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THE UNITED SPACE SCHOOL: A PROVEN APPROACH TO SECONDARY SCHOOL EDUCATION

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ABSTRACT

The global space industry is evolving with the influx of Generation Y. It is these folks, inspired by the Space Shuttle, Galileo, and X-Prize that will lead a new era in space exploration. How best to tap into this wide talent pool than by introducing them to the multidisciplinary nature of the space industry in early adolescence? For 16 years, the United Space School (USS) program has brought together the brightest students between the ages of 16-20 in Houston, Texas, USA for a 2-week summer academic and cultural introduction to space science, technology & exploration. Operated by the Foundation for International Space Education (FISE) (501c3) in collaboration with the University of Houston-Clear Lake (UHCL), University of Texas Medical Branch (UTMB) and NASA's Johnson Space Center, approximately 600 students from 48 nations have been inspired and educated by way of USS. This paper seeks to provide an overview of the United Space School's objectives and aims, history, operational structure, lessons learned, future developments and the status of its current global network in partnership with the International Space School Alumni Association (ISSA). The authors produce this manuscript with an aim that other organizations with similar programs in existence may wish to collaborate, adopt or develop new methodologies to educate the next wave of future space professionals. Furthermore, the authors aspire to highlight substantial programs that support international space education.

I. OVERVIEW

The United Space School (USS) has brought secondary-level space education to high-school students from 48 countries over the past 16 years. This program, designed to provide an academic-driven multicultural environment has introduced the space industry including cutting-edge research, benefits and people to the world's future leaders. This is inherently unique about the USS when compared to other youth space-related programs. Operated by the non-profit charity (501c3) Foundation for International Space Education (FISE) in Houston, Texas with a strong volunteer base in the Clear Lake community and surrounding space industry, the USS is able to deliver a high-calibre curriculum to its invited international delegates. The structure of the USS organization along with its interdisciplinary curriculum and truly cross-cultural nature supports the cultivation of creativity that is critical for the future career development of young delegates attending the program.

II Aims & Goals

The United Space School aims to provide its students a realistic perspective on the space industry while using an international, intercultural, and interdisciplinary approach. To achieve this mission, FISE has set the following goals:

- Provide the opportunity and the venue whereby international students come together to participate in a space-based academic initiative
- Develop and implement a curriculum to facilitate student development of a *Manned Mission to Mars Project*
- Provide subject matter instruction by space industry experts, appropriate team management by Team Mentors, and adequate research and development opportunities for completion of *Manned Mission to Mars Project*

- Develop student awareness of the many workforce opportunities available in the aerospace and peripheral industries
- Introduce awareness of international cultural diversity as an element in team building in preparation for international collaboration on space exploration initiatives
- Provide an introduction to American culture through appropriate social, cultural and recreational opportunities

Each activity on the United Space School schedule can be directly traced to one of these specific goals.

II. HISTORY

The United Space School (USS) Program has its roots embedded within the dedicated NASA Houston/Clear Lake community. Created in 1995 by NASA Public Service Medal recipients Geoff & Annette Mules to inspire young students in the space industry, Mr and Mrs. Mules began billeting a handful of Welsh students for 2 weeks every summer to learn more about what life was like at the Johnson Space Centre. By 1997 a formal educational program was in place and the International Space School received its first class of students largely from the UK, Canada and France. Under the direction of the International Space School Foundation (ISSF) the program grew to include students from numerous other nations, as diverse as Russia and Sri Lanka. Alumni of the school, along with a mixture of dedicated educators and NASA civil and contract staff were recruited to mentor the students both with academic exercises and personal development.

In 2007, Geoff and Annette Mules decided to discontinue the International Space School program. For legal reasons, they chose to dissolve the ISSF. A group of former ISSF volunteers, not wanting to see such a beneficial program lost for good, chose to take on the responsibility of organizing and operating the Space School program. They created a new non-profit corporation, the Foundation for International Space Education (FISE), and renamed the existing program the United Space School (USS). The USS is identical in aim and nature to the International Space School program, though the program continues to evolve under the FISE leadership. The volunteers made up the initial Board of Directors of FISE and elected Rob Alexander to be the first Executive Director. Their intent was to have FISE act as an umbrella organization for multiple space education initiatives, with the United Space School as its flagship program. With a short time to plan and very limited budget, FISE was able to conduct the first session of the United Space School in July 2008.

