HASP Payload Specification and Integration Plan

Payload Title: Distant Aerial Cosmic Radiation Acquisition Package

Payload Class: (Small) Large (circle one)

Payload ID: Payload #08

Institution: West Virginia University

Contact Name: Kyle Phillips

Contact Phone: 330-21-7437

Contact E-mail: kphilli1@mix.wvu.edu

Submit Date: June 22nd, 2009

I. Mechanical Specifications:

A. Measured weight of the payload (not including payload plate)

In its current configuration, the measured weight of the payload is 2935.00 grams (2.9 kg), as seen in the itemized table, Table 1 (next page). However, this weight is based upon two factors that are not completely accurate, currently, but will be adjusted based upon the final components that have already been purchased and designed, respectively to follow. First, the West Virginia University (WVU) High Altitude Research Team (HART) has ordered a new analog-to-digital conversion (ADC) board, specifically the TS-ADC24, which will allow WVU HART to have more ADC channels for instrumentation, has not been officially weighed yet. Second, the frame that was measured and recorded in the table below is currently being modified to allow for the electrical components of the package to be mounted outside the original frame. These modifications can be viewed in section B of the Mechanical Specifications section. The modifications to the frame will add to the total weight. However, the final WVU HART will not exceed the maximum allowable weight of 3 kg for small payloads.

Table 1: WVU HART Payload Weight Budget

Payload Item	Weight [g]	Brief Item Description / Notes
Specified Payload Mounting Plate:	552.00	PVC, including wiring / Provided by HASP
Insulation and Protection Case:	148.00	Protective Styrofoam Case
Fully Assembled Frame:	390.00	Aluminum Frame, including Plate Mounting Bolts
Scintillation Detector Protective Core:	60.00	Protective Styrofoam Core, including plastic
Scintillation Detector:	1788.00	Provided by Saint Gobain, including B14 Sockets
Amptek DP4 Circuit Board:	38.00	Provided by Amptek
Amptek PC4-2 Circuit Board:	20.00	Provided by Amptek
Power Supply Board (estimated):	250.00	Designed by Dr. Mike Palmer
GPS (w/ Antenna and Cable):	27.00	Designed and Produced by Dr. Mike Palmer
Technologic Systems TS-5400 (estimated)	100.00	Single Board Computer from Technologic Systems
Technologic Systems TS-ADC24 (estimated)	50.00	ADC Board from Technologic Systems
Measured Total Weight (w/ Plate, w/o Misc.):	3423.00	Measured Weight with HASP PVC Mounting Plate
Measured Total Weight (w/o Plate, w/o Misc.):	2871.00	Measured Weight without HASP PVC Mounting Plate
Misc. Components (conservative estimate):	64.50	Includes weight of wiring, and yet-to-be-added components, like Temp. Sensors
Estimated Measured Weight (w/o Plate):	2935.50	Includes Miscellaneous Components
Maximum Allowable Weight:	3000.00	Maximum Small Payload Class Weight, as Specified by HASP
Weight Limit Check:	Good	Ensures Measured Total Weight Without Mounting Plate is Within HASP Limits

B. Provide a mechanical drawing detailing the major components of your payload and specifically how your payload is attached to the payload mounting plate

As the WVU HART has modified the electronics package that it will contain since the 2007-2008 campaign, it has had to make modifications to the frame that houses those components for the 2008-2009 campaign. Therefore, the WVU HART has decided to move the electrical components outside the original frame, into new additions that they describe as "modules," with the exception of the scintillation detector, which will remain inside of the original core portion of the frame. These modules will all be the same size, as the team has kept to its original objectives of versatility and strength in the design of the frame for future teams. The modules were designed based on the physically largest electrical component, the Single Board Computer (SBC). Therefore, each module's dimensions are 5" in width, 8" in height, and 1" in depth. The 1" of depth space was confirmed by an LSU HASP team member via e-mail. As specified in HASP documentation and e-mails, since the cross-sectional dimensions of the frame modules exceed the standard footprint, the enlarged cross-sectional area must start at a minimum of 3" above the PVC mounting plate. Thus, the new frame modules start 3.5" from the PVC mounting plate, allowing for ½" Styrofoam® to envelope the frame for thermal and environmental protection. These specifications may be found in Figures 1a and 1b (next page). Moreover, depending on the amount of weight added by the module framing, and the increased amount of insulation that accompanies it, the WVU HART plans to add thin

sheet metal to the larger area of the framing (i.e. the 5” by 8” sides). The sheet metal sides will serve two purposes. First, the sheet metal will allow the WVU HART to attach its electrical components anywhere on that surface, allowing for even greater versatility. Second, the sheet metal surfaces will allow radiative cooling for the electrical components mounted on them. The WVU HART has yet to determine the best method, but one that has been widely discussed is using non-electrically conductive, heat-sink epoxy affixed between the circuitry and the sheet metal to provide that cooling. Other methods will also be tested and considered, such as heat piping, radiative fins, etc. Once again, only the sides that contain the sheet metal will be exposed to the atmosphere, while everything else will be contained with Styrofoam® casing for environmental protection. Also, note that the total base-width of the payload, including the Styrofoam® case, is no more than the allotted 5.875” by 5.875” footprint.

