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ENSURING NO AIRCRAFT IN DISTRESS IS LOST

ICAO-GADSS CONCEPT OF GLOBAL FLIGHT TRACKING

BY DREW WILKINSON

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Blue Sky Network is a pioneer in the development of satellite tracking and two-way communication for remotely active private, commercial, and government fleets worldwide. Today, Blue Sky Network is an industry leading developer and supplier of complete global SATCOM solutions for the aviation, marine, and land-mobile industries. Blue Sky Network's interactive web portal, SkyRouter, offers extensive tracking, communicating and managing functionality without the expense and difficulty of additional computer hardware/software.

INTRODUCTION

The delay in finding Air France AF447 and the tragic disappearance of Malaysia Airlines MH370 from Kuala Lumpur, Malaysia to Beijing (the search is still on-going), prompted the International Civil Aviation Organization (ICAO) to hold a global flight tracking gathering May 12-13, 2014 at ICAO's headquarters in Montreal.

Since then, development steps to a full ICAO resolution have taken place in order to insure that no aircraft is "lost" and that global aviation safety takes a big step forward.

CONTENTS

With respect to aircraft tracking, the ICAO Global Aeronautical Distress and Safety System (ICAO-GADSS) concept of operations was developed and includes both normal tracking (defined as a minimum of every 15 minutes) and distress tracking (reporting a minimum of every minute).

The Aircraft Tracking Task Force (ATTF) was created in April 2014 and by May 2015 the exploration of using various technologies was underway, led by a Normal Aircraft Tracking Implementation Initiative and corresponding Steering Committee. This was done with the intention of better evaluating the details of the GADSS concept.

On March 8th, 2016, ICAO announced new Standards and Recommended Practices (SARPS), with a press release detailing that the ICAO council had "adopted new provisions aimed at preventing the loss of commercial aircraft experiencing distress in remote locations". These provisions will be reflected as amendments to Annex 6 to the Chicago Convention (Operation of Aircraft) and will take effect between now and 2021.

Given the high-profile nature of the disappearance of MH370, the evolving implementation of the ICAO-GADSS global flight tracking initiative is of significant interest to all stakeholders involved in commercial aviation, including airline passengers. Still it is evident that misconceptions linger regarding what exactly the ICAO-GADSS global flight tracking initiative recommends and what the capabilities required of an ICAO-GADSS qualifying solution must be.

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WHITE PAPER

OBJECTIVE

TIMELINE

June 1, 2009
Air France Flight AF447 is declared missing.

June 6, 2009
Authorities locate first signs of aircraft wreckage on the ocean surface.

March 8, 2014
Malaysia Airlines Flight 370 disappears—still missing over two years later.

May 12-13, 2014
The first ICAO meeting on global aircraft tracking is held. Blue Sky Network presents to aviation industry leaders at this Multi-disciplinary Meeting on Global Flight Tracking (MMGFT).

November 11, 2014
Aircraft Tracking Force (ATTF) publishes its report and recommendations.

February 2-5, 2015
The second ICAO High Level Safety Conference (HLSC 2015) is held.

Given that the ICAO-GADSS is designed to be an industry-led initiative, it is absolutely crucial that those involved in commercial aviation possess a comprehensive understanding of what exactly is required.

This white paper seeks to contribute to this understanding by:

- Providing an overview of the global flight tracking initiative (referred to as the 'GADSS concept' or simply 'GADSS' hereinafter).
- Dispelling some of the most common misconceptions that currently surround the GADSS concept.

Note: The Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) issues will not be addressed (see Page 4).

To achieve this, an analysis of the provisions adopted by ICAO is provided. Following this, five common "myths" surrounding GADSS are addressed. This white paper then charts the GADSS requirements against the capabilities of several existing technologies often tendered as GADSS qualifying. The conclusion offers a blueprint for action and urges the commercial aviation community to move swiftly in making global flight tracking a reality.

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TIMELINE

February 25, 2015
One year after MH370's disappearance, 24,000 km^2 has been searched in an attempt to locate the aircraft.

April 30-May 1, 2015
A Communications & Aircraft Tracking Service Providers' workshop is held in Montreal and Blue Sky Network is invited to participate.

June 12, 2015
Global Aeronautical Distress & Safety System (GADSS) concept of operations is devised by the ad-hoc working group on aircraft tracking.

September 1, 2015
Normal Tracking Implementation Initiative (NATII) Steering Committee publishes an update.

March 8, 2016
ICAO announces adoption of new provisions aimed at preventing the loss of aircraft experiencing distress in remote locations. These provisions are reflected as amendments to Annex 6 to the Chicago Convention (Operations of Aircraft) and will take effect between now and 2021.

