MUNICH AEROSPACE

MUNICH AEROSPACE SUMMER SUMMIT

GREEN AEROSPACE

26 – 28 JUNE 2017

LUDWIG BÖLKOW CAMPUS

Monday, 26 June 2017

Host: Professor Mirko Hornung, Bauhaus Luftfahrt

TIME	PLACE	TITLE	SPEAKER
12.00 p.m. – 1.00 p.m.	Reception Area	Registration	
1.00 p.m. – 1.30 p.m.	Airbus Showroom	Welcome	Professor Klaus Drechsler | Managing Executive, Munich Aeropsace
1.30 p.m. – 2.30 p.m.	Airbus Showroom	Long-term Development of Aviation – Future Drivers and Key Technologies	Professor Mirko Hornung | Executive Director Research and Technology, Bauhaus Luftfahrt
2.30 p.m. – 3.30 p.m.	Airbus Showroom	Electric Propulsion Systems for Aircraft	Dr Frank Anton | Executive Vice President, eAircraft, Siemens
3.30 p.m. – 4.00 p.m.	Foyer	Coffee Break	
4.00 p.m. – 5.30 p.m.	Airbus Showroom	The Potential of Public-Private Partnerships for Green Aerospace Technologies	Dr Frank Anton | Siemens Professor Hany Moustapha | Montreal Aerospace Institute Professor Klaus Drechsler | Munich Aerospace Hans J. Steininger | MT Aerospace Professor Fernando Catalano | University of São Paulo
6.00 p.m.	Franz Josef Strauß Pavillon	Dinner	

Tuesday, 27 June 2017

Host: Professor Michael Pfitzner, University of the German Armed Forces

TIME	PLACE	TITLE	SPEAKER
8.30 a.m. – 9.00 a.m.	Reception Area	Registration	
9.00 a.m. – 9.45 a.m.	Airbus Showroom	Electric Propulsion for Satellites: Concepts, Applications and European Missions	Davina M. Di Cara | Electric Propulsion Engineer, Directorate of Technology, Engineering & Quality (D/TEC), ESA ESTEC Noordwijk (NLD)
9.45 a.m. – 10.30 a.m.	Airbus Showroom	Green Propulsion: Experimental and Numerical Investigation of Methane/Oxygen-fired Rocket Combustors	Professor Oskar J. Haidn | Professor for Rocket Propulsion, Technical University of Munich, Munich Aerospace Research Group Leader (DEU)
10.30 a.m. – 11.00 a.m.	Foyer	Coffee Break	
11.00 a.m. – 11.45 a.m.	Airbus Showroom	Aerospace Technology: A Driver for Green Aviation	Fassi Kafyeke | Senior Director Strategic Technology and Innovation, Bombardier, Montreal (CAN)
11.45 a.m. – 12.30 p.m.	Airbus Showroom	Green Technologies and Design Options	Johannes Stuhlberger | Airbus, Taufkirchen (DEU)
12.30 p.m. – 2.00 p.m.	Franz Josef Strauß Pavillon	Lunch	

Tuesday, 27 June 2017

Host: Professor Michael Pfitzner, University of the German Armed Forces

TIME	PLACE	TITLE	SPEAKER
2.00 p.m. – 3.30 p.m.	Airbus Showroom	Ludwig Bölkow Campus Tour Stops at the TUM-AlgaeTec Center, Powerlab and Aeronautical Engineering (registration required)	Professor Thomas Brück and Dr Daniel Garbe | Technical University of Munich Simon Best | Head of CIS New Business Professor Markus Dietz | University of the German Armed Forces
3.30 p.m. – 4.00 p.m.	Foyer	Coffee Break	
4.00 p.m. – 4.45 p.m.	Airbus Showroom	Aircraft Emissions Facing Climate Change and Airport Air Quality	Professor François Garnier | Professor at Engineering School ÉTS, Quebec University, Montréal (CAN)
4.45 p.m. – 5.30 p.m.	Airbus Showroom	The Brazilian Silent Aircraft Program	Professor Fernando Catalano | Head of the Aeronautical Engineering Department, University of São Paulo (BRA)
6.00 p.m. – 7.00 p.m.	Foyer	Dinner	
7.00 p.m. – 8.00 p.m.	Franz Josef Strauß Pavillon	Cyber Challenges and the Aviation Industry	Professor Udo Helmbrecht | Executive Director, ENISA – The European Union Agency for Network and Information Security, Heraklion/Crete (GRC)

