Southeastern Space Supporter

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

Volume 6, Number 6 — November–December 1997

FIRST WORD

HALO Sky Launch 2 (SL-2) Clears Concept Design Review (Destination — Space!)

(by Greg Allison, HALO Program Manager)

On the 2nd of December 1997, HAL5's HALO Sky Launch 2 project conducted a concept design review. Concepts were presented for both the electronics and the rocket. Issues were raised resulting in the assignment of several action items. (See page 3 for details.)

The bottom line is that we came out of the meeting with a much clearer understanding of what it is we have to do to establish our performance objectives of achieving an amateur space flight and validating our altitude. Tim Pickens presented a new concept for a composite wound oxidizer tank to compensate for weight growth.

Clay Sawyer presented a problem with our downlink data package transmissions, wherein the packets were to large for the rotational rate of the vehicle given our downlink antenna radiation patterns. Several action items were assigned to deal with this issue. To date those actions have lead to the selection of a different microprocessor with much shorter data packets and better data handling capabilities, an antenna redesign exercise, and consideration of different downlink transmitter baud rates. The rocket and electronics teams argued over payload canister diameter with the rocket team winning out with a 6 inch diameter payload canister.

As a result of this process the SL-2 rocket will be a much better vehicle! The improved mass fraction due to a better tank design (thanks to Tim and Steve Mustaikis) should ensure that we can indeed hit space. Clay's redesign of the downlink telemetry system, and Gene Young's antenna redesign will give us a much better assurance of altitude verification. Better yet, Clay's redesign will permit the downlink of data from a student payload.

Happy Holidays!

Kudo's To HALO Space Pioneers!

Special appreciation goes out to the entire HALO Team. Thank you all for hanging in there over the long haul. Your determination is a tremendous credit to your strength, endurance, and character. I am proud to work with a team of such high caliber! Together we shall do it! Next stop: SPACE!

HAL5 Recruits NSS Memberships

HAL5 won third place in the NSS chapter's contest to recruit new members for the NSS. This won HAL5 a license for *Moonlink* to present to a local school. We have chosen the Huntsville Center for Technology (see page 2). Special thanks goes to Ronnie Lajoie for organizing this campaign. ☆

HALO NEWS

Minutes of the HALO SL-2 Concept Design Review

(by Peter Ewing, HAL5 Secretary)

The HALO SL-2 Concept Design Review held at the HATS Office on Tuesday, December 2, started at 7 PM and lasted over two hours. The first 90 minutes of the meeting were recorded and have been transcribed. The following are excerpts from the meeting minutes to give you a sense of the interaction of the HALO team members.

Rocket Telemetry and Antennas

CLAY: We want to take the GPS data and put it on a video overlay so that we at least get that in case the MIM chip fails. If we don't get telemetry at all we can at least get video. Today at lunch we wondered what would happen if we lost all telemetry data. We discussed the probability of that happening and the possibility of going a different route. ... I'll still build what we've got but have this optional means of transmitting data because there's a serious risk of losing telemetry. ...

CLAY: The problem is the rocket is spinning, for one thing. We are transmitting [telemetry] on two different transmitters, 1256 and 441 MHz. There are two quarter wave antennas for the 441 and two for the 1256, and we'll be transmitting simultaneously on both of them. Well, as the rocket is spinning there are dead zones, and the time it takes for all the data to go out, the data will be transmitting during dead zone. The standard format does what's known as a non-return to zero. In dead zone you lose your data and it's just trash after that, and it's hard to even reconstruct the data, just by the nature of it.

(see Minutes on page 6)

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The *Southeastern Space Supporter* is a bimonthly 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://advicom.net/~hal5/`

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 35757
Day phone/message: 205-461-3064
Night/Weekend phone: 205-721-1083
Electronic mail address: hal5@advicom.net

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.

HAL5 Selects Two Schools to Receive *Moonlink* Program

(by Ronnie Lajoie, HAL5 Campaign Chair)

As reported in the last HAL5 newsletter, thanks to the many of you who joined (or rejoined) the National Space Society via HAL5 between April and September 1st, our chapter finished 3rd Place in the NSS 1997 "Campaign for the Future" membership drive. HAL5's prize for achieving 3rd Place was a free registration (valued at $360) for the *Moonlink* education program to go to the high school (or perhaps middle school) of our choice.

"Center for Technology" Chosen

Last month, after receiving suggestions from HAL5 members, and speaking with officials from many local schools, the HAL5 Executive Committee voted to select the Huntsville Center for Technology (HCT) as the recipient of our *Moonlink* prize. The HCT serves as the vocational school for all Huntsville high schools. HCT Principal Sadler is working with those of the high schools so that any interested Huntsville high school student (up to 24) can participate.

