MODULAR AND STANDARDIZED GAS PAYLOAD HARDWARE

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Objectives:

Numerous payloads have been carried out within NASA's GAS program in the past and much more will be flown in the future. Therefore, besides the existing NASA GAS hardware, only modular and standardized payload hardware will lead to a reliable, cost efficient experimental platform with short turn around times.

Effort should be concentrated on science and experiments and not to much spend with standard service systems and related paperwork.

Payload requirements:

Common payload requirements within the GAS program can be summarized to

- economic use of available space and payload weight capacity
- adequate power sources
- variable payload timing and control including the GAS typical three on-off commands
- flexible housekeeping, data acquisition and recording systems
- standardized ground support equipment

All on board systems have to be capable to survive vibration and mission related temperature environment.

Standard payload service systems:

The design concepts for standard payload service systems are based on the common payload requirements.

Basically two different configurations of experiment/payload support structures are existing: one which uses round decks, hard mounted to struts (fig. 1), while rectangular shelves are attached to columns via shock absorbers with the other version (fig. 2). This design allows a more unique use of the GAS space and weight capacities, adequate inflight load carrying capability and a gentle environment for the deckmounted hardware.

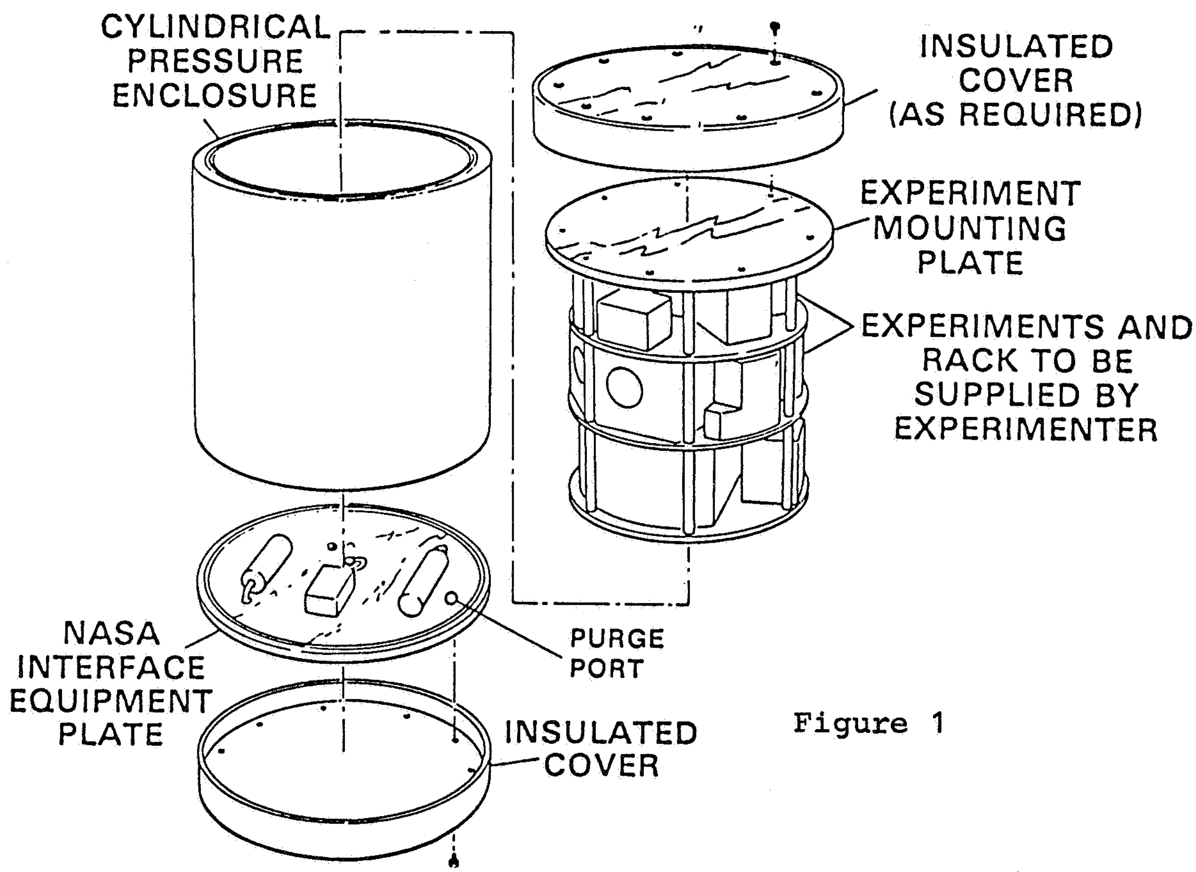


Figure 1

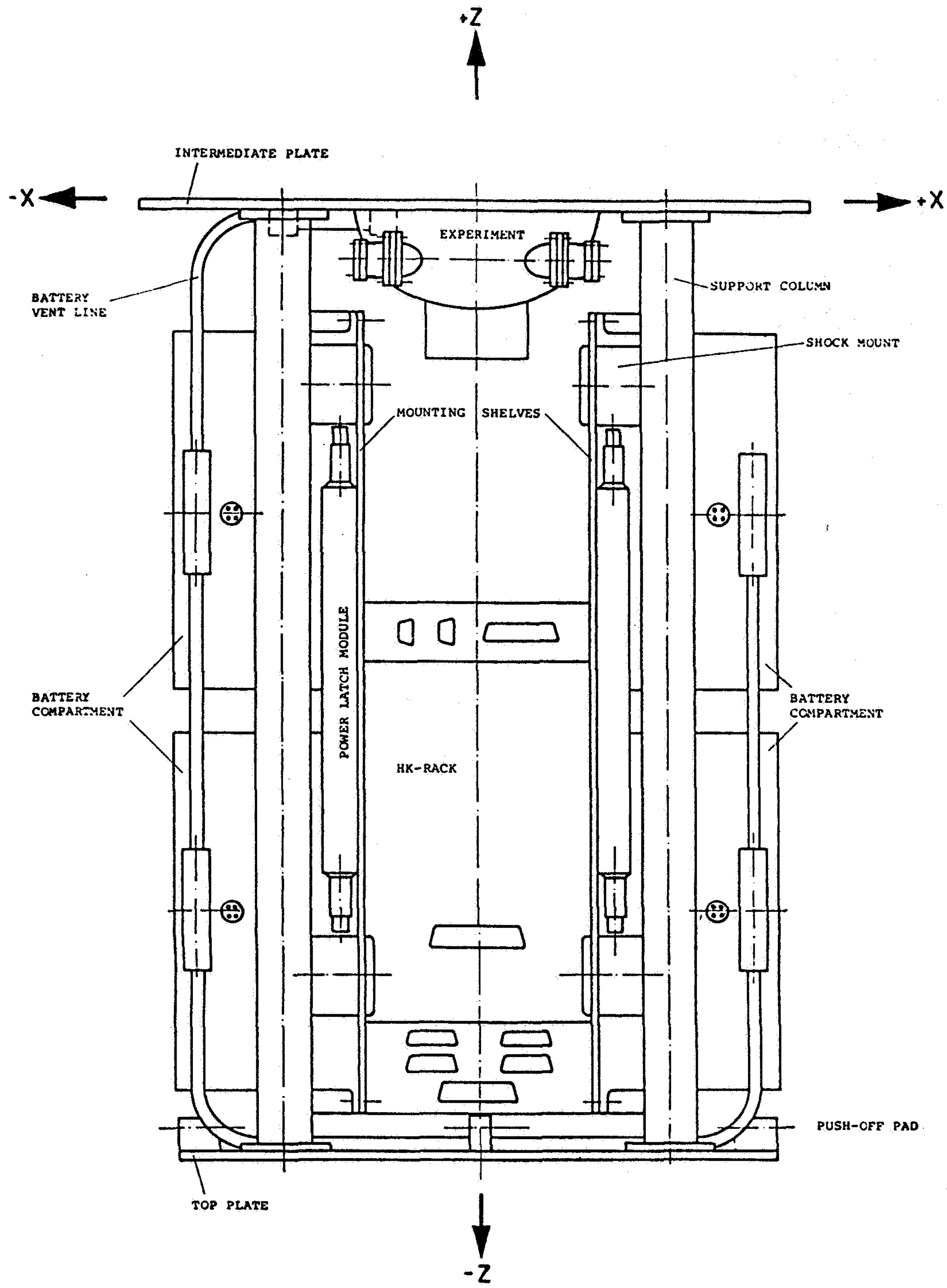

+Z
INTERMEDIATE PLATE
-X
+X
EXPERIMENT
BATTERY VENT LINE
SUPPORT COLUMN
SHOCK MOUNT
MOUNTING SHELVES
POWER LATCH MODULE
BATTERY COMPARTMENT
BATTERY COMPARTMENT
HK-RACK
PUSH-OFF PAD
TOP PLATE
-Z

FIGURE 2

As power source silver zinc batteries were chosen presently representing the best compromise with respect to energy density, discharge characteristics, life time, self discharge rate, handling and safety. Some effort is involved with pressure tight and sealed battery boxes, the H_2 outgassing lines, temperature monitoring and fusing as well as the low voltage cut-off. Fusing and low voltage cut-off circuitry and the interface to the GAS PPC is integrated into the standardized power latch modules housed separately outside of the battery boxes.

To provide variable payload timing and control the three GAS typical on-off commands may not be sufficient for most applications. Therefore a microprocessor controlled and easily programmable sequencer with low power consumption (0,3 W) was designed. Redundancy is incorporated by using independend subroutines.

