EUFAR.net
European Fleet for Airborne Research

Introduction to EUFAR

Integrating Activity of the EC FP7

Budget 8 M€ ***Duration 4 years (2008-2012)*** ***33 Partners***

7 instruments and 19 aircraft open to Trans-national Access

www.eufar.net

Jean-Louis Brenguier, Coordinator

EU-DG Research Work Program for Research Infrastructures

EUFAR is an Integrating Activity of the 7th EU Framework Program for Research Infrastructures

Objectives

- **To provide scientists with access at equal terms to the most complete range of research infrastructures**
  - To develop trans-national access to national infrastructures
  - Reduce redundancy and fill the gaps
  - Improve the service by strengthening expertise through exchange of knowledge, development of standards and protocols, constitution of data bases, and joint instrumental research activities
  - Promote the use of research infrastructures, especially for young scientists from countries where such infrastructures are lacking

European Support to Airborne Research Infrastructure

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007

TRANS-NATIONAL ACCESS PROGRAMMES

STAAARTE	CAATER
3 aircraft, 44 users, 433 flight hours, 3.1 M€	4 aircraft, 24 users, 240 flight hours, 2.6 M€

INFRASTRUCTURE NETWORKING

EURASER	EUFAR-FP5
0.1 M€	0.64 M€

PREPARATORY PHASE STUDY
COPAL-FP7 - 1 M€
WP2 : Legal Structure
WP3 : Aircraft selection and Costs
WP4 : Designation of the operators
WP5 : Network for Instrumentation
WP6 : Scientific Governance

INTEGRATED INFRASTRUCTURE INITIATIVE EUFAR-FP6

25 aircraft,
230 users, 420 flight hours
Networking (0,9 M€)
TA (2,9 M€),
JRA (0,9 M €),
MGT (0,3 M€)
TOTAL : 5 M€

INTEGRATED INFRASTRUCTURE INITIATIVE EUFAR-FP7

25 aircraft or instruments,
205 users, 520 flight hours
Networking (2 M€) , TA (3 M€),
JRA (2,3 M €), MGT (0,7 M€)
TOTAL : 8 M€

The existing European Fleet








OPERATORS	CATEGORIES				
	1. Strato. jet	2. Jets	3. Large A/C	4. Medium A/C	5. Small A/C
Geophysica EEIG	Geophysica				
DLR		HALO		Cessna 208B	
NLR		Citation			
ENVISCOPE		Learjet			Partenavia
SAFIRE		F-20	ATR-42		Piper-Aztec
MetOffice			BAe-146		
NERC				Do-228	
INTA				2 CASA-212	
TAU				King-Air 200	
GTK				Twin-Otter Caravan	
TU-BS				Do-128	
FUB					Cessna 207 TMG-ASK-16
UNIMAN					C-182
CNR-IBIMET					ky-Arrow
IFU					Microlight
TOTAL AIRCRAFT : 24	**1**	**4**	**2**	**8**	**9**
k€ /flight hour:	**16**	**9 - 28**	**9 - 11**	**3 to 6**	**0.8 to 3**



