

Final Programme* ASMS/SPSC Conference 2018 – online version

*the conference programme may still be subject to last-minute changes

Day 1 (10/09/2018)

09:00 – 09:15 Opening Ceremony (Room 909)

09:15 – 10:45 Panel Discussion (Room 909)

"Satellite Communications and 5G in Germany and Europe"

- Moderators: [S. Scalise \(DLR\)](#) and [D. Mignolo \(ESA\)](#)
- Panellists:
 - [T. Jarzombek \(Federal Government Coordinator of German Aerospace Policy, German Federal Ministry of Education and Technology\)](#) – TBC
 - [W. Bocquet \(Director Spectrum management & Policy, Eutelsat\)](#)
 - [J.P. Choffray \(Vice President, System Architecture and Innovation, SES\)](#)
 - [W. Mohr \(Head of Research Alliances, Nokia\)](#)
 - Representative of Mobile Network Operator – TBC

10:45 – 11:15 Coffee-Break

11:15 – 12:30 Keynote Speech (Room 909)

"SatCom for Internet of Things Mass Market"

[D. Fernandez, \(SigFox\)](#)

12:30 – 14:00 Lunch-Break

14:00 – 16:00 Tutorial (Room 088)

"Mega-Constellations: Opportunities, Trends and Challenges"

[E. Re \(European Space Agency\)](#)

16:00 – 16:30 Coffee-Break

16:30 – 18:30 Tutorial (Room 088)

"A Brief Introduction to Machine Learning (with Applications to Communication) "

[O. Simeone \(King's College London\)](#)

Technical Session (Room 089)

Satellite Systems and Deep Space Communications

From 19:00

Cocktail-Reception

Day 2 (11/09/2018)

07:30 – 08:30

Jogging Session

09:15 – 10:45

Keynote Speech (Room 909)

["New Generation of Digitally Beamformed MEO and GEO Satellites: System Perspective"](#)

[J.P. Choffray \(SES\)](#)

10:45 – 11:15

Coffee-Break

11:15 – 12:30

Workshop (Room 909)

["Precoding Techniques in Very High Throughput Satellite Systems"](#)

- including live demonstration

[A. Ginesi \(European Space Agency\), J. Ebert \(Joanneum Research\) and S. Andrenacci \(University of Luxembourg\)](#)

12:30 – 14:00

Lunch-Break

14:00 – 16:00

Tutorial (Room 088)

["5G Release 15: Where Are We Going in Terrestrial and Satellite Networks?"](#)

[R. Aguiar \(Univ. Aveiro\) and S. Cioni \(European Space Agency\)](#)

Technical Session (Room 089)

[Precoding in Satellite Communications](#)

16:00 – 16:30

Coffee-Break

16:30 – 18:30

Tutorials (Room 088)

["SatCom Reconfigurable Active Antennas for Space Applications"](#)

[A. Catalani \(Space Engineering\)](#)

["Affordable Phased-Arrays for User Terminals Using Silicon Technologies"](#)

[G.M. Rebeiz \(UCSD\)](#)

Technical Session (Room 089)

[Satellite Terminals and Antennas](#)

19:00 – 20:00

Walking Guided Tour

From 20:00

Conference Dinner

Day 3 (12/09/2018)

07:30 – 08:30

Jogging Session

09:15 – 10:45

Panel Discussion (Room 909)

["How Optical Free-Space Communications Could Boost New Space"](#)

- Moderator: [D. Giggenbach \(DLR\)](#)
- Panellists:
 - [Z. Sodnik \(ESA-ESTEC\)](#)
 - [P. Wertz \(Tesat Spacecom\)](#)
 - [A. Grabs \(Airbus DS\)](#)
 - [M. Emanuelli \(GOMspace\)](#)

10:45 – 11:15

Coffee-Break

11:15 – 12:30

Tutorial (Room 088)

Tutorial (Room 089)

["Zephyr – Airbus Solution for HAPS Systems"](#)

[A. Grabs \(Airbus DS\)](#)

["Beyond DVB-S2x: a Glimpse into a Future Air-Interface"](#)

[A. Vanelli-Coralli \(Univ. Bologna\)](#)

12:30 – 14:00

Lunch-Break

14:00 – 16:00

Technical Session (Room 088)

Technical Session (Room 089)

[Networking Aspects](#)

[Physical Layer Aspects](#)

16:00 – 16:30

Closing Ceremony and Best Paper Award Assignment (Room 909)

Technical Sessions

Satellite Systems and Deep Space Communications

Session-Chairs: Domenico Mignolo (ESA-ESTEC) and Alessandro Guidotti (University of Bologna)

Monday 10/09, 16:30 – 18:30, Room 089

DTN Performance in Complex Deep-Space Networks	Nicola Alessi and Carlo Caini (University of Bologna, Italy); Tomaso De Cola (German Aerospace Center (DLR), Germany); Sebastian Martin (ESA/ESOC, Germany); Jeremy Mayer (GMV-INSYEN, Germany)
Wideband Data Transmission in E-Band Between an Aircraft and a Ground Station	Ingmar Kallfass (University of Stuttgart, Germany); Ralf Henneberger (Radiometer Physics GmbH, Germany); Rainer Sommer (Fraunhofer-FHR, Germany); Parisa Harati and Seyyid Dilek (University of Stuttgart, Germany); Joerg Eisenbeis and Sören Marahrens (Karlsruhe Institute of Technology (KIT), Germany); Stephan Palm (Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR, Germany); Axel Tessmann (Fraunhofer IAF, Germany); Benjamin Schoch (University of Stuttgart, Germany)
Performance Bounds of a Single LEO Satellite Providing Geolocation of an RF Emitter	Patrick Ellis (University of California at Santa Cruz & Southwest Research Institute, USA); Farid Dowla (University of California at Santa Cruz, USA)
A New Earth-LEO Propagation Campaign at Q and W-band	Joel Flávio (JOANNEUM RESEARCH, Austria); Félix Cuervo and Michael Schönhuber (Joanneum Research, Austria); Michael Schmidt (Researcher & Joanneum Research, Austria); Danielle Vanhoenacker-Janvier (Université catholique de Louvain, Belgium); Arturo Martin Polegre and Antonio Martellucci (European Space Agency, The Netherlands)
A LEO Small Satellite Constellation with Intersatellite Link	Zizung Yoon (Technische Universität Berlin)