Students selected are expected to act as ambassadors for their home country, set a high standard of deportment and academic aptitude of aerospace and space through summative evaluations, and share their culture with those around them. These principles still extend to the students of the United Space School today. Voluntary donations of time, equipment and financial resources ensure this program continues year after year with significant credit toward the community of Houston-Clear Lake.

III. OPERATIONAL STRUCTURE

Every facet of the United Space School can be traced to one of its goals outlined in the following underlined sub sub-headings.

III.I Academic Program

Provide the opportunity and the venue whereby international students come together to participate in a space-based academic initiative

The participating countries and their respective schools are recommended by individuals associated with NASA JSC as well as various international aerospace organizations. Many countries invited to select students for Space School are currently partners of the International Space Station, though in recent years emphasis has been given to include developing space and non-space faring nations.

Each participating country selects its students through open competition providing equal opportunities regardless of race, creed or gender – a FISE guideline. These students receive space-based instruction in various disciplines and complete a *Manned Mission to Mars Project*. Approximately 600 international male and female students representing 48 countries, and their respective races and religions, have participated to date.

Each student is both a country representative and a FISE representative and, as such, must abide by FISE guidelines and regulations regarding general deportment, academic expectations, extracurricular activities and behaviour. These guidelines and regulations are provided to each student, their guardian, and sponsoring entities, and must be signed by all parties and placed on file at FISE.

Upon completion of Space School, the students return home to share their experiences with their families, schools, and communities, and share the possibilities of a career in a space-related industry. Alumni assist in selecting the student for the subsequent

space school intakes, as part of a greater web of alumni referred to in the VI. Network section.

The venue for United Space School is Bay Area Houston, Texas, home to NASA's Manned Space Flight Center, the Lyndon B. Johnson Space Center (JSC). JSC is home to the astronaut corps, human space flight training, Mission Control, and the Shuttle and International Space Station Programs. Bay Area Houston is the home of a large and diverse aerospace community. The University of Houston Clear Lake, adjacent to JSC, is the venue for much of Space School's classroom training, in conjunction with training experiences at JSC, the George Observatory, and Space Center Houston.

Develop and implement a curriculum designed to allow the students to design a Manned Mission to Mars Project

Having been selected by their respective countries as outstanding science & math scholars, the students must prepare for Space School by completing academic requirements identified by FISE. Six (6) assignments created by FISE must be completed. These assignments include exercises in mathematics, biology, chemistry, and physics, as well as a book reading assignment from the USS reading list. The assignments are reviewed by FISE Technical Advisors for accuracy. The students must also complete additional internet research on selected Mars topics, including identifying which project crew positions they wish to assume and the job descriptions and requirements for these positions. They must construct a resume to apply and interview for these positions.

To provide the knowledge necessary to complete the *Manned Mission to Mars Project*, a curriculum has been designed to provide appropriate training by knowledgeable instructors qualified in appropriate disciplines. Civil and contractor aerospace professionals are selected to provide needs-based instruction on topics relevant to developing a human mission to Mars. Library and on-line research is provided at the University of Houston Clear Lake campus.

Provide subject matter instruction by space industry experts, appropriate team management by Team Mentors, and adequate research and development opportunities for completion of the aforementioned Manned Mission to Mars Project

