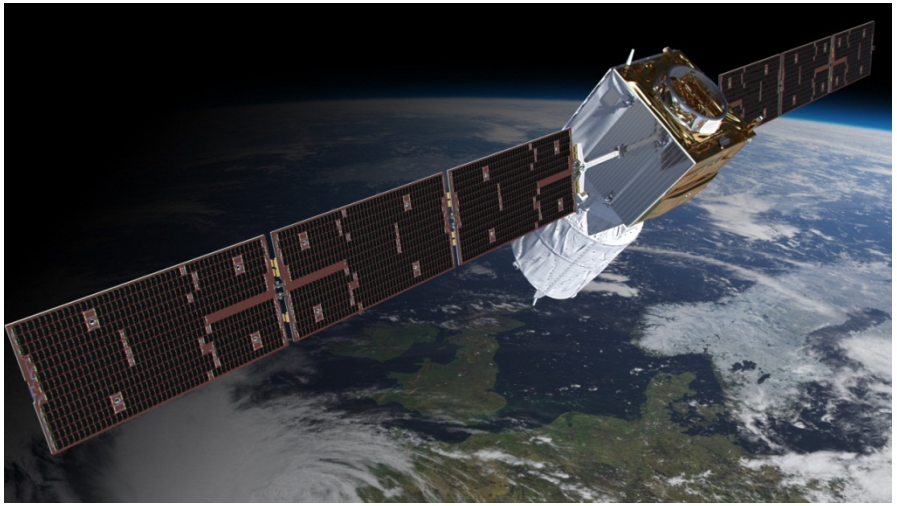
ADM-Aeolus – getting ready for CAL/VAL and the scientific exploitation



A.G. Straume[1], D. Schuettemeyer[1], F. de Bruin[1], T. Kanitz[1], A. Elfving[1], F. Buscaglione[2], A. Dehn[2], S. Casadio[2], W. Lengert[2]

[1]ESA-ESTEC, The Netherlands [2]ESA-ESRIN, Italy

http://www.esa.int/esaLP/LPadmaeolus.html

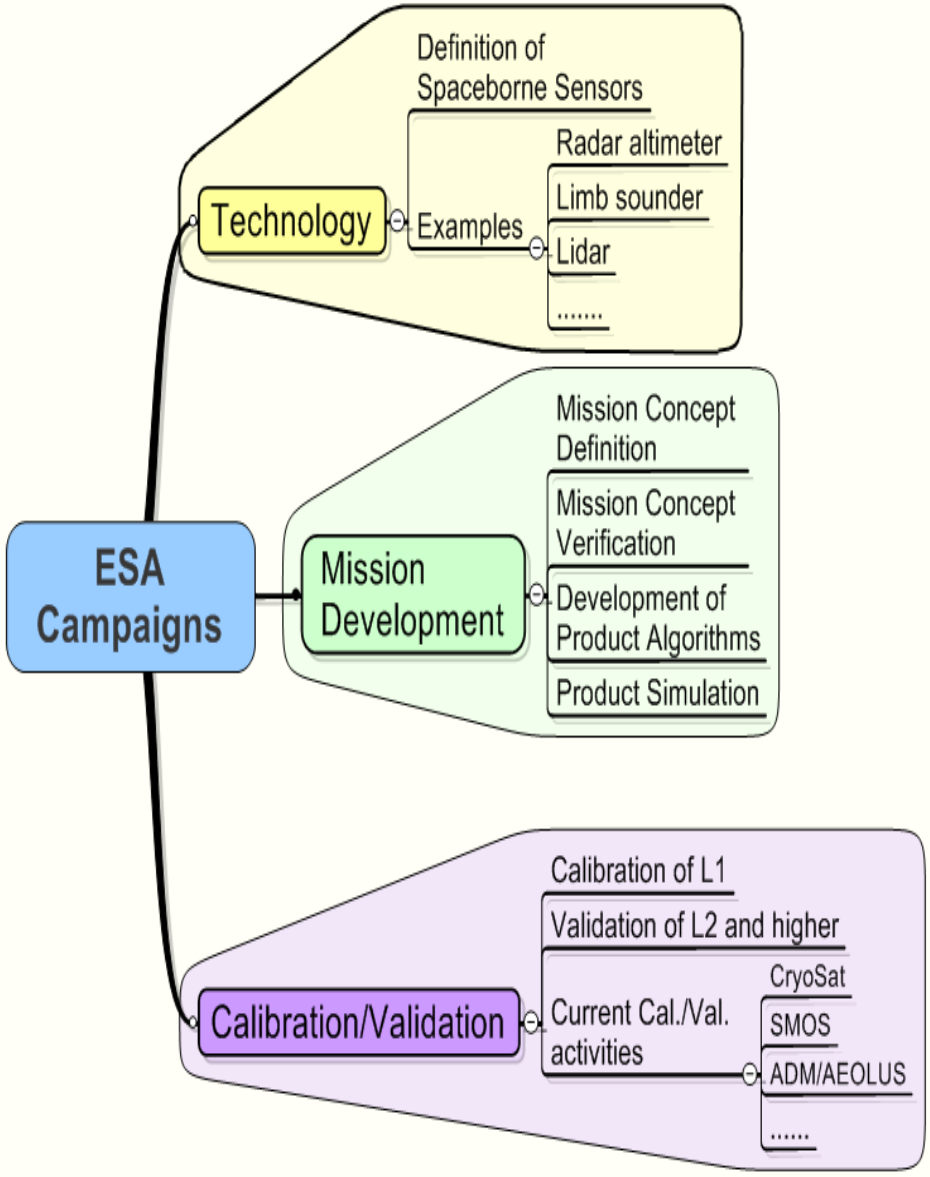
Aeolus during flight, an artists impression