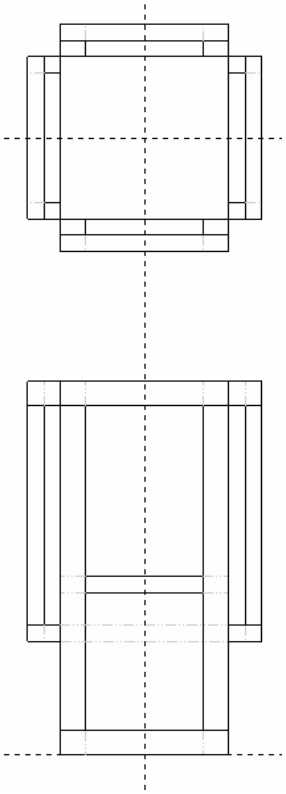

Figure 1a: Modified Frame, Including Modules

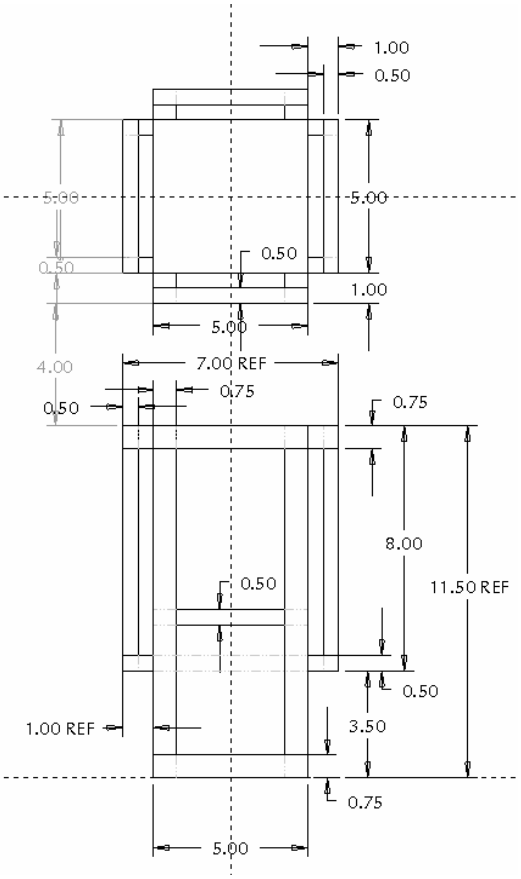

Figure 1b: Modified Frame Specifications

Eight ¼”-20 bolts will be used to secure the WVU HART payload to the HASP-provided PVC mounting plate, at the location of payload 08. Assuming that the WVU HART's payload weighs the maximum allotted amount for a small class payload, 3 kg, at a 10g vertical loading and a 5g horizontal loading, the WVU HART payload would exert a force of 294 N (i.e. 66.09 lb_f) and 147 N (i.e. 33.05 lb_f) in the vertical and horizontal directions, respectively. The mounting bolts to be used to connect the WVU HART's payload to the HASP-provided PVC mounting plate are ¼”-20 brass flat head bolts, which have head diameters of 0.477 in., yielding head areas of 0.1787 in^2. One may note that each bolt will carry maximum stresses of 369.84 psi and 184.95 psi in the vertical and horizontal directions, under the 10 g and 5 g loading conditions, respectively. However, the minimum tensile strength of the mounting bolts is 53,000 psi, each, as provided by McMaster-Carr's website. Hence, factors of safety of 143 and 287 exist in the vertical and horizontal directions, respectively, easily supporting the WVU HART's payload under the HASP-specified loading conditions presented in the “Call for Payloads 2008-2009” document. Figure 2 specifies the locations of the bolts that will mount the frame to the HASP-provided mounting plate.

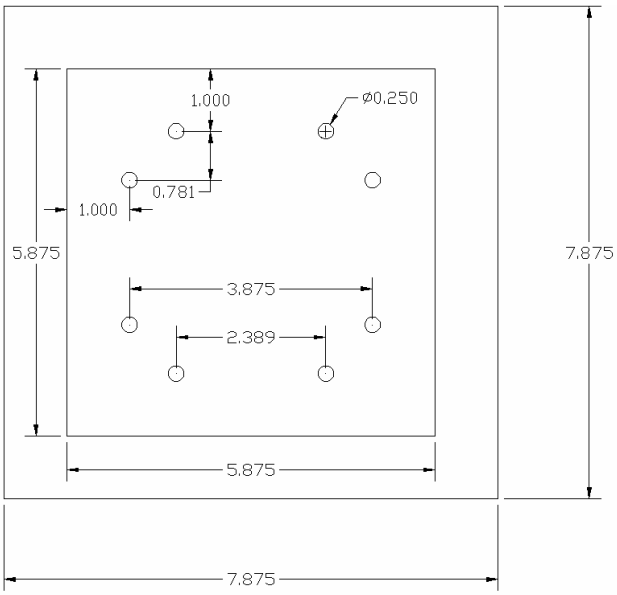

Figure 2: Payload 08 Modified HASP-Provided Mounting Plate

C. If you are flying anything that is potentially hazardous to HASP or the ground crew before or after launch, please supply all documentation provided with the hazardous components (i.e. pressurized containers, radioactive material, projectiles, rockets…)

The WVU HART's payload will not contain any exotic, potentially hazardous materials. However, hazardous potentials still exist. The WVU HART's payload carries an inherent risk due to its vast abundance of electronics. Any time that electronics are active and the power is on, there exists the risk of accidental electric shock or accidental electrocution. The highest voltage contained within the current electrical configuration nears 1250 VDC, an amount considered to be high voltage (i.e. voltage above 500 V), which is very hazardous to the human body. Thus, certain procedures must be followed when handling the WVU HART's payload. Whenever the Styrofoam® protective case is removed from the exterior of the payload, the power supplied to the electronics must be turned off before the removal of the case. Furthermore, if the electronics are to be maintained or measured, precaution and common sense must be used abundantly. One may note that all of the electronics contained within WVU HART's payload will be properly protected, and a high voltage warning sign will be affixed to the exterior Styrofoam® casing of the package.

Additionally, the Styrofoam® pieces, the MSDS of which may be found in Appendix B, were bonded with Loctite® Brand epoxies. Two different types of epoxies were used to construct this payload, specifically 5 Minute Instant Epoxy and 5 Minute Quick Set Epoxy, both MSDS's of which are included in Appendix A. Lastly, an MSDS in Appendix A is provided for the scintillation crystal, even though it will be permanently encased in an aluminum housing, within the Styrofoam® protective core. However, one may note that all of these hazards are relatively low-risk hazards, as long as the proper precautions are taken with the electronics.

D. Other relevant mechanical information

No other relevant mechanical information is applicable at this time.

II. Power Specifications:

A. Measured current draw at 30 VDC

Since the WUV HART does not know the specifics of the HASP payloads supplied power, and the fact that it did not have a 30 VDC power supply available, it measured the current draw of its components at 35 VDC, which is presented in Table 2. One may note from Table 2 that the WVU HART current draw will be significantly below that of the maximum allowed current draw of 0.5 A.

Table 2: WVU HART Power Consumption

Electrical Component	Measured Current Draw @ 35V
DP4/PC4-2 (Amptek Assembly)	5 mA
SBC (TS-5400)	140 mA
ADC (TS-9700)	10 mA
Scintillation Detector	6 mA
Total Current Draw	161 mA

B. If HASP is providing power to your payload, provide a power system wiring diagram starting from pins on the student payload interface plate EDAC 516 connector through your power conversion to the voltages required by your subsystems.

Figure 3 (next page) introduces an overview diagram, at the systems level, of the WVU HART electronics package.

A power system wiring diagram is provided in Figure 4 (page 8). Several observations may be made from this diagram. First, two DC-to-DC converters convert the 28 VDC supplied by HASP to both 12 VDC and 5 VDC. The 12 VDC is then converted to 1500 VDC high-voltage that supplies the scintillation detector. The 5 VDC powers the AMPTEK DP4 Digital Pulse Processor. Furthermore, one may note the switches that accompany the DC-to-DC converters. These switches have been installed to limit the current transients encountered during startup of the electronic

hardware, enabling a "slow, soft start" of the hardware. In addition, a positive regulator is used to supply a 3.3 V power source for the GPS.

Figure 5 (next page) presents schematics for several miscellaneous electrical components contained within the WVU HART electronics package, including power schematics for the GPS receiver, the temperature sensors, and the LED indicators.

