Southeastern Space Supporter

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

Volume 4, Number 3 — May–June 1995

FIRST WORD

Hot On The Trail!

(by Gregory Allison, HAL5 President and Project HALO Program Manager)

Any "GOOD OLE' BOY" from Alabama can tell you that when the beagles are howling and the furry critter is bouncing between the bushes THAT YOU ARE HOT ON THE TRAIL! I'm proud to announce that is exactly where HAL5 is today. But a word to the wise, if you want to hunt with the big dogs you'd better get off the porch and run!

Consider this past weekend. The HAL5 Project HALO rocket motor test stand roared to life with two successful tests of hybrid rocket motors. Our little asphalt nitrous motor exceeded our expectations, producing over 200 pounds of thrust with a specific impulse of over 205 seconds. That compares with the best of solid motors! To top it off this test series was conducted under a low nitrous pressure that resulted in a low O/F (oxygen to fuel) ratio.

(see First Word on page 8)

Major Upcoming Events

TABES '95

Tue. May 16 thru Wed. May 17, 1995
Programming 9 AM – 5 PM
Von Braun Civic Center, Huntsville
with **Professionals of the Year Dinner**
Tue. May 16, 6:30 PM, VBCC Parlor A

1995 ISDC

Thur. May 18 thru Sun. May 21, 1995
Holiday Inn, Cleveland, Ohio

PROJECT HALO NEWS

Rocket Motor Test Successes

(by Tim Pickens, HALO Propulsion Lead)

There have been many activities transpiring since my last HALO Propulsion Team report (Jan-Feb issue). Since March 25, we have had a total of six hybrid rocket motor test firings. I would like to inform you on our past progress and current development pertaining to our hybrid research development program.

First Hybrid Motor Test Day

It was Saturday, March 25, and the day of reckoning had finally arrived. Much work had been performed preparing for this day. The test facility (see Figure 1) was to be christened with an asphalt and nitrous-oxide (N_2O) hybrid rocket motor (in the middle of the stand test) capable of achieving a total impulse of 2000 lb-sec (200 pounds of thrust for 10 seconds), which we estimate could loft a balloon-launched rocket into space. The large gauge would monitor the chamber pressure inside the motor, while the smaller one would monitor the pressure inside the oxidizer tank (protruding above the test stand). Electronic monitoring was also to be performed using a circuit board (inside the metal box) to relay data back to a computer in the "HALO control room" (that is, the barn of Herman Pickens).

Preparing the First Hybrid Motor

There were many unknown factors. Although asphalt is a common roof coating (and road material), it was difficult obtaining an exact chemical formula and other pertinent design information. Asphalt offers an affordable way for us to develop, produce, and test our instrumentation, flow system, ignition system, and other

(see Motor Testing on page 3)

Figure 1. HALO Rocket Motor Test Stand with first hybrid motor installed.

Huntsville Alabama L5 Society

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May / June 1995

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 Homepage on Internet via:
http://www.cici.com/~hal5/index.html

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
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. unless sent with a SASE. Hand-delivered diskettes will be hand-returned. No compensation will be paid for submissions.

No, not some New Age ritual. Bill Brown looks on as HALO members prepare balloon for launch.

HALO Balloon Test Event

(by Ronnie Lajoie, HALO member)

On Saturday, March 18, HAL5 helped launch Space Week by sending a balloon once more to 100,000 feet. This time however, the balloon carried a student experiment and vital test components for Project HALO, in addition to the color video camera, HAM radio relay, and new HAL5 membership cards carried previously.

The day opened with a mini arsenal of model rockets firing up into the sky, sponsored by HARA, followed by several launches of sounding rockets sponsored by Project SOAR. HAL5 member Ed Stluka flew many student experiments aboard the rockets, to the delight of the students.

