

CRISTAL Toulouse

**Fourth Meeting of ADS-B Study and Implementation
Task Force**

26-28 October 2005 – Nadi, Fiji

CASCADE Validation Approach

EUROCONTROL Project focusing on ADS and Data Link

Include validation activities

- Trials and Simulations for the applications and infrastructure
- With involvement of controllers and pilots where possible
- Using state-of-the-art infrastructure components and validation tools

CRISTAL projects

- Partnerships with the local stakeholders to perform validation on site

CASCADE Validation Main Priorities in 2005

ADS-B NRA

- Ops usability in continental airspace (Sweden)
- Technical feasibility in non-continental airspace (Ireland)

ADS-B RAD

- Ops applicability and technical feasibility (London TMA)

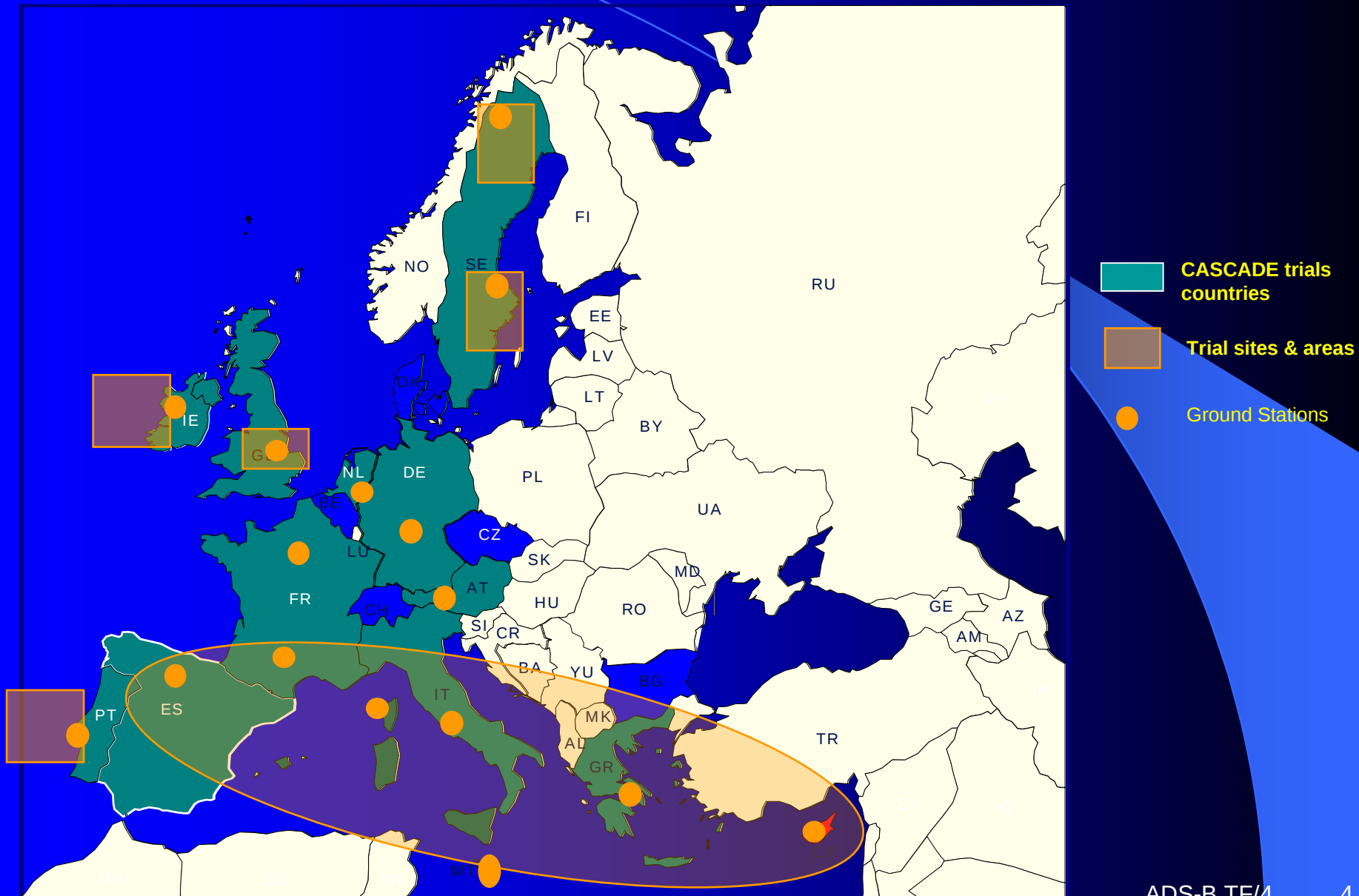
Sequencing & Merging

- Ops usability and Benefits (Paris, Frankfurt)

