Airways Training
Courses, programmes, partnerships

AIRWAYS International

SP07 - Understanding the Development through to Retirement Phases of the ADS-B Surveillance Process

The System Lifecycle Program as used for the Airways National ADS-B System

Presented by Dr. Herman Wezenberg

Development phase

The overall plan from a project perspective was:

- Stage 1 (2015):

Planning for progressive implementation of ADS-B to meet future mandates

- Stage 2 (2018):

ADS-B mandatory airspace above FL 245 with a newly installed surveillance network of ADS-B receivers

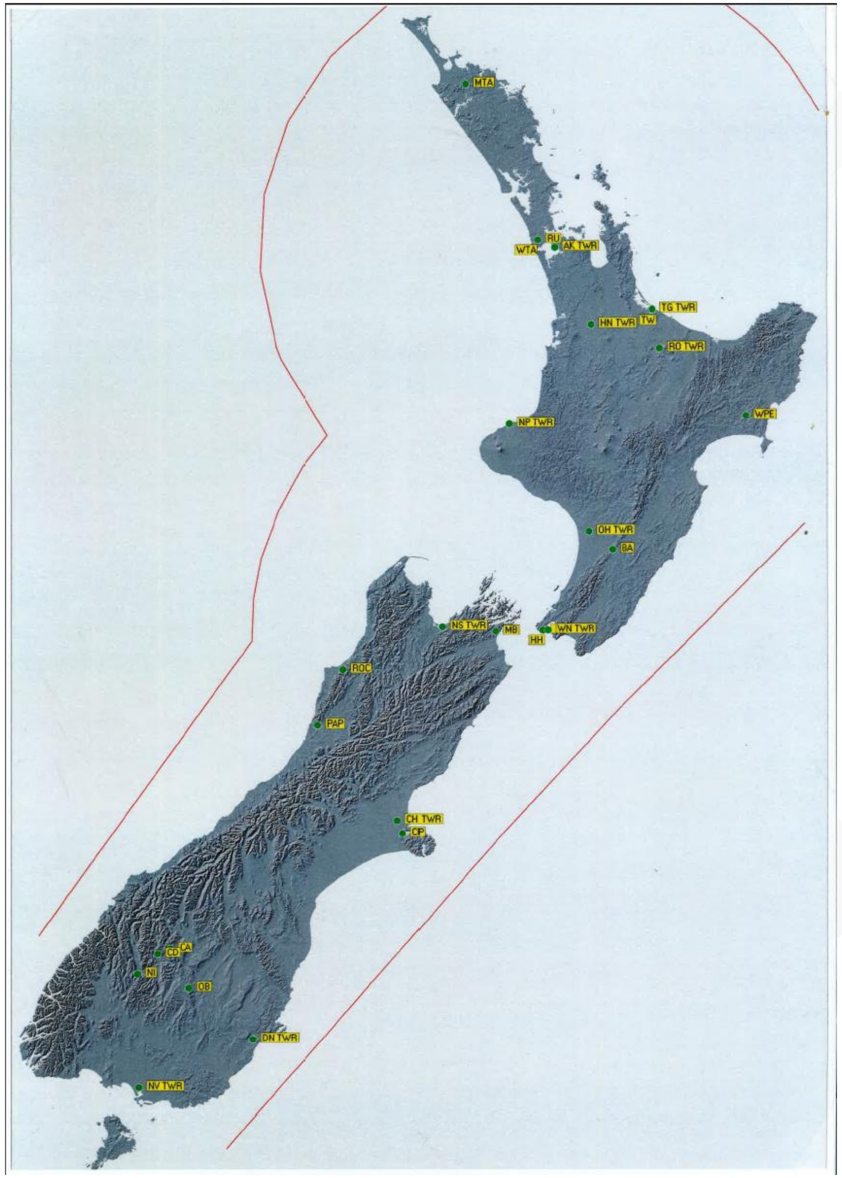
- Stage 3 (2023):

ADS-B mandatory in all controlled airspace from 2023 and supported by a contingency surveillance network.

AIRWAYS TRAINING working smarter together

Development phase

Envisaged 26 ADS-B ground stations throughout NZ



AIRWAYS TRAINING
working smarter together

Development phase

- Sugarloaf trial with 4 potential equipment suppliers

Development phase

- For the trial, different ADS-B antennas on the roof
- From the trial, one supplier was clearly identified with the best performing equipment , a good HMI interface and excellent backup/assistance

AIRWAYS TRAINING
working smarter together

Development phase

Equipment Factors

From a technical viewpoint, the supplied equipment was judged on factors such as:

- receiver performance, (e.g. sensitivity, range, consistency, etc.)
- data output (e.g. Cat21, 23, 247, raw data)
- suitability of data to ATM system requirements
- straightforwardness of any installation
- ease of equipment configuration
- ease of equipment modifications
- additional features (e.g. built-in antenna monitoring, redundant data ports, etc.)
- suggested methods for fault location and trouble-shooting,
- human-machine interface (HMI) comprehensibility
- vendor backup and communication

Acquisition Process

ADS-B acquisition strategy was agreed and signed off with the procurement manager and the project control group.

Due to the testing at Sugar Loaf this part of procurement process took a relatively short 4 months.

The key elements were:

- A request for proposal (RFP) which went to the preferred suppliers from the Sugar Loaf trial phase
- Responses from tenders were evaluated and a final supplier was short-listed
- A contract was negotiated with this supplier
- A contract was signed between the ANSP and Thales Germany.

Development Phase

Your Key takeaways?

- Development Phase
  - A lot of Project planning required
  - Delivery had to fit within the regulator’s (NZ CAA) timeframe and a previously published New Southern Sky framework,
  - A 2-staged delivery model was employed (*main trunk* first, followed by *regional*)
  - A trial provided a great insight into capability of technologies and suppliers
- Acquisition Process
  - The information gained during the trial assisted with the Agreement Process
  - The strategy was agreed and signed off

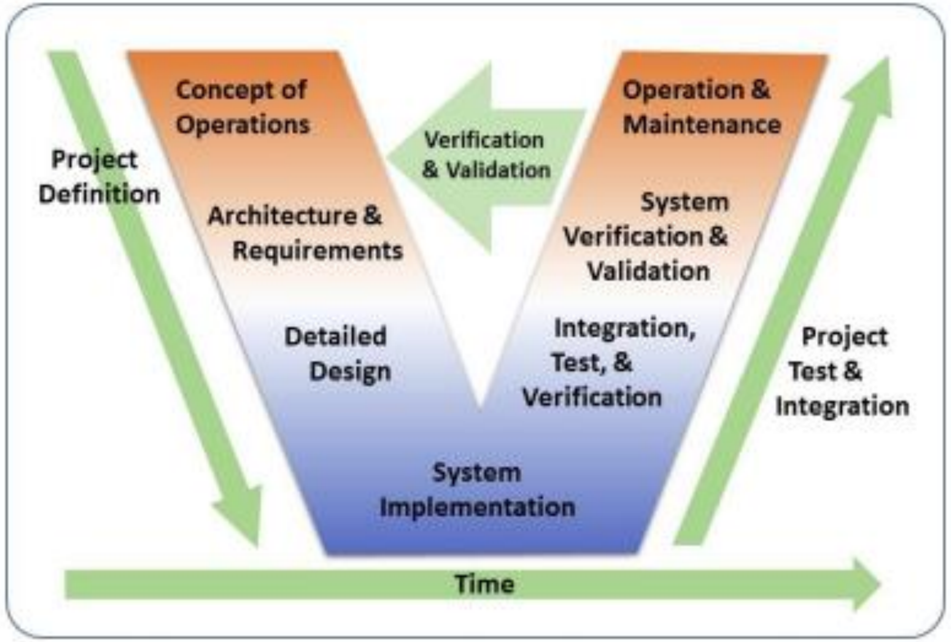
AIRWAYS TRAINING working smarter together