Precoding in Satellite Communications

Session-Chairs: Alberto Ginesi (ESA-ESTEC) and Gianluigi Liva (DLR)

Tuesday 11/09, 14:00 – 16:00, Room 089

Message-Splitting for Interference Cancellation in Multibeam Satellite Systems	Tomas Ramirez and Carlos Mosquera (University of Vigo, Spain); Màrius Caus, Adriano Pastore and Monica Navarro (Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain); Nele Noels (Ghent University, Belgium)
Code Design for Non-Coherent Detection of Frame Headers in Precoded Satellite Systems	Farbod Kayhan (University of Luxembourg, Luxembourg); Guido Montorsi (Politecnico di Torino, Italy)
Cross-Layer Forward Packet Scheduling for Emerging Precoded Broadband Multibeam Satellite System	Eva Lagunas, Stefano Andrenacci and Symeon Chatzinotas (University of Luxembourg, Luxembourg); Björn Ottersten (University of Luxembourg, Luxembourg)
Link Adaptation and Carriers Detection Errors in Multibeam Satellite Systems with Linear Precoding	Anxo Tato (AtlanTTic Research Center, University of Vigo, Spain); Stefano Andrenacci and Symeon Chatzinotas (University of Luxembourg, Luxembourg); Carlos Mosquera (AtlanTTic Research Center, University of Vigo,)
Geographical Scheduling for Multicast Precoding in Multi-Beam Satellite Systems	Alessandro Guidotti and Alessandro Vanelli-Coralli (University of Bologna, Italy)

Satellite Terminals and Antennas

Session-Chairs: Sandro Scalise (DLR) and Daniele Tarchi (University of Bologna)

Tuesday 11/09, 16:30 – 18:30, Room 089

Mobile Ka-band Receiver for Vehicles - A Detailed Trade-off Analysis	Ernst Eberlein (Consultant, Eutelsat S.A., Germany); Michael Bergmann (Eutelsat, France); Nemanja Stamenic (Joanneum Research, Austria); Ivana Markovic (JOANNEUM RESEARCH, Austria); Michael Schönhuber (Joanneum Research, Austria); Fernando Pérez-Fontán (University of Vigo, Spain)
Ka-band Smart Flat Panel User Terminal for NGSO Networks	Ferdinando Tiezzi (ViaSat, Switzerland); Ashok Rao (O3B Networks, USA)
Low Complexity Detectors for Spread Spectrum Receivers	Gennaro Gallinaro (Space Engineering S.p.A., Italy); Roberto Romanato and Sabino Titomanlio (Space Engineering, Italy); Emanuele Tirrò (Space Engineering S.p.A., Italy); Nader Alagha (European Space Agency, The Netherlands); Stefano Cioni (European Space Agency & ESTEC, The Netherlands); Marco Andrenacci and Ivan Chesi (MBI, Italy); Agostino Isca (MBI srl, Italy)
Characterization Method for Distortions in Multi-Port Amplifiers	Tony Colin, Thomas Delamotte and Andreas Knopp (Bundeswehr University Munich, Germany)

Sparsity-Aided Low-Implementation Cost Based On-Board Beamforming Design for High Throughput Satellite Systems	Ashok Bandi and Vahid Joroughi (University of Luxembourg, Luxembourg); Bhavani Shankar Mysore R (Interdisciplinary Centre for Security, Reliability and Trust & University of Luxembourg, Luxembourg); Joel Grotz (SES, Luxembourg); Björn Ottersten (University of Luxembourg, Luxembourg)
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Networking Aspects

Session-Chairs: Tomaso De Cola (DLR) and TBD

Wednesday 12/09, 14:00 – 16:00, Room 088

Caching at the Edge with Fountain Codes	Estefania Recayte (German Aerospace Center - DLR, Germany); Francisco Lázaro (German Aerospace Center (DLR), Germany); Gianluigi Liva (DLR - German Aerospace Center, Germany)
Controlled Delay Scheduler for VoIP over LEO Constellations on LMS Channels	Bastien Tauran (ISAE & TESA, France); Emmanuel Lochin (Université de Toulouse & ISAE-SUPAERO, France); Jerome Lacan (University of Toulouse, France); Fabrice Arnal and Mathieu Gineste (Thales Alenia Space, France); Nicolas Kuhn (CNES, France)
Integration of 5G and Satcom: The SaT5G System	Fabrice Arnal, Jean-Michel Houssin and Nicolas Chuberre (Thales Alenia Space, France)
SATis5: A 5G Testbed Integrating Satellite and Terrestrial Infrastructures	Marius Corici (Fraunhofer FOKUS, Germany); Konstantinos Liolis (SES, Luxembourg); Frank Burkhardt (Fraunhofer Institute for Integrated Circuits IIS, Germany); Ilie Gheorghe Pop (Fraunhofer FOKUS, Germany); Stefan Covaci (Technische Universität Berlin, Germany); Christos Politis and Alexander Geurtz (SES, Luxembourg); Jan Koernicke (Newtec GmbH, Germany); Florian Völk (Bundeswehr University Munich, Germany); Adam Kapovits (Eurescom GmbH, Germany)
Assessing the Quality of Video Delivery over Ka-Band to Mobile Terminals (Extended Abstract)	Nemanja Stamenic and Werner Bailer (Joanneum Research, Austria); Ernst Eberlein (Consultant, Eutelsat S.A., Germany); Stefanie Wechtitsch and Ivana Markovic (JOANNEUM RESEARCH, Austria); Michael Schönhuber (Joanneum Research, Austria); Michael Bergmann (Eutelsat, France)

