AIRWAYS

MODE-S DAPS DATA - New Zealand

MODE-S ADDRESS AND FLIGHT IDENTIFIECATION

ICAO APAC - SURICG8 SEMINAR - BANGKOK

ANDY ALFORD AIRWAYS NEW ZEALAND

06-06-2023

NEW ZEALANDS MODE S BACKGROUND

- **1991 – Airways installed 6 Thales RSM970 MSSRs as part of an ATMS modernisation programme**
- **2005 – RSM970 electronics upgraded to provide MODE-S capability. Allowed for up to 5 DAPS interrogations.**
  - **DAPS equipage was limited to international flights and some domestic RPT with Enhanced or Elementary MODE-S**

AIRWAYS

- **2013 – Airways began operational use of DAPS to assist with the introduction of Wide Area Multilateration (WAM) and ADS-B.**

- **Initial use of DAPS was limited to 2 data items to assist with FPL to Surveillance Track correlation/coupling.**

  - **Unique ICAO MODE-S address (MODE-S HEX CODE)**
  - **Aircraft Identification (Flight ID)**

- **“Operational use of MODE-S and DAPS” – ADS-B SITF/14 IP16 (16/5/2015)**

MODE-S ENABLERS

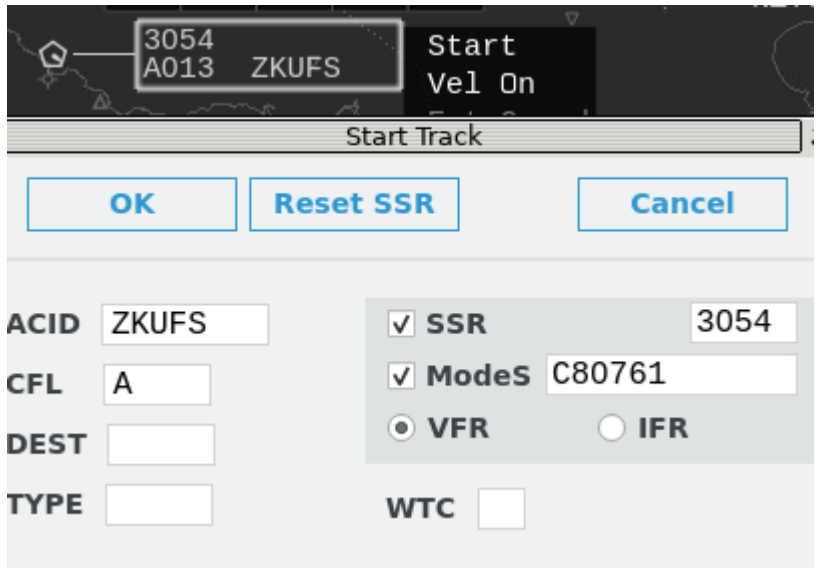
- **Two enablers used by Airways to introduce MODE-S DAPS data within the Air Traffic Management System (ATMS) were the Domestic ATM Software Team and ANS Requirements Team.**
- **These teams provide the ability for Airways to produce 6 fully tested software updates to the ATMS per year, and urgent software fixes if required**
- **Costing and workload is internal to Airways and controlled by Airways**
- **Use of multiple labs, including virtual labs, using live FPL and Surveillance data, allows full system development and testing to ensure the required implementation date is met.**

