MARKLOGIC WORLD 19

Airbus: How and aircraft knowledge database can boost aircraft operations and design

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?
StorageTek

4,5

Petabytes

KILO bytes
MEGA bytes
GIGA bytes
TERA bytes
PETA bytes

AIRBUS

A321 family
Autoland on +
Cross wind +
In Toulouse Airport ?

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Test Data Processing Expert,
Flight & Integration Test Center

Airbus

Stéphane Neuzillet

Head of Aircraft Data Processing

Airbus

We Make It Fly

AIRBUS

A commercial aircraft manufacturer with two Divisions: Defence and Space and Helicopters.

We make it fly.

129,000
Total workforce

997 billion
Order book

€59 billion
Annual revenue,restated IFSR 15

AIRBUS

An Airbus takes off or lands every 1.4 seconds.

19,340
Aircraft sold

60
Produced monthly

25,000+
Daily flights

11,763
Delivered

End January 2019

AIRBUS

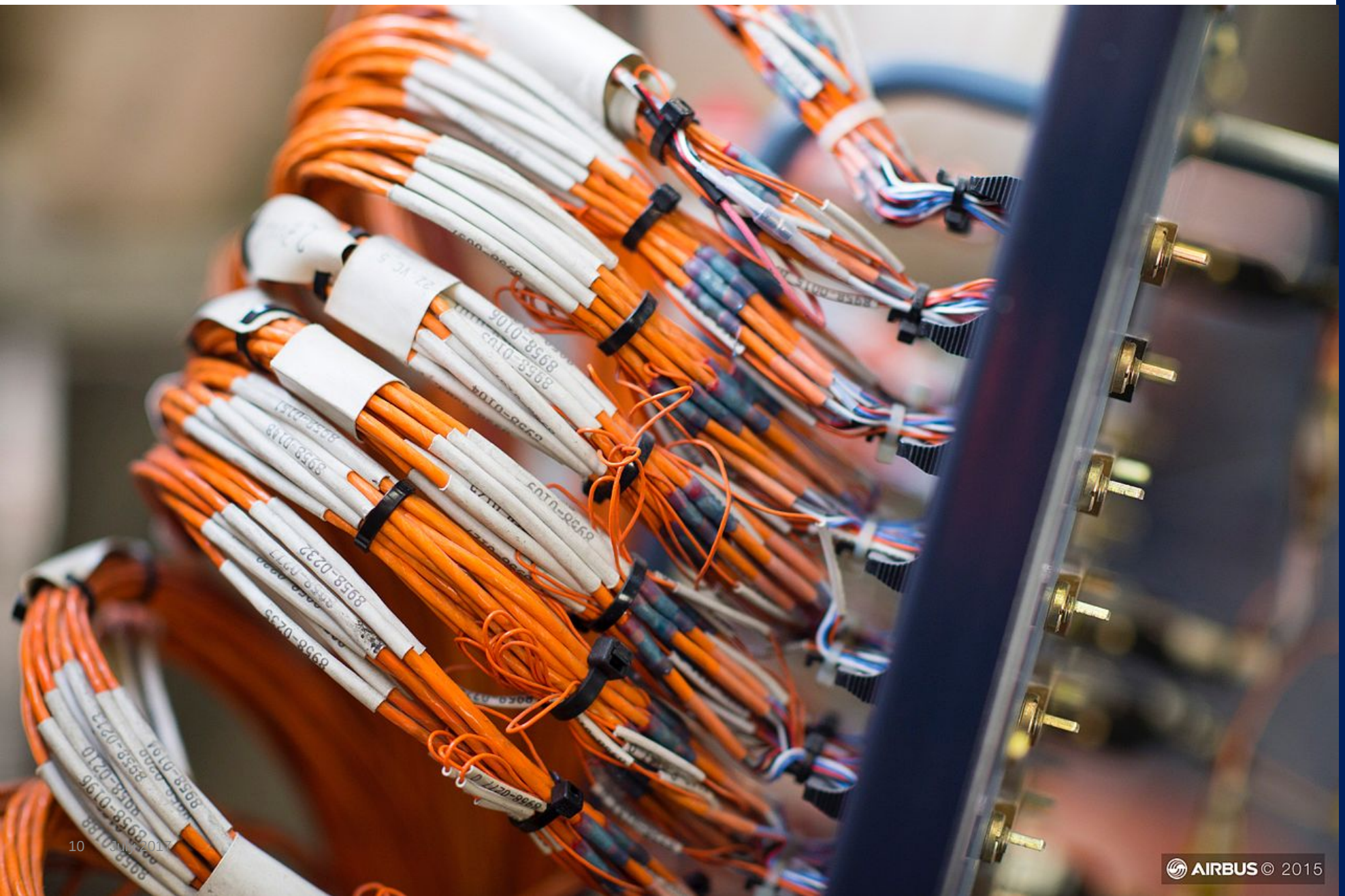
Airbus flight tests excel in Testing, Test for Excellence

Our Mission

- Ensure Safety of our products and Operations.
- Drive Maturity of Airbus products.
- Reduce cycles of new aircraft certification.
- Contribute to overall cost reduction.