Why are ESA Earth Observation campaigns required ?

1. Explore EO possibilities
2. Prove EO concepts
3. Develop interpretation
4. Develop calibration
5. Develop validation
6. Simulate data products
7. Check (validate) results
8. Develop applications

Programmatic Background

1. **ESA campaign activities started in 1981**
   a. 110 campaigns as of May 2013
   b. Typically 4-7 campaigns/year
2. **Strategic objectives:**
   a. Support to EO programs
   b. Transnational access to airborne instrumentation and data in Europe
   c. Partnerships with national and international organisation
3. **Campaign activities address three main areas:**
   a. Technology
   b. Mission development
   c. Calibration/validation
4. **Campaign data archive supporting science and applications**



Campaigns for different project phases

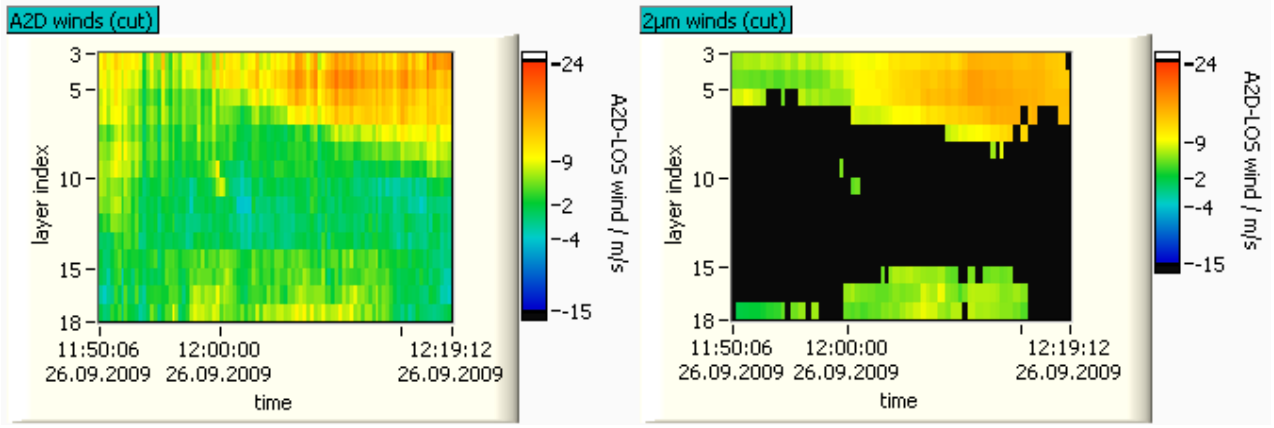
1. ESA campaigns are performed during all phases of a typical ESA space mission
2. Various types of campaigns are performed during certain periods of the lifecycle of a space mission

