

SPACE LAW STUDENTS PARTICIPATION IN REAL ENGINEERING RELATED PROJECTS AND RESEARCH

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ABSTRACT

Space Law is a recognized way of collaboration, promotion of sustainable development and international cooperation since it started, with the launch of world first artificial satellite in 1957. Likewise education and research in a scientific, technical and juridical way constitute a key factor in the development of Space Law. Laboratory for Space and Microgravity Research (LEEM), a Spanish non-profit space students and young professionals association dedicated to motivate and support students to develop space related projects has created a Juridical Committee whose principal objectives are to divulgate this field between science and law students, and to collaborate in Space Law development. Through direct participation in real space projects, LEEM provides to students the opportunity of having a real hands-on the topics of these activities. Students research about all related aspects of Space Law concerning a specific project at the same time they collaborate in its development, making possible a wide knowledge in technical and legal aspects. These research activities support the legal aspects of LEEM and the development of more ambitious projects, assuring all applicable laws. Our initial research line is concerned about launch of sounding rockets and picosatellites. Spain has not a clear regulation about them and in some cases; activities related with these fields are not specifically covered by the present legislation. Our Juridical Committee finds ways where our activities are adapted to Spanish legislation and ways to motivate a fluent contact with authorities in order to promote a specific regulation. On the other hand, students and young professionals who develop these Space Law researches have the possibility of networking with professional and experts, presenting their results, and discussing about new ideas during the association annual congress, the Spanish Space Students (S3). This innovative way of research makes possible to study the current status of local applicable legislation in space from a practical point of view, to promote Space Law field among students of different disciplines and collaborating to its development and progress. In addition, it constitutes an opportunity to include practical ideas and knowledge in a future national law.

I. INTRODUCTION

Space Law is one of the disciplines with more future work in the Space related activities due to the requirement of higher detail in the current Law and new jurisprudence for the incoming problems. The new objectives of this discipline of the Law are related with the current goal of the Space business. The commercial spaceflights or the international collaboration to avoid Near-Earth object impacts, are examples of the necessity of having an adequate juridical environment to solve these problems. The development of the Space Law requires lawyers, engineers and scientifics that working together serve like an engine of such development. For that reason, these objectives require educational programs, which provide the required space specialization of all of them. In such framework, the Laboratory for Space and Microgravity Research (LEEM), association with the objective is to motivate and to support students to develop their own Space related projects, has created a Juridical Committee. This committee has the aim of the Space Law promotion among the students of different disciplines at the same time that

provides legal support for all the association activities. From the creation of this Juridical Committee in the beginning of 2008, there are two main lines of work. On one hand, there is the aim to promote the Space Law, as referred before, among the different university disciplines. On the other hand, the association projects and conferences, lectures and congresses are the perfect framework for the introduction to space student of the Space Law basis. The two work packages have been already started. Firstly, the different projects of the association as Sounding rockets, International Space Facilities for experimentation and Satellites projects have been studied from a juridical point of view. This paper will present the main conclusions acquired. Secondly, the first Space Law Workshop has been done among the LEEM members. The purpose of the training is to equalize the knowledge in space topics among the different disciplines required for the understanding of the several points of view of the Space. This paper will detail the actions items, conclusions and lessons learned. The main goal of the LEEM

Space Law Committee is to create the basis for the development of more ambitious projects in the future with more students and Space Law related Institutions.

II. SPACE LAW THROUGH ENGINEERING RELATED PROJECTS

The Juridical Committee recent activities have been focused in the support of the engineering projects developed by the LEEM members. Depending on the experimentation platforms different juridical considerations are required. Until today, the Juridical Committee has support the sounding rocket activities carried out by our association during the present year. The committee has identified the main problems and risks derived from these activities and it has supported the search of ways to develop them. The experimentation at international space facilities and the development of a picosatellite constitute the new activities, which allow students to introduce them to the Space Law through the participation in real engineering projects.

Sounding rockets

The First International LEEM CanSat Competition was organized during 2008 with the sponsorship of the Technical University of Madrid. It took place from 10th to 12th of April 2008, and had a participation of ten teams from different Spanish universities and two teams from Malaysia, with a total of 85 students participating on the event.

A CanSat (1) is a scale satellite integrated within a soft drink can, that it is launched up to 500 meters onboard an amateur rocket. Inside this reduced volume, all subsystems must be fit (power, telemetry & command, recovery, payload). Once it is built and launched the CanSat should accomplish a full mission as to come back to a previous defined position or to obtain telemetry data. This "scale" project undergoes all the same phases as a real satellite mission, including the launch campaign and the data analysis, having an important educational value.

In addition to the organization of the competition, LEEM decided to develop the rockets needed to launch the device. At the same time that this project offered to student the opportunity to participate on real hands-on engineering activities, it has been used as a way to introduce students into the Space Law discipline through the collaboration with the Juridical Committee in the support of this activity.

