

**870-REF-0201**

**Hitchhiker  
Ground Data Systems  
Product Plan,  
Maintenance Effort**

**Revision C  
August 1, 2002**

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References to documents and data (hard copy or electronic) in the Product Plan *not* directly under the Team's control shall contain the version identification in the Reference Appendix of the Product Plan.

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## Document Change History

<u>Revision</u>	<u>Section</u>	<u>Description of Changes</u>	<u>Date</u>
Baseline			April 2, 1999
A	Throughout Document	Changes due to ISC Product Development Handbook Update.	August 9, 1999
B	Throughout Document	Changes made based on Code 580 ISO 9000 Checklist audit. Comprehensive rewrite.	February 25, 2000
C	Throughout Document	Changes made to reflect ISC Product Development Handbook Update	August 1, 2002

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**Customer Agreement  
for the  
Shuttle Small Payloads Project Office  
Hitchhiker Ground Data System Development  
Release Date  
8/2002**

Prepared by: Judy Miller 8/1/2002  
Judy Miller/the Hammers Co./Code 584

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Approved by: Barbara Pfarr 8/5/02  
Barbara Pfarr/Code 584 Branch Head  
Information Systems Division Management Representative

The Team Lead, the Customer/Designee, and the Information Systems Division Management Representative constitute the Configuration Control Board for the Customer Agreement portion (Section 1) of this document.

**Product Development  
for the  
Shuttle Small Payloads Project Office  
Hitchhiker Ground Data System Development  
Release Date  
8/2002**

Prepared by: Judy Miller 8/1/2002  
Judy Miller/the Hammers Co./Code 584

Approved by: Eve Rothenberg 8/01/2002  
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Hitchhiker Ground Data System Team Lead

Approved by: B. B. A. 8/05/02  
Barbara Pfarr/Code 584 Branch Head  
Information Systems Division Management Representative

The Team Lead and the Information Systems Division Management Representative constitute the Configuration Control Board for this document, with the exclusion of the Customer Agreement (section 1).

## 1.0 Customer Agreement (GPG 1310.1)

This section describes the agreement between the Shuttle Small Payloads Project Office, herein referred to simply as 'the Customer', and the Hitchhiker ACCESS GDS Team including those issues related to requirements, deliverables, and maintenance.

### 1.1 Background

The NASA Goddard Space Flight Center SSPP Office manages the Hitchhiker program. This program is intended for experimenters to fly payloads on the shuttle whose space activity requires power, data, and command services. The Hitchhiker system provides for real-time communications between an experimenter in the Hitchhiker Attached Shuttle Payload Center (ASPC) at Goddard and their experiment on the shuttle.

The Hitchhiker Avionics Ground Data System (GDS) consists of the following components:

- The Advanced Carrier Customer Equipment Support System (ACCESS) is a PC-based networked system that allows Hitchhiker experimenters to receive telemetry from and send commands to their experiment during Integration and Test (I&T) and mission operations. The ACCESS system includes a User Interface Unit (UIU), which is the main console for the system operator, and a Carrier Interface Unit (CIU), which receives low rate telemetry from and sends commands to the carrier, acting as a front end for the UIU, during Integration and Test (I&T) of the flight hardware.
- The Medium Rate Demultiplexer Unit (MRDU) receives medium rate (2Mb/s) data from the avionics and distributes user data through RS422 serial ports.
- The Data Display Unit (DDU) displays health and safety and status information about the ACCESS system and the Hitchhiker equipment, as well as snapshots of the data from the experiments.
- The Remote ACCESS Unit (RAU) allows experimenters to remotely access their experiments via the Internet.
- The Hitchhiker Old Avionics Thermal System (HOATS) monitors and plots various telemetry points for the old avionics system.
- The Stand Alone Mission Processing (STAMP) Program is a windows-based software package that generates low-rate post-mission data products for Hitchhiker experimenters.
- The Medium Rate Post (MRPOST) Program is a windows-based software package that generates medium-rate post-mission data products for Hitchhiker experimenters.

The Hitchhiker Central Unit (HCU) is a component of the Next Generation Hitchhiker Avionics Ground Data System known as the Advanced Carrier Equipment (ACE). It is the central processor of the system, which along with the Hitchhiker Remote Interface Unit (HRIU), gathers telemetry from and distributes commands to experiments. In addition, it provides telemetry for Hitchhiker health and safety status and executes commands for controlling power to the experiments. The ACE System includes the following components:

- ACCESS is a PC-based networked system that allows Hitchhiker experimenters to receive telemetry from and send commands to their experiment during Integration and Test (I&T) and mission operations. The ACCESS system includes a UIU, which is the main console for the system operator, and a CIU, which receives low rate telemetry from and sends commands to the carrier, acting as a front end for the UIU, during I&T of the flight hardware.
- The Medium Rate Demultiplexer Unit (MRDU) receives medium rate (2Mb/s) data from the NIU or CIU and distributes user data through RS422 serial ports.
- The Ground Umbilical Programmer (GUMP) is used to program the HCU EEPROM with HCU flight software and group commands prior to flight.
- The Hitchhiker ACE Thermal System (HATS) monitors and plots various telemetry points for the ACE System.
- The NASCOM Interface Unit (NIU) is the NASCOM front-end system of the GDS during the mission and provides the NASCOM block encapsulation and deencapsulation services along with Customer Ancillary System (CAS) decommunication and CAS packet creations. The NIU communicates with NFP to send and receive NASCOM blocks and communicates with UIU and MRDU to send and receive commands, command acceptance patterns, telemetry transfer frames, and CAS packets.
- NASCOM Front-end Processor (NFP) has two network interfaces. One connects to the NASCOM IPTX network and the other connects to the Open IONET. The main job of the NFP system is to exchange data between these two networks.

