Southeastern Space Supporter

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

Volume 5, Number 3 — May–June 1996

FIRST WORD

Ground Launch — Success!

(by Gregory Allison, HAL5 President)

Who said 13 was an unlucky number? There we stood in a windswept cornfield near Manchester, Tennessee on Saturday, the 13th of April, with the HALO rocket stowed in its launch gondola in the back of Al Wright's pickup truck. Wind gusts were so bad that the local volunteer fire department, which was running a barbecue concession for the event had to take down their canopy. Then, a heavy rainstorm swept in followed by more wind. The wind was almost steady with a few breaks of just four or five minutes. Our launch window was only open from 2:00 to 4:00 pm. Launch conditions did not appear to be optimal.

Woeful Weather

We feared that any gust of wind catching our oversized fins (designed for a one percent atmosphere) would pitch our rocket horizontal to the horizon converting it into an unguided ground strafing cruise missile! Well of course that wouldn't do!

What to do?!? As it approached the time we would have to initiate setup, I polled all the HALO experts. With hands stuffed into pockets and feet kicking at the dirt and cornstalks I got the resounding response: silence. Tim Pickens, anxious about the weather, looked at me and said, "You guys (HAL5 Executive Committee, I suppose?) tell me what to do, it's your decision", or something like that. I looked across the field into the faces of all our members present and thought of all the work they had done and sacrifice they had made for this day.

To quit now would have crushed all their spirits. I knew we owed it to them to at least try to set for launch and hope for a miracle break in the weather. I looked at Tim and uttered the mundane

(see First Word on page 2)

TABES 1996

Tuesday, May 14, 1996: 9am – 5pm
Wednesday, May 15, 1996: 9am – 4pm
Von Braun Civic Center Exhibit Halls

HAL5 will be displaying its Project HALO exhibit. The TABES exhibit is open to the public and is free.

Professional of the Year Awards

This year, HAL5 has selected Timothy Pickens to be our Professional of the Year. Please join us in saluting him at the Awards Dinner on Tuesday night at 6:30 pm. Cost is $15 per person.

Timothy Pickens Selected HAL5 Professional of the Year

(by Ronnie Lajoie, Editor)

At the HAL5 general membership meeting on April 24, the members voted unanimously to select "Business Major" turned rocket-engineer Timothy Pickens as the 1996 HAL5 Professional of the Year.

(see Professional on page 3)

HAL5 President Greg Allison proudly holds aloft the HALO rocket.

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

Southeastern Space Supporter
Volume 5, Number 3
May / June 1996

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 newsletter are those of the authors or of the Editor, and, unless expressly so stated, are not necessarily those of HAL5 or the 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 or articles to: Ronnie Lajoie
162 Kirby Lane, Madison, AL 35758
Day phone/message: 205-461-3064
Night/Weekend phone: 205-721-1083
FAX number: 205-461-2551
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.

(First Word, continued from page 1)

response, "No Guts — No Glory! Let us at least set up and then we'll see what happens."

Race Against Time — and Rain

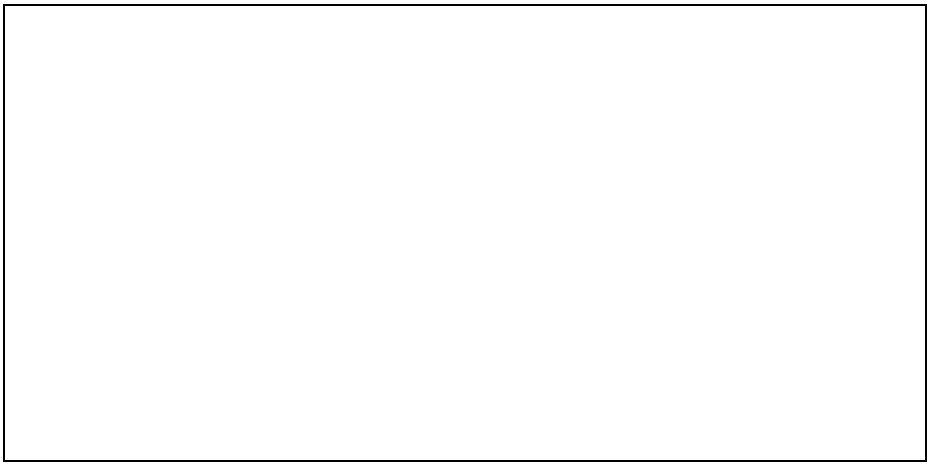
The rain had stopped so everyone cheerfully pitched in to initiate setup. We pulled the plastic off the rocket/gondola launch system and transported it to our designated launch area. (Launch site director, Rick Kauffman had specified a separate launch site for us so that other groups could continue launch activities with little regard to our schedule.) We took a few photographs with the rocket and proceeded to integrate the avionics. We discovered a connector problem and discovered we had to drill an additional hole. Time was ticking and the launch window was eroding. The avionics were integrated, the rocket reinstalled into the gondola (launch tube) the system was erected and staked down. Then — more rain!

We rushed to cover the rocket with a plastic tarp while Al Wright and Tim Pickens prepared to load the liquid nitrous oxide oxidizer. There we all stood, in the rain, working and preparing for the dubious chance that we might actually fly this bird. Loading was proceeding slowly and the launch window was ticking down. I commandeered Clay Sawyer's car (which was at our launch site) and went to Rick Kauffman to plead for ten extra minutes. As it turned out he had 30 minutes of reserve, keeping our window open until 4:30 pm. A few minutes before 4:00 pm, as the nitrous oxide loading was nearing completion, the clouds broke and our spirits lifted.

Frozen Valve Frost Over Nose Cone

Tim Pickens and Al Wright, who had been loading the nitrous oxide attempted to close the gaseous vent valve. In order to maximize liquid oxidizer content in the tanks a gaseous vent valve is necessary to get rid of gaseous phase oxidizer. Unfortunately, due to the expansion of the exiting gasses there was an ice build up on the valve and several adjacent components. Tim and Al each struggled with two laborious attempts to close the valve — no success. Meanwhile, supercold leaking nitrous gas caused the bottom three inches of the nose cone to frost over. Al and Tim both recommended we scrub the flight.

Once again I looked around the field into all those now distant faces bearing great expectations. It was as if something deep inside told me was to fly that day. "Tim", I said, "try it just one more time." With a look of total determination on his face, a picture forever locked into my mind, Tim once more set himself upon the task. I said a little prayer. The valve began to move — it closed! AT LAST! The hook-ups were removed and we all walked or drove quickly to our launch positions.



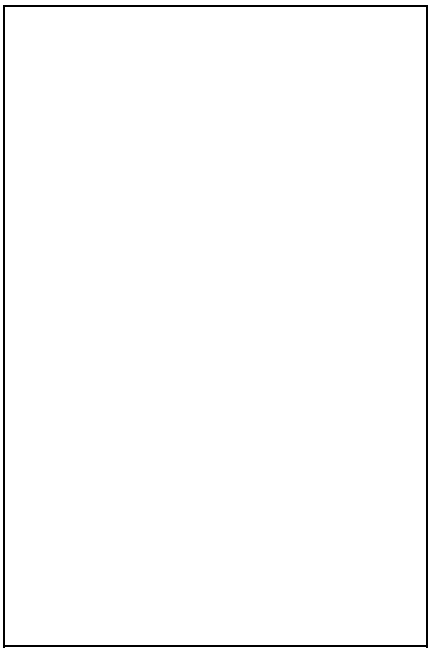
Al and Tim bravely load the oxidizer, while Drew Prentice monitors safety.

Mysterious Electrical Problems

4:05 pm. The wind and rain had finally stopped. A big round patch of beautiful blue sky hovered over us, as if sent by God. I handed the fire control box to Al Wright. A large passenger jet flew overhead. Though we had a high altitude launch window from the FAA we were instructed to watch for aircraft and to not fly into clouds that could block visibility of such aircraft. The plane passed over. Al switched the safety shunt off, counted down and threw the fire switch — nothing happened. We all waited spellbound — long enough to permit a cook-off of the igniter. Again — nothing. Amazed, we switched the safety shunt back on.

Drew Prentice, president of Hybridine Aerospace Corporation (and HAL5 member from Georgia) was first to reach the HALO rocket. Tim Pickens, Al Wright, and I were close behind. We all fully understood that we were approaching a potential hot bomb that we might never walk away from. The operative word was "mission". At that moment that was all that counted.

