INTERNATIONAL SPACE UNIVERSITY

ISU

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Nakhon Ratchasima

Summer Session 99

June 26-September 4

Program Handbook

Suranaree University of Technology
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CONTRIBUTION

ISU Summer Session Sites

1988
Massachusetts Institute of Technology
Cambridge, Massachusetts, USA

1989
Université Louis Pasteur
Strasbourg, France

1990
Institute for Space and Terrestrial Science
Toronto, Canada

1991
Ecole Nationale de l'Aviation Civile
Formation Internationale de l'Aéronautique et Spatiale
Toulouse, France

1992
City of Kitakyushu, Japan

1993
University of Alabama in Huntsville
Huntsville, Alabama, USA

1994
Universitat Autònoma de Barcelona
Barcelona, Spain

1995
Royal Institute of Technology
Stockholm, Sweden

1996
Austrian Society for Aerospace Medicine
Vienna, Austria

1997
Rice University
Houston, Texas, USA

1998
Cleveland State University
Cleveland, Ohio, USA

1999
Suranaree University of Technology
Nakhon Ratchasima, Thailand

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ISU Credo

12 April 1995

We, the founders of the International Space University, do hereby set forth this Credo as the basis for fulfilling ISU's goals and full potential.

International Space University is an institution founded on the vision of a peaceful, prosperous and boundless future through the study, exploration and development of Space for the benefit of all humanity.

ISU is an institution dedicated to international cooperation, collaboration and open, scholarly pursuits related to outer space exploration and development. It is a place where students and faculty from all backgrounds are welcomed; where diversity of culture, philosophy, lifestyle, training and opinion are honored and nurtured.

ISU is an institution which recognizes the importance of interdisciplinary studies for the successful exploration and development of space. ISU strives to promote an understanding and appreciation of the Cosmos through the constant evolution of new programs and curricula in relevant areas of study. To this end, ISU will be augmented by an expanding base of campus facilities, networks and affiliations both on and off the Earth.

ISU is an institution dedicated to the development of the human species, the preservation of its home planet, the increase of knowledge, the rational utilization of the vast resources of the Cosmos, and the sanctity of Life in all terrestrial and extraterrestrial manifestations. ISU is a place where students and scholars seek to understand the mysteries of the Cosmos and apply their knowledge to the betterment of the human condition. It is the objective of ISU to be an integral part of Humanity's movement into the Cosmos, and to carry forth all the principles and philosophies embodied in this Credo.

This, then, is the credo of ISU.
For all who join ISU, we welcome you to a new and growing family. It is hoped that each of you, as leaders of industry, academia and government will work together to fulfill the goals set forth herein. Together, we shall aspire to the Stars with wisdom, vision and effort.

Peter H. Diamandis,
ISU Founder; SpaceGen Director

Todd B. Hawley,
ISU Founder, SpaceGen Exec. Director

Robert D. Richards,
ISU Founder; SpaceGen Director

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ISU Summer Session Aims

As a dynamic institution of higher education, the International Space University is dedicated to the creation, expansion, exchange and dissemination of knowledge and ideas, and to the development of space-related activities for peaceful purposes. With the support of the world space community, ISU offers interdisciplinary programs in an international and intercultural environment preparing professionals of all sectors to meet the present and future challenges of international space cooperation.

In this context, the ISU Summer Session has proved to be an ideal forum for students and faculty to network with international leaders in space research and development. The interactive international environment provides all participants with numerous opportunities to forge new professional relationships. Over the years, Summer Session alumni, numbering over 1,200 to date, faculty members, visiting lecturers and members of the host community have contributed to creating a professional network facilitating access to information and exchanges which have been successful in advancing various projects.

Instrumental in the implementation of the ISU mission, the Summer Session is an intensive ten-week program for postgraduate students and young professionals of all disciplines. They participate in a outstanding educational experience covering the principal space-related fields, both technical and non-technical. These include space and society, space business and management, space policy and law, space systems analysis and design, space engineering, space resources, robotics and manufacturing, satellite applications, space physical sciences, space life sciences and an informatics lecture series.

All course work at ISU is conducted in English. However, in order to enhance the international goals of ISU, all students whose first language is English are requested to demonstrate proficiency in a second language. Likewise, throughout the ten weeks, students are encouraged to share their cultural specificity with their fellow students, faculty members and staff to further international understanding and tolerance.

Student Selection Criteria

In support of its goals, ISU selects students on the basis of several criteria. These include:

Excellence. ISU seeks students who demonstrate outstanding ability in their chosen field of academic study, research, or professional work.

Motivation. ISU seeks individuals who will take on personal and professional responsibilities in the development and peaceful exploration of space: leaders, innovators, managers, researchers.

Openmindedness. ISU seeks individuals who, working within an interdisciplinary environment, are committed to international understanding and cooperation.

Only those students exhibiting high levels of academic and extracurricular achievement are considered for attendance at ISU. Such students from around the world will benefit significantly from this unique, international educational experience.

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The 1999 Summer Session Host Institution

Suranaree University of Technology (SUT) is the host site for the 1999 Summer Session Program (SSP'99). It is located in Nakhon Ratchasima, Thailand. Suranaree University of Technology is the first state university, a regional university, a national and international university, under the Thai civil service system. A corporation under supervision of the Minister of University Affairs, SUT's status is a university under government supervision according to the 1990 Suranaree University of Technology Bill and the 1994 Ministry of University Affairs Civil Service Procedures Royal Bill. Hence SUT has a different administrative system from other civil service systems in order to be highly effective in educational administration at the international level.

SUT, established with the goals of promoting administrative efficiency and academic freedom, and to be a community of scholars in arts, sciences, and technology, pledges to pursue excellence in all missions, to bear fruit in the collection and celebration of knowledge and wisdom for the eternal growth of mankind.

SUT pursues five missions as follows:

1. Producing and training highly qualified science and technology personnel in response to Thailand's developmental needs.
2. Research and development: advancing academics and using research and development results in enhancing Thailand's growth.
3. Technology adaptation and transfer: to help Thailand become more technologically self reliant.
4. Academic servicing for the public and various bodies, both state and private.
5. Cultural heritage enrichment, both at the national and regional level, especially the art and culture of Thailand's Northeast.

Suranaree University of Technology welcomes the 1999 Summer Session Program participants to Nakhon Ratchasima, Thailand.

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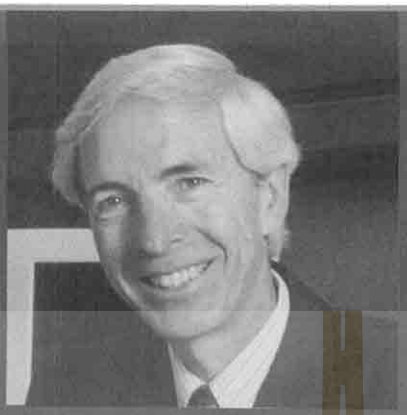

In an intensive 10-week program, the ISU Summer Session offers a unique educational experience highly valued by the more than 1,200 alumni who have benefited from it. The interdisciplinary curriculum with its emphasis on international cooperation exposes students to broad new perspectives on the world's space activities, perspectives otherwise reserved for those with many years of diverse professional experience. By working together with fellow students and teachers from around the world, especially in the design projects, students gain a useful ability to operate effectively in a multicultural environment and acquire a worldwide network of professional colleagues and friends.

The purpose of this chapter of the Program Handbook is to give the reader a clear picture of the various components of the academic program and how they fit together. It is hoped that, armed with this knowledge, the student will be well prepared to cope with the intensity of the program and to derive the maximum benefit from the experience. Figure 1 introduces in a schematic form the elements of the Summer Session academic program and their arrangement in the overall program.

The following sections give a description of each activity together with some suggestions about how best to approach it.

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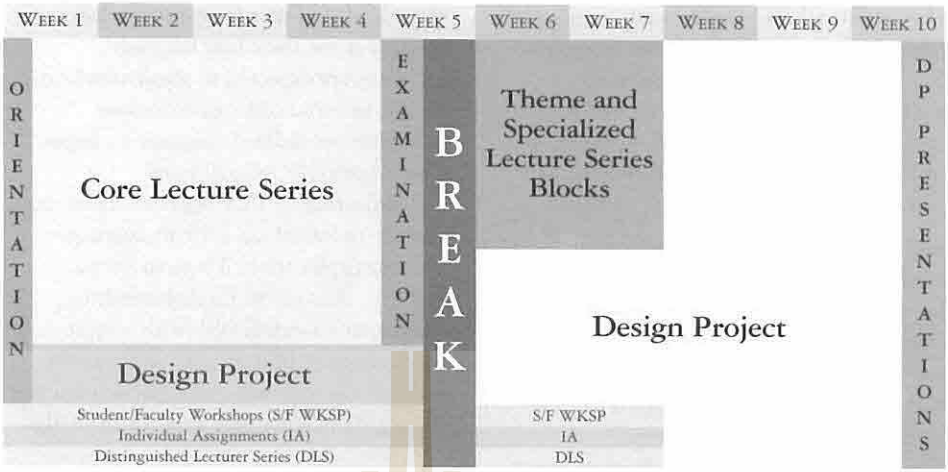

Fig.1 Academic Program Summary

Orientation

The Summer Session begins with an orientation program aimed at reviewing the goals and elements of the program, introducing the faculty and staff, presenting the host site institution, its facilities and surroundings. Both design projects are introduced to participants before they select the one on which they will work. The Academic Program outlined in this chapter will be discussed further and elaborated, as will the Academic and Ethical guidelines in the Appendices, Section 1.0. A description of each program element's requirements is given.

A tour of the Library and the Computer Center is included also. Computer orientation workshops are given on the computers the students will be using.

Discussions on multicultural living, communication, and approaches to problem-solving within different cultures also are presented and form an integral part of the orientation process. Interest in and respect for different cultures and backgrounds are strongly encouraged and reflect ISU's pedagogical approach and vision.

Core Lecture Series

The purpose of the core lecture series is to ensure that each student has a basic grounding in all the disciplines that are relevant to space programs and understands the relationships between these disciplines in any space-related activity. Good decision-making and management in today's complex space programs requires an understanding of a very large range of factors, both technical and non-technical. The core lecture series is attended by all students, and is intended to create a basic framework of knowledge to prepare students for informed and balanced judgment. First, the lectures

ensure that all ISU students are acquainted with the basic concepts in each discipline. Second, they give all ISU students an appreciation for the relevance of these concepts during the conception, planning, implementation, and exploitation of space activities.

Each academic department presents a series of lectures designed primarily for students from other departments. Thus, lectures on propulsion systems can be understood by medical specialists, and lectures on human physiology can be understood by rocket engineers. The lectures do not go into depth or enter into detail in any subject, except perhaps as an illustration of a point. The great breadth and diversity of the subjects means, however, that a large quantity of material is covered. Many core lectures are grouped around clusters to highlight the interrelation between disciplines. A short question and answer discussion takes place at the end of each cluster.

The core lecture series consists of two to four lectures a day for four weeks and requires a certain amount of stamina on the part of the students. At the end of the lecture series however, when the whole picture can be pieced together, students agree that they have gained a valuable, new and exciting perspective on space activities.

Students are expected to attend all lectures, including the lectures in their own area of specialization. There are two key reasons for this. First, it is important in later team work for students to realize how much (or how little) their colleagues in the team know about the subject. Second, students who are knowledgeable in a subject are better able to offer informal help to fellow students who may be experiencing difficulty with the subject.

Lectures are 75 minutes in duration, and 15 minutes are reserved for questions at the end of each lecture. Lecturers know that their talks are aimed at non-specialists, and that for many students English is not their first language. Lecturers are expected to speak slowly and clearly, to avoid colloquialisms and to explain specialized language or jargon. They appreciate a signal from the auditorium if they begin to speak too quickly or introduce difficult language without explanation. Those students, native or non-native English speaking, who experience difficulty with a topic can seek assistance from faculty and teaching assistants at any time and especially during the regularly scheduled English tutorials.

Departments

From an organizational standpoint, the SSP is structured around nine academic departments under the overall direction of the Summer Session Program Director. The departments provide an anchor to the students and are created for administrative convenience rather than for the compartmentalization of the program. The focused knowledge gained in the departmental activities is extremely important for the design project work. In addition, when the design project work requires specific information, students can obtain this information via the department channel. Departmental specific aspects of the SSP include student/faculty workshops, individual assignments, and departmental activity day.

Student/Faculty Workshops

The student/faculty workshops are regularly-scheduled periods when the members of each department meet together as a department – students, department chairperson, faculty members, teaching assistants, and any lecturer who may be in residence. The basic objective of the workshops is to exchange knowledge, facts, ideas, and opinions to enable the participant to interact in debate and discussion, and to provide hands-on

experience when possible.

Depending on the nature of the academic discipline, the size of the department, and the teaching style of the department faculty, the workshops may include:

- an extension of the question and answer period started at a core or specialized lecture
- designing and building a robot
- a seminar and discussion following a core or specialized lecture and going into greater depth
- building and using a very low frequency radio receiver
- a working session on problems encountered within a design project
- remote sensing projects using local imagery and involving ground truthing
- presentations by students on their own work or interests
- designing and building a model rocket
- limited hands-on experience with data systems or experimental hardware.

The workshops provide an important opportunity to interact with faculty members and lecturers, and students should not hesitate to do so. They also provide a means for students to become sensitive to the cultural differences that govern personal interactions in a group setting and to develop skills in dealing with this cultural diversity.

Themes and Specialized Lecture Series Blocks

As the name implies, this aspect of the SSP includes blocks of lectures which concentrate on a theme and are more specialized, more focused and go into greater depth than the core lectures. There are two types of blocks: theme blocks and the specialized lecture series (SLS) blocks. For theme blocks, several departments combine their efforts to cover the chosen theme from an interdisciplinary perspective. The specialized lecture series blocks typically involve an in-depth look into a single discipline area. Since a number of themes and specialized lectures are given in parallel, the number of students attending each block is much smaller than that for the core lectures. This leads to a less formal atmosphere and the possibility of much more interaction with the lecturer.

Each academic department organizes a theme and/or SLS block. For both types of blocks, the departments do not attempt to offer comprehensive, in-depth courses, but instead, choose to be selective in their offerings. Departments take different approaches with blocks, dictated partly by the intrinsic nature of the subject matter and partly by the preferences of the department faculty. Some departments offer lectures on topics that are typical of their disciplines to give students further insight into the subjects. Others deal with contemporary issues to give students a better appreciation of current problems and opportunities facing space program managers. Others offer short sequences of lectures progressing in depth in a given area. Most departments include lectures that are of direct relevance to the design projects.

For SSP'99, there are four theme blocks and two specialized lecture series blocks. Students are required to select and attend one theme in each of Blocks 2, 3, 4, and 6. Students also are required to select and attend one specialized lecture series in both Block 1 and Block 5. Students must select at least one block in their own department and attend all lectures and discussions in all selected blocks. Students are strongly encouraged to study carefully the summaries which describe each block before making their choices. Individual interviews between each student and the department chair are organized in the first half of the Summer Session to help students make their choices in light of the student's knowledge of the subject and personal interests.

Individual Assignments

As part of the requirements for the Department Evaluation (see the Appendices, Section 1.1), a short exercise or project will be assigned by the department chairperson for each student. This will be fully explained to the student during the personal interview by each department Chair during the start of the summer program. Examples of individual assignments may be an oral presentation on one's professional research during a department workshop session, a paper on current issues or participation in a poster session.

Design Projects

In the design projects, students work together to produce a complete conceptual design of an international space project. This element of the Summer Session program has three main objectives:

1. The design project provides students with the opportunity to put into practice what they have learned from lectures, workshops and other presentations. Students are faced with the challenge of dealing with the design of a complete system involving all disciplines and where conflicting requirements emerge and compromises must be made. The capabilities of all current national and international space programs must be evaluated with regard to their relevance to the design project, and concepts for new international programs developed.

2. The design project provides students with the opportunity to experience and experiment with top-level decision-making processes within a multicultural environment. For many students, this is their first involvement with decision-making above the level of specialized technical design. It is a considerable challenge to the student group to develop their own method for this process. The intensity of the team work rapidly exposes the great diversity of approaches stemming from the cultural backgrounds of the students. Every single student has to make adjustments to his or her way of working in order to achieve a successful group effort.

3. The end-product of the design project activity is a report, which is the subject of a formal presentation at the end of the Summer Session. The report describes a conceptual design for the chosen space program, covering all aspects – technical, financial, organizational, political, etc. The reports have served, as a whole or in parts, as resource material which the world space community can use when the appropriate decision points are reached.

The structure of the design projects depends to some extent on the nature of the project and the style of the individual design faculty members, but some basic aspects are common to all design projects:

- an early phase of exploratory or brainstorming discussion of the project
- a series of factual lectures specific to the design project
- research and an intensive fact finding period
- a challenging period of wrestling with different ways of organizing the study effort
- extensive opportunities for engaging departmental faculty members and lecturers in discussion of design project issues
- two interim presentations and reviews at which organized comments and advice from faculty members will be given
- a period of very intense work to complete the final report.

Students should not expect:

- to be assigned tasks in their area of specialization by the design project co-chairs
- to find an externally-imposed decision-making structure.

In these matters, the role of the design project chairperson is to help and support the students in their project, and not to act as decision-maker.

Post-SSP Design Project Activities

In recent years, ISU has been requested to present the results of SSP design projects at international conferences and meetings. SSP alumni are asked on an invitation basis to give these presentations. The selection of the alumni to participate and give presentations is made by the Summer Session Program Director in collaboration with the design project co-chairs. The amount of funding available to support the conference, in addition to the student's contribution to the design project, may be a determining factor in the selection criteria.

Distinguished Lecture Series

The Distinguished Lecture Series is a series of lectures for which world-renowned individuals are invited to speak on contemporary issues in the space sector. On occasion, these are presented in a debate format. These events typically occur in the evening and are open to the public.

Examination

A midterm examination will take place after the core lecture series and will be based mainly on the core lectures. This will better assess the student's comprehension and understanding of the material presented during the first half of the program. Examination results comprise 100% of the Core Curriculum Evaluation (see Appendices, Section 1.0, Academic and Ethical Guidelines). Students are not expected to memorize detailed information on each lecture but to have a grasp of the fundamental concepts being taught. The examination focuses on the basic concepts from each department. It will consist of multiple choice and essay type questions. The passing grade is 60% of the total number of points.

Evaluation

Each student's academic performance is evaluated on the basis of:

- performance in the midterm examination on the fundamentals of the core lecture series
- participation in departmental activities, principally workshops, themes, specialized lectures and an individual assignment or exercise assigned by the department chair
- contribution to the design project.

Students are required to obtain a satisfactory evaluation in each of these three elements in order to obtain a Certificate as discussed in the Academic and Ethical Guidelines in the Appendices, Section 1.0. All students are required to familiarize themselves with these guidelines and will be asked to sign an agreement stating that he/she has fully understood its terms and conditions at the start of the Summer Session Program.

Alumni Conference

The 8th Alumni Conference will take place on July 30, 1999 at Suranaree University of Technology in conjunction with Alumni Weekend to be held 30 July – 1 August 1999. This is an event for all Summer Session students, faculty and staff. The conference co-chairs are Sart Sukprasert (SSP'96, Thailand), Hiroyasu Mizuno (SSP'98, Japan) and Gongling Sun (SSP'98, China).

The main theme of the 1999 Alumni Conference is "The Promotion of Space Related Activities for Peaceful Purposes." This conference will provide an excellent opportunity to boost international cooperation in space activities, notably to Southeast Asia. ISU alumni are invited to submit papers in any relevant field – e.g. space science, education, system

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integration, administration of space projects, engineering – that will promote the peaceful use of space. Participants will also learn more about how space activities relate to Southeast Asian cultures. The keynote speaker will provide a general overview of the status of space technology applications in modern society with a particular focus on Southeast Asia and Thailand.

Throughout the day, SSP'99 students, staff, faculty and ISU alumni will attend presentations of the papers submitted to the conference. A detailed agenda of the presentations and speakers will be published prior to the start of the conference.

Questions concerning the Alumni Conference and the Alumni Weekend can be directed to: ISUAlu99@ccs.sut.ac.th

Poster Session

Poster sessions, in general, involve displaying ideas and concepts on paper. All relevant information about a topic is summarized and arranged to fit on a poster board which is approximately 20 by 30 inches (50 by 76 cm). The posters are then exhibited in a display area. Hands-on demonstrations and other forms of interactive displays are encouraged and can be conducted. During the Poster Session, the person stands beside his/her poster to explain the work and to answer questions as the other students, staff, faculty and alumni walk through the display area.

Held in conjunction with the Alumni Conference, the Poster Session gives students, faculty, staff and alumni a chance to discuss their work and research projects and to interact with other participants working in the same field. It also provides the opportunity to learn more about associates from around the world.

Students, faculty, staff and alumni all are invited to participate in giving a poster. Those who plan to participate should bring the relevant materials with them to the Summer Session.

Departmental Activity Day

A day is set aside during the second half of the program to allow departments more flexible time to do activities with their students. Often the departmental activity day involves a visit to a local institution which does research or work in the department's discipline. The specific activities vary based on the available local resources.

Some examples of departmental day activities are:

- visiting local industry and companies
- one day field trip to an astronomical observatory
- robot building
- hands-on training of Geographical Information System (GIS).

English Tutorials

At scheduled times, language-help volunteers will be available to assist students having difficulty with English. Help will be provided for English in core lectures, specific help in English for essay questions in the exam, and help in student presentations and project essays. It is up to the individual student to take the initiative to make use of these opportunities as well as to contribute whenever one's expertise is needed for the benefit of other students.

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The preceding sections are intended to help students to approach each component of the academic program with the appropriate expectations so that they can get the maximum benefit. Many former students have commented that what one gets out of the experience is directly proportional to what one puts into it. Students are strongly encouraged to contribute their own knowledge, experience, ideas, and opinions as well as their energy and enthusiasm.

The academic program has evolved over the years and will continue to develop and change as space activity progresses and, in particular, in response to the needs of Summer Session students. Feedback from students is an important part of this process, and questionnaires are distributed at different stages of the program as one means of evaluating students' needs.

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Fields of Study and Academic Personnel

Information on lecturers is current at time of printing. Other invited lecturers are to be confirmed.

