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ON THE COVER

FRONT: The International Space Station photographed from the space shuttle Atlantis as the orbiter completed the mission and the shuttle performed their relative separation in the early hours of July 19, 2011. (Source: NASA)

BACK: "Point Lake" Outcrop in Gale Crater. One priority target for a closer look by NASA’s Mars rover Curiosity before the rover departs the ‘Glenelg’ area east of its landing site is the pitted outcrop called “Point Lake” in the upper half of this image. (Source: NASA/JPL-Caltech/MSSS)
In May, I attended a national tribute to Sally Ride who was praised not just as a national hero but also for her post-NASA advocacy efforts on science, technology, engineering and math (STEM) education. NASA Administrator Bolden announced an internship program in her name to encourage students to go into STEM careers. And a camera onboard the International Space Station, used by hundreds of thousands of students supported by Sally Ride Science to conduct space research, was renamed the Sally Ride EarthKAM. On the same day, President Obama announced that she would be receiving the Presidential Medal of Freedom later this year. As I was thrilled to be there with so many friends and colleagues celebrating Sally Ride’s accomplishments and contributions to STEM education, I was struck by the irony that the President’s Fiscal Year 2014 budget request would, if approved by Congress, shift almost $100 million of funding for NASA’s education programs to other federal agencies as part of its efforts to consolidate all STEM activities across the federal government. While striving for more efficiency in government is an important goal, in this case it will not result in the best educational outcome. NASA’s education programs have been very successful in reaching out to students. They provide many benefits to the nation including engaging the expertise of researchers and enabling them to partner with educators. This proposal has alarmed many professional space organizations, and AAS partnered with them on a letter to Congress to explain why it is important not to lose the link between students and researchers. “The creation and dissemination of knowledge is inextricably linked to science, technology development, and exploration. Stripping the education responsibility from organizations that create new knowledge weakens the connection to the individuals and institutions engaged in discovery… Our nation is rightly concerned with STEM education for it is crucial to our national competitiveness and achievement; keeping a direct connection between our students and our researchers should be a priority.” Sally Ride understood this link and spent the rest of her life successfully using it to interest young people in STEM.

Our Society is currently involved in a number of activities to support education and future space leaders and professionals. AAS Executive Director Jim Kirkpatrick just returned from the ninth annual Design/Launch/Build Student CanSat Competition held June 7-9 in Texas. Twenty-five college and university teams from the U.S., Canada, Turkey, India, United Kingdom, Guatemala, Colombia, Iran, and the UAE launched payloads the approximate size of a large soda can via rocket to an altitude of 650 meters. Details of the competition are featured in this issue. I am extremely pleased that from the beginning AAS has taken a leading role in planning and supporting this event. The CanSat Competition inspires students to undertake space-related careers – one of AAS’ core missions – by allowing them to experience, on a small scale, a typical aerospace program from preliminary design review to post-mission debrief. As an added benefit, it brings together over 170 students from diverse backgrounds to a working ranch in Texas who hopefully left with a better understanding of this country and each other.

In April, AAS entered into a partnership with the Future Space Leaders Foundation, a non-profit organization dedicated to the career development of young space and satellite industry professionals. The Foundation organizes events and raises funding for grants to be awarded to students and young professionals seeking careers in the space industry to attend space-related events such as the International Astronautical Congress (IAC). AAS will assist in the Grant Recipients’ selection and will invite awardees to participate in selected AAS events, with their participation funded by the Foundation. The Grant Recipients will also receive a one-year membership with AAS.

This summer, AAS is partnering with the Challenger Center which is organizing several events for corporate and legislative leaders to highlight key components of the America COMPETES Reauthorization Act. AAS will be a co-sponsor of events that will focus on the importance and emerging needs of STEM education in the U.S. and the impact of STEM education on workforce development.

AAS has been collaborating with the International Space University for several years, including the selection of a young person to receive a scholarship sponsored by one of our long time members. The Society also nurtures the participation of undergraduate and graduate students at many of its conferences and technical meetings. And we are co-organizing an event on human space exploration for young professionals at the IAC in Beijing.

While the Society can be proud of what we are doing in this arena, we know we can do more to maximize the benefits of these activities and identify other initiatives where AAS can contribute. AAS Vice President for Education Lance Bush plans to establish an AAS Education Committee to focus and enhance the Society’s efforts to support STEM education and help prepare tomorrow’s leaders and workforce. The committee will identify new activities that AAS can undertake in support of these goals and will lead the implementation of current and new education initiatives. You soon will receive a message soliciting members for the committee, and I encourage you to consider joining and lending your energy and expertise to supporting the next generation.

AAS – Advancing All Space

Lyn D. Wigbels
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Susan Irwin, President of the U.S. Office of Euroconsult, is the new AAS Vice President-International. Previously she served on the Board of Directors and Executive Committee. Irwin has spent her career in the space business, particularly commercial communications satellites, and was honored by induction into the Society of Satellite Professionals Hall of Fame in March 2013. She was interviewed on March 11, 2013 by Marcia Smith, Editor of SpacePolicyOnline.com and AAS Board member, about her 30-year career in the space business, the history and future of communications satellites, and her plans as AAS VP-International.

Congratulations on your election into the Society of Satellite Professionals International (SSPI) Hall of Fame. When was SSPI created?

Thank you! I was among a group of colleagues who decided in the early 1980s that it was time for a professional development association for those of us in the communications satellite industry. So we created the Society of Satellite Professionals (SSP). About a year later, we expanded it to recruit members from other countries and it became SSP International or SSPI. We’ve always had a chapter in Japan, and there have been chapters at various times in the UK and Canada. SSPI has corporate sponsors, but the members are individuals. It provides networking opportunities and professional development. The Mid-Atlantic chapter has programs throughout the year with panels of people to discuss various topics. The Hall of Fame was established in 1987 to recognize leaders in the field. Individuals are elected biannually, and Arthur C. Clarke was one of the first. SSPI also provides scholarships for students interested in satellite communications. Details are on the SSPI website, www.sspi.org. It’s very important to bring new people into the industry.