Technical Advisor	Area of Expertise	Subject
Grant Schaffner, Ph.D.	Human Physiology	Physiological Effects on the Human Body in a Weightlessness Environment
Franklin Chang-Diaz, Ph.D.	Propulsion	Plasma Propulsion Rocketry
Mike Powell, M.D.	Life Sciences	Human Exploration of Mars
Jack Bacon	International Space Station	Life Support & Environmental Systems
Nigel Packham, Ph.D.	Space Habitats	Psychological Factors in Long Duration Spaceflight
Justin Kugler	Spacecraft Development	Design of Human Exploration Spacecraft
Amie Allison	JAXA	Japanese Space Program
Topical Speaker		
Comm. Scott Kelly	NASA Astronaut	Various Topics
Chris Stott	ManSat LLP	Space Business and Law
Andy Thomas	NASA Astronaut	Long Endurance Spaceflight
Kieran Smart, M.D.	Flight Surgeon	Medical Care During Spaceflight
Chris Hadfield	Canadian Astronaut	Spaceflight Experiences
Jason Dyer	Canadian Arrow Team	X-Prize Competition
Lee Morin	NASA Astronaut	Mars Exploration

Table 1: Sample list of USS subjects covered, the Technical Advisors and Topical Speakers, their subjects and their expert credentials to demonstrate the applicability of the curriculum to the required project



*Astronaut speaks to United Space School class
(Credit: FISE)*

To enhance instruction students participate in a variety of space-related activities at the Johnson Space Center, the University of Houston Clear Lake, Space Center Houston, the George Observatory at Brazos Bend State Park, the Houston Museum of Natural Science, and the Space Medicine Institute at the University of Texas Medical Branch in Galveston. These activities include a VIP tour of JSC facilities, *Challenger Missions*, and a special project at the George Observatory.

To complete the *Manned Mission to Mars Project* during the two week Space School session, the project is divided into four (4) teams each responsible for a specific, yet integrated, portion of the Mission. A coloured uniform designates each team:

Mission Control (Yellow Team); Mars Destination (Red Team); Mars Habitation (Green Team); and Mars Exploration (Blue Team).

On the first day, students apply for two (2) crew assignments within the team of their choice, submit their resume and participate in an interview for each position. Each team's Mentor, an expert from the JSC aerospace community, participates in the interview process to guide the committee in selecting the appropriate individual for each team position, as they learn each student's strengths to contribute to the team.

The Mentor answers team questions, oversees the research, guides the activities of the team, and advises on the scope of the final report presentation. Using the information imparted by the subject presentations, the students design and construct their team assignment. Each team meets daily to discuss status and incorporate applicable new information into their project assignment.

Mission Control (Yellow Team): The Yellow Team is responsible for the overall *Mission Budget*, as well as all aspects of space law and political issues applicable to the *Mission*. They are also responsible for designing the lunar base that will be used to support the *Manned Mission to Mars*. As a result, the Yellow Team will be in close communication with the other three (3) teams to coordinate these aspects of the Mission. The Yellow Team will research design considerations including living quarters, utilities, physical plant requirements, hazardous environment, municipal support requirements, politics and law, launch and landing facilities, and other human habitation requirements.

The Yellow Team project assignment must answer:

- Why did we come to the Moon?
- How shall we survive?
- How shall we proceed safely?
- How shall we support the Mission to Mars?

Mars Destination (Red Team): The Red Team is responsible for all aspects of the journey from Earth to Mars and back, in a safe, timely and feasible manner. The Red Team considers many areas of science, technology, engineering and mathematics, including spacecraft and habitat design, propulsion systems, communications, construction and launch timelines, system integration, orbital inclination, crew requirements, human physiology and psychology in hazardous space environments, nutrition and exercise, launch and landing, risk assessment, radiation, etc.

The Red Team project assignment must answer:

- Why do we go?
- How do we go safely?
- What is our scientific mission?
- How shall the crew manage the journey?
- What data shall we send back to Earth and how?
- How shall we land and launch again?

Mars Habitation (Green Team): The Green Team is responsible for all aspects of crew survival upon touch down on Mars. Green Team members consider some of the same STEM applications as the Red Team, in addition to aspects such as choosing landing and living sites, habitat requirements and in situ construction, communications, robotic living and exploring components, replenishment of survival resources, Martian resource utilization, recreation and interpersonal relationships, radiation and climate hazards, etc.

The Green Team project assignment must answer:

- Why are we here?
- How shall we survive?
- What are the risks
- How shall we proceed safely?
- What are our physical and/or psychological needs?
- What is our scientific mission?

