

In-service Aircraft for a Global Observing System

# In-service Aircraft for a Global Observing System

## *Status and Perspectives*

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IAGOS-Meeting 2010

# Objectives

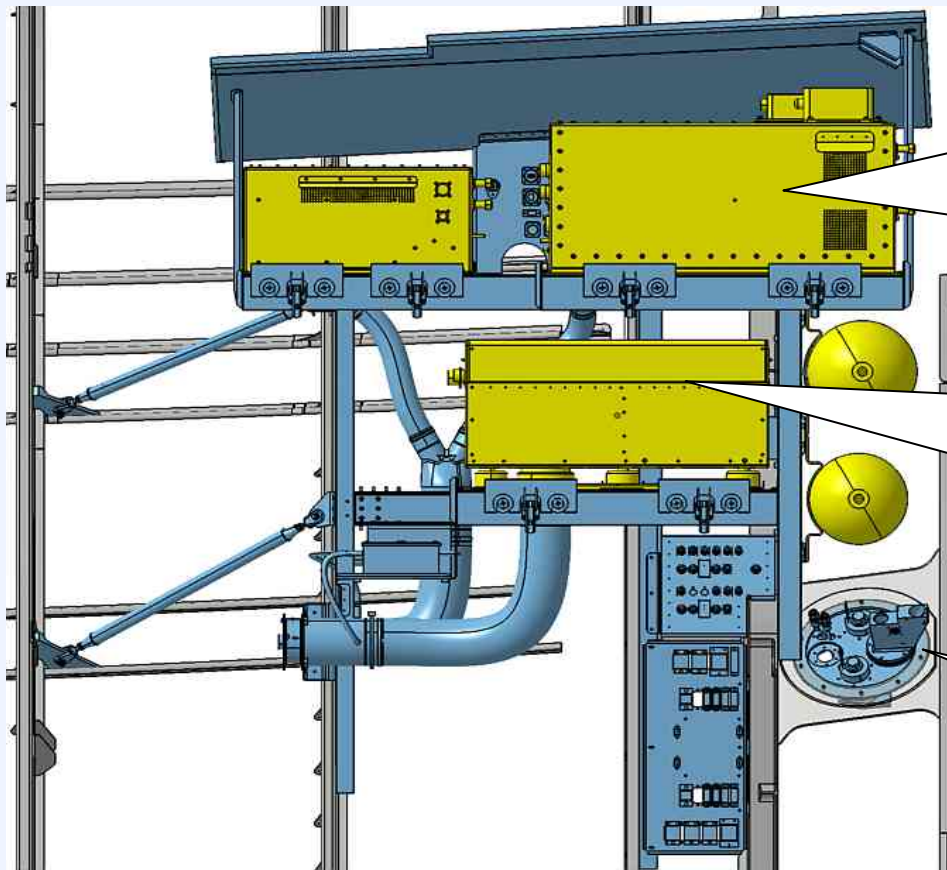
- **Equip 20 longhaul aircraft with scientific instruments for:**
  - chemical composition (H<sub>2</sub>O, O<sub>3</sub>, CO, NO<sub>x</sub>, NO<sub>y</sub>, CO<sub>2</sub>, CH<sub>4</sub>),
  - aerosol
  - cloud particles
- **Longterm deployment (20 yrs)**
- **Global coverage**
- **Open data policy (GEO/GEOSS)**
- **Near-realtime data provision to GMES-GAS and Met Services**
- **Monthly deployment of CARIBIC container aboard Lufthansa D-AIHE**

# Scientific Value

- **Changes in the Tropopause Region**
  - Spatial and temporal resolution (ozone background and trend)
- **Validation of Atmospheric Models and Satellite Retrievals**
  - Tropospheric profiles of O<sub>3</sub>, CO, NO<sub>x</sub>, aerosol, CO<sub>2</sub>, CH<sub>4</sub>
- **Global Air Quality**
  - Influence of developing regions, biomass burning, climate change,...
- **International Transfer Standard**
  - Same systems everywhere
  - Regular Quality Assurance

# IAGOS System

to be deployed on 20 Airbus A340/A330



## Package 1 (on all ac):

O<sub>3</sub>, CO (CNRS, F)

Data acquisition (CNRS, F)

Database (CNRS, CNES, F)

Realtime data (CNRM, F, AMDAR, WMO)

H<sub>2</sub>O (FZJ, D)

## Package 2 (1 of 4 options):

a: NO<sub>y</sub> (FZJ, D)

b: NO<sub>x</sub> (FZJ, D)

c: CO<sub>2</sub>+CH<sub>4</sub> (MPI-BGCH, D)

d: Aerosol (DLR, D)

Cloud Particles (UMAN, UK)

# Installation of IAGOS-STC at LHT

## Nov 2009



# IAGOS Rack on D-AIGT



# IAGOS Inlet Plate

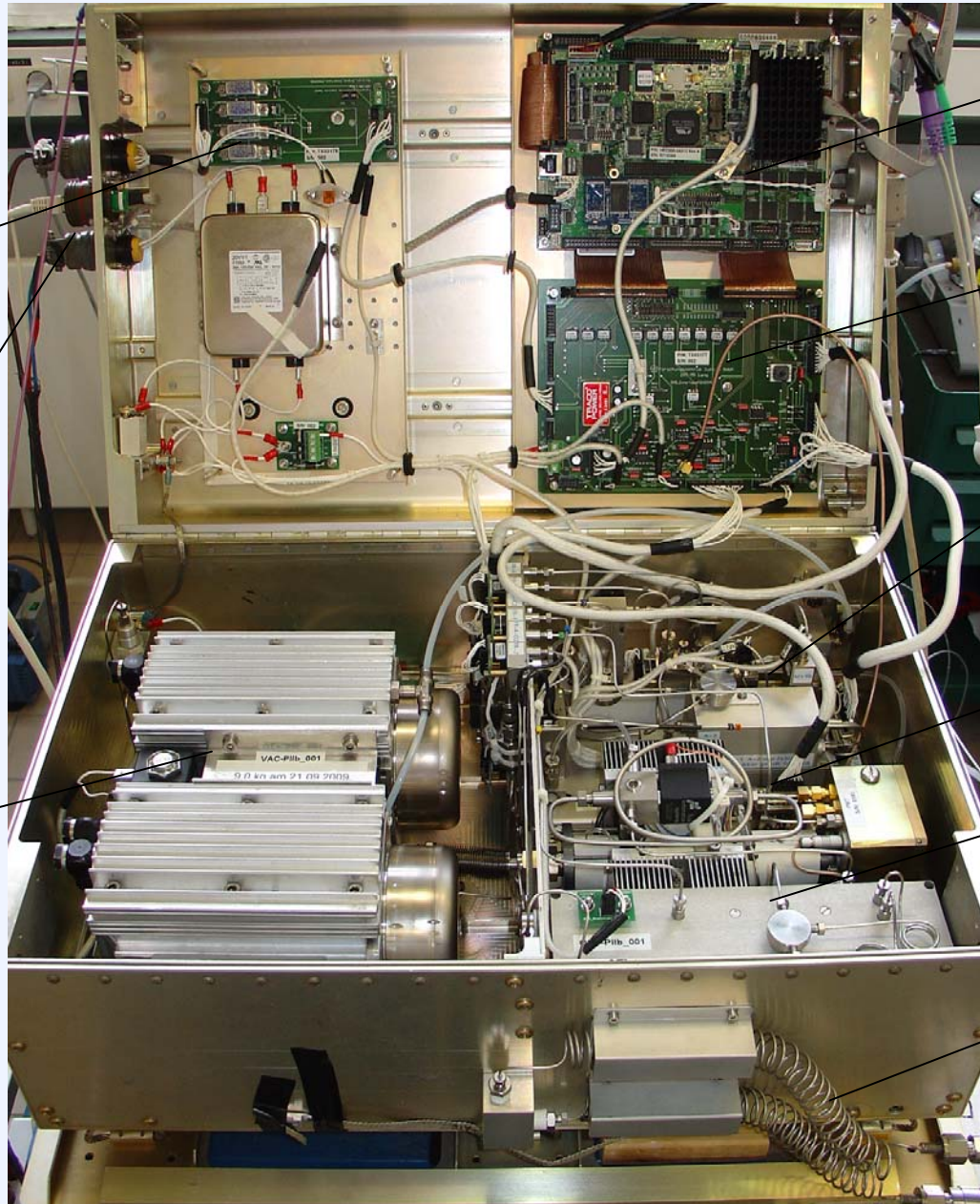


# Package 2 b: NOx

Safety  
logic

Power  
input

Pumps



CPU

Interface

Converter and  
Calibration

NO-detector

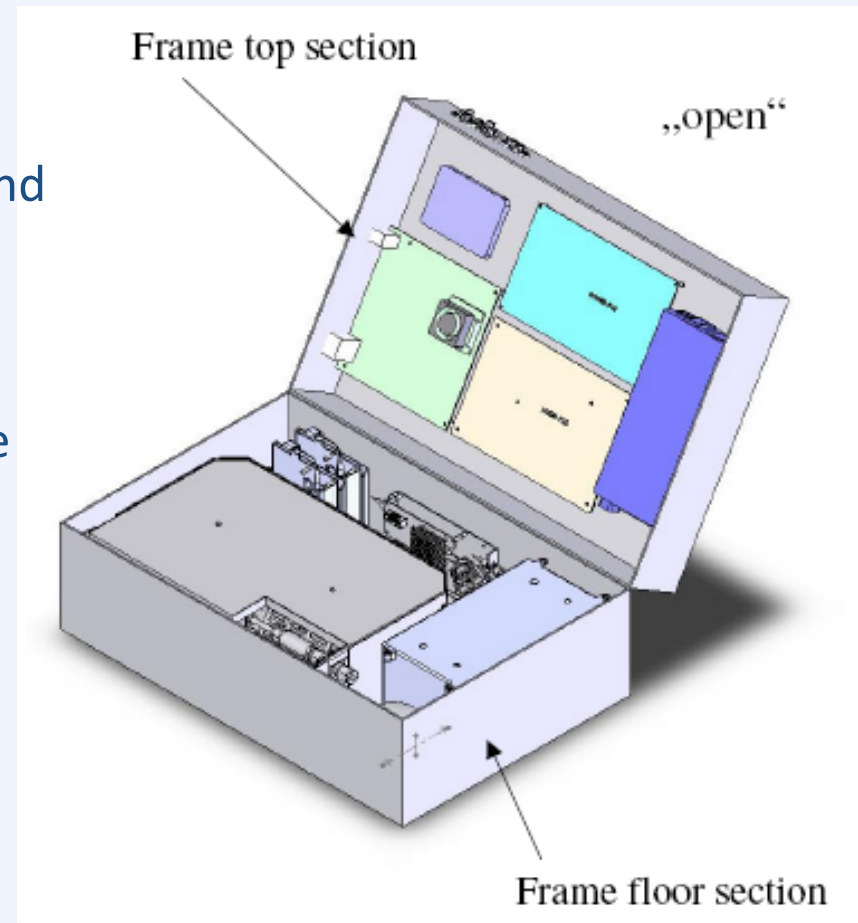
Ozone  
Generator

Oxygen  
Supply

# IAGOS CO<sub>2</sub> and CH<sub>4</sub> Package

under development by MPI-Jena, Picarro, enviscope

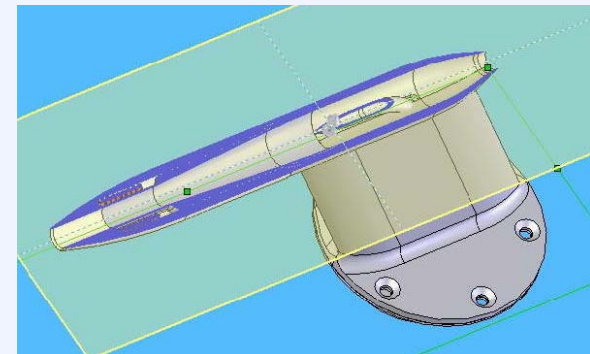
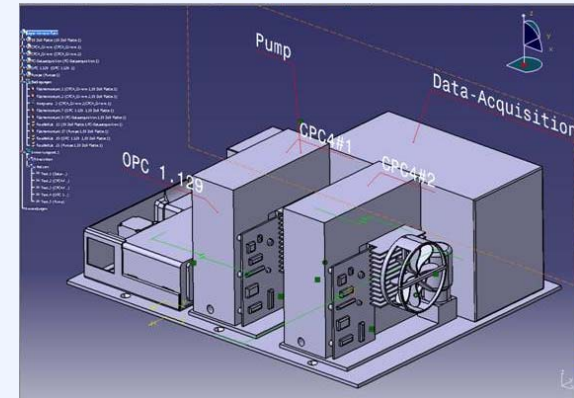
- Cavity Ringdown Spectroscopy (PICARRO)
- Simultaneous measurement of CO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub>O
- Precision < 0.1 ppm (CO<sub>2</sub>); < 1ppb (CH<sub>4</sub>)
- No drying needed
- Insensitive to changes in ambient pressure and temperature
- Calibration traceable to WMO scales
- Time resolution 2s
- Power consumption < 300 VA @ 28V DC
- Weight < 30 kg



# IAGOS Aerosol Package

under development by DLR, IfT, enviscope

- Robust instrument for routine measurements from in-service aircraft
  - particle size distribution
  - integral number of particles
  - non-volatile particle cores.
- OPC (> 100 nm) and two CPC (> 5nm):
  - Particles available for the formation of water and ice clouds
  - Information on gas-to-particle conversion and nucleation
- Thermo denuder:
  - Information on non-volatile particles, e.g.:
    - Soot particles emitted by aircraft
    - Volcanic ash
    - Sand and dust
- Special inlet for particle sampling
  - Rosemount footprint



# Status

- Design Study (IAGOS-DS) 4/2004-1/2010
  - Technical developments, EASA STC, first A340 equipped (D-AIGT)
  - Due to electrical problem with Package-1: STC with IAGOS deactivated
  - Package 2a (NO<sub>y</sub>) and 2b (NO<sub>x</sub>) certified by LHT
- Preparatory Phase (IAGOS-ERI) 9/2008 – 8/2012
  - Legal structure and funding in preparation (WP3)
  - Operational issues and maintenance (WP4)
  - Integration of new MS, PGGM, USA, .... (WP2)
  - Technical developments CARIBIC and Small Package (WP5)

# Implementation

- 2010 CARIBIC container revised and certified  
3 MOZAIC aircraft back to operation
- 2010/11 IAGOS on Lufthansa operational, STC  
Orders for additional equipment (HGF, CNRS funds)
- 2011 IAGOS on China Airlines & Air France  
CO<sub>2</sub>/CH<sub>4</sub> package certified  
legal form for infrastructure agreed
- 2012 aerosol package certified  
installation on IBERIA, Cathay Pacific, USA

