Grant Agreement No: 687591

Big Data Analytics for Time Critical Mobility Forecasting

datAcron

D6.4 Aviation data preparation and curation (final)

Deliverable Form	
Project Reference No.	H2020-ICT-2015 687591
Deliverable No.	6.4
Relevant Work Package:	WP 6
Nature:	R
Dissemination Level:	PU
Document version:	1.0
Due Date:	28/06/2018
Date of latest revision:	16/07/2018
Completion Date:	16/07/2018
Lead partner:	CRIDA
Authors:	Garcia Martinez, Miguel; Calvo Fernandez, Esther; Costas, Pablo; Fresno Cambre, Laura; López Ballestín, Elena; Iglesias Martinez, Enrique; Lopez Leones, Javier; Scarlatti, David; Cordero, José Manuel
Reviewers:	Vouros, George; Artikis, Alex, Doulkeridis, Christos, Maria Halkidi
Document description:	This deliverable details the Aviation datasets to be considered and provided for the Aviation use case and scenarios

Document location:	H2020-ICT-2015 687 591

Version	Date	Changes	Author	Remarks
0.1	15/May/2016	Creation	Garcia Martinez, Miguel	
0.2	10/06/2016	Strawman: inclusion of sources (not final) and organization of document	Garcia Martinez, Miguel; Calvo Fernandez, Esther; Costas, Pablo; Fresno Cambre, Laura; Lopez Leones, Javier; Scarlatti, David; Cordero, José Manuel	
0.3	15/06/2016	Inclusion of reviewers comments	Doulkeridis, Christos; Garcia Martinez, Miguel; Calvo Fernandez, Esther; Costas, Pablo; Fresno Cambre, Laura; Lopez Leones, Javier; Scarlatti, David; Cordero, José Manuel	
0.4	24/06/2016	Final Version for internal review	Garcia Martinez, Miguel; Calvo Fernandez, Esther; Costas, Pablo; Fresno Cambre, Laura; Lopez Leones, Javier; Scarlatti, David; Cordero, José Manuel	
0.5	28/06/2016	Inclusion of reviewers comments	Vouros, George; Artikis, Alex; Garcia Martinez, Miguel; Calvo Fernandez, Esther; Costas, Pablo; Fresno Cambre, Laura; Lopez	

			Leones, Javier; Scarlatti, David; Cordero, José Manuel	
1.0	30/06/2016	Final version	Garcia Martinez, Miguel; Calvo Fernandez, Esther; Costas, Pablo; Fresno Cambre, Laura; Lopez Leones, Javier; Scarlatti, David; Cordero, José Manuel	
1.1	25/05/2018	Update version of D6.2	López Ballestín, Elena; Scarlatti, David; Cordero, José Manuel	
1.2	20/06/2018	Inclusion of reviewers comments	Doulkeridis, Christos; Halkidi, María; López Ballestín, Elena; Scarlatti, David; Cordero, José Manuel; Vouros, George	
1.3	17/07/2018	Inclusion of reviewers comments	Doulkeridis, Christos; Halkidi, María; López Ballestín, Elena; Iglesias Martinez, Enrique Scarlatti, David; Cordero, José Manuel; Vouros, George	

EXECUTIVE SUMMARY

The datAcron Aviation data preparation and curation (final), D6.4, contain an extended detail reference of the datasources identified to cover the use case scenarios identified and described in D6.1, Aviation use case detailed description, and in D6.3, Aviation Experiments Specification

This deliverable aims to be a reference for WP1, WP2, WP3 and WP4 on how to use and exploit aviation data sources in order to achieve the project goals.

Eight different categories have been identified: weather, radar, airspace, network manager, synthetic trajectories, aircraft identification, flight plans, and context information, containing a set of different datasources (some of them covering several categories).

High level of detail and specification has been included in this document, for every datasource. Additionally, initial identification of usage of the described datasources in each use case has been addressed in the final section of this deliverable by means of a traceability matrix identifying, by operational expertise, the essential sources initially identified per use case, assuming this information may be of help for the rest of work packages.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

TERMS & ABBREVIATIONS

ACC	Area Control Center
ADS-B	Automatic Dependent Surveillance-Broadcast
AIC	Aeronautical Information Circulars
AIP	Aeronautical Information Publication
ALS	Alarm Service
AMDT	AIP Amendments
ANSP	Air Navigation Service Providers
ASM	Air Space Management
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATZ	Aerodrome Traffic Zones
CAS	Calibrated Air Speed
CM	Center of Mass
CNS	Communication, Navigation and Surveillance
CTA	Control Traffic Areas
CTOT	Calculated Take Off Time
CTR	Controlled Traffic Regions

D-ATIS	D-ATIS Digital Automatic Terminal Information Service
DOC	Direct Operational Costs
DSTs	Decision Support Tools
EAS	Equivalent Air Speed
ECAC	European Civil Aviation Conference
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETOT	Estimated Take Off Time
FDPs	Flight Data Processing Systems
FIR	Flight Information Region
FIS	Flight Information Service
FMS	Flight Management System
GS	Ground Speed
IAF	Initial Approach Fix
IAS	Indicated Air Speed
IATA	International Air Transport Association
ICAO	International Civil Air Organization
IFR	Instrumental Flight Rules
IMC	Instrument Meteorological Conditions
IOC	Indirect Operational Costs
MET	Meteorological Information Services

NARI	The Naval Academy Research Institute
NOTAM	Notice to Airmen
QNE	pressure when the altimeter is regulated with standard 1013.25 hPa isobar
QNH	barometric pressure adjusted to sea level – Query: Nautical Height
QoS	Quality of Service
RNAV	Area Navigation
RNP	Required Navigation Performance
SID	Standard Instrument Departure
STAR	Standard Terminal Arrival Route
SUP	AIP Supplements
TAS	True Air Speed
TCAS	Traffic Alert and Collision Avoidance System
TMA	Terminal Manoeuvring Areas
ToC	Top of Climb
ToD	Top of Descent
TP	Trajectory Prediction
UIR	Upper Information Region
UOCs	User Operations Centers
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

1. INTRODUCTION

1.1. Purpose and Scope

This document contains a detailed description of the data sources considered within the datAcron Aviation use case and scenarios to be performed in WP6. The objective of this document is to provide a high level of knowledge and understanding of the available information to the technical work packages (I.e. WP1, WP2, WP3 and WP4) that will make use of it to achieve datAcron goals.

The amount of candidate Aviation data sources to be used for the Aviation use case is quite big. Thus, this document is the result of a previous analysis from the Aviation stakeholders of the datAcron consortium (BRTE and CRIDA) identifying the most relevant data sources to be used in the Aviation use case.

In some cases, there are different sources available for Europe and Spain. In order to avoid segmentation, in these situations only the European-wide data source has been considered and detailed in the current document. In some cases, as the Spanish air navigation information is more detailed and accurate, it still be used.

1.2. Approach for the Work package and Relation to other Deliverables

The technological developments in datAcron will be validated and evaluated in user-defined challenges that aim at increasing the safety, efficiency and economy of operations concerning moving entities in the Air-Traffic Management and Maritime domains. The overall objective of work package 6 (WP6) is to validate the research results by means of experiments relevant to an Aviation Industry (ATM) use case. It relates directly to proposal objective 5: “[O.5] Validation and evaluation of the datAcron system and individual components on the surveillance of moving entities in the ATM and marine domains.”

This deliverable greatly expands the information related to dataset contained in D6.1, describing Aviation use cases. It is an essential piece to achieve datAcron objectives and provides a deeper insight in aviation datasets. It sets the scene for other WP experiments, as well as to start preparation of effective data packages to be used.

1.3. Methodology and Structure of the Deliverable

This deliverable is structured around eight groups of data sources, or categories. This aims to avoid confusion of what a source is good (or usable) for, particularly in the scope of datAcron, as well as clarifying some issues related to terminology in the Aviation use case, where non homogeneous terminology can be found. The categorization included in this document will allow to clarify and improve understanding in D6.1, Aviation use cases detailed description (i.e., understanding if there is any difference between "Weather" and "NOAA"; as stated by D6.2 deliverable, they are referring to the same information, being "weather" a category of datasets).

This deliverable faces also the question of what sources are necessary, and/or essential. Nowadays the proposed Use Cases and scenario are managed by considering some of the described data sources (and/or others). However, as datAcron follows a different, research approach in order to provide a predictive approach to the same operational problems, is not clear if any of the usually not considered data sources can help in that purposes, by containing existing relationship that are usually not identified in practice. On the other hand, obviously, dealing the whole set of available aviation data sources in search of these potential links between them are a task difficult to be managed in a practical way. In this document, a previously analysis of the necessary data sources is done, including also some good, appealing candidates which information can be of use finding the pattern relationship that datAcron looks for.

For this purposes, as well as for traceability, in the last part of the document a traceability matrix has been included. It details the use of the described data sources in the Aviation scenarios, also weighting them from considered essential for the scenario, to potentially useful. This way, technical work packages get some insight of the perceived value of each of them by Aviation experts. However, this prioritization is purely qualitative

and technical work packages are fully entitled (and encouraged) to explore further relationships than those pre-assessed.

2. SOURCES DESCRIPTION

Data sources are structured in this section in eight different categories: Weather, Radar, Airspace, Network Manager, Synthetic Trajectories, Aircraft Identification, Flight Plan and Context Information, all of them essential "bricks" for the different use case scenarios. At the end of the document, a traceability matrix detailing the relationship between data sources and use cases is included.

A scheme of data sources organization in this document is as follows:

Weather	NOAA
Radar	IFS
	ADSB
	DDR
	FlightAware 2
Airspace	DDR
Network Management	CFMU
Synthetic Trajectories	Synthetic Trajectories
Aircraft Identification	Aircraft Identification
Flight Plan	Network Manager
	DDR
Context Information	Network Manager

Table 1: Datasources description

2.1. Weather Datasources

Even though a set of weather data sources is available, and some of them were present in draft versions of D6.2, analysis suggest that only a single data source (NOAA), should be finally be considered for this category, as is the only European-wide weather data available. Thus, in the context of Aviation within datAcron, Weather data must be considered a synonym of NOAA.

a. NOAA

Brief explanation

This data source is used mainly to obtain the weather conditions at the position an aircraft is at any given time of the flight. So, for each 4D position (latitude, longitude, altitude and time) we can obtain the value of different variables. The most relevant variables are the Temperature, the Pressure, and the two horizontal components of the Wind Speed, u and v (a positive u component represents wind blowing **to** the East and a positive v component is wind to the North), since they affect the performance of the aircraft.

Typically, variables are available at a number of isobaric levels (pressure altitude) (26 levels is common), which works at the same time as a proxy for the altitude since the height is known for each isobaric level using this equation:

Height (Feet)=(1-(millibars/1013.25)^.190284))*145366.45

It is important to notice we are talking about weather models; there is no way to know the real value of these variables at all given positions in the atmosphere. The models can represent a prediction of the weather (a forecast) or represent the "best guess" of reality (a reanalysis).

Weather models use a Grid which may have more or less resolution. For aviation in datAcron we'll work with NCEP Grid 4 which has a resolution of 0.5º. (See http://www.nco.ncep.noaa.gov/pmb/docs/on388/tableb.html)

Forecast models can be run several times a day, for aviation in datAcron we'll typically use the latest forecast available previous to the time we are interested in. Forecast models has too a time resolution, or "forecast step", which we expect to be 1 hour.

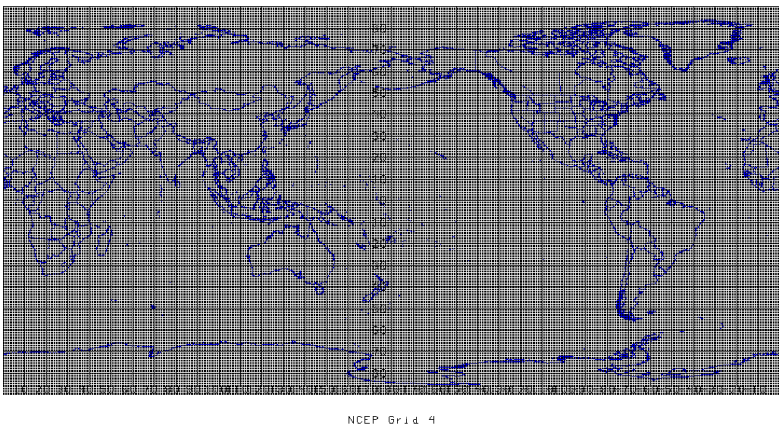

Figure 1: NOAA Datasource

Metadata

Data for weather models is typically distributed in "GRIB" format files. GRIB (**GRIdded Binary** or **General**

Regularly-distributed Information in Binary form) format allows compressing a lot the weather data and includes metadata about the content of the file, so it is very convenient for transferring the data. The data can be extracted with many available tools (I.e. GRIB API from ECMW available at https://software.ecmwf.int/wiki/display/GRIB/Home).

Fields description

Once the "dataset" is extracted from the GRIB file, these fields are expected:

- Reftime - "GRIB reference time" - Is the time when the forecast was produced
- Time - "GRIB forecast or observation time" - Is the time for the forecast, typically as hours since the Reftime.
- Lat – Latitude typically in "degrees_north"
- Lon – Longitude typically in "degrees_east"
- Temperature_isobaric – Temperature in K
- u-component_of_wind_isobaric – Wind speed vector component u in m/s.
- v-component_of_wind_isobaric– Wind speed vector component v in m/s.
- Geopotential_height_isobaric – Geopotential Height in gpm.
- Isobaric surface – The pressure in Pa for each isobaric level
- Relative_humidity_isobaric
- Absolute_vorticity_isobaric in 1/s
- Cloud_mixing_ratio_isobaric in kg/kg
- Wave_Geopotential_Height_isobaric in gpm

Range of available dates

The NOAA forecasts was available for any time when there are trajectories available.

Range of available areas (per stage of the project maybe)

Forecast coverage is Global.

Join procedure with other sources

The weather data can be related with other data source according to the time (UTC is recommended) and the position: Latitude and Longitude and altitude.

Approximate Size

As a reference a global forecast, 6 hours step, for 24h, for 14 isobaric levels at .5º resolution expanded from .grib to .csv can amount about 3.2 Gb.

Delivery procedure

The forecasts was delivered in .grb files to datAcron. These files may be converted to .csv files using tools like "wgrib2".

Use cases Exploit

In scenario FP02 for each position of the aircraft in the trajectory the weather context measurements forecasted can be obtained from this datasource. A conversion of Flight Level to pressure altitude is needed (see section 2.2.b)

In scenario FP07, FP08 and FP09 it may be needed to query the value of weather measures forecasted in a given future 4D position.

In scenario FM01 “Regulations detection and prediction”, the report of weather information is used in order to predict those regulations caused by different conditions.

In scenario FM02 “Demand and capacity imbalance detection and prediction”, demand and capacity imbalances are linked temporally and spatially with NOAA information.

From end user point of view, in Scenario FM03 “Resilience assessment” the queries in this scenario are linear combination from scenario FM01 and FM02 ones previously calculated in order to obtain, through heat maps, the excess of demand that the system is able to manage without any regulations applied.

2.2 Radar datasources

This data category comprises of three sources of surveillance information: IFS, ADS-B and DDR. The first one is the operational data source, high quality, but limited to Spanish airspace. The second one is European-wide. The third one, also European wide, is embedded in the flight plan data coming from the Eurocontrol Demand Data Repository (DDR), and is only mentioned here to make clear that it is a source of surveillance/radar data, but will be described in detail in the Flight Plan Category.

a. IFS

Brief explanation

This data source provides radar tracks of the Spanish airspace controlled by the Spanish ATC provider EnAire. A radar track file consists on tabular data rows with a timestamp key and several columns of geospatial information for each one of these timestamps. The update interval is 5 seconds. The area provided is separated into 5 different regions delivered each one on a different plain text file (ifs files). The regions (m,b,c,p and s) are **approximately** shown on the next figure (Figure 1 - IFS Regions).

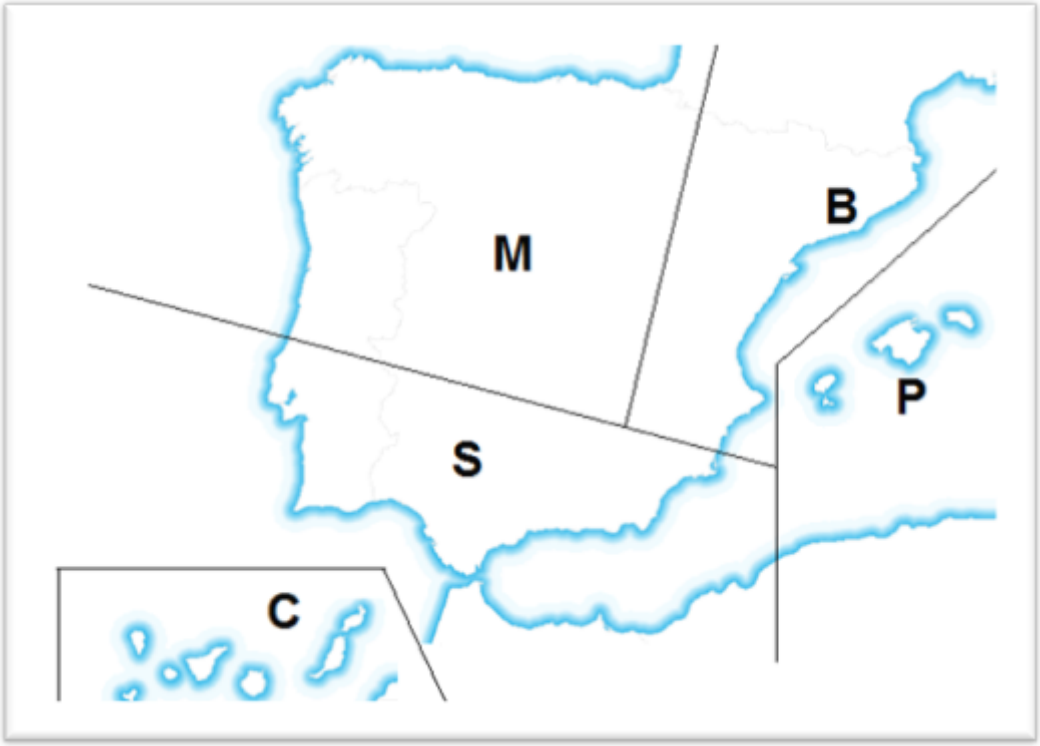

Figure 2: IFS datasource

Figure 1 - IFS Regions

Each region is completely independent from the others so neighbour regions files could have repeated information while flights can be at the same time under the coverage zone of 2 radars (never more than 2).