Mars Exploration (Blue Team): The Blue Team is responsible for all aspects of exploration and experimentation exterior to the Martian habitat environment. The Blue Team considers the same STEM applications as the Red and Green Teams, in addition to aspects such as communications, rover/robotic requirements, robotic and manned vehicle propulsion and guidance, hazardous environment protective suits, radiation and contamination, site exploration and selection, sample retrieval equipment, exploration and research timelines and the search for life, etc.

The Blue Team project assignment must answer:

- What is our mission?
- Where to go?
- How do we go safely?
- What do we need?
- What are our human versus robotic needs and capabilities?
- What and how will samples be excavated?
- What shall our experiments consist of?
- What measurements are required?
- How shall we communicate our discoveries?



*Students in design team meeting
(Credit: FISE)*

Develop student awareness of the many workforce opportunities available in the aerospace and peripheral industries

During their Space School experience, each student has numerous contact with members of the Bay Area Houston aerospace community. The Team Mentors, Technical Advisors, and Astronauts are all NASA / JSC civil or contract personnel. They have daily one-on-one interaction with the students, and will serve as exemplary members of local aerospace workforce as they demonstrate the requirements of their positions and their expertise in their job. The majority of the Space School sponsors are corporate members of the aerospace contract community, and FISE Board members work in the aerospace industry. Each one of these people will have an impact on the students' perceptions of possible careers in a space-related field.

As the students visit the various educational venues and participate in the space-related learning initiatives, they will be exposed to a myriad of space-related careers and opportunities in the peripheral industries.

III.II Host Family Support & Logistics

A novel attribute of the USS program is the billeting of students by families residing in the Clear Lake Region of Bay Area Houston, whose family members work within the aerospace community. These pre-screened families take 2-3 students during the USS intake, providing them accommodations along with a first-hand experience of the American culture. Aside from the logistics support of providing transportation to and from pick-up points, food and shelter, each party stands to reap mutual benefits from this experience. The daily one-on-one interaction between the student and their family will provide many personal and professional examples of being a part of the American aerospace community.

The billeted student has the opportunity to introduce his/her culture to the host, share knowledge about respective interests, and stand to gain similarly from that of the host in terms of personal and career development.

The host family has the opportunity provide support in-kind towards the USS program, learn about a new culture and country, and furthermore introduce the billet to a side of the family's own national culture which perhaps could break many stereotypes communicate in the media. It is also a chance for the student to interact with someone within the space industry to understand it from an alternative point of view.

The core host family aspect of the USS we have found to be extremely successful, allowing for a more personal connection to the program for both the student and host, as well as administratively reducing costs for a program that is heavily reliant on donated finances and in-kind contributions.

III.III Cross-Cultural Exchange

Introduce awareness of international cultural diversity as an element in team building in preparation for international collaboration on space exploration initiatives

The students participate in several cultural and social events designed to provide a setting in which they will demonstrate and share their respective cultures with each other and with their host families. Experiencing and celebrating international diversity as a Space School student is frequently the first step for these students as they work closely with each other on their respective teams. Learning about differences in communication due to language barriers, linguistic differences, varying levels of educational competency, and cultural differences, galvanizes these students to recognize how such differences are magnified in professional situations. A takeaway result of the Space School is to demonstrate that building upon diversity in an educational team-building environment can lay the foundation for international collaboration in space exploration initiatives. Such an environment will be required to design and complete projects of a magnitude capable for successful global space exploration and development.

A Tex-Mex fiesta is a popular cultural event, at which the students get their initial taste of international cuisine adapted for Texas. The students bond with each other, share their reactions to a new experience, and demonstrate their particular cultural talents. Many perform native dances, Celtic to Indian to African to Native American tribal dancers. Instrumental music and singing are favorites, as is reciting poetry by a country's poet laureate and/or in a native tongue. Exotic performances of Tai Kwan Do *poom se* and the New Zealand *Hakka* are very popular.