Physical Layer Aspects

Session-Chairs: Alessandro Vanelli-Coralli (University of Bologna) and Stefano Cioni (ESA-ESTEC)

Wednesday 12/09, 14:00 – 16:00, Room 089

Feasibility of Energy Management Techniques for Ultra-low Power M2M SatCom Terminals	Nader Alagha (European Space Agency, The Netherlands); Jesus Alonso-Zarate (Centre Tecnologic de Telecomunicacions de Catalunya - CTTC, Spain); Marco Andrenacci (MBI, Italy); Alessandro Bion (University of Padova, Italy); Luis Blanco (Centre Tecnològic de les Telecomunicacions de Catalunya (CTTC), Spain); Ivan Chesi (MBI, Italy); Daniele Tarchi (University of Bologna, Italy); Michele Zorzi (Università degli Studi di Padova, Italy)
Resource Allocation Approach for Differential Doppler Reduction in NB-IoT over LEO Satellite	Oltjon Kodheli, Stefano Andrenacci, Nicola Maturo and Symeon Chatzinotas (University of Luxembourg, Luxembourg); Frank Zimmer (SES S.A., Luxembourg)
Shared Position Technique for Interfered Random Transmissions in Satellite Communications	Selma Zamoum (University of Toulouse, INPT & TESA, Telecommunications for Space and Aeronautics, France); Jerome Lacan (University of Toulouse, France); Marie-Laure Boucheret (University of Toulouse IRIT Enseiht, France); Jean-Baptiste Dupé (CNES, France); Mathieu Gineste (Thales Alenia Space, France)
Polar-Coded Pulse Position Modulation for the Poisson Channel	Delcho Donev (Technical University of Munich, Germany); Georg Böcherer (Huawei Technologies, France)
A Design Method of Cognitive Overlay Links for Satellite Communications	Luciano B C Silva (IMT-Atlantique, France & National Institute for Spatial Research, Brazil); Tarik Benaddi (IMT Atlantique, France); Laurent Franck (Télécom Bretagne, France)

Panel Discussions, Keynote Speeches, Workshops and Tutorials

Panel Discussion: "*Satellite Communications and 5G in Germany and Europe*"

The future communications system referred to as 5G represents far more than just the next generation of terrestrial mobile services. It will drive a convergence of fixed and mobile services, introduce a new set of technologies and standards, create a network of networks and facilitate communications between everyone and everything, whilst focusing on some key vertical markets. Satellite systems have useful attributes for 5G in terms of security, resilience, coverage, mobility and delivery of broadband; and in this future environment the choice of communication technology should be transparent to the end user and based upon location, type of service and cost efficiency. 5G thus provides a major opportunity for the space sector to deliver parts of the future generation of communications networks and services. Representatives of both the space and telecom industry will engage in a lively discussion highlighting the strengths, weaknesses, opportunities and threats from different business perspectives and covering technical, market and spectrum related aspects. A representative of the German Federal Ministry of Education and Technology will add the political view to the potential role of SatCom in 5G within Germany and Europe.

Monday 10/09, 09:15 – 10:45, Room 909

Moderators: S. Scalise (DLR) and D. Mignolo (ESA)

Sandro Scalise graduated in Electronic Engineering specialising in Telecommunications (with honours) from University of Ferrara, Italy in 1997. In 2007, he received his PhD (summa cum laude) from University of Vigo, Spain. Since 2001, he is within the Institute of Communications and Navigation, DLR (German Aerospace Centre), Germany, where, from October 2004 to June 2008, he has been leading the Mobile Satellite Systems Group. Since July 2008, he is leading the Satellite Networks Department. His department deals with the conception, design and demonstration of new satellite as well as free space optical communication systems. He is IEEE Senior Member and received the "Satellite Communications Distinguished Service Award" from IEEE ComSoc in 2013. He is co-author of more than 70 international journal and conference papers, co-chairman of the biennial Advanced Satellite Multimedia Systems Conference since the 2006 edition and has been active in many standardisation groups within DVB and ETSI.

Domenico Mignolo has joined the European Space Agency in 2002 and he is currently Head of ground Segment Section in the Telecom and Integrated Application Directorate. He has initiated several projects and programmatic initiatives in the framework of ARTES Programme. He has been technical officer of several two-way satellite system projects sponsored by ESA and has followed standardization activities. In the past he has worked for Alenia Spazio as responsible of two-way satellite user terminals.

Panellists:

W. Bocquet (Director Spectrum management & Policy, Eutelsat)

Wladimir Bocquet is the Director of Spectrum Management & Policy for Eutelsat. In this role, he leads the global regulatory activity and build up policy supports for the business development of Eutelsat. Previously, at the GSMA, he was Head of Policy Planning for Government and Regulatory

Affairs. In this role, he provided public policy analysis and recommendations to the GSMA executive team and offers a strategic view of global policy trends to GSMA members. He started at the GSMA as a Senior Director of Spectrum Policy, responsible for building consensus on spectrum policy positions and promoting best practice in spectrum management. In October 2008, Mr Bocquet was appointed Deputy Director in charge of Spectrum Strategy and International Planning at Orange-France Telecom Group, and he led the Orange delegation at WRC-12. He worked in Japan for several years, first in mobile broadband communication for Fujitsu Laboratories and subsequently as senior manager of broadband access technologies for Orange Labs Tokyo-Seoul (formerly France Telecom R&D). In addition to his GSMA responsibilities, Mr Bocquet also served as a lecturer for the US Telecom Training Institute (USTTI) and other international training bodies. Mr Bocquet earned a degree in telecommunications from Telecom Bretagne (Ecole Nationale Supérieure des Télécommunications de Bretagne, France) and a doctorate from the University of Kyoto, Japan.