Also there is not an unique id per flight on the files since ids of the radar tracks are reused after a certain time interval once they are released (close to the half hour but never a fixed value) and call signs of flights are used several times per day for common routes (the same plane/flight goes and returns the same route on the day). Besides system errors, a flight should be on the same radar track for the whole time under the coverage of specific radar but this track id is different on the rest of radar regions.

All this means that the way to provide meaning to these files is using mainly timestamp and call sign information with some help of the geospatial information. The files are named with the first letter according to

the region and the date on format yyMMdd.

All this Information has been processed and structured in a single table with only the meaningful data to provide a whole flight unique track identified by a unique flight key.

Metadata

None.

Data curation

Not required.

Field description

Structured data

Field	Description
factId	This field identifies uniquely the row of data.
flightKey	This Key identifies uniquely the flight
callsign	This string is the call sign of the flight. These call signs are reused permanently by flights so it would be repeated over the data.
adep	Aerodrome of departure (If is indicated)
ades	Aerodrome of destination (If is indicated)
flightRule	Rules of the flight (I – Instrumental; V – Visual)
wake	Wake of the plane (J = Super, H = High, M = Medium, L = Low). This means how close a plane can be following to another one. The bigger is the plane the farer has to be.
aircraft	Aircraft type
Date	Point's date [yyyy-MM-dd]
Time	Point's time of the day [HH :mm :ss]
lat	Latitude [DDD]
lng	Longitude [DDD]
modo_c	Altitude (Hundreds of feet]
vel_mod	Module of the horizontal speed [Knots]
hdg	Heading [degrees from 0 to 360]
Vel X	Speed on X axis [Knots]
Vel Y	Speed on Y axis [Knots]
Vel Z	Speed on Z axis [Feet/min]

Table 2: Fields use in IFS data

Range of available dates

IFS data is available for from 2013 till 2016 (complete years).

Range of available areas

The covered area is the Spanish airspace.

Approximate Size

On structured version, one day is around a hundreds millions of records.

Delivery procedure

Structured version could be provided by web services, database direct connection or CSV files.

Use cases Exploit

The IFS tracks could be used on all use cases described since they provide the real movement of the plane. So anytime a trajectory is interesting this historical data maybe useful. To join this source with others key columns

are the time and the coordinates.

b. ADSB

Brief explanation

This Data source refers to the ADS-B messages broadcasted by many airplanes (practically all airliners) using their transponders. These messages are received by ground based receivers and can be used to reconstruct the trajectory of the flight. There are several types of messages that can be found but for datAcron the relevant ones are these about aircraft identification and position.

datAcron source of ADS-B messages is the ADSBHub network. This network is formed by 81 stations across the globe, 61 of them in continental Europe. The messages received by this network are stored in a human readable format known as "SBS-1 BaseStation port 30003".

Metadata

Messages are contained in a single line of CSV files. ADS-B messages are captured in CSV format. An excerpt of such messages, describing a particular flight, look as follows:

MSG,3,,,34324E,,2015/08/03,01:05:03.844,2015/08/03,01:05:07.058,,30050,,,45.69032,5.54741,,,0,0,0,0
MSG,6,,,34324E,,2015/08/03,01:05:03.844,2015/08/03,01:05:07.058,,30050,,,,,,1021,0,0,0,0
MSG,4,,,34324E,,2015/08/03,01:05:03.744,2015/08/03,01:05:07.058,,,428.0,51.0,,,-384,,,,
MSG,1,,,34324E,,2015/08/03,01:05:04.344,2015/08/03,01:05:07.058,IBE34CP,,,,,,,,,
MSG,3,,,34324E,,2015/08/03,01:05:05.943,2015/08/03,01:05:15.337,,30025,,,45.69296,5.55218,,,0,0,0,0
MSG,6,,,34324E,,2015/08/03,01:05:05.943,2015/08/03,01:05:15.337,,30025,,,,,,1021,0,0,0,0
MSG,4,,,34324E,,2015/08/03,01:05:10.643,2015/08/03,01:05:15.337,,,426.0,51.0,,,-128,,,,

ADS-B messages are formatted according to the SBS Station schema original from Kinetics' SBS-1 & SBS-3 Mode-S. They comprise 22 fields of data to describe six different types of messages which are classified into two main families: i) messages sent by the aircrafts (MSG), and ii) messages triggered by user inputs or system settings (SEL, ID, AIR, STA, and CLK). All of these messages are described as follows:

- MSG messages describe eight different types of events from the aircraft:
  - Messages of type 1 identify the flight using its *callsign* attribute.
  - Messages of type 2 send information about the surface position (obtained from nose gear squat switch) of the flight.
  - Messages of type 3 and 4 send information about the airborne position and velocity of the flight respectively.
  - Messages of type 5 and 6 provide particular surveillance information from ground radar. Both types of messages must be preceded by messages 1,2,3,4, or 8.
  - Messages of type 7 describe air to air information from TCAS. These messages are included in the SBS socket output.
  - Finally, messages of type 8 implement all-call replies.
- SEL messages are generated when the user changes the selected aircraft in BaseStation.
- ID messages are generated when an aircraft being tracked sets or changes its *callsign*.
- AIR messages are generated when the SBS picks up a signal for an aircraft that it is not currently tracking.
- STA messages are generated when an aircraft's status changes according to the time-out values in the Data Settings menu.
- CLK messages are generated when the user double-clicks (or presses return) on an aircraft (i.e. to bring up the aircraft details window).

All fields used by these ADS-B messages are described in the following table:

#Field	Name	Description
1	Message type	Value describing the type of

		message (MSG,STA,ID,AIR,SEL,CLK)
2	Transmission Type	Value describing the type of MSG (1-8).
3	SessionID	Database session record number.
4	AircraftID	Database aircraft record number.
5	HexIdent	Aircraft mode S hexadecimal code.
6	FlightID	Database flight record number.
7	Date message generated	Date when the message was generated by the aircraft.
8	Time message generated	Time when the message was generated by the aircraft.
9	Date message logged	Date when the message was captured by the base station.
10	Time message logged	Time when the message was captured by the base station.
11	Callsign	Flight number (ICAO airline code plus flight number).
12	Altitude	Aircraft altitude (Mode C) relative to 1013.2mb (Flight Level), not height AMSL.
13	GroundSpeed	Aircraft speed over ground (not indicated airspeed).
14	Track	Aircraft track (not heading). Derived from the velocity E/W and velocity N/S.
15	Latitude	Aircraft latitude (North and East positive. South and West negative).
16	Longitude	Aircraft longitude (North and East positive. South and West negative).
17	VerticalRate	Aircraft vertical rate (64ft resolution).
18	Squawk*	Assigned Mode A squawk code.
19	Alert (Squawk change)	Flag to indicate the squawk value has changed.
20	Emergency	Flag to indicate emergency code has been set.
21	SPI (Ident)	Flag to indicate transponder Ident has been activated.
22	IsOnGround	Flag to indicate ground squat switch is active.

(*) transponder code assigned by air traffic controllers to uniquely identify an aircraft in their control areas.

Table 1. Fields used in ADS-B messages.

The next Figure illustrates the field configuration for all types of messages.

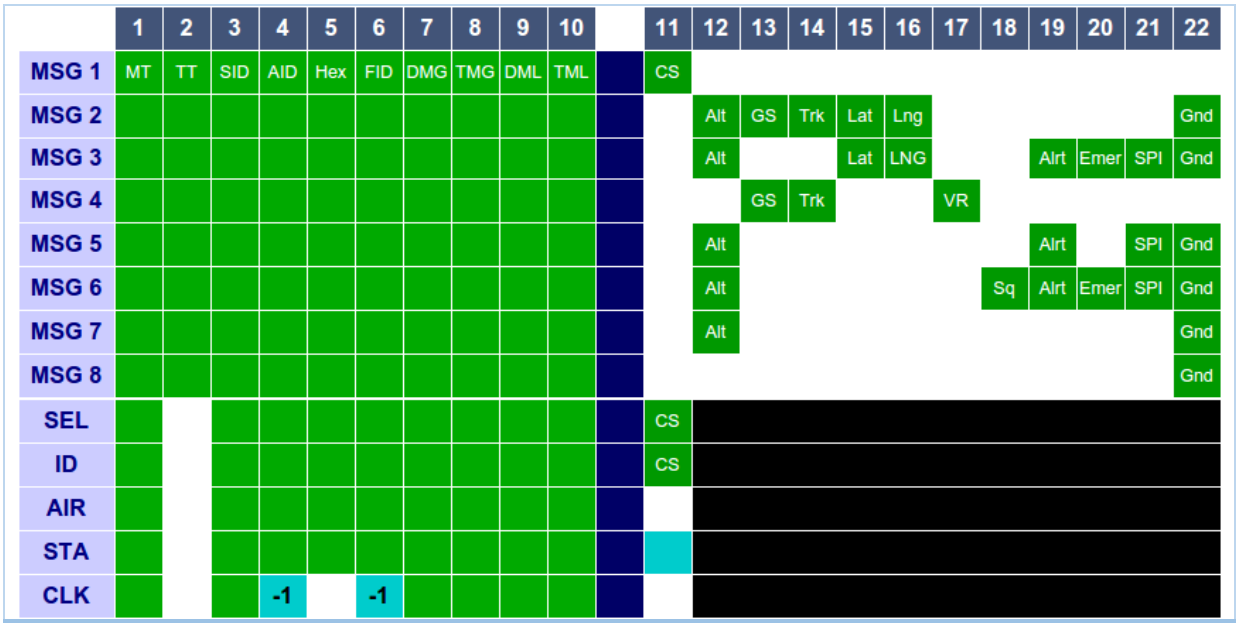

Table 3: ADS-B messages description.

It is worth noting that only the first ten fields are filled for all messages (with the exception of the *transmission type*, which only has sense for MSG messages). In turn, field #11 (describing the flight *callsign*) is only provided by MSG-1, SEL, and ID messages, all of them describing information about the flight identification. Finally, fields from #12 to #22 are used by MSG messages (except MSG-1) to describe their particular semantics. It is worth noting some additional remarks about the field configuration:

- Boolean fields use -1 for *true*, and 0 for *false*. Empty fields means that they are not used.
- The special value @@@@@@@@, for the *callsign* (field #11), indicates that the crew has enter eight spaces in the cockpit. This usually occurs few minutes after landing.
- Altitude (field #12) resolution can be 25ft or 100 ft. Mode-C is 100 ft., but many aircraft send out 25 ft. resolution to be able to fly in Europe IFR (RVSM) space. BaseStation only displays Barometer altitude but in the data are HAE (height above ellipsoid), which is sent as the difference between GPS altitude and barometric altitude.

Fields description

Field	Description
message_type	See MessageType.
transmission_type	See TransmissionType.
session_id	String. Database session record number.
aircraft_id	String. Database aircraft record number.
hex_ident	String. 24-bit ICACO ID, in hex.
flight_id	String. Database flight record number.
generated_date	String. Date the message was generated.
generated_time	String. Time the message was generated.
logged_date	String. Date the message was logged.
logged_time	String. Time the message was logged.
callsign	String. Eight character flight ID or callsign.
altitude	Integer. Mode C Altitude relative to 1013 mb (29.92" Hg). (Flight Level)
ground_speed	Integer. Speed over ground.
track	Integer. Ground track angle.
lat	Float. Latitude.
lon	Float. Longitude

vertical_rate	Integer. Climb rate.
squawk	String. Assigned Mode A squawk code.
alert	Boolean. Flag to indicate that squawk has changed.
emergency	Boolean. Flag to indicate emergency code has been set.
spi	Boolean. Flag to indicate Special Position Indicator has been set.
is_on_ground	Boolean. Flag to indicate ground squat switch is active.

Table 4: Fields description in ADSB data

MessageType

There are 6 types of SBS-1 messages represented by the MessageType enum:

Enum	Value
SELECTION_CHANGE	"SEL"
NEW_ID	"ID"
NEW_AIRCRAFT	"AIR"
STATUS_AIRCRAFT	"STA"
CLICK	"CLK"
TRANSMISSION	"MSG"

Table 5: Types of SBS messages

SELECTION_CHANGE, NEW_ID, NEW_AIRCRAFT, STATUS_CHANGE, and CLK indicate changes in the state of the SBS-1 software and aren't typically used by other systems.

TRANSMISSION messages contain information sent by aircraft.

TransmissionType

There are 8 subtypes of transmission messages, specified by the TransmissionType enum:

Enum	Value	Description	Spec
ES_IDENT_AND_CATEGORY	1	ES identification and category	DF17 BDS 0,8
ES_SURFACE_POS	2	ES surface position message	DF17 BDS 0,6
ES_AIRBORNE_POS	3	ES airborne position message	DF17 BDS 0,5
ES_AIRBORNE_VEL	4	ES airborne velocity message	DF17 BDS 0,9
SURVEILLANCE_ALT	5	Surveillance alt message	DF4, DF20
SURVEILLANCE_ID	6	Surveillance ID message	DF5, DF21
AIR_TO_AIR	7	Air-to-air message	DF16
ALL_CALL_REPLY	8	All call reply	DF11

Table 6: Subtypes of transmission messages

Only ES_SURFACE_POS and ES_AIRBORNE_POS transmissions have position (latitude and longitude) information.

Range of available dates (per stage of the project maybe)

ADSB data is available since late 2015 and is continuously recorded; however, not all the sensors are 100% of the time up and the recording system is not 100% of the time up. Power supply and/or network outages can create dates with less or even without data.

Range of available areas (per stage of the project maybe)

The covered are will vary depending on the sensors up at each time. The location of the network is shown in next table:

Sensor	Country	Location
AT0002	Austria	Salzburg
AT0006	Austria	Krems an der Donau
AT0008	Austria	Frauenkirchen
BE0004	Belgium	Oostende
BG0004	Bulgaria	Jambol
CH0001	Switzerland	
DE0001	Germany	EDDG
DE0011	Germany	Stammheim
DE0015	Germany	Hannover
DE0016	Germany	Siegburg
DE0019	Germany	Heilbronn
ES0004	Spain	Madrid
ES0006	Spain	Madrid
ES0008	Spain	Santander
FR0001	France	Rennes
FR0012	France	Clermont-Ferrand
FR0015	France	Coligny
IE0005	Ireland	Santry
LT0001	Lithuania	Kaunas
NL0011	Netherlands	Amsterdam
NL0012	Netherlands	
NL0013	Netherlands	Breda
NL0019	Netherlands	Almere
NL0020	Netherlands	Soest
NL0027	Netherlands	Lemelerveld
NL0035	Netherlands	Tilburg
NL0036	Netherlands	EHTW
NO0001	Norway	Moss
NO0007	Norway	Stavanger
RU0005	Russia	Moscow
RU0017	Russia	Tyumen
RU0022	Russia	Novy Urengoy
RU0024	Russia	St Petersburg
RU0027	Russia	Moscow
RU0030	Russia	Chelayinsk
RU0034	Russia	Stavropol
RU0040	Russia	Abakan
RU0042	Russia	Anadyr
RU0046	Russia	Surgut
RU0047	Russia	Sochi
RU0055	Russia	Novosibirsk
RU0065	Russia	Kodinsk
RU0066	Russia	Vladivostok
RU0067	Russia	Vladivostok
RU0077	Russia	Barnaul
SE0004	Sweden	Gothenburg

UA0003	Ukraine	Lviv
UA0009	Ukraine	UKDE
UK0001	UK	South
UK0020	UK	Windsor
UK0023	UK	Lincolnshire
UK0060	UK	London
UK0061	UK	Lincoln
UK0066	UK	Leeds
UK0067	UK	Swindon
UK0068	UK	Northumberland
UK0071	UK	Bournemouth
UK0073	UK	Stockport
UK0075	UK	Birmingham
UK0077	UK	Milton Keynes
UK0078	UK	London

Table 7: Range of available areas (ADSB data)

Join procedure with other sources

The key field for linking this data with other sources is ***hex_ident*** which uniquely identifies an aircraft.

Other important field is ***callsign*** which uniquely identifies a flight at a given date.

Regarding the position of the aircraft latitude and longitude can be used for horizontal position and Altitude (Flight Level) for vertical position.

Flight Level indicates the height at which the aircraft would be in a standard atmosphere given the pressure their sensors are measuring. To know that pressure these formula can be used:

Feet=FL*100=(1-(millibars/1013.25)^.190284))*145366.45

$$(1-(millibars/1013.25)^{.190284}))*145366.45$$

So

Pressure (mb)=((1-(ft/145366,45))^(5,2553026))*1013,25

Pressure (mb)=((1-(FL*100/145366,45))^(5,2553026))*1013,25

That pressure can be used to look for data in the weather models which refer to isobaric levels. Typically an interpolation is needed since only 26 isobaric levels are available.

Approximate Size

One day of messages tops about 2.3 Gb (not compressed).

Delivery procedure

Historical data: Files for specific time periods can be assembled and delivered through Internet or physical media (I.e. DVD).

Real time data: Once a VPN connection is established to BR&TE Laboratory Network the client can issue a netcat command to receive the real time feed.

Use cases Exploit

ADSB data source can be used in any use case where real trajectory from aircrafts is needed.