Around noon, HAL5 began preparing the weather balloon for launch. Tim Pickens and Steve Mustakis had worked hard to develop and prepare both a test ignitor and a test valve for the flight. Bill Brown stayed up late the previous evening preparing the electronics. Unfortu-nately, a power surge fried the circuit board, and ruined the chance of sequencing the tests and relaying test data to the ground. As a quick fix, an on-board timer was set-up to start the test 90 minutes after launch, and the video camera was posi-tioned so that we could at least watch the tests.

The balloon launch was flawless and the crowd cheered as it quickly climbed into the sky. The video downlink was great and both Ed and Ronnie recorded the flight. Bill converted the Morse-code-like telemetry from the balloon, which provided us with altitude and tempera-ture data. At one point, the temperature inside the test chamber was a quite frigid –30°C. By test time, though, the chamber temperature had risen to a less chilly –10°C.

The test time came and went, yet the video showed no change to the test canister. The most likely cause was a frozen battery, since the selected 9V alkaline battery is not meant to operate at such a cold temperature. The next test will probably use a lithium battery.

The balloon burst and the payload parachuted back to Earth, landing high in a tree just a few miles away from Lake Guntersville. The homing beacon led the search party right to the location and, with a little ingenuity, the group recovered the payload.

The test parts were recovered and actually used successfully in the first ground tests. The student X-ray experiment was sent for processing, but no difference was seen. The HAL5 membership cards were sent off for processing and will be ready in June. ☆

(Motor Testing, continued from page 1)

motor-related components. HAL5 is very fortunate to have talented people as members of Project HALO to allow us to do 100 percent in-house design, construction, and testing.

The major theoretical motor design aspects were accomplished by Steve Mustakis, who is a propulsion major about to earn his Bachelor's degree from UAH. He has been very instrumental in all aspects of design and construction.

Our hybrid motor casing consisted of a 2.5-inch diameter, 23-inch long steel pipe. Each end (injector and nozzle) was threaded for screw-on caps, which allowed for quick assembly and disassembly. The fuel "grain" consisted of a 15-inch long cylinder of asphalt with a 1-inch core (hole) down the center. The separate motor nozzle was a 3-inch long Delavel design carved from solid graphite (in Tim Picken's garage). Separating the asphalt fuel from the nozzle was a 4-inch, post-mixing combustion chamber.

Preparing the Oxidizer Flow System

With the initial fuel grain weighing in at 1.6 lbs, Steve calculated that about 10 lbs of N_2O would be required to achieve the best rocket performance (based on the optimum fuel-to-oxidizer ratio). To achieve the desired 200 lbs of thrust for 10 seconds, we needed an average oxidizer flow rate of 1.0 lb/sec. We first tried to design an oxidizer injector with a single central port (hole), but calculations showed that the oxidizer would not expand properly and might cause fuel regression problems near the injector. We chose to go instead with a multi-port injector design, which proved to have very good expansion properties. A cold flow test of our test injector showed that we could achieve the desired flow rate.

At the HALO Rocket Motor Test Stand, our oxidizer flow system was oriented vertically above the motor, a "flight-ready" configuration. This was done to allow us to gather realistic flow data. A pressure tap allowed us to examine the N_2O blow-down characteristics during the test. The flow system was to be driven by the vapor pressure of the N_2O inside the oxidizer tank; no pumps were to be used. This was one of the factors in selecting N_2O, although there are some performance penalties. N_2O is very safe and easy to work with, and can survive the projected two-hour balloon trip to the launch altitude.

The oxidizer valve we used (for its simplistic design) was a ball valve that was spring loaded to fully open. A string was wrapped around a pulley attached to the valve to hold the valve in a closed position. A squib was placed near the string. Once the squib ignited, the string would break and the spring would pull the valve open. Many successful ground tests of the valve were performed. A high altitude test of the valve never occurred due to a cold battery aboard the balloon.

