Aircraft Tracking Task Force

Report and Recommendations

November 11, 2014

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I. Executive Summary

Introduction

The Aircraft Tracking Task Force (ATTF) was established by the International Air Transport Association (IATA) following the tragic disappearance of Malaysian Airlines Flight 370 on March 8th, 2014. The ATTF's charter was straightforward: assess what can be done to improve global aircraft tracking capabilities. The so far unexplained loss of a modern commercial aircraft operating in government controlled air traffic airspace is an extreme anomaly for an industry that provides the safest mode of transportation available today. During a typical day almost 100,000 airline flights are completed without incident. Continued public confidence in this industry is essential to its future growth.

Aviation is and remains safe because its culture is one of seeking continuous improvement and learning from all events that can affect aircraft operations. While the circumstances surrounding MH370's disappearance are still unknown the ATTF has developed this Report with these three principles:

1. The safety of passengers and crew is the primary consideration of the airline industry.
2. There are technologies and best practices in use today to conduct aircraft tracking.
3. Technologies will continue to evolve, and as they do so will the ability to continue to improve global aircraft tracking.

The ATTF was endorsed and actively supported by the International Civil Aviation Organization (ICAO), demonstrating that industry and government continue to work together to improve aviation globally. An integrated approach is critical to improving and sustaining global aircraft tracking capabilities, both in the near term as well as the longer term.

Key Findings

After evaluating the current state of aircraft tracking and conducting an assessment of available and planned aircraft tracking products, services, and practices the ATTF findings are that:

1. There is a range of existing technologies and services, many already installed on aircraft, which can be used to enhance worldwide aircraft tracking in the near-term.

2. This range of technologies and services will enable operators to take a performance-based approach when implementing or enhancing aircraft tracking capabilities.
3. There is a need both to amend existing procedures and to develop new or improved communications protocols between airlines and air navigation service providers.
4. A set of performance based criteria will establish a baseline level of aircraft tracking capability.
5. Any equipment changes to address unlawful interference are a long term prospect owing to significant design, operational, procedural, certification, and safety considerations.
6. Additional options will become available in the future as new products and services are integrated into the global air navigation infrastructure through ICAO's Aviation System Block Upgrades.

Consistent with these key findings, the ATTF developed a set of performance criteria, defined in Section VI of this Report, to establish a baseline level of aircraft tracking capability. These criteria are intended for use by aircraft operators, air navigation service providers, tracking and communications service providers, and ICAO and its Member States when implementing the recommendations detailed in Section VII of this Report.

Conclusion

Commercial aviation is not sustainable if the public does not have confidence in the safety of the system. The ATTF recognizes that public trust and confidence in aviation is at risk when a large and modern aircraft cannot be located and that, in the absence of confirmed facts, speculation defines the incident. Driven by this speculation, public perception compels questions on complex issues such as making equipment on board aircraft resistant to unlawful interference. The ATTF has attempted to consider these aspects, including internal protective measures currently installed in aircraft, in developing this Report. The ATTF also believes that the content of this Report will serve to improve the collective ability to identify and track aircraft globally, significantly reducing the remote probability of such an occurrence. The ATTF Members/Observers who contributed to the development of this Report and Recommendations include representatives from:

The International Air Transport Association
The International Civil Aviation Organization
Airlines for America
The Association of Asia Pacific Airlines

The Civil Air Navigation Services Organization
The Flight Safety Foundation
The International Federation of Air Line Pilots' Associations
The International Coordinating Council of the Aerospace Industries Associations
The Boeing Company
Airbus SAS
Embraer Commercial Aviation
Bombardier Aerospace
The MITRE Corporation Center for Advanced Aviation System Development

II. Overview

The formation of an Aircraft Tracking Task Force (ATTF) was announced by IATA on April 1st, 2014 following the disappearance of Malaysian Airlines Flight 370. The still unexplained loss of a modern, highly sophisticated aircraft brought together senior experts from across the aviation industry, including representatives from airlines, air navigation service providers, safety organizations, pilot groups, airframe and equipment manufacturers, and civil aviation authorities represented by ICAO. These experts came together from May until September 2014 with the purpose of assessing the current state of global aircraft tracking capabilities and identifying what can be done to enhance that state.

In conjunction with the industry led initiative, ICAO hosted a Special Multi-disciplinary Meeting on Global Flight Tracking on May 12-13, 2014. That meeting resulted in number of outcomes, including an agreement that industry, through the ATTF, would identify near term options for enhancing global aircraft tracking and that governments, through ICAO, would assess mid-term and long-term actions that may be needed.