Updates to the SSP'99 schedule and curriculum can be found on the ISU Web Site
http://www.isunet.edu/Academic/SSP

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Space Systems Analysis and Design

The Space Systems Analysis and Design (SSAD) Department emphasizes the fact that the design of spacecraft, space missions, and entire international space programs all involve highly complex, integrated systems. The department emphasizes seeing the many pieces of these systems each as a part of a "big picture." It seeks to expand each student's vision as it illustrates the interconnection of space systems at multiple levels. The SSAD core lectures describe the nature of systems, and presents systems integration tools and processes which can be applied to spacecraft system engineering, mission design, and space program architecture. It utilizes the design of a human Mars mission as a capstone illustration of the core lecture materials. Workshops and visiting lectures explore specific real-world space system projects in coordination with the core lectures.

Personnel

Co-Chairs

Sheila Bailey
NASA Glenn Research Center

John Connolly
NASA Johnson Space Center

Michihiro Natori
ISAS, Japan

Joseph Pellegrino
Hughes Space and Communications, USA

Yutaka Kaneko
NASDA

Annalisa Weigel
Adroit Systems, Inc., USA

Lecturers

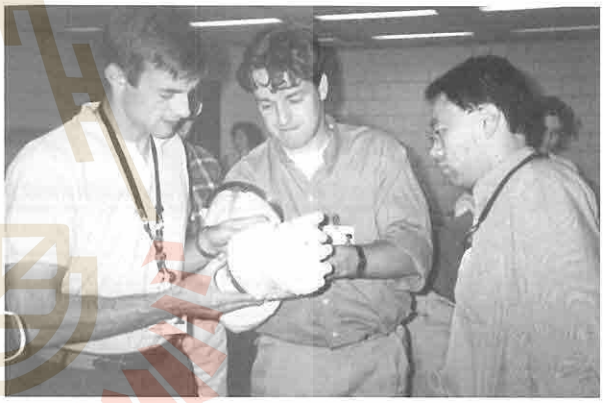
Suthee Aksornkit
KMIT, Thailand

David Bearden
Aerospace Corporation, USA

Peter Eckart
Technical University of Munich, Germany

Teaching Assistant

Isabelle Tremblay
Canadian Space Agency (SSP'98, Canada)



Space Systems Analysis and Design Schedule Overview

Core Curriculum

1.01	Nature of Systems	Connolly	*2 July*
1.02	From Requirements to Reality	Connolly	*9 July*
1.03	Space Mission Design	Connolly	*16 July*
1.04	Decision Making Process	Bailey	*20 July*
1.05	Mars Mission Design	Bailey	*23 July*

Theme Blocks

Block 3	Space Architecture	*7 August*

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Space Business and Management

The business and management aspects of space projects and programs are examined in this department. In the core lectures, the basics of such topics as management techniques, financing, cost estimation, risk management and business planning are presented and then illustrated with examples. Specific management tools are covered with the aim to provide students with the practical capability needed to effectively manage projects in today's space world. Students are also introduced to both the economics of, and the contractual aspects of, space activities. During the workshops, specialized lectures and theme days, these areas are further developed and augmented through the use of case studies. Departmental students will get additional hands-on experience applying these space business and management tools and techniques while preparing a bid in response to a Request for Proposals.

Personnel

Co-Chairs

Stefano Fiorilli
European Space Agency

Christian Sallaberger
Canadian Space Agency

Faculty

Patrick Cohendet
Université Louis Pasteur, France

Juan de Dalmau
European Space Agency

Lecturers

Philippe Charest
Lockheed-Martin, USA

Jingiai Hanchanlash
Loxley Public Company Ltd., Thailand

Mark Matossian
Teledesic, USA

Olivier Meert
European Space Agency

Shunji Murai
STAR Program, Asian Institute of Technology, Thailand

Ichiro Nakatani
ISAS, Japan

Teaching Assistant

Gongling Sun
COSTIND (SSP'98, China)

Space Business and Management Schedule Overview

Core Curriculum

2.01	Economic Rationale for Space Activities	Cohendet	*29 June*
2.02	Management of Space Projects	Sallaberger	*1 July*
2.03	Business Structures and Planning	Sallaberger	*5 July*
2.04	Financial Issues and Techniques	Sallaberger	*15 July*
2.05	Cost Estimation and Risk Management	Sallaberger	*16 July*
2.06	New Economic & Industrial Development in Space Activities	de Dalmau	*23 July*

Theme and Specialized Lecture Series Blocks

Block 1	Management of Space Projects	*4-5 August*
Block 3	New Trends in the Financing of Space Activities	*7 August*

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Space Engineering

Courses in the Space Engineering department expose and illuminate the fundamental concepts of on-orbit space vehicles and their associated ground and launch systems.
The engineering elements of these systems, including configuration, structure, power, thermodynamics, propulsion, navigation, guidance, control and electronics are explored. In addition, the topics of orbital mechanics and the impact of the space environment on spacecraft design are discussed. Using examples of existing and proposed space vehicles, students are familiarized with design and construction of large-scale space engineering projects. Departmental discussions will address approaches for spacecraft design and the engineering aspects of manned and unmanned space flight. The workshops will focus on expanding the concepts introduced in the lectures in an interactive way. Space Engineering lectures will be coupled with and complimentary to lectures and workshops presented by the departments of Space Systems Analysis & Design, Space Resources, Robotics & Manufacturing and Satellite Applications.

Personnel

Co-Chairs

Tarik Kaya
NASA Goddard Spaceflight Center, ISU Strasbourg

Masamichi Shigehara
Tokyo Metropolitan Institute of Technology, Japan

Faculty

Angie Bukley
Aerospace Corporation, USA

Dennis Irwin
Ohio University, USA

Lecturers

Cyril Bardi de Fourtou
Matra Marconi Space, France

Victor Bensimhon
SNECMA, France

Philippe Berthe
Aérospatiale, France

Juan de Dalmau
European Space Agency

Daniel Dumbacher
NASA Marshall Space Flight Center

Debra Facktor Lepore
Kistler Aerospace Corporation, USA

Amy Gerson
Boeing Commercial Space Company, USA

Tomonao Hayashi
Chiba Institute of Technology, Japan

James Koppersmith
Analytical Graphics, Inc., Malaysia

Norikazu Maeda
Rocket System Corp., Japan

Ichiro Nakatani
ISAS, Japan

Brian Rishikof
LinCom Corporation, USA

Franceska Schroeder
Winthrop, Stimson, Putnam & Roberts, USA

Jozef van der Ha
Consultant, Germany

Teaching Assistant

Fang Yang
(SSP'98, China)

Space Engineering Schedule Overview

Core Curriculum

3.01	Introduction to Astrodynamics	Kaya	*30 June*
3.02	Space Propulsion Systems	Kaya	*5 July*
3.03	Space Transportation Systems	Kaya	*7 July*
3.04	Spacecraft Configuration	Kaya	*8 July*
3.05	Payload Design	Bukley	*12 July*
3.06	Environmental Control	Bukley	*13 July*
3.07	Spacecraft Structures	Bukley/Irwin	*13 July*
3.08	Thermal Control and Power Systems	Kaya	*16 July*
3.09	Guidance, Navigation, and Control	Irwin	*21 July*

Theme and Specialized Lecture Series Blocks

Block 1	Smaller, Faster, Better Approach for Space Missions	*4-5 August*
Block 4	Access to Space	*10 August*

Space Life Sciences

The Space Life Sciences department examines the physiological and psycho-sociological changes which are unique to spaceflight and planetary exploration, and the challenges these present to mission success. Courses examine both basic science issues such as the effects of gravity on living organisms and the difficulties of performing controlled space experiments, and applied aspects such as space operational medicine, countermeasures to prevent human functions deconditioning, and human requirements for extra-vehicular activities and life-support systems.

Personnel

Co-Chairs

Susanne Churchill
Harvard Medical School, USA

Gilles Clément
Centre de Recherche Cerveau et Cognition, France

Inessa Kozlovskaya
Institute for Biomedical Problems, Russia

Faculty

Douglas Hamilton
KRUG Life Sciences, USA

Jeffrey Jones
NASA Johnson Space Center

Didier Schmitt
European Space Agency

Lecturers

Antonio Guell
CNES

Eugene Ilyin
Institute for Biomedical Problems, Russia

Teaching Assistant

Patrick Sullivan
Canadian Space Agency (SSP'93, Canada)

Space Life Sciences Schedule Overview

Core Curriculum

4.01	Introduction to Space Life Sciences	Churchill	*30 June*
4.02	Cardio-Vascular Physiology	Churchill	*6 July*
4.03	Bone and Muscle Physiology	Churchill	*8 July*
4.04	Medical and Psychological Issues of Spaceflight	Clément	*13 July*
4.05	Neuroscience	Clément	*14 July*
4.06	Space Biology	Clément	*21 July*

Theme and Specialized Lecture Series Blocks

Block 6	International Space Station	*14 August*

Space Policy and Law

The aims of the Policy and Law department are twofold. First, to consider the role of politics and policy in shaping current and future civilian space activities, and second, to examine the international legal framework within which space activities must operate. A general overview is given of both the objectives that have led various countries to develop space capabilities, and the capabilities of exemplary space programs that have subsequently developed. Major policy issues facing global space activities are also addressed. The international legal framework is examined through international agreements adopted by the United Nations and its specialized agencies. An overview is given of the international regulation of satellite applications such as remote sensing and telecommunications, as well as of the implications of commercial uses of space, notably impediments to transfer of technology. It is the intent of the Policy and Law department to have students derive a better understanding of the externally determined parameters that shape the environment within which space scientists and engineers must operate.

Personnel

Chair

Paul Henry Tuinder
European Commission

Ray Williamson
Space Policy Institute, George Washington University, USA

Faculty

Joan Johnson-Freese
Asia Pacific Center for Security Studies, USA

Walter Thiebaut
European Space Agency

Lecturers

Prachuab Chaiyasan
Ministry of University Affairs, Thailand

Caroline Guillon
CNES

Bertrand de Montluc
CNES

Richard Obermann
House of Representatives, USA

Teaching Assistant

To Be Determined

Space Policy and Law Schedule Overview

Core Curriculum

5.01	Rationale for Space Programs	Williamson	*29 June*
5.02	Policy Issues and Major Space Powers	Williamson	*30 June*
5.03	Principles of International Space Law	TBD	*5 July*
5.04	Legal & Economic Aspects of Space Commercialization	TBD	*15 July*
5.05	Organization of Space Activities	Williamson	*19 July*
5.06	National Space Programs I	TBD	*19 July*
5.07	National Space Programs II	TBD	*20 July*
5.08	Legal Aspects of Space Applications	TBD	*22 July*

Theme and Specialized Lecture Series Blocks

Block 2	Earth Observation for Tropical Countries - Access, Distribution, Uses and Policies	*6 August*
Block 5	Space Technology and Cooperation for Developing Worlds including Space Education	*11 & 13 August*

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Space Resources, Robotics and Manufacturing

The Resources, Robotics and Manufacturing department examines our present capability to locate, study, collect, process and exploit non-terrestrial resources for practical uses in space (such as in energy generation, construction and in-situ fuel production) and Earth-bound applications (experimentation and production of new materials). The manufacturing and processing of materials and experimentation in a microgravity environment is covered with current state-of-the-art in hardware, and basic theories of fluids and materials behavior in space. The use of automation and robotics to gather and use these resources, along with the use of space robotics for construction and exploration, will also be studied. Using case studies and laboratory work, it will become evident how these three areas are interlinked. The relationships between Resources, Robotics and Manufacturing, and the other space disciplines, will also be studied. Workshops will take place for hands-on involvement in robotics, micro-gravity experiments and other related topics.

Personnel

Co-Chair

Gregg Maryniak
X-Prize Foundation, USA

David Miller
KISS Institute for Practical Robotics, USA

Lecturers

James Burke
NASA Jet Propulsion Laboratory

James Dator
University of Hawaii, USA

Rajiv Desai
USA

Joan Johnson-Freese
Asia Pacific Center for Security Studies, USA

David Kendall
Canadian Space Agency

David Lavery
NASA Headquarters

Ichiro Nakatani
ISAS, Japan

Kazuya Yoshida
Tohoku University, Japan

Teaching Assistant

To Be Determined

Space Resources, Robotics and Manufacturing Schedule Overview

Core Curriculum			
6.01	Design and Control of Space Robots	Miller	*2 July*
6.02	Application and Command Strategies for Space Robots	Miller	*5 July*
6.03	Microgravity and Fluid Dynamics	Miller	*7 July*
6.04	Space Resources and the Breakout into Space	Maryniak	*13 July*
6.05	Long Term Implications of Space Resources	Maryniak	*14 July*
6.06	Space Power for Earth	Maryniak	*21 July*
Theme and Specialized Lecture Series Blocks			
Block 6	Robot Mission Design		*14 August*

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Satellite Applications

Access to space can provide practical benefits to all humankind. The ISU Satellite Applications department examines the various useful applications offered by our access to space, primarily through Earth-orbiting satellites and their associated ground infrastructure. One of the most important areas of focus is on telecommunications and the many types of new satellite telecommunication systems. The other key area of focus is on Earth remote sensing, environmental and weather satellites, Global Positioning Systems (GPS) other specialized telemetry systems such as Cospas/SarSat, ARGOS, and Geographic Information Systems (GIS). The enabling technologies, applications, and scientific benefits are all considered to be equally important. The development, use, and future of telecommunications technologies, the fundamentals and physics of remote sensing, data acquisition and analysis methods, and use of geographic information systems are all important areas of interest. Visits to local telecommunications and remote sensing facilities and hands-on activities are an important aspect of our department activities.

Personnel

Co-Chairs

Scott Madry
University of North Carolina at Chapel Hill, USA

Shunji Murai
STAR Program, Asian Institute of Technology, Thailand

Faculty

Michel Bousquet
SUPAERO, France

Daniel Glover
NASA Glenn Research Center

Manu Omakupt
Suranaree University of Technology, Thailand

Vern Singhroy
Canadian Center for Remote Sensing, Canada
ISU Strasbourg

Lecturers

Lim Hock
CRISP, Singapore

Kiyoshi Honda
ACRoRS, Asian Institute of Technology, Thailand

Takashi Iida
Communications Research Laboratory, Japan

James Koppersmith
Analytical Graphics, Inc., Malaysia

Mark Matossian
Teledesic, USA

Teaching Assistant

Alexander Liess
(SSP'98, Austria)

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Satellite Applications Schedule Overview

Core Curriculum

7.01	Intro. to Satellite Applications & Remote Sensing	Madry	*1 July*
7.02	Telecommunications I	Glover	*6 July*
7.03	Telecommunications II	Glover	*8 July*
7.04	Space Remote Sensing – Payloads & Platforms	Madry	*12 July*
7.05	Global Navigation Satellite Systems	Madry	*21 July*
7.06	Digital Image Processing	Madry	*22 July*
7.07	Geomatics and Global Modeling	Madry	*22 July*

Theme and Specialized Lecture Series Blocks

Block 1	Advanced Telecommunications	*4-5 August*
Block 2	Earth Observation for Tropical Countries - Access, Distribution, Uses and Policies	*6 August*

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Space Physical Sciences

The Space Physical Sciences department covers the basic principles of space physics and astronomy. This includes an introduction to: the electromagnetic spectrum; plasma physics; the geospace environment; the nature, composition and evolution of our solar system; and stellar, galactic and extragalactic astrophysics. Student/Faculty Workshops will emphasize two hands-on activities. In previous years, each student has built his/her own very low frequency (VLF) radio receiver followed by taking measurements in the field and analyzing the data. These VLF receivers measure both man made and natural radio emissions from the earth and its magnetosphere. The students have also learned how to use the Internet to find information and data relating to the space environment. Of special interest will be two interdisciplinary theme lecture series given in conjunction with other departments. These themes will include discussions on space weather, the effect of solar particle events on the terrestrial environment and human spaceflight, as well as a series exploring our scientific understanding and fascination with the Moon and Mars.

Personnel

Chair

Mikhail Marov
Keldysh Institute/ Academy of Science, Russia

Faculty

Giovanni Fazio
Harvard Smithsonian Center for Astrophysics, USA

James Green
NASA Goddard Space Flight Center

David Kendall
Canadian Space Agency

Wendell Mendell
NASA Johnson Space Center

Sheila Bailey
NASA Glenn Research Center

Peter Eckart
Technical University of Munich, Germany

James Koppersmith
Analytical Graphics, Inc., Malaysia

David Lavery
NASA Headquarters

Gordon Rostoker
University of Alberta, Canada

Richard Vondrak
NASA Goddard Space Flight Center

Lecturers

Fernand Alby
CNES

James Burke
NASA Jet Propulsion Laboratory

Teaching Assistant

James Manners
(SSP'98, UK)

Space Physical Sciences Schedule Overview

Core Curriculum

8.01	Electromagnetic Spectrum	Green	*1 July*
8.02	The Plasma Universe	Green	*6 July*
8.03	The Sun and the Heliosphere	Green	*9 July*
8.04	Solar System I	Marov	*14 July*
8.05	Our Universe	Fazio	*19 July*
8.06	Solar System II	Marov	*20 July*
8.07	Birth, Evolution, & Death of Stars	Fazio	*23 July*

Theme and Specialized Lecture Series Blocks

Block 4	Moon-Mars	*10 August*
Block 5	Space Weather	*11 & 13 August*

Space and Society

The Space and Society department addresses the meaning and significance of humankind's exploration of and expansion into the cosmos. Approaches from traditional humanities disciplines such as philosophy, history and literature as well as social sciences (anthropology, political science, futures studies, and sociology) are employed to ask why we are going into space and what impact space expansion is having on the human condition, as well as to think about the futures of our descendants in space.

Personnel

Co-Chairs

James Dator
University of Hawaii, USA

Ben Finney
University of Hawaii, USA

Faculty

Vladimir Lytkin
Tsiolkovsky Space Museum, Russia

Lecturers

Sheryl Bishop
University of Texas Medical Center, USA

Louis Laidet
CNES

Debhanom Muangman
Mahidol University, Thailand

Suriya Smutkupt
Suranaree University of Technology, Thailand

Teaching Assistant

Noel Siemon
(SSP'91, Australia)

Space and Society Schedule Overview

Core Curriculum

9.01	The Origins of the Space Age	Finney/Lytkin	*29 June*
9.02	The Space Flight Revolution	Finney/Lytkin	*9 July*
9.03	The Cosmicization of Humankind	Finney	*14 July*
9.04	Searching for Extraterrestrial Intelligence	Finney	*19 July*

Theme and Specialized Lecture Series Blocks

Block 1	Futures Studies and Space	*4-5 August*
Block 2	Space and Popular Culture	*6 August*

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Space Informatics Lecture Series

The lectures in Space Informatics will provide an overview of many current and future space-related data and information systems. These systems range in capability from providing rapid access to space acquired data through the International Master Directory to obtaining information about a space agency's strategic plans and policies. The latest computer-to-computer network tools and technologies supporting the World Wide Web will be covered as they are used in space informatics. Use of many of these network tools to access a number of information systems and databases will be covered in the hands-on sessions. The data and information systems used by a number of missions will also be discussed. These systems are extremely important in providing a cost effective way to process, distribute, and archive large amounts of space data.

Coordinator

James Green
NASA Goddard Space Flight Center

Space Informatics Schedule Overview

Core Curriculum

10.01	Space Informatics I	Green	*28 June*
10.02	Hands-on Session during the following Student/Faculty Workshop Times		
	Student/Faculty Workshop 4	Green	*7 July*
	Satellite Applications, Space Physical Sciences, Space Business & Management, Space & Society		
	Student/Faculty Workshop 5	Green	*7 July*
	Space Systems Analysis & Design, Space Engineering, Space Life Sciences, Space Policy & Law, Space Resources, Robotics, & Manufacturing		
10.03	Space Informatics II	Green	*12 July*

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Design Project:
Disaster Management in Southeast Asia

Each year, natural disasters including horrific storms, volcanoes, flooding, earthquakes, droughts, infestations, and crop diseases inflict death, injury or displacement upon tens of thousands of individuals and cause untold damage to the environment, property and infrastructure around the planet. Homes are lost as are the livelihoods of many of those affected. Indeed, the trend of losses, deaths and injuries caused by disasters has been increasing almost exponentially since statistics have been kept. For a graphic illustration of the situation, one need only think back to late summer of 1998 when a ferocious hurricane ravaged Honduras and Nicaragua. Hurricane Mitch set these countries back decades in development. The region of Southeast Asia is particularly vulnerable to the destructive powers of major natural disasters, in particular flooding and volcanic activity. It is on this area of the world and the hazards that plague the region that this design project will focus.

Many of the losses imposed by the occurrence of natural disasters could be prevented or reduced if information regarding the onset and course of such disasters were better known and communicated. There has been over the last ten years a growing realization that hazard and disaster management is a interdisciplinary, international, and interagency endeavor that spans all levels of government and involves at some stages in the process many non-government organizations, national as well as international, and ultimately reaches each and every person affected. It is not simply a problem of the application of technology. It is, in fact, very significantly a political, organizational, legal and policy problem and one that encompasses some very real human issues. Natural disasters do not recognize political boundaries. Governments of countries that are not necessarily on the best of terms must cope with major disasters that transcend their borders. The displaced and injured must be fed, provided medical care and sheltered. After the brunt of the event is over, recovery begins and often goes on for many years after the damage is done. Multiple agencies, governments and charity operations are always involved in responding to disasters, each with its own method of conducting relief efforts and often without the benefit of communications amongst themselves. There must be a better way of doing things.

It will be the challenge of this Design Project Team to contrive an effective means to deal with the primary natural disasters that effect the region of Southeast Asia. All four major areas of hazard and disaster management will be considered, including preparedness, mitigation, response, and recovery. Drawing upon information derived from the guidance of the DP co-chair, invited experts, and their own research, members of the team will assess which two natural disasters cause the most death and destruction in the region. Existing resources, including organizational structures, of the countries affected will be assessed and analyzed as to the degree to which they can be leveraged to reduce the damage imparted by the natural disasters selected. Once the existing situation and potential applicable assets in the region have been assessed, the team will proceed to develop a strategy for accomplishing the goal of this design project – the design of an effective disaster management system that reduces the overall impact of natural hazards on the lives and property of the inhabitants of the region. A project organizational structure will be established, schedules developed and work done to develop the final product of this project. A clear and concise written

report that might serve as the starting point for actual implementation of such a system in Southeast Asia will be the product of the effort.

