User Requirements for Air Traffic Services

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Foreword

Dear Reader,

There are times when airlines are taken by surprise from announcements of new equipment for air traffic control being purchased that, as far as airlines are concerned, holds little promise of benefit. In most of these cases, airlines and other airspace users were not consulted during the planning process and the technology was bound to disappoint.

Such misadventures are costly to everyone and are a waste of scarce funding. Regrettably, such undesirable situations continue to occur today, when waste can be ill afforded by the air transport industry.

On the other hand, successful procurement projects are invariably associated with a planning and consultation process that draws upon input from representatives of the airspace users, as well as equipment manufacturers and neighbouring States. Such planning also helps airlines schedule their own investments in aircraft technology to work in synch with new air navigation services equipment, leading to clear operational benefits.

Based on a thorough understanding of airspace user requirements and capabilities, these projects are far more successful in providing much-needed benefits to airspace users in terms of increased safety, on-schedule operations and cost efficiency.

We have prepared this report to offer a better understanding of international airlines' requirements and capabilities for communications, navigation, surveillance and air traffic management.

Best regards,

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IATA Report on User Requirements for Air Traffic Services

Executive Summary

IATA has prepared this report to offer guidance to Air Navigation Service Providers (ANSPs), States, vendors and funding organizations on international airline infrastructure requirements for air traffic services between now and the 2020 timeframe.

This report considers technologies that are widely available or under consideration to provide Communications, Navigation and Surveillance (CNS) for Air Traffic Management (ATM). The structure consists of a brief technology description followed by IATA's position on implementation. Recommendations are based on the evaluation of operational benefits, e.g. schedule, safety, efficiency, cost, risk, and availability.

This document is meant to serve as a planning tool and represents the consolidated view of IATA's members, which comprise some 230 airlines as of December 2008 – the world's leading passenger and cargo airlines among them - representing 93 percent of scheduled international air traffic.

In general, IATA's position on short to mid term CNS/ATM infrastructure improvements is to maximise the existing capabilities that are on aircraft today and to support the implementation of the following technologies where operationally feasible, in consultation with airlines:

- Voice migrating to data link as the primary means of controller-pilot communication while continuing the provision of voice communication as a backup and for non-routine communications.
- Performance Based Navigation (PBN), enabled by GNSS as the primary radio navigation aid for all phases of flight.
- Surveillance based primarily on Automatic Dependent Surveillance Broadcast (ADS-B) and when required supplemented with Multilateration (MLAT) as the next generation replacement to radar. Additionally, Automatic Dependent Surveillance Contract (ADS-C) should be the common means of surveillance in oceanic airspace.

The following table summarizes IATA's position on current CNS/ATM Infrastructure technologies and applications, while figures 1-3 offer suggested timelines for the commissioning of the newer technologies and the decommissioning of the older technologies.

Summary: IATA's Positions on CNS / ATM Infrastructure

Technologies & Applications		IATA's Position		
		Support where justified	**Maintain during transition**	**Do NOT support or support in limited cases**
COMMUNICATIONS	AFTN		X	
	AMHS	X		
	VSAT	X		
	AIDC	X		
	VHF Voice 8.33 KHz Channel Spacing	X		
	HF Voice	X		
	SatCom	X		
	IRIDIUM	X		
	HFDL	X		
	ACARS	X		
	VDL Mode 2	X		
	VDL Mode 3			X
	VDL Mode 4			X
	CPDLC	X		
	ATN	To be Determined		
NAVIGATION	PBN	X		
	WGS-84	Essential		
	DME	X		
	ILS	X		
	MLS			X
	NDB			X
	TACAN			X
	VOR		X	
	GNSS	X		
	ABAS	X		
	GBAS	X		
	SBAS			X
SURVEILLANCE	PSR			X
	SSR Mode A/C		X	
	SSR Mode S	X		
	PAR			X
	ADS-B OUT	X		
	ADS-B IN	X		
	ADS-C	X		
	TIS-B		X	
	MLAT	X		
CANDIDATE ADS-B DATA LINKS	1090 ES	X		
	VDL Mode 4			X
	UAT			X
OTHER DATA LINK SERVICES	D-ATIS	X		
	AWOS	X		
	PDC	X		

Infrastructure should have timelines for commissioning and decommissioning. An approximate transition roadmap through the 2020 timeframe is depicted in figures 1 through 3 and table 1.

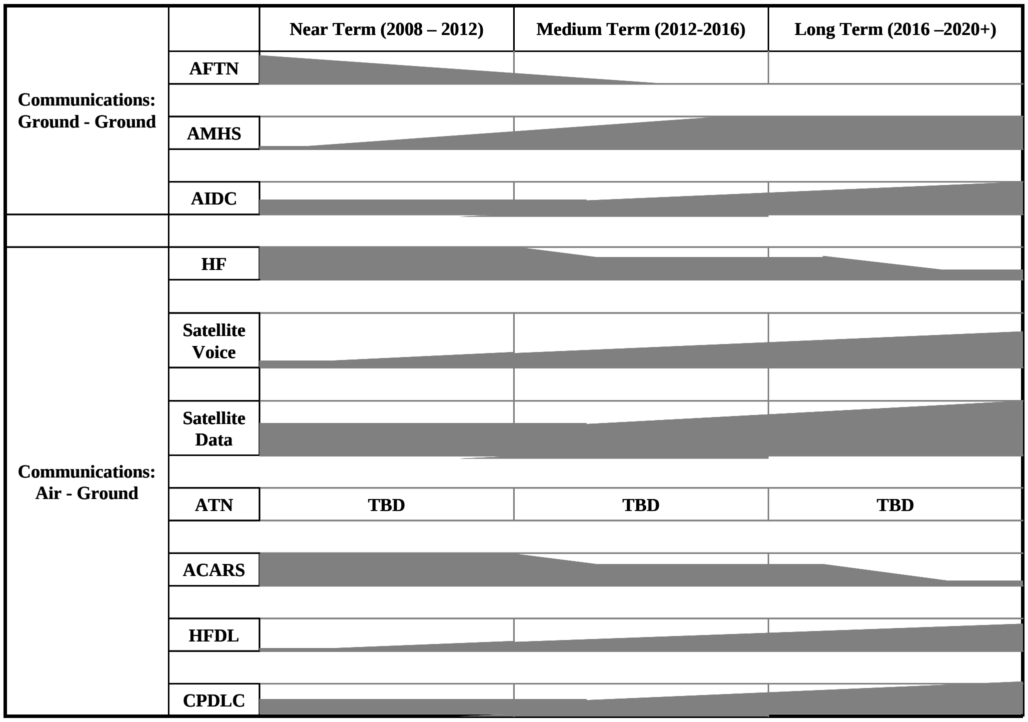

Figure 1. Communications Roadmap (present – 2020)

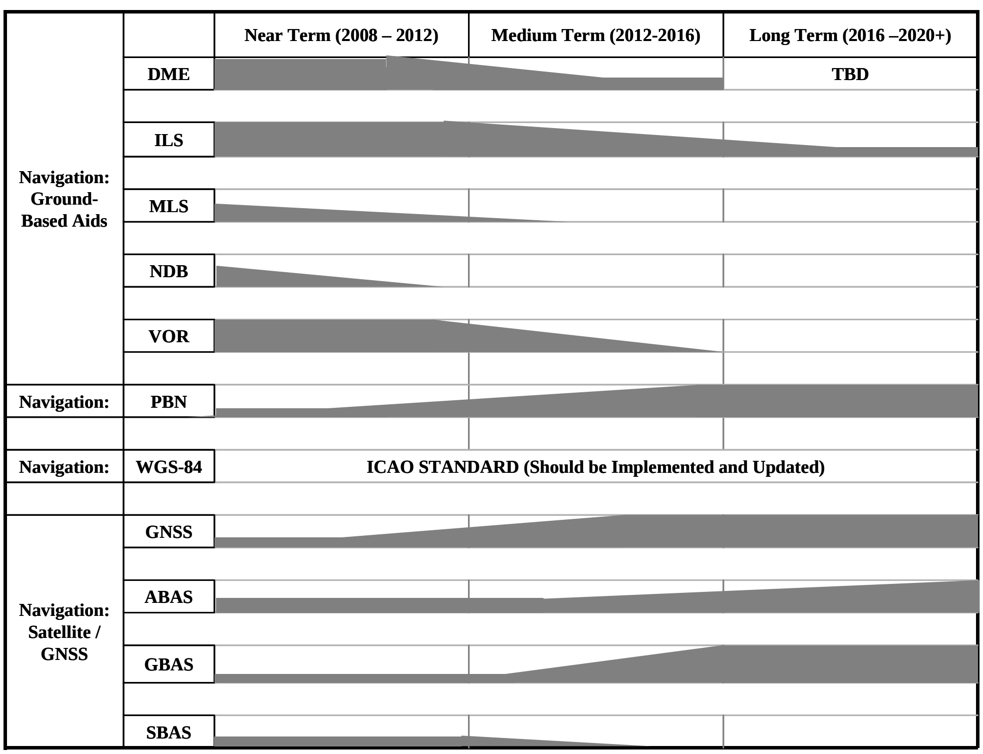

Figure 2. Navigation Roadmap (present – 2020).

