CCR Number: 0011	CRITICALITY: URGENT	DUE:03/20/98

DISTRIBUTION SHEET
EO-1 LEVEL II CCB

Matt Jurotich/EO-1 Payload Manager

Pete Spidaliere/EO-1 Mission Mgr

Nick Speciale/EO-1 Mission Technologist

D.Mandl/ Ops. Mgr/GSFC

M. Perry/SYS Engineer/Swales

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Brian Smith/S/C Engineer/GSFC

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Dennis Reuter/LEISA AC

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Ken Anderson/ALI Instrument Mgr

Otis Brooks/EO-1

Steve Unger/EO-1 Mission Scientist

Tom Brakke/Code 932

Randy Harbaugh/Code 511

Dave Folta/Enhanced Formation Fly

John Loiacono/ALI Instrument Engr

Don Lencioni/EO-1 Instr. Scientist

NEW MILLENNIUM PROJECT CONFIGURATION CHANGE REQUEST

PROGRAM EO-1

CCR NO. 0011

DATE INITIATED ORIGINATOR'S CHG. NO. 03/09/98

DUE DATE

TITLE B/L EO-1 GROUND SEGMENT LEVEL II REQUIREMENTS DOC.

ORIGINATOR R. CARTER/GSFC

SPONSOR/CODE R. CARTER PHONE x8421

EFFECTIVITY

ITEM: ~~POTS DOC~~

S/N

ITEM:

S/N

ITEM:

S/N

CHANGE CLASS

	I	II
PRELIMINARY	☐	☐
FORMAL	☐	☐

TYPE OF CHANGE

MILESTONE	☐	INTERFACE	☐	SOFTWARE	☐
DOCUMENT	☒	POWER	☐	OTHER	☐
	☐	WEIGHT	☐	_____	☐

DOCUMENTS OR SOFTWARE AFFECTED

EO-1 Level-II Ground Segment Requirements

PROBLEM

The attached draft version of Earth Orbiter-l (EO-1) Ground Segment Level II Requirements Document squires baselining. This document contains the New Millennium Program (NMP) EO-1 Ground Segment Leve I Requirements. The Level II ground segment requirements specify and define requirements at the ground segment level, addressing ground segment subsystem level functional and performance specifications as well as interface requirements to spacecraft and technology.

NOTE: Significant changes with regards to WIS, GIS and FODB are currently being considered. This CCR toes not address these concerns, but will be addressed at a later date when the scope is better defined. The goal here is to baseline the requirements document and add changes via the CCR process at a later date.

PROPOSED SOLUTION

Approve the attached draft version of EO-1 Ground Segment Level II Requirements Document by the EO-1 Level II Configuration Control Board (CCB). Approval of this CCR will officially baseline this draft version of he Requirements document. Future changes will be initiated by submittal of Configuration Change Requests CCRs) and Preliminary Specification Change Notices (PSCNs) for CCB approval. This document is naintained by the EO-1 Configuration Management Office (CMO).

BOARD ACTION

APPROVE	☐
APPROVE WITH CHANGE	☑
DISAPPROVE	☐
WITHDRAW	☐

APPROVAL LEVEL REQUIRED

LEVEL I H Q S	☐
LEVEL II GSFC	☐
LEVEL III c I	

CRITICALITY LEVEL

EMERGENCY	☐
URGENT	☒
ROUTINE	☐

PROCUREMENT CHANGE ORDER CLASSIFICATION

ROUTINE	URGENT	EMERGENCY ☐
OPTION 1 ☐	OPTION 1 ☐	
OPTION2 ☐	OPTION? ☐	

COMMENTS

CHAIRPERSON _____ DATE 22 Jun 98

3/28/96

New Millennium Program/Earth Orbiter-1 Ground Segment Level II Requirements

1.0 Introduction

This document contains the New Millennium Program (NMP)/Earth Orbiter-1 (EO-1) Ground Segment Level II Requirements. The Level II EO-1 ground segment requirements specify and define requirements at the ground segment level. These requirements address ground segment subsystem level functional and performance specifications as well as interface requirements to spacecraft and technology.