Experiment and housekeeping data are acquired at a data rate of 5 kbit/sec by a 16 channel, 12 bit PCM system.
The PCM system provides 12 analog and one digital channel for the experiments, while using two digital channels for housekeeping data and one additional for recording experiment time in minutes. All data are stored on a NAGRA cassette tape recorder with a total running time of approx. three hours and a storage capacity of approx. 56 Mbit. If operated in an intermittent mode, recording data for one second every minute covers a total payload operation time of approx. 120 hours.

During integration and ground tests the payload will be operated mostly by its ground support equipment which also allows recording and display of payload PCM data stream. The ground support equipment consists of standard power supply, battery simulator, NASA interface simulator, modular payload operation panel, display unit, PCM decoder and an Apple personal computer with dual floppy disk and monitor. All components are mounted in two portable racks. Last minute access to the payload is provided even if it is already installed into the flight canister. The payload can be completely operated via the NASA interface connector while status and data are monitored at the same time.

Standard experiment facilities:

Besides the payload service systems flight proven experiment facilities are available at Kayser Threde, too.

For fluid physics experiments a H_e-N_e laser Doppler interferometer with an optional splitted beam exists. The laser output power is 0,5 mW.

Optical observation can be done by a modified 24mm x 36mm photographic camera (Olympus) with a 250 picture film storage and a time display onto each picture by a LED array. Film cameras will be available at a later date.

For thermal processing of probes up to 500 ^{o}C an isothermal, multipurpose furnace can be provided. The chamber is 40 mm in diameter and 160 mm in length.

Plant development can be carried out in growth compartments furnished with temperature control, day/night simulation as well as liquid storage and injection devices.

Summary:

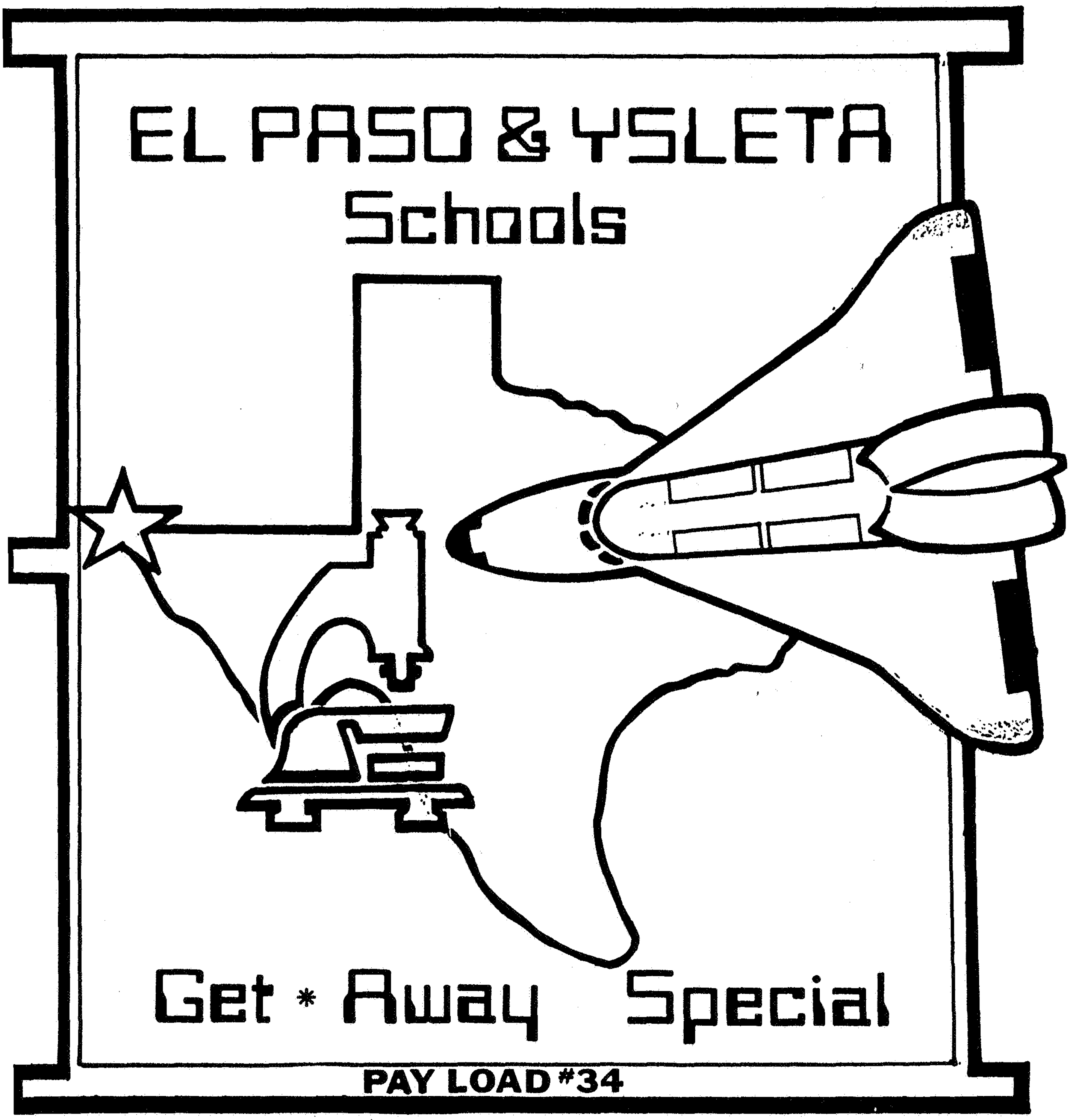
The use of modular and standardized GAS payload hardware has many advantages.