Wednesday, 28 June 2017

Host: Professor Hartmut Graßl, Max Planck Institute for Meteorology

TIME	PLACE	TITLE	SPEAKER
8.30 a.m. – 9.00 a.m.	Reception Area	Registration	
9.00 a.m. – 9.45 a.m.	Airbus Showroom	Modeling and Computational Challenges to Simulate Alternate Fuel Combustion in Gas Turbines and Rockets	Professor Suresh Menon | Hightower Professor of Engineering, Georgia Institute of Technology (USA)
9.45 a.m. – 10.30 a.m.	Airbus Showroom	Overview of Aerospace Control and Automation Research at Stellenbosch University in the Western Cape	Dr Japie Engelbrecht | Senior Lecturer, Department of Electrical and Electronic Engineering, Stellenbosch University (ZAF)
10.30 a.m. – 11.00 a.m.	Foyer	Coffee Break	
11.00 a.m. – 11.45 a.m.	Airbus Showroom	How New Space Disrupt the Conventional Accesses to Space	Guillaume Girard | Partner at Zero 2 Infinity (ESP/DEU)
11.45 a.m. – 12.30 p.m.	Airbus Showroom	Understanding and Mitigating the Climate Impact of Aviation	Professor Markus Rapp | Director DLR-Institute of Atmospheric Physics, and Chair for Atmospheric Physics, Ludwig Maximilians Universität, Munich (DEU)
12.30 p.m. – 2.00 p.m.	Foyer	Lunch	
2.00 p.m. – 4.30 p.m.	Franz Josef Strauß Pavillon	RLS-Aerospace Project "Global Aerospace Campus": Status and Next Steps (by invitation only)	Professor Klaus Drechsler | Managing Executive, Munich Aerospace Dr Eva Rogowicz-Grimm | Managing Director, Munich Aerospace Gloria Stamm | Academic Coordinator, Munich Aerospace
2.00 p.m. – 4.30 p.m.	Jochen Schweizer Arena	Munich Aerospace Fellows' Day (by invitation only)	Maria Reck | Academic Administrator, Munich Aerospace
4.30 p.m.		End of Event	

MUNICH AEROSPACE SUMMER SUMMIT

Monday, 26 June 2017

Host: Professor Mirko Hornung, Bauhaus Luftfahrt

07	**PROFESSOR KLAUS DRECHSLER** WELCOME	1.00 p.m. – 1.30 p.m.
08	**PROFESSOR MIRKO HORNUNG** LONG-TERM DEVELOPMENT OF AVIATION – FUTURE DRIVERS AND KEY TECHNOLOGIES	1.30 p.m. – 2.30 p.m.
09	**DR FRANK ANTON** ELECTRIC PROPULSION SYSTEMS FOR AIRCRAFT	2.30 p.m. – 3.30 p.m.
	COFFEE BREAK	3.30 p.m. – 4.00 p.m.
10	**PANEL DISCUSSION** THE POTENTIAL OF PUBLIC-PRIVATE PARTNERSHIPS FOR GREEN AEROSPACE TECHNOLOGIES	4.00 p.m. – 5.30 p.m.
	DINNER	6.00 p.m.

Monday, 26 June 2017 | 1.00 p.m. – 1.30 p.m.
Airbus Showroom

WELCOME

DEAR ATTENDEES OF THE
MUNICH AEROSPACE SUMMER SUMMIT,
DEAR RLS NETWORK MEMBERS,

Climate change issues have been shaping scientific and public discourse worldwide and have increased environmental awareness. Fewer emissions of greenhouse gases, pollutants and noise will reduce our ecological footprint in the near future. The considerable technological advancements spurred by this trend have had a major impact on the aeronautics and space industries. Emerging alternative fuels and the development of sustainable engineering concepts such as hybrid-electric aircraft will help us move closer to achieving **'Green Aerospace'**.

For the first time, the *Munich Aerospace Summer Summit* brings together scientists and experts from the partner regions united in the **'Regional Leaders' Summit'** network. Speakers and guests from Georgia (United States), Québec (Canada), São Paulo (Brazil), Shandong (China), Upper Austria, the Western Cape (South Africa) and Bavaria (Germany) are invited to present on technical innovations and the current status of their countries' research. It is the first event of its kind, and the event venue will rotate between the seven partner regions to foster and promote dialogue in the aerospace industry.

Munich Aerospace is honoured to be the host of this first *Aerospace Summer Summit* – a promising start to what will hopefully become a prominent international event series within the next few years.

We wish you a rewarding time at the event and a very pleasant stay in Munich.

Sincerely yours

PROFESSOR KLAUS DRECHSLER
Managing Executive, Munich Aerospace – Faculty for Aeronautics and Space

Klaus Drechsler studied Aerospace Engineering at the University of Stuttgart. After his PhD he spent several years as Research Manager in the automotive and aerospace industries. Today he is Head of the Institute for Carbon Composites at the Technical University of Munich and Director of the Fraunhofer Institute IGCV in Augsburg. He is also Scientific Manager of the Ludwig Bölkow Campus and Managing Executive of Munich Aerospace.

Monday, 26 June 2017 | 1.30 p.m. – 2.30 p.m.
Airbus Showroom

KEYNOTE LECTURE

LONG-TERM DEVELOPMENT OF AVIATION – FUTURE DRIVERS AND KEY TECHNOLOGIES

The European Commission has formulated with its 'Flightpath 2050' quite challenging targets for the long term development of aviation. Besides considerable reductions in CO2, NOx and noise emissions, travel time is to be drastically reduced. Eighty percent of all journeys are to be less than 4 hours in duration from door to door. In a broader view, innovations and design options for aviation will be presented in the areas of alternative energy and propulsion as well as novel operational models for air transport systems.

While alternative fuel options and novel propulsion concepts like hybrid electric and novel thermodynamic cycle design will enable drastic reductions in emissions, there is a great need to better integrate the air transport system into the intermodal traffic system, especially in megacities. Initial concepts will be discussed in the course of the presentation.