Preparing the Ignition System

Our ignitor would be a very critical area of our hybrid test program. Faulty ignitors are the most probable cause of past rockoon failures. We needed an ignitor with low power requirements because we were attempting to keep the future rocket weight at a minimum, and batteries are relatively heavy. The ignitor would be required to burn for a minimum of three seconds, generating enough heat to vaporize the surface of the fuel grain near the injector and ensure a good ignition when the oxidizer started flowing past. We needed a considerable amount of heat (about 570_F) in order to disassociate the oxygen from the N_2O.

Our ignitor design of a cylindrical wire mesh wrapped in Thermalite (described in the Mar-Apr issue) achieves all of these requirements. The squibs which ignite the Thermalite can be fired using a common watch battery. Our ignitor burns for about five seconds, then is totally consumed by fire once the motor itself ignites.

Preparing the Data System

All data was to be recorded on a Macintosh computer inside the control room (see Figure 2). HALO member Larry Larsen had set up a very nice system (using **Lab View** software) that would make data acquisition a "state of the art" affair. The command controls would be manual by toggling a series of switches. The switches were connected to a relay card, which would allow us (eventually) to run the controls via the computer.

The motor had sensors for monitoring thrust, starting and flow pressure, and chamber pressure. HALO member Gene Hornbuckle built amplifiers to

Figure 2. Larry Larsen checks the computer inside the HALO Control Room.

increase the millivolt output of the sensors up to 10 Volts. Gene packaged the amplifiers and relays onto a single board which sits in a metal box next to the test stand when in use; and can be easily removed after. Gene, Larry, and Steve worked long hours refining and calibrating the equipment.

The First Rocket Motor Test

The ignitor was slid into the motor, then the motor was strapped to the test stand and connected to the oxidizer tank via the oxidizer valve mechanism. We then sounded an alarm siren briefly to clear the immediate area so that we could begin loading the oxidizer tank. This was a safety issue because we wanted to test a lightweight tank that we could later use for the flight vehicle. We wanted as much data as we could obtain on all aspects of our designs.

The N_2O supply bottle was kept safely behind a concrete wall at one end of the test stand. Two people (Steve and myself) stood next to the bottle and filled the tank from behind the wall. (We plan to eventually go with a much safer remote loading capability.) The bottle sat on a scale so that we could monitor the change in weight as we filled the oxidizer tank. Knowing the internal volume, pressure, and mass of the oxidizer in the tank, we could compute the tank ullage (the amount of relatively useless gaseous N_2O floating above the thrust-enabling liquid N_2O below). After filling the tank, we removed ourselves to the safety of the control room.

Our rocket motor test system is completely safe until the oxidizer tank is loaded. Even then, two events must occur to start the test. First, the ignitor must be triggered; second, the oxidizer valve must be opened. We even had a backup for the oxidizer valve; a long string between the valve and the control room, which could be used to yank open the valve if the squib failed.

After a second and final siren warning, we counted down five seconds, then threw the switch. With a loud "snap", the ignitor squib fired and started the ignition process, heating the asphalt and filling the combustion chamber with fuel vapor. Two seconds later, we fired the valve squib, which successfully opened the oxidizer valve and allowed the N_2O to enter the chamber. Whoosh! Motor ignition! All eyes were focused on this historic moment for Project HALO (see Figure 3).

Figure 3. The historic first HALO rocket motor test firing.

The test looked great! This test seemed to burn forever, although the video recording proved that the actual burn time was only eight seconds. Motor ignition was very good and thrust quickly climbed to a peak. Chamber pressure went as high as 700 psi, 300 more than our design requirement (we would later correct this). It was evident from our pressure gases that there was coupling ("chugging") taking place between our chamber pressure and our blowdown pressure.

Unfortunately, our data acquisition system still had a few bugs, and our data was very noisy. (We later corrected this by replacing the power supply in the metal box.) We believe we achieved a thrust of about 125 lbs at a specific impulse (Isp) of about 210 seconds. All data indicated that we were with 25% of our theoretical predictions.

The only casualty of the test was a wooden flame deflector, which looked like burnt toast after the test. The motor flame burned a hole right through the deflector and gouged out a small crater in the concrete pad! All in all, however, we were very pleased with our first test firing.