Leveraging information gathered in the SSP Core Lectures (there will be many lectures directly applicable to this design project), as well as that garnered from visiting experts and additional research, the team will begin to assess which space technologies are applicable to this problem. The most obvious ones are remote sensing, the global positioning system (GPS), and on-orbit communications assets. In addition to space-based assets, the team will explore what can be done with airborne assets and the value-added of using combinations of space-based, airborne, and ground based systems. Should it be the case that assets to work the problem currently do not exist, it will be the job of the team to identify these gaps and propose new systems, executing to the level possible in the short time available, their designs to fill the requirements. The team will then address the issue of how the data collected from the various systems are analyzed and converted into usable information by people providing preparation, mitigation, or relief on the ground. It is not a significant technical challenge to collect data. A major challenge comes in understanding what information can be derived from the data and what information is required by and is useful to the disaster management community. It will be part of the design project effort to discover exactly what information is required and in what form and to whom it should be provided to effectively implement a disaster management system.

A crucial issue for the team to consider will be the coordination of efforts to use such data and information in emergency situations. Rapid decision making has often proved difficult because several countries and many agencies may be involved. In most cases appropriate institutions have not been developed to respond quickly and efficiently to the effects of natural disasters. Without institutions in place to collect and coordinate research and response, the information that advanced space and computing technologies provide will be useless in planning for and responding to natural disasters. Hence, an important aspect of this project will be the crafting of innovative and appropriate regional institutions to provide needed humanitarian response and adequate planning for disasters.

Probably the most limiting factors for an effective disaster management scheme are organizational structure and communications. Broad sharing of scientific and applications data and information is a crucial component of successful detection, monitoring and response. Policy issues in international sharing of applicable information must be examined. Information sharing and standardization in the region are tools that are vital to addressing natural disasters in all phases. The design project will also explore the various possible institutional mechanisms for gaining access to space data and integrating these with other information to assist in preparing, predicting, and responding to natural hazards. Focus will also be placed on determining which groups would be the ultimate end users of the information derived.

Crafting innovative methods to reduce the risks of natural hazards, indeed – preventing them from becoming natural disasters, among the diverse cultures and political institutions of Southeast Asia will challenge the creative energies of the ISU students who are on this design project team. Complex scientific, technological, economic, social and policy aspects must be studied and considered, making ISU an ideal venue for tackling these issues. The results of

this project could serve as a model for addressing similar problems in other regions of the world. All Departments in the ISU SSP will provide information relevant and useful to this project. The design project on Disaster Management in Southeast Asia will focus on producing comprehensive and technically feasible solutions that reduce the risk of natural disasters to the people of Southeast Asia.

The team will execute the following:

- Collect and document current activities and research undertaken in Southeast Asia regarding Disaster Management
- Review the needs of the region, and then critically assess if and how these needs have been met
- Conduct an end-to-end analysis of the means (space-based, airborne, ground-based, hardware & software, legal, political, and institutional) required to meet the needs, effectively including the end-user requirements, such as education and familiarization, in the analysis
- Critically assess existing means and their potential applicability
- Conceive a realistic process and organization chart for Disaster Management in the Southeast Asia region
- Identify areas of overlap and missing pieces
- Propose an implementation scheme, taking into account what exists and other constraints (political, ethical, religious) to meet the needs and eliminate the gaps identified
- Document findings, proposed system configuration and recommendations for future work in a clear, concise report.

Personnel

Co-Chairs

Angie Bukley
Aerospace Corporation, USA

Vern Singhroy
Canadian Center for Remote Sensing, Canada
ISU Strasbourg

Erik Slachmuylders
European Space Agency

Faculty

James Burke
NASA Jet Propulsion Laboratory

Joan Johnson-Freese
Asia Pacific Center for Security Studies, USA

Shunji Murai
STAR Program, Asian Institute of Technology, Thailand

Lecturers

Lukman Aziz
Bandung Institute of Technology, Indonesia

Francis Canisius
ACRoRS, Asian Institute of Technology, Thailand

Lim Hock,
CRISP, Singapore

Kiyoshi Honda
ACRoRS, Asian Institute of Technology, Thailand

Mona Lacoul
ACRoRS, Asian Institute of Technology, Thailand

Louis Walter
NASA Headquarters

Teaching Assistant

Alain Suskind
(SSP'93, Belgium)

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Design Project: *Strategies for Human Exploration Away from Earth*

In the ISU Summer Session of 1999, at Suranaree University of Technology, a student team will conduct a design project intended to explore and advocate options for human flight beyond low Earth orbit. The team will determine possible ways to energize and execute precursor activities and will arrive at findings intended to aid program decisions. A key aspect of the project will be to develop strategies for engaging needed public support, not only in the nations presently pursuing human spaceflight but also in regions hitherto excluded from participation.

Given this general goal of sending humans on voyages beyond the realm of low-Earth orbiting space stations, several main pathways are available. Should people settle the Moon and, by living there over a period of time, develop public acceptance of the idea that humanity's place is not just on Earth but also in the cosmos? Or would such a development cause unnecessary delays on the road to farther ventures such as exploiting asteroid resources or exploring Mars? Or should a free-flying space station be established high in the outer parts of Earth's gravity well, when other exploitations could later proceed? These choices involve many subtle and complex trade-offs, not just in engineering and management but also in the realm of public interest, international politics and policy.

Experience has shown that this problem isn't treated successfully with any one country or agency. In the US, for example, no political consensus has emerged to support any human spaceflight beyond the International Space Station (ISS), whose successful construction and operations are regarded as essential prior proofs that NASA and the international partners can deliver on their promises. In other countries the problem is even farther from becoming the subject of a full public debate. Thus there is a need for an objective, critical assessment of the program possibilities, including plans for scientific and engineering activities preceding commitment to large human flight efforts.

These precursor activities are of several kinds. Scientific, robotic flight missions can serve not only to answer questions affecting later decisions, but also to sustain and enhance contemporary public interest in the program. Engineering precursors, including those intended to validate technology, check for environmental hazards and certify human performance under realistic stresses, all are parts of the lead-in to a future combining human and robotic explorations.

The ISU 1999 Summer Session design project team will have access to planning data from existing efforts such as that of the NASA Johnson Space Center, where a Mars reference mission architecture is maintained as a guide for human-exploration trade-off studies.

The project team will produce a carefully thought out program of research and development, precursor missions, and human ventures beyond low Earth orbit. The results will be independent of existing agency views while recognizing world budget realities and containing options for a variety of possible future public preferences.

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The team will do the following:

- Describe what are the drivers for human exploration away from Earth.
- Collect and document current information on world activities in the field of human flight beyond low Earth orbit, including studies and proposals for missions to the Moon, near-Earth asteroids, and Mars.
- Critically assess current efforts, particularly in regard to their generation of public support for the initial steps in each proposed program.
- Identify gaps and overlaps. Determine why certain entities, with applicable but unused capabilities, are not involved in planning and recommend means for bringing them in.
- Define a candidate robotic precursor mission which will provide information which will be useful as a stepping stone to the human exploration; develop a program plan for this mission which will make use of international capabilities; and make an engineering design for this mission.
- Derive technology development, funding, and policy requirements for each of the selected mission sets.
- Identify possible sources of contributions, emphasizing those from places where, up to now, relevant capabilities have existed but not been applied to this problem. Because of the location of the 1999 Summer Session this part of the project should concentrate on Asia.
- Document findings and recommendations intended to assist planners in many countries when they start trying to gain public support for, and begin executing projects in this grand human adventure.

Personnel

Co-Chairs

Victor Bensimhon
SNECMA, France

Geoffrey Landis
Ohio Aerospace Institute, USA

Faculty

Wendell Mendell
NASA Johnson Space Center

David Miller
KISS Institute for Practical Robotics, USA

Lecturers

Augustin Chicarro
European Space Agency

Peter Eckart
Technical University of Munich, Germany

David Lavery
NASA Headquarters

Ichiro Nakatani
ISAS, Japan

Teaching Assistant

Caroline De Vos
(SSP'98, Belgium)

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Mon., 28 June 1999

10.01 Space Informatics I
Green 16:00

This lecture provides an overview of world-wide computer networks and network usage techniques. The latest computer-to-computer network tools and technologies such as Web browsers, ARCHIE, and Gopher servers will be discussed. An understanding of these tools is necessary to understand how current space-related data and information systems are organized and accessed. These systems range in capability from providing rapid access to space acquired data through the International Master Directory to obtaining information about a space agency's strategic plans and policies.

Tue., 29 June 1999

9.01 The Origins of the Space Age
Finney/Lytkin 9:00

This lecture introduces the humanities approach to space issues by examining the development of the theory of spaceflight by Konstantin Tsiolkovsky (1857-1935), Robert Goddard (1882-1945), and Herman Oberth (1894-1989), outlining their achievements, and inquiring into the historical and motivational background of their efforts. It explores the philosophical dimensions of the question of why we seek to expand into space by focusing on what led Tsiolkovsky, a provincial Russian schoolteacher, to be the first to work out how humans could leave the pull of Earth's gravity, and on how Tsiolkovsky's thinking was part of "Russian Cosmism," a late 19th and early 20th century Russian intellectual movement in which philosophers, historians, religious leaders, and poets, as well as scientists such as Tsiolkovsky, explored the role of humankind in the cosmos.

5.01 Rationale for Space Programs
Williamson 10:45

This lecture begins with a broad overview of the world's space activity and traces the security, political, technological, scientific, social and economic objectives that led various countries to develop space capabilities.

2.01 Economic Rationale for Space Activities
Cohendet 14:00

Why do tax payers put money in space projects? What are the spin-offs from space projects? How do space agencies justify their budgetary existence to their funding governments, in light of competing terrestrial needs? This lecture examines these and related issues.

Wed., 30 June 1999

5.02 Policy Issues and Major Space Powers
Williamson 9:00

Government policy sets the stage for national space activity. This lecture discusses policy issues of concern to space powers and examines the decision-making processes through which those issues are addressed. The lecture is supplemented by printed fact sheets on the objectives, organizations and programs of major space organizations.

4.01 Introduction to Space Life Sciences
Churchill 10:45

This introductory lecture will take you on a hypothetical space voyage to introduce the many ways in which space flight affects the human body. We will start with a brief consideration of the hazards the space environment poses (radiation, vacuum, extreme temperatures, and microgravity), progress to the "typical" flight mentioned above, and end with

an historical review of human space flight as a means of providing a perspective on what may be possible for the future.

3.01 Introduction to Astrodynamics

Kaya 15:00

Astrodynamics underlies all the dynamic aspects of the orbital motion of a satellite. Newton's laws of motion provide us with the theoretical framework to describe spacecraft paths through space called orbits and trajectories. This lecture presents the two-body problem, the classical orbital elements, and describes typical orbits around the Earth, and trajectories to other planets of the solar system. The orbital perturbations and maneuvering strategies used to change a satellite orbit are also briefly discussed.

Thu., 1 July 1999

8.01 Electromagnetic Spectrum

Green 9:00

This lecture will provide an introduction to the electromagnetic spectrum, which includes radio, infrared, optical, ultraviolet, x-ray, and gamma radiation. We will discuss the characterization of radiation both as waves and as particles. We will present the concept of blackbody radiation and discuss absorption and emission mechanisms, along with other interactions with matter. We will show how the use of spectroscopy provides scientists information about the temperature and composition of stars.

7.01 Introduction to Satellite Applications and Remote Sensing

Madry 10:45

Remote Sensing is defined as the art, science, and technology of obtaining reliable information about physical objects and the environment by recording, measuring, and interpreting photographic or digital images. Many remote sensing systems exist and are used for a variety of purposes. Remote sensing uses imagery acquired with a sensor such as by electromagnetic scanning, or systems using electromagnetic radiation outside the normal visual range – microwave, radar, thermal infrared, and ultraviolet, as well as multispectral (using several wavelengths). These digital data can be manipulated in a variety of ways to conduct a wide variety of investigations. Much of what we know about the Solar System, the Moon, and the Earth is learned through the use of various remote sensing systems. Topics to be discussed include the definition and advantages of remote sensing, basic remote sensing elements, a history of remote sensing activities and applications, and a description of spatial, temporal, radiometric, and spectral resolution. Remote sensing technologies have been widely applied on the Earth in a variety of scientific and commercial applications. This lecture will cover the many civilian uses of remote sensing, including applications in forestry, agriculture, oceanographic, hydrology, geology, oil and resource exploration, meteorology, mapping and cartography, and ecology. This lecture builds upon the introduction to the Space Physical Science department lecture on the electromagnetic spectrum which precedes it, which covers the basic radiometric terms and units of measurement, blackbody and line radiators, radiation laws (Planck's, Wein's, and Stefan-Boltzman's), absorption, reflection and refraction laws, spectral reflection signatures, atmospheric scattering.

2.02 Management of Space Projects

Sallaberger 15:00

This lecture will present the role of the space project manager, as well as the various tools used today for space

project management. Gantt Charts, PERT Charts, Critical Path Analysis, Work Breakdown Structures, and Earned Value Methods will be among those covered. Also discussed will be negotiation techniques, management of space technology development, and intellectual property management.

Fri., 2 July 1999

6.01 Design and Control of Space Robots

Miller 9:00

Space is an expensive and dangerous place for humans to work. The requirements for human presence in space can be reduced through the use of robots. This lecture covers the basics of robotics, and what separates robots designed to work in space from terrestrial robot systems. The six basic subsystems of space robots are described, as well as fundamentals in robot kinematics and dynamics. We show how all these pieces are integrated into a functioning system, suitable for use in space.

1.01 The Nature of Systems

Connolly 10:45

This introductory lecture challenges the students to begin observing the many and varied facets of aerospace as interconnected pieces of a large puzzle. A model will be presented which begins at the most compact space systems – individual spacecraft, and continues through levels of integration represented by space missions, and then by an entire architecture of space systems up to the socio-political environment. Throughout the presentation of this model, the student will be shown how integration is required at each of the various levels, and will be shown actual examples at each level. The lecture will also include examples of how different professions outside aerospace solve complex system problems.

Mon., 5 July 1999

5.03 Principles of International Space Law

To Be Determined 9:00

This lecture introduces the basic principles of international law applicable to space activities. These include the space law treaties, the law making process with respect to outer space, and the role of the United Nations Committee on the Peaceful uses of Outer Space and its resolutions. The lecture examines principles of registration, liability, responsibility, jurisdiction, and control. Finally, the status of space objects, astronauts, and celestial bodies are analyzed.

6.02 Application and Command Strategies for Space Robots

Miller 10:45

Robots can be used in space to service other spacecraft, run experiments in a space station, and explore the surfaces of distant planets and moons. This lecture describes the various applications of space robotic systems, and how different applications require different command strategies. The tremendous distances, and differing energy densities of different space environments effect how robots are constructed and operated. Mission goals and duration can also effect robot design. We will discuss the major types of robot control strategies: teleoperation, telepresence, programmed control and autonomous systems. Examples using these different strategies are given from a variety of space applications using robots in orbit, inside spacecraft and rovers for planetary surfaces.

2.03 Business Structures and Planning

Sallaberger 15:00

This lecture will begin by explaining the structure of a corporation. The formal roles of the board of directors, the shareholders, and the executive will be presented. The preparation of a business plan will also be examined in detail.

The distinction between debt and equity financing will be covered. The balance sheet, the income statement, and the cash flow chart are the financial statements commonly used in business planning and operation and will be introduced in this lecture.

3.02 Space Propulsion Systems

Kaya 16:45

There is no single technology more fundamental to space exploration than rocket propulsion. This lecture addresses rocket propulsion from the component to the system level. Basic principles of rocket propulsion are reviewed. Types of rocket motors and their performance are described. Propulsion subsystem selection, sizing, and integration are discussed in relation to the end use–Earth to orbit, orbit transfer, and other applications. Present and future generation propulsion systems are reviewed.

Tue., 6 July 1999

8.02 The Plasma Universe

Green 9:00

Almost all matter found in the Universe exists as a plasma (ionized particles). The study of space plasmas provides a link between the study of the Sun, the heliosphere, and solar-planetary physics with plasma astrophysics in general. This lecture will primarily discuss the basic properties of space plasmas. The knowledge we have gained through the study of space plasmas in the solar system will be reviewed and its relevance to many phenomena observed in the Universe will be examined.

4.02 Cardio-Vascular Physiology

Churchill 10:45

One of the major concerns for both short and long term space flight is the phenomenon of cardiovascular deconditioning. This lecture will introduce the principles of cardiovascular fluid and electrolyte control in order to better understand the symptomology typically reported by space travelers. Data from space flight experiments will be discussed as well as the value of ground based models such as bed rest, head down tilt and head out water immersion. The value of exercise, inflatable suits, saline loading and artificial gravity will be discussed.

7.02 Satellite Communications I – Telecommunications and the Space Segment

Glover 15:00

This introduction begins with an overview and brief history of telecommunications. It then addresses the role that satellite communication services and emerging new satellite systems have and will play in terms of global telecommunications systems of the 21st century. With this background, basic theoretical concepts of satellite communications are addressed with a focus on satellite networks. This includes an overview of the following: satellite communications systems and antennas, modulation and coding techniques, radio frequencies, different types of orbital configurations, and characteristics of satellite communications systems. There will be a brief consideration of satellite communications payload design objectives and major constraints to be overcome in satellite design. (Note: Since the design topics for the spacecraft "bus" used to carry the telecommunications payload is generic to various types of satellite systems such as remote sensing, meteorological, scientific, etc., those topics are covered in other lectures).

Wed., 7 July 1999

6.03 Microgravity and Fluid Dynamics

Miller 9:00

Gravity dominates most physical processes on the Earth. In the microgravity environment, forces and processes that might have only minor effects on Earth can become the main drivers behind how objects and fluids interact. The behavior of gasses and liquids under microgravity conditions affects almost all aspects of living, working, manufacturing in and moving through the space environment. This lecture will examine the physics of fluids in space and how the behavior of fluids in the microgravity environment affects biological, engineering and production processes.

3.03 Space Transportation Systems

Kaya 10:45

Once a mission is defined and a spacecraft is designed, the appropriate transportation system must be selected to place the spacecraft in the desired orbit or trajectory. In this lecture the basics of space transportation systems and the process for choosing the proper launch system for a particular space mission will be discussed. A complete survey of the world launch systems and their performance will be provided. In addition, launch system parameters and environments will be discussed.

Thu., 8 July 1999

3.04 Spacecraft Configuration

Kaya 9:00

The configuration, or final design of a spacecraft, results from accommodating and compromising all mission, and payload and spacecraft bus requirements into a single unit. The design drivers such as space environment; propulsion, power, thermal and attitude control subsystems; payload and spacecraft bus weight and size; and constraints derived from the launch vehicle are discussed. The design flow and related trade-offs are presented to show how the spacecraft configuration is defined.

7.03 Satellite Communications II – Ground Stations and Other Concepts

Glover 10:45

This lecture continues with a discussion of satellite communications services and the increasing importance of ground stations in moving toward mass consumer markets. These trends will be particularly addressed in terms of mobile satellite services, direct-to-the-home/DBS and multimedia services. The fundamentals of earth station technologies will be addressed. A discussion of various applications of satellite technology (especially the Internet) and examples of services will be given. Although these lectures are focused on satellite communications as an application of space technology, a brief discussion of spacecraft bus communication systems will be included.

4.03 Bone and Muscle Physiology

Churchill 15:00

Is the reported loss of bone mass which occurs during space flight self-limiting or does it continue? Is it permanent or is it reversible? Could the parallel loss of muscular strength and coordination jeopardize the return of piloted spacecraft or limit work capability and performance for surface operations on Mars? The lecture will examine the effects of space flight on structure and function of the musculo-skeletal system, what the implication of such changes might be for long duration exploratory missions and what countermeasures might be employed to prevent undesirable changes.

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Fri., 9 July 1999

9.02 The Space Flight Revolution

Finney/Lytkin 9:00

A new generation of brilliant engineers such as Werner Von Braun and Sergei Korolev actually translated theory into rockets capable of reaching space. This spaceflight revolution was accelerated by bitter international rivalries. Wars "hot" and "cold" drove first Germany and then the United States and the Soviet Union to apply massive amounts of money and resources to develop rockets to carry warheads to distant targets. Continued Cold War competition then led the US and the USSR to seek international prestige by employing their rocket technology and resources for space exploration. Now that these rivalries and the massive expenditures they spawned have subsided, is the spaceflight revolution over? Have we entered into an era of slower-paced, "normal" technological development driven more by commerce and science than national rivalry and competition? If so, what material or spiritual goals might motivate us, perhaps on an international level, to once more focus our energies toward moving into space?

8.03 The Sun and the Heliosphere

Green 10:45

The Sun is of great scientific interest, both because of the effect it has on our planet and because it is a convenient star for observation. The structure of the Sun is being probed by observing the neutrino flux from its interior and by oscillations of its surface. New helioseismic results from the SOHO spacecraft are changing our understanding of the Sun. In astronomical terms, the Sun is not considered a variable star; but it does have dramatic cycles and sporadic eruptions that cause major space weather disturbances, disrupting spacecraft and even power transmission grids on the Earth. The heliosphere is the region of space around the Sun encompassing most of the solar system and is primarily composed of low and high speed solar wind plasma streams, magnetic fields, interstellar neutrals, cosmic rays, and very energetic particles which are produced during solar flares and coronal mass ejections. This lecture will discuss the structure of the Sun, the solar wind, and how the planets interact with the solar wind in the heliosphere.

1.02 From Requirements to Reality

Connolly 15:00

With the growth of large, international space projects, requirements have become an ever important first step in the process of achieving a desirable final product. The initialization of space projects first requires that the problem be documented – most often in the form of requirements. This lecture will discuss the skills required to separate out only the functional and performance parameters of the problem, and to avoid specifying implementations. A process will be presented for writing requirements, and frequent examples will be shown of good and bad requirements, and their ultimate effect upon the actual products delivered.