PROFESSOR MIRKO HORNUNG
Executive Director Research and Technology, Bauhaus Luftfahrt

Mirko Hornung has been Executive Director Research and Technology at Bauhaus Luftfahrt and Professor of the Institute of Aircraft Design at the Technical University of Munich since 2010. He became founding member of the Aviation Initiative for Renewable Energy in Germany e.V. ('aireg') in June 2011. Since July 2010 he has been the representative of Bauhaus Luftfahrt at the Members' Meeting of Munich Aerospace and the representative of Munich Aerospace at the Ludwig Bölkow Campus Steering Committee.

Monday, 26 June 2017 | 2.30 p.m. – 3.30 p.m.
Airbus Showroom

KEYNOTE LECTURE

ELECTRIC PROPULSION SYSTEMS FOR AIRCRAFT

DR FRANK ANTON
Executive Vice President, eAircraft, Siemens

Frank Anton studied Physics in Bochum and Bonn and has researched particle acceleration and storage in Bonn and Grenoble. He joined Siemens AG in 1988. Following positions in the healthcare branch, he was appointed Head of Innovation at Siemens AG in 2007 and later moved to the drive technology sector where he ran the traction drives business segment. He is now building up the eAircraft start-up business with electric propulsion systems for aircraft as part of Siemens next47. He is member of the Munich Aerospace Board of Trustees.

Monday, 26 June 2017 | 4.00 p.m. – 5.30 p.m.
Airbus Showroom

DISCUSSION

THE POTENTIAL OF PUBLIC-PRIVATE PARTNERSHIPS FOR GREEN AEROSPACE TECHNOLOGIES

In the past few decades, a clear trend towards public-private partnership arrangements has been discernible worldwide. These are recognised as a way to fund large public and research projects (e.g. H2020 Research cPPPs). Contractual agreements between one or more public entities and private companies willing to invest in – often critical – projects lower the risk for every partner, while the public partner often receives ownership. PPPs are thus seen as having definite potential for promoting disruptive technologies. In view of the worldwide need to lower emissions, major changes in aeronautics and space technologies are inevitable. New finance models have to be found to accelerate research in an innovative field.

HOST
Mirko Hornung

has been Executive Director Research and Technology at Bauhaus Luftfahrt and Professor of the Institute of Aircraft Design at the Technical University of Munich since 2010. He is founding member of the Aviation Initiative for Renewable Energy in Germany e.V. ('aireg') since June 2011. Since July 2010 he has been a member of the General Assembly and of the Ludwig Bölkow Campus Coordinating Council of Munich Aerospace.

Fernando Catalano

coordinated two EMBRAER/USP Silence Aircraft projects, "Development of Improved Solutions, Aircraft External Noise" and "Advanced Configurations for Noise Reductions" as well as a BOEING/USP project on "Nose Landing Gear Aeroacoustics Testing". He was invited as ICAO Independent Expert for IEP2 in 2012 and for the Committee on Aviation Environmental Protection CAEP11_IEIR in 2017. He is Head of the Aeronautical Engineering Department at the University of São Paulo.

Hany Moustapha

was Senior Manager of Technology, Collaboration and Technical Training Programs for P&WC from 1999 to 2009, and was named P&WC Senior Research Fellow in 2011. He joined ÉTS (Québec University) in 2010 as Professor and Director of Aerospace Programs. He has been the Canadian industry and academic member of NATO's Aviation Technology since 2000 and founder/co-founder of the Montreal Aerospace Institute (MAI, 2001), the Consortium for Research and Innovation in Aerospace in Québec (CRIAQ, 2002) and the Green Aviation Research and Development Network (GARDN, 2007).

Frank Anton

studied Physics in Bochum and Bonn and has researched particle acceleration and storage in Bonn and Grenoble. He joined Siemens AG in 1988. Following positions in the healthcare branch, he was appointed Head of Innovation at Siemens AG in 2007 and later moved to the drive technology sector where he ran the traction drives business segment. He is now building up the eAircraft start-up business with electric propulsion systems for aircraft as part of Siemens next47.

Klaus Drechsler

studied Aerospace Engineering at the University of Stuttgart. After his PhD he spent several years as Research Manager in the automotive and aerospace industries. Today he is Head of the Institute for Carbon Composites at the Technical University of Munich and Director of the Fraunhofer Institute IGCV in Augsburg. He is also Scientific Manager of the Ludwig Bölkow Campus and Managing Executive of Munich Aerospace.

Hans J. Steininger

is Chief Executive Officer and co-investor of MT Aerospace in Augsburg, which in July 2005 emerged in the course of the acquisition of the MAN Technology AG by OHB S.E. and Apollo Capital Partners. Before, he had various management positions within BMW Rolls Royce and BMW and founded the Private Equity firm Apollo Capital Partners. He chairs Munich Aerospace's Board of Trustees.