The ICAO meeting also concluded that a comprehensive concept of operations was needed for aircraft tracking. In parallel with the ATTF deliberations throughout the summer of 2014, ICAO formed a working group to develop an overall Global Aeronautical Distress and Safety System (GADSS) Concept of Operations. GADSS addresses the role of governments, airlines, air navigation service providers, and search and rescue agencies in both routine and non-routine aircraft tracking situations and the ATTF contributed to this work by developing the routine aircraft tracking concept portion of the document.

This Report and Recommendations will be submitted to IATA and to ICAO in order for industry and civil aviation authorities to determine the way forward. The ATTF will address any required clarifications to this Report.

III. Current State of Global Aircraft Tracking

The ATTF looked at information from ICAO, airlines, air navigation service providers (ANSPs), communication service providers, and manufacturers in order to conduct an analysis on the current state of global aircraft tracking and determine where "gaps" in tracking capabilities exist. Unfortunately, owing to limited time and available information, the picture is not as complete as had originally been anticipated. The ATTF did receive enough information, however, to conduct a general assessment of how aircraft tracking is done today, whether through ANSP provided surveillance services or by the airlines themselves. This current state assessment also relates directly with the information contained in capabilities assessment in Section IV of this Report—most notably with the technologies and services that are identified as being available today.

Aircraft Tracking via Surveillance Services

Commercial aircraft are under air traffic control/air traffic services (ATC/ATS) throughout all phases of their flight(s). ATC/ATS includes essential communication, navigation, and surveillance services; surveillance is used to manage aircraft separation requirements. Because surveillance services provide the location and identification of an aircraft in order to manage separation it also can serve as a form of aircraft tracking. In fact, a large number of commercial aircraft operators currently use ATS surveillance services for the purpose of tracking their aircraft, particularly in medium to high density airspace. Surveillance services can be disrupted, however, due to planned or unplanned maintenance issues or equipment availability. For ground based radars that provide surveillance services, there can be permanent or periodic line of sight limitations due to obstructions and the curvature of the earth. These disruptions need to be taken into account when considering aircraft tracking options.

In low density airspace—commonly referred to as oceanic or remote airspace—aircraft location and identification is approached differently. This information is often provided by periodic position reports and voice communications between the flight crew and the ANSP. In some low density airspace, Automatic Dependent Surveillance - Contract (ADS-C) is used to obtain position reports; however, this use of ADS-C is limited either because the ANSP does not support ADS-C or the aircraft is not equipped.

Aircraft Tracking by Airlines

In an effort to verify tracking practices in use today the ATTF conducted a limited survey of airlines to obtain information based on areas of operation, fleet size and type, and business models. The main points addressed by the survey included whether or not the airline currently tracked their aircraft or had plans to do so, whether or not a triggering capability was available, reporting intervals being used, and what communications,

navigation, and/or surveillance technologies were in use to support the tracking function.

The results showed that many airlines track their fleets through their Operations Control Center (OCC) using ACARS, a digital datalink system that transmits short messages between the aircraft and ground stations via VHF/HF radio or satellite communications. The results also indicated that there are areas of the world where aircraft tracking capabilities are limited by lack of communications infrastructure, interference issues, or other factors that impact use of technology. The results were considered in the development of the performance criteria contained in the Report.

In order to obtain a more robust assessment of current and planned aircraft tracking capabilities by airlines a more systematic and rigorous survey would be needed. It is also important to underscore that this current state assessment does not discuss in detail planned upgrades to ATS surveillance capabilities, fleet upgrades, or any other future improvements that would potentially impact tracking capabilities by either ANSPs or airlines.

As part of the current state assessment, the ATTF also considered the issue of human intervention with respect to equipment on board aircraft. Equipment such as transponders that are used for ATS surveillance can be disabled by the flight crew for operational or aircraft safety reasons. A malfunctioning airborne component may adversely impact ATC operations. For this reason it is necessary that means exist to deactivate such components if they are not working properly. From a safety perspective, all electrical components on board an aircraft must have the ability to have their power source interrupted in the event of an electrical system malfunction or fire. While these types of operational and safety related events are rare, the fact remains that equipment on board aircraft can be disabled.

This section of the ATTF Report is not intended to be a definitive description as current capabilities and practices vary and may also change in response to airline operations, air traffic services, or other factors which are part of the global aviation system on any given day.