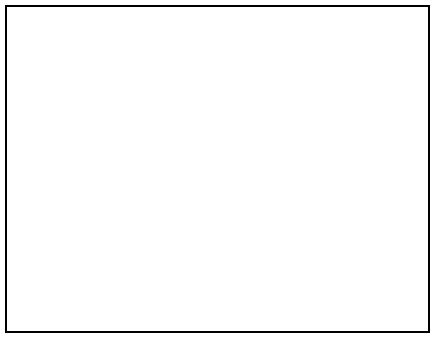
Battery leads were tightened, voltage checks were made. It seemed we had isolated the problem. Once again we hurried to our launch positions.



The long nerve-racking wait

I took the launch control box. Another large passenger jet had just passed overhead. I threw the safety shunt switch off, counted down and threw the fire switch — nothing happened, again! We all stood in amazed silence. How could this be? I wondered if the switches were cross wired (they were not). I began to toggle the firing switch and the safety shunt switch alternately to see what would happen.

I looked up at the rocket as my hopes were falling through my chest, when suddenly — WHOOSH! — the rocket SCREAMED skyward! We saw it cavort a bit, shed a few black objects which we assumed were fins, spin stabilize, and climb straight into the sky! It disappeared in less than 20 seconds. The launch time? 4:13 pm! Who said 13 was an unlucky number?



WHOOSH! HALO rocket soars!

The follow up details, recovery, what's and why's are likely to be covered in other articles in this issue. It looks like our HALO rocket flew over 30,000 feet. Performance exceeded expectations!

The basic message that comes across to me is that greatness lies at the ragged edge of the undoable. When it can't be done — you just have to push through it! Ad Astra! ✯

****

(Professional, continued from page 1)

The following is the full citation submitted to HATS for publication in *The Huntsville Times* as part of their special preview of TABES 1996:

Tim is the kind of person who can bring the word "amateur" back into a good light. While the engineering "professionals" in our society were busy pushing paper, Tim, with only a Bachelors degree in Business and an Associates in Machining, was busy making and flying his own steam-powered rocket. After joining HAL5 in late 1994, Tim quickly became the lead of the Propulsion Team for Project HALO. HALO (for "High Altitude Lift-Off") is HAL5's "amateur" effort to build its own rocket and launch it into space from a balloon 20 miles high — using only volunteer labor and its own money.

Tim's love of rocketry, machining-expertise, business-savvy, leadership skills, and incredible imagination (and support of his great wife Melanie) has taking the team from test-stand ground-breaking in early 1995 to a successful ground launch of its asphalt-and-nitrous hybrid rocket (to over 20,000 feet) this past April. Tim has performed most of the design work, has provided numerous articles for our newsletter, has arranged for major donations of surplus test equipment, and has provided a wonderful team spirit. For all this, and more, HAL5 proudly names him our 1996 Professional of the Year.

Professional of the Year Awards

Each year at TABES, HATS provides an award and accolades to the chosen Professional of the Year for each member society. Past HAL5 winners include President Gregory Allison and Treasurer Ronnie Lajoie.

This year's Awards Dinner is to be held at 7 pm on Tuesday, May 14 at the Von Braun Civic Center, and follows the reception from 5 to 7pm (see page 8). Tickets, which may be purchased at the HATS Office, cost $15 per person and include entertainment by singer Al McCree. For details, call Bryan Jones of the HATS Office at 837-4287.

HAL5 has reserved one 8-person table and may reserve another if more members are interested in attending. Please come on out and join us in saluting our 1996 HAL5 Professional of the Year! ✯

HALO Launch Preparation

(by Ronnie Lajoie, HALO team member)

Greg gave a good description of the events of the day leading up to the launch. Before I discuss what happened after the launch, I would like to first review how we got to this point.

In the last issue, Tim reported on the successful static firing our of rocket propulsion system on February 24. The last issue's Calendar listed a number of "HALO Rocket Work Party" days between that time and the ground launch on April 13. Believe me, those were not the only days that HALO team members worked to prepare for the ground launch. Many worked at home and several unannounced Work Party days had to be added as well. The successful results speak for themselves.

With the propulsion system design proven, the team concentrated there efforts in five areas: (1) rocket nose cone and payload section, (2) rocket parachute deployment system, (3) rocket composite motor case and fuel grain, (4) rocket composite aerodynamic fins, and (5) rockoon gondola (or rocket launch tube). Alfred Wright and Tim Pickens both did an outstanding job of coordinating the design and development in all areas.

Rocket Nose Cone Preparation

Tim and Al led this activity, but almost all team members were involved at one point or another. The fiberglass nose cone was purchased from Rocket Science of South Carolina. The length was fine, but the bottom diameter was too wide for our first rocket. We decided to cut off the lower section enough to bring the bottom diameter closer towards that of the oxidizer tank it would be mounted to.

A perfect diameter match would have left us with a short nose cone with too little internal volume, so a compromise was reached. The excess diameter of about one-inch would be handled by a wooden adapter ring, which was epoxied to the inside of the nose cone. Four small holes were drilled into the right and then reinforced with metal guides for the attachment screws.

Since we dare not drill mounting holes into the oxidizer tank, a wood and aluminum adapter ring was constructed and epoxied to the top of the tank. Four tiny angle brackets were cut from metal and screwed into the ring, placed to match the one inside the nose cone. (These tiny screws later proved grossly insufficient in handling the 10-g launch loads. Stress analysts, we need you!)

Since oxidizer fueling and venting would be done from the top of the tank, we drilled many holes into the lower side of the nose cone to allow for access to plumbing valves and venting ports. We also drilled holes for access to the payload section electronics. Ronnie used his computer to print color labels for the many holes and also painted our HALO logo onto the side (see Figure 1).

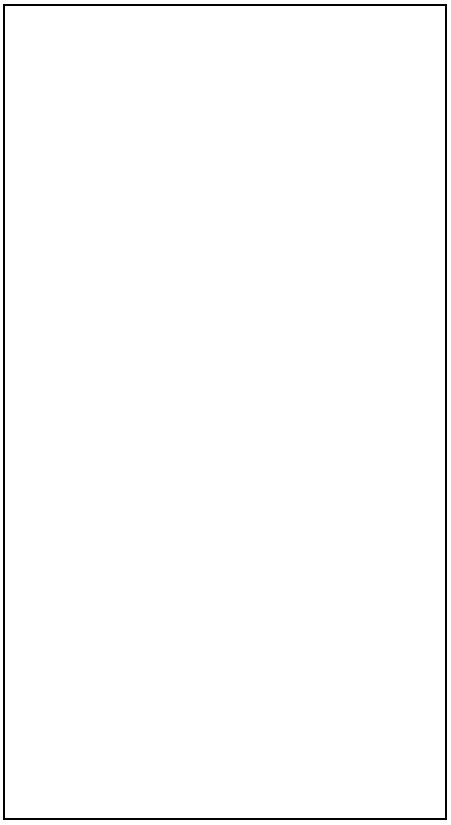


Figure 1. HALO rocket nose cone.

Rocket Payload Section

Clay Sawyer, Project HALO's newest team member, jumped right into the task of preparing the rocket electronics. Greg Allison, who had led this activity prior to recruiting Clay, continued to play an active role in payload design and testing, as did Gene Hornbuckle.

The payload, or payloads rather, consisted of the following: one IA-X95 single-axis accelerometer purchased from The Cambridge Group, one loud homing beacon purchased from Radio Shack, and one radio transmitter loaned from Bill Brown. The IA-X95 was entrusted with collecting data from the flight (acceleration, velocity, and distance traveled versus time) and firing the parachute door release mechanism (just after apogee). The homing beacon and radio transmitter were crucial for locating the rocket once it landed. (An additional radio transmitter was loaned to us in Manchester, which allowed us later to track down the payload section.)