HCT teacher John Stingel will led the effort at the school. HAL5 has agreed to provide assistance when necessary. If you would like to help, please contact him at 650-4450 or stingel@hiwaay.net.

Mt. Gap Middle School Also Chosen

Because of interest in *Moonlink* by other schools, the Executive Committee voted to select Mt. Gap Middle School as the recipient of another *Moonlink* program.

The $360 registration fee will be paid with funds raised from HAL5 members. Thus far, Larry Scarborough (Mt. Gap's leading advocate) has donated $100; and Ronnie Lajoie, $50. **If YOU would like to donate, please send your check to HAL5 at the address on page 8.**

Mt. Gap teacher Nell Fisher will led the effort at her school. HAL5 has also agreed to provide assistance when necessary. If you would like to help, or just visit, please contact Mrs. Fisher at 650-4400 or nfisher@hsc.k12.al.us.

The *Moonlink* Educational Program

The *Moonlink* program, created by Space Explorers, Inc. of Wisconsin, consists of lesson plans, computer software, and Internet access to the project scientists and engineers for the NASA Lunar Prospector mission, now scheduled to be launched on January 5, 1998, weather permitting.

Up to 24 students (grades 6 to 12) can participate (based on 2 students per computer). The computer requirements are high however: up to 13 Pentium-class PC's with ISDN or T1 connections to the Internet. For more details, please see the flyer enclosed with the last issue of the HAL5 newsletter, or call Ronnie Lajoie at 461-3064 or 721-1083. ☆

Revised Telemetry Board Design for SL-2

(by Clay Sawyer, HALO Electronics Lead)

Packet Transmissions will use at frequency of 441.050 MHz and a rate of 1200 baud (bytes per second)

Call Sign Telemetry (transmitted periodically during flight)
- Call Sign (ASCII)

Accelerometer Telemetry (transmitted during entire flight)
- Acceleration (Binary)
- Vertical Speed (Binary)
- Altitude (Binary)
- Max. altitude (ASCII)

GPS Telemetry (transmitted after Thrust Phase)
- Latitude (Binary)
- Longitude (Binary)
- Course (Binary)
- Horizontal Speed (Binary)
- Altitude (Binary)
- Max. altitude (ASCII)

Test Data Telemetry (transmitted after Thrust Phase)
- Student Payload Analog
- Student Payload Digital
- Atmospheric pressure
- Payload temperature

ATV Transmissions at frequency of 1255 MHz
- Video
- Real time acceleration in frequency format

Flight Phases

Pre-launch Phase: Commenced on power up
- Monitor Launch Detect (Thrust Phase trigger)

Thrust Phase: Commenced on Launch Detect
- Start End Experiment Timer (Separation Timer trigger)
- Monitor Acceleration Levels (Ballistic Phase trigger)
- Commence Integration
- Cease GPS & Test Data Telemetry Packet Transmission

Ballistic Phase: Commenced on Acceleration below 1/4g (?)
- Commence Student Experiment(s)
- Start GPS & Test Data Telemetry Packet Transmission
- On End Experiment Timer timeout:
  - Start Separation Timer (Separation Phase trigger)
  - End Experiment

Separation Phase: Commenced on Separation Timer timeout
- Separate Payload
- Deploy Drogues
- Start Separation Check Timer (Main Phase trigger)

Main Phase: Commenced on Sep. Check Timer timeout
- If sep. does not occur within 5 sec, Go Deploy Main
- If separation occurs within 5 sec, set Main Timer
- Upon Main Timer timeout:
  - Commence pressure checks (Deploy Main trigger)
- Deploy Main on atmospheric pressure = 3km Altitude

Inputs Table

Inputs	Data Type
GPS	Serial
Acceleration	12 bit analog
Student Analog	12 bit analog
Outside Air Pressure	12 bit analog
Payload Temperature	12 bit analog
Launch Detect	1 bit Digital
Drogue Detect	1 bit Digital
Primary Drogue Squib Status	1 bit Digital
Redundant Drogue Squib Status	1 bit Digital
Primary Main Squib Status	1 bit Digital
Redundant Main Squib Status	1 bit Digital
Student Experiment	8 bit Digital

Outputs Table

Outputs	Data type
Telemetry	Serial
Fire Primary Drogue	1 bit Digital
Fire Redundant Drogue (555 Timer)	1 bit Digital
Fire Primary Main	1 bit Digital
Fire Redundant Main	1 bit Digital
Commence Student Experiment	1 bit Digital