Mon., 12 July 1999

3.05 Payload Design

Bukley 9:00

In this lecture, the process of how to design and estimate the size and configuration of a payload for a space-based imaging mission will be addressed. The basic philosophy and fundamental principles for sizing the system to meet the given mission requirements and operating environment will be provided with a complete set of equations for subsequent use by the student. An overview of typical science and applications payloads will also be provided.

7.04 Space Remote Sensing - Payloads & Platforms

Madry 10:45

There are many civil remote sensing systems existing today, and many more are planned in the near future. What are these systems, how do they differ, and why are there going to be so many of them? This lecture will be an overview of such systems as Landsat, IRS-1, AVHRR, ERS-1, METEOR, JERS-1, SIR-C, EOS, Radarsat, etc. The difference between active (microwave) and passive systems will be discussed, and the advantages of each will be covered, as well as geosynchronous weather systems. New ultra-high resolutions commercial systems will also be discussed. Sensor design and data characteristics, including those of current, as well as future systems will be reviewed. There will also be a discussion of manned and man-tended systems, as well as the relative advantages and disadvantages of each. The impact of emerging and new technologies and their impact on unmanned, manned, and man-tended space activities will be covered.

10.03 Space Informatics II

Green 14:00

A brief overview will be presented of many existing and planned space data and information systems. How these information systems are organized, what data they contained, and how they are used to facilitate the conduct of space research will be emphasized. This lecture will also review the space information systems that the students uncovered during the hands-on sessions.

Tue., 13 July 1999

4.04 Medical and Psychological Issues of Spaceflight

Clément 9:00

This lecture will explore the medical challenges posed by spaceflight and the solutions currently planned to address them. What medical emergencies can be managed inflight, and which will require evacuation to Earth? This lecture will also emphasize the importance of mental and social well-being in the success of both short and long term space missions. What are the psychological and sociological issues which must be addressed, especially for international missions?

3.06 Environmental Control

Bukley 10:45

The functions collectively referred to as "life support" include providing and maintaining a comfortable and respirable atmosphere, providing food and water, and managing waste. Systems which provide these functions may use physical/chemical (e.g. pumps) or biological (e.g. plants) processes. Non-regenerative and regenerative life support functions, the technologies available to provide them, criteria used for making design decisions, and the engineering challenges in designing life support systems will be reviewed.

6.04 Space Resources and the Breakout into Space

Maryniak 15:00

The space resources sequence of lectures examines the resources available for use in space and the methods of utilizing these to provide for human needs. This first lecture presents the basic rationale for the use of space resources. The Copernican model of the solar system is augmented by the Gravity Well model as developed by Clarke and O'Neill. The relative energy required for lunar vs. terrestrial escape

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is provided by both mathematical and qualitative means. A summary of the categories of material resources available for use in the inner solar system is presented, with the major advantages and disadvantages of each. In addition to such considerations as delta-v requirements for transportation, the travel times, radio signal times, opportunities for the use of teleoperations, processing requirements and other factors are considered in comparing the relative merits of the various classes of nonterrestrial resource. New discoveries such as the lunar polar ice discovered by Lunar Prospector, near-Earth asteroids discovered by Gehrels and the recently discovered class of planetesimals between the orbits of Earth and Mars are considered.

3.07 Spacecraft Structures

Bukley/Irwin 16:45

The spacecraft structure is the main frame or skeleton that provides mechanical support to all spacecraft subsystems. It must endure environments from manufacture to different launch phases, and meet demanding requirements in the micro-gravity operational environment. A brief overview of the fundamentals of structural dynamics, elements and materials is presented. Preliminary design process is explained using examples. Spacecraft testing methods as an inherent part of the structural design activity are summarized.

Wed., 14 July 1999

4.05 Neuroscience

Clément 9:00

This lecture will review the effects of microgravity on the functioning of the sensory organs primarily used for the maintenance of equilibrium and spatial orientation. Disorientations and malaise so frequently encountered during early exposure to microgravity, and on return to Earth, due to misinterpretation of signals coming from these sensors, and non-adequate responses by the brain, will be described. Theories and actual data regarding the role of the central nervous system in the adaptation of sensory-motor functions (including the control of posture, eye movements, and self-orientation) to changing environmental gravity level will be explored. The value of predictive testing will also be examined.

8.04 Solar System I: Planets, Satellites, and Small Bodies

Marov 10:45

The major planets of the solar system fall into two categories: the solid terrestrial planets and the giant gaseous planets. Terrestrial planets but Mercury have atmospheres, while atmospheres of giant planets are their outer gas envelopes. Despite similarities within a category each planet exhibits unique characteristics. Most of satellites belong to the giant planets which possess also the systems of rings. Through a comparative planetology approach, we study various surface landforms and atmospheric phenomena on the terrestrial planets, which are related to geological and climatological processes to learn what has occurred, occurs or might occur on Earth. The environment of our solar system also includes asteroids (minor planets), comets, meteoroids, and meteor dust. Asteroids are mostly located in the asteroid belt between the orbits of Mars and Jupiter and in the Kuiper belt beyond the orbit of Neptune. The main family of comets populates the Oort Cloud at the very periphery of the solar system, The small bodies teach us about the processes which formed the solar system. Their debris resulted from collisional processes in space which impacted the Earth and were found on its surface; meteorites are our current samples of these primitive objects.

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6.05 Long Term Implications of Space Resources

Maryniak 15:00

This class has two distinct purposes. The first purpose is to explore the most important processes and systems for the processing of non-terrestrial resources into useful products. The second is to consider the long term capabilities enabled by the use of space resources and to examine the philosophical and ethical ramifications of the application of space resources.

9.03 The Cosmicization of Humankind

Finney 16:45

What has been the impact so far on humankind of space initiatives, and what might we expect in the future? Russian space philosophers have developed the useful concept of the "cosmicization of humankind" to stand for all the changes in the human condition that follow from our activities in space. This lecture explores the cosmicization process by examining the human implications of four successive levels of space development, one actual and three speculative: 1) the current situation; 2) a near future in which the Solar System is exploited by humans, but without any significant colonization; 3) an intermediate term future in which the Solar System has been colonized and we have become an inter-planetary species; 4) a distant future in which our descendants have spread to other star systems resulting in the diaspora of humankind through the Galaxy.

Thu., 15 July 1999

2.04 Financial Issues and Techniques

Sallaberger 9:00

This lecture will continue to develop the financial theme introduced in the previous lecture. Interest, inflation, and the cost of capital will be examined. Techniques such as Profitability Analysis, Present Worth, Internal Rate of Return, Equivalent Annual Worth, Payback Period, and Sensitivity Analysis will be covered. A discussion of sources of capital, obtaining financing, counter trade and currency risk will also be included.

5.04 Legal and Economic Aspects of Space Commercialization

To Be Determined 10:45

This lecture will discuss private space activities, including telecommunications, remote sensing and launching. Both the legal and business management aspects will be treated.

Fri., 16 July 1999

1.03 Space Mission Design

Connolly 9:00

Successful space mission design transfers mission requirements into descriptions of spacecraft, payload, launch vehicle, orbital dynamics, communications infrastructure, operations, and other segments required to meet these requirements. This lecture will present a methodology for performing both robotic and human space mission design. Building upon the initial core lectures, the student will be shown examples of the interaction among the segments of mission design, including actual examples of how both successful and unsuccessful designs have emerged from the design process.

2.05 Cost Estimation and Risk Management

Sallaberger 10:45

This lecture will cover both cost estimation of space projects and risk management for space projects. It will begin with an investigation of various methods for determining the cost of large scale space projects. Costing with parametric models, by analogy, and via engineering models will be covered.

The importance of life cycle costing will be discussed. The Risk Management topics of risk analysis, risk types, failure analysis, insurance, and risk mitigation and tracking, will be explained with a special emphasis on their role in space project management.

3.08 Thermal Control and Power Systems

Kaya 15:00

This lecture addresses two separate spacecraft systems. In the first part, the thermal control system is introduced. The function of the spacecraft thermal control system is to maintain the temperature of all the spacecraft components within acceptable operating limits. The basic physical principles of heat transfer that define this problem – radiative, conductive, and convective heat transfer – are reviewed. Active and passive system design strategies and practices are presented. Typical system elements are described. In the second part, the spacecraft power system, which provides electrical power for all planned functions of the payload and spacecraft subsystems, is presented. The design steps are presented starting with user requirements and constraints such as peak load, average load, duty cycle, lifetime, solar distance, eclipse duration, and voltage. Example design strategies and practices are presented.

Mon., 19 July 1999

8.05 Our Universe

Fazio 9:00

An overview of the properties of the Universe will be presented beginning at the planet Earth, continuing past the solar system, through our galaxy, and into extragalactic space to the edge of the known Universe. The origin, evolution, and structure of the Universe as well as its ultimate fate will be discussed.

9.04 Searching for Extraterrestrial Intelligence: A Competing or Complimentary Paradigm?

Finney 10:45

Are the dreams and schemes about expanding into space symptomatic of the hubris of a young, ignorant, and overconfident species? Advocates of the Search for Extraterrestrial Intelligence (SETI) consider that the Galaxy may already be populated with intelligent civilizations, and that we should expand our intellectual horizons by establishing radio communication with them rather than attempt the foolish if not impossible task of space colonization. Advocates of space colonization respond by posing the "Fermi Question" (if our Galaxy is already populated, why have we not seen any signs of the others?) and then answering it by saying that since we have not seen any such signs we must be alone in the galaxy and are therefore free to expand beyond our Solar System. This lecture explores SETI theory and the search now underway at radio astronomy observations around the world to detect electromagnetic signs of other civilizations, and points out that however contrasting the SETI and space colonization approaches may seem they are both examples of the growing cosmic consciousness of our species.

5.05 Organization of Space Activities

Williamson 14:00

This lecture examines the various governmental and non-governmental structures that have been developed to organize space activities. It examines both formal and informal structures, and explores the affects of using one form rather than the other. Examples are drawn from a variety of space disciplines, including science, applications and exploration.

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5.06 National Space Programs I

To Be Determined 15:45

Representatives present overviews of their countries' space programs. This lecture provides students with information about the programs in the context of public and private motivations and ambitions.

Tue., 20 July 1999

8.06 Solar System II: Origin and Evolution

Marov 9:00

This lecture will review current theory and observational evidence of one of the most fundamental problems of the natural sciences. Theories for the origin of the solar system must invoke astrophysical processes which were probably responsible for the current configuration of the Sun and the planets. Our current concepts are also based on the observed mechanical characteristics and cosmochemical data available. We assume that the formation of planets is a general process and that other planetary systems exist. Although there is a general understanding of the main sequence of events which produced the planets, involving the theory of condensation of solid bodies at different distances from the Sun, the details of various steps remain unclear. Observations of star-forming processes elsewhere in the universe is critical to resolve some of the uncertainties. The recent discovery of single planets around other stars gives us confidence that our situation is not unique, but we have yet to observe any other solar systems.

5.07 National Space Programs II

To Be Determined 10:45

Representatives present overviews of their countries' space programs. This lecture provides students with information about the programs in the context of public and private motivations and ambitions.

1.04 Decision Making Process

Bailey 14:00

Complex system design, such as the design of spacecraft, space missions, or entire space programs, require that many decisions be made to reduce the number of probable solutions to be studied, and to further reduce this to the single solution which can be implemented. Because of the many disciplines, companies, and countries that are involved in space projects, the process of decision making is often difficult and time consuming. This lecture describes methods for understanding and tracking the many variables of a complex system, and presents methods to study the variables individually or in small sets in order to arrive at a solution to the initial problem which optimizes the most important variables. Common decision making tools such as trade-off analyses, decision trees, and parametric analysis will be discussed in depth with many real world examples used to illustrate the use of decision making processes.

Wed., 21 July 1999

3.09 Guidance, Navigation, and Control

Irwin 9:00

Attitude control is the process of pointing a spacecraft in the desired direction. Guidance and navigation are the processes which work together to place and maintain a spacecraft in a desired inertial position. This lecture introduces the principles of attitude and orbital dynamics together with the basics of automatic control and feedback theory, and describes how they are applied to a spacecraft system to achieve mission goals. Typical attitude control examples such as spinning and 3-axis control systems are presented to illustrate the design approach, including subsystem selection and component sizing. In addition, sensor and actuator accuracy and its impact on overall system performance are discussed.

7.05 Global Navigation Satellite Systems

Madry 10:45

This lecture will address the new and exciting area of Global Navigation Satellite Systems, which are having a major scientific and commercial impact, and are quickly becoming an important part of our world. Topics to be covered include the US Navstar Global Positioning Systems (GPS), the Russian Glonass, the COSPAS/SARSAT Search and Rescue system, and ARGOS and DORIS telemetry systems. Development, current status, political issues, and future potential for these systems will be discussed.

6.06 Space Power for Earth

Maryniak 14:00

One of the most fundamental needs of civilization is energy. There is a world-wide market for this resource and the growing demand for energy in the developing world coupled with our growing awareness that traditional means of satisfying this demand cause stress to our environment. This lecture examines the international efforts directed at satisfying this demand through the use of space resources.

4.06 Space Biology

Clément 16:15

Gravity provides a directional stimulus which may play an important role in basic life processes in the cell, such as biosynthesis, membrane exchange, and cell growth and development. Growth and development of plants are determined by hormones whose transport is also influenced by gravity. Will these functions develop normally when deprived of the gravitational stimulus? This lecture will review the fundamental questions raised by the space environment in the areas of gravitational biology, developmental biology, and radiobiology.

Thu., 22 July 1999

7.06 Digital Image Processing

Madry 9:00

This lecture is a general introduction to digital image processing, which involves a broad range of techniques and capabilities that are widely used in many space-related disciplines to extract useful information from raw data. These include, but are not limited to, satellite remote sensing of the Earth for scientific and practical applications, Planetary remote sensing, a wide range of astrophysical investigations, and medical imaging. The lecture will cover the basic common elements of digital imagery analysis, including data reduction, georeferencing, image enhancement, and classification. Examples of digital image processing products for Earth observation will be presented.

7.07 Geomatics and Global Modeling

Madry 10:45

This lecture will be a general introduction to Geomatics, focusing on the integration of data using a Geographic Information System (GIS). Topics will include the fundamentals of data capture, data management, data manipulation, data analysis, and graphic output. Geographic Information Systems are computer mapping and analysis systems which allow users to quantitatively measure, analyze, and model complex combinations of features. These computerized "maps" can be derived from a variety of sources, including remote sensing imagery, paper maps, point data (such as water or atmospheric quality information located by GPS), or many other sources. Any information that can be located on a map can be entered into a GIS system. GIS is one aspect of Geomatics, which is the functional integration of GIS, remote sensing, GPS, visualization, modeling, etc.

Digitally integrating and manipulating these data using a computer allows complex analysis and modeling activities for a variety of regional and global research initiatives. Examples of Global Earth applications using GIS will be discussed.

5.08 Legal Aspects of Space Applications

To Be Determined 15:00

This lecture will focus on the legal implications of the most important space applications. These are telecommunications, remote sensing, launching and microgravity. Also the role of international operational organizations will be analyzed.

Fri., 23 July 1999

8.07 Birth, Evolution, and Death of Stars

Fazio 9:00

One of the outstanding problems that exists in modern astronomy and astrophysics is the understanding of how stars are born in the interstellar medium and what forms they take in their early stages of evolution. Our present knowledge of stellar birth in giant molecular clouds of gas and dust will be presented as well as the processes by which various types of stars are formed and evolve. The later stages of stellar evolution and the violent results of stellar death are described, with particular emphasis on exploding stars known as supernovae.

2.06 New Economic and Industrial Development in Space Activities

de Dalmau 10:45

How does one facilitate technology transfer? How does one allocate financial and human resources to best meet space program objectives? These and related topics will be covered in this lecture.

1.05 Mars Mission Design

Bailey 15:00

Humans and robotic Mars missions occur when scientific justification, space program budgets, political forces and planetary physics come into conjunction. Planetary missions are among the most complex undertakings in today's world. The design of these mission require an understanding of how all the non-technical issues affect the technical design of the mission, and then requires a disciplined approach to accomplish the engineering of the mission. This lecture will begin with an understanding of the sources of requirements which shape a Mars mission, and an identification of key trade-off studies. It will then develop a mission design methodology which will synthesize the results of the many technical decisions to arrive at a solution which meets the original objectives. Actual human and robotic Mars mission designs will be used as examples throughout the discussion.

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Themes and Specialized Lecture Series Descriptions

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Block 1 (August 4-5)
Specialized Lecture Series (SLS)

Futures Studies and Space

Space and Society

"To Boldly Go where grand-daddy already went!"

That seems to be the best "vision" of the future that most space agencies can muster today. Is this the best we can do for a vision of space exploration and settlement in the 21st Century? No! It is a basic mission of ISU to generate vibrant visions of the future of space which will capture the imagination (and pocketbook) so that we can help lift humanity off this fragile blue marble and begin to move throughout the solar system, and cosmos, within the next several decades and beyond. This block will combine lectures, exercises, and a workshop to help you understand what futures studies is, and is not, so as to enable you to envision and design powerful preferred futures for space exploration and settlement.

Management of Space Projects

Space Business and Management

Management of Space Projects, being they of commercial or institutional nature, require that, within the multidisciplinary framework which is so specific to Space, sufficient and accurate attention be given to aspects like contracts law, negotiation techniques, cost control, etc. Two full mornings are dedicated to specialized lectures given by international experts, focusing on some of the above-mentioned aspects and examining different management methodologies and experiences relating to both large and small projects. The topics covered will include the following :

- Principles of contract law and application to satellite procurement
- Project management : the Thai perspective
- Case Study : the Ariane 5 development and associated management issues
- Case Study : the cost control in the ESA scientific satellite projects
- The decision-making process before a space project is approved
- Different approaches for space project management in Japan

Smaller, Faster, Better Approach for Space Missions

Space Engineering

The Smaller, Faster & Better (SFB) Approach is a new key for expanding space development. Smaller satellites, with a lower development cost and shorter time span, will expand the range of applications and create new services in space. This SLS is intended to address overall aspects of this approach, including system design/technology, merits and demerits, policy/management structure and involvement of non-space ventures. The new concept associated with these issues is a focus of these lectures, as well as the existing successful examples. Also, the specific miniaturization of spacecraft technology, as well as implementation and utilization of commercial technology is discussed. Through these discussions during two days, open exchanges between students and lecturers is encouraged, and a wrap-up meeting will be planned, where necessary.

Advanced Telecommunications

Satellite Applications

This SLS will focus on the new developments in satellite communications techniques. Included in the discussions will be new developments such as personal communications, digital video broadcasting and broadband/multimedia

services. Technical, policy (regulatory, business) and social issues will be addressed in each session. To provide personal communication services, the use of LEO and MEO satellites is an appealing alternative. A summary of the relevant technical and policy issues, and an overview of the systems which are being implemented will be provided. Another session will discuss the new generation of direct-to-the-user digital audio and TV broadcast satellites in the light of North-American, European and Asian perspectives. The GII (Global Information Infrastructure) and electronic highway concepts imply the availability of an expanding range of new services (entertainment, tele-education, tele-medicine, tele-work...). Various issues will be discussed such as: role of satellites, use of Ka-bands, overview on proposed systems, etc. The SLS will include a session for interactive discussions on such topics as: the new capabilities that a global electronic highway can make available to the so-called developing worlds are exciting and hopeful, but also pose a host of new issues as well.

Block 2 (August 6)
Theme Block

Space and Popular Culture

Space has a powerful hold on the popular mind in many cultures, but each culture expresses its views somewhat differently, according to its own cosmologies and traditions. Using video clips and other examples, in this block we will encounter diverse perceptions of space from cultures of Asia (especially Thailand), the Pacific islands and Australia, as well as North America and Europe. Each participant in this block is urged to bring images of space from her/his culture to share with the rest. One purpose of this block will be to consider how these or other images might be harnessed to increase public and private support for space exploration and settlement.

Earth Observation for Tropical Countries - Access, Distribution, Uses and Policies

This block will address the state of the art techniques in the domain of satellite applications as they apply to Earth observation. A main focus will be the access to and distribution of space data. Many different data types are collected from Space, with new sensors being launched at record rates. There is currently a shift from governmental to commercial systems, and there are important new issues relating to access to these data. This theme day will address the data access and distribution from the data providers' and the data users' points of view. Topics addressed will include policy issues on data access and distribution, new high resolution systems, new applications, data cost and new technologies for accessing, processing, and integrating space data into the decision making process.

Block 3 (August 7)
Theme Block

Space Architecture

Classical "Architecture" focuses on the interaction between humans and their built environment, but architects have only in recent decades turned their unique creative abilities towards the problem of humans living and working in the extreme environment of space. Guest lecturers will present interdisciplinary discussions including the evolutions of humans into space, future space structures, and future planetary bases.

New Trends in the Financing of Space Activities

The constant evolution of political and economic constraints require the space actors to adapt their approaches and methods for financing space projects and tailor them according to these changing circumstances. In this context, the common and predominant trend in both commercial and institutional space activities is to take better account of the market needs and the opportunities for spin-offs and transfer of technology. The day is organized around lectures and interactive discussions, which will cover some of the tools being increasingly used for financing space projects in general (Partnership and co-funding) and illustrate specific experiences in the fields of science, telecommunications, and space transportation.

Block 4 (August 10)
Theme Block

Moon-Mars

This theme day will explore our understanding and fascination with the Moon and Mars from an inter-disciplinary perspective.

Access to Space

In this theme, access to space is considered in its various aspects, from the launch system provider and from the user points of view. Examples of management of a launcher development program will be given, as well as the description of the operation of a launch site and of launcher itself. Providers and users meet on the world market of space transportation. This market and its evolution will be discussed. Financing of launch services is an important aspect of access to space along with risk and insurance. Different ways to handle these matters will also be described. The offer of launch systems is evolving rapidly. Original launch systems are appearing using conventional launchers but also using reusable launch vehicles. They will be described and discussed during this day where open exchanges between students and lecturers will be encouraged.