THE GADSS CONCEPT
THREE KEY ELEMENTS

GADSS consists of three elements:

- The Aircraft Equipment
- The Communications Link
- The Airline Operations Center (AOC)

While virtually all aircraft safely depart and arrive at specified destinations, it is surprising that most commercial aircraft—including long range routes over water as well as Polar Regions—only send automated position data to other proximate aircraft and, to some degree, specifically equipped air traffic control stations. This limits the ability to pinpoint exact aircraft positions for all aircraft at all times.

Most of these longer route commercial aircraft communicate largely using high-frequency radio. Pilots check in at fixed "reporting points" along the way, providing the position, air speed, and altitude. This is problematic as atmospheric conditions and weather can affect the performance of high frequency radio. Radio silence between reporting points is not uncommon and, for obvious reasons, very problematic.

The GADSS tracking concept has been defined in order to provide more accurate information about an aircraft's condition and exact location in a timely manner, especially in these 'blind spots'. To be clear, there is an exemption for operators flying in highly organized airspace such as the United States. As mentioned, GADSS has been designed to be an industry-led initiative, as this was seen as the most streamlined and adoptable manner of achieving implementation.

What the GADSS concept has, in essence proposed, is seamless aircraft tracking for commercial air transport operations (i.e. activated at takeoff and operational throughout the course of a flight to landing). It is envisaged that this tracking would address all phases of the flight, under all conditions, including distress.

It is important to note that the required automatic position reporting information would be sent directly to the airlines and their operations centers, rather than the Air Traffic Control (ATC). Therefore, all command and control is between the Airline Operation Center (AOC) and aircraft.

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GADSS

KEY COMPONENTS OF TRACKING

The ICAO figure below defines the key aircraft tracking components of GADSS. This paper paper does ***not*** address the GADSS concepts surrounding flight data recorder (FDR) recovery or cockpit voice recorder (CVR) and instead focuses on the first three flight tracking components depicted below:

ICAO UNITING AVIATION

GADSS KEY TRACKING COMPONENTS

The GADSS Concept covers normal, abnormal and distress conditions

(Source: GADSS Global Aeronautical Distress and Safety System Search and Rescue Aspects Presentation-Modified)

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GADSS
COMPONENTS OF TRACKING

Normal automated tracking of aircraft would be required to occur a minimum of every 15 minutes (assuming a mile every 10 seconds, this equates to 125 miles). Each automated position report is required to be 4-dimensional (4D) which includes the aircraft's latitude, longitude, altitude, and the exact time at each position.

Both the Abnormal Aircraft Tracking (AAT) and Autonomous Distress Tracking (ADT), on the other hand, would initiate independently from normal aircraft tracking and be, as the name implies, automatically triggered by anomalies such as unusual attitude, speed, acceleration, or a departure from its normal flight path.

KEY TRACKING COMPONENTS

Normal Aircraft Tracking

- 4D reports sent automatically every 15 minutes from aircraft to AOC
- Possible subset of ATS surveillance
- Used for airline operational functions

Autonomous Abnormal Aircraft Tracking

- Triggered by airline defined event anomalies
- Automatically increases position reporting rate depending on severity
- Can be activated by flight crew
- Can ONLY be renormalized by AOC

Autonomous Distress Aircraft Tracking

- Triggered by airline defined event anomalies
- Automatically increases position reporting rate depending on severity
- Can be activated by flight crew
- Can ONLY be renormalized by AOC

The position reporting rate of the aircraft tracking system in distress situations would automatically increase as the anomaly advanced ultimately to positions being reported at no more than a one-minute interval, an increase in rate that theoretically translates to knowing the aircraft's position within six nautical miles.

The maximum one-minute tracking interval is designed to provide search and rescue agencies with a more manageable search radius in the event of a crash or aircraft disappearance. **This would also require that the aircraft tracking system be tamper-proof or 'independent' of the airplane's power (at least for the expected duration of the flight) in order to qualify it as truly autonomous.**