As shown in Figure 2, these three payloads were glued to either side of a wooden plate (or its bottom disk), which later would be slid into the nose

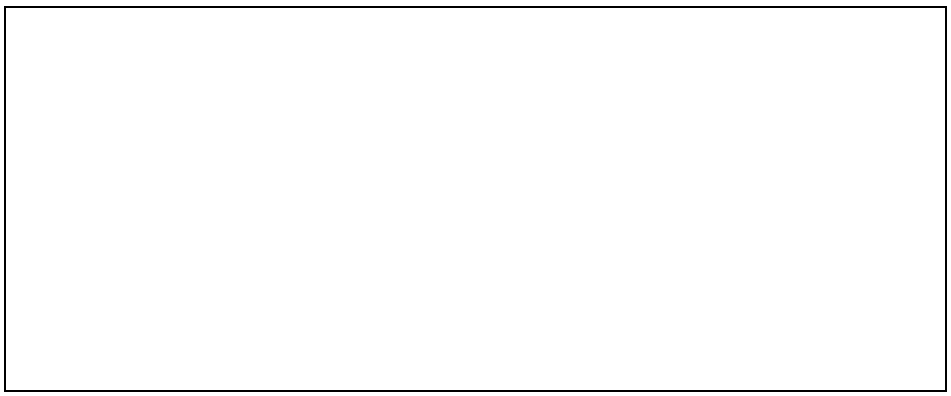


Figure 2. HALO rocket payload section, upon recovery after the launch.

cone and screwed onto the nose cone's adapter ring. Three 9V batteries, one a lithium, were also glued to the plate in various spots. Epoxy was not used since we wanted to reuse the parts. (Gluing parts also later proved insufficient in handling the launch loads.)

Plugs were passed through the side holes drilled in the nose cone, and wiring was passed through bottom holes drilled in the adapter ring. Tests were then performed to verify the electronics.

Parachute Deployment System

The neck connection area of our two bottle oxidizer tank provided a unique place for the parachute. Located near the center of mass, the area would allow the spent rocket to parachute back to Earth in a horizontal position and soften its impact on the ground.

Ron Creel and Tim worked together to design and build the parachute door — a short flat piece of sheet metal rolled around the tanks and tied off shoelace-style. The parachute stuffed inside would provide the internal pressure to push away the door once Thermolite burned through the string. Ron successfully tested the door release prior to the ground launch (see Figure 3).

Motor Case, Fuel, and Nozzle

To get the dry weight of the rocket down and the propellant mass fraction up, we reluctantly switched from cheap aluminum pipe to a more expensive composite motor case. The phenolic tubing used previously as an insert would be the case itself. We hired John Pavlick of Advanced Composites to wrap two phenolic tubes with composite fibers and oven-cure it with an epoxy-resin. Sound high tech? Yes it does, but a bargain at "only" $400 (including setup) — versus the thousands of dollars such work used to cost. Before he left, Steve Mustaikis crafted aluminum end-caps for the two cases, for attaching to tank and nozzle.

Peter Ewing and I, under Tim's watchful eye, performed the delicate, yet messy, operation of lining the interior wall of the case with asbestos paper and a high-temperature cement affectionately called "black goop". We then made a special "jig" so that Gene could pour in the melted asphalt and make the fuel grain (see Figure 4).

Meanwhile, Tim carved out a special graphite nozzle optimized for the ground launch. The nozzle extension to be used for the space launch would not be used for the ground launch.

Rocket Aerodynamic Fins

Gene was not sitting idle while waiting for me and Peter to prepare the case. He was busy making three rocket fins. Gene started by carving foam insulation board into the size specified by Al Wright, with a wedge airfoil-shape. He then epoxied fiberglass strips over it to give it the required strength.

Meanwhile, Al was preparing a home for them; making a "fin jig" — a large board with a hole in the middle for the case fastening screw. On the board, Al drew out the guiding lines for placing the fins. Once the fins arrived, Tim and Al checked the final alignment. The fins, sized for the high-altitude launch, were 10-times oversized for the ground launch (100 times the surface area) — a slight misalignment could rip them off the rocket and potentially destabilize it.

In "Operation Attach Fins", first Al and Ron Creel, then also Tim, Peter, Ronnie, and whoever else was on hand; hurried to epoxy the fins to the motor case, and (the next day) to epoxy fiberglass support strips to secure the fins. The final assembly looked more like a scene from "Operation Petticoat" once Al was through securing Gene's pink fin holders around the fin and fiberglass combination (see Figure 5).

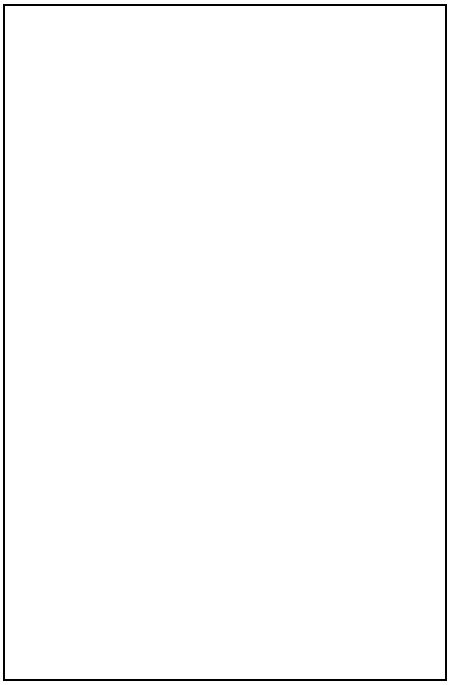


Figure 4. Asphalt motor case jig.

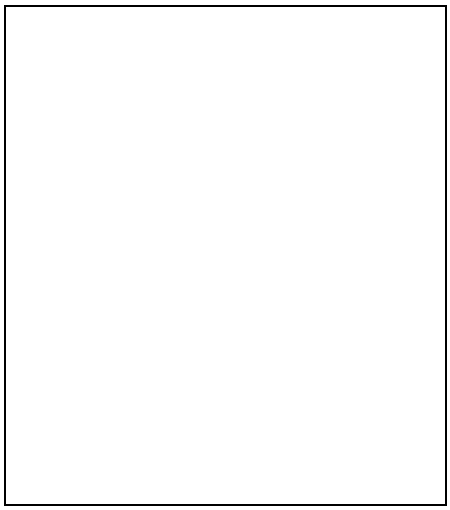


Figure 3. Test of parachute door.

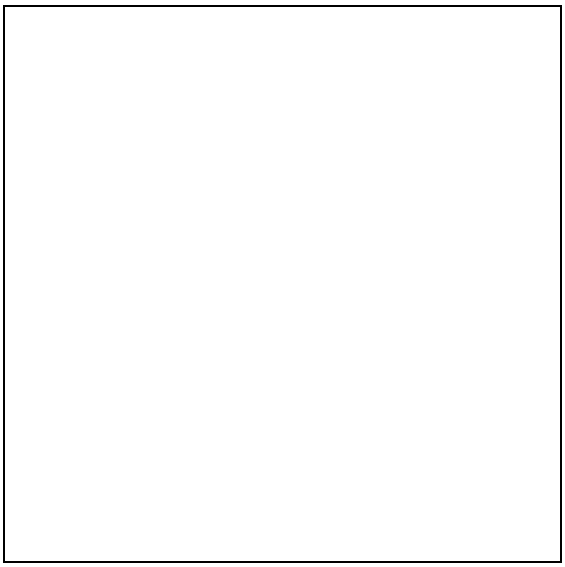


Figure 5. Al Wright secures the fin assembly.

Rockoon Balloon Gondola

Once the shape and size of the rocket were determined by Tim and Al, Larry Scarborough began the effort of making the full-sized launch tube, which would eventually be the foundation of the balloon gondola. With help from Ron Creel, the 8-foot-tall finished product was a latticework of wood, wire, and string (see Figure 6), with guides for both the fin tips and the main body. Many fit checks were performed and adjustments were made. Though only weighing less than 10 pounds, the gondola was very sturdy (as the successful ground launch proved). (For more on the gondola, see Larry's article later in this issue.)

"We have a lot of work to do, guys."