AIRBUS

Our instrumentation brings data to find the truth



Up to
5000
measures

430+ kms
of cables for A380

13+ physical
measurements

Pressure, T°, noise,
flow, strain, icing …

AIRBUS

Data volume x50 since 80’

Parameters # x50

670 000 parameters
450 Tb archived

320 000 parameters
150 Tb archived

14 000 parameters
12,8 Tb archived

12 000 parameters
8,5 Tb archived

Data archived x50

AMPEX 28 tracks
8 GB

1987

SONY AIT 2/3
50/100 GB

1992

SCSI hard disk
300 GB

2005

SSD hard disk
700 GB

2013

4+

Petabytes of data

From
22 Feb 1987
to 2019

 # Parameters x50

 # Data archived x50

AIRBUS

Flight by flight analysis

Each request is covered by a flight

No global view

No transversal analysis

No sharing between specialities

AIRBUS

Can I find existing test points covering my need?

A "Google" search within all the test data?

Digital
Engineering
Assistant

Re-use of existing test points

Flight hours optimisation

Shorter lead time for analysis and operations support

AIRBUS

Major objectives

Optimise flight hours

Provide operational data during conception phase

Ease analysis to improve Aircraft maturity

Create predictive models before first delivery

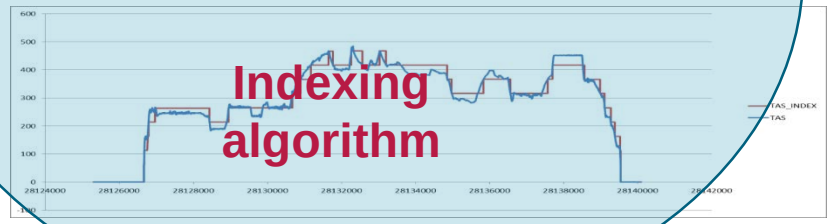
AIRBUS

How does it work ?

TEST A/C

Sensor data

Storage and processing



Graph of Events (temporal patterns)

