May 2014 I **N°19**

NET*ALERT* - the Safety Nets newsletter

WELCOME

For the past two years EUROCONTROL's Safety Improvement Sub-Group (SISG) has been working on its Top 5 ATM Operational Safety Priorities. One of these is the risk of operations without a transponder or with a dysfunctional one.

This was the chosen focus for this edition of NET*ALERT* at our editorial planning meeting early this year. Our intention was to explain how despite advances in technology and safety, the dependence of the ATM system on an aircraft's transponder means a failure has the potential to make it blind to both ATC and safety nets, including TCAS. Events have overtaken us. In the intervening weeks the transponder on Malaysian Airlines flight MH370 stopped working for the reasons yet to be explained, emphasising the importance of this topic both to those working in aviation and to the general public.

In this edition we recap the role of transponders in aviation and summarise the impacts, methods of detection, actions and mitigations for a total loss of transponder and other transponder failure modes. We also present findings from a real-life incident.

Transponders in aviation

Transponders play an important role in tracking an aircraft. They provide a vital link between aircraft and the ATC systems on the ground, as well as ACAS/TCAS in the air. Conversely, an inoperative transponder, or one providing erroneous information, poses a potential safety risk. You can read more about faulty or non-functioning transponders elsewhere in this issue. Here we go back to basics to provide a brief recap of transponders and their role in aviation.

Transponders are...

A transponder is an avionic system located on board the aircraft that provides information about the aircraft identification and barometric altitude to the ATC system on the ground and to TCAS on other aircraft. The reply from the transponder is also used by radar on the ground to determine the position of the aircraft. The information to the ground is provided in response to an interrogation by systems such as secondary surveillance radar (SSR) or multilateration systems. ADS-B (Automatic Dependent Surveillance – Broadcast) capable transponders also allow the aircraft to 'broadcast' information to ground stations and other aircraft without interrogation.

Transponders are not just carried by commercial aircraft they are also used by helicopters, military aircraft, General Aviation, gliders and UAS. Some airside ground vehicles are also equipped with transponders.

Uses in aviation

Information from the aircraft transponder is used to provide the controller with a more complete surveillance picture compared to primary radar. The displayed barometric altitude is taken directly from the information provided by the aircraft's transponder whereas the identification information provided by the transponder is used to correlate the aircraft track to its

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Transponders in aviation

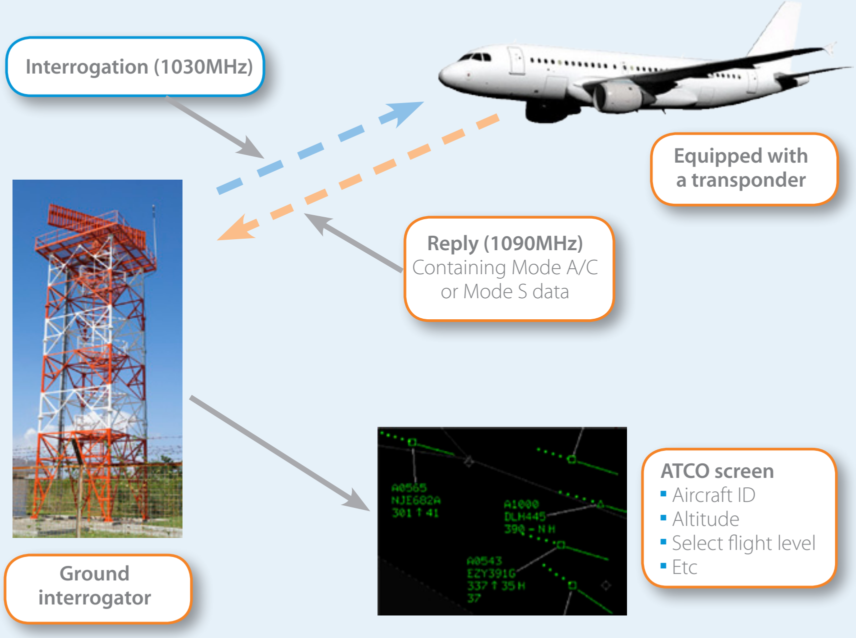
continued

flight plan. The latter can also be used to feed controller tools such as AMAN, MTCD and various conformance monitoring tools. With the evolution of Mode S transponders, the ATC system can now downlink other aircraft parameters (known as Downlink Airborne Parameters, DAPs). For example, the selected altitude set by the crew can be used both to alert ATC if there has been any misinterpretation of the altitude/level clearance and to improve STCA alerting performance.

