



# *Southeastern Space Supporter*

*Newsletter of HAL5 - the Huntsville Alabama L5 Society chapter of the National Space Society*

Volume 4, Number 5 — September–October 1995

## **FIRST WORD**

### **HALO Prepares for Flight**

(by Gregory Allison, HAL5 President)

In the issue before last I took the opportunity to have a little fun with my tongue in cheek article “Hot On the Trail!” Laced in with that humor were some very significant truths. With two high altitude balloon flights and 30 hybrid rocket motor firings under our belts we have proven that HAL5 is not an organization of idle talk.

Our objective is both extremely bold and within reach: to provide ultracheap access to the space environment for student experiments. Before the end of this calendar year Project HALO flight hardware should be flight ready. From that point on it is only a matter of obtaining the waivers to fly.

We are well poised, by accomplishing our objective, to become the first amateur group to put an object into space (achieve an altitude greater than 50 nautical miles). More importantly, we are laying the groundwork for technology and methodology which eventually can accomplish far more.

Meanwhile, HAL5 has also reengaged in development of an educational program aimed at getting grade school students interested in space, science, and mathematics. We are currently refining text for six, or alternately nine, classroom sessions geared toward the fifth grade level. Sessions for the higher grades would expand on these materials with more advanced concepts and introduce a project development workshop to be called the “Junior Foundry.” We plan to prototype the

text with students before the end of the year.

Participants in the Junior Foundry process would be offered opportunities to fly experiments on ground based rockets, tethered balloons, high altitude weather balloons (to approximately 100,000 feet), and rockoon missions into space on ballistic trajectories.

Currently we are planning to do a public program on the educational project in mid-November. See the next issue of the *Southeastern Space Supporter* for details.

If you are not already actively involved, I invite you to participate. With our “hands on” engineering/hardware development, educational programs, and public lectures, HAL5 offers opportunities across the board of interest, talents, and skills. If you are already involved, recruit other participants. We are looking for all the help we can get.

To get involved call me at 971-1041 (day), or preferably 895-5538 (nights). We will find something for you to do. Ad Astra! ☆

### **Project HALO Main Events**

Project HALO is rapidly approaching the end of Phase 0, Subsystem Testing, and the beginning of Phase 1, Rockoon Design and First Flight (see Calendar)

Note the following upcoming events:

**Sat, Sep 30 – Final Balloon Test**

**Sat, Oct 7 – Motor Test Day #8**

**Sat, Oct 28 – Flight Motor Test**

All HAL5 members are encouraged to attend, and to bring interested friends and co-workers. Free admission.

## **PROJECT HALO NEWS**

### **Hybrid Rocket Flies, Proves Hybrid Motor Design**

(by Tim Pickens, Propulsion Team Lead)

I have good news to report. Thanks to our HALO (and HARA) member Gene Hornbuckle, we now have performed two successful flights of a hybrid rocket incorporating our asphalt and nitrous-oxide (N<sub>2</sub>O) hybrid motor design.

Gene offered to build the vehicle if we would design and build the propulsion system. We felt it would be a great idea to scale our system down and build a motor, tank, plumbing, and pyro-valve. The motor has been mentioned in our past newsletters (“The Little Motor That Could”).

First flight of the completed rocket was performed on Sunday, September 10. The rocket was about 6 feet tall and weighed (loaded) about 8 pounds. The thrust was over 50 pounds for 4 seconds. The rocket preparation, N<sub>2</sub>O filling, and flight was flawless. The rocket climbed to about 1800 feet, before parachuting back to the ground.

It was spectacular! It really was an exciting moment for those few HALO members that went to the remote launch site in Manchester, Tennessee. It gave everyone a shot of confidence for the even bolder flights of Project HALO to come. Everyone who has worked on the HALO Propulsion Team should be proud that our hard work has paid off!