There is one scenario specifically designed to reconstruct the trajectory from ADSB messages (scenario FP01 in datAcron deliverable D6.1).

For historical data all messages in a period of time can be used to reconstruct the tracks of each aircraft in that period. The track have a hex_ident and one or more callsign (if Message Type 1 is available) to identify them. Dividing a track in flights can be done based on several criteria like:

1. Gaps of time without messages
2. Altitude zero for detecting landings and departures
3. Is_on_ground indicator
4. Changes in callsign field

For real time data the hex_iden field is used to associate the new messages to the already received and when message type 1 is received the callsign is associated to the existing track.

c. Flightaware Firehose

Brief explanation

This data source was added to the project to solve the coverage issues in some European areas by ADSBHub.

Firehose is a FlightAware API for receiving streaming flight positions (e.g., RADAR, ADS-B, Mode S multilateration (MLAT), datalink, etc.) as well as flight status data (e.g., flight plans, departure/arrival messages, flight updates) and surface movement positions. Only access levels 1 and 2 are available for datAcron project:

1. ADS-B: Worldwide
2. MLAT: Worldwide

Surface data is access level 7 and is not available for the project. This would limit coverage around airports.

Metadata

FlightAware Firehose data source comes in json files according to following schema:

Position - a position report (Schema)		
Summary	Field name	Description
		Mandatory
Reporting facility hash	`facility_hash`	A consistent and unique obfuscated identifier string for each source reporting positions to FlightAware
Longitude	`lon`	In decimal degrees, rounded to 4 decimal points
Message type	`type`	Value is always position
Air/Ground	`air_ground`	Air/Ground or Weight-on-Wheel (WOW) switch... "A" air, "G" ground
Flight Identifier	`ident`	Callsign identifying the flight. Typically, ICAO airline code plus IATA/ticketing flight number, or the aircraft registration.
Report Time	`clock`	POSIX epoch format. Time should be the time generated by flight hardware if possible
FlightAware flight id	`id`	FlightAware flight id
Latitude	`lat`	In decimal degrees, rounded to 4 decimal points
Update Type	`updateType`	Specifies source of message, A for ADS-B, Z for radar, O for transoceanic, P for estimated, D for datalink, M for Multilateration (MLAT), X for ASDE-X, S for Space-based ADS-B
Reporting facility name	`facility_name`	A description of the reporting facility intended for end-user consumption. May be a blank string if undefined.
Point In Time Recovery	`pitr`	Timestamp value that should be supplied to the "pitr" connection initiation command when reconnecting and

		you wish to resume firehose playback at that approximate position
		Optional
Origin	`orig`	ICAO airport code, waypoint, or latitude/longitude pair
Altitude	`alt`	In feet (MSL)
GPS altitude	`gps_alt`	GPS altitude in feet
Transponder Mode S code	`hexid`	24-bit Mode S transponder code assigned by aircraft registrar. Formatted in upper case hexadecimal
Groundspeed	`gs`	In knots
Transponder squawk code	`squawk`	4 digit octal transponder beacon code assigned by ATC
Next expected reported position latitude	`rp1lat`	In decimal degrees
Aircraft Registration	`reg`	The tail number or registration of the aircraft, if known and it differs from the ident.
Aircraft Type	`aircrafttype`	ICAO aircraft type code
Text route	`route`	Textual route string
Destination	`dest`	ICAO airport code, waypoint, or latitude/longitude pair. May be missing if not known.
Course	`heading`	In degrees
Filed cruising speed	`speed`	In knots
ETA	`eta`	Estimated Time of Arrival. POSIX epoch format
ATC Ident	`atcident`	Identifier used for ATC, if it differs from flight identifier
Barometric altitude	`baro_alt`	Barometric altitude in feet
Outside air temperature	`oat`	In Celsius
Next expected reported position altitude	`rp1alt`	In feet
Next expected reported position longitude	`rp1lon`	In decimal degrees
Estimated Departure Time	`edt`	Revised timestamp of when the flight is expected to depart. POSIX epoch format
Winds aloft	`winds`	3 digit direction in whole degrees and 3 digit speed in knots concatenated
Waypoints	`waypoints`	2D, 3D, or 4D list of locations, times, and altitudes formatted as a list of JSON arrays
En route Time	`ete`	In seconds. May be missing if not known.
Fuel on board	`fob`	In kilograms
Next expected reported position time	`rp1clock`	POSIX epoch format
Altitude Change	`altChange`	"C" for climbing, "D" for descending, " " when undetermined

Table 8: Fields description in FlightAware Firehose

Range of available dates (per stage of the project maybe)

FlightAware Firehose is available for the whole datAcron project timespan (2016 to 2018).

Range of available areas (per stage of the project maybe)

The coverage of FlightAware Firehose is shown in next image:

Figure 3.Flightaware Firehose

Approximate Size

One day of messages tops about 17Gb (not compressed).

Delivery procedure

Historical data: Files for specific time periods can be assembled and delivered through Internet or physical media (I.e. DVD).

Real time data: There is one connection available for the datAcron project. The script provided for consumption is this:

```
#!/bin/bash
while :
do
coproc p1 {
  /usr/bin/openssl s_client -quiet -connect firehose.flightaware.com:1501
2>/dev/null
}
sleep 5s
echo "live version 7.0 username BRTEUser password ***" >&${p1[1]}
while :
do
read line <&"${p1[0]}"
echo "$line"
done
done
wait $p1_PID
```

Use cases Exploit

FlightAware Firehose data source can be used in any use case where real trajectory from aircrafts is needed.

There is one scenario specifically designed to reconstruct the trajectory from ADSB messages (scenario FP01 in datAcron deliverable D6.1).

For historical data all messages in a period of time can be used to reconstruct the tracks of each aircraft in that period. The track have a hex_ident and one or more callsign to identify them. Dividing a track in flights can be done based on several criteria like:

1. Gaps of time without messages
2. Altitude zero for detecting landings and departures
3. Is_on_ground indicator
4. Changes in callsign field

For real time data the hex_iden field is used to associate the new messages to the already received and when callsign is received the callsign is associated to the existing track.

d. DDR

DDR, or Demand Data Repository, is an European wide valuable datasource that contains surveillance/radar data, which is embedded in the flight plan data. This data source, including the radar part, is described in the Flight Plan category, and is only mentioned here for reference as a key radar datasource.

2.3 Airspace datasources

This category comprises of one single data source, DDR (in particular, the sector configuration part of this repository that also appears in Radar and in Flight plan categories).

Airspace data source can be seen from a dual perspective. On the one hand, describes the existing airspace organization, with no gaps or overlaps, and all the possible ways of combining volumes to generate different operational sector configurations, also with the associated sector capacities, or flights that a sector can manage in a period of time (this static data generically called "adaptation data"), and on the other hand, described the schedule of effective sector configurations that have been effectively put in place in European airspace.

This Airspace datasource category covers only the second of the two. The essential, first one, is covered in the Context Information Category (static data).

a. DDR Sector Configuration

Brief explanation

Air traffic control (ATC) is a service provided by ground-based controllers who direct aircraft on the ground through controlled airspace. The primary purpose of ATC worldwide is to prevent collisions, organize and expedite the flow of air traffic, and provide information and other support for pilots.

Airspace can be divided in a set of ways, with a different numbers of pieces (sectors). A sector configuration 9A means that a particular airspace (a region in Spain) is divided in 9 sectors, in a particular way. 9B also mean 9 sectors, but divided in a different way. Typically, due to low traffic at nights, the configuration set at those times is a 1A, meaning that a single sector (thus, a single controller) is in place.

This leads to the fact that configurations available are fixed, but configuration “in place” varies during day, adapting capacity resources (Air Traffic Controllers, mainly, as more sectors open mean more capacity, but also more controllers) to the expected demand.

Fields detailed description (structured data)

The Sector and Volumetry information in Demand Data Repository (DDR) is organized per year and AIRAC cycle in six files:

-*Configurations* file (.cfg)

-*Opening scheme* file (.cos)

-*Capacity* file (.ncap)

-*Volumetry* file, where are included:

O *Airspace* file (.spc)

O *Sector Gasel level* file (.gsl/sls)

O *Airblock* file (.gar/are)

Configurations file

This file contains the information related to airspace configuration and its filename extension is .CFG

Data sample:

```
LEMDTMA;CNF10N;LEMDAPN
LEMDTMA;CNF10N;LEMDDEN
LEMDTMA;CNF10N;LEMDDWN
LEMDTMA;CNF10N;LEMDENN
LEMDTMA;CNF10N;LEMDESN
LEMDTMA;CNF10N;LEMDREN
LEMDTMA;CNF10N;LEMDRWN
LEMDTMA;CNF10N;LEMDWNN
LEMDTMA;CNF10N;LEMDWSN
LEMDTMA;CNF10S;LEMDAPS
LEMDTMA;CNF10S;LEMDDES
LEMDTMA;CNF10S;LEMDDWS
LEMDTMA;CNF10S;LEMDENS
LEMDTMA;CNF10S;LEMDESS
LEMDTMA;CNF10S;LEMDRES
LEMDTMA;CNF10S;LEMDRWS
LEMDTMA;CNF10S;LEMDWNS
LEMDTMA;CNF10S;LEMDWSS
```

-Field 1: name of the area control center (ACC) or group of sectors

-Field 2: name of the airspace configuration

-Field 3: name of the sector

Field 2 of .CFG is linked with table Field 5 of .COS table

1.- ACC	2.- AIRSPACE CONFIG.	3.- SECTOR

Opening Scheme file

This file contains information of the airspace configuration applied in a certain period of time (day and start/end time). Its filename extension is .COS

Data sample:

```
02/04/2016;LEMDTMA;00:00;03:29;CONF1;E
02/04/2016;LEMDTMA;03:30;05:29;CNF4BN;T
02/04/2016;LEMDTMA;05:30;11:22;CNF7BN;T
02/04/2016;LEMDTMA;11:23;11:29;CNF7BN;T
02/04/2016;LEMDTMA;11:30;14:50;CNF7CS;T
02/04/2016;LEMDTMA;14:51;15:28;CNF7CS;T
02/04/2016;LEMDTMA;15:29;20:29;CNF7CS;T
02/04/2016;LEMDTMA;20:30;21:59;CNF3AS;T
02/04/2016;LEMDTMA;22:00;23:59;CNF2CS;T
```

-Field 1: date

-Field 2: name of the area control center (ACC) or group of sectors

-Field 3: start time

-Field 4: end time

-Field 5: name of the airspace configuration.

-Field 6: source of info

Field 2 of .COS table is linked with Field 1 of .CFG table

Field 5 of .COS table is linked with Field 2 of .CFG table

1.- DATE	2.- ACC	3.- START TIME	4.- END TIME	5.- AIRSPACE CONFIG	6.- SOURCE OF INFO

Capacity file

This file contains information of the airspace capacity in a certain period of time (day and start/end time). Its filename extension is .NCAP

Data sample:

```
31/03/2016;LEJR;00:00;23:59;999;_;AD;D;B
31/03/2016;LEJRALL;00:00;23:59;12;_;TV;G;B
31/03/2016;LEJRARR;00:00;23:59;8;_;TV;G;B
31/03/2016;LEJRDEP;00:00;23:59;8;_;TV;G;B
31/03/2016;LEJU;00:00;23:59;999;_;AD;G;B
31/03/2016;LELA;00:00;23:59;999;_;AD;G;B
31/03/2016;LELC;00:00;23:59;4;_;AD;G;B
31/03/2016;LELC;00:00;23:59;4;_;AD;A;B
31/03/2016;LELCARR;00:00;23:59;0;_;TV;G;B
31/03/2016;LELL;00:00;23:59;999;_;AD;G;B
31/03/2016;LELM;00:00;23:59;999;_;AD;G;B
31/03/2016;LEMD;00:00;19:59;78;_;TV;G;B
31/03/2016;LEMD;00:00;23:59;999;_;AD;D;B
31/03/2016;LEMD;00:00;23:59;999;_;AD;G;B
31/03/2016;LEMD;00:00;23:59;999;_;AD;A;B
```

-Field 1: date

-Field 2: ID of the element

-Field 3: start time

-Field 4: end time

-Field 5: capacity of the element

- O 999 value = not defined capacity

-Field 6: empty

-Field 7: type of the element:

- O AD = Aerodrome
- O AS = Airspace
- O TV = Traffic Volume
- O PT = Significant Point
- O AZ = Set of aerodromes

-Field 8: category of the element:

- O G = Global for AS, TV and SP
- O A = Arrival for AD and AZ
- O D = Departure for AD and AZ

-Field 9: source table

O B = body/default

O P = permanent

O T = temporary

O N = tact

1.- DATE	2.- ID	3.- START TIME	4.- END TIME	5.- CAPACITY	6.- EMPTY	7.- TYPE	8.- CATEGORY	9.- SOURCE

Volumetry file

The volumetry information is divided in three files:

O *Airspace* file (.spc)

O *Sector Gasel level* file (.gsl/sls)

O *Airblock* file (.gar/are)

These three tables are linked by airspace, sectors and airblocks identifiers

Airspace file

This file contains information of the airspace, its id, the number of sectors, and the name of each of the sectors that compose it. Its filename extension is .SPC

Data Sample:

```
A;ENLECP;SPAIN PALMA;AUAG;4;_
S;LECPCTA;AUA
S;LEIBCTR;AUA
S;LEMHTMA;AUA
S;LEPATMA;AUA
```

-Header line:

O Field 1: type of element

- A = airspace

O Field 2: ID of the element

O Field 3: region

O Field 4: number of component sectors

-Sector line (one for each of the sectors):

O Field 1: type of element

- S = sector

O Field 2: ID of the element

O Field 3: type of sector

1.- TYPE OF ELEMENT: A	2.- ID	3.- REGION	4.- NUMBER OF SECTORS

1.- TYPE OF ELEMENT: S	2.- ID	3.- TYPE

Sector Gasel Level file

This file contains information of the airspace sector configuration, its id, the number of airblocks, the name of each of the airblocks that compose it and its boundary levels. Its filename extension is .GSL or SLS

Data Sample:

```
S;LECMASL;MADRID SECTOR ASTURIAS LOWER;11;_;ES
A;001LP;+;105;345
A;160LE;+;0;285
A;201LE;+;245;345
A;221LE;+;155;345
A;260LE;+;0;345
A;261LE;+;0;345
A;262LE;+;145;345
A;269LE;+;145;345
A;270LE;+;0;345
A;550LP;+;245;345
```

-Header line:

O Field 1: type of element

- S = sector

O Field 2: ID of the element (sector)

O Field 3: region

O Field 4: number of component airblocks

O Field 5: empty

O Field 6: country

-Airblock line (one for each of the airblocks):

O Field 1: type of element

- A = airblock

O Field 2: ID of the element

O Field 3: lower level

O Field 4: higher level

1.- TYPE OF ELEMENT: S (SECTOR)	2.- ID (SECTOR)	3.- REGION	4.- NUMBER OF AIRBLOCKS	5.- EMPTY	6.- COUNTRY

1.- TYPE OF ELEMENT: A (AIRBLOCK)	2.- ID (AIRBLOCK)	3.- LOWER LEVEL	4.- HIGHER LEVEL

Airblock file

This file contains information of the airblock configuration, its id, the number of waypoints, and the name of each of the waypoints that compose it and its latitude and longitude. Its filename extension is .GAR or ARE

Data Sample:

```
A;001LP;6
P;41.9416666666667;-6.625
P;41.9333333333333;-6.56666666666667
P;41.7697222222222;-6.49944444444444
P;41.9363888888889;-7.11694444444444
P;41.9366666666667;-7.11638888888889
P;41.9416666666667;-6.625
```

-Header line:

O Field 1: type of element

- A = airblock

O Field 2: ID of the element (airblock)

O Field 3: number of component waypoints

-Waypoints line (one for each of the waypoints):

O Field 1: type of element

- P = point

O Field 2: latitude

O Field 3: longitude

1.- TYPE OF ELEMENT: A (AIRBLOCK)	2.- ID (AIRBLOCK)	3.- NUMBER OF WAYPOINTS

1.- TYPE OF ELEMENT: P (POINT)	2.- LATITUDE	3.- LONGITUDE

Range of available dates

From 01/06/2011 to present

Range of available areas

European airspace

Approximate Size

As a reference each AIRAC cycle is around 12MB.

Delivery procedure (Database, fileset,etc…)

Raw data: Text plain files. ('.cfg', '.cos', '.ncap', '.spc', '.gsl/sls', '.gar/are').

Use cases Exploit

This source gives a description of the organization that the airspace has on a certain instant, so probably would be interesting for all use cases. To join this data with the rest of sources there is always the time dimension that in addition with the IDs (names) of the sectors and configurations can be crossed with any other source with sectors.

For three flow management scenarios (FM01, FM02 and FM03), Airspace Environment Datasets are essential not only for the modeling but also for the test/use phase.

2.4 Network Management datasources

This category covers the data sources that contain Network Management (also known as Flow Management) information, meaning this the regulations put in place to ensure a proper Demand Capacity balance in a tactical way. There is a single source considered: CFMU, coming from the Network Management organization (Eurocontrol), thus covering European airspace. CFMU is the former name of the current Network Manager, and within datAcron this source is referred as CFMU.

a.CFMU

Brief explanation

This data source provides a list of flights and regulations that the network manager can apply to them. The source is separated in two tables, one for flights and other for regulations. When a flight has a regulation, the code of the regulation applied is provided on the row. When a regulation is applied to a flight, a CTOT is set for the flight and a delay over this time without a window [-15; +5] minutes is recorded.

Metadata

None.

Data curation

Not required.