Production phase

Production Phase has a Design Definition Process:

Design Definition Process includes the following (recall the basic V model) :

- Project Team
- Design Definition
- Systems Requirements Definition
- Integration
- Configuration Management
- Verification and Validation
- Transition
- Quality Assurance



A Project team with the relevant expertise that can do:

- The Design process, followed by;
- The purchase and installation of the required equipment and;
- The integration of hardware, software and interfaces on selected sites, such as hill-top communication towers and air traffic control towers, the control centres, the ATM system and the test lab, along with;
- The installation of the OEM software and;
- The verification and validation testing of the system.

Design Definition Process

The purpose of the design definition process is to provide sufficient detailed data and information about the system

- The “Detail Design” produces the necessary detail in terms of engineering system requirements, system configuration, equipment installation, risk management, maintenance and training documentation that builds on the overall system architecture as previously defined in the “Preliminary Design” and Customer Requirements.

- The overall design is also driven by the solution contracted (in this case a system from Thales Germany) and the wider communications network and security policies from Airways NZ.

AIRWAYS TRAINING working smarter together

Production phase

For the ADS-B system the key architecture decisions were driven by:

- 26 operational Receivers located throughout New Zealand
- All Receivers to connect to two different physical locations (Auckland or Christchurch)
- Achieve an overall ADS-B system reliability and availability of at least 99.95%.
- Each ground station receiver has 2 independent data channels (i.e., lines of communication).
- Remote ground station sites (e.g., mountain tops with long repair time) were fitted with dual receivers for the same purpose.
- 26 sites chosen allowed for extensive overlap of target detection coverage.

AIRWAYS TRAINING working smarter together

Production phase

ADS-B site in the far south of NZ

Production phase

Production phase

AIRWAYS TRAINING
working smarter together

Systems Requirements Definition Process

The purpose of this process is to transform the desired capabilities into a solution that meets the operational needs of the user.

- The Thales ADS-B system is a specific set of equipment capable of receiving and processing a number of ICAO standard DF 17, 18 and 19 (military) signals.
- The system complies with the DO-260B standard (for the transponders).
- Only the equipment used for Receiving (the ground station and antennas) and Monitoring (CPMS, RCMS and LCMS) were purchased.
- Target Track processing and subsequent display has been taken over by the ANSPs ATM system.
- Each site ground station is a stand-alone unit and outputs Asterix Cat21, 23, and 247 data. In addition, it can also output “raw” data.
- The system design was done in conjunction with Thales Germany, as per the agreed contract.

Integration Process

The purpose of the Integration process is to create a system that satisfies requirements, architecture, and design.

The most important outcomes are:

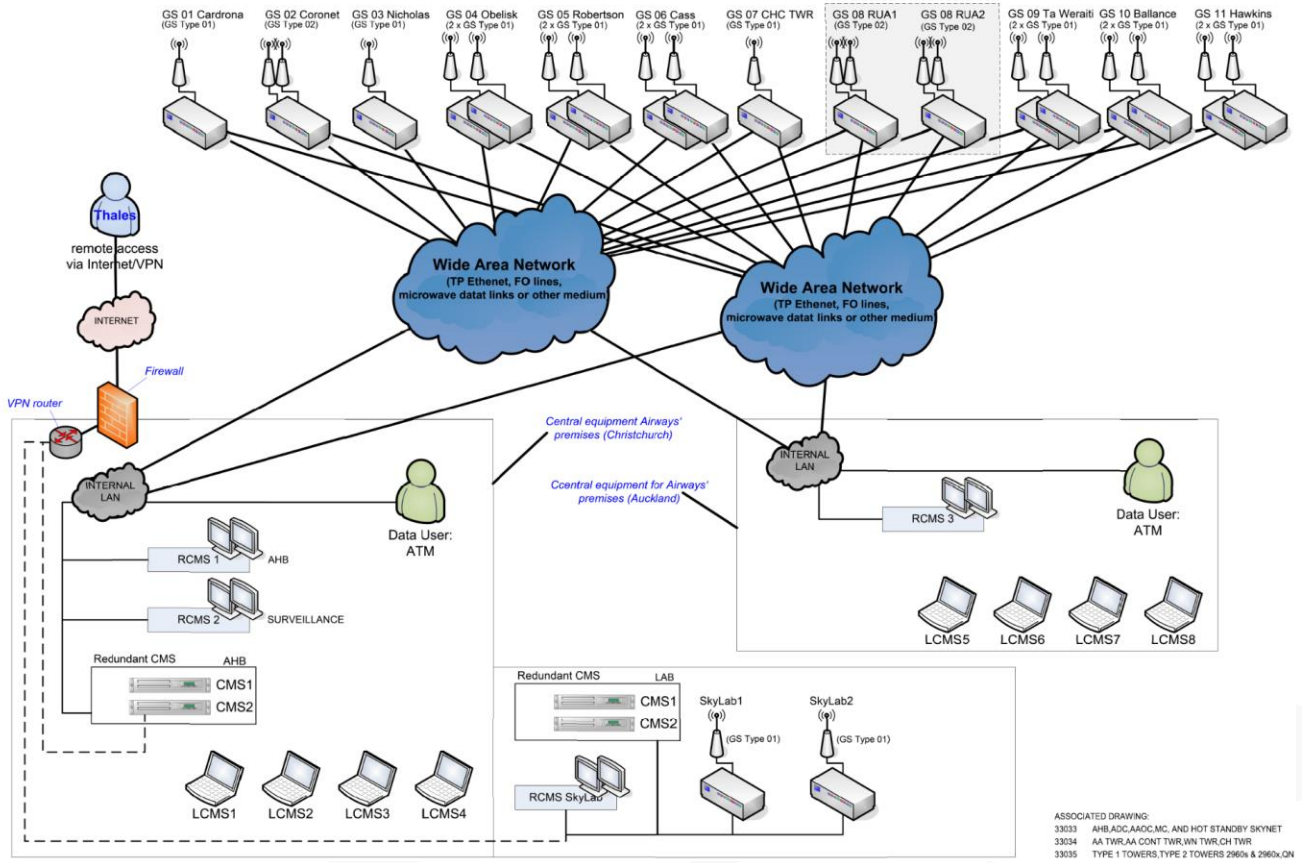
- Constraints on the system are identified
- Approach and checkpoints for the system functions are defined
- Any other systems or services needed for integration are available
- The interfaces between the implemented system elements are checked
- The interfaces between the system and the external environment are checked