TCAS also relies on transponder signals to detect potential conflicts and provide Traffic Advisories (TAs) and Resolutions Advisories (RAs) to the pilot. Where both aircraft are equipped with Mode S transponders (see 'different modes' below) TCAS is capable of co-ordinating RAs between both aircraft to ensure safe conflict avoidance manoeuvres. If not coordinated there is a significant risk of selecting incompatible RAs that increase the risk of collision.

How do transponders work?

Transponder operations are standardised in ICAO Annex 10 Volume IV. First the ground interrogator (or in the case of TCAS the airborne interrogator) transmits an interrogation sequence on 1030MHz (either continuously to all aircraft in the vicinity for Mode A/C or selectively to a single aircraft for Mode S). Upon receipt, the transponder on-board the aircraft immediately responds on 1090MHz. Once the return signal is received by the ground station, the data is processed and relayed on to the controller's display/used by tools and safety nets.



Different modes

In civil aviation there are two main interrogation-reply modes, Mode A/C and Mode S. There are also modes operated by the military.

In response to Mode A interrogations the transponder transmits an identity code for the aircraft in the octal range 0000-7777, with some codes allocated to transmit specific emergency situations. Mode C provides the aircraft's barometric altitude in 100 feet increments. Mode A/C operation has a number of technical limitations such as its inefficient use of the radio spectrum and the limited number of Mode A codes available.

Mode S was developed to overcome the limitations of Mode A/C. In particular, Mode S has over 17 million unique 24-bit aircraft addresses, altitude reports in 25 feet increments and "selective interrogation". Unlike traditional Secondary Surveillance Radar (SSR) stations which elicit multiple replies containing the same information from all aircraft within their range, Mode S makes selective (Mode S is abbreviated from Mode Select) interrogations of each specific aircraft. 'All call' interrogations are also made to identify new aircraft to be interrogated. Mode S also has the ability to transmit DAPs. Mode S transponders are backward compatible with the older Mode A/C radars. Typically Mode S radars will be backward compatible with Mode A/C transponders, but this depends on local implementation.

Deployment and carriage requirements

Mode A/C transponders and secondary surveillances radars were a mainstay of air traffic control for many decades. However, with these systems reaching the limit of their operational capability there has been a shift to Mode S.

On the ground, many SSR Mode S systems are deployed and operational across the core European area and beyond. In Europe they are a mix of Elementary and Enhanced Surveillance. In the air Mode S transponder equipage is now mandatory for flights conducted as IFR/GAT in many European States and also for VFR flights in some designated airspace. These local mandates have been supplemented by a European wide regulation. The current regulation stipulates that all aircraft operating IFR/GAT in Europe are to be compliant with Mode S Elementary Surveillance by January 2015 and December 2017 for new and retrofit aircraft respectively. Within the same timescales, aircraft with a minimum take-off mass greater than 5,700 kg and/or with a maximum cruising true air speed greater than 250 knots are required to be compliant with Mode S Enhanced Surveillance (EHS) and, through the carriage and operation of an extended squitter transponder, with "ADS-B Out" requirements in support of ground and airborne surveillance applications. Early discussions are now taking place with regards to extending the applicability of EHS so as to increase the opportunities for rationalisation of the surveillance infrastructure on the ground.

The future

Several initiatives are underway which will see continued reliance on transponders in the future. This includes the increased use of ADS-B for surveillance in low density and remote regions, as well as oceanic surveillance - potentially by transponders broadcasting data to satellite-based ADS-B receivers. There is also an impetus to increase the number of transponder-equipped aircraft, for example by using low power, low cost transponders e.g. for gliders.

Transponder failure

Now the obvious question. With so much reliance on aircraft transponders, what happens when one fails, is switched off or provides erroneous data? To find out, read on…

Further reading

- PANS-ATM Doc 4444, Chapter 8.5 - SSR Code Management
- PANS-OPS Doc 8168, Flight Procedures Part VIII - Secondary Surveillance Radar (SSR) Transponder Operating Procedures
- Surveillance Activities within EUROCONTROL: http://www.eurocontrol.int/articles/surveillance

No transponder
- what now?

The total failure, of an aircraft's transponder has the potential to make it effectively invisible to ATC. It also renders safety nets, including those in the cockpit, ineffectual. Below EUROCONTROL's Stanislaw Drozdowski answers questions on possible impacts, methods of detection and potential mitigations.

What happens when a transponder fails?

