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Model Curricula: George Washington University

Masters Degree in Satellite Applications
A CURRICULUM PROPOSAL

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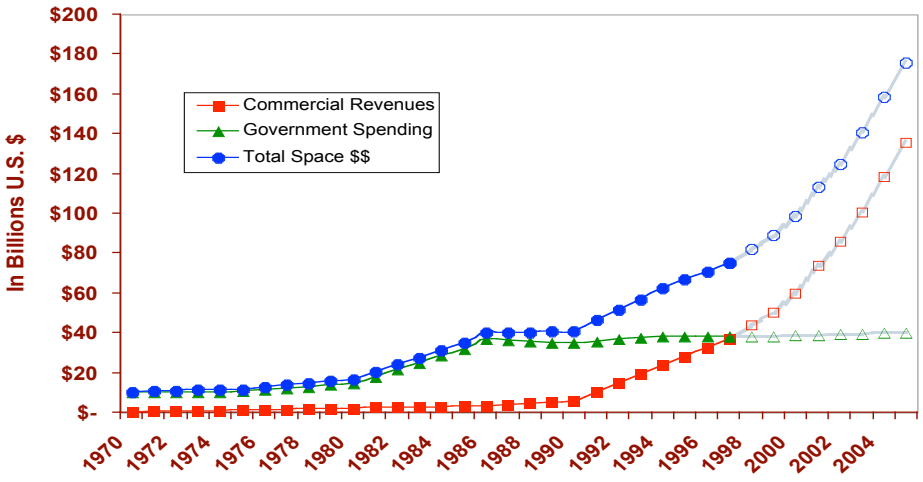
Introduction

In 1998 the net revenues for worldwide commercial satellite communications and other space applications for the first time exceeded the expenditure levels for global governmental and military expenditures on space. It is projected by 2005 that the commercial market will have increased to double the size of governmental and military expenditures as rapid growth occurs in the satellite communications, space broadcasting (television and radio), remote sensing and the space navigation and positioning fields. This overall trend of commercial growth in the space application field outstripping governmental expenditures (as monitored by the Futron Corporation) is shown in figure 1 below.



There is a growing need for qualified engineers, scientists, technicians, marketing and sales and management personnel in the field of satellite applications and only a few universities that are actually offering undergraduate or graduate degrees in this area. The Society of Satellite Professionals International and its Academic Advisory Committee are currently studying a proposal for a new Master of Science degree in Satellite Applications. There are several special academic problems with such a degree. First, although the courses involved with such a degree are primarily technical, the focus is actually broad. The proposed course of study set forth below would involve study in the fields of electrical engineering, aeronautical and astronautical engineering, computer

science and mechanical engineering. Arranging such a course of study across these various disciplines is a difficult task. Secondly, it is believed that such a degree would also require some knowledge and study in the field of policy, regulation and economics. Most universities are not structured in a way that is conducive to the award of interdisciplinary degrees. The following draft curriculum is designed to meet future industry and governmental needs in the satellite applications field. This curriculum is only under preliminary study but is provided for consideration and comment within the forum processes now created by the new SSPI electronic journal.

Recommended Curriculum in Space Applications

The following ten courses could be offered to graduate students within a traditional classroom context or on in a more open format through IP based tele-education courses. This proposal assumes that each course will be for 3 credits and that the research project at the end of the Masters Degree will be for 6 credits. Students applying with an appropriate undergraduate degree (i.e., perhaps in space operations) might be given credit for one or more of the advanced “mezzanine” courses based on a competency test or based on having obtained an “A” grade).

The concept behind this degree is that individuals who are seeking a career in the aerospace industry, government or military agencies, or consulting firms with an interest in satellite communication, remote sensing, or space navigation will find this academic program of great utility. The proposed courses (on which comment and discussion are invited) are as follows:

Satellite Applications Spacecraft Technologies: This course would cover spacecraft structures, power systems, advances in solar cells and thermo-ion processes, thermal management, radiation and high energy bombardment, stabilization and deployment techniques, ionic and other advanced propulsion systems, TTC&M, and orbital orientation (including satellite clusters and various orbital systems such as Leo, Meo, Geo, Highly elliptical orbital (Heo), Equatorial Circular Orbit (ECO) and Lagrangian)

Space Telecommunications Systems: This course would examine the key telecommunications technology associated with digital satellite communications. It would focus on multiplexing, modulation systems, advances in modem technology, and advances in antenna technology (including phased array antennas, deployable antennas, use of polyimide and other advanced materials as well as use of piezo-electric techniques, etc.). It would also review basic skills such as calculation of link-budgets, intermodulation products, and margins for rain attenuation.