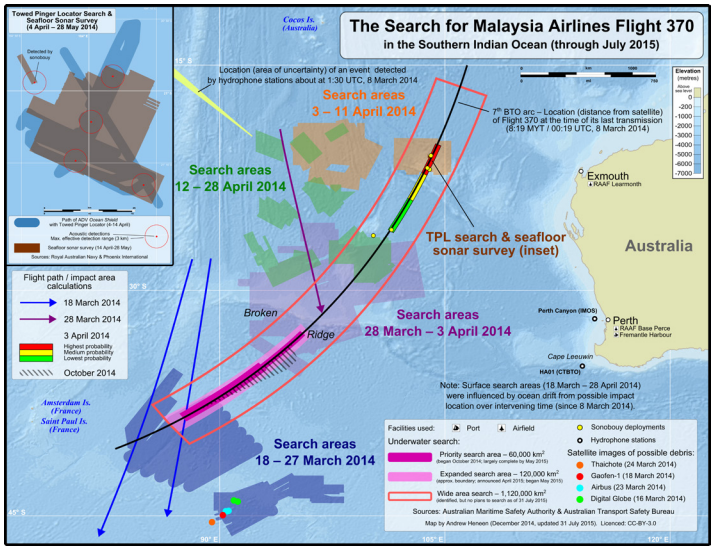
Reporting parameters and event determination/anomalies are independently identified and defined by individual airlines and onboard devices, and include making decisions on the increase in reporting frequencies with respect to each event/anomaly. ICAO notes that a distress alert may also be related to criteria surrounding aircraft position and phase of flight.

Some commentators note that "the power source for any autonomous distress tracking system would need to be engineered so as not to introduce new safety concerns." What complicates matters is that there is also the need for the autonomous distress tracking system to be renormalized after a "confirmed nuisance activation" or a return from abnormal to normal operations. Therefore, an ICAO-GADSS qualifying solution needs to be both autonomous and remotely configurable—the mandatory two-way link aspect.

GADSS also focuses on the corresponding procedures and management of information generated from the tracking of these aircraft. Therefore, in addition to technology, the GADSS identifies key areas of needed or expected improvement, such as existing Seach and Rescue (SAR) and Air Navigation Service Provider (ANSP) handoff procedures, improved coordination and information sharing, and enhanced training of personal in reacting to emergency circumstances among all the stakeholders—airline, ATC, ANSP, SAR, etc. As a result, the Airline Operation Center must be capable of sharing position data in real-time with local ATC as anomalies move to a distress condition.

IDENTIFYING AND ADDRESSING
5 COMMON MISCONCEPTIONS
SURROUNDING THE GADSS CONCEPT

In studying the written conversation surrounding the tracking provisions contained in GADSS it has become clear that several views exist. This white paper offers three broad reasons why this may be the case and then proceeds to review five of the most common 'fallacies'.



Malaysia Airlines MH370 Search Areas

The International Civil Aviation Organization was established in 1944 to foster the planning and development of international air transport

Providing Context to These Misconceptions

GADSS is a set of performance-based requirements

One of most important aspects of the GADSS is that the recommended standard is performance-based and not prescriptive, meaning that airlines are able to meet it using the available and planned technologies and procedures that they deem suitable. GADSS also notes that any system may bring additional benefits with it.

Performance-based requirements define general safety objectives that may be met by service providers through a variety of means, so long as the safety objectives are achieved. This allows states and industry to take advantage of the most technically and cost-effective solutions at any given time, allowing for valuable flexibility to service providers who, in this case, may need to upgrade their tracking capabilities. While a sensible approach for the reasons outlined above, performance-based requirements can also be misconstrued.

A changing regulatory environment

The ecosystem of commercial aviation is changing considerably. The United States, FAA's Next Generation Air Transportation System (NextGen) is transforming America's air traffic control system from a radar-based system to an ADS-B based one in stages between 2012 and 2025. For Europe, it is the Single European Sky (SES) scheme.

Other changes are simultaneously occurring or have already occurred. For example, airlines that wish to take advantage of optimal flight paths between North America and Europe are now required to be FANS-equipped. Therefore, FANS equipage is expected to increase significantly in the future. Finally, Aireon is making space-based ADS-B a reality by 2018.

This has led to a certain degree of confusion over what the necessary steps are in order to meet the various on-coming regulatory changes.

Commercial aircraft already have the proper equipment

While fantastic avionic systems may possess tracking functions to a certain degree, this does not automatically qualify them as a GADSS solution. The belief that aircraft operators already possess the technology is routinely cited, even though this is clearly not the case upon closer examination.

THE FIVE COMMON MISCONCEPTIONS ABOUT GADSS

1. With ground-based ADS-B replacing radar around the world (U.S., Europe and Australia), why is a global flight tracking initiative necessary?

2. What if ADS-B becomes a satellite-based system with 100% global coverage?

3. Moving beyond ADS-B, isn't there other existing technology on most commercial airplanes that can fulfill the GADSS vision of global flight tracking?

4. If new technology is required, how are operators going to afford to meet the cost of equipping their aircraft?

5. The ICAO Council has no power to enforce the GADSS concept. Doesn't it make sense to wait and see how individual ANSPs proceed first?

