



# 3<sup>rd</sup> International Transport Forum

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## Item 5.2

### Big Data to monitor air and maritime transport

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- ***Big Data at Eurostat – introduction***
- ***Maritime - AIS data***
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  - *ESS Big Data Pilot on AIS*
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  - *Aircraft Tracking System*

# Big data at Eurostat

## ESS (European Statistical System)

- [Scheveningen Memorandum Sep 2013](#)
  - ↳ Task Force Big Data
  - ↳ [Big Data Roadmap and Action Plan June 2014](#)
    - ↳ May 2015 Big Data Business Cases
    - ↳ Nov 2015 Big Data ESSnet
    - ↳ Jan 2016 Contract on supporting services
- **ESS Vision 2020**

## European Commission *Communication*

- Data4Policy Networking Group

## International cooperation (UNSD, UNECE, etc.)

- UN/ECE project "[Big data in official statistics](#)" (**Sandbox**)
- UNSD Global WG on Big Data



# ESS Big Data Pilots



## □ List of pilot projects (Specific Grant Agreement)

- Web scraping
  - job vacancies ; enterprise characteristics
- Smart meters
  - electricity consumption ; temporary vacant dwellings
- ▪ Automatic Identification System (Ships)
  - vessel identification data
- Mobile phone data
  - Preparing for Access to data
- Scenario for using multiple inputs



# Maritime transport related initiatives

**There are several initiatives in development under the e-Maritime and Blue Belt umbrellas which could potentially make the production of maritime statistics more efficient on national level and in Eurostat:**

- Implementation the e-Maritime initiative is Directive 2010/65/EU according to which ship reporting formalities shall be transmitted and exchanged electronically via national single windows (NSW).
- SafeSeaNet (SSN) platform, which is a system hosted and technically developed by European Maritime Safety Agency (EMSA). It allows for centralised collection and exchange of maritime data between the EU and EEA countries. Currently it contains standardised data on vessel positions in European waters (**AIS** data on vessel positions, vessel speed, vessel type etc.) and port notifications for vessels calling in European ports (number of passengers, hazardous cargo information, last port of call, next port of call etc.)
- Establishment an electronic 'eManifest' with harmonised information on goods transported by vessels to be included in future versions of the NSW/SSN systems.

# Automatic Identification System AIS

- Safety instrument required by the International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea (SOLAS) that became fully operational in 2008;
- Provides a means for ships to electronically send data (about their position, destination, speed, etc.);
- Messages are transmitted by ships using VHF signals. By transmitting a signal, vessels can be tracked by AIS base stations located along coastlines. When a vessel's position is out of the range of the terrestrial networks, signals are received via satellites that are fitted with special AIS receivers. Then, the satellite-based AIS is capable of globally monitoring the ship's movement in real time if the number of the satellite and the ground station is satisfied;
- This progressively extends the geographical range of the AIS system.

# AIS data coverage

## **AIS is obligatory for vessels:**

- over 300 gross tonnage (GT) on international voyages,
- all passenger ships and vessels over 500 GT on domestic voyages.

## HOWEVER

- a very large number of vessels is fitted with AIS and the number is growing as smaller and cheaper devices are fitted even in small vessels on a voluntary basis.

The information and frequency of AIS data provided depend on the class of the vessel and may contain up to 21 types of information (Class A). They are sent either every 2-10 seconds (depending on the vessel's speed), or every 3 minutes (if at anchor) or every 6 minutes (static (ship related) info).

# AIS data – information available

- 1. Information on vessel:** Maritime Mobile Service Identity (MMSI), International Maritime Organisation's (IMO) ship identification number, Radio call sign, Vessel's Name, Type of ship/cargo, Length, Current draught of ship (0.1 meter to 25.5 meters), Type of positioning system (GPS, DGPS or LORAN-C), Location of positioning system's (e.g. GPS) antenna on board the vessel (in meters aft of bow and meters port of starboard).
- 2. Navigation and position aspects:** Status ('at anchor', 'under way using engine(s)', 'not under command'), Rate of turn (right or left - degrees per minute); Speed over ground (knots); Course over ground (degrees, relative to true north to 0.1 minute), Position (longitude/latitude to 0.0001 minutes), True bearing at own position (degrees) True heading (degrees), Destination port; UTC Seconds (The second field of the UTC time when these data were generated - a complete timestamp is not present), Estimated time of arrival (ETA) at destination (UTC month/date hour: minute).