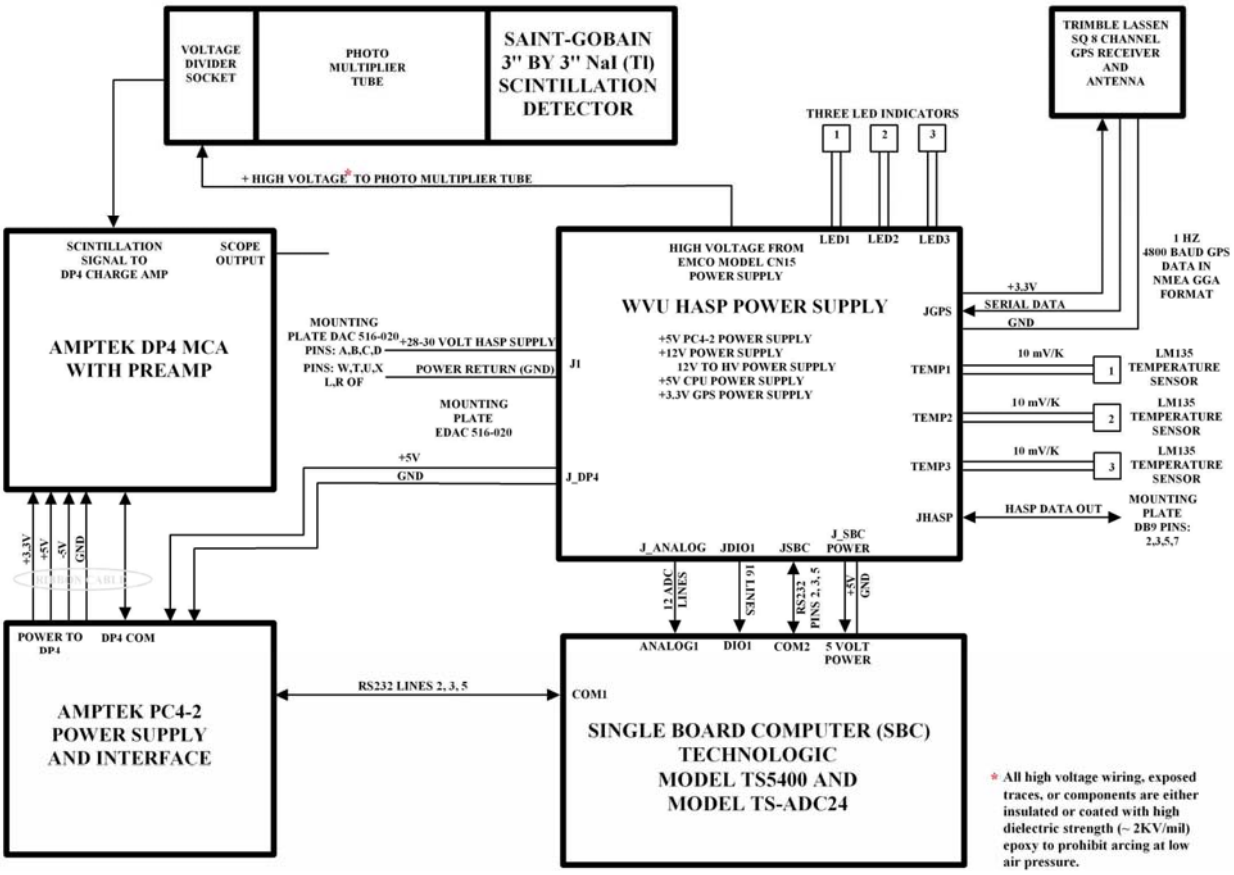

Figure 3: WVU HART System Overview Block Diagram

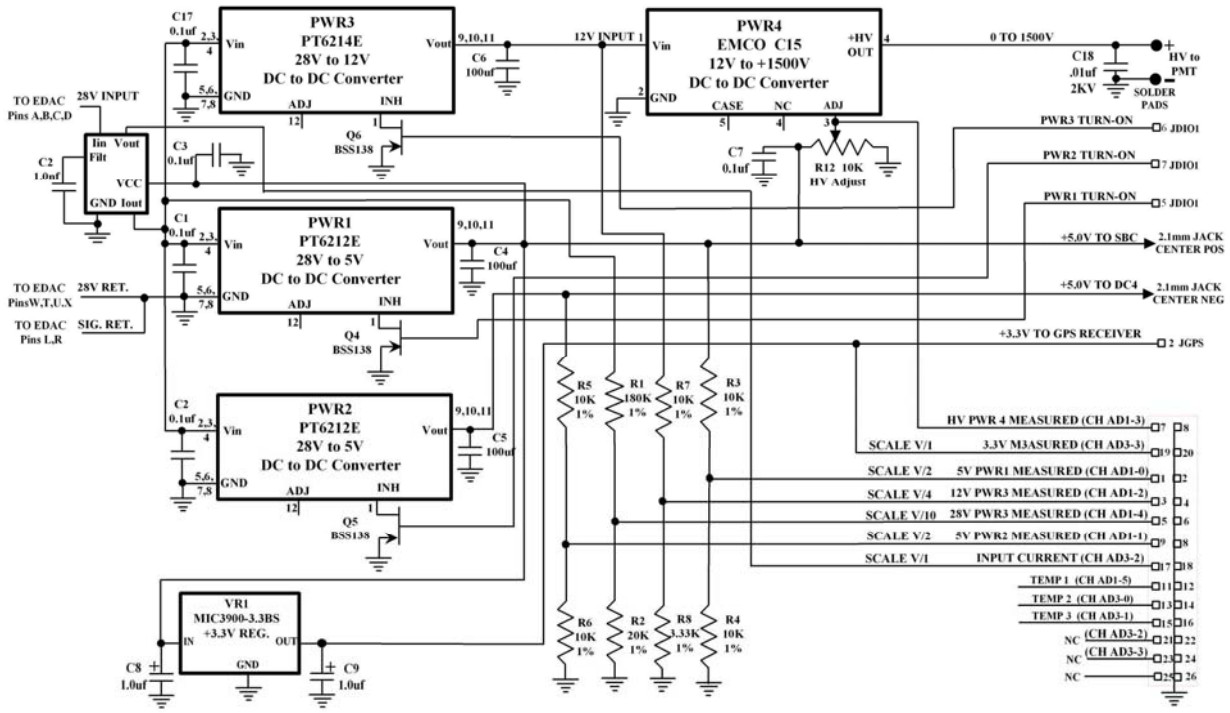

Figure 4: WVU HART Power Supply Diagram for Major Components

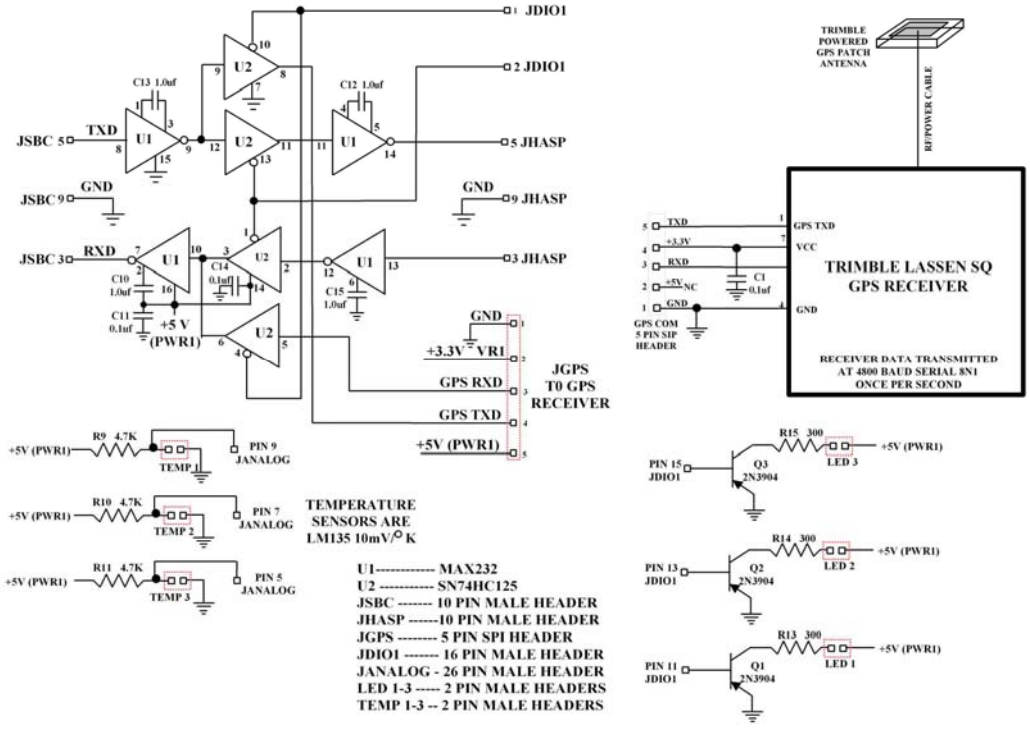

Figure 5: WVU HART Power Supply Diagram for Peripheral Components

C. Other relevant power information.

No other relevant power information is applicable at this time.