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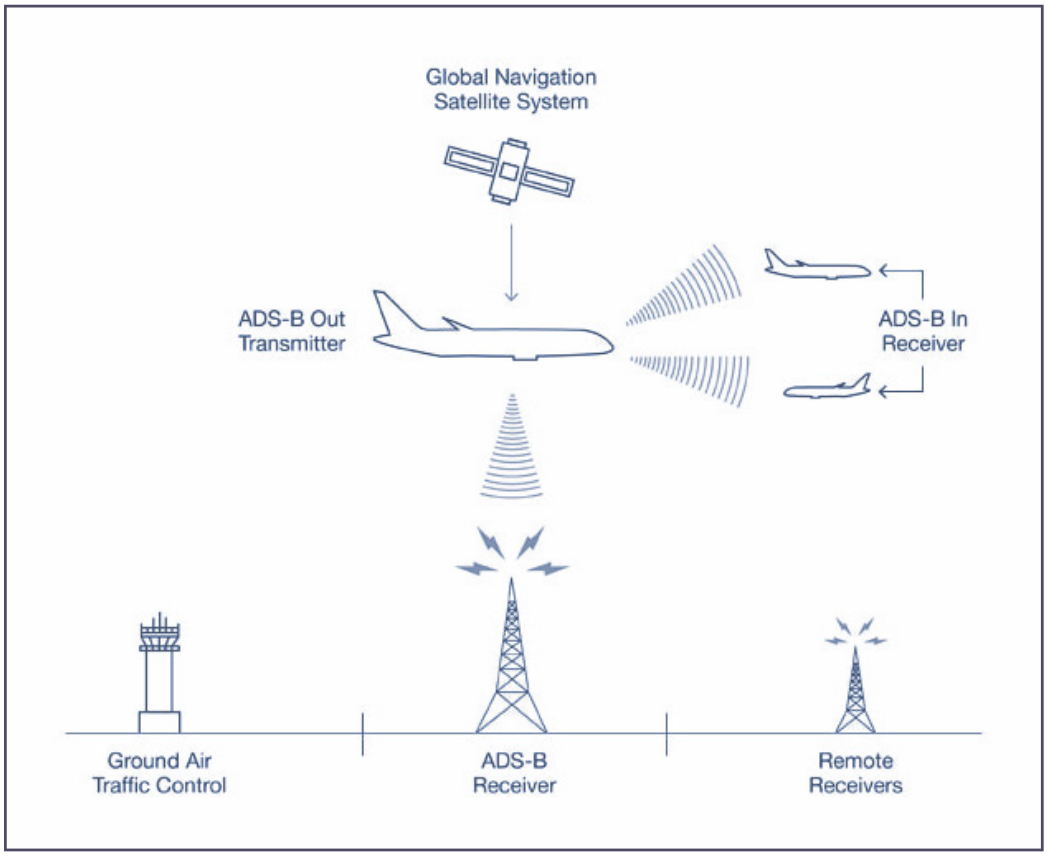
WHY IS A GLOBAL TRACKING INITIATIVE NECESSARY?

With ground-based ADS-B replacing radar in the U.S., Europe, and Australia, why is a global flight tracking initiative necessary?

Automatic Dependent Surveillance–Broadcast (ADS–B) is used for air traffic surveillance purposes. Historically, ADS-B has been used to augment existing primary and secondary radar or used in lieu of those radar technologies. However, in the U.S. the FAA has mandated ADS-B Out by 2020 on all aircraft operating in Mode-C airspace (around class B and C airspace along with above 10,000 feet), replacing radar as the primary surveillance method used by ATC. It is believed that this transition will allow ATC to monitor and control airplanes with greater precision.

