TV   1651 x 1100 x 150

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Thank You For Your Attention!

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WITH BAE SYSTEMS**