J.P. Choffray (Vice President, System Architecture and Innovation, SES)

Jean-Pierre Choffray is currently Vice President, System Architecture and Innovation within SES and is leading the development of innovative satellite system architectures. He received his MS degree from the Université Catholique de Louvain in 1986 and has been teaching assistant and researcher in Digital TV coding at UCL until 1988. He has been Project Manager at Gillam in Liege until 1998, working to the development of various products and equipment for telecommunication applications. He has been Project Manager at ETCA in Charleroi until 2001, mainly working on the SkyBridge constellation definition and demonstration activities. He joined SES in Betzdorf in 2001 in the Systems Engineering team. He has represented SES in the DVB-S2 working group. He initiated the Satmode technology development activities having led to the Astra2Connect Broadband system for which he was system architect. In the recent times he has been in charge of the initiatives having led to the procurement of SES-12, 14, 16 and 17. In his current role, he's in charge of the SES Next initiative aiming at accelerating the innovation pace in the space industry by changing the way GEO/MEO satellites are designed and produced.

W. Mohr (Head of Research Alliances, Nokia)

Werner Mohr was graduated from the University of Hannover, Germany, with the Master Degree in electrical engineering in 1981 and with the Ph.D. degree in 1987. Dr. Werner Mohr joined Siemens AG, Mobile Network Division in Munich, Germany in 1991. He was involved in several EU funded projects and ETSI standardization groups on UMTS and systems beyond 3G. Werner Mohr coordinated several EU and Eureka Celtic funded projects on 3G (FRAMES project), LTE and IMT-Advanced radio interface (WINNER I, II and WINNER+ projects), which developed the basic concepts for future radio standards. Since April 2007 he is with Nokia Solutions and Networks (now Nokia) in Munich Germany, where he is Head of Research Alliances. In addition, he was chairperson of the NetWorld2020 European Technology Platform until December 2016. Werner Mohr was Chair of the Board of the 5G Infrastructure Association in 5G PPP of the EU Commission from its launch until December 2016. He was chair of the "Wireless World Research Forum – WWRF" from its launch in August 2001 up to December 2003. He was member of the board of ITG in VDE from 2006 to 2014. He is co-author of a book on "Third Generation Mobile Communication Systems" a book on "Radio Technologies and Concepts for IMT-Advanced" and a book "Mobile and Wireless Communications

for IMT-Advanced and Beyond". In December 2016 Werner Mohr received the IEEE Communications Society Award for Public Service in the Field of Telecommunications.

Keynote Speech: "*SatCom for Internet of Things Mass Market*"

The SatCom industry and technology for IoT (Internet of Things), previously called M2M (Machine to Machine) has been developed since the 1990s and is enabling few millions of objects to be connected to the internet. The market is targeting niche market applications with high margin and low volume, limited by the cost of connecting the objects and collecting the data. The development of LPWA (Low Power Wide Area) is proving to disrupt the IoT terrestrial market by enabling to reduce this collection cost of the data. This disruption is also arriving for the SatCom market. On the network side, the technology enabling to complete LPWA coverage with satellite will provide a new value proposition at a fraction of the current price of what is now available. On the object side having the satellite capability on the same object used than the one used to connect to the LPWA will reduce the total cost of ownership (TCO) of the data collection. This new capacity will enable to address high volume markets.

Monday 10/09, 11:15 – 12:30, Room 909

Speaker: D. Fernandez (SigFox)

David Fernandez is graduated from the French engineering school Telecom ParisTech. He is holding a specialized master in space communications from the ISAE Supaero. David has held several positions in the SatCom industry in R&D and high tech. He has also led the product development of high companies. David is currently managing satellite communication program at Sigfox.

Tutorial: "*Mega-Constellations: Opportunities, Trends and Challenges*"

The tutorial will guide the audience through the main challenges and opportunities related to Non-Geostationary constellations for telecommunication services. After a short historical perspective and an overview of the main constellation initiatives in place today, the presentation will highlight differences with respect to traditional GSO systems, and will dive into some details related to system throughput in constellations and interference aspects with GSO systems as well as coexistence of multiple NGSO systems.

Monday 10/09, 14:00 – 16:00, Room 088

Speaker: E. Re (European Space Agency)

Emiliano Re graduated in Telecommunications engineering at the University of Rome Tor Vergata. He obtained a PhD at the same university with a Thesis on Advanced Mobile Satellite Services physical layer and integration with 4G networks. He worked then in "Carlo Gavazzi Space" (today OHB Italy) focusing on reception of Automatic Identification System (AIS) signals from space. Since 2009 he works at the ESA European Space Research and Technology Centre as a telecom system engineer, mainly on Fixed and Mobile satellite broadband systems as well as Search and Rescue.

Since 2015 Emiliano is involved in an ESA internal task force aimed at analysing the potential of large satellite constellations. He has been developing the LEOSIM simulator, able to estimate throughput of NGSO systems as well as interference between GSO and NGSO and among NGSO systems.

Tutorial: "A Brief Introduction to Machine Learning (with Applications to Communications)"

Given the unprecedented availability of data and computing resources, there is widespread renewed interest in applying data-driven machine learning methods to problems in which the deployment of conventional engineering solutions is challenged by modelling or algorithmic deficiencies. The talk starts by addressing the questions of why and when such techniques can be useful, and then it provides a high-level introduction to the basics of both supervised and unsupervised learning. For both classes of learning algorithms, exemplifying applications to communication networks are discussed by distinguishing tasks carried out at the edge and at the cloud of the network at different layers of the protocol stack.

