

« Space sciences and the rise of New Space »,

*a Quality Charter proposed by CNRS-INSU and CNES,
for Graduate Schools in the domain of space sciences
and Nano Satellites projects*

Approved June 20th 2017 by INSU, CNES and the candidate EURs (see page 4)

A. Context and objectives

Sixty years after the beginning of space exploration, the use of space is currently subject to profound and rapid changes often referred to as “New Space”. These changes affect:

- i)** the methods to invent and produce space equipment,
- ii)** the use of space data and services,
- iii)** the increasing place of private partners in space entrepreneurship.

One of the objectives of PIA-3 is to adequately prepare such a transition so that France is able to remain a world leader in the space domain¹. CNRS-INSU, CNES and the following *Écoles Universitaires de Recherche* (EUR, see below) competing in the PIA-3 2017 bid have agreed on the terms of this Quality Charter. They share the same vision and they will work together, with CNRS-INSU and CNES playing the role of national coordinator of their network, to offer renewed high-standard master and doctorate training that will prepare the future scientists, engineers and managers of the space domain in our laboratories.

B. CNRS-INSU and CNES acting as national coordinator/networker

Several “*Centres spatiaux universitaires*” have been settled in the country during the last decade and are significant components of the space science EUR projects adhering to this Quality Charter. CNRS-INSU, as the national strategic pilot of the *Unités Mixtes de Recherche* (UMR) involved in these EURs and as the first CNES partner in space research, will be in charge of their national coordination and networking, helping them to share competences, methodologies and experience.

The objective of the partners of this charter will be to center the activities in the EURs on the development of payloads or servitudes and to use as much as possible the growing existing offer : industrial NanoSat platforms or hardware, engineering support, ground

¹ « A côté des enjeux liés au marché commercial des satellites de télécommunication (y compris « machine to machine »), à l’export des satellites d’observation très haute résolution, aux applications sociétales de l’observation de la Terre (climat et eau) et à la compétitivité future des services de lancement européens, le PIA 3 doit aussi prendre en compte des évolutions majeures dans le secteur des satellites avec notamment : (i) des exigences plus pressantes en termes de conception et développement de satellites de plus faible taille et de petit prix, susceptibles de s’inscrire dans le cadre de larges constellations et (ii) la nécessité de faire émerger un tissu de PME innovantes capables définir de nouveaux modèles d’affaires, notamment dans le champ de l’exploitation des données spatiales. » **from** « *Préparer la France aux défis de demain* » **PIA-3 presentation document, page 43.**

segment, etc.

This national coordination and networking will focus on the following actions:

i) Sharing expertise, tools and competences:

Expertise in space technologies and use of space data are located in a few national sites (especially in Île-de-France, Toulouse, Marseille, Orléans and Grenoble). There is a pressing need to share them all-over the country. This network activity is especially needed to avoid wasting the human resources in the UMRs and redeveloping systems or subsystems that have already been developed or are commercially available.

ii) Building common risk management standards:

Although risk-taking in NanoSat projects can be deliberately high, this does not mean that quantitative risk evaluation is unnecessary: risk management is at the heart of space-based developments and of the methodologies that the students have to learn. Therefore, space science EURs must share quality standards (see next section).

iii) Relations with the industry:

The link with the industrial sector is crucial since the private sector is a major subcontractor of space science research projects. It is also a potential employer for most of the master and doctorate students formed in the EURs. Regarding the two objectives of 1/ renewing space-platform technologies and instrumentation and 2/ of developing new services using space data, a high degree of interaction is needed between the research laboratories of the EURs and the private sector. This will be done with the help of “Club-Nano” at CNES and in close collaboration with regional innovation poles and boosters: ASTech, Aerospace Valley, SAFE Cluster, Morespace, Aerospace Cluster, Optitec, Minalogic, etc.

C. Adopting and sharing appropriate methodologies and quality standards in space instrumentation.

Risk management in NanoSat projects is currently under construction. Defining the common rules to follow in the EUR space projects is not the subject of this document. Our purpose is rather to define a suitable framework and agree on a common vision towards building shared standards.

Although the CNES JANUS initiative has set a context for such projects, the advent of the EURs will see in our UMRs (including the “historical” CNRS-CNES space laboratories) the development of more NanoSat projects with different types of objectives and thus different levels of risk management. The classical risk management used for the development of space instrumentation will not apply as such to the diversity of NanoSat projects. We can already foresee at least three categories that can be labelled in ascending requirements as:

- Student projects,
- Technology demonstration projects,
- Science projects.

Student projects:

Students can participate in all categories of NanoSat projects, but some projects have clear educative purposes within a specific and agreed pedagogical approach. In such cases, “flight events” may be important for the motivation of the group and for the image of the school, but in-orbit performance is not their main objective. It will thus be possible for such projects to take risks such as the use of non-qualified components. However, we need to teach the methodology of risk management to the students through their involvement in NanoSat projects. Those projects will then have to follow an educational methodology on risk assessment, and try as far as possible to quantify the risks that are taken on a case-by-case basis. For obvious reasons, this class of projects shall be restricted to formation up to the Master degree.

Technology demonstration projects:

The NanoSat concept is particularly interesting as a test bed for future space components or subsystems. A large number of projects will thus have as a prime objective the necessity to fly parts, components or subsystems and to monitor their behaviour during the flight. For those projects, risk assessment should guarantee the inflight performance, functionality and communications with a good confidence level.

Science projects:

Science oriented projects will be the most demanding category in terms of risk assessment. There is no obvious reason for these projects not to follow the usual standards of space science projects, except that as part of a real innovation process in space technologies, NanoSats will very probably define their own renewed standards. Here, the objective of the networking activity will be to construct these new standards in close connection with similar efforts in other countries.

D. Partners:

In signing this Quality Charter we hereby acknowledge that we share the same vision for the development of space activities for teaching and research at the master and doctorate levels in our EURs in the “NewSpace” context.

We will work together under the national coordination of CNRS-INSU and with the help of its regional quality insurance engineers in order to share expertise, tools, methodology and experience in a well-understood mutual interest and to avoid duplication of work and waste of human resources.

One of our objectives regarding NanoSat instrumentation will be to build a common reference frame of risk management, suitable for this innovative context.

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