When Tim said the above statement, he wasn't kidding! After writing this, I am amazed we did all this and more in just 6 weeks — after work hours! I am proud to say that I am part of this team of hard-working, dedicated space enthusiasts; and I am now convinced that we will indeed succeed in our space launch efforts. Ad Astra per HAL5! ☆

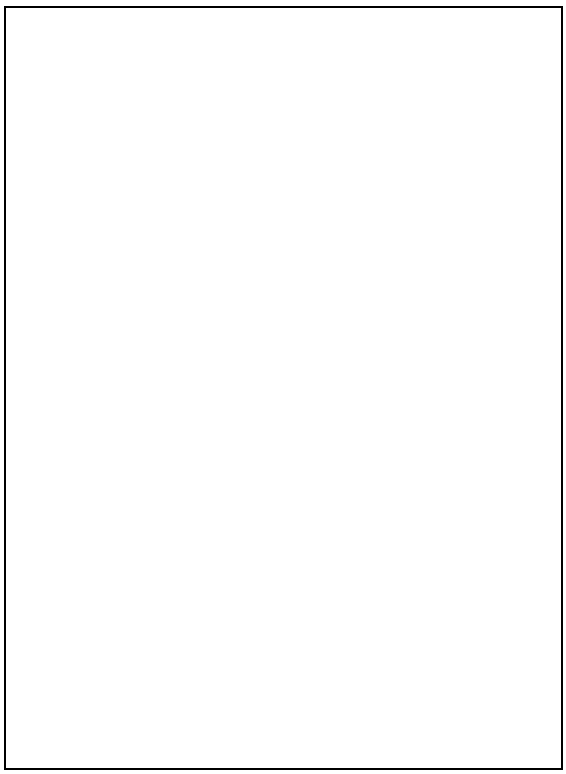


Figure 6. Larry and Ron check the gondola.

HALO Launch Aftermath

(by Ronnie Lajoie, HALO team member)

Saturday, April 13, 9:00 am. A caravan of automobiles assembles at a gas station on the border between Alabama and Tennessee. I pass out T-shirts to HALO team members so that we can arrive looking like a team. We head out confident we have left no one behind. (Except for Larry who had driven over to the pumps to get some gas — Oops!)

10:00 am — Near Tuscaloosa, students Matt Beland and David Hewitt somehow manage to catch up with us. We reach Manchester by 10:30 am and soon arrive at the Barrens Test Range, a muddy cow pasture followed by a field of last season's trampled corn stalks. It's so windy we keep everything in our cars. After all, we have plenty of time.

1:00 pm — We no longer have plenty of time. The rain which had been avoiding us is now barreling right over us. It stops by 1:15 and magically takes the gale-force wind with it. We decide to unpack and prepare for launch.

3:00 pm — Halfway through our 2–4 pm launch window and it starts raining again. A tarp is put over the gondola, and another is put over the rocket. The rocket needs the nose cone attached and the ignition system prepared. We struggle as best we can in the rain.

3:30 pm — 30 minutes left in our window. The rocket is in the gondola and we begin loading the N_2O oxidizer, while trying to protect it from on-again, off-again wind and drizzle. Most of us walk to a safer distance away leaving Tim and Al to load the tanks.

3:53 pm — 7 minutes left. The rain has stopped and the sun begins to peek through the clouds. The N_2O is loaded and we're waiting for it to heat up a bit. The cold oxidizer temperature shifts the frequencies on the radio transmitters.

4:00 pm — Our launch window closes, or so most of us observers think. The clouds above finally break and open up a big round patch of beautiful blue sky.

4:05 pm — First launch attempt. Car horns beep to alert others. Blue sky above and there is amazingly no wind. Countdown, but nothing happens. Al and others go back to check the wiring.

4:13 pm — After one failed attempt, we here Al signal the start of attempt #2. **Ronnie:** "One more time. Blue sky above. . . . They're counting down! . . . And, they've pressed the button and it's still sitting there, dangerous as ever." 14 seconds of silence go by, then WHOOOOSH!! The rocket takes off! After taking some quick photographs, **Ronnie:** "It went up; I don't know what it was waiting for, but it went up." **Another:** "Can you believe that, God Almighty!" 23 seconds after launch, **Ronnie:** "It's still firing!"

4:14 pm — Tim cries out to Bill: "Tell me if you lose that [radio] signal" Bill Brown sadly replies: "Lost it! . . . Lost both beacons shortly after take-off. The G-forces must have ripped the batteries off or something."

4:15 pm — **Bill:** "No, we got one beacon! . . . One beacon." Word quickly spreads. The group collects and discusses the launch delay.

4:16 pm — **Ronnie:** "Wait a minute, we still have a gondola!" The group collectively suddenly notices it and runs over to inspect the gondola for damage. It's in great shape. (See Larry's article.)

4:18 pm — At the gondola, the group discusses the black objects seen falling off the rocket, presumed to be the fins.

4:19 pm — Brent Sandlin returns from the field with a black object in his hand. **Tim:** "Here comes Brent with it now." **Ronnie:** "I think we got a fin here."

(see Aftermath on page 8)

HAL5 CALENDAR OF EVENTS (Post Me!)

May 1996

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Huntsville Association of Technical Societies' 1996 **Technical and Business Exhibition / Symposium with an exhibit booth promoting Project HALO** May 14-15 at the Von Braun Civic Center (VBCC)			1	2 **HAL5 Executive Comm. Meeting** Noon at Ponds	3	4
5	6 Inputs to HAL5 newsletter due	7	8	9 **HAL5 Executive Comm. Meeting** Noon at Ponds	10 **HALO Day at Mountain Gap** 11:30a at School	11
12	13	14 **TABES 1996** 9–5 at VBCC 7pm POY Dinner	15 **TABES 1996** 9 am to 4 pm at the VBCC	16 **HAL5 Executive Comm. Meeting** Noon at Ponds	17	18
19	20	21	22 **ISDC and SSDC Prep. Meeting** 6:30 pm at HATS	23 No HAL5 Exec. Comm. Meeting due to ISDC	24 **HAL5 attends 1996 ISDC** New York City	25 **HAL5 attends 1996 ISDC** New York City
26 **HAL5 attends 1996 ISDC** New York City	27 **HAL5 attends 1996 ISDC** New York City	28	29	30 **HAL5 Executive Comm. Meeting** Noon at Ponds	31	June 1

June 1996

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2	3	4	5	6 **HAL5 Executive Comm. Meeting** Noon at Ponds	7	8
9	10	11	12	13 **HAL5 Executive Comm. Meeting** Noon at Ponds	14	15
16	17	18	19	20 **HAL5 Executive Comm. Meeting** Noon at Ponds	21	22
23	24	25	26 **HAL5 Elections & Social Night** 6:30 pm at HATS	27 **HAL5 Executive Comm. Meeting** Noon at Ponds	28	29

July 1996

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
June 30	1	2	3	4 **HAL5 Executive Comm. Meeting** Noon at Ponds	5	6
7	8	9	10	11 **HAL5 Executive Comm. Meeting** Noon at Ponds	12 Inputs to HAL5 newsletter due	13

Technical and Business Exhibition / Symposium (TABES), May 14–15, 1996

The Southeast's Premier Space Defense Technology Business Exhibition and Symposium, sponsored by Huntsville Association of Technical Societies

TABES established in 1985, is the premier symposium addressing critical issues in today's changing global marketplace, particularly in the areas of space, defense, business, emerging technologies and the environment.

TABES is a close-knit atmosphere allowing vendors and customers to form long-term business contacts, including corporate presidents and CEOs, aerospace engineers, defense program managers, buyers, hardware and software developers, scientists, researchers, administrators, and other key decision-makers from institutions worldwide.

New contacts in the international marketplace. Eight countries were represented at the 1995 event. Attendance has increased yearly, with a 1995 record of more than 6000 attendees. **Exhibits and symposia are free to attendees.**

Tuesday, May 14, 1996

Business Symposium

Symposium Chairman: C. Thomas Houser
Time: 9:00 - 11:30 am
Place: Salon I, North Hall, 2nd Floor

Symposium Theme: Increasing domestic competition and other factors, as well as the growth of the global economy, are stimulating high interest in international markets among US companies.

1. Doing Business Internationally: What You Don't Know Can Hurt You
2. Making the Move to be World-Wide... Accugraph's 1995 First Step
3. Engineering Services in the International Market: A Case Study in International Partnerships
4. Developing International Strategic Alliances
5. Penetrate New Commercial or Defense Markets

Emerging Technology Session

Session Chairman: Raymond E. Minter
Time: 9:00 - 11:30 am
Place: Salon II, North Hall, 2nd Floor

Session Theme: The diverse high technology capability of the Huntsville community provides the ideal setting for this session's focus on new technologies that are coming to our area. Speakers will describe these technologies and the opportunity for economic growth they will provide for our industry, education and government sectors.

