Traineeship Opportunity for “Young Graduate Trainees”

<table>
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<th>Reference</th>
<th>Specialist Area</th>
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<td>ESA/YG-ESTEC(2015)035</td>
<td>RF Systems, Payload and Technology: Payload Engineering, Microwave Technologies and Equipment for Space and Ground Segment</td>
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<td>Duty Station</td>
<td>ESTEC</td>
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<td>Closing Date</td>
<td>15 December 2015</td>
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Overview of the Division’s mission

The RF Systems, Payload and Technology Division is part of Electrical Engineering Department and of Technical and Quality and Management Directorate.

The RF Systems, Payload and Technology Division is responsible for space instrumentation and end to end communication systems, subsystems, equipment and technologies which cover the following domains:

- Communication systems and subsystems design and validation;
- Commercial ground and user segment products for navigation, telecommunications and remote sensing;
- Systems for TT&C communication, navigation, remote sensing and scientific applications;
- Satellite payloads (e.g. repeaters for telecommunications or navigation instruments, earth remote sensing instruments for scientific applications);
- Microwave and millimetre wave equipment and technologies;
- Complex on-board payloads for communications and remote sensing, and processing core of such systems, including optically based implementations;
- Systems testing for performance evaluation or validation;
- Laboratories to test/proof concepts soundness and validation.

The Division consists of five sections and the divisional laboratories. They are:

1) Communication - TT&C systems and techniques
2) Microwave and millimetre wave
3) Payload engineering
4) Radio navigation systems and techniques
5) Commercial Ground and User Segment Products
6) Laboratories

Overview of the field of activity proposed

The following distinct opportunities are proposed with various selectable (multiple) options within each area. The candidate should indicate his/her preferred area and one of more options inside the selected area:

Area 1: Microwave Earth Observation Instruments

- **A1.1:** Image reconstruction in two-dimensional microwave interferometric radiometers: This first objective of the YGT proposal comprises the theoretical study of image reconstruction in microwave interferometric radiometers and the formulation of spatial ripple errors in the brightness temperature images, including its quantification and prediction given a specific instrument geometry. The results of this study are to be applied to an SMOS follow on mission as well as to other similar missions, such as the geo-sounder (a millimetre wave interferometer proposed for meteorological observations from geostationary orbit).
- **A1.2:** New applications of microwave interferometry: Following the consolidation of aperture synthesis as a valid remote sensing technique, this task aims at studying new applications of it. The target prospective investigation is Earth crust sounding. The study shall aim at identifying suitable frequency bands and geometries where sub-
surface imaging could be achieved using aperture synthesis. High level instrument concepts are to be presented. Other applications are to be explored if considered worth, including atmospheric observations.

- A1.3: Microwave Earth Observation Instruments
- Digital Beam Forming (DBF) for phased array and reflector based SAR systems: DBF has high potential to enhance significantly the performance of next generation SAR systems in terms of coverage and/or sensitivity.
- The objective for the YGT is to study achievable performance improvements by applying digital beam forming for C-band SAR and Ka-band interferometric SAR systems. The study shall include front-end implementation trade-offs on architecture level. The trade-off shall be supported by extensive simulation with system simulation tools as Advanced Design System (ADS) and Matlab.

Area 2: Telecommunications Payload Engineering

- A2.1: In interactive broadband satellite communications systems, smaller antenna beams allow supporting increased throughput and higher data rates but imply higher load and beam variability in space and time. A flexible allocation of bandwidth and power to beams would allow serving the hot spots without resulting in wasted capacity/power/bandwidth in the cold spots. The objective of the activity proposed is to set-up an automatic test bench and characterise the behaviour of a flexible Traveling Wave Tube Amplifiers (TWTA) when submitted to a realistic flexible payload mission profile. The tests will be performed on available, state-of-the-art Flex-TWTAs in Ku- and/or Ka-band. This will allow validating the design of state-of-the-art Flex-TWTAs and their reliability against the required flexibility in power and bandwidth.
- A2.2: The objective of this activity is to perform a feasibility study to determine, for different amplifier operating conditions, the optimal AM/AM and AM/PM characteristics of a Linearized Traveling-Wave Tube (TWT), which maximize the end-to-end performance according to a suitable system level figure-of-merit. The optimal AM/AM and AM/PM characteristics of the LTWT may be different depending on the selected amplifier operation (e.g., type of modulation, number of carriers, etc.). Finally, the advantage provided by the identified optimal LTWT characteristics in terms of overall performance will be clearly assessed against typical characteristics of state-of-the-art LTWTs.

Area 3: RF Equipment and Technologies

- A3.1: RF Passive component design and analysis: Current trend in telecommunication payload is to increase the transmitted power and reduce the size of all the components. This activity target both requirements at the same time by using dielectric materials. Thermal and RF performance play a critical role when compact and high power channel filters have to be implemented. The candidate will study the combination of different dielectric materials in order to provide the desire Q-factor and the adequate thermal conductivity.
- A3.2: Metalmatrix material application in high power RF hardware: High power channel filters are key elements at the payload output to combine signals previously amplified. Losses due to the finite conductivity of the employed material contribute to increase the temperature in the structure. Thermal issues often dictate the mass and complexity of the design due to the characteristic of the available materials. Novel materials could overcome current limitations and eliminate the need for any complex temperature compensation mechanism. In this activity, design and techniques for self-compensated high power channel filters based on advances material such as metalmatrix will be studied.
- A3.3: Corona breakdown: The proposed investigation deals with the different parameters affecting a gas discharge in RF hardware as well as its mitigation. This study shall investigate the parameters affecting the Corona breakdown. A number of tests samples shall be produced and tested to confirm the findings of this study. A dedicated software tool shall be developed including all the studied parameters above mentioned.
- A3.4: Effect of modulated signals in RF breakdown: In order to theoretically predict under which conditions multipactor would appear a Multipactor simulator software will be developed. A dedicated test bed shall be implemented to prove the theoretical studies.
Educational and other requirements

Applicants should have just completed, or be in their final year of a University course at Masters Level (or equivalent) in a technical or scientific discipline.

Applicants should have good interpersonal and communication skills and should be able to work in a multi-cultural environment, both independently and as part of a team.

Applicants must be fluent in English and/or French, the working languages of the Agency. A good proficiency in English is required.

Specific requirements per areas:

**Area 1:** Applicants should have just completed, or be in their final year of a University course at Masters level in a technical or scientific discipline.

**Area 2:** Applicants should have just completed a University course at Masters Level (or equivalent) in Telecommunications/Electrical/Microwave Engineering. Good knowledge of RF and microwave systems is required as well as some experience in RF test of microwave equipment. Experience in computer programming and MATLAB is also required. Background knowledge on satellite telecommunications techniques & systems and familiarity with Travelling Wave Tube Amplifiers is an asset.

**Area 3:** Applicants should have just completed a University course at Masters Level (or equivalent) in Microwave Engineering. The knowledge of design tools such as HFSS, CST, FEST, MICIAN, etc...

How can I apply?

Please fill in the [online application form](#).

Please note that only one application may be submitted for the YGT Scheme.

The YGT Scheme is open to recently qualified young men and women who are nationals of one of the following states:
Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and the UK, or Canada as a Cooperating State, Bulgaria, Latvia, Lithuania, Slovakia and Slovenia as European Cooperating States (ECS).