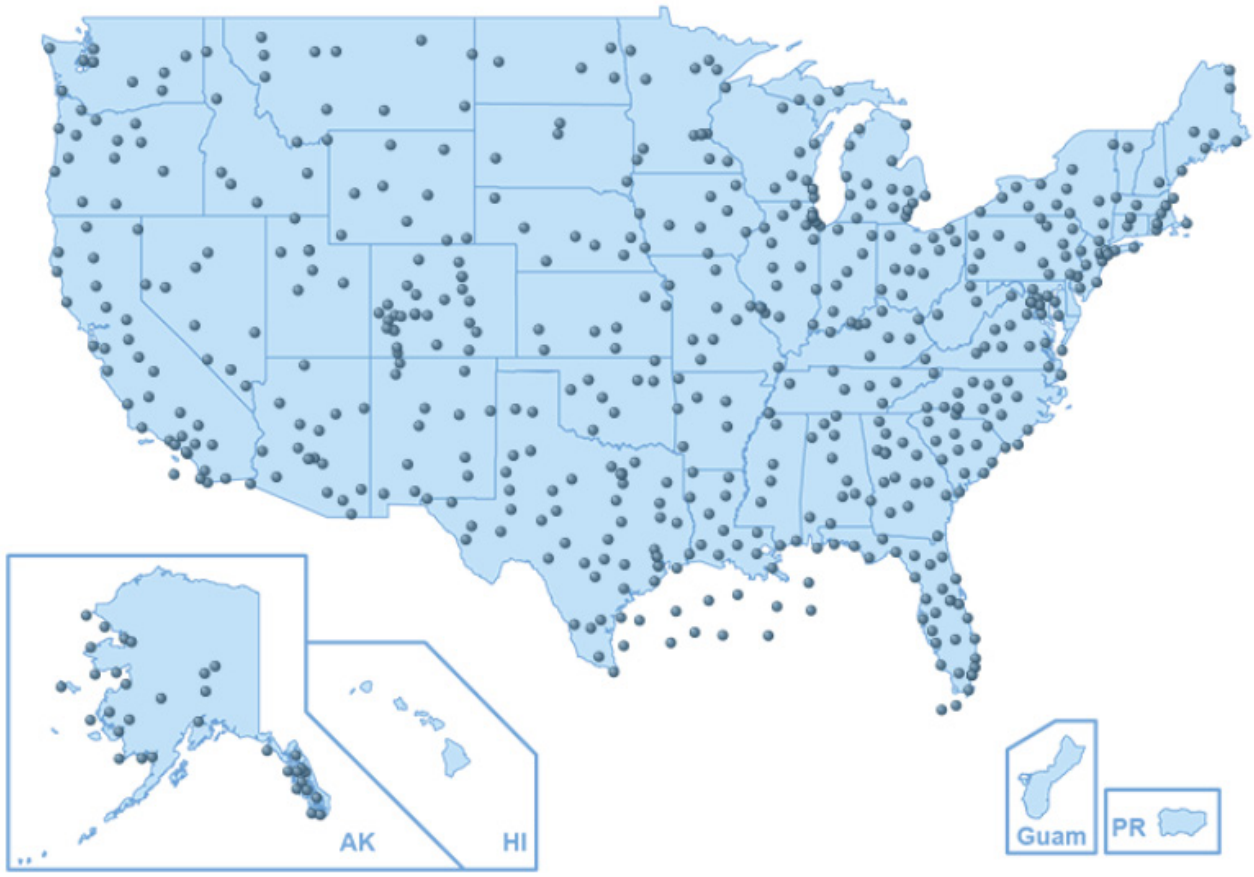


A graphical depiction of ground-based ADS-B
(Source: Boeing, "New Air Traffic Surveillance Technology," Quarter 2, 2010)

ADS-B Out allows an aircraft to broadcast its position via transponder and a GPS navigation source to air traffic surveillance, to a land-based receiver, which then transmits it to air traffic control displays (see above for a graphical depiction). ADS-B In allows an aircraft to receive broadcasts from other proximate aircraft as well as FAA ground stations. Some ADS-B systems possess both ADS-B In and Out.

WHY IS A GLOBAL TRACKING INITIATIVE NECESSARY?

However, ADS-B is often restricted by the location of land-based receivers (ADS-B surveillance systems currently only have a range of 200-250nm of land-based receivers). Ultimately this leaves an estimated 70 percent of global airspace without real-time aircraft surveillance coverage via ADS-B. While ADS-B has other failings with regards to its ability to meet the GADSS concept of flight tracking (see Page 14), the limitations of land-based receivers immediately rule it out as a viable method for preventing the loss of such aircraft as flight MH370.



Map of ADS-B Coverage in the USA
(Source: www.faa.gov/nextgen/programs/adsb/coveragemap)

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WHAT IF
ADS-B WAS SATELLITE-BASED
WITH 100% GLOBAL COVERAGE?

What if ADS-B becomes a satellite-based system with 100% global coverage?

Aireon, a joint venture between four ANSPs and the satellite service provider Iridium, is on track to make this a reality by using ADS-B receiver technology on satellites to provide a global aircraft surveillance system. Hence, instead of ADS-B Out systems broadcasting to ground-based receivers, broadcasts could be sent to satellites, and then to ATC, removing the limitations of land-based receiver locations. Aireon's space-based ADS-B system is scheduled to be fully deployed and operational in 2018.