How did you get started in the communications satellite business?

I got involved in the late 1970s when the first commercial satellites were being launched. The cable television industry was getting started when community-access television (CATV) stations were able to receive nationally distributed programming by utilizing the newly launched commercial satellites.

I was hired as a consultant to the Appalachian Education Satellite Project, which was demonstrating the use of NASA’s ATS-6 satellite for distance learning, training, and public service applications in rural Appalachia. The project ultimately evolved into The Learning Channel.

Later I worked for NTIA [the National Telecommunications and Information Administration in the Department of Commerce] as the program manager for its Satellite Applications Program, which was established to use commercial satellites for the same types of public service programs that had been demonstrated with the ATS-6. We also developed training programs for emerging countries like India, Indonesia, and the Philippines to demonstrate how satellites could be used for education and public services. It was an exciting and interesting time. Commercial communications satellites were just being launched – the industry was getting started. The United States was the first country to commercialize this business. It was a new industry. Everything was happening.

What happened to the public service element of communications satellites as the decades passed?

I went from NTIA to a start up that was developing private satellite networks for corporate training – Business Television networks. We used Ku-band satellites, which enabled the distribution of satellite signals to relatively small antennas installed in urban areas. That was the beginning of the VSAT [Very Small Aperture Terminal] industry. Our customers were large corporations and government agencies. Universities and nonprofit organizations were also using satellites for distance learning.

But eventually distance learning moved to the Internet. Transmission was less expensive, and training could be accessed by individuals on demand. Distance learning via satellite was broadcast live in a classroom with questions over the phone. The use of satellites for live training diminished. Now it is almost all online.

What are the primary uses of communications satellites now?

Television transmission is the largest application today. Initially satellites were used as the distribution system for the major TV networks to their local stations. TV distribution via satellite grew as cable TV expanded. Then, as video distribution went from analog to digital, it became even
more cost effective to deliver via satellite, which enabled the whole multichannel environment today where there are hundreds of TV channels, as well as direct-to-home broadcasting, such as DirecTV and Dish. That business was all driven by digital TV. Satellites are perfect for delivering any signal point-to-multipoint over large geographic areas, including internationally. It doesn’t cost any more to send a signal to a thousand locations as it does to one. TV distribution is probably 60-70 percent of satellite communications revenue globally. The remaining 30-40 percent of the business is data in various forms – for VSATs, cellular backhauls, business continuity, and broadband access. Satellite broadband is a growing application in rural areas and an increasingly cost-effective alternative to other forms of broadband. “High Throughput Satellites” are becoming competitive to terrestrial systems.

Was there a big change in the satellite business with the privatization of Inmarsat and Intelsat?
Yes, there was a big difference. Privatization and deregulation made satellite operators more competitive, as well as leaner and more profitable.

Was there a cost in terms of innovation? Did companies decide not to invest their profits in innovation?
You can’t have a tech-based industry without innovation and without developing new applications and new products and new solutions. Otherwise industry doesn’t move forward. With new applications come new profit centers and revenue streams.

In terms of the overall cost-benefit for satellite operators, how much difference do launch costs make? If launch costs were to be cut that in half, for example, since companies are getting 15-20 year satellite lifetimes, is the launch cost important?
Costs are typically expressed as the cost of building, launching, and operating, not really as the cost of launching compared to 15 years of operational revenue. If it costs $300 million to build and launch a satellite, and launch is maybe $100 million of that, I can’t really say how that compares to revenues for the life of satellites.

A big topic of conversation today is hosted payloads. Do commercial satellites have a lot of unused capacity so they can accommodate other users on their satellites?
No, that’s not what it’s about. Hosted payloads are not really a new concept. What is new is the push to host government payloads on commercial satellites. The idea is for the government to meet mission requirements without building and launching its own satellites. The satellite operator benefits by sharing the risk and cost of building and launching the satellite from the beginning instead of waiting for the government to decide to lease capacity after it’s in orbit. The government benefits because it owns a piece of the satellite and is developing that payload as the satellite is being manufactured. The government can meet its requirements, and the satellite operator reduces its cost and shares the risk. It’s a win-win situation.

What are the big issues facing the commercial satellite industry today? Will there be any big fights at the next World Radio Conference (WRC) in 2015?
One of the big fights is between the wireless industry fighting for C-band frequencies and the satellite industry that has been using C-band frequencies for years. Although the satellite industry has moved to Ku-band in many places in the world, C-band is still important in some areas, particularly where rain attenuation is a problem. There’s very little Ku-band left, too, which is one reason that Ka-band satellites are becoming more popular. But there is much more of it available and little interference, so High Throughput Satellites using spot beams for frequency re-use are being built by most of the major operators worldwide. Interference issues can be significant, whether accidental or deliberate (jamming signals that are politically motivated). The other issue for the business as a whole is that satellites are not cost competitive with fiber for point-to-point communications. That may change somewhat as High Throughput Satellites get launched, but, overall, the proliferation of fiber, wireless, Wi-Fi, etc., makes satellite communications less attractive.

The satellite industry needs to continue to invent new applications and continue to be innovative. Among the growth areas are mobile applications for the military, disaster management, the oil and gas industry, and aeronautical communications. One innovative business venture is O3b’s plan to build wholesale backhaul networks for the “other 3 billion.” It is planning a medium earth orbit satellite system, which will not have the latency (time delay) problems of GEO satellites. And as compression technologies advance and more efficient modulation schemes are developed, there will be ways to increase the utilization of what bandwidth there is. That’s what’s been happening – getting more from less.

How does Euroconsult fit into this?
Euroconsult was established in 1983 to provide research and consulting in the broad space industry, including satellite communications. It continues to be the leading global expert in forecasting demand, supply, trends – all those aspects of the satellite industry. Euroconsult helps companies figure out how to position themselves, strategize their business, and maintain their profitability as some markets diminish and others grow.