### **Rocket Motor Test Day #7**

Prior to this flight, we held another Project HALO rocket motor test day, on (see Motor Testing on page 2)

**Huntsville Alabama L5 Society**

President — Gregory Allison  
Day: 971-1041, Eve: 859-5538  
Vice-President — Ethan Scarl  
Day: 461-2747, Eve: 534-3993  
Treasurer — Ronnie Lajoie  
Day: 461-3064, Eve: 721-1083  
Secretary — Larry Scarborough  
Day: 881-1944, Eve: 881-4363  
Membership — Philomena Grodzka  
Day: 837-4287, Eve: 536-8638  
Communications — Ron Creel  
Day: 881-8016, Eve: 881-8016  
Special Projects — Alfred Wright  
Day: 876-8037, Eve: 420-6273

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The Southeastern Space Supporter is a bi-monthly publication of the Huntsville Alabama L5 Society (HAL5), a not-for-profit 501(c)(3) organization devoted to the goal of seeing everyday people living in thriving communities beyond the Earth.

Any opinions expressed in this news-letter are those of the authors or of the Editor, and, unless expressly so stated, are not necessarily those of HAL5 or NSS.

Visit the HAL5 Web Page on Internet via:  
<http://www.cici.com/~hal5/index.html>  
Courtesy of Community Internet Connect.  
Contact Bob Ehresman for info: 722-0199

HAL5 encourages its members to speak out on space-related issues, and welcome submissions of both fact and opinion articles of interest to HAL5 members.

Submit letters/articles to: Ronnie Lajoie  
162 Kirby Lane, Madison, AL 35758  
Day phone/message: 205-461-3064  
Night/Weekend phone: 205-721-1083  
FAX number: 205-461-2939  
Electronic mail address: hal5@cici.com

Deadline for submittal is the last day of the following months: February, April, June, August, October, and December.

Preferred format for text is ASCII on a diskette or sent by E-Mail. Preferred format for text with graphics is Word on a diskette. Also acceptable are letters and articles sent by mail or faxed; however, the more retyping required, the less likely the acceptance. HAL5 is not responsible for receipt of mailed submissions; none will be returned unless sent with a SASE. Hand-delivered diskettes will be hand-returned. No compensation is paid for submissions.

(Motor Testing, continued from page 1)  
Saturday, August 12. That old baseball superstition — about bringing bad luck for mentioning “no-hitter” during a no-hit game — struck Project HALO, not once, but twice!

While setting up the first test, a member (who will remain anonymous) noted that Mother Nature had been kind to us so far, and that all our tests had been held in fair weather. Within a half hour, Mother Nature taught us a lesson with a downpour even Noah would have appreciated! The path between the barn and the test site, mostly dirt from recent excavation, turned into thick, sticky mud. Although the rain stopped, for the rest of day we felt like World War I infantry. Man, did we get exhausted!

**Test Objectives**

We were to test five HALO hybrid motors, this time with a longer burn time, 6 seconds instead of the usual 3. We were also to test two hybrid motors made by James Mitchell of Tennessee.

The HALO motors were all designed to deliver a total impulse of 2000 lb-sec. The planned 6 second burn time would allow us to measure the regression rate of the asphalt propellant, as well as other pertinent data for later analysis.

Our objectives for the day would be to increase our motor’s efficiency or “specific impulse” (Isp), to test our new flight-capable aluminum motor casing, to test our new plug valve design, to measure the flow characteristics of our new motor injector, and to test our motor’s ability to survive a 6-sec burn.

**First Test to Check Motor Design**

We first tested a motor in a standard steel casing (as in the past). The first test was primarily to see if the Isp and oxidizer-to-fuel (O/F) ratio would deliver the required performance.

The test would use an all-asphalt motor with a 1-inch core diameter and an 11-inch length. The test proceeded very well, with good ignition, and a burn

time of 6 seconds. All hardware appeared unharmed. Nozzle wear was minimal. The motor yielded an average thrust of 161 lb and an Isp of 203 sec.

**Aluminum Casing Has Burn-Through**

Next up, after a lunch break, was an all-asphalt motor with a 1<sup>1</sup>/<sub>4</sub>-inch core diameter and an 11-inch length. This motor would be placed in a light-weight aluminum casing, similar to what would be used for an actual flight. Like the steel pipe used previously, the aluminum casing had pipe threads on each end to accommodate our current nozzle and injector end-caps.

The test had good ignition — the new plug design was working very well! After 4 seconds into the test, fire erupted from the side of the casing, located just above the nozzle in the post-mixing combustion chamber. We immediately aborted the test. Aside of the casing, no damage was caused to the test stand, property, or personnel. Prior to the burn through, the motor yielded an average thrust of only 150 pounds and an Isp of 200 seconds.

