Towards a service to assist mitigation of ash cloud impact on aviation?

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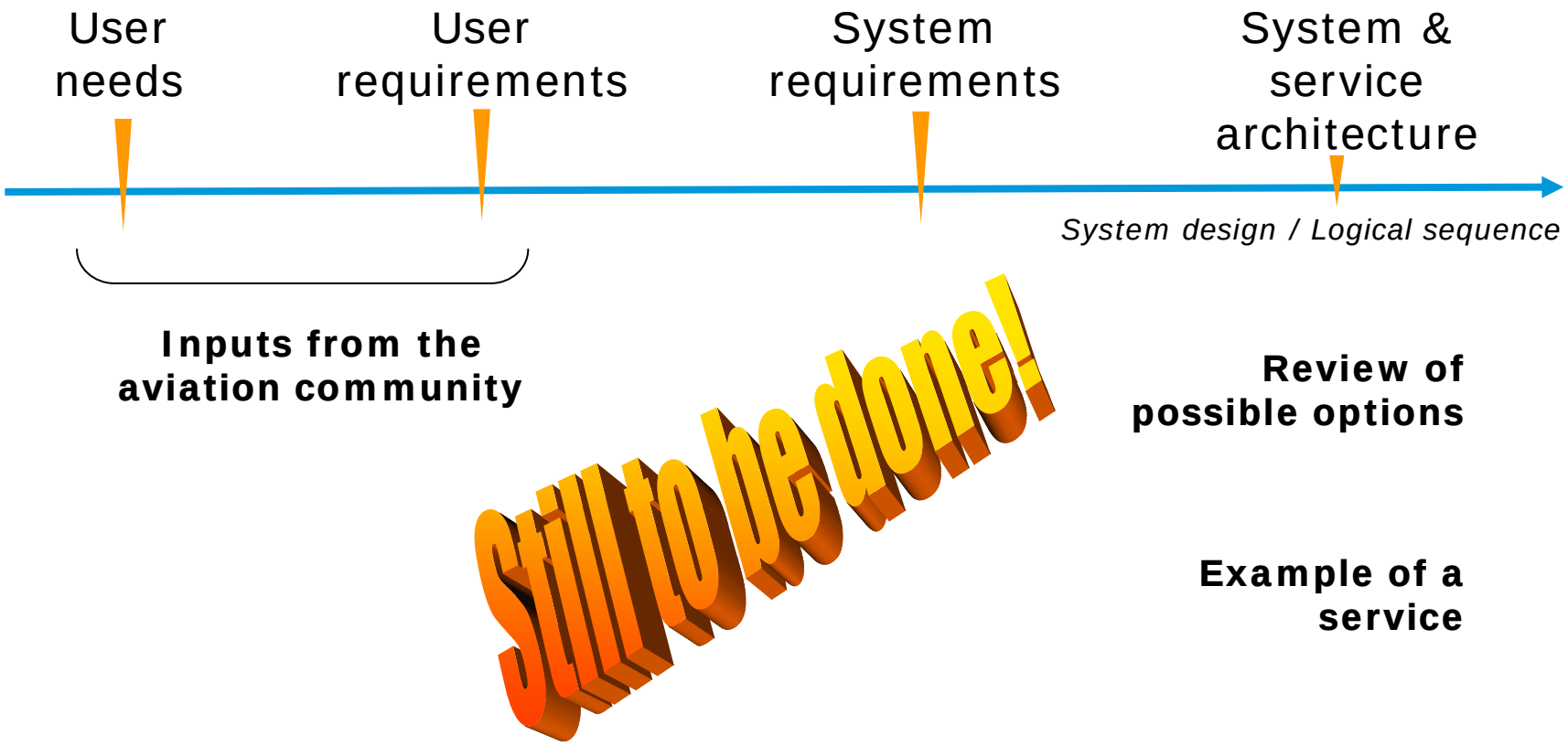
Presentation approach



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Review of major needs & requirements

User NEEDS & requirements

NEEDS

Pre-eruption warning

Early detection of ash cloud

Monitoring & quantitative characterization of ash cloud

Critical need to characterize the **source**

Quantitative Now - Forecasting of ash cloud

REQUIREMENTS

When: How long before?

What: Geographical location / Intensity prevision?

Performance: Level of reliability required?

When? Within 3h of eruption outset, including during night time?

What? Geographical location / depth / height

Performance: Accuracy required (m)?

When? Update every 3-6h?

Maximum delay between measurement and reception of readily usable information by end user?

What: Position / height / horizontal and vertical extent

Source strength (ash outflow rate)

Particle concentration

Particle size distribution & optical properties

Performance: Vertical / horizontal resolution?

Accuracy of measurement?

Significance of source quantitative characterization

Source characterization: Why?

OBSERVATIONS

In-situ / Remote sensing

Particle size distribution

Physical particle density

Particle concentration

Optical properties
(scattering / absorption coefficient / etc…)

?