## 1.2 Team Charter

The Hitchhiker Development GDS Team will provide all necessary software and operational support to produce a quality interface to Hitchhiker experimenters in the ASPC at Goddard Space Flight Center (or via remote locations) and their experiments on the shuttle.

The scope of the Development GDS Team's effort extends to all software related activities necessary to enhance or maintain the existing GDS and to provide operational support, including round-the-clock mission support for all Hitchhiker missions.

Procurement and maintenance of all hardware and supplies (toner cartridges, paper, tapes, and CDs) is the responsibility of the Development GDS Team.

### 1.3 Customer Identification

Shuttle Small Payloads Project (SSPP) Office, Code 870.

### 1.4 Customer Goals and Objectives

The goal of the Customer is to provide high quality ground support to Hitchhiker experimenters by maintaining and enhancing both the ACE and Avionics Ground Support Systems.

### 1.5 Requirements

Requirements for the Hitchhiker GDS have been established, reviewed, and approved via design reviews, design documents, and meetings with the Customer. These were pre-ISO 9000 activities.

All new requirements to the existing GDS will be through signed Software Development Plans and Requirements Documents. Software Development Plans will address all new requirements, high level architecture, planned builds and reviews, required resources, and any new documentation deliverables.

The following table lists design packages, management plans, and requirements documents that are used in the development effort of the Avionics GDS.

Controlled Document	Comment	Record Held By
Hitchhiker ACCESS Design Review Package	Review held on 02/08/1993. Attended by project management and peers.	GDS CM Lead
Y2K Project Management Plan for the SSPP	Signed/dated by team members and customer.	SSPP CM Office

Requirements for the Avionics GDS have been established, reviewed, and approved via design reviews, design documents, and meetings with the Customer. These were pre-ISO 9000 activities. Additional requirements levied by the project since the design review include development of the RAU, TDU, and AFT Programs:

- The RAU requirements are described in detail within the *Hitchhiker Remote POCC Development Plan*.
- The TDU requirements are described in a memo from the project titled *Hitchhiker Attitude and Thermal Data Display Unit Requirements*.
- The AFT Program requirements are described in detail within the *ACCESS Full Functional Avionics Testing Software Requirements Document*.

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The following table lists design packages, management plans, and requirements documents that govern the development effort of the ACE ACCESS GDS.

<b>Controlled Document</b>	<b>Comment</b>	<b>Record Held By</b>
Hitchhiker ACCESS Design Review Package	Review held on 02/08/1993. Attended by project management and peers.	GDS CM Lead
Hitchhiker ACE Thermal System (HATS) Software Review Package	Reviewed on 12/19/2000.	GDS CM Lead
Requirements for Hitchhiker/GAS Bus Communications	Signed/dated by team members and customer.	SSPP CM Office
Requirements for Hitchhiker Carrier to Ground System Communications	Signed/dated by team members and customer.	SSPP CM Office
Communication Requirements for the Umbilical UART Programmer to Hitchhiker Central Unit	Signed/dated by team members and customer.	SSPP CM Office
Y2K Project Management Plan for the SSPPO	Signed/dated by team members and customer.	SSPP CM Office
Requirements for the ACCESS NASCOM Interface (ANI) System	System name changed from ANI to NIU. Signed/dated by team members and customer.	SSPP CM Office
Requirements for the ACE ACCESS 2000 System.	Signed/dated by team members and customer	SSPP CM Office

## 1.6 Deliverables

The following items are planned deliverables for the Development GDS Team:

- Hitchhiker Ground System software development releases and CM packages shall be delivered prior to the start of environmental testing for each mission.
- Hitchhiker Ground System enhancements, procedures, mission procedure documents, and pages, are to be finalized and delivered L-1 month. ASPC configurations shall be completed by L-2 months. Post-mission products shall be delivered within L+30 Days.
- Hitchhiker Ground System User's and Programmer's Guides shall be delivered by L-2 months.

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## 1.7 Schedules

The GDS Development Team Lead will track all team efforts and responsibilities on the ACCESS schedule on a regular basis. This schedule will reflect software modification due dates, software releases, documentation updates, system administration efforts, I&T and mission support, and planned reviews (if any).

A milestone chart will also be maintained to reflect upcoming events, including subsystem integration, acceptance testing, I&T support at GSFC and at KSC, and mission support activities.

## 1.8 Necessary Customer Training

The Hitchhiker GDS Development Team supports all ground system activities. Civil Servants and Contractors (outside the GDS team) supporting the Project and experimenters contracted to fly under the Hitchhiker Program require some training on the components of ACCESS. The appropriate team members will train all GSFC engineers using the GDS. Thermal engineers will be trained to use the HATS located in the Attached Shuttle Payload Center (ASPC), Building 14 room S287. Hitchhiker experimenters will receive an overview and training session prior to each mission on ASPC procedures and hardware, including DDU's. Remote experimenters will receive necessary training and documentation to utilize the RAU system.

## 1.9 Medium/Method for Product Delivery (GPG 6400.1)

Hitchhiker GDS Software executables will be installed by the GDS Development Team on the appropriate system supporting an activity. ACCESS executables will be electronically transferred from the server to I&T systems and ASPC systems. All other programs in support of the GDS will be delivered via diskette or electronically, when available.

Software releases will follow the procedures outlined in the *Hitchhiker Ground Data System Configuration Management Plan*.