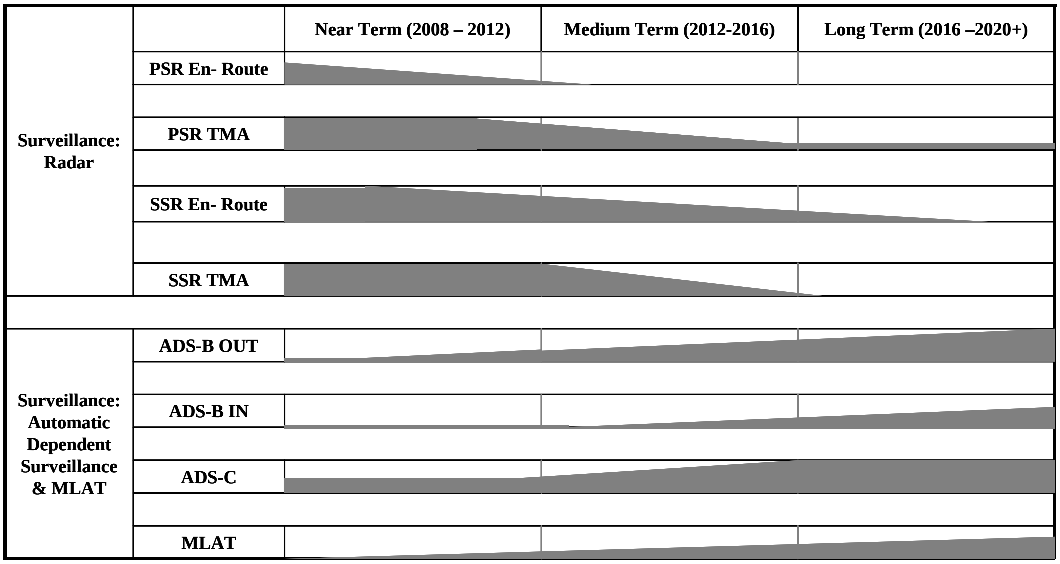

Figure 3. Surveillance Roadmap (Present – 2020)

Table 1. Surveillance Technologies (2020 approximate time frame)

	Oceanic / Remote	**En-Route Continental**	**Terminal Area**	**Surface Monitoring**
Primary	ADS-C / ADS-B	ADS-B	ADS-B or MLAT	ADS-B or MLAT
Backup	Procedural Control	MLAT	MLAT	MLAT or ADS-B

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1. Ground-to-Ground Communications

Ground-ground communications refer to exchanges of messages concerning planning and movement of aircraft between ATS units and with other aeronautical or military organizations. Such communications are moving from analogue to digital format and are becoming increasingly automated.

Technologies and applications reviewed in this section include:

- Aeronautical Fixed Telecommunications Network (AFTN) and ATS Message Handling Services (AMHS)
- Very Small Aperture Terminal (VSAT) and
- Air Traffic Services Interfacility Data Communications (AIDC)

1.1 Infrastructure

1.1.1 Aeronautical Fixed Telecommunications Network (AFTN) and ATS Message Handling Services (AMHS)

The AFTN is a message-handling network that has existed for over 40 years. It is a closed network in the sense that its users belong to ATS authorities and associated organizations such as airline operators, general aviation, and meteorological offices.

The AFTN is character-based only and cannot meet the need to carry bit-oriented applications.

The aviation industry has adopted AMHS to replace the AFTN. The AMHS can carry digital information such as text, graphics, images, files, databases, audio and video. ICAO has specified standards to ensure interoperability between AMHS and AFTN during the migration period.

***IATA's Position*:**

IATA supports a rapid decommissioning of AFTN and replacement by AMHS. Interoperability during transition must be ensured by interconnecting legacy AFTN terminals to the AMHS.

1.1.2 Very Small Aperture Terminal (VSAT)

The VSAT is a ground station that uses satellites to relay voice and data from small terminals to other terminals. VSATs are typically used for communications between ATC centers in areas where leased circuits are unreliable or uneconomical.

VSAT ground station terminals on a shared network are versatile, economical and scalable, whereas the deployment of new VSAT networks is considerably more expensive.

IATA's Position:

Support deployment of VSAT station terminals where operationally justified, as they offer a versatile, economical, and scalable solution for ground-to-ground aeronautical communications. However, proliferation of VSAT networks, which are considerably more expensive, should be avoided where existing ones, both national and international, can be expanded to serve new areas.

1.2 ATS Application

1.2.1 Air Traffic Services Interfacility Data Communication (AIDC)

AIDC is a ground-ground data link communication service that provides the capability to automatically exchange data between ATS units for notification, coordination and transfer of aircraft between flight information regions (FIRs). AIDC message format and procedures is an international standard designed for use through any ground-ground circuit, including the legacy AFTN.

AIDC greatly reduces the need for voice coordination between ATC facilities, resulting in fewer errors and reduced workload.

IATA's Position:

Support AIDC deployment as the primary means of coordination between ATC facilities, while maintaining the capability for controllers to intervene via voice for non-routine communications.

2. Air-to-Ground Communications

Controller-pilot communications use primarily voice links provided by analog radios operating in the VHF and HF bands. Aviation is moving towards a new communications infrastructure that will provide superior communication through use of air-ground data link. A first generation of ATC applications was implemented using Aircraft Communications Addressing and Reporting System (ACARS) air-ground data links. ACARS now needs to transition to modern communications protocols (e.g. VDL Mode 2) in order to support increasing user traffic and provide the performance needed for ATS.

The objective is to adopt data link as the primary means of communication while maintaining the requirement for voice communications as a backup and for non-routine communications.

This section overviews the following technologies and applications:

- VHF Voice 8.33 KHz Channel Spacing
- High Frequency (HF Voice)
- Satellite Communications (SatCom)
- IRIDIUM
- Aeronautical Telecommunications Network (ATN)
- VHF Data Link (VDL) Mode 3
- Aircraft Communications Addressing and Reporting System (ACARS)
- High Frequency Data Link (HFDL)
- VHF Data Link (VDL) Mode 2
- Controller Pilot Data Link Communications (CPDLC)

2.1 Infrastructure

2.1.1 VHF Voice 8.33 KHz Channel Spacing

VHF analog radios use channels of varying bandwidth. Since aircraft started using VHF radios, progress in radio technology has enabled the channel bandwidth to be reduced from 100 kHz down to 8.33 kHz.

In March 2007, the ICAO European Region made the carriage and operation of 8.33 kHz radios mandatory above FL195.

***IATA's Position*:**

Support implementation of 8.33 kHz channel spacing only in regions where 25 KHz channel spacing does not provide an adequate number of frequencies. Where implemented, carriage of 8.33 kHz-capable radios should be mandatory to ensure that all potential safety and capacity benefits are realized.

2.1.2 High Frequency (HF) Voice

HF voice is used for air-ground ATC communications in remote and oceanic areas outside the range of VHF frequencies. In most cases, an HF radio operator functions as an intermediary between controllers and pilots, transcribing and relaying the contents of HF voice communications.