# AIS data in SafeSeaNet system

European Maritime Safety Agency (EMSA) currently operates three maritime monitoring systems: - **SafeSeaNet**, the EU Long Range Identification and Tracking (LRIT) Data Centre, CleanSeaNet.

**SafeSeaNet (SSN)** is the European Community maritime information and exchange system. It provides information such as:

- a. estimated or actual arrival and departure times in ports;
- b. details of dangerous or hazardous goods being carried;
- c. information on accidents and incidents; the number of people on board and;
- d. vessel positions acquired by the Automatic Identification System (AIS).

It acts as a platform for maritime data exchange. It works by tracking Automatic Identification System (AIS) radio signals transmitted by ships. These provide identity details, latest positions and other status information in near-real-time for around 17,000 vessels operating in and around EU waters.

# Eurostat initiative

Investigate feasibility of computation of Eurostat's maritime transport statistics based on AIS data

**a. Number of vessels** - can be almost directly computed from AIS data by simple aggregation of the detailed position data at the desired time and location. Thus, the number of vessel arrivals at a port can be derived by aggregating the number of those vessels that were at port during a period of reference.

**b. Gross tonnage of vessels** that arrived at port is another variable that can be calculated (not as simple as number of vessels) on the basis of the available data. It is provided for example by MarineTraffic's API on vessel positions. This is the key variable required for the computation of Eurostat's relevant variable on gross tonnage of vessels. For the derivation of the statistics broken down by size class and size of vessel categories, the additional following information would be required:

- **Type of vessel** - Current data cover a detailed classification of vessel that may be linked to the positioning data. A reclassification may be needed in order to convert the commercial one to the Eurostat's classification.
- **Size class of the vessel (in gross tonnage)** - the size of the vessel is determined by its gross tonnage. This information is available for a large number of vessels in the positioning data. In this case, the size class categories can be computed according to Eurostat's classification.

**c. Gross weight of goods:** Eurostat's variable on gross weight of goods cannot be directly derived from the available (position) data.

# Initiative within the ESS

- **Eurostat launched call for grants in February 2016**
- **Work Package 4: Pilot project on the use of Automatic Identification System (AIS) of vessels for official statistics**, under which the following actions should be performed:
  - Data Access
  - Source feasibility
  - Feasibility of Methodology and technology
  - Feasibility of outputs
  - Future Perspectives

The action shall start in the first quarter 2016.

The maximum duration of the action is 26 months.

# Initiative within the ESS

- **Feasibility of Methodology and technology part foresees the following actions:**
- Analysis of AIS and other data to extract characteristics relevant for producing statistical output, e.g. statistics on feeder traffic;
  - Analyse if AIS data could be used to create a reference frame for maritime transport statistics;
  - Analyse feasibility for linking data with already existing data from port and other authorities;
  - Analyse feasibility of relating maritime traffic data to location and time;
  - Development methodology and IT-infrastructure for data processing, visualisation and production of statistical outputs, including linking to administrative registers or other statistical data;
  - Production of provisional statistical data for participating NSIs.