Quality Record	Comment	Record Held By
ACE ACCESS V.xx.1 CM Release Notes and Test Summary	Release Tape or CD, Release Notes, and Test Summary	Hitchhiker CM Office

## 1.10 Product Destination

The Hitchhiker GDS for mission support, including all associated hardware and software, will be located in the ASPC, Building 14 room S287. The I&T Systems will reside at GSFC, Building 5 and Building 7/10 for all testing activities and at KSC for field support. Source code will reside on the ACCESS and ACCESS 2000 servers located in Building 5 room W56.

### **1.11 Post Delivery**

Maintenance of the Hitchhiker GDS is the responsibility of the GDS Team. Post delivery maintenance of the Avionics GDS and the ACE GDS will be covered under this product plan. This product plan will also include any other Ground Data Systems assigned to the maintenance/enhancement mode in the future.

In summary, the maintenance will include any modification as a result of a software/hardware problem or a mission-specific enhancement. All modifications to the GDS software or hardware are performed by the GDS Development Team and will follow the processes described in the *Hitchhiker Ground Data System Configuration Management Plan* and the *SSPPO Configuration Management Plan & Procedures*.

### **1.12 Customer Supplied Elements (technical and resources)**

The Customer shall provide all funding necessary to support the Hitchhiker GDS maintenance effort. This includes funding for all personnel, travel expenses, software, and hardware, including third-party maintenance support for some hardware.

The Customer shall provide the overall system requirements for the Hitchhiker GDS, the governing ISO documents for guidance, and the Hitchhiker Shuttle Manifest Schedules in preparation for I&T and Mission support.

### **1.13 Customer Involvement**

Throughout the enhancement and maintenance of all Hitchhiker GDS, the Customer will continue to serve as a point of contact for questions regarding detailed requirements and operation concepts. The Customer will review and approve all significant changes to the source code resulting in an impact to schedule or cost. The Customer will be invited to participate in regular status meetings. The GDS Development Lead will act as the PDL and will make regular contact with the Customer in order to provide status and discuss timely issues. The development team's status meetings will be open to the Customer. The GDS Development Team and the Customer may also meet on an as needed basis for discussion and resolution of certain issues affecting the ground system effort.

### **1.14 Acceptance Criteria**

Acceptance testing of new Hitchhiker GDS software will follow the process outlined in the *Software Management Plan for the Shuttle Small Payloads Project*. The GDS will be ready to support a Hitchhiker mission after successful completion of standard I&T activities and Payload Operation Control Center (POCC) Simulations. The GDS Development Team will assist with all levels of testing. The Customer will determine which, if any, of the discrepancies noted during testing must be rectified before supporting a mission.

The Hitchhiker GDS Team Lead and the Customer Representative will sign the formal acceptance test plan and summary. Prior to mission support, the Hitchhiker GDS will undergo

third party system level acceptance testing and the results will be presented at the Pre-ship Review that takes place prior to shipping a HH payload to KSC for integration into the shuttle.

Other acceptance criteria are as follows:

- Software Enhancements: Acceptable performance is that each modification achieves expected results, follows documented CM procedures, and is delivered in a timely manner.
- Procedures, Mission Procedure Documents, and Pages: Acceptable performance is that each is accurate and delivered in a timely manner.
- ASPC Configurations: Acceptable performance is that the ASPC is configured for each mission, specific to the needs of the customers, in a timely and accurate manner.
- User's and Programmer's Guides: Acceptable performance is that the guides are updated to reflect any software enhancements. Updated guides will be maintained on the ACCESS Home Page.
- ISO Product Plans: Acceptable performance is that the plans are kept current and accurately reflect the latest version of the ISC ISO 9001 Product Development Handbook and governing Hitchhiker ISO documents.
- System Administration and IT Security Activities: Acceptable performance is that system and account activities are securely monitored and maintained, and that the operating system patches are kept current on all I&T and mission operations systems.

### **1.15 Customer Agreement Review and Update Process**

The Hitchhiker GDS Team Lead, the Customer/Designee, and the Information Systems Division Management Representative constitute the Configuration Control Board (CCB) for the Customer Agreement, this section of the document. Requested changes will be reviewed and must be approved by the CCB before any changes are implemented.

The Hitchhiker GDS Lead will evaluate all requests for changes to requirements and design concepts for time and technical risks.

## 2.0 Design Planning and Interface Management (GPG 8700.1)

Controlled Document	Comment	Record Held By
Hitchhiker Ground Data System for Avionics Product Plan	Signed & dated by the CCB but has been incorporated into this Product Plan.	Hitchhiker CM Office
Hitchhiker Ground Data System for ACE Product Plan	Signed and dated by the CCB but has been incorporated into this product plan.	Hitchhiker CM Office

Objective Evidence	Comment	Record Held By
ACCESS Task Schedule	Contains work assignments, due dates, and history of completed tasks.	Team Lead or appointed team member
Team Organizations	Described within this product plan.	Team Lead
Milestone Charts	Planned activities for upcoming months	Team Lead
Procurement Budget	Inputs submitted to and approved by the Customer on an as needed basis.	Team Lead
Contractor Budget	Inputs submitted to and approved by the Customer on a yearly basis.	Team Lead

## 2.1 General Development Approach

The general development approach of the Hitchhiker GDS effort is dictated by the Shuttle Manifest Schedules. Team members will be responsible for timely delivery of software modifications, I&T support, and mission operations support as assigned by the GDS Team Lead. All modifications to the existing software will be made to support a specific Hitchhiker mission or to enhance the system as a whole.

## 2.2 Resources Needed

Overall support of the Hitchhiker GDS Team is determined by the Customer in the form of a Statement of Work (SOW) request given to the Code 584 Branch Management. Based on the SOW, the GDS Team Lead writes a task assignment to the contractor supporting the Hitchhiker Project. The Code 584 Branch Management also provides civil servant support to the Customer.