Monday 10/09, 16:30 – 18:30, Room 088

Speaker: O. Simeone (King's College London)

Osvaldo Simeone is a Professor of Information Engineering with the Centre for Telecommunications Research at the Department of Informatics of King's College London. He received a M.Sc. degree (with honours) and a Ph.D. degree in information engineering from Politecnico di Milano, Milan, Italy, in 2001 and 2005, respectively. From 2006 to 2017, he was a faculty with the Electrical and Computer Engineering (ECE) Department at New Jersey Institute of Technology (NJIT), where he was affiliated with the Center for Wireless Information Processing (CWIP). His research interests include wireless communications, information theory, optimization and machine learning. Dr Simeone is a co-recipient of the 2017 JCN Best Paper Award, the 2015 IEEE Communication Society Best Tutorial Paper Award and of the Best Paper Awards of IEEE SPAWC 2007 and IEEE WRECOM 2007. He was awarded a Consolidator grant by the European Research Council (ERC) in 2016. His research has been supported by the U.S. NSF, the ERC, the Vienna Science and Technology Fund, as well by a number of industrial collaborations. He currently serves in the editorial board of the IEEE Signal Processing Magazine, and he is a Distinguished Lecturer of the IEEE Information Theory Society. Dr Simeone is a co-author of two monographs, an edited book published by Cambridge University Press, and more than one hundred research journal papers. He is a Fellow of the IET and of the IEEE and of the IET.

Keynote Speech: "New Generation of Digitally Beamformed MEO and GEO Satellite: System Perspective"

Until very recently, the complexity of digital beam forming has limited its usage onboard satellites to narrowband systems, for example MSS satellites in L band. The adoption of cutting edge ASIC technologies for FSS satellites in Ku and Ka bands is however giving a new perspective to these techniques, allowing beam forming of massive amounts of bandwidth for a reasonable fraction of the satellite power budget. Digital payloads with beamforming capabilities allow a level of flexibility

completely out of reach of analog implementations: frequency selective beam forming, flexible channelization, any to any connectivity, programmability in orbit in real time... The subject of the presentation is to explore at system level the benefits of digital beam forming for video and data satellite applications. The rationale of using digital beam forming to design cost competitive satellites despite the largely increased technological content of the payload will be discussed. Key enabling core technologies and their impact of the satellite design tradeoffs will be briefly presented giving a context to the fundamental "why now and not before" question. The application to video services will be discussed to first demonstrate the relevance to legacy DTH services and then to show with a few examples how new services can be developed at hot orbital slots thanks to the new technology. The application to data services both for GEO and MEO orbits will be explained, with a particular focus on the overall efficiency of the solution in terms of satellite resource usage (essentially spectrum and power). The possibility for the solution to support an open platform approach with a pure FDM scheme while ensuring at the same time a very high efficiency will also be briefly analysed. The possibility for a given spacecraft to support efficiently and simultaneously video and data applications will also be discussed. This combination opens the perspective of new DTH services relying on a linear TV core complemented by non-linear video applications, leveraging the strength of the new architectures. Last but not least, the principles of satellite resource management automation, naturally coupled to the new possibilities of digitally beamformed payloads, will be presented giving a new perspective to the way the capacity of satellite fleets can be commercialised, provisioned and optimized.

Tuesday 11/09, 09:15 – 10:45, Room 909

Speaker: J.P. Choffray (SES)

Jean-Pierre Choffray is currently Vice President, System Architecture and Innovation within SES and is leading the development of innovative satellite system architectures. He received his MS degree from the Université Catholique de Louvain in 1986 and has been teaching assistant and researcher in Digital TV coding at UCL until 1988. He has been Project Manager at Gillam in Liege until 1998, working to the development of various products and equipment for telecommunication applications. He has been Project Manager at ETCA in Charleroi until 2001, mainly working on the SkyBridge constellation definition and demonstration activities. He joined SES in Betzdorf in 2001 in the Systems Engineering team. He has represented SES in the DVB-S2 working group. He initiated the Satmode technology development activities having led to the Astra2Connect Broadband system for which he was system architect. In the recent times he has been in charge of the initiatives having led to the procurement of SES-12, 14, 16 and 17. In his current role, he's in charge of the SES Next initiative aiming at accelerating the innovation pace in the space industry by changing the way GEO/MEO satellites are designed and produced.

Workshop: "Precoding Techniques in Very High Throughput Satellite Systems"

Multi-user Multiple-Input Multiple-Output (MU-MIMO) has allowed the recent releases of terrestrial LTE standards to achieve significant improvements in terms of offered system capacity. The publications of DVB-S2x and of its superframe structure have effectively enabled similar techniques to be applied to telecom broadband satellite systems. In particular, precoding techniques have been

extensively investigated for its promising performance improvement to Very High Throughput Satellite Systems. Many R&D activities have been carried out (some with the support of the European Space Agency) on system performance estimation, feasibility and demonstrations. In this workshop a summary of the key findings to date will be presented together with some key results stemming from practical implementations. The Workshop will also include a live demonstration provided by University of Luxembourg.

Tuesday 11/09, 11:15 – 12:30, Room 909

Speakers: A. Ginesi (European Space Agency), J. Ebert (Joanneum Research) and S. Andrenacci (University of Luxembourg)

Alberto Ginesi was born in Parma, Italy, in November 1967. He received the Dr. Ing. cum laude) and Ph.D degrees in electronic engineering from University of Pisa, Italy, in 1993 and 1998, respectively. In 1996-1997 he spent one year at Carleton University, Ottawa, Canada, performing research on digital transmissions for wireless applications. In 1997, he joined Nortel Networks and in 2000 Catena Networks, both in Ottawa, Canada, where he worked on Digital Subscriber Loop (DSL) technologies and contributed to the definition of the second-generation ADSL standards within the ITU-R standardization body. Since 2002 he joined ESA Research and Technology Centre (ESTEC), Noordwijk, The Netherlands, where he is currently covering the position of the Head of the Telecommunication-TT&C Systems & Techniques Section of the Technical and Quality Management Directorate and is responsible for the R&D of satellite telecommunication and TT&C systems. His main research interests lie in the area of advanced digital communication systems and techniques from theory to HW implementation.