III. Downlink Telemetry Specifications:

A. **Serial data downlink format**: Stream (Packetized) (circle one)

B. Approximate serial downlink rate (in bits per second)

50 – 60 bits per second (averaged over the transmission period)

C. Specify your serial data record including record length and information contained in each record byte.

Approximately every 60 seconds, a diagnostic record will downlink via the HASP primary payload. Table 3 (next page) presents a breakdown of the contents of each record. Each record will be 313 bytes in length. In addition to the regular status records, the payload may also downlink a data packet upon manual command, uplinked from HASP (See *Uplink Modifications*). The data packet will consist of 270 bytes of data, as outlined in Table 4 (next page), that can be used to confirm proper data collection by the payload. All these records will be transmitted at 1200 baud via the HASP serial connection.

Table 3: Diagnostic Record

Byte	Description
0-13	Record Header (“WVU_HASP_2009”)
14-17	Record Number
18-37	Date & Time
38-45	SBC Status
46-53	ADC Status
54-62	DP4 Communication Status
63-70	DP4 Status Packet Acquisition Status
71-79	DP4 Configuration Status
80-87	DP4 Spectrum Acquisition Status
88-93	GPS Status
94-97	PWR1 Status
98-101	PWR2 Status
102-105	PWR3 Status
106-249	ADC Individual Channel Readings
250-261	GPS – Time Code
262-273	GPS – Latitude & Card. Sign
274-286	GPS – Longitude & Card. Sign
287-288	GPS – Fix Quality
289-291	GPS – Satellites
292-301	GPS – Altitude
302-311	Last 5 Manual Commands Received
312	Record End Byte (<CR>)

Table 4: Data Packet Record

Byte	Description
0-17	Record Header (“WVU_HASP_2009_DATA”)
18-21	Data Record Number
22-41	Date & Time
42-45	Data Collection Cycle Number
46-56	DP4 – Last Cycle Detection Data (Fast Count)
57-67	DP4 – Last Cycle Detection Data (Slow Count)
68-74	DP4 – Last Cycle Detection Data (Accumulation Time)
75-78	DP4 – Board Temperature Reading
79-168	DP4 – Ten (10) Sample Channel Readings
169-268	GPS – Raw GPS String
269	Record End Byte (<CR>)

D. **Number of analog channels being used**: 0

E. **If analog channels are being used, what are they being used for?** N/A

F. **Number of discrete lines being used**: 0

G. **If discrete lines are being used what are they being used for?** N/A

H. **Are there any on-board transmitters? If so, list the frequencies being used and the transmitted power.** No

I. Other relevant downlink telemetry information.

No other relevant downlink telemetry information is applicable at this time.

IV. Uplink Commanding Specifications:

A. **Command uplink capability required**: (Yes) No (circle one)

B. **If so, will commands be uplinked in regular intervals**: Yes (No) (circle one)

C. How many commands do you expect to uplink during the flight (can be an absolute number or a rate, i.e. *n commands per hour*)

Ideally, it will not be necessary to uplink any commands during flight. This capability will only be utilized in the event of a malfunction or any other off-nominal event. Therefore, a specific number or rate is not possible to specify, at this time.

D. Provide a table of all of the commands that you will be uplinking to your payload

While all specific manual commands have not yet been determined, they currently include, but are not limited to, those listed in Table 5.

Table 5: Diagnostic Record

Command Byte Value (Hex)	Description
0x1A	Complete Restart
0x2B	Cycle Power to DP4/PC4
0x3C	Cycle Power to Scintillation Detector
0x4D	Transmit Data Record
0x5E	End Current Detection Cycle

E. Are there any on-board receivers? If so, list the frequencies being used.

The payload has a GPS receiver operating at the standard civilian L1 band at 1575.42 MHz

F. Other relevant uplink commanding information.

No other relevant uplink telemetry information is applicable at this time.

V. Integration and Logistics

A. **Date and Time of your arrival for integration**:

Sunday, August 2nd, 2009 (i.e. 8-2-2009)

B. **Approximate amount of time required for integration**: 5-7 hours (maximum)

C. **Name of the integration team leader**: Kyle Phillips

D. **Email address of the integration team leader**: kphilli1@mix.wvu.edu

E. **List ALL integration participants (first and last names) who will be present for integration with their email addresses**:

Table 6: WVU HART Integration Members

WVU HART Team Member	WVU HART Member's E-mail
Lee Blake (Software Engineer)	leepaulblake@hotmail.com
Mehran Mohebbi (Project Lead)	mmohebbi@mix.wvu.edu
Kyle Phillips (Integration Lead)	kphilli1@mix.wvu.edu
Dr. John Kuhlman (Faculty Advisor)	John.Kuhlman@mail.wvu.edu
Dr. Mike Palmer (Faculty Advisor)	gmpalmer@verizon.net

F. **Define a successful integration of your payload**:

The integration of the WVU HART payload will be considered to be successful upon the completion of the integration process outlined in Section G.

G. **List all expected integration steps**:

On Monday, August 3rd, the integration team leader, Kyle Phillips, and WVU HART, will initiate final inspections, mechanically and electronically, on the WVU HART payload, with the help of the integration participants listed in Table 2 (Section E). The final mechanical inspections will include, but not be limited to, checking bolt tightness, inspection of epoxy adhesives and the seals created by those adhesives, and overall structural support of all electronics. The final electrical inspections will include, but not be limited to performing, both hardware and software diagnostics. Hardware diagnostics may include such steps as the observation of startup current transients and the observation of voltage levels throughout the circuit boards, in addition to ensuring the current draw and power requirements are within limits. Software diagnostics may include such steps as running a typical radiation detection software simulation, without the use of a radiation source. During this simulation, all of the systems will function as if they were in a flight-ready status. The simulation will record test data and run the hardware in a simulated flight-ready status manner. This will allow the WVU HART to observe the operation of both the hardware and the software in a simulated flight mode. Any faults found in either

the mechanical or the electrical inspections will be promptly and completely resolved, using any WVU HART materials and tools necessary.

Additionally, the WVU HART requests use of the NASA CSBF Thermal and Vacuum Chamber, as specified in the overall HASP integration procedure, to test for pressure and temperature levels, as well as electrical arching at altitude, a problem believed to have been encountered in previous failures. Furthermore, the Thermal and Vacuum Chamber test will ensure the proper functioning of the payload at environmental conditions encountered throughout flight, testing the mechanical and electrical systems of the WVU HART's payload.

On Tuesday, August 4th, 2008 (i.e. 8-4-2008) the WVU HART is scheduled for their official integration with the primary HASP payload. The integration process will be very similar to the final inspections that will be carried out on August 3rd. First, the WVU HART will complete the mechanical integration with the primary HASP payload at its designated position (i.e. Payload 08). The mounting of the payload will be inspected thoroughly to ensure a tight and secure mechanical integration. In addition, a quick mechanical inspection of the WVU HART's payload will include inspection of the electronic mounting within the payload, an inspection of the frame, an inspection of the mounting between the frame and the HASP-supplied PVC mounting plate. After the electronic integration, an inspection of the final and secure position of the Styrofoam® protective and insulating case will be carried out, completing the mechanical integration of WVU HART's payload. Additionally, as previously alluded to, an electrical integration is also very necessary, as a connection must exist between the primary HASP payload and the WVU HART's payload. After a successful physical electrical integration, and after a proper inspection of the electrical connection between HASP and the WVU HART payload, the remainder of the electrical integration will also be similar to the electrical inspection performed on August 3rd. However, a foremost electrical diagnostic that must be run is to ensure that there is proper communication between the WVU HART payload and the primary HASP payload. Once a successful connection between the two payloads has been fully established, a software simulation will be run, as was completed on August

3rd. Once again, as completed on August 3rd, after all hardware and software diagnostics have been run and found to run successfully, the integration of the WVU HART's payload will be considered to have been successfully integrated, at that time. The entire integration of the WVU HART's payload is expected to take no longer than a maximum of 5-7 hours. Again, any faults found in either the mechanical or the electrical inspections will be promptly and completely resolved using any WVU HART materials and tools necessary. Lastly, one may note that the WVU HART's HASP Flight Operation Plan will accompany the WVU HART to NASA's CSBF, and will be submitted at that time.