Configuration Management Process

The purpose of Configuration Management is to manage and control system elements and configurations over the life cycle

The general configuration of the ADS-B system is shown in the diagram:

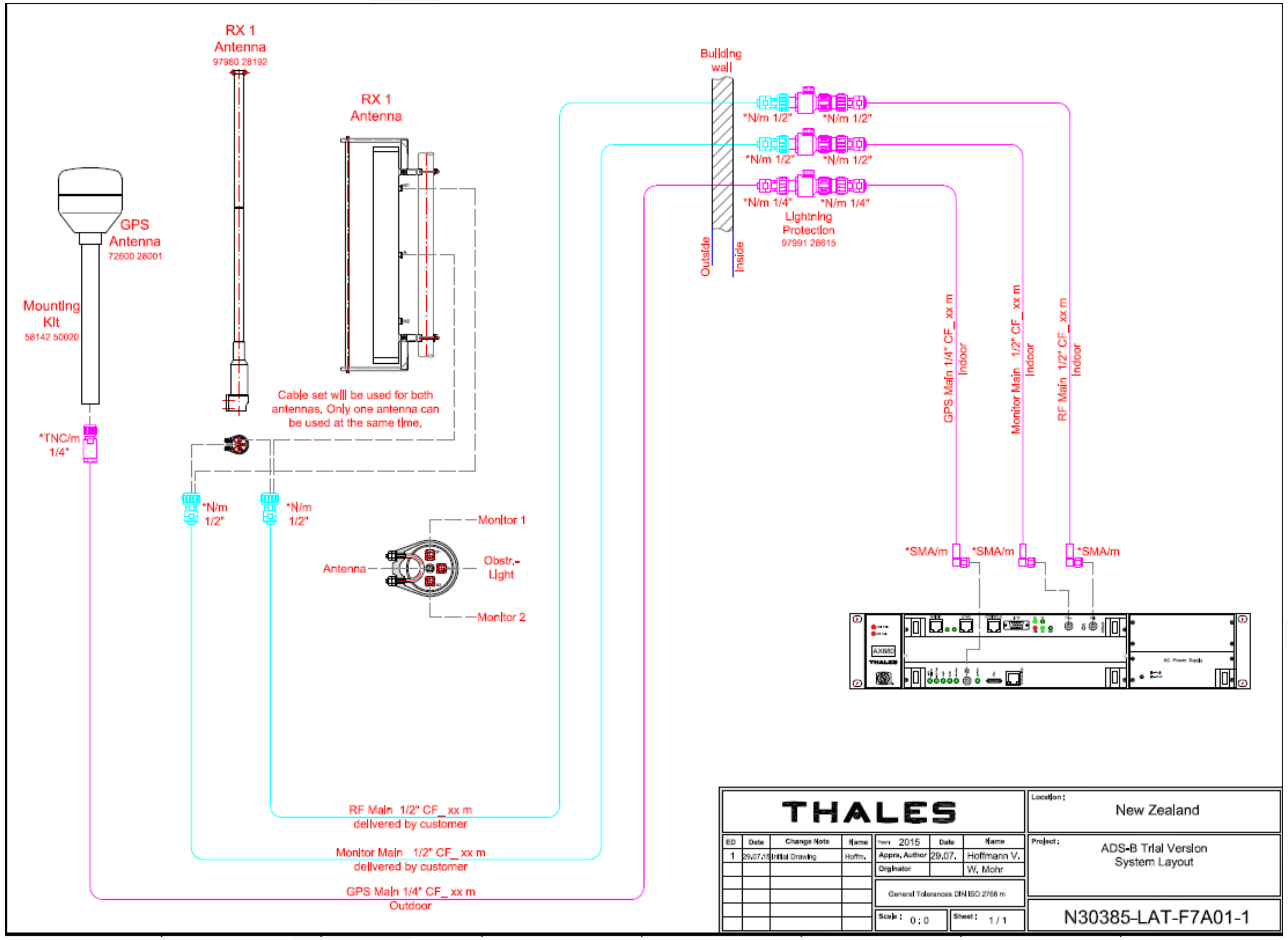
- Single indoor AX680 receiver (most control tower sites) with an antenna mounted on/near the roof;
- Dual indoor AX680 receivers (SSR radar sites and the remote sites) with antennas mounted on the side of the available facilities (tower structure or building).
- CPMS servers that are dualised for redundancy and allow for error logs/data storage for at least 30 days
- RCMS and LCMS for monitoring and maintenance of the system.
- .An ATM system that is independent of the supplier.
- Test lab setup with 2 receivers to allow for a safe test environment prior to operational deployment



AIRWAYS TRAINING working smarter together

Production phase

- The drawing shows a typical Connection diagram for the Thales equipment.
- Cable types and quantities of both equipment and cables will of course vary according to the place of installation.



Production phase

Typical installation with dual Omni Rx and GPS antennas, note the comms link dishes mounted on the safety barrier …

Production phase

Hinged mast for ease of installation and maintenance

Production phase

Proper support for cabling with fasteners and cable trays

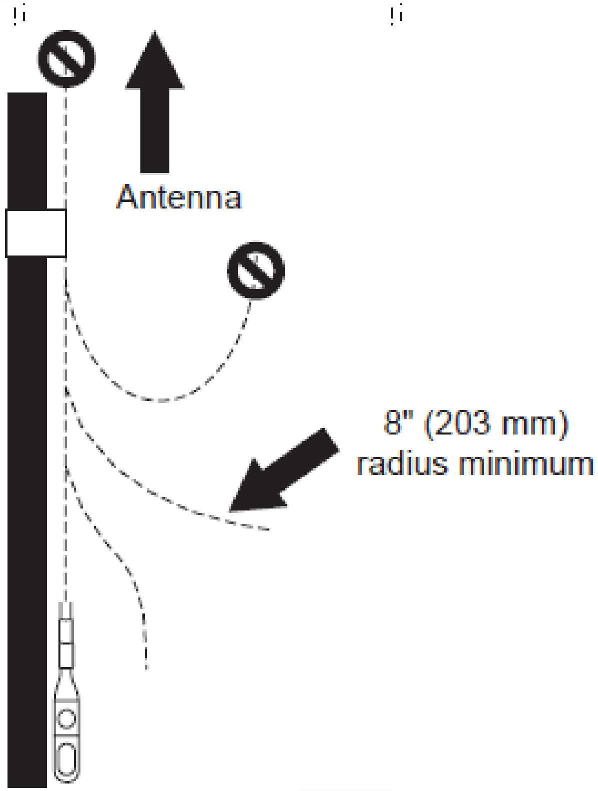
- to avoid movement (wind, being knocked, earthquake, etc)
- Ensure correct bending radius.
- Tempting to use cable ties (don’t, they deteriorate)

Production phase

Correct installation of RF cable grounding kits

- Grounding kits shall be on all external RF cabling.
- Grounding kit tail wires shall be pointing away from antenna and towards the grounding point.
- Radius limit shall not be exceeded.
- Grounding kit tails shall be joined to 50 mm2 sheathed earth cable or larger using stainless steel lugs with M10 fasteners.
- Connections shall be sealed with self-amalgamating tape.