The total loss of a transponder for an aircraft in flight results in no transponder based data for an aircraft (identification and altitude) being presented on the controller working position (CWP). This means that altitude information is lost. If primary radar is present the track may remain correlated with a flight plan, or the controller can manually perform the correlation. If no primary radar is present, the track (position) is lost as well. This affects controller tools and safety nets used by both pilots and controllers which rely upon transponder data.

How common is complete transponder failure?

Thankfully, complete failure is rare. However, a number of ANSPs were able to contribute real-life examples of transponder failure to a EUROCONTROL Operational Safety Study on this subject. In recent months there have been two known examples of aircraft returning to major European hubs due to complete transponder failure. So while not everyday occurrences, it's not unheard of in Europe.

Isn't there a back-up transponder on the aircraft and a warning given to the crew in the event of a failure?

The number of transponders depends on the size of the aircraft, but modern passenger aircraft will typically carry two. One is operating and the other is a back-up. Both are fed by separate altimeters, with the active transponder typically being fed by the altimeter used by the pilot flying the aircraft.

There may be a warning to crew in the case of a transponder failure, but it won't necessarily be prominent and may go unnoticed, or there may even be no warning at all. For example, in 2006 an Embraer business jet was cruising towards a B737 at the same flight level over Brazil. The transponder of the Embraer had for some reason stopped working and the crew was not aware of this. As TCAS does not function if the transponder does not work, the TCAS system on the Embraer did not detect the B737, and the B737's TCAS could not detect the Embraer. Consequently the aircraft tragically collided.

What are the impacts of a total loss of transponder on the controller?

As I said at the start, all altitude and identification information is lost, and the track as well, if no primary radar is present – effectively making the aircraft invisible to the controller. This results in an increase in workload due to loss of situational awareness, reliance on procedural control/voice reporting and a severely reduced ability to provide tactical instructions – including issuing instructions for collision avoidance. Even if primary radar is available, altitude and, possibly, identification will be lost so there will also be workload impacts in this situation as well.

Is the controller given a warning that all information relating to an aircraft has disappeared? If not, how is the loss detected?

It's not possible to generalise. Some ATC systems include a loss of track alert functionality, but it depends on the system

No transponder - what now?

continued

and local implementation. In the absence of this, it's down to the controller to identify a failure through situational awareness, regularly scanning the screen, or during handover between sectors when the aircraft contacts ATC but the controller can't identify it on the screen. Total failures can quickly become apparent if there is only one aircraft in the sector, but may be much more difficult to detect when multiple aircraft are in the sector (see next article). This means total failures may sometimes go unnoticed for a period of time and their potential consequences can be critical, hence their inclusion in the Top 5 ATM Operational Safety Priorities. The irony is that in previous decades transponder failures were more frequent and controllers were regularly expecting them. With failures less frequent today, it's not something that tends to be expected.

What does a controller do on detection? Are there standard procedures?

PANS-ATM provides some guidance but no specific procedures, these tend to be ANSP -specific. If primary radar is available, flight plan correlation should be maintained, however the availability of primary radar varies between States. In the absence of primary radar, steps taken can range from voice reporting by the pilot to enable procedural control by the ATCO, to military escort, or in extremis refusing the aircraft entry to the next sector/FIR or returning the aircraft to the airfield of departure/nearest suitable airfield. The aircraft should also be cleared out of RVSM airspace and be kept well clear of other aircraft.

Can flight plan data be used as an alternative?

Flight plan data is not as precise as radar-derived tracks. It may be out of date, and requires updating automatically or manually to be of real value. However, if a track associated with a flight plan is lost before the end point of the flight plan, some systems continue to coast the track along the flight plan route to give some increased awareness to the controller. The colour of the track or the track symbol changes to indicate that there is no radar data behind the track. This serves as a warning to the controller that the radar data has been lost. However, the accuracy of the position information will decrease over time and has to be manually adjusted using reports from the pilot.

Will controller tools or STCA and TCAS be affected?

Controller tools using transponder based information will either not operate (i.e. those using real-time information such as conformance or adherence monitoring tools) or will become less reliable.

Safety nets such as STCA and TCAS rely on transponder replies. Therefore, without an active transponder, an aircraft will effectively be invisible to these and other safety nets (as in the earlier example involving the Embraer business jet and the B737).

Given the potentially hazardous consequences of the total loss of a transponder, are there failsafe mitigations?

Despite all the advances in systems and safety, there is no system-wide back-up for information derived from the aircraft transponder, and therefore there are no fail-safe mitigations. Given this, it is not surprising that our studies show the most effective mitigations to be an ability to quickly detect a total transponder failure and effective procedures for dealing with it. There are technical mitigations, such as using flight plan data, but these are system and implementation specific.