Post-test analysis revealed that the casing threads (which reached almost to the post-mixing chamber) locally weakened the casing. Once heat burned away the carbon-phenolic mixing tube, it quickly melted the locally thin aluminum, creating a hole by which flame could pass through. The hole grew to two inches wide and one inch high, before the test firing was aborted.

One solution to the problem is to use snap rings (already used for Gene’s motor) instead of pipe threads. Another is to insert either an ablative or flame-resistant liner inside the carbon-phenolic mixing-chamber tubing. Both solutions will probably be implemented.

**Back to the Steel Casings**

With an obviously damaged aluminum casing, we decided to return to using  
(see Motor Testing on page 5)

# HAL5 CALENDAR OF EVENTS (Post Me!)

## September 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
17	18	19 <b>HALO Program Design Review</b> 7pm at Tim's	20	21 <b>HAL5 Executive Comm. Meeting</b> 11:30a at Ponds	22	23
24	25	26 <b>8th Von Braun Space Forum</b> 6:30p at VBCC	27 <b>AIAA Space Conference</b> 8a-5p at VBCC	28 <b>HALO Education Team Meeting</b> 6:30p at Greg's	29	30 <b>Project HALO Balloon Test</b> 9am, Old Airport
<b>8th Annual Von Braun Exploration Forum</b> "Outposts of Exploration — Living at the Frontier" with Hugh Downs, Chairman, NSS Board of Governors 6:30 pm, Tuesday, September 26, VBCC Concert Hall			<b>HALO Education Team Meeting</b> 6:30 pm, Thursday, Sept. 28, at the home of Greg Allison, 112 Stilwell Drive, Toney, AL		<b>HALO Balloon Test at 20 mi.</b> 9:00 am, Saturday, Sept. 28, at the Old Huntsville Airport HARA Rocket Event after	

## October 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3 No HALO Lunch Meeting at Ponds again until Nov. 7	4	5 <b>HAL5 Executive Comm. Meeting</b> 11:30a at Ponds	6	7 <b>HALO Rocket Motor Testing</b> 12pm, Gurley
8	9	10	11	12 <b>HALO Motor Testing Review</b> 11:30a at Ponds	13 Project HALO Phase 0 Ends Phase 1 Begins	14
15	16	17	18 <b>HALO Rocket Design Review</b> 7pm at Tim's	19 <b>HAL5 Executive Comm. Meeting</b> 11:30a at Ponds	20	21
22	23	24	25 <b>HAL5 Program Night</b> 7pm at Library	26 <b>HAL5 Executive Comm. Meeting</b> 11:30a at Ponds	27	28 <b>HALO Rocket Motor Testing</b> 12pm, Gurley
29	30	31	<b>HAL5 October Program Night with guest speaker:</b> <b>Thad Mauldin, new Director of the U. S. Space and Rocket Center</b> 7:00 pm, Wednesday, October 25, at the Huntsville Public Library		<b>HALO Rocket Flight Motor Testing</b> (Final test in preparation for ground launch on Dec. 2) <b>Noon, Saturday, October 28 at the HALO Rocket Test Facility at Herman Pickens home in Gurley</b>	

## November 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<b>Constellation XIV, Science Fiction Convention</b> with Science Track featuring Project HALO Noon, Friday, Nov. 3 to Noon, Sunday, Nov. 5 Tom Bevill Center at UAH, Huntsville			1	2 <b>HAL5 Executive Comm. Meeting</b> 11:30a at Ponds	3 <b>Constellation XIV</b> Tom Bevill Ctr	4 <b>Constellation XIV</b> Tom Bevill Ctr
5 <b>Constellation XIV</b> Tom Bevill Ctr	6	7 <b>HALO Launch Analysis Review</b> 11:30a at Ponds	8	9 <b>HAL5 Executive Comm. Meeting</b> 11:30a at Ponds	10 Articles and Inputs for Next Newsletter Due	11
12	13	14	15 <b>HALO Rocket Design Review</b> 7pm at Tim's	16 <b>HAL5 Executive Comm. Meeting</b> 11:30a at Ponds	17	18

PLACE ADVERTISEMENT HERE

(Motor Testing, continued from page 2) our sturdier steel casings. Three more HALO motor were successfully test fired, and all-but-one ignited on the first attempt. The only ignition failure followed immediately after a member remarked "At least the new ignitors are working well." (Baseball's "no-hitter" curse strikes again!)