Second Rocket Motor Test

To lower the chamber pressure and also increase the thrust, we carved the graphite nozzle (which survived the first test extremely well) more to increase the throat diameter. We cast another asphalt fuel grain and assembled another test motor. We also built several ignitors (in case one failed), and prepared the oxidizer valve assembly.

Three weeks after the first test, on Easter Sunday, April 15, we began the second test. The crew came out early to correct the data acquisition problems, and were getting very clean (non-noisy) data by 1pm. Meanwhile, others prepared the motor for firing. We also laid out rows of bricks over a steel plate as our new flame deflector. We inserted an ignitor into the motor, strapped the motor to the test stand, and loaded the oxidizer tank.

After the final siren warning, we counted down five seconds, then threw the switch. With a loud "snap", the ignitor squib fired and started the ignition process.

(see Motor Testing on page 6)

HAL5 CALENDAR OF EVENTS

May 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7 **HALO Rocket Work Session** 1p at T.Pickens	8	9 **HALO Technical Team Meeting** 11:30a at Ponds	10	11 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	12	13
14 **HALO Rocket Work Session** 1p at T.Pickens	15	16 **TABES 1995 & Awards Dinner** 9a–5p/7p: VBCC	17 **TABES 1995 Exhibits & Talks** 9a–5p at VBCC	18 **1995 ISDC** Cleveland, OH (all day)	19 **1995 ISDC** Cleveland, OH (all day)	20 **1995 ISDC** Cleveland, OH (all day)
21 **1995 ISDC** Cleveland, OH (morning)	22	23 **HALO Technical Team Meeting** 11:30a at Ponds	24 **HAL5 Meeting HALO Update** 6:30p at HATS	25 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	26	27 **HALO Rocket or Balloon Test** TBD
28	29	30 **HALO Technical Team Meeting** 11:30a at Ponds	31	**HAL5 General Membership Meeting Update on Project HALO Wed., May 24, 6:30 pm, HATS Office**		

June 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
HAL5 Elections and Pizza Party (HAL5 supplies the pizza, you supply the drinks, etc.) Wednesday, June 28, 6:30 pm, HATS Office				1 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	2	3
4 **HALO Rocket Work Session** 1p at T.Pickens	5	6 **HALO Technical Team Meeting** 11:30a at Ponds	7	8 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	9	10
11 **HALO Rocket Work Session** 1p at T.Pickens	12	13 **HALO Technical Team Meeting** 11:30a at Ponds	14	15 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	16	17
18 **HALO Rocket Work Session** 1p at T.Pickens	19	20 **HALO Technical Team Meeting** 11:30a at Ponds	21	22 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	23	24
25 **HALO Rocket Work Session** 1p at T.Pickens	26	27 **HALO Technical Team Meeting** 11:30a at Ponds	28 **HAL5 Elections and Pizza Party** 6:30p at HATS	29 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	30	July 1

July 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2 **HALO Rocket Work Session** 1p at T.Pickens	3	4 **HALO Technical Team Meeting** 11:30a at Ponds	5	6 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	7 Inputs to HAL5 newsletter due	8
9 **HALO Rocket Work Session** 1p at T.Pickens	10	11 **HALO Technical Team Meeting** 11:30a at Ponds	12	13 **HAL5 Executive Comm. Meeting** 11:30a at Ponds	14	15

(Motor Testing, continued from page 4)

In my eagerness, I threw the oxidizer valve switch too early (only one second later). Raw N_2O shot from the motor nozzle and rolled along the ground like a dense fog. Eventually, the oxidizer pressure dropped low enough that motor ignition finally occurred, but only about 50 lbs of thrust was produced. All was not lost however. Data acquisition this time was great and Steve said that he could use this “cold flow” data to verify the mass flow.

Since we had another ignitor and the motor fuel grain was still mostly intact, we decided to try again. But first, we feasted on a meal of hot dogs, cokes, and Mel’s delicious cookies, provided by Tim Pickens, and prepared by our hosts Herman and Chris Pickens.