An overall budget is determined by the GDS Team Lead and submitted to the Customer's Resource Representative.

## 2.3 Team Organization

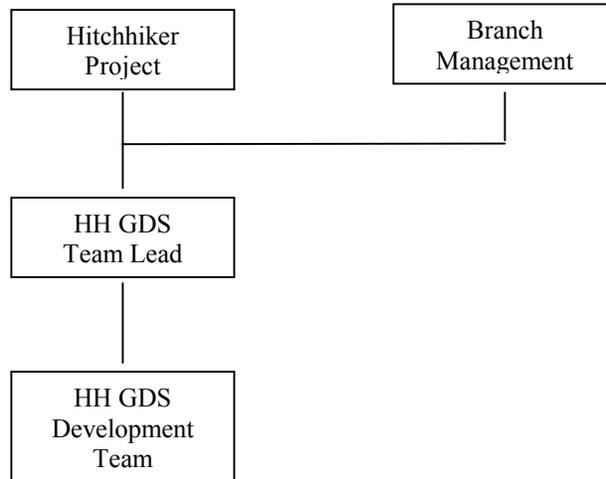
This section describes the organization and purpose of the Hitchhiker GDS Development Team.

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### 2.3.1 Team Organization Chart

The following chart depicts the organization of the Hitchhiker GDS Development Team.



### 2.3.2 Roles, Responsibilities, Authority, Accountability

#### 2.3.2.1 Hitchhiker GDS Lead

The Hitchhiker GDS Lead will act as the Product Design Lead (PDL) and is responsible for the overall development approach and management of the product development effort. The GDS Lead will assign and track work assignments via the PC-based database tool, MS ACCESS. The GDS Lead will also act as one of the GDS developers and the GDS IT Security Lead.

The GDS Lead will provide cost and schedule status to the project on a regular basis via development team status meetings and on an as-needed basis. The GDS Lead is accountable to the Customer for successful performance of the development team's responsibilities.

#### 2.3.2.2 Hitchhiker GDS Developer

The Hitchhiker GDS Developer is responsible for supporting the GDS Lead in the development effort. In addition, the GDS Developer will work as a team to provide all necessary documentation of the product, status reports as required, and support of all Hitchhiker-related operations.

As assigned by the GDS Team Lead, one or more of the GDS developers will act as the GDS CM Lead and the GDS System Administrator.

### **2.3.2.3 Real Time Software Engineering Branch (Code 584)**

The Real Time Software Engineering Branch, as the AETD provider of engineering support for this project will provide organizational support for all aspects of the maintenance/enhancement effort. This support may include generalized development tools and development environments, documentation support, development computers, related training if available within the branch, augmentation of effort levels as required for development, internal reviews or audits, and software development standards and policies.

### **2.3.3 Decision Making and Conflict Resolution Process**

Decisions related to the Hitchhiker GDS effort will be made collaboratively by the Development Team including the Customer, who has final authority in the event of a conflict.

## **2.4 Team Interfaces**

The GDS Development Team will interface with the Electrical Leads for Hitchhiker Payloads. Team members will attend any mission specific meeting held by the Electrical Lead. Team members will support any I&T activity led by the Electrical Lead.

The GDS Development Team will interface with the Hitchhiker Mission Managers. Team members will provide status as required on specific GDS activities to the Mission Managers.

The GDS Development Team will interface with the Hitchhiker Experimenters. Team members will assist with all troubleshooting activities in support of the experimenter. Team members will treat all experimenters with respect and professionalism.

The GDS Development Team will interface with other elements within the ASPC, at Johnson Space Center (JSC), and at Kennedy Space Center (KSC). Team members will support troubleshooting and other operational activities on an as needed basis.

## **2.5 Procurement (GPG 5100.1)**

This section describes the purchases planned for the project.

### **2.5.1 Procurement Needs and Dates**

No new hardware needs are anticipated as a result of HH GDS maintenance efforts. When funding is available (through the Project or Branch) items will be procured as upgrades are required.

All purchase requests will be tracked on the ACCESS schedule on an as needed and funding availability basis. Hardcopies of all purchase requests initiated by the Team Lead will be maintained in a notebook (kept by the Team Lead).

No new facilities will be required for this effort.

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### 2.5.2 Procurement Process

All purchase request needs will be tracked on the ACCESS schedule on an as needed and funding availability basis. Hardcopies of all purchase requests initiated by the Team Lead will be maintained in a notebook (kept by the Team Lead).

Purchases of hardware and/or software will be accomplished using the Small Purchases Systems (SPS) or a Government Credit Card issued to the Team Lead. All purchases will be compliant with Federal Acquisition Regulations.

All contractor support will be obtained through the following venue:

Contract Number: NAS5-01090 (MSES contract)

Contractor Name: the Hammers Company

Quality Record	Comment	Record Held By
SPS Purchase Request Printout	Printout from SPS system kept in logbook. If purchase requires a WOA, WOA number hand written on SPS printout.	Team Lead

### 2.6 Team Training Plan (GPG 3410.2)

Training for the GDS Civil Servant Team Members may include relevant center-funded courses offered by GSFC or third party vendors. The GDS Lead on a periodic basis will assess training requirements for each team member. All training required of the civil servant team members will also be required of the contractor team members. The contractor will be reimbursed through the task for the appropriate costs.

Quality Record	Comment	Record Held By
Records of required training needed	Anticipated training is listed on employees' performance plans.	Branch Level
Records of required training completed		Branch Level

### 2.7 Risk Mitigation

The Hitchhiker GDS effort is at low risk for time, resource, and technical issues. To mitigate risks, all software modifications require thorough acceptance and regression testing as per the *Hitchhiker Ground Data System Configuration Management Plan* and via Hitchhiker CCB approval as per the *SSPPO Configuration Management Plan & Procedures*.