Field description

Regulations

Structured data

Ítem	Description
dateReference	Date of reference
RegulationStart	Start time of the regulation
RegulationId	Regulation ID
TrafficVolumeSet	Set where the traffic volume belongs.
ReferenceLocation	A code used in the Central Flow Management Unit (CFMU) Air Traffic Flow and Capacity Management (ATFCM) systems to describe one or more aerodromes, an Air Traffic Control (ATC) waypoint or an entire ATC sector.
ReferenceLocationType	Type of the regulation location (AD - Aerodrome, AS - Airspace)
TrafficVolume	Volume where the regulation has been applied.
RegulationEnd	End time of the regulation
RegulationActivity	Regulation Activity
RegulationCancelTime	Regulation Cancel time (if it exists)
RegulationDuration	Regulation duration [Minutes]
AiracCycle	Airac cycle Id
RegulationCategory	Regulation Category
RegulationReasonCode	Regulation Reason •C: ATC capacity •I: ATC industrial action •R: ATC routeing •S: ATC staffin •T: ATC equipment •A: Accident / incident •G: Aerodrome capacity •D: De-Icing

	•E: Equipment NON-ATC •N: Industrial action NON-ATC •M: Airspace management •P: Special event •W: Weather •V: Environmental issue like noise •O: Other •81: ATC restriction en-route or capacity •82: ATC restriction due to staff shortage or equipment failure en-route •83: ATC restriction at destination •84: ATC restriction due to weather at destination •85: Mandatory security •86: Immigration, Customs, Health •87: Airport Facilities, parking stands, ramp congestion, buildings, gate limitations, … •88: Restrictions at airport of destination, airport/runway closed due obstruction, industrial action, staff shortage, political unrest, noise abatement, night curfew, special flights, … •89: Restrictions at airport of departure, airport/runway closed due obstruction, industrial action, staff shortage, political unrest, noise abatement, night curfew, special flights, start-up and pushback, … •73: Weather en route and alternate
RegulationDescription	Regulation Description (optional)

Table 9: CFMU data

Flights

Structured data

Ítem	Description
LOBT	Local on board time
FlightUID	Flight unique ID
ADEP	Aerodrome of departure
ADES	Aerodrome of destination
EFTimeOfEntry	Estimated First Time Of Entry of the flight in the FPM (Date)
AFTimeOfEntry	Actual First Time Of Entry of the flight in the FPM
AiracCycle	Id of the Airac cycle
AircraftId	Call sign
AircraftType	Aircraft type (i.e. A320)
ATOT	Actual Take Off Time
CTOT	Calculated Take Off Time
ETOT	Estimated Take Off Time
IOBT	Initial Off Block Time
TaxiTime	Time of taxi from the stand to the take-off position.
ATA	Actual Time of Arrival
CTA	Calculated Time of Arrival
ETA	Estimated Time of Arrival

mostPenalizingRegulationId	Most penalizing regulation that the flight has suffered.
mostPenalReguATO	ATO of the most penalizing regulation that the flight has suffered.
mostPenalReguEtO	ETO of the most penalizing regulation that the flight has suffered.
RegulationsCount	Number of regulations that the flight has suffered
ATFDelay	Delay assigned to the flight.

Table 10: Fields description in CFMU datasource

Range of available dates

CFMU data is available for from 2013 till 2016 (complete years).

Range of available areas

The European airspace regulations.

Approximate Size

On structured version, one year of information is around the 70 MB on compressed files.

Delivery procedure

Structured version could be provided by web services, database direct connection or CSV files.

Use cases Exploit

CFMU regulations are used in any use case involving regulated traffic. It implies that this data source is fundamental in the first flow management scenario "Regulation detection and prediction", where CFMU data is used as an input in the modeling and predicted in the test/use phase To join this source with another one, the time and the traffic volume applying the regulation should be the main key columns.

2.5 Synthetic trajectories datasources

This category contains a single datasource, being the one related to the trajectories that are not actual but generated using specific tools.

a. Synthetic Trajectories

Brief explanation

This data source represents trajectories generated by a Trajectory Predictor (TP). A TP is a software/routine that is included in any software or tool that needs to forecast the future state of the aircraft to perform its tasks. Examples of these tools are flight planning tools (assist the airline to optimize the flight operations), flight data processing tool (assist air traffic controllers to ensure the safe separation, optimal handover of the flights and visualize potential conflicts), conflict detection and resolution tools (assist users to detect potential conflicts among aircraft and possible alternatives to avoid them), arrival managers (assist users to perform sequencing and scheduling of the arrival flow), flight management system (creates the reference path that the aircraft control system will try to attain), etc. Depending on the particular application that the TP serves, the level of detail (i.e., number of variables and number of aircraft states) that needs to be included in the aircraft state may vary. All these tools need certain aspects of the aircraft state depending on the particular application. For instance, an arrival manager might just need the time at the threshold for performing the scheduling and runway assignment tasks, therefore the trajectory generated by its TP could just include one single state containing the predicted variable time at the runway threshold. The trajectory generated by flight management system (FMS) contains multiple aircraft states (e.g., an aircraft state at least each 30 seconds) and each state multiple variables, such as latitude, longitude, altitude, time, calibrated airspeed or mass. These variables are used by other FMS subsystems to generate guidance modes, or monitor the aircraft performances.

The format of a synthetic trajectory depends on the particular TP model and software design and implementation of that model.

datAcron source of synthetic trajectories messages is a stand-alone model-based TP engine developed by BR&T-E (BRTE TPE) to generate trajectories for a set of given input information (flight plan, weather, aircraft model, operational context). For a given particular flight, BRTE TPE can be used to generate different alternative synthetic trajectories representing all the possible conditions that the flight may encounter of for what if analysis. Under the aviation use case, BRTE TPE is used to generate reference synthetic trajectories that will serve as benchmark.

In datAcron we provide the format generated by a stand-alone TP engine developed by BR&T-E (BRTE TPE) to generate trajectories.

Metadata

N/A

Fields description

The trajectory output format is an XML file containing several fields associated to the aircraft which is represented in the trajectory (**trio:aircraft_identifier_information**) and the trajectory itself (**op_solver:trajectory**). Within the trajectory field, there are several sub-elements which link the input information (intent information) with trajectory states, a reference time and a sequence of aircraft states containing a certain set of variables. The following table describes each of these fields and subfields. Under the column XO, it is indicated if this element would be always included (X) or is optional (O) depending on the requisites over the synthetic trajectories (certain fields or subfields can be removed from the output trajectory to reduce size)

AII - aircraft_identifier_information

TR – Trajectory

AS – Aircraft State

Those variables which description is "-" are internal BRTE TPE variables and they don't need to be processed. They have a physical meaning but out of the scope of the project. They can be removed if needed, together with optional variables to reduce file size.

Units column indicates the possible units associated to the variable., as well as the expected string

Field	Subfield	Name	Description	Units	Value	XO
All		aircraft_id	Unique identifier for the aircraft which trajectory is included	N/A	String	X
All		flight_number	Unique identifier for the flight for a particular time and date given by the airline			O
All		beacon_code	N/A	N/A	N/A	N/A
All		APM_id	Aircraft performance model used for the calculation of the trajectory by the TP	N/A	String	X
TR		UTC_time	Reference time from where the aircraft state time is measured from		date="AAAMMDD" time="HH:MM:SS" timezone="Continent/City"	X
TR		op_begin	TP internal debug information	N/A		N/A
TR		flight_phase	TP internal debug information	N/A		N/A
TR		active_effects	TP internal debug information	N/A		N/A
TR		active_triggers	TP internal debug information	N/A		N/A
TR	cost	Flight_cost	Kg of fuel consumed by this flight for the portion of trajectory represented in the file	Kilograms; pounds [kg/lb]		o
TR	Op_states	Size	Number of aircraft states in the trajectory	N/A	double	X
TR	state	position	Position of the state in the		double	X

			trajectory			
TR	state	t	Time: Number of seconts with respect to the date/time in the variable UTC_time field	Seconds [sec]	double	X
TR	state	lambda	longitude	Radians/degrees [rad/deg]	double	X
		phi	latitude	radians/degrees[rad/deg]	double	X
		h	height	Meters/feet [m/ft]	double	o
		Hp	Pressure altitude	Meters/feet [m/ft]	double	X
		Hi	Indicated pressure altitude	Meters/feet [m/ft]	double	o
		H	-		double	o
		d	distance	Meters/nautical miles [m/nm]	double	o
		m	mass	Kilograms/pounds [kg/lb]	double	o
		ththeta	-		double	o
		M	Mach number	Adimensional [adim]	double	o
		tas	True airspeed	Meters per second/knots [mps/kt]	double	o
		cas	Calibrated airspeed	Meters per second/knots [mps/kt]	double	o
		eas	-		double	o
		c	-		double	
		vg	Ground speed	Meters per second/knots [mps/kt]	double	o
		chi	True bearing	radians/degrees[rad/deg]	double	o
		chimag	Magnetic bearing	radians/degrees[rad/deg]	double	o
		gamma	Geometric/absolute Path angle	radians/degrees[rad/deg]	double	o
		chiTAS	True Heading	radians/degrees[rad/deg]	double	o
		chiTASmag	Magnetic Heading	radians/degrees[rad/deg]	double	o
		gammaTAS	Aerodynamic path angle	radians/degrees[rad/deg]	double	o
		muTAS	Aerodynamic bank angle	radians/degrees[rad/deg]	double	o
		gammapre	-		double	
		gammaTASpre	-			
		gammaind	-			
		gammaTASind	-			
		cl	-			

		cd	-			
		ct	-			
		cf	-			
		lift	-			
		drag	-			
		fuel_rate	-			
		deltaHL	-			
		deltaLG	-			
		deltaSB	-			
		esf	-			
		af	-			
		T	-			
		p	-			
		rho	-			
		dHp_dt	Rate of climb	Meters per second/feet per minute [mps/fpm]	double	o
		dh_dt	-			
		dHi_dt	-			
		DH_dt	-			
		Wind_llsi	North component of the wind at the aircraft position and time as obtained from the weather model used for the trajectory generation	Meters per second/knots [mps/kt]	double	o
		Wind_llsii	East component	Meters per second/knots [mps/kt]	double	o
		wind_llsiii	Down component	Meters per second/knots [mps/kt]	double	o
		t_eff_long1	-			
		t_eff_long2	-			
		t_eff_lat	-			
		t_eff_hl	-			
		t_eff_sb	-			
		t_eff_lg	-			
		t_eff_mode	-			

Table 11: Fields description in Synthetic Trajectories

Range of available dates

Synthetic trajectory data is available under demand for the particular scenario that is going to be studied. In principle, the range of available dates should coincide with the range of available flight plans and surveillance. Problems in the trajectory generation algorithms could make difficult to reproduce or forecast the trajectory of certain flights, therefore for some flights might be difficult to generate the alternative trajectory (e.g., optimal trajectory based on the flight plan, ATC constraint-free trajectory, or what if trajectory). Ideally, for a particular data set of flight plans and/or corresponding surveillance data, should be a set containing *n* synthetic trajectories per flight, where *n* is driven by the particular use case scenario that want to be studied.

Range of available areas

See above

Join procedure with other sources

The key field for linking this data with other sources is the **aircraft_id** which uniquely identifies an aircraft.

Other important field is **flight_number** which uniquely identifies a flight at a given time.

Approximate Size

One synthetic trajectory for one aircraft containing 300 aircraft states, each of them with 56 different variables would be around 1 MB (XML format; text file of near 20000 lines). This size can be easily reduced either by decreasing the number of variables and/or the sample rate (number of aircraft states)

Delivery procedure

Historical data: Files processed for specific time periods can be assembled and delivered through Internet or physical media (I.e. DVD).

Use cases Exploit

Synthetic trajectory data is be available under demand for the particular FP scenario

2.6 Aircraft Identification datasource

As in the previous case, this category contains a single dataset, very specific. It provides specific information on the aircraft flying a particular trajectory (thus enriching the information available in the general raw datasources).

a. Aircraft Identification

Brief explanation

This data source is used to know more details of the aircraft in known trajectory. In ADSB sources the aircraft is identified by ICAO 24-bit address or (informally) Mode-S "hex code". The ICAO 24-bit address can be represented in three digital formats: hexadecimal, octal, and binary and typically in ADSB sources are represented in hexadecimal. One of the most important data to obtain given the ICAO address is the model of the aircraft, or more specifically, the ICAO Type Designator, according to DOC 8643.

Metadata

A .csv file was be used to distribute the list of known aircrafts for datAcron.

Fields description

- icao character varying(6) - ICAO address in hexadecimal.
- regid character varying - Unique alphanumeric string issued by a National Aviation Authority to identify an aircraft.
- mdl character varying – Aircraft Type according to ICAO DOC 8643
- type character varying- Aircraft model
- operator character varying – last known operator

Range of available dates

The identification is available for most of the aircraft in the trajectories.

Join procedure with other sources

"icao" field matches "hex_ident" from ADSB data sources.

Approximate Size

About 25Mb.

Delivery procedure

The csv is stored in datAcron.

Use cases Exploit

In scenario FP02 for each trajectory the model (icao type designator) of the aircraft isadded as a minimum.

2.7 Flight Plan datasources

Flight Plan is an essential category as contains the information that triggers a lot of operational decision, both in planning and execution phase, and both on the Air Navigation Service Provision side, and in the Airline one.

Two sources of information are considered: Network manager and (again) DDR. They have similar information but each one of them may be preferable for different Aviation scenarios as described in the traceability matrix at the end of this document.

DDR datasources have embedded the radar data information mentioned in the Radar datasources section as contained in DDR.

a. Network Manager

Brief explanation

The Flight Plan is the specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.

Metadata

A xml file for every Flight Plan update for every flight is used to distribute Flight related information.

Field description

Every XML document received from the Eurocontrol Network Manager containing a Flight Plan follows the following structure:

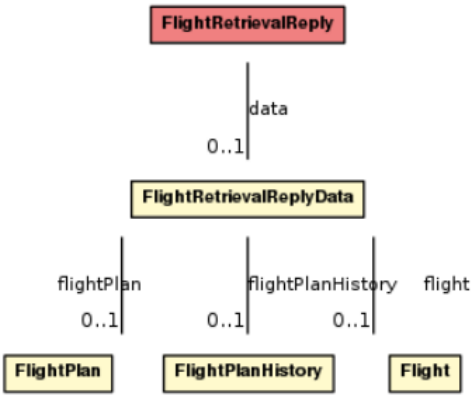

Figure 4: Flight Plan structure from the Network Manager

Where:

-**FlightPlan**: ICAO 4444 Flight Plan 2012 direct translation to XML format.

Detailed ICAO 4444 field explanation available at http://www.eurocontrol.int/sites/default/files/content/documents/nm/network-operations/HANDBOOK/ifps-users-manual-current.pdf

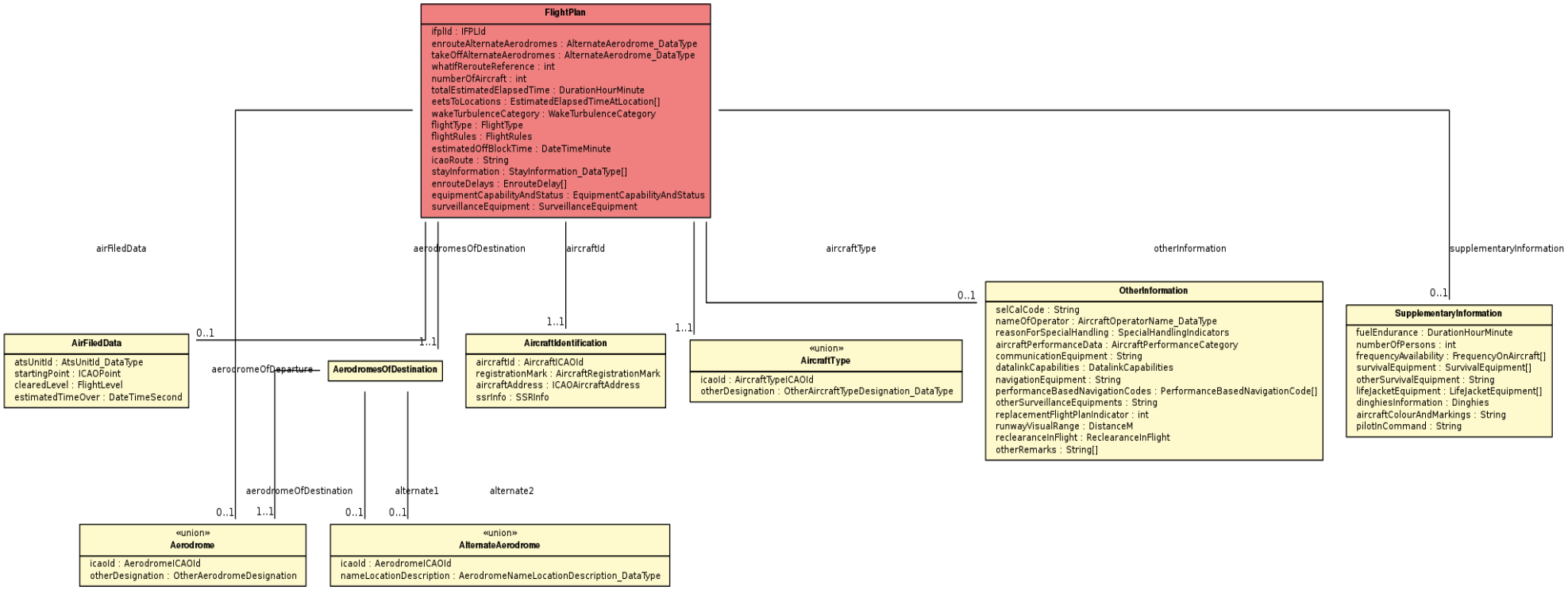

Figure 5: Network Manager Flight Plan

The FlightPlan fields are common to any Flight Plan filled on the world:

Field	Mandatory/Optional	Description
iFPLid	M	Unique, opaque identifier assigned by the NM system to a submitted flight plan.
airFiledData	O	Estimate data provided when the flight plan was filed airborne.
aerodromeOfDeparture	M	Aerodrome of departure.
aerodromesOfDestination	M	Aerodromes of destination, including the alternates.
enrouteAlternateAerodromes	O	Aerodromes where the aircraft may land in case of emergency along the route.
takeOffAlternateAerodromes	O	Aerodromes where the aircraft may land in case of emergency at take-off.
aircraftId	M	Information regarding the aircraft in this flight plan, i.e. the aircraft id but also other information like registration mark or SSR info.
whatIfRerouteReference	O	Indication of AO What-If rerouting reference in a flight plan.
numberOfAircraft	O	Number of aircraft in a formation flight. Optional: default is 1.
aircraftType	M	Aircraft type.
totalEstimatedElapsedTime	M	Total estimated elapsed flight time
eetsToLocations	O	Array of locations and the corresponding accumulated elapsed time to these locations.
wakeTurbulenceCategory	M	Wake turbulence category (heavy/light/medium).
flightType	M	Type of the flight, e.g. scheduled, not scheduled, etc.
flightRules	M	Indicates if the rules applicable to the flight are visual (FlightRules.VFR), instrumented (FlightRules.IFR) or visual and then instrumented (FlightRules.VFR_THEN_IFR) or vice versa (FlightRules.IFR_THEN_VFR).
estimatedOffBlockTime	M	Estimated off-block date/time.
icaoRoute	M	Represents the Flight Plan ICAO Route (Field15).
stayInformation	O	Information concerning the type of activity (training, photographic mission, etc) to be performed during the stay periods mentioned in the route of the flight. Item N in the array corresponds to the "STAY<N>" reference in the stay periods of the route, where N is in [1, 9].
enrouteDelays	O	Gives the list of delays or holdings planned at given points. Corresponds to the ICAO DLE/ field. Note that in the EUR region the usage of the STAY within the route description is preferred to the DLE. Constraint: Size must be comprised between 0 and ∞.

equipmentCapabilityAndStatus	M	Represents the capability and status of the equipment of the aircraft of the flight.
surveillanceEquipment	M	Surveillance equipment of the aircraft of the flight.
otherInformation	O	Any other flight data Items specified in the bilateral agreement. Refer to ICAO 4444 field type 18 (Other information).
supplementaryInformation	O	Supplementary flight data. Refer to ICAO 4444 field type 19 (Supplementary information).