Johannes Ebert received his master and doctoral degree in telematics from the Graz University of Technology. Currently, he holds the position of a senior scientist, system architect and project manager at JOANNEUM RESEARCH in Graz, Austria. His research interests are in the field of satellite communication systems and signal processing.

Stefano Andrenacci received his M.S. Degree in Telecommunication Engineering (cum laude) from the Polytechnic University of Marche, Ancona (Italy), in 2008 and his Ph.D. on Telecommunication Engineering from the same University, in 2011. From July 2011 to June 2014 he was a Post-Doctoral Researcher at the Interdepartmental Centre for Industrial Research on Information and Communication Technologies (CIRI-ICT) of the University of Bologna, where he worked on Interference Management techniques in ESA funded research projects and on Hardware Implementation of Satellite Terminals in ESA funded technological development projects. From July 2014 to January 2015, he was a Post-Doctoral Researcher at the Department of Electrical and Information Engineering (DEI) "Guglielmo Marconi" of the University of Bologna. Since February 2015 he is a Research Associate at the Interdisciplinary Centre for Security, Reliability and Trust of the University of Luxembourg. His research activities are mainly focused on Interference Management techniques, synchronization procedures and techniques for digital receivers, DVB-S2/S2x systems, DVB-RCS2 systems, Software Defined Radios (SDR) and spread spectrum systems.

Tutorial: "5G Release 15: Where Are We Going in Terrestrial and Satellite Networks?"

The next generation networks under the 3GPP have finally started to recognize satellite as a relevant technology. The last year has been very positive, culminating inside 3GPP Release 15 with the successful completion of the first study items related to the identification of use cases for 5G satellite access (TR 22.822) and the definition of deployment scenarios, channel models, and potential areas of impact in Non-Terrestrial Networks (TR 38.811). The tutorial will start by presenting the current aims of the 5G network design, and identify current progresses inside Release 15. The second part of the tutorial will go over the main achievements in this integration between terrestrial and satellite networks and will present the upcoming challenges to make more effective this unique opportunity to standardize 3GPP solutions and technologies to facilitate 5G service provision via satellite.

Tuesday 11/09, 14:00 – 16:00, Room 088

Speakers: R. Aguiar (Univ. Aveiro) and S. Cioni (European Space Agency)

Rui L. Aguiar received his degree in telecommunication engineering in 1990 and his Ph.D. degree in electrical engineering in 2001 from the University of Aveiro. He is currently a Full Professor at the University of Aveiro, responsible for the networking area, and has been previously an adjunct professor at the INI, Carnegie Mellon University and a visiting Research Scholar at Universidade Federal de Uberlândia, Brazil. He is coordinating a research line nationwide in Instituto de Telecomunicações, on the area of Networks and Multimedia. He is the current Chair of the steering board of the Network2020 ETP. His current research interests are centred on the implementation of advanced wireless networks and systems, with special emphasis on 5G networks and the Future Internet. He has more than 450 published papers in those areas, including standardization contributions to IEEE and IETF. He has served as technical and general chair of several conferences, from IEEE, ACM and IFIP, and is regularly invited for keynotes on 5G and Future Internet networks. He is senior member of IEEE, Portugal ComSoc Chapter Chair, and a member of ACM. He currently sits on the Advisory Board of several EU-projects and research units from several countries and on the editorial board of several journals.

Stefano Cioni received the Dr.-Ing. degree in Telecommunication Engineering and the PhD from the University of Bologna, Italy, in 1998 and in 2002, respectively. In 2010, he joined the European Space Agency (Noordwijk) where he is currently a communications systems engineer within the Radio Frequency Systems, Payload and Technology Division. His research activities are mainly focused on the next generation broadcast/broadband satellite systems for fixed and mobile satellite services, as well as M2M services via satellite. Concerning the 5G standardization, Stefano Cioni is the RAN plenary and RAN-1 delegate for ESA since 2016, and he mainly follows the topics related to the satellite integration in terrestrial networks. Dr. Cioni co-authored more than 100 papers and scientific conference contributions, and he is a co-recipient of the Best Paper Award at IEEE ICT 2001 and at IEEE ASMS/SPSC 2012.

Tutorial: "SatCom Reconfigurable Active Antennas for Space Applications"

Antennas are the key components in satellite communications systems. Traditionally, high-gain reflector antennas have served as the mainstream technology. During recent decades, however, the

ever increasing demands of end users have pushed forward the development of antennas able to provide capabilities in terms of re-configurability and power allocation flexibility. Active Antennas are considered best suitable to fit these needs: these solutions provide several advantages to the satellite missions such as high data rate, autonomous beam steering capabilities, multi-beam functioning; The tutorial is focused to provide an overview of the current state-of-the-art of research on Active Antennas (AAs) for satellite communications, highlight the latest developments and innovations, and propose new applications, solutions, and challenges for the future. The suitable active antennas configurations will be presented (e.g., Direct Radiating Arrays [DRA], Active Discrete Lens [ADL], Confocal Antennas, etc...) exploiting for each one their pros and cons; also considering the recent needs of the operators to develop Very High Throughput Satellites (VHTSs). Since Active antennas (AAs) are devices combining a radiating subsystem as well as backing active circuits in tight integration; an exploitation on the applicable solution to provide a drastically reducing of the complexity by means of the adequate selection of the antenna layout and the individuation of the Beam Forming Network (BFN) considering analog and digital configurations.