Surveillance Infrastructure

- Fleet monitoring report (various sites, including Toulouse)
- Assessment of 1090 ES datalink capacity (update)
- Preliminary assessment of ADS-B / Radar data fusion

Cascade Validation sites and ground stations deployment



Towards ADS-B certification (Cristal Toulouse)

- ADS-B data collection and analysis from AIRBUS test and ferry flights as well as from opportunity traffic around Toulouse airport
- Comparison of airborne and ground ADS-B data as well as radar data
- Using representative transponder installations (Rockwell, Honeywell and ACSS) and a 1090 ES GS (Thales ATM)
- Performed by CRISTAL Toulouse Consortium (AIRBUS, DSNA, Thales ATM, Alticode)

Project objectives

Validate the use of ADS-B for ground surveillance:

- Check the ES content and format of the different transponders installed on Airbus aircraft,
- Validate the completeness and usability of data received in/by the ADS-B ground station (input/output data),
- Ensure that interpretation of standards made by the manufacturers results (avionics, ground station suppliers) on interoperable system,
- Initiate a study on separation aspect for the ground surveillance

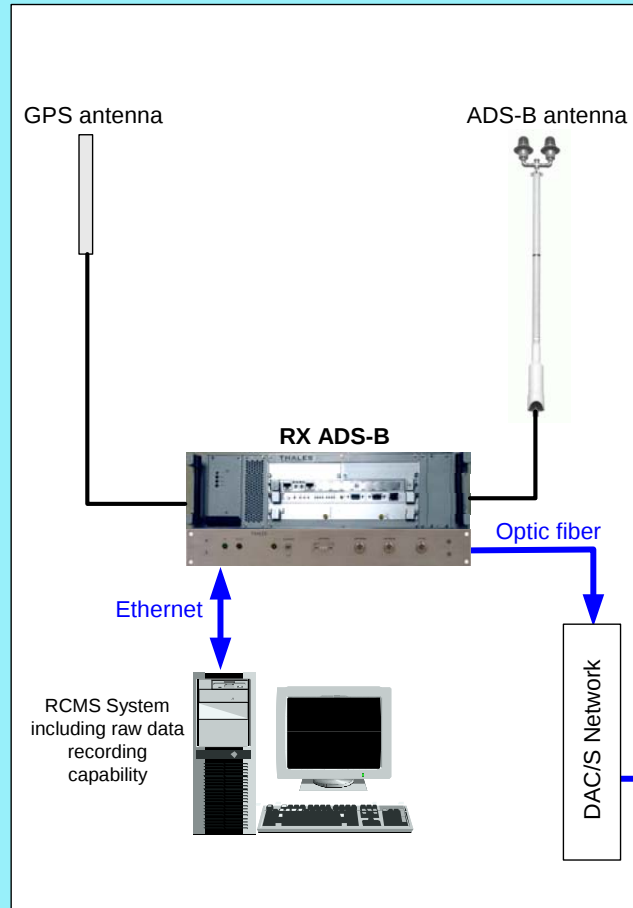
Project activities and organization

To reach the objectives, the following activities are carried out:

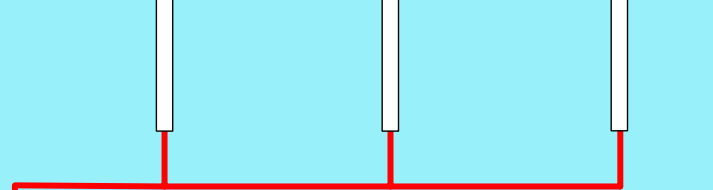
- Install an ADS-B 1090ES ground station in TLS Blagnac and equip two airport ground vehicles
- Collect data during a six months period
- Analyze collected data
- Conduct a study on separation minima
- Produce a certification roadmap identifying the main of the activities required for certification process
- Produce a document summarizing the status of various transponders used during the data collection