H. **List all checks that will determine a successful integration**: See Section G

I. **List any additional LSU personnel support needed for a successful integration other than directly related to the HASP integration (i.e. lifting, moving equipment, hotel information/arrangements, any special delivery needs…)**:

The WVU HART does not expect that any LSU personnel, except those overlooking the integration process, or LSU equipment will be needed. However, small hand tools and technical advice may be needed, as unforeseen events could arise.

J. **List any LSU supplied equipment that may be needed for a successful integration**: See Section I.

Appendix A
MSDS Sheets

Styrofoam® MSDS (Reference: http://building.dow.com/styrofoam/na/res-us/products)

Material Safety Data Sheet
The Dow Chemical Company

Product Name: STYROFOAM* R3 Residential Foam Sheathing Insulation

Issue Date: 02/21/2007

Print Date: 22 Feb 2007

The Dow Chemical Company encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. Product and Company Identification

Product Name
STYROFOAM* R3 Residential Foam Sheathing Insulation

COMPANY IDENTIFICATION
The Dow Chemical Company
2030 Willard H. Dow Center
Midland, MI 48674
USA

Customer Information Number: 800-258-2436

EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: 989-636-4400
Local Emergency Contact: 989-636-4400

2. Hazards Identification

Emergency Overview
Color: Blue
Physical State: Board
Odor: Odorless
Hazards of product:

Toxic fumes may be released in fire situations.

OSHA Hazard Communication Standard
This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential Health Effects
Eye Contact: Solid or dust may cause irritation or corneal injury due to mechanical action. Fumes/vapor released during thermal operations such as hot-wire cutting may cause eye irritation.
Skin Contact: Essentially nonirritating to skin. Mechanical injury only.
Skin Absorption: Skin absorption is unlikely due to physical properties.

* Indicates a Trademark

Inhalation: Dust may cause irritation to upper respiratory tract (nose and throat). Fumes/vapors released during thermal operations such as hot wire cutting may cause respiratory irritation. Concentrations of the blowing agents anticipated incidental to proper handling are expected to be well below those which cause acute inhalation effects and below exposure guidelines.
Ingestion: Swallowing is unlikely because of the physical state. Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts. May cause choking or blockage of the digestive tract if swallowed.

3. Composition Information

Component	CAS #	Amount
Styrene, polymers	9003-53-6	> 85.0 %
1-Chloro-1,1-difluoroethane	75-68-3	< 10.0 %
Copolymer mixture	Not applicable	< 15.0 %
Talc	14807-96-6	< 5.0 %

Extruded polystyrene foam containing a halogenated flame retardant system.

4. First-aid measures

Eye Contact: Flush eyes with plenty of water; remove contact lenses after the first 1-2 minutes then continue flushing for several minutes. Only mechanical effects expected. If effects occur, consult a physician, preferably an ophthalmologist.
Skin Contact: Wash skin with plenty of water.
Inhalation: Move person to fresh air; if effects occur, consult a physician.
Ingestion: If swallowed, seek medical attention. May cause gastrointestinal blockage. Do not give laxatives. Do not induce vomiting unless directed to do so by medical personnel.
Notes to Physician: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. Fire Fighting Measures

Extinguishing Media: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam.
Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Soak thoroughly with water to cool and prevent re-ignition. If material is molten, do not apply direct water stream. Use fine water spray or foam. Cool surroundings with water to localize fire zone.
Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.
Unusual Fire and Explosion Hazards: Mechanical cutting, grinding or sawing can cause formation of dusts. To reduce the potential for dust explosion, do not permit dust to accumulate. This product contains a flame retardant to inhibit accidental ignition from small fire sources. This plastic foam product is combustible and should be protected from flames and other high heat sources. For more information, contact Dow. Dense smoke is produced when product burns.
Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. In smoldering or flaming conditions, carbon monoxide, carbon dioxide and carbon are generated. Combustion products may include and are not limited to: Hydrogen fluoride. Hydrogen chloride. Combustion products may include trace amounts of: Hydrogen bromide. Based on combustion toxicity testing, the effects of combustion from this foam are not more acutely toxic than the effects of combustion from common building materials such as wood.

Product Name: STYROFOAM* R3 Residential Foam Sheathing Insulation **Issue Date:** 02/21/2007

6. Accidental Release Measures

Steps to be Taken if Material is Released or Spilled: Contain spilled material if possible. Sweep up. Collect in suitable and properly labeled containers. See Section 13, Disposal Considerations, for additional information.
Personal Precautions: There are no special required instructions.
Environmental Precautions: There are no special required instructions.

7. Handling and Storage

Handling

General Handling: This product is combustible and may constitute a fire hazard if improperly used or installed. When installed, this product should be adequately protected as directed by national building regulations or instructions in the specific application brochure. Fabrication methods which involve cutting into this product may release the blowing agent(s) remaining in the cells. Provide adequate ventilation to assure localized concentrations in release areas are maintained below the lower flammable limit. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Storage

Minimize sources of ignition, such as static build-up, heat, spark or flame. When large quantities of this product are stored or fabricated, blowing agents may be released. Released blowing agents may thermally decompose to form gases which may accelerate corrosion or rust formation of heaters, boilers, gas fired recirculating air furnaces or heaters, or gas water heaters. Flammable vapors may accumulate in some storage situations. In order to prevent buildup of combustible vapors, do not store large quantities of this product in unventilated spaces.

8. Exposure Controls / Personal Protection

Exposure Limits

Component	List	Type	Value
1-Chloro-1,1-difluoroethane	WEEL	TWA	4,100 mg/m3 1,000 ppm

Concentrations of the blowing agents anticipated incidental to proper handling are expected to be well below those which cause acute inhalation effects and below exposure guidelines.

Personal Protection

Eye/Face Protection: Eye protection should not be necessary. For fabrication operations safety glasses are recommended. If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles.
Skin Protection: No precautions other than clean body-covering clothing should be needed.
Hand protection: Chemical protective gloves should not be needed when handling this material. Consistent with general hygienic practice for any material, skin contact should be minimized. Use gloves to protect from mechanical injury. Selection of gloves will depend on the task.
Respiratory Protection: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, including but not limited to saw, router or hot-wire cutting, use an approved air-purifying respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.
Ingestion: No precautions necessary due to the physical properties of the material.

Engineering Controls

Ventilation: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

9. Physical and Chemical Properties

Physical State	Board
Color	Blue
Odor	Odorless
Flash Point - Closed Cup	Not applicable
Flammable Limits In Air	**Lower:** Not applicable **Upper:** Not applicable
Autoignition Temperature	354 °C (669 °F) *ASTM D1929*
Vapor Pressure	Not applicable
Boiling Point (760 mmHg)	Not applicable.
Vapor Density (air = 1)	Not applicable
Specific Gravity (H2O = 1)	0.027 - 0.064 *Estimated*
Liquid Density	Not applicable
Freezing Point	Not applicable
Melting Point	90 - 130 °C (194 - 266 °F) *Estimated*
Solubility in Water (by weight)	insoluble in water
pH	Not applicable
Kinematic Viscosity	Not applicable

10. Stability and Reactivity

Stability/Instability
Thermally stable at typical use temperatures.
Conditions to Avoid: Avoid temperatures above 300°C (572°F) Exposure to elevated temperatures can cause product to decompose. Avoid direct sunlight.