Table 12: Fields description in Network Manager Flight Plan

-**Flight**: description of a flight from the Network Manager Point of view. Includes estimations before flight and during flight provided by Eurocontrol. Contains the following European specific fields:

Field	Mandatory/Optional	Description
flightId	M	FlightIdentificationOutput flightId IFPL id and flight keys associated to the flight. This attribute is always returned.
divertedAerodromeOfDestination	O	AerodromeICAOId divertedAerodromeOfDestination Diverted aerodrome of destination, if the flight was diverted. Null if the flight was not diverted.
aircraftType	O	ICAO id of the aircraft type.
readyEstimatedOffBlockTime	O	Last flight plan related estimated off-block time, but amended by NM OPS room or READY message (filing time).
cdmEstimatedOffBlockTime	O	Corresponds to the FTFM flight profile off-block time.
revisionTimes	O	Revision times, i.e. times to insert an aircraft in sequence and remove an aircraft from sequence at the aerodrome of departure.
estimatedTakeOffTime	O	Estimated take-off time: the take-off time corresponding to the FTFM flight profile, that is flow management estimated trajectory.
calculatedTakeOffTime	O	Calculated take-off time: the take-off time corresponding to the RTFM flight profile.
actualTakeOffTime	O	Estimated Actual take-off time: the take-off time corresponding to the CTFM flight profile. The corresponding estimated actual off-block time is the flight.
ctotShiftAlreadyAppliedByTower	O	Shift of calculated take-off time already applied by tower.
requestedFlightLevel	O	it represents the requested flight level applicable to a the portion or the compete flight route.
taxiTime	O	Taxi time for the FTFM profile.
currentlyUsedTaxiTime	O	Taxi time corresponding to the highest

		available TFM flight profile.
estimatedTimeOfArrival	O	Estimated time of arrival: time of arrival according to the FTFM flight profile.
calculatedTimeOfArrival	O	Calculated time of arrival: time of arrival according to the RTFM flight profile.
actualTimeOfArrival	O	Estimated Actual time of arrival: time of arrival according to the CTFM flight profile.
lateFiler	O	True if the status of the flight is "Late Filer".
lateUpdater	O	True if the status of the flight is "Late Updater".
suspensionStatus	O	Suspension status.
suspensionResponseBy	O	The time limit for the confirmation message (FCM) after the issuance of a flight suspension, if present for the flight.
famStatus	O	FAM (Flight Activation Monitoring) status.
readyStatus	O	Ready status.
aircraftOperator	O	Aircraft operator.
operatingAircraftOperator	O	Operating aircraft operator.
reroutingIndicator	O	Indicates if the flight was rerouted, why, and the resulting rerouting state.
newRouteMinShiftDelayImprovement	O	Minimum improvement needed (by reducing either the shift or the delay of the flight) to allow an Aircraft Operator What-If-Reroute. In the current implementation, this value is a system parameter: the returned value is always the same for all flights.
reroutable	O	Indicates if the flight is reroutable and under what conditions.
reroutingOpportunitiesExist	O	Indicates if there exist rerouting opportunities for this flight.
cdm	O	CDM (Collaborative Design Making) information. Mainly airport related information.
slotIssued	O	Indicates that the flight is in state slot-issued or was in that state prior to activation/termination.
slotImprovementProposal	O	Proposal for slot improvement.
timeAtReferenceLocationEntry	O	Indicates the entry time at the reference location.
timeAtReferenceLocationExit	O	Indicates the exit time at the reference location.
flightLevelAtReferenceLocationEntry	O	Indicates the entry time at the reference location.
flightLevelAtReferenceLocationExit	O	Indicates the exit time at the reference location.
trendAtReferenceLocationEntry	O	Flight trend at the entry point of the location, i.e. cruising, climbing or descending.

trendAtReferenceLocationExit	O	Flight trend at the exit point of the location, i.e. cruising, climbing or descending.
trendAtReferenceLocationMiddle	O	Flight trend at the middle point of the location, i.e cruising, climbing or descending.
exemptedFromRegulations	O	True if the flight is exempted from regulations.
delay	O	Delay applying to this flight (calculated take-off time minus estimated take-off time).
delayCharacteristics	O	Identifies the characteristics of the delay value associated to the flight.
mostPenalisingRegulation	O	Most penalising regulation impacting this flight.
hasOtherRegulations	O	Indicates if this flight is impacted by other regulations than the most penalizing one.
regulationLocations	O	Locations of the regulations impacting this flight.Constraint: Size must be comprised between 0 and ∞.
atfcmMeasureLocations	O	Locations of the ATFCM measures impacting this flight.Constraint: Size must be comprised between 0 and ∞.
lastATFMMessageType	O	Indicates the type of the last exchanged ATFM message.
lastATFMMessageReceivedOrSent	O	Indicates whether the last ATFM message was received or sent by NM.
runwayVisualRange	O	Minimum visible range in meters for a flight to land. Must be in [0, 999].
confirmedCTFM	O	Describes the distance on the CTFM (Current Tactical Flight Model) route that has been confirmed by CPR's.
exclusionFromRegulations	O	Quantitative information regarding the regulations from which this flight is possibly excluded.
requestedInitialFlightLevel	O	The first flight level requested for this flight after departure.
requestedInitialSpeed	O	The first true airspeed requested for this flight after departure.
estimatedElapsedTime	O	Estimated elapsed time.
filingRule	O	Filing rule.
flightPlanOriginator	O	Originator of the flight plan.
icaoRoute	O	Complete ICAO field 15 information comprising of initial requested speed and flight level and route. Contains corrected flight plan route information sent from NM to addressees outside NM. Note that the route is not always available, e.g. for flights that are full VFR.
routeLength	O	Length of the route.
reroutingReference	O	Rerouting reference (if any).
defaultReroutingRequestedFlightLevel	O	When rerouting, suggested flight level

		to be used for generating an alternate route.
defaultReroutingRequestedSpeed	O	When rerouting, suggested air speed to be used for generating an alternate route.
departureTolerance	O	Departure tolerance.
mostPenalisingRegulationCause	O	Cause of the most penalizing regulation impacting this flight.
lastATFMMessageOriginator	O	If the last ATFM message exchanged was received by NM, indicates its originator.
ftfmPointProfile	O	FTFM (Filed Tactical Flight Model) point profile. The FTFM flight profile corresponds to the trafficType DEMAND. So in the operational dataset, it reflects the latest AO flightplan: i.e. the latest filed flightplan but updated (shifted) with the latest CDM related info and READY messages or amended by NM OPS room.Constraint: Size must be comprised between 0 and ∞.
rtfmPointProfile	O	RTFM (Regulated Tactical Flight Model) point profile.Constraint: Size must be comprised between 0 and ∞.
ctfmPointProfile	O	CTFM (Current Tactical Flight Model) point profile.If a flight has an CTFM, then it is the CTFM flight profile that is used for trafficType LOAD. Typically a flight has a CTFM point profile once it is off-block. However if the flight is involved in airport CDM, then the flight can have a CTFM point profile even if its CTFM off-block time is still relatively far in the future (e.g. 40 minutes) due to T-DPI-s. Constraint: Size must be comprised between 0 and ∞.
ftfmAirspaceProfile	O	FTFM airspace profile. Constraint: Size must be comprised between 0 and ∞.
rtfmAirspaceProfile	O	RTFM airspace profile. Constraint: Size must be comprised between 0 and ∞.
ctfmAirspaceProfile	O	CTFM airspace profile. Constraint: Size must be comprised between 0 and ∞.
ftfmRequestedFlightLevels	O	FTFM requested flight levels. Constraint: Size must be comprised between 0 and ∞.
rtfmRequestedFlightLevels	O	RTFM requested flight levels. Constraint: Size must be comprised between 0 and ∞.
ctfmRequestedFlightLevels	O	CTFM requested flight levels. Constraint: Size must be comprised

		between 0 and ∞.
flightHistory	O	Ordered (time) list of events that make up the flight history. Constraint: Size must be comprised between 0 and ∞.
operationalLog	O	Ordered (time) list of entries that make up the flight operational log. Constraint: Size must be comprised between 0 and ∞.
equipmentCapabilityAndStatus	O	Indicates the radio communication, navigation and approach aid equipment and capabilities of an aircraft.
ftfmRestrictionProfile	O	FTFM restriction profile. Constraint: Size must be comprised between 0 and ∞.
rtfmRestrictionProfile	O	RTFM restriction profile. Constraint: Size must be comprised between 0 and ∞.
ctfmRestrictionProfile	O	CTFM restriction profile. Constraint: Size must be comprised between 0 and ∞.
cfmuFlightType	O	Indicates state and/or origin of the flight in the NM system.
ccamsSSRCode	O	SSR code as assigned by CCAMS.
filedRegistrationMark	O	Aircraft registration mark as it was filed via flight plan messages.
isProposalFlight	O	Indicates if this flight is a proposal flight or not.
proposalExists	O	Indicates if a proposal flight exists or not.
hasBeenForced	O	Indicates if for this flights, the delay is or has been forced.
caughtInHotspots	O	Indicates this flight in how many hotspots has been caught.
hotspots	O	Locations of all hotspots that are impacting this flight.
mcdmInfo	O	Measure Collaborative Decision Making Info associated with to this flight: the most relevant M-CDM measure and its M-CDM state and indications if other M-CDM measures are impacting the flight.
worstLoadStateAtReferenceLocation	O	Indicates what is the worst monitored (entry or OTMV) load state in which this flight is involved.
ctotLimitReason	O	Possible exceptional reasons that may affect the CTOT allocation of a flight.
profileValidity	O	Contains data relating to the validity of the RTFM, or else the FTFM with respect to Flight Plan violation errors.
targetTimeOverFix	O	The target time over the relevant flight profile point for the most penalizing regulation of the flight and the actual

		time over (according to the CTFM point profile)
flightState	O	Flight state.
lastKnownPosition	O	Last known position of the aircraft expressed as geo-location, flight level and time over. It corresponds to either the last Correlated Position Report (CPR) or last Aircraft Position Report (APR) received by the ETFMS system. IMPORTANT: this field is updated ONLY in the following circumstances: • When any airborne report deviates significantly from the computed Current Tactical Flight Model (CTFM) profile and therefore the CTFM is recomputed (in this case the lastKnownPosition corresponds to the latest CPR or APR received); • When a CPR does not deviate significantly from the computed CTFM profile but the CTFM was not updated during the 10 minutes prior to the reception of the CPR.

Table 13: Flight description in Network Manager Flight Plan

-**FlightPlanHistory**: historical information containing the evolution of the Flight Plan.

Contains the following fields:

Field	Mandatory/Optional	Description
timeStamp	O	Date and time of the checkpoint logging.

<table>
<tr><td>checkPoint</td><td>O</td><td>
<table>
<tr><th>Checkpoint</th><th>Abbreviation</th><th>Possible mode</th><th>Description of the corresponding action</th></tr>
<tr><td>FUM Update</td><td>FU</td><td>A</td><td>NM Internal message.</td></tr>
<tr><td>Reprocess Suspended</td><td>RS</td><td>A, O</td><td>A flight plan is suspended by the automatic revalidation or by an operator.</td></tr>
<tr><td>Reprocess Advisory</td><td>RA</td><td>A</td><td>A flight plan is revalidated and has been invalidated in status REVAL_ADVISORY</td></tr>
<tr><td>Reprocess Compliant</td><td>RC</td><td>A</td><td>A flight plan becomes compliant as a result of automatic revalidation.</td></tr>
<tr><td>Force Compliant</td><td>FC</td><td>O</td><td>A flight plan is forced to the NORMAL (compliant) state by an operator action.</td></tr>
<tr><td>Create</td><td>CR</td><td>A,M,S</td><td>A message is successfully processed, and an flight plan is created.</td></tr>
<tr><td>Update</td><td>UP</td><td>A,M,S</td><td>A message is successfully processed, and the associated flight plan is updated.</td></tr>
<tr><td>Backup</td><td>BU</td><td>A,M,S</td><td>A message is received at the back-up IFPU.</td></tr>
<tr><td>Duplicate</td><td>DU</td><td>A</td><td>Exactly the same message was already received.</td></tr>
<tr><td>Invalid</td><td>IN</td><td>A,M</td><td>A message is processed and is invalid. It is passed to manual processing.</td></tr>
<tr><td>Reject</td><td>RE</td><td>A,M,S,O</td><td>A message is rejected.</td></tr>
<tr><td>Close FPD</td><td>CL</td><td>A,M,S,O</td><td>The flight plan is closed.</td></tr>
<tr><td>Multiple</td><td>MU</td><td>M</td><td>An invalid message contains more than one flight plan.</td></tr>
<tr><td>Delete Message</td><td>DE</td><td>O</td><td>An operator has deleted an invalid message.</td></tr>
<tr><td>Refer</td><td>RF</td><td>O</td><td>NM Internal event.</td></tr>
<tr><td>Escape</td><td>ES</td><td>O</td><td>NM Internal event.</td></tr>
<tr><td>Manual Transmit</td><td>MT</td><td>O</td><td>An operator has manually requested the transmission of a message.</td></tr>
<tr><td>Transmit</td><td>TO</td><td>A</td><td>Successful transmission of a message.</td></tr>
<tr><td>Transmit Fail</td><td>TF</td><td>A</td><td>Failed transmission of a message.</td></tr>
<tr><td>Edit</td><td>ED</td><td>O</td><td>Flight plan editor opened by an operator on an invalid message.</td></tr>
<tr><td>Associate</td><td>AS</td><td>O</td><td>Manual association done by an operator</td></tr>
<tr><td>Discard</td><td>DI</td><td>A</td><td>The processing of the message failed</td></tr>
</table>
</td></tr>
<tr><td>mode</td><td>O</td><td>
<table>
<tr><th>Mode</th><th>Abbreviation</th><th>Description</th></tr>
<tr><td>Auto</td><td>A</td><td>The checkpoint logged in Auto mode corresponds to an automatic action.</td></tr>
<tr><td>Man</td><td>M</td><td>The checkpoint logged in Man mode corresponds to an action performed by an NM operator when correcting an invalid flight plan.</td></tr>
<tr><td>Semi_Auto</td><td>S</td><td>The checkpoint logged in Semi_Auto mode corresponds to an action performed by an NM operator in the context of semi-automatic processing of invalid messages in the invalid group window after the correction of an initial message.</td></tr>
</table>
</td></tr>
<tr><td>msgIn</td><td>O</td><td>The ICAO 4444 type (FPL, CHG, …) of the received or processed message.</td></tr>
<tr><td>msgOut</td><td></td><td>The ICAO 4444 type of the transmitted message.</td></tr>
<tr><td>addresses</td><td>O</td><td>The address of the originator if msgIn; Addresses to which the msgOut is transmitted.
Constraint: Size must be comprised between 0 and ∞.</td></tr>
<tr><td>detail</td><td></td><td>The text of the message concerned by the action.</td></tr>
</table>

Table 14: Flight Plan History in Network Manager Flight Plan

b. DDR

Brief explanation

The Demand Data Repository (DDR) provides ATM actors with the best accurate picture of the pan-European air traffic demand, past and future, and supports the Network Operations Planning process. DDR produces future traffic samples, mainly using historical traffic samples adjusted with STATFOR forecast data and the FIPS (Flight Increase Process) and also collects early available flight intentions from airlines (SSIM/INNOVATA data) and from coordinated airports through the European Union Airport Coordinators Association (EUACA). Collected flight intentions are used to enrich historical traffic demand and to improve the accuracy of traffic demand forecasts.