Ground Test Infrastructure

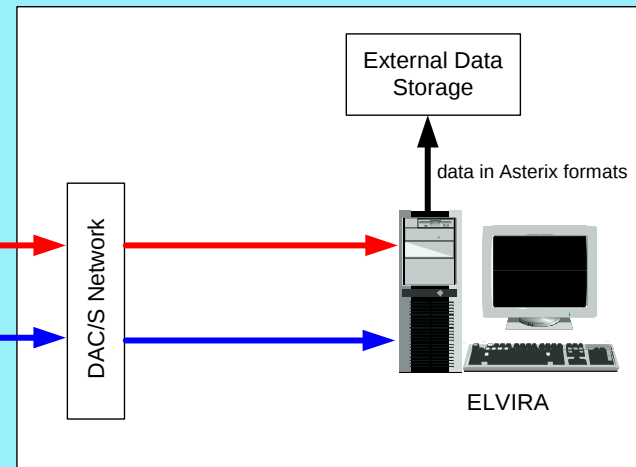
Shelter ADS-B at Blagnac Airport



Tlse Mode S radar Auch SSR Montpellier SSR

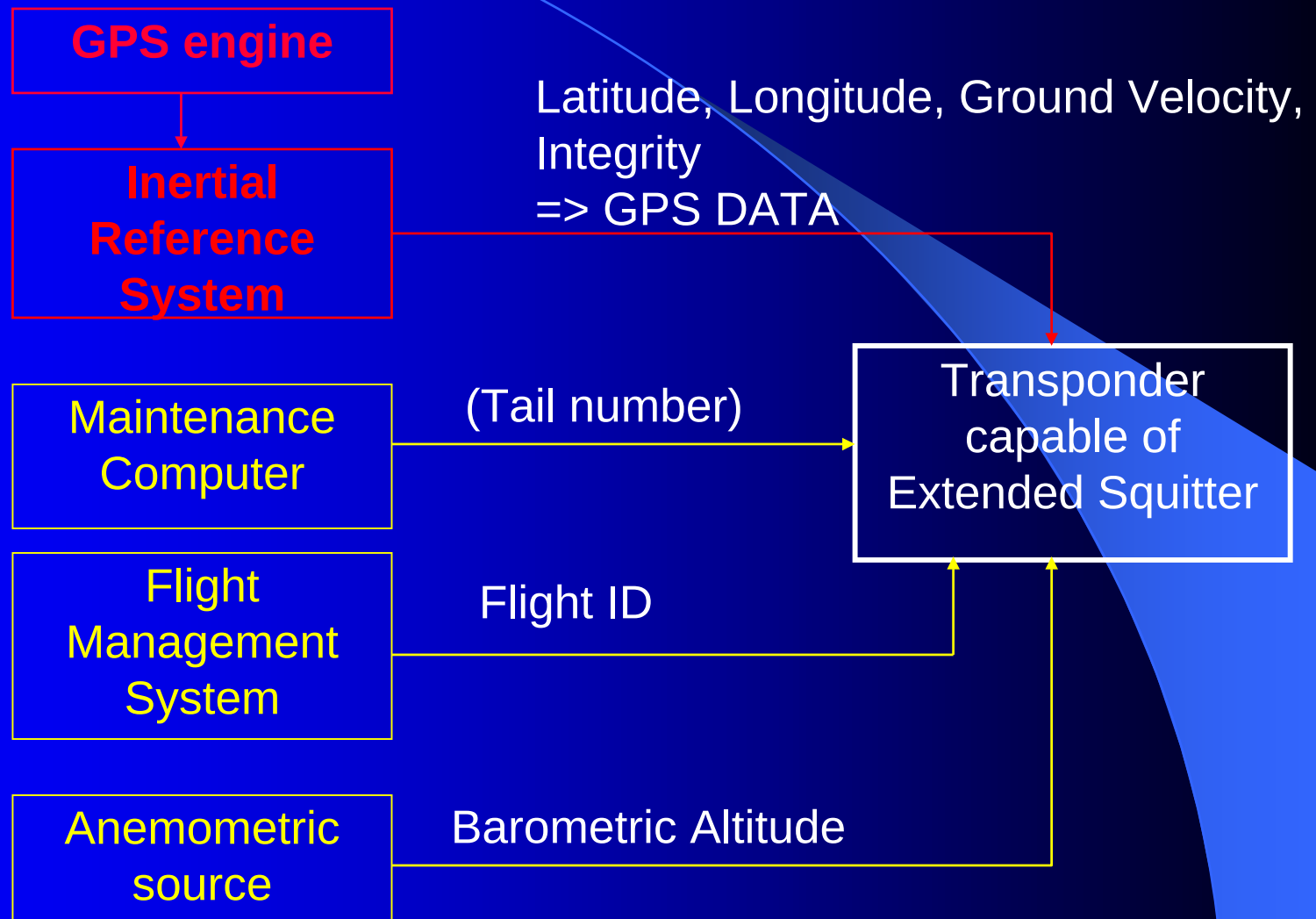


DTI/SO/3ES Laboratory



— MAC/LLC protocol
— UDP protocol

Airborne Architecture (Example)