During the preparation phase of the competition the Juridical Committee identified a lack of a clear law about the experimentation with sounding rockets in Spain. These problems are caused mainly by the absence of a specific law, which regulates the operation of sounding rockets as experimental devices. In consequence, a lot of difficulties arise focused on these aspects:

- Purchase of materials.
- Transport of the rockets.
- Authorization to use the launch camp.
- Closing of their surrounding airspace.
- Management of a risk insurance, which would cover the damage and responsibilities of a potential accident. The difficulty is higher if we try to get an insurance for an on board or deployable (CanSat) payload within the sounding rocket.
- Lack of support of the local authorities (police, fireman, and so on).
- Socially confused vision, which relates Sounding rockets to military activities.

This gap in the Law confuses the local governments and institutions at the moment of designating the required organism, which would be on charge of the activities supervision to guarantee the safety. In addition it is necessary to clarify if this activity should be developed under the military supervision (use of military facilities to launch the rockets) or not (use of civil aerodromes). On the other hand, this lack of definition difficulties the support to the experimentation from government and institutions.

The solution applied by LEEM has been to cover their activities by different legal frameworks. For instance, the rocket engines were bought abroad Spain as educational material, the igniters were acquired as pyrotechnic material, the event was managed as aero model aircraft flying exhibition and the civil responsibility was assured until an specific quantity. It is not the proper one and has the risk to involve sounding rocket activities in a non defined law framework if an accident occurs. In addition this lack of legal frame means the assumption of real risk from the organizers side, because if the material imported (mainly the engines) is understood as explosive it could mean the arrest of the purchase responsible.

Based on the experience in the operation of sounding rockets, we think necessary that the following measures will be considered in order to develop the current state of the law:

- The clarification of a clear framework for the sounding rocket experimentation and educational activities, which facilitates them.
- The establishment or the designation of an organism, which provides the certification of engines, rockets and operators. Nowadays the sounding rockets activities in Europe are developed under the American Tripoli license. While, this certification is recognized by vendors and buyers, it is not by the competent national authorities. Into this situation the best solution is to cover the product and its operation through the American certification.
- The specification of the upper airspace law related aspects for sounding rockets. In case of a high altitude rocket, the Law should be clear, in order to avoid critical problems as the invasion of different airspace from the one where the rocket is lifted off.

- The clarification of the Civil Responsibility on the rocket landing. The lack of a governmental organism able to certify and supervise the activities makes that all the assurances do not cover the damage caused by aircrafts or devices destined to the aerial navigation.

We understand that these measures contribute to the promotion of the sounding rockets as experimentation platform and will facilitate the support to these activities from institutions and the government. Furthermore we consider that it is especially important to develop this framework to make possible the operation of high altitude sounding rockets, which will allow the microgravity experimentation on board of them, constituting a low cost platform for the research in conditions closer to the weightlessness.

Further projects to introduce to Space Law

Members of LEEM have participated in projects that use international space facilities for their experimentation. Examples of these platforms are the International Space Station or the Foton Satellite. They are used as a research platform where high-level educational experiments are operated by an astronaut or automatically at unmanned spacecrafts. From this experience we have identified, several points to pay attention if any collaboration between our association and a third party is established to develop similar experimentation projects. Firstly, it is necessary to clarify the rights of the data obtained from the experimentation by students on behalf of a university, association or other, who normally have the supervision of a teacher or a person from the institution on behalf of they work. Secondly, there is the possibility of an error of the students experiment which could be propagated to the facility system and, consequently, to other experiments. Because of this, it is necessary to establish previously all the responsibilities of each party involved in the experimentation activities.

On the other hand, the development of a picosatellite is one of the main projects that LEEM will carry out for the coming years. Currently, the project is in the conceptual phase and the main objectives have been established. They are the creation of know-how needed to develop further more ambitious projects, the organization of an operational network based on different universities, infrastructure, partnership with industry and institutions, and the entire development by students of the satellite, covering the design, the manufacturing, the test and the operation. The Juridical Committee will foresee the possible legal handicaps that this project can lead.

Through these lines that will be developed by the Juridical Committee in a short term, the students will have the opportunity to collaborate with real engineer projects at the same time that it introduces themselves to the Space Law.

III. SPACE LAW THROUGH EDUCATION ACTIVITIES

The second line of work during the present year of the Juridical Committee has been focused on the development of educational activities to students related to Space Law. Due to Space Law is a very specialized discipline, LEEM does not expect to develop educational activities, which covers in depth all related aspects of the Space Law. LEEM has the intention of performing a training whose objective is to level the knowledge of student from different disciplines (law, technical, scientific, etc).

Through this training is expected to carry out an introduction to the basic concepts and the recent history of the Space Law, providing to the student a compilation of the resources available on the net in order to make possible their development in an autonomous way. The last objective of the committee related to education is to bring the Space Law to students.

Space Law Workshop

As previous step to develop more ambitious educational activities with the collaboration of other third parties specialized in this discipline, it was decided to organize a pilot Space Law Workshop to be performed in a small training scale in Space Law. The purpose of this pilot is to obtain the lessons learnt necessities to develop trainings with a major scope, open to university students. LEEM members, coming from technical and law studies, carried out the pilot workshop. In this way we simulate the heterogeneity that has a standard group of training in Space Law. Likewise, this pilot workshop was used to identify the expectative of the participants in a Space Law training to adapt the contents and the methodology of our training.

