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Zeppelin NT N07-100 airship promotion to EUFAR

December 2016

- Proposal: Enlist the airship Zeppelin NT N07-100 under the EUFAR fleet
- Rationales for the N07-100/101 airship in EUFAR:
 - Numerous successful scientific missions were already performed with the N07
 - Coverage of most of the endurance-payload capability of nearly the full EUFAR fleet (exceptions G550 HALO, C130-Q, BAe 146, ATR42) at less than 3k€ per flight hour
 - Enhancing the fleet capabilities:
 - ++50% max. endurance; More payload & more endurance in the 5k€/hr segment
 - Providing new fleet capabilities
 - VTOL (Vertical take-off/landing) & Hover → Measuring vertical atmospheric profiles
 - Ability to operate from non-certified landing strips → increase time on station
 - Unique airship properties such as low vibration, low flight speed
 - Answering the user's needs as expressed in the 2015 EUFAR survey
 - >30% of the users are interested in having a PBL/Troposphere Airship
 - >50% of the users like to fly 30m/s and slower
 - >50% of the users want a flight altitude of 3'000m/10'000ft and less
 - Logical, low-risk step towards stratospheric airship, as under investigation in the current N3FF activities

- Purpose:
- Provide scientific and technological advise wrt. the members' scientific discipline
 - Support the introduction of the N07 airship to the scientific community
 - Help to sustain the use of the airship for scientific missions in the coming years



Prof. Dr. Dr. Andreas Wahner

Director of the Institute for Energy and Climate Research IEK-8: Troposphere, **Jülich, Germany**



Prof. Dr. Michael Schaepman

Professor of Remote Sensing, Vice Dean, Faculty of Science, Director, University Research Priority Program 'Global Change and Biodiversity, **Zurich, Switzerland**



Prof. Dr. Dr. Oliver Ullrich

Professor of Space Biotechnology University of **Magdeburg, Germany**, Space Life Sciences Laboratory Kennedy Space Center, Professor of Anatomy, University of **Zurich, Switzerland**



Prof. Dr. Burkard Baschek

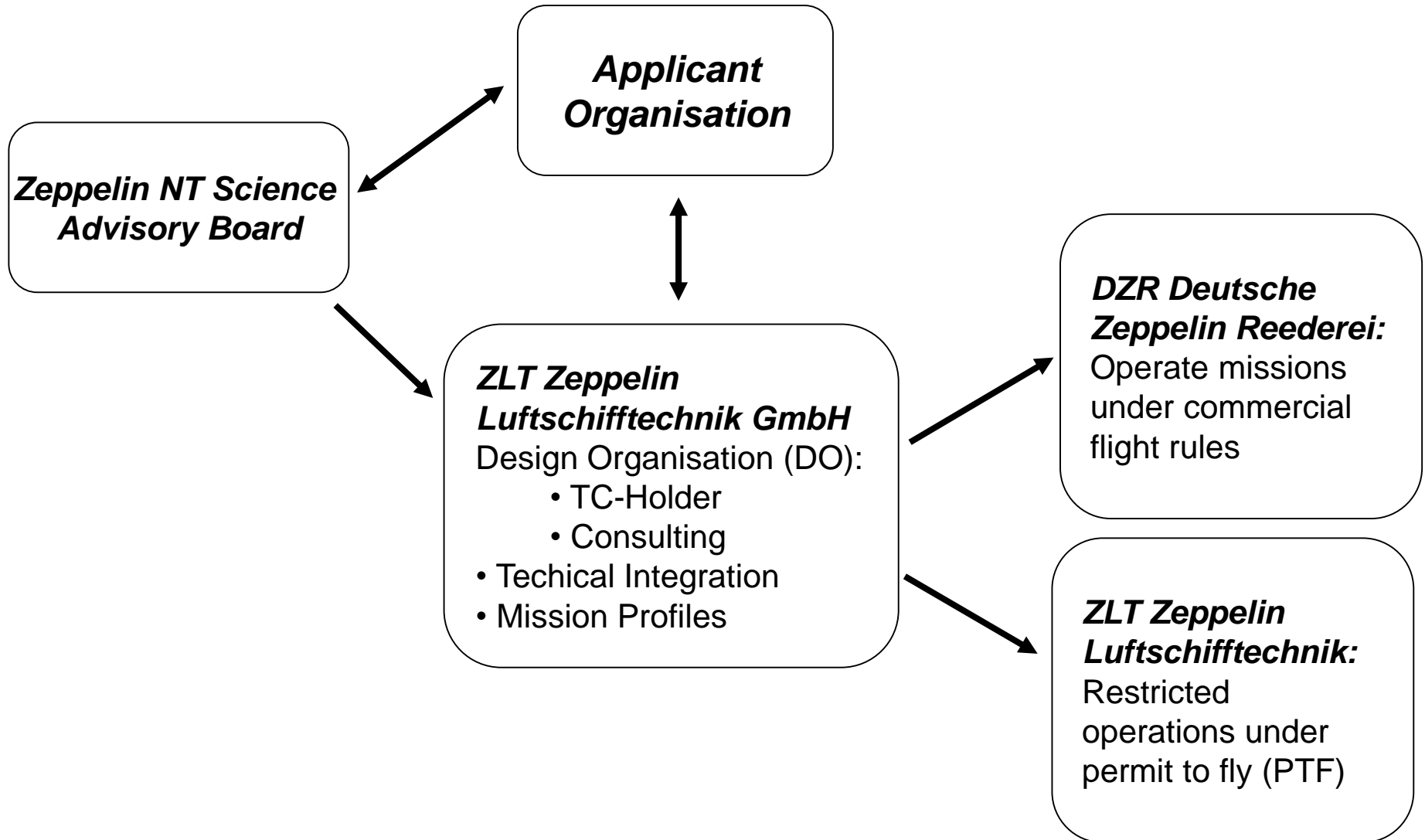
Director of the institute of Coastal Research, Helmholtz-Zentrum **Geesthacht, Germany**
Professor for Coastal Research and Instrumentation, University of **Kiel, Germany**