There appears to be a sizeable group of commentators who believe that space-based ADS-B could meet the ICAO-GADSS initiative and, according to an article in Air Traffic Management magazine "resolve the lack of global coverage without requiring any change to aircraft already equipped with 1090 MHz ADS-B Out systems." However, space-based ADS-B also has several limitations:

1. Position reports can not report anomalies, at least not over the ADS-B channel, which is a cornerstones of the ICAO-GADSS tracking vision.
2. Space-based ADS-B is designed to report to ATC, and not to commercial aircraft operators.
3. To fulfill the global aircraft tracking initiative, all states need to purchase ADS-B services from Aireon. There is no indication that every country is planning to do so.
4. The ICAO-GADSS requires a two-way link, while space-based ADS-B only supports ADS-B Out.

HOW ABOUT USING OTHER EXISTING TECNOLOGY TO FULFILL THE GADSS VISION?

Moving beyond ADS-B, is there other existing technology on commercial airplanes that can fulfill the GADSS vision of global flight tracking?

It is important to remember that the GADSS concept consists of two elements: Normal Aircraft Tracking and Autonomous Distress Tracking (ADT). While certain existing technology may meet the normal tracking portion, it will not meet the crucial Abnormal or Autonomous Distress Tracking element.

Some major airlines already monitor the progress of flights from their operational centers using technologies such as the Aircraft Communications Addressing and Reporting System (ACARS) and Future Air Navigation Systems (FANs). ACARS- and FANS-equipped aircraft can be configured to report aircraft positional information, although ACARS is not currently designed for that function and FANS (of which ADS-C is an aspect) is designed to report to air traffic control, ANSPs, and not directly to airlines.

Also, altitude is not generally included in ACARS position reports and if altitude is not included, ACARS position reports alone cannot be used to satisfy the 4D requirements of the 15-minute and one-minute tracking proposals. For FANS (and hence ADS-C) there are a limited number of events that can be monitored to trigger event reporting. The NATII Steering Committee also noted the issue of multiple ADS-C contracts exceeding the limitation allowed on the aircraft.

Neither ACARS nor FANS is tamper-proof, which means that a knowledgeable individual could disable both systems and the aircraft's transponder, which is one hypothesis for what occurred onboard flight MH370. To illustrate the limitations of these systems, the table on Page 14 highlights the individual components of GADSS and highlights in tabular form where these systems meet, or fail to meet, the GADSS concept.

Certain avionics manufacturers have built systems that merge and standardize data (ADS-B, ATC radar, ACARS and ADS-C) from various inputs in response to ICAO's tracking proposals. However, once again it is possible that the systems providing this data on the aircraft could be disabled or that these systems fail to even meet the automated one-minute tracking requirement, without significant further development.

WHAT ABOUT THE COSTS OF ACQUIRING THE REQUIRED TECHNOLOGY?

If new technology is required, how are operators going to afford to meet the cost of equipping their aircraft?

Source: PowerPoint Slide from Blue Sky Network Presentation to ICAO Tracking Forum, May 2014

The Normal Aircraft Tracking Implementation Initiative (NATII) reported that operators in general appear to have a perception that the cost of tracking is high. Hence there appears to be a disconnect between the perceived cost and the actual cost, which means that many operators are not considering all of the currently available tracking options.

This is understandable given the cost of retrofitting aircraft with technology most commonly tendered as ICAO-qualifying. It is reported that costs to equip with ACARS using VHF radio could be up to $100,000 per aircraft. ACARS using satellite communications would cost another $60,000 to $150,000 per aircraft. A higher frequency of reporting with ACARS or FANS, would also likely incur an increased recurring and reporting cost. For ACARS, this would range from $500 per month for short-haul aircraft using VHF radio systems to approximately $1,000 per long-haul aircraft using satellite communications over oceans.

For Aireon's space-based ADSB, the real-time surveillance costs provided by this system are being discussed with individual air navigation service providers. As a result, exact costs to the airline remain an unknown.

Current commercially available systems that are both more robust and considerably less expensive, especially when examining the cost of providing position reports, are readily available. Using Blue Sky Network, as an example, the actual charge of reporting 200 times during a 10 hour flight from Moscow to John F. Kennedy International Airport shown above was $20.

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WHY NOT WAIT UNTIL STANDARDS & REGULATIONS ARE OFFICIALLY ENFORCED?

The ICAO Council has no power to enforce the GADSS concept. Doesn't it make sense to wait and see how individual ANSPs proceed first?

It is true that ICAO cannot directly enforce this tracking initiative. Instead it issues standards and recommended practices (SARPs) related to the proposed tracking intervals, in this case part of Annex 6. It is up to individual aviation authorities to then enforce or follow these SARPs.

Ensuring global adoption is crucial. According to the AF447 final report, information inquiries regarding the aircraft were not coordinated, resulting in air traffic control, search and rescue, and the operators questioning each other without making a decision about what the right action to take was. MH370 also highlights the complexities of coordinating search and rescue activities in areas with multiple flight information regions when the final location of the plane is truly unknown.