IV. Assessment of Aircraft Tracking Capabilities

In evaluating the current state of aircraft tracking the ATTF was able to verify that there are many products, services, and procedures available and in use today that provide air carriers the ability to locate and track their aircraft. The ATTF determined that a summary of this information would be helpful to air carriers who need to implement or enhance their tracking capabilities. Similarly, the ATTF recognized that emerging technologies such as space-based ADS-B are expected to be available in the next three to four years and determined that these longer term options should also be reflected in the summary.

In order to provide a level of consistency in summarizing both existing and planned capabilities the ATTF and ICAO developed a survey that was sent to a limited number of systems and/or applications vendors whose products and/or services either currently support aircraft tracking or are expected to become available in the mid to longer term. Following an analysis of the survey results the ATTF invited those respondents whose products and services best and most completely addressed the items in the questionnaire to give a detailed overview of their product/service and to answer questions that had been identified during the evaluations.

Based on the survey information and discussion the following is an assessment of current and planned aircraft tracking capabilities:

Air Traffic Service Surveillance Systems

1. As noted in the current state assessment, most continental airspace with medium to high traffic density has ATS surveillance systems in place, such as Secondary Surveillance Radar (SSR), Multi-lateration, and/or ground-based Automatic Dependent Surveillance –Broadcast (ADS-B). As also noted in the current state assessment, there are commercial airlines that use ATS surveillance information to locate and identify their aircraft.

   The limitations of this approach to aircraft tracking is that these surveillance systems are not available in all parts of the world, and in some cases where the service does exist, coverage can be disrupted or limited.

   As a final consideration, most ATS surveillance systems have airborne components such as transponders. As noted in the current state assessment, this equipment is designed to allow for deactivation in the event of operational or aircraft safety needs. Once a transponder is deactivated the aircraft is “invisible” to ATS outside areas with primary radar coverage. However, there are established procedures for the flight crew and ATS to follow to confirm the

position of the aircraft and ensure that separation is maintained. The ATTF considered the issue of transponder deactivation in the broader context of unlawful interference to flight systems and discussed the issue in detail with aircraft and avionics manufacturers. The ATTF concluded that any changes to the ability to deactivate equipment on board aircraft are a long term prospect owing to significant design, operational, certification, and procedural considerations.

2. A substantial percentage of the current wide-body fleet of aircraft are equipped and capable of transmitting Automatic Dependent Surveillance–Contract (ADS-C) positions using FANS 1/A datalink equipment. This provides a near-term capability for aircraft tracking where ATS surveillance systems are not available. ADS-C has both advantages and limitations:

    a. Position reports from ADS-C enabled aircraft meet the performance criteria identified in this Report. ADS-C also provides the capability to initiate reports based on deviations from the intended lateral and vertical flight profiles through conformance monitoring; for example, deviations from planned flight routes, level range deviations, and vertical rates.

    b. ADS-C service has been implemented by many ANSPs. The geographical coverage is dependent on the satellite constellation used for communications as geostationary systems do not cover portions of the Polar Regions. Once an ADS-C contract is established between a capable aircraft and a capable ANSP, the aircraft position information can be shared with an airline over the existing communication service providers (CSP) networks.

    c. In areas where ATS surveillance is not available, a direct ADS-C feed can be provided to airline Operations Control Centers (OCC), as well as authorized third parties, through existing CSP networks, independent of the ANSP's capability to support this service. Airlines that use a direct contract to receive ADS-C position reports may incur full end-to-end transmission costs for the sole purpose of aircraft tracking.

ACARS

3. ACARS position reports can also fulfill the near term aircraft tracking criteria independent of ADS-C. ACARS uses FMS derived position information and is used today by many airlines to track their flights. The use of ACARS is still

dependent upon the use of the existing communication service provider networks and there are associated costs. Unlike ADS-C, ACARS does not provide conformance monitoring, although it is possible for an OCC to monitor flight path conformance using customized software.

Some airlines have added tracking capabilities to their ACARS maintenance reporting system with software modifications to their on board equipment. This modification provides position reports every 10 minutes, with increased reporting frequency triggered by unanticipated altitude changes or flight levels below a pre-determined altitude. In addition, flight track deviations are flagged to the OCC through dedicated software.