Incompatible Materials: Avoid contact with oxidizing materials. Avoid contact with: Aldehydes. Amines. Esters. Liquid fuels. Organic solvents.

Hazardous Polymerization
Will not occur.

Thermal Decomposition
Does not normally decompose. Evolution of small amounts of hydrogen halides occur when heated over 250°C (482°F). Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Aromatic compounds. Aldehydes. Ethylbenzene. Hydrogen bromide. Hydrogen fluoride. Polymer fragments. Styrene. Under high heat, non-flaming conditions, small amounts of aromatic hydrocarbons such as styrene and ethylbenzene are generated.

11. Toxicological Information

Repeated Dose Toxicity
Based on available data, repeated exposures are not anticipated to cause significant adverse effects. Additives are encapsulated in the product and are not expected to be released under normal processing conditions or foreseeable emergency.

12. Ecological Information

CHEMICAL FATE

Movement & Partitioning

No bioconcentration is expected because of the relatively high molecular weight (MW greater than 1000). In the terrestrial environment, material is expected to remain in the soil. In the aquatic environment, material is expected to float.

Persistence and Degradability

Surface photodegradation is expected with exposure to sunlight. No appreciable biodegradation is expected. Chlorodifluoroethane (HCFC-142b) remains in the foam and diffuses out slowly, most of it degrading in the troposphere to CO2, HCl, and HF. Chlorodifluoroethane (HCFC 142b) has a stratospheric ozone depletion potential (ODP) of 0.065, relative to CFC 12 (ODP=1).

ECOTOXICITY

Not expected to be acutely toxic to aquatic organisms.

13. Disposal Considerations

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. DOW HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Recycler. Reclaimer. Landfill. Incinerator or other thermal destruction device. As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Group at 1-800-258-2436 or 1-989-832-1556 (U.S.), or 1-800-331-6451 (Canada) for further details.

14. Transport Information

DOT Non-Bulk
NOT REGULATED

DOT Bulk
NOT REGULATED

IMDG
NOT REGULATED

ICAO/IATA
NOT REGULATED

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. Regulatory Information

OSHA Hazard Communication Standard

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	No
Delayed (Chronic) Health Hazard	No
Fire Hazard	No
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313

This product contains the following substances which are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and which are listed in 40 CFR 372.

Component	CAS #	Amount
1-Chloro-1,1-difluoroethane	75-68-3	<= 10.0 %

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Component	CAS #	Amount
1-Chloro-1,1-difluoroethane	75-68-3	<= 10.0 %
Talc	14807-96-6	< 5.0 %

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

Toxic Substances Control Act (TSCA)

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30

CEPA - Domestic Substances List (DSL)

All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

16. Other Information

Hazard Rating System

NFPA	Health	Fire	Reactivity
	0	1	0

Recommended Uses and Restrictions

Thermal insulation. For industrial use. Dow recommends that you use this product in a manner consistent with the listed use. If your intended use is not consistent with Dow's stated use, please contact Dow's Customer Information Group.

Product Name: STYROFOAM* R3 Residential Foam Sheathing Insulation **Issue Date:** 02/21/2007

Revision

Identification Number: 81892 / 0000 / Issue Date 02/21/2007 / Version: 2.0
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

N/A	Not available
W/W	Weight/Weight
OEL	Occupational Exposure Limit
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
DOW IHG	Dow Industrial Hygiene Guideline
WEEL	Workplace Environmental Exposure Level
HAZ_DES	Hazard Designation
Action Level	A value set by OSHA that is lower than the PEL which will trigger the need for activities such as exposure monitoring and medical surveillance if exceeded.

Epoxy MSDS (Reference: http://www.henkelcamsds.com/product.asp)

HENKEL CONSUMER ADHESIVES 03/20/07
AVON, OH 44011
TELEPHONE: (440) 937-7000

MATERIAL SAFETY DATA SHEET Page 01 of 04

Loctite Quick Set 5 minute Epoxy Instant Mix
01-06924

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Loctite Quick Set 5 minute Epoxy Instant Mix
Item No.: 01-06924
Product Type: Epoxy

2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredients	CAS No.	%
RESIN		
Bisphenol A epoxy resin	25068-38-6	60-100
HARDENER		
Mercaptan termninated polymer	Proprietary*	60-100
*New Jersey trade secret registry number	33611900-5145KP	
Modified Amine	52338-87-1	0-20

3. HAZARDS IDENTIFICATION

Toxicity: Causes eye and skin irritation.
May cause sensitization by skin contact.
May cause respiratory tract irritation.

Primary Routes of Entry: Ingestion, skin, inhalation, eye contact
Signs and Symptoms of Exposure: Eye or skin irritation or injury. Allergic responses such as sensitization or dermatitis.
Existing Conditions Aggravated by Exposure: Skin disorders. Skin allergies. Respiratory disorders. Eye disorders. Asthma

4. FIRST AID MEASURES

Ingestion: Do not induce vomiting. Keep individual calm. Obtain medical attention.
Inhalation: Remove to fresh air. If symptoms persist, obtain medical attention.
Skin Contact: Wash immediately with soap and water. Do not use solvents for cleaning skin. If irritation should develop, consult physician.
Eye Contact: Flush with plenty of water for 20 minutes and get prompt medical attention. Washing within one minute is essential to achieve maximum effectiveness.

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MATERIAL SAFETY DATA SHEET Page 02 of 04

Product Name: Loctite Quick Set 5 minute Epoxy Instant Mix
Item No.: 01-06924

5. FIRE FIGHTING MEASURES

Flash Point: > 150°C (302°F) Method: Tag Closed Cup

Recommended Extinguishing Agents: Water spray (fog) Carbon dioxide, foam, dry chemical

Special Firefighting Procedures: Wear self-contained breathing apparatus and full protective clothing, such as turn-out gear. Toxic gases may be released during fire.

Hazardous Products formed by Fire or Thermal Decomp: phenolics, carbon monoxide, carbon dioxide, oxides of sulphur and nitrogen.

Unusual Fire or Explosion Hazards: The smoke may contain polymer fragments of varying compositions.

Explosive Limits:
(% by volume in air) Lower Not available
(% by volume in air) Upper Not available

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken in case of spill or leak: Wear appropriate personal protective equipment. Wipe up or absorb on suitable material and shovel up. Prevent entry into sewers and waterways. Avoid contact with skin, eyes or clothing.

7. HANDLING AND STORAGE

Handling: Ensure good ventilation during processing. Do not breathe mist or vapors. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Storage: Store between 35 and 120°F. Store in original container until rea to use. Keep in a cool, well-ventilated area away.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Eyes: Safety glasses or goggles.

Skin: Rubber gloves. Immediately remove all contaminated clothing.

Ventilation: For the product at ambient temperature, use adequate ventilation.
For the heated product, use exhaust ventilation to remove vapor.

Respiratory: No respiratory protection should be needed.