Prof. Dr. Nikolaus Kuhn

Director of the institute for Urban and Landscape studies
Professor for Geo sciences / Environmental research University of **Basel, Switzerland**

Strong partnership to ensure scientific mission success



Introduction of the ZLT Zeppelin Luftschifftechnik Design Organisation (DO) capabilities



Mr. Robert Gritzbach, Design Organisation (DO) Leader, Head of Development, Chief Technical Officer and Vice President of Zeppelin Luftschifftechnik

- Provide advise to scientific partner for integration and qualification / certification of mission equipment into the airship
- Privilege and capability to perform and certify all modifications to the airship (if required) as TC-Holder EASA 21J.273
- Provide and perform all development, design, calculation, safety analysis and EASA certification work
- Create and release design documents, service bulletins, etc.
- In-house manufacturing of customized equipment, established contacts to external manufacturing companies
- Define special scientific airship mission profiles
- Project management and project supervision
- Additional possibility to operate the airship under permit-to-fly (PTF) with eased preliminary type certification. (Standard missions will be operated by DZR with full type certification under commercial operating rules)

The DO offers engineering and expert capabilities as well as certification privileges to utilize scientific missions with the N07-100 airship. All tasks provided by single source.
➔ Significant advantage to scientific customer

Scientific missions on N07 Airship (selection)

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PEGASOS (Jülich/EU) 2012-2013
Explore chemistry of the PBL atmosphere

I2c campaign (EU): 2013-2014
Maritime surveillance



Helmholtz-Zentrum Geesthacht & Potsdam (HZG&GFZ)
Marine & costal research 2014, 2016



