ATTACHMENT

ICAO QUESTIONNAIRE ON TECHNOLOGY FOR TRACKING FLIGHTS GLOBALLY

BACKGROUND

Recent events, where there has been uncertainty on the whereabouts of an airliner, have identified the need to review the means to track flights worldwide. To this end, ICAO seeks to gather information regarding technologies and services that could potentially provide the means to support global tracking of flights at a reasonable cost.

While it is not the intent of ICAO to specify the technology or service providers that could support global flight tracking, it is essential that we gain an accurate picture of technologies and capabilities available today and in the near future. We are, therefore, approaching various providers of flight tracking technologies and services and requesting that you complete the attached questionnaire that would give us a clearer picture of what is available today and in the near future. We would then present a composite view of existing technologies to a Special Meeting on Global Flight Tracking to be held in ICAO Headquarters, Montréal from 12 to 13 May 2014.

You are kindly requested to confirm receipt of this questionnaire and to indicate if you are willing to provide the information as requested. If you are willing to provide this information to ICAO, we would then request that the completed questionnaire be forwarded to ICAO no later than 30 April 2014 via e-mail at ATMinbox@icao.int.

SURVEY QUESTIONNAIRE

Company name:	APEX FLIGHT OPERATIONS	www.apexflightops.com info@apexflightops.com +61 2 8003 5837

1. Please describe current technologies and/or services your company offers that could provide tracking of flights worldwide or could be used as a component in a larger system used to track flights:

Apex Flight Operations manufactures and markets the Falcon tracking system which is used in a variety of aircraft types to feed data back to our flight following solutions.
We also provide our IndigoTrack Aircraft Tracking software, which consolidates data from more than 20 service providers to give our clients a single interface for tracking their fleet.

2. Can your system provide position reports with the following parameters:

• Lat/Long position	(Y) / N
• Altitude (GPS height or MSL)	(Y) / N
• Ground speed	(Y) / N
• Heading or track	(Y) / N
• Time of the position fix (UTC)	(Y) / N
• Aircraft ID	(Y) / N

3. Are there additional parameters that your system can provide? (Y) / N

If yes, please specify below:

Fix Type (2D/3D)
Dilution Of Precision (DOP)
Number Of GPS Satellites
Flight Status (Stationary, Taxi, Takeoff/Landing, Cruise)
Alert Status

4. Is the technology or service described above available today? (Y) / N

If no, please provide below the expected date that the technology/service will be available:

5. Please describe the assumed architecture of the flight tracking system. Include all the segments of the end-to-end system from the airplane systems to the end user. Note which parts of the system your company offers and assumptions regarding interfaces to other parts of the system.
The components of our flight tracking system are: 1. Aircraft Equipment – this is installed in the aircraft, with the only requirement being a connection to the avionics power supply in the cockpit via a 2A circuit breaker. Although not required, we recommend the use of an external antenna to ensure the optimal connection with the data satellites. 2. Air Crew Software – we provide Windows, iOS and Android applications which can be used on a variety of devices (such as iPads, Tablets etc), and which, when paired via Bluetooth to our Aircraft Equipment, allow the crew to send and receive email and text communication via the satellite, as well as many other functions. 3. Satellite Constellation – we use the Inmarsat I4 constellation, utilizing the IDP data service. Whilst out of our control, we have experienced excellent reliability from this service. 4. Data Processing Servers – we host servers in the UK and Australia in a redundant architecture that can easily be scaled to include multiple additional locations depending on load requirements. 5. Web application software – clients use our secure web-enabled software (IndigoTrack) to view the aircraft's track in real-time, and to communicate with the air crew via the satellite. There is a wide range of additional functionality that provides full aircraft operations management to the ground center, including automated flight time and cycle feedback to maintenance, crew management and accounting systems. 6. Data Sharing – our servers provide a data retrieval facility, using the Automated Flight Following (AFF) data standard. External software, having provided valid security credentials, can retrieve the data from the aircraft, allowing integration with systems such as third-party flight following companies, air traffic control and others. AFF not only specifies the data format, but also the service requirements for performance, availability and reliability. Our company provides all of the above, except for number 3. The AFF format described in 6 is defined by the US DOF; more details are available at www.aff.gov
6. Please describe the concept of operation including pertinent use cases for the proposed system. Include how data is generated, packaged, routed, who receives the data, who gets access to the data, how and where the data is retained and for how long, etc. Please indicate coverage area if not global.
The data is generated by our equipment with position information from a built-in GPS. On a configured interval, the hardware sends the current position via the satellite – event notifications (eg. Takeoff) are sent as they occur, and communication is sent out on demand. All data is packaged in a proprietary format, optimised for size, encrypted and compressed, and then sent out via the Inmarsat ISatDataPro service. A typical position report consists of 18-bytes of data, and contains all of the fields detailed in 2 and 3 above. The data is routed via the Inmarsat I4 constellation to one of the ground-stations situated around the world, and consolidated at SkyWave (www.skywave.com) our Inmarsat partner, and the manufacturer of the satellite modem incorporated in our equipment. SkyWave makes the data available to us via a secure web service, and we retrieve the raw data on a 30-sec refresh cycle. Note that although SkyWave has access to the data, the payload containing the position information of the aircraft is still encrypted and compressed at this point, so they don't have access. The data is retrieved by our Data Servers from SkyWave, processed and stored in our databases (data is permanently available to our clients), after which it can then be retrieved by the aircraft owner using our IndigoTrack software. Data can also be retrieved by our servers using the AFF web service provided – all retrieval of data is 256-bit encrypted, and requires full security credentials to access the services.