ICAO Doc 4444, PANS-ATM, section 8.8.3.3, aircraft transponder failure in areas where the carriage of a functioning transponder is mandatory

When an aircraft experiencing transponder failure after departure is operating or expected to operate in an area where the carriage of a functioning transponder with specified capabilities is mandatory, the ATC units concerned should endeavour to provide for continuation of the flight to the aerodrome of first intended landing in accordance with the flight plan. However, in certain traffic situations, either in terminal areas or en-route, continuation of the flight may not be possible, particularly when failure is detected shortly after take-off. The aircraft may then be required to return to the departure aerodrome or to land at the nearest suitable aerodrome that is acceptable to the operator concerned and to ATC.

EUROCONTROL Top 5 ATM Operational Safety Priorities

The Top 5 were identified through workshops with ANSPs and the use of data from high severity (classified as 'A' and 'B') incidents. This work focussed on two high priority risk areas - runway incursions and loss of separation en-route. The priorities identified (in no particular order) were:

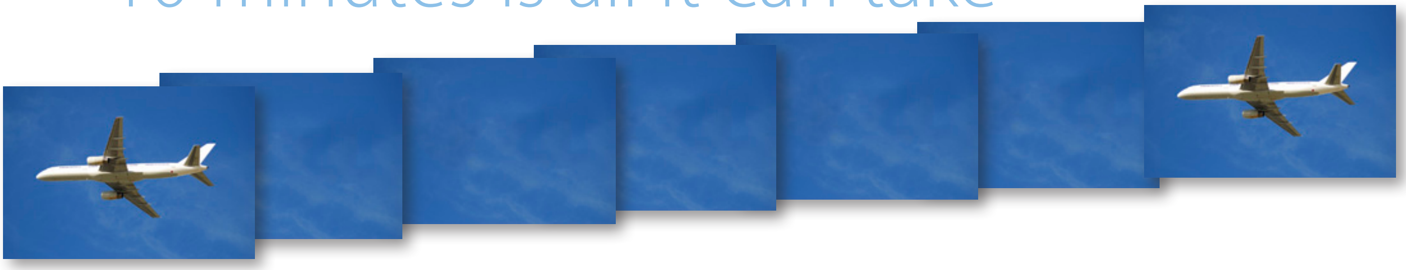
- Risk of operations without transponder or with a dysfunctional one
- Landing without clearance
- Detection of occupied runway
- 'Blind spot' – inefficient conflict detection with the closest aircraft
- Conflict detection with adjacent sectors

Each priority has undergone a dedicated Operational Safety Study to provide additional insight on causal/contributory factors and identify mitigations, best practices and lessons learnt. They will also inform the development of SKYbrary materials.

Further reading

More information can be found at: http://publish.eurocontrol.int/sites/default/files/article/files/top5_factsheet_web.pdf

Flying without a transponder
– 10 minutes is all it can take



What follows is a real-life example of the potential consequences of flying without an operational transponder. In March 2011, a Delta Airlines B757 took off from Atlanta without its transponder being activated. A succession of mistakes by both the crew and ATC resulted in the aircraft flying undetected for several minutes after departure. During this time it flew in a close horizontal proximity to three other aircraft. This article details the incident and highlights the difficulty of identifying an aircraft without an operating transponder in busy airspace.

Summary of incident

13:19	Tower clears aircraft for take-off on RWY27R Aircraft departs without its transponder activated
13:20	Following take-off, tower instructs the crew to turn left to waypoint FUTBL and contact the departures controller Crew reads back instruction correctly but does not contact the departures controller Tower controller is distracted and does not verify the departing aircraft has a valid radar label
13:24	Departures controller realises there is an unaccounted flight strip for the aircraft but cannot positively identify the flight on his display Departures controller contacts tower and queries the situation Subsequent searches do not positively identify the aircraft
13:26	Aircraft contacts tower to request an update Tower tells crew they should be in contact with departure
13:27	Aircraft contacts departure Departures controller requests crew to state their position Departures controller requests crew to verify transponder is turned on After 6 seconds, crew replies that transponder is on
13:29	Radar contact is established and aircraft radar label appears on departure display

The departing aircraft was transferred from the tower controller to the departures controller without his knowledge and without an operational transponder. This happened for three reasons:

1. Prior to departure the crew did not activate the aircraft's transponder.
2. Before transferring to the departures controller, the tower controller should have verified that the departing aircraft displayed a valid radar label. However, the tower controller's attention was temporarily drawn to a situation somewhere else and he did not notice this.
3. Despite reading back the tower controller's instructions to contact the departures controller, the pilot did not do so.