MODE-S ADDRESS

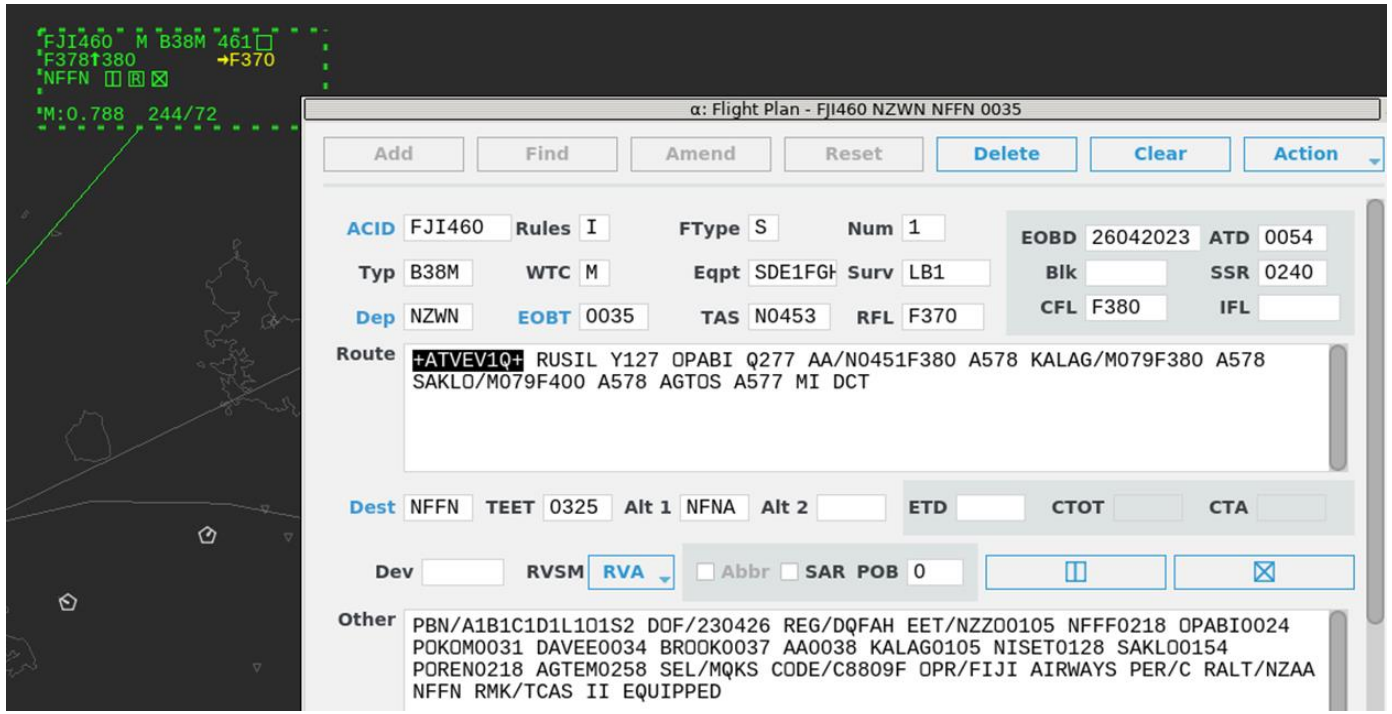
ICAO AIRCRAFT (MODE-S) ADDRESS

- **The 24-bit MODE-S Aircraft Address (or Hex Code)**
  - **Must be compliant with ICAO Annex 10 requirements**
  - **Must be unique to each aircraft**
  - **Must meet local regulatory requirements. In New Zealand guidance around this includes:**
    - **NZCAA Advisory Circular 91-1 (Rev 2 26/2/2022) – Rule 91.247(b) – each aircraft must be assigned a unique 24-bit SSR MODE S address (e.g., C81818)**
    - **NZAIP ENR 1.6-2, Aircraft equipped with a MODE S:**
      - **Must include a MODE S address in field 18 of the Flight Plan (e.g. CODE/C81818), and**
      - **Must transmit a correct Flight ID (either ACID in use or in the flight plan, or the aircraft registration)**

- MODE-S address Is squitted by the aircraft transponder approximately every second
- Cannot be modified within the aircraft while airborne
- Can by used by the ATMS for correlation/coupling of the surveillance track to a Flight Plan
- Is available from DO260, DO260A, DO260B and DO260C ADS-B systems.



ZKUFS - TRANSMITTING CODE C80761



FJI460 - CODE/C8809F entered in Field 18 of the FPL

DUPLICATED MODE-S ADDRESS

- **A Duplicated MODE S address:**
  - **Is considered two or more aircraft transmitting the same MODE-S address**
  - **Is normally a domestic issue**
  - **Cannot be resolved in the air by the pilot**
- **Will be reported to Operator and Regulatory authority for remedial action.**