Power Table

Power In	
15 to 12 Vdc	Primary Power
9 to 7 Vdc	Redundant Power

Timer Table

Name	Trigger	SClock Start	SClock End	Duration	Result
Acce_Update	Self Triggered	N/A	N/A	0.1 sec	Update every 0.1sec: (1) Acceleration, (2) Speed, (3) Altitude
End Experiment	Launch Detect	0	235	235 sec	End Experiment
Separation	End Experiment	235	240	5 sec	Separate Payload
Separation Check	Separation	240	245	5 sec	Check
Main Chute	Separation Check	245	345	100 sec	Commence atmospheric pressure monitoring

INSERT GRAPHIC HERE

INSERT GRAPHIC HERE

(Minutes, continued from page 1)

GEORGE: I need to bring it back to ... the dropout characteristics of these antennas that we're talking about. Are these antennas circularly polarized?

CLAY: They're just like this. They stick out one on each side, and transmit out like a donut.

GENE: We don't really have much, I don't think, to circularly polarize them.

GEORGE: It depends on what angle you're looking at, and so on, so probably not. On the other hand, you said you had two dipoles for each one?

GENE: It's really a dipole for each frequency, one sticking out on this side, the quarter wave on this side, but we don't have anything at ninety degrees.

GEORGE: So what we're looking at is a classic dipole pattern. ... What happens is that the frequency varies, it's a sine function, you know, as you go around. You're only in a complete null for a fairly short period of time. Once you get ten or fifteen degrees back off that null then you start getting back signal again. That means that five sixths of the time you'll be getting signal, if it's a classic dipole situation that you've got. ... These things like temperature are not fast changing parameters. So the question you come down to now is, is this really a serious problem? You'll lose some data, there's absolutely no question about it.

CLAY: You can pass all the data, but the way non-return to zero works, if you have say a one, and a one and a one, starting off high, stays high, high, high, no transition. Let's say the first one's a one you go high and then zero, so you transition. And if you have another zero you'll transition, if you have a one it'll stay the same, one stay the same, zero transition. It looks for the transitions.

AL: You're gonna lose everything *after* that first dropout.

CLAY: The data will be there but you don't know the transition.

AL: You're taking the whole packet, and you're saying where's the first dropout, boom, I've got that much of a packet left. Can't get anything past that because you don't know what the other packets are saying.

CLAY: Is it possible we could get four antennas for a transmitter?

GENE: We could study it and build it.

BILL: I'd rather go for a couple of patches.

GENE: NASA doesn't like those patches. I've talked to 'em about that and they say they wouldn't be any better off. To get a better pattern ideally we want a doughnut pattern around that thing. ... I intend to go back and look at antennas.

BILL: How about making a Plexiglas payload section? Then you could have each loop sticking out beyond the payload. So you're gonna have little loops of wire outside. ... I want a Plexiglas ring between the top of the rocket and the payload, one in the middle, and turn the two metal sections into an antenna.

GREG: That's what they did to the original rockoons.

BILL: A vertical dipole that the whole rocket radiates with no distortion.

GREG: That's what they did with the deacon rocket. It had a two piece metal section dipole antenna.

Rocket Telemetry and Data

TIM: Let's look at the real important data we're really interested in. To me this acceleration data is what's really important to get either real time, or have enough smarts on board, so when it does record some apogee point, then that's the data that it keeps sending back. ... We're interested in apogee. ...

GREG: Hey is this MIM chip interrupt driven?

CLAY: No it's not.

GENE: How many bits per packet?

CLAY: I'm not sure.

GENE: ... let me put an action item on Clay to count the number of bits.

GEORGE: The problem is we've got a spin rate of one RPS and we've got a packet which lasts a second, which means that if you lose any part of it then you lose the whole packet. ... So we gotta get short packets.

BILL: Either that or the antenna.

GEORGE: The antenna in part solves the problem ... So the thing you want to do is maybe break this thing up into three or four packets. Not change the amount of data but just three or four packets, each packet different than the one before, unless you've got some like the acceleration he (Tim) wants to see.

STEVE: So basically 30 seconds of acceleration data is the most important data during that, at least to us.

TIM: It'd be nice to have the coast to apogee.

STEVE: You'll have coast to apogee but realistically the first 20 seconds to 30 seconds is what you need. And everything else, if you get one packet during that whole period of time, we're okay. ... Now the video we would like back but that'll be phasing in and out and we shouldn't have too much of a problem with that. ...

TIM: You're gonna need acceleration for the full time to get impulse of the system.

STEVE: I want velocity is what I really want, on the screen. ... Just stick velocity on the screen, if you got any two points in time, you go to velocity after the burnout.