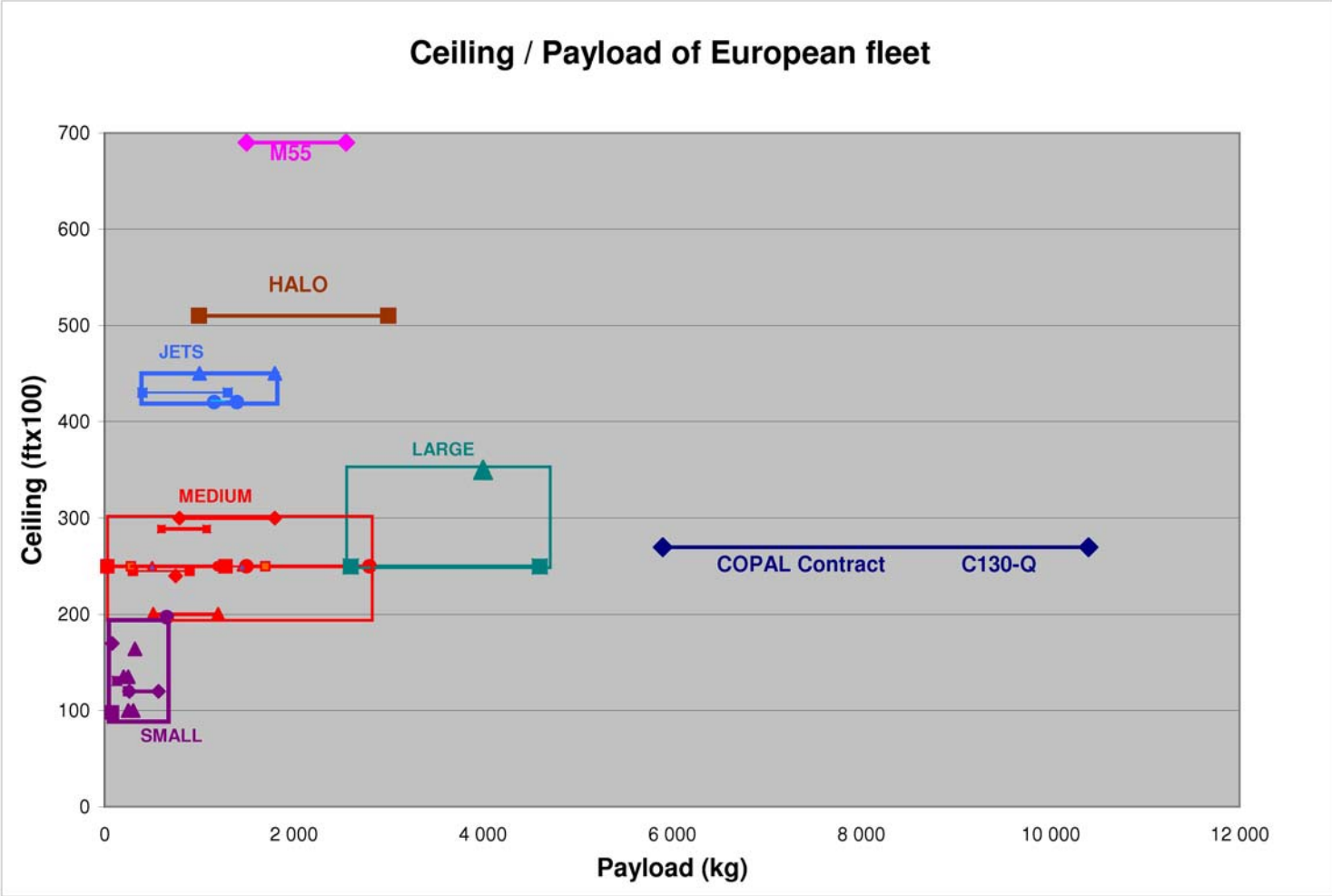






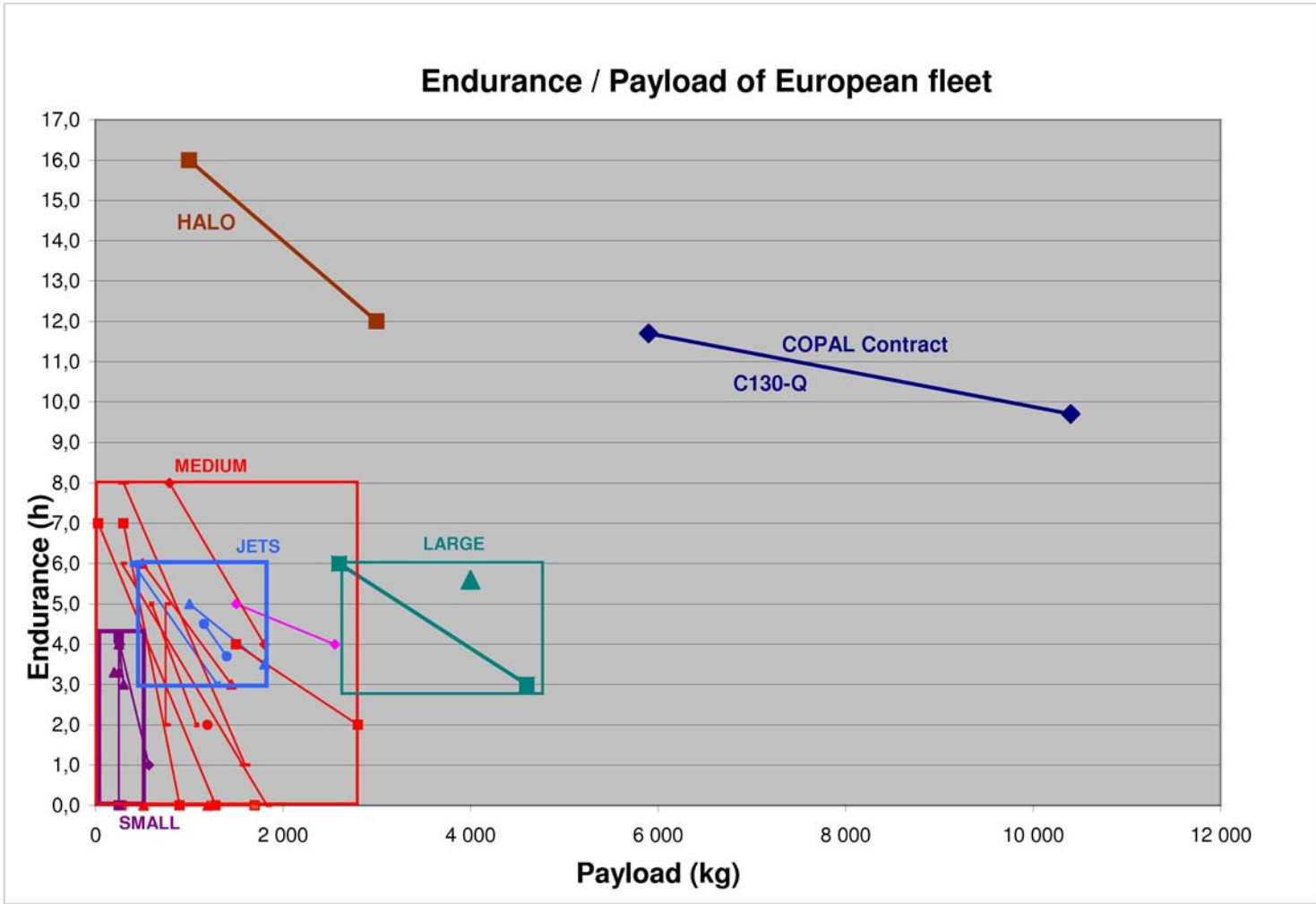

The existing European Fleet

Which aircraft model ? Pay-load / Ceiling



The existing European Fleet

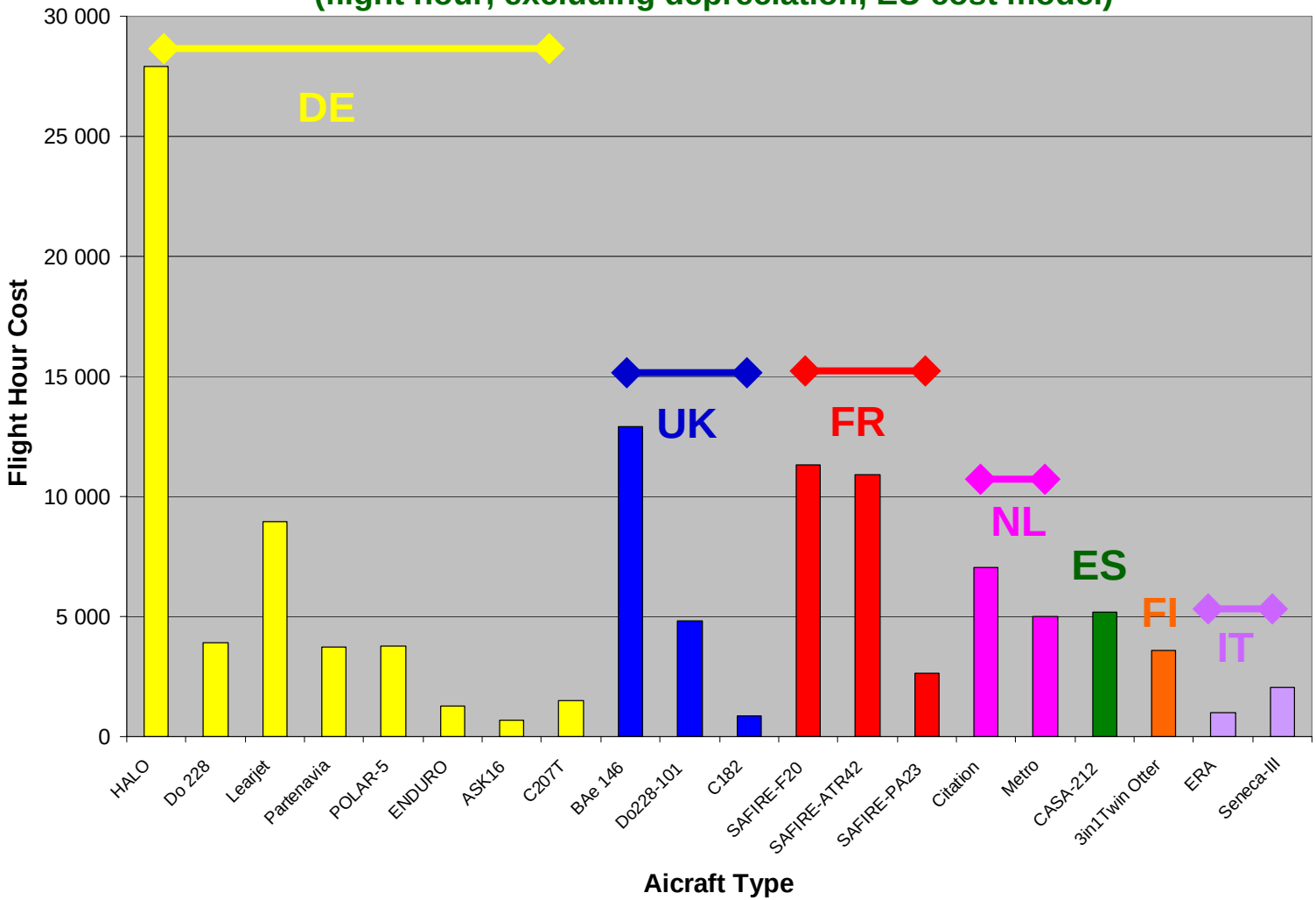
Which aircraft model ? Pay-load / Endurance



The existing European Fleet

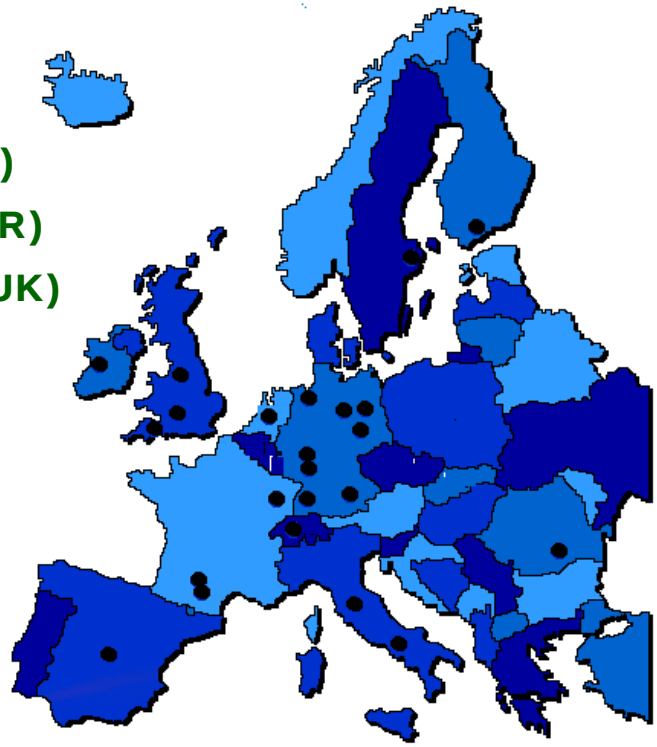
Which aircraft model ? Cost

(flight hour, excluding depreciation, EU cost model)



The EUFAR-FP7 Consortium

- Météo-France (FR)
- MetOffice (UK)
- DLR (DE)
- NLR (NL)
- Enviscope (DE)
- INSU-CNRS (FR)
- NERC-ARSF (UK)
- INTA (ES)
- GTK (FI)
- FUB (DE)
- FZK (DE)
- AWI (DE)
- CNR (IT)
- UNIMAN (UK)
- VITO (BE)



- FZJ (DE)
- JOGU (DE)
- BADC (UK)
- USZ (HU)
- UCAM (UK)
- UHEI (DE)
- UWAR (PL)
- COSINE (NL)
- IRSN (FR)
- COMAT (FR)
- VKI (BE)
- UZH (CH)
- WU (NL)
- ISBE (CZ)
- TAU (IL)
- UEDIN (UK)
- GFZ (DE)
- PML (UK)

The EUFAR-FP7 Activities

- **Management (0,6 M€)**

Networking Activities (2 M€)

N1. Scientific Advisory Committee (CNRM-FR)
N2. TA coordination (MetOffice-UK)
N3. Future of the Fleet (Jülich-DE)
N4. Expert Working Groups (U Mainz-DE)
N5. Education and Training (VITO-BE)
N6. Standards and Protocols (DLR-DE)
N7. Airborne Data Base (BADC-UK)
N8. e-Communication (CNRM-FR)
N9. Sustainable Structure (CNRM-FR)

Trans-National Activities (TA) (3 M€)

Joint Research Activities (JRA) (2,4 M€)

JRA1 Evaluation of hygrometers (Jülich-DE)
JRA2 Quality layers for hyperspectral imaging (VITO-BE)
JRA3 Optical cloud drop spectrometer (IRSN-FR)

The EUFAR-FP7 Activities
NETWORKING

N1-SAC

To provide the EUFAR Consortium with independent strategic recommendations on EUFAR objectives and long term developments

The Scientific Advisory Committee (SAC) will

• Provide advice to ***EUFAR*** on the needs of the broad scientific user community for airborne measurements

• Provide advice and guidance about the strategic directions that ***EUFAR*** is taking