Congratulations also on your election as AAS VP-International. What are your plans in your new role?
I’m hoping that my understanding of the satellite and space industries and my expertise over the last 30 years can fulfill the primary goal of the international aspect of AAS by encouraging and increasing international cooperation. As VP-International I chair the AAS International Program Committee (IPC), which is made up of AAS members, space attachés from other countries, and representatives of various non-U.S. space agencies. The AAS IPC serves as a forum to bring everyone together and inform each other of programs and projects. An exchange of information can only encourage cooperation among countries and move efforts for space forward when there might not be enough money for any one country or agency to act independently.
How Space Can Contribute to Africa’s Development

by Christopher Johnson, Ricardo Topham, and Rafa Hernandez Villatoro

With its breathtaking vistas, pristine environments, unique flora and fauna, and inspiring peoples and cultures, the continent of Africa is beauty defined. But forests destroyed by logging and industrial pollution spilling into rivers and streams paint a bleaker picture. And while Africa is known for its incredible wilderness and unique biological diversity, irresponsible management and poaching threaten this ancient and irreplaceable heritage. The continent’s rich natural environment also suffers catastrophic floods that bring havoc to homes and threaten lives, while endemic droughts threaten animal populations and jeopardize human communities.

At the International Space University’s 2011-2012 Masters Program, a team of students investigated space and its potential impact on Africa. After learning about Africa’s political, economic, health, and environmental challenges, the IDEAS for Africa team focused its investigations on promoting space technology for the needs and in the interests of Africans. Our group agreed that research and applications from the space sector should be used to improve lives and strengthen African communities. Please visit the ISU library website at isulibrary@isunet.edu for our full report. We wish to sincerely thanks the NASA Earth Science Division’s Applied Science Program for their generous support of this project, and for helping to make space a reality for future African students.

UNDERSTANDING AFRICA

Proposing space-related solutions with the potential to ease Africa’s problems is not a clear task, and first warrants that we better understand the root causes of problems afflicting life in Africa, and the obstacles to alleviating them. The team investigated life in Africa with special attention on the following socio-political focus-areas: agriculture, education, energy, environment, health, and STEM (Science, Technology, Engineering, and Mathematics).

It would be impossible to prescribe a single space application to solve all of Africa’s problems. Different countries and regions have different needs and capabilities. To address this challenge, South Africa, Morocco, and Liberia were chosen as example or “target” countries representative of the whole continent. These three countries are geographically diverse, with differing climates and environments - including deserts, semi-arid regions, and even tropical rainforests. They also reflect different developmental challenges and contain different political systems.

In recognition of this diversity, the goal of the IDEAS for Africa team is to assist Africa in improving its socio-economic development – by evaluating the impact, distribution, and utilization of space spin-off technologies, satellite applications, and space business potentials that address our six focus areas.

AGRICULTURE

Agriculture is the most important sector in Africa’s economy, employing approximately 60 percent of the labor force. When compared to a three percent world average, African labor provides almost a quarter of the continent’s GDP. Still, agricultural development suffers from unpredictable environmental conditions and the challenge of a rapidly increasing population. Despite recent improvements, Africa’s food security remains a major issue.

FarmaBooths

Placed in strategic locations and close to African farmers, FarmaBooths are small information centers that provide up-to-date data from satellite imagery about crop distribution, irrigation management, and soil nutrient variations. The connectivity gap between the satellites and the FarmaBooths will be filled in by the Pan-African e-Network, which provides satellite internet connectivity to rural areas across Africa.
FarmaBooth information centers can be tailored to specific geographic locations, crop varieties, and environmental characteristics of the surrounding area. For example, information provided on croplands in more arid regions should include advanced details about water reservoirs. On the other hand, crowded agricultural zones require access to mapping information to ensure farmers respect land boundaries and property rights. There is already an adequate space-based infrastructure to provide both the remote sensing needs and related communication requirements. Data interpretation centers will convert raw satellite data into easily understandable information for farmers.

This proposal is based on the successful Indian project VCR (Village Resource Centre), with already 275 centers installed all over the India benefiting more than 200,000 people. African food security can be improved through this application of space industry technology. Liberia is well suited for implementation of the FarmaBooth proposal, largely because of its insufficient food production capabilities, and its involvement with the Pan African e-Network.

**Organically Derived Colloids**

Spinoffs are technologies or processes used in applications unrelated to their original purpose. Organically Derived Colloids (ODCs) - a spin-offs from NASA’s Space Shuttle Program - are chemical compounds extracted from the shells of marine animals that reduce fungal infections and provide nutrients to crops. Combined with aeroponic growing techniques, this space spin-off allows for higher yielding crops using less water.

ODCs stimulate a plant’s natural defense system in the presence of pathogens, and switch it off when the disease is eliminated. The ODC molecules first cling to cells in the tree roots. Once these molecules have attached to the plant cell receptors, a chemical response is activated throughout the plant that stimulates photosynthesis and helps to overcome environment stresses such as invasive species. One of the main advantages of ODCs is the inexpensive nature of the product and the almost immediate effects on plant growth. The cost per acre of ODCs is around USD $25 and can quicken sprouting time by over 50 percent.
Moreover, countries that have difficult growing conditions because of desert environments can use ODCs in conjunction with an aeroponics growing system, as this uses up to 95 percent less water than traditional methods, though aeroponics can be prohibitively expensive for developing nations. The cost of an aeroponics system depends on the needed growing area and the average cost per square meter is approximately USD $5,250. With an estimated plant growth of 200 plants per square meter, this means that the aeroponics system costs approximately USD $26 per plant.