Tuesday 11/09, 16:30 – 17:30, Room 088

Speaker: A. Catalani (Space Engineering)

Alfredo Catalani received the Electronic Engineering (Telecommunications) Master Degree from Polytechnic of Turin, Italy, in 1998. In May 2001 He joined Space Engineering, as member of the Antenna Division where he worked up 2001 covering design and program management tasks of several ESA project. During more than 17 years working on antennas design, He gained experience on different antenna typologies, considering the waveguide and microstrip technologies, reflector and active phased array arranged in regular or sparse lattice. In 2016 He became responsible of the Antenna Team and, actually, he heads the Active and Flexible Antenna Team. The main programs where He was involved are: RADARSAT-1 and 2, COSMO Sky-Med, MOWGLY, eHERO, EXPRESS AM, SHARAD, AlphaSat, QUANTUM, PLATINO, etc... In the frame of MicroWave Imager (MWI) instrument of the MetOP Second Generation, actually He is the Antenna Architect and the responsible for the design of the two antennas of the radiometer instrument (i.e., the Main Reflector and the Cold Sky Reflector)

Tutorial: "Affordable Phased-Arrays for User Terminals Using Silicon Technologies"

Silicon technologies, such as SiGe and CMOS, is ideal for phased-arrays as it allows for low-power LNAs, complex 8 and 16-channel beamformer chips with 6-bit phase control and 30 dB gain control, and efficient power amplifiers in the 7-14 dBm range for X, Ku and Ka-band SatCom. These chips have been developed by universities first and then companies, and are now commercially available at low-cost. Also, advances in PCB technologies (printed-circuit boards) and low-cost packaging have allowed engineers to design 12-16 layer boards suitable for X, Ku and Ka-band SatCom, with efficient antennas and on-grid placement of the silicon chips, so as to result in affordable 3-D fully steerable phased-array terminals with polarization control. The talk summarizes the recent advances in this area, and its effect on the new LEO, MEO and GEO constellations for world-wide connectivity.

Tuesday 11/09, 17:30 – 18:30, Room 088

Speaker: G.M. Rebeiz (UCSD)

Gabriel Rebeiz is a Distinguished Professor and the Wireless Communications Industry Endowed Chair at UCSD. He is a member of the National Academy and is considered as one of the fathers of tunable radios, affordable silicon-based phased arrays for SatCom and 5G, and mm-wave and THz antennas. He has also led the development of high-resolution phased-array imaging radars for automotive applications. Prof. Rebeiz has graduated nearly 100 PhD students and post-docs, and his group has published more than 700 IEEE publications.

Panel Discussion: "*How Optical Free-Space Communications Could Boost New Space*"

Laser Communications in space has been developed and tested since decades for the use in high-speed LEO-GEO data relays and it is now operationally used within EDRS (European Data Relay System). With the advent of so-called NewSpace – implying new and innovation-oriented players in space industry – this technology sees new areas of application such as backbones for satellite mega-constellations, or interconnects and downlinks in stratospheric platform systems. With specialists in the areas of space laser communications, high-altitude platform systems, LEO constellations, nanosatellite technologies and representative of the European Space Agency also participating in the discussion, this panel can review current developments and challenges that this potentially breakthrough technology still has to face in the context of the new market opportunities offered by the take up of NewSpace players.

Wednesday 12/09, 09:15 – 10:45, Room 909

Moderator: D. Giggenbach (DLR)

Dirk Giggenbach received the Dipl.-Ing. (M.S.) degree in electrical engineering from the Technical University of Munich in 1994 and the Dr.-Ing. (Ph.D.) degree from the University of the German Federal Armed Forces at Munich in 2004. He established and managed the Group “Optical Free-Space Communications” of the German Aerospace Center (DLR), at the Institute of Communications and Navigation, where he is now Scientific Advisor for Optical Communications. In 2009, he co-founded “ViaLight-Communications GmbH” (now Mynaric AG), a DLR spin-off developing aeronautical FSO Systems. In 2011 he was visiting researcher at the University of South Australia. Giggenbach is member of the board of VDE-ITG (Informationstechnische Gesellschaft im VDE) and German delegate to CCSDS (Consultative Committee for Space Data Systems) for the standardization of optical space communications systems.

Panellists:

Z. Sodnik (ESA-ESTEC)

Zoran Sodnik obtained a Ph.D. in Optical Engineering from Stuttgart University in 1989 and joined the European Space Agency (ESA-ESTEC) in The Netherlands in 1993 as a senior optical engineer. His responsibilities included managing of R&D activities in optical systems development, supporting ESA programs (such as ARTEMIS, DARWIN, LISA, SMART-1, SMART-3, AIM) and optical communications technologies. He supervised the development of ESA’s optical ground station in Tenerife, Spain, for

which he became the responsible station manager in 1995. He was project manager of ESA's developments for the lunar optical communication link experiment, a NASA led optical communication demonstration from the Lunar Atmospheric and Dust Environmental Explorer spacecraft. Since December 2013 he is heading the Opto-Electronics Section (TEC-MME) at ESTEC, dealing with technology developments for detectors, lasers, photonics systems, quantum technologies, LIDAR systems and optical and quantum communication systems.

P. Wertz (Tesat Spacecom)

Philipp Wertz studied Electrical Engineering at the University of Stuttgart, focusing on radio frequency technology. He continued his studies with a doctorate in 2000 at the Institute of Radio Frequency Technology at the University of Stuttgart, where he was involved in a number of research projects for different industry partners, focusing on system simulations of 3rd generation mobile communication networks. After joining Tesat Spacecom in 2007, he participated in several hardware programs and studies as a system engineer for data downlink systems. Since 2010, he worked as manager of the subsystem engineering group with special emphasis on high rate data downlink systems and the optical/RF hybrid payloads for the European Data Relay System (EDRS-A & -C). Since 2015, he is working as Product Manager for Communication Systems. In this role, he is managing new product developments including Hybrid RF/Optical Downlink solutions with high data rates. He is also involved in multiple proposals for NewSpace constellation applications.