BILL: How much could you store on a second BASIC stamp?

CLAY: That option is to have a second BASIC stamp and have the integrator just have analog to digital format.

STEVE: I was thinking you've got an analog signal out here going to your MIM chip, right, and you can get the voice recorder chips ... and record that analog signal as a tone, or whatever, and basically have an A to D on the other side of that which is gonna send out a word, and we display that word on the video out.

CLAY: We have several alternatives ... One is to reconfigure the antennas, two, get a second BASIC stamp and store the data, and then start spitting out the maximum values, after apogee. The other thing is to put integrator data on the video overlay ... We definitely need that as a backup because, even if its spinning, we could still see the data. That's probably our best bet right there. Then as a last alternative we have a possibility of just changing the actual telemetry that we send down, but that's gonna be a lot of work.

GEORGE: I'm trying to get short packets.

CLAY: ... This MIM chip that you're seeing right here, everything coming in there's these five analogs, these eight channels, that includes speed, altitude, temperature, pressure, your latches and all that. That's sent as one packet. You can't separate it. ... I can't do anything to the packet. Not with what we have. We have to design our own telemetry to do anything else.

GEORGE: So, the only real solution then to this problem is the antenna.

GREG: This is an issue we're gonna have to come back to. It's gonna have to be the group that we've got here tonight. It's gonna have to be both electronics and rocket performance people involved here. ... This is gonna require some major discussion.

Gondola Electronics

GENE: The requirements as I see 'em for the uplink avionics module (that's how we command the firing of the rocket and the cutdown of the balloon). A two meter radio link capable of firing five electronic batch circuits over a 200 mile range and a three and a half hour time period. I'm saying carry batteries that will keep us working for three and a half hours. Provide control for rocket oxidizer tank heaters, temperature is 60 degrees, 75 degrees. Power ... we'll be needing the wattage for that control.

Electromagnetic compatibility, we down-link the rocket data, provide electronic redundancy, provide operational capability to 100,000 feet, low weight (less than 20 lbs), volume less than one cubic foot, provide simple mechanical-electrical interface for the rocket, provide for simple safe and quick checkout capability, provide for personnel and rocket safety in all operational modes, provide standardized design for application to future missions.

Ground Station Electronics

BILL: Ground stations, we're gonna have TV for the gondola video, TV for the 1200 just like we had before. Command radio, probably redundant radio for telemetry, particularly if we're gonna do the transponder idea. And I've gotten antennas, I've got the TVs we need, but I will need one TV and one VCR. I've got one that I used before, the little portable sized one. ...

TIM: Are they providing us power on the barge as in generator, real 110 AC?

GREG: That's something we've gotta talk about. Another thing we've gotta talk about is radio frequencies back to shore, make sure we've got a good shore line of communication, which we did not have on the boat recovery vessel of SL-1. But it will be required because the FAA requires that we communicate with them, and a cell phone ain't gonna work ...

BILL: ... the TV downlink can either mount near Gene's thing or inside the package itself. It'd be a lot to see how it would mount.

GREG: Bill, the important thing here is that we coordinate the assets we're gonna need, the frequencies we're gonna need, that we can identify and have them available on the barge, and coordinate with groups to have at least two sites set up on shore.

BILL: We've got a school on Dothan Island and they're very interested, and I've got at least one Ham group in Mobile, I met 'em at the Hamfest here last summer, and a guy was real excited, he even has a couple of chase planes.

BILL: ... balloon techniques from the boat, what I think would probably be the best, if our balloon link stretches beyond the length of the boat, is to have part of it still in the box, and that's how they do it, when they do the Arctic launches. They just reel it out of the box when they launch it. So you'll still have the Kjome launcher like this ...

GREG: So, the bottom line is we can use our current [Kjome] launcher ... with a 300,000 cubic foot balloon.

TIM: This is something probably Dr. Larry needs to be Action item on. He's sitting there waiting on plans to build a launcher from us, and any support for this Dr. Larry's gonna be doing. Because a lot of this is gonna be some wood structure and support for holding the rocket cradles and whatever.

Propulsion Systems

STEVE: This is still in the works so I'm gonna draw up here what we've got right now. Stuff we've concluded so far, our injector design ...

After the Tape Ran Out

Three fourths of the review was accomplished before the tape ran out. Steve Mustaikis' main point concerning the propulsion system was that it would essentially remain the same as the one used for HALO SL-1. This is the where the recording ends.