Test Meta-data + Avionic configuration

Structured data

Rich Metadata boolean index

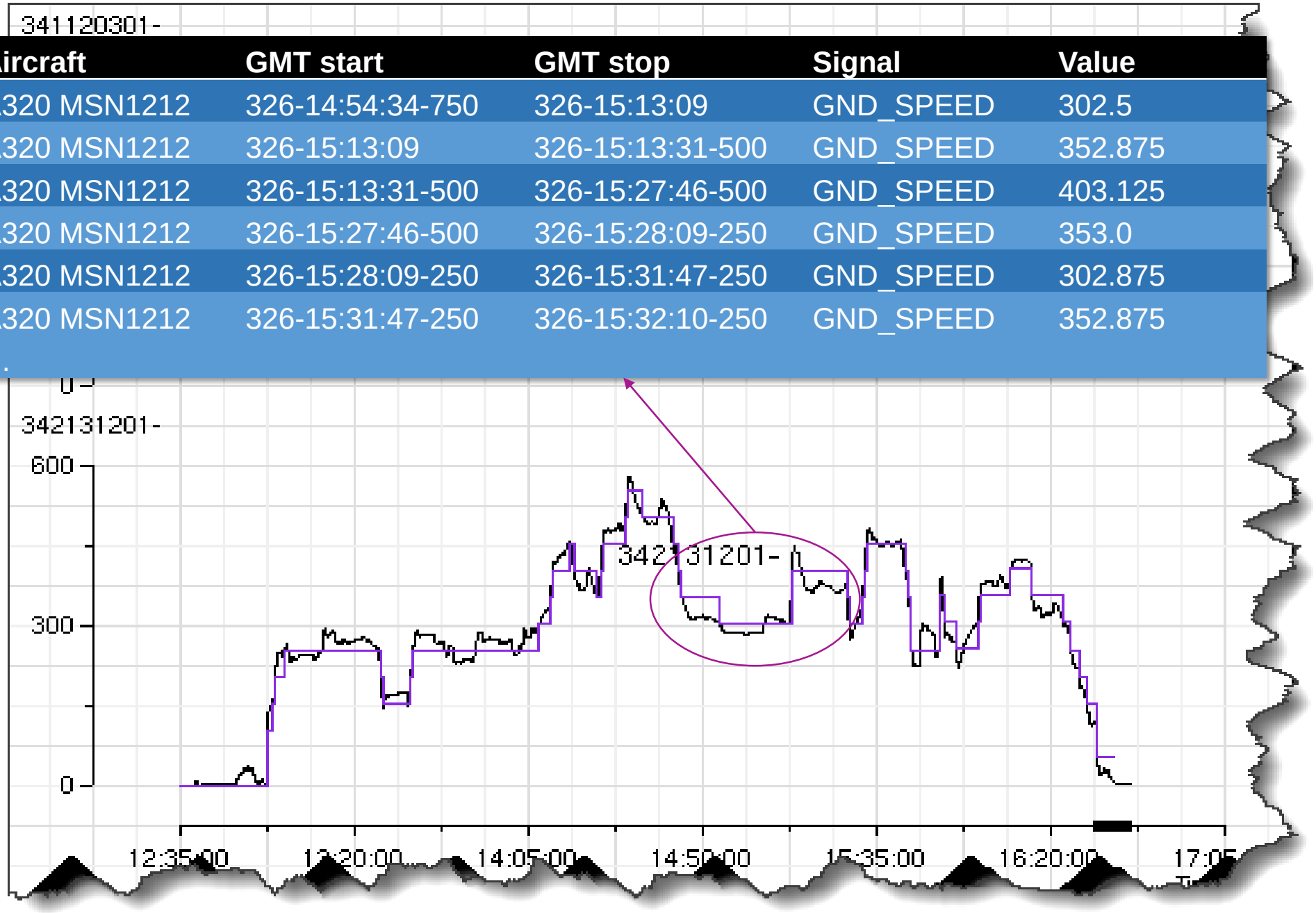
Flight Crew Report

Unstructured text

Text index of Context & Snags

Timeseries indexing

Aircraft	GMT start	GMT stop	Signal	Value
A320 MSN1212	326-14:54:34-750	326-15:13:09	GND_SPEED	302.5
A320 MSN1212	326-15:13:09	326-15:13:31-500	GND_SPEED	352.875
A320 MSN1212	326-15:13:31-500	326-15:27:46-500	GND_SPEED	403.125
A320 MSN1212	326-15:27:46-500	326-15:28:09-250	GND_SPEED	353.0
A320 MSN1212	326-15:28:09-250	326-15:31:47-250	GND_SPEED	302.875
A320 MSN1212	326-15:31:47-250	326-15:32:10-250	GND_SPEED	352.875
…				