Source strength and **injection height** for ash dispersion model

Parameterisation of key processes in the dispersion model (sedimentation / aggregation / etc…)

(x,y)

z

t

Retrieval of remotely sensed data

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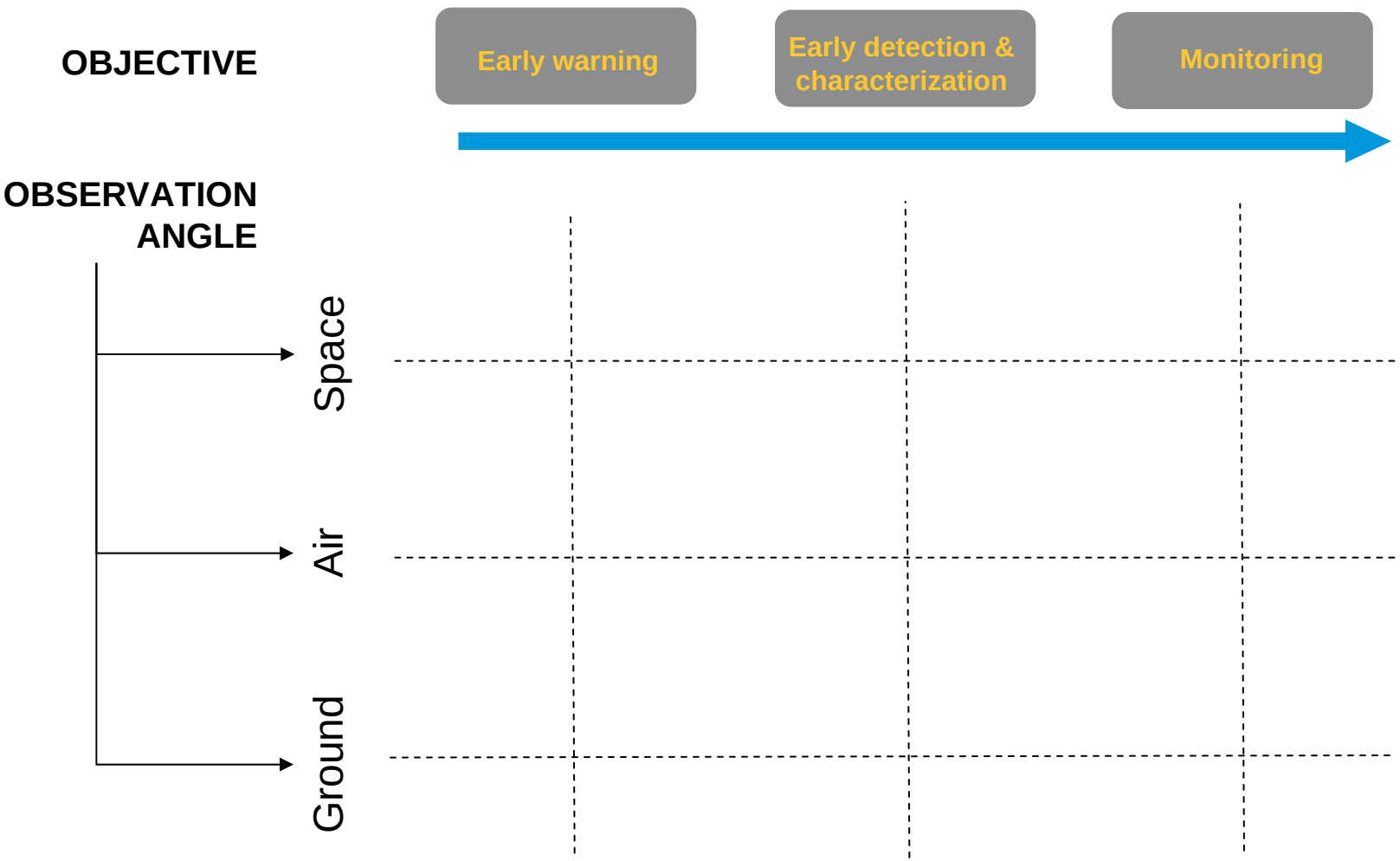
Data collection: Possible options
Reference matrix



