Training Opportunity for Polish National Trainees

Reference	Title	Duty Station
PL-2023-OPS-GSB-2	**End-to-End Space Communications**	**ESOC, Darmstadt**

Overview of the mission:

Our team is developing ground segment software related to space communication protocols and ESA's network of ground stations. We are very active in research and development and contribute to global standardisation activities related to space communication. We collaborate with other space agencies, European Industry and Academia and support world-wide initiatives to advance towards a Solar System Internet.

Overview of the field of activity proposed:

The trend towards higher data rates, bigger data volumes and the need for more automation in mission operations makes the current, pre-planned and communication link focussed way of space communication impractical. Future missions would benefit from a networked communication paradigm, a Solar System Internet, which provides end-to-end delivery of data via multiple hops. However, space communication is sometimes characterized by long roundtrip delays, less reliable communication links, highly asymmetric data rates and frequent lack of end-to-end connectivity.

To overcome these challenges Delay or Disruption Tolerant Networking (DTN) communication architectures have been proposed and related communication protocols have been standardised for the space domain. These protocols are implemented by ESA, simulated, and validated for Earth Observation, Lunar and Mars exploration scenarios. Furthermore, upcoming Earth Observation Missions and optical direct to Earth links will feature downlink data rates in the order of Gbit/sec which are beyond the available terrestrial data rates at ground stations. For that, specific ground segment architectures based on a standardised File Delivery Protocol for space missions are currently developed and deployed.

As a Polish National Trainee, you will directly contribute to these activities by supporting the following tasks:

- Support the establishment of the European Optical Nucleus Network in the area of end-to-end data delivery
- Deployment of prototypic operational systems on ground to prepare and execute DTN communication experiments and demonstrations with ESA, NASA, or Third-Party missions
- Acceptance testing, verification and validation of protocol and system implementations received from Industry
- Prototypic implementation and validation of new protocol features for international standardisation activities

By supporting these activities, you will get first-hand experience in the way ESA is doing software development and space communication. You will be exposed to the latest research and development in Disruption Tolerant Networking and can contribute towards international standardisation and the global vision of a Solar System Internet.

Depending upon the applicant's interest, further work could be performed in areas currently under active development and standardisation, such as network and security management for DTN networks, DTN messaging protocols or mission operations for DTN-enabled spacecraft.

Required education and skills:

- You should have just completed, or be in the final year of your Master' s degree in software engineering, computer science or network engineering
- You should have good computer programming skills and ideally some background knowledge related to Internet protocols and computer networking. Practical experience in agile software development, related tools and the Linux Operating System is considered beneficial.
- Good interpersonal and communication skills
- Ability to work in a multi-cultural environment, both independently and as part of a team
- Fluency in English and/or French, the working languages of the Agency