[A. Grabs \(Airbus DS\)](#)

M. Emanuelli (GOMspace)

Matteo Emanuelli received a Master's Degree (MSc) in Space Engineering to Politecnico di Milano (Italy) with a thesis on space debris remediation carried out in collaboration with Omsk Technical University (Russia). Matteo has worked as a business developer for HE Space in the Netherlands before taking a position as Research Engineer at Université de Picardie Jules Verne in France, where he managed the CubeSat program of the university for 3 years. Matteo is now Systems Engineer at GomSPACE, a leading nanosatellite company located in Denmark. He is the technical manager on Starling, a constellation of spacecraft with the purpose of tracking aircrafts and ships over the equatorial area. Matteo is also Chair of Space Generation Advisory Council (SGAC), a global, non-governmental organisation and professional network which aims to bring the views of students and young space professionals to the United Nations, space industry and agencies.

Tutorial: "Zephyr – Airbus Solution for HAPS Systems"

This speech provides an overview of the Airbus Zephyr capabilities. Flying well above other air traffic and weather for weeks and months is one of the main characteristics of Zephyr. Such platform could be operated as a "hook in the sky" with a quasi-geostationary flight pattern. This may be used as a pseudo GEO satellite near to earth. Alternatively, large areas could be covered whereby the platform would rapidly perform larger flying orbits at high ground speed. Such concept would complement LEO missions with more flexibility in re-tasking and at much closer distance to earth. These two dimensions span the synergies of HAPS from a quasi-permanent station ("pseudo SAT

mode”) to a targeted observer with a dynamic flight orbit (“pseudo Aircraft mode”) adapted to specific observation scenarios. Airbus Zephyr is a solar-electric HAPS which complements satellites and fuel-powered aircraft, to provide affordable, persistent, local satellite-like services with the focus of an aircraft. The Zephyr programme has involved the design, development, build and flight trials of successive evolutions, with Zephyr 7 achieving a world record flight of over 14 days in 2010. Overall, the programme has achieved over 950 flight hours, with flights on four continents. The 25m wingspan, 65kg, Zephyr S now in production offers significantly improved performance, increased payload capacity, Beyond Line of Sight (BLOS) operation and reduced crewing requirements. As current battery technology development matures, the objective is to provide year round capability at latitudes up to $\pm 40^\circ$, which covers more than 80% of the world population, and seasonal coverage at higher latitudes. The Zephyr S aircraft can support Airbus or third party payloads to provide a flexible capability with potential applications in remote sensing, communications and surveillance markets for civil and military customers. Communications applications include fixed broadband service for internet service provision, wide area relay and broadcast or as a comms hub for disaster response. Combined with SatCom networks, it offers a potential connection for higher data rates and implementation of optical comms. As part of the Zephyr programme roadmap, the next evolution, Zephyr T, is in development with first flight planned in 2019. This twin tail design is 50% larger and intended to carry four times the payload mass and provide more payload power, giving increased capability for applications such as communications and/or ultra-high resolution SAR for maritime surveillance, where it can provide an extension of satellite SAR systems with much higher digital data quality for weather and elevation modelling.

Wednesday 12/09, 11:15 – 12:30, Room 088

Speaker: A. Grabs (Airbus DS)

Mr. André Grabs (Airbus Defence and Space) has a diploma in Engineer Communication Electronics at University Rostock. After his studies he started at DASA-DS in 1996 where he collected experiences in software engineering, in avionic system test and integration engineering as well as in avionic system engineering for the Eurofighter. Before he changed to Cassidian / ADS, he was Lead Engineer for the Airborne Mission System Talarion UAV. In 2012 he was appointed as Lead Engineer for High Altitude Systems (HALE). Since 2013 he is Solution Architect for Solar HAPS. Mr. André Grabs has long-term experience in the development and implementation of system engineering processes (Development Plan, CM-Plans, Q-Plans) as well as in the development and implementation of technical project management processes and tools.

Tutorial: "Beyond DVB-S2x: a Glimpse into a Future Air-Interface"

This short tutorial will guide the audience through the definition of a new air interface for unicast SatCom services. Stemming from the successful DVB-S2x, a new air interface has been designed to support constant frame lengths on-the-air, new forward error correction based on the 5G LDPC schemes, adapted to the specific SatCom environment, new optimized modulation schemes for the linear channel, and new physical layer signals for synchronization and control. Although the new interface uses a completely new waveform, it is backward compatible with the DVB-S2x standard, since it is designed to fit into the superframe container foreseen by the S2x specifications. The new

air interface is particularly prone to support interference management techniques. An example of use of the new air interface will be provided for a system adopting average and single user precoding techniques. The presentation is co-authored by S. Andrenacci, S. Chatzinotas, A. Guidotti, F. Kayhan, G. Montorsi, A. Ugolini, and A. Vanelli-Coralli.

Wednesday 12/09, 11:15 – 12:30, Room 089

Speaker: A. Vanelli-Coralli (Univ. Bologna)

Alessandro Vanelli-Coralli received the Dr. Ing. Degree in Electronics Engineering and the Ph.D. in Electronics and Computer Science from the University of Bologna (Italy) in 1991 and 1996, respectively. In 1996, he joined the University of Bologna. During 2003 and 2005, he was a Visiting Scientist at Qualcomm Inc. Dr. Vanelli-Coralli chairs the PhD Board on Electronics, Telecommunications, and Information Technologies and is an elected member of the Steering Board of the Network2020 European Technology Platforms. Dr. Vanelli-Coralli has been the Project Coordinator of the FP7 STREP CoRaSat (Cognitive Radio for SatCom), and the Scientific Responsible for several European Space Agency and European Commission funded projects. Dr. Vanelli-Coralli has been appointed member of the Editorial Board of the Wiley InterScience Journal on Satellite Communications and Networks, has been guest co-Editor for several special issues in of international scientific journals, and has served as General Chairman and Technical Chairman of several scientific conferences. Dr. Vanelli-Coralli is co-recipient of several Best Paper Awards.