• Assist the ***EUFAR*** management team in prioritizing activities, and identifying redundant and missing activities to meet the strategic goals

Chair: Prof. Bjorn Stevens, head Climate Research at MPI Hamburg

- Sandro Fuzzi (CNR Italy)
- Andreas Kääb (Univ Oslo, Norway)
- Jose Moreno (Univ Valencia, Spain)
- Kevin Noone (Univ Stockholm, Sweden)
- Michael Petrakis (Nat Observatory Athens, Greece)
- Ulrike Seibt (Univ Paris VI, France)
- Iwona Stachlewska (Univ Warsaw, Poland)
- Jeff Stith (NCAR, Boulder Colorado)

The EUFAR-FP7 Activities
NETWORKING

N1-SAC To provide the EUFAR Consortium with independent strategic recommendations on EUFAR objectives and long term developments

N2-TAC To co-ordinate EUFAR Trans-national Access activities

In FP6, 74 proposals have been submitted to EUFAR, 46 user groups (corresponding to 232 users) were selected by the User Group Selection Panel.

A total amount of 2 361 998 € (+ T&S) was allocated to 44 projects, for a total of 404 flight hours. 2 projects were cancelled due to logistical reasons.

In FP7, more than 2.9 M€ is provisioned for access costs.

To improve the scientific impact of Trans-national Access, new evaluation criteria will be defined. The new strategy will be to reduce the number of field experiments, increase the amount of access units allocated to the selected ones and, when possible, allow clustering with existing cutting-edge experiments. To avoid double funding, the EUFAR contribution in a cluster will be distinct from the other contributions, and separately measurable.

The EUFAR-FP7 Activities
NETWORKING

N1-SAC To provide the EUFAR Consortium with independent strategic recommendations on EUFAR objectives and long term developments

N2-TAC To co-ordinate EUFAR Trans-national Access activities

N3-FF To evaluate the performance of the existing fleet and identify gaps. To provide solutions for the long-term development of the fleet.

In FP6, the N3-FF working Group concluded that the main limitation of the European fleet was the endurance (5 flight hours max). HALO (Gulfstream-V), operated by DLR, will soon provide 3 tons of payload and more than 12 FH of endurance for research in the upper troposphere / lower stratosphere. The priority for a new infrastructure was thus given to a heavy payload and long endurance aircraft for research in the middle and lower troposphere. The proposal was selected in the ESFRI roadmap and the COPAL Preparatory Phase project funded by the European Commission.

In FP7, the priority will be to develop operational solutions for providing access to a stratospheric aircraft in Europe.

The EUFAR-FP7 Activities
NETWORKING

N1-SAC To provide the EUFAR Consortium with independent strategic recommendations on EUFAR objectives and long term developments

N2-TAC To co-ordinate EUFAR Trans-national Access activities

N3-FF To evaluate the performance of the existing fleet and identify gaps. To provide solutions for the long-term development of the fleet.

N4-EWG To improve the expertise among the specialized scientists in the field of airborne research.
To facilitate the transfer of expert knowledge to users, operators, and funding agencies.
To compile the knowledge in a high-level handbook on “Airborne Physical Measurements – Methods and Instruments”.

In FP6, 10 expert workshops have been organized on the following scientific fields: Certification and Operational Issues,

- Certification and Operational
- Design of New Instruments and Installations,
- maging Remote Sensing,
- Active Remote Sensing,
- Gas-Phase Chemistry,
- Radiation,
- Stratospheric Measurements
- Aerosols / Cloud Microphysics
- Turbulence
- Thermodynamics.

The EUFAR-FP7 Activities
NETWORKING

In FP7, new EWGs have been constituted, especially in the field of hyperspectral observation of the surface. International experts will contribute to the handbook on airborne measurements.

Support to airborne measurements:

Calibration/Validation (Tim Malthus)
Certification/Operation (Stefan Kommallein)
Instrument Integration (Phil Brown)
Imaging sensors (Koen Meuleman)
Processing (Daniel Schlaepfer)
Unmanned Aerial Systems (Jochen Reuder)
Polar Research (J. E. Kristjannson)
Stratospheric Research (Cornelius Schiller)

Specific measurement fields:

Thermodynamics (Martin Zoeger)
Turbulence (Marco Esposito)
Active Remote Sensing (Jaques Pelon)
Radiation (Jonathan Taylor)
Gas-Phase Chemistry (Jim McQuaid)
Cloud Microphysics (Manfred Wendisch)
Aerosols (Paola Formenti)
Vegetation applications (Michael Schaepman)
Water applications (Steve Groom)
Soil applications (Eyal Ben-Dor)

Handbook on
Airborne Measurements – Methods and Instruments

1. **Introduction**
   (Wendisch, Brenguier)
2. **Basic Thermodynamic and Dynamic Parameters**
   (Lenschow, M. Esposito)
3. **Gas Phase Measurements**
   (McQuaid, Schlager)
4. **Particle Sampling Issues**
   (Krämer, Twohy)
5. **In Situ Measurements of Aerosol Particles**
   (Petzold, Coe)
6. **In Situ Characterization of Clouds and Precipitation Particles**
   (Brenguier, Baumgardner)
7. **Radiation Measurements**
   (Wendisch, Pilewskie)
8. **Hyperspectral Remote Sensing**
   (Eyal Ben-Dor, Müller)
9. **Active Remote Sensing**
   (Pelon, Vali)

The EUFAR-FP7 Activities
NETWORKING

In FP6, 2 Training Courses on Airborne Research Methodology have been organized

Boundary layer
Iasi, Roumania
10-20/07/2007
40 candidates, 27 selected
SAFIRE ATR-42

Aerosol/cloud
Utrecht, The Netherlands
17–25/04/2008
53 candidates, 20 selected.
FAAM BAe-146

The EUFAR-FP7 Activities NETWORKING

EUFAR.net
European Fleet for Airborne Research

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fast Access

-Select an aircraft-

-Select a working group-

Help

Frequently Asked Questions
Help
Report bugs

Welcome to EUFAR.NET

EUFAR is an Infrastructure Cooperation Network of the European Commission HPRI programme under FP5/FP6. EUFAR aims at coordinating the operations of the European fleet of instrumented aircraft in the field of environmental research in the atmospheric, marine, terrestrial and Earth sciences.
Read More

Transnational Access

Get 100% funded flight hours for your experiments!
The European Commission supports access to EUFAR research aircraft for research campaigns.