Aircraft can use radios operating in the HF radio band for long-range communications because signals are reflected by the ionosphere. Link quality and availability are variable, and influenced by a number of factors, including frequency congestion, sunspot activity, the eleven-year solar cycle, and day/night ionospheric conditions.

Data communication can reduce the current congestion of HF voice traffic, and therefore improve HF voice communication services.

IATA's Position:

Support data link as the primary means of communication for oceanic and remote areas while continuing to provide HF voice service as a backup. Ground based HF transceivers should be equipped with Selective Calling (SELCAL).

2.1.3 Satellite Communications (SatCom)

Satellite communications for the provision of air traffic services in oceanic and remote airspace are primarily offered through a constellation of 11 INMARSAT geosynchronous orbit (GEO) satellites and associated Ground Earth Stations (GES) operated by independent telecommunications providers. The INMARSAT satellite network offers voice and data services except in extreme Polar Regions (above 82' 30'' North). The Japanese MTSAT system offers voice and data services in parts of the Pacific and Asia.

SatCom enables a direct communication channel between pilots and controllers, as opposed to transcribed data messaging where an HF radio operator functions as intermediary. Satellite communications are considered more reliable (although more costly) than HF, which is subject to interference, disruption, and delays due to its exposure to ionospheric and operating conditions.

IATA's Position:

Support SatCom as the data link enabler to allow direct controller-pilot data communications in oceanic and remote areas. Satellite voice for non-routine communications is recommended to reduce HF voice congestion in oceanic and remote areas.

2.1.4 IRIDIUM

The IRIDIUM Satellite Network is a constellation of 66 Low Earth Orbit (LEO) satellites, allowing aircraft to have smaller and lighter avionics than necessary for service via Geo-stationary satellites.

IRIDIUM offers complete earth coverage, including voice and data service in the Polar Regions. Additionally, IRIDIUM can be a good backup for ground-to-ground communications for ATS.

Air transport aircraft are beginning to be equipped with avionics that use IRIDIUM satellites. ICAO is currently working on approval of IRIDIUM for safety of life services by Air Traffic Control. Once approved, there will be airlines using this service.

***IATA's Position*:**

There is a global requirement for satellite data link and voice air-ground communications in airspace outside of VHF coverage (see 2.1.3), including the Polar Regions.

2.1.5 High Frequency Data Link (HFDL)

HFDL is used for air-ground communications in remote and oceanic airspace. Many carriers use HFDL instead of satellite services, or as a backup system. The addition of HFDL communications represents only a small increment in cost for HF equipped aircraft. One drawback of HFDL is that it does not have the communication performance of SatCom data link. However, HFDL provides data-link coverage for polar operations, where GEO based SatCom has no coverage.

***IATA's Position*:**

Support HFDL service availability in oceanic and remote areas, especially in the polar region, while considering that HFDL does not have the communication performance of SatCom data.

2.1.6 Aircraft Communications Addressing and Reporting System (ACARS)

ACARS is a data link technology developed for airlines in the late 1970s for exchange of operational data between their operations centers and aircraft in flight.

Today, ACARS is also used by many ANSPs for controller-pilot-data-link communications (CPDLC) for air traffic control with FANS-1/A aircraft.

Use of ACARS for ATC purposes has reduced workload for controllers and pilots, reduced potential for error inherent in voice communications, and off-loaded congested ATC radio voice channels.

ACARS is available via HF, VHF, and satellite data links.

IATA's Position:

Support upgrade to a full-bit oriented service while continuing to use ACARS as a basis for transition. ACARS is a proven technology that still meets user requirements for aeronautical communications.

2.1.7 VHF Data Link (VDL) Mode 1

ICAO developed VDL Mode 1 based on the ACARS physical layer in an effort to transition from a character-oriented VHF data link to a bit-oriented protocol with higher data integrity. Although ICAO published Standards and Recommended Practices (SARPs) for VDL Mode 1 in 1996, the development of VDL Mode 2 rendered VDL Mode 1 obsolete.

VDL Mode 1 has been withdrawn from ICAO standards.

2.1.8 VHF Data Link (VDL) Mode 2

VDL Mode 2 is an air-ground digital data link that is being introduced as an ACARS upgrade for ATC controller-pilot data communications while still allowing ACARS equipped aircraft to use the same network.

VDL Mode 2 is a bit-oriented system, which means that messages are sent more efficiently. ACARS transmission is limited to letters and numbers, while VDL Mode 2 sends coded data.

VDL Mode 2 delivers data at 31.5 Kbps, which is over 13 times faster than the VHF ACARS 2.4 kbps rate. This is the highest possible bit rate that can be supported by a 25 kHz channel while providing a range of 200 nautical miles. A 250 character block will take about 0.06 seconds to cross the VDL Mode 2 link instead of 0.83 seconds on the ACARS link.

VDL Mode 2 uses the Carrier Sense Multiple Access (CSMA) protocol to detect when a VHF channel is clear in order to avoid overlap with other transmissions. The VDL Mode 2 CSMA technology is superior to that of ACARS, as it detects a clear channel much quicker. This in turn results in reduced message delay and higher success rates under heavy loading conditions.

VDL Mode 2 has been accepted by the industry as the natural upgrade for ACARS.

IATA's Position:

Support upgrade of existing ACARS networks to a more efficient full-bit oriented service via VDL Mode 2.

2.1.9 VHF Data Link (VDL) Mode 3

VDL Mode 3 is a four-channel, digital/analog VHF digital link providing a pipeline for data and digital voice communications. VDL Mode 3 is based on a Time Division Multiple Access (TDMA) protocol, which operates by dividing a single channel into continuous discrete time slots and enabling up to four channels in a single 25 KHz frequency. Users interact with a master control station to mediate access to the channel. TDMA supports the delivery of time-critical messages and non-interfering voice and data transmissions.

VDL Mode 3 data link was proposed to relieve VHF voice channel congestion in the U.S. It faced competition from 8.33 kHz channel spacing, which is already implemented in Europe. Because many airlines have already equipped to 8.33 kHz, the proposal for VDL Mode 3 was withdrawn.

International airlines are against requirements for multiple equipment carriage to serve similar ATS services.

IATA’s Position:

Do not support VDL Mode 3 deployment.

2.1.10 VHF Data Link (VDL) Mode 4

VDL Mode 4 is a bit-oriented VHF data link capable of providing air to air and air to ground communications. VDL Mode 4 supports time-critical applications and it is efficient in exchanging short repetitive messages.

VDL Mode 4 is based on the Self-organising Time Division Multiple Access (STDMA) protocol. Through this self-organizing system, the time available for transmission is subdivided into multiple time-slots. Each time slot is planned and reserved for transmission by users’ radio transponders within range of each other. This enables efficient data link use and prevents simultaneous transmission from different users. STDMA allows users to mediate access to discrete time slots without reliance on a master control station.

VDL Mode 4 was a data link candidate for ADS-B. However, 1090 MHz Mode S Extended Squitter (ES) has been chosen as the standard for international aviation.

IATA’s Position:

Do not support VDL Mode 4 deployment.

2.1.11 Summary VHF Data Links

Table 2 provides a summary on the physical and data communication characteristics of the VHF data links 2.1.7 through 2.1.10.

Table 2. Summary: Comparison VHF Data Links

	VHF ACARS	VDL M2	VDL M3	VDL M4
Voice	No	No	Yes	No
Data	Yes	Yes	Yes	Yes
Spectrum required	25KHz	25 KHz	25 KHz	25 KHz
Data Rate	2.4 Kbps	31.5 Kbps	31.5 Kbps	19.2 Kbps
Protocol Specification	Character - oriented	Bit – oriented May also handle character-oriented messages, uses lower bandwidth	Bit – oriented	Bit – oriented
	Air-to-ground	Air-to-ground	Air-to-ground	Air-to-ground & air-to-air
Media Access Control (MAC)	CSMA	CSMA	TDMA	STDMA
Applications	AOC & ATS comm. (PDC/DCL, ATIS, CPDLC)	Supports CPDLC comm. & graphic weather services.	Digitized voice & data comm. Supports 4 sub-channels within the 25Khz channel	Supports comm., graphic weather service, ADS-B, TIS-B, CDTI, GNSS local area augmentation
IATA Supports	Yes	Yes	No	No

2.2 ATS Application

2.2.1 Controller Pilot Data Link Communications (CPDLC)

CPDLC refers to communications between controllers and pilots using pre-defined message sets, with a free-text option for non-routine messages.

