10/93

INSTRUCTIONS FOR PREPARING A GAS PAYLOAD ACCOMMODATIONS REQUIREMENTS DOCUMENT (PAR)

BLANK PAR ATTACHED
For purposes of standardization, please use applicable verbiage as presented.

COVER SHEET

The Customer Contact and Payload Manager as specified on the PAR must be the same persons whose names appear on the Launch Services Agreement (LSA). The Customer Contact and Payload Manager may be the same person. The original signed cover sheet must be submitted with your final PAR. Persons signing must be of legal age.

HEADING

Please enter the GAS payload reservation number assigned to you for this payload by NASA Headquarters. If you hold several payload reservations, enter only the reservation number for the particular payload this PAR represents.

1.0 Introduction

Please include this introduction verbatim in your PAR and note the last paragraph. Souvenirs and saleable items are not allowed in GAS payloads and the third paragraph is your certification that you are complying with that restriction. The Payload Integration Plan (PIP) discussed in this section is used to describe the requirements the payload has to the Space Shuttle Program (SSP). The PIP is prepared directly from the PAR.

2.0 Payload Description

In this section, we would like you to briefly describe your GAS payload. You will provide this information in 2.1 through 2.4. This information will be provided to GAS support people throughout NASA and our contractors. Please clearly state in this section (2.0) what parts (if any) of this payload description you consider proprietary. This entire section should contain no more than 3-4 pages of text. Please insert in sequence. No appendages please.

2.1 Size and Weight

Please state the maximum volume (2.5 or 5.0 cu. ft.) and weight (60,

100, or 200 lbs.) for this payload. Be certain to subtract for an optical window or opening door if applicable. In addition, the shipping plate or EMP should not be considered when assessing experiment weight. An accurate weight assessment will be needed once a flight assignment is accepted.

Optical Window = 10 lbs.
Standard Door Assembly = 40 lbs.
Ejection System = 50 lbs.

2.2 Experiment Description(s)

Include here a brief description of the scientific objectives and experimental techniques of each experiment associated with your payload.

2.3 Device Description(s)

Include here a brief description of each major subsystem in your payload (experiment apparatus, structure, battery(s), controller(s) or sequencer(s), recorder(s), etc. If you know what kind of batteries your payload will have, NASA needs to know that information as soon as practical. A line drawing depicting your payload is required. Sketches that fit on 8 1/2 by 11 inch sheets are appropriate supplemental information. Please assign each diagram a figure number (e.g., 2.3-1) and refer to it in the text. Detailed drawings, schematics and device manufacturer specification sheets are not required at this time. Photographs may be sent but should not be included as part of the PAR itself. See attached G-399 configuration drawing.

2.4 Operational Scenario

Include a brief narrative description of how your payload works during flight. This should include your description of the sequence of events of your payload operations and the activities resulting from the controlling relays actuations. Emphasis should be placed on how your payload works with respect to the controlling relays (table 3.2.2-1).

3.0 Standard Services

3.1 Container Accommodations

3.1.1 Internal Atmosphere

Select the paragraph that describes the internal atmosphere your payload requires. The dry nitrogen or air atmospheres will normally be at one atmosphere (14.7 psia) pressure. We can evacuate an empty 5 ft^3 container to 10^{-2} mm of mercury (10^{-4} atm). If the container is allowed to evacuate through the filtered relief valve, tests in a vacuum

chamber have shown that the pressure in an empty container reaches 10^{-3} atmospheres

after 3 days. The vacuum achieved for your payload will be dependent on the materials in your payload. If an air atmosphere is required, you should consider keeping it localized (i.e., sealed biological containers) in order to reduce combustion hazards.

3.1.2 Insulated End Plate Cover

Delete the insulated end plate cover option if you do not wish to use it. The experiment mounting plate will normally have an irridite exterior surface coating when the insulated end plate cover is used. If no insulated end plate cover is installed, the exterior of the experiment mounting plate will be coated with silverized teflon.

3.1.3 Battery Box Venting

Certain types of batteries used in GAS payloads must be housed in a sealed battery box which is vented outside the container through two parallel lines and pressure relief valves. This is to prevent the accumulation of an explosive mixture of battery gasses inside the container. This section of the PAR can be left unspecified until it is determined as part of the safety assessment of your payload whether or not your batteries need to be vented. If your battery box must be vented, we will provide the pressure relief valves, and you must provide the parallel plumbing from your sealed battery box to those valves.

3.1.4 Baroswitch

The capability to operate Relay A using a pressure actuated switching system (Baroswitch) is available as a part of the standard GAS electrical control system. It can switch GCD relay A to "Hot" during ascent. Payload de-activation is always controlled by the crew prior to deorbit. The baroswitch operation may also be overridden in an emergency de-activation. This baroswitch is set to change state at an altitude of approximately 50,000 feet. Indicate in this section whether or not you plan to use this capability. Also, in table 3.2.2-2, The Payload Operations Plan, please indicate "by baroswitch" in the box with "to hot and/or "to latent" for appropriate Relay A operations. Remember, the baroswitch operation is applicable to Relay A only.