Five minutes after take-off the departures controller realised he had a flight strip that was unaccounted for and called the tower. The tower controller and his coordinator both searched for the missing target on their traffic situation display and reported a possible primary radar target to the departures controller. However, due to the large number of primary targets in the vicinity the departures controller could not positively identify the aircraft. The departures controller and his supervisor then conducted a search in the general area of the aircraft's departure route but could not identify a potential target. The aircraft was only identified when it called the tower controller. It was subsequently transferred to the departures controller who asked the pilot to verify the transponder was turned on.

Subsequent investigations identified that during the time the aircraft was operating without a transponder, and not under the direct control of ATC, it was involved in three separate losses of horizontal separation. The minimum separation distances with other aircraft were 1.44 miles, 0.81 miles and 2.36 miles. This was concluded from the position of the primary radar track, hence it is not possible to establish what vertical separation existed at the time.

The incident, due to its seriousness, has been investigated by the US National Transportation Safety Board (NTSB). In its final report, the NTSB concluded that the probable causes of the incident were: "The air traffic controllers' failure to adhere to required radar identification procedures, which resulted in loss of separation between the departing Boeing 757 and three other airplanes. Contributing to the incident was the pilots' inadequate preflight checks, which resulted in the airplane departing with an inoperative transponder."

Further reading

The full NTSB incident report (OPS11IA410) can be found at (http://www.ntsb.gov/aviationquery/brief.aspx?ev_id=20110324X53002)

Transponder failure
is not always total

In addition to the total loss of a transponder, the EUROCONTROL Operational Safety Study also investigated a subset of other possible transponder failure modes. The findings of this work are summarised in this article.

Failure modes investigated

The failure modes investigated were intermittent Mode C pressure altitudes, duplicated Mode S 24-bit addresses and corrupted Mode A identification codes. For each, the investigations focussed upon transponder-based errors or detection failures as opposed to ground system processing failures:

Intermittent Mode C: Transponder-based altitude information is lost from the controller working position (CWP) for short periods of time.

Duplicated Mode S 24-bit address: Two aircraft are operating with the same Mode S 24-bit address in proximity to one another (e.g. within the same sector or adjoining sectors).

Corrupted Mode A: Information received at the CWP is incorrect, primarily due to an erroneous input into the transponder, or the processing and transmission of the Mode A code by the transponder.

Possible impacts - display of the aircraft track to the controller

For each of the failure modes, how the associated aircraft track is displayed (or not) to the controller will depend upon the local configuration of the ATM system. Some examples are given in the table to the right.

In turn, local system configuration will influence detection by the controller and the possible impacts. Some ATM systems may have functions to warn the controller of possible failures. For example, validation functions highlighting: a loss of barometric altitude, the track of one of the aircraft not conforming to the flight plan route or that no correlation has taken place. Additionally, some modern ATC systems may address

Possible impacts – display of the aircraft track to the controller

Intermittent Mode C	Duplicated Mode S 24-bit address	Corrupted Mode A
■ Complete loss of track (track dropped as system considers it invalid) ■ Normal display of track, but with no altitude information in the label ■ Aircraft assumed to be at all heights in the system	■ Displayed correctly ■ Never initiated ■ Dropped (assumed to be a "ghost track" even if two valid flight plans exist) ■ Swapped	■ No discernable impact (e.g. correlation with the fight plan is made using the 24-bit Mode S address) ■ No correlation with the flight plan (e.g. where only Mode A is used) ■ Track swaps ■ Split tracks

Possible impacts – TCAS II

Intermittent Mode C	Duplicated Mode S 24-bit address	Corrupted Mode A
■ Delayed, incorrect or prematurely terminated alert	■ Missed alerts (intruders with the same Mode S address(es) as own are ignored by TCAS II)	■ No impact (no reliance on Mode A)

Possible impacts – ground-based safety nets

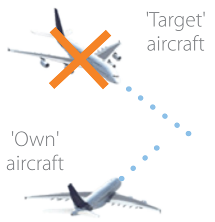
Intermittent Mode C	Duplicated Mode S 24-bit address	Corrupted Mode A
■ Delayed or prematurely terminated alert ■ Nuisance alerts due to the ATM system thinking the aircraft is at all altitudes	■ Missed alerts due to the track never being initiated or dropped	■ False alerts due to split tracks or, for example, if the corrupt code is one not permitted in a certain airspace volume ■ Missed alerts, for example, if the corrupt code is on a list of codes that do not alert against each other or a protected volume of airspace