CPDLC is significantly safer and more reliable than voice communications, as it reduces voice errors and misinterpretations, increases clarity, and helps reduce communication delays.

IATA's Position:

Support CPDLC deployment as the primary means of communication in oceanic and remote airspace where the quality of voice communications is often poor. At the same time, CPDLC should be gradually introduced to busier en-route and terminal airspace in order to relieve voice communications.

2.2.2 Aeronautical Telecommunication Network (ATN)

ATN is an internetwork architecture that allows ground, air-ground and avionic data sub-networks to interoperate by adopting common interface services and protocols based on the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) reference model.

During the mid-eighties, the ICAO Future Air Navigation System 1 (FANS 1) Committee recognized the need for aviation to introduce a global data network that would connect those playing a role in air transport such as Air Traffic Control (ATC), pilots, airlines, and military. The methodology chosen was designated the Aeronautical Telecommunication Network (ATN). Shortly thereafter, the aviation industry developed a FANS 1/A[1] data link capability using VHF air-ground stations and communication satellites. Despite its successful implementation, specifically in the Pacific Ocean region, it was not considered an integral part of the ATN.

ICAO started work on standardization of the ATN, based on the Open Systems Interconnect (OSI) seven-layer protocol stack as defined in International Telecommunications Union (ITU) and International Standards Organisation (ISO) specifications. ICAO further developed standards for the interface of Secondary Surveillance Radar (SSR) Mode S data link, Very High Frequency Data Link (VDL) modes 2, 3 and 4, and SatCom air ground data links.

ATN standards for an airborne certifiable ATN/OSI system became available in 2002, by which time the OSI protocol stack was already becoming outdated in the telecommunication industry.

Since 2003, ICAO has endeavoured to transform the ATN into a modern network by specifying use of Internet Protocol (IP) - the same protocol suite used today by the telecommunication industry. This development facilitates an ATN topology in which all relevant parties can be connected whilst at the same time making the physical network transparent to users. The relevant ICAO standards have been adopted by the ICAO Council and became applicable in November 2008.

Consequent to the need for a high quality communication infrastructure in the SESAR and NextGen programmes, a draft communication roadmap has been developed. Table 3 provides a comparison of communication technologies supporting information exchange within SESAR / NextGen.

It should be noted that SESAR divides the transition roadmap toward the year 2020 in three implementation steps IP 1, 2 and 3, while NextGen identifies three phases towards its target year of 2025, level 1, 2 and 3.

[1] FANS 1 is the Boeing designation while FANS A is the Airbus term.

Table 3. NextGen and SESAR Transition Roadmap – Communication Technologies

	Air-Ground	**Ground-Ground**	**Air-Air**
NextGen: Legacy	VHF voice UAT SatCom HF Voice/DL Mode S	Legacy voice switching	1030/1090 ACAS
SESAR: Present	VHF voice SatCom HF Voice/DL Mode S		1030/1090 ACAS
NextGen: Level 1	VDL Mode 2	Analog services, point-to-point digital services and IP network services over a common data transport layer.	ADS-B not addressed as air to air link but only surveillance
SESAR: IP 1	VDL Mode2/ATN	VoIP IP based network	1090 ES (ADS-B OUT)
NextGen: Level 2	VDL Mode 2 Multiple A/G links beyond VHF band	Integrated VoIP, data and Video IP services.	ADS-B not addressed as air to air link but only surveillance
SESAR: IP 2	VDL Mode2/ATN IEEE 802.16(WIMAX-Surface communication)		1090 ES (ADS-B IN/OUT)
NextGen: Level 3	Integrated Ground and Air Network for Voice /Data	Integrated Ground and Air Network for Voice /Data	ADS-B not addressed as air to air link but only surveillance
SESAR: IP3	New L-band Terrestrial and satellite link		L-band link

Under these programmes the following conclusions can be drawn:

a) The projects are specific on the next generation network physical elements and protocols, without being precise on the next steps.
b) Acknowledgment of the need for an increased air-ground data communication capacity, but system selection will be left to system planners.
c) IP protocols are favoured over original ATN specification.
d) Move to voice/data network integration.
e) Aside from identifying the content and evolution of the information to be exchanged, there is very limited data on the measurable Quality of Service parameters (e.g. capacity, latency, integrity, and availability) required to support the operational concept.
f) Issue of VHF congestion due to inefficient voice spectrum utilization is suppressed.
g) Appears to be no clear overall roadmap to a net centric architecture supporting System Wide Information Management (SWIM) services.

Today, the lines between traditional telecommunication services are becoming increasingly blurred due to convergence in the Information Technology (IT) sector. This facilitates a wide range of services over a single, Internet Protocol (IP) based network. Therefore, regarding ATN versus IP, the main question is how fast are we moving and can we go directly to IP without taking the ATN intermediate step? Reasons to directly move to IP are that ATN is an aviation specific solution, meaning that there are no commercial off-the-shelf (COTS) solutions and it has limited backwards compatibility.

In summary, although FANS 1/A and aeronautical telecommunication network (ATN) applications support similar functionality, the avionics requirements are different. There are a little over 350 aircraft today ATN equipped flying in Europe and about 3,000 aircraft that are FANS 1/A equipped, which take advantage of the data link services offered in certain oceanic and remote regions.

IATA's Position

Due to the rapid evolution of telecommunication standards and protocols, further evaluation is required before a final recommendation can be made on the next generation global communication network system.

3. Navigation: Performance Based Navigation (PBN)

Performance-based navigation (PBN) is a global set of area navigation standards, defined by ICAO, based on performance requirements for aircraft navigating on departure, arrival, approach or en-route. These performance requirements are expressed as navigation specifications in terms of accuracy, integrity, continuity, availability and functionality required for a particular airspace or airport. PBN will eliminate the regional differences of various Required Navigation Performance (RNP) and Area Navigation (RNAV) specifications that exist today.

The PBN concept encompasses two types of navigation specifications:

- **RNAV specification**: navigation specification based on area navigation that does not include the requirement for on-board performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.
- **RNP specification**: navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4.

The 2007 36th ICAO General Assembly resolution A36-23 urges all States to implement PBN for en route and terminal areas, and to implement PBN approach procedures with vertical guidance (APV) using Baro-VNAV and/or augmented GNSS (see section 6.1) for all instrument runway ends (as primary or back-up for precision approach) by 2016 - with 30% by 2010, 70% by 2014.

It is expected that all future navigation applications will identify the navigation requirements through the use of PBN performance specifications, rather than defining equipage of specific navigation sensors. Table 4 gives a more complete description and status of the PBN RNAV and RNP values.

Table 4. PBN Values & Application

Area of Application	Navigation Accuracy (NM)	Navigation Specification (current)	Navigation Specification (new)	Require performance monitoring & alerting
Oceanic & Remote	10	RNP 10	RNP 10	No
	4	RNP 4	RNP 4	Yes
En route – Continental	5	RNP 5 Basic RNAV	RNAV 5	No
En route – Continental and Terminal	2	US RNAV type A	RNAV 2	No
	2	*N/A*	*Basic-RNP 2 (TBD*)*	*Yes*
Terminal	1	US RNAV type B P RNAV	RNAV 1	No
	1	N/A	Basic-RNP 1	Yes
	1	*N/A*	*Advanced RNP 1 (TBD)*	*Yes*
Approach	0.3	RNP 0.3	RNP APCH (RNP 0.3)	Yes
	0.3-0.1	RNP SAAAR	RNP AR APCH (RNP 0.3-0.1)	Yes

* *To be Developed (TBD)*

Benefits

The advantage of PBN to the ANSP is that PBN avoids the need to purchase and deploy navigation aids for each new route or instrument procedure. The advantage to everyone is that PBN clarifies how area navigation systems are used and facilitates the operational approval process for operators by providing a limited set of navigation specifications intended for global use.