The process of development had a preparation phase to search the information and the pedagogic material to use, a phase to check with the participant if the initial objectives of the workshop fulfil their expectatives, a phase to adjust the contents, a phase to give the pilot workshop and finally a lesson learnt phase.

It was remarkable the inputs provided by the students concerning their expectations on the training. It reflected that beyond a traditional training, there are very valued factors as the repercussion of the training in their future career, the network of people interested in the discipline and professionals that the training provides or the flexibility of the training.

According to these expectations the objectives of the workshop were defined as:

- To know the history, the current status and the future challenges of the Space Law.
- To know the institutions and organizations which collaborate in the development of the Space Law and their opportunities.

- To provide the basic concepts and the information sources which make able the student to develop their own knowledge.
- To establish a base to develop those Space Law aspects which are related to experimentation activities.
- To organize a network between students and young professionals interested in this discipline, which allows to collaborate in the development of the Space Law.

In a transversal manner to these objectives, it was agreed to provide the enough flexibility to the workshop to make it compatible with other activities at the same time that the aim of the project will be reached. With this proposal, it was decided to develop a 60% of the training on line supported by on site sessions which facilitates the contact with the other participants and their interaction.

Once the objectives and the format were established, the pedagogic tools were developed. These tools were designed to balance contents, teamwork, and reflection activities which helps to obtain the capabilities to the further development of the discipline by the student.

Based on this scheme five sessions were designed. The first three sessions were given on line through an Internet platform with a restricted access area destined to the student communication and interaction. The first session was dedicated to learn about the platform, to solve the problems and doubts and to meet the other participants. The second session was used to read the theoretical contents focused on the history, the principal agreements, the challenges and the institutions, solving by mail all related doubts. The third session was composed by a forum in which the student answered to an open question. The fourth and fifth sessions were given on site. In the fourth one the theoretical concepts were explained in detail. In addition a round table was carried out to perform a brainstorming about student projects to develop related to Space Law with the objective to facilitate the formation of a student collaboration network in this discipline. Finally, the fifth session was dedicated to a highlight session by a member LEEM in which it was exposed the experience related to the legal difficulties that the association has found during the development of student space related projects.

From this pilot experience we have obtained the following conclusions:

- Due to the knowledge heterogeneity among technical, scientific and law students, it is necessary to focus the contents on those basic aspects of each discipline, which are essential for the Space Law. It is also important to level the knowledge of the participants to start from an equal base.
- The on line sessions provide a great flexibility at the same time that facilitates the interaction with all the participants of the workshop.

- One remarked expectative of the participants is that the workshop will have a positive repercussion in their careers. A practical focus of the workshop is essential to reach this objective. At the same time it is important to promote the creation of ideas, projects and collaborations, which contribute to the development of the participants.

These conclusions joint to the experience developed during this pilot Space Law Workshop is the base to prepare more ambitious projects which promotes the Space Law, collaborating with the Spanish institutions and making possible to bring Space Law to students in an effective way.

IV. SPACE LAW THROUGH RESEARCH

The Spanish Space Students Congress is the annual congress of the association in which students from all over the country meet to share their projects status, their experiences, their difficulties and their results. Furthermore, the Spanish Space Students Congress is a meeting point for students, industry and institutions facilitating the network among them, and the scene of the general meeting of all the members of the association.

As support activity to the two lines of action of the judicial committee previously referred to, and with the objective of collaborating in the promotion of the Space Law among the students, a section into the congress dedicated to it will be organized. In this section, the students will have the opportunity to present their works in Space Law in front of the institutions and organizations of reference of this discipline in our country. On the other hand a series of highlight sessions finish each day of this section of the congress. Besides, a reduced workshop of introduction to Space Law will be given to the attendants, which includes a round table to promote the collaboration in further projects.

The final objective of this section of the Spanish Space Students Congress dedicated to the Space Law is to collaborate in the aim of bringing the Space Law to students.

V. CONCLUSIONS

The Juridical Committee has supported the association to avoid any conflict between our educational projects and the absence of a clear framework and to prevent any potential risk of our activities, and on the other hand has anticipated the potential problems derived of further projects.

At the same time we have identified a series of problems, which are not covered by the current law, that we consider a practical point of view to the legal aspects of this activities. It constitutes a practical contribution to a future national law. Also, it has provided to students the opportunity to introduce to Space Law through the participation in real hand on projects.

Besides, we have promoted the Space Law among the students through educational activities.

After its first activities, the LEEM Space Law Committee has reached the initial experience necessary to develop more ambitious projects. This step makes possible a stronger support to further LEEM activities as well as a wider promotion of the Space Law among the Spanish students. On the other hand, it facilitates the collaborations with the reference institutions to work for the promotion of this discipline.

All these aspects make the Juridical Committee an essential part of the mission of our association as well as an important actor in the development of the Space Law through the students' community.

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(1) The CanSat Concept was proposed by Prof. Bob Twiggs of the Stanford University Space Development Laboratory, at the Japan-U.S. Science, Technology and Space Applications Program (JUSTSAP) conference in November 1998.