Another cultural event is the International Food Fayre. Students prepare, present and share cuisine native to their country, including a cultural artistic performance. If students have not decided ahead of time and packed their particular ingredients, they often have to use their problem-solving skills with logistical challenges to find and substitute American ingredients for their cultural requirements. Students, often 'assisted' by their aerospace hosts, have to accurately convert

measurements and adjust cooking requirements for altitude and humidity to produce an edible, recognizable dish. They get to share their reactions to food drastically different from their own in ingredients, taste, colours & textures.

Provide an introduction to American culture through appropriate social, cultural and recreational opportunities

A requirement of each host family is to introduce their students to American culture while learning about the culture of their student guests. Being plunged into an entirely different and exhilarating environment of an American family often proves a very interesting, and often vocal, experience for an international student. Differences in cuisine, climate, geographical location, social situations, and the frantic pace of high-technology lifestyles often provide intriguing anecdotes from all participants.

Recreational and cultural events designed to introduce the students to American culture include a trip to watch the MLS Champion Houston Dynamo soccer team, a cook-out on the beach, bowling, and shopping – at a mall, in our large grocery stores or 24-hour convenience gas marts etc. Each of these experiences provide a unique insight into American culture and social identity.

The final event of United Space School, the Graduation Ceremony, provides the venue for closure. The students are treated to another banquet of specifically American cuisine, as they prepare to say goodbye to their host families, a new culture and their newfound friends. The students give audiovisual presentations of their *Manned Mission to Mars Projects*, where their efforts are recognized and applauded. Sponsors are acknowledged, the final cultural performances take place, appreciation is shared all around and memories are cemented. The students prepare to depart, and planning for the following United Space School intake begins.



*Students presenting their work at Graduation
(Credit: FISE)*

IV. LESSONS LEARNED

IV.I Areas of Strength

The United Space School has successfully completed its aims each year working with a group of volunteers and a relatively small cash budget. Though the program has averaged about \$20,000 in annual expenses, the in-kind donations total over \$100,000 in value. Overall, the effects of the program show life changing benefits for each student for a minimum expense per capita.

Students who graduate from the United Space School return to their home countries and share their experiences with their communities. This provides a strong public affairs benefit for NASA and the international space community. Their enthusiasm in doing this work also gets students from their home countries excited about the prospect of having a Space School experience of their own, thus perpetuating the candidate pool of future USS students. USS graduates have a very high success rate in university acceptance and enrolment. The majority of these enrolments are in pursuit of engineering, science, medicine, or education. After university, the USS alumni have seen a high degree of success in their careers, as demonstrated in the examples quoted in the following section VI. Network.

IV.II Areas for Improvement

FISE is a young organization, and is in the early stages of developing its fundraising apparatus. Though the program has operated in the black since the establishment of FISE, an endowment fund or further revenue streams would allow for expansion of the program and ensure its security for the future.

The United Space School is also a gruelling, two-week intensive experience that asks for a high level of effort from its organizers, mentors, and host families. Though host family retention is reasonably high for a program of this nature, steps could be taken to provide increased convenience and recognition for the host families that continue involvement in the program.

V. FUTURE DEVELOPMENT

The United Space School model has been a proven model for teaching students of almost any background the basics of space exploration, program management, and teamwork. The Texas Aerospace Scholars Program at NASA used this model for several years, and Space Center Houston also uses it for its paid education programs. However, each of these options require the student to travel to the JSC area in order to benefit. FISE hopes to open the door for possibilities around the world.

United Space School graduate Marcus Bunn ran a smaller version of the United Space School model for junior high students at Trinity College in Perth, Australia in early 2010, with indications of higher student interest in STEM education afterwards. USS Mentor Angela Alexander will be running the Space School model for the astronomy classes at South Houston High School in the spring of 2011. This will be the first time that the Space School model will be used for students in low income areas. Lessons learned from each of these efforts will be rolled into future FISE developments.

Early development has also begun on courses for teachers using the United Space School model in various participant nations around the world. The first planned session for teachers will be at the Isle of Man, at a time yet to be determined.

