

Report on granted activity in the framework of the European Inventor Network



Name of the alumnus who implemented the activity:

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Short description of the activity

Innovation and Entrepreneurship Laboratory in a school garden. Summary of the seminars on Space Electronics and innovation, in Angers and in Velizy.

The first seminar took place in Angers, at ESEO (Ecole Supérieure d'Electronique de l'Ouest [Electronic High School of West (of France)]), the 17th of January 2024.

The talk was in French. I introduced the 2-hour conference by a welcome speech, introducing the addressed subjects that is space electronics, and notably radiofrequency, as well as innovation in that field. I mentioned the triple sponsorship of this conference:

- 1) CNES, the French space agency, my employer as a transmission and GNSS expert
- 2) EPO (by also introducing the European Inventor Network)
- 3) ESEO (my electronics and computer science engineering school)

I introduced myself, as well as some events to which I participated, to illustrate with some examples how much interests and satisfactions we could have when we get involved in our technical field with the mindset of inventing.

I then introduced the "Club Aerospatial de l'Ouest" (Western [France] Aerospace Club) which I founded during my engineering studies at ESEO, by presenting pictures of the rockets and their student manufacturers, and highlighting how useful the technical clubs are to favor capacities and spirit of innovation.

I then presented the EPO, the interest of protecting the inventions with patents, and shown some related EPO videos:

- *EPO European Patent Index 2022*
- *Highlights and interests of the EPO European Inventor Award*
- *Exemple of European Inventor Award; research category; 2017*

Then generalities on satellites mission and architectures were introduced.

The more technical part of the conference followed, with the effects of the space radiation affecting electronics in orbit, and the related mitigations means.

The next part of the conference was dedicated to the Doppler and Doppler rate effects on space transmissions, and their impact on the architecture of the radiofrequency satellite devices.

Another specificity of space electronics was described, related to its need to be designed and tested to cope with the space thermal environment, as well as with the vibrations and chocs during the launch.

Then I provided quite a number of examples of space electronics equipment, and the related systems, in radio frequency and optical transmissions, and in radionavigation by satellite, with the hope this could infuse some ideas or innovations from the attendees.

The conference also included a brief description of ways to calculate the CO2 equivalent footprint of space systems, and a sensibilisation about the need to consider such calculations in space system engineering, having in mind keeping the sustainability of the space sector.

A Q&A concluded the conference; the students look very interested in the field, some interesting questions were raised, notably on the sustainability of space launches. Several students also shared that they were seeking internships in the space sector.

After the conference, I visited and discussed with students involved in technical clubs, and in particular:

-The ESEO CURIOSITY club, involved in astronomy and rocketing, and organising conferences on space, like this one.

-The ESEO ROBOT club, known to have won the worldwide robot student competition. The next national robot contest will concern robots planting seeds in Martian-like soils.

The following links are examples of the communication made by ESEO hosting the conference. The video of the full conference is provided below. Updates of the texts and cuts in the video are possible.

https://www.linkedin.com/posts/curiosity-eseo_bonjour-%C3%A0-tous-eseo- curiosity-est-fier-activity-7150421013107810304-8xx6?utm_source=share&utm_medium=member_android

<https://www.youtube.com/watch?v=AqXbByz6HXE> (full video of the talk)



After the discussions with the technical clubs

The second seminar took place in Velizy, in the Paris suburb, at ESEO, January 23, 2024.

I gave a 2 hour talk in ESEO-Velizy, similar to the one delivered in ESEO-Angers, described above.



Before the conference in Velizy



Beginning of the conference in Velizy



During the conference in Velizy

Then, I was presented with three student projects concerning autonomy and security improvement for autonomous cars, involving various sensor and related data processing, deep learning and AI. The technical dialogues with the students also highlighted the high potential for innovations in these projects, and some concrete innovations have even been discussed.



Discussions about the 1st presented student project

The following links illustrate the communication decided by ESEO about the conference. Update of the text is possible. There is no video.

https://www.linkedin.com/posts/jeremie-haquet-876819a0_lidar-eclairage_challengeutac-activity-7155632800962912256-kLhh?utm_source=share&utm_medium=member_android

https://www.linkedin.com/feed/update/urn:li:activity:7155833999804780544/?utm_source=share&utm_medium=member_android

I hope that the two conferences have motivated some students to be involved and innovate in the space sector, or in similar fields. Very positive feedback was provided.

Recommendations for future events:

Since these two events looked well appreciated and useful for the students, I would suggest:

*A similar conference, in French, in ENSAT engineering school in Lannion, Brittany, France. Since ENSAT is a school dedicated to optical communications, the suggestion would be me giving the talk on space electronics in general, and a CNES colleague, Geraldine Artaud, would provide a talk detailing laser data transmissions in or from space, and the related areas of innovations. We would also visit the optical laboratories and related projects involving the students, and would discuss about possible innovations in the frame of their projects, and more generally, in the area of terrestrial or space optical communications. This could take place in June or September 2024.

*A similar conference on space electronics in Cote d'Azur University, near Nice, France. More focus would be given on optical space transmissions and on GNSS, two areas of research of this University involving Master and Doctoral students. A visit of the optical ground stations and GNSS monitoring sites would be made with the students, at the top of a mountain, and discussions on innovations would be triggered. Since there is an international environment in the Cote d'Azur University, the talk would be in English. This could occur in April 2024.