NOTE: The baroswitch should only be used to thermally regulate your experiment. Activation of the experiment should be by means of a timer and/or other relay operations.

3.2 Flight Operations

3.2.1 Flight Design

Your payload may have specific altitude, inclination, orientation, stabilization, or other requirements. Record them in the space provided. This information will be used to help identify the STS flight which best meets your payload's needs. The orientation and stabilization requirements should be stated in general terms (e.g., Earth Pointing Orientation or Low Gravity Stabilization). Specific constraints associated with your flight activity requirements can be specified in Table 3.2.2-2. Remember that restrictive requirements may limit your flight opportunities. If you have no special requirements, enter "No Requirement."

Please remember that GAS payloads cannot tell the Orbiter what to do or not to do. However, Shuttle mission planners will do their best to fit your payload's operational needs into the scheduled mission activities. If there are any difficulties meeting the conditions or constraints you specify in your PAR, we will contact you to discuss them.

3.2.2 Flight Activity

The GCD as described in the Experimenter's Handbook is your functional interface with the Space Shuttle. Describe the function of each state (Hot or Latent) of the three GCD latching relays for your payload in Table 3.2.2-1. Relay A is the prime relay assigned to operate the GAS Payload Power Contactor (PPC) to control main payload power (Relays K1 & K2). The latent state must be used to turn off payload power. If you do not need all three relays, you are not using the PPC malfunction inputs, and you will not draw more than 2 amperes of current through the GCD relays, then it is acceptable to use relay B or C for payload power control. Again, the latent state must be used to turn off payload power. If any GCD relay is not going to be used, enter NOT USED as the function of that relay.

In the Operational Scenario (Section 2.4) you should relate the operation of your payload to the relay assignments and operation sequence.

Your desired plan for operating your payload using the GCD relays should be documented in Table 3.2.2-2. This plan establishes the sequence in which the GCD relays should be operated for your payload as well as the Shuttle mission conditions under which you would like them to be operated. Information from this table will be used by Shuttle mission planners to

establish the times when the crew will operate the GCD relays for your payload. The following describes the columns of Table 3.2.2-2.

RELAY OPERATION SEQUENCE - This column lists the order of relay operations in sequence, from top to bottom.

GCD RELAY - In this column, name the GCD relay (A, B, or C) that will be used to perform the command.

STATE (1) (to H or to L) - In this column, enter the state to which the relay is being changed in order to initiate the operation.

MISSION CONDITION(s) AND CONSTRAINTS - In this column, you should enter the specific conditions or constraints associated with the relay operation.

General condition specifications are preferred if they are appropriate. Typical of these are:

1. As early as possible in flight.

2. At the start of a minimum "g" period (normally the desired length would also be specified, e.g., lasting 3 to 5 hours).

3. Shuttle cargo bay towards Earth.

4. Immediately after relay operation 01.

In specifying conditions desired or constraints, please provide ranges of values (e.g., 3 to 5 hours); upper or lower bounds (e.g., greater than 10^{o} above the horizon); or orders of magnitude (accelerations less than 5×10^{-4} g's). In specifying times between relay operations, please provide a range of time (e.g., for relay operation 04 "at least 3 hours after relay operations 03"). This can also take the form of a tolerance (e.g., 24 hours $\pm$10 hours. Again, upper or lower bounds can be used for time specification (e.g., at least 8 hours after relay ops 02).

If certain Shuttle operations are undesirable, please indicate this as a constraint (e.g., no OMS burns between relay ops 02 and 03). For your reference, the following approximate "g" levels and durations associated with various Shuttle control system firings are given below:

	g's	sec
Orbiter Maneuvering System (OMS)	0.1	120
Primary Reaction Control System (PRCS)		
Translation	0.05	30
Rotation	0.01	30

Vernier Reaction Control System (VRCS)
Rotation only 0.001 1 to 5

However, it is better to specify the basic need associated with your payload, such as the desired "g" level, than to get too specific about particular Shuttle or crew activities. This gives the mission planners more flexibility in meeting your needs and, thus, leads to a greater probability that your operational needs can be met.

MINIMUM ACCEPTABLE OPERATING TIME - At the bottom of Table 3.2.2-2, please specify the minimum time that your payload must be operated for successful achievement of your experimental objectives. Normally, this will be the minimum time between first and last relay operation. When selecting this time, view it as the operating time below which you may as well not fly the payload. Keep in mind that this minimum acceptable time may constrain the number of Shuttle missions on which your payload can fly. Also, it could mean that your payload won't be activated if a mission has to be shortened due to a problem on orbit.

3.2.3 Payload Power Contactor (PPC) Malfunction Inputs

Please list the payload parameters, such as battery temperature, main buss current, or container pressure, that are being monitored to cause the PPC to turn off your main power if a malfunction condition exists. Please be specific about the type and location of the measurement.

3.3 Launch Site Operation

3.3.1 Payload Final Preparation

Record a complete list of all items such as samples, film, etc., you plan to install in your payload at the launch site prior to the installation of your payload in its flight container. You will have a maximum of three (3) standard eight (8) hour workdays to complete your final payload preparations.