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Block 5 (August 11 & 13)
Specialized Lecture Series (SLS)

Space Weather

Space Physical Sciences

Grounding of the Space Shuttle; sudden losses of satellites; power blackouts on Earth; automatic teller machine networks not responding; your favorite TV channel off the air. What these actual events have in common is that they all can be caused by solar effects on the near-Earth environment. The Earth is being continuously bombarded by radiation from the Sun. This radiation is in the form both of electromagnetic waves (sunlight) and a constantly changing particle flux (principally electrons and protons). Fortunately for us, we are protected from the most harmful of these radiations by the Earth's magnetic field and atmosphere. However, the combination of the magnetic field/atmosphere and the solar particles/sunlight produces an interesting regime surrounding the Earth which induces more complex phenomena that can seriously affect Earth-based and space-based systems. Examples of affected systems include: communications satellites, GPS systems, hydro transmission lines, pipelines, and planetary probes and habitats. There is, presently, an international effort to understand more fully this complex "geospace" and develop prediction software to provide forecasts of this dynamical Space Weather regime in order to allow operators of susceptible systems to take evasive actions when solar events occur. This lecture series will explore our current understanding of the near-Earth environment in a non-technical manner and discuss the scientific, technological, economic, social and political implications of the effects that such a weather system has on our lives. It will also provide an opportunity for the participants to discover how space weather predictions are currently being derived from the many satellites monitoring the near-Earth environment and how to access these data and forecasts.

Space Technology and Cooperation for Developing Worlds including Space Education

Space Policy and Law

Space technologies are of great importance in the cooperation with Developing Worlds. One can mention remote sensing and telecommunications as examples. However, the use of space technologies in international cooperation raises questions as to the access and transfer of space technologies and data, training and education, and the definition of projects that meet the specific needs of these countries. This SLS will address in particular the role of (space) policy and law in such cooperation. Case examples will be analyzed to illustrate what kind of obstacles are encountered in implementing cooperation projects.

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Design and Prototype of a Robotic Space Surface Mission

The Parliament of Isuland has decided to launch a mission to the Moon to develop the water resources located at the Lunar poles. The Parliament is issuing a Call for Proposals (CFP). The goals of the CFP are to:

- Solicit concepts for extracting and transporting the H2O resources
- Find ways to raise popular and political support for this project
- Prototype the necessary robotic technology
- Develop the strategic and business plan to carry out the mission

Participants in this theme block will receive a number of short Isuland briefings to supply background on the CFP. They will then divide into small teams to create a response to the CFP. Based on the reviews of the formal presentations by each team, the Parliament will allocate funds to each team. Teams will then work to create functional prototypes of key pieces of the mission. They will procure parts from the Isuland technology Emporium making sure to stay within their assigned budget. At the conclusion of the day a final "bake-off" demonstration will be held of all the technology that has been developed. The contracting team for the flight hardware will then be selected.

International Space Station

The Russian space station, MIR, and the planned International Space Station are surrounded by controversy. The geopolitical environment in which they were conceived has changed dramatically; the complexity of international management is proving to be an enormous challenge to the national and regional space agencies; some potential users had been hostile, while others have welcomed space stations as essential research facilities; the long-term operational costs looked to be daunting; and, above all, the projects suffered from a lack of consensus on their fundamental objectives. In spite of all these difficulties and problems the first two components of the ISS have been already launched and the first International team has opened the Station for the future activities. A day of interactive discussions about the International Space Station issues will take place during this block. Discussions will focus on design process, construction and assembly, issues of medical care and evacuation, crew selection and training, international cooperation and legal issues, research applications and their benefits to humankind. There will be eight-ten short talks on specific subjects with a question and answer period after each talk. There will be a group lunch after the morning session for speakers and participants to formulate open discussion on issues addressed in the morning. There will be a forum/round-table for open discussion on the issues discussed during the day after the afternoon discussion.

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Distinguished speakers invited for the Summer Session include:

Mr. Tomifumi Godai
NASDA

Mr. Guo Baozhu
China National Space Administration

Dr. K. Kasturirangan
Indian Space Research Organization (ISRO)

Dr. U. R. Rao
Indian Space Research Organization (ISRO)

Dr. Antonio Rodota
European Space Agency (ESA)

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Sheila Bailey
Space Systems Analysis and Design
Co-Chair

Sheila is a senior research physicist in the Photovoltaic and Space Environments Branch at NASA Glenn Research Center. Her research has focused on the texturing of GaAs and InP to enhance light absorption and radiation tolerance in solar cells. This work has included the fabrication of the first V-groove GaAs and InP solar cells. She is an expert in space radiation effects on solar cells and has recently completed a modeling program to predict degradation in space cells. She has authored or co-authored over 80 journal and conference publications and has one patent. She is an active member of the American Physical Society and a speaker for the American Institute of Physics Visiting Scientist Program. She is a member of AIAA Aerospace Power Systems technical committee and the Interagency Advanced Power Group Photovoltaic Panel. She has served on the executive committee of the IEEE Photovoltaic Specialist Conference (PVSC) since 1987 and was the Technical Program chair for the 25th PVSC in Washington DC in 1996 and the US General Chair for the 2nd World Conference in Photovoltaic Energy Conversion in Vienna in 1998. She is a member of the Lewis Business and Professional Women and vice president of the Lewis Engineers and Scientists Association. Currently she is an adjunct professor at both the Ohio Aerospace Institute and Baldwin Wallace College. She had previously taught at the University of North Carolina at Charlotte, the Univ. of Delaware, and Oberlin College. Her B.S. is from Duke University in Physics, her M.S. in Solid State Physics from the Univ. of North Carolina at Chapel Hill, and her Ph.D. in Solid State Physics from the University of Manchester in England. She spent a post-doctoral year at the Royal Military College (part of the Univ. of New South Wales) in Canberra, Australia and a year traveling in Indonesia, Malaysia, Thailand and Africa, including an overland trip from Liverpool, England to Cape town, South Africa. She is the recipient of the faculty excellence award from Baldwin Wallace College in 1988 and the Federal Women's Program award in 1993. She became an Ohio Academy of Science "Exemplar" in 1990. She completed the Office of Personnel Management's Executive Potential Program in 1994. She is an alumnus of the ISU 1989 Summer Session Program (SSP'89), served as faculty for SSP'92 and as lecturer for SSP'98. She has a strong interest in promoting science education, particularly to women and minorities, and hence serves as an available speaker for schools, colleges, and universities. She is married with three children; a son who is a graduate student at Rockefeller University, a daughter attending Case Western Reserve University and a daughter attending Alfred University. The family resides in Lakewood, Ohio with a border collie, beagle, two cats, and tropical fish.

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Victor Bensimhon
Strategies for Human Exploration Away from Earth Design Project
Co-Chair

Victor Bensimhon is currently in charge of Technology Strategy for SNECMA, a French group specialized in propulsion of aircraft and rockets and in the equipment and services related to the latter. His experience is very diverse, comprising research, engineering, production and management in the fields of aircraft and rockets engines, and other industrial activities. Victor Bensimhon has over twenty-five years of experience in the field of propulsion. He started with jet engines at Société Nationale d'Etudes et de Construction de Moteurs d'Aviation (SNECMA), where he held the positions of Advanced Project Manager and Chief Engineer for the CFM56-3 jet engine development. He then turned to rocket engines within SEP (Société Européenne de Propulsion) where he was in charge of the Industrial Group of the Liquid Propulsion Division and in that function, responsible for the production of Ariane propulsion systems. As Director of Research and Industry of the Brakes Division of SEP he was involved in the spin-off of space activities of SEP in the field of carbon composites for brakes. Victor Bensimhon received his engineering degree from the Institut National Polytechnique de Grenoble and his Licence es Science from the French University. He is currently a lecturer at Ecole Nationale Supérieure de l'Aéronautique et de l'Espace (SUPAERO) in Toulouse and for the ISU MSS in Strasbourg. He authored a textbook about off-design operation in turbomachines.

Michel Bousquet
Satellite Applications
Faculty

Professor Michel Bousquet is in charge of the under- and post-graduate programs in aerospace electronics and communications at SUPAERO (Ecole Nationale Supérieure de l'Aéronautique et de l'Espace, Toulouse, France). He has about twenty years of teaching and research experience in the field of electronics and communication system, and has authored many papers in the areas of satellite communications systems and digital communications and textbooks on satellite communications systems and techniques. Prof. Bousquet was a visiting lecturer at ISU 89 and 91 Summer Sessions, a member of the faculty at ISU 92, 93, 95 and 98 Summer Sessions, and co-chair of the Satellite Applications department at ISU 94 and 97 summer sessions. In August 1995, he was appointed to head the School of Engineering, Systems and Technologies at the ISU Central Campus in Strasbourg in the framework of a cooperative agreement between SUPAERO and ISU. Michel Bousquet is a member of the ISU Faculty and also an Affiliated Professor at Télécom Paris (Ecole Nationale Supérieure des Télécommunications), and at the University of Surrey. He holds graduate and post-graduate degrees from the University of Toulouse and from SUPAERO. He is a member of the Satellite and Space Communications Technical Committee of the Communications Society of the Institute of Electrical and Electronic Engineers (IEEE), a member of the Communication Technical Committee of the American Institute of Aeronautics and Astronautics (AIAA), an active member of Association

Aéronautique et Astronautique Française (AAAF) and Société des Electriciens et Electriniciens (SEE). He serves as a member of technical committees and session chairman of various international conferences focusing on satellite communications.

Angie Bukley
Disaster Management in Southeast Asia Design Project and Space Engineering
Co-Chair and Faculty

Angie Bukley is a Senior Project Engineer for The Aerospace Corporation in Albuquerque, New Mexico, USA. Her areas of expertise are control theory, structural dynamics, remote sensing and bicycle maintenance. Prior to her move to Albuquerque in 1997, she was an Aerospace Engineer at the NASA Marshall Space Flight Center (MSFC) in Huntsville, Alabama, USA. While at Marshall she forwarded as an official MSFC project the Global Emergency Observation and Warning System (GEOWARN), which was one of the two SSP'93 design projects. In addition to being an alumnus of SSP'93, Angie was a guest expert for the GATES design project at SSP'94, served full-time on the Team Design Project Faculty during the inaugural year of the Master of Space Studies (MSS'95-'96), and has served as Co-Chair of the Space Engineering Department during SSP'97 and SSP'98. When she's not doing rocket science or enjoying ISU sessions, Angie does a lot of bike riding, snowboarding, skiing, hiking, beer-drinking and bike maintenance.

James Burke
Disaster Management in Southeast Asia Design Project
Faculty

James D. Burke (Jim) is a senior member of the technical staff, retired on-call, at the Caltech Jet Propulsion Laboratory. After receiving his undergraduate and graduate aeronautical engineering degrees at Caltech and after duty as a US naval aviator, Burke joined JPL in 1949. Since then he has participated in many American and international projects in lunar and planetary exploration. On leave from JPL he has had a role in each ISU summer session since 1989, and he has been a visiting lecturer for the Master of Space Studies program at ISU in Strasbourg. Burke's primary professional interest is in missions for the exploration and settlement of the Moon. He is a Fellow of the British Interplanetary Society and a member of the American Geophysical Union, the American Institute of Aeronautics and Astronautics, The Planetary Society and the Division for Planetary Sciences of the American Astronomical Society.

Susanne Churchill
Space Life Sciences
Co-Chair

Dr. Susanne Churchill is currently Associate Dean for Research at Harvard Medical School. She has been a member of the faculties of the Harvard Medical

School, where she has received numerous prizes for Excellence in Teaching, and at MIT, where she has served as course director for the Fundamentals of Space Life Sciences course. Dr. Churchill organized the first Life Sciences curriculum for the ISU'88 Summer Session and has served as Co-Chair or faculty at every subsequent SSP. Dr. Churchill received her bachelor's degree in biology from Tufts University in Medford, Massachusetts and her Ph.D. from Boston University Medical School. She completed her post-doctoral training as a research fellow at Harvard Medical School. Dr. Churchill teaches at Harvard Medical School. She was for many years principle investigator on several NASA projects studying the effects of weightlessness on cardiovascular function, including an experiment manifested for Shuttle mission SLS-2 and a CNES-NASA project scheduled for SLS-3. Dr. Churchill has also served on several NASA advisory committees. She is a member of the American Physiological Society and the American Society for Gravitational Biology. She is the editor of the teaching textbook *Fundamentals of Space Life Sciences*.

Gilles Clément
Space Life Sciences
Co-Chair

Gilles Clément received Doctoral Degrees in Neurobiology from the University of Lyon in 1981 and in Natural Science from the University of Paris in 1986. Dr. Clément is currently Director of Research in the Centre de Recherche Cerveau et Cognition at the French National Center for Scientific Research (CNRS) in Toulouse. Since 1982, research in space life sciences has been his primary focus with experiments on Salyut-7, MIR, Spacelab, and the Space Shuttle. His research topics include influence of microgravity on posture, spatial orientation, and eye movements. In 1998, he was the principal investigator of an experiment flown on the NEUROLAB (STS-90) mission using a human-rated centrifuge in-flight, developed by ESA. Dr. Clément has spent two years at NASA Johnson Space Center at the Neuroscience Laboratory preparing for the Microgravity Vestibular Investigation (MVI) project, which was part of the first International Microgravity Laboratory (IML-1) Space Shuttle mission, and conducting neurovestibular experiments for the NASA Enhanced Duration Orbiter Medical project (EDOMP). He also spent three years at the Institute of Space Medicine (MEDES) in Toulouse to prepare biomedical projects for the European contribution to the International Space Station and future manned lunar bases.

Patrick Cohendet
Space Business & Management
Faculty

Patrick S. Cohendet is a Professor of Economics at the Université Louis Pasteur in Strasbourg. He has taught at the University of Virginia (USA), and the University of Tokyo (Japan). He is presently member of the BETA laboratory in Strasbourg, a research laboratory studying the economic and social impact of new technologies. Professor Cohendet is a specialist in forecasting methods, strategic planning and theory of innovation. His experience includes study of and economic counseling for international organizations, in particular the CEE and the European Space Agency (ESA). He has conducted a series of studies

on the economic spin-offs of European Space Projects and has authored several books on the economic impact of new technologies, including *Choix Stratégiques et Grands Programmes Civils* (with A. Lebeau, Economica, 1987), which describe the main results of his study on European space spin-offs.

John Connolly
Space Systems Analysis & Design
Co-Chair

John Connolly is a mission designer and project manager for NASA, studying advanced missions for sending both robotic probes and human crews to the surface of the moon and Mars. Since joining NASA in 1987, he has conducted research on and authored many papers on lunar and Mars missions, planetary engineering, rovers, robotics, extra-terrestrial construction, and extraterrestrial resource utilization. He holds an architectural engineering degree from Penn State University and an Engineering Management degree from the University of Colorado. Prior to joining NASA in 1987, he worked as a licensed Professional Engineer in Texas. He is a member of the American Institute of Aeronautics and Astronautics, and co-chairman of the American Astronautical Society's Committee on Space Exploration. He also serves on the Space Education Committee for the American Society of Civil Engineer's Aerospace Division. He currently serves as the Manager of Human Exploration Payloads for the Mars 2001 Surveyor Orbiter and Lander Missions, and is on the planning team for the 2003 and 2005 Mars Sample Return Missions.

James Dator
Space and Society
Co-Chair

Jim Dator is Professor and Head of the Alternative Futures Option of the Department of Political Science, and Director of the Hawaii Research Center for Futures Studies, University of Hawaii. He is the past president of the World Futures Studies Federation. At ISU he specializes in futures studies, political design of space settlements, social science and space, and other human and philosophical issues of space exploration and settlement.

Juan De Dalmau
Space Business & Management
Faculty

Juan De Dalmau is responsible for strategy and business development at the European Space Agency (ESA) Headquarters in Paris, France. Mr. De Dalmau graduated in mechanical engineering in 1981 at the Polytechnic University of Catalonia, Spain, and followed with graduate courses in Business Administration in Philadelphia, USA. His first professional experiences were as commercial exports engineer in Frankfurt, Germany and in Barcelona, Spain. In 1985, he started as management controller at ESA'S Directorate of Administration in Paris. In 1987 he was seconded to the French Space Agency CNES in Kourou as Range Operations Manager (DDO) for Ariane-4 launch campaigns. From 1992 to 1997, he was

facilities engineer at ESA's Directorate of Launchers, involved with the construction and qualification of the Ariane-5 ground facilities, and with the ESA/CNES contract on the financing and management of the Guiana Space Centre, Europe's Spaceport. Mr. De Dalmau is an alumnus of the ISU'89 Summer Session. In 1991 he initiated the participation of the Barcelona Universities to ISU. He presently offers part-time assistance to ISU's Marketing effort. He has also been regularly teaching since 1990 at ISU's programs and was elected member of the Academic Council in 1996.

Giovanni Fazio
Space Physical Sciences
Faculty

Dr. Fazio is presently Senior Physicist, Harvard-Smithsonian Center for Astrophysics; Lecturer, Astronomy Department, Harvard University; and a Member of the Faculty, International Space University, Strasbourg, France. He received B.S. (Physics) and B.A. (Chemistry) degrees (Summa Cum Laude) from St. Mary's University, Texas, and a Ph.D. (Physics) from the Massachusetts Institute of Technology in 1959, having done his graduate work in elementary particle physics. The same year, he joined the University of Rochester, where he pioneered the development of balloon-borne gamma-ray telescopes and was the Principal Investigator for the gamma-ray detector experiment on the first Orbiting Solar Observatory. In 1962 he joined the Smithsonian Astrophysical Observatory and the Harvard College Observatory, where he initiated a program in gamma-ray astronomy using balloon-borne and ground-based detectors. In the early 1970's he pioneered the development of large balloon-borne telescopes for infrared astronomical observations above the atmosphere, and in the 1980's flew the first infrared astronomical telescope on the Space Shuttle. He has been a member of numerous NASA advisory committees and principal investigator on the following NASA infrared programs: the 1-Meter Balloon-Borne Far-Infrared Telescope Experiment, the Infrared Telescope Experiment which flew on the Spacelab 2 flight of the Space Shuttle, and the Infrared Array Camera experiment to be flown on the Space Infrared Telescope Facility (SIRTF), one of NASA's Great Observatories, and co-investigator on the Submillimeter Wave Astronomical Satellite (SWAS). His current research interests also include the development of infrared instrumentation and the use of infrared array cameras on ground-based telescopes to observe infrared luminous galaxies, young stellar objects, planetary nebulae, and star formation regions. Dr. Fazio is also past President of the International Astronomical Union's Division XI and Commission 44 (Space and High Energy Astrophysics); past Chairman, Universities Space Research Association (USRA) Science Council for Astronomy and Space Physics; and past Vice-Chairman of the COSPAR Commission on Research in Astrophysics from Space. Dr. Fazio is a Fellow of the American Physical Society and past chairman of its Astrophysics Division, a Fellow of the American Association for the Advancement of Science (AAAS), a member of the American Astronomical Society and past chairman of its High Energy Astrophysics Division. He is also a member of the International Astronomical Union, the International Academy of Astronautics, the Optical Society of America, and a Fellow of the Royal Astronomical Society. He is a regional editor of the journal "Astrophysical Letters and Communications."

Ben Finney
Space and Society
Co-Chair

Ben Finney received his Ph.D. in Anthropology from Harvard University in 1964. He taught there, at the University of California, and at the Australian National University before coming to the University of Hawaii where he is now professor of anthropology. Before becoming an anthropologist, Dr. Finney worked in the aerospace industry, where he was inspired by Kraft Ehricke, a veteran member of Von Braun's rocket team who was then calling for an "anthropology of space." After gaining his Ph.D. in anthropology and conducting extensive anthropological research in the Pacific islands, Dr. Finney was able to turn his attention to developing an anthropological approach to the exploration, utilization, and eventual colonization of space. He has worked at NASA's Ames Research Center and with colleagues from other institutions on such issues as the social organization of a moon base, the evolution of humanity in space, and the radioastronomy search for extraterrestrial intelligence. Most recently he has been investigating the history and philosophical background of the Russian space movement. In addition to writing numerous books and articles on the migration, culture, and economic development of Pacific island nations, Dr. Finney has published *From Sea to Space* and *Interstellar Migration and the Human Experience* and other works exploring the role of humanity in space.
He is a member of the International Academy of Astronautics, a recipient of the Tsiolkovsky Medal for contributions to cosmonautics studies, and an associate editor of "Space Power."

Stefano Fiorilli
Space Business & Management
Co-Chair

Stefano Fiorilli is a Contracts Officer in the Contracts Department of the European Space Agency (ESA). He is responsible for all legal and contractual aspects of satellite procurements, and more particularly those relating to Earth Observation. He holds a bachelors degree in law from the Facultés Universitaires Saint-Louis, Brussels, Belgium and a graduate degree in law from the Université Catholique de Louvain, Belgium. His fields of interest include both international public law issues and private law matters like contract law, intellectual property, corporate merging and acquisitions, and arbitration.
Mr. Fiorilli has been practicing between 1987 and 1990 as a private lawyer specialized in corporate merging and acquisitions. He served as graduate assistant in 1986 at the Commission of the European Community, Directorate General of External Relations, Japan Division. He has been a visiting lecturer of the Business and Management Department during the ISU Summer Sessions in 1996 (Vienna) and 1997 (Houston), and a faculty member of that department in 1998 (Cleveland).

Daniel Glover
Satellite Applications
Faculty

Daniel R. Glover is a technical manager working for the NASA Glenn Research Center's Plans and Programs Office (0170) in Cleveland, Ohio. Since joining Glenn in 1982, most of his time has been spent working on spacecraft or space experiment design projects. In 1993-94, he was detailed to the Jet Propulsion Laboratory where he worked on the Galileo and Pluto Fast Flyby projects. He received a Bachelor of Science in Electrical Engineering from The Ohio State University in 1980, a Master of Science in Electrical Engineering from the University of Toledo in 1986, and a Doctor of Philosophy degree in engineering from the University of Toledo in 1992. He is a licensed professional engineer in the state of Ohio and is a senior member of the IEEE. In 1997 he was awarded the NASA Medal for Exceptional Achievement. Dr. Glover is an Engineering Duty Officer in the U.S. Naval Reserve. His hobbies include playing and coaching soccer as well as reading and writing about history. He is the author of the electronic picturebook PlanetQuest. He is married and has two children. In his previous position at Lewis, Dr. Glover worked in the Satellite Networks and Architectures Branch of the Communications Technology Division. He participated in the TCP Over Satellite Working Group of the Internet Engineering Task Force.