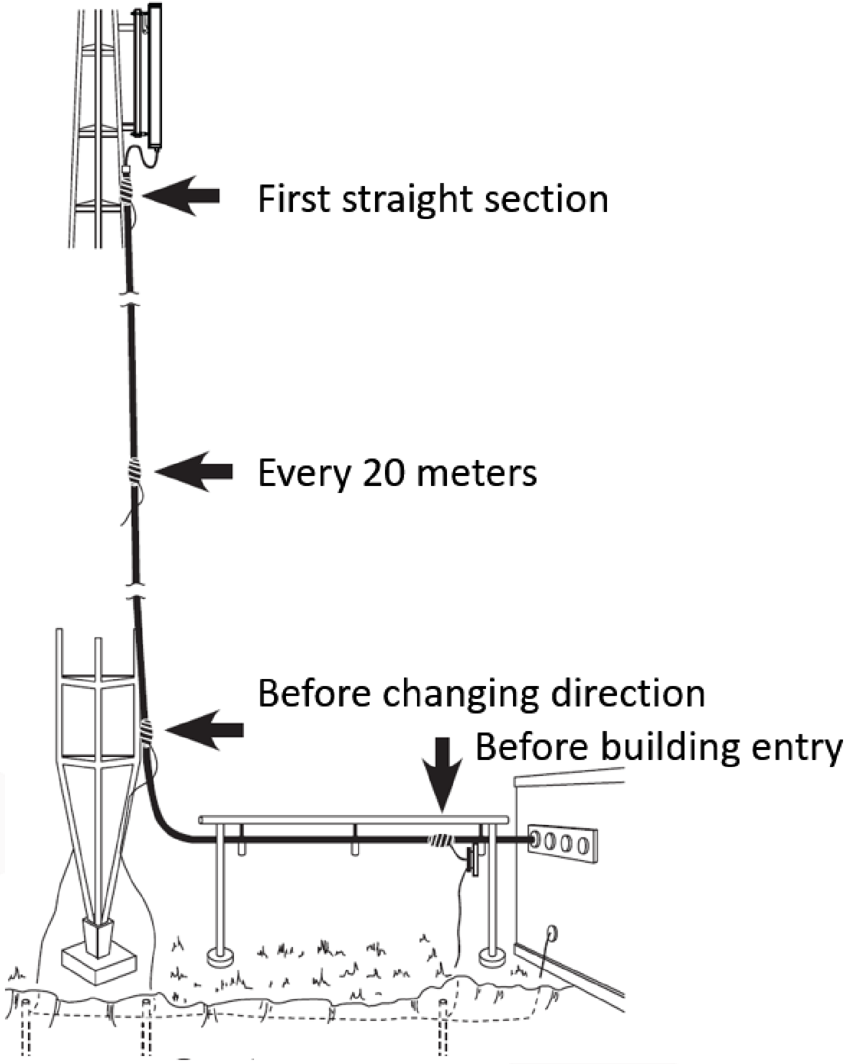
Straighten the grounding wire in the direction to the grounding point (shortest way possible).
The fixation of the wire is recommended.
Follow applicable local standards and rules.



Production phase

Correct installation of grounding kits

- First straight section of cabling at the antenna end.
- Every 20 meters.
- Before changing direction on the straight section.
- Before building entry.



Production phase

Correct installation - grounding and building entry

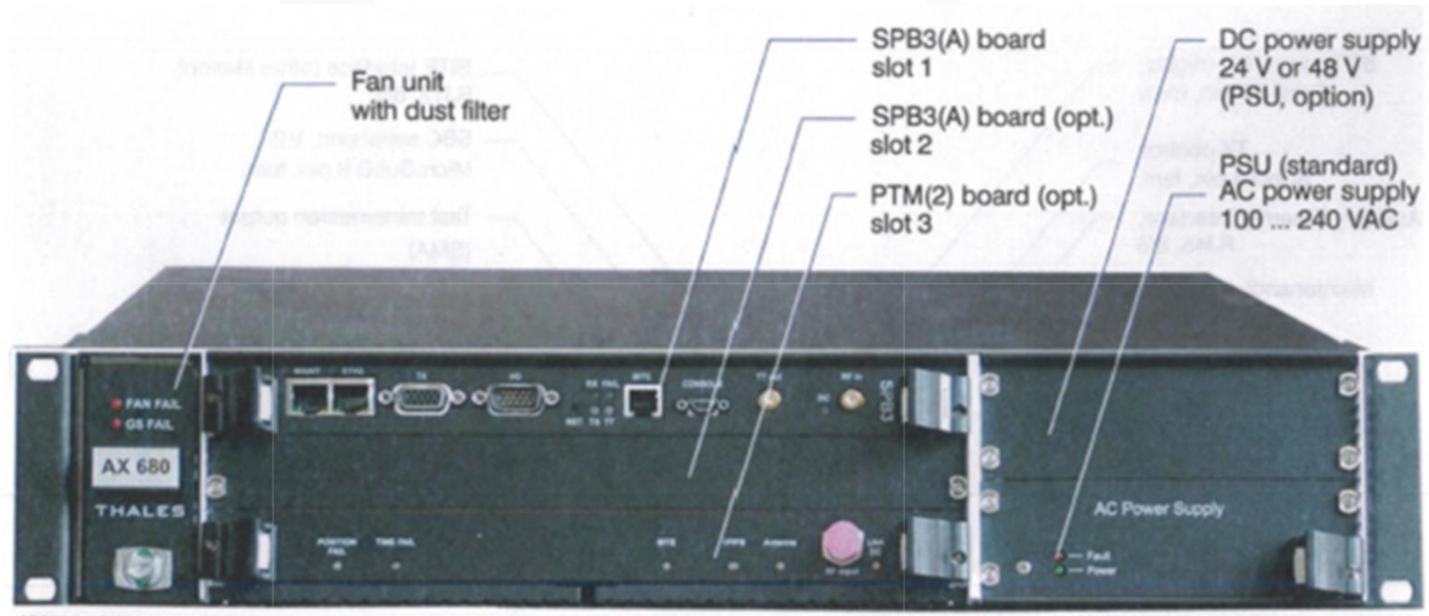
- 50 mm2 cu sheathed earth cable or larger shall be used to connect M12 Omni 115 ADS-B antenna U-bolt to the site lightning earth.
- Cadweld molds shall be used to connect new earth wire to the existing lightning protection earth system.
- No dissimilar metals that can cause galvanic corrosion shall be in contact of each other without appropriate protection that will last the life of the installation.
- New cable entries into building are expected to be fitted with appropriately sized entry plates and boots (e.g. Andrew's or Fimo) including appropriate plugs for the cable sizes; e.g. 50mm2 sheathed earth, CNT-400, LDF4, AVA5, and AVA7.