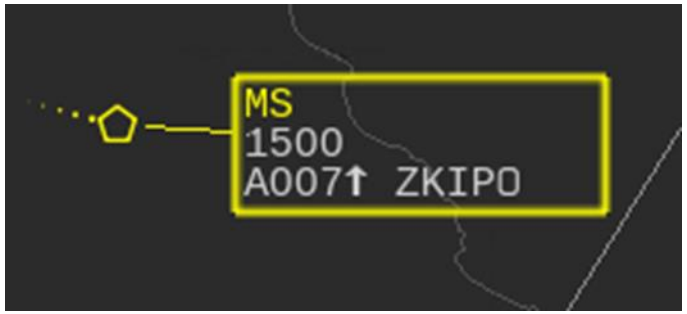
MODE-S ISSUES

- **Airways testing showed two issues during the early introduction of MODE-S Address. The first: Multiple tracks with the same MODE-S address.**
- **These were generated by two or more aircraft transmitting the same MODE-S address. Common causes were:**
  - **An incorrect MODE-S address being inserted during transponder installation in aircraft 2, which is already in use by aircraft 1**
  - **A previously used transponder being installed in a new aircraft without the MODE-S address being updated to the new aircraft address.**
  - **Split tracks from one sensor or between multiple sensors**

    - **Duplicate MODE-S addresses cause confusion to surveillance systems if tracks are close to each other (less than 6nm apart) – e.g. track swaps, loss of one track from tracker processing, swapping of track IDs or swapping track information.**

SOFTWARE USED TO IDENTIFY DUPLICATE MODE-S ADDRESSES

- **New Software together with HMI functionality was required to help identify the issue to ATC**
  - **Duplicate MODE-S alert indicated by Yellow MS in Line 1 of track Label (correlated or uncorrelated)**
  - **Identified by 2 (or more) tracks with MS Alerting**



MODE-S ALERT

MODE-S ALERT

AIRWAYS

AIRCRAFT MODE S ADDRESS DATA VERSUS FPL DATA

- **The second MODE-S address issue is a mismatch between the MODE-S address being transmitted by the aircraft and the MODE-S HEX CODE entered into Field 18 of the FPL**

- **Low occurrence during testing and initial introduction. This has increased recently after local operators changed their FPL handling from in-house to overseas providers**

  - **This change is primarily due to late notice airframe changes, with the change messages (CHG) not being generated, or arriving after the flight becomes airborne.**

- **The issue is identified to ATC with alerting. However such alerting, while accurate, may be considered nuisance alerting by some.**

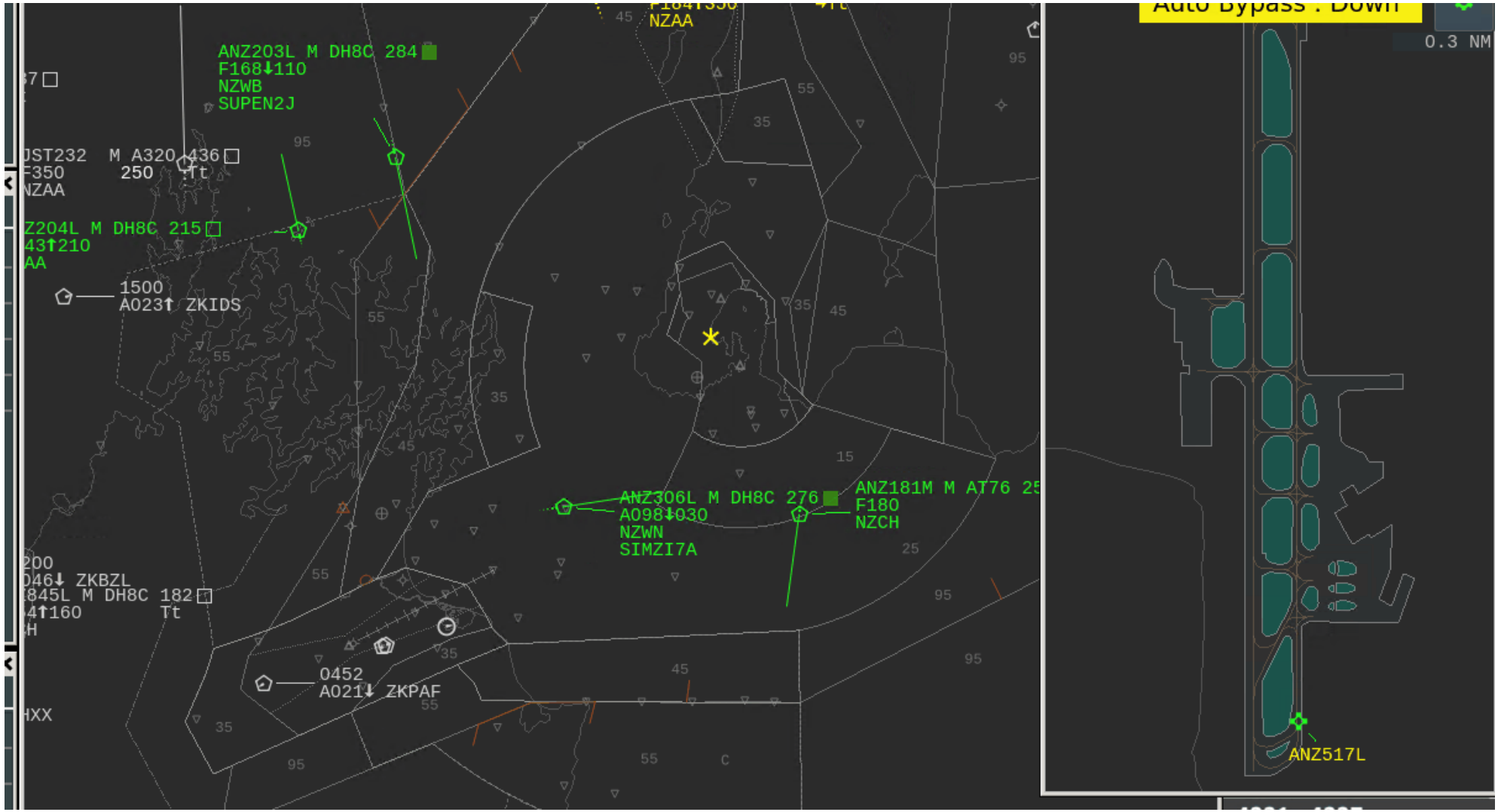
  - **However, it should not be an issue unless your system is solely reliant on MODE S address for correlation/coupling.**