600 000+ signals
80% booleans

Massive bigdata processing
to reduce
the sampling rate

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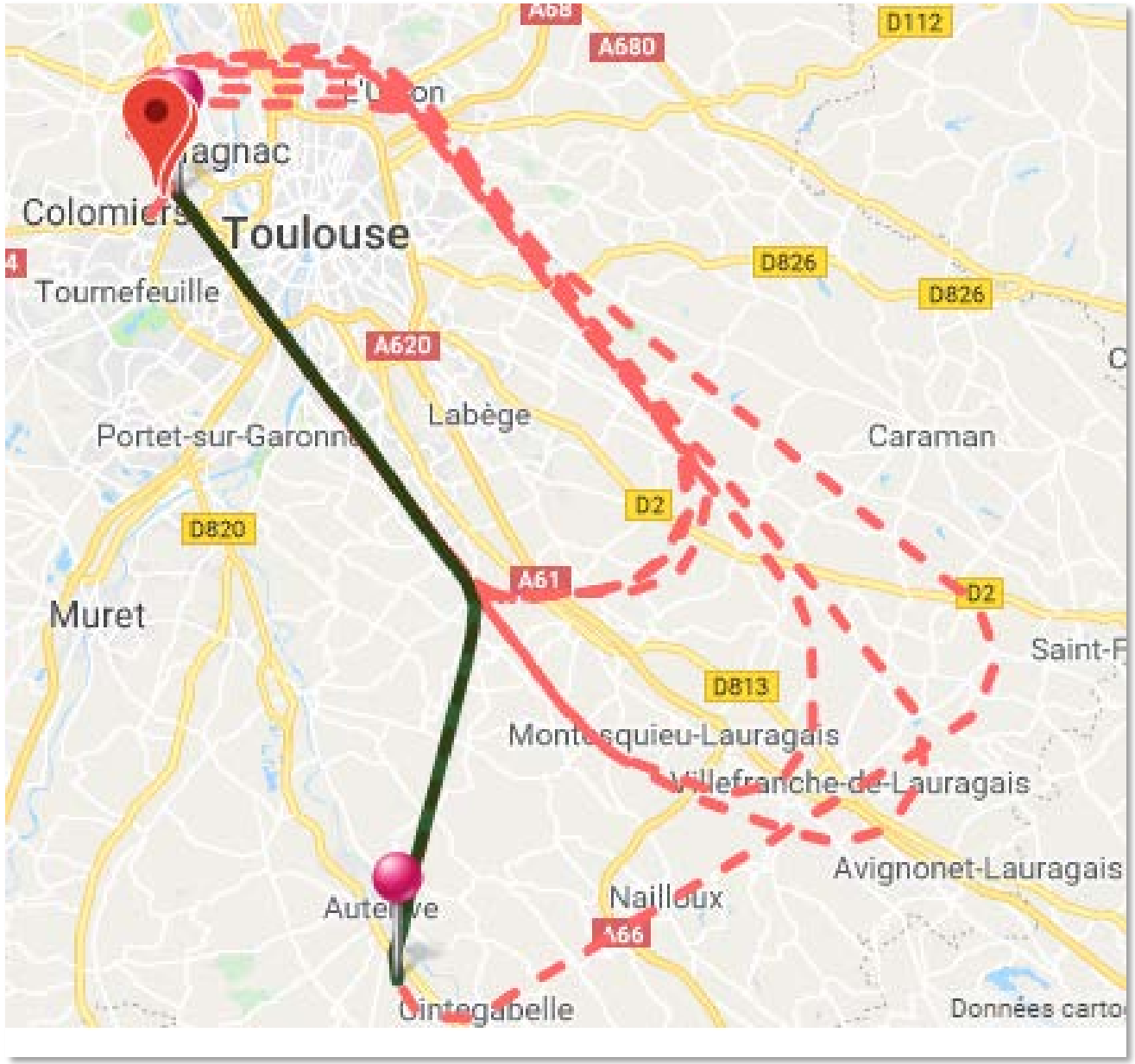
Trajectography indexing



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Ata	Name	Program	Shortname	Title	Unit	Source
Search	ALT	SA	Search	Search	Search	Search
LR:22E,SA:22G	ALTITUDE_HOLD_CONTROL_LAW_ACTIVE	SA/LR	BXALTCL_C1,BALTCL_FGA1	BXALTCL_C1,BALTCL_L276B25_FGA1	boolean	FMGEC
22G	BALT	SA	L274B19 FGA1		boolean	FMGC
22M	CRUISE_FLIGHT_LEVEL_ALTITUDE_feet	SA/LR	CRZ FL FC1,NCRZFL KMCR 1	CRZ FL	ft	LR:FMGEC,SA:FMGC
22M	FLIGHT_PATH_ALTITUDE_feet	SA/LR	FPALT_FC1,FLPALT_KMER_1	FLIGHT_PATH_ALT	ft	FMGEC
22M	MINIMUM_DECISION_ALTITUDE_OR_HEIGHT	SA/LR	MDA_MDH_BARO_FE1,MDAMDH_KMER_E1	KMER_MDAMDH	ft	FMGEC
22C	SELECTED_ALTITUDE_feet	SA/LR	SELALT,A2ALTSEL_10201_3		ft	FCU
341	STANDARD_PRESSURE_ALTITUDE_feet	SA/LR	ADIRU_203_Altitude_1		ft	ADIRU

Assistant to select the right signal

Multiple naming conventions

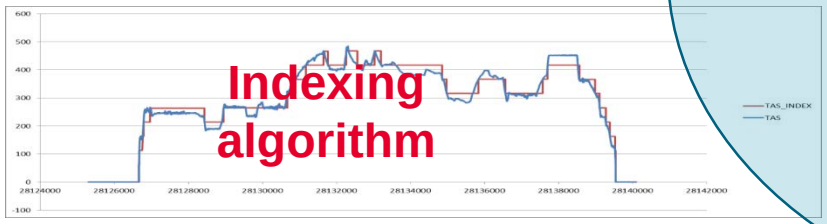
Naming not homogeneous for different program