# Eurostat Pilot Activities



- Web activity evidence for nowcasting
  - Google Trends
  - Employment



- Wikipedia as source for statistics
  - Cultural and regional statistics



- Mobile communication data
  - Population
  - Urban
  - Tourism



- Flight Reservation Systems for true Origin/Destination
  - Amadeus Database

- Aircraft Tracking System
  - Satellite system to receive flight positions from aircrafts

# EU Air transport statistics

- **Legal basis:**

*Regulation (EC) N°1358/2003*, implementing *Regulation N°437/2003* of the European Parliament and of the Council on statistical returns in respect of the carriage of passengers, freight and mail by air

- **Datasets:**



Eurostat  
data

- » Flight Stage dataset (A1)
- » On Flight Origin/Destination dataset (B1)
- » Airport dataset (C1)

## True O/D – what is the problem?

- The existing data collection of air transport statistics in the EU provides figures on the on **flight** origin/destination (OFOD).
- Only the **last airport of origin** or **the first airport of destination** is known (with the exception of direct transit passengers) for one stop journeys.
- In case of changing flight in a connecting airport the real airport of origin/destination is unknown (transfer passengers/freight)

## Air passenger movements between Australia and its top aviation markets, 2007



Note: Total international air passenger movements to and from Australia was 22.974 million in 2007 with 8.620 million passengers travelling on routes not shown above.

Source: ABS, *Overseas Arrivals and Departures, Australia* (ABS cat. no. 3401.0).



## DATA:

- Australian Bureau of Statistics (ABS): 4 553 160 passengers
  - Eurostat transport statistics: 1 337 447 passengers
  - Difference : > 3 000 000 passengers (> 200%!)
- +
- Eurostat tourism statistics: 4,6 million (1,1 million outbound trips by EU residents + 3,5 million inbound arrivals at accommodation)

# Why true Origin/Destination is needed?

- **The Commission** needs this information for several main purposes:
  - To negotiate and follow up air service agreement with third countries
  - To monitor competition in the air transport market
  - To evaluate the need of resources linked to security and custom policies at the airports
  - To monitor tourism flows
  - To assess health risks and implement prevention measures linked to health alerts
- **At national level** this information is also relevant for governments, airports and airlines  
(in addition to some of the above mentioned reasons):
  - To know the distribution of passengers by country of origin/destination (tourism flows) and allow breaking down between national and international markets.
  - To define a variable pricing of landing charges at the airports
  - To plan investment on airport infrastructure taking into account the number of transfer passengers
  - To plan direct flights for better comfort of the passengers, gain of time and fuel consumption for total trip and less environmental impact.

## Work done

- 2009 - Air Transport Statistics Task Force worked out the dataset which would fulfil the need for True O/D data
- 2010 - test data collection - only **5** countries were able to provide the data
- Eurostat investigated alternative data sources:
  - ✓ Amadeus
  - ✓ UBM data
  - ✓ IATA Paxis
  - ✓ IATA DDS
  - ✓ SITA
  - ✓ FLIRT



## Work done cont.

- EUROSTAT – requested Amadeus product for 2-week test period in order to check whether it could be used for:
  - **the compilation of True O/D data**
  - **additional data quality checks**
  - **other purposes (tourism statistics)**

# The way forward

**As the outcomes of the tests show that Amadeus seems to be globally coherent with the expectations:**

- Eurostat will launch a call for tender (or use negotiated procedure) in order to get the licence (not necessarily with Amadeus) and continue further tests with test data for 2014-2015 (if provided by the countries)
- The priority would be to obtain data to fill in need for True O/D + details on methodology applied when compiling the data from different booking systems/databases
- Secondly, comparisons with Eurostat datasets would be performed in order to extend data quality checks performed by Eurostat
- Eventually additional use of the data would be further explored – possible use of the data in BD projects related with tourism statistics