James Green
Informatics Lecture Series Coordinator & Space Physical Sciences
Faculty

Dr. James Green is currently the Chief of the Space Science Data Operations Office, a co-investigator on the IMAGE mission, and the Deputy Project Scientist for the Wind, Polar, and Geotail spacecraft at NASA's Goddard Space Flight Center. He received his Ph.D. in Physics from the University of Iowa in 1979. Dr. Green has written over 70 technical articles appearing in various books, technical memorandum, and magazines on data management and computer networking and has published over 55 scientific articles in referred journals in space science research. His major activities in space science research have involved various aspects of magnetospheric physics of the Earth and Jupiter. He has developed data processing systems for various experiments on board the Hawkeye, IMP-6, IMP-8, Dynamics Explorer, and the Voyager 1 & 2 spacecraft. Dr. Green has also worked at NASA's Marshall Space Flight Center from 1980 to 1985. At Marshall, Dr. Green developed and managed the Space Physics Analysis Network, which provided scientists, all over the world, with rapid access to data, other scientists, and specific NASA computer and information resources. In addition, Dr. Green was a safety diver at the Marshall Neutral Buoyancy Simulator Facility supporting over 300 EVA tests and simulations. From 1985 to 1992 he was the Head of the National Space Science Data Center, NASA's largest space data archive. He is one of NASA's leading experts in data management, processing, archiving, and

distribution technologies. Dr. Green was a 1988 recipient of the Arthur S. Flemming award given for outstanding individual performance in the federal government and was awarded the Kotani Prize in 1996 in recognition of his international science data management activities.

Dennis Irwin
Space Engineering
Faculty

Dr. Irwin received his Ph.D. in Electrical Engineering from Mississippi State University in 1986. From 1980 to 1982, as a research assistant at Mississippi State, he worked on developing system identification codes for determining transfer function models of components of the Air Force's Airborne Laser Lab and on Air Force sponsored work involving adaptive filtering schemes for the control of vibrating systems. From 1982 to 1986, as an instructor at Mississippi State, a Staff Engineer for Control Dynamics Company, and a consultant for Control Dynamics Company, he worked on the development of modern control design software and reliable large scale algorithms, reviewed qualification flight tests for the Spacelab IPS, and developed advanced guidance laws for missile interceptors. From 1986 to 1987, as an Associate Senior Staff Engineer at Logicon Control Dynamics, Dr. Irwin served as Project Leader on the NASA Marshall Large Space Structure Ground Test Facility support contract and as Project Leader on the NASA-Marshall/Wright Patterson Air Force Base Active Control Technique Evaluation for Spacecraft (ACES) project involving the design, implementation and testing of three advanced control laws for the NASA ground test facility. He also developed models for the NASA Transient Pressure Test Article (TPTA) hydraulic load control system for simulating Shuttle external tank strut loads and designed controllers for the R2P2 (Rapid Retargeting and Precision Pointing) study. Since 1987, Dr. Irwin has been a faculty member in the School of Electrical Engineering and Computer Science at Ohio University, where he is currently Professor and Chair. He received NASA/ASEE Summer Faculty Fellowships to NASA Marshall in 1988, 1989, and 1990, and his research for the Control System Division there in the areas of system identification and control of large flexible systems has been continuously funded since 1988. He has also received funding in the area of manufacturing control from Wright Patterson Air Force Base and has served as a consultant to Logicon Control Dynamics, Wright State University, Systran Corporation, and Nichols Research Corporation. He and his students have developed models for NASA flexible structure test facilities via system identification, designed controllers based on these models, and have implemented and tested these controllers in the test facilities. Dr. Irwin has also directed the development of several comprehensive interactive software systems for system identification, control analysis and design, and dynamical system simulation. In 1993 he completed a major controller redesign study for the Hubble Space Telescope pointing control system which included extensive enhancements to the existing simulation and completed work on developing analytical techniques and software for modeling vibration effects in the Space Shuttle Main Engine (SSME) turbopumps for NASA. Most recently, he completed construction and testing of a web-accessible flexible structure control test facility at Ohio University. He and his students are continuing their work on material behavior optimization software for Wright-Patterson Air Force Base, SSME modeling software for NASA,

a computer-aided control design software system for NASA, and reliable and expandable software for high order system identification. Dr. Irwin is a member of the honoraries Tau Beta Pi, Eta Kappa Nu, Phi Kappa Phi, and Sigma Xi and the professional organizations of AIAA (Senior Member), IEEE (Senior Member), ASEE, and AAS. He is a registered Professional Engineer in the state of Ohio and received an Outstanding Achievement Award from the Ohio Society of Professional Engineers in 1990 and a service award from the IEEE Columbus Section in 1992. He is listed in Who's Who in Science and Engineering. Dr. Irwin is the author or co-author of 40 technical papers and 15 technical reports. Since 1987, 15 Master of Science students and three Ph.D. students have graduated under his direction. He currently is advising 3 Ph.D. students and 2 M.S. students. He has been selected as the school's Outstanding Graduate Instructor three times and as its Outstanding Undergraduate Instructor three times.

Joan Johnson-Freese
Space Policy & Law and Disaster Management in Southeast Asia Design Project
Faculty

Dr. Johnson-Freese is a Professor of Transnational Studies at the Asia Pacific Center in Honolulu, Hawaii. Prior to that, she was on the faculty at the Air War College, Maxwell Air Force Base, AL, and the Political Science Department at the University of Central Florida. She was also the Director of the Center for Space Policy & Law at that institution. Her research and publications include five books: *The Chinese Space Program: A Mystery Within a Maze* (1998); *Space, the Dormant Frontier: Changing the Space Paradigm for the 21st Century* (1997); *Changing Patterns of International Cooperation and Competition in Space* (1990); *Over the Pacific: Japanese Space Policy Into the 21st Century* (1993); and *The Prestige Trap: A Comparative Study of the US, European and Japanese Space Programs* (1994). Her work focuses on international cooperation and competition in space; Asian space programs; and military space systems.

Jeffrey A Jones
Space Life Sciences
Faculty

Jeffrey A. Jones is a Flight Surgeon and Medical Operations Physician for the NASA Johnson Space Center leading the Countermeasures and Radiation IPT's, and working on the X-38, EVA and NASA HEDS projects. He is an Adjunct Associate Professor at Baylor College of Medicine, Urology Department. He also serves as Commander for the US Naval Reserves Medical Corp serving Marine Air Group 42, and supports the 147th Medical Squadron, 111th Fighter Wing for the Texas Air National Guard. He is the Principal Investigator for Genitourinary Cancer Clinical Trials for PIVOT and SWOG at the VA Medical Center in Houston, and is a designated Aviation Medical Examiner for the Federal Aviation Administration. Prior to this, Dr. Jones served as Associate Professor, Chief of Urology, and Director of Urologic Oncology for Texas Tech University Health Services Center, as Urology Section Head, Department of Surgery, Fleet Hospital 21, for the US Naval Reserve,

as the Associate Medical Director of the Southwest Cancer Center, UMC Hospital in Lubbock, Texas, USA, and as Extracorporeal Shock Wave Lithotripsy Program Regional Director and at UMC Hospital. His current areas of research for NASA involve telemedicine/telesurgery in microgravity, including contingency planning for in-flight acute ureteral calculus; telemedicine evaluation of environmental influences on health in closed loop systems – immune function and toxicolgic exposure as part of the Lunar-Mars Life Support Test Project Phase III; biodosimetry and intervention strategy for deep space radiation and induced carcinogenesis; and renal stone risk countermeasures development for International Space Station. He also is conducting research for Texas Tech University Health Sciences Center in the area of monoclonal antibody-cytotoxic conjugates in prostate cancer therapy which includes cancer diagnostic imaging by 3-dimensional spectroscopy. Dr. Jones participated as a lecturer at ISU for both SSP'97 and SSP'98. Dr. Jones is a member of several professional organizations and societies including the American Aerospace Medicine Association, Space Medicine Branch, Society of US Air Force and Navy Flight Surgeons, American Association for Cancer Research, American Association for the Advancement of Science, American Medical Association, American Urological Association, American Society of Clinical Oncology, Society of Urologic Oncology, Society of Surgical Oncology, American College of Surgeons. He earned his B.A. degree in both biology and psychology from Trinity University, Texas, USA in 1981 and his M.D. from Baylor College of Medicine, Texas, USA in 1984, and a Masters of Science from the University of Texas Medical Branch in Galveston, TX. In his spare time, he enjoys golf, tennis, racquetball, skiing, flying, sailing and windsurfing, white water rafting, scuba diving, backpacking – wilderness preservation, wilderness medicine, electronics, computers, photography, home gardening, and keyboards.

Tarik Kaya
Space Engineering
Co-Chair

Dr. Tarik Kaya received his Ph.D. in Fluid Dynamics-Propulsion from Ecole Nationale Supérieure de l'Aéronautique et de l'Espace (SUPAERO) in Toulouse, France. Presently, Dr. Kaya is a National Research Council (NRC) Resident Research Associate in the Thermal Engineering Branch at NASA Goddard Space Flight Center. He also is an Assistant Professor at ISU on leave of absence. His current research involves testing and mathematical modeling of two-phase heat exchange systems for spacecraft thermal control. Dr. Kaya's research experience includes experimental and computational fluid dynamics, and propulsion system design and testing. He is an alumnus of SSP'91.

David Kendall
Space Physical Sciences
SSP'99 Program Director and Faculty

Dr. Kendall is presently a Acting Chief Scientist with the Space Science Program of the Canadian Space Agency. His duties include planning and evaluating the Canadian Solar Terrestrial Relations,

Atmospheric Sciences and Space Astronomy Programs supported by the agency. Dr. Kendall obtained his Bachelor of Science degree in Honours Physics from the University of Wales and both his Masters and Doctorate degrees in Atmospheric Physics at the University of Calgary. He later joined BOMEM Inc. in Quebec City where he was a research and development scientist for four years performing research and developing applications relating to very high resolution Fourier Transform Spectroscopy. In 1982 he joined the National Council of Canada, with the Canada Centre for Space Science. He was principal investigator of the OGLOW experiment that was flown on Shuttle mission STS-41G and is presently co-investigator on four space science experiments. His present scientific interests include the dynamics of the MLT (Mesosphere/ Lower Thermosphere) region using data from WINDII (Wind Imaging Interferometer) onboard the Upper Atmosphere Research Satellite (UARS) as well as the physics and chemistry of the stratosphere and mesosphere via participation in the Swedish ODIN satellite project. He is also leading a Canadian "Space Weather" initiative. In 1990, Dr. Kendall transferred to the newly created Canadian Space Agency. Dr. Kendall has authored numerous scientific publications, and serves on a number of national and international advisory committees and working groups. He is the Canadian National Representative to COSPAR and SCOSTEP, is the current Chairman of ISU's Academic Council, and is the Chairman of the Board of Advisors of SEDS Canada.

Inessa Kozlovskaya
Space Life Sciences
Co-Chair

Inessa B. Kozlovskaya, M.D., Ph.D., D.Sc., Professor, Head of the Department of Neurophysiology of the Institute of Biomedical Problems, Moscow. In this capacity she is responsible for developing, ensuring and implementing all the institute activities linked to studies of the effects of altered gravity on the sensory-motor functions including the International Program of Neurophysiological studies on monkeys in space flights of Russian biosatellites, International Neurophysiological Programs on board Russian space stations, as well as the development and implementation of means and methods of physical countermeasures for negative effects of microgravity on human bodily functions. Professor Kozlovskaya has authored more than 200 scientific publications, including 3 monographs in the field of motor control, sensory cerebellar physiology, gravitational neurophysiology. Her works in the area of gravitational physiology and countermeasure of negative effects of space flights brought her national as well as international recognition. She is a member of the Board of Trustees of the International Academy of Astronautics (IAA), Vice-President of the Research Group on Space and Underwater Neurology, member of the Board of Trustees of the International Commission on Gravitational Physiology of the IUPS. At present she serves as a member of the Editorial Board of the International Journal of Vestibular Research and Russian Journal "Sensory Systems." Dr. Kozlovskaya is a member of the ISU Faculty.

Geoffrey Landis
Strategies for Human Exploration Away from Earth Design Project
Co-Chair

Dr. Geoffrey Landis received his Bachelor's Degrees in physics and electrical engineering from the Massachusetts Institute of Technology in 1980. He completed a Master's Degree in Physics in 1984, a Master's Degree in Engineering in 1985 and a Ph.D. in Physics in 1987, all from Brown University. As a Staff Scientist from 1977-1982 at Spire Corporation, Dr. Landis conducted analysis and design of high-efficiency solar cells and arrays. Spire achieved world-record efficiency silicon cells with technology developed partly under the direction of Dr. Landis. From 1988-1990, he was a National Research Council Resident Research Associate at NASA Lewis Research Center, conducting research on improving the efficiency and radiation tolerance of solar cells for space. As a Research Scientist from 1990-1993, Dr. Landis worked with NASA Lewis on innovative concepts for space power and propulsion, and initiated a program on power transmission by lasers. He also worked on the analysis of solar power systems on Mars, work which contributed to the design of the power system for Mars Pathfinder. In 1994 he proposed a sensor to fly on the Mars Pathfinder probe to characterize atmospheric dust, and served as Principal Investigator on the "New Instrumentation for Mars Dust Characterization" project. Dr. Landis is currently a Senior Researcher at the Ohio Aerospace Institute on permanent assignment to the NASA Glenn Research Center Photovoltaics Branch. He is Principal Investigator for several space flight experiments, including the MAE instrument on Pathfinder "Sojourner" rover; the Dust Accumulation and Removal Test on Mars Surveyor-2001 Lander; and the Photovoltaic Testbed on the International Space Station. He is a member of Atmospheric Imaging Research team for Mars Pathfinder, leader of the development project "Ultra-miniature CCD-microscope for Mars", a contributor to the NASA "Fresh Look" study of solar power satellites, and continues to work on development of improved solar cells. Other research include the use of tethers for space propulsion, analysis of laser-pushed lightsails for interstellar flight, and use of lunar and planetary resources for power and propulsion in space. He is the author of 200 technical papers, and holds four patents on advanced solar cell designs. More information can be found on his OAI web page at http://www.oai.org/SRA/g_landis.html or on his personal web page at: http://www.sff.net/people/Geoffrey.Landis/

Vladimir Lytkin
Space & Society
Faculty

Vladimir V. Lytkin was born in 1959 in Kaluga (Russia). He began his scientific work in 1982 after becoming a scientific worker at Konstantin E. Tsiolkovsky State Museum of the History of Cosmonautics. Since 1988 he is the Scientific Director of this museum. He acquired his basic historical education at Kaluga's State Pedagogical University and post-graduate education at Leningrad State University, Philosophical Department in 1984-1987.

In Leningrad he wrote and defended his dissertation work "Philosophical ideas of K. Tsiolkovsky and his Attitude to Religion and Atheism." After that (in 1990) he received his Candidate of Philosophy Degree. His interests include: philosophical ideas of Tsiolkovsky, other Russian cosmic thinkers and pioneers of space exploration, history of Russian and global process of development of cosmism philosophy, history and philosophy of global space exploration; cosmism philosophy as the origin of modern and future space exploration processes. He is an official member of the Organizing Committee and active participant of the Scientific Annual Readings of K. Tsiolkovsky, which has taken place in Kaluga since 1966. He currently teaches a course of "The History of Cosmism Philosophy as Phenomenon of Global Culture" in Kaluga State Pedagogical University, Social Workers Department. Since 1996, he is a member of Academy of Social Education, Moscow, Russia and International Academy of Astronautics. He took part in the ISU'94 – ISU'98 Summer Session Programs as the faculty of the Space and Society Department.

Scott Madry
Satellite Applications
Co-Chair

Dr. Madry is a Research Associate Professor at the University of North Carolina at Chapel Hill. He is also President and founder of Informatics International, an international remote sensing/GIS/GPS company based in North Carolina (http://www.informatics.org). He was a member of the Resident Faculty of ISU in Strasbourg from '97-'99. He was most recently the Senior Associate Director of the Center for Remote Sensing and Spatial Analysis at Rutgers University (1989-'97), and before that a Senior Project Manager at the Institute for Technology Development at the NASA Stennis Space Center ('86-'89). He received his Ph.D. from the University of North Carolina in 1986. Dr. Madry's academic specialty is the application of Geomatics (the integration of satellite remote sensing, Geographic Information Systems, GPS, etc.) to regional environmental and ecological research issues. He is active in training, development, and applications of GIS and remote sensing, having conducted field research in North America, Europe, and Africa, and he has given over 120 short courses in 15 countries around the world. Some of his research has been featured in the McGraw Hill 1991 yearbook of Science and Technology. He has been involved in ISU since its beginning at the Founding Conference in 1987, serving as Co-Chair for the Satellite Applications Department in 1988, '90, '91, '92, '93, '94, '95, '97, and '98 as faculty in 1989 and 1996, Associate Dean of Faculty in 1992, and Managing Director in 1993. He is a member of the ISU Academic Council.

Mikhail Marov
Space Physical Sciences
Chair

Professor Marov graduated from the Moscow Technical University in 1958 and received his Ph.D. in Atmospheric Physics in 1964 and full Doctorate degree in Physics and Mathematics in 1970. From 1958 to 1961, he worked as a research engineer in the S.P. Korolev Space

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Corporation Energia. In 1962, he joined M.V. Keldysh Institute of Applied Mathematics as a research scientist. Since 1968 he has held the position of Head of the Department of Planetary Physics and Aeronomy, and since 1977 has been professor of the Institute. The principal scientific interests of Professor Marov are focused on the fundamental problems of space physics, especially solar system studies, incorporating both theoretical problems of rarefied gas dynamics and chemical kinetics with application to planetary atmospheres and aeronomy, along with experimental studies of the Earth's upper atmosphere and the atmospheres of other planets.
He has been deeply involved in many major endeavors of the Russian space program, from the first satellites and space flight to the Moon and planets up to the present. He has worked as Project Scientist and/or Principal Investigator on the VENERA and MARS lander series which made several important pioneering studies of Venus and Mars and their atmospheres. In the last decade, he has been involved in the VEGA and PHOBOS missions, as well as Principal Investigator for the study of the atmosphere of Mars on penetrators of the MARS'96 Project. From 1994 to 1995, Professor Marov worked as Visiting Professor at the North Carolina State University where he was involved in the studies of basic strategy and mission profiles in the Mars Mission Research Center, as well as in teaching both graduate and senior students in space science. Since 1996 he was appointed as Adjunct Professor at this University. Professor Marov has authored approximately 180 publications in Russian and International refereed journals and has also published several books and monographs.
His experience in teaching has been complemented beginning in 1989 with the deep involvement in the International Space University for which he has taught nine summer sessions as faculty and Co-Chair of the Physical Sciences department. He also served as member of the ISU Academic Council and a Trustee, and in 1996 he was appointed as Emeritus Member of the ISU Board of Trustees.

Gregg Maryniak
Space Resources, Robotics & Manufacturing
Co-Chair

Gregg E. Maryniak is the Chief Operating Officer of the X PRIZE Foundation. Maryniak received his Juris Doctor degree from Northwestern University in 1978. Following his career as a trial attorney in Chicago, he served as the Vice President for Research and Development and Chief Executive Officer of the Space Studies Institute in Princeton, New Jersey. In 1985 he originated the Lunar Prospector space probe (which is presently mapping the resources of the moon from lunar orbit.) He has briefed the President's National Commission on Space, members of the NASA Office of Exploration and NASA Administrators, on space resources and space power. He has been an Instructor at the Adler Planetarium and the Field Museum of Natural History. He has lectured throughout North America, Europe and Asia. The American Institute of Aeronautics and Astronautics named him a Distinguished Lecturer in 1991 for his presentation, "The Harvest of Space." Maryniak is the President of the SUNSAT Energy Council and an Associate Founder of the International Space University. He has served on the Faculty of the International Space University since 1987. In 1996 he was awarded the Tsiolkovsky Medal for his work in the use of the resources of free space.

Wendell Mendell
Space Physical Sciences and Strategies for Human Exploration Away from Earth Design Project
Faculty

Dr. Wendell W. Mendell received a B.S. in Physics from the California Institute of Technology, an M.S. in Physics from UCLA, and his Ph.D. in Space Physics and Astronomy from Rice University. He is a Planetary Scientist at the NASA Johnson Space Center, where he has been employed for 36 years. He served as a Principal Scientist on the Apollo 17 Infrared Scanning Radiometer Experiment and has done research in planetary remote sensing, specializing in thermal emission radiometry and spectroscopy. He has been the editor of several collections of scientific papers in the field of planetary science. Currently, his principal professional responsibilities derive from his position as a scientist in the Earth Science and Solar System Exploration Division of the NASA Johnson Space Center. There he participates in the development of long-range strategies for initiating and sustaining manned and unmanned planetary exploration, taking into account scientific, technological, programmatic, fiscal, and political factors. He has edited two collections of papers on this topic under the title Lunar Bases and Space Activities of the 21st Century. He has served on the faculty of the International Space University in every summer session and has directed four ISU Design Projects.

David Miller
Space Resources, Robotics & Manufacturing
Co-Chair

David Miller has been working in robotics since 1980. He has a bachelors degree in Astronomy from Wesleyan University where he created an automated photometry data collection and processing system, and a Ph.D. in computer science from Yale University. He has worked on a variety of robotics projects, from prototyping NASA's current line of small planetary rovers, to the design of automatic wheelchairs. His robots are sometimes constructed from exotic metals, and sometimes from LEGO. He is the Technical Director of the KISS Institute for Practical Robotics and a consultant on robotics and space applications.

Shunji Murai
Satellite Applications
Co-Chair

Prof. Dr. Shunji Murai is Chair Professor and Coordinator of the Space Technology Applications and Research (STAR) Program at the Asian Institute of Technology in Bangkok, Thailand. He was awarded a Doctor of Engineering from the Department of Civil Engineering at the University of Tokyo in 1970. His specialty is remote sensing, GIS and computer mapping. Prof. Murai has published more than 250 technical papers and more than 20 books including co-author. He is

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currently First Vice President of the International Society for Photogrammetry and Remote Sensing (ISPRS), the General Secretary of the Asian Association on Remote Sensing (AARS) and the President of the Japan Association of Remote Sensing (JARS). On November 21, 1998, Dr. Murai was honored to be awarded the Honorary Doctor of Technical Science by the Swiss Federal Institute of Technology (ETH Zurich), Switzerland.