Figure 2. Using a Village Resource Center (Source: ISRO)

EDUCATION

Although access to quality and equal education has improved, it remains a challenge in Africa. Universities suffer from overcrowding, regional conflict, and loss of staff lured abroad by higher pay and better living conditions. An African high-technology workforce is in short supply and almost all African countries lack educational institutions dedicated to space science and technology. As a result, most African countries don’t train their own engineers and those individuals with the potential to study engineering often pursue education abroad, reinforcing African “brain drain.”

African Space Education Center

An African Space Education Center can be developed in a few different African locations. To be effective, the host nation should be strategically located, with some space capabilities, have an established aerospace industry, and should be economically and politically stable. For these reasons, the target country of Morocco was chosen as a suitable host nation for a space education center. Morocco is strategically located between mainland Africa and Europe, and between the Americas and Asia. There are currently more than 100 American and European space and aerospace companies with a presence in the country that use Morocco as a base for international logistics. Additionally, Morocco has a remote sensing education center offering courses to domestic and regional users, and strong historical links to France, which is a major force in aerospace in Western Europe. The center offers short Geographic Information Systems (GIS) and Remote Sensing courses throughout the year. The courses cover all aspects of remote sensing and its various applications.

An African Space Education Center could provide education in engineering, sciences, management, policy, economics, law, and satellite applications. This program would allow the students to gain a complete background in space-related disciplines and would ensure that they are fully capable of participating in the space professions. To provide this training, the Center would promote a
hands-on approach to education, which is crucial for educating industrially competent space professionals.

**ENERGY**

Energy development in many African countries is restricted by the high cost of electricity generation, which is caused by the small scale of demand. High efficiency electrical power plants require significant upfront investments and are expensive to maintain. The main energy sources in Africa are coal, oil, and hydroelectric power. Coal consumption takes the lead, whereas hydroelectric potential remains vastly under-exploited. This homogeneous generation profile - constrained by minimal financial investments and lacking regional links to facilitate power trade - has resulted in a severe energy crisis in many countries across the continent.

*Solid Oxide Fuel Cells*

A fuel cell is a device that converts chemical energy from a fuel into electrical energy through an electrochemical reaction. Used in spaceflight as a source of electrical power, the most common type of fuel cells also produces usable water as a byproduct. Solid Oxide Fuel Cells (SOFCs) use natural gas as an input fuel, operate at very high temperatures (typically in the range of

![Solid Oxide Fuel Cells](source: Wikimedia Commons)

Figure 3. Operating principle of an SOFC (Source: Wikimedia Commons)
800°C), use solid oxides or ceramic electrolytes, and do not require expensive platinum catalysts to initiate their electrochemical reactions. As power sources, SOFCs provide a continuous level of power for lower electricity demands.

An advantage of using SOFC-based power sources in developing African nations is that they are highly efficient on low scales, and local infrastructure can be built near their locations of consumption. As existing situations in many African countries impede large-scale building of hydroelectric or advanced natural gas plants, SOFCs are the most convenient and cheapest power source for Africa.

In Liberia, most electricity is generated at the local level, so SOFCs would be well suited to meet the demand for inexpensive electric power generation on a small scale.

ENVIRONMENT

Preservation and protection of Africa’s priceless natural environment and wildlife is crucial to any sustainable social and economic development. Every year, the continent loses four million hectares of forests through desertification. The main cause of desertification is deforestation, as trees are cut to meet energy needs and to expand agricultural lands. Additionally, Northern Africa is one of the driest areas of the World, and Eastern Africa has suffered from severe recent droughts. Illegal poaching is another major environmental concern in Africa. Poaching is the hunting or catching of game or fish that is either on another’s property or is subject to environmental protection. The IDEAS report offers two space-related solutions to combat poaching and the encroachment of deserts, with application in the target countries of South Africa and Morocco.

Anti-Poaching

Wildlife is a major component of Africa’s environment, but illegal poaching is a serious problem in many African countries. Preservation is a moral obligation, and as an economic resource, wildlife brings tourist revenue. Nevertheless, poaching in South Africa is rampant. Amongst other species, the rhinoceros is hunted for its horns, while the perlemoen (a large sea snail) is illegally
harvested as a delicacy. Many African countries have anti-poaching programs involving national park and law enforcement officers; however, wide geographical distribution and dispersed animal populations make enforcement difficult.

The IDEAS for Africa team proposes a system for real-time monitoring and response to poaching using Global Navigation Satellite Systems (GNSS) and satellite communication technologies. Macro species like the rhinoceros would be equipped with satellite tracking collars containing heartbeat sensors, accelerometers, and microphones. Information from these sensors would be relayed to law enforcement agents to inform them if the animal is running or has been killed, indicating gunfire sounds or a poaching incident. For microspecies like perlemoen, using hydrophones anchored to a rock near a known colony location is a more effective way to detect poachers. Hydrophones would provide alerts for the sound of small boats, once again indicating a poaching event.

Figure 5. Sand encroaching on Nouakchott, the capital of Mauritania (Source: NASA)
**Desert Movement Predictor**

In the arid regions of Africa, water resources are scarce and access to them is often unpredictable. These constraints increase human pressure on the environment, resulting in further water depletion. Desertification is a process where fertile lands become deserts. Population growth, increased food consumption, and short-term economic interests all contribute to desertification. Other contributing factors include over-grazing, excessive firewood gathering, wasteland cultivation, inefficient use of water resources, excessive agricultural harvesting, and lack of environmental regulations related to factories, mines, and transportation infrastructure. Human activities are not the only source of desertification, as natural climate effects from wind, water, salination, and freeze-thawing erosion also contribute. Rehabilitation measures are often difficult and expensive. While prevention measures are cheaper, they require management and policy approaches that promote the sustainable use of arid regions. If no countermeasures are taken, desertification will threaten future improvements in human well-being.

The IDEAS team believes that desertification across Africa can be combated and alleviated with an international Desert Movement Prediction Center, whose activities would include data acquisition from satellite operators, remote sensing data-processing and analysis, research on the physics of dune movement, as well as desert movement prediction and recommendations. There are a large number of satellites available to provide the required imagery and data products, including Landsat, Aqua/Terra, SMOS, and Meteosat. To assess and predict dune movements, both wind patterns and InSAR optical images are necessary.