The DDR service relies on the following 4 components:

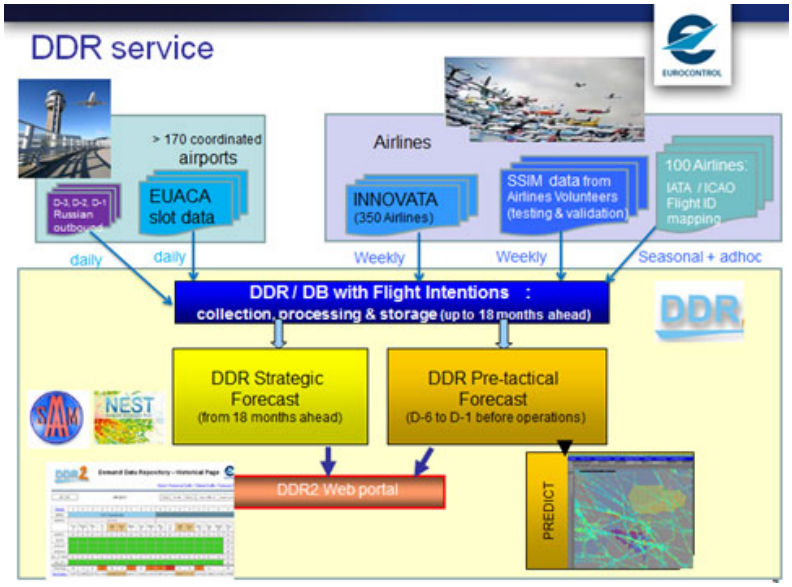

Figure 6: DDR service

- **DDR DB with flight intentions:** collected from Airlines and Airports, flight intentions are processed, stored and distributed to internal NM subscribers systems.
- **Strategic traffic forecast:** generate consolidated and enriched traffic forecasts, possibly with calculated 4D trajectories, from 18 months ahead with collected DDR intentions.
- **Pre-tactical traffic forecast:** forecast traffic demand over the next 6 days before operations, using historical data enriched with DDR collected flight intentions and the forecast NAT tracks. Pre-tactical traffic Demand is accessible by users from the NM (Network Manager) PREDICT HMI and from the DDR2 Web portal.
- **DDR2 Web portal** allowing authorized users to access and download generated traffic demand from strategic and pre-tactical components along with past Airline Trajectories.

Thus, the DDR service supports efficient network operations planning. It also provides a refined analysis of past demand, which have been validated from a network perspective and which therefore provide a comprehensive and consistent view of the traffic demand and use enhanced traffic demand files for operations planning, airspace design or post-operations analysis

The DDR provides pan-European air traffic forecasts, covering the time period from several years ahead till the day before operations. It also provides a refined analysis of past demand to facilitate post-operations analysis and identify best practices for future operations. DDR also contributes to flight efficiency for airline users by visualizing and comparing flight plan trajectories for any past period, providing opportunities for flight planning improvement.

Summarizing, the DDR2 web application supports the generation and the download of:

- **Historical 4D Trajectory SAAM traffic files (built on EUROCONTROL NM data**),
- Forecasted 4D Trajectory traffic files (built on SAAM Environment dataset files, based on flight intentions and STATFOR/FIPS dataset files),
- **Environment** and Forecast (STATFOR**) DataSet**,
- And the download of the NEST and SAAM associated software tools
- Forecasted 4D Trajectory files are generated during the pre-tactical planning (PREDICT) for D6 to D1

Flight plans from DDR

In spite of the existence of all of those capabilities, in this section we will be focused on the **historical traffic data stored in ALLFT+, which contains the flight plans information**.

Metadata

This data source has no metadata information.

Fields detailed description (row data)

Files format

The format of the files is plain text, where each line contains all information of a single flight. The fields per flights are defined in next section.

File fields (per flight)

id	field description
	Group 1. GENERAL
1	departureAerodromeIcaoId
2	arrivalAerodromeIcaoId
3	aircraftId
4	aircraftOperatorIcaoId
5	aircraftTypeIcaoId : AircraftTypeIcaoId
6	aobt : DateAndHms (YYYYMMDDHHMMSS)
7	ifpsId : IfpsId
8	iobt : DateAndHms (YYYYMMDDHHMMSS)
9	OriginalFlightDataQuality
10	FlightDataQuality flightDataQuality
11	Source
12	ExemptionReasonType
13	ExemptionReasonDistance
14	LateFiler: YesNo. Indicating whether the originator of the flight plan FILED he latter less than x minutes before EOBT
15	LateUpdater : YesNo. Indicating whether the originator of the flight planupdated he latter less than x minutes before EOBT
16	NorthAtlanticFlight : YesNo
17	cobt : DateAndHms (YYYYMMDDHHMMSS)
18	eobt : DateAndHms (YYYYMMDDHHMMSS)
19	lobt : DateAndHms (YYYYMMDDHHMMSS)
20	FlightState: Final status on activation
21	PreviousToActivationFlightState: before activation FlightState
22	SuspensionStatus: Qualifies the event for the reason for flight Suspension e: SM slot missed
23	Unique identifier associated to a flight
24	samCtot : DateAndHms (YYYYMMDDHHMMSS)
25	Slot Allocation Message : Yes or No

26	sipCtot : DateAndHms (YYYYMMDDHHMMSS)
27	Slot Improvement Proposal Message
28	Slot Forced Y/N
29	MostPenalizingRegulationId
30	No. of regulations affecting
31	No. of regulations Excluded
32	lastReceivedAtfmMessageTitle
33	lastReceivedMessageTitle
34	lastSentAtfmMessageTitle
35	ManualExemptionReason
36	SensitiveFlight: YesNo
37	ReadyForImprovement : YesNo
38	ReadyToDepart : YesNo
39	Revised Taxi Time: Amount of time expressed in seconds
40	Time to Insert in Sequence
41	Time to Remove from Sequence
42	ToBeSentSlotMessageTitle
43	toBeSentProposalMessageTitle
44	lastSentSlotMessageTitle
45	lastSentProposalMessageTitle
46	lastSentSlotMessage : DateAndHms (YYYYMMDDHHMMSS)
47	lastSentProposalMessage : DateAndHms (YYYYMMDDHHMMSS)
48	flightCountOption : Indicates which flight plan should be / has been used when doing flight/count. Normal/Proposal
49	NormalFlightTactId : TactId
50	ProposalFlightTactId : TactId
51	OperatingAircraftOperatorI
52	ReroutingWhy : ReroutingWhy
53	ReroutedFlightState
54	RunwayVisualRange
55	NumberIFPSIgnoredErrors: Describes the number of errors that are ignored by the IFPS operator on the FTFM
56	ArcAddrSource : ArcAddrSource
57	ArcAddr : HexDigit, The address attribute contains the 24 bit ICAO aircraft address of the flight.
58	IfpsRegistrationMark : RegistrationMark
59	flightType : Indicates the type of flight set
60	AircraftEquipment
	Group 2. CDM
61	cdmStatus : Collaboratice Decision Making status
62	cdmEarlyTtot : DateAndHms (YYYYMMDDHHMMSS)
63	cdmAoTtot : DateAndHms (YYYYMMDDHHMMSS)
64	cdmAtcTtot : DateAndHms (YYYYMMDDHHMMSS)
65	cdmSequencedTtot : DateAndHms (YYYYMMDDHHMMSS)
66	cdmTaxiTime : TimeElapsedMmmmSs
67	cdmOffBlockTimeDiscrepancy : StatusYesNo
68	cdmDepartureProcedureId : DepartureProcedureIcaoId
69	cdmAircraftTypeId : CdmAircraftType
70	cdmRegistrationMark : CdmRegistrationMark
71	cdmNoSlotBefore : DateAndHms (YYYYMMDDHHMMSS)
72	cdmDepartureStatus : DepartureStatus
	Group 3. FTFM (M1- Filed traffic flight model)
	3.1. General
73	ftfmEetFirNrOfInstances : NrOfInstances

74	ftfmEetFirList : AllFtEetFir[0..ftfmEetFirNrOfInstances]
75	ftfmEetPtNrOfInstances : NrOfInstances
76	ftfmEetPtList : AllFtEetPt[0..ftfmEetPtNrOfInstances]
77	ftfmAiracCycleReleaseNumber : AiracCycleReleaseNumber
78	ftfmEnvBaselineNumber : EnvBaselineNumber
79	ftfmDepartureRunway : RunwayDirection
80	ftfmArrivalRunway : RunwayDirection
	3.2 Required Flight level and speed
81	ftfmReqFlightlevelSpeedNrOfInstances : NrOfInstances
82	ftfmReqFlightlevelSpeedList : ReqFlightLevelSpeed[0 .. ftfmReqFlightlevelSpeedNrOfInstances]
	3.3 Consumed Fuel
83	ftfmConsumedFuel : ConsumedFuel
	3.4 Route Charges
84	ftfmRouteCharges : RouteCharges
	3.5 Points profile
85	ftfmAllFtPointNrOfInstances : NrOfInstances
86	ftfmAllFtPointProfile : AllFtPointProfile[0 .. ftfmAllFtPointProfileNrOfInstances]
	3.6 Airspace Profile
87	ftfmAllFtAirspaceNrOfInstances : NrOfInstances
88	ftfmAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. ftfmAllFtAirspaceProfileNrOfInstances]
	3.7 Circle Intersections
89	ftfmAllFtCircleIntersectionsNrOfInstances : NrOfInstances
90	ftfmAllFtCircleIntersections : AllFtAirspaceProfile[0 .. ftfmAllFtAirspaceProfileNrOfInstances]
	Group 4. RTFM (M2-Regulated traffic flight model)
	4. 1 General
91	rtfmAiracCycleReleaseNumber : AiracCycleReleaseNumber
92	rtfmEnvBaselineNumber : EnvBaselineNumber
93	rtfmDepartureRunway : RunwayDirection
94	rtfmArrivalRunway : RunwayDirection
	4.2 Required Flight level and speed
95	rtfmReqFlightlevelSpeedNrOfInstances : NrOfInstances
96	rtfmReqFlightlevelSpeedList : ReqFlightLevelSpeed[0 .. rtfmReqFlightlevelSpeedNrOfInstances]
	4.3 Consumed Fuel
97	rtfmConsumedFuel : ConsumedFuel
	4.4 Route Charges
98	rtfmRouteCharges : RouteCharges
	4.5 Points profile
99	rtfmAllFtPointNrOfInstances : NrOfInstances
100	rtfmAllFtPointProfile : AllFtPointProfile[0 .. rtfmAllFtPointProfileNrOfInstances]
	4.6 Airspace Profile
101	rtfmAllFtAirspaceNrOfInstances : NrOfInstances
102	rtfmAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. rtfmAllFtAirspaceProfileNrOfInstances]
	4.7 Circle Intersections
103	rtfmAllFtCircleIntersectionsNrOfInstances : NrOfInstances
104	rtfmAllFtCircleIntersections : AllFtAirspaceProfile[0 .. rtfmAllFtCircleIntersectionsNrOfInstances]
	Group 5. CTFM (M3 – Computed traffic flight model)
	5. 1 General
105	ctfmAiracCycleReleaseNumber : AiracCycleReleaseNumber
106	ctfmEnvBaselineNumber : EnvBaselineNumber
107	ctfmDepartureRunway : RunwayDirection
108	ctfmArrivalRunway : RunwayDirection
	5.2 Required Flight level and speed
109	ctfmReqFlightlevelSpeedNrOfInstances : NrOfInstances

110	ctfmReqFlightlevelSpeedList : ReqFlightLevelSpeed [0 .. ctfmReqFlightlevelSpeedNrOfInstances]
	5.3 Consumed Fuel
111	ctfmConsumedFuel : ConsumedFuel
	5.4 Route Charges
112	ctfmRouteCharges : RouteCharges
	5.5 Points profile
113	ctfmAllFtPointNrOfInstances : NrOfInstances
114	ctfmAllFtPointProfile : AllFtPointProfile[0 .. ctfmAllFtPointProfileNrOfInstances]
	5.6 Airspace Profile
115	ctfmAllFtAirspaceNrOfInstances : NrOfInstances
116	ctfmAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. ctfmAllFtAirspaceProfileNrOfInstances]
	5.7 Circle Intersections
117	ctfmAllFtCircleIntersectionsNrOfInstances : NrOfInstances
118	ctfmAllFtCircleIntersections : AllFtAirspaceProfile[0 .. ctfmAllFtCircleIntersectionsNrOfInstances]
	Group 6. Other
	6.1 no CPGCPF Reason
119	noCPGCPFReason : NonEligibleReason
	6.2 scr
120	scrObt : DateAndHms (YYYYMMDDHHMMSS)
121	scrConsumedFuel : ConsumedFuel
122	scrRouteCharges : RouteCharges
123	scrAllFtPointNrOfInstances : NrOfInstances
124	scrAllFtPointProfile : AllFtPointProfile[0 .. scrAllFtPointProfileNrOfInstances]
125	scrAllFtAirspaceNrOfInstances : NrOfInstances
126	scrAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. scrAllFtAirspaceProfileNrOfInstances]
127	scrAllFtCircleIntersectionsNrOfInstances : NrOfInstances
128	scrAllFtCircleIntersections : AllFtAirspaceProfile[0 .. scrAllFtCircleIntersectionsNrOfInstances]
	6.3 srr
129	srrObt : DateAndHms (YYYYMMDDHHMMSS)
130	srrConsumedFuel : ConsumedFuel
131	srrRouteCharges : RouteCharges
132	srrAllFtPointNrOfInstances : NrOfInstances
133	srrAllFtPointProfile : AllFtPointProfile[0 .. srrAllFtPointProfileNrOfInstances]
134	srrAllFtAirspaceNrOfInstances : NrOfInstances
135	srrAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. srrAllFtAirspaceProfileNrOfInstances]
136	srrAllFtCircleIntersectionsNrOfInstances : NrOfInstances
137	srrAllFtCircleIntersections : AllFtAirspaceProfile[0 .. srrAllFtCircleIntersectionsNrOfInstances]
	6.4 sur
138	surObt : DateAndHms (YYYYMMDDHHMMSS)
139	surConsumedFuel : ConsumedFuel
140	surRouteCharges : RouteCharges
141	surAllFtPointNrOfInstances : NrOfInstances
142	surAllFtPointProfile : AllFtPointProfile[0 .. surAllFtPointProfileNrOfInstances]
143	surAllFtAirspaceNrOfInstances : NrOfInstances
144	surAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. surAllFtAirspaceProfileNrOfInstances]
145	surAllFtCircleIntersectionsNrOfInstances : NrOfInstances
146	surAllFtCircleIntersections : AllFtAirspaceProfile[0 .. surAllFtCircleIntersectionsNrOfInstances]
	6.5 dct
147	dctObt : DateAndHms (YYYYMMDDHHMMSS)
148	dctConsumedFuel : ConsumedFuel
149	dctRouteCharges : RouteCharges
150	dctAllFtPointNrOfInstances : NrOfInstances
151	dctAllFtPointProfile : AllFtPointProfile[0 .. dctAllFtPointProfileNrOfInstances]

152	dctAllFtAirspaceNrOfInstances : NrOfInstances
153	dctAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. dctAllFtAirspaceProfileNrOfInstances]
154	dctAllFtCircleIntersectionsNrOfInstances : NrOfInstances
155	dctAllFtCircleIntersections : AllFtAirspaceProfile[0 .. dctAllFtCircleIntersectionsNrOfInstances]
	6.6 cpf
156	cpfObt : DateAndHms (YYYYMMDDHHMMSS)
157	cpfConsumedFuel : ConsumedFuel
158	cpfRouteCharges : RouteCharges
159	cpfAllFtPointNrOfInstances : NrOfInstances
160	cpfAllFtPointProfile : AllFtPointProfile[0 .. cpfAllFtPointProfileNrOfInstances]
161	cpfAllFtAirspaceNrOfInstances : NrOfInstances
162	cpfAllFtAirspaceProfile : AllFtAirspaceProfile[0 .. cpfAllFtAirspaceProfileNrOfInstances]
163	cpfAllFtCircleIntersectionsNrOfInstances : NrOfInstances
164	cpfAllFtCircleIntersections : AllFtAirspaceProfile[0 .. cpfAllFtCircleIntersectionsNrOfInstances]
165	aircraftidIATA : AircraftidIATA
166	intentionFlight : Boolean
167	intentionRelatedRouteAssignmentMethod : IntentionRelatedRouteAssignmentMethod
168	intentionUID : IntentionUID
169	intentionEditionDate : DateAndHms (YYYYMMDDHHMMSS)
170	intentionSource : IntentionSource
171	associatedIntentions : AssociatedIntentions
172	enrichmentOutput : EnrichmentOutput

Table 15: Fields description in DDR Flight Plan

File group information (per flight)

1. General: Departure Aerodrome/Destination Aerodrome, Departure Time, Aircraft Identification, Flight Rules, Type of Flight, Type of Aircraft, Radio Communication, Navigation and Approach Aid Equipment and Capabilities, Surveillance Equipment …

2. CDM: Airport Collaborative Decision Making information. The Airport CDM integrates processes and systems aiming at improving the overall efficiency of operations at European airports. Particularly focusing on the aircraft turn-round and pre-departure sequencing process.

3. ETFMS Model 1 flight information (FTFM, M1- Filed traffic flight model): this information is the information captured in ETFMS (Enhanced Tactical Flow Management System) after all the modifications to the initial flight plan, including AFP (Air Traffic Control Flight plan Proposal) and DLA (delay) messages. It is the last filed flight plan from the airline.

    3.1. General
    3.2. Required Flight level and speed
    3.3. Consumed Fuel
    3.4. Route Charges
    3.5. Points profile
    3.6. Airspace Profile
    3.7. Circle Intersections

4. ETFMS Model 2 flight information (RTFM, M2-Regulated traffic flight model). This message contains information only if the flight has been regulated.