The EO-1 mission requirement definition is accomplished in three levels. The Level I requirements define the EO-1 mission objectives and products. The Level II requirements identify and allocate appropriate requirements to mission segments (Technology, Spacecraft, Ground Segment). The Level II requirements are top level requirements for each mission segments. The Level III requirements are the lowest level requirements for the mission. The Level III requirements are directly implemented at the hardware and software levels. The Level III requirements are traced to Level II and then to Level I, respectively. All Level III requirements have either parent requirements in Level II and/or Level I, or have justification for its orphan status.

2.0 Requirement Organization

Requirements are organized and identified by Requirement ID, Requirement Type, Requirement Title, and Requirement Statement. The Requirement ID is a numbering system where each requirement is assigned a unique number. This number is used in tracing a requirement from parent to child and vice versa. The Requirement Type is an indicator for a type of requirement. The detailed description of the Requirement Type is provided in the section 3.0. The Requirement Title is a title for a requirement. The Requirement Statement provides the required action or activity. There is only one required action or activity per requirement statement.

3.0 Requirement Type Definition

H (Hierarchical) Requirement: A requirement which is not directly verifiable, but provide structure to a set of requirements. A Hierarchical requirement must be verified “through validation.” This means that the child requirements must be validated to define the success of the parent, and the child requirements must be verifiable. (Note: Child requirements may themselves be hierarchical.)

FC (Functional Category): A hierarchical requirement, which is the parent of a set of child requirements. Generally the functional category may be viewed as a container of a set of requirements which are “alike” in some manner such as; a. Similar Functionality
b. Same functionality applied to different elements
c. Are verified as a group.

F (Functional) Requirement: A functional requirement is a child requirement to a functional category. A functional requirement is the parent requirement to performance requirements. Functional requirements specify functions of the system, subsystem, instrument, or component. Functional requirements must be verifiable by test, analysis, or inspection.

P (Performance) Requirement: A performance requirement is a child requirement to a functional requirement. The performance requirements are directly verifiable, and each performance levels are verified. The performance requirements specify discrete performance levels of the system, subsystem, instrument, and/or component. The verification methods for performance requirements are test, analysis, and/or inspection.

4.0 Requirement Verification

The requirements shall be verified using methods accepted by the EO-1 Mission management. The acceptable verification methods include testing, analyses, and/or inspection. Positive verification for each requirement shall be provided. A requirement shall be verified either directly or indirectly. An example of an indirect verification would be such that Level I requirement is traced to Level II and then to Level III, where a direct verification of the Level III requirement is accomplished. In this case, the Level I and II requirements are verified indirectly and the Level III requirements are verified direcly. This is an acceptable verification approach.

5.0 Requirements Verification Matrix

The requirement verification matrix shall be developed. The matrix shall identify requirement, verification method, verification acceptable criteria, verification results, and the date of verification.

6.0 EO-1 System Validation

The requirement verification matrix, along with requirements tracing to either parent or child shall be the basis for the EO-1 system validation.

Requirement ID	Requirement Type	Requirement Title	Requirement Statement
01	H	NMP/EO-1 Ground System (EGS) Level II Requirements	This document defines Level II requirements for the New Millennium Program (NMP) EO-1 Ground System (EGS).
01.01	H	NMP/EO-1 Mission Operations Center	The NMP EO-1 mission operations center shall provide the capability to implement all phases (pre-launch through disposal) of the EO-1 mission operations.
01.01.01	FC	Mission Command and Control (MCC)	The MCC shall operate and control EO-1 spacecraft, manage commands, schedule ground stations, trend telemetry, and monitor spacecraft health and safety.
01.01.01.01	F	Spacecraft Operations and Control	EO-1 spacecraft operations and control shall be created based on inputs from the Mission Science Office, Flight Dynamics System, Landsat 7 MOC, and Wallops Scheduling Group.
01.01.01.02	F	Command Management	Real-time and stored command load shall be created and uploaded.
01.01.01.03	F	Telemetry Management	The OGS shall be capable of receiving housekeeping and science telemetry, from the ground stations, at least twice a day.*
01.01.01.04	F	Maintain Observatory Health and Safey	Observatory Health and Safety shall be monitored, analyzed, and corrective commands generated.
01.01.02	FC	Level-0 Processor (LZP)	The LZP shall receive and process science and housekeeping data to create input files for the SDC.
01.01.02.01	F	Data Reformat	The LZP shall reformat data as required by the Science Validation Facility (SVF).
01.01.02.02	F	Data Transfer	The reformated data shall be transferred to the Science Validation Facility (SVF) and the transfer verified.
01.01.02.03	F	Data Archiving	The Science Validation Facility (SVF) shall archive science data.
01.01.03	FC	Flight Dynamics System (FDS)	The FDS shall ensure that spacecraft orbit is maintained and shall validate attitude and orbit.
01.01.03.01	F	Orbit Maintenance	The FDS shall ensure that the EO-1 spacecraft maintains an orbit with high precision relative to Landsat 7*.
01.01.03.02	F	GPS Validation	The FDS shall provide validation of the onboard GPS orbit determination.