Transponder failure is not always total

continued

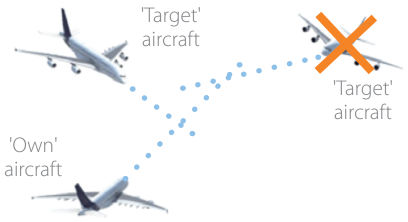
Filtering of duplicated Mode S addresses by TCAS II

Example 1: 'Own' and 'target' aircraft have the same 24-bit Mode S address



TCAS on-board the 'own' aircraft filters out the 'target' aircraft

Example 2: Two 'target' aircraft have the same 24-bit Mode S address



TCAS on-board the 'own' aircraft filters out the further 'target' aircraft

corrupted Mode A by using a weighted combination of aircraft identifications (primarily using Mode A code and Mode S 24-bit address but also aircraft callsign) to correlate a track.

Possible impacts – TCAS II

Duplicated Mode S 24-bit addresses and intermittent Mode C will also have potential impacts on TCAS II. Corrupted Mode A codes will have no impact as TCAS II has no reliance on this information.

Two TCAS II equipped aircraft will coordinate their RAs through the Mode S data link. So that it does not alert against itself, an aircraft will ignore any duplicate Mode S addresses. As per the diagram above, this has two possible impacts. Firstly, where the 'own' and 'target' aircraft have the same Mode S address, TCAS II will not alert. Secondly, where two 'target' aircraft have the same Mode S address, the TCAS II on the 'own' aircraft will only alert against the nearest threat aircraft and filter the furthest.

Also, TCAS II does not produce Resolution Advisories (RAs) against an aircraft that is equipped with a Mode A/C transponder but does not provide altitude information (Mode C). This aircraft will be tracked as a non-altitude reporting target using range and bearing information, and will be shown on the TCAS traffic display without a data tag or trend arrow associated with the traffic symbol. Traffic Advisories (TAs) can be generated against non-altitude reporting aircraft when the range test for TA generation is satisfied (non-altitude reporting aircraft are deemed to be at the same altitude as the 'own' aircraft), but RAs are suppressed. Therefore, if the altitude information from the threat aircraft is intermittent, it is possible that an RA could be generated late, not at all, be of incorrect sense or terminated prematurely.

Possible impacts – ground-based safety nets

For ground-based safety nets the impacts relate to the potential for either missed alerts, prematurely terminated, late initiating alerts or false/nuisance alerts. Again, which impacts occur will depend upon the local configuration of the ATM system.

Of interest are the mitigation choices faced by the ANSP for dealing with intermittent Mode C (e.g. due to the track not being initiated or dropped). If the ground-based safety nets assume the aircraft to be at all altitudes (see table on previous page) there is the potential for nuisance alerts, particularly in the case of MSAW. However, if the track is dropped or maintained without altitude information, an alert may missed, generated late or terminated early.

Solutions

As Helios Director Ben Stanley explains, dealing with different transponder failure modes requires several steps: *"There is no single mitigation to deal with the different forms of transponder failure. Solutions start with the effective reporting of transponder anomalies, including ensuring they are addressed.*

At the sharp end it's about providing the controller with the necessary alerts and procedures to quickly identify the malfunction and undertake any necessary action. This could include alerts for any change in track status (e.g. loss of information, dropped track, change of identity etc.), transponder validation procedures on first contact, procedures in the case of malfunctions (e.g. potentially squawking 0000) and even co-ordination with neighbouring sectors who may be able to see the aircraft correctly.

At the system design stage there is also a need to consider both how the system deals with malfunctions on detection and how it can support the controller in any subsequent action – be it still providing useable information or warning about erroneous data or information loss."

Duplicate Mode S addresses in the same airspace – is it possible?

Given that one of the benefits of Mode S is the unambiguous identification of aircraft by means of a 24-bit address, can two aircraft have the same address? It is feasible; sometimes an incorrect address can be assigned to an aircraft, for example, due to the block allocation of addresses to a State, when a transponder is transferred from one aircraft to another without re-setting the address or a fault in the aircraft wiring.

However, for any significant safety impact both aircraft would need to be in the same airspace. While this is unlikely, it has happened. For example, two aircraft flying in the airspace of a European ANSP were found to have duplicated Mode S addresses. Two different ATC systems were tracking the aircraft – in one the anti-reflection algorithms filtered one of the tracks, in the other both aircraft were seen at all times.