1. Partnerships & Technologies Supporting Apache Low Bow
2. Emerging Satellite Communication Technology
3. Electric Transportation; Energizing the Future
4. The Human Genome Project – New Technologies and Opportunities

Aerospace Symposium

Symposium Chairman: Harry Craft, Jr.
Time: 3:00 - 5:00 pm
Place: Salon I, North Hall, 2nd Floor

Symposium Theme: This symposium examines issues and examples in the formation of partnerships between industry and state, local, federal government and international organizations to promote the transfer of aerospace technology and economic growth.

1. State Partnership for Economic Growth
2. The Incubator as a Stimulus for Economic Growth
3. International Partnerships to Promote Economic Development
4. An Industry/Government Partnership for Technology Development
5. An Update on Methods for Measuring Economic Growth

Wednesday, May 15, 1996

Defense Session

Session Chairman: Dr. J. Richard Fisher
Time: 9:00 - 11:30 am
Place: Salon I, North Hall, 2nd Floor

Session Theme: This session will focus on partnerships formed within the Department of the Army community which offer the promise of economic growth for the Huntsville area. The main segment will feature a panel discussion of the planned consolidation of the U.S. Army Aviation and Troop Command (ATCOM) and the U.S. Army Missile Command (MICOM) at Redstone Arsenal.

1. Creating a Unified Command: MICOM & ATCOM
2. Government/Academia Partnership: Foundations of Information Noting & Discriminating Center
3. Government/Industry Partnership: Emergency Management Using Remotely Sensed Data
4. International Partnership: Medium Extended Air Defense System

Virtual Reality Session

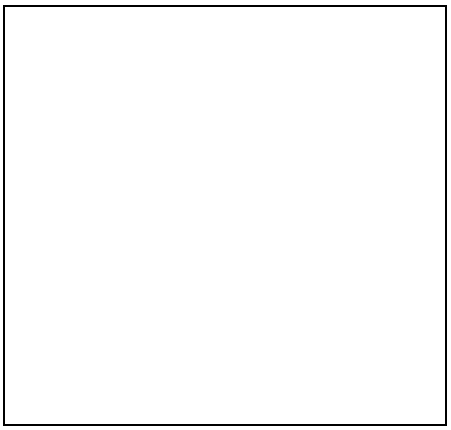
Session Chairman: Jerry Evens
Time: 2:00 - 5:00 pm
Place: Orchestra Rehearsal Room, 2nd Floor

Session Theme: The VR session will explain Virtual Reality and the efforts of the Tennessee Valley Virtual Reality Alliance to focus and expand on the use of this emerging technology. The Tennessee Valley VR talent will also showcase various demonstrations around the exhibit hall. Visit or stop by any of the Alliance booths and sign up to experience the reality of Virtual Reality.

1. Virtual Reality & the VRV Alliance
2. Virtual Reality Future Outlook
3. Space Applications
4. Training Applications
5. Auto Industry - EDS Virtual Reality Center

(Aftermath, continued from page 6)

Drew: "That is the nose cone! That's the nose cone." **Ron:** "That's not a fin!" **Ronnie:** "Oh no!" **Drew:** "That's the nose cone!" **Ronnie:** "How could we lose the nose cone?! Oh, man!" **Greg:** "Payload still in it?" **Brent:** "No, it's still on the rocket." **Ron:** "It shucked the nose cone!" **Ronnie:** "Oh, I see, it ripped it off." **Bill:** "That's bad news."



The recovered nose cone.

The group quickly discusses the possibilities. Drew describes how cold nitrous vent gas frosted over the entire bottom of the nose cone. We theorize the frost made the epoxy shrink and/or brittle, separating the adapter ring from the fiberglass nose cone. The group also discusses the fins. Al is convinced he saw all three fall off.

4:23 pm — The group hops in the back of Al's truck and heads out in search of the rocket via the radio transmission.

4:30 pm — Someone cries out that they see something hanging in a distant tree, which is in another field on the other side of a barb wire fence.

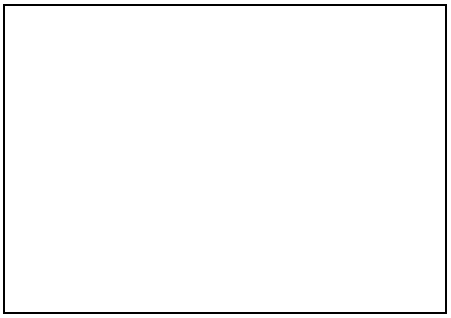
4:45 pm — A boy named Matthew finds the payload section — sans rocket — in a field. I trade him two HALO T-shirts for it. Bill's transmitter is gone, but the smaller one we borrowed is still connected and beeping. The homing beacon is gone, as is its battery. The IA-X95 accelerometer is still attached and looks fine; we should be able to get some data from the beginning of the launch. Gene takes it for downloading.

4:50 pm — Without the payload section, the parachute door could not open and the rocket would come screaming in and probably crash. Chances of finding the rocket without a transmitter now are slim to none. Greg encourages us to wander into the fields and "look for holes". Many join in.

5:05 pm — Greg finds the hole, in a nearby field less than 1/4 mile from the launch site. The rocket is still in it and only 2 feet down. The impact site is not a crater, but a perfect post-hole.

The rocket is amazingly intact — the tanks are still connected, as is the motor case. The force of the impact slammed the parachute door against the top tank, but the parachute is undamaged. The impact also slammed the nozzle deep into the motor case. The case pulls off the tank as the group tries to free the rocket. The case shows no sign of either a rupture or a burn-through. As intended, some of the ablative material is still lining the case.

The outside of the case is a different story. Strips of fiberglass hang loose and the remains of one broken fin clings to the case. The other two fins are completely gone, leaving only some fiberglass. Another hour of searching fails to finds the fins or Bill's radio.

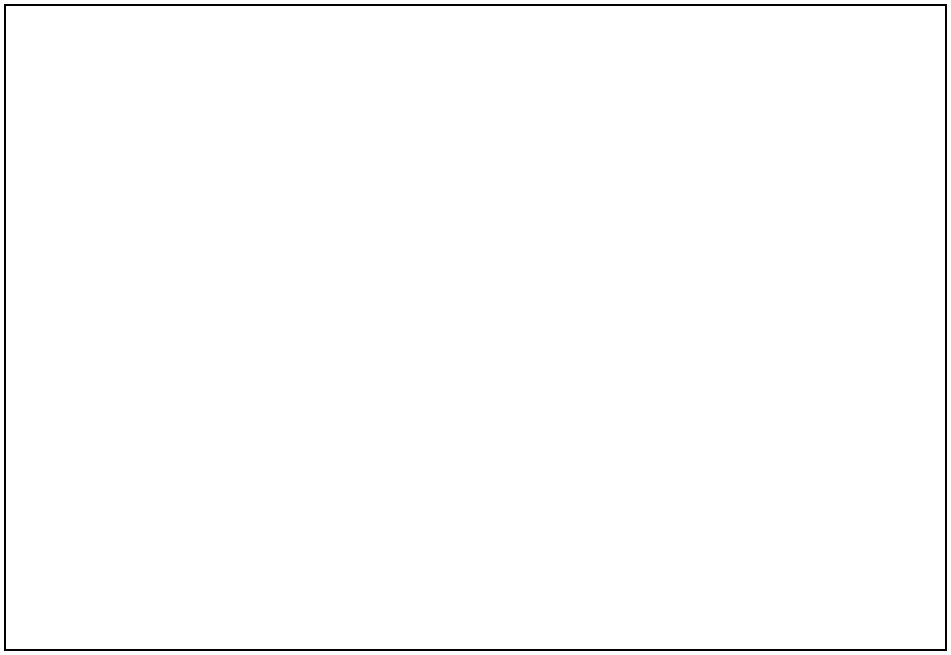


The post-hole made by the rocket.

An Overall Successful Flight

Overall, it was a very successful flight. The motor performed fabulously. The loss of the fins is disappointing but not unexpected; they would have stayed had this been the space launch. The nose cone loss was surprising, but that problem can be solved fairly quickly. There are no barriers to a space launch.