Flight hours TA Application form

Education & Training

Training for university students:
- Get 100% funded flight hours for your scientific experiment using aircraft
- Join existing research campaigns
- Attend EUFAR summer schools on airborne research

Education & Training Activities

Expert working groups

12 Expert Working Groups meet at workshops and provide recommendations to aircraft operators, funding institutions and researchers.
If you are an experienced researcher involved in airborne measurements, how about joining them!

Expert Working Groups

What's New?

Contact : bureau@eufar.net

The EUFAR-FP7 Activities
NETWORKING

N6-SP

To develop common protocols for airborne hyperspectral remote sensing
To support users and operators with recommendations on best practice and state-of-the-art software for airborne data pre-processing
To develop and publish open source software toolboxes for higher level data products, and data analysis
To define standards for data transfer in real-time

N7-DB

To provide a centralised gateway to data acquired onboard aircraft (both in situ and remote sensed) along with supporting metadata, collected by the aircraft of the EUFAR Fleet.

N8-EC

To elaborate solutions on Internet for the dissemination of the EUFAR information, for facilitating the electronic submission of trans-national access proposals, and their evaluation by the EUFAR User Group Selection Panel, and for providing all EUFAR working groups with a secured domain for collaborative activities.

N9-SST

To develop a framework for a sustainable EUFAR structure, by
- evaluating possible models of legal structure for a joint management of the network,
- promoting the extension of trans-national access beyond Community support
- compiling information on the activities of the fleet and their scientific impact to support strategic decisions
- developing coordination with the COPAL Preparatory Phase study and the international community of research aircraft operators

The EUFAR-FP7 Activities
NETWORKING

ISPRS-WG I/1 - Standardization of Airborne Platform Interface

1. *Chair : Andrew Roberts / USA / NASA / andrew.c.roberts@nasa.gov*
2. *Co-Chair: Jean-Louis Brenguier / France / Meteo / jlb@meteo.fr*

Secretary: James Huning / USA / SAIC / jimhuning@gmail.com

1) Coordinate a forum for discussion between the international airborne science communities

2) Develop airborne sensor interface format standards in coordination with other working groups to promote maximum sensor portability between aircrafts increasing science yield from the sensors.

3) Develop airborne satellite data relay systems use for science research programs between aircraft and ground in coordination with other working groups

4) Develop an airborne science literature search to identify peer reviewed published papers and citations and make a available in a data base.

5) Support the regulatory agencies in supporting airborne science sensor certification and approval requirements for Lidar, Dropsonde and electromagnetic spectrum emissions.

6) Maintain an inventory of the international airborne science capabilities and report annually.

7) Develop a forum to discuss transnational access system(s) for airborne users.

8) Support the use of UAS vehicle activity for science observations in civil and restricted airspace on an international basis and engage the ICAO.

9) Promote the education and outreach on an international basis of airborne based science activity.

10) Develop a forum to coordinate expert international workshops in categories of airborne science sensors for both Remote Sensing and insitu systems.

Transnational Access within EUFAR and its wider development

Phil Brown, Met Office

EUFAR / ICCAGRA meeting at ISPRS, 3-6 May 2009, Stresa, Italy

Aims of Transnational Access in EUFAR

- **To provide access to research aircraft or instrumentation that is not available via the user's own national research funding.**
- **Available to both expert and non-expert users**
- **Principal eligibility criteria:**
  - The proposer and the majority of the user group should be employed at institution in an EU Member State or Associated State
  - The infrastructure (aircraft or instrumentation) to which they propose access should be from a different EU Member State

The History of European Research Aircraft TA

- **Began under EU Framework Programme 4 (STAARTE) and 5 (CAATER) with access to 3 aircraft (UK, France, Germany)**

- **Expanded in EUFAR FP6 to a network of over 20 aircraft**
  - provided TA to 46 user groups (230 users)
  - 413 flight hours total
  - most-heavily used aircraft flew 40-55 hours each

- **In FP7, merging with the HYRESSA community now continues to provide access to over 20 research aircraft plus 4 hyperspectral imaging systems**

Key Issues in EUFAR TA under FP6

- Typical allocation of flight hours to a user group was ~9-10 – insufficient to accomplish high-impact scientific research.
- EC rules allow access costs to be specified only in simple units – flight-hours – with no allowance for other typical costs (detachments away from home base, transit flight time, instrument integration etc.).
- Limited to <20% of the aircraft operator's total activity.
- Initially, fixed allocations of flight-hours were provided to each aircraft within TA.
- After 2 years, and with the agreement of all partners, a re-allocation system was created.
- This allowed funds to be transferred from unused flight-hours on some aircraft to support additional hours on other aircraft

Aims for the development of TA in FP7

- **To increase the overall scientific impact of TA activities**

- **Methods:**
  - Clustering of TA projects with those supported by national or other EC funds
    - ability to share transit costs
    - larger community of scientists with whom to interact
  - Promotion of specific instrument testing and development activities via TA flying
    - problem of instrument integration costs
  - Promotion of summer schools as a specific activity
  - Tutoring – pre-review guidance to applicants
    - instruments, methods, flight strategy etc.
    - from within the identifiable pool of EUFAR Experts
  - Stricter scientific review process with clear guidelines on expected output quality

Types of TA activity

- ***Science projects***
  - Similar to those undertaken during EUFAR under FP6.
  - May be submitted by both expert and non-expert users of research aircraft.
  - Expert users will be gaining access to an aircraft from outside their home country with measurement capabilities not available via national or other EC research funding.
  - Non-expert users from countries and/or institutions without access to research aircraft via national funding.
  - Primary acceptance criterion will be the quality and impact of the science, as judged by independent peer-review process.
  - Secondary criterion will be impact on scientific users. Seeking to ensure that potential users of the flight data are identified at an early stage in the application process.
  - Project will be more likely to secure TA funding if it can identify a large potential user base.

Types of TA activity

- ***Summer schools***
  - Similar to those undertaken in FP6 with ATR42 and BAe146
  - Primary acceptance criterion will be quality of teaching proposed, both in terms of people and programme.
  - Summer schools may be proposed both for existing students (primarily studying at the Ph.D. level) in the selected field.
  - also summer schools that involve staff currently teaching in such areas of science, but who have not had any previous activity in airborne measurement fields.