By now, night had fallen, but we were ready to try again. After the “snap” of the ignitor, we were determined to wait a full two seconds before opening the valve. We did so, but nothing happened after we heard the “snap” of the oxidizer valve squib firing. The valve was still closed and the ignitor was still burning away creating more fuel vapor.

As soon as I realized what was happening, I pulled hard on the string serving as our backup, manual release. By now five seconds had elapsed, and the chamber was filled with excess hot fuel vapor. When the fuel and oxidizer finally mixed, the chamber pressure rose so high that it blew out the copper tubing running to our big pressure gauge. The rocket motor roared to life, but some of the thrust went sideways out through the $1/4$-inch hole of our chamber pressure tap. The test lasted for 16 seconds.

It was quite a sight to see, especially at night (see Figure 4). Since we had no way of stopping the test (this was later corrected), we just watched in awe as the powerful vertical thrust slid aside our flame deflector bricks (so much for <u>that</u> idea), while the less powerful (but more exciting) horizontal thrust spewed arc-welder-like sparks across the test stand where they bounced off the concrete wall (thankfully protecting our N_2O supply bottle).

Lessons from the Second Test

The second motor test proved to be a turning point for our test oxidizer flow system. We decided to abandon the unreliable ball valve design in favor of one which could be activated by a pyrotechnic charge. There would be no room for failure in our flight vehicle.

We also decided to stop testing potential flight-capable oxidizer valves while trying to prove that the motor itself worked. For ground tests, therefore, we switched to a sturdier pneumatically-controlled valve which could be closed by command, thus shutting off the oxidizer flow. We also added a second one-way valve which would prevent any thrust from running back into the oxidizer tank. Our last test revealed a fuel-rich condition and a low fuel regression rate; therefore we built a new injector which would allow more mass flow.

We replaced the broken copper tubing with a sturdier flexible steel hose. We also added “snubbers” to all our pressure sensors, which would filter out big spikes in pressure and thus help to prevent another blowout. Steve assembled a sequencer which would allow us to precisely control the time between ignition and the valve opening, and also to control the length of the burn.

The Third Rocket Motor Test

Three weeks after the second test, on Saturday, May 6, we began the third test. Steve, Gene, Ron Lajoie, Ron Creel, new member Peter Ewing, and myself had worked hard the previous week preparing the electronic equipment, the new valves, and the new motors, including three donated by HAL5 member David Dean of McDonnell Douglas.

Each of the foot-long test grains were cut into four 3-inch long cylinders. This way, after a short burn, the center cylinders could be removed and the grain could be measured to plot the fuel regression. (Unlike a solid rocket motor, hybrid rocket motor fuel does not contain any oxidizer; thus these types of cross-cuts do not promote burning between the cylinders.)

While waiting for Larry Larsen to return from Texas (on a trip to get a large milling machine for making even larger motors), we decided to have lunch. Compared to our last event, this was a feast! Hot dogs, beans, chips, cokes, cake, and ice cream — brought by HAL5 members, family, friends,

Figure 4. Sparks fly during the second HALO hybrid rocket motor test.

and associates, including a McDonnell Douglas colleague of Dr. Dean. Ron Lajoie, designated that day's HALO Safety Officer, passed around a safety statement from McDonnell Douglas and a HALO safety form/waiver for each person to sign. This was the largest turnout to date, with over 20 people in attendance.

The first test of the day was our third asphalt motor. When all was ready, Steve started the sequencer. The now familiar "snap" of the ignitor squib was heard by all, and 1.5 seconds later (as programmed), the valve was opened. In a repeat of the Test Day 2, the N_2O poured from the nozzle without burning. This time, however, we were able to shut off the flow and stop the test. (We vented the remaining N_2O from the oxidizer for safety reasons.) Steve reprogrammed the sequencer for a 2.5 second delay, while I changed out the ignitor in our asphalt motor.