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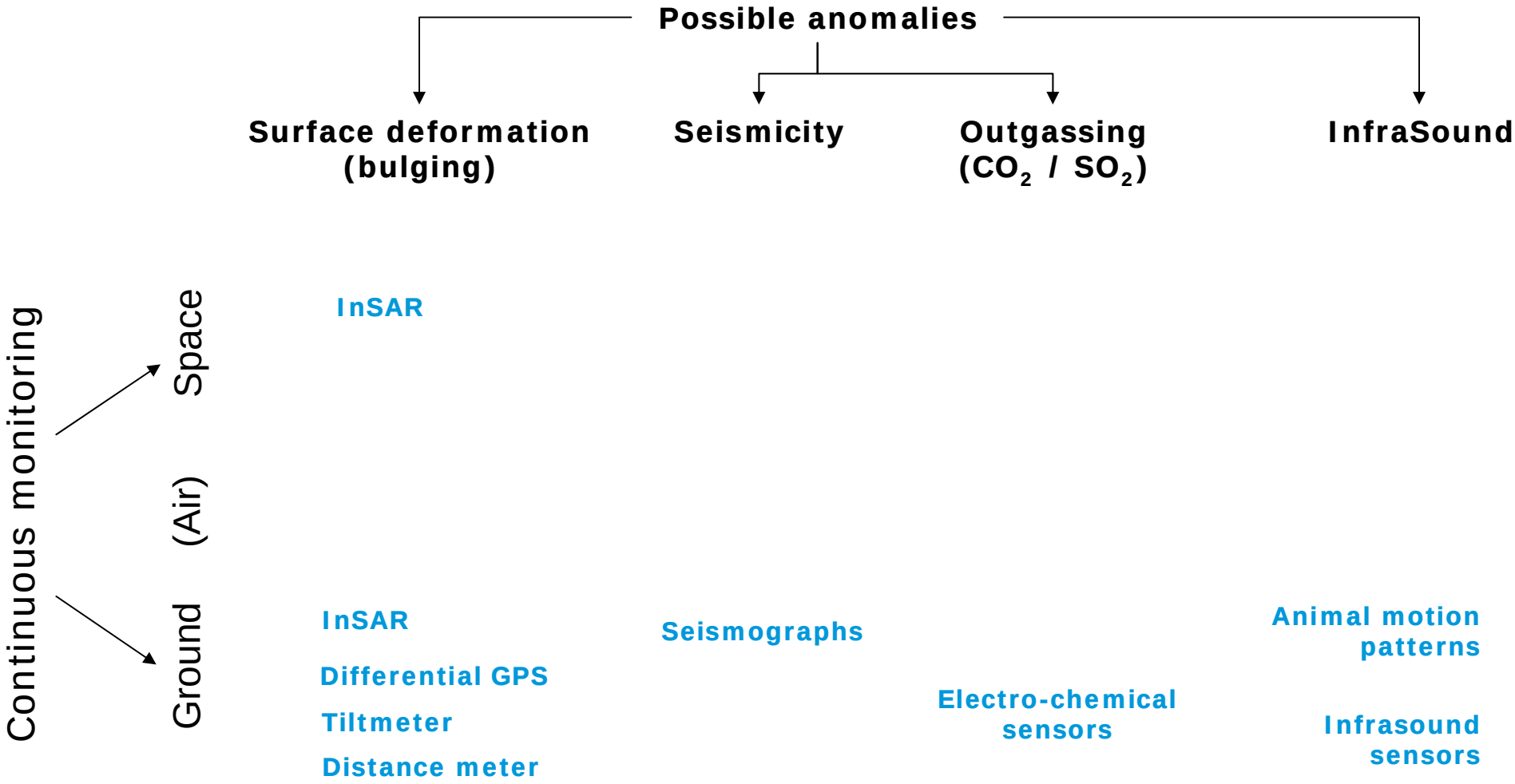
Data collection: Possible options
Early warning



European Space Agency

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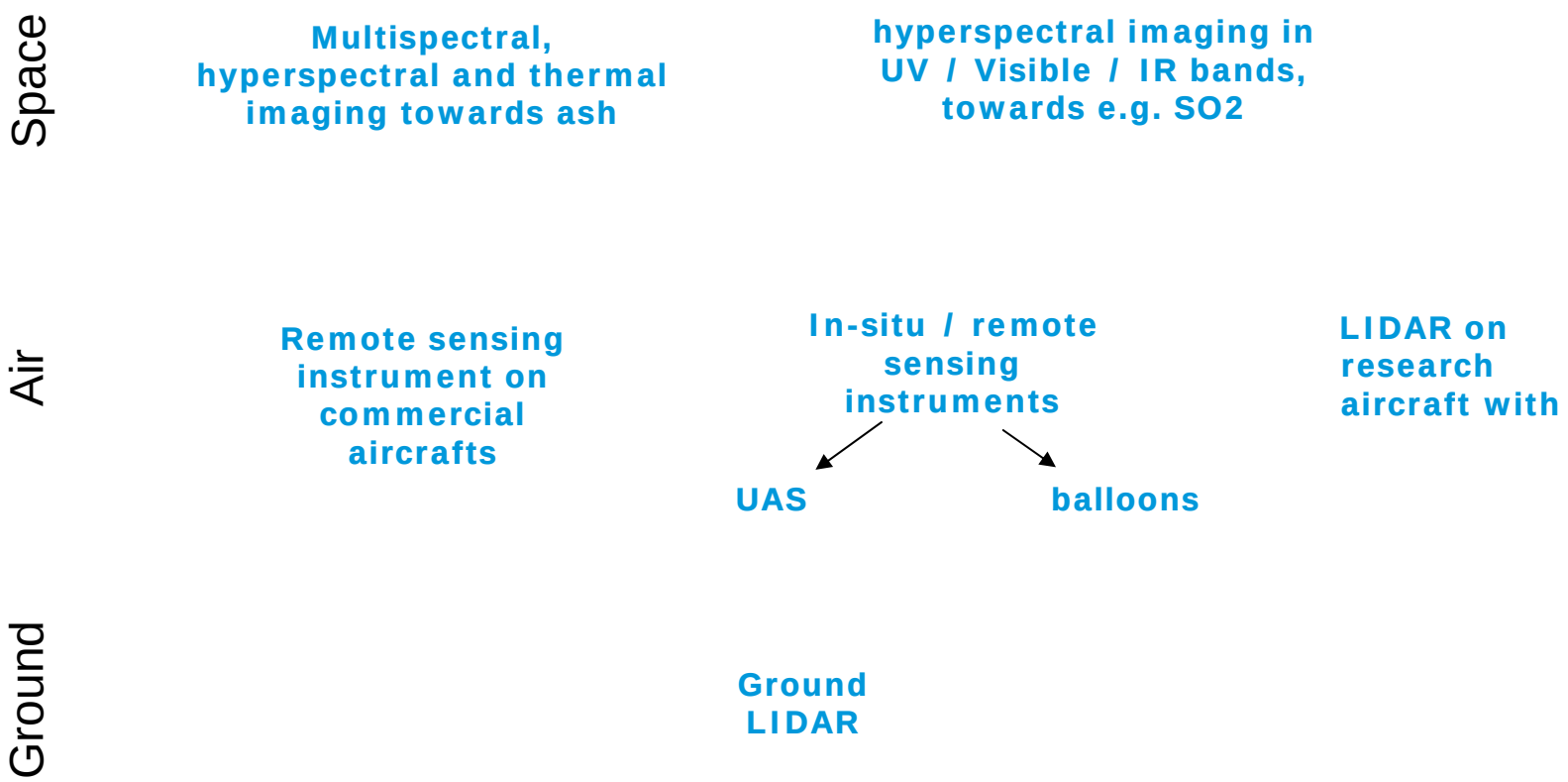
Data collection: Possible options
Early detection / characterization