	Pre-Phase A	Phase A Feasibility	Phase B Design	Phase C/D Development	Phase E1 Commissioning	Phase E2 Operation	Data Archive
Technology	X	X					
Mission Development (Geophysical)	X	X	X	X			
Mission Development (Simulation)	X	X	X	X			
Cal/Val				X	X	X	
Science/ Applications						X	X

Aeolus campaigns in the Past

1. **Objectives:**
   a. Validation of the predicted instrument radiometric and wind measurement performance using the Aladin Airborne Demonstrator (A2D)
   b. Establishing a dataset of atmospheric measurements obtained with an Aeolus type Lidar to improve algorithm development

2. **2006 – 2009 A2D Campaigns:**
   a. Two ground-based (2006, 2007) and three airborne (2007, 2008 and 2009)
   b. So far, on the order of 100 recommendations for the Aeolus mission (instrument and algorithm development and testing)
   c. First atmospheric measurements worldwide with a Fizeau and Double Fabry-Perot UV lidar system



Preliminary comparisons of A2D and DLR 2µm wind lidar measurements on-board the Falcon, near Greenland, 2009.
Courtesy: U. Marksteiner, DLR

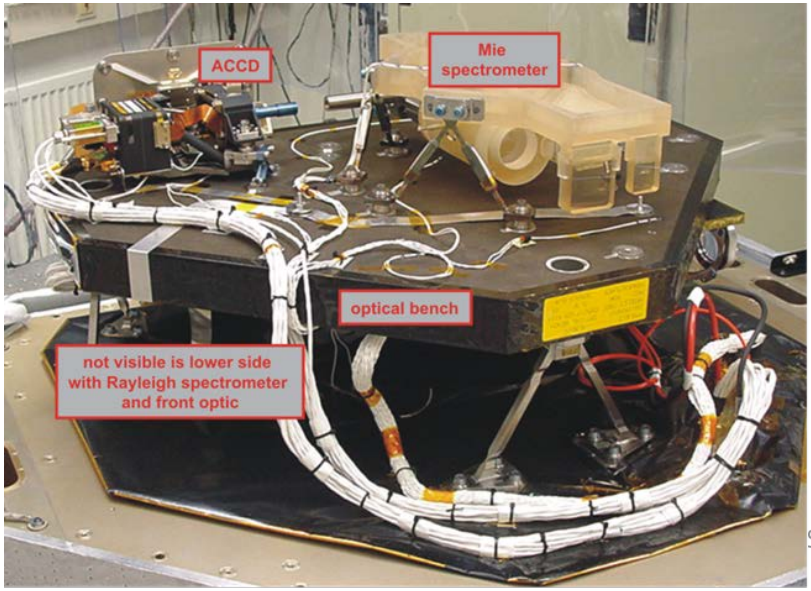
ADM-Aeolus technical objectives for a Pre-launch campaign

Airborne instrument must be as representative as possible to the satellite instrument

- Several **new technologies** for ALADIN not used before in lidars

- Space industry performs instrument characterization in a laboratory **without signals from the real atmosphere**

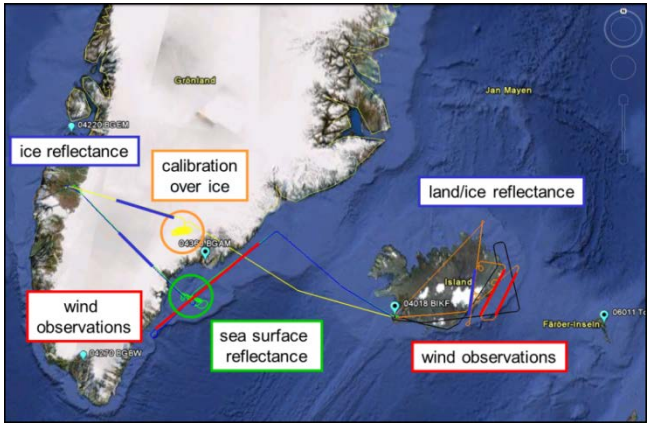
- No proof of concept before with direct-detection wind lidar in **downward looking geometry** as from space