AIRBUS

TEST A/C

Sensor data

Storage
and
processing



Indexing algorithm

Test Meta-data + Avionic configuration

Structured data

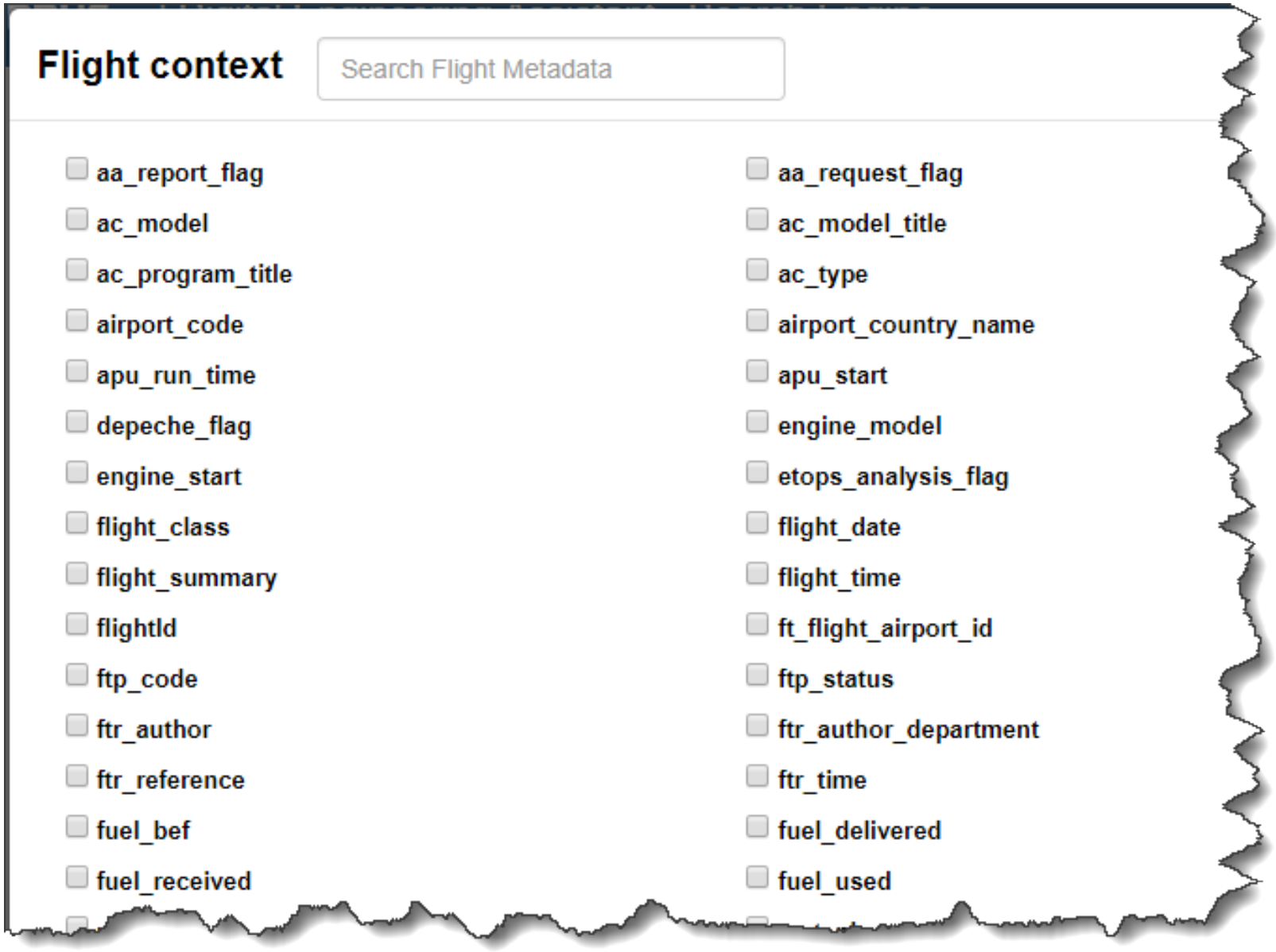
Flight Crew
Report

Unstructured text

Graph of Events
(temporal patterns)

Rich Metadata
boolean index

Text index of
Context & Snags



Metadata: Test context

Structured data

5+ databases

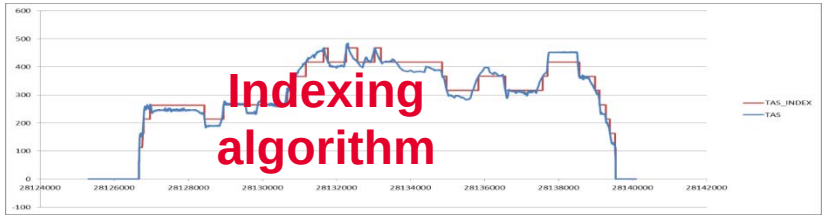
- Aircraft configuration
- Weather
- Airport, runway
- Crew