    4.1. General
    4.2. Required Flight level and speed
    4.3. Consumed Fuel
    4.4. Route Charges

4.5. Points profile
4.6. Airspace Profile
4.7. Circle Intersections

5. ETFMS Model 3 flight information (CTFM, M3 – Computed traffic flight model): it is the information captured in ETFMS (Enhanced Tactical Flow Management System) after the flight has been operated and CPR – Correlated Position Report - data is received showing which 4D trajectory it actually followed. It corresponds to the last filed flight plan data updated with available CPR information whenever a flight deviates from its filed flight plan by more than any of the pre-determined NMOC (Network Manager Operations Centre) thresholds of 5 minutes, 7FL or 20NM. The frequency of the radar data feed used by NMOC to update filed flight plans to construct the actual trajectory is one minute. This trajectory represents the closest estimate data files of the flight trajectories actually handled by controllers on the day of operations.

    5.1. General
    5.2. Required Flight level and speed
    5.3. Consumed Fuel
    5.4. Route Charges
    5.5. Points profile
    5.6. Airspace Profile
    5.7. Circle Intersection

6. Other: complementary information.

Units

-Date and time expressed as YYYYMMDDHHMMSS
-Flight level expressed as hundreds of feet.
-Speed expressed as knots.

Range of available dates

From 01/06/2011 to present

Range of available areas

European airspace

Join procedure with other sources

Flights affected by a regulation (CFMU Source) are linked by an aircraft unique identifier [1] with its flight plans.

The airspace profile (field 88 from FTFM, field 102 from RTFM and 116 from CTFM) is linked with DDR sector configuration information (section 2.3.a) through the Airspace file (.spc)

Approximate Size

File size (one day) is about 130 MB

Delivery procedure (Database, file set, etc…)

Daily Files for European airspace.

Use cases Exploit (How the source could be exploit on each Use Case)

In scenario FM01, flight plans are used in order to know the flight intentions and predict based on that, the

regulations needed to be imposed. In FM02, flow management is a process that tries to anticipate critical events as imbalances between demand and capacity. Considering that, flight plan is the required data by the flow manager in order to applied measures over them.

[1] This unique identifier could be created using the fields: i) departure Aerodrome ii) arrival Aerodrome, iii) aircraft Id and iv) time reference.

2.8 Context Information datasources

As previously stated, this Context Information category is the complementary one to the airspace data. This category contains a single datasource, Network Manager, and is purely static data, describing the operation environment: describes the existing airspace organization, with no gaps or overlaps, and all the possible ways of combining volumes to generate different operational sector configurations, also with the associated sector capacities, or flights that a sector can manage in a period of time.

a. Network Manager

Brief description

The Context Information provided at European Level by Eurocontrol is intended to provide services related to the management and sharing of **Airspace data** (e.g. airspaces, routes, aerodromes, etc.)

The Airspace Data consists of two types of information:

a) **AirspaceStructure** Information: for retrieving up-to-date airspace data from the CACD database.

The CACD database is the repository for the environment data (a.k.a. airspace data) used in the NM systems to perform Flight Planning and Flow Management. This data includes AIP concepts (such as Routes, Points and Aerodromes), and non-AIP concepts (such as Flows, RAD Restrictions and Traffic Volumes).

b) **AirspaceAvailability** Information: for querying and modifying the airspace availability information; this includes the Flexible Use of Airspace (AUP/UUP and EAUP/EUUP).

The Airspace services make use of AIXM 5.1/ADR-E (http://www.aixm.aero) types when possible (ADR-E stands for ADR Extension). The objective of the Aeronautical Information Exchange Model (**AIXM**) is to enable the provision in digital format of the aeronautical information that is in the scope of Aeronautical Information Services (AIS). The AIS information/data flows that are increasingly complex and made up of interconnected systems. They involve many actors including multiple suppliers and consumers. There is also a growing need in the global Air Traffic Management (ATM) system for high data quality and for cost efficiency.

In order to meet the requirements of this increasingly automated environment, AIS is moving from the provision of paper products and messages to the collection and provision of digital data. AIXM supports this transition by enabling the collection, verification, dissemination and transformation of digital aeronautical data throughout the data chain, in particular in the segment that connects AIS with the next intended user.

The following main information areas are in the scope of AIXM:

- Aerodrome/Heliport including movement areas, services, facilities, etc.
- Airspace structures
- Organizations and units, including services
- Points and NavAids
- Procedures
- Routes
- Flying restrictions

Metadata

An xml file for every AIXM feature or set of AIXM features update for was used to distribute context information.

Fields detailed description

The structured Airspace Information uses a subset of AIXM 5.1, composed by the following features:

Attributes and Associations	Item - Description
name	Airport name in plain text
locationIndicatorICAO	ICAO airport Identifier
designatorIATA	IATA airport identifier
controlType	Authority controlling the airport (CIVIL / MILITARY)
defaultTaxiTime	Default time elapsed from aircraft off-block time from the gate to lineup in the runway
servedCity	City served by the airport
ARP	Point corresponding to the geometrical center of the airport

Table 16: AirportHeliport Feature

Example:

```
<aixm:AirportHeliportTimeSlice gml:id="ID_167_1385510754492_3483">
  <aixm:name>BRUSSELS/BRUSSELS-NATIONAL</aixm:name>
  <aixm:locationIndicatorICAO>EBBR</aixm:locationIndicatorICAO>
  <aixm:designatorIATA>BRU</aixm:designatorIATA>
  <aixm:controlType>CIVIL</aixm:controlType>
  <aixm:servedCity>
    <aixm:City gml:id="ID_167_1385510754492_3484">
      <aixm:name>BRUSSELS</aixm:name>
    </aixm:City>
  </aixm:servedCity>
  <aixm:ARP>
    <aixm:ElevatedPoint gml:id="ID_167_1385510754492_3485">
      <gml:pos srsName="urn:ogc:def:crs:EPSG::4326">50.90138888888889 4.484444444444445</gml:pos>
    </aixm:ElevatedPoint>
  </aixm:ARP>
</aixm:AirportHeliportTimeSlice>
```

Attributes and Associations	Item - Description
hostAirport	Link to Airport feature containing the host airport of the airport set
dependentAirport	Link to Airport feature containing a dependent airport of the airport set

Table 17: AirportHeliportCollocation Feature

Example:

```
<aixm:AirportHeliportCollocationTimeSlice gml:id="ID_167_1385510754492_3484">
  <aixm:hostAirport xlink:href="urn:uuid:35b44a15-2cb5-455d-98e0-1f2cc09b3160"/>
  <aixm:dependentAirport xlink:href="urn:uuid:2fc069c4-3a18-46f2-9ea8-a77c96701fc9"/>
</aixm:AirportHeliportCollocationTimeSlice>
```

Attributes and Associations	Item - Description
airportHeliport	Link to Airport feature containing an airport that belongs to the set
airportHeliportSetPattern	To implicitly add groups of aerodromes to an AirportHeliportSet based on a pattern in the designator. The value is a string of alfabetic characters and represents the first letters of the ICAO identifier. The semantic is therefore the following: "include all aerodromes whose ICAO identifier starts with the pattern". For example a pattern such as "EB" includes all aerodromes whose ICAO designator starts with 'EB'.

Table 18: AirportHeliportSet Feature

Example:

```
<AirportHeliportSetTimeSlice id="ID_690_1423477720241_130">
  <airportHeliport href="urn:uuid:b6f0ff0c-397c-4140-bf25-c47830a3ddc0"/>
  <airportHeliport href="urn:uuid:ed6ffa29-2e87-439e-a899-d942791ac9cd"/>
  <airportHeliport href="urn:uuid:c3c8b035-26fd-4c9d-a5c9-7dd177d14c08"/>
  <airportHeliport href="urn:uuid:b4274096-7463-40ee-a6b9-008c4fa19834"/>
  <airportHeliportSetPattern>
    <AirportHeliportSetPattern id="ID_690_1423477720241_133">
      <pattern>EGA</pattern>
    </AirportHeliportSetPattern>
  </airportHeliportSetPattern>
</AirportHeliportSetTimeSlice>
```

Attributes and Associations	Item - Description
type	AIXM type of the airspace
designator	Textual name of the airspace
designatorICAO	Designator is ICAO or not.
flexibleUse	Yes/No
level1	the airspace is manageable at the strategic level. The act of defining and reviewing as required the national airspace policy taking into account national and international airspace requirement.
level2	the airspace is manageable at the pre-tactical level. The act of conducting operational management within the framework of pre-determined existing ATM structure and procedures defined in level1 and of reaching specific agreement between civil and military authorities involved.
level3	the airspace is manageable at the tactical level.
isFBZ	this attribute is only exported when the Airspace.type is one of ('D', 'R', 'P', 'TSA', 'TRA', 'RCA', 'CBA') or Airspace.type is 'D_OTHER' and Airspace.localType is one of ('MRA', 'MTA'). These types correspond to the CACD RestrictedAirspace(RSA). When the attribute isFBZ=='YES', then the Airspace is an FPL Buffer Zone
fbzDefaultActive	this attribute is only exported when Airspace.isFBZ=='YES'. The attribute fbzDefaultActive is used in the context of FUA.
geometryComponent	Geometry of the airspace.
activation	refers only to AirspaceActivations with status=AVBL_FOR_ACTIVATION. The related Timesheet (PropertiesWithSchedule) contains a Time Schedule.
nearby	refers to RoutePortions potentially extended with a range(AirspaceLayer Object). When the RSA Airspace is allocated, the nearby RoutePortions are considered to be so near that need to be closed.
offload	refers to RoutePortions potentially extended with a range(AirspaceLayer Object)
notAffected	refers to RoutePortions. When the RSA Airspace is allocated, these RoutePortions are considered as not affected.
rsaActivation	refers to AirspaceActivations with status=ACTIVE. In reality they are the result of the publication of an AUP/UUP.
ownerRSA	only set when Airspace.isFBZ=='YES'. The owning RSA in indicated with a uuid.

Table 19: AirSpace Feature

There are basically three levels of composition:

a) Airblocks
b) Airspaces composed of Airblocks associated with AltitudeRange to give a 3D volume
c) Airspaces composed of other Airspaces

Example:

```
<aixm:AirspaceTimeSlice gml:id="ID_171_1385510754499_41296">
  <aixm:type>SECTOR</aixm:type>
  <aixm:designator>BIRDES</aixm:designator>
  <aixm:designatorICAO>YES</aixm:designatorICAO>
  <aixm:geometryComponent>
    <aixm:AirspaceGeometryComponent gml:id="ID_171_1385510754499_41297">
      <aixm:operation>BASE</aixm:operation>
      <aixm:theAirspaceVolume>
        <aixm:AirspaceVolume gml:id="ID_171_1385510754499_41298">
          <aixm:upperLimit uom="FT">UNL</aixm:upperLimit>
          <aixm:upperLimitReference>MSL</aixm:upperLimitReference>
          <aixm:lowerLimit uom="FL">55</aixm:lowerLimit>
          <aixm:lowerLimitReference>STD</aixm:lowerLimitReference>
          <aixm:contributorAirspace>
            <aixm:AirspaceVolumeDependency gml:id="ID_171_1385510754499_41299">
              <aixm:dependency>HORZ_PROJECTION</aixm:dependency>
              <aixm:theAirspace xlink:href="urn:uuid:a2cf60ce-8fe9-4ee1-913f-06cc0a9bdb84"/>
            </aixm:AirspaceVolumeDependency>
          </aixm:contributorAirspace>
        </aixm:AirspaceVolume>
      </aixm:theAirspaceVolume>
    </aixm:AirspaceGeometryComponent>
  </aixm:geometryComponent>
  <aixm:geometryComponent>
    <aixm:AirspaceGeometryComponent gml:id="ID_171_1385510754499_41300">
      <aixm:operation>UNION</aixm:operation>
      <aixm:theAirspaceVolume>
        <aixm:AirspaceVolume gml:id="ID_171_1385510754499_41301">
          <aixm:upperLimit uom="FT">UNL</aixm:upperLimit>
          <aixm:upperLimitReference>MSL</aixm:upperLimitReference>
          <aixm:lowerLimit uom="FL">55</aixm:lowerLimit>
          <aixm:lowerLimitReference>STD</aixm:lowerLimitReference>
          <aixm:contributorAirspace>
            <aixm:AirspaceVolumeDependency gml:id="ID_171_1385510754499_41302">
              <aixm:dependency>HORZ_PROJECTION</aixm:dependency>
              <aixm:theAirspace xlink:href="urn:uuid:418f6ebc-1bfe-41f0-ac9b-d70f584f3375"/>
            </aixm:AirspaceVolumeDependency>
          </aixm:contributorAirspace>
        </aixm:AirspaceVolume>
      </aixm:theAirspaceVolume>
    </aixm:AirspaceGeometryComponent>
  </aixm:geometryComponent>
</aixm:AirspaceTimeSlice>
```

Attributes and Associations	Item- Description
serviceProvider	this is always a reference to a Unit Feature
clientAirspace	this is always a reference to an airspace

Table 20: AirportaficManagementService Feature

Example:

```
<aixm:AirtrafficManagementServiceTimeSlice gml:id="ID_171_1385510754499_198518">
  <aixm:serviceProvider xlink:href="urn:uuid:4cfcafb8-1841-405c-9c75-454dafd8e5d4"/>
  <aixm:clientAirspace xlink:href="urn:uuid:27b59518-f53c-4ccf-9c38-0495935946c9"/>
  <aixm:clientAirspace xlink:href="urn:uuid:11f90918-73dd-450a-832a-ca5c2b0d061d"/>
</aixm:AirtrafficManagementServiceTimeSlice>
```

Attributes and Associations	Item- Description
angle	Numerical value
angleType	magnitude
fix	This association refers to a DesignatedPoint
pointChoice	The pointChoice always refers to a Navaid

Table 21: AngleIndication Feature

Example:

```
<aixm:AngleIndicationTimeSlice gml:id="ID_171_1385510754499_198518">>
  <aixm:angle>10</aixm:angle>
  <aixm:angleType>MAG</aixm:angleType>
  <aixm:fix xlink:href="urn:uuid:c608da02-859e-4c93-a228-73da81d686c9"/>
  <aixm:pointChoice_navaidSystem xlink:href="urn:uuid:529f213e-0568-4334-86c0-8bb1a268b9dc"/>
</aixm:AngleIndicationTimeSlice>
```

Attributes and Associations	Item- Description
upperLimitAltitude and upperLimitReference	Altitude numerical value and units
lowerLimitAltitude and lowerLimitReference	Altitude numerical value and units
startPoint	Reference to navaid, designated point or airport
endPoint	Reference to navaid, designated point or airport
Arrival /departure	Reference to arrival point

Table 22: ArrivalLeg adn departureLeg Features

Example:

```
<aixm:ArrivalLegTimeSlice gml:id="ID_172_1385510754499_780064">
  <aixm:upperLimitAltitude uom="FL">20</aixm:upperLimitAltitude>
  <aixm:upperLimitReference>STD</aixm:upperLimitReference>
  <aixm:lowerLimitAltitude uom="FT">GND</aixm:lowerLimitAltitude>
  <aixm:lowerLimitReference>MSL</aixm:lowerLimitReference>
  <aixm:startPoint>
    <aixm:TerminalSegmentPoint gml:id="ID_172_1385510754499_780064">
      <aixm:pointChoice_navaidSystem xlink:href="urn:uuid:69ed4c7b-d34c-457c-a780-3baed58fe767"/>
    </aixm:TerminalSegmentPoint>
  </aixm:startPoint>
  <aixm:endPoint>
    <aixm:TerminalSegmentPoint gml:id="ID_172_1385510754499_780065">
      <aixm:pointChoice_airportReferencePoint xlink:href="urn:uuid:dd2a6f3f-bd9b-436e-98..."/>
    </aixm:TerminalSegmentPoint>
  </aixm:endPoint>
  <aixm:arrival xlink:href="urn:uuid:28b8122d-ca51-4cbb-aa5f-b78d859099c9"/>
</aixm:ArrivalLegTimeSlice>
```

Attributes and Associations	Item- Description
designator	Waypoint designator
type	Waypoint type
name	Waypoint textual name
location	Waypoint georeferenced location

Table 23: DesignatedPoint Feature

Normally contains a DesignatedPointTimeslice in order to set waypoint validity time.

