EDUCATION CORNER

SPACETECH
- A UNIQUE APPROACH TO HIGHER EDUCATION IN SPACE SYSTEMS ENGINEERING -

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The "space" part of an undergraduate aerospace engineering education has generally received relatively little emphasis compared to that given to the "aero"-nautical part. Indeed, most engineers and scientists working today in the space field have come into the field after being educated in completely different areas of engineering, science, or mathematics. Their "space" education has been learned, in many instances, as a type of "on-job training". This is, however, a bit like teaching someone to swim by rowing them on a boat out to the middle of a lake, throwing them in, and asking them to make it as best they can to the shore.

Fortunately, most who undergo this kind of on-job training in space engineering survive the ordeal, and the accomplishments that have been achieved in the past fifty years in exploring and utilizing space attest to the excellence, expertise, and dedication of those working in the field. Nevertheless, one can only conclude that there must be a better way to develop tomorrow's space engineers and project managers.

The situation gets a bit better when one looks beyond an undergraduate education to graduate school. A number of universities offer Master's Degrees in space related fields, and of course, a lot of PhD students are doing research related to space. In Europe, in particular, there is even the International Space University (ISU) near Strassbourg in France, which offers one of two space-related Master's Degree programs. The ISU program, in fact, already receives support from Japan, and has enrolled students from here.

Going to graduate school to get a Master's Degree is something that, if done at all, is done by most students immediately after receiving their Batchelor's degree. What about the practicing engineer, however, who has been working in the field already, and wants to expand his knowledge and "marketability" by getting an "MBA like" Master's Degree? There is one university that is catering specifically for such individuals.

The Technical University of Delft (TUD) in the Netherlands was founded in 1842, and, with some 15,000 students, is among the largest technical universities in Europe. It offers internationally recognized and accredited Batchelor's, Master's, and PhD degrees in 17 different engineering and scientific disciplines. One of its sub-divisions, Delft TopTech, the School of Executive Education, offers an International Master’s degree program (called the SpaceTech program) in Space Systems Engineering. It is a rather unique program, in that it is not, as are most Master’s programs, designed for students that have recently received their Bachelor’s degree. Rather, it is intended for more mature participants that have generally been working in a space-related field for at least 5-10 years, and who then want to go on to get their Masters.

Most Master’s Degree programs require at least one continuous year in residence at a graduate school. However, because the SpaceTech students are already employed, and their employer’s would normally be reluctant to lose them for a full year, the TUD program has been laid out differently. It consists of a series of five 2-week periods of study, during which all students are co-located, together with intervening periods of typically six weeks duration when the students all return back to their jobs. During these intervening periods, however, the students use the Internet in the evening and on weekends to maintain close contacts with each other and with their instructors, to jointly work on a “Central Case Project - CCP.”

The CCP is, in fact, a full-fledged satellite project (communications, earth observation, navigation, etc, and generally one that includes at least two of these) which has to be defined and designed in detail, and for which the students have to write a detailed proposal for its development. This is another unique aspect of the program. The CCP proposal includes not only the technical details and analyses of what is to be developed, but also a comprehensive market survey and a complete economic business case to demonstrate its economic viability. The curriculum of the classroom teaching also combines technical engineering disciplines together with business, management, and personal skills development subjects more commonly found in a conventional MBA program (see Figure 1). The reason behind this is that the goal of the program is not merely to produce better space engineers; it is to produce better space systems engineers and space program managers. It is thus rather intended for those in the space industry or in space development organizations whose superiors feel are capable of moving soon into technical management positions, perhaps to lead a group to develop a major new satellite system.

The two-week periods together are held at various "host" locations, not just in the Netherlands. The host is a company, organization, or university that is willing to provide classroom facilities for 15-20 students, provide logistic support (helping to arrange travel and/or visits to national space related facilities, helping with hotel reservations, etc., and possibly also providing lunch facilities for the students and teachers). Hosts also often provide experts as guest lecturers.

The motivation for SpaceTech using such host locations is that, by doing so, students are able to meet and get to know a wide range of experts in the space field. In addition, visits to space related industries located near each of the hosts provide the students with knowledge of how the techniques and technology which form part of their curriculum are actually being put into practice. This combination of academic together with practical knowledge is another strong point of the SpaceTech program.

In the past, sessions have been hosted by the European Space Agency (ESA) technical center, ESTEC, in the Netherlands, the French Space Agency (CNES) technical center in Toulouse, France, the ESA Earth Observation data center (ESRIN) in Frascati, Italy, and the German Space Agency (DLR) center in Oberphaffenhofen, Germany. Figure 2 shows the locations and timing of the sessions planned for the forthcoming school year.