NEW SOFTWARE SOLUTION

- **A new software solution was implemented to indicate an incorrect MODE-S between Aircraft and FPL**
  - **Indicated with Yellow S in Line 1 of Track Label**
  - **Resolved by right clicking on Yellow S**
  - **Corrects FPL details to show code being transmitted by aircraft**

AIRWAYS

VIDEO SHOWING CONTROLLER FIXING MODE-S CODE ISSUE



AIRWAYS

HANDLING OF INCORRECT MODE-S ADDRESS ISSUES

- **The first and main solution used to handle an incorrect MODE-S address was to use software to create new alerts in the ATMS to identify the issue to ATC**

- **The second solution was to work with the Regulator and/or operator to correct the problem. There are a number of issues with this:**

  - **Time delay between event and the Regulator being able to contact the operator, especially those domiciled overseas**

  - **Inadequate details on the operator, particularly for non-scheduled international traffic**

  - **The ability of the overseas operator's Regulator to action requests from another country**

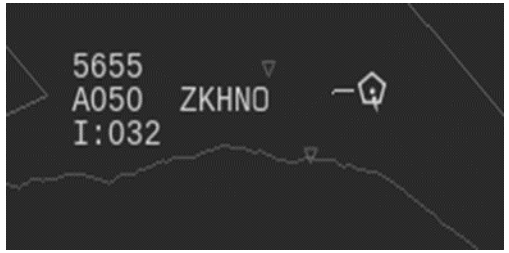
  - **Lack of feedback from the Regulator and/or operator**

FLIGHT ID ISSUES

USE OF AIRCRAFT IDENTIFICATION

- **Aircraft identification (Flight ID)**
  - **Squitted or obtained from register BDS 2.0;**
  - **Can be used as a method for correlation/coupling between the surveillance track and flight plan – especially for DO260 ADS-B systems in ADSB NRA**
  - **Useful to help identify uncorrelated/coupled flights (VFR or IFR)**

Uncorrelated VFR



Uncorrelated IFR

ISSUES WITH THE USE OF AIRCRAFT IDENTIFICATION

- **Issues observed with the application of Flight ID**
  - **Incorrectly set Flight ID set (e.g., ANZ123 instead of ANZ321)**
  - **No Flight ID set**
  - **Spaces in Flight ID (e.g., AN Z12 3 instead of ANZ123) which produces a corrupted Flight ID**
  - **Using aircraft registration instead of approved ACID (e.g., ZKABC instead of WPR3)**

WHAT ARE SOME OF THE IMPACTS OF INCORRECT FLIGHT ID

- **Incorrect correlation/coupling – e.g., coupling to the wrong aircraft**
- **No correlation/coupling occurring**
- **Misidentification of uncorrelated/uncoupled target**
- **Nuisance alerting due to poor application by flight crew**