AIRBUS

TEST A/C

Sensor data

Storage and processing



Indexing algorithm

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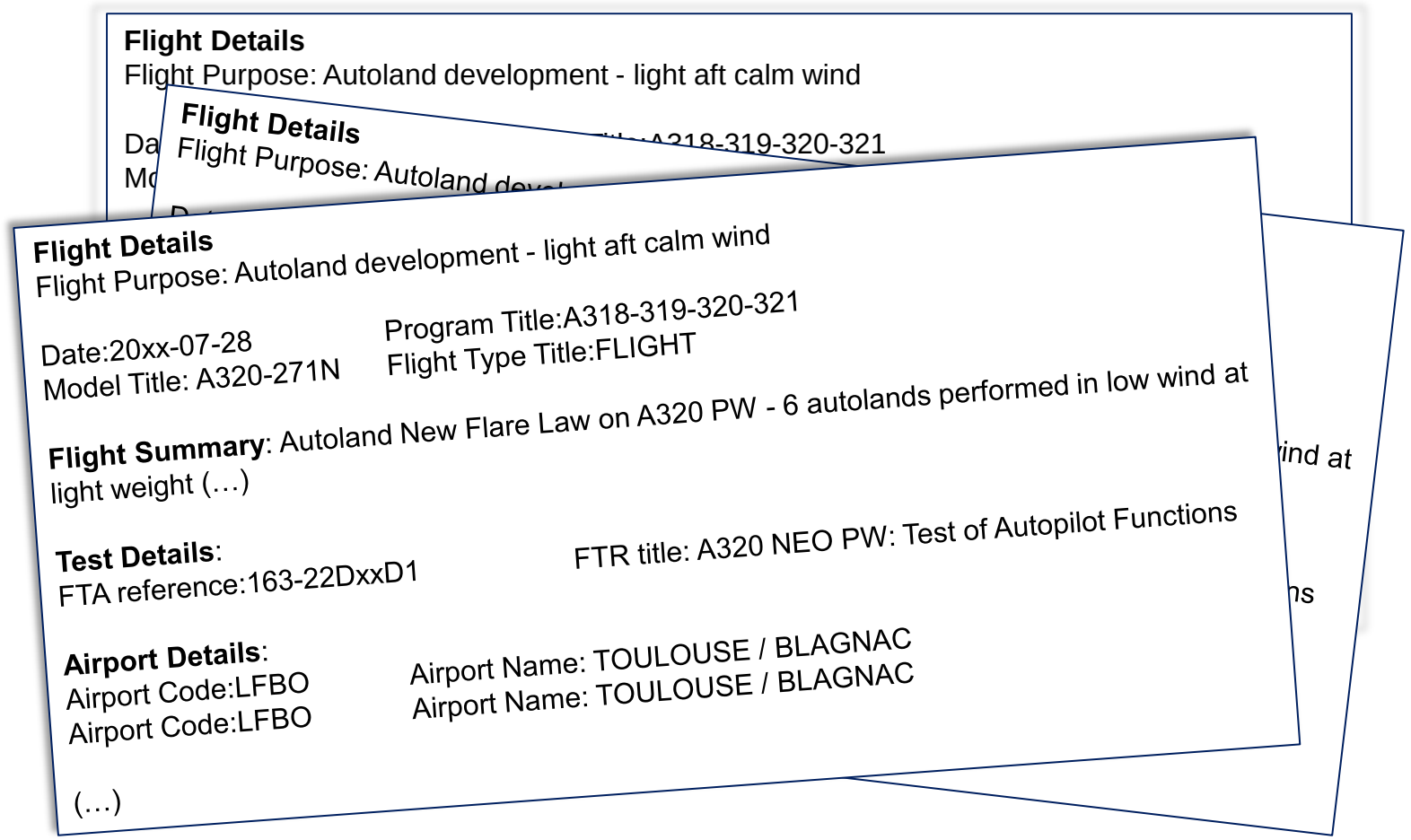

Plain text indexing

Use specific vocabulary

- Requirements
- Tests Reports
- Anomalies records
- Technical logs

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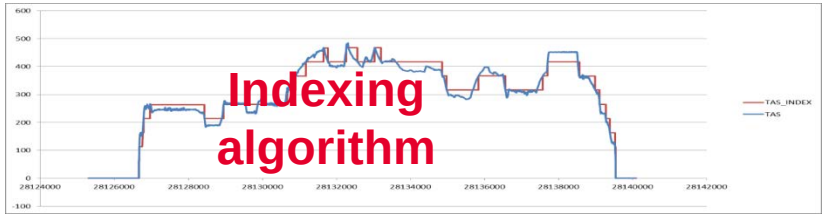
TEST A/C