MUNICH AEROSPACE SUMMER SUMMIT

Tuesday, 27 June 2017

Host: Professor Michael Pfitzner, University of the German Armed Forces

13	**DAVINA DI CARA** ELECTRIC PROPULSION FOR SATELLITES: CONCEPTS, APPLICATIONS AND EUROPEAN MISSIONS	9.00 a.m. – 9.45 a.m.
14	**PROFESSOR OSKAR J. HAIDN** GREEN PROPULSION: EXPERIMENTAL AND NUMERICAL INVESTIGATION OF METHANE/ OXYGEN-FIRED ROCKET COMBUSTORS	9.45 a.m. – 10.30 a.m.
	COFFEE BREAK	10.30 a.m. – 11.00 a.m.
15	**FASSI KAFYEKE** AEROSPACE TECHNOLOGY: A DRIVER FOR GREEN AVIATION	11.00 a.m. – 11.45 a.m.
16	**JOHANNES STUHLBERGER** GREEN TECHNOLOGIES AND DESIGN OPTIONS	11.45 a.m. – 12.30 p.m.
	LUNCH	12.30 p.m. – 2.00 p.m.
17	LUDWIG BÖLKOW CAMPUS TOUR	2.00 p.m. – 3.30 p.m.
	COFFEE BREAK	3.30 p.m. – 4.00 p.m.
18	**PROFESSOR FRANÇOIS GARNIER** AIRCRAFT EMISSIONS FACING CLIMATE CHANGE AND AIRPORT AIR QUALITY	4.00 p.m. – 4.45 p.m.
19	**PROFESSOR FERNANDO CATALANO** THE BRAZILIAN SILENT AIRCRAFT PROGRAM	4.45 p.m. – 5.30 p.m.
	DINNER	6.00 p.m. – 7.00 p.m.
20	**PROFESSOR UDO HELMBRECHT** CYBER CHALLENGES AND THE AVIATION INDUSTRY	7.00 p.m. – 8.00 p.m.

ELECTRIC PROPULSION FOR SATELLITES: CONCEPTS, APPLICATIONS AND EUROPEAN MISSIONS

Electric Propulsion (EP) encompasses any propulsion technology in which electricity is used to produce thrust. A gas, conventionally Xenon, is ionised by electrical energy, accelerating the resulting plasma to very high exhaust velocity, thus saving significant propellant in contrast to chemical propulsion. With over 50 years of flight heritage, today the use of EP is established. New LEO constellations of thousands of small satellites will use EP for station keeping and disposal. Micro-Newton EP thrusters are considered for scientific missions requiring very accurate positioning control.

New interplanetary cargo missions will benefit from the propellant-saving aspect and next-generation Galileo satellites will benefit from the resulting launch flexibility and cost reduction. The European Space Agency is involved in several EP-related activities from basic R&D to manufacturing, integration, testing and satellite operation. ESA missions such as Artemis, Smart-1, GOCE, AlphaSAT and SmallGEO have paved the way for the use of EP in future missions such as BepiColombo, NeoSAT, Electra and G2G.

DAVINA DI CARA
Electric Propulsion Engineer, Directorate of Technology, Engineering & Quality (D/TEC), ESA ESTEC Noordwijk, Netherlands

Davina Di Cara graduated from Polytechnic University of Turin in 2003 with a degree in Aerospace Engineering. She joined the European Space Agency in 2004 as Young Graduate Trainee. Since 2006 she has worked as Electric Propulsion Engineer in the Directorate of Technology, Engineering & Quality of the Agency. She provides technical support on electric propulsion to the Agency's project teams and is technical manager of studies, experimental investigations and engineering development projects involving electric propulsion subsystems. In addition she has managed and conducted several tests on EP equipment in the ESA Propulsion Laboratory (EPL) and is a propulsion specialist of the ESA Concurrent Design Facility (CDF).

INDUSTRY TALK

GREEN PROPULSION: EXPERIMENTAL AND NUMERICAL INVESTIGATION OF METHANE/OXYGEN-FIRED ROCKET COMBUSTORS

Comparisons of single-injector results from model combustors with square and circular cross sections reveal the expected similarities in combustion performance but differences in heat fluxes, which can be attributed to the impact of near-injector recirculation effects. Furthermore, injector recess investigations provide insight into flame holding mechanisms and propellant mixing and their impact on combustion performance, wall heat fluxes and combustion stability.

To improve computational investigations performed by JAXA and TUM, a reduced chemical kinetic model for methane/oxygen combustion has been developed in co-operation with the DLR Stuttgart. The validation results achieved through this modelling effort are in excellent agreement with a large set of experimental data for ignition delay and laminar flame speed. Comparisons of different numerical approaches by the JAXA and TUM and further comparisons with experimental data help identify shortcomings to some of the current modelling approaches and to understand the consequences of typical modelling assumptions for rocket engine applications, paving the way for optimisation of such challenging combustion modelling applications.

PROFESSOR OSKAR J. HAIDN
Professor for Rocket Propulsion, Technical University of Munich, Munich Aerospace Research Group Leader

Oskar J. Haidn is Associate Professor for Space Propulsion at the Technical University of Munich. Before joining the University in 2011 he graduated from the Friedrich-Alexander University Erlangen-Nürnberg in 1984 with a degree in Chemical Engineering followed by a PhD in Fluid Mechanics in 1991. He joined the German Aerospace Center (DLR) in Lampoldshausen as Project Manager for the H2/O2 Steam Generator as early as 1990 and became Head of the Energy Technology Group in 1993. After heading the Combustion Technology Department, the Modelling and Simulation Department and the Technology Department, he acted as Deputy Director of Research and Technology at the Institute of Space Propulsion from 1999 to 2009.