The safety benefits to PBN are significant, as even airports located in the poorest areas of the world can have runway aligned approaches with horizontal and vertical guidance to any runway end without having to install, calibrate and monitor expensive ground based navigation aids. Therefore, with PBN all airports can have a stabilized instrument approach that will allow aircraft to land into the wind, as opposed to a tail wind landing.

Airline Requirements

Airlines want to quickly adopt PBN, as the benefits are significant for all phases of flight.

- For departures, airlines want standard instrument departures (SIDs) for every departing runway that quickly allows aircraft to join their route to destination.
- For en-route, airlines ideally want routes that are flexible based on that day's operating conditions and upper winds. If flexible routes are not possible then a network of RNAV or RNP direct routes is preferred.
- For arrivals, airlines want standard arrivals (STARs) off every airway that provides the least track miles to the initial approach fix, preferably with a continuous descent profile from the top of descent.
- For approaches airlines need a runway aligned approach with lateral and vertical guidance (APV) for every runway end that terrain allows.

The decision to plan for RNAV or RNP has to be decided on a case by case basis in consultation with the airspace user. Some areas need only a simple RNAV to maximise the benefits, while other areas such as nearby steep terrain or dense air traffic may require the most stringent RNP. Also, since RNP AR Approaches require significant investment and training, ANSPs should work closely with airlines to determine where RNP AR Approach should be implemented. In all cases PBN implementation needs to be an agreement between the airspace user, the ANSP and the regulatory authorities.

IATA's Position:

Fully support early implementation of RNAV and RNP based on the ICAO PBN. IATA also supports the implementation of Approach with Vertical Guidance (APV) for all runways with a Barometric VNAV used for vertical path guidance during the final approach segment.

During the transition period to PBN, regional specific area navigation requirements should honour PBN navigation approvals that also meet the regional specific criteria. For example, in the European Flight Efficiency Plan there is a provision where all operators that are approved against the PBN criteria for RNAV 1 should be eligible to operate on European P-RNAV routes with no further approval required.

4. Navigation: WGS-84

There are many different geodetic reference datums in use throughout the world that provides reference to terrain and charting. However, for aviation there is only one acceptable standard, which is WGS-84. This ICAO Standard is found in Annexes 4, 11 and 14, which states "World Geodetic System — 1984 (WGS-84) shall be used as the horizontal (geodetic) reference system for air navigation." These requirements became applicable on 1 January 1998.

Consequentially the Global Navigation Satellite System (GNSS) and all aircraft navigation and terrain avoidance systems are based solely on WGS-84. All aircraft systems assume that the latitude and longitude coordinates provided are based on WGS-84. If such charted coordinates are not WGS-84, then there is a positional discrepancy between where the pilot and controller thinks the aircraft is at and the actual position of the aircraft itself. Such a discrepancy is not tolerable and adversely affects the safety of flight, especially at lower altitudes near terrain and obstacles. Therefore, all routes and all instrument procedures must be based upon WGS-84 coordinates.

States that have not implemented WGS-84 are in a serious safety violation and need to implement WGS-84 as soon as possible. Additionally, WGS-84 must undergo periodic maintenance and validation, as terrain and man-made obstacles (whether temporary or permanent) do change.

IATA's Position:

Implementation and maintenance of WGS-84 coordinates is a paramount priority due to consequential safety implications.

5. Navigation: Ground-Based Aids

Conventional navigation aids are ground stations in fixed locations with limited coverage according to their Standard Service Volumes. Aircraft usually calculate their position using radio signals from navigation aids in known locations. This section provides an overview of the following ground-based navigation aids:

- Distance Measuring Equipment (DME)
- Instrument Landing Systems (ILS)
- Microwave Landing System (MLS)
- Non-Directional Beacon (NDB)
- Tactical Air Navigation (TACAN)
- VHF Omni-directional Range (VOR) stations

5.1 Distance Measuring Equipment (DME)

The DME is a ground-based navigation aid that measures distance between an aircraft and a ground station by timing the propagation delay of radio signals.

DME has been considered a cost effective contingency navigation system to GNSS, and it is also part of the navigation infrastructure that supports Performance Based Navigation.

IATA's Position:

Support continued DME deployment where required as a contingency navigation system to GNSS and in accordance with an agreed airspace concept.

5.2 Instrument Landing System (ILS)

The ILS is a ground-based precision landing system that provides horizontal and vertical guidance to an aircraft approaching a runway. ILS is the primary international non-visual precision approach system approved by ICAO, serving the industry for over 40 years and undergoing a number of safety related improvements to increase its accuracy and reliability.

IATA's Position:

ILS is a proven technology that meets user requirements today and is still considered an essential navigation system where precision approaches are required. When the Ground Based Augmentation System (GBAS) becomes a viable option for CAT II/III approaches, then there should be a transition to replace ILS with GNSS Landing System (GLS).

5.3 Microwave Landing System (MLS)

The MLS is a ground-based precision landing system operating in the microwave spectrum. MLS was intended to be the next generation precision approach system that would replace ILS. MLS has the potential to enable closely spaced auto-land approaches in low visibility conditions, as it does not suffer from broadcast interference problems like ILS. Additionally, MLS enables curved approaches through its ±60 degrees of lateral coverage from the runway.

Although some MLS systems became operational in the 1990s, widespread application never occurred due to the introduction of GPS. Consequentially the majority of airlines did not equip. Although there is some renewed interest in Europe, most of the aviation world is waiting to see if GBAS will be able to provide cost effective CAT II/III services to replace ILS (target date for CAT II / III ICAO Standards is 2013).

IATA's Position:

ANSPs / States should only consider MLS implementation at specific aerodromes and these should be limited to places where the airspace users are willing and able to equip and fund for its installation.

5.4 Non-Directional Beacon (NDB)

The NDB is a ground-based navaid that broadcasts non-directional signals, which permit equipped aircraft to determine bearing to or from radio beacon. NDBs were the basis of early air route systems and are used as non-precision approach aids for NDB instrument approaches.

Many of the NDBs in service today are deemed to be obsolete and not required for safe navigation in a navigational infrastructure utilizing GNSS.

IATA's Position:

Support transition to GNSS as the primary radio navigation aid and recommend rapid decommission of NDBs for navigation services. Additionally, airports that only have a non-precision NDB approach should develop a RNAV or RNP approach that meets ICAO's PBN criteria.

5.5 Tactical Air Navigation (TACAN)

TACAN is a ground-based navigation aid used primarily by the military for en-route, non-precision approaches and other military applications. It provides azimuth in the form of radials and distance from the ground station.

IATA's Position:

There are no civil aviation requirements for TACAN.

5.6 VHF Omni-directional Range (VOR)

VOR is a navigation aid that transmits very high frequency navigation signals 360° in azimuth. VOR is the basis for the VHF airway structure and is used for VOR non-precision instrument approaches.

The majority of VORs are over 30 years old and are becoming difficult to maintain. Several ANSPs have indicated a reduced reliance on VORs and are planning their withdrawal as they transition to a Performance Based Navigation (RNAV and RNP) environment.

IATA's Position:

Support transition to GNSS as the primary radio navigation aid and recommend a target date of 2016 for the withdrawal of all VORs. Additionally, airports that only have a non-precision VOR approach should develop an RNP approach that meets ICAO's PBN criteria.

6. Navigation: Global Navigation Satellite System (GNSS)

Navigation is evolving from ground based navigation aids to satellite based navigation systems called the Global Navigation Satellite System (GNSS). GNSS provides standardized positioning information to the aircraft for precise navigation globally. Satellites in the core constellations broadcast a timing signal and a data message. Aircraft GNSS receivers use these signals to calculate their range from each satellite in view and also calculate 3-D position and precise time. Airlines are urging States to move from the current ground-based navigation systems to GNSS that is capable of being used in all airspace during all phases of flight.

As of 2008, the United States NAVSTAR Global Positioning System (GPS) is the only fully operational GNSS used by airlines. However, the Russian GLONASS is currently being restored to full operation (20 satellites by 2009) and the European Galileo global navigation system is scheduled to be operational in 2013. Other future GNSS candidates include China's COMPASS navigation system (potential of 35 satellites) and India's Regional Navigational Satellite System (IRNSS).