VI. NETWORK

The USS annually attracts the world's best and brightest students whom go on afterwards to develop their academic and professional careers. Approximately 600 participants have been inspired and educated over the history of the program, not including the mentors, host families, distinguished lecturers and program support personnel that also share in extracting from the cultural and social aspect of the USS. All these individuals make up the membership of the International Space School Alumni Association (ISSA), a Canadian organization founded by Tahir Merali (2002 class) and currently sustained by alumni from 5 nations.

Designed in 2007 due to a recognized lack of networking between alumni, the ISSA is also reservoir of talent, many of whom are currently in the peaks of their career development or are seeking that first, full-time employment in a multi-disciplinary field.

The ISSA has registered 146 alumni (2009) with 289 listed (2010) on the official Facebook group. The chart below depicts the demographics from a 2009 survey.

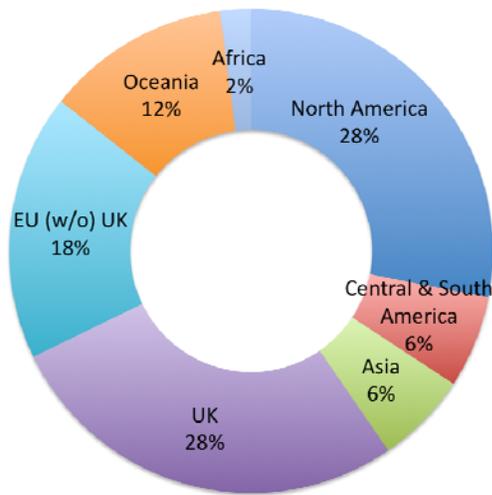


Fig. 1: Number Of United Space School Alumni By Region (1997-2008 Respondents) Total: 146 Survey conducted by International Space School Alumni Association (ISSA) in 2009.

Following are profile examples of four alumni who have successfully graduated from the space school program.

Name: Gregorio Drayer

USS/ISS year: 1999

Country: Venezuela

Career/Academic: Ph.D. Fulbright S&T and Sam Nunn Fellow at Georgia Tech

Impact: ISS 1999 fuelled my enthusiasm to work hard and aim high all throughout my undergraduate studies and beyond while still living in Venezuela. Today, I am fortunate to continue with the impulse of ISS and many other programs, which continue to enhance and open new opportunities.

Name: Sam Smith

USS/ISS year: 2000

Country: UK

Career/Academic: MBChB (MD) Hons. Physiology, Medical Education Fellow at University of Edinburgh

Impact: I was 17 when I was invited to the International Space School. My experience at the space school broadened my horizons and empowered me to make my medical school applications. The space school encouraged me to be ambitious in my career, and has certainly helped me get where I am today.

Name: Laura Gibson

USS/ISS year: 2002

Country: United States of America

Career/Academic: Marketing and Communications Advisor for the European Space Agency Directorate of Human Spaceflight

Impact: I remained devoted to and passionate about human spaceflight due to my continued participation in this programme. During my time at the International Space School I first came into contact with both the international and the political aspects of spaceflight. It was during this program in 2002 that I first realized that there is a place in the space world for people like me who are not quite scientists, but are passionate about the story of space. I now work to help bring the benefits of spaceflight to the attention of decision makers in Europe. Both the international and the political aspects of space that I first learned about so many years ago at the International Space School are now a daily part of my work. I will always look back on my time at the school as the true start of my dedication to mankind's collective future in space.

Name: Javiera Arraño

USS/ISS year: 2009

Country: Chile

Career/Academic: Final year of high school & planning to pursue engineering

Impact: When I attended the USS I had no idea what to study after school, and it wasn't until I participated in this program that I realized that I loved working with people, creating solutions for problems and space. I learned a lot about many different careers and jobs that involve all those characteristics and that I didn't know existed, which I found very interesting. My experience at the USS has helped me make my choice of becoming an engineer and working in an area related to space.

Each year the membership of the ISSA gets stronger and more developed as each new class of USS graduates. Driven by a truly unique international experience, it is these alumni who will form valued opinions and impact many in the future, within the space industry and elsewhere. About 40 percent of USS graduates are pursuing careers in space related industries and many are currently seeking related degrees at various universities. While not all students choose to enter the aerospace or space industries, the skills that they hone at USS can be applied across a wide range of careers.