The Desert Movement Prediction Center is an application for the target countries of Morocco and South Africa. Both countries are affected and threatened by desertification and both have the means to afford the USD $64 million project cost.

**HEALTH**

Because Africa lacks sufficient numbers of trained medical professionals and improper health practices are common, the African health care system is often incapable of meeting the basic healthcare needs of its people. In addition to the human lives lost, the poor healthcare system slows economic development. Resources that could otherwise have been committed to economic growth are instead put towards combating infectious disease, maternal death, and malnutrition. A space spinoff and an ingenious use of space-based technology such as the DHA supplement can help Africans lead healthier and longer lives, as shown through the following examples in the target countries of Liberia and South Africa.

**DHA Supplement**

In the 1980s, NASA used strains of microalgae as a food source, a supplier of oxygen, and a catalyst for waste disposal under their Controlled (or Closed) Ecological Life Support Systems (CELSS) experiments. During this research, NASA realized that these microalgae could not only be used in space, but also had potential applications on Earth. Further research discovered that a certain strain of algae naturally produced DHA in large quantities.

DHA (Docosahexaenoic Acid) is a dietary fatty acid that acts as a major structural fat in the brain and retina. DHA acts to change specific cell properties, including cell membrane viscosity, elastic compressibility, permeability, and interaction with regulatory proteins. The combination of these factors promotes electrical signaling to the Central Nervous System, resulting in increased signaling to the brain and an increase in learning ability and memory. High levels of DHA are deposited into the central nervous system during the early stages of life. Inadequate supplies of DHA during the early stages of child development can lead to impaired learning abilities and visual acuity. The purpose of the DHA supplement is to promote neurological and retinal development at various stages of life, including infancy, childhood, adulthood, pregnancy, lactation, and aging.

The DHA supplement is a spin-off technology that could be implemented in any of the three target countries, all of which need to promote nutrition. Nevertheless, because of its food security and malnutrition challenges, Liberia is most urgently in need of DHA. Most importantly, the price of USD $25 for a two-month supply places DHA well within Liberia’s reach for application.

**Telemedicine Van**

Telemedicine is a satellite application that provides health care services and helps distribute medical information to remote areas. It is also a mobile service that can be used to perform diagnoses, apply therapies, aid preventative measures, and improve individual health education. Telemedicine vans include the capacity for remote consultation, diagnosis, treatment, radiology, dermatology, and ophthalmology. In other words, a higher quality of healthcare services is possible.

Telemedicine vans are not a new concept, as they have been previously implemented in Bosnia, Italy, and India, and their
implementation is currently underway in Zambia. By combining satellite communications, information technology, and modern medical sciences, the Telemedicine Van will enable rural African populations to access national and international medical specialists in medical centers located in urban areas and abroad, while also providing the capabilities to store and manage clinical data.

This proposal is relevant for all three target countries, but would most likely see the highest degree of implementation in South Africa because of the relatively high costs of more than USD $400,000 per van.

**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH**

Technological advancements will play a key role in bringing sustained development across Africa, but implementing these advancements will require skilled science and engineering professionals. Science, Technology, Engineering, and Math (STEM) industries and education within Africa will help reduce the number of highly-skilled workers who leave the continent to seek opportunities elsewhere.

**Overberg Test Range**

During Apartheid Era sanctions in the mid-1980s, South Africa developed its own autonomous launching facilities at the Overberg Test Range (OTB). The facility was built to handle up to ten Low Earth Orbit launches per year, but was cancelled in 1994.
(along with the entire Republic of South Africa space program). Without significant governmental assistance, no commercial entity could re-establish the OTB into a full launching facility. The IDEAS Team recommends that the OTB be initially developed into a sounding rocket research facility.

Developing a sounding rocket research facility will lay the foundation for South Africa to become a spacefaring nation. It will establish the country as a hub of science and technology advancements in Africa, and will help to further reinforce South Africa as a leader in space development on the continent. The establishment of a commercial sounding rocket research facility will allow engineers, scientists, and technicians to gain experience in rocket design, testing, and construction. These skills will be necessary in the future to fully use the OTB without incurring the high risks associated with development of a full launch facility. It will also enable skilled workers to remain in South Africa and contribute to that country’s sustainable technological advancement.

![Satellite image of the OTB and testing facilities](source: Google Maps)

Figure 7. Satellite image of the OTB and testing facilities (Source: Google Maps)

It is expected that the project would cost upwards of USD $16 million over five years to launch sounding rockets with performances similar to NASA’s Terrier-Malemute.

**CONCLUSION**

Our recommendations have three critical elements in common: they address problems in Africa that hinder growth and development; they use space technologies that have a significant advantage over existing terrestrial technology; and they are practical to implement. The twenty-first century will be the century of African development, driven by technological advancements – including those from space technologies described above. The proposals of the IDEAS for Africa Team are ripe to become realities.

It is our hope that these recommendations will be of interest to both African leaders and space professionals, and will encourage them to exploit the promise that space applications hold for Africa. The benefits and innovations from space should be in the interests of all humankind. Only then will the promise of the space age and its capacity for innovation be fulfilled.
Let’s Launch, Not Deorbit, NASA Education

by Nancy Colleton

U.S. President Barack Obama’s NASA budget request for fiscal year 2014 is filled with many surprises – from sending humans to a captured asteroid to the transfer of climate sensors from the National Oceanic and Atmospheric Administration to a new Mars rover in the next decade. There’s something for everyone.

However, one proposal that continues to capture more and more attention is the president’s initiative to move nearly $50 million of education and public outreach funding out of NASA as part of an effort to consolidate the majority of activities of 12 federal agencies under only three: the Department of Education for kindergarten through grade 12 (K-12) science, technology, engineering and mathematics, or STEM, programs; the National Science Foundation for undergraduate and graduate programs; and the Smithsonian Institution for informal science education.