Ground Antenna Systems Technology and Mobile User Terminals: This course would examine the technology and systems design issues associated with ground antenna systems for space telecommunications, mobile communications, broadcasting (radio and television) and multi-casting applications, broadband services, messaging and SCADA applications, pointing requirements, phased antenna systems, power and battery systems and health standards.

Space Based Remote Sensing Systems: This course would examine all types of multi-spectral sensing and radar systems including synthetic aperture systems, infra-red and other forms of remote imaging systems for commercial, governmental and military

applications, including the use of these systems for planetary exploration and applications in astrophysics research. It will examine the processing, pre-processing, image development, ground-truthing and other analytic techniques associated with the use of space-based imaging, including the use of expert systems and artificial intelligence to assist in more rapid and efficient processing. Also examined will be the various orbits that are used by these systems and the various types of ground systems that support centralized and decentralized processing of data and the delivery of remote sensing data to customers.

Space Navigation, Targeting and Mapping Systems: This course would examine all forms of space-based navigation, targeting, and mapping applications and existing and planned satellite systems that support these services including Navstar/GPS, Glonass, Galileo and Inmarsat. This course will explore the various orbital configurations, the various types of position location techniques, the accuracies that can be obtained for fixed and mobile locations, the ground systems and terminals that are available and the trends in commercial, governmental and scientific applications. It will examine the Global Information System (GIS) and software that is used with regard to both space navigational and position location services as well as for remote sensing and other space based imaging applications.

Space Markets and Business Trends: This course would examine trends in the use of space for commercial, military and governmental applications, the size and growth in these markets in terms of launch services, spacecraft, ground systems and space-based services and applications. Market and business trend analyses of space services will include telecommunications, broadcasting, mobile services, space-based imaging, remote sensing, mapping, targeting and navigation, SCADA and messaging, and related space based applications in transportation, earth quake monitoring, meteorological applications, pollution monitoring, and space weather and astrophysics research.

Space Regulatory and Legal Systems and Spectrum Management: This course would examine the legal and regulatory framework that controls the operation of satellite systems in terms of spectrum management, control of space debris, world trade, access to local markets, landing rights and licensing. This course will include review of the activities and authority of the UN, UNCOPUOS, ITU, WTO, UNESCO, IBRD, UNIDO, UNDP, ICAO and IMO, the revised status and meaning of changes that have occurred with regard to Intelsat, Inmarsat and Eutelsat. This course will also examine the control and operation of governmental and military systems in space both in the past and as envisioned for the future.

Government and Military Space Programs of the World This course would examine the status of the various civilian space research organizations, their current missions, status and funding levels, the various types of military applications of space, the significance of dual use systems for communications, remote sensing and space navigation and position location and how these may change as new military space systems are deployed.

Future Trends in Space Applications and Convergence: This course would examine changing patterns of technology, applications, regulation, trade, and use of space as well as how space and ground systems are used in competitive as well as cooperative ways. It will also examine how space systems use digital convergence to integrate

systems and to integrate satellite applications using common or complementary standards. This course will thus be of an interdisciplinary nature.

Seminar in Global Trends in Satellite Systems and Applications: This would be a final interdisciplinary course offered in conjunction with a research project. It would feature guest speakers that would highlight key trends in the field and focus on drivers of changes in terms of technology, applications and services, management, capital finance and economic forces, policy and regulation, standards, globalization, markets and world trade.

Final Research Project: This would be a six-credit course that would be designed to integrate the courses completed in the Masters degree program. An advisor would work with the student (or possibly team of students) to define this project and provide support as the research project is carried out.