Global Space League Upcoming Ride-Along Opportunities

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Abstract. Global Space League is a new organization which arranges for students nationwide to take part in real science experiments being performed in places not usually accessible to them: the stratosphere, the ocean, onboard test flights of new flight vehicles, and similar environments. Global Space League has three key customers: scientists exploring interesting environments willing to provide a "ride-along" capability to Global Space League experiments; working scientists who want to come up with a student participatory experiment that can uniquely get some useful data in that environment; and students who want to be involved in some actual missions. This year we are working on arrangements for several stratospheric opportunities for small payloads as well as a variety of other extreme-environment expeditions. This paper discusses flight and field opportunities planned for the near term and will describe the partnering arrangements available for universities wishing to take advantage of opportunities. We are working toward a state in which expeditions are frequent and the pool of students is large so that good ideas can be implemented for deployment quickly and with minimal effort on the part of the scientist and the students. More info can be found at www.globalspaceleague.org.

Introduction

Global Space League will allow kids to take part in real science experiments which will travel onboard experimental aircraft, under the oceans, on far-north tundra and similar remote regions. Global Space League, Inc., has recently incorporated in Frederick, Oklahoma, a rural community of population approximately 5,000. The goal is to both improve science educational performance for students nationwide and at the same time increase the opportunities for low-cost, partially-sponsored flight tests for all kinds of vehicle entrepreneurs and explorers.

Schools subscribe to Global Space League and are sent Announcements of Opportunity to compete for participation in the events. Some events may allow for

hundreds of students to participate; some for only one or a few. The students learn the competitive science process; the need to clearly describe why they are doing an experiment; and the excitement of being able to participate in a limited-access event. Costs of the event itself are covered by sponsors and/or grants.

We are currently partnering with scientists with ideas for experiments and explorers and vehicle developers with available "ride-along" opportunities for our pilot events in 2003. We are also teaming with sponsors that might benefit either from the science explorations per se, or from the local, regional, or national level exposure that may result from our media-friendly activities. Our mission is to tie these groups together and in particular to let kids in very different regions help each other learn about the environment and living things they each take for granted.

Background and Recent Accomplishments

The first Global Space League event took place as part of the Centennial of Frederick, Oklahoma on September 28, 2002. At that event a lighter-than-air vehicle (Figure 1) carried hundreds of paper airplanes made by kids in Frederick up to altitude where they were autonomously released. Airplane dispersal was then tracked online at the website http://www.okspaceplanes.com, developed by partner Digital Radiance, Inc.

Global Space League also flew student-built avionics equipment from Santa Clara University and a RocketCam(TM) camera (Figure 2) which took video from a weather balloon's point of view on a flight across Oklahoma, complete with a parachute fall to earth into a tree. The video can be seen at http://www.eclipticenterprises.com/gallery.shtml. This vehicle also successfully tested a tiny tracking system built by Santa Clara University in California, intended for later use in student-built low cost spacecraft. (http://rsl.engr.scu.edu/).

We also see this program as a means for the growing entrepreneurial space launch industry to get some exposure as they work to make it cheaper and easier to get passengers and cargo up to outer space. The prototype and test vehicles built by these innovators often resemble general-aviation airplanes more than "rockets" and are oriented towards carrying smaller spacecraft -- so much so that one of their major markets may be taking student-built and educational spacecraft up to orbit.

Like the 1930s aviation barnstormers before them, the first thing space pioneers need is exposure to help them raise major sponsorship and investment to move beyond their prototypes and build their operational vehicles (1). Global Space League helps this process by arranging for sponsored dedicated flights to allow our student science experiments to proceed. Where possible, we fly the vehicles in front of a crowd to maximize interaction and exposure for all.

Our September 2002 paper airplane event was designed to excite kids about the experience of interacting with small flight vehicles. We realized, however, that for this to be a sustainable educational endeavor we needed to reach out to the practicing science community to design real experiments that would allow students to gather cutting-edge data on these flights and other expeditions.

Figure 1. The First Global Space League Event.

Figure 2. RocketCam(TM) Gondola Ready To Fly

Participatory Science

Due to air traffic and similar liability concerns, Global Space League flight experiments on innovative vehicles are most sensibly a rural activity. Since the rural population is underserved by the traditional hands-on science activities found in museums in major markets, there is a natural unmet need for this type of interaction. Our main launch site in Frederick, OK is in an interesting position with respect to activities like this one. There are 250,000 people within an hour and a half's drive of Frederick, and Frederick routinely draws thousands of people for events like its annual Fourth of July festival into the area.