Surprisingly, the president’s proposal takes NASA science out of science education and opts for a more generic approach for teaching the universe, Earth, aeronautics and rocketry.

NASA would retain four major programs deemed by some unknown criteria to be unique to the agency. However, programs that communicate truly unique NASA missions such as the Hubble Space Telescope and the important science they produce somehow do not meet that criteria, and would therefore be transferred to the three lead agencies. The Department of Education, not NASA, would be responsible for delivering Hubble Space Telescope content to K-12 classrooms.

Yes, you read that correctly.

Increasing the public’s understanding of NASA, its missions and the exceptional science and technology it produces would now be the job of the Department of Education, National Science Foundation and Smithsonian, depending on the audience.

On a broad level, the extensive and proactive network of scientists and educators that has evolved from a dedicated and supportive culture that prioritizes STEM education would go away.

On a more specific level, the over 1,800 peer-reviewed space and Earth science education and public outreach resources included in the searchable database, NASAWavelength.org would disappear even as Wired.com recently featured it, stating, “Watch out, space educators, there’s a new tool in town!”

As a result, inspiring the next generation of explorers just got a lot more difficult.

Bill Nye “the Science Guy” and a host of other planetary scientists agree that this move would be detrimental to the goal of advancing STEM education. They voiced their concerns in response to a question at a recent Capitol Hill briefing about cuts to NASA’s Planetary Science Division sponsored by the Planetary Society.

Nye fondly recalled that when he was a student at Lafayette Elementary School in Washington, a NASA representative visiting his classroom dipped a cigar in liquid oxygen, and it burned like a road flare. “It’s what got me interested in science!” Nye said.

The Jet Propulsion Laboratory’s Bobak “Mohawk Guy” Ferdowski had a similar story, recalling when he was a child seeing the first images from the Mars Pathfinder mission via the Internet. Had NASA not embarked on such an active public outreach campaign, Ferdowski may not be part of NASA’s Mars Curiosity rover team today. As a NASA engineer, he believes it is essential to engage with students and the public, to tell the story of science in one’s own narrative.

The stories shared by Nye and Ferdowski illustrate the reach and impact of NASA science education and certainly question the benefits of threatening it. As Nye points out, NASA has one of the best brands in the world, especially with teachers and students.

And NASA science education goes well beyond anecdotes. Consider the impact of the president’s proposed budget on the following Science Mission Directorate education and public outreach activities, which would be zeroed out:

- More than 500,000 preservice and in-service teachers use Hubble standards-based classroom-ready materials annually. Hubble educational resources are utilized by 42 of the largest 100 school districts in the country and more than half of the state departments of education. In the proposed plan, educators returning to school in the fall would find that these materials are no longer available to them and would need to rework their curricula.

- MY NASA DATA provides access to over 200 data products from NASA Earth science missions, tools, and peer-reviewed lessons – designed specifically for K-12 audiences. The National Research Council’s Framework for K-12 Science Education (July 2011) identifies eight practices that are considered essential for K-12 science and engineering curriculum. Using MY NASA DATA enables students to hone their skills across all of these interrelated, essential practices. The up to 80,000 educators and learners who annually use MY NASA DATA are at risk of losing a critical resource that makes taxpayer-funded NASA data accessible for STEM education.

- The NASA Science Mission Directorate’s approach to education and public outreach enabled Mars Odyssey instrument scientists and educators at Arizona State University to create the Mars Student Imaging Project, where students work together to develop a question about Mars, target an image using a NASA spacecraft,
receive their image and analyze it, and write a formal scientific report on their findings. The project has won the Science magazine Prize for Inquiry-Based Instruction. Such opportunities would be nearly impossible to re-create within a centralized education structure that lies apart from NASA.

- Earth to Sky is a partnership among NASA, the National Park Service, and the U.S. Fish and Wildlife Service that enables informal educators to access and use relevant NASA science, data, and educational and outreach products in their work. A longitudinal evaluation has demonstrated that these professional educators have, in turn, reached over 4 million National Park and Wildlife Refuge visitors with content derived from Earth to Sky professional development. They have also provided training to over 2,000 other educators. Removing funding would eliminate this growing interagency partnership, which provides a large return on investment and leverages the strength and capabilities of three agencies.

It is difficult to imagine the 21st century classroom without the excitement, awe, and content of NASA. The fact is that NASA programs simply could not be reproduced by any other agency as they depend on a vibrant ecosystem of explorers, engineers, scientists, education specialists, communications experts, and data visualizers.

In recent testimony, Patti Grace Smith, former associate administrator for commercial space transportation for the Federal Aviation Administration, may have said it best: “No one teaches what NASA does like NASA.”

The Obama administration’s science education proposal should be reconsidered. NASA should maintain its robust, rigorously evaluated, and far-reaching education and outreach activities as the agency is a vested stakeholder in developing the next generation of scientists and engineers.

Hopefully then, all future surprises will result from the nation’s visionary space exploration and discovery missions, not questionable budget proposals.

Nancy Colleton is president of the Arlington, Va.-based Institute for Global Environmental Strategies, which specializes in Earth science education and outreach and Earth observations. This commentary was first published in Space News on June 3, 2013 (Volume 24, Issue 2).

Deadline is September 30 for Awards and Fellows Nominations

Fellows are members of the Society who have made significant scientific, engineering, academic and/or management contributions to astronautics and space. In addition, contributions to AAS will be considered. Only current AAS members will be considered for AAS Fellows, and nominations will be accepted from any active AAS member. For a complete list of Fellows, click on AAS Fellows in the scroll down menu under the Membership button on the AAS website.

AAS presents awards to recognize the excellence and professional service of our own membership and members of the space community. AAS members (and non-members) are invited and strongly encouraged to nominate worthwhile candidates for this year’s awards. Award descriptions, previous recipients and nomination procedures can be viewed on the AAS website. The Awards Committee will review submissions and forward names of recommended candidates to the officers and directors for approval.