DeBeers Botswana 2005-2007
Mineral exploration

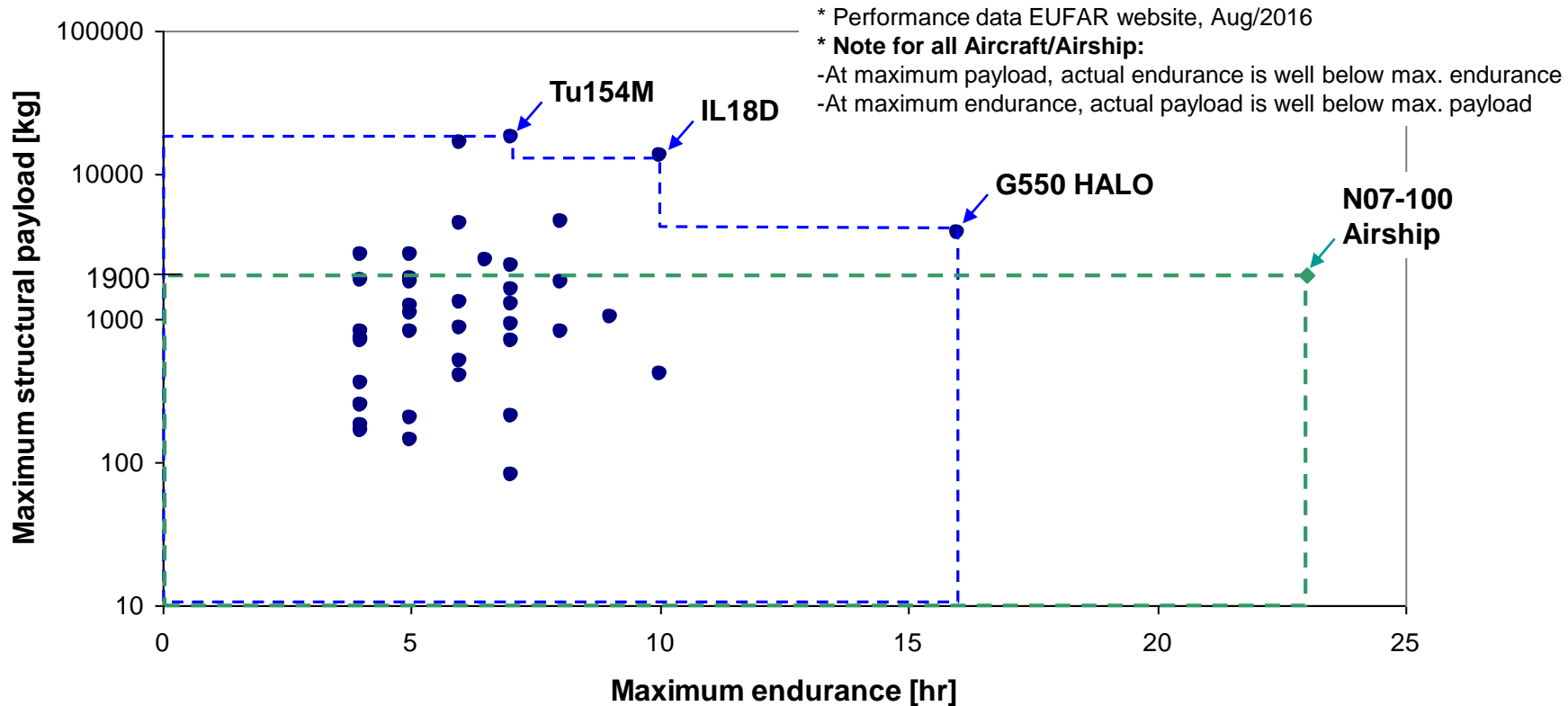


Commissariat à l'Énergie Atomique (CEA)
Gamma ray map of Paris – 2011

LATMOS Paris - 2014
Air quality measurements

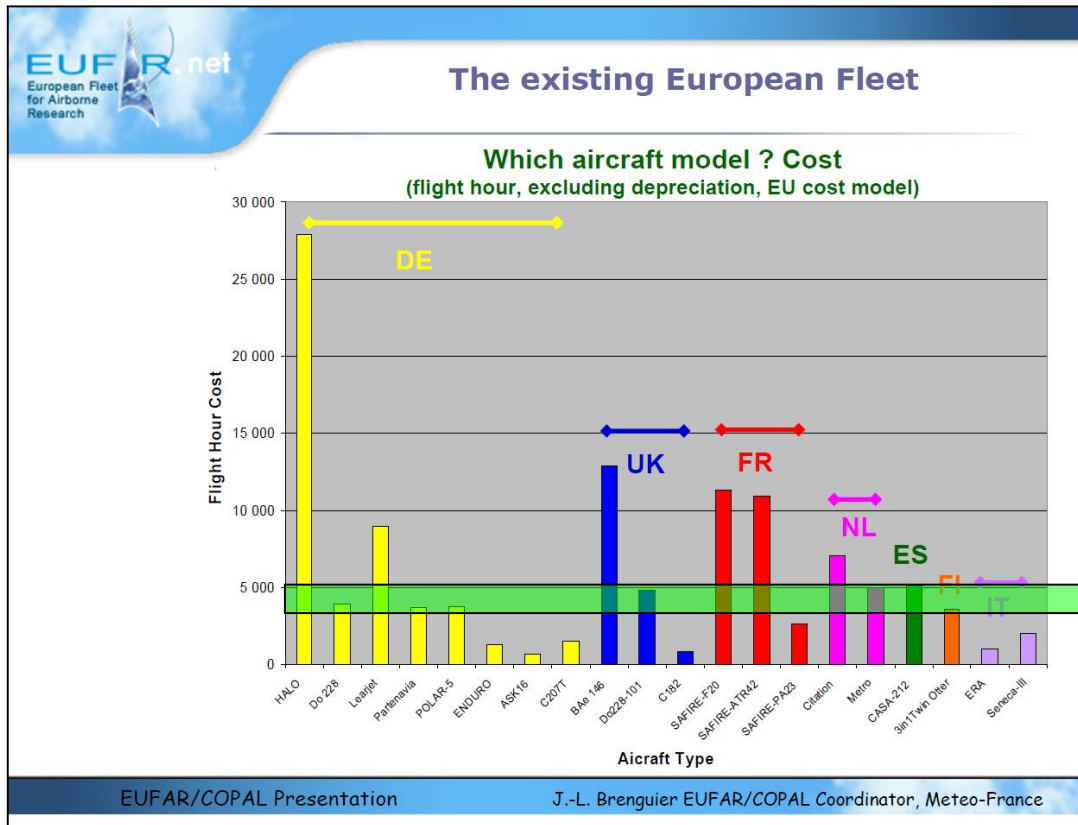


Payload-endurance: N07-100 airship vs. EUFAR fleet



- N07-100 airship covers most of the payload-endurance performance of the EUFAR fleet
- N07-100 airship provides a huge endurance extension vs. current EUFAR fleet
- Range/endurance extender kit available for beyond 36hrs of endurance
- Opportunity for fleet capability enhancement
- Opportunity for fleet diversity reduction without compromising cost or performance

Cost per flight hour: N07-100 airship vs. EUFAR fleet



← 2009 EUFAR presentation

RoM for N07-100 airship cost per flight hour, depending on actual cost model and total scientific mission length

- N07-100 airship operating cost incl. depreciation and overhead roughly 5.5k€/FH