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## 2.8 Security

There are two security plans for the HH GDS. *The Information Systems Division Security Plan* covers HH GDS I&T systems and the *HH GDS ASPC Security Plan* covers the HH GDS Mission systems. All systems have password security protection and are located within locked facilities during non-business hours. Center security messages are to be read on a daily basis and implemented where needed. HH GDS System Administrators shall participate in the System Administrator's Security Working Group (SASWG) of the Information Systems Division.

## 2.9 Detailed Schedule

As described in section 1.7 (Schedules) of this document, the GDS Team Lead will track all team efforts and responsibilities on the ACCESS schedule on a regular basis. This schedule will reflect software modification due dates, software releases, documentation updates, system administration efforts, I&T and mission support, and planned reviews (if any).

A milestone chart will also be maintained to reflect upcoming events, including subsystem integration, acceptance testing, I&T support at GSFC and at KSC, and mission support activities.

## 2.10 Technology and Commercialization Plan

There will be no technology and commercialization plan for this product

### 3.0 Technical Approach

This section describes the technical approach that will be used to maintain and enhance the GDS.

#### 3.1 Design Development (GPG 8700.2)

The general approach to the software development of the Hitchhiker GDS is to upgrade and enhance the existing software with minimal impact to the overall system. New capabilities are designed, developed, tested, and released in incremental builds. Builds are determined by customer needs and mission-specific requirements.

The following documents are provided by the Customer and will be used as guidelines for the development effort: *SSPPO Product Development Management Plan, 870-PG-8700.1.1* and *the Software Management Plan for the Shuttle Small Payloads Project, 870-PG-8700.1.2*.

##### 3.1.1 Product Requirements

All product-related requirement documents are listed in Customer Requirements Section 1.5 of this document.

The following table lists interface control documents and protocols followed by the Hitchhiker GDS Development Team:

<b>Controlled Document</b>	<b>Comment</b>	<b>Record Held By</b>
Hitchhiker ACCESS Network Communication Protocol	Pre-ISO document. Available on ACCESS homepage.	GDS CM Lead
Interface Control Document (ICD) Between Attached Shuttle Payload Center (ASPC) and Hitchhiker Remote POCC	Pre-ISO document. Available on ACCESS homepage.	GDS CM Lead
Hitchhiker Remote POCC Development Plan	Pre-ISO document. Available on ACCESS homepage.	GDS CM Lead

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### 3.1.2 Product Design

Quality Record	Comment	Record Held By
Hitchhiker ACCESS Design Review Package	Review held on 02/08/1993. Attended by project management and peers.	GDS CM Lead
Hitchhiker ACE Thermal System (HATS) Software Review Package	Reviewed on 12/19/2000.	GDS CM Lead
Ground Umbilical Programmer (GUMP) Design Documentation	Pre-ISO Review attended by peers and Customer Designee.	Team Lead

### 3.1.3 Development Methodology (GPG 8072.1)

This section describes the methodology that will be employed in the maintenance of this product.

The general approach to the software development of the Hitchhiker GDS is to maximize the reuse of the existing GDS software. All modifications to existing software will be made to support customer needs and mission-specific requirements.

The methodology used for the maintenance and enhancement of the Hitchhiker GDS will follow the Structured Design Approach outlined in the *Software Management Plan for the Shuttle Small Payloads Project*. Typically, the use of classic top-down structured design will be the primary software engineering life cycle model to be used for the SSPPO.

The following documents are provided by the Customer and will be used as guidelines for the development effort: *SSPPO Product Development Management Plan* and the *Software Management Plan for the Shuttle Small Payloads Project*.

#### 3.1.3.1 Buy Approach (GPG 5100.1)

No special purchasing strategies are required to obtain any hardware or software procurement.

#### 3.1.3.2 Build Approach

The system will be built and released on a per mission basis. The build approach will be iterative; where all software units are present in some form with new capabilities added in subsequent builds.

Quality Record	Comment	Record Held By
Completed Build Plan	Part of Software Order Authorization (WOA)	Team Lead

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### 3.1.3.3 Prototyping Approach

No special prototyping approach is used to develop the Hitchhiker GDS. As stated earlier in the section, the general approach to the software development of the Hitchhiker GDS is to maximize the reuse of existing Hitchhiker GDS software.

### 3.1.3.4 Customer Supplied Products Approach

No customer-supplied elements are anticipated.

## 3.1.4 Product Testing

### 3.1.4.1 Product Inspection and Test (GPG 5330.1)

Inspection and test will be performed in accordance with the *Hitchhiker Ground Data System Configuration Management Plan*.

The Hitchhiker GDS Lead will be the inspection authority for all test verification and validation plans. The Hitchhiker GDS Lead will also approve changes to these plans.

Controlled Document	Comment	Record Held By
Hitchhiker Ground Data System Configuration Management Plan	Defines the overall CM approach adopted by the HH GDS team.	Hitchhiker CM Office
Acceptance Test Plan for ACE ACCESS V.xx.1 (ACE GDS)	The purpose of this test plan is to verify the elements of each task it incorporated into ACE ACCESS Version x.x	GDS CM Lead

Quality Record	Comment	Record Held By
CM package for each task item.	Includes: <ul style="list-style-type: none"> <li>• Unit Test Plans</li> <li>• Integration Test Plans</li> </ul>	GDS CM Lead
ACE ACCESS V.xx.1 CM Release Notes and Test Summary (ACE GDS)	Release Tape, Release Notes, and Test Summary	Hitchhiker CM Office
Product Release Letter for ACE ACCESS V.xx.1 (ACE GDS)	Lists the release number, included capabilities of the release, and a summary of an outstanding minor or major nonconformance.	Customer - original GDS CM Lead - copy

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## Acceptance Criteria and Objectives

Acceptance criteria and objectives will be established in accordance with the *Software Management Plan for the Shuttle Small Payloads Project*. Acceptance testing for each build will be performed according to an Acceptance Test Plan. The plan includes a matrix of requirements and test objectives, test operational scenarios, and required test equipment (hardware/software). Results of the acceptance test will be published in an Acceptance Test Report. Based on this report, the Customer will determine if a build will be accepted or rejected for re-work. Acceptance Test Plans and Acceptance Test Reports will be reviewed and approved by the HH GDS Lead.