The third test involved an all-asphalt motor with a 1<sup>1</sup>/<sub>4</sub>-inch core diameter and an 11-inch length. A completely successful 6.0 second test yielding an average thrust of 154 pounds and an Isp of 192 seconds.

The fourth test involved an all-asphalt motor with a 1<sup>1</sup>/<sub>4</sub>-inch core diameter and a longer, 12-inch length. Another successful 6.0 second test yielding an average thrust of 175 pounds and an Isp of 182 seconds.

The fifth test involved an asphalt-with-aluminum motor with a smaller, 1-inch core diameter, but still a 12-inch length. Again, another successful 6.0 second test, yielding an average thrust of 171 pounds and an Isp of 184 seconds. So far, no significant performance gains have been achieved by adding the aluminum powder to the asphalt.

### More Firings into the Night

James Mitchell had driven a long way to attend this event, and we were all determined to test-fire his motors, despite the hot, muggy weather, and the mud — which by then was on everyone's nerves (and clothes). Chris Pickens came to rescue again with some delicious, home-made ice cream. Just what us weary infantrymen needed!

James, previously came down from Tennessee to test home-made solid motors (the J, K, and L-class motors mentioned in the last newsletter). He had expressed an interest in creating a hybrid motor, but using PBAN rather than asphalt as the propellant. Steve Mustaikis and I gave him the critical design information, such as the injector area, grain length, core diameter, and nozzle dimensions.

James' first test, performed just after sunset, involved an all-PBAN motor with a 1-inch core diameter and an 12-inch length. A successful 4.0 second test yielding an average thrust of 114 pounds and an Isp of 168 seconds.

James' second test, performed at night following a dinner break, involved a PBAN-with-rubber-and-charcoal motor with a 1-inch core diameter and an 12-inch length. A successful 6.0 second test yielding an average thrust of 129 pounds and an Isp of 202 seconds.

This is extremely good for a first timer! James has also had a very good success rate with solid motors. He builds all his own hardware and is quite a machinist. He has offered his services to Project HALO for building some hardware that we cannot do locally because of time.

### End of a Successful, but Tiring, Day

It was the end to another good day at the HALO Rocket Motor Test Facility. The group agreed not to purposely test-fire motors at night again, not only for safety reasons, but also out of courtesy to the neighbors of Herman and Chris Pickens.

Overall, the performance was very good for all these tests. Ignition was excellent, startup looked good, and our Isp was above 200 seconds — which is very good for asphalt fuel grain with a N<sub>2</sub>O oxidizer. Steve has done an excellent job in his mathematical modeling of the chemical combustion for the asphalt-and-N<sub>2</sub>O combination.

The next test day is scheduled to start at Noon on Saturday, October 7. Based on the results of several rocket design reviews, we will be scaling up our propulsion system in order to improve the vehicle propellant mass fraction. The new design should yield a thrust of 340 pounds and a 10 second burn time, for a total impulse of 3400 lb-sec.

Much new hardware needs to be built or otherwise prepared to support these upcoming tests. Anyone interested in helping should call me at 971-1566. ☆

## HALO Education Program

(by Larry Scarborough, Education Lead)

Many of you have heard for quite some time about the education program that HAL5 would like to provide. Education has always had high priority in the NSS. A space-faring society has to be built on a foundation of a public that understands what space is all about.

In recent days, HAL5 president Greg Allison, Martha Feld (who served as Director of the 1993 ISDC Junior Cadet Program), and I have begun working on the Project HALO Education program. We have been reviewing scripts for a proposed series of 6 (or more) sessions geared, initially, for 5th grade students.

The genesis of the program goes back several years, before the 1993 ISDC, to when HAL5 and Junior Achievement (JrA) discussed creating a joint program for teaching science and technology education to local elementary and secondary school children, modeled after JrA's business education program. Back in 1991, Greg Allison led a team of HAL5 members in drafting a script by which students would aid the cartoon character Garfield the Cat in planning a space trip to the Moon or to Mars.

Our present program is building on this past work. It involves a series of working sessions whereby guest speakers guide students into addressing the various challenges in preparing for a trip to the Moon or Mars.