AEROSPACE TECHNOLOGY: A DRIVER FOR GREEN AVIATION

The forces driving aviation innovation are still around: traffic growth, safety and, more importantly now, environmental and security concerns. Bombardier's recent additions were developed to be the greenest airplanes of their categories. In 2016, Bombardier published the first ISO-certified Environmental Product Declaration in the history of commercial aviation for its C-series CS-100. Several new technologies, such as advanced geared fan engines, composite primary structures and fly-by-wire, were the enablers for this environmental performance, having been developed over several years in a collaborative environment between industry, universities and research centres, both in Canada and internationally. The presentation will outline this innovation ecosystem.

There are still many promising technologies able to make aviation even better. Successful implementation will require a high level of maturity, positive cost/benefit analysis and answers to certification challenges. Developing these key technologies is best done through international collaborative efforts.

FASSI KAFYEKE, ING., PHD
Senior Director, Strategic Technology and Innovation, Bombardier, Montreal, Canada

Fassi Kafyeke joined Bombardier Aerospace in 1982 as a Computational Fluid Dynamics and Aerodynamics engineer and was appointed Manager, Advanced Aerodynamics in 1996. After positions in the strategic development branch, he was named to his current post in 2016 as member of the Product Development Engineering Leadership Team and Senior Director for Strategic Technology and Innovation. He graduated as an electromechanical engineer from Belgium's Université de Liège in 1980. In 1981, he obtained a Master's degree in Air Transport Engineering from the Cranfield Institute of Technology, UK, and a PhD in Mechanical Engineering at École Polytechnique de Montréal in 1994. Dr Kafyeke is actively involved in numerous industry agencies and consortiums.

Tuesday, 27 June 2017 | 11.45 a.m. – 12.30 p.m.
Airbus Showroom

INDUSTRY TALK

GREEN TECHNOLOGIES AND DESIGN OPTIONS

Committed to establishing an environmentally acceptable growth of air traffic, the community is in the process of assessing and driving promising solutions for the future. Carbon-neutral energy sources, intelligent functionality interaction in aircraft design and operational aspects are part of this commitment. There are a large number of potential combinations which have not yet been fully assessed and integrated into configuration planning. Nevertheless, some options are on their way to demonstrating the feasibility on smaller-scale solutions, although others face steep improvement curves before they can become successfully established in commercial aircraft.

JOHANNES STUHLBERGER
Airbus, Taufkirchen

Johannes Stuhlberger has studied Aerospace Engineering at the Technical University in Munich. He started his career at the predecessor of Airbus (MBB) in 1989 as a rocket scientist. After various management positions in space business he joined Airbus CTO organisation in 2007 as Head of Global Innovation Network. Within this responsibility he headed the hybrid electric roadmap. He is member of the German National Platform for electro-mobility and is now responsible for Tech Scouting Europe and Scouting Coordination.

Tuesday, 27 June 2017 | 2.00 p.m. – 3.30 p.m.
Airbus Showroom

TOUR

LUDWIG BÖLKOW CAMPUS TOUR

Following an introductory presentation on the Ludwig Bölkow Campus, the LBC GmbH invites registered guests to a guided Campus tour with stops at the TUM-AlgaeTec Center, Powerlab and the Aeronautical Engineering Department.
(Registration required)

X-Works

SIMON BEST
Head of CIS New Business

TUM-AlgaeTec Center

PROFESSOR THOMAS BRÜCK / DR DANIEL GARBE
Technical University of Munich

Aeronautical Engineering

PROFESSOR MARKUS DIETZ
University of the German Armed Forces

AIRCRAFT EMISSIONS FACING CLIMATE CHANGE AND AIRPORT AIR QUALITY

The two main challenges for air transport in the future will be the protection of our environment and global competitiveness. Indeed, civil aviation traffic is forecast to increase at a rate of about 5% per year over the next decades. Civil aviation contributes to degradation of air quality around airports and to climate change through emissions of greenhouse gases and particulate matters. These include soot particles formed in the combustor, volatile aerosols and contrails generated in the aircraft wake.
Today the Canadian Aerospace Environmental Technology Road map (CAETRM) has identified research and technology development possibilities allowing a further drastic reduction of gas and particulate emissions.

The proposed presentation will address past and future research activities at ÉTS University performed in collaboration with the French Aerospace Lab on the global and local impact of aircraft emissions, including contrail formation and airport air quality.

PROFESSOR FRANÇOIS GARNIER
Professor at Engineering School ÉTS,
Quebec University, Montréal, Canada

François Garnier received a PhD in 1990 and a Qualification for Directing Research in Mechanical Engineering in 1999 from the French Aerospace Research Center (ONERA) and the University of Paris VI. He was a senior scientist and half-time professor at the University of Paris-Est and manager of aero-propulsion activities at ONERA. Since 2011 he has been professor at Quebec University's ÉTS. He was involved in several major European projects addressing the impact of aircraft engine emissions on the atmosphere and more recently led an international Airport Air Quality project at Montreal airport in partnership with McGill University and P&WC.