Hence very accurate information must be provided in a timely manner and to the right people quickly to support search and rescue, recovery, and accident investigation activities.

Promisingly, the European Commission in advance of the ICAO adoption has been quick to mandate the implementation of the tracking portions of GADSS in regulations. Foot dragging on the part of airlines and ANSPs must be avoided as the strength of the mandate, especially corresponding procedures and management of information, relies on improved coordination and fluid sharing of information worldwide.

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COMPARING THE PROPOSED SOLUTIONS

Comparing Proposed Solutions for the ICAO-GADSS Initiative

REQUIRED CAPABILITIES	FANS/ADS-C	ACARS VIA SOME AIRCRAFT EQUIPMENT	GROUND-BASED ADS-B	SPACE-BASED ADS-B	BLUE SKY NETWORK HE7200A & SkyRouter**
100% global coverage	✓ (1)	✓	✗	✓ + ✗ (1)	✓
Designed to transmit information to Airline Operation Center	✗ (4)	✓	✗	✗	✓
Automated minimum 4D 15-minute tracking	✓	✗ (3)	✓	✓	✓
Automated distress reporting triggered by abnormal/distress Events	✗ (5)	✓	✗	✗	✓
Automated trigger of one-minute reporting in abnormal/distress states	✗	✓ (6)	✗	✗	✓
Can function autonomously of other aircraft systems/aircraft's power	✗	✗	✗	✗	✓
Distress signal activatable by flight crew	✓	✓	✓	✓	✓
Cannot be renormalized by flight crew; only by AOC	✗	✗	✗	✗	✓
Two-way link between device and Airline Operation Center	✗	Unknown	✗	✗	✓

***Notes are further explained in Appendix II**
****See Appendix III to Learn more**

Arguably the greatest misconception regarding GADSS is the necessary capabilities of the technology required to meet all the provisions contained within the initiative (three of the five misconceptions noted on Page 7 were related to proposed solutions).

Cherry picking specific elements of the tracking requirement and ignoring others is not a viable option if the full benefits of the GADSS concept are to be reaped. This table highlights each element of GADSS and then references specific systems that have been tendered as ICAO qualifying.

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THE NEW IS *NOW*

The push to make global flight tracking a reality as a result of the AF447 and MH370 tragedies should follow in the aviation community's historical tradition of learning lessons from the past.

Many of the solutions currently tendered as GADSS qualifying are simply inadequate. Besides failing to meet several key requirements of this well thought out ICAO global flight tracking initiative, these solutions do not address the comprehensive intention of ICAO nor a basic right of the flying public.

This white paper's focus has been to lay bare the misconceptions and misrepresentations that have appeared surrounding GADSS. If insufficiently comprehensive technology kludged together becomes the default used for the purposes of tracking commercial aircraft in both normal and abnormal circumstances, then the efforts of ICAO will be wasted. As Albert Einstein famously said, "We cannot solve our problems with the same level of thinking that created them."

To ensure that it no longer remains possible to lose a state-of-the-art passenger aircraft, we must have new thinking and new solutions, real solutions, not patch-work ideas. Rashly choosing solutions that, on the surface, appear to fulfill basic GADSS aircraft tracking functions is ultimately a waste of time and resources. After all, a global flight tracking initiative—if implemented and executed properly—will not only enhance the ability to locate aircraft in distress, or increase the likelihood of rescuing survivors, but may provide its own added logistic value to the airline. This safety aspect of flying is an extension of the good faith agreement the public has with airlines—it's the right thing to do.

Blueprint for action:

- **Recognize that real-time aircraft tracking will ultimately become a standard feature of global aviation no matter today's push-back, like seatbelts in cars. The flying public will accept no less.**
- **Understand the comprehensive performance-based requirements of GADSS (equipment and AOC back-end connectivity) and how this two-way "link" concept differs from other avionic regulatory requirements. We want this white paper to serve as a reference document for discussion, with additional informative reading material included in the References section.**
- **Ultimately, every airline around the world, no matter the size, should begin the process of evaluating its status today with respect to this mandate and develop its own plan to GADSS implementation—"fore-warned is fore-armed."**

To start the conversation on how to fulfill the ICAO-GADSS global flight tracking initiative, contact Blue Sky Network at 858-551-3894 or visit www.blueskynetwork.com.