INTERNAL REPORTING TOOL TO MONITOR INCORRECT FLIGHT ID

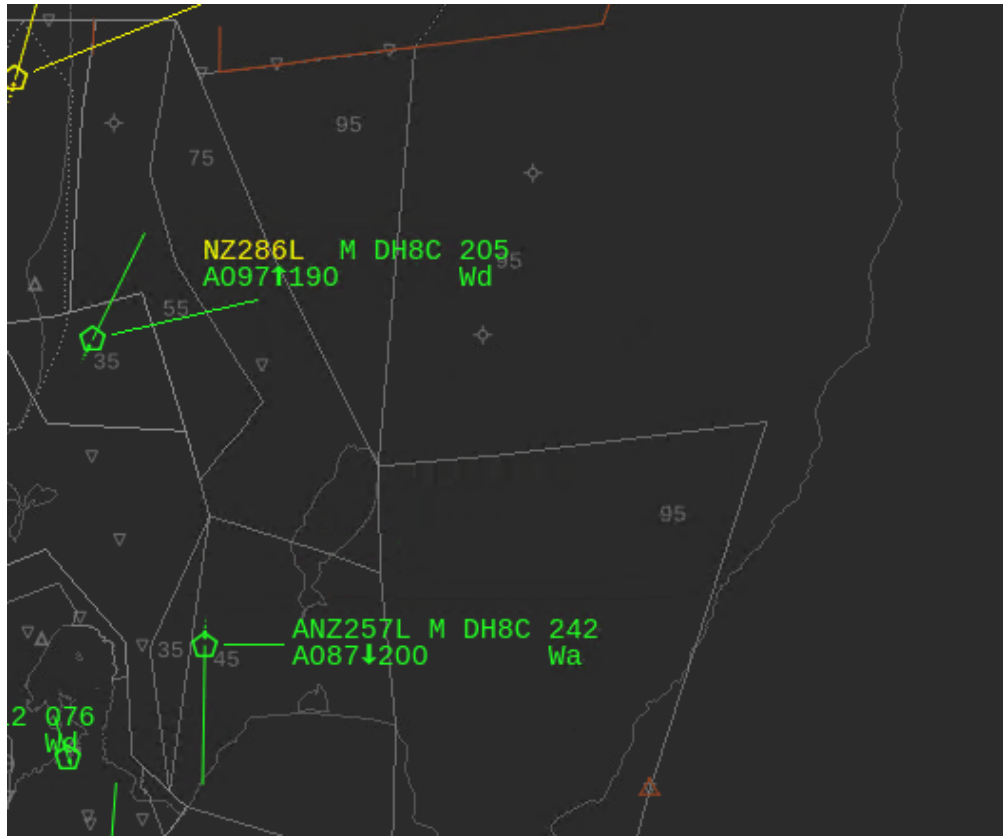
- **Daily Flight ID mismatch report**
- **Part of internal monitoring system.**
- **Identifies Aircraft/Airline and time taken to resolve issue**

Mismatched Flight IDs

			Flight Plan					Track			
Date	Start time	End Time	Number	Correlation	ACID	Mode S	SSR	Number	TID	Mode S	SSR
2023/04/17	2302:34	2303:44	52784	MODE A	CVA827	000000	5230	536	CVA829	C81076	5230
2023/04/18	0142:17	0147:14	53766	START TRACK	MSY436	C819D3	2521	52	ZKFXY	C819D3	2521
2023/04/18	1435:40	1438:55	54002	MODE A	APK79	000000	5575	229	APK76	C82396	5575
2023/04/18	1644:30	1648:06	54022	MODE A	APK80	000000	5602	786	APK79	C82396	5602

HANDLING OF FLIGHT ID ISSUES

- **A new Flight ID alert was developed to identify the issue to controllers**
- **A yellow Flight ID alert is generated in the datablock.**
- **The controller acknowledges the alert, informs the pilot and requests a reset of the Flight ID**
  - **Phraseology “RE ENTER IDENTIFICATION”**
- **Correction of the Flight ID by the crew will remove the alert from the datablock**
- **If not corrected, the Flight ID remains WHITE in the datablock.**
- **The controller will inform the Duty Manager (SUP), who will file a DEFECT INCIDENT (DI) with NZCAA**



