

9/3/85-

IMPROVED WASTE COLLECTION SYSTEM

STATEMENT OF WORK

SPACE SHUTTLE PROJECTS OFFICE

1.0 Introduction

This Statement of Work describes the development, testing, and provisioning of a 1-g prototype of an IWCS (Improved Waste Collection System) for the Orbiter using piston compaction as a means of control and stowage of fecal matter and the design, development, testing, and provisioning of a simplified version of the IWCS to support an early flight demonstration of these concepts. The target for this flight demonstration is mission STS 61-A, currently scheduled for October 30, 1985. Provided both the 1-g prototype and the simplified flight demonstration model are successful, there is an option to develop and provide a prototype flight system of an operational IWCS for additional flight evaluation.

2.0 Scope

The scope of this statement of work includes the design and manufacture of a 1-g prototype of an IWCS, a simplified flight demonstration model, and an option for an operational flight system prototype.

## 2.1 1-g Model of the IWCS

Provide the design, development, manufacturing, and testing of a working 1-g model of the IWCS. The salient features of this IWCS are depicted in Figure I and include but are not limited to the following:

- an automatic plunger face sheet loader which positions the interface paper material and cuts it from the supply roll
- an air circulation system which pulls air from the fecal collection chamber, directs it through the collection orifices beneath the seat and through the positive pressure jets
- air collection inlet jet protection system
- filtration system to remove particles and drops from operation of the system, and the odors from the air returned to the cabin
- gas and odor vacuum removal system through flow restricted vent outlets
- drive for various control, sequencing and mechanical operations

Examples of these mechanisms include but are not limited to the following:

- bi-directional plunger activation
- compressive force limitation
- seat slide valve
- air inlet occluder
- paper advance and cutting mechanism
- a seat with a properly sized and orientated air jet system to optimize the fecal separation and transport functions
- restraint system



- manual override\* for all critical mechanical functions
- capability of not less than 40 defecations

Each system will be independently tested as necessary to demonstrate its suitability and reliability before integration into the 1-g prototype for total system testing. The use of non-flight materials and hardware, such as motors, in the 1-g prototype is permissible.

## 2.2 Simplified Flight Demonstration Unit

When the key features of the system, such as plunger facing and plunger drive, meet the NASA requirements, the simplified flight demonstration unit will be designed, developed, manufactured, tested, and provided to NASA on or before October 15, 1985. This unit will include as a minimum:

- automatic piston facing
- seat and restraint
- plunger drive
- air circulation system
- vent system

In order to support an early flight demonstration of the concepts of this IWCS, maximum use of manual systems and simplified design should be exercised.

## 2.3 Operational Flight System Prototype

Provided both the 1-g prototype and the simplified flight demonstration unit successfully demonstrate the feasibility of the IWCS, an option will be exercised to design, develop, test, and provide a full-up prototype flight system of an operational IWCS for additional flight testing. Consideration should be given not only to perfecting each subsystem in the prototype, but to integrating it into the location, volume, plumbing, and wiring of the current WCS.

## 3.0 Contractor Responsibilities

### 3.1 1-g Prototype

The contractor shall be responsible for all manpower, materials, and facilities to design, manufacture, test, demonstrate, and provide a 1-g prototype of the IWCS to JSC for manned testing.

#### 3.1.1 Materials and Hardware

Non-flight quality materials and hardware, such as motors, may be used in the 1-g prototype. However, this unit must be compatible with and safe for manned testing at JSC.



### 3.1.2 Documentation

The contractor shall provide sufficient documentation to support a safety analysis for manned testing to support manned testing at JSC. This includes but is not limited to the following:

- operational instructions
- safety considerations
- limitations - strength, mounting, etc.
- test reports

### 3.1.3 Testing

The contractor shall conduct testing to insure that each separate subsystem and the assembled IWCS operate satisfactorily and the system is safe for manned testing at JSC. The results of this testing shall be documented clearly for understanding of the system performance and capability and for use in establishing the testing of this system at JSC.