A large contingency of HAL5 members attended this first flight, including: Greg Allison, Tim Pickens, Al Wright, Ron Creel, Larry Scarborough, Ronnie Lajoie, Gene Hornbuckle (and son), Bill Brown, Clay Sawyer, Peter Ewing, Herman and Chris Pickens, Matt Beland, David Hewitt, Drew Prentice, Philomena Grodzka, Chuck Schlemm, and Brent Sandlin (and friend). All were valuable in making this flight and Project HALO thus far a success! ☆



The recovered rocket, after its flight and liberation from its impact post-hole.

Rockoon Gondola Test Results

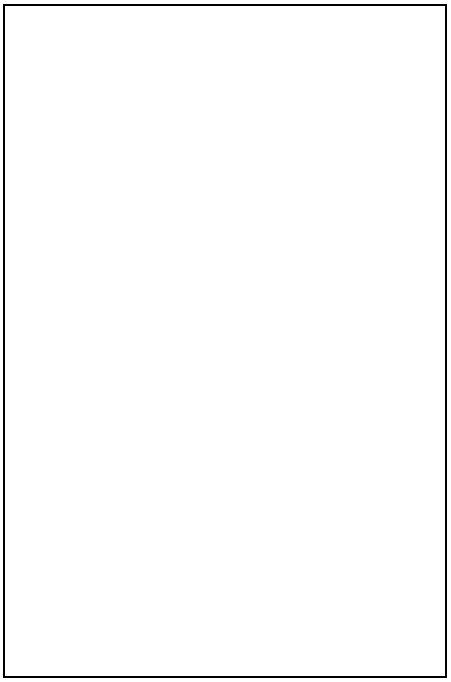
(by Larry Scarborough, Gondola Team lead)

By this point in the newsletter, you have read much about the ground launch of the HALO rocket at Manchester on April 13. Some have said that the loss of the fins and nose cone soon after launch means Friday the 13th came on Saturday in April. Some have said that the non-christened rocket should have been called the Anne Boleyn.

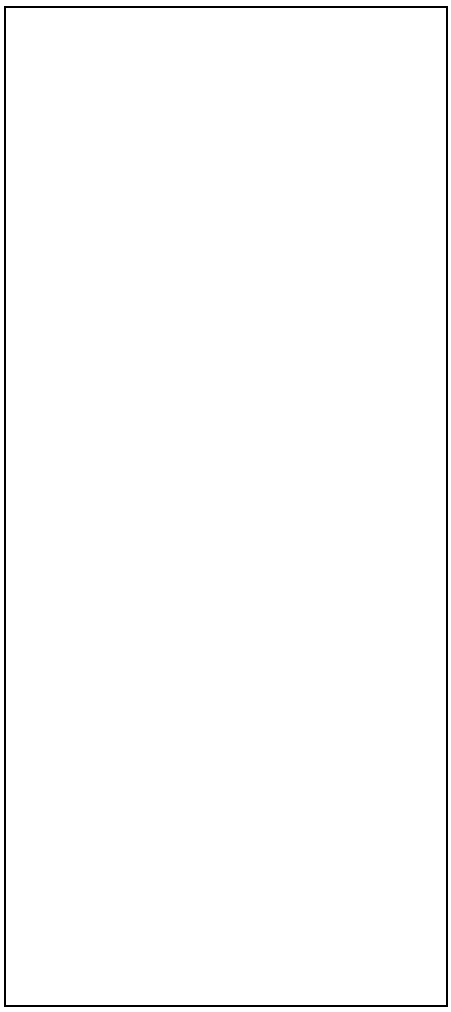
But I saw open-mouthed amazement in the spectators who had become a little jaded by the several spectacular launches that preceded ours. For even sans fins and nose cone, our rocket just kept going, having developed enough spin to stabilize its flight, fins or no. It went straight on up out of sight.

This rocket could have done with much smaller fins. But one goal of this launch was to test the performance of the gondola (pronounced "gon-DO-la"). Would these big fins, required for the high altitude lift off, get tangled in the framework that will carry the rocket to its 20-mile-high launch site?

Thus, this ground launch started from a huge triangular gondola (also called the "launch tube" since it was sitting on the ground) that was built to accommodate those fins.



The rockoon gondola — before



The rockoon gondola — after

Even though the construction of the gondola was my primary involvement in this undertaking, it was hard even to notice the thing once the rocket lit up. Tim Pickens' rocket team had produced a truly remarkable machine. But once it was out of sight, I did survey the wooden framework that had guided the rocket's initial movement.

Once the smoke cleared and the dust settled, there sat the gondola looking a little like that tower in Italy. As I walked closer I saw that it now perched on the edge of a crater; the lower half of the gondola was plastered with mud.

A later review of a videotape of the launch revealed the steps involved in this reorientation. As the rocket launched, it carried the gondola along in its wake for a few inches. When gravity pulled it back to its starting place, it no longer had a flat cornfield to rest on, but settled into a crater dug by the rocket's fiery plume.

The good news is that the gondola had done its job of guiding the rocket skyward during launch. From the standpoint of the gondola, the ground launch had been a total success! I would like to thank Tim Pickens for his design guidance, and Ron Creel for his construction assistance in helping me to make the gondola's first test a success.

As I watch the video again and again, and see that finless, noseless wonder punch a hole right through the sky, I have to repeat the assessment of the crowd of rocket enthusiasts that witnessed our ground test. "Wow!" ☆

****

HALO–1 Flight Analysis

(by Ron Creel, HALO flight engineer)

The first ground flight test of the HALO rockoon was quite a sight and sound experience and a glorious success after long months of ground engine firings and launch preparations. I have undertaken an attempt to reconstruct the flight performance of the HALO–1 launch vehicle. This effort has been difficult because, unfortunately, the payload section in the nose cone was removed during the first few seconds of flight, and therefore no data from the flight accelerometer was recorded. The wooden mounting plate which was used to connect the payload section to the forward mounting bulkhead on the N_2O oxidizer tank was not sufficiently strong enough to endure launch aerodynamic loads. Improvements in the mounting method for future flights are already in the works.

Taking the measured inert weights including tanks, valves, fins, electronics, parachute equipment, asphalt fuel, and an estimated amount of loaded oxidizer, (total launch weight of 36 pounds) combined with appropriate assumptions for thrust level, burntime, and specific impulse, have yielded the reconstructed performance plots shown

in Figures 1 through 3. This analysis was performed using a modified PC version of the U.S. Air Force ROCKET trajectory code. (ROCKET stands for Rand's Omnibus Calculator of the Kinematics of Earth Trajectories — a conveniently derived acronym.) High velocity rocket aerodynamic drag coefficient and standard atmosphere calculation subroutines were used for this analysis.

HALO–1 appeared to clear the launch gondola fairly well. There may have been some torquing or spin induced as it cleared the gondola. Shortly after this, a deflecting movement was observed, and it is believed that this correlates with the loss of the bulk of all three fins (which was observed in real-time and is quite evident on recorded videos. It is appropriate to note here that the fins were purposely designed to be extremely light weight for operation at approximately 100,000 ft altitude for balloon launch at a much lower maximum aerodynamic load.

All three fins were removed when aerodynamic loads exceeded their strength. The good news was that this removal probably tended to increase the spinning of the HALO–1 rocket, and thereby minimized adverse off-axis thrust effects and increased stability. The vehicle was certainly very stable in flight after shucking its fins and appeared to correct itself and fly almost vertically. We had previously debated the desirability of having fins on the HALO rockoon. We certainly proved they were not required, and are already investigating an alternate method of spinning up the HALO rockoon for launch — not using fins at all.