Following Steve's presentation came that of Tim Pickens, concerning the vehicle systems. All modifications to the vehicle systems were considered workable. It was agreed that the electronics package could not exceed seven inches in diameter. Concern was raised that a surplus government nozzle was being used, preventing HAL5 from winning the NSS "R-Prize". (The group that sends their rocket the highest by May 1999 wins $10,000.) Tim agreed to search for commercial surplus instead.

George said he was not receiving enough input concerning safety issues. Greg got agreement from group to forward more safety data to George.

Mark Wells, scheduled to speak, did not attend the meeting, and the payload canister concept was not presented. ✯

1997 Ends with 82 Members

(by Ronnie Lajoie, HAL5 Treasurer)

No doubt about it. 1997 was our best year ever for membership recruitment. As of December 21, we now stand at 82, plus 10 newsletter subscriptions. This record membership consists of 42 renewals and 40 new members.

The latest person to join HAL5 is NSS member Kent Rothermel of Canton, Ohio, who learned about us via our HALO article in *Ad Astra* magazine and our Web site. Our chapter NSS membership now stands at 58 or 71%! In addition to joining HAL5, Mr. Rothermel also bought a HALO T-shirt and included a donation to Project HALO. Thank you very much and welcome aboard!

Ad Astra with HALO article Available

As reported in the last HAL5 newsletter, the HAL5 Executive Committee voted to buy 101 extra copies of the special September/October 1997 education issue of *Ad Astra* magazine. The issue features a three-page article on HAL5's Project HALO. We still have plenty!

As a member, you are entitled to get **ONE FREE** copy, upon request, provided that you can pick it up at a HAL5 meeting, Program Night, or HALO worknight. If you want it mailed, please send a check for $2 to cover the postage. You may also purchase additional copies for $1 each if picked up ($3 if mailed). Non-members may purchase copies at $3 each if picked up ($5 if mailed). Send your requests to me at "hal5@advicom.net" or leave a phone message at 721-1083 or 461-3064. Please mail checks to the HAL5 address below.

1998 to Yield 200th HAL5 Member

Mr. Rothermel is the 199th person to join HAL5. The NEXT person to join HAL5, the first new member of 1998, will be our 200th member. He or she will receive a certificate and a free HALO T-shirt. So start recruiting! You could have the honor of finding that person! ✰

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Changes in NSS Officers

(by Ronnie Lajoie, NSS Board of Advisors)

Members of the National Space Society get to vote every two years for who serves on the Board of Directors (BOD). The BOD then votes for Officers to serve on the NSS Executive Committee. The Officers are members of the BOD.

The BOD also votes on who serves on the NSS Board of Governors (BOG) and NSS Board of Advisors (BOA). The BOD also votes for the Executive Director of NSS Headquarters, who is responsible for the Headquarters staff. These people, except for the Chairs, are not members of the BOD.

1998 NSS Officers

As reported by outgoing NSS Secretary Marianne Dyson (who is also Chair for the 1999 ISDC), several changes have taken place.

HAL5 member Charlie Walker retains his position of President. Similarly, Buzz Aldrin is still Chair of the BOD and Hugh Downs is still Chair of the BOG. Currently there is no BOA Chair.

Kirby Ikin of NSS Australia is the new Chair of the NSS Executive Committee, replacing Robert Zubrin. Dr. Zubrin is now Senior Vice President. HAL5 member Gordon Woodcock is now the Executive Vice-President (back in April he was "acting").

Marianne Dyson is now Vice President for Public Affairs, Shirley Smith is Vice President for Chapters, and Greg Rucker (of Georgia) is Vice President for Fund Raising. Jeff Liss (outgoing *Inside NSS* newsletter editor) continues as Vice President for Membership. Lauri Zeman is now Secretary with David Brandt-Erichsen assisting. Joe Redfield continues as Treasurer with Joseph Ausmann assisting. Joe Whitebread will serve as General Counsel.

These individuals in these positions are very good for HAL5 as well as NSS. Many are well aware of our chapter and our Project HALO.

Lajoie Joins NSS Board of Advisors

In September, NSS Director Bruce MacKenzie sent me an E-mail message asking if I would like to serve on the Board of Advisors. The BOA has been inactive most of its life, and the BOD was hoping to make it more productive. I replied that I would be honored — as long as it did not interfere with my current chapter duties or my post as Chair of the NSS Chapters' Assembly. He confirmed this and I was elected to the BOA in the October elections. At this time, my specific duties are still unknown as there is no Chair as yet.

A list of all members of the NSS BOD, BOG, and BOA appears on the first pages of each issue of *Ad Astra*. ✰

Special Announcement

Merry Christmas!

Joyeux Noel!

Happy Hanukkah!

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