European Space Agency

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Data collection: Possible options
Monitoring

Space

Retrieval of vertical integrated ash column (TIR)

Retrieval of e.g. SO2 integrated column (Visible / UV / TIR)

Air

In-situ / remote sensing instruments

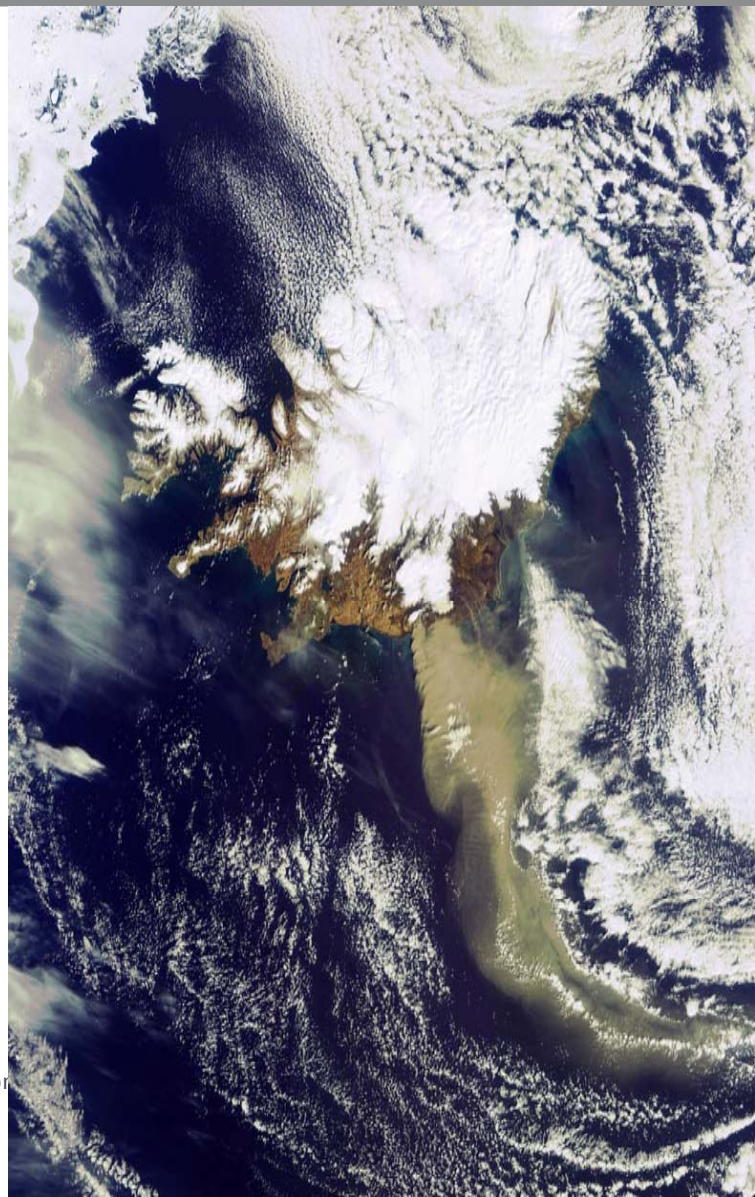
UAS

balloons

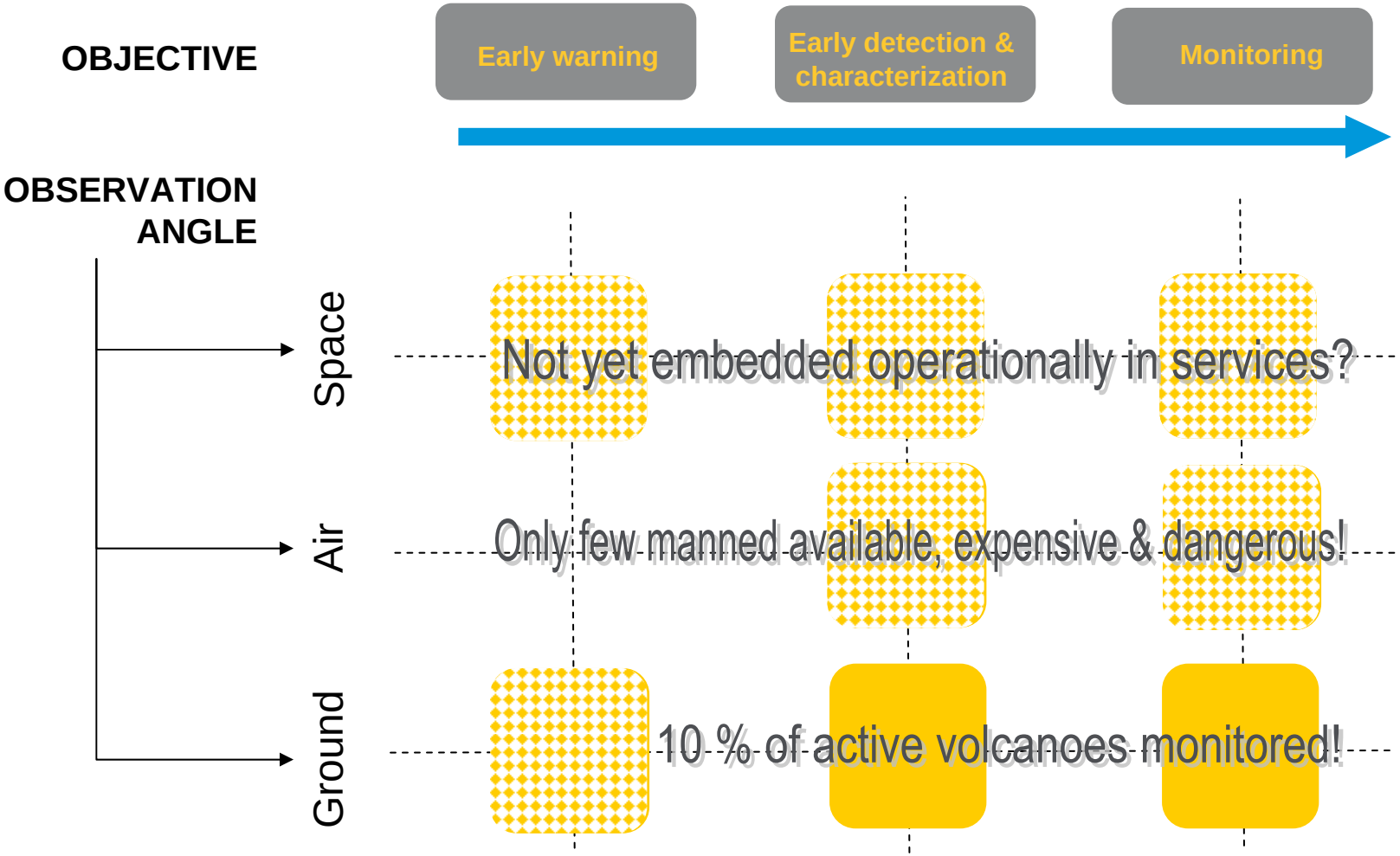
LIDAR on research aircraft

Ground

Ground LIDAR



Data collection
Available instrumentation in practice



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Data collection

Integrated approach is needed to provide the right data at the right time!

Problem: Aircrafts and ground based assets are very expensive to procure and operate

A relevant solution?

Example of a potential service
Functional elements

Volcano routine monitoring

Volcano pre-eruption surveillance

Ash cloud early characterization & monitoring

Space data retrieval & analysis

Anomaly alert

Ground based instrumentation

- Deployment / installation
- Operation
- Info retrieval & analysis

Air borne instrumentation

- Deployment / installation
- Operation
- Info retrieval & analysis

Eruption alert

Coordination / data integration

standardization of data input – product output / quality assurance

Integrated Application Promotion
Objective

Exploit systematically the extended use of space capacity and capability through the development, in close partnership with end-users, of integrated applications which can demonstrate a potential for user-side sustainable services.