APPENDIX I

KEY ACRONYMS

Acronym	Definition
ACH	Advanced Control Head
ACARS	Aircraft Communications Addressing and Reporting System
ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-C	Automatic Dependent Surveillance - Contract
AF447	Air France 447
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
BSN	Blue Sky Network
CVR	Cockpit Voice Recorder
FAA	Federal Aviation Authority
FANS	Future Air Navigation System
FDR	Flight Data Recorder
GADSS	Global Aeronautical Distress and Safety System
HE7200A	HawkEye 7200A
HLSC	High Level Safety Conference
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IGO	Intergovernmental Organization
LEO	Low-Earth Orbiting
MH370	Malaysian Airlines Flight MH370
NATII	Normal Aircraft Tracking Implementation Initiative
SAR	Search and Rescue
SARPS	Standard and Recommended Practices
SES	Single European Sky
SWIM	System-wide Information Management
VHF	Very High Frequency
4D	4-dimensional

APPENDIX II

ACCOMPANYING NOTES

Notes to Proposed Solutions Table (Page 14)

(1) Only when connected to the Iridium Satellite network.

(2) As previously mentioned, global space-based ADS-B would require each ANSP/nation-state to sign-up for the service.

(3) Current ACARS position reports do not include altitude – only 3D.

(4) It depends on the contract with provider – Inmarsat or Iridium; primarily for ATC.

(5) There are some events that FANS can identify but the number of events is currently limited.

(6) According to the GAO report referenced in this whitepaper “ACARS is configurable for enhanced reporting triggered by unanticipated altitude changes or flight levels below a predetermined altitude.”

APPENDIX III

THE HAWKEYE 7200A-2529

A SOPHISTICATED TRACKING SYSTEM THAT MEETS THE ICAO-GADSS MANDATE

The HawkEye 7200A (HE7200A-2529) was specifically designed and created in order to fulfill the ICAO-GADSS vision for automated global tracking of aircraft.

This system meets both elements of the flight tracking initiative (normal and autonomous distress tracking) as shown on Page 14, and provides a back-office portal (SkyRouter) from which Airline Operation Centers (AOCs) can follow their aircraft either directly or through an API feed to their own back-office resource.

HAWK·EYE

HARDWARE FEATURES
Weighs only ~1 pound
Dimensions: 5.5 x 5.61 x 1.6 inches
Battery back-up option for true “autonomy” and isolation from ship power
Flexible firmware platform allowing for easy, over-the-air upgrades to onboard hardware
Iridium Core 9523 transreceiver, Iridium's smallest, lightest and most advanced transceiver module ever. This enables simplified global data connectivity pole-to-pole
High precision GNSS engine for concurrent GPS, GLONASS, Galileo providing superbly accurate position reports
Embedded AHRS chipset (Attitude and Heading Reference System) allowing sophisticated determination of aircraft attitude information allowing parameter setting for individuated exception reporting of aircraft roll, pitch and yaw
Device hosted geofences initiated from back office (AOC) insuring locally determined alerting
Military-spec aviation grade connectors
Option to connect to remote panel ELT type switch (On/request Reset)
Operating temperature of -30 ºC to + 70 ºC

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APPENDIX III

SKYROUTER

THE COMPLETE SOLUTION

Also integral to the HE7200A as an ICAO-GADSS solution is SkyRouter. Airline Operation Center (AOC) staff can log into SkyRouter to view, control, and communicate with the HE7200A-2529. If an abnormal or distress event does occur in flight, the system will autonomously recognize this anomaly and automatically, concurrently change the reporting frequency, initiating alerts to SkyRouter (AOC) at an accelerated rate, ultimately down to one-minute or less reporting, thereby meeting the ICAO requirement for abnormal and distress events.

SkyRouter™

SOFTWARE FEATURES
Complete two-way AOC control for Normal position reports alternatively calculated in time, distance, above altitude, etc.
AOC control over event report determination such as take-off/landing, minimum en-route, and AHRS criteria for attitude events (pitch, roll, and yaw)
Parameter and profile updates/acknowledgments
Ping request/reply functionality
User defined “on-the-fly” circle or polygon geofences

APPENDIX III

COMPOUND RULES

Operators will be able to construct compound rules i.e. program the device to report or alert when two or more events occur together.

To illustrate this with an example the HE7200A-2529 could be programmed to alert the Airline Operation Center (AOC) when the pitch of an aircraft exceeds negative 20 degrees, for 120 seconds, altitude is less than 20,000 feet, and at any speed.

To ensure maximum flexibility each airline has the ability to define these compound rules based upon their own operational SARPS guideline and send over-the-air to devices.

To learn more about how the HawkEye 7200A-2529 fulfills the ICAO-GADSS global flight tracking initiative, please contact Blue Sky Network at 858-551-3894 or visit www.blueskynetwork.com.

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