GNSS is the ideal radio navigation aid to allow full exploitation of the global benefits to be gained from RNAV and RNP. IATA member airlines have expressed support for GNSS as the primary radio navigation aid for positioning and timing in the future, allowing navigation to migrate from an inefficient fragmented terrestrial system to an efficient GNSS based global air navigation system.

IATA's Position:

Support GNSS as the primary radio navigation aid for all phases of flight.

6.1 GNSS Augmentation

To meet required performance for the more stringent navigational applications, such as precision approaches, augmentation of the GNSS signal is required in order to improve accuracy and monitor data integrity.

The following sections present an overview of IATA's positions on:

- 6.1.1 Aircraft Based Augmentation System (ABAS)
- 6.1.2 Ground Based Augmentation System (GBAS); and
- 6.1.3 Satellite Based Augmentation System (SBAS)

ICAO has published Standards and Recommended Practices (SARPs) for all three of these augmentation systems.

6.1.1 Aircraft Based Augmentation System (ABAS)

ABAS is a self-contained system on board the aircraft that augments and/or integrates the information obtained from the other GNSS elements with information available on board the aircraft. ABAS meets ICAO's GNSS signal-in-space performance requirements for accuracy, integrity, continuity and availability.

ABAS is the most cost-effective augmentation system, as it utilizes avionics already on board the aircraft.

***IATA's Position*:**

With the exception of GBAS for precision approach, ABAS is the preferred and most cost-effective system for augmenting the accuracy, integrity, availability, and continuity of the GNSS signal.

6.1.2 Ground Based Augmentation System (GBAS)

GBAS is an augmentation system in which the user receives augmentation information directly from a ground-based transmitter. GBAS uses a group of local ground stations, typically located at an airport, to collect information from the GPS constellation. The correction message is broadcasted from the local ground-based transmitter via a VHF data link to the aircraft operating within the range of the transmitter. A single GBAS installation, which should cost approximately the same as an ILS, is designed to provide precision approach capability for all runway ends at an airport.

GBAS meets ICAO's GNSS signal-in-space performance requirements for accuracy, integrity, continuity and availability. GBAS is intended to support all types of approach, landing, departure and surface operations and may support en-route and terminal operations. ICAO has published SARPs that support Category I precision approach with curved and segmented flight paths. The SARPs for Category II/III precision approach should be effective 2013.

GBAS has the potential to be a superior cost-effective replacement for ILS at a fraction of the cost of SBAS or ILS to all runway ends.

***IATA's Position*:**

IATA considers GBAS as the GNSS candidate to replace ILS CAT I/II/III. However, a business case is still required based on CAT II/III requirements.

6.1.3 Satellite Based Augmentation System (SBAS)

SBAS is a satellite based wide-coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter. Compared to the other forms of augmentation, SBAS is extremely costly, as it comprises a network of ground-based reference stations to monitor satellite signals; master stations to process data from ground reference stations and generate SBAS signals; uplink stations to send messages to geostationary satellites, and satellite transponders to broadcast integrity and correction messages to aircraft. Additionally, SBAS would require costly changes to airborne equipage used by airlines today.

SBAS can provide vertical guidance down to 250-foot decision height, and the United States SBAS system (WAAS), under favourable specific conditions, can provide vertical guidance to a 200-foot decision height for Category I precision approach. In this case, there is a 50-foot improvement over RNP with Baro-VNAV. However SBAS is not a solution for 100-foot decision height or for auto-land. Moreover, the vast majority of airports that service air transport operators (and alternates) offer standard ILS operations. Therefore, SBAS is not an airline requirement but GBAS remains a requirement for the future implementation of GNSS Category II and III precision approach.

There are several SBAS systems either operational or under development that enhance the performance of the GPS signal for general public use, such as WAAS in North America, EGNOS in Europe, MSAS in Japan, and GAGAN in India. However, SBAS does not offer a global solution for aviation. There is no Cost-Benefit Analysis (CBA) supporting a business case for airlines, and their aircraft are not equipped for SBAS. Furthermore, most aircraft manufacturers do not offer SBAS avionics as an option for airlines, nor do they have plans to offer SBAS capability in the future - one reason being is that the new generation aircraft already have RNP 0.3-0.1 functionality already available. This capability combined with Baro-VNAV meets airlines' GNSS approach requirements until GBAS CAT II/III capability is available (around the 2013 timeframe).

In conclusion, airlines see no operational benefit from SBAS and are not convinced of its short or long term potential. Therefore, IATA does not support the continued development and implementation of SBAS.

***IATA's Position*:**

Do not support the continued investment, development, and implementation of SBAS. No business case involving tangible operational benefits has been demonstrated for airlines in support of SBAS; therefore, this is the only GNSS augmentation system that airlines are not willing to pay for cost recovery.

7. Surveillance: Radar

Technologies used for surveillance of air transport category aircraft are varied. Systems currently employed include:

- Procedural Position Reports
- Primary Surveillance Radar (PSR)
- Secondary Surveillance Radar (SSR) – Mode A, Mode C, and Mode S
- Multilateration (MLAT)
- Precision Approach Radar (PAR)
- Automatic Dependent Surveillance – Contract (ADS-C)
- Automatic Dependent Surveillance – Broadcast (ADS-B)

ANSPs traditionally base aircraft surveillance on radar in dense airspace and voice or ADS-C position reports in remote and oceanic airspace. Where radar needs to be maintained or established, IATA views Secondary Surveillance Radar (SSR) & Mode S as the preferred technology. Further details on radar surveillance technologies are provided in the following sections.

7.1 Primary Surveillance Radar (PSR)

Primary surveillance radar (PSR) relies on a narrow beam of transmitted pulses of radio energy being reflected back from aircraft. The PSR uses the reflected energy to determine the aircraft's position for presentation on the controller's display.

Although in the past PSR provided useful support to en-route ATC, currently there is no airline requirement for using this technology. Secondary Surveillance Radar (SSR), Multilateration, and Automatic Dependent Surveillance Broadcast (ADS-B) have vastly superseded PSR.

Some ANSPs have justified PSR retention on its ability to detect thunderstorms. However, PSR has limited storm penetration and it may sometimes display rudimentary (or false) thunderstorm activity. Airborne radar systems provide accurate weather information to airlines and State meteorological services provide weather information derived from Doppler radar to ATC.

PSR remains the system of choice for the identification of unknown or unlawful intrusions into sovereign or territorial airspace. However, this is a national security service and its infrastructure cost should be borne by the State and not by air navigation fees for civil aviation.

Continued use of PSR within terminal areas may ensure detection and tracking of non-cooperative targets i.e. aircraft not equipped with SSR transponder or experiencing avionics failure. However, Multilateration (see section 8.6) will be a superior replacement for PSR in terminal airspace.

IATA's Position:

Do not support PSR deployment for civil air traffic services, as SSR and ADS-B have vastly superseded this technology and there is currently no operational benefit for PSR surveillance. Therefore, user charges associated with future upgrades or new PSR installations should be removed.

7.2 Secondary Surveillance Radar (SSR): Mode A/C and Mode S

SSR sends out signals that interrogate aircraft transponders. Replies provide position and include a four-digit identity code (Mode A) and pressure-altitude reports (Mode C). Replies are used to display aircraft position, altitude and identity on controllers' screens. Due to the increase in air traffic density, the number of potential Mode A code combinations became insufficient.

Mode S (Selective Addressing) is now a commonly employed SSR technique. Aircraft equipped with Mode S transponders are assigned a permanent and unique 24-bit ICAO address code. Mode S radars interrogate airframes selectively and receive individual replies. SSR Mode S improves the quality and integrity of the detection, identification and altitude reporting, overcoming some of the issues associated with mode A/C, such as the 4096-code limitation, radio frequency (RF) pollution, and lost targets.

IATA's Position:

Support SSR Mode S over SSR Mode A/C where radar must be established or replaced. SSR Mode S improves the quality and integrity of surveillance compared to Mode A/C.

7.3 Precision Approach Radar (PAR)

PAR allows controllers to monitor the approach path of an aircraft and provide lateral and vertical guidance by issuing instructions to pilots.