Manu Omakupt
Satellite Applications
Faculty

Manu Omakupt, born in Pichit, Thailand, is a teacher in the School of Remote Sensing, Institute of Science at Suranaree University of Technology (SUT), Nakhon Ratchasima, Thailand. Prior to his position at SUT, Mr. Omakupt was Director of the Land Use Planning Division at the Department of Land Development, Thailand, from 1990-1994. He served for three years as the United Nations (UN) Coordinator for the Thai-UN Project for Drug Abuse Control. He worked for several years as Agronomist for the Chief of Land Use Survey and Planning Sub-Division for the Department of Land Development, and prior to that as a team leader in the Soil Survey Division in Thailand. Mr. Omakupt has been involved in remote sensing and GIS as related to the domains of soil suitability, land use planning and management, watershed classification and management, wetland classification and management, highland development projects. He also worked the Global Change Analysis for Land Use, Land Cover Change, and Human Dimension program. Mr. Omakupt is a visiting lecturer at many universities. He has presented his research at the Asian Conference on Remote Sensing (ACRS), the ERIM Symposium, and ISPRS among others. His current interests are in the area of application of remote sensing and GIS for natural resources and environment management projects. He holds has a Bachelor of Science degrees in soil science from Kasetsart University and in political science from Sukhothai Thamathirat University, both in Thailand. He holds a Master of Science in soil science from the University of Arkansas, USA. He is a member of the Thailand's Soil and Water Conservation Association, Soil and Fertilizer Society, Agricultural Science Society, and Geography Society. He also is a member of the Asian Association on Remote Sensing (AARS). He has received several awards including Honorable Certificate as a Founder of the Asian Association on Remote Sensing, Honorable Certificate from NRCT as Honorable Fellow in Remote Sensing Activities, and was named Honorable Fellow by the Kasetsart University Alumni Association.

Christian Sallaberger
Space Business & Management
Co-Chair

Dr. Christian Sallaberger is the Manager of the Space Exploration Program at the headquarters of the Canadian Space Agency (CSA) in Montreal.
He is responsible for Canada's planetary exploration activities. Prior to joining the CSA, Dr. Sallaberger worked for the European Space Agency in the Netherlands, where he did engineering systems design and economic analysis for the robotic elements of future European Moon missions. He has also worked for Spar Aerospace in Canada, on the design

of the Shuttle and space station robotic arms, and for IBM. He has numerous technical and programmatic publications and a patent. Dr. Sallaberger obtained degrees from the University of Waterloo in Canada, and the University of California at Berkeley, and received his doctorate from the University of Toronto in the area of Aerospace Science and Engineering. He is also a graduate of the first ISU session at MIT in 1988, and currently sits on the board of directors of the Canadian Foundation for the International Space University. He represents the Canadian Space Agency on the International Mars Exploration Working Group (IMEWG), is a member of the Space Exploration committee of the International Astronautical Federation, and represents Canada on the Moon/Mars Committee of the International Academy of Astronautics. Dr. Sallaberger was also recently elected to the Academic Council of the ISU.

Didier Schmitt
Space Life Sciences
Faculty

Dr. Didier Schmitt, an ISU alumnus of the 1989 Summer Session, holds Master's and undergraduate degrees in science and in medicine. He received his Ph.D. in Immunology and Pharmacology in 1990 from the University of Strasbourg and his M.D. in 1992 from the University of Toulouse. Dr. Schmitt was selected as a semi-finalist astronaut candidate for the Spacelab-Neurolab mission in 1997. He was the Project Scientist for the Biorack experiments on the IML-2 Spacelab mission (1994), assisted in crew training and worked at the Payload Operations and Control Center in Huntsville, Alabama during that mission. Dr. Schmitt received first prize in the European competition for the best idea to use microgravity as a tool for application-oriented research (Low G Award'95). Didier Schmitt has served as the Principal Investigator for many Space Life Science experiments. Included are seven parabolic flights (1990-1992), Space Shuttle/Spacelab (IML-2, 1994) and Spacehab (Shuttle-Mir Missions – 03, 05, and 06, 1996-1997), sounding rocket (Sweden, 1995), flights aboard the Mir space station (1992, 1993, 1994), long duration bed rest (1992 in Toulouse and Houston, 1994 in Toulouse), long duration confinement (ESA/EXEMSI 1992 in Cologne, ESA/HUBES 1994 in Moscow), Antarctic winterings (1993-1995) and Biosatellite flights (rhesus monkeys, 1993). Dr. Schmitt has published 41 articles in reviewed international journals (13 in space biology and physiology). From 1992-1996, Dr. Schmitt served as Assistant Professor at the University of Toulouse. In 1996-1997, he was an Associate Professor at the International Space University in Strasbourg. Currently, Dr. Schmitt is head of Life Sciences, in charge of program planning and scientific coordination at the European Space Agency.

Masamichi Shigehara
Space Engineering
Co-Chair

Dr. Masamichi Shigehara is a Professor of the Department of Aerospace Engineering, Tokyo Metropolitan Institute of Technology (TMIT). Up to 1991, he served as an Executive Technology (Chief Engineer) at Toshiba Corporation to administrate the Space Programs Division. After graduating from the Department

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of Aeronautics at the University of Tokyo, he started his engineering career at Toshiba by studying guidance and control systems. There he had more than 30 years of experience in the design and integration of various spacecraft. In the meantime, he worked for Japanese NASDA in developing the guidance and attitude control systems of the NASDA Q' launch vehicles and spacecraft. At TMIT, he is studying a construction methodology of large space structures. He received a doctorate degree on the Attitude Control of the Spacecraft and his academic specialty is spacecraft engineering and guidance/control. Dr. Shigehara is a member of the AIAA and IAA, and was a former chair of Aerospace Division of the Japanese Society of Mechanical Engineering (JSME). He has been with ISU since 1990, was an associate Dean in 1992 and Co-Chair of the Engineering Department in '91, '92 and '95 and now is a member of the ISU Academic Council. He has published several books on guidance/control and spacecraft design, one of which entitled Introduction to Space Engineering – Guidance and Control of Space Vehicles, was awarded as a book of excellence in 1995 by the Japanese Society of Instrument and Control Engineering (SICE).

Vern Singhroy
Disaster Management in Southeast Asia Design Project
Co-Chair

Vern Singhroy is a senior research scientist at the Canada Centre for Remote Sensing (CCRS) in Ottawa, Canada. He received his Ph.D. in Environmental Engineering and Remote Sensing from the State University of New York, Syracuse. Dr. Singhroy is a professional engineer, and worked for over 20 years in the use of Earth Observation data for resource, environmental and natural hazard mapping in Australia, Brazil, Canada, China, Colombia, Caribbean, Guyana, Indonesia, Jordan, Japan, and Peru. He also has extensive experience in technology transfer to developing countries. Dr. Singhroy is principal investigator for RADARSAT applications in geological and natural hazards studies at CCRS and CSA. He has published over 180 scientific papers in journals, proceedings and books. He was the Editor-in-Chief for the Canadian Journal of Remote Sensing from 1992-1996. Dr. Singhroy is also an executive member of COSPAR, IGARSS and IUGS. In 1998, Dr. Singhroy was the Co-editor for a special issue on Natural Hazards in the Advances in Space Research. At the ISU, Dr Singhroy was the Co-Chair for the SSP design project on the International Program on Earth Observation in Toronto in 1990, and is a resident faculty member at the MSS 98-99 program in Strasbourg.

Erik Slachmuylders
Disaster Management in Southeast Asia Design Project
Co-Chair

Erik Slachmuylders, Belgian, has Master of Science degrees from the University of Ghent (Electromechanical/Control Engineering) in Belgium and of the California Institute of Technology (Aeronautical Engineering), and has spent most of his professional career working in various technical fields and positions in ESA (European Space Agency), mainly at its technical center in The Netherlands ESTEC. This includes: attitude and orbit

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control, orbital and body dynamics, structures and mechanisms, propulsion and aerothermodynamics, thermal control & life support and power systems, i.e. basically the spacecraft platform area. He is presently in the ESA Brussels office, which has been created to support the links with the European Union, but recently he has also been acting as Head of the European Astronaut Center in Cologne (Germany) in addition. Mr. Slachmuylders has been associated with ISU for a number of years, starting with the Summer Session in Toronto. He has been successively lecturer in the engineering department, Co-Chair of the DP "Global Disaster Warning and Mitigation" (GEOWARN), Co-Chair of the Engineering department, and Co-Chair of the DP "Hazards to Spaceflight." He also lectures Space Systems & Technology at the University of Ghent in a special aerospace engineering course set up jointly by the Dutch speaking universities in Belgium (Brussels, Louvain and Ghent). His hobbies are (classical) music and cycling.

Walter Thiebaut
Space Policy and Law
Faculty

Dr. Thiebaut was born in Dijon, France on December 17, 1945, but is of Belgian nationality. He obtained a Doctor's degree in law and a degree in European law from the Catholic University of Leuven (Belgium). He started his career as a contracts officer in the European Launcher Development Organization (LEDO) and in the Contracts Department of the European Space Research Organization (ESRO). After the creation of ESA, Dr. Thiebaut became an assistant to the Head of the Washington Office of ESA, where he was responsible for the liaison with NASA, NOAA and Intelsat. He joined the Legal Affairs Department of ESA in Paris in 1979 until today except for a period of two years, from 1987 to 1989, when he was seconded to the Space Unit of the Commission of the European Community, where he participated in the elaboration of the first policy document on space of the European Commission. Presently he is the Head of General Legal Matters, particularly in charge of the Science programme, the regime of privileges and immunities and the insurance programme of ESA. Dr. Thiebaut is a faculty member in ISU since 1992 and is also a lecturer at the European Centre of Space Law.

Paul Henry Tuinder
Space Policy and Law
Co-Chair

Mr. Tuinder is a scientific officer at the European Commission Directorate General XII, Science, Research and Development. He is involved in the Controlled Thermonuclear Fusion Programme. Mr. Tuinder was a visiting lecturer at the International Institute of Air and Space Law of the University of Leiden and a consultant specialized in international legal and policy questions with respect to space and telecommunications activities. Mr. Tuinder participated in various studies for the European Commission and the European Space Agency on legal and economical aspects of satellite telecommunications services in Europe. Mr. Tuinder lectured international law, telecommunication law and space law at the University of Amsterdam and at the Institute of Social Studies in the Hague.

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In 1991, Mr. Tuinder was appointed Executive Secretary of the European Centre for Space Law (ECSL) in Paris. This Centre functions under the auspices of the European Space Agency and initiates research, colloquia and other activities to promote the research of space law in Europe. Mr. Tuinder is an active member of the International Institute of Space Law (IISL) of the International Astronautical Federation (IAF), of the European Centre for Space Law (ECSL) and of the International Law Association (ILA) and has published articles and reports on various international space law subjects.

Ray Williamson
Space Policy and Law
Co-Chair

Ray A. Williamson is Research Professor of Space Policy and International Affairs in the Space Policy Institute of The George Washington University. His primary policy research includes studies of international Earth observations issues related to environmental security, sustainable development, and international information transparency. He is also working on methods to broaden the usefulness of Earth observations data for research and applications and on commercial space transportation policies. Dr. Williamson holds a Ph.D. in physics and astronomy and was a Senior Associate with the Congressional Office of Technology Assessment before joining the Space Policy Institute. He is a member of the Aeronautics and Space Engineering Board of the US National Academy of Engineering.

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Appendices

1.1 Evaluation

All students will have their Summer Session academic performance evaluated using the following three program elements:

A. Core Curriculum Examination

This written examination assesses the student's comprehension and understanding of the basic concepts from each department presented during the Core Lecture Series.

B. Department Evaluation

Written evaluation of student's comprehension, participation and performance within his/her area of specialty by the department chairperson with input from appropriate faculty/staff. Part of this evaluation shall be based upon participation in theme days, specialized lecture series and the student/faculty workshops, as well as the results of a short assignment agreed to by the department chairperson.

C. Design Project

Evaluation by the design project chairperson with input from department chairperson, other appropriate faculty/staff of the student's participation and significant contribution to the development, production and presentation of his/her design project.

1.2 Grading

A student may receive one of two grades at the completion of the Summer Session Program. They are:

Pass

This grade will be given to students who receive satisfactory evaluations in all three of the program evaluation elements.

A Certificate will be conferred upon students who have received a pass grade for the Summer Session Program.

Unsatisfactory

This grade will be given to students who do not obtain a satisfactory evaluation in any one of the program evaluation elements.

A student who stays until the end of the program and receives an unsatisfactory grade in any one of the three program evaluation elements will be given a Letter of Participation.

A personalized letter will be given to any student who leaves the Summer Session Program before its completion with good academic standing.

Students are evaluated based on criteria approved by the ISU Academic Council.

1.3 Withdrawal

Any student who is not undergoing disciplinary proceedings may petition for early withdrawal from the program. Petition for withdrawal must be submitted in writing to the Program Director.

Upon receipt of the written request, the petition for withdrawal will be decided upon by the Program Director, in consultation with the Assistant Director, Academic Unit and the student's department chairperson.

If the petition for withdrawal is approved by ISU, the student may request to be re-admitted to the following Summer Session.

1.4 Attendance and Participation

The International Space University experience is a composite of knowledge gained through formal methods such as lectures, as well as through more informal channels of discussion and participation in activities inside and outside of the classroom. In addition, ISU seeks to develop each student's capabilities, network of associates and interpersonal skills in small and large group settings.

Attendance and active participation are expected at all official ISU functions.

Any extended absence from ISU requires the prior written approval of the Program Director, with the concurrence of the student's department chairperson. Extended absences include: absence which prevents a student from participating in student/faculty workshops, orientation, ISU field trips, design project activities, and excessive absences from classroom lectures.

1.5 Academic Warning

Students whose academic performance is unsatisfactory will be subject to one or more of the following procedures:

A. Core Curriculum Examination

When a student fails the core curriculum examination, the following procedure will be instituted:

1. The student is notified in a letter from the Assistant Director, Academic Unit that he/she has failed.

2. The Assistant Director, Academic Unit then consults with the student's department chairperson and the Program Director.

3. If it is determined by the department chairperson that the student failed the examination due to extraneous circumstances (poor language skills, personal difficulties, illness, etc.), an oral re-examination will be scheduled by the department chairperson.
If the student passes the oral re-examination, he/she will receive a grade of Pass.
If the student fails the oral re-examination, he/she will receive a grade of Unsatisfactory for this evaluation element of the program.

4. If no extraneous circumstances for the failure are found, the student will be informed by the department chairperson and in writing by the Assistant Director, Academic Unit that he/she will receive a grade of Unsatisfactory for this evaluation element of the program.

B. Department

If a student's academic performance is unsatisfactory within this program element, the student will be placed on academic probation and will receive a written warning containing the reasons for his/her unsatisfactory performance from the Program Director. The student will have two weeks to improve his/her performance.

If the student's performance does not improve to the satisfaction of the Program Director, Assistant Director, Academic Unit, and the student's department chairperson, the student will be notified that he/she will receive an Unsatisfactory grade for this evaluation element of the program.

C. Design Project

If a student's academic performance is unsatisfactory within this program element, the student will be placed on academic probation and will receive a written warning containing the reasons for his/her unsatisfactory performance from the Program Director. The student will have two weeks to improve his/her performance.

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If the student's performance does not improve to the satisfaction of the Program Director and the design project chairperson, the student will be notified that he/she will receive an Unsatisfactory grade for this evaluation element of the program.

1.6 Committee on Academic and Disciplinary Proceedings (CADP)

The CADP shall be composed of the Program Director who shall serve as CADP Chair, the Assistant Director, Academic Unit, the Student Affairs Coordinator and the chairperson of the concerned department. When there is conflict that directly involves the department chairperson, another faculty member will be chosen to replace the department chairperson by the CADP. Alleged violations of ISU's Code of Conduct and Ethics and matters pertaining to academic performance shall be decided by the CADP. In all matters brought before the CADP, all parties will be given fair and equal opportunity to present their views to the CADP.

1.7 Disciplinary Measures

The Program Director may impose one of the following disciplinary measures for violation of ISU's Code of Conduct and Ethics depending on the severity of the offense: warning and/or dismissal.

A. Warning

A warning will result in a written notice to be kept in the student's permanent record. Probation will result in a record of the misconduct, with notification that continued improper activity may result in dismissal.

B. Dismissal

A student can be dismissed from ISU for the following reasons:

1. If a student's academic conduct is determined to be detrimental to the student's department, design project, or program as a whole

or

2. If the student violates the ISU Code of Conduct and Ethics, as outlined in Section 2.0.

Dismissal proceedings will be initiated by the Program Director. Upon notification to the student of his/her detrimental academic conduct and/or violation of the ISU Code of Conduct and Ethics, the Program Director will appoint a fact finding panel composed of the Assistant Director, Academic Unit, one member of faculty, and a member of the Academic Unit. The panel will report its findings and make a recommendation to the CADP.

After receiving the report and the recommendations of the fact finding panel, the CADP shall either:
1. terminate the dismissal proceedings or
2. send the student a written warning outlining the student's infraction(s).
If, after the warning, the student does not improve within a reasonable time frame to the satisfaction of the Program Director and the student's department chairperson, dismissal proceedings will be continued by the CADP.

If the CADP determines that the student has not made a good faith effort to improve his/her conduct, the CADP will dismiss the student from the program.

Dismissal of a student from ISU will exclude the student from all ISU activities.

1.8 Privacy of Student Record

All student records are confidential. All student evaluations for the Summer Session Program, examination

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scores and other evaluations of a student's performance are confidential and can not be released to anyone without the express written consent of the student. Students may request to see their record by submitting a form provided for this purpose. It is the student's responsibility to make an appointment with the Assistant Director, Academic Unit to inspect the record.

2.0 Code of Conduct and Ethics

2.1 Code of Honorable Conduct

All ISU students, staff and faculty shall conduct themselves in a manner that is honorable and respectful of other people. This shall pertain to activities associated with the admissions process, within the class, during examinations, while participating in ISU sponsored events and within the host communities.

2.2 Academic Honesty

All members of the ISU community shall conduct themselves in accordance with accepted principles of academic honesty. Plagiarism, copyright violations, cheating or other forms of dishonesty are prohibited and will not be tolerated.

Students, staff and faculty witnesses of academic dishonesty are encouraged to approach the offender. Every attempt should be made to resolve the situation in a manner that assists the offender to correct his/her behavior while maintaining the integrity of ISU and other individuals who may be involved. In instances where the offense is considered to merit additional action, the matter is to be referred to the chairperson of the department concerned.

2.3 Policy on Harassment and Discriminatory Behavior

Discrimination against or harassment of an individual on the basis of his/her race, nationality, gender, sexual orientation, religion, color or physical challenge is prohibited and will not be tolerated at ISU.

3.0 Grievance Procedures

Students are encouraged to raise issues of concern about all matters relating to the University. Confidentiality shall be fully respected when requested. It is the University's policy that lodging a grievance shall not result in sanctions of any kind against the individual who initiated the grievance procedure.

Grievance procedures should be lodged with the Academic Unit through the Student Affairs Coordinator. If the matter cannot be resolved satisfactorily at this point, then it shall be referred, in writing, to the Assistant Director, Academic Unit, who will accordingly notify the Program Director for further appropriate action.

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ISU Academic and Research Policy

ISU is dedicated to the development of outer space for peaceful purposes through education and research programs conducted in an international and multidisciplinary setting. Participation in ISU programs shall be open to individuals and institutions of all nationalities. As an open academic forum, ISU research activities and publications shall be funded, developed and distributed without censorship or secrecy. Programs and activities which would in any way limit ISU's international participation and dedication to peaceful objectives will not be undertaken.