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MATERIAL SAFETY DATA SHEET Page 03 of 04

Loctite Quick Set 5 minute Epoxy Instant Mix
01-06924

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Viscous liquid
Appearance:	Hardener: clear liquid Resin: colourless to pale yellow
Odor:	Hardener: unpleasant/epoxy Resin: mild
Boiling Point:	> 500°F (resin)
pH:	6-7 (resin); 3-5 (hardener)
Solubility in Water:	Hardener:dispersable in water Resin: negligible(in water)
Specific Gravity	Resin 1.18 , Hardener 1.1
Vapor Pressure:	< 0.13 @ 356°F (kPa), resin
Viscosity (@86°F):	Resin: 6000-8000 cps, Hardener: 10000-15000 cps

10. STABILITY AND REACTIVITY

Stability:	Stable at normal temperature and pressure.
Hazardous Polymerization:	Will not occur
Incompatibility:	Strong oxidizers, acids, Halogonated compounds. Strong mineral acids. Reactive materials. Calcium hypocholrite. Sodium hypochlorite. Nitrous acid and other nitrosating agents.
Conditions to Avoid:	This product is normally stable and is not reactive with water Excessive heat. Storage with incompatible materials.

11. TOXICOLOGICAL INFORMATION

Toxicity (resin): >5,000 mg/kg (LD50 - Rat)
(hardener): >2,000 mg/kg (LD50 - Rat)

Irritating to skin and eyes.

12. ECOLOGICAL INFORMATION

Ecological toxicity:
Large quantities of product should not be allowed to enter drains or water courses or be deposited where it can affect ground or surface water.
Degradability (resin):
Theoretical oxygen demand (ThoD)is calculated to be 2.35p/p. In the atmospheric environment, material is estimated to have a tropospheric half life of 1.92 hr.

13. DISPOSAL CONSIDERATIONS

Recommended methods of disposal: Dispose of in accordance with federal, state and local regulations.

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MATERIAL SAFETY DATA SHEET Page 04 of 04

Product Name: Loctite Quick Set 5 minute Epoxy Instant Mix
Item No.: 01-06924

14. TRANSPORTATION INFORMATION

DOT (49 CFR 172) Domestic Ground Transport
Proper Shipping Name: Not regulated for transport

IATA
Proper Shipping Name: Not regulated for transport

IMO/IMDG
Proper Shipping Name: Not regulated for transport

15. REGULATORY INFORMATION

CA Proposition 65: No Prop65 chemicals are known to be present.

16. OTHER INFORMATION

TSCA 8(b) Inventory Status: All components are listed or are exempt from listing on the Toxic Substances Control Act Inventory.
TSCA 12 (b) Export Notification: None

CERCLA/SARA Section 302 EHS: None above reporting de minimus.
CERCLA/SARA Section 311/312: None.
CERCLA/SARA Section 313: None above reporting de minimus.

Estimated HMIS(R) Code:
Health Hazard: 1
Flammability Hazard: 1
Reactivity Hazards: 0
Personal Protection: See Section 8.

HMIS is a registered trademark of the National Paint and Coatings Assn.

Prepared by:
Company: Henkel Consumer Adhesive
Regulatory Affairs (440) 937-7000

HENKEL CORPORATION 02/19/08
AVON, OH 44011
TELEPHONE: (440) 937-7000

MATERIAL SAFETY DATA SHEET Page 01 of 05

Quick Set(TM) Epoxy Hardener

HARDENER

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Quick Set(TM) Epoxy Hardener
Part No.: QM-50
Product Type: Epoxy hardener

2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredients	CAS No.	%
Polymercaptan	Proprietary	80-85
Substituted aminophenol	90-72-2	5-10
Nonylphenol	25154-52-3	3-5
Heptakis (dipropyleneglycol) triphosphite	116265-68-0	1-3

Ingredients which have exposure limits

Exposure Limits (TWA) Ingredients	ACGIH (TLV)	OSHA (PEL)	OTHER

Exposure Limits (STEL) Ingredients	ACGIH (TLV)	OSHA (PEL)

3. HAZARDS IDENTIFICATION

Toxicity: Skin and eye irritant. Possible respiratory irritant. The aminophenol can cause severe irritation and may be corrosive on prolonged contact. It may be a sensitizer. It can also be corrosive to eye tissue leading to permanent injury including blindness. It may irritate the respiratory tract and may cause delayed lung damage upon overexposure to fumes or vapors. It can also cause fatigue, muscular weakness, labored breathing, or gastrointestinal irritation if swallowed. The relatively low concentration of the aminophenol in the product may minimize some or all of these effects.

Primary Routes of Entry: Skin, ingestion, inhalation.

Signs and Symptoms of Exposure: Eye, skin, respiratory, or gastrointestinal irritation. It is possible that such irritation may be severe and lead to burns. Allergic

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MATERIAL SAFETY DATA SHEET Page 02 of 05

Product Name: Quick Set(TM) Epoxy Hardener

3. HAZARDS IDENTIFICATION (continued)

reactions may occur.
Existing Conditions
Aggravated by Exposure: Skin, eye, lung conditions.

Ingredients	Literature Referenced Target Organ and Other Health Effects	Carcinogen NTP	IARC	OSHA
Polymercaptan	No Data	NO	NO	NO
Substituted aminophenol	ALG IRR	NO	NO	NO
Nonylphenol	ALG COR IRR KID	NO	NO	NO
Heptakis (dipropyleneglycol) triphosphite	No Data	NO	NO	NO

Abbreviations

ALG Allergen
IRR Irritant
COR Corrosive
KID Kidney

4. FIRST AID MEASURES

Ingestion: Do not induce vomiting. Keep individual calm. Obtain medical attention.
Inhalation: Remove to fresh air. If symptoms persist, obtain medical attention.
Skin Contact: Wash with soap and water.
Eye Contact: Flush at least 15 minutes with water. Obtain medical attention.

5. FIRE FIGHTING MEASURES

Flash Point: More than 200øF Method: Tag Closed Cup
Recommended Extinguishing Agents: Carbon dioxide, foam, dry chemical
Special Firefighting Procedures: Not available
Hazardous Products formed by Fire or Thermal Decomp: Oxides of carbon, sulfur, nitrogen and phosphorus, phosphite/phosphate esters, hydrocarbon fragments, hydrogen sulfide, phenols, phosphine.
Unusual Fire or Explosion Hazards: None

Explosive Limits:
(% by volume in air)Lower Not available
(% by volume in air)Upper Not available

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MATERIAL SAFETY DATA SHEET Page 03 of 05

Product Name: Quick Set(TM) Epoxy Hardener

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken in case of spill or leak: Take up with an inert absorbent. Store in a closed container until disposal.

7. HANDLING AND STORAGE

Safe Storage: Store below 110øF.
(Contact Loctite Customer Service 1-800-243-4874 for shelf life information)
Handling: Avoid skin contact. Keep away from eyes. Do not breathe vapors.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Eyes: Safety glasses or goggles.
Skin: Rubber or plastic gloves.
Ventilation: Local exhaust ventilation should be provided.
Respiratory NIOSH/MSHA approved organic cartridge respirator if ventilation is inadequate.

See Section 2 for Exposure Limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Colorless, viscous liquid.
Odor:	Unpleasant
Boiling Point:	More than 300øF
pH:	Does not apply
Solubility in Water:	Slight
Specific Gravity	1.08
Volatile Organic Compound (EPA Method 24)	11.08%; 119.7 grams per liter
Vapor Pressure:	Less than 5mm at 80øF
Vapor Density:	Not available
Evaporation Rate (Ether = 1)	Not available

10. STABILITY AND REACTIVITY

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility:	Strong oxidizing agents, epoxy/amine mixtures. Possibly acids, peroxides, acetaldehyde, caustics.
Conditions to Avoid:	Not available
Hazardous Decomposition Products (non-thermal):	None

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MATERIAL SAFETY DATA SHEET Page 04 of 05

Product Name: Quick Set(TM) Epoxy Hardener

11. TOXICOLOGICAL INFORMATION

See Section 3.