Stand-alone GNSS Position Reporting Devices using Satellite Communications

4. Many aircraft operating beyond the range of ATS surveillance systems are not equipped with ADS-C or, in some cases, ACARS. There are products available today that determine the aircraft position using Global Navigation Satellite System (GNSS) and transmit that information using satellite relay. For the most part, these products are assumed to be lower cost alternatives to integrated avionics solutions as some of them are small units that could be attached to an airframe. Based on available information the majority will offer global coverage once full satellite constellations are in place. The ATTF also noted that certification requirements could potentially and significantly impact both the cost and availability of these products for commercial aviation use.

Space- Based ADS-B

5. Space- based ADS-B is expected to have a significant impact on global ATS surveillance services and thus on global aircraft tracking capability. Space-based ADS-B will use signals from Mode-S transponders which are already installed or planned to be installed on most commercial aircraft.

   Space-based ADS-B should be available in 2018. In addition to the launch of satellites, frequency allocation is a critical element to making this capability a reality. At present, the 1090 MHz band is allocated to the Aeronautical Radio Navigation Service. For satellites to receive aircraft transmitted ADS-B signals, as required for at least one space based ADS-B concept, the band would also need to be designated for the Aeronautical Mobile Satellite Route Service by the International Telecommunications Union. Efforts are underway to obtain this designation.

Aircraft tracking should be considered on a global, rather than a regional or national, basis. Aircraft often cross several regional boundaries in a single flight. Different coverage, capabilities, and practices may be required to ensure that the aircraft is tracked from the moment it is airborne until it touches down. Specifically, aircraft operators need to assess their network and operations from an end-to-end perspective when considering implementation of or enhancement to aircraft tracking capabilities.

The ATTF recognizes that there are many other products and/or services either available today or which will be available in the future which may meet the performance criteria for routine aircraft tracking. This capabilities assessment is not comprehensive nor is it intended to recommend the use of any specific vendors, technologies, or services. It was developed to help aircraft operators when considering existing and future options to implement or enhance aircraft tracking.

Finally, the ATTF received only limited information from vendors on the costs of their products and services. Where applicable, the ATTF has identified potential cost considerations for each of the capabilities noted.

Summary Table of Aircraft Tracking Capabilities as Assessed by the ATTF

Technology	Timeframe	Benefits	Limitations/Cost Considerations
ATS surveillance systems (SSR, Multi-lateration, ADS-B)	Near term	• Viable alternative to OCC aircraft tracking • Widely available • Cost-effective if already in use for ATS	• Line of sight • Information not always shared with OCCs and other ANSPs
ADS-C through an ANSP	Near term	• Information available through existing networks • Global coverage (depending upon the satellite constellation) • Conformance monitoring	• Not all ANSPs are ADS-C capable • Not all aircraft are ADS-C enabled • Increased costs when reporting intervals are more frequent than ATS requirements • Installation costs • Geographical limitations due to satellite footprint
ADS-C direct to the OCC	Near term	• Aircraft tracking independent of ANSP capabilities • Global coverage (depending upon the satellite constellation)	• Investment required to support OCC functionality • Additional data transmission costs • Installation costs • Geographical limitations due to satellite footprint
ACARS	Near term	• Independent of ADS-C • Presently in use and configurable for enhanced aircraft tracking capabilities	• Reporting costs • Data transmission costs • Installation costs
Stand-Alone GNSS Positioning Devices using Satellite Communications	Near term for certified devices; mid to long term for non-certified	• Global coverage (depending on the satellite constellation) • Independent of ADS-B and ADS-C • Flexibility—some products can be configured to meet customer requirements • Potential to isolate device on aircraft	• Installation, maintenance, data transmission, and possible certification costs • Not widely used on air transport class airplanes • Reporting costs
Space-based ADS-B	Longer term	• Uses existing equipage (Mode-S transponders) • Global coverage	• Frequency allocation dependent • Undetermined cost of service • Some concepts require additional aircraft equipment

V. Concept of Operations

The following describes the desired characteristics of commercial aircraft tracking during routine operation, provides an overview of the required communication protocol between stakeholders, and highlights the point at which aircraft tracking may no longer be considered routine. This concept is also incorporated into the routine tracking section of the ICAO GADSS document.

Aircraft Tracking

In order to be effective, the aircraft tracking functionality needs to be active at take-off and remain operational while the aircraft is airborne. The aircraft's position should be reported at least every 15 minutes. In airspace where ATS surveillance services or ADS-C identifies the position at least every 15 minutes, the aircraft operator may rely on those systems for tracking information.