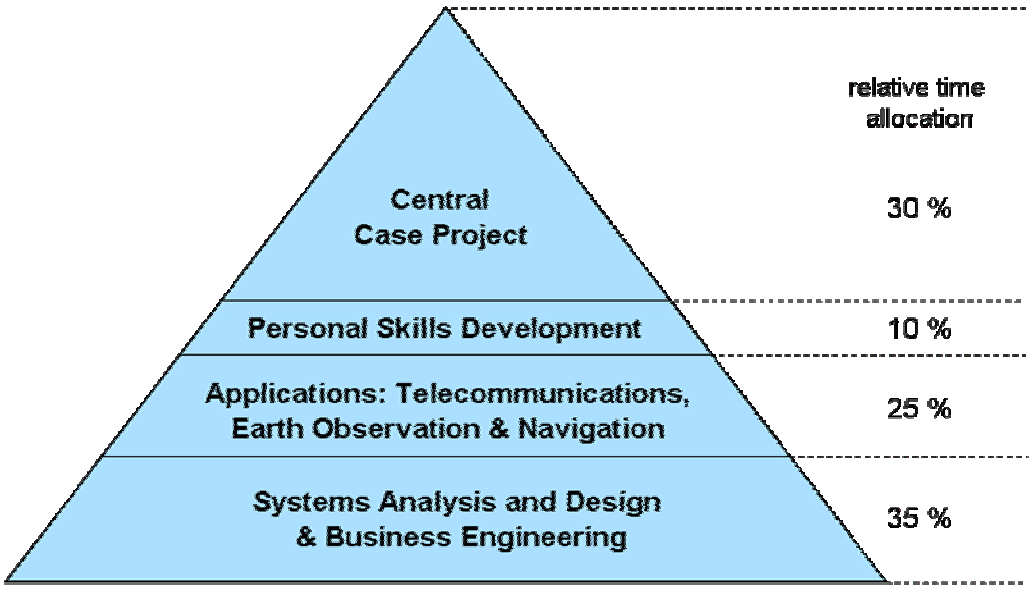

Figure 1: Content of the SpaceTech Master's Degree Program

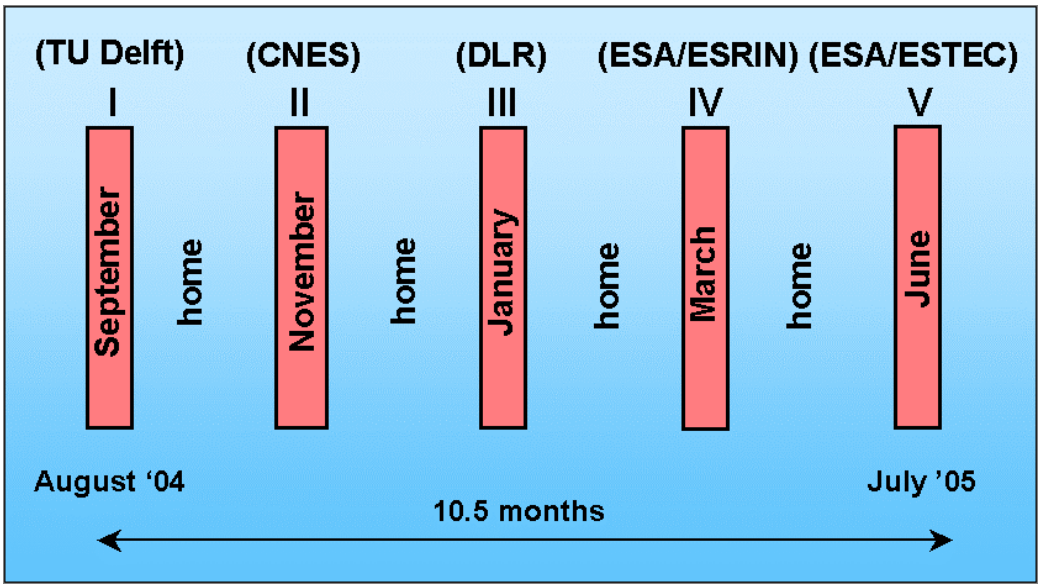

Figure 2: Planned locations and timing of the sessions for the next SpaceTech year

Finally, the fourth aspect of the program is that it is international. Most of the students so far have been, as you might expect, European, but attempts are being made to select students from as many different cultures and languages (English is the common working language and the language of instruction) as possible. Students have attended from the USA (from both NASA and industry), and from other countries, but the university would like to increase the level of non-European participation.

Representation from Asia in particular has been limited, and there have so far not been any students from Japan. It was precisely because of this that the SpaceTech Project manager, Ying Sit, and I made a trip to Japan earlier this year, both to acquaint potential students and their management with the program, and to look for a prospective host so that a future two-week SpaceTech session might be able to be held here. This, it was felt, would not only make it easier to attract Japanese students to the program, but it would also give its other international students an introduction to Japan as a major player in the space field. Presentations were made to representatives of JAXA, NICT, NEC-TOSHIBA, and JEPICO, and these organizations were invited to consider the possibility of either/both enrolling students in the program or acting as a host for a future SpaceTech session. Both these possibilities are now, I understand, under consideration by these organizations.

The SpaceTech program might, at first sight, appear to be in competition with that of ISU, but this is not in fact the case. They are, instead, complementary. Students in the ISU program are generally younger, with little or no previous working experience in the space field, while the SpaceTech program is aimed at the more mature student. The ISU program offers two streams of study, one more technically oriented and the other concentrating more on business issues, while SpaceTech combines the two into a single program. Because of this complementarity, both programs receive financial support (and students) from, for example, the European Space Agency, which also provides guest lecturers to both.

In summary, the SpaceTech program offers a unique opportunity for those already working in the space domain to improve and broaden their knowledge and to obtain an internationally respected Masters Degree in Space Systems Engineering. Anyone interested in obtaining further information on the subject can contact the SpaceTech Program Manager at "y.sit@delft-toptech.nl".