- ***Instrument development***
  - Primary criterion for acceptance will be on the perceived demand for, and scientific impact of, the new instrument.
  - Judged by independent peer-review process involving experts in airborne instrumentation.
  - Secondary acceptance criterion will be ability to cluster with other projects to increases the cost-effectiveness of the flying.

Instrument Development activities

- Proposed to have a separate call for proposals with a longer lead time than normal
- Allows time to seek separate funding for instrument integration
- Also, hoping to get EC approval that such costs may also be incorporated within an operator's allowable subcontracting costs – could become incorporated in the final audited flight hour costs which would be reimbursed to the operator

Clustering of TA projects

- **With both national- and other EC-funded activities (including other EUFAR TA)**
  - auditing required to cover ALL activities of the field campaign to clarify that there is no double-funding
- **Contact a wider group of scientific users to increase collaboration.**
- **Share transit costs – maybe allowing projects in locations remote from the operator's home base.**
- **Enable a TA project to have greater time in the field – improve probability of encountering optimum measurement conditions.**

Pre-review Tutoring – feedback to applicants

- Are the scientific aims of the project clearly stated?
- Is an aircraft the most appropriate platform for obtaining the required measurements?
- Is the instrumentation that is proposed to be operated appropriate to the task and being utilised in the correct way?
- Are the flight patterns that are proposed the most appropriate to acquire the necessary measurements?
- Does the data analysis plan pay appropriate attention to any issues that may arise due to instrument operating limitations, calibrations issues etc.?
- Does the project require any special weather or ground surface conditions and if so, does the field observation plan consider where or how these conditions might be met?
- Is there a reasonable probability that the project can acquire sufficient data to address its scientific aims within the proposed operating period?

- should be a **dialog** between applicants and tutor

Scientific review – follows similar overall guidelines to national research funding schemes

9 - Exceptional scientific merit and expected to make a major scientific impact.

8 - At the leading edge of its field, and will produce a significant advance of general understanding. May develop a measurement technique that will open up a new field of study.

7 - A well-planned study that will produce competitive science and some advances within its field. May generate significant advances within a specialist measurement area.

6 - A good-quality study that will produce results that strongly support other work within the field of study. May generate a useful advance within a specialist measurement area.

5 - Has some aspects of merit, but likely to provide only moderate support to other studies within the field, or to provide only a modest advance within a specialist measurement area.

4 - Scientifically sound but unlikely to make any advances within a field of science or specialist measurement area.

3 - Identifiable flaws in the approach or proposed methods.

2 - Significant flaws in the approach or methods.

1 - Rejected due to similar measurements or analyses having already been performed

Minimum threshold required for allocation of TA funding

Allocation of TA funding in EUFAR FP7

- Propose to have a more open system from the start, which incorporates the spirit of the re-allocation funding pool that was implemented in FP6 (at end-Yr2)
- No pre-allocations to individual aircraft – the aim is to achieve a more "open market" promoting collaboration between proposers and TA operators.
- All aircraft operators are free to express interest in supporting any new application – they may contribute to the pre-review tutoring process.
- Final decision on allocation made by User Group Selection Panel (UGSP) composed of 4 EUFAR and 5 independent representatives
- Aircraft selected on the basis of which will most closely match the proposers' objectives and instrumentation requirements

Allocation of TA funding in EUFAR FP7

- **Flight-hours allocation likely to remain at around 10 hours per user group**
- **but with the possibility of additional hours where scientific outcomes of high quality or impact are expected**
- **Total budget for 4 years (2008-2012) of approx €3,000,000**
  - providing approx 520 flight hours
- **anticipate flight hours to be split roughly**
  - 20% small low-cost aircraft
  - 55% medium-size aircraft
  - 25% large aircraft or high-altitude jets
- **Remains limited to 20% of operator's total activity (over 4 years).**

The EUFAR-FP7 Activities
JOINT RESEARCH

JRA1

Development and characterisation of novel or improved compact airborne hygrometers for different airborne applications within EUFAR; including investigation of the sampling characteristics of different gas/ice inlets and the development of an improved ultra fast thermometer for near- and in-cloud measurements

JRA2

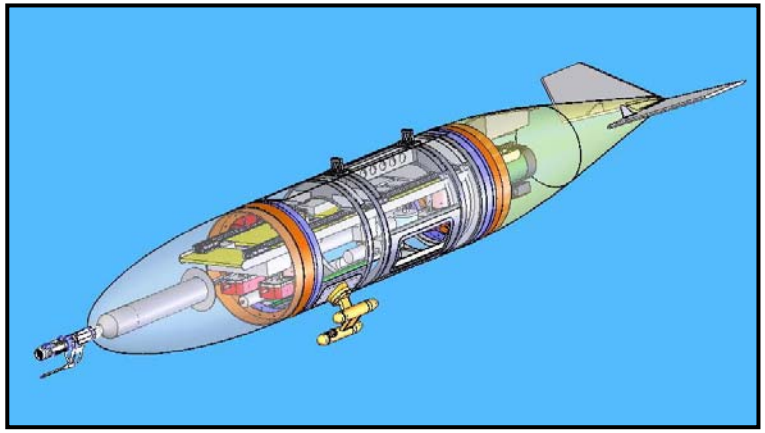
- To develop quality indicators and quality layers for airborne hyperspectral imagery
- To develop quality indicators and quality layers for higher level data products
- To implement and to test quality layers in existing processing chains of airborne hyperspectral imagery
- To develop higher performing water and soil algorithms as demonstrators for end-to-end processing chains with harmonized quality measures

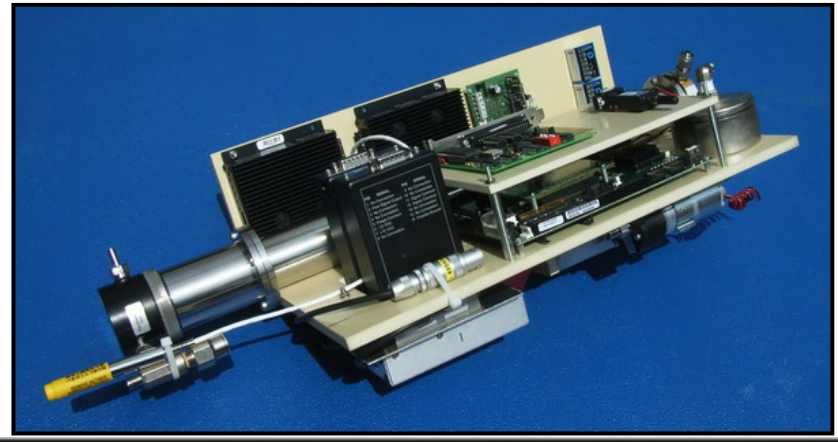
JRA3

To design and construct an airborne drop spectrometer based on a new principle, that provides absolute measurements of the drop size and a large sampling section (laser interferometer).