In response to unanticipated operational events, e.g. altitude deviations or changes to potential area of operation, there may be a need for the reporting rate to be increased. At this point an analysis must be conducted to determine if a move to an alert phase is warranted. This analysis may require a dialogue between the aircraft operator and the air traffic service provider. For aircraft operators who receive tracking information directly from the aircraft they will need to ensure that procedures are in place to respond to instances of missed reporting. If the conditions that led to increased reporting rate cease to exist then the reporting may revert to the original rate.

In airspace where aircraft tracking is provided through ANSP surveillance services and there is no agreement in place between that ANSP and the aircraft operator for transmission of routine tracking information, the ANSP will make information available to the aircraft operator when/if required in a non-routine situation.

Key stakeholders in routine aircraft tracking depend on the option(s) selected by the individual aircraft operator and can include:

- The aircraft operators' flight operations or flight planning organization;
- The airline Operations Control Center or Mission Control Center;
- Air Navigation Service Providers;
- Other aircraft tracking service providers selected by the operator
- Communication service provider(s)

Communication Procedures and Protocol

When establishing an aircraft tracking functionality the aircraft operator must ensure that responsibility for aircraft tracking is assigned to a specific sector within the company; this sector has either the capability to receive and assess the specific aircraft position information, or the ability to conduct qualified decisions based on the information received from an external tracking service provider. If the aircraft operator is using an external tracking service provider the operator needs to ensure that clearly defined communication procedures are in place and that the operator's contact information is forwarded to all relevant stakeholders.

The operator's designated sector will monitor the aircraft position information to ensure that it meets the performance criteria or will act based on information received by the service provider. If the information received from the aircraft or the service provider indicates unpredicted or unexplainable developments, or is missing completely, the operator's designated sector will use established procedures to gather more detailed information. This can include additional information from other airlines or external stakeholders including ANSPs.

Based on this information, the operator's designated sector and the air traffic service unit (ATSU) will evaluate whether the circumstances meet the criteria to initiate an alert phase or return to routine aircraft tracking. If the criteria are met, coordination between the airline and the ATSU will be conducted using an established communications protocol and maintained throughout the situation. If the tracking service is provided by an ANSP they will contact the operator's designated sector according to the established communications protocol.

If an alert phase is initiated the ATSU will contact the appropriate Rescue Coordination Center (RCC).

VI. Aircraft Tracking Performance Criteria

The ATTF has developed a set of performance criteria to describe a baseline for aircraft tracking functionality based on information from the current state assessment, the capabilities assessment, and the concept of operations. These criteria must be considered in their entirety by air carriers when implementing or enhancing aircraft tracking capabilities:

1. The aircraft tracking function should track aircraft within potential areas of operation and range;

2. The aircraft tracking functionality should be available and operating while the aircraft is airborne;

3. The information required for aircraft tracking should include the aircraft 4D position (latitude, longitude, altitude and time) and aircraft identification;

4. When transmitted by the aircraft, the tracking accuracy of the position report should be at least 1 NM or better depending on the aircraft's navigation system capability;

5. The aircraft tracking function should report at least every 15 minutes. In airspace where ATS surveillance services or ADS-C identifies the position of the aircraft at least every 15 minutes the aircraft operator may rely on that system for tracking information;

6. The aircraft tracking system should have the ability to increase its reporting rate based on established triggering parameters;

7. A communications protocol must exist between the airline and the air traffic service unit to facilitate coordination during the alert phase of an event that may be detected through aircraft tracking;

8. Operators who receive tracking information directly from the aircraft should ensure that procedures are in place to address instances where required reporting does not occur;

9. Any new airborne equipment or modification to existing equipment shall meet the appropriate airworthiness requirements.

These criteria were developed to enable effective, near term implementation and can be achieved through a combination of existing technologies and procedures. More elaborate solutions can be developed in the longer term and integrated into global air navigation infrastructure evolution through ICAO's Aviation System Block Upgrades.

VII. Conclusions and Recommendations

The ATTF has concluded that comprehensive and sustained improvement to global aircraft tracking can only be attained through commitment and support from regulators, ANSPs, and aircraft operators. While this Report is focused on providing guidance to commercial aircraft operators to implement or enhance their aircraft tracking capabilities it also considers the role of ICAO and ANSPs in the process.