In previous **NET*ALERTS***…
Ground based safety nets and transponder data have been covered in a number of previous issues:

- **Issue 10**: Safety nets and DAPs/loss of transponder data
- **Issue 11**: Safety nets in Malta
- **Issue 14**: Operating STCA at airports outside of major TMAs
- **Issue 17**: Split Tracks

SESAR update

Our regular review of SESAR safety nets related projects follows…

Evolution of Ground-Based Safety Nets and Airborne Safety Nets (P4.8.1-3)

Enhanced ground-based safety nets

Work Area 1 (enhanced ground-based safety nets using existing down-link aircraft parameters (DAPs) in TMA and en-route environments) completed an operational validation in the Milan ACC, in October for nominal situations, and in April for non-nominal situations. The V3 validation activity assessed an enhanced STCA industrial prototype developed by P10.4.3 using existing down-linked aircraft parameters (DAP). The associated validation report has been produced. Based on the results, the maturity of the concept will be checked by the SJU in June.

Fast time simulations and workshops were undertaken for the V2 validation in Work Area 2 (enhanced ground-based safety nets adapted to future TMA and en-route environments with enhanced 3/4D trajectory management) in the last quarter of 2013. The exercise evaluated the use of system-wide information management (SWIM) and new surveillance means (e.g. Automatic Dependent Surveillance-Broadcast (ADS-B)) to enhance ground-based safety nets, particularly STCA and APW, in a future trajectory-based environment. An associated validation report is being produced. However, the partners considered that the concept was not mature enough to be able to conduct the planned V3 validation, which may then occur only in the follow-up to SESAR, SESAR 2020.

The merge of P4.8.1, P4.8.2 and P4.8.3 into a single (P4.8.1) project is effective as of 01/01/2014 but still needs to be formalized.

ACAS X_A

The estimation of potential generated risks, safety benefits, operational performance and interoperability of TCAS II-ACAS X_A are all to be completed in summer 2014. In parallel, the preparations for the V2 validation exercises assessing the evaluation of ACAS X_A in Europe are still on-going. These exercises aim at assessing the potential safety and operational benefits, and dis-benefits, of ACAS X_A for Europe (compared to TCAS II), as well as the interoperability of TCAS II-ACAS X_A operations.

Early results from three of these exercises (led by DSNA) show a significant reduction of the risk of mid-air collisions and a significant reduction in operationally undesired Resolution Advisories (RAs). However, operational and safety issues have also been identified, including greater deviations resulting from remaining RAs (which might impact ACAS X_A compatibility with ATC practices), too many complex RA sequences (which might impact safety and pilot acceptability) and some TCAS II / ACAS X_A interoperability issues (with more Crossing & Reverse RAs on TCAS II aircraft when encountering ACAS X_A aircraft).

ACAS RA downlink

Work continues on the display of downlinked ACAS RAs to the controller. The preliminary operational concept, validation and evaluation of the concept are to be completed in the first half of 2014.

Partners: DSNA (leader), NATS, EUROCONTROL

Safety Nets Adaptation to New Modes of Operation (P10.4.3)

P10.4.3 supported the V3 validation on enhanced STCA using DAPs conducted by P4.8.1.

The project is now working towards its next validation exercise, enhanced safety nets and Resolution Advisory data processing (RADP), planned for November 2014. The exercise will assess Indra's prototype safety nets server (SNS) and controller working position (CWP). The SNS computes the short term conflicts based on the aircraft tracks (among others) and has an integrated RA data processor (RADP) prototype. In the planned exercise the CWP will display both RAs and STCA alerts. A number of related deliverables have either been submitted to the SJU or are in progress.

Partners: INDRA (leader), ENAV, EUROCONTROL, SELEX

TCAS Evolution (P9.47)

The prototype to assess implementing an extended hybrid surveillance capability into TCAS II is now ready for its technical validation.

A joint meeting has taken place between P9.47, RTCA SC147 and EUROCAE WG75 to start the development of the ACAS-X Minimum Operational Performance Standards (MOPS).

The definition of operational requirements, assumptions and scenarios for General Aviation (GA) collision avoidance capability in a European environment is nearing completion. Similar work is nearing completion for surveillance in an ACAS-X_A environment. Additionally, a number of activities including the assessment of issues and mitigation means for TCAS-equipped and GA aircraft encounters, as well as the development and V&V planning for the Surveillance Tracking Module (STM), are to start early this year.