Production phase

In the next slides we outline the equipment that was purchased from Thales Germany

Thales AX680 Receiver Ground Station

- The receiver unit is installed in a 19” rack inside the available building. It is fitted with a dual power supply, one of which accepts 240 VAC and the other 24 VDC.
- The AX680 is essentially a ruggedised PC with a linux based operating system. It is essentially maintenance free .
- At the top of the unit is the SPB3A which is the processing board (it has space for two). At the bottom is the GPS board (PTM).
- Note that only the SPB3A is hot-swappable.



AX 680 SPU, front view

Production phase

Equipment installation in a 19” rack

- Dual receivers
- Network modules (WAN access)
- Backup power supplies for the period that the generator starts

Production phase

Kathrein Omnidirectional Antenna

- This 11.5 dBi, 50 ohm, 1090 MHz vertically polarised antenna consists of a number of identical, decoupled half-wave dipoles.
- All metal parts are grounded and therefore are able limit the damage from possible lightning strikes; special crowns are fitted to the top and bottom of all antennas that are outside - or close - to the boundaries of existing lightning protection zones.
- Specific to this antenna are the two antenna monitoring probes located inside the fibreglass radome. These can be used to assess the functionality of the receiver antenna without having to physically inspect the antenna for possible faults (reduced maintenance and working-at-heights).

KATHREIN
Antennen · Electronic

Production phase

Equipment installation and maintenance also takes place on sites belonging to 3rd parties

AIRWAYS TRAINING
working smarter together

Production phase

At some 3rd party sites, we prefer to provide our own huts for equipment housing.

AIRWAYS TRAINING
working smarter together

Production phase

Kathrein Omnidirectional Antenna site installation

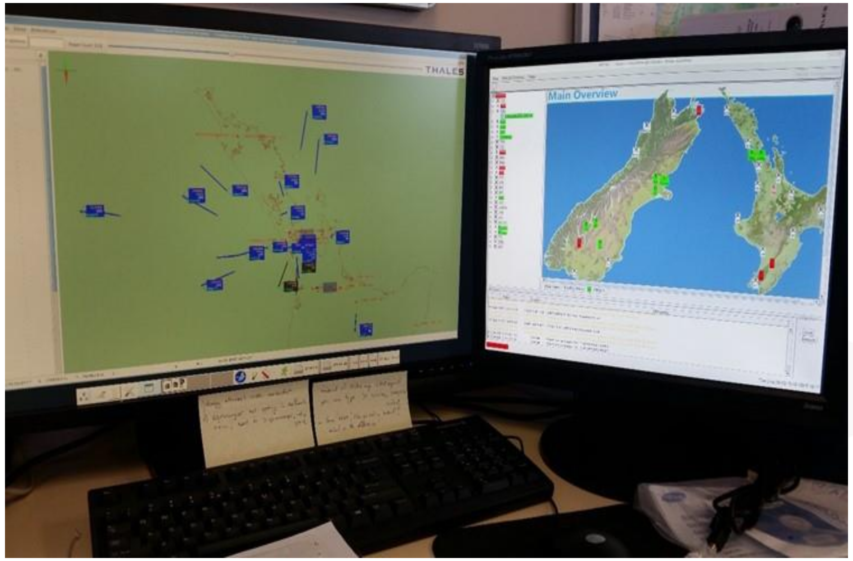
- Dual set-up with lightning protection spikes at top of antenna and guy ropes (note the formation of “flag-ice” on the guy ropes, which in fact failed).

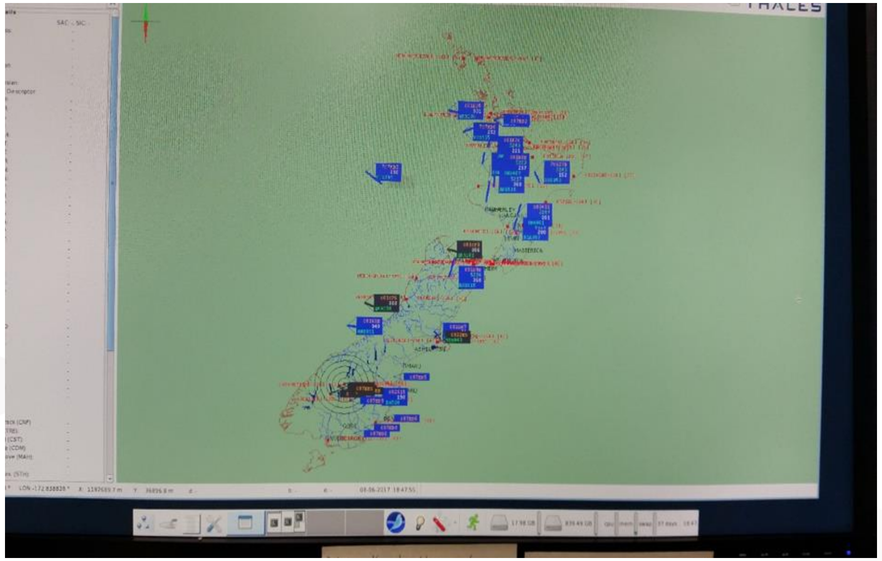
AIRWAYS TRAINING working smarter together

Production phase

Thales RCMS (Remote Control and Monitoring System)

- The RCMS workstations are PCs running Linux with Thales prepared software.
- A total of 4 RCMS stations are part of the ADS-B system; 2 for operational duty and a further 2 are used for testing and monitoring by engineering staff.
- Each RCMS is able to interface with the existing ANSP monitoring A-RCMS system (presently units supplied by Lee-Dickens in the UK)..





Production phase

Important Design Aspects High-lighted:

Availability

ATS requires the system availability to be at least 99.95%. This is achieved via overlapping coverage and/or equipment redundancy within an ADS-B site. The project aimed to design the ADS-B system so that the availability:

- At each individual site is 99.95% or above.
- From an overall Surveillance system perspective (i.e., including power and network elements) it is 99.95% or above.

Tower Bypass Requirements (Resilience)

On failure of the ATM system, the tower controller is able to switch directly (thus bypassing the ATM) to a local ADS-B receiver (also referred to as a ground station). These receivers are on the roof of the tower itself.

At major NZ airport Towers

- Tower Emergency Bypass is required from multiple forms of available co-operative surveillance systems; i.e., SSR, MLAT or ADS-B..

Regional Towers

- Tower Bypass is required from at least one form of co-operative surveillance system, e.g., ADS-B.
- In the case of Bypass at regional airports, preference is to have tower bypass directly from the tower Ground Station where possible.

Production phase

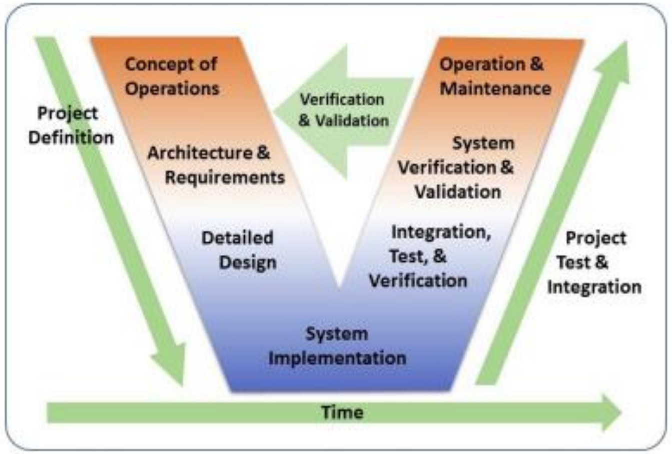
Verification and Validation Process

The purpose of Verification process confirms the system element's conformance to requirements.