VII. COLLABORATIONS

USS collaborating organizations include:

- NASA Johnson Space Center
- The University of Houston at Clear Lake
- University of Texas Medical Branch, Galveston
- George Observatory at Brazos Bend, Texas
- Challenger Learning Centers, Houston
- Agencia Especial Mexicana
- Japanese Aerospace Exploration Agency

Financial support of the United Space School comes from:

- Aerospace Museum Association of Calgary
- MDA Space Missions
- ManSat Corporation
- The Wood Group
- American Airlines
- Reperi LLC
- SpaceIsle.com

The recruitment of further sponsors and collaborators is ongoing.

VIII. SUMMARY

Since 1995, the United Space School (USS) program has brought together the brightest students between the ages of 16-20 in Houston, Texas, USA for a 2-week summer academic and cultural introduction to space science, technology & exploration. Operated by the Foundation for International Space Education (FISE) (501c3) in collaboration with the University of Houston-Clear Lake (UHCL), University of Texas Medical Branch (UTMB) and NASA's Johnson Space Center, approximately 600 students from 48 nations have been inspired and educated by way of USS.

This program, designed to provide an academic-driven multicultural environment has introduced the space industry, including cutting-edge research, benefits and people, to the world's future leaders. This is inherently unique about the USS when compared to other youth space-related programs. The United Space School program itself aims to provide its students a realistic perspective on the space industry while using an international, intercultural, and interdisciplinary approach.

This approach can be summarized as follows:

- Provide the opportunity and the venue whereby international students come together to participate in a space-based academic initiative
- Develop and implement a curriculum to facilitate student development of a *Manned Mission to Mars Project*
- Provide subject matter instruction by space industry experts, appropriate team management by Team Mentors, and adequate research and development opportunities for completion of *Manned Mission to Mars Project*
- Develop student awareness of the many workforce opportunities available in the aerospace and peripheral industries
- Introduce awareness of international cultural diversity as an element in team building in preparation for international collaboration on space exploration initiatives
- Provide an introduction to American culture through appropriate social, cultural and recreational opportunities

The United Space School has successfully completed its aims each year working with a group of volunteers and a relatively small cash budget. Overall, the effects of the program show life changing benefits for each student for a minimum expense per capita.

Students who graduate from the United Space School return to their home countries and share their experiences with their communities. This provides a strong public affairs benefit for NASA and the international space community. Since FISE is a young organization, it is still in the early stages of developing its fundraising apparatus. Further revenue streams would allow for expansion of the USS program and ensure its security for the future.

The United Space School model has been a proven model for teaching students of almost any background the basics of space exploration, program management, and teamwork. Future developments include a space school model focused on students in low income areas of the Houston area as well as courses for teachers using the United Space School model in various participant nations around the world.

Without the voluntary contributions of time, knowledge and financial resources from collaborating institutions, their experts and our host families, the USS program would not be nearly as successful as it is today with a network of young professionals so diverse and engaged to improve our society. It is these alumni who will form valued opinions and impact many in the future, within the space industry and elsewhere. About 40 percent of USS graduates are pursuing careers in space related industries and many are currently seeking related degrees at various universities. While not all students choose to enter the aerospace or space industries, the skills that they hone at USS can be applied across a wide range of careers.

The USS program along with its interdisciplinary curriculum and truly cross-cultural nature supports the cultivation of creativity that is critical for the future career development of young delegates from all four corners of the globe.

IX. ACKNOWLEDGEMENTS

- Tireless volunteers year after year who donate their time, resource or homes to support scholastic achievement in space education
- Foundation for International Space Education (FISE) Board of Directors
- Geoff & Annette Mules, Founders, International Space School program
- Chris Greenfield & Clare Leonard, Head Teachers, United Space School
- George Abbey, Former Director, NASA Johnson Space Centre



*International Space School Class of 1998
(Credit: Chris Greenfield/FISE)*



*United Space School Class of 2010
(Credit: Sabiha Mahmood/FISE)*