The Inmarsat I4 satellite constellation guarantees coverage between 78°N and 78°S, but we have tracked aircraft successfully as far as 83°S – there is, however, no coverage of the polar regions above these latitudes.

7. Please describe how the authenticity, originality and integrity of the data transmitted through the overall network is ensured:

The communication between the satellite and the modem in our equipment is authenticated using an IMEI and Inmarsat's authentication process, but carries encrypted data in the payload.
During the processing of this payload, the decrypted data is confirmed using a check-bit authentication – the quality of the data is further checked using the Dilution of Precision and Fix Type metrics obtained from the GPS on board the aircraft.
Transmission of data through the Internet is done via HTTPS using TLS and SSL – a good description of how this provides authenticity, originality and integrity can be found at http://en.wikipedia.org/wiki/Transport_Layer_Security

8. Please describe a typical aircraft installation and precise aircraft interfaces (e.g. cooling, power supply, etc.):

Our Falcon tracking system is mounted on the glareshield of the aircraft using a custom bracket, and connects to the avionics power bus via a power cable terminated with either an auxiliary power socket, or by a direct connection to the avionics bus (protected by a 2A circuit breaker). The unit has an operational temperature range between -35°C and +85°C (-31°F and +185°F). The Falcon requires no further integration with the aircraft in order to operate.
The optional external antenna is mounted outside on the roof of the aircraft, with a minimum separation of 2m from other L-band antennae (such as GPS) – the cable from this antenna is routed down to the Falcon unit. The antenna installation requires doubler protection of the pressure vessel; we expect a number of STCs to be developed as installations on different aircraft types are completed.

9. Can this system be installed as a retrofit to out-of-production airplanes in service? (Y) / N

If yes, please specify below the nature of the upgrade including categories such as (include more than one, if applicable):

a) software upgrade of an existing system
b) new hardware and/or software installation
c) modification of ground and/or satellite equipment
d) any other (please specify):

(b) the system requires our Falcon tracking unit to be added as new hardware in the aircraft. If chosen, the external antenna would also require new hardware installation.

Is your product certified for installation on aircraft? (Y) / N

If yes, describe the experience of the certification process (e.g. supplemental type certificate (STC)) and the aircraft types for which the product is certified:

Although the equipment is classified as a Portable Electronic Device (PED) according to regulations, and can be used on any aircraft on the basis of a No Hazard/No Interference analysis from a Licensed Aircraft Maintenance Engineer (or local equivalent), we have further certified our equipment under the RTCA DO-160G. As there is no modification of the aircraft when using our equipment, no STC is required.