The purpose of the Validation process is to provide evidence that the system fulfils its objectives and requirements in an operational environment.

- The verification process for the ADS-B system was largely contained in the Factory Acceptance Test (FAT) and a more specific Thales Site Acceptance Test (SAT) which ensured that the installed equipment performed to the relevant standards and regulations.

- This was then followed by a validation process in the form of a System Acceptance Test and Commissioning process (also sometimes known as a SAT, welcome to the world of confusing acronyms!) which looked closely at the performance of the overall ADS-B system and how it met the Surveillance and ATM standards and regulations, and especially its behaviour and fit within the ATM system.



AIRWAYS TRAINING working smarter together

Production phase

Verification and Validation Process

Design Standards and Regulations Used:

- MPLS Standard Specifications
- ICAO Annex 10, “Volume 4, Surveillance and Collision Avoidance Systems”.
- ED-129: “Technical Specification for a 1090 MHz Extended Squitter ADS-B Ground Station”.
- ED-126: “Safety, performance and interoperability requirements document for ADS-B NRA application”.
- ED-138: (Part 1: Network Specification) “Network Requirements and Performances for Voice over Internet Protocol (VoIP) Air Traffic Management (ATM) Systems
- ED-138: (Part 2: Network Design Guideline) “Network Requirements and Performances for Voice over Internet Protocol (VoIP) Air Traffic Management (ATM) Systems
- ED-161: “Safety, performance and interoperability requirements document for ADS-B RAD application”.
- ED-163: “Safety, performance and interoperability requirements document for ADS-B Airport Surface Surveillance application”.
- ED-102A, RTCA DO-260B: “Minimum operational performance standards for 1090MHz extended squitter ADS-B and TIS-B”.
- Refer to relevant CAA Regulations, e.g.
    - Part 171: Aeronautical Telecommunications
    - Part 139: Aerodromes
    - Part 174: Aviation Meteorology
    - Part 172: Air Traffic Services Organization

Production phase

Typical regional control tower

AIRWAYS TRAINING
working smarter together

Production phase

Production phase

Transition Process

The purpose of this process moves the system into the operational status, such that the system is functional, operable, and compatible with other operational systems.

It installs a verified system, together with relevant enabling systems, e.g., planning system, support system, operator training system, user training system, as defined in contractual agreements.

As a result of the successful implementation of the transition process:

- A transition strategy is developed
- Transition constraints that influence system requirements, architecture, or design are identified
- Any enabling systems or services needed for transition are available
- The site is prepared
- The system installed in its operational location can deliver its specified functions
- Operators, users and other stakeholders necessary to the system utilisation and support are trained
- The installed system is activated and ready for operation

Production phase

Transition Process

For the ADS-B system the transition strategy was developed in conjunction with Thales and the ANSP’s Requirements during the design phase of the project.

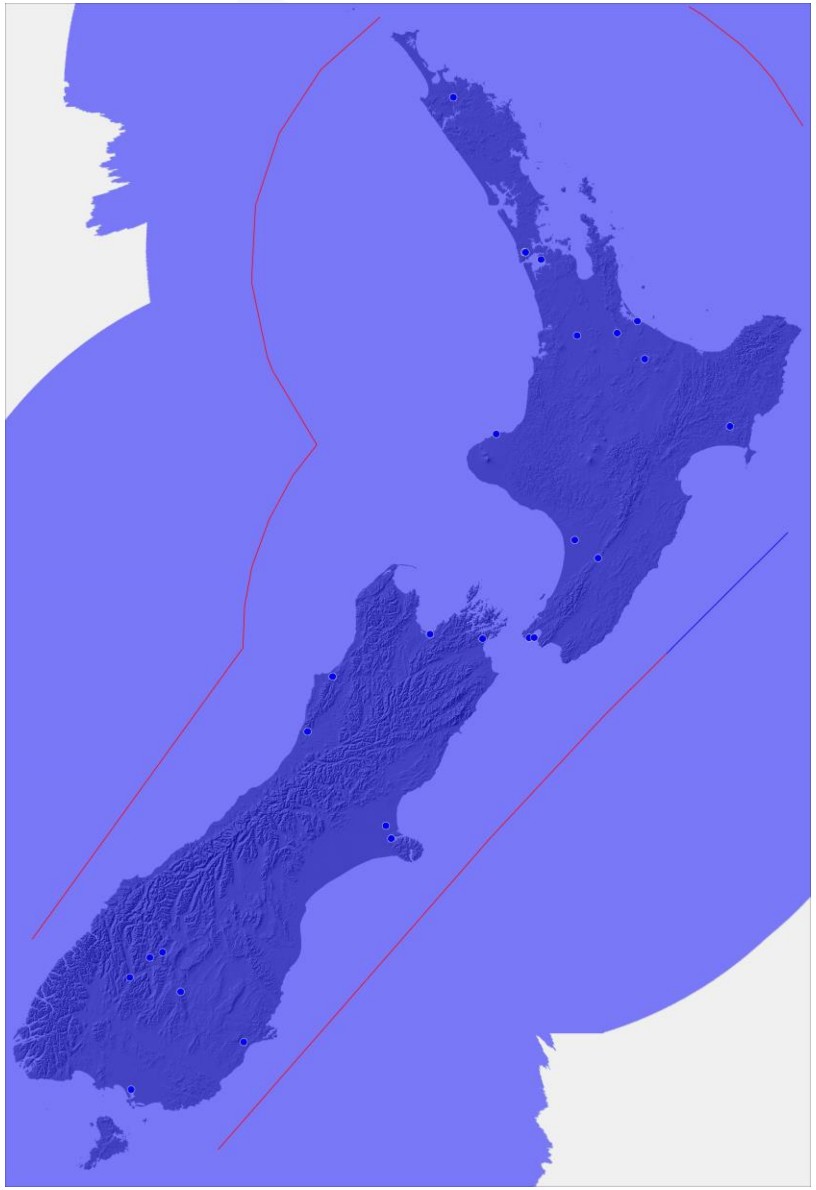
The transition was split into 2 stages:

- **Stage 1** covered the “higher” located dual ground stations and the coverage over the Main Trunk Routes. (This allowed the system to be commissioned for the New Zealand CAA Mandate for compulsory transponder fitment for flying above FL245 in controlled airspace).

- **Stage 2** work, specifically equipment purchasing and installation work, followed on immediately from Stage 1 and concentrated mainly on the single ground stations located on “lower” sites such as the Airport Towers. (The aim here, amongst other reasons, was to meet Tower Bypass Requirements as discussed earlier).

Production phase

ADS-B coverage at
30,000ft ASL



Production phase

Christchurch Airport Control Tower

Transition Process

A key element of the ADS-B transition strategy was the nation-wide training of:

- The Air Traffic Control staff in the extended coverage provided by the new surveillance data.
- The Technical staff in the functionality, maintenance and fault diagnosis/repair of the new equipment.
- The trainers, who will pass this knowledge on to all of the above on a regular basis (introductory and refresher courses).