Partners: Honeywell (leader), AIRBUS, DSNA, EUROCONTROL

ACAS monitoring (15.4.3)

The integration study for the ACAS monitoring system prototype is being updated by EUROCONTROL. The evaluation report is being revised, with a planned handover to the SJU during the summer.

Partners: THALES (leader), INDRA, EUROCONTROL, DFS

Airport Safety Support Tools for Pilots, Vehicle Drivers and Controllers (6.7.1)

In Work Area 2 (runway safety lights (RWSL)), a new prototype RWSL system is under development. Once integrated, the operational validation will take place at Paris Charles de Gaulle.

Work Area 3 (conflicting ATC clearances) has been merged into Work Area 4 (conformance monitoring). The associated operational services and environment descriptions (OSEDs) for the controller element of these the two concepts have been delivered to the SJU and the safety and performance requirements (SPRs) are being updated. Work on the OSEDs and SPRs for the corresponding pilot elements of these concepts is in progress.

In Work Area 5 (alerts for vehicle drivers), a second V2 validation exercise has taken place in Malmö. The exercise demonstrated how drivers

SESAR update

continued

could be alerted to safety-critical issues on the airport manoeuvring area (e.g. risk of collision or infringement of closed areas) using an on-board system and/or uplinked alerts.

In Work Area 6 (traffic alerts for pilots), the OSED and interoperability deliverables are being updated, and the SPRs are being finalised.
Partners: DSNA (leader), AIRBUS, ALENIA, DFS, NORACON, THALES, SEAC, EUROCONTROL

Enhanced Surface Safety Nets (12.3.2)

The development and verification of industrial prototypes to support validation activities (both simulations and live trials) for enhanced surface safety nets is progressing according to plan. A number of deliverables related to the NATMIG and Indra prototypes have been submitted to the SJU. The development of the Thales and DFS systems is on-going. Support to operational validation tasks is on-going while technical specifications and support to standardisation activities are expected to be launched later this year.
Partners: THALES (lead), DFS, DSNA, INDRA, NATMIG, SELEX, EUROCONTROL

Also in SESAR - SESAR airport SNET trials at Milan Malpensa

In November 2013, ENAV and its SESAR partners conducted the V3 validation of new airport safety nets under the umbrella of P6.3.2 "Airport ATM Performance - Execution Phase".

The exercise focused on the early detection of conflicting vehicle trajectories on the airport surface/runways and the provision of related alerts to controllers. The first part of the validation was a real-time simulation of innovative alarms for controllers (for example, non-conformance to ATC procedures/instructions, conflicting ATC clearances, surface conflict prediction & detection, runway incursion detection & area intrusion) and their display to controllers. A shadow mode exercise also took place, investigating the accuracy and reliability of Automatic Dependent Surveillance-Broadcast (ADS-B).

The results of these trials will be analysed and published as part of SESAR Release 3 package.

For more information

http://www.sesarju.eu/newsroom/all-news/airport-safety-net-concept-successfully-validated-milan-malpensa-airport.

Snippets

Trending SNETs news...

DSNA and DFS join forces over CoSNET

DSNA and DFS have jointly developed, validated and deployed the CoSNET (Cooperative Safety Nets) safety net system leading to significantly reduced procurement costs for both ANSPs. CoSNET is based on DSNA's experience with its own safety net system which has been in operation since 1996. DFS introduced CoSNET at its largest control centre in Langen in December 2013, with the Munich and Bremen centres due to receive CoSNET later this year. DSNA plans to replace its existing safety net servers with CoSNET servers, beginning in autumn 2014 at the Strasbourg approach control unit. CoSNET can provide the safety nets MSAW, STCA, APW and APM.
For more on this: http://www.airtrafficmanagement.net/2014/03/watm-dsna-dfs-launch-cosnet/

2014 Safety Forum: Airborne Conflict

The 2014 Safety Forum, organised by the Flight Safety Foundation, EUROCONTROL and the European Regional Airlines Association will take place at EUROCONTROL on 10-11 June. The forum will focus on Airborne Conflict Risk, covering a wide range of subjects such as: pilot-controller interaction, ATC system functionality, airspace design and aircraft performance. The risk from operations without a functioning transponder study will also be presented. To register or see the latest agenda go to http://www.skybrary.aero/index. php/Portal:Airborne_Conflict

Contact

Contact us by phone:
Ben Bakker (+32 2 729 3146),
Stan Drozdowski (+32 2 729 3760) or by
email: safety-nets@eurocontrol.int