 - Cost per flight hour excluding depreciation below 4'000EUR/FH
- Very competitive cost vs. performance, increased fleet access to lower-funded researchers

New fleet capabilities

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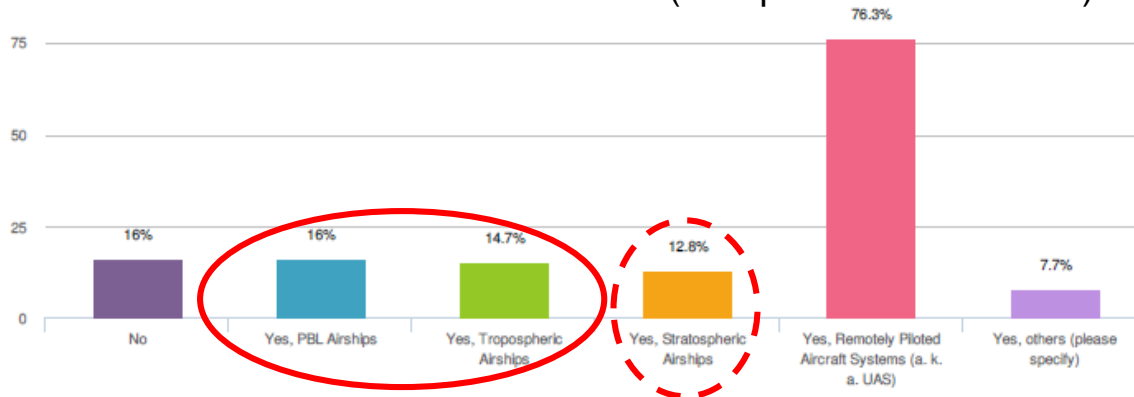
- Ability to operate from non-certified landing strips
 - Base airship close to site of operation
→ Maximize time on station
- Hover ability, Vertical Takeoff/Landing (VTOL)
 - Hover on precise position with long endurance
→ continuous time-dependent data measurement
 - Vertical climb/descent: Measure vertical profiles of the atmosphere
- Very low vibration levels compared to fixed wing aircraft and helicopters
 - Increased instrument accuracy
→ better data quality
 - Reduce effort to de-couple instrument from aircraft vibration → cost
- Non-pressurized cabin, zero minimum flight speed
 - Reduced effort to install external payloads
 - In-flight accessible floor hatch



