ABSTRACT

Small satellites are becoming increasingly important in the context of capacity building in space technology for developing countries. The use of commercial off-the-shelf technologies and focus on specific missions can speed up the development process, providing faster as well as cheaper access to space. Only small groups of engineers in universities and government agencies are needed to execute a programme and this overcomes the problem of limited human resources. These engineers can get involved in the entire life cycle of the satellite, thereby facilitating and maximizing technology transfer. As capability in space is becoming a more essential means to solving many earthly problems, such as resource management and environmental problems, the United Nations is convinced that small satellites provide an excellent vehicle for developed countries to bridge the gap between technology have and have-nots in space, while at the same time responding to the call to ensure space benefits all humanity.

1. INTRODUCTION

Small satellites have already been launched with considerable success by many organizations in developing countries. Their attraction lay in the promise of low-cost and short development times made possible by the use of proven standard equipment and off-the-shelf components and techniques. Coupled with realistic and focussed goals, such satellites make it possible for a country with even a small research budget and little or no experience with space technology to participate in their development, launching and operation. Small satellites thus present an ideal opportunity for training students, engineers and scientists in different disciplines, including engineering, software development for on-board and ground computers and management of sophisticated technical programmes. Their value in capacity building and essential contribution towards problem solving are attributes that are at the heart of the United Nations philosophy.
2. THE UNITED NATIONS POSITION ON SMALL SATELLITES

2.1 UNISPACE III

The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) was held in July 1999 in Vienna. UNISPACE III was different from the two meetings in that it not only involved UN Member States, but also the private sector, NGOs and other non-governmental entities. This change is a reflection of the important role private sector plays today in the space arena. It also reflects the openness that exists in the space community today as a result of the end of the cold war. All of this augurs well for developing countries.

Several technical conferences were held during UNISPACE III. The Workshop on Managing Space Programmes in Developing Countries: Experience and Needs observed that many developing countries have initiated their own space technology and applications programmes. The essential impetus for embarking on such programmes was the need to support the nation's developmental needs and to deal with the problems of education, pollution, health, telecommunications, environmental management, utilization of natural resources, weather and climate applications, food security, urban and rural infrastructure, land-use management and many other local-level resource problems. The Workshop acknowledged that technology development was a major issue that was being addressed by developing countries, specifically by means of small satellites and their launches. As a result of this, the participants recommended that efforts should be made by international bodies and developed countries to share technology elements in support of space programme development in developing countries, especially in the development of small satellites.

The Workshop on Small Satellites at the Service of Development Countries concluded that small satellites were valuable tools in the development of space infrastructure and scientific and application programmes. They could also have an important role to play in every country's space plan. The Workshop recommended that each country prepare a space plan that identified how space assets could best be used to support its development. That in preparing space plans, small satellites should be considered one of the most valuable tools to initiate and develop and indigenous space capability.

The Workshop recognized that small satellites offered opportunities to developing and developed countries to establish cooperative programmes not only for the purpose of training, but also with a view to preparing collaboration for scientific or application missions. They also made it possible for developing countries to pool their efforts in building their individual space capabilities. It was therefore recommended that, in preparing its space plan, each country consider incorporating into it an element of international cooperation.

Prior to UNISPACE III, several regional preparatory conferences were held. The Regional Preparatory Conference for Africa and the Middle East recommended that Member States should invest in the development of the necessary knowledge and skills in their citizens in different aspects of space science and technology, in particular through their participation in the development, design and production of small satellites, with a view to gaining an understanding of the technology and the subsequent use of
such satellites for various socio-economic applications, bearing in mind the relatively low cost of designing, constructing, launching and operating small satellites. Programmes on small satellites could be carried out through regional collaboration.

The Regional Preparatory Conference for Eastern Europe recommended that as a consequence of the evolution of space-related technologies, the joint development, construction and operation of a variety of small satellites offering opportunities to develop indigenous space industry should be undertaken as a suitable project for enable space research, technology demonstrations and related applications in communications and Earth observation. Member States in the region should seek the necessary support for such ventures.