Example:

```
<aixm:DesignatedPoint gml:id="ID_10215_1432519476711_37">
<gml:identifier codeSpace="urn:uuid:">a06b139a-8c91-4d88-b729-edbabcdd4f24</gml:identifier><aixm:timeSlice>
<aixm:DesignatedPointTimeSlice gml:id="ID_10215_1432519476711_38">
<gml:validTime><gml:TimePeriod gml:id="ID_10215_1432519476711_39"><gml:beginPosition>2003-12-25T00:00:00</gml:beginPosition><gml:endPosition
indeterminatePosition="unknown"></gml:endPosition></gml:TimePeriod></gml:validTime><aixm:interpretation>BASELINE</aixm:interpretation><aixm:featureLifetime><gml:TimePeriod
```

gml:id="ID_10215_1432519476711_40"><gml:beginPosition>2003-12-25T00:00:00</gml:beginPosition><gml:endPosition indeterminatePosition="unknown"></gml:endPosition></gml:TimePeriod></aixm:featureLifetime><aixm:designator>PIRAP</aixm:designator>
<aixm:type>ICAO</aixm:type>
<aixm:location>
<aixm:Point gml:id="ID_10215_1432519476711_41">
<gml:pos srsName="urn:ogc:def:crs:EPSG::4326">50.99388885498047 13.981666564941406</gml:pos>
</aixm:Point>
</aixm:location>
</aixm:DesignatedPointTimeSlice>
</aixm:timeSlice>
</aixm:DesignatedPoint>

Attributes and Associations	Item- Description
distance	Numeric value of the distance
fix	Reference to a navaid/designatedPoint/Airport
pointChoice	Reference to a navaid/designatedPoint/Airport

Table 24: DistanceIndication Feature

Example:

```
<aixm:DistanceIndicationTimeSlice gml:id="ID_172_1385510754499_780099">
  <aixm:distance uom="NM">14</aixm:distance>

  <aixm:fix xlink:href="urn:uuid:c608da02-859e-4c93-a228-73da81d686c9"/>
  <aixm:pointChoice_navaidSystem xlink:href="urn:uuid:529f213e-0568-4334-86c0-8bb1a268b9dc"/>
</aixm:DistanceIndicationTimeSlice>
```

Attributes and Associations	Item- Description
designator	Restriction identifier
type	Restriction characteristics
instruction	Textual description
processingIndicator	is Processed
enabled	Is Enabled
usage	Indicates whether the TimeSlice is operational or not
isFUA	Indicates whether the FlightRestriction is a FUARestriction or not.
fuaDefaultActive	indicates that this FlightRestriction should be activated by defaultwhen its dependent RSA airspace is allocated by an AUP/UUP. The creation/update of an AUP/UUP must indicates which FlightRestrictions are activated or not
flight	Link to flight
regulatedRoute	Link to route
annotation	Textual description

Table 25: FlightRestriction Feature

Example:

```
<aixm:FlightRestrictionTimeSlice gml:id="ID_168_1385510754493_5">
  <aixm:designator>DS2000A</aixm:designator>
  <aixm:type>FORBID</aixm:type>
  <aixm:instruction>GITER NOT AVAILABLE $FOR TRAFFIC ARR ESMS</aixm:instruction>
  <aixm:flight>
    <aixm:FlightConditionCombination gml:id="ID_168_1385510754493_6">
      <!-- not expanded here -->
    </aixm:FlightConditionCombination>
  </aixm:flight>
  <aixm:regulatedRoute>
    <!-- not expanded here -->
  </aixm:regulatedRoute>
  <aixm:annotation>
    <aixm:Note gml:id="ID_4941_1381916120390_9">
      <aixm:propertyName>instruction</aixm:propertyName>
      <aixm:purpose>REMARK</aixm:purpose>
      <aixm:translatedNote>
        <aixm:LinguisticNote gml:id="ID_4941_1381916120390_10">
          <aixm:note>TO SEGREGATE ARR ESMS TO DEP EKCH</aixm:note>
        </aixm:LinguisticNote>
      </aixm:translatedNote>
    </aixm:Note>
  </aixm:annotation>
</aixm:FlightRestrictionTimeSlice>
```

Table 26: Flow Feature

A Flow identifies a pattern of traffic and it is used inside a ReferenceLocation or a TrafficVolume. It catches flights by defining where they come from, where they are directed and what they cross.

This is done by combining Flow Elements.

A Flow Element is in fact a location, which can be one of the following:

- An AirportHeliport
- An AirportHeliportSet
- An Airspace
- A Significant Point (i.e. either a Navaid or a DesignatedPoint)

This location is not to be confused with the Reference Location. A Flow Element is a location used to define how the Flow is composed.

More precisely a Flow is defined by sequences of upstream and downstream Flow Elements, where the concepts of upstream and downstream are to be intended with respect to the Reference Location to which the Flow is linked. This allows the same Flow to be linked to several Reference Locations or Traffic Volumes without having to redefine the Flow Elements in each Reference.

Attributes and Associations	Item- Description
Downstream/upstream element	Reference to location

Example:

```
<FlowTimeSlice id="ID_101_1423664342095_20">
  <flowId>18GWC&gt;SO</flowId>
  <downstreamFlowElement>
    <FlowLocationElement id="ID_101_1423664342095_23">
      <index>3</index>
      <locationChoice_airportHeliportSet href="urn:uuid:b7ed0827-57a6-489a-8fad-6788b1616ee0"/>
    </FlowLocationElement>
  </downstreamFlowElement>
  <upstreamFlowElement>
    <FlowLocationElement id="ID_101_1423664342095_24">
      <index>1</index>
      <locationChoice_airspace href="urn:uuid:f61af630-fe9e-4847-9757-9ba4d36dcd82"/>
    </FlowLocationElement>
  </upstreamFlowElement>
  <upstreamFlowElement>
    <FlowLocationElement id="ID_101_1423664342095_25">
      <index>2</index>
      <locationChoice_navaid href="urn:uuid:f967e31c-5b26-4c4e-8a9d-9c85291f62ee"/>
    </FlowLocationElement>
  </upstreamFlowElement>
</FlowTimeSlice>
```

Attributes and Associations	Item- Description
designator	Navigation aid identifier
type	Navigation aid characteristics
name	Textual description
location	Georeferenced location

Table 27: Navaid Feature

Example:

```
<aixm:NavaidTimeSlice gml:id="ID_170_1385510754495_73754">
  <aixm:type>NDB_MKR</aixm:type>
  <aixm:designator>AA</aixm:designator>
  <aixm:name>AASIAAT</aixm:name>
  <aixm:location>
    <aixm:ElevatedPoint gml:id="ID_170_1385510754495_73755">
     <gml:pos srsName="urn:ogc:def:crs:EPSG::4326">68.72305555555556 -52.78472222222222</gml:pos>
    </aixm:ElevatedPoint>
  </aixm:location>
</aixm:NavaidTimeSlice>
```

Attributes and Associations	Item- Description
designator	Organization identifier
type	Organization characteristics
name	Textual description

Table 28: OrganizationAuthority Feature

Example:

```
<aixm:OrganisationAuthorityTimeSlice gml:id="ID_170_1385510754495_73755">
  <aixm:name>KINGDOM OF BELGIUM</aixm:name>
  <aixm:designator>BELGIUM</aixm:designator>
  <aixm:type>STATE</aixm:type>
</aixm:OrganisationAuthorityTimeSlice>
```

A Reference Location can be one of the following entities:

- An Airspace
- An AirportHeliport
- An AirportHeliportSet
- A SignificantPoint (either a DesignatedPoint or a Navaid)

One Reference Location can be used in multiple Traffic Volumes. If the location is a Significant Point, it has an association to a Flight Level Range (AirspaceLayer).A Reference Location can have associated Flows (see also Flow Feature and TrafficVolume Feature).

This allows reusing the same Reference Location and the same Flows in multiple Traffic Volumes without having to duplicate the Flows in each Traffic Volume. When this happens, a Traffic Volume associated to this Reference Location may have

- Linked Flows, i.e. Flows which are directly linked to the Traffic Volumes,
- Associated Flows, i.e. Flows which are associated to the Reference Location

These concepts will be further explained below, when discussing Traffic Volumes.

Attributes and Associations	Item- Description
referenceLocationId	Location identifier
category	Reference location category
location	Link to location type
airspaceLayer	Airspace definition. Optional.

Table 29: ReferenceLocation Feature

Example:

```
<ReferenceLocationTimeSlice id="ID_704_1423477742163_19">
  <category>ALL</category>
  <referenceLocationId>ASEBTCWXG</referenceLocationId>
  <locationChoice_airspace href="urn:uuid:a875ce9c-512b-40ba-9ac6-e85032350cb0"/>
</ReferenceLocationTimeSlice>
```

Attributes and Associations	Item- Description
designatorPrefix	Route prefix character
designatorSecondLetter	route second character
designatorNumber	route number

Table 30: Route Feature

Example:

```
<aixm:RouteTimeSlice gml:id="ID_170_1385510754495_73755">
  <aixm:designatorPrefix>K</aixm:designatorPrefix>
  <aixm:designatorSecondLetter>H</aixm:designatorSecondLetter>
  <aixm:designatorNumber>501</aixm:designatorNumber>
</aixm:RouteTimeSlice>
```

Attributes and Associations	Item- Description
upperLimit and upperLimitReference	Upper flight level in the route
lowerLimit and lowerLimitReference	Lower flight level in the route
start	Link to start point
routeFormed	
end	Link to end point
availability	these are the "permanent" availabilities, i.e. the Timesheets (PropertiesWith-Schedule) express a Time Schedule
cdrUpdate	these are the temporary overriding availabilities, i.e. the Timesheets (PropertiesWithSchedule) express a TimePeriod

Table 31: RouteSegment Feature

Example:

```
<aixm:RouteSegmentTimeSlice gml:id="ID_172_1385510754499_82">
  <aixm:upperLimit uom="FL">430</aixm:upperLimit>
  <aixm:upperLimitReference>STD</aixm:upperLimitReference>
  <aixm:lowerLimit uom="FL">185</aixm:lowerLimit>
  <aixm:lowerLimitReference>STD</aixm:lowerLimitReference>
  <aixm:start>
    <aixm:EnRouteSegmentPoint gml:id="ID_172_1385510754499_82">
      <aixm:pointChoice_fixDesignatedPoint xlink:href="urn:uuid:f24473c7-85f8-4329-965f-..."/>
    </aixm:EnRouteSegmentPoint>
  </aixm:start>
  <aixm:routeFormed xlink:href="urn:uuid:024bb6f8-3265-472a-9988-c765f519bcef"/>
  <aixm:end>
    <aixm:EnRouteSegmentPoint gml:id="ID_172_1385510754499_83">
      <aixm:pointChoice_fixDesignatedPoint xlink:href="urn:uuid:7ae44b19-3827-4ce9-8fd1-..."/>
    </aixm:EnRouteSegmentPoint>
  </aixm:end>
  <aixm:availability/><!-- not expanded here -->
</aixm:RouteSegmentTimeSlice>
```

Attributes and Associations	Item- Description
type	Special Date type
dateDay	Day and month
dateYear	year
name	Description text
authority	Link to authority

Table 32: SpecialDate Feature

Example:

```
<aixm:SpecialDateTimeSlice gml:id="ID_172_1385510754499_82">
  <aixm:type>HOL</aixm:type>
  <aixm:dateDay>25-12</aixm:dateDay>
  <aixm:name>CHRISTMAS DAY</aixm:name>
  <aixm:authority xlink:href="urn:uuid:2ada7e48-c90d-4f2c-b33e-3f75dd995566"/>
</aixm:SpecialDateTimeSlice>
```

Attributes and Associations	Item- Description
designator	STAR identificator
instruction	Descriptive text
availability	Usage schedule
airportHeliport	Link to arrival airport
connectingPoint	Designated point reference
initialApproachFix	Initial designated point. STAR entry

Table 33: StandarInstrumentalArrival Feature

Example:

```
<aixm:StandardInstrumentArrivalTimeSlice gml:id="ID_172_1385510754499_784149">
  <instruction>VIA UP/P7</instruction>
  <availability>
    <!-- not expanded here -->
  </availability>
  <airportHeliport href="urn:uuid:02876331-3e92-4cea-a67f-a4cf6cf9aefd"/>
  <designator>ABBOT1B</designator>
  <extension>
    <StandardInstrumentArrivalExtension id="ID_142_1423664916078_10">
      <connectingPoint>
        <TerminalSegmentPoint id="ID_142_1423664916078_11">
          <pointChoice_fixDesignatedPoint href="urn:uuid:260a38b8-61ec-4f0e-91d8-d9c79270f461"/>
        </TerminalSegmentPoint>
      </connectingPoint>
      <connectingPoint>
        <TerminalSegmentPoint id="ID_142_1423664916078_12">
          <pointChoice_fixDesignatedPoint href="urn:uuid:376efb12-ca41-46fb-895e-e1a8060210d1"/>
        </TerminalSegmentPoint>
      </connectingPoint>
      <connectingPoint>
        <TerminalSegmentPoint id="ID_142_1423664916078_13">
          <pointChoice_fixDesignatedPoint href="urn:uuid:fe43cb87-cd23-47ad-9a60-60f25cfe451b"/>
        </TerminalSegmentPoint>
      </connectingPoint>
      <connectingPoint>
        <TerminalSegmentPoint id="ID_142_1423664916078_14">
          <pointChoice_fixDesignatedPoint href="urn:uuid:64464f67-bb36-4d72-b664-1acf24332780"/>
        </TerminalSegmentPoint>
      </connectingPoint>
    </StandardInstrumentArrivalExtension>
```

Attributes and Associations	Item- Description
designator	SID identificator
instruction	Descriptive text
availability	Usage schedule
airportHeliport	Link to departure airport
connectingPoint	Designated point reference
initialApproachFix	Initial designated point. SID entry

Table 34: StandarInstrumentalDeparture Feature

Example:

```
<aixm:StandardInstrumentDepartureTimeSlice gml:id="ID_172_1385510754499_780091">
  <aixm:instruction>FL 110 MAX -----&gt; ONLY DEST LFCI/FL110 MAX</aixm:instruction>
  <aixm:availability/><!-- not expanded here -->
  <aixm:airportHeliport xlink:href="urn:uuid:5ba9179b-3306-486e-8970-edce59758396"/>
  <aixm:designator>AB5E</aixm:designator>
  <aixm:extension>
    <adr:StandardInstrumentDepartureExtension gml:id="ID_172_1385510754499_780092">
      <adr:connectingPoint>
        <aixm:TerminalSegmentPoint gml:id="ID_172_1385510754499_780093">
          <aixm:pointChoice_navaidSystem xlink:href="urn:uuid:8b359a52-bf2c-4dc6-af1a-..."/>
        </aixm:TerminalSegmentPoint>
      </adr:connectingPoint>
      <adr:connectingPoint>
        <aixm:TerminalSegmentPoint gml:id="ID_172_1385510754499_780094">
          <aixm:pointChoice_navaidSystem xlink:href="urn:uuid:aca80964-9e4f-4e59-970b-..."/>
        </aixm:TerminalSegmentPoint>
      </adr:connectingPoint>
    </adr:StandardInstrumentDepartureExtension>
  </aixm:extension>
</aixm:StandardInstrumentDepartureTimeSlice>
```

A Traffic Volume represents a volume of air traffic.It is used for monitoring the amount of air traffic over a given object (e.g. an Airspace) called Reference Location, so that a Regulation can be applied if the load is

higher than the available capacity. A Traffic Volume is always associated to exactly one Reference Location.

In a simplistic approach, it would seem enough to define a capacity for the Reference Location and count all the flights entering that location in a given unit of time (which is the hour). In reality not all flights crossing a location contribute to the complexity of the traffic in the same way: for example if the majority of the traffic is in the southern part of an airspace and only few flights cross the northern part, it would be desirable to set a specific monitoring for the southern flights alone.

A Traffic Volume is therefore the combination of one Reference Location and potentially multiple Flows.

It is worth noticing here that a Reference Location can itself have Flows (see ReferenceLocation Feature).

- The Flows defined in the Reference Location are called Associated Flows
- The Flows defined in the Traffic Volume are called Linked Flows

Traffic Volumes can be active or not according to a timetable. This reflects in principle the Sector Configurations and the rationale behind is that the amount of traffic changes according to the period of the year, the day of the week and the time of the day. So for example in a time frame when the traffic is relatively low, a single Traffic Volume could suffice, whereas in a time of high load, the same volume could be split into smaller Traffic Volumes to allow a more granular monitoring.

So according to a timetable, the large Traffic Volume could be made inactive and the smaller ones active.

Attributes and Associations	Item- Description
tvId	Volume identification
activation	Activation schedule
linkedFlow	Link to flow

Table 35: TrafficVolume Feature

Example:

```
<TrafficVolumeTimeSlice id="ID_705_1423477842671_179">
  <tvId>EGPESTX</tvId>
  <referenceLocation href="urn:uuid:00495049-ecc1-4936-a1d0-35bbbdaaf2fe"/>
  <activation>
    <TrafficVolumeActivation id="ID_705_1423477842671_182">
      <!-- not expanded here -->
    </TrafficVolumeActivation>
  </activation>
  <linkedFlow>
    <TrafficVolumeLinkedFlow id="ID_705_1423477842671_186">
      <role>EXCLUDED</role>
      <theFlow href="urn:uuid:c9c75b61-4c5e-4e4f-be75-cdef7b94f258"/>
    </TrafficVolumeLinkedFlow>
  </linkedFlow>
</TrafficVolumeTimeSlice>
```

Attributes and Associations	Item- Description
tvsetId	Traffic volume set identificator
trafficVolume	Traffic Volume included in this TrafficVolumeSet

Table 36: TrafficVolumeSet Feature

Example:

```
<TrafficVolumeSetTimeSlice id="ID_46_1423644956269_3">
  <tvSetId>AEROEDNY</tvSetId>
  <trafficVolume href="urn:uuid:64b3ec4b-f673-4709-9771-4517fb70b72b"/>
  <trafficVolume href="urn:uuid:ba60a7d2-11e1-4948-9c0f-566f2db6a23e"/>
  <trafficVolume href="urn:uuid:4b2a81eb-f2dc-4e82-b296-00a406fc9850"/>
</TrafficVolumeSetTimeSlice>
```

Attributes and Associations	Item- Description
name	Unit name
type	The type is always OTHER:__ADR__AMC
designator	Unit identificator

Table 37: Unit Feature

Example:

```
<aixm:UnitTimeSlice gml:id="ID_172_1385510754499_780092">
  <aixm:name>BELGIUM</aixm:name>
  <aixm:type>OTHER:__ADR__AMC</aixm:type>
  <aixm:designator>EBBRZAMC</aixm:designator>
</aixm:UnitTimeSlice>
```

3. RELATIONSHIP MATRIX (USE CASES x SOURCES)

		Weather	Radar			Airspace	Network Management	Synthetic Trajectories	Aircraft Identification	Flight Plan		Context Information
		NOAA	IFS	ADSB	DDR	DDR	CFMU	Synthetic Trajectories	Aircraft Identification	Network Manager	DDR	Network Manager
Use Cases Scenarios	FM01	x		x	x	x	x			x	x	x
	FM02	x		x	x	x	x			x	x	x
	FM03	x		x	x	x	x			x	x	x
	FP01		x	x								
	FP02	x	x	x		x			x	x		x
	FP03		x	x				x	x			
	FP04		x	x		x			x	x		x
	FP05	x	x	x		x		x	x	x		x
	FP06		x	x		x		x	x			x
	FP07	x	x	x		x			x	x		x
	FP08	x	x	x		x			x	x		x
	FP09	x	x	x		x			x	x		x
	FP10		x	x				x	x			

Table 38: Uses Cases vs Datasources relatinship

A mark reflects that the affected datasource is considered to be useful for the specific use case scenario. Not all the sources are equally essential, however. Priority of sources are assessed and reflected in D6.2.2.