“Connecting expert Communities & Combining Technologies”

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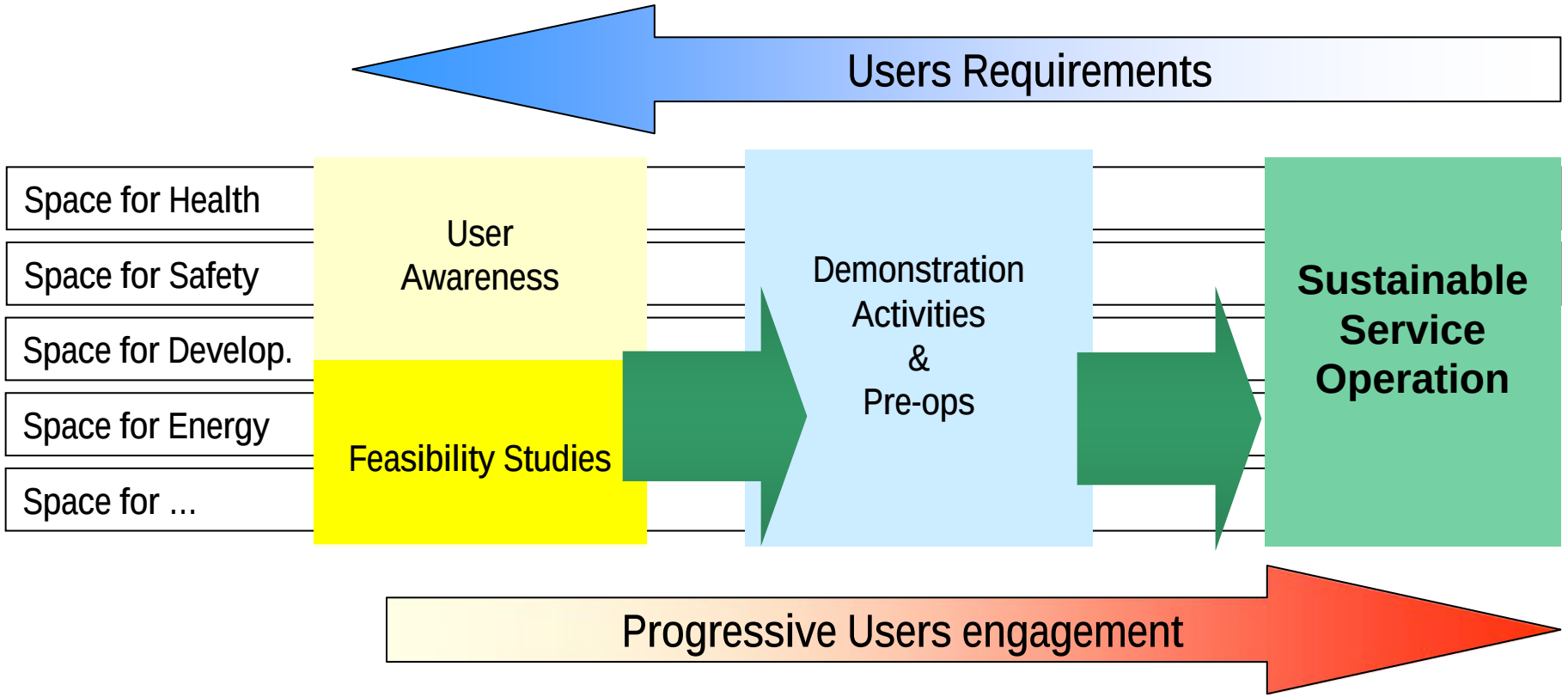
Integrated Application Promotion
Programme Structure



Awareness Activities: Understand, foster and organise stakeholder demands.

Feasibility Studies: Assess technical and economic viability of services.

Demonstration Projects: Implement pre-operational services in partnership with users.

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Scope of IAP activities

- Financing & management of feasibility studies and demonstration projects
- Activities are aimed at setting up OPERATIONAL end-to-end services
- The system architecture is composed of mature elements. Only minor pre-operational developments needed (in particular at interfaces)
- The service should leverage on more than one space asset (among SatEO, SatNAV, SatCom). Space assets are typically integrated with terrestrial assets within the system architecture

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Integrated Application Promotion
FlySafe Avian Alert System

Yearly economical Impact of Bird Strikes

1. German Air Force (1997-2004): **360** collisions
2. French Air Force (1998-2005): **320** collisions
3. Royal Air Force **110** documented serious accidents until 2004
4. Estimated conservative cost due to damage and delays of **commercial aircraft worldwide 1.2 billion USD**

Integrated Application Promotion
FlySafe Avian Alert System

FlySafe objectives:

Improve flight safety & increase flight operation time in northwest Europe by:

- **Improving existing bird route detection**
- **Reducing human dependency**
- **Developing bird forecast models**
- **Developing tools for bird flight activity detection at and near airports**
- **BIRDTAM Cross border harmonization**