Quality Record	Comment	Record Held By
Acceptance Test Plan for ACE ACCESS V.xx.1  (ACE GDS)	The purpose of this test plan is to verify the elements of each task id incorporated into ACE ACCESS V.xx.1	GDS CM Lead

### 3.1.4.2 Incoming Inspection and Test (GPG 4520.2)

No inspection other than kind, count, and condition of purchased products is planned.

The Receiving Inspection and Test System (RITS) will be used for all ground hardware associated with mission operations use. The RITS WOA number and paperwork will be kept with the purchase order hardcopy (SPS Purchase Request Notebook kept by Team Lead).

Quality Record	Comment	Record Held By
RITS Work Order Authorization (WOA)	RITS entry made by Team Lead or Team purchase person	Team Lead
Incoming Inspection Nonconformance Report	See GPG 5340.2	Center Nonconformance Reporting /Corrective Action (NCR/CA) System

### 3.1.4.3 Statistical Techniques (GPG 8070.2)

The team has evaluated the need for statistical testing of the products developed under this Product Plan and has determined that statistical techniques are not required.

## 3.1.5 Development Status

### 3.1.5.1 Design Implementation Status

Objective Evidence	Comment	Record Held By
ACCESS task schedule	<ul style="list-style-type: none"> <li>Includes status of each task element.</li> </ul>	Team Lead

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### 3.1.5.2 Testing Status

Objective Evidence	Comment	Record Held By
ACCESS task schedule	<ul style="list-style-type: none"> <li>Includes status of each task's testing effort.</li> </ul>	GDS Team Lead
CM package for each task item.	Includes: <ul style="list-style-type: none"> <li>Unit Test Plans</li> <li>Integration Test Plans</li> </ul>	GDS CM Lead

### 3.1.6 Development Environment

The Hitchhiker GDS software modifications will be made on development systems located at GSFC in building 5.

Operational support using the GDS will vary depending on the activity, I&T activities within lab areas and clean rooms will be located at GSFC in buildings 5 and 7/10. KSC I&T activities take place as the experiment is installed within the orbiter, location is TBD. All mission operation activities are located at GSFC in the ASPC building 14, room S287.

All modifications to the Hitchhiker GDS software will be performed on personal computers. The platforms vary depending on the component. The following platforms will be utilized:

- SCO Unix, Linux
- Visual Basic and Borland C++ Builder under Windows 95, 98,2000
- Microsoft C under DOS
- Red Hat Linux

### 3.1.7 Technical Review Program (GPG 8700.4)

All modifications, as part of the Hitchhiker GDS, will comply with the types of reviews described in the *Software Management Plan for the Shuttle Small Payloads Project*.

Specifically, the Hitchhiker GDS will conduct, at a minimum, a team design review for new subsystem development consisting of medium-size system changes. A peer review (covering requirements and design) will be conducted for new components of ACCESS or large subsystem development efforts, including redesigns of the existing GDS. Both the team review and the peer review will include the Customer.

Quality Record	Comment	Record Held By
Review Meeting Notes with Action Item List and Resolutions	Peer Reviews only	GDS CM Lead
Attendance Sheet with subject, date, and signatures of attendees.	Peer Reviews only	GDS CM Lead

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### 3.2 Process for Handling, Storage, Packing, Marking, Preservation, and Transportation (GPG 6400.1)

No formal transportation of the product will be done. The product will be delivered as described in section 1.9 (Medium/Method for Product Delivery) of this plan.

### 3.3 Servicing – Process for Product Maintenance

Software maintenance will be the responsibility of the GDS Development Team. Servicing of all hardware will be evaluated on a per incident basis. Parts will be interchangeable or replaced at the expense of the Customer.

<b>Quality Record</b>	<b>Comment</b>	<b>Record Held By</b>
CM package for each task item.	Includes: <ul style="list-style-type: none"> <li>• Unit Test Plans</li> <li>• Integration Test Plans</li> </ul>	GDS CM Lead
ACE ACCESS V.xx.1 CM Release Notes and Test Summary (ACE GDS)	Release Tape, Release Notes, and Test Summary	Hitchhiker CM Office
Product Release Letter for ACE ACCESS V.xx.1  (ACE GDS)	Lists the release number, included capabilities of the release, and a summary of an outstanding minor or major nonconformance.	Customer - original GDS CM Lead - copy

## 4.0 Product Assurance

This section describes the processes and procedures that will be followed in order to assure that the product continues to satisfy the Customer's requirements.

### 4.1 Product Quality Assurance

This section describes the processes and procedures that will be followed in order to assure that the Customer receives a quality product.

#### 4.1.1 Control of Non-Conforming Products and Corrective Action (GPG 5340.2/GPG 1710.1)

Control of non-conforming products will be in accordance with the *SSPPO Quality Management Plan*. Minor non-conformances are written on a 'Hitchhiker Ground Data System Anomaly Report.' The HH GDS Lead will track the status of all reported (minor or major) non-conformances on the ACCESS Task Schedule.