Requirement ID	Requirement Type	Requirement Title	Requirement Statement
01.01.03.03	F	Attitude Validation	The FDS shall provide attitude validation and calibration informatin for the on-board attitude control system.
01.01.03.04	F	Ground Station View Periods	The FDS shall generate ground station view periods.
01.01.03.05	F	Spacecraft Manuver Commands	The FDS shall generate manuver command engineering inputs.
01.01.03.06	F	Spacecraft Antenna Pointing	The FDS shall generate spacecraft antenna pointing inputs.
01.01.03.07	F	Ephermeris File Generation	The FDS shall be capable of generating an ephermeris file during GSP.
01.02	H	NMP/EO-1 Ground Station Network and Ground Communication	The Ground Station Network shall be established to support all phases (pre-launch through disposal) of the EO-1 Mission.
01.02.01	FC	Ground Stations	EO-1 Mission shall be supported with both primary and back-up ground stations.
01.02.01.01	F	Primary Ground Station	The primary ground station shall be the Automated Orbital Tracking Station at Spitzbergen.
01.02.01.02	F	Back-up Ground Stations	The back-up ground stations during L&EO shall be Automated Orbital Tracking Stations at Poker Flats and WFF.
01.02.01.03	F	McMurdo Ground Station	McMurdo shall provide back-up ground station support during L&EO and manuvers during the mission.
01.02.01.04	F	TDRSS	TDRSS shall provide downlink telemetary support during L&EO.
01.02.02	FC	Ground Station Functions	Ground Stations shall provide the functions listed below.
01.02.02.01	F	Telemetry	The ground stations shall be capable of receiving both X-band and S-band telemetry.
01.02.02.02	F	Commands	Commands shall be throughput to the spacecraft upon receipt at the
01.02.02.03	F	Tracking	Shall provide doppler and/or ranging support.
01.02.02.04	F	Data Recording and Processing	The ground stations shall be capable of recording and processing data on site.
01.02.02.05	F	Data Transfer	Ground stations shall transfer telemetry data electronically upon receipt, and science data via storage media to the MOC.

Requirement ID	Requirement Type	Requirement Title	Requirement Statement
01.03	H	NMP EO-1 Mission Science Office	The NMP EO-1 Mission Science Office shall support all phases (pre-launch testing through disposal) of the EO-1 Mission.
01.03.01	FC	Mission Planning	The Mission Science Office shall conduct mission planning.
01.03.01.01	F	Science Plans	The Mission Science Office shall plan image taking basd upon interaction with the Landsat 7 science team.
01.03.01.02	F	Spacecraft Command Generation	The Mission Science Office shall provide agreed to science plans as needed for command generation to the MCC.
01.03.02	FC	Science Validation Facility (SVF)	The SVF shall receive data from the LZP.
01.03.02.01	F	Level-0 Files	The SVF shall receive, process, and archive science and housekeeping level-0 files from LZP.
01.03.02.02	F	Scene Assessment	The SVF shall assess quality of imager scenes.
01.03.02.03	F	Scene Processing	The SVF shall generate Level-1 EO-1 imager scenes as required.
01.03.02.04	F	Paired Scene Archiving and Distributing	The SVF shall archive and distribute science data.
01.03.02.05	F	Instrument Boresite	The SVF shall refine instrument to ACS alignment estimate.