Too bad we had to vent that N_2O. The supply bottle was clearly getting low, and Steve had a difficult time of coaxing N_2O into the oxidizer tank. The second attempt, however, was a **great** success! The motor fired beautifully, fully achieving the desired 200 lbs of thrust we need to get into space. After three seconds, when the tank pressure dropped too low to sustain thrust, we stopped the test and began the nitrogen purge to cool the rocket motor.

Our systems operated perfectly; we got great data, nothing was damaged, and even our new flame deflector (a simple thick steel plate) survived intact. I am very pleased thus far with all areas of our HALO rocket motor development program, put together in only eight months. I invite everyone to the HAL5 General Membership meeting on Wednesday, May 24 at the HATS Office. We will show pictures and videos taken of all these tests and discuss areas which need help (there are still plenty, believe me!) I encourage all interested persons to contact me at 971-1566 (Home) or 772-8885 (Work).

The David Dean Motor Test

After the successful asphalt motor test, we set up the first of Dr. Dean's test motors. By now the N_2O supply bottle was obviously low, and Steve barely managed to get enough N_2O into the oxidizer tank. The test itself, however, went very well. The sequencer worked fine, and the motor burned gaseous N_2O for three seconds. Despite the lack of sufficient thrust, all agreed that this first test was a good data point.

The N_2O supply bottle will be replaced. The next series of tests should be truly wonderful. I invite all HAL5 members and their guests out the HALO Rocket Motor Test Facility. A map is enclosed in this issue. Come on out! Dad'll put s'more hot dogs on the barby! ✰

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Personal Insights on HALO Rocket Motor Tests

(by Peter Ewing, HAL5 member)

Last Saturday's (May 6) test, as opposed to the last one I went to (April 15), was distinguished by the number of people in attendance, both expert and spectator alike. Twenty-five to thirty people showed up, including some from such important firms as Boeing, McDonnell Douglas and NASA, and others who had come from as far as Jackson, TN and Athens, GA just to "see the show."

Two types of hybrid motors were to be tested — the HPTB motors developed by Dr. Dean of McDonnell Douglas, and the tried and true asphalt motors favored by HAL5 members. Nitrous oxide served as the gaseous component for both types. The NO_2 (aka "laughing gas") was vented away from the test stand to prevent misjudgment from occurring during the pressurization procedure.

When the asphalt motor fired, I noted that the exhaust flame's intensity had not been as bright as that of the first firing's (April 15). However, based on the crowd-pleasing echo which reverberated among the hills at the test's completion, all else amounted to a resounding success. ✰

The McDonnell Douglas Rocket Connection

In an unlikely partnership (which reflects the budget realities of the 1990's), aerospace giant McDonnell Douglas, via Dr. David Dean (a new member of HAL5), has asked little space club HAL5 to test a new hybrid rocket fuel he designed last year, but ran out of budget before he could fully tested it. Dr. Dean has offered his fuel as a possible candidate for our HALO rocket motors.

According to Dr. Dean, the fuel should achieve a sea-level Isp of 250 seconds when N_2O is used as the oxidizer, and 290 seconds when GOX (gaseous oxygen) is used. (By comparison, we predict our asphalt motor to have an Isp around 220 seconds using N_2O.)

As part of the agreement, HAL5 will supply the motor tubing, which Dr. Dean will fill with his fuel. HAL5 will test the motors as instructed by Dr. Dean and provide him with a copy of all data taken during the tests.

HAL5 is honored to have been given this chance to prove how "professional" an "amateur" organization can be. We thank both Dr. Dean and the McDonnell Douglas Corporation for taking this great leap of faith. In this new era calling for "faster, better, cheaper" solutions, HAL5 is proud to be carrying the lead banner for a change, instead of a picket sign. Ad Astra per HAL5! ✰

(First Word, continued from page 1)

We also fired one of the special formula motors donated to HAL5 by McDonnell Douglas. Everyone present was impressed by the clean efficient burn of the McDonnell Douglas motor.