Production phase

Quality Assurance Process

Quality Assurance focuses on providing confidence that the desired quality is met, and that organization and project policies and procedures are followed.

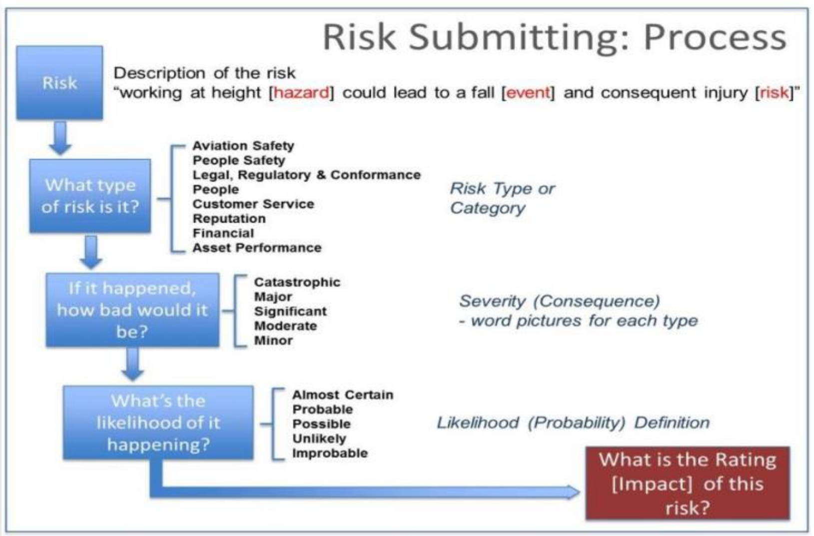
For the ADS-B system project, several audits were scheduled to maintain quality assurance.

- Audit of the Thales Germany supplied ISO credentials and the Thales documentation.
- Audit of the ADS-B project as part of the organisation ISO 9001 Audit
- Usually, some recommendations were made to reduce risks to the project. The reports were viewed by Airways key Executives and the Board.
- Agreed actions from the recommendations in the audits were tracked and closed out following the audit.

Production phase

Risk Assessment Process

This is a continuous process for any work done on or with the system during its lifetime. An example at Airways would be the risk assessment incorporated in the Engineering Orders for ADS-B improvements.



Likelihood →

Consequence		1 Improbable	2 Unlikely	3 Possible	4 Probable	5 Almost Certain
5	Catastrophic	5	10	15	20	25
4	Major	4	8	12	16	20
3	Significant	3	6	9	12	15
2	Moderate	2	4	6	8	10
1	Minor	1	2	3	4	5

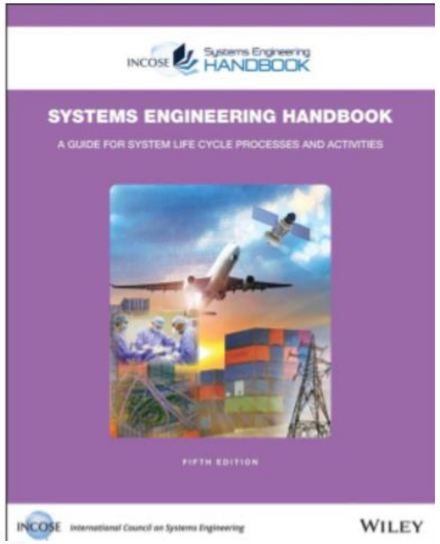
Likelihood	Probability	Description
Almost Certain	90 - 100%	It will almost certainly happen within a year
Probable	50 - 90%	Very likely to happen. Almost certain once every 2 years
Possible	10 - 50%	May not happen in a year. Very likely to happen over 5 years
Unlikely	3 - 10%	Quite rare over a year. Very likely to happen every 10 or so time years
Improbable	<3%	Very rare in a year. Likely to happen once every 25 or so years

Score	Risk Rating
>16.01	Extreme
12.01 - 16	High
9.01 - 12	Medium
<9	Low

AIRWAYS TRAINING
working smarter together

Production Phase

Your Key takeaways?



- A number of ISO 15288 Processes are used as per INCOSE handbook
- Design Definition Process
  - Detailed Design required to implement the solution
- Systems Requirements Definition Process
  - Working with the supplier was key to Integrate the Sensors into the ANSPs ATM Surveillance Processor
- Integration Process
  - Key aspects include Site works, Network connectivity, Monitoring, Power etc and a test environment
- Configuration Management Process
  - A combination of single and dual receiver sites deployed
- Verification and Validation Processes
  - Factory and Site testing and adherence to international standards is essential
- Transition Process
  - Have a transition strategy (Stages 1 & 2)
- Quality Assurance Process and Risk Assessment Process
  - ISO 9001 Credentials and Internal Audits, Risk Assessments and actions

AIRWAYS TRAINING
working smarter together

Utilisation phase

The Utilisation phase is where the system is operated in its intended environment to deliver its intended services.

Product modifications are often planned for introduction throughout the operation of the system. Such upgrades enhance the capabilities of the system.

- The ADS-B example of this module went into operation in 2018 as part of what was called Mandate 1 for Aircraft flying 24 500’ (FL245) and above.
- The Mandate 2 was planned to be operational from Jan 2022 and cover all controlled airspace. However, due to the slower avionic upgrade due to COVID impacts, the Civil Aviation Authority (CAA) allowed one more year before this mandate was put in place.
- That decision put extra pressure on our PSR & SSR backup surveillance project and escalated support as an extra year of service was required from the end-of-life surveillance systems.
- The original supplier was Thales Germany, however Technical and Commercial Ownership of the system was transferred to Thales Italy with notification in 2021. New relationships had to be established to affect a smooth transfer and ongoing support of the system.

Utilisation Phase

Your Key takeaways?

- Alignment required with the Regulators Mandate
- Stakeholder readiness can impact your plans
  - The need to extend the End of Life of PSR/SSRs
- Supplier Support change from Germany to Italy

Support phase

The Support Phase begins with the provision of maintenance, logistics and other support for the system. Planning for this stage begins in the preceding phases. The Support Phase is completed with the retirement of the system.

Operation Process

The purpose of the operation process is to use the system to deliver its services.

Problems encountered since commissioning

- There are different software/firmware programs that run on the system modules. Two software changes have taken place since commissioning;
- the first was due to an error found that provided incorrect information in the Asterix data stream to the ATM, this was a Thales global issue, and resulted in a new **software**. The second error was specific to the ATM system and how it handled track identification numbers.
- A **hardware** change has also taken place, with the AC power supply module superseded by an improved version.
- An outstanding issue concerns the warning messages created by the GPS Almanac download; for this there is a new PTM3 board.
- Thales supplied CPMS which is a COTS Hewlett Packard Proliant servers running the Thalix Server operating system. Will Thales recommend an update or complete replacement of the CPMS in a 10 year time-frame? (**update**: complete replacement by Thales Italy)

AIRWAYS TRAINING working smarter together

Support phase

Maintenance Process

Prior to going live with the new system technical staff need to be trained on the new system to enable routine and preventative maintenance, fault repair, system monitoring and remote control.