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Weekly Schedules

Week 0

	Monday June 21	Tuesday June 22	Wednesday June 23	Thursday June 24	Friday June 25	Saturday June 26	Sunday June 27	
9:00								9:00
9:15								9:15
9:30								9:30
9:45								9:45
10:00								10:00
10:15								10:15
10:30								10:30
10:45								10:45
11:00								11:00
11:15							Welcome Brunch	11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15								12:15
12:30								12:30
12:45							Late Registration & Faculty A/V Orientation	12:45
13:00								13:00
13:15								13:15
13:30								13:30
13:45							ISU Orient. & Opening Ceremony Briefing & Fac. Orient.	13:45
14:00								14:00
14:15								14:15
14:30								14:30
14:45								14:45
15:00								15:00
15:15							Thai Cultural Presentation	15:15
15:30								15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30								16:30
16:45								16:45
17:00								17:00
17:15							Bus Tour of SUT and Nakhon Ratchasima	17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15								19:15
19:30								19:30
19:45							Dinner & Introduction Party	19:45
20:00								20:00
20:15								20:15
20:30								20:30
20:45								20:45

Student and Faculty Arrival and Registration Day

Activities for Faculty/Staff Only *Optional Activities*

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Week 1

	Monday June 28	Tuesday June 29	Wednesday June 30	Thursday July 1	Friday July 2	Saturday July 3	Sunday July 4	
9:00	8:00-9:30 Class Photos	The Origins of the Space Age (SAS)	Policy Issues and Major Space Powers (PL)	Electro-magnetic Spectrum (PS)	Design and Control of Space Robots (RRM)	Team Building		9:00
9:15								9:15
9:30								9:30
9:45								9:45
10:00								10:00
10:15	Opening Ceremony							10:15
10:30								10:30
10:45		Rationale for Space Programs (PL)	Introduction to Space Life Sciences (LS)	Introduction to Satellite Applications & Remote Sensing (SA)	Nature of Systems (SSAD)			10:45
11:00								11:00
11:15								11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15		English Tutorials	English Tutorials	Q&A Discussion	English Tutorials			12:15
12:30								12:30
12:45								12:45
13:00		Director's Meeting	*Design Project Selection Form Due*					13:00
13:15	Academic Orientation							13:15
13:30		Computer Class 1	Computer Class 2	Computer Class 3				13:30
13:45								13:45
14:00		Economic Rationale for Space Activities (BM)	Staff Meeting	Academic Meeting				14:00
14:15								14:15
14:30	Design Project Orientation							14:30
14:45								14:45
15:00			Introduction to Astrodynamics (EG)	Management of Space Projects (BM)	Student/ Faculty Workshops 2 & 3			15:00
15:15								15:15
15:30		Q&A Discussion						15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30				English Tutorials				16:30
16:45	Space Informatics I	Student/ Faculty Workshop 1						16:45
17:00			**D.P. 1** Design Project Orientation (Both projects)					17:00
17:15								17:15
17:30				Orientation Rotation 2				17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15			Distinguished Lecture Series 1					19:15
19:30								19:30
19:45	Reception							19:45
20:00								20:00
20:15		Orientation Rotation 1		Orientation Rotation 3				20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only — *Optional Activities*

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Week 2

	Monday July 5	Tuesday July 6	Wednesday July 7	Thursday July 8	Friday July 9	Saturday July 10	Sunday July 11	
9:00								9:00
9:15	Principles of International Space Law (PL)	The Plasma Universe (PS)	Microgravity and Fluid Dynamics (RRM)	Spacecraft Configuration (EG)	The Space Flight Revolution (SAS)			9:15
9:30								9:30
9:45								9:45
10:00								10:00
10:15								10:15
10:30								10:30
10:45	Application and Command Strategies for Space Robots (RRM)	Cardio-Vascular Physiology (LS)	Space Transportation Systems (EG)	Telecommun-ications II (SA)	Sun & the Heliosphere (PS)			10:45
11:00								11:00
11:15								11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15	English Tutorials	English Tutorials	English Tutorials	English Tutorials	English Tutorials			12:15
12:30								12:30
12:45								12:45
13:00								13:00
13:15								13:15
13:30								13:30
13:45								13:45
14:00	*Directors' Meeting*	*ERC Meeting I*	*Staff Meeting*	*Academic Meeting*	*Sub-ERC Meeting I*			14:00
14:15								14:15
14:30								14:30
14:45								14:45
15:00	Business Structures and Planning (BM)	Telecommun-ications I (SA)	Student/ Faculty Workshop 4	Bone & Muscle Physiology (LS)	From Requirements to Reality (SSAD)			15:00
15:15								15:15
15:30								15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30								16:30
16:45	Space Propulsion Systems (EG)	**D.P. 1**	Student/ Faculty Workshop 5	ERC Mtng. 2 **D.P. 2**	Class Meeting I			16:45
17:00								17:00
17:15								17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15			Distinguished Lecture Series II					19:15
19:30								19:30
19:45								19:45
20:00					Cultural Night I			20:00
20:15								20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

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Week 3

	Monday July 12	Tuesday July 13	Wednesday July 14	Thursday July 15	Friday July 16	Saturday July 17	Sunday July 18	
9:00	Payload Design (EG)	Medical & Psychological Issues of Space Flight (LS)	Neuroscience (LS)	Financial Issues & Techniques (BM)	Space Mission Design (SSAD)			9:00
9:15								9:15
9:30								9:30
9:45								9:45
10:00								10:00
10:15								10:15
10:30								10:30
10:45	Space Remote Sensing - Payload & Platforms (SA)	Environmental Control (EG)	Solar System I (PS)	Legal & Economic Aspects of Space Commer-cialization (PL)	Cost Estimation and Risk Management (BM)			10:45
11:00								11:00
11:15								11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15		Q&A Discussion	English Tutorial	English Tutorial	Q&A Discussion			12:15
12:30								12:30
12:45						*Distribution of Essay Questions for Midterm Exam*		12:45
13:00								13:00
13:15								13:15
13:30	*Directors' Meeting*							13:30
13:45								13:45
14:00	Space Informatics II	*ERC Meeting 3*	*Staff Meeting*	*Academic Meeting*	*Sub-ERC Meeting II*			14:00
14:15								14:15
14:30								14:30
14:45								14:45
15:00		Space Resources and the Breakout into Space (RRM)	Long Term Implications of Space Resources (RRM)	Student/ Faculty Workshop 6	Thermal Control and Power Systems (EG)			15:00
15:15								15:15
15:30	Q&A Discussion							15:30
15:45								15:45
16:00	**D.P. 4**							16:00
16:15								16:15
16:30								16:30
16:45		Spacecraft Structures (EG)	The Cosmicization of Humankind (SAS)	Student/ Faculty Workshop 7	**D.P. 5**			16:45
17:00								17:00
17:15								17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15			Q&A Discussion					18:15
18:30								18:30
18:45								18:45
19:00	Distinguished Lecture Series III							19:00
19:15								19:15
19:30								19:30
19:45								19:45
20:00						Cultural Night II		20:00
20:15		MSS Review			Exam Briefing			20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

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Week 4

	Monday July 19	Tuesday July 20	Wednesday July 21	Thursday July 22	Friday July 23	Saturday July 24	Sunday July 25	
9:00	Our Universe (PS)	Solar System II (PS)	Guidance, Navigation and Control (EG)	Digital Image Processing (SA)	Birth and Death of Stars (PS)			9:00
9:15								9:15
9:30								9:30
9:45								9:45
10:00								10:00
10:15								10:15
10:30								10:30
10:45	Searching for Extra-terrestrial Intelligence (SAS)	National Space Programs II (PL)	Global Navigation Satellite Systems (SA)	Geomatics & Global Modeling (SA)	New Econ. & Industrial Development in Space Activities (BM)			10:45
11:00								11:00
11:15								11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15	Q&A Discussion		Q&A Discussion	English Tutorials	English Tutorials			12:15
12:30								12:30
12:45					*Last Day for Block Selection Form*			12:45
13:00								13:00
13:15								13:15
13:30		*Directors' Meeting*						13:30
13:45								13:45
14:00	Organization of Space Activities (PL)	Decision Making Process (SSAD)	Space Power for Earth (RRM)	*Academic Meeting*	*Staff Meeting*			14:00
14:15								14:15
14:30								14:30
14:45								14:45
15:00				Legal Aspects of Space Applications (PL)	Mars Mission Design (SSAD)		TUTORIALS (TAs available for consultation)	15:00
15:15								15:15
15:30								15:30
15:45	National Space Programs I (PL)	**D.P. 6**	Space Biology (LS)					15:45
16:00								16:00
16:15								16:15
16:30				Q&A Discussion				16:30
16:45								16:45
17:00								17:00
17:15					Student/ Faculty Workshop 8			17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00			Distinguished Lecture Series IV					19:00
19:15								19:15
19:30								19:30
19:45								19:45
20:00								20:00
20:15								20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

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Week 5

	Monday July 26	Tuesday July 27	Wednesday July 28	Thursday July 29	Friday July 30	Saturday July 31	Sunday August 1	
9:00	*Exam*	*Mid-Session Break*	*2nd Half Faculty Arrival*	*2nd Half Faculty Orientation*	Alumni Conference & Poster Session	**D.P. 9**	*1st Half Faculty Departure*	9:00
9:15								9:15
9:30								9:30
9:45								9:45
10:00								10:00
10:15				*Faculty Lessons Learned Meeting*				10:15
10:30								10:30
10:45					**D.P. 8**	**D.P. 10**		10:45
11:00								11:00
11:15								11:15
11:30				*Staff Lessons Learned Meeting*				11:30
11:45								11:45
12:00								12:00
12:15								12:15
12:30								12:30
12:45								12:45
13:00				2nd Half Faculty Intro.				13:00
13:15								13:15
13:30								13:30
13:45				ISU Programs Overview				13:45
14:00					*8th Annual Alumni Conference & Poster Session*			14:00
14:15								14:15
14:30						**D.P. 11**		14:30
14:45								14:45
15:00	*Mid-Session Break*			Student/ Faculty Workshop 9				15:00
15:15								15:15
15:30								15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30								16:30
16:45				**D.P. 7**				16:45
17:00								17:00
17:15								17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15								19:15
19:30								19:30
19:45								19:45
20:00		MSS Final Presentation				Space Masquerade PARTY		20:00
20:15								20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

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Week 6

	Monday August 2	Tuesday August 3	Wednesday August 4	Thursday August 5	Friday August 6	Saturday August 7	Sunday August 8	
9:00								9:00
9:15		SYSTEM REQU'TS REVIEW PROJECT I						9:15
9:30	D.P. 12							9:30
9:45								9:45
10:00			*Specialized Lecture Series (SLS) Block One*					10:00
10:15								10:15
10:30					*Theme Block Two*	*Theme Block Three*		10:30
10:45								10:45
11:00		SYSTEM REQU'TS REVIEW PROJECT II						11:00
11:15	D.P. 13							11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15			English Tutorial	English Tutorial				12:15
12:30								12:30
12:45								12:45
13:00								13:00
13:15								13:15
13:30	*Directors' Meeting*							13:30
13:45								13:45
14:00								14:00
14:15		*Academic Meeting*	*Staff Meeting*	*Academic Meeting*				14:15
14:30								14:30
14:45								14:45
15:00		Design Project I Review Feedback						15:00
15:15								15:15
15:30					*Theme Block Two (cont.)*	*Theme Block Three (cont.)*		15:30
15:45								15:45
16:00	D.P. 14	Design Project II Review Feedback	D.P. 17	Student/ Faculty Workshop 10				16:00
16:15								16:15
16:30								16:30
16:45								16:45
17:00								17:00
17:15								17:15
17:30								17:30
17:45	D.P. 15	D.P. 16	D.P. 18	Student/ Faculty Workshop 11				17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15			Distinguished Lecture Series V					19:15
19:30								19:30
19:45								19:45
20:00								20:00
20:15						Cultural Night III		20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

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Week 7

	Monday August 9	Tuesday August 10	Wednesday August 11	Thursday August 12	Friday August 13	Saturday August 14	Sunday August 15	
9:00								9:00
9:15								9:15
9:30								9:30
9:45			*Specialized Lecture Series (SLS) Block Five* (Part 1)		*Specialized Lecture Series (SLS) Block Five* (Part 2)			9:45
10:00								10:00
10:15	Director's Meeting	*Theme Block Four*				*Theme Block Six*		10:15
10:30								10:30
10:45								10:45
11:00								11:00
11:15								11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15	*Departmental Activity Day*		English Tutorial		English Tutorial			12:15
12:30								12:30
12:45								12:45
13:00								13:00
13:15								13:15
13:30								13:30
13:45								13:45
14:00			*Academic Meeting*		*Staff Meeting*			14:00
14:15								14:15
14:30								14:30
14:45								14:45
15:00								15:00
15:15								15:15
15:30		*Theme Block Four (cont.)*	**D.P. 19**		Student/ Faculty Workshop 13	*Theme Block Six (cont.)*		15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30								16:30
16:45								16:45
17:00								17:00
17:15			Student/ Faculty Workshop 12		Student/ Faculty Workshop 14			17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15			Distinguished Lecture Series VI					19:15
19:30								19:30
19:45								19:45
20:00								20:00
20:15						Cultural Night IV		20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

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Week 8

	Monday August 16	Tuesday August 17	Wednesday August 18	Thursday August 19	Friday August 20	Saturday August 21	Sunday August 22	
9:00								9:00
9:15								9:15
9:30	**D.P. 20**	**D.P. 24**	**D.P. 28**	**D.P. 32**	**D.P. 36**			9:30
9:45								9:45
10:00								10:00
10:15								10:15
10:30								10:30
10:45								10:45
11:00								11:00
11:15	**D.P. 21**	**D.P. 25**	**D.P. 29**	**D.P. 33**	**D.P. 37**			11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15								12:15
12:30								12:30
12:45	*Academic*	*Academic*	*Academic*	*Academic*	*Academic*			12:45
13:00	*Meeting*	*Meeting*	*Meeting*	*Meeting*	*Meeting*			13:00
13:15								13:15
13:30								13:30
13:45								13:45
14:00						Work		14:00
14:15	*Directors'*		*Staff*	*Academic*	Class	on Design		14:15
14:30	*Meeting*		*Meeting*	*Meeting*	Meeting II	Project		14:30
14:45						9:00 - 20:00		14:45
15:00								15:00
15:15								15:15
15:30	**D.P. 22**	**D.P. 26**	**D.P. 30**	**D.P. 34**	**D.P. 38**			15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30								16:30
16:45								16:45
17:00								17:00
17:15	**D.P. 23**	**D.P. 27**	**D.P. 31**	**D.P. 35**	**D.P. 39**			17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15								19:15
19:30								19:30
19:45								19:45
20:00								20:00
20:15								20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

มหาวิทยาลัยเทคโนโลยีสุรนารี

Week 9

	Monday August 23	Tuesday August 24	Wednesday August 25	Thursday August 26	Friday August 27	Saturday August 28	Sunday August 29	
9:00								9:00
9:15	DESIGN PROJECT I FINAL REVIEW	**D.P. 40**	**D.P. 44**	**D.P. 48**	**D.P. 52**	**D.P. 56**		9:15
9:30								9:30
9:45								9:45
10:00								10:00
10:15								10:15
10:30								10:30
10:45								10:45
11:00	DESIGN PROJECT I I FINAL REVIEW	**D.P. 41**	**D.P. 45**	**D.P. 49**	**D.P. 53**	**D.P. 57**		11:00
11:15								11:15
11:30								11:30
11:45								11:45
12:00								12:00
12:15								12:15
12:30								12:30
12:45		*Academic Meeting*	*Academic Meeting*	*Academic Meeting*	*Academic Meeting*			12:45
13:00								13:00
13:15								13:15
13:30					*Final Written Student Evaluations due from Department Chairs*			13:30
13:45								13:45
14:00								14:00
14:15	*Academic Meeting*	*Directors' Meeting*	*Staff Meeting*					14:15
14:30								14:30
14:45								14:45
15:00								15:00
15:15								15:15
15:30	Design Project I Final Review Feed Back	**D.P. 42**	**D.P. 46**	**D.P. 50**	**D.P. 54**	**D.P. 58**		15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30								16:30
16:45								16:45
17:00								17:00
17:15	Design Project II Final Review Feed Back	**D.P. 43**	**D.P. 47**	**D.P. 51**	**D.P. 55**	**D.P. 59**		17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15								18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15								19:15
19:30								19:30
19:45								19:45
20:00								20:00
20:15								20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

มหาวิทยาลัยเทคโนโลยีสุรนารี

Week 10

	Monday August 30	Tuesday August 31	Wednesday Sept. 1	Thursday Sept. 2	Friday Sept. 3	Saturday Sept. 4	Sunday Sept. 5	
9:00								9:00
9:15								9:15
9:30	**D.P. 60**	**D.P. 64**						9:30
9:45								9:45
10:00								10:00
10:15								10:15
10:30			Design Project 9:00 - 21:00					10:30
10:45								10:45
11:00								11:00
11:15	**D.P. 61**	**D.P. 65**		FINAL PRESENTATION DESIGN PROJECT I				11:15
11:30								11:30
11:45								11:45
12:00					*Hand out to students DP Final Reports, Transcripts, Contacts Directory, and More!*			12:00
12:15								12:15
12:30								12:30
12:45								12:45
13:00								13:00
13:15								13:15
13:30								13:30
13:45								13:45
14:00	*Lessons Learned Staff/TAs*	*2nd Half Faculty Lessons Learned*						14:00
14:15								14:15
14:30								14:30
14:45								14:45
15:00								15:00
15:15								15:15
15:30	**D.P. 62**	**D.P. 66**		FINAL PRESENTATION DESIGN PROJECT II		*Departure Day*		15:30
15:45								15:45
16:00								16:00
16:15								16:15
16:30								16:30
16:45								16:45
17:00								17:00
17:15	**D.P. 63**	**D.P. 67**	Design Project 9:00 - 21:00 (continued)					17:15
17:30								17:30
17:45								17:45
18:00								18:00
18:15		*Final Written Design Project Evaluation for DP Chairs*						18:15
18:30								18:30
18:45								18:45
19:00								19:00
19:15				*Computer Lab Closes*	Closing Ceremony and Reception Party			19:15
19:30								19:30
19:45								19:45
20:00	TALENT NIGHT							20:00
20:15								20:15
20:30								20:30
20:45								20:45

Activities for Faculty/Staff Only *Optional Activities*

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In general, the role of liaisons is to develop awareness of ISU and its programs within the liaison's geographical area and to respond to questions about ISU programs. They provide advice to prospective applicants and assist them in their search for funding to support their attendance. Some liaison offices are themselves actively engaged in fund-raising activities and provide scholarships to applicants from their country.

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Canadian Alumni of ISU (CAISU)

The Canadian Alumni of the International Space University (CAISU) is a non-profit organization devoted to preserving and promoting contacts between all Canadian alumni of ISU, informing any interested party in Canada about the affairs of ISU, representing its members when dealing with ISU, and advancing and promoting space education and research in Canada. Membership in CAISU is open to all alumni of ISU who are Canadian citizens or who are currently living in Canada. At present, CAISU consists of approximately 100 individuals spread throughout the country.

One of the major events organized annually by CAISU is a space education workshop aimed at high school and undergraduate students interested in a career in the space field. CAISU also publishes a quarterly newsletter, organizes a speaker's bureau to promote ISU, supports space-related presentations by its members, helps in preparing Canadian students prior to the Summer Sessions, and organizes social and professional events for its members. CAISU looks forward to welcoming its new members from the class of '99!

For further information on CAISU, please contact:

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http://www.caisu.ca

Chinese Alumni Association of ISU (CAA)

The CAA, established in 1997, aims to promote social, professional and academic linkage among ISU alumni in China. The CAA also serves as a body to communicate and collaborate with other ISU alumni organizations. All Chinese alumni, awarded a certificate of SSP or a degree of MSS, become automatically CAA's members.

Dr. Guohong XIA (SSP'88), Vice President of China Aerospace Corporation (CASC) and Mr. Xianzheng ZHU (SSP'96) Deputy Director of Space Continue Education Center, serve as the first and current president and vice president of CAA respectively. Mr. Xiaoxiong MENG (SSP'91), General Manager of AI International Consulting Corp. (AIC) under CASC is holding the position of general secretary. Now, CAA has about 40 members and most of them are playing important roles in the Chinese Space Field.

CAA's outline, the list of Chinese alumni, and their current activities in English are accessible at www.aic.com.cn/caa.html.

For further information on CAA, please contact:

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European Alumni Association (EAA)

Aims of the European Alumni Association

The European Alumni Association is the organized voice of European Alumni. It exists to help alumni maintain contacts and friendships made during the summer sessions and the master's program.

Membership

Membership of the EAA is free and has always been automatic to all ISU students from European countries and

those from other regions living or working in Europe for a period of greater than 3 months. "Europe" has always been deliberately defined very loosely, and since early 1995 this has been extended to include all those alumni not previously members of other alumni associations, (South America, Africa, Asia, Australasia, etc.). Currently, the EAA has more than 500 members from 40 countries.
All members receive a newsletter, "Space Talk" free of charge. Members who choose to pay the optional membership fee of 10 Euro (about $10) are deemed to be "active members" with the right to vote at official meetings of the EAA.

The EAA Structure

The EAA Executive Committee is an elected body having 14 members: President, Secretary, Treasurer, Publicity and 10 Networkers. The Networkers are regional contact points, each covering one or more countries. The main aim of this system is to improve communication between the EAA and its members (40% of our membership do not have E-mail.) There is also a Board of Advisors, consisting of one alumni from each SSP and MSS year, whose responsibility is to advise on any major decision that must be taken and on the general direction and structure of the EAA.

Annual Meeting and Ski Week

The Annual General Meeting (AGM) of the EAA is usually held in March, as part of a ski week. This event has steadily grown with some 70 people attending every year and is open to all ISU alumni, not just those of the EAA.
In addition there are also several regular, informal, regional gatherings of alumni, such as those in The Netherlands and United Kingdom.

The EAA Newsletter "Space Talk"

This is mailed to all members of the EAA free of charge, through an arrangement with ESA. One of the main aims of "Space Talk" is to help alumni keep in touch with each other. To this end, an EAA Directory has been published giving phone, fax, E-mail and address information for all EAA alumni. Updates to this Directory are published in "Space Talk." Alumni whose contact information changes are urged to inform the EAA. All information updates we receive are shared with ISU. "Space Talk" also serves as a forum for discussion and announcements, carrying alumni articles, the latest news about alumni activities, changes of address and the latest news about ISU. The alumni articles may be on any topic including social activities and work-oriented, semi-technical articles. All alumni are welcome and encouraged to write articles, whenever they wish, on whatever subject they wish.

For further information on EAA, please contact:

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ISU U.S. Alumni Organization (IUSAO)

The IUSAO's goal is to promote social, professional and academic linkage between ISU alumni, in particular those residing in the United States of America; and to support the ISU's goal of academic excellence. The IUSAO also serves as a body to communicate and collaborate with other ISU alumni organizations. Any person who has been awarded a certificate of completion or a degree from ISU qualifies for membership in IUSAO. The IUSAO does not limit its membership to US citizens

and is open to alumni of both the masters program and the summer session.

The IUSAO draws much of its strength and activities from the close-knit members in particular cities and regions that organize and implement social and professional gatherings. These activities at the regional level make up the rich fabric of the IUSAO.

We welcome alumni to join the IUSAO and its vibrant activities. If you would like more information on our activities or membership please contact:

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Nippon Alumni Club (NAC)

The Nippon Alumni Club (NAC) was formed in 1992 to maintain ties among ISU alumni throughout Japan and international alumni who work in the country. All the national alumni automatically obtain membership, and associate memberships are given to Japanese faculty and staff upon request. Mikiya Okumura (SSP'90) serves as the first and current president. The NAC hosts nearly 90 members and, in close cooperation with the ISU Japan Liaison Office, it maintains the members' directory and holds a pre-session meeting with new Summer Session students in summer and an annual meeting/party at Christmas time. Although no regular nation-wide bulletin is issued, local activities such as newsletters, public presentations and get-togethers are frequently held, depending upon regions. The Japanese-language-based Internet mailing list <NAC-Net> is open to all members (convenor: Yuji Osawa of NASDA (SSP'92)) and the WWW Home Page (**http://eosp71b.hq.nasda.go.jp/isu/home.html**) is also accessible.

From May 1995 – April 1998, the NAC sent Hajime Yano of ISAS (SSP'93) to the ISU Board of Trustees as the global alumni representative.

For further information on NAC please contact:

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