AIRWAYS

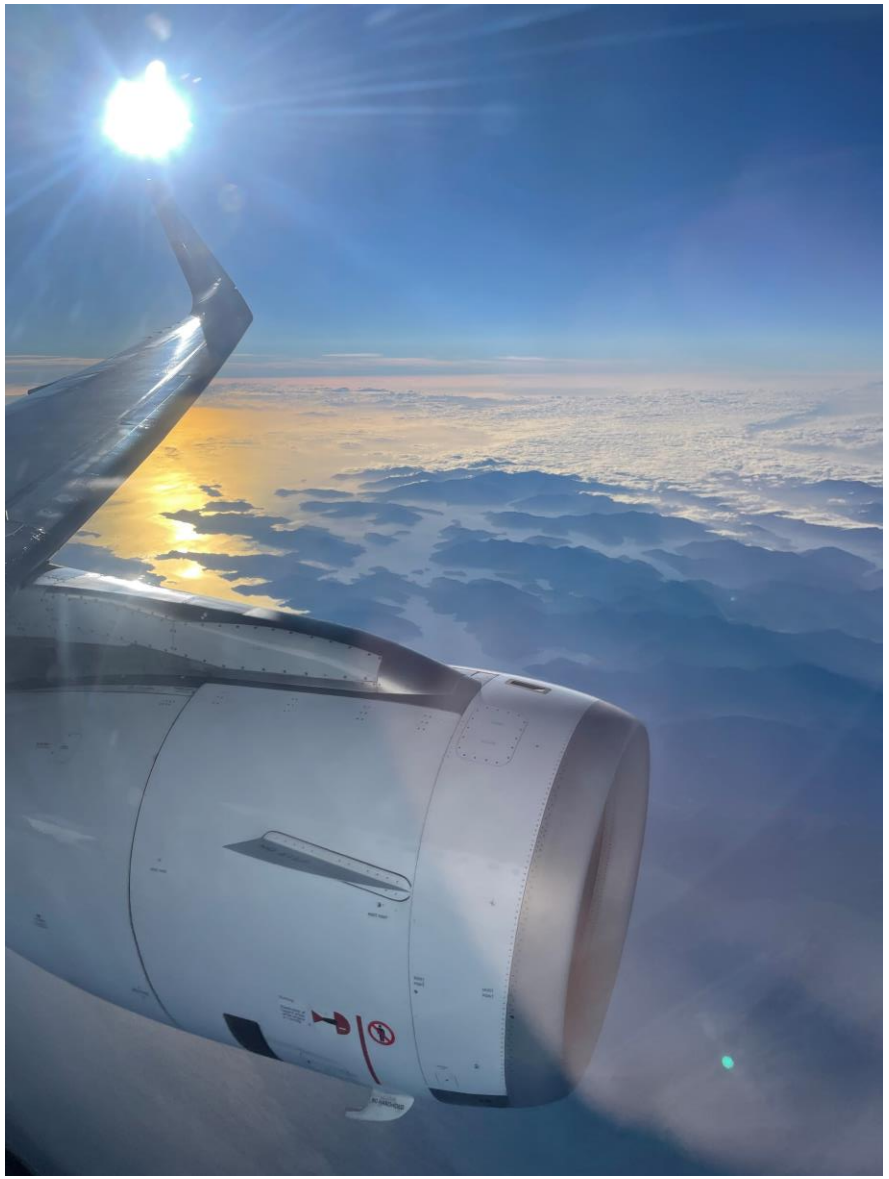
AIRWAYS

KEY LEARNINGS

KEY LEARNINGS

- **The local Regulatory Authority and ANSP need to work closely together to ensure a seamless introduction of the use of MODE-S DAPS**
- **Users of the systems must be engaged early (e.g. Equipment Installers, Airline and Aircraft Operators/Owners, Flight Crew and ATC)**
- **Appropriate training material is provided in a timely manner to Flight Crew and ATC**
- **Humans are fallible. Software solutions can help identify and/or resolve these issues in a short period of time**
  - **Ensures appropriate alerting is provided to ATC when issues are detected**
- **Methods are in place to allow ATC to alert Pilots, and the ANSP to advise Aircraft Operators and/or Regulatory Authority of an issue, allowing them to remedy the issue.**
- **International cooperation between Regulatory Authorities and operators is essential**
- **Feedback is essential**

UPDATE ON OTHER DAPS USE AND ISSUES



AIRWAYS

USE OF SELECTED ALTITUDE (SFL)