Competency certificates need to be issued to staff who have the responsibility to return the equipment to operations after maintenance or fault repairs.

If a third party is required for hardware support or software support, maintenance agreements/ contracts need to be in place with agreed levels of support and costs.

In this case there is a Maintenance Contract with Thales:

- For module repair or replacement
- For system failure or impaired performance

Support phase

Maintenance Process

Maintenance and repair are typically required due to adverse conditions

AIRWAYS TRAINING working smarter together

Support phase

Maintenance Process – high sites are difficult and risky to maintain

Support phase

Maintenance Process – Sometimes even 5 days backup power is not sufficient, and reception is non-existent. Note the flag ice …..

Support phase

Maintenance Process – Sometimes even 5 days backup power is not sufficient, and reception is non-existent. Note the flag ice …..

AIRWAYS TRAINING working smarter together

Support phase

Maintenance Process

Maintenance Manual with a preventative maintenance schedule:

Maintenance & Support Manual
ADS-B Thales

Section 5: Page 2 of 5
Preventive Maintenance Schedule

5.4 Preventive Maintenance Requirements Table

PM Number	Applicability	PM Routine	Nominal Periodicity	Tasks	Release required?	Restoration time (mins)	Estimated Man-hours	Skill level	Competency Level
ADS-B1	GS Antenna & Couplings in RUA, and AA	Spray all accessible exposed metal coupling, i.e. fastenings, securing points and RF feed thru's with lanolin spray.	1Y	N	N	n/a	1 hr	4	1
ADS-B2	All AX680 Ground Stations	Ground Station Annual Checks	1Y	Y	Y	30 mins	1 hr	4	1
ADS-B3	CMS and RCMS Servers	Server Annual Checks	1Y	Y	Y	30 mins	1 hr	4	1
ADS-B4	GS on Kordia Sites only	Replace UPS Batteries (See section 7.5.1)	4Y	N	Y	100 mins	1	4	1
ADS-B5	CMS and RCMS Servers	Replace Lithium Batteries in servers. (See supplier manuals for details.)	5Y	N	Y	30 mins	2	4	1
ADS-B6	All GS cables	Use the field Fox to measure the VSWR, Return Loss and DTF of the ADS-B RX, TT and GPS cables from the AX680 connectors to the Antennas and compare with the Installation report values for your site.	2Y Same time as ADS-B2	N	Y	30 mins	1 hr	4	1

: : Uncontrolled copy when printed : :

Issue 1, Revision 3

Last edited: 11-01-2021
Effective from: 11-Jan-2021

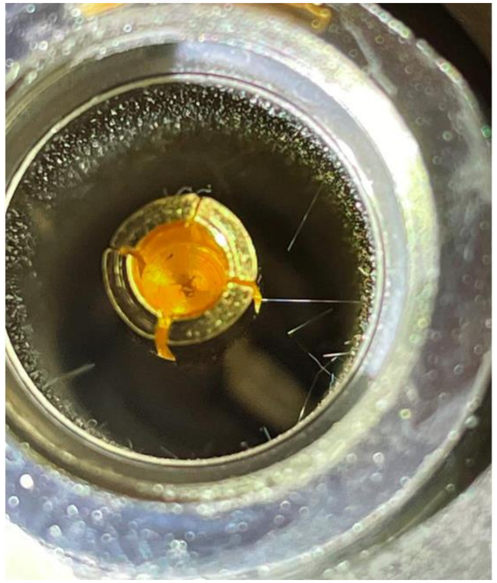
NOTE: All changes to this manual shall be actioned through the RFC process.

Support phase

Maintenance Process

Long term issues added to the Preventative Maintenance Schedule:

- RF path loss due to OVP “whiskers” (ERA). *Regular cleaning with contact cleaner cotton buds.*
- Water entry due to UV degradation of the antenna radome. *Recoating with UV resistant 2-pack paint.*



Support Phase

Your Key takeaways?

- Operation Process
  - A Software Configuration Process is required
  - Supplier Provided Software and Hardware Upgrades must be actioned
- Maintenance Process
  - Have a Support Contract in place as part of the Agreement Strategy
  - Support Contract to have SLA definitions and targets
  - Internal Maintenance Documentation required
  - High sites provide challenges

Retirement phase

The retirement phase involves the decommissioning and disposal of the system and related operational and support services.

Disposal Process

Every component in a system has a finite life span. It will start to exhibit increasing failures as the system ages, and thus the idea is to:

- regularly review system performance and issues;
- replace individual components or the system as a whole before reliability/availability is affected;
- make a timely decision on the decommissioning and disposal of the system.

Information and test data on component/system life-cycle can usually be had from the equipment supplier, who will also have a future roadmap for improvements.

According to the supplier Thales, the expected mean time of the system technical life is longer than 10 years. The typical asset life of the complete system is therefore assumed to be around 15 to 20 years maximum

Retirement Phase

Your Key takeaways?

- Need to plan for the Systems eventual end-of-life
- Have periodic reviews which increase towards the systems end-of-life
- Stay in touch with the supplier's future roadmap
- Be aware of new solutions that can provide the service (Satellite based ADS-B)

FINISHED

Questions?

Knowledge check

Question 8

Prior to RFP, the ANSP's technical staff attached great importance to

SELECT ONE

a having detailed discussions/meetings with potential suppliers

b doing an initial performance test of supplier's equipment

c holding ADS-B training sessions with all stakeholders

d None of the above

Knowledge check

Question 1

What is one advantage of ADS-B surveillance over conventional MSSR/PSR radar surveillance

SELECT ONE

a Hardware is more robust

b Software is easier to upgrade

c Coverage can be achieved in rugged terrain

d The display is easier to read

Knowledge check

Question 3

What is the main operational reason that ADS-B surveillance will be introduced in two phases

SELECT ONE

a Not all sensors are working

b Not all airplanes have ADS-B transponders yet

c Software requirements need adaptation

d Allow ATC staff to be properly trained

Knowledge check

Question 4

Which portion of the verification process took place at the suppliers premises?

SELECT ONE

a FAT

b SAT

c FAT and SAT

d None of the Above

Knowledge check

Question 5

A key element of the ADS-B transition strategy was the nation-wide training. Which of the following were least involved?

SELECT ONE

a Engineers

b Air Traffic Controllers

c Trainers

d Managers

Knowledge check

Question 6

Which phase in the system life-cycle is the SAT process

SELECT ONE

a Development Phase

b Support Phase

c Production Phase

d Concept Phase

Knowledge check

Question 7

Who authors the design for the ADS-B system?

SELECT ONE

a The supplier of the system

b Engineers and maintaineers

c System uses (i.e. ATS)

d all of the above, in a collaborative design process

Knowledge check

Question 10

Which standard best describes the technical specifications that apply to an ADS-B ground station?

SELECT ONE

a ICAO Annex 10

b ED-163

c ED-129

d ED-102 and ED-126

AIRWAYS TRAINING
working smarter together