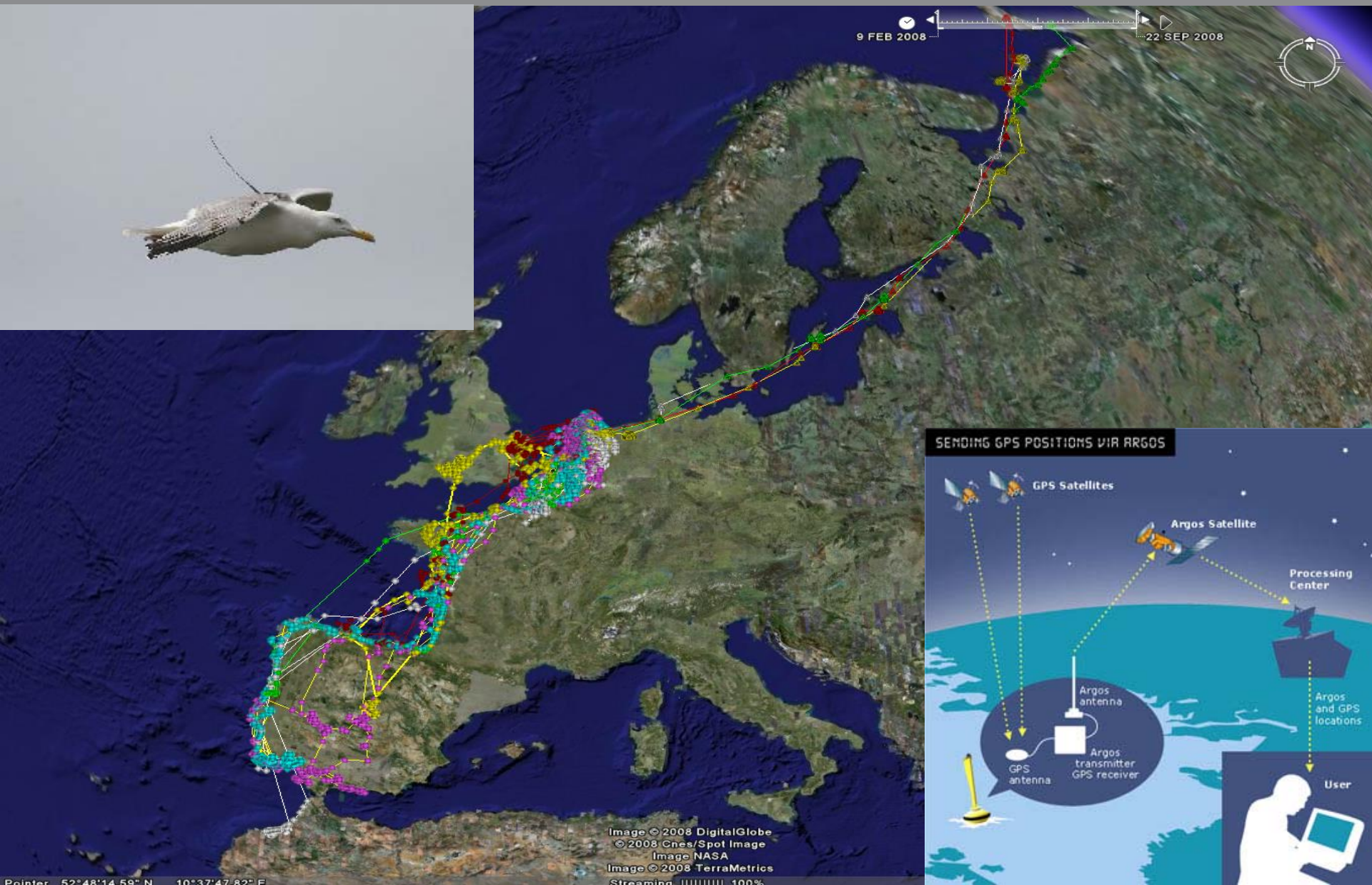
FlySafe activities:

Started 2007

Partners: **RNLAF** **BAF** **FAF** **GAF**

ARMÉE DE L'AIR

Studying behaviour using tracking data

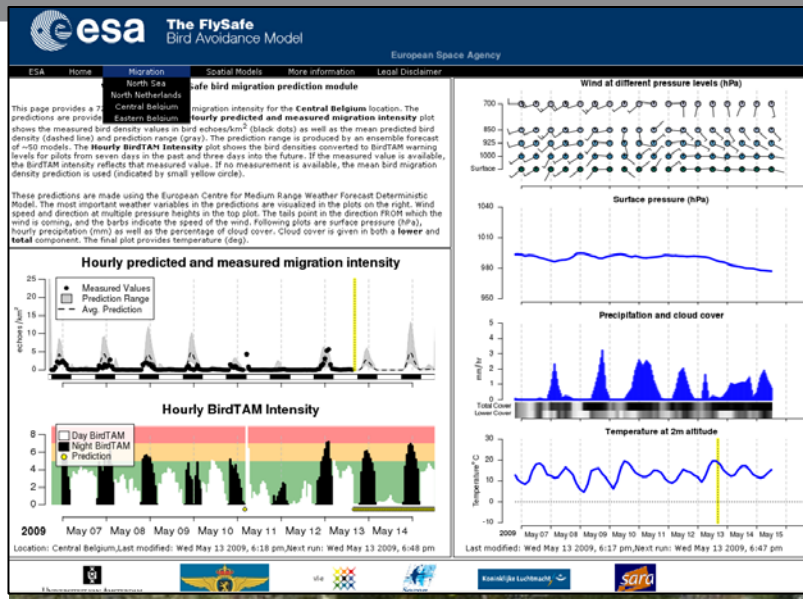


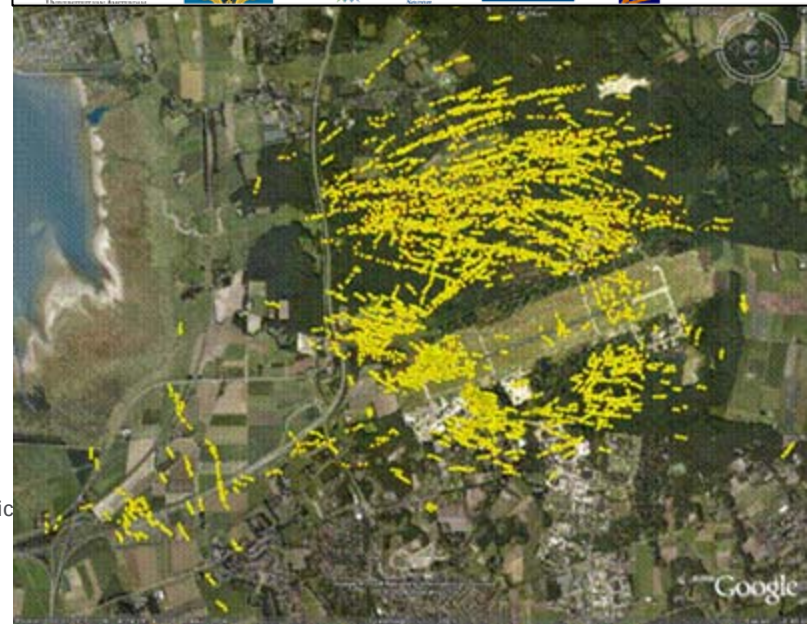
Integrated Application Promotion
FlySafe Avian Alert System

"It's just to let you know that FlySafe is really able to do spectacular things"

1. Belgian BIRDTAM forecast developed in the framework of the ESA FlySafe Project

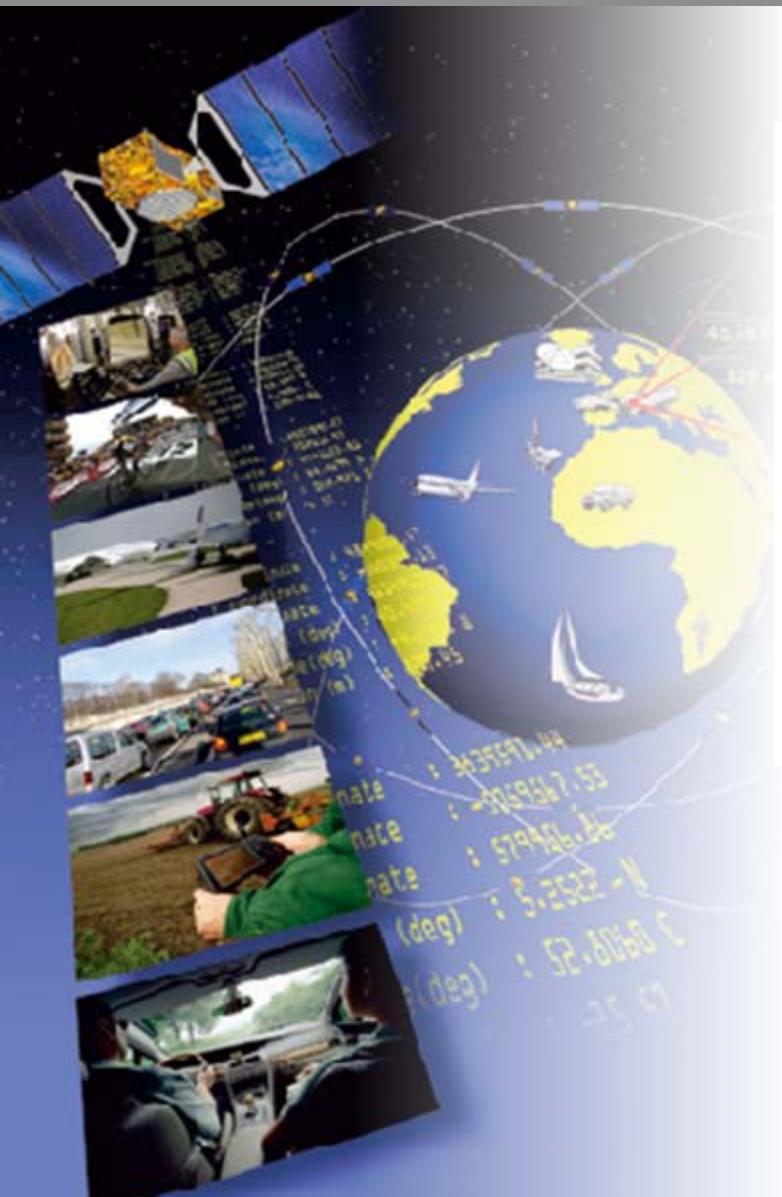
2. BIRDTAM forecast: *« For AF's, a way to save money and life»*





1. Gulls movement at Woensdrecht Airbase, NL., night of Feb. 20th 2008.

Photo: RNLAF



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