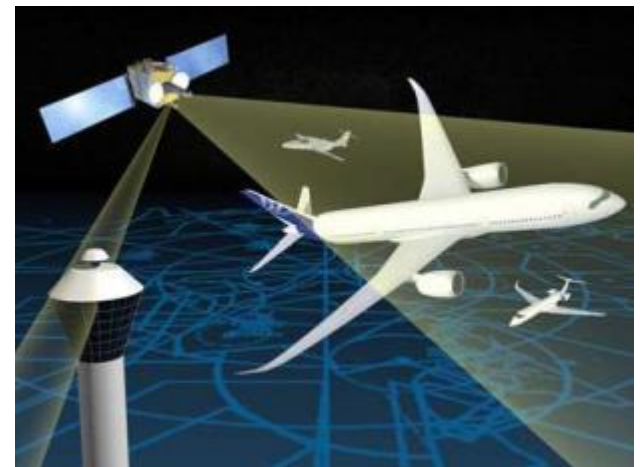
# Aircraft Tracking System

## Satellite based ADS-B

- **Automatic** - It is always working; Aircraft measures its own position. The information is transmitted automatically
- **Dependent** - It relies on external GNSS data, extremely accurate position and velocity vector from aircraft (GPS / GNSS)
- **Surveillance** - It provides surveillance services; aircraft id, position, altitude, velocity vector, etc...
- **Broadcast** - It is always broadcasting, free to air.

ADS-B includes surveillance data such as the following:

- airborne position (latitude, longitude)
- identity and category
- airborne velocity
- barometric altitude