Answering/Addressing the EUFAR user's needs

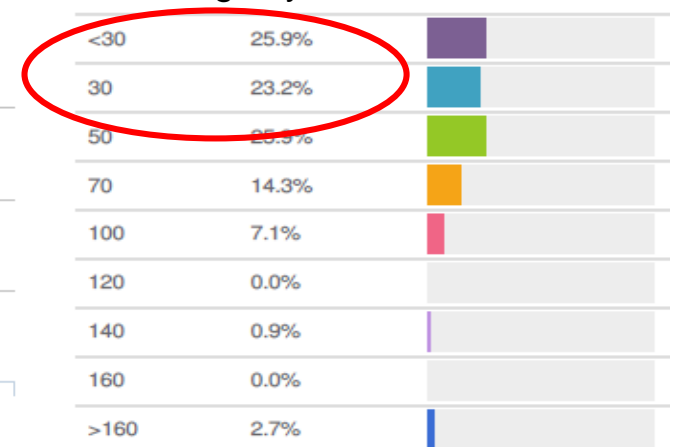
EUFAR user survey 2015:

12. Are you aware of, or interested in, steerable platforms for airborne research other than aircraft? (Multiple choices allowed)

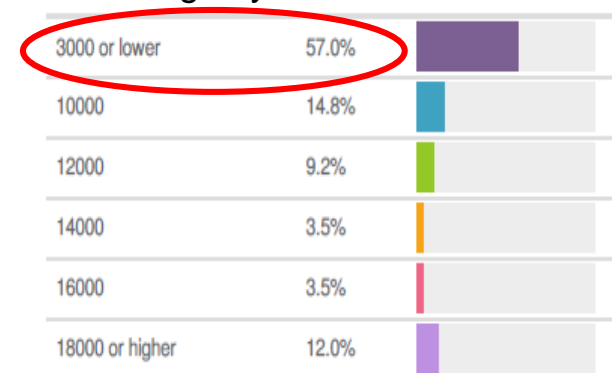


- >40% of the users are interested in access to airships, 30% interested in airships for PBL/Troposphere
 - ~50% of the users require minimum flight speeds of 30m/s and below
 - >50% of the users require a max. ceiling of below 3000m
- All these users needs are reflected in the N07-100 airship

20. What is the minimum speed (in m/s) the research aircraft should fly, according to your needs?



22. What is the ceiling altitude (m) the research aircraft should fly, according to your needs?



- According to EUFAR website N3FF mission is to „provide a forward look on user needs and direct progress beyond the capabilities of the existing fleet“:
 - Clear user need towards airships and airship-like performance requirements, see preceding slide
 - N07-100 provides a significant fleet capability extension, as presented
- EUFAR2 GA meeting, April 2016 presentation on Future of Fleet: Airships with stratospheric capabilities studied as possible enhancement to scientific network
 - No such airship exist in Europe
 - Only few examples worldwide, either demonstrators or intelligence platforms
→ no access for European scientific community
 - Start with the N07-100 airship as a stepwise, low-risk approach
 - Explore, advance and multiply the already demonstrated advantage of airships for scientific research
 - Use the N07-100 airship as testbed to get the instruments ready for higher altitudes
 - Make use of our company’s airship experience and expertise to explore the real capabilities of stratospheric airships

- We'd like to (re)promote the Zeppelin NT N07-100 airship to be enlisted in the EUFAR fleet
 - Process initiated 2007, stalled in 2010
- N07-100 airship is an EASA/FAA certified aircraft with more than 10 years of experience in performing scientific missions at highest level
- N07-100 airship is an attractive enrichment to the EUFAR fleet
 - Adds new capabilities with significant benefit to scientific missions
 - Very competitive cost vs. performance
 - Covers a significant part of the current EUFAR fleet in payload vs. endurance → can help to reduce fleet diversity without compromising performance
 - Addresses the users needs as expressed in the 2015 survey
- ZLT/DZR company structure offers the unique advantage of being an EASA design organisation, TC-holder, manufacturer and operator, all in one
- Usage of the N07-100 airship and the expertise of our company would be a low-risk step-wise approach to the N3FF activity concerning stratospheric airships