THE BRAZILIAN SILENT AIRCRAFT PROGRAM

The production of civil aircraft has become an important strategic industry for the continuous sustainable development of Brazil. Seeking self-sufficiency in conception, design and certification of civil aircraft, the Brazilian aeronautical industry led by Embraer has looked for technological advances in several important areas such as external aircraft noise. Environmental issues have emerged as an important and difficult technological challenge for the growth of the global aeronautical industry. Among various concerns, the reduction of aircraft noise has constantly been growing in importance over the past years.

To consolidate the development and research of this area in Brazil, Embraer and six Brazilian universities and institutes initiated the Brazilian Silent Aircraft Program. The programme objective has been to integrate and consolidate aerodynamic and acoustic research efforts focused on external noise. One of the main goals is to establish this area firmly at the universities for continuous development even after the end of the program.

PROFESSOR FERNANDO CATALANO
Head of the Aeronautical Engineering
Department, University of São Paulo, Brazil

Fernando Catalano graduated from the University of São Paulo with a degree in Mechanical Engineering in 1980, followed by a Master's degree in Aerodynamics in 1988. He received his PhD in Aerodynamics at Cranfield University, UK. From 2002 to 2010, he was Coordinator of the Aeronautical Engineering Course EESC-USP. Further, he coordinated two EMBRAER/USP Silence Aircraft projects, "Development of Improved Solutions, Aircraft External Noise" and "Advanced Configurations for Noise Reductions" as well as a BOEING/USP project on "Nose Landing Gear Aeroacoustics Testing". Professor Catalano was invited as ICAO Independent Expert for IEP2 in 2012 and for the Committee on Aviation Environmental Protection CAEP11_IEIR in 2017.

Tuesday, 27 June 2017 | 7.00 p.m. – 8.00 p.m.
Franz Josef Strauß Pavillon

FIRESIDE CHAT

CYBER CHALLENGES AND THE AVIATION INDUSTRY

Cyberspace has challenged traditional models of physical boundaries and law enforcement methods. International conflicts move from the real world into the virtual cyber world. Aviation is the perfect example of an industry that is embracing digital technology with all of its advantages and challenges. While the focus on digitalisation has been on the functionality of digital technology, cyber security aspects have often been addressed only at a later stage and as a separate project. At a typical modern smart airport, digital technology is used to facilitate a seamless travel experience and heighten security. Key components of a smart airport include deployment of the Internet of Things, which is essentially internet-connected devices processing data to support human decisions and automated responses.

ENISA produces around sixty reports per year on all aspects of cyber security, including smart airports. The objectives of ENISA in addressing cyber challenge include delivering security by design, fostering co-operation and awareness by building cyber communities, promoting information sharing and furthering standardisation and research.

PROFESSOR UDO HELMBRECHT
Executive Director, ENISA – The European Union Agency for Network and Information Security, Heraklion, Crete

Udo Helmbrecht has more than 35 years of professional management experience in the fields of IT and security, having worked in a variety of industries including energy, insurance, engineering, aviation, defence, and aerospace. He studied Physics, Mathematics and Computer Science at Ruhr-University Bochum and received his PhD in Theoretical Physics in 1984. In 2010 he was appointed honorary professor at the University of the German Armed Forces Munich. He was named President of the German Federal Office for Information Security (BSI) in 2003, and took office as Executive Director of the European Union Agency for Network and Information Security (ENISA) in October 2009.

MUNICH AEROSPACE SUMMER SUMMIT

Wednesday, 28 June 2017

Host: Professor Hartmut Graßl, Max Planck Institute for Meteorology

22	**PROFESSOR SURESH MENON** MODELING AND COMPUTATIONAL CHALLENGES TO SIMULATE ALTERNATE FUEL COMBUSTION IN GAS TURBINES AND ROCKETS	9.00 a.m. – 9.45 a.m.
23	**DR JAPIE ENGELBRECHT** OVERVIEW OF AEROSPACE CONTROL AND AUTOMATION RESEARCH AT STELLENBOSCH UNIVERSITY IN THE WESTERN CAPE	9.45 a.m. – 10.30 a.m.
	COFFEE BREAK	10.30 a.m. – 11.00 a.m.
24	**GUILLAUME GIRARD** HOW NEW SPACE DISRUPT THE CONVENTIONAL ACCESSES TO SPACE	11.00 a.m. – 11.45 a.m.
25	**PROFESSOR MARKUS RAPP** UNDERSTANDING AND MITIGATING THE CLIMATE IMPACT OF AVIATION	11.45 a.m. – 12.30 p.m.
	LUNCH	12.30 p.m. – 2.00 p.m.
26	**SESSION I / PROFESSOR KLAUS DRECHSLER** **DR EVA ROGOWICZ-GRIMM** **GLORIA STAMM** RLS-AEROSPACE PROJECT "GLOBAL AEROSPACE CAMPUS": STATUS AND NEXT STEPS (BY INVITATION ONLY)	2.00 p.m. – 4.30 p.m.
27	**SESSION II / MARIA RECK** MUNICH AEROSPACE FELLOWS' DAY (BY INVITATION ONLY)	2.00 p.m. – 4.30 p.m.
	END OF EVENT	4.30 p.m.