PAR is still used by military organisations but airline users no longer derive benefit from this technology.

IATA's Position:

- ***There is no airline requirement for PAR. User charges associated with existing PAR installations should be eliminated.***

8. Surveillance: Automatic Dependent Surveillance and Multilateration

In general, IATA views ADS-B IN based on the 1090 Extended Squitter (ES) data link as the most desirable next-generation form of surveillance, while acknowledging that equipage requirements are still being defined.

ADS-B and Multilateration (MLAT) build on a common technological framework. Surveillance based primarily on ADS-B and supplemented with MLAT should be used, whenever operationally feasible, as the next generation replacement to radar. In oceanic and remote areas, ADS-C is the preferred surveillance technology.

Technologies reviewed in this section include:

- Automatic Dependent Surveillance Broadcast (ADS-B) OUT
- Automatic Dependent Surveillance Broadcast (ADS-B) IN
- Candidate ADS-B Links
- Automatic Dependent Surveillance Contract (ADS-C)
- Traffic Information Service Broadcast (TIS-B)
- Multilateration (MLAT)

8.1 Automatic Dependent Surveillance Broadcast (ADS-B) OUT

ADS-B OUT is a surveillance technology by which an aircraft periodically and automatically broadcasts its state vector (horizontal and vertical position and velocity) and other aircraft data such as identification. Ground stations receive ADS-B OUT position reports and display them on air traffic controllers' screens. ADS-B OUT broadcasts may also be received, processed, and displayed by other aircraft in the vicinity that are equipped with ADS-B IN.

***IATA's Position*:**

Support implementation of ADS-B OUT based on Mode S Extended Squitter (1090ES) data link to supplement and eventually replace radar, and in non-radar airspace if traffic could benefit from ATC surveillance. Transition timelines need to be determined in consultation with airspace users. Operational and maintenance savings should be passed on to airspace users.

8.2 Automatic Dependent Surveillance Broadcast (ADS-B) IN

ADS-B IN is a surveillance technology by which an aircraft is able to broadcast as well as receive, process, and display the information broadcasted by another ADS-B equipped aircraft. Such information is shown on a Cockpit Display of Traffic Information (CDTI).

ADS-B IN is seen as a long-term (2020+) solution. Although information obtained through ADS-B IN greatly improves cockpit situational awareness and provides the potential for further shared air and ground separation responsibility, much remains to be accomplished in terms of system certification, application validation, human factors considerations / roles, procedures, and regulatory policies. Additionally, retrofit of existing fleets implies a major avionics upgrade and will require a lead-time of approximately ten years.

IATA's Position:

ADS-B IN is seen as the preferred next generation surveillance technology for air transportation. IATA endorses the concept of ADS-B IN according to ICAO's Global Air Navigation Plan.

However, before going forward with implementation, global consensus must be reached on:

- ***Avionics requirements and standards***
- ***Roles, responsibilities, and liabilities of pilots and air traffic controllers***
- ***Cost and benefit Analysis that presents a positive business case for airspace users and ATS providers.***

8.3 Candidate ADS-B Data links

ICAO has formalized standards for three broadcast mode data links for ADS-B: 1090 MHz Mode S Extended Squitter (1090 ES), VDL Mode 4, and Universal Access Transceiver (UAT).

Although there are three standards, there is general global consensus, including IATA, CANSO, EUROCONTROL, FAA, Airbus and Boeing, to use 1090 ES as the supporting data link for international ADS-B applications, as it is available and mature, enabling early implementation.

The majority of stakeholders do not support VDL Mode 4 after consideration of the risks and investments associated to its implementation versus the added value.

UAT carriage is of no interest to commercial air carriers.

IATA's Position:

Support Mode S 1090 ES as the single, interoperable data link to support ADS-B for the foreseeable future. Mode S 1090 ES is a technology available and mature today, enabling early application. IATA does not support VDL Mode 4 or UAT for international air traffic services or user charges associated with these technologies.

8.4 Automatic Dependent Surveillance Contract (ADS-C)

ADS-C is a surveillance technology designed for oceanic and remote airspace. ADS-C reports are sent from the aircraft to ATC via a VHF or SatCom data link and include position, velocity, intent, and weather.

Reports are automatically generated based on an electronic contract established between the aircraft Flight Management System (FMS) and a ground-based ATC installation. An aircraft typically transmits its information every 32, 27, or 14 minutes (per ICAO PANS-ATM recommendation for 50nm or 30nm separation minima), as determined by the FMS electronic contract with ATC. Contracts could be based on a specified reporting rate, event, or on-demand. The information is displayed to ATC and can also be used by automated flight tracking and monitoring systems.

IATA's Position:

Support ADS-C based surveillance for oceanic and remote airspace where appropriate. ADS-C contracts should be determined with an agreed service in consultation with airspace users, i.e. a 32 minute periodic contract for a RNP4 approved aircraft for 50NM longitudinal separation or a 14 minute periodic contract for a RNP4 approved aircraft for 30NM longitudinal separation, etc.

8.5 Traffic Information Service - Broadcast (TIS-B)

TIS-B enables SSR (Mode S and Mode A/C) or ADS-B surveillance data from multiple link sources to be combined and uplinked to an aircraft equipped with ADS-B IN, increasing situational awareness in the cockpit.

TIS-B is designed to deliver benefits in a mixed surveillance environment during the transition from radar to ADS-B surveillance or in a dual link ADS-B environment. TIS-B could fulfill an intermediary role until full deployment of ADS-B IN. It is anticipated that cockpit display of traffic information (CDTI) will predominantly be based on TIS-B during the initial transition period from radar to ADS-B IN.

IATA's Position:

Support a single data link standard based on 1090ES. If a single standard is not implemented, then ADS-B IN systems will require TIS-B functionality to display all aircraft of relevance in any given traffic situation. TIS-B should be considered to increase situational awareness during the transition from radar to a full ADS-B environment.

8.6 Multilateration (MLAT)

MLAT is a ground based surveillance system that uses transmissions from a transponder, Traffic Collision Avoidance System (TCAS), ADS-B, or military IFF transmissions to triangulate the position of a cooperative target. MLAT is also known as Hyperbolic Positioning and functions by measuring the Time Difference of Arrival (TDOA) of a signal at a number of dispersed receivers.

Note: Wide Area Multilateration (WAM) is a term commonly used to describe the surveillance of en-route airspace, while the abbreviation MLAT tends to be employed when discussing the monitoring of terminal airspace and airport surface traffic.

A limited number of ANSPs have deployed MLAT/WAM for ATM surveillance in combination with ADS-B or SSR to meet specific surveillance requirements. Some ANSPs are also deploying

MLAT as a Precision Runway Monitor (PRM) sensor and for surveillance of airport ground movements. Additional MLAT/WAM applications include ADS-B backup and RVSM height monitoring.

Depending upon the required number of sites and their locations, MLAT/WAM systems can cost considerably less than conventional radar to purchase, install, and maintain.

Global MLAT separation standards have been agreed. The Aeronautical Surveillance Panel (ASP) and the Separation and Airspace Safety Panel (SASP) have developed ICAO guidance materials and separation minimums of 5nm and 3nm for MLAT/WAM. Anticipated availability is 2010.

***IATA's Position*:**

Support MLAT to meet specific surveillance requirements when supported by clear operational requirements, separation minima, and a Cost-Benefit Analysis (CBA) involving all stakeholders. If MLAT is deployed, it should be configured to facilitate possible integration of ADS-B ground stations in a future surveillance mix.

9. OTHER DATA LINK OPERATIONAL SERVICES

Airlines support the move to migrate to a fully digital environment for aeronautical information and meteorological services to ensure that information is made available to the user in a timely manner.

This section provides an overview on the following technologies and applications:

- Digital Automatic Terminal Information Service (D-ATIS)
- Automated Weather Observing System (AWOS)
- Departure Clearance Service (DC)

9.1 Digital Automatic Terminal Information Service (D-ATIS)

ATIS is predominantly a voice broadcast service over a dedicated VHF frequency that provides operational information to aircraft operating in the vicinity of an airport, eliminating the need for a controller to transmit the information to each aircraft individually. It is normally accomplished through a voice recording, updated when conditions change.