The external antenna has a TSO certification.		
10. Can this system be operated autonomously without any human interaction or interference?	(Y)/ N	
How is the system operated, configured, customized, set on/off?		
The system is powered from the Avionics bus in the aircraft, and will switch on or off with the Avionics on board; there is no specific action required by the crew for normal operation. There are 5 buttons on the front of the unit which the crew can use to initiate an Alert notification, as well as to pair the unit to a Bluetooth device. Configuration of the unit can either be done via a Bluetooth-enabled device running our software apps, or by using our IndigoTrack software at the ground center with the update done via satellite. During the configuration, the unit can be customized to change the reporting interval, event notifications, triggers and all unit behaviour. The unit cannot be powered down whilst in normal operation, but if external power is lost (e.g. if unplugged or avionics loss of power) during flight, the unit will immediately notify the ground center of an Abnormal Loss Of Power with the current position, and whilst appearing to be off, will continue to transmit positions for as long as the internal battery sustains power (up to 60 min depending on reporting frequency).		
11. Is the system protected against interruption or failure of the aircraft power system?	(Y)/ N	
If yes, please specify the protection used:	As described in 10 above, the unit will utilize its internal battery to notify the ground operations center of an Abnormal Loss Of Power, and will continue to track the aircraft for up to 60 minutes.	
12. Given the system described above, please provide estimates for the following cost breakdown:		
a) airplane equipment costs:	U.S.$ 1,495	
b) airplane system integration costs (non-recurring engineering):	U.S.$ 0	
c) airplane installation costs:	U.S.$ 250 (?)	
d) estimate required time for airplane installation:	____1_____ (no.) hours	
e) scheduled maintenance:	Work duration: __0__hours Intervals: ___0_____	
13. If equipage already exists, please estimate the number of installed units in the field:	750	

14. Please describe non-aircraft infrastructure requirements and note where such infrastructure does or does not exist, or where existing infrastructure would require modifications to support global airline flight tracking worldwide:	
Our IndigoTrack software requires a normal PC to provide the flight following capability, and runs on all operating systems from Windows XP and above. The AFF data format is an XML-based web service, so existing air traffic systems software would require modification to be able to connect and receive data for aircraft from our system. Adopting the AFF standard would allow these systems to connect to all providers in the same way to consolidate data from a variety of service providers, although IndigoTrack currently provides such a consolidation already. For example, IndigoTrack is used by the United Nations to track all aircraft on WFP and Peacekeeping missions; to provide this we consolidate data from more than 20 other service providers to give the UN a seamless view of their operations.	
15. Please provide information for the following items covering recurring communications:	
a) cost of air-to-ground transmission of short position reports (assume ~20-40 bytes per report):	U.S.$0.035
b) maximum position reporting rate supported:	6 reports per min
c) limitations (e.g. bandwidth) of the non-aircraft infrastructure (e.g. to support flight tracking of up to 20 000 aircraft):	We do not foresee limitations to the non-aircraft tracking infrastructure – modern Internet connectivity and data storage provide more than adequate capability for tracking 20,000 aircraft.
16. Please estimate the probability that the tracking functionality would be unavailable on a per hour basis (assuming the aircraft power and data inputs are available):	We have operated on a 99.999% uptime capability since 2007.
17. Do you anticipate any potential technical barriers (e.g. frequency spectrum availability, unusual aircraft attitude, polar route, not worldwide service coverage, etc.) that might prevent you from providing your flight tracking service? If yes, please describe below:	(Y)/ N
• The Inmarsat I4 constellation does not cover the Polar Regions, with guaranteed coverage only between 78°N and 78°S. • Our modem is also only rated to Mach 0.95, so any flights that operate at higher speeds will prevent normal operation of our system.	

18. Global flight tracking could start through an industry led initiative. However, do you feel that a complementary regulatory framework would facilitate implementation? If yes, please describe below:	(Y)/ N	

A regulatory framework would provide the industry with a standards guideline that would ensure that there is safe introduction of satellite tracking technology into aircraft. We would hope to see performance requirements for equipment, and a clear guideline on certification requirements for this equipment.

All satellite tracking systems currently available are classified as non-essential equipment on board the aircraft, and therefore require the ability for the crew to disable them in the event of an emergency. For global flight tracking to be completely reliable and dependable, these systems would have to be classified as essential equipment; a certification standard established by ICAO to have these systems classified as such would need to balance the

We are aware of a number of service providers who blatantly market uncertified equipment to aircraft operators on the basis of finding a “loophole” in regulations that allow the Captain to allow the use of PEDs during critical phases of flight, even though the Captain is not provided with any definitive proof that said equipment is not going to cause interference in the cockpit. We are further aware of service providers marketing car and truck tracking solutions (using mobile phone communication) to aircraft operators under the same “loophole”.

We would hope that before satellite tracking on commercial flights is mandated, regulations governing minimum certification of tracking equipment be established by ICAO, as this would facilitate the easier introduction of this technology on board aircraft.

We would also hope to see the AFF data standard taken over by an international standards organization to ensure a global standard for Aircraft Flight Following data sharing can be adopted.

— END —