Sensor data

Storage and processing



Indexing algorithm

Test Meta-data + Avionic configuration

Structured data

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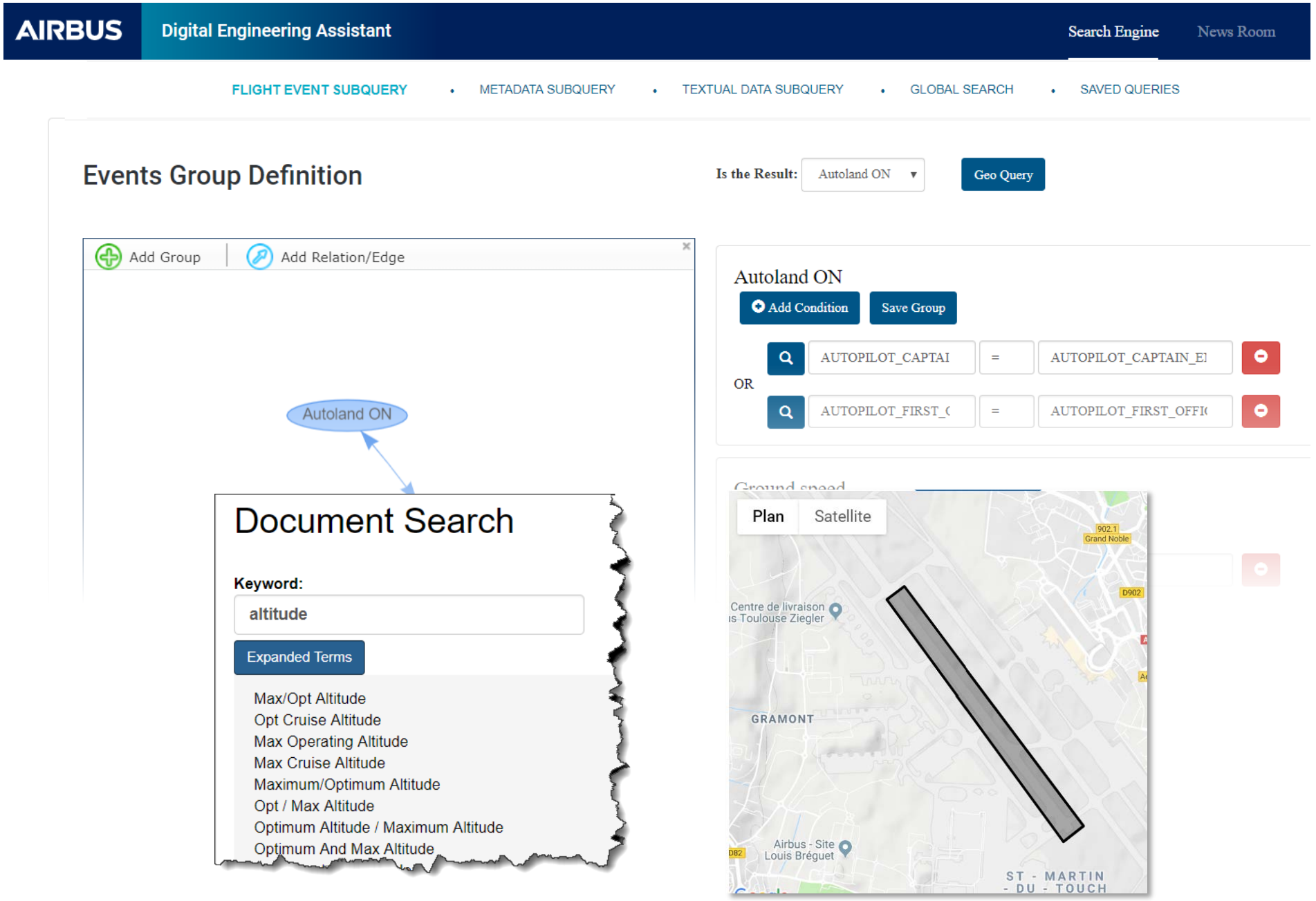
DEA: Multisource search
For Aircraft / test / time zones