Data link is an alternative means of transmitting ATIS to suitably equipped aircraft. It reduces flight crew workload as D-ATIS information is printed on a cockpit printer or is recallable on a data link display.

IATA's Position:

Support D-ATIS deployment at major international airports while providing dual-stack support during transition from ATIS to D-ATIS.

9.2 Automated Weather Observing System (AWOS)

AWOS is a suite of sensors that measure, collect, and disseminate weather data to help meteorologists, pilots, and flight dispatchers prepare and monitor weather forecasts. The sensors measure such elements as wind velocity, ambient air and dew point temperatures, visibility, cloud height and sky condition, precipitation occurrence and type, as well as identifying icing or freezing conditions.

In addition to safety benefits associated with weather, AWOS facilitates potential reduction in flight disruptions.

IATA's Position:

Support AWOS where operationally justified and cost-effective, for example, at airports where weather observers are not available 24 hours.

9.3 Pre-Departure Clearance Service (PDC)

A flight due to depart from an airfield must first obtain departure information and clearance from the controlling ATS unit. The pre-departure clearance service provides an automated means for requesting and delivering clearances, with the objective of reducing pilot and controller workload and diminishing clearance delivery delays.

The benefits for the introduction of PDC are:

a) Reduction of the potential for communication errors between pilots and controllers;
b) Reduction of frequency congestion;
c) Reduction of ground delays.

IATA's Position:

Support PDC deployment at major international airports to supplement and eventually replace conventional voice clearances.

10. SPECTRUM REQUIREMENTS FOR INTERNATIONAL CIVIL AVIATION

Performance of CNS/ATM systems are dependent upon the availability of radio frequency spectrum that can support the integrity and availability requirements associated with aeronautical safety of life systems, and demands special protection measures to avoid harmful interference to these systems. It was recognized by the ICAO 11th Air Navigation Conference that new radio spectrum for CNS/ATM systems will be required while the current systems continue to be maintained.

Global allocations of radio spectrum, including that for aviation, are agreed by the 191 States of the International Telecommunications Union (ITU) at World Radiocommunication Conferences (WRCs), which meet every 3-4 years. The resolutions that come out of these meetings become radio regulations and, once signed by States, have the status of international treaties.

Article 4.10 of the Radio Regulations states that ITU Member States recognize that the safety aspects of radionavigation and other safety services requires special measures to ensure their freedom from harmful interference. These factors must be taken into consideration in the allocation, assignment and use of frequencies for aeronautical systems.

IATA's Position:

To work jointly with ICAO to promote a common aviation position at the ITU WRC that aims to preserve and protect aeronautical spectrum for radiocommunication and radionavigation systems, which are required for current and future safety-of-flight applications.

11. CONCLUSION

The introduction of any new technology must be managed in a manner that enables airlines to develop a business case with near-term investment payback. IATA encourages ANSPs / States to only adopt technologies which have valid business and operational cases as agreed in consultation with airlines and other airspace users.

There are many technological "solutions" that have been developed by industry for air traffic services. However, unless they are adopted as a global standard and have agreed cost/benefits and implementation timelines with the airspace users, such technologies have no value to international aviation. For technologies that will soon be introduced (e.g., ADS-B, Multilateration, GBAS, etc.), it is essential that each application undergoes a thorough due process of safety case analysis, agreed cost-benefit, development of globally harmonized policies and procedures, establishment of separation minimums and standards, and setting of deployment timelines, involving all airspace users.

IATA is happy to address specific questions on infrastructure. Please send questions and comments to…

infrastructure@iata.org

GLOSSARY

ABAS	Aircraft Based Augmentation System
ACARS	Aircraft Communications Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-C	Automatic Dependent Surveillance – Contract
AIDC	Air Traffic Services Interfacility Data Communication
AMSS	Aeronautical Mobile Satellite Service
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
AOC	Aeronautical Operational Control Communications
APV	Approach with Vertical Guidance
ASP	Aeronautical Surveillance Panel
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
AWOS	Automated Weather Observing System
Baro-VNAV	Barometric Vertical Navigation
CANSO	Civil Air Navigation Services Organization
CBA	Cost-Benefit Analysis

CDTI	Cockpit Display of Traffic Information
CNS/ATM	Communications Navigation Surveillance/Air Traffic Management
COTS	Commercial Off-The-Shelf
CPDLC	Controller Pilot Data Link Communications
CSMA	Carrier Sense Multiple Access
D-ATIS	Digital - Automated Terminal Information Service
DL	Data Link
DME	Distance Measuring Equipment
EGNOS	European Geostationary Navigation Overlay Service (Europe)
ES	Extended Squitter
EURO-CONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration (USA)
FANS	Future Air Navigation Systems (FANS)
FIR	Flight Information Region
FMS	Flight Management System
GAGAN	GPS Aided Geo Augmented Navigation (India)
GBAS	Ground Based Augmentation Service
GEO	Geosynchronous Orbit
GES	Ground Earth Station
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HF	High Frequency

HFDL	High Frequency Data Link
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IEEE	Institute of Electrical and Electronics Engineers
IFF	Identification Friend or Foe
ILS	Instrument Landing System
IRNSS	Indian Regional Navigational Satellite System
ISO	International Organization for Standardization
IP	Internet Protocol
IT	Information Technology
ITU	International Telecommunications Union (ITU)
LEO	Low- Earth Orbit
MLS	Microwave Landing System
MSAS	MTSAT Satellite Based Augmentation System (Japan)
MTSAT	Multi-functional Transport Satellites (Japan)
NextGen	Next Generation Air Transportation System
NDB	Non Directional Beacon
NRA	Non-Radar Airspace
OSI	Open Systems Interconnection
PAR	Precision Approach Radar
PBN	Performance Based Navigation
PDC	Pre-Departure Clearance
PRM	Precision Runway Monitor

RAIM	Receiver Autonomous Integrity Monitoring
RF	Radio Frequency
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP APCH	Required Navigation Performance Approach
RNP/AR	Required Navigation Performance Authorization Required
RVSM	Reduced Vertical Separation Minimum
SASP	Separation and Airspace Safety Panel
SARPs	Standards and Recommended Practices
SBAS	Satellite Based Augmentation System
SESAR	Single European Sky ATM Research
SMR	Surface Movement Radar
SSR	Secondary Surveillance Radar
STDMA	Self-Organising Time Division Multiple Access
SWIM	System Wide Information Management
TCAS	Traffic Collision Avoidance System
TDMA	Time Division Multiple Access
TDOA	Time Difference of Arrival
TIS-B	Traffic Information Service Broadcast
TMA	Terminal Area
UAT	Universal Access Transceiver
VDL	VHF Digital Link
VHF	Very High Frequency

VNAV	Vertical Navigation
VoIP	Voice over IP
VOR	VHF Omni-directional Range
WAM	Wide Area Multilateration
WAAS	Wide Area Augmentation System (USA)
WGS-84	World Geodetic System –1984
WIMAX	Worldwide Interoperability for Microwave Access

APPENDIX 1.

User Requirements for Air Traffic Services – Planning Checklist

Some of the questions that ANSPs, States and international funding organizations need to answer when planning for the implementation of new technology are:

- What are the current and forecast requirements of airlines?
- What are the benefits of this technology to airlines in terms of safety, schedule maintenance, operation and efficiency?
- What is the timeline for realization of benefits and technology transition?
- What are the system and infrastructure requirements as well as the policies and procedures necessary to enable full realization of technology benefits?
- What is the cost to airlines in terms of increased air navigation and communication fees, on-board equipment, aircraft down time, training, maintenance, etc?
- When do these benefits recover the associated costs?
- Does the technology meet existing international standards? If new standards are required, will they be ready within an appropriate timeframe?
- Is the investment consistent with international planning, and does it contribute to seamlessness of regional and global airline operations?
- Does the technology represent the most effective use of resources?
- Is the purchase consistent with an incremental approach to technology deployment that promises early benefits to airlines and a path to future benefits?
- Are neighbouring ANSPs and States willing to consider sharing common infrastructure projects in order to save costs and promote seamless operations?

IATA