Figure 2 Reconstructed Rocket Velocity vs. Flight Time

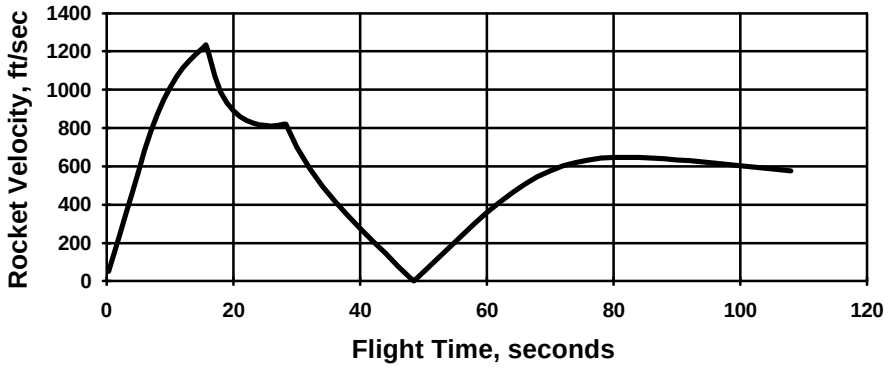
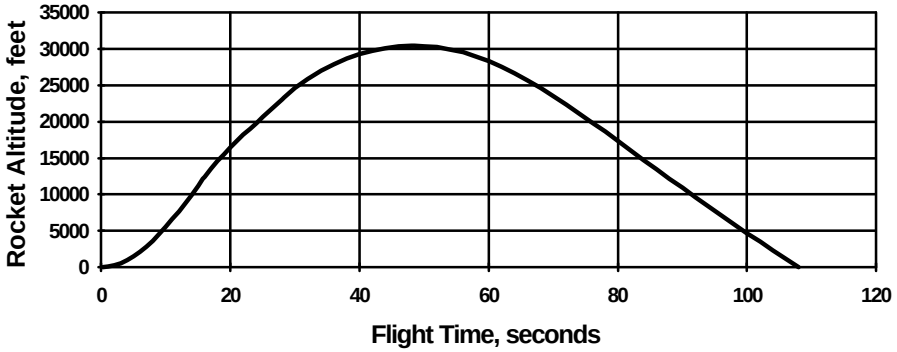


Figure 3 Reconstructed Rocket Altitude vs. Flight Time

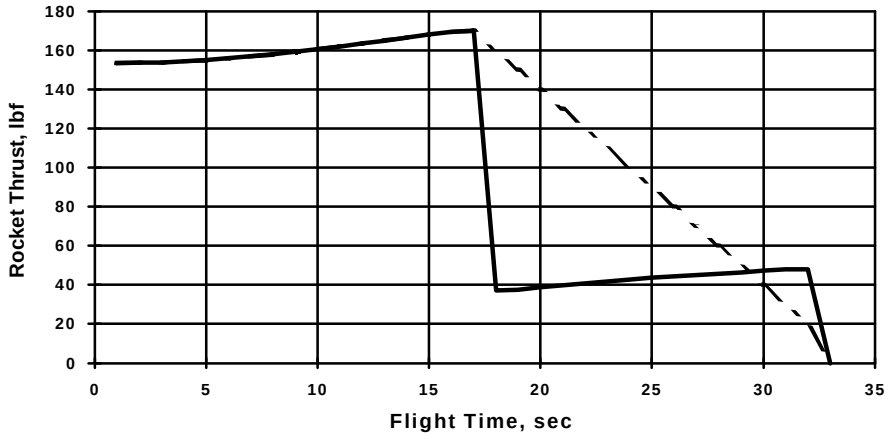


Pre-launch predictions had shown that the expected burntime was on the order of 12 to 14 seconds. However, observers of the launch and recorded video estimate that the burntime was about twice this duration. Previous ground engine firings had indicated a specific impulse of about 210 seconds and an initial thrust level of about 320 pounds force for an initial oxidizer ullage pressure of 750 psia. Indications are that the HALO-1 internal pressure at launch was about 680 psia. This would have resulted in a somewhat lower thrust level. In order to get a significant increase in burntime (i.e. lower propellant flowrate) it is necessary either to use a lower thrust level or lower specific impulse. I chose to use the former. Reversing this would not significantly change the results of the analysis.

Therefore, assuming that we had a total of 19 pounds of propellant (16.2 pounds of N_2O oxidizer and 2.8 pounds of asphalt fuel), specific impulse of 210 seconds, and sea level thrust of 200 pounds force during about 85 percent of the burntime (corresponding to the liquid oxidizer phase) and the remaining 15 percent of burntime using gaseous N_2O — we get the reconstructed thrust timeline shown in Figure 1.

(see Analysis on page 12)

Figure 1 Estimated Rocket Thrust vs. Flight Time



HAL5 Survey Results

(By Ronnie Lajoie, Survey Coordinator)

In January, HAL5 mailed to each member a survey form. As this issue goes to press, 20 out of 42 have been returned (about one-half). This is an improvement from the last survey, when only one-third were returned. As before, hopefully, the survey results are representative of the views of the membership as a whole, or at least of the vocal part of it.

The additional replies come from members who are not as active as HAL5 officers or Project HALO team members, and from those who recently joined HAL5. This is welcome because it provides the Executive Committee with a more realistic overall view.

The details of the survey results are shown in the table at right. For each survey statement the table shows the average numerical response from the 1994 and 1996 surveys, where 1 is a strong Agreement with the statement and 5 is a strong Disagreement. (Agreements are not always desired.) An average near 3 means either an Unsure response (from people selecting 3's) or a Split response (from people selecting 1 or 2's and 4 or 5's).

HAL5 Program Nights

Speaking of split responses, there was a 11 to 9 split between respondents in attendance of the monthly Program Nights, and a 9 to 11 split for the socials at Shoney's afterwards. The lesser crowd at Shoney's is because many members need to get back to their families. The major reason for many members not attending the Program Nights is that they cannot get *away* from their families, cannot bring them, or have other commitments.

The 4th Wednesday still seems to be good for many (13); the form will be revised in the future to specifically request alternates. The 7-9pm timeslot was preferred by most respondents (17), as was the format (17) and location: the Huntsville Public Library (18).

Comparison of Average Responses for 1994 and 1996 Surveys

QUESTION	1994	1996
1) I regularly attend the (mostly) monthly HAL5 Program Nights	A-1.7	S-2.9
a) The 4th Wednesday of the month is a good day for me.	A-2.0	S-2.3
b) The 7-9 pm time slot is a good time for me.	A-1.2	A-1.6
c) The Huntsville Public Library is a good location for me.	A-1.2	A-1.3
d) I would pay a small admission fee ($1-2) to attend event.	S-2.6	S-2.6
e) I like the 1-2 person lecture/forum format of the programs.	A-1.5	A-1.6
f) I attend and like the post-program socials at Shoney's.	A-2.1	S-3.0
2) I would like HAL5 to be more involved in the following:		
a) Educational programs	A-2.3	A-2.3
b) Conferences	U-2.7	A-2.3
c) Political activism	U-2.5	D-3.2
d) Hands-on technical projects	A-1.4	A-1.7
3) I would like myself to be more involved in the following:		
a) Educational programs	S-3.0	S-2.9
b) Conferences	S-3.0	A-2.6
c) Political activism	S-2.9	D-3.8
d) Hands-on technical projects	A-1.8	A-2.3
e) Project HALO	A-1.9	A-2.4
4) I regularly read the HAL5 *Southeastern Space Supporter*.	A-1.2	A-1.5
a) I want more. I would prefer a monthly newsletter.	A-2.4	S-3.1
b) I would prefer a quarterly newsletter or less.	D-3.9	D-4.0
c) My newsletter arrives in time for me to attend events.	A-2.3	A-1.7
5) I like the format of the *Southeastern Space Supporter*.	A-1.5	A-1.5
a) I like the format of the HAL5 Calendar of Events.		A-1.4
6) I like the content of the *Southeastern Space Supporter*.	A-1.5	A-1.6
a) The newsletter provides me with the information I want.	A-1.9	A-1.8
b) I would prefer more articles on local space activities.	A-2.0	A-2.3
c) I would prefer more articles on national space news.	A-2.4	S-3.0
d) I would prefer more articles on NSS space activities.	S-2.8	S-2.8
d) I would like to see advertisements for space books and art.	S-2.9	U-2.7
e) I would like to read HAL5 member ambitions and desires	A-2.3	A-2.6
f) I would be willing to write articles for the newsletter.	A-2.2	S-2.8
7) I am satisfied with the services I get with my membership.	A-1.3	A-1.7

A = Agree, D = Disagree, S = Split response, U = Unsure, don't agree / disagree

The respondents are still divided (7 to 4) over whether or not they would be willing to pay a $1-2 admission charge to cover such fees. So far, HAL5 has avoided being charged for use of the Library's auditorium by holding only the public lectures there and using the meeting room at the HATS office for membership-only meetings.

HAL5 Activities

As in 1994, technical projects scored highest (16 agrees and no disagrees), thanks to the successes of Project HALO. 13 respondents agreed to volunteer both on Project HALO and other technical projects of HAL5, while 6 responded they could not participate.