MODELING AND COMPUTATIONAL CHALLENGES TO SIMULATE ALTERNATE FUEL COMBUSTION IN GAS TURBINES AND ROCKETS

Simulation of turbulent combustion in gas turbine and rocket engines is challenging due to interaction between the wide range of scales from the molecular scales where mixing and combustion occurs to the large-scale that control the global processes. Simulation models optimized to work in one specific region of application invariably fail when another area is simulated. New challenges now arise since alternate (environmentally friendly) fuels with different performance sensitivity are being tested for both liquid fueled gas turbines and solid propellant rocket motors.

Massively parallel computational and new in-situ data processing tools are needed to carry out parametric studies if such simulations are expected to help in the design cycle. A multi-scale large-eddy simulation approach is used to assess combustion in these systems. Subgrid modeling uncertainties, fidelity in predictions, and challenges in big data processing are discussed with some examples of successes and failures.

PROFESSOR SURESH MENON
Hightower Professor of Engineering, Georgia Institute of Technology, Atlanta GA USA

Suresh Menon is the Hightower Professor of Engineering in Georgia Institute of Technology, Atlanta, Georgia USA. He received his Ph.D. from the University of Maryland, in 1984 and worked as a Research Scientist in Flow Research, Inc., WA where he developed large-eddy simulation (LES) methods for turbulent combustion modeling. In 1993, he joined Georgia Tech and has been a Professor since 1997. His recent work focusses on combustion of alternate fuels in gas turbines, combustion instability in rocket engines and modeling of green propellants for solid fueled rockets.

OVERVIEW OF AEROSPACE CONTROL AND AUTOMATION RESEARCH AT STELLENBOSCH UNIVERSITY IN THE WESTERN CAPE

The lecture will provide an overview of research in aerospace control and automation performed at the Electronic Systems Laboratory (ESL) at Stellenbosch University in the Western Cape. The Electronic Systems Laboratory is an internationally respected research facility that specialises in the control and automation of aircraft, ground vehicles, underwater vehicles, and space satellites. The ESL was founded in 1992 as a space systems laboratory and was responsible for the development of SUNSAT, the first South African satellite, which was commissioned and launched in 1999. Since 2004, the ESL has cultivated a strong research focus on the control automation of aircraft, both unmanned aerial vehicles and large transport aircraft.

Research topics include: precise automated landing on moving platforms, fault tolerant flight control, automatic collision prediction and avoidance, autonomous path planning and re-planning, automatic in-flight refuelling and automatic flight envelope recovery.

DR JAPIE ENGELBRECHT
Senior Lecturer, Department of Electrical and Electronic Engineering, Stellenbosch University, South Africa

Japie Engelbrecht is a senior lecturer in Control Systems at Stellenbosch University. Before joining the university in 2008, he worked at the satellite engineering company Sun Space & Information Systems (now Denel Spaceteq), where he was the team leader for the Attitude and Orbit Control Systems for three international earth observation satellites, including the South African Sumbandila-Sat. His research group at Stellenbosch University, the Electronic Systems Laboratory (ESL), focuses on the control and automation of aircraft, from unmanned aerial vehicles to large transport aircraft.

HOW NEW SPACE DISRUPT THE CONVENTIONAL ACCESSES TO SPACE

The upsurge in performance of small-satellites has set the conditions for a disruption in the Space industry. OneWeb, Boeing, SpaceX, Samsung, are all coming up with mega satellite constellations for global-web access, with more than 10,000 small-satellites together. For this to occur, the fundamental tool that will allow small-satellites to be deployed in Space doesn't exist yet and the market craves for a dedicated small-satellite service. With Bloostar, we are simplifying access to Space to serve it an efficient, affordable and sustainable way. By means of a hybrid Balloon-Rocket solution (a "Rockoon"), Bloostar uses a stratospheric balloon as the initial ascent stage followed by three rocket stages to reach orbit. The balloon stage delivers the rocket stage above the atmosphere to start its rockets in a quasi-vacuum environment. It becomes an elegant and efficient solution to response in an affordable way the emergence of the new Space Internet, Observation, Security and Science.

GUILLAUME GIRARD
Partner at Zero 2 Infinity, Barcelona/Munich

Guillaume Girard started his career as a satellite propulsion engineer for Thales, and Spacecraft Operations engineer. In 2007, he moved to Munich to operate the ISS Columbus module. He worked as a spaceflight controller for 8 years and supported the ground segment, on-board payload experiments and astronaut planning. Guillaume became a partner of Zero 2 Infinity in 2014 and developed the company strategy and international outreach. Since then, the company has gained global recognition and fine-tuned its vision to disrupt access to space and service the new commercial small-satellites market.

FINAL LECTURE

UNDERSTANDING AND MITIGATING THE CLIMATE IMPACT OF AVIATION

Aviation ensures mobility and plays an important role in economic growth and human welfare. However, the emission of combustion products from aviation drastically changes the composition of the atmosphere, e.g. the abundance and properties of clouds and eventually the climate. Aviation fuel burn and its atmospheric effects have been growing substantially during recent decades. Since this trend is forecast to continue, strategies have to be devised that allow us to minimise the adverse climate effects of aircraft emissions. One option is to optimise the air transport system by implementing such innovations as eco-efficient flight routing without changing aircraft hardware or propellant. Another option is to modify the aircraft itself or, at any rate, its propulsion technology or the propellant used.