The EUFAR-FP7 Activities
JOINT RESEARCH

In FP6, a consortium of European laboratories developed a unique system for measurement of aerosol physical and optical properties in two portable pods





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COPAL

Preparatory Phase Project

COPAL aims at providing the European scientific community in the field of environmental and Geo-sciences, with a unique research aircraft platform, capable of reaching and operating in any remote area in the world. It will offer an unprecedented opportunity to countries that are not yet operating research aircraft to develop expertise in airborne measurements and participate to international multidisciplinary experiments.

With a payload of **10 tons or more and an endurance of 10 hours**, a heavy-payload, long endurance (HPLE) aircraft will more than double the capabilities offered to European scientists.

COPAL Consortium

Beneficiary Number *	Beneficiary name	Beneficiary short name	Country	Date enter project	Date exit project
1	Météo-France, Centre National de Recherches Météorologiques	CNRM	FR	Month 1	Month 48
2	Instituto Nacional de Técnica Aeroespacial	INTA	ES	Month 1	Month 48
3	Finish Meteorological Institute	FMI	FI	Month 1	Month 48
4	Natural Environment Research Council	NERC	UK	Month 1	Month 48
5	Fundação para a Ciência e a Tecnologia	FCT	PT	Month 1	Month 48
6	Consiglio Nazionale delle Ricerche	CNR	IT	Month 1	Month 48
7	General Secretariat for Research and Technology	GSRT	EL	Month 1	Month 48
8	University of Warsaw, Institute of Geophysics	IGFUW	PL	Month 1	Month 48
9	Enviscope GmbH	Enviscope	DE	Month 1	Month 48
10	The Meteorological Office	Met.Office	UK	Month 1	Month 48
11	Centre National de la Recherche Scientifique	CNRS	FR	Month 1	Month 48
12	SJ Berwin LLP	SJ BERWIN	UK/BE	Month 1	Month 48

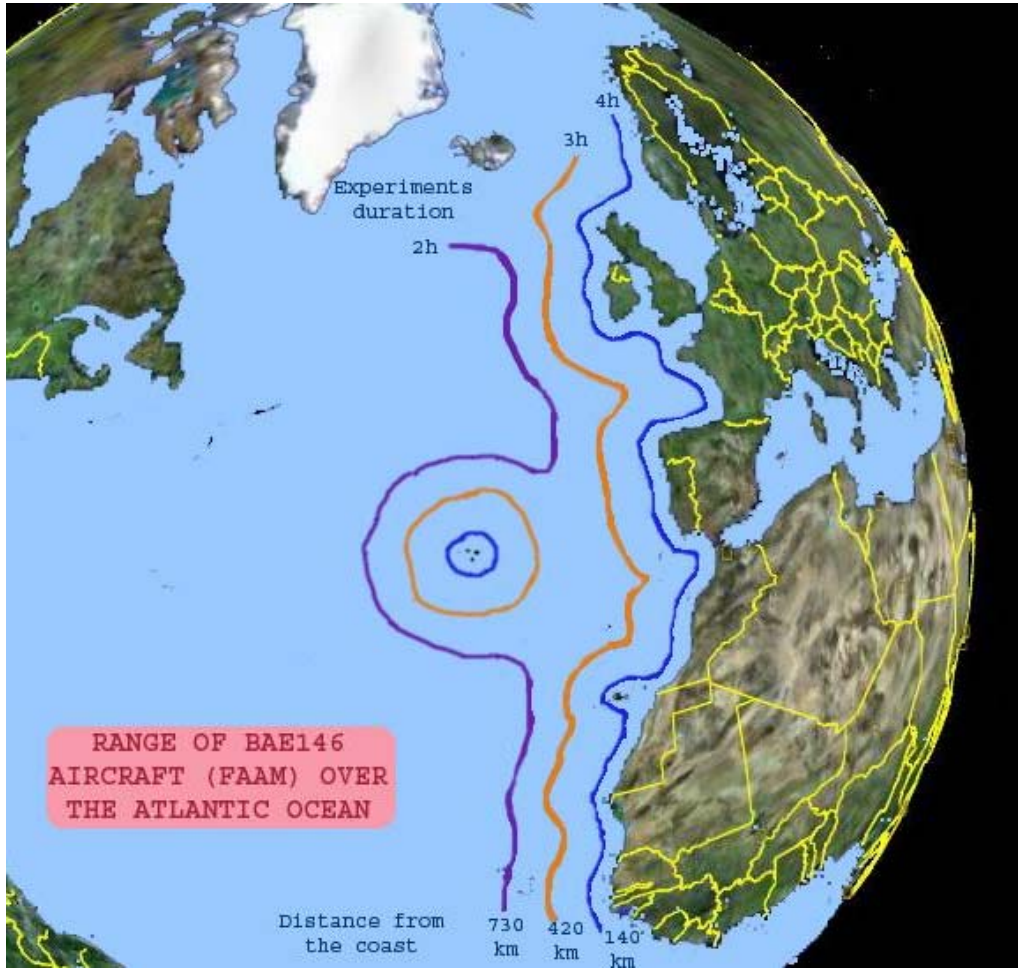
COPAL

Feasibility Study for procurement, refurbishing, modification and instrumentation of a heavy-payload (10 Tons) and long-endurance (10 hours) aircraft for research in the lower and middle troposphere.

- Propose a legal structure for joint management of the COPAL aircraft
- Quantify the costs for procurement, refurbishing, modification for research, certification, and operation of the COPAL aircraft
- Designate the aircraft operator and scientific operator of the COPAL aircraft
- Constitute a network of academic laboratories and SME for development, maintenance and operation of research instrumentation
- Define the governance model for access proposals evaluation and allocation of flight time

The endurance is the main limitation of the European fleet

With and endurance of 5.5 hours, the Bae-146 (UK) is limited to a few hours of scientific activities in remote areas such as the ocean, polar regions or underdeveloped countries (Sahel))



The Origin of COPAL

As part of the EUFAR FP6 activity on the Future of the Fleet, a survey of the scientific demand was completed by the European Science Foundation in 2006 :
Among the 6 options that were suggested by ESF, the majority of the 203 responses supported as the first priority for the development of the fleet :

"A European medium-altitude / heavy -payload / long-endurance research aircraft, for atmosphere / low-troposphere campaigns (in multi-disciplinary / multi-national settings): a turboprop aircraft (Lockheed C130, Airbus A400M)"

A proposal was thus submitted to ESFRI for the construction of a heavy-payload and long endurance research aircraft for tropospheric research, indicating that two options had to be considered : a *Lockheed C130 and an Airbus A400M*

After selection of the proposal by ESFRI in October 2006, a proposal was submitted to the Commission at the first FP7 call for Infrastructures in May 2007 for the construction of a heavy-payload and long endurance research aircraft for tropospheric research, indicating that three options had to be considered :
a *Lockheed C130 and an Airbus A400M, and a CASA-295*

The proposal was selected by the EU Commission and started on 1st November 2007

The concept of Community Airborne Laboratory (NCAR/C130)

During international experiments, 15 to 20 research laboratories contribute to the multidisciplinary instrumental setup (dynamics, chemistry, aerosol, radiation, remote sensing) that is necessary to address crucial issues such as climate and general circulation.

The concept of Distributed Infrastructure

Because of its limitations in term of available space and weight, a research aircraft is generally a tightly integrated measurement platform, that shall be managed by a single operator.

When space and weight are no longer a constraint, the instrumented aircraft can be managed following a different approach:

One operator shall still be designated to act as the aircraft responsible for aviation authorities and registration. He is in charge of the operations and of the maintenance of a basic measurement system, that includes standard atmospheric parameters, positioning, and time. He also manages the central acquisition system and defines standards for integration and certification of innovative instruments developed by other laboratories.

The concept of Community Airborne Laboratory

This concept of distributed infrastructure is particularly interesting at the present stage of integration of European Research Infrastructures.

It allows all countries in Europe to contribute to the overall system, at their possible level of investment .

It allows to mobilize the best teams in Europe over the very broad range of expertise that is required for today research on the Earth System .

It will have a strong integrating impact on the « measurement and instrumentation » scientific community, because field campaigns on an aircraft always create durable links between groups of different origin working towards a common objective

The concept of Community Airborne Laboratory

Benefits : With an endurance of 10 to 12 hours, the COPAL aircraft will be able to reach any area of the globe, and still perform a significant amount of scientific time on site.

With a scientific payload of 6 T, a comprehensive multidisciplinary set of instruments will be installed on the COPAL aircraft, without severe constraints of miniaturization

A turboprop, limited to an altitude of 9 km, is two times cheaper than a jet, with a lower payload and similar endurance, but a much higher ceiling of 15 km.

Contraints : For optimal operation (600 hours/year), the COPAL aircraft shall be open to a broad community of scientific users, like the NCAR in the US, which operates the C130 turboprop and G-V jet.

Estimated COPAL Construction Costs (ref NCAR-C130 2006)

Construction costs : The procurement, refurbishing, modifications for research and civil certification amount to 30 M$ for a C130K with a potential of 15000 hours).

Operation Fixed costs : The fixed costs, including indirect costs (60% of direct costs), insurance, training, navigation service, maintenance and provision for inspection, plus salaries and overheads (53.4%) for 3 pilots, 2 navigators, 2 flight engineers et 3 mechanists, amount to 3,5 M$.

Operation Variable costs : The variable costs, on the basis of 600 flight hours per year, including fuel, spare parts, maintenance for engines, propellers and APU, amount to 3,6 M$, i.e. $6000 per flight hours.

Financing Scheme for Construction & Operation

Construction costs : 30 M$

The European Commission develops new tools for the financing of research infrastructure of pan-European interest.

The European Investment Bank is ready to support the COPAL project with a long term (25 years) loan of 30 M€ over 25 ans. Reimbursement of the debt: 2 M€/ year.

Operation costs : 3,5 M$/year

Cumulating operation costs and reimbursement of the debt, the COPAL annual budget will be less than 5 M€.

The variable additional costs ($6000/hour) is comparable to the one of the existing large pay-load EUFAR aircraft UK-BAe146 or FR-ATR42

Long Term Commitments for COPAL

Participation in COPAL is a strategic decision for countries, which have not yet invested in airborne research infrastructures

An investment of 5 M€ is just sufficient for procurement, modification and instrumentation of a medium size tropospheric aircraft (Merlin-IV), with less than 1 ton of payload and 3 hours of endurance

It is difficult to develop rapidly all fields of expertise necessary to operate a research airborne infrastructure (dynamics, radiaiton, chemistry, microphysics,…)

At the national level, the facility will therefore be focused to address some specific fields, for a limited user community. The aircraft will therefore be used well below its optimum potential (600 flight hours /year).

An initial budget of 5 M€ is difficult to obtain from research funding institutions

SUMMARY

There are no long endurance and heavy payload instrumented aircraft in Europe for tropospheric research, while 7 such aircraft (C130s and P3s) are currently available to the US scientific community

COPAL aims at providing the European users community with the same capabilities as in the US

Year 1 : - Examine possible legal structure models
- Select aircraft models that fulfil the specifications for quantification of costs
- Define criteria to select the aircraft and data management operators
- Build the network of instrument providers
- Define the scientific governance model

Year 2 : - Select the legal structure models
- Select aircraft models that fulfil the specifications for quantification of costs
- Start the selection of the aircraft and data management operators
- Build the network of instrument providers
- Finalize the scientific governance model

Year 3&4 : - Towards the signature of long term commitments