12. ECOLOGICAL INFORMATION

No data available

13. DISPOSAL CONSIDERATIONS

Recommended methods of disposal: Incinerate following EPA and local regulations.
EPA Hazardous Waste Number: NH - Not a RCRA Hazardous Waste Material

14. TRANSPORTATION INFORMATION

DOT (49 CFR 172)
Domestic Ground Transport
Proper Shipping Name: Unrestricted
Hazard Class or Division: Unrestricted
Identification Number: None
Marine Pollutant: None
IATA
Proper Shipping Name: Unrestricted
Class or Division: Unrestricted
UN or ID Number: None

15. REGULATORY INFORMATION

CA Proposition 65: No Californis Proposition 65 chemicals are known to be present.

16. OTHER INFORMATION

Estimated NFPA(R) Code:
Health Hazard: 2
Fire Hazard: 1
Reactivity Hazard: 0
Specific Hazard: Does not apply

Estimated HMIS(R) Code:
Health Hazard: 2*
Flammability Hazard: 1
Reactivity Hazards: 0
Personal Protection: See Section 8.

NFPA is a registered trademark of the National Fire Protection Assn.
HMIS is a registered trademark of the National Paint and Coatings Assn.

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TELEPHONE: (440) 937-7000

MATERIAL SAFETY DATA SHEET Page 05 of 05

Product Name: Quick Set(TM) Epoxy Hardener

16. OTHER INFORMATION (continued)

Prepared by:
Company: Regulatory Affairs - North America,
Henkel Consumer Adhesives Inc. 32150 Just Imagine Dr, Avon OH 44011
(24hr.) Phone: (800) 321-1733

Sodium Iodide Thallium Activated NA(Tl) Crystal MSDS Sheet

(Reference: http://www.detectors.saint-gobain.com/home.asp)

March 2007

MATERIAL SAFETY DATA SHEET

PRODUCT: SODIUM IODIDE (TL) SCINTILLATION CRYSTAL

SECTION I SUPPLIER INFORMATION

Common Name	: Sodium Iodide (Tl) Scintillation Crystal
Chemical Name	: Sodium Iodide Thallium Activated
Formula	: NaI/Tl
Product CAS #	: 7681-82-5/7790-30-9
Supplier	: Saint-Gobain Crystals
Address	: 12345 Kinsman Road
City, State, Zip	: Newbury, OH 44065
Phone	: 440-564-2251

EMERGENCY PHONE #: ChemTrec 1-800-424-9300

SECTION II HAZARDOUS INGREDIENT INFORMATION

INGREDIENT	% Wt.	PEL-OSHA	TLV-ACGIH
Thallium Iodide (as Tl) CAS #: 7790-30-9	< 1	0.1 mg/m^3 SKIN	0.1 mg/m^3 SKIN
Sodium Iodide CAS #: 7681-82-5	99-100	None established	None established

INGREDIENT HAZARD STATEMENT

NOTE: Due to formed nature of this product, no airborne concentrations are expected.
May cause eye and skin irritation.
Harmful if swallowed.

Unless otherwise noted, all values are reported as 8-hour Time-Weighted Averages (TWAs) and total dust (particulates only). All ACGIH TLVs refer to the 2006 Standards.

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point	: 1300°C
Specific Gravity (H_2O=1)	: 3.7
Melting Point	: 661°C
Vapor Pressure (mm Hg)	: Not applicable
Vapor Density (Air=1)	: Not applicable
Evaporation Rate (Butyl Acetate=1)	: Not applicable
% Solubility/Water	: Soluble

APPEARANCE AND ODOR

Light yellow solid; odorless.

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point : Not available
Auto-Ignition : Not available
LEL : Not available
UEL : Not available

NFPA HAZARD CLASSIFICATION

Health: 1 Flammable: 0 Reactivity: 0

HMIS HAZARD CLASSIFICATION

Health: 1 Flammable: 0 Reactivity: 0

EXTINGUISHING MEDIA

Use water, carbon dioxide or foam.

SPECIAL FIRE FIGHTING PROCEDURES

Wear positive-pressure self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION PROCEDURES

Not a fire or explosion hazard. However, toxic emissions are possible in a fire situation.

SECTION V REACTIVITY DATA

Stability : : Generally considered stable.
Avoid : None expected.

INCOMPATIBILITY (Materials to Avoid)

Bromine trifluoride, perchloric acid.

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS

When heated to decomposition, emits toxic fumes of iodine.

Polymerization : Polymerization is not expected to occur.
Avoid : Not applicable.

SECTION VI HEALTH HAZARD DATA

ROUTES OF ENTRY

Eyes? YES Skin? YES Inhalation? YES Ingestion? YES

EFFECTS OF OVEREXPOSURE

EYE CONTACT may cause irritation.

SKIN CONTACT may cause irritation and allergic reaction.

INHALATION may cause delayed toxic effects if exposure is repeated to prolonged.

INGESTION is harmful. May cause irritation and/or systemic toxicity may occur.

NOTE: Although THALLIUM overexposure can result in neurological disturbances, kidney dysfunction, joint pain and alopecia, the small amount in this solid solution is not expected to represent a health hazard unless large amounts of crystals were ingested or large amounts of dust/fume were inhaled.

CARCINOGENICITY

NTP? NO IARC? NO OSHA? NO

CHRONIC HEALTH HAZARDS

None known.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

None known.

EMERGENCY AND FIRST AID PROCEDURES

EYES AND SKIN CONTACT : Procedures normally not needed. If exposed to dust, immediately flush eyes with plenty of water and wash skin with soap and water.

INHALATION : Procedures normally not needed. If exposed to excessive levels of dust or fumes, remove to fresh air and seek medical attention.

INGESTION : Procedures normally not needed. If large quantities are ingested, seek medical advice.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

EPA Waste # : Not regulated
UN # : Not applicable
DOT Classification : Not regulated

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

If broken or not useable, scoop up or vacuum into a container for disposal.

It is recommended that each user establish a spill prevention, control and countermeasure plan (SPCC). Such plan should include procedures applicable to proper storage, control and clean-up of spills, including reuse or disposal as appropriate (see waste disposal method, below).

WASTE DISPOSAL METHOD

Federal, state and local disposal laws and regulations will determine the proper waste disposal procedure. All waste materials should be reviewed to determine the applicable hazards (testing may be necessary). Disposal requirements are dependent on the hazard classification and will vary by location and the type of disposal selected. Some waste materials are amenable to recycle/reuse.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Keep container closed.

PERSONNEL SAMPLING PROCEDURE

For METALLIC COMPONENTS: Refer to NIOSH Manual of Analytical Methods, 3rd Edition, Volume 1, Method 7300.

SECTION VIII CONTROL MEASURES

RESPIRATORY PROTECTION

A NIOSH/MSHA-approved respirator as necessary.

VENTILATION

General; if machined, provide local exhaust ventilation as necessary to control dust.

PROTECTIVE EQUIPMENT

Safety glasses (with side shields).
Rubber or neoprene gloves.
Body protection as necessary to prevent skin contact.
If machined, provide exhaust and dustmask.

WORK/HYGIENE PRACTICES

Wash hands with soap and water after handling.

SECTION IX FEDERAL AND STATE REGULATIONS

SARA HAZARD CATEGORIES

IMMEDIATE (Acute) Health Hazard	: YES
DELAYED (Chronic) Health Hazard	: NO
FIRE Hazard	: NO
REACTIVITY Hazard	: NO
Sudden Release of PRESSURE	: NO

SARA SECTION 313 NOTIFICATION

This product contains a toxic chemical (or chemicals) subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

CHEMICAL NAME	CAS#	% Wt.
Thallium Iodide (as Tl)	7790-30-9	< 1

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