The test guest list included James. Prentice, President and CEO of Hybridine Aerospace Corp.. Hybridine has secured 18 months of private financing to develop a low cost orbital hybrid launcher for small satellites. They have offered to develop a launcher for Project HALO. Additionally they want to test one of their motors on the HAL5 HALO test pad.

Imagine that! McDonnell Douglas and Hybridine have turned to HAL5! It's great being the lead dog in this cutting edge field. Get off the porch, join, and run with the pack! We have successfully fired ignitors built by English majors. Shoot, if you can chew tobacco and hunt rabbits you can be a rocket scientist too!

O.K., enough fun for now. In short, Project HALO is doing spectacular! KUDOS are due to several volunteers. First I want to thank Mr. Herman Pickens and his wife Chris Pickens for their most generous hospitality for welcoming our adventurous crusades into their home. I thank Tim Pickens for his leadership and vision to pull together an amazing propulsion team. I thank Steve Mustakis for his modeling of the system, controller development, and hours spent grinding the motor nozzle. I thank Larry Larsen and Gene Hornbuckle for developing the test instrumentation and control software. I thank Al Wright and Ronnie Lajoie for their work in high altitude simulation test chambers. And I thank our special high-altitude research scientist Bill Brown for taking HAL5 test projects to our launch altitude of over 20 miles high twice already.

Here is what really impresses me. Last summer I had a vision for how HAL5 could have a significant impact toward “paving the road to space” (pun with asphalt motors intended). Upon selling this vision, based on rockoons, the trail was set. Despite the fact that my current job took over 330 hours (8.25 work weeks) above and beyond the expected 9 hours a day my company expects, as a minimum (which is extremely rough on a single parent), these guys sensed a hot trail and have proceeded with spectacular results. With little leadership from “yours truly” these guys have shown us all how to shine. These days in which I do so little and HAL5 accomplishes so much is a testament to our maturity as an organization.

How To Eat The Little Dogs

If you weren't there last Saturday you missed it! Not only did we fire rocket motors, we had one grand cookout! HALO Hot Dogs, two cakes, baked beans, and two freezers of home-made ice cream. We were all fit to burst! Thanks to Ms. Chris Pickens and others for all the great fix'ins.

How To Hunt With The Big Dogs

Things are now happening fast. Our newsletter cannot possibly be fast enough to inform you of our latest and greatest activities. To hunt with the big dogs you have to pick yourself off the porch and run. To join the chase call Greg Allison at 859-5538 (leave a message), Ronnie Lajoie at 721-1083 (H) or 961-4832 (W), or Tim Pickens at 971-1566 (H). To Support the HALO educational program, call Dr. Larry Scarborough at 881-4363 (H). If that does not work for you, attend either our Tuesday Engineering Working Group Meeting or our Thursday Executive Committee Meeting, both at the Ponds Restaurant at the Holiday Inn near Madison Square Mall. Ad Astra! ✰

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HAL5 Membership Update

(by Ronnie Lajoie, Treasurer)

The following is a list of additions to the paid membership of HAL5. Membership now stands at 31, which includes 21 renewals and 10 new members. (At this time last year we had 27 members.) Welcome to our new and renewed members!

William	Adams	(R)
Peter	Ewing	(N)
Edward	Kenny	(N)
Steve	Mustakis	(N)
Craig	Presson	(VP)

(VP) - Vice-President
(N) - New Member
(R) - Renewed Member

Note that HAL5 membership currently does not include several people who are very actively involved in Project HALO, including Gene Hornbuckle and expired member Larry Larsen. We greatly appreciate their help and invite them to join or rejoin HAL5. ✰

Special Announcements

TABES 1995 at the VBCC

Tues. May 16 thru Wed. May 17

1995 ISDC in Cleveland, Ohio

Thur. May 18 thru Sun. May 21

Huntsville Alabama L5 Society
1019-A Old Monrovia Rd, Suite 168
Huntsville, AL 35805

Place
First Class
Stamp
Here