Standard hardware minimizes time effort and cost for design and qualification. Flight proven hardware ensures proper function and operation during mission. It demands less effort with respect to the preparation of the payload accommodation requirements and the safety review data packages for the user as well as for NASA.

Modular systems allow to be combined in order to serve an enlarged number of experiments if two GAS canisters are interconnected.

These facts enable the user or experimenter to concentrate on the experiments and related science instead of spending time in development of own hardware while standard, flight proven systems are available.

Nevertheless, cost efficiency for standard service systems encreases by each reflight.


EL PASO & YSLETA
Schools
Get * Away Special
PAY LOAD #34

Mr. Richard N. Azar, through reserving three Get Away Special (GAS) containers, began the GAS program for El Paso, Texas. "Space is a challenge, always has been," Azar said. "The canisters offered us an opportunity to challenge young minds."

Azar got the idea for participation in the space shuttle program in 1977 when he read a magazine article about the National Aeronautics and Space Administration's offer to let private individuals send experimental projects into space aboard what was then called the "space truck" Columbia.

Azar contacted NASA and made a down payment of $500 each for three canisters. Each capsule has a price tag of $10,000.

One canister was set aside for the twin cities of El Paso and Juarez, another for the University of Texas at El Paso and the third was designated for projects developed by high school students.

The El Paso containers are numbered 33, 34, and 35, and are grouped under the Education queue. El Paso Independent School District and the Ysleta Independent School District have deposited the necessary $9,500 with the El Paso Community Foundation to complete the funding for payload #34.

The El Paso/Juarez Space Shuttle efforts began in late 1977 to provide research opportunities and interesting space related activities for the El Paso Area school systems. In the Fall of 1982 more than 100 students in the local school districts participated in an advanced science seminar giving background on the project. Any student interested in the study of space and space activities was invited to prepare research and prepare an experiment in his or her field of interest. Twelve students from the El Paso area have developed scientifically worthwhile projects. These students will have the opportunity to send their experiments on board the NASA Space Shuttle in August of 1984.

This experimental opportunity for students is an effort to motivate those interested to reach new horizons through space research. Through planned activities, trips, contests, seminars, and speaker programs, thousands of El Paso students have become aware of what the future holds in space. They, too, have contributed valuable insight and questions to be asked. Expanding young minds is the greatest resource for mankind.

This GAS payload consists of an Aluminum 6061 frame, with four shelves supporting the experiment hardware, the system controller and power supply. This frame was designed developed and tested by Farah Manufacturing and El Paso Natural Gas of El Paso. The experiment hardware is machined out of plexiglass. Engineers Vernon Strickland and Mike Izquierdo assisted students with design plans. The containers were built to specifications by Whaller Specialties and Falco Machine & Tool Company. The power supply for the payload consists of Gates lead-acid batteries with a power life of 45 hours at 1 amp/12 volts DC. The power supply will be used to operate linear actuators, light emitting diodes, thin film heaters and other electronic devices in the payload. The cost of the batteries was underwritten by El Paso Electric Company.

This particular GAS payload is unique in regard to the planned operational scenario. Experiment 7-P(the Fuel Wicking Experiment) is designed to measure the wicking of a simulated fuel on a thin wire screen during acceleration. Its operational period is from SSME ignition through the OMS-1 burn. Experiment 7-P will have a self-contained power supply and controller separate from the main payload controller and power supply. It will be activated by the noise of the shuttle liftoff and, through a timer, shut itself down upon completion of the OMS-1 burn.

The container will be purged with dry nitrogen prior to installation in the Orbiter. An insulated cover will be installed over the container experiment mounting plate exterior. No unique flight design requirements are requested for orbit altitude, inclination, or orientation and stabilization. The assignment of GAS Control Decoder (GCD) relay states to specific payload functions is shows in Table 3.2.2-1. The required payload crew activities during the flight are shown in Table 3.2.2-2.