Educational programs is still second highest (with 12 agrees and only 1 disagrees). 9 respondents agreed to volunteer, while 6 had to disagree. HAL5 is looking for a member to lead one or more of our current educational activities, which include public lectures, school visits, and our new Project HALO Achievement program.

Now that most HAL5 members have recovered from the 1993 ISDC, many are becoming more interested in hosting conferences again (11 to 1 in 1996 versus 5 to 2 in 1994). HAL5 has begun the process to host a regional space development conference (SDC) in late October. It would be one-quarter the size of a national ISDC (half the programming for half the time). This conference should be *much* easier to plan and execute than the 1993 ISDC, both because of its smaller size and because our members have the ISDC experience. 10 respondents agreed to volunteer (compared to 5 in 1994), which is great! We'll be calling soon!

Most HAL5 members are even less interested in political activism now than in 1994 (2 to 5 in 1996 versus 5 to 1 in 1994), especially from a volunteering basis (1 to 11 in 1996 versus 5 to 3 in 1994) With most still unsure, it seems likely that HAL5 will continue to be a politically reactive organization rather than a proactive one.

Members who want to be politically proactive, and are willing to take a leadership role, should discuss the matter with the Executive Committee. There are supplies left over from the ISDC which can be used for such activities, as well as funds which can be used to reimburse reasonable expenses.

HAL5 Newsletter

Most (17) of the respondents regularly read and like this newsletter. Thank You! They were split (4 to 6) in terms of making the newsletter monthly, probably because many remember last time when I mentioned that dues would have to be increased by $10 to cover the additional cost. The membership still does not want the newsletter to go quarterly (with 14 disagrees to only 1 agrees). Don't worry, the newsletter will remain a bi-monthly publication.

Almost everyone (18) reported that they received their newsletter on time, and no one did not. This is great news! As editor, I have worked hard toward achieving my goal to have your copy in your mail box at least one week before critical upcoming events. I am getting closer, not I am not there yet.

Most (18) still like the overall format of this newsletter, and even more (19) like the tabular format of the Calendar of Events. This is good to hear. We all have Philomena Grodzka to thank for setting up the original format, and for designing our newsletter logo.

Most (18) still like the content of this newsletter, with 17 agreeing that it provides them with the information they want. As in 1994, articles on local space activities are the most preferred (11 to 0), with articles on member ambitions/desires still second (9 to 2). Most respondents (12) remain unsure about seeing advertisements for space books and art in the newsletter.

The club is split in regards to articles on national space news (5 to 5) and NSS activities (5 to 3), mainly because *The Huntsville Times* and national magazines such as *Ad Astra* and *Space News* already provide many HAL5 members with this information.

Fewer respondents are willing to write articles now (6 to 6 in 1996 versus 9 to 1 in 1994) mainly because some have done so and realize how much work is involved. As "Bones" might say, "I'm an editor, not a reporter!" I appreciate ALL articles, no matter how short — as long as they have something to do with space. My mail box is always available, both physical and electronic. See the sidebar on page 2 for details.

HAL5 Membership

The best news of the survey is that most respondents are happy (9) or very happy (8) with their membership to HAL5. This is great news for us in the Executive Committee, who's only contact with many of you is through this newsletter. Especially as our membership grows, it will harder for us to please everyone. We appreciate all comments and suggestions for making HAL5 a better society.

Your Executive Committee has an open invitation for members to join us at our weekly meetings at Noon on Thursdays, at the Holiday Inn Ponds Restaurant near Madison Square Mall — especially if you have an idea for a HAL5 activity or project. As always, our monthly meetings at either the Library or the HATS office is open to members and non-members alike — so next time bring a friend! Ad Astra! ☆

****

Project HALO News

(Analysis, continued from page 10)

I assumed that the effective thrust level would be reduced by a factor of three during the gaseous N_2O phase from 15.75 seconds until N_2O depletion. The thrust might actually follow a curve like the dashed one in Figure 1.

About 28.35 seconds of total effective burntime is the maximum I can reproduce at this time. Note that effective thrust for the balloon launched HALO will be significantly increased with use of the high altitude nozzle extension. Velocity versus time corresponding to the thrust curve is shown in Figure 2. A maximum Mach number of 1.16 was calculated at the end of the liquid burn phase at 15.75 seconds at an altitude of about 12,000 feet. A maximum altitude of just over 30,000 feet was calculated as shown in Figure 3.

I have no doubt that had we been able to launch HALO–1 from a balloon at 90,000 feet altitude, we would have certainly gone into space — that is, above 50 nautical miles. From a launch altitude of 100,000 feet we would have approached an apogee of 70 nautical miles. We are ready — Let's Do It! ☆

New HAL5 Membership Record Made in April!

(by Ronnie Lajoie, Treasurer)

1996 is turning out to be a great year for HAL5 in terms of membership. It's only May and already we have broken the record of 42 from the last two years. We now stand at 44, plus 2 newsletter subscriptions.

Why is this a big deal? Let me explain. As mentioned in past issues, everyone's membership expires at the end of the year. Thus, the total of 46 is for people who have renewed or joined this year alone. This is great, especially since there are still some previous members who have yet to renew.

This is also great because we are almost at the critical mass necessary for HAL5 to pursue more than one big activity at the same time. Project HALO is taken up large quantities of our most active members' free time. We would like to put on a Southern (regional) Space Development Conference this year, and need some different individuals to lead its planning and preparation. If you would like to help plan this event (tentatively scheduled for late October or early November), contact Greg Allison at 859-5538 or Ronnie Lajoie at 461-3064 or 721-1083.

The following is a list of additions to the current paid membership of HAL5, which includes 27 renewals and 17 new members, for a total of 44. Also shown is a new subscriber to our newsletter. Welcome to all our new and renewed members and subscribers!

Matt	Beland	(N)
Bill	Brown	(R)
Gary	Buck	(N)
Martha	Feld	(N)
David	Hewitt	(N)
Bryan	Jones	(N)
Rick	Kauffman	(R)
Edward	Kenny	(R)
Phillip	May	(N)
John	Pavlick	(N)
Timothy	Pickens	(R)
David	Smitherman	(R)
Larry	Kos	(S)

(N) - New Member
(R) - Renewed Member
(S) - Newsletter Subscriber

HAL5 welcomes back its previous members Bill Brown, Rick Kauffman, Edward Kenny, and Timothy Pickens; and also past member David Smitherman, who is one of the founding fathers of HAL5 and its first Treasurer.

HAL5 also welcomes its new members. Martha Feld is a teacher at the Center for Science and Foreign Language and coordinated the extremely successful Junior Cadet Track for the 1993 ISDC. Students Matt Beland (SEDS-UAH president) and David Hewitt have been part of the HALO team since late last year. John Pavlick is President of Advanced Composite Technologies & Associates, the company which fiber-wound the cases for our HALO rockets. Bryan Jones is the very able office administrator for HATS. Gary Buck and Phillip May saw Project HALO in action for the first time during our successful ground launch in Manchester. ☆

Project HALO T-Shirts for Sale

T-shirts are white with red ink showing the HALO logo and the words "Race for Space" over a starry background. T-shirts are a 50-50 cotton blend and come in Men's sizes ranging from Small to XXL.

T-shirt prices are $10 for HAL5 members, and $12 for non-members. Buy yours now to help us save on the cost of shipping them to the 1996 ISDC in New York City (where we hope to sell all that we have left).

For more information, call Ronnie Lajoie at 461-3064 or 721-1083.

TABES 1996 Reception Free for HAL5 Members

On Tuesday, May 14, HATS is hosting a reception at their TABES 1996 conference for all members of HATS. Since HAL5 is an Associate Member of HATS, all HAL5 members are invited to attend for free. Two tickets are provided with this newsletter so that you may bring your spouse or other guest. The reception will be held from 5 pm to 7 pm in the Exhibit Halls of the Von Braun Civic Center (location of all TABES exhibits, including HAL5's for Project HALO). There will be complementary hors d'oeuvres and soft drinks. Cash bars will also be available for alcoholic beverages. ☆

Special Announcements

TABES 1996 at the VBCC

Tues. May 14 thru Wed. May 15

TABES Reception, Tuesday at 5 pm

2 FREE TICKETS ENCLOSED*

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

Place First Class Stamp Here

*Members within 1-hour drive only