3.3.2 Leak Test Levels

In order to check for leaks, we would like to pressurize the container with dry nitrogen or dry air (as specified in Section 3.1.1) after your payload is installed in the container and the container has been sealed. If anything in your payload can tolerate only a limited pressure or time, please state those limits in the spaces provided. If no pressurization can be tolerated by your payload, delete "will" in the first sentence and delete the second sentence. If no leak check is possible, and you require a sealed container, we cannot be sure that your container will hold pressure and there is a risk to

your payload from depressurization. Normally the leak check will be done at 4 psig for about 20 hours. If you chose preflight evacuation of the container, the leak check will consists of a check on the vacuum hold over about 16 hours.

3.4 Safety

3.4.1 Inspection

Record here the names of all assemblies in your payload which cannot be opened for inspection at the launch site. Be sure to schedule the submission of those assemblies to NASA for inspection and your desired return date in Section 6.0. Alternative inspection methods include built in viewing ports or possibly x-raying items that are unable to be opened during integration.

The experiment will be inspected at the launch site to ensure that it complies with the design presented in the approved Phase III Safety Data Package. Any deviations will result in the removal of the experiment from the flight since post Phase III changes at this stage require more time than will be available.

3.4.2 Preliminary Hazard Analysis

A description of the Shuttle system safety requirements is in NHB 1700.7B. Clarification of those requirements with respect to GAS payloads and a primer on how to do a hazard analysis are given in the GAS Safety Manual. The results of a preliminary hazard analysis are documented on a Safety Matrix and Hazard List as described below. If you are not familiar with system safety, be sure to read the GAS Safety Manual before completing them. Your first draft PAR submitted to the GSFC should have these forms completed to the best of your ability.

Figure 3.4.2-1 Preliminary Safety Matrix

Preliminary safety matrix hazard groups and subsystems are defined and described in the GAS Safety Manual. The subsystems list may be expanded or modified for a specific payload or its Ground Support Equipment (GSE). The intent of this form is to assist in tabulating identified hazards associated with payloads and GSE.

1. Two matrixes are required, one for the payload, and another for GSE/ground operations.

2. Complete blocks for payload/GSE title, payload organization, date, and page.

3. Determine applicable subsystem elements for the payload/GSE that are unique to your payload.

4. For each safety subsystem element, check the hazard group(s) that apply to hazards that have been identified for this subsystem. This will apply to hazards that have been identified for this subsystem. This will be based on the particular hardware, design, and operation of the subsystem.

Figure 3.4.2-2 GAS Hazard List

Two hazard lists are required, one for the payload and another for GSE/Ground operations. Complete the Hazard List for each subsystem checked on the payload Safety Matrix. Hazard lists for more than one subsystem may be included on one hazard list form. The Preliminary Hazard Analysis does not have to be completed if the Preliminary Safety Data Package has been submitted with this PAR.

PAYLOAD - Enter G number and title of payload or payload GSE.

SUBSYSTEM - Enter payload or GSE subsystem checked on Safety Matrix.

HAZARD TITLE - Enter hazard title(s) which identify the safety concern for each hazard group listed. These hazards are identified as a result of your safety analysis.

APPLICABLE SAFETY REQUIREMENTS - Paragraph number of applicable technical requirement from NHB 1700.7B.

3.5 Post Flight Shuttle Mission Data

All Shuttle mission data listed in this section will be provided to you by the GSFC as soon as it is available after the mission. No information is needed from you in this section. If more mission data than described is needed, specify your requirements in the Optional Services, Section 4.1.

4.0 Optional Services

4.1 Attach a description of any post-flight data required over and above that described in 3.5.

4.2 If your payload requires an optical window in the top end plate, say so here.

4.3 If your payload requires a Standard Door Assembly (SDA) in the top, say so here. Also, Section 3.1.2, Insulated Cover, should read, "The SDA upper surfaces will be insulated and covered with beta cloth."

4.4 If your payload has special launch site support requirements, state them here.

If you need an optional service that does not fit one of the above categories, add it at the end as a new subsection. If you need no optional services enter "this payload has no optional services" under the 4.0 heading and strike out all of the associated subsections.

Please be aware that you will be charged for optional services.

Also, any optional services directly involving the Shuttle, such as special mission requirements, cannot be agreed to by the GAS program until they are first agreed to and priced by the Shuttle program. This may delay our signing of your PAR.

5.0 Technical Support Services

If your payload will require technical support services by GSFC, please identify those services here.

6.0 Schedule

Figure 6.0-1 contains the major milestones associated with the accommodation of a GAS payload. In the right-hand column are the nominal times (for a standard payload), relative to the launch of the payload when these milestones should be completed. Please replace these relative times with specific dates based on the earliest launch date you are targeting for the flight of your payload. This date need not relate to any specific Shuttle mission. We will mutually refine this schedule as we finalize your PAR. The specification of a launch date on this schedule does not imply an official flight assignment.