Create complex query

Drag&drop UX

Specific algorithm to find overlapped time periods

Semantic extension for plain text search

Geospatial request

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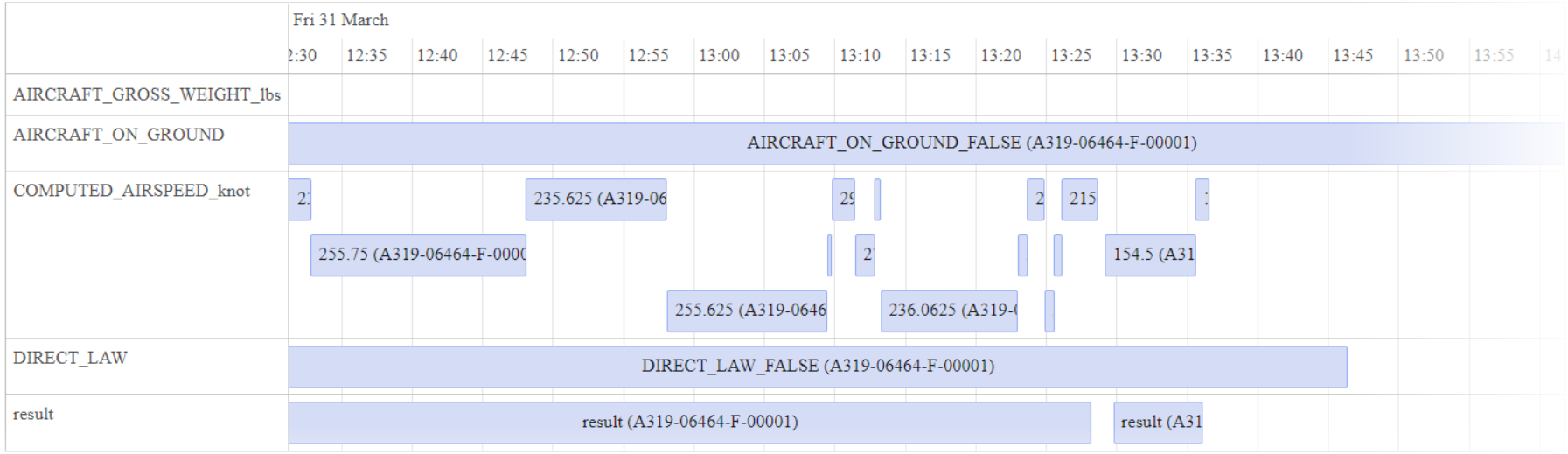
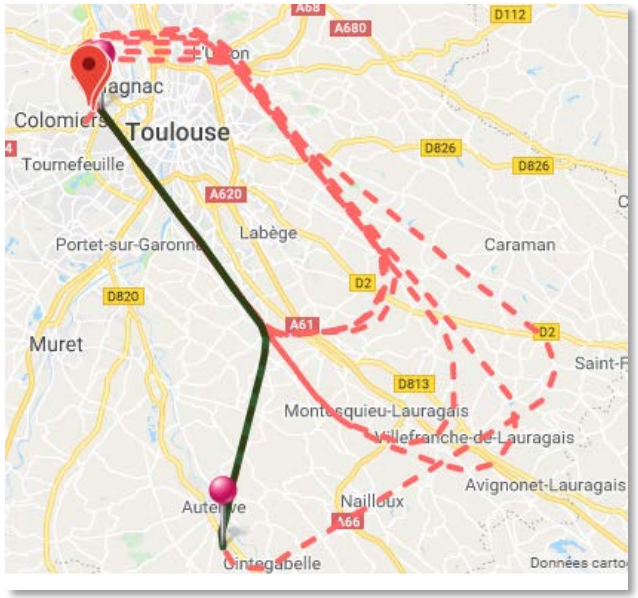
Flight Trajectory Show map





Flight	GMT START	GMT END
A320-06101-F-00240	Thu, 28 Jul 2016 06:21:26 GMT	Thu, 28 Jul 2016 06:27:09 GMT
A320-06101-F-00240	Thu, 28 Jul 2016 06:32:40 GMT	Thu, 28 Jul 2016 06:38:13 GMT
A320-06101-F-00240	Thu, 28 Jul 2016 06:43:11 GMT	Thu, 28 Jul 2016 06:49:24 GMT
A320-06101-F-00240	Thu, 28 Jul 2016 07:00:25 GMT	Thu, 28 Jul 2016 07:08:00 GMT
A320-06101-F-00240	Thu, 28 Jul 2016 07:14:05 GMT	Thu, 28 Jul 2016 07:22:44 GMT
A320-06101-F-00240	Thu, 28 Jul 2016 07:29:05 GMT	Thu, 28 Jul 2016 07:36:44 GMT

Multiple output format

Ready to be integrated in an analytic workflow

AIRBUS

Benefits of the solution

Document base = easy to integrate

Links between objects easy to map

Temporal notion matching with Time Series

Native and user-friendly search feature

DEA is a MARKLOGIC base product

Single Aisle
Long Range
& Beluga

Production deployment started in 2018

DEA is just a tool, but sustaining a strong process change

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MarkLogic ?

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Thank you

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