Ground Data collection

Date	ADS-B	Mode S radar	SSR Radar	Note
1/07 to 4/07/05	✓		Auch + Montpellier	No Mode S training) Aircraft Data
5/07 to 18/07/05	✓		Auch	No Mode S (training) Aircraft Data
19/07 to 23/07	✓	Toulouse	Auch	Aircraft Data
24/07 to 26/07	✓	Toulouse	Auch	Aircraft Data
27/07 to 11/08	✓	Toulouse	Auch + Montpellier	Aircraft Data
12/07 to 25/07		Toulouse	Auch + Montpellier	No ADS-B due to network pb Aircraft Data
26/07 to 2/09	✓	Toulouse	Auch + Montpellier	Aircraft Data

Airborne Data collection (1 Jul 05)

a/c type	MSN	mode S address	date	XPDR / EHS	take off	landing
A320	1	38005A	01/07/2005	ACSS / YES	1414	1506
A340-600	360	38007A	01/07/2005	Collins / YES	735	931
A380	1	383E7A	01/07/2005	Hwl AESS / YES	637	1055

Flight Test Aircraft

Example Airborne data collection (1 Jul 05 - A340-600)

Microsoft Excel - K0360V0591STE_BDS05.xls

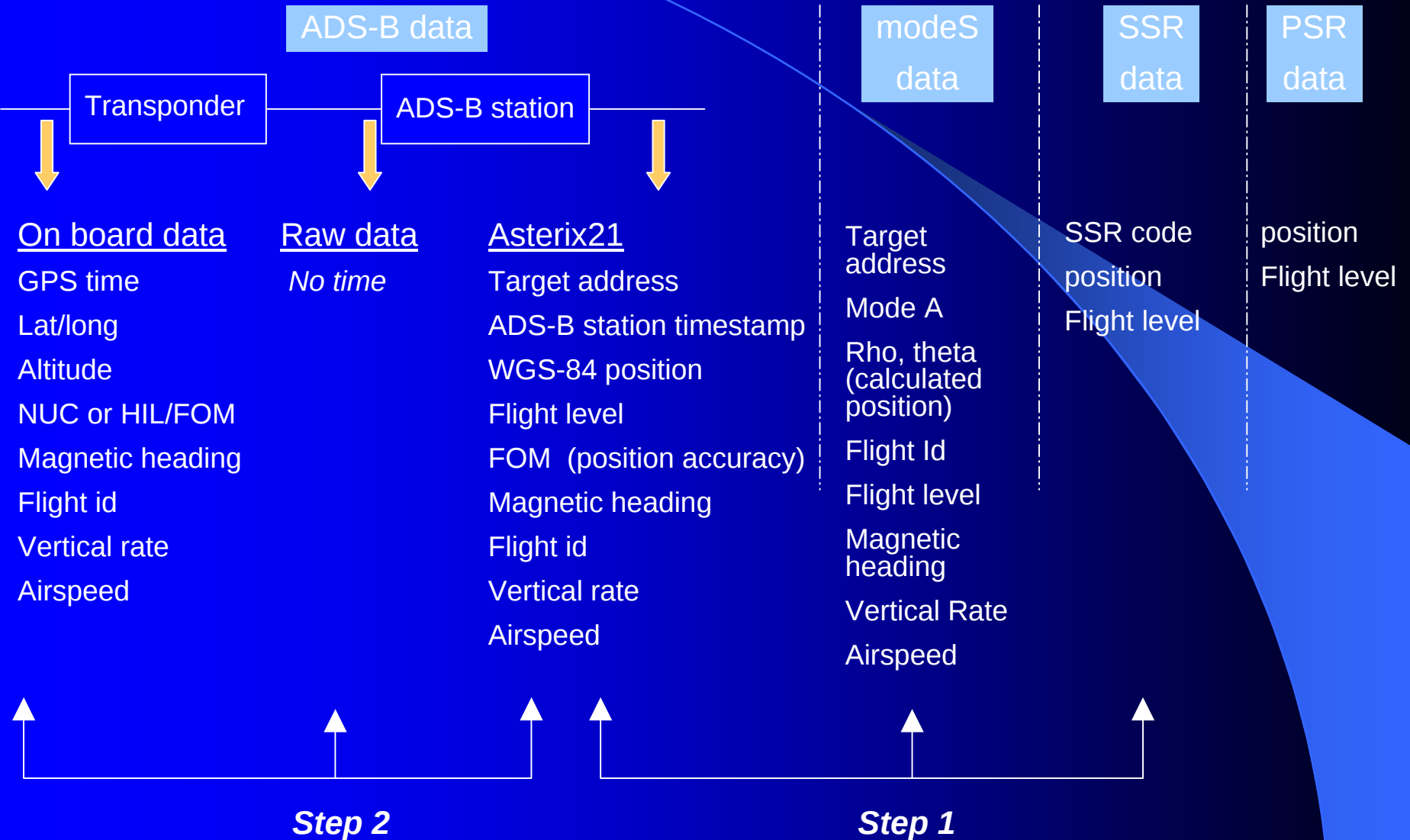
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	A	B	C	D	E	F	G	H	I	J	K	
1		label 110	label 110	label 111	label 111	label 112	label 112	label 130	label 130	label 247	label 247	
2		latitude coarse	latitude coarse	longitude coarse	longitude coarse	Ground speed	Ground speed	HIL	HIL	HFOM	HFOM	
3		GPS 1	GPS 2	GPS 1	GPS 2	GPS 1	GPS 2	GPS 1	GPS 2	GPS 1	GPS 2	
4												
5												
6	182-13:50:36-	43.614521	43.614521	1.363335	1.363335	0.375	0.25	0.12085	0.12085	0.009949	0.009949	
7	182-13:50:37-	43.614521	43.614521	1.363335	1.363335	0.625	0.25	0.12085	0.12085	0.009949	0.009949	
8	182-13:50:38-	43.614521	43.614521	1.363335	1.363335	0.625	0.25	0.12085	0.12085	0.009949	0.009949	
9	182-13:50:39-	43.614521	43.614521	1.363335	1.363335	0.75	0.5	0.12085	0.12085	0.009949	0.009949	
10	182-13:50:40-	43.614521	43.614521	1.363335	1.363335	0.875	0.75	0.120728	0.12085	0.009949	0.009949	
11	182-13:50:41-	43.614521	43.614521	1.363335	1.363335	1.625	0.625	0.120728	0.12085	0.009949	0.009949	
12	182-13:50:42-	43.614521	43.614521	1.363335	1.363335	1.75	1.125	0.120728	0.12085	0.009949	0.009949	