Corrective and preventive action will be in accordance with the *SSPPO Quality Management Plan*. During the Product Nonconformance Process, the Hitchhiker GDS Team will determine the cause of the problem (including any process related causes), document any recommended changes, and submit them to the CCB for approval and implementation.

Quality Record	Comment	Record Held By
Hitchhiker Ground Data System Anomaly Reports	Retained in Anomaly Report logbook.	Team Lead
Nonconformance records from Center NCR system		Center NCR system
Corrective Action Plan for NCR #xxx	In the NCR system	Team Lead
Product Release Letter for ACE ACCESS V.xx.1  (ACE GDS)	Lists the release number, included capabilities of the release, and a summary of an outstanding minor or major nonconformance.	Customer - original GDS CM Lead - copy

### 4.2 Configuration Management (GPG 8700.2)

Configuration management will be performed in accordance with the *Hitchhiker Ground Data System Configuration Management Plan* and the *SSPPO Configuration Management Plan and Procedures*.

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#### 4.2.1 Control of Team Software, Hardware, Documentation, and Data

Identification and 'traceability' of a software release will be performed in accordance with the Configuration Change Request (CCR) process described in the *Hitchhiker Ground Data System Configuration Management Plan* and the *SSPPO Configuration Management Plan & Procedures*.

The Hitchhiker GDS Lead will control all documents and software programs/executables as per the *Hitchhiker Ground Data System Configuration Management Plan* and the *SSPPO Configuration Management Plan & Procedure*.

In an effort to safeguard the GDS software products between build releases, the following procedure will be followed to backup and store software on a daily/weekly basis.

- Store one week worth of daily backup tapes in team member's cabinet in Bldg. 5 room W50 (not at the ACCESS fileserver). Each backup tape will be labeled with a day-of-week. On a daily basis, Monday through Friday replace the previous night's tape with the appropriately labeled tape (i.e. put backup tape marked 'Tuesday' into tape device on Tuesday morning).
- Every Monday, take the previous week of tapes (5) from team member's cabinet for storage in the Bldg. 14 ASPC ACCESS cabinet. Take the previously stored tapes from the ASPC back to Building 5 for reuse during that week.
- In addition, every Monday a CD backup from the previous week is transported for storage in the ASPC ACCESS cabinet.

Quality Record	Comment	Record Held By
List of items under configuration management	A combination of the QRL and the GSFC Centralized CM System.	GDS CM Lead
Copy of signature page of configuration management items.	Original signature pages are store with the CM lead.	GDS CM Lead
HH GDS CCB Records	The CM Lead retains a copy of an original CCR. Signed off CCR is retained in the HH CM Office.	Hitchhiker CM Office
ACE ACCESS V.xx.1 CM Release Notes and Test Summary (ACE GDS)	Software releases will be made periodically to maintain the GDS system.	Hitchhiker CM Office

#### 4.2.2 Control of Test Software and Hardware (GPG 8730.1)

Control of the test equipment provided by the Customer is the responsibility of the Customer. Control of significant test software products under the cognizance of the development team will be achieved through processes defined in the *Software Management Plan for the Shuttle Small Payloads Project*.

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Controlled Document	Comment	Record Held By
Documentation of Test Software Verification Activities	Includes Test Plans	GDS CM Lead

Quality Record	Comment	Record Held By
Test software test results		GDS CM Lead
Records of Verification from Contractor	Records for test results of the MCIO cards.	GDS CM Lead

### 4.2.3 Quality Records (GPG 1440.7)

Control of quality records will be in accordance with the *SSPPO Quality Management Plan*. The Hitchhiker GDS Lead is the quality record coordinator and will maintain a copy of the Quality Record List.

As quality records are generated, they will be placed under GDS CM control and added to the GDS Quality Record List (QRL). The QRL will then be signed and placed with other quality records in a file cabinet maintained by the GDS CM Lead in Building 5 Room W050.

Controlled Document	Comment	Record Held By
Quality Records List		GDS CM Lead

### 4.2.4 Control of Customer Supplied Elements (GPG 5900.1)

No customer-supplied elements are anticipated.

## 4.3 Process and Product Metric Analysis

The process of the Hitchhiker GDS maintenance and enhancement effort will be analyzed through status meetings with the Customer.

A metrics matrix based on Appendix E of the *Code 580 Product Development Handbook* will be maintained throughout the product life cycle. This matrix identifies and tracks key metrics associated with the Hitchhiker GDS maintenance and enhancement effort and will be updated and reviewed periodically to monitor the progress towards meeting planned milestones. This matrix is part of the quality records maintained for the GDS product.

Quality Record	Comment	Record Held By
Required Metrics	Contains the Project, Schedule, Cost, and Quality Metrics.	Team Lead

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## 5.0 Product Development Journals

### 5.1 Team Lessons Learned

Official 'lessons learned' are not kept. As deficiencies are found, every effort to enhance the software or documentation will be made to alleviate the problem for the future. Anomalies will be documented in the ACCESS Task Schedule; and proposed workarounds will be discussed and assigned at the weekly ACCESS Status meetings.

During each Hitchhiker mission, a mission logbook is kept. The logbook documents all activities and anomalies, including time and a detailed response to each issue. These logbooks are reviewed post mission and corrective action is implemented to prevent similar anomalies in the future. These logbooks are stored within the ASPC for quick reference during subsequent missions.

Objective Evidence	Comment	Record Held By
STS-xxx Mission Logbook	Mission specific issues are documented. Documents are stored at the ASPC.	Team Lead (indirectly)

### 5.2 Key Issues, Decisions, and Rationale

A log of key issues, decisions, and rationale will be maintained throughout the life cycle of the Hitchhiker GDS Team.