This presentation will first review our current understanding of the climate effects of aircraft emissions and then turn to the above-mentioned mitigation options, showing recent results regarding climate-optimised aircraft trajectories as well as results from a recent joint DLR/NASA flight experiment revealing the promising potential of using biofuels instead of conventional kerosene.

PROFESSOR MARKUS RAPP
Director DLR-Institute of Atmospheric Physics, and Chair for Atmospheric Physics, Ludwig-Maximilians-Universität, Munich

Markus Rapp is Director of the DLR-Institute of Atmospheric Physics located in Oberpfaffenhofen and holds a chair in Atmospheric Physics at the Ludwig-Maximilians-Universität, Munich. One main research focus of his institute deals with the environmental impact of air traffic and other means of transportation and weather-related aviation safety. Within the institute, these research areas are addressed via the full suite of available methods ranging from sensor development to in-situ and remote sensing observations from research aircraft and satellites to theory and modelling.

Wednesday, 28 June 2017 | 2.00 p.m. – 4.30 p.m.
Franz Josef Strauß Pavillon

SESSION I

RLS-AEROSPACE PROJECT "GLOBAL AEROSPACE CAMPUS": STATUS AND NEXT STEPS (BY INVITATION ONLY)

Within the framework of the Regional Leaders' Summit 2016, Munich Aerospace had invited scientists and government representatives to a workshop on the Global Aerospace Campus. The Global Aerospace Campus is a transnational teaching concept for aerospace students and researchers based on Massive Open Online Courses. The project was presented to government officials and researchers at the Regional Leaders' Summit held at Munich's Residenz. The Final Declaration was signed in Munich on 15 July, 2016 by the Heads of the Governments of Georgia, Québec, Sao Paulo, Shandong Province, the State of Upper Austria, Western Cape Province and Bavaria and included the following paragraph:

AEROSPACE – A VIRTUAL CAMPUS

11. In order to strengthen the specialised training of aerospace engineers, researchers and industrial experts from our regions have come together to build a new online training platform with virtual and in-person components. Training modules reflecting the regional specialisations will be created and shared with the other regions. An initial teaching session on 'Flying Robots' was successfully held in June 2016 as part of the Munich Aerospace Summer School in Herrsching, Bavaria."

Since then, Munich Aerospace has released a concept paper and complied with participants' wishes by hosting this first RLS-Aerospace event titled the 'Munich Aerospace Summer Summit'.

PROFESSOR KLAUS DRECHSLER
Managing Executive, Munich Aerospace – Faculty for Aeronautics and Space

DR EVA ROGOWICZ-GRIMM
Managing Director, Munich Aerospace – Faculty for Aeronautics and Space

Munich Aerospace would like to take this opportunity to kindly invite representatives from each partner region to discuss the latest developments, shape the project's future and foster its ambitious aim: close collaboration in teaching and research between the seven members of the worldwide RLS-Aerospace network.

BACKGROUND: Aerospace is a key economic driver and a research priority in the RLS regions. Worldwide, the field is extremely competitive. Continuous innovation is required to remain operational under increasing financial and environmental constraints. Skilled labour has proven to be of crucial importance. Different teaching approaches are employed within the RLS group. There is a strong understanding among the RLS partners that sharing this regional aerospace expertise can lead to the development of enhanced teaching and training programs, benefiting all RLS regions. The Regional Leaders' Summit is a global network of seven regions established in 2002 to strengthen political, economic and cultural ties and address the challenges of globalisation.

GLORIA STAMM
Academic Coordinator, Munich Aerospace – Faculty for Aeronautics and Space

Representatives from the RLS regions:

DR FLORENCE GAUZY (BAVARIA)
Senior Scientific Officer
Bavarian Research Alliance (BayFOR)

NICOLAS MARTIN (QUEBEC)
Director Economic Services
Quebec Government delegation in Munich

DR DE MELO-REINERS (SAO PAULO)
Managing Director
Centro Universitario de Baviera para América Latina (BAYLAT)

SESSION II

MUNICH AEROSPACE FELLOWS' DAY (BY INVITATION ONLY)

Meeting Point: Jochen Schweizer Arena, Ludwig-Bölkow-Allee 1, 82024 Taufkirchen

Munich Aerospace grants scholarships to support young scientists in their doctoral studies. Munich Aerospace scholarship recipients conduct their research at one of the four founding partner institutions of Munich Aerospace, the Technical University of Munich, the University of the German Armed Forces Munich, the German Aerospace Center or Bauhaus Luftfahrt. The Munich Aerospace Summer Summit offers opportunities for supplementing industry and technical knowledge and for subject-specific and interdisciplinary dialogue. At the Munich Aerospace Fellows' Day, scholarship recipients have the chance to meet and network while engaging in an active team event.

MARIA RECK
Academic Administrator, Munich Aerospace – Faculty for Aeronautics and Space

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