Given the Internet and other means of distance learning, we see a likely participation of urban kids through their schools but most likely not personal attendance at vehicle launches. Note the interesting reversal of the usual situation -- the city kids will have to participate at a distance, and the rural kids will be able to be where things are happening!

The Internet has enabled several high-visibility science analysis projects in which the general public can participate. One of the more notable of these has been SETI@HOME. Scientists gathering data from antennas listening for signs of intelligent life elsewhere in the universe developed a screen saver that allows hundreds of thousands of ordinary people to perform useful data analysis on their home PCs. See for example (http://setiathome.ssl.berkeley.edu/index.html)

Another exciting project more aimed at children is Project Starshine (http://www.azinet.com/starshine/). Starshine has launched three satellites so far; these satellites resemble disco balls and are covered with small mirrors. The mirrors are polished by schools and assembled onto the "disco ball" by volunteer engineers. Once the spacecraft is launched, children track it as it goes overhead. The data is used to keep key atmospheric models up-to-date.

We feel these projects had several key admirable features in common:

(1) Professional, world-class scientists defined the scientific problem and use the data in their published research.

(2) Many people can participate.

(3) The science effort scales well and lends itself to good teaching opportunities around a relatively simple core activity. Public events, lectures, and the like can be "branded" from the scalable, simple core activity.

Very few projects have all three of these features. Many amateur rocketry and ballooning groups fly experiments made by kids, but these are rarely designed as a large effort with many kids solving one professional problem and results even more rarely see the light of day. Since these many worthy efforts are all small and mostly ad-hoc, few of them get any significant media attention or have any lasting educational outcomes.

Our own first paper airplane event (Figure 3) was limited in the first criterion, although there was some anecdotal winds aloft insights obtained from the distribution of the planes. We did receive quite a few suggestions to make variants of this dispersal that would in fact provide good winds aloft data after the American Meteorological Society published a report on the event in their August 2002 *Bulletin.*

Figure 3. A Young Scientist Prepares Her Flight Experiment For Integration.

We are approaching scientific professional groups and societies to help us find scientists willing to come up with interesting experiments that fit these criteria that can be flown by vehicles committed to fly in upcoming Global Space League events. We publicized our program at the American Meteorological Society's 2003 annual meeting in Febuary and its general public oriented "WeatherFest". There we let kids see themselves on the video from a mini-airship mounted RocketCam(TM) flying around tethered at the meeting.

Expanding The Concept

As we described the concept to scientists it became clear that the general concept could be expanded far

beyond giving rides on interesting flying vehicles. The "coolness factor" of riding along to explore the ocean, volcanoes, ice floes, and the like is just as appealing to students and creates a critical mass of activities that allows us to have enough subscribers to attract sponsors and similar support.

Therefore, we have started getting in touch with various scientific exploration groups to ask them whether they might be able to take Global Space League packages along on their field excursions. Early indications are that the earth-sciences community often has placeholders for K-12 experiments on their manifests, but sometimes those slots are difficult to fill since it takes time and effort to find willing schools and supervise execution of development of experiments. Global Space League's added value is that of an aggregator within each of these three communities: students, scientists with interesting experimental ideas that fit the constraints, and field explorers or vehicle pioneers willing to negotiate for a ride-along slot for the experiment.

As the participation grows, we are also initiating a "buddy school" program that would, for example, partner a Manhattan school with a school on Hawaii. The Hawaiian kids would put an experiment designed by a Manhattan-based scientist and school out on their nearest reef for a few days to measure quantities of biological interest. The Manhattanites, on the other hand, could put a Hawaiian-designed experiment out their window to measure snowfall. A website and electronic "science journal" with content written both by kids and our professional investigators will be a key part of the long-term growth of this concept.

University Participation

In addition to the airborne missions, Santa Clara University, our major partner in developing many of the vehicles for Global Space League, will be able to provide us use of a small submersible that will be able to take experiments down to the coastal sea floor off the coast of California.

We are also approaching space vehicle entrepreneurs to take along Global Space League payloads when they break records or otherwise have notable flights.

Besides the opportunities for K-12 students to participate in our activities, we will encourage universities looking for particular flight regimes to submit their requirements to us and we will attempt to provide space where feasible, or, even better, to turn their research question into one which can be performed by our younger students. In return, we will ask university participants to attempt to arrange rides for us on any field science expeditions they plan and/or ask their faculty to be scientific advisors for our student proposals.

In an ideal world, we feel that scientists and engineers should also be able to supplement their research funds by participating in projects like these, that capture the imagination of the public while generating revenue. In this era of tight grant funding, some interesting science might be enabled by Global Space League revenue streams that might not be possible otherwise.