Objective Evidence	Comment	Record Held By
Log of Key Issues, Decisions, Rationale	New requirement in place as of the signing of this document.	Team Lead

## Appendix A: Acronym List

ACCESS	ACcess to Customer Experiments on Shuttle/Station
ACE	Advanced Carrier Equipment
AETD	Applied Engineering and Technical Directorate
AFP	Avionics Front-end Processor
ASPC	Attached Shuttle Payload Center
CAP	Command Acceptance Pattern
CARS	Customer Accommodations and Requirements Specifications
CAS	Carrier Ancillary System
CCB	Configuration Control Board
CIU	Carrier Interface Unit
COTS	Commercial off-the -shelf
CM	Configuration Management
DDU	Data Display Unit
EDDU	Engineering Data Display Unit
GDS	Ground Data System
HCU	Hitchhiker Central Unit
HH	Hitchhiker
HATS	Hitchhiker ACE Thermal System
HOATS	Hitchhiker Old Avionics Thermal System
HRIU	Hitchhiker Remote Interface Unit
ICD	Interface Control Document
IEEE	Institute of Electrical and Electronic Engineers
IMTE Team	Inspection Measuring Test Equipment Team
IP	Internet Protocol
ISD	Information Systems Division

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I&T	Integration and Test
KSC	Kennedy Space Center
MCIO	Multi-Channel Input/Output
MRDU	Medium Rate De-multiplexer Unit
MRPOST	Medium Rate Post Program
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications
NCR	Non-Conformance Record
NFP	NASCOM Front-end Processor
NIU	NASCOM Interface Unit
PDI	Payload Data Interleave
POCC	Payload Operation Control Center
PSK	Phase Shift Key
PTP	Programmable Telemetry Processor
RAU	Remote ACCESS Unit
RFA	Requests for Action
RITS	Receiving Inspection and Test System
SPS	Small Purchases System
SPIF TAC	Shuttle POCC Interface Facility Telemetry and Command
SSPP	Shuttle Small Payloads Projects
SSPPO	Shuttle Small Payloads Project Office
STAMP	Stand Alone Mission Processing Program
S/W	software
TBD	To be determined
UDP/IP	User Datagram Protocol
UIU	User Interface Unit
TCP/IP	Transmissions Control Protocol/Internet Protocol
WOA	Work Order Authorization

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## **Appendix B: References**

### **Reference List Specific to the Avionics Ground Data System**

1.Hitchhiker Attitude & Thermal Data Display Unit Requirements

Memo from the Project (Revision 10/25/1996)

2..Hitchhiker Full Functional Avionics Testing Software Requirements

ACCESS Homepage

<http://sspp.gsfc.nasa.gov/hh/access/access.htm>

3.Hitchhiker Ground Data System for Avionics Product Plan

870-REF-0201 (Revision C, 01/31/2001)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

4.Hitchhiker Remote POCC Development Plan

ACCESS Homepage

<http://sspp.gsfc.nasa.gov/hh/access/access.htm>

### **Reference List Specific to the ACE Ground Data System**

1.ACCESS Front-end Protocol Specifications

SSPP-SPEC-0060

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

2.Communication Requirements for the Umbilical UART Programmer to Hitchhiker Central Unit

870-SPEC-0070 (Revision E, 04/16/1999)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

3. ACE ACCESS Release Notes and Test Summary

Quality Record

4.Hitchhiker ACE Thermal System (HATS) Software Review Package

Quality Record (12/19/00)

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5.Hitchhiker Ground Data System for ACE Product Plan

870-REF-0202 (Revision C, 01/31/2001)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

6.Requirements for Hitchhiker Carrier to Ground System Communications

870-SPEC-0069 (Revision H, 04/16/1999)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

7.Requirements for Hitchhiker/GAS Bus Communications

870-SPEC-0068 (Revision N, 04/16/1999)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

8.Requirements for the ACE ACCESS 2000 System

870-PLAN-0056 (Baseline, 01/26/2001)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

9.Requirements for the NASCOM Front-end System and NASCOM Interface Unit System

SSPP-SPEC-0059 (Revision A, 08/27/2001)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

## Common References

1.Customer Accommodations and Requirements Specifications

740-SPEC-008

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

2.Hitchhiker ACCESS Design Review Package

Quality Record (02/08/1993)

3.Hitchhiker Ground Data System Configuration Management Plan

870-REF-0215 (Baseline, 02/02/2000)

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4. ISC Product Development Handbook

580-PG-8730.3.1 (Revision F, 6/15/02)

<http://isc.gsfc.nasa.gov/Iso9k/pdh/PDH.pdf>

5. Software Management Plan for the Shuttle Small Payloads Project

870-PG-8700.1.2 (Revision E, 09/22/2000)

<http://gdms.gsfc.nasa.gov/gdms/plsql/masterlist.pgwi>

6. SSPPPO Configuration Management Plan and Procedures

870-PG-1410.2.1 (Revision C, 12/18/2000)

<http://gdms.gsfc.nasa.gov/gdms/plsql/masterlist.pgwi>

7. SSPPPO Product Development Management Plan

870-PG-8700.1.1 (Revision C, 09/22/2000)

<http://gdms.gsfc.nasa.gov/gdms/plsql/masterlist.pgwi>

8. Y2K Project Management Plan for the SSPPPO

870-MGMT-0005 (03/17/1999)

<http://gdms.gsfc.nasa.gov/gsfcm/plsql/frontdoor>

9. Information Systems Division Security Plan

Draft

10. HH GDS ASPC Security Plan

3/18/2002