### 3.2 Simplified Flight Demonstration Unit

The contractor shall provide manpower, materials, and facilities to design, manufacture, test, demonstrate and provide an simplified flight demonstration unit with only the key functions for an inflight demonstration. This portion of the IWCS program is a shared effort with JSC. The JSC support will be described in section 4.0.

### 3.2.1 Materials and Hardware

All materials and hardware used in the simplified flight demonstration unit will be flight-qualified or qualifiable.

### 3.2.2 Documentation

The contractor shall provide documentation to support a flight certification for the demonstration, a safety assessment and to establish operational procedures. Information to establish all interfaces including the attachment hardware and the stowage provisions will also be provided.

### 3.2.3 Testing

The contractor shall perform testing to insure that each separate subsystem and the assembled simplified flight demonstration unit operate satisfactorily for a flight demonstration. The documentation of these results shall be provided to support certification of this unit for the flight demonstration.



#### 4.0 Government-Furnished Items

##### 4.1 1-g Prototype

No hardware or support will be supplied for the 1-g prototype.

##### 4.2 Elementary Flight Demonstration Unit

This will be a shared effort in which JSC will accept the flight demonstration unit, with the available data and information; and complete the certifications for the flight demonstration. To support this approach, JSC will provide manpower and the following qualified or qualifiable hardware:

A. Electrical power receptacles to mate with the JSC-furnished electrical cords for either 28V DC or 115V AC 3 phase 400 cycle

B. WCS seat

C. Vacuum hose quick disconnect

D. Vacuum supply

E. All mounting and stowage hardware and effort

F. Urine collection system

#### 5.0 Deliverable Items

The contractor will deliver the following major items:

- 1-g prototype
- simplified flight demonstration unit

## 6.0 Schedule

The IWCS units should be delivered to JSC in accordance with the following schedule:

- 1-g prototype: Nine months from "go ahead"
- simplified flight demonstration unit: October 15, 1985

## 7.0 Option-Operational Flight System Prototype

### 7.1 Introduction

Provided both the 1-g prototype and the simplified flight demonstration unit successfully demonstrate the feasibility of the IWCS, this option will be exercised to provide the design, development, testing, and provisioning of a full-up prototype flight system of the operational IWCS for additional flight testing. Consideration should be given not only to perfecting each subsystem in the prototype, but to integrating it into the location, volume, plumbing, and wiring of the current WCS.



## 7.2 Operational Flight System Prototype

### 7.2.1 Scope

This unit will contain the design feature of the 1-g model of the IWCS listed in paragraph 2.2 as modified to incorporate any changes found necessary after the JSC testing of the 1-g model and the flight test of the simplified flight demonstration unit.

### 7.2.2 Materials and Hardware

All materials and hardware used in the operational flight system prototype will be flight-qualified or qualifiable.

### 7.2.3 Documentation

The contractor shall provide documentation to support a flight certification for the demonstration, a safety assessment and to establish operational procedures. Information to establish all interfaces including the attachment hardware and the stowage provisions will also be provided.

### 7.2.4 Testing

The contractor shall perform sufficient testing to insure that each separate subsystem and the assembled operational flight system prototype operate satisfactorily for a flight demonstration. The documentation of these

results should be provided to support certification of this unit for the flight demonstration.

#### 7.2.5 Government-Furnished Items

This will be a shared effort in which JSC will accept the operational flight system prototype with the available data and information; and complete the certifications for the flight demonstration. To support this approach, JSC will provide manpower and the following qualified or qualifiable hardware:

- A. Electrical power receptacles to mate with the JSC-furnished electrical cords for either 28V or 115V AC 3 phase 400 cycle
- B. WCS seat
- C. Vacuum hose quick disconnect
- D. Vacuum supply
- E. All mounting and stowage hardware and effort
- F. Urine collection system

#### 7.2.6 Deliverable Items

The contractor will deliver an operational flight system prototype of the improved waste collection system.



#### 7.2.7 Schedule

The operational flight system prototype shall be delivered to JSC on or before 9 months after the option is exercised.