- **Added May 2016, available from register BDS (4, 0), interrogated for every 20 seconds.**

- **Available from ADSB DO260A and DO260B but not DO260**

- **“Implementation of MODE-S DAPS (SFL) in Airways ATM” - Refer to SURICG/1 IP3 14/04/2016**

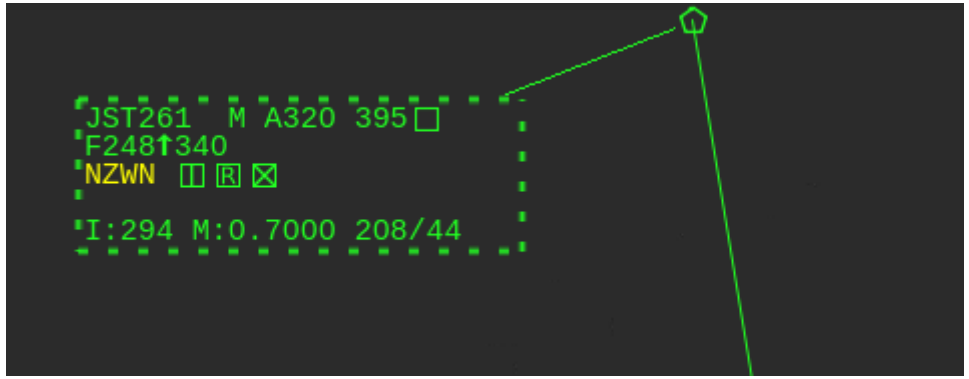
SFL ALERT – CLEARED LEVEL F340 AIRCRAFT SET FL300

USE OF IAS/MACH

- **Added Feb 2017, available from enhanced MODE-S only - from register BDS (6, 0)**

- **IAS reportedly available from ADSB DO260B only but rarely seen, while MACH speed is not available. Implementation of DO260C was asked to include both IAS and MACH**

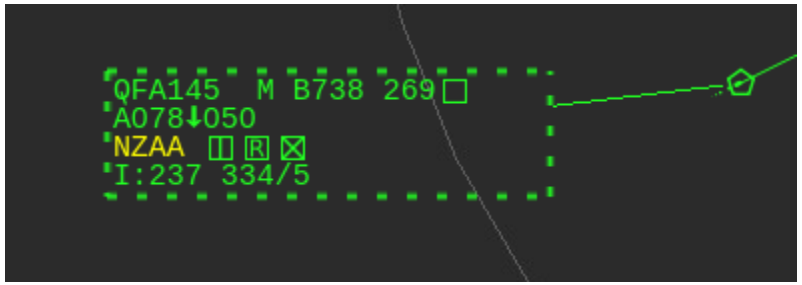
- **"USE OF MODE-S DAPS DATA (IAS AND MACH)" – Refer to SURICG/2 WP05 30/5/2017**



IAS 294 AND MACH 0.70

OTHER DAPS DATA UNDER CONSIDERATION

- **Use of WIND DATA**
  - **Calculated from DAPS using True Airspeed (5, 0), Track Angle (5, 0), Magnetic Heading (6, 0) and Ground Speed (5, 0)**
  - **Initial testing showed Calculated Winds are consistent with Spot Winds provided by aircrew.**
  - **Not available from ADS-B as ADS-B ADD does not provide all the required data.**



WIND 334/05

- **Enables:**
  - **Updating of GRIB forecast winds**
  - **Enhancing sequencing tools such as the Arrival Manager (AMAN)**
  - **Enhancing safety net processing**
  - **Provides ATC with a visual indication of the winds at various levels**

USE OF QNH

- **BARO or QNH is available in MODE S BDS (4, 0) and ADS-B ADD (6, 2)**

- **Initial testing showed that data above the transition level (A130 to FL150) for some aircraft types was incorrect between what the crew set in the cockpit and what the aircraft downlinked. This issue was identified by an EASA SIB**
  - **Currently QNH alerting above the transition level is considered unusable unless the EASA SIB is applied by all operators**

    - **EASA SIB-2016-05R2 (“Incorrect Downlinked Barometric Pressure Settings (BPS)”)**

- **Below the transition level spurious alerting could occur with early/late changes by the crew when the aircraft is moving from an Area QNH to a local Aerodrome QNH.**

    - **“Use of MODE-S DAPS QNH DATA” – refer CNS SG/20 IP17**

QUESTIONS

AIRWAYS

THANK YOU