## Calendar of events

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|---|---|
| **1. December 2018** | Announcement |
| **15. January 2019** | Call for Papers |
| **1. March 2019** | Deadline for Abstract Submission |
| **2. April 2019** | Notification to Authors |
| **2.May 2019** | Preliminary Program |
| **15. May 2019** | Deadline for Early Registration Fee |
| **15. May 2019** | Deadline for IEEE papers submission |
| **1. July 2019** | Deadline for Papers submission |
| **1. July 2019** | Notification to IEEE papers Authors |
| **24th Sept. 2019** | TTC Workshop |

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# Call for Abstracts

## TTC2019

**8th ESA International Workshop on**

**Tracking, Telemetry and Command Systems**

**for Space Applications**


24-27 September 2019 ESOC, Darmstadt (Germany)

# INTRODUCTION

The Ground Station Engineering Division (OPS-GS) of the Ground Systems Engineering and Innovation Department (OPS-G) is pleased to announce the Eight ESA International Workshop on Tracking, Telemetry and Command Systems for Space Applications, TTC2019, which will be held from the 24th to the 27th September 2019 at the European Space Operations Centre (ESOC) in Darmstadt (Germany).

Tracking, Telemetry and Command systems are of fundamental importance in the space programmes. Recent developments in the areas of telecommunications, signal processing, computing and electronics, provide new capabilities in the design and functionality of TTC systems either in space or in ground systems. New frequency bands, including optical, start to be a reality. New Modulation and Coding schemes allow a more efficient use of the link resources. Its adequate exploitation is also a very attractive area for innovation of the space to ground link and for extraction of the consequent benefits. The way to operate a mission is evolving with the introduction of the latest innovations in TTC technologies, methods and system architectures, ranging from small nanosats to large Deep Space missions.

Alongside with the workshop, an industrial exhibition will be organized. European companies active in the TTC area will be invited to exhibit their products either by mean of equipment demonstrations or by appropriate posters. The workshop will offer the opportunity of joining many professionals in a single place allowing to interact with a wide sample of the TT&C community.

# OBJECTIVES

The aim of the TTC 2019 Workshop is to offer an international forum where TTC equipment designers, systems developers, added value system suppliers, operators, experts, universities, users and space agencies can openly networking, discuss their ideas, share their experiences and formulate challenges to be met. The workshop will offer an overview of the technologies in use or in development. Hence, it will be a suitable forum for identifying trends in the requirements, architectures and technologies to be given attention during the coming years. Participants will have the opportunity to share their technical expertise and views by formal presentations, informal discussions and round tables

# ABSTRACT TOPICS

## 1. Ground Systems Technology

This topic will cover aspects related with Ground Stations, ranging from the complete system Architecture and performances to the technology of individual pieces of equipment like Feeds, Frequency Selective Surfaces, High power and Low Noise (also cryogenic) Amplifiers, Antenna Pointing and Mechanics, etc…, related either with Near Earth or Deep Space communications.

## 2. On Board Systems Technology

Under this topic will be covered the aspects related to On Board Technology, ranging from the complete system Architecture and performances to the technology of individual pieces of equipment like TT&C Transponders, On board antennas, RF distribution and switching networks, Filters and Diplexers, SSPAs and TWTs, Modulators and Demodulators, etc… , related either with Near Earth or Deep Space communications.

## 3. Payload Data Telemetry

Missions with demanding data rates requirements often employ separate links for Payload (high rate) TM and Housekeeping TTC, implementing a Payload Data Telemetry subsystem in parallel with the TT&C subsystem. Under this topic, aspects relative to the development of Payload Data Telemetry sub-systems with the inclusion of the latest advances of VCM and ACM will be covered.

## 4. Digital Signal Processing

This topic will cover aspects related with Software Radio, Intelligent and reconfigurable receivers, Algorithms for High Speed or Low SNR demodulation and decoding and any other topic related with the processing of the signal with digital technologies.

## 5. Modulation And Coding

Advanced modulation and coding schemes will be discussed under this topic . The main drivers are the bandwidth efficiency, the power efficiency and the high data rate communications as well as the regulatory issues.

## 6. Regulation and Space Link Protocols

The aspects related to regulatory bodies (CCSDS, ECSS, ETSI, …), Frequency allocations, Standardisation, as well as Space Link Protocols including Disruptive Tolerant Networks will be covered inside this topic. Other aspects like Space Internet, Proximity link protocols, … will be covered too.

## 7. Spacecraft Radiometric Techniques

This topic will cover the different radiometric techniques employed by Space missions. Classic Ranging and Doppler (either by tones, PN, TM-RG, spread spectrum, transparent or regenerative) together with VLBI, $\Delta$-DOR or use of Global Navigation Satellite Systems are items to be discussed in this topic.

## 8. Security and Reliability

This topic will consider the techniques and protocols for Secure communications in wide sense including Encryption and Authentication Techniques, Protection against Interference, Spread Spectrum modulation, Threats/Vulnerabilities and Reliability of the communication.

## 9. Radioscience and Propagation

Radioscience is not a TT&C function but the TT&C signal employed to communicate with the spacecraft is often used for Radioscience experiments. Radioscience and the associated propagation issues are an important element to be considered when designing a TT&C link. This topic will cover the aspects of the propagation of the signal (in the Earth atmosphere and through the Solar System), calibration techniques to compensate the effect of the propagation disturbances and the impact of the Radioscience experiments on the requirements and implementation of the TT&C systems.

## 10. Optical Space Links

Optical communications are becoming a reality and are a candidate for future high data rate space links. Optical terminals (Ground and On Board), Propagation issues, modulation and demodulation, Trade-offs optical/RF, On-going activities and experiments, … are examples of the issues to be covered under this topic

## 11. TT&C technologies and architectures for small missions

This topic will cover different aspects related to innovative TT&C architectures and technologies enabling operational (commercial or scientific) missions based on small to nanosatellite platforms, with the main focus on Cubesats, and considering point to point links as well as (small or large) constellations. Innovative communication system architecture, on-board architectures and specific technologies are possible examples.

## 12. Novel Architectures

One objective of the workshop is to broadcast and discuss about innovative ideas. This topic will allocate issues related (but not limited) to novel systems and technologies like Arraying, Superior conjunctions, EDL, Variable rates, Q/V Band Feeder Uplink, Earth Data Relay systems, Planetary Relay Systems, Delay tolerant Networks, Very High Data Rate links, etc…