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**Bringing Exploration Forward**

October 7-10, 2013

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**Program Outline**

**Monday, October 7**

5:30 pm  Kick-off Networking Reception *(University Center, Exhibit Hall)*

**Tuesday, October 8**

7:15 am  AAS Corporate Members Breakfast *(Invitation Only)*

7:30 am  Registration Opens / Networking / Continental Breakfast *(Business Administration Building, Lobby)*

8:30 am  Welcome to Campus *(Chan Auditorium)*

Dr. Robert Altenkirch, President, The University of Alabama in Huntsville

Remarks by AAS President

Lyn Wigbels

8:45 am  Marshall Space Flight Center Update

Patrick Scheuermann, Director, NASA Marshall Space Flight Center

9:00 am  Keynote

10:00 am  Panel: Exploration Going Forward with SLS and Orion – 2020 and Beyond

12:00 pm  Luncheon *(University Center, Exhibit Hall)*

1:30 pm  Panel: Industry Perspectives from the Washington Operations Executives

3:30 pm  Panel: Perspectives on Exploration from Former NASA Officials

5:30 pm  Reception and Student Poster Displays *(Burritt on the Mountain – Baron Bluff Building)*

**Wednesday, October 9**

7:15 am  Registration Opens / Networking / Continental Breakfast *(Business Administration Building, Lobby)*

8:00 am  Panel: Status of Commercial Cargo and Crew

9:30 am  Panel: Education ...

10:45 pm  Panel: Privately Funded Space Launch

12:15 pm  Luncheon *(University Center, Exhibit Hall)*

Announcement of Student Poster Awards

2:15 pm  Panel: Privately Funded Space Utilization

3:45 pm  Adjourn – Winning Student Poster Displays

**WERNHER VON BRAUN MEMORIAL DINNER** *(New Davidson Center at the U.S. Space and Rocket Center)*

5:30 pm  Reception

7:00 pm  Dinner

Special Guest Speaker: Dennis Tito

**Note:** The dinner is a separate event and is not included as part of the symposium registration. For information on the dinner go to www.spaceclub-hsv.org

**Thursday, October 10**

8:30 – 11:30  Tour of the United Launch Alliance Atlas and Delta Rocket Production Facility *(optional)*
America’s Space Sentinels: The History of the DSP and SBIRS Satellite Systems

Reviewed by Shawn M. Riem


On May 7, 2011, the Air Force launched its first geosynchronous (GEO) Space Based Infrared Satellite (SBIRS) from Cape Canaveral. Its purpose was to augment a constellation comprised of the legacy Defense Support Program (DSP) satellites and more recent payloads in highly elliptical orbit (HEO). These satellites, collectively, served to provide space-based early warning of missile attacks. In light of SBIRS launch, the 2012 publication of Jeffrey T. Richelson’s second edition of America’s Space Sentinels is timely. The original edition, published in 1999, titled America’s Space Sentinels: DSP Satellites and National Security, offered valuable insight into the DSP program – both its strengths and weaknesses. The second edition, essentially an addendum, brings the timeline to currency. This proves to be both the new volume’s strength and weakness.

Both of Richelson’s editions open with the post-World War II missile warning climate, along with a lengthy discussion of the proposed detection systems and those that were actually built. These ranged from ground-based systems such as the Distant Early Warning (DEW) system of radars and the Ballistic Missile Early Warning System (BMEMS) to “picket airplanes” flying in regular patterns. Since these failed to provide adequate reaction time to an intercontinental ballistic missile launch from the Soviet Union, the proposal for a space-based system of satellites was made. The author’s narrative then describes MIDAS and Program 461, which were employed or implemented prior to the once highly classified DSP system. Finally, Richelson settles into a detailed examination of the DSP satellite system’s development, budget woes, and how political maneuvering affected the program. He touches briefly on SBIRS as the next-generation space-based early warning system, but reserves most of that discussion, along with a wrap-up of DSP launches since the previous edition, for the epilogue.

While Richelson presents an informative discussion in the new edition’s first appendix regarding how the DSP satellite functions, this might have been better placed in the main narrative on DSP satellite development. The author’s overview of the DSP program is excellent, including description of failed or abandoned developments and additions to the program. However, conjecture about capabilities and detections abound. This conjecture is unnecessary, since ample evidence exists in declassified documentation to effectively illustrate the satellite’s capabilities in terms of both strengths and shortcomings. Finally, although the legacy DSP system has been integrated with the SBIRS system, Richelson fails to mention this. He implies that the United States Air Force has two discrete space-based missile early warning systems – DSP and SBIRS. While HEO payloads and GEO satellites will eventually replace the legacy DSP constellation, the two currently augment one another to provide uninterrupted early warning. They will continue to do so as long as DSP satellites remain functional. Likewise, ground systems for the constellations have been fully integrated and operate as part of the SBIRS system.

America’s Space Sentinels certainly speaks to a select audience. Space professionals will find this an interesting and informative, albeit presumptuously conjecture-filled, addition to their libraries. Nonetheless, less informed readers interested in modern missile defense also would find this second edition enlightening.

Shawn M. Riem is Air Force Space Command’s 460th Space Wing historian, Buckley AFB, Colorado.
Rearming for the Cold War, 1945–1960

Reviewed by Rick D. Sturdevant


A glance at the title of this volume, the first of five in a new series on the history of acquisition of major new weapon systems by the U.S. Department of Defense, might lead one to wonder why it merits a review in *Space Times*. It should not take long, however, for historically informed readers to recall that the military services studied the feasibility of earth-circling spaceships in the immediate postwar period, and nearly all development of U.S. space launch vehicles during the 1950s–early 1960s occurred under army, air force, or navy direction. Furthermore, the military services expended substantial resources during the early years of the cold war on research and development (R&D) of satellite systems—both orbital and terrestrial elements—initially, for purposes of intelligence, reconnaissance, surveillance, communications, and navigation, with other space-based applications following after 1960. Nor did U.S. military visionaries overlook prospects for human spaceflight into and beyond earth orbit, as evidenced by early programs like Dyna-Soar and Man in Space Soonest.