13	182-13:50:43-	43.614521	43.614521	1.363335	1.363335	1.75	1.75	0.120728	0.120728	0.009949	0.009949	
14	182-13:50:44-	43.614521	43.614521	1.363335	1.363335	2	1.75	0.120728	0.120728	0.009949	0.009949	
15	182-13:50:45-	43.614521	43.614521	1.363335	1.363335	2.5	1.75	0.120728	0.120728	0.009949	0.009949	
16	182-13:50:46-	43.614521	43.614521	1.363335	1.363335	3	2.125	0.120605	0.120728	0.009949	0.009949	
17	182-13:50:47-	43.614521	43.614521	1.363506	1.363335	3	2.75	0.120605	0.120605	0.009949	0.009949	
18	182-13:50:48-	43.614521	43.614521	1.363506	1.363506	3	3	0.120605	0.120605	0.009949	0.009949	
19	182-13:50:49-	43.614521	43.614521	1.363506	1.363506	3.125	3	0.120605	0.120605	0.009949	0.009949	
20	182-13:50:50-	43.614521	43.614521	1.363506	1.363506	3	3.125	0.120605	0.120605	0.009949	0.009949	
21	182-13:50:51-	43.614521	43.614521	1.363506	1.363506	2.875	3.125	0.120605	0.120605	0.009949	0.009949	
22	182-13:50:52-	43.614521	43.614521	1.363506	1.363506	2.875	2.875	0.120483	0.120483	0.009949	0.009949	
23	182-13:50:53-	43.614521	43.614521	1.363506	1.363506	2.875	2.875	0.120483	0.110229	0.009949	0.013184	
24	182-13:50:54-	43.614521	43.614521	1.363506	1.363506	2.875	2.875	0.120483	0.110229	0.009949	0.013184	
25	182-13:50:55-	43.614521	43.614521	1.363506	1.363506	2.875	2.875	0.120483	0.110229	0.009949	0.013184	

Recorded Data



Project Status

Installation of ground equipment and test means: done

- ADS-B Ground Station
- Recording and Data Analysis Tools

Data collection: done (however data still recorded)

- ADS-B Ground Station
- Mode S Radar (Toulouse)
- MSSR (Auch + Montpellier)

Data analysis: on-going

- **Mode S/SSR/ADS-B comparison**
- **Dedicated analyses in order to explain origins of anomalies automatically detected (trajectory, refresh rate, call sign,...)**
- **Compliance of the content of extended squitter with available standards**

Study on separation minima: on-going

Certification roadmap: on-going

Questions ?

Contact

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