2003 Pilot Programs

In 2003 we plan several major pilot events. These events, currently in the planning stages, are:

4th of July, Frederick OK: "Messages From Future Explorers." A HighShips vehicle will take paper airplanes both from our subscriber schools and from participants at festivals in Europe to 100,000 feet similar to the September 2002 events. The criterion for winning planes that get to fly is that the student must decorate the plane to show the value of exploration; winning planes will be displayed at the Omniplex Science Center in Oklahoma City before flight. The event will be a memorial to the Shuttle Columbia crew.

Mid-September, off the coast of San Diego, CA: "Follow That Fish!" The Santa Clara University submersible *Triton*, a shallow-water (<1000 ft) 3 Hp tethered vehicle is being used for a variety of marine science studies as well as for several robotic technology studies (Figure 4).

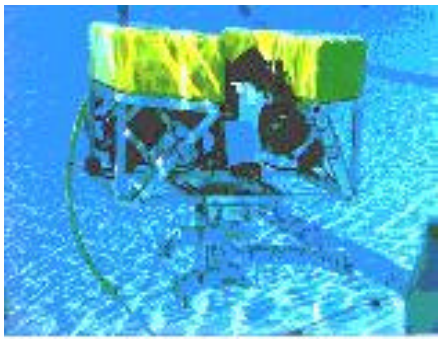

Figure 4. The Santa Clara University *Triton* Submersible.

For this activity, *Triton* will be deployed off the San Diego coast. Our member students will be asked to request a picture to be taken at a particular depth and/or spot along the planned route, and in their request will need to tell us the science they expect to accomplish

with their picture. Winning "principal investigators" will need to analyze their picture and write back what they saw and whether it was as expected.

September 27, 2003: "Extreme Measures." A HighShips vehicle will take student instruments designed to measure and hold the minimum temperature or pressure (or, better, both) encountered on a trip to 100,000 feet within mass and volume constraints.

Fall/Winter 2003: Ride-Along to Sea: Ride-Alongs of a standard size box carrying student experiments on planned professional field expeditions. Experiment opportunities will vary with expedition destination and constraints.

No scientific experiment would be complete without publication of the results. We expect the many professional scientists providing the ride or experiment concept to publish their results, of course, in traditional academic journals. However we want to also develop a channel -- whether it be online only or a mix of online and a newsletter or magazine -- for students to compare notes with each other on how they developed their part, how they are analyzing the data, and so on. We are exploring options for this community creation, which we see as the core of our membership long-term model. In particular, we hope that rural kids able to actually see a launch will be able to fill in their urban counterparts on the experience.

We are also exploring various means of working with organizations experienced in providing teacher training materials so that teachers can more easily integrate our projects into their mainstream curriculum.

Conclusion

Arranging for K-12 participation in activities is surprisingly time-consuming, since schools today have many other competing demands on their time, particularly on science teachers' time. Many field activities that do not have the resources for a K-12 program but desire one can work with us to have student involvement at minimal effort levels. On the other hand, university programs looking for specific rides can work with us for arrangements of mutual benefit and/or tag along at minimal or no cost on any of our dedicated expeditions.

Acknowledgements

We have been very fortunate to have community support and corporate sponsorship for our early efforts in Oklahoma. Founding Global Space League sponsors for the 2002 Frederick event included First National Bank of Altus, Frederick Office; Metzeler Automotive Profile Systems; Red River Transportation Service; Frederick Electric; BancFirst; and Fitch Industrial and Welding Supply, as well as the Oklahoma Space Industry Development Authority and Frederick Chamber of Commerce. CallWave of Santa Barbara, California contributed web hosting and HighShips and Santa Clara University provided services and support. Our Weatherfest opportunity was provided by the American Meteorological Society. July event sponsors at press time include Sam's Club of Lawton, the City of Frederick, HighShips, and Omniplex Science Center in Oklahoma City. Ecliptic Enterprises Corporation contributed use of a RocketCam(TM) camera for several events. We also owe special thanks to the FAA Southwestern Region and Frederick Municipal Airport's manager, Kathy Inman.

A grant from the Oklahoma Space Industry Development Authority has allowed us to include fifty Oklahoma schools in the pilot program. Santa Clara University has made it possible to include ten schools from the San Jose, CA area, and Pasadena-based Entretech, a regional tech industry development organization, is supporting ten schools from its service area. The City of Frederick and its Chamber of Commerce have also provided endless volunteer support for all aspects of this program, without which we never could have gotten off the ground. Finally, Berlin, Germany's Oberbaumbruckenfest and Spacebenefit, and Netherlands-based Delta-Utec are coordinating European participation on our behalf.

References

1. Jessen, G.N. The Powder Puff Derby of 1929: The First All Women's Transcontinental Air Race, Sourcebooks Trade, 2002.