Specific action programmes which formed the body of the recommendations of UNISPACE III included the following:

In preparing a space plan, each State may consider small satellites one of the most valuable tools to initiate and develop indigenous space capability. As small-satellite programmes also offer an ideal possibility for training, States are encouraged to include training programmes based on small satellites in their space plans and in plans for international cooperative programmes.

Through international cooperation, developed countries should employ their best efforts to transfer to developing countries the necessary knowledge and skills of their citizens in different aspects of space science and technology, in particular through their participation in the design, development and fabrication of small satellites, with a view to gaining an understanding of the technology and subsequent use of such small satellites for various socio-economic activities.

2.2 Other United Nations sponsored events

The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (COPUOS), at its thirty-third session, held in February 1996, had recognized the importance of missions involving small satellites by including the issue in its programme as a special theme. In that meeting, the Committee on Space Research (COSPAR), the International Council of Scientific Unions and the International Astronautical Federation (IAF) had organized, in liaison with States, a symposium on the theme "Utilization of micro- and small satellites for the expansion of low-cost space activities, taking into particular account the needs of developing countries", to complement discussions on the subject within the Subcommittee.

The United Nations co-sponsored two events on small satellites in Member States. In September 1996, together with INTA (Spain) and the European Space Agency (ESA), the United Nations organized in Madrid an International Conference on Small Satellites: Missions and Technology.

With over 200 participants, the Conference reflected the growing interest in the use of small satellites for dedicated missions applied to everything from scientific Earth observation to demonstrations on technology. Participants stressed on several occasions that such missions could be conducted quickly and inexpensively and could increase the
opportunities for developing countries to gain access to space, which in turn would offer advantages related to the developmental and industrial aspects of space technology.

In October 2000, the United Nations organized jointly with the International Academy of Astronautics (IAA) a Workshop on Small Satellites at the Service of Developing Countries: The Latin American Experience, in conjunction with the International Astronautical Federation (IAF) Congress in Brazil.

The Workshop clearly demonstrated that the Latin American experience in the field of small satellites has grown substantially since the first workshop that was held in Brazil in 1994. In addition to several projects concluded or under development in Brazil, Argentina and Chile, national activities in the field were reported also by Mexico and Peru. The experiences reported covered a very wide spectrum, ranging from educational nano- and micro-satellites, to some small-to-medium sized fairly sophisticated satellites devoted to operational application missions, especially for remote sensing, such as the joint initiative under study by Brazil and Argentina.

The participants in the Workshop recognized that small satellite projects in Latin America were promoting international cooperation within the region, as well as with European partners. They also noted that several satellite missions developed in Latin America could be of interest to other continents, especially Africa.

3. A DEVELOPING COUNTRY SUCCESS: THE SOUTH AFRICAN STORY

The history and achievements of SUNSAT, a post-graduate student designed and built satellite, proves what can be achieved through perseverance, enthusiasm and innovation even in the face of severe manpower and funding restrictions. Built at the University of Stellenbosch, South Africa, the SUNSAT programme procured its resources from governments and industry, including funding, facilities, components, engineering support, etc.

The programme has exceeded all its original goals and had the following notable achievements:

- to operate as OSCAR-35 with the amateur radio and amateur satellite communities worldwide, contributing new standards in the field;
- to demonstrate high resolution imaging not before considered possible with a satellite this size and costs;
- to stimulate challenging research and technology development at graduate student level;
- to foster valued international ties in the science and engineering community; and
- to promote science, engineering and technology among the school children of South Africa.

This success story can be emulated by developing countries.

4. CONCLUDING REMARKS

Despite launch opportunity problems, the future for developing countries in small satellites is rosy. The change in mentality to the utility of small satellites was by no means a
small change. Developing the technology for smaller systems is only the first step to enabling their implementation. Small satellite programmes require that new organizational thinking be put in place. Cultural changes are needed as well, both in the corporate sense and in attitudes of satellite builders.