In *Rearming for the Cold War*, retired air force colonel and professional historian Elliott Converse offers a thoroughly researched, masterfully crafted, richly detailed, analytically astute survey of the evolution of acquisition processes and practices during 1945–1960 from the perspective of the Office of the Secretary of Defense and from each individual service. Beginning with his prefatory explanation of how the term “acquisition” evolved and his first chapter on World War II as a “watershed” for acquisition, and ending with an elaboration of the ascendancy of the weapon system concept within each of the services after 1953, Converse exposes misconceptions, misinterpretations, and factual errors found in secondary sources. He carefully and methodically blends the content of primary documents and the insights of his scholarly predecessors to weave an intricate narrative based on case studies.

Some astronautics professionals might find the selection of specific cases lacking with respect to space systems. A more careful reading, however, reveals that R&D and production of guided missiles—the source of most early U.S. space launch vehicles—became key drivers in the transformation of military acquisition processes. Herein, this reviewer finds one reason *Rearming for the Cold War* might prove useful to nonmilitary readers. Knowing how and why military acquisition changed at the dawn of the space age might give NASA officials, corporate leaders, congressional staff members, and elected representatives insight as they wrestle to make tough decisions in a severely constrained fiscal environment. A refreshing exception to the many bureaucratic histories devoid of human actors, Converse’s volume brings to life the role of individuals in changing how the U.S. military acquired its hardware during flush and not-so-flush times. More than a half-century later, we can learn from this.

By understanding procedural problems, organizational impediments, and political roadblocks that plagued acquirers of military systems in the past, acquirers of space systems today might find themselves better prepared to navigate troubled waters. Recognizing, as Converse does, that goals and outcomes were not the same thing, that fissures between R&D and production/procurement caused schedule delays and cost increases, that lack of clear lines of responsibility or accountability hampered production, that adoption of systems engineering practices and concurrency in fielding new systems had a downside, and that technical achievements sometimes masked serious deficiencies in acquisition organization and processes might help today’s acquirers chart less hazardous courses. Knowing these things also might humble acquisition experts, who should realize that for all the significant adjustments to acquisition approaches over time, hauntingly similar challenges persist.

**Dr. Rick W. Sturdevant** is the deputy director of history for Air Force Space Command headquarters at Peterson AFB in Colorado Springs, Colorado.
College students from the United States, Canada, Colombia, Guatemala, Iran, India, Turkey, UAE, and United Kingdom gathered June 7-9 in Abilene and Burkett, Texas, to compete in the annual Student CanSat Competition. In order to experience a hands-on aerospace program at an affordable cost, each team had to build and launch an autonomous CanSat payload via rocket to an altitude of 700 meters. Each CanSat, weighing between 690-710 grams was required to carry one large raw hen’s egg intact from launch to landing, as well as an audible locating device. During the flight and descent, real-time GPS position and telemetry were transmitted to a ground station, with the descent controlled so the egg was not damaged upon landing. Several teams also designed their payload to take images during descent. Each team was also required to write a mission proposal, conduct preliminary and critical design reviews with staff engineers, and prepare/present a post-mission debrief.

The competition is purposely designed to reflect key aspects of real world missions, including telemetry requirements, budget restrictions, communications and autonomous operations. The goal is for all teams to experience, on a small scale, a typical aerospace program from preliminary design review to post-mission debrief. Teams are scored throughout the competition on deliverables such as...
as schedules, design reviews, and demonstration flights.

Kapi'olani Community College from Honolulu, Hawaii, took first place with the highest overall score, followed closely by Amirkabir University from Tehran, Iran, in second place. Ryerson University (Toronto, Canada) came in third, followed by The University of Petroleum and Energy Studies (Dehradun, India) and SRM University (Chennai, India) as the fourth and fifth place winners.

This year’s competition was supported by AAS,
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**AAS Events Schedule**

**July 16-18, 2013**  
2nd Annual International Space Station (ISS) Research and Development Conference  
*Discoveries, Applications and Opportunities*  
Denver Marriott City Center  
Denver, Colorado  
[www.astronautical.org](http://www.astronautical.org)

**August 11-15, 2013**  
* AAS/AIAA Astrodynamics Specialist Conference  
Hilton Head Marriott Resort  
Hilton Head, South Carolina  
[www.space-flight.org](http://www.space-flight.org)

**September 23-27, 2013**  
International Astronautical Congress (IAC)  
Beijing, China  
[www.iafastro.com](http://www.iafastro.com)

**October 7-9, 2013**  
* 6th Wernher von Braun Memorial Symposium  
* Bringing Exploration Forward  
The University of Alabama in Huntsville  
Chan Auditorium, Business Administration Building  
Huntsville, Alabama  
[www.astronautical.org](http://www.astronautical.org)

**January 26-30, 2014**  
* 24th AAS/AIAA Space Flight Mechanics Meeting  
Santa Fe, New Mexico  
[www.space-flight.org](http://www.space-flight.org)

**January 31-February 5, 2014**  
37th Annual Guidance and Control Conference  
Beaver Run Resort  
Breckenridge, Colorado  
[www.aas-rocky-mountain-section.org](http://www.aas-rocky-mountain-section.org)

**March 4-6, 2014**  
52nd Robert H. Goddard Memorial Symposium  
Greenbelt Marriott  
Greenbelt, Maryland  
[www.astronautical.org](http://www.astronautical.org)

**June 17-19, 2014**  
3rd Annual International Space Station (ISS) Research and Development Conference  
Hyatt Regency McCormick Place  
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**Call for Papers:** September 2013  
**Abstract Deadline:** March 1, 2014

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