Spidaliere comments. CR-0011

Requirement ID	Requirement Type	Requirement Title	Requirement Statement
01	H	NMP/EO-1 Ground System (EGS) Level II Requirements	This document defines Level II requirements for the New Millennium Program (NMP) EO-1 Ground System (EGS).
01.01	H	NMP/EO-1 Mission Operations Center	The NMP EO-1 mission operations center shall provide the capability to implement all phases (pre-launch through disposal) of the EO-1 mission operations.
01.01.01	FC	~~Mission Command and Control (MCC)~~ Mission Operations Center (MOC	The MOC shall operate and control EO-1 spacecraft, manage commands, schedule ground stations, trend telemetry, and monitor spacecraft health and safety.
01.01.01.01	F	Spacecraft Operations and Control	EO-1 spacecraft operations and control shall be created based on inputs from the ~~Mission~~ Science Office, ~~Flight Dynamics System~~, Landsat 7 MOC, and Wallops Scheduling Group.
01.01.01.02	F	Command Management	Real-time and stored command load shall be created and uploaded.
01.01.01.03	F	Telemetry Management	The EGS shall be capable of receiving housekeeping and science telemetry, from the ground stations, at least twice a day *
01.01.01.04	F	Maintain Observatory Health and Safety	Observatory Health and Safety shall be monitored, analyzed, and corrective commands generated.
01.01.02	FC	~~Level 0 Processor (LZP)~~ Data Processing System (DPS)	The ~~LZP~~ DPS shall receive and process science and housekeeping data to create input files for the ~~SDC~~ associated Science Validation Facility (SVF)
01.01.02.01	F	Data Reformat	The ~~LZP~~ DPS shall reformat data as required by the Science Validation Facility (SVF).
01.01.02.02	F	Data Transfer	The reformated data shall be transferred to the Science Validation Facility (SVF) and the transfer verified.
01.01.02.03	F	Data Archiving	The Science Validation Facility (SVF) shall archive science data.
		Science Data Quantity *	The SVF shall be capable of processing up to 800 scenes per year, 20 per week.
01.01.03	FC	Flight Dynamics System (FDS)	The FDS shall ensure that spacecraft orbit is maintained and shall validate attitude and orbit.
01.01.03.01	F	Orbit Maintenance	The FDS shall ensure that the EO-1 spacecraft maintains an orbit with high precision relative to Landsat 7 *
01.01.03.02	F	GPS Validation	The FDS shall provide validation of the onboard GPS orbit determination.

Insert in this section under MOC

The MOC shall plan all Satellite activities

Mission Planning

I don't know if this is really a req, more a process

* not defined

Need to define

(Descending node 1 minute behind Landsat 7 and ±3 km cross track)

Move this requirement to SVF requirements section

Requirement ID	Requirement Type	Requirement Title	Requirement Statement
01.01.03.03	F	Attitude Validation	The FDS shall provide attitude validation and calibration informatin for the on-board attitude control system.
01.01.03.04	F	Ground Station View Periods or & pointing vectors	The FDS shall generate ground station view periods. and pointing vectors
01.01.03.05	F	Spacecraft Manuver Commands	The FDS shall generate manuver command engineering inputs. (reboost, inclination adjust, science collection, lunar and Solar calibration)
01.01.03.06	F	Spacecraft Antenna Pointing	The FDS shall generate spacecraft antenna pointing inputs.
01.01.03.07	F	Ephermeris File Generation	The FDS shall be capable of generating an ephermeris file ~~during GSP~~. for uplink
01.02	H	NMP/EO-1 Ground Station Network and Ground Communication	The Ground Station Network shall be established to support all phases (pre-launch through disposal) of the EO-1 Mission.
01.02.01	FC	Ground Stations	EO-1 Mission shall be supported with both primary and back-up ground stations.
01.02.01.01	F	Primary Ground Station	The primary ground station shall be the Automated Orbital Tracking Station at Spitzbergen.
01.02.01.02	F	Back-up Ground Stations	The back-up ground stations during L&EO shall be Automated Orbital Tracking Stations at Poker