We are planning to present a prototype program this Fall to some students. Our next meeting will be held at Greg's house on Thursday, September 30, at 6:30 pm. Anyone interested in helping prepare the program should call me at 881-4363 or Greg at 859-5538.

Directions to Greg's house, located at 112 Stilwell Drive. From Huntsville, take Jordan Lane north until it (now Highway 53) intersects Jeff Road. Travel north on Jeff about one mile. Stilwell Drive will be on the left. From Madison, take Slaughter/Jeff Road north, past Highway 53, to Stilwell. ☆

**SPACE NEWS**

**NASA Projects Still Funded**

(Dallas Morning News, August 21)

Reports of the deaths of several NASA projects are greatly exaggerated, the most recent news out of Washington indicates.

Astronomers and physicists working on the Cassini mission to Saturn, the SOFIA flying telescope, and the Gravity Probe B mission are breathing bewildered sighs of relief now that the projects are back in the federal government's 1996 budget. In July, the House subcommittee responsible for NASA's budget had cut all three projects, insisting that if NASA could not decide how to reduce its costs, Congress would have to do so.

But just before leaving for its August recess, the House approved a 1996 budget for NASA that included funding for all three missions. The Cassini and gravity missions received full funding, and the flying telescope got about 60 percent of its original budget.

Dan Lester, a professor at the University of Texas at Austin, led the lobbying effort for SOFIA, a telescope that NASA plans to build over the next five years. If started next year, the new airborne telescope would begin flying around the turn of the century. NASA's current flying telescope, the 21-year-old Kuiper Airborne Observatory, is scheduled for its last mission in mid-October of this year.

The probe Cassini, whose cost will total \$2.66 billion, is scheduled to reach

Saturn early in the next century.

The gravity probe project, which will cost \$500 million and is designed to test an aspect of Einstein's theory of general relativity known as "frame dragging," is scheduled for launch in 2000. ☆

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**Meteor Destroys Mobile Home**

(The Associated Press, August 25)

A tremendous bluish-green flash of light, apparently from a blazing meteor, illuminated the night sky over a 400-mile area from Michigan to New York.

An object believed to be a meteorite slammed into a vacant mobile home early today in Windsor, Ontario, burning it to the ground, police said. No injuries were reported.

The fireball streaked across the sky around 12:30 a.m. and lasted a few seconds. Emergency officials received numerous telephone calls from the curious and the worried, including many who thought a plane had crashed.

"[The fireball] was about the size of an airplane, with an orange tail behind it, and at the top it seemed to have a crown of greenish light," said Joe Stocco of Liverpool, NY, near Syracuse. "I'd never seen anything like this before. It was pretty interesting."

Firefighters who went to the mobile home recovered the apparent meteorite, which was about three times the size of a beach ball, said Windsor police Sgt. Ken McFarland. He was unsure what would be done with the object.

The National Weather Service in Cleveland said the reports of bright lights "are presumed to be a meteor shower ... a typical happening in late August." The Coast Guard received calls from Saginaw Bay, about 110 miles north of Detroit, to the St. Lawrence River, about 400 miles to the east. ☆

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**Cheap New Expendable Launch Vehicle Sought**

(The Associated Press, August 25)

Four defense companies won \$30 million contracts to design competing versions of a new space launch vehicle the Air Force predicts will save billions of dollars in launch costs in the 21st century.

In 1998, one of the four contractors' designs will be selected for actual production, and the winning company could earn up to \$2 billion.

The new space boosters will be used to launch both military and commercial satellites. They will replace the existing Titan, Delta, and Atlas space boosters, which were derived from the nation's first generation of ICBMs built in the 1950s to carry nuclear warheads.

The Air Force said Lockheed Martin Technologies, McDonnell Douglas Aerospace, Boeing Defense and Space Group, and Alliant Technologies, will split an initial \$120 million for the first phase of the program. ☆

**Special Announcements**

**Project HALO — Balloon Test**

**Saturday, September 30, 9 am**

**Project HALO — Motor Firings**

**Saturday, October 7, Noon, Gurley**

**Huntsville Alabama L5 Society**  
1019-A Old Monrovia Rd, Suite 168  
Huntsville, AL 35806

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