As presented in Section VI of this Report, the ATTF has developed a set of performance criteria and hereby recommends that:

1. Aircraft operators, air navigation service providers, tracking and communications service providers evaluate their current aircraft tracking capabilities against these performance criteria;
2. Operators not currently meeting these criteria implement measures do so within 12 months of the issuance of this ATTF Report;
3. Operators exchange best practices regarding aircraft tracking via a venue and methodology to be defined by IATA;
4. Any future ICAO provisions for aircraft tracking be performance-based and take into consideration experience gained by operators in implementing these criteria;
5. Any future ICAO aircraft tracking standards not prescribe specific solutions in order to allow industry to make best use of existing and emerging technologies appropriate to their operation;
6. ICAO encourage Member States to require ANSPs to establish communication protocols between themselves and aircraft operators;
7. ICAO encourage Member States to conduct practice exercises involving airline operation centers, air navigation service providers, and rescue coordination centers to test and verify their ability to respond and coordinate in an integrated manner to abnormal flight scenarios.

The ATTF submits this report to IATA and ICAO for review, consideration, and identification of next steps by both industry and governments.

APPENDIX A—Explanation of Terms

The ATTF determined that a common understanding of terms would help to facilitate the deliberations and the outcomes discussed in this document. The terms contained herein are used in the context of this document only and except where indicated, have no official status within ICAO or other regulatory body.

Aircraft Identification (PANS-ATM)
The identification of a particular aircraft by a defined group of letters or figures, which allow the recognition of an individual aircraft by the parties involved in aircraft tracking.

Aircraft position (location) (new)
The position of an individual aircraft defined by latitude, longitude, and altitude at a given time.

Aircraft Tracking (new)
A ground based process that maintains and updates, at standardized intervals, a record of the four dimension (4D) position of individual aircraft in flight.

Air Navigation Service Provider (ANSP) (new)
An organization responsible and authorized to provide air navigation services.

Air Traffic Service (ATS) (PANS-ATM)
A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).

Air Traffic Services Unit (ATSU) (PANS-ATM)
A generic term meaning variously, air traffic control unit, flight information center or air traffic services reporting office

ATS Surveillance System (PANS-ATM)
A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system which enables the identification of aircraft.

Automatic Dependent Surveillance — Broadcast (ADS-B) (PANS-ATM)
A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link.

Automatic Dependent Surveillance — Contract (ADS-C) (PANS-ATM)
A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports.

ADS-C Agreement (PANS-ATM)
A reporting plan which establishes the conditions of ADS-C data reporting.
Note: *Data required by the air traffic services unit and the frequency of ADS-C reports have to be agreed to prior to using ADS-C in the provision of air traffic services.*

ADS-C Position Report (new)
An automatic position report made to an ATS unit in the form of a data block.
Note: *The requirements for the transmission and contents of ADS-C reports are established by the controlling ATS unit on the basis of current operational conditions and communicated to the aircraft and acknowledged through an ADS-C agreement.*

Capability (new)
The ability to perform or achieve certain actions or outcomes through a set of controllable and measurable faculties, features, functions, processes, or services.

Commercial Air Operations (new)
That part of civil aviation which involves operating aircraft for hire to transport passengers or cargo.

Conformance Monitoring (new)
A function that compares the present position of the aircraft with the current flight plan and indicates deviation within set parameters.

Data Link (PANS-ATM)
An electronic means of transmitting and receiving digital information

FANS 1/A (new)
An avionics system which provides direct data link communication between the pilot and ATC that includes air traffic control clearances, pilot requests, and position reporting. FANS 1/A design is a range of Future Air Navigation System (FANS) products; FANS-1 refers to the Boeing solution, while FANS-A is the Airbus solution

Flight Monitoring (New)
The active tracking of a flight by suitably qualified operational control personnel throughout all phases of the flight.

Global Navigation Satellite System (GNSS) (PANS-OPS)
A worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers and system integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation.

Near term (new)
Refers to those technical and operational aircraft tracking capabilities that are currently available and which may be implemented with relatively limited effort and at reasonable expense.

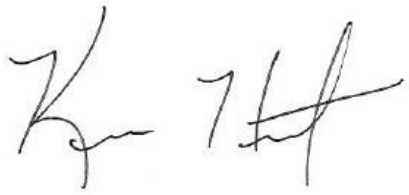
Potential Area of Operation (new)
The area in which a particular aircraft can operate according to its flight plan, including alternate airports and/or eventual diversion.

The ATTF Report and Recommendations

This document has been submitted to the International Civil Aviation Organization to be a part of the Global Aeronautical Distress and Safety System (GADSS) Concept of Operations.

Date of submission to ICAO is December 8, 2014

Respectfully,



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