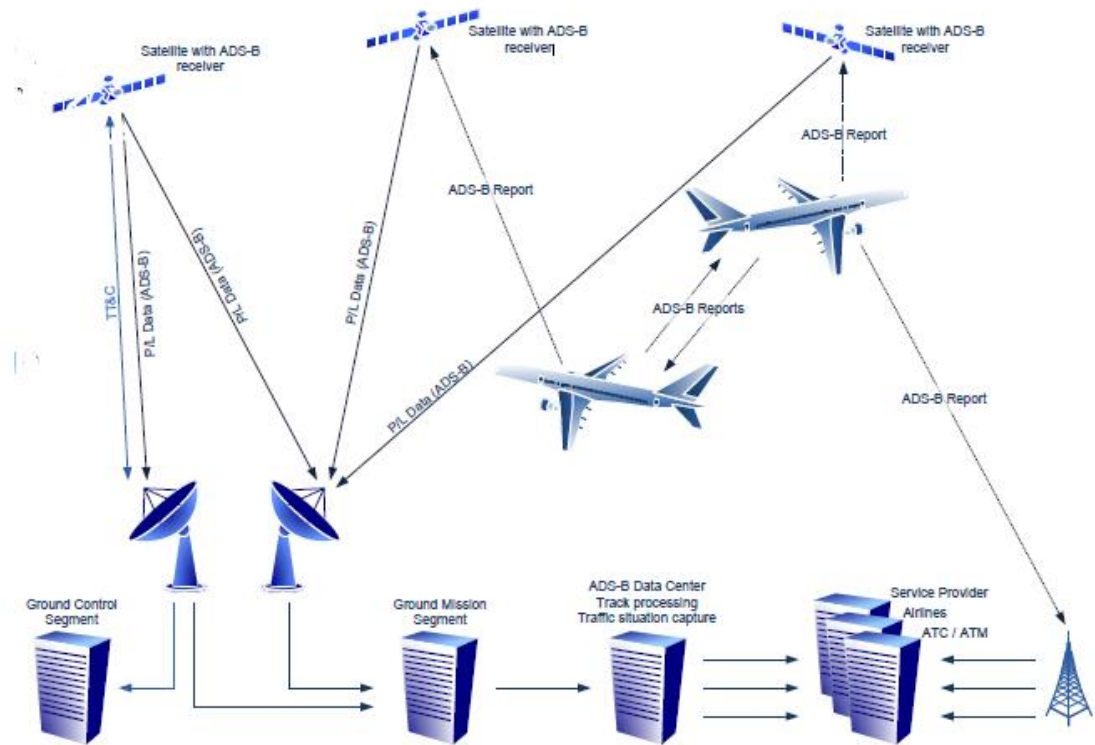


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# Satellite based ADS-B

## ADS-B reception are to:

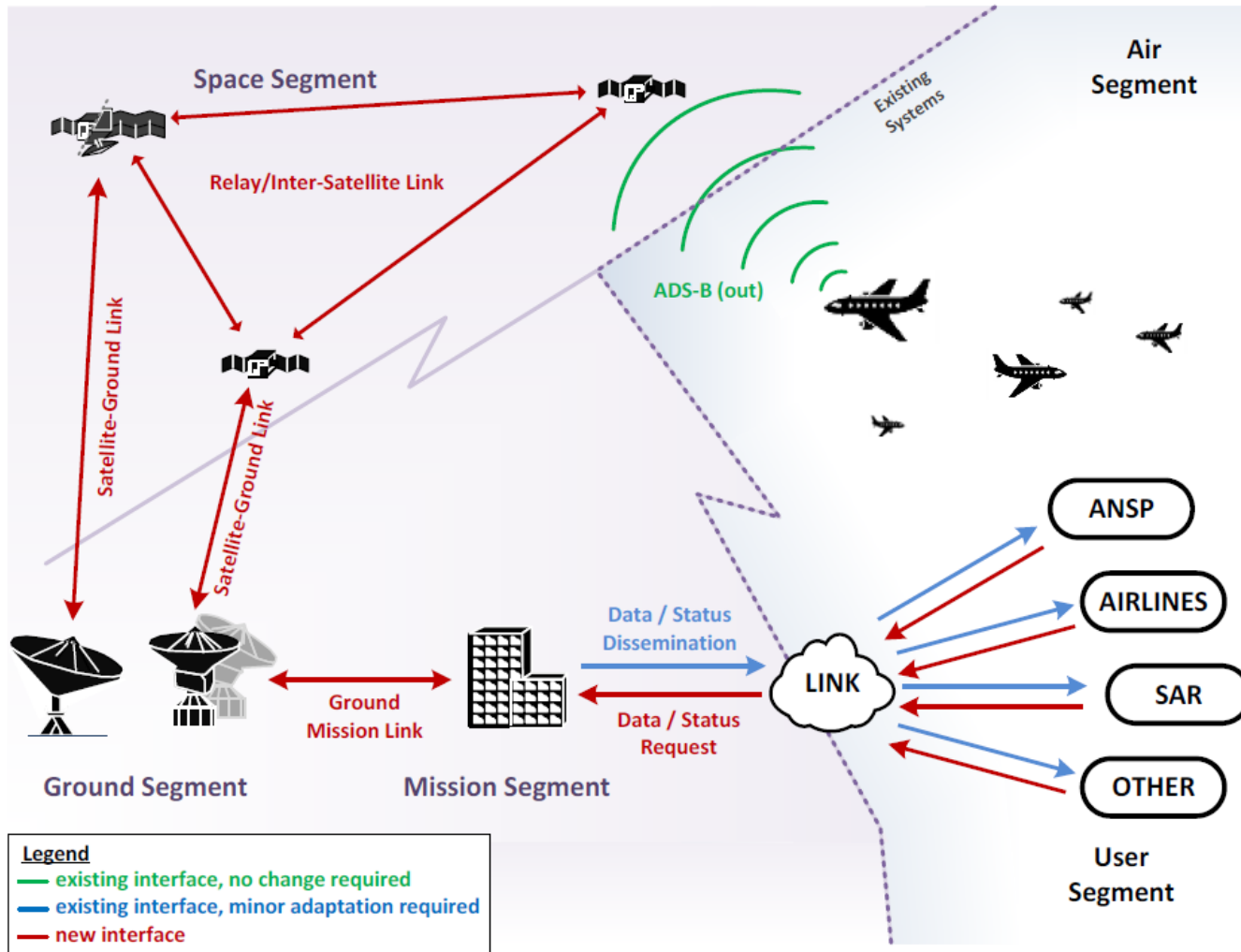
- Provide air traffic situational awareness in Non Radar Airspace (NRA), over oceans, Africa...
- Increase air space capacity in NRA, by optimizing the airplane separation
- Optimize and secure flight paths
- Increase efficiency of search and rescue activities
- Come towards the future increase of the air traffic volume.
- **Existing airplane on-board equipment and ground infrastructure support standard ADS-B messages.**
- **ADS-B transponder becomes mandatory for Europe and US by 2020**





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# System architecture planned





## Links to additional information:

[CIRCABC/Estat/BigData/Library](#)

<http://www.cros-portal.eu/content/big-data>

## Thank you for your attention !