Space Agency

Fig.: Reitebuch et al. , JTECH, 2009

ADM-Aeolus science objectives for a Pre-launch campaign



ADM Airborne Campaign in 2009

- Discussion and consolidation of objectives during ADM-Aeolus Mission Advisory Group in October 2013

Objectives for next pre-launch campaign

- Extend dataset on Rayleigh and Mie wind observations
  - highly variable conditions (vert./hor.) for wind
  - heterogeneous scenes wrt clouds
  - atmospheric scene with high aerosol backscatter
- Extend dataset on response calibrations over ice or land in nadir-pointing mode
- Rehearsal for airborne cal/val activity
- Science objectives, e.g. related to T-NAWDEX, or variability of UV albedo over ice

=> Baseline is a 2-weeks campaign from Iceland

Objectives for a campaign related to atmospheric dynamics over the North Atlantic

- North Atlantic is sensitive area for NWP; targeted observations to improve medium-range weather forecast (e.g. Weissmann and Cardinali 2007)
- South tip of Greenland is windiest place on earth for ocean winds (Sampe and Xie 2007) => high sea surface winds observed from spaceborne scatterometers and radiometers; objectives related to scatterometer/lidar intercomparisons, and measurement of sea surface reflectance with lidar instruments (Li et al. 2010)
- Distortion of the flow by Greenland (Renfrew et al. 2008); investigation of Greenland Tip Jet (Doyle and Shapiro 1999, Moore and Renfrew 2005) and its relation to deep see convection (Pickart et al. 2003)
- Greenland as a hot spot for gravity wave excitation (Jiang et al. 2003, Leutbecher and Volkert 2000)
- Objectives related to THORPEX North Atlantic Waveguide Experiment T-NAWDEX in 2016 (see next slide)

Baseline Planning for Pre-Launch campaign

- Laser thermal test are on-going
- DLR Falcon aircraft equipped wit updated ALADIN airborne demonstrator A2D and 2-µm coherent wind lidar
- Perform test flights late 2014 with A2D from Oberpfaffenhofen, Germany
- Option to add science elements
- Airborne Campaign during April/May/June with A2D and 2-µm wind lidar from Iceland
- Back-up for August/September 2014

Aeolus CAL/VAL AO call 2007

Aeolus CAL/VAL AO call, 2007:

1. Draft Phase E1 (and E) CAL/VAL plan and requirements established
2. Call open to experts/scientists worldwide
3. 16 (joint) proposals received and reviewed
4. 15 proposals were selected but now uncertain/no longer valid due to launch delays

5. **Ground-Based activities** (e.g.)
    - *Validation of ADM-Aeolus Winds using Radar or lidar data*
    - *Aerosol and cloud product validation using the European Aerosol Research Lidar Network EARLINET*
6. **Airborne activities** (e.g.)
    - Utilizing ALADIN or TwiLite
7. **Model studies** (e.g.)
    - *Atmospheric model Comparison*

Aeolus CAL/VAL AO delta-call 2014

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⇒ **DELTA AO CAL/VAL CALL NEEDED**

Aeolus AO delta-call Objectives:

1. Allow for confirmation/update of current proposals
2. Attract new proposals

CAL/VAL Schedule:

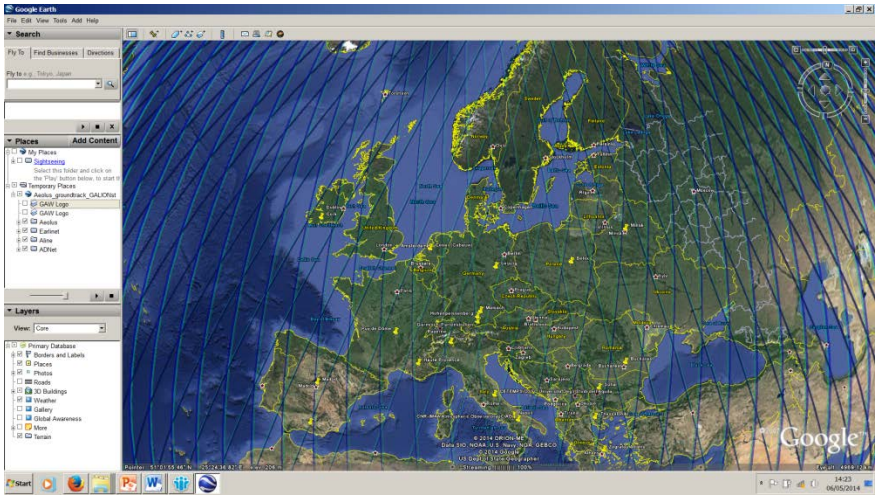
1. Delta-call release: 1 May 2014, http://earth.esa.int/aos/AeolusCalVal
2. Phase E1 preparatory CAL/VAL Workshop end 2014 / early 2015:
    a. Refinement of CAL/VAL plan and compile implementation plan
    b. Campaigns planning and coordination amongst AO proposals and external campaigns
3. Launch (End 2015)
4. Phase E1 CAL/VAL Workshop/meeting (date TBC)
5. Phase E CAL/VAL monitoring and Workshops (coordinated by Mission Manager)

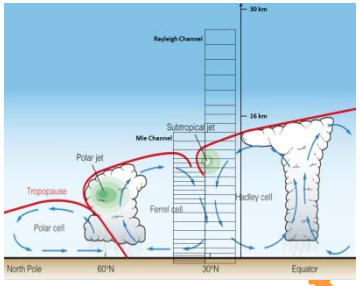
Scientific Cal/Val Requirements

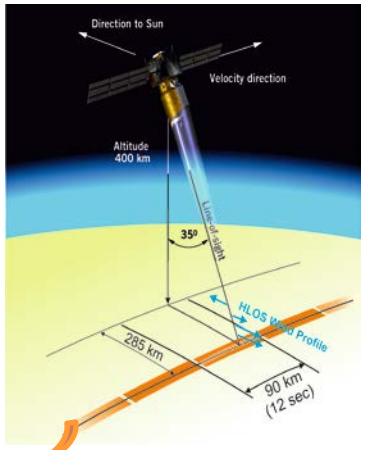
1. Understanding of the products and product properties
2. Establish product requirements (Mission Requirements Document)
3. Areas of special attention:
    a. Atmospheric sampling by the space-borne and validation instrumentation
        - Horizontal (scene dependent)
        - Vertical (scene and commanding dependent)
        - Variable along the orbit
    b. Space-borne and validation product quality as function of
        - measurement and retrieval technique
        - atmospheric scene (clear and cloudy products, use of a-priori)
    c. Complementarity of different validation techniques
        - Validation over different spatial and temporal scales
        - Different information content
    d. Co-location criteria
    e. …

Aeolus sampling and CAL/VAL requirements

1. Reference orbit: Equat. cros. time ascend node: 18:00 LT
2. Repeat cycle: 7 days
3. Track spacing: 285 km, no ref. ground track
4. Example orbital coverage - one repeat cycle:

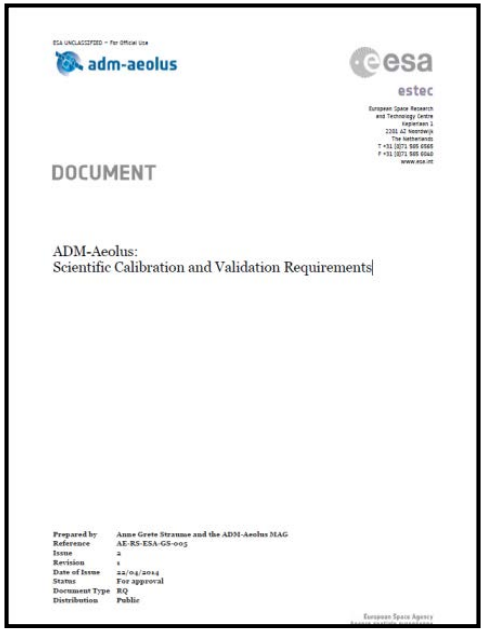






Prepared by
T. Kanitz

5. **ADM-Aeolus: Scientific Cal. and Val. Requirements**
   a. Detail Aeolus specifics concerning its wind and aerosol products and areas for special CAL/VAL attention:
   b. Available at http://earth.esa.int/aos/AeolusCalVal


adm-aeolus

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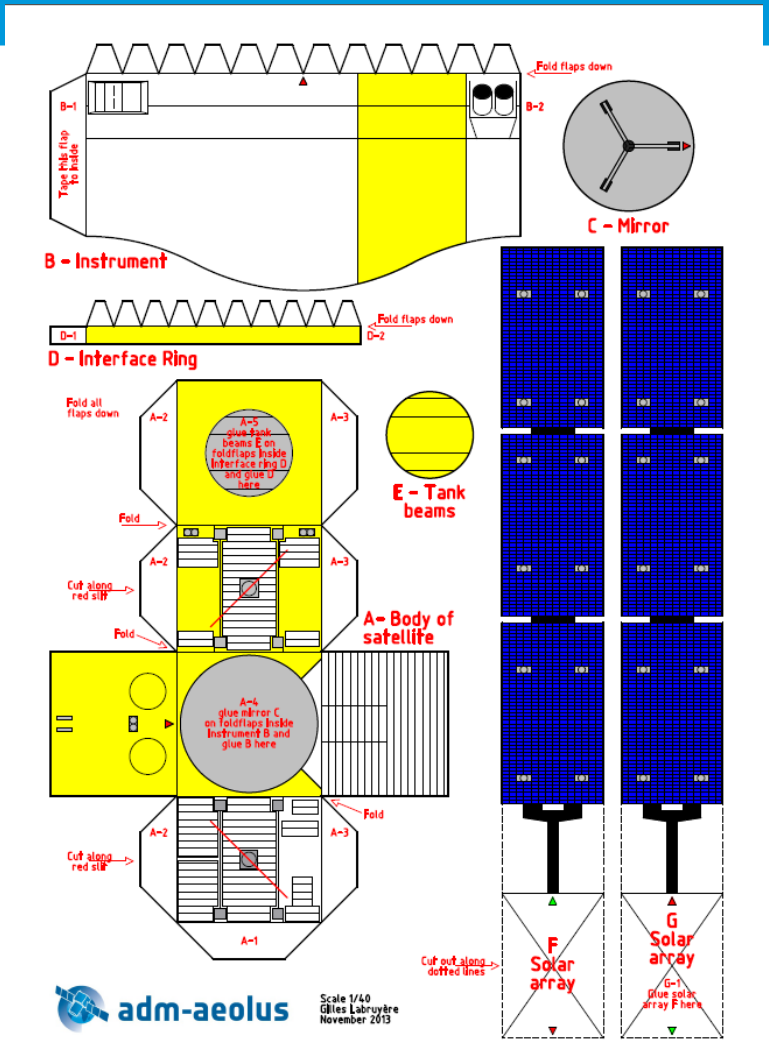
DOCUMENT

ADM-Aeolus:
Scientific Calibration and Validation Requirements

Conclusions

1. Pre-Launch campaign in Planning
2. Baseline to perform campaign in spring 2015
3. CAL/VAL AO delta-call released: 1 May 2014, deadline 15 July
4. The Aeolus off-line L2a optical properties products will be made available to users off-line (now every 12 hours) but could in the future become available every 4 hours or more often
5. Launch: End 2015

You want to build your own?



Thank You!

Questions?

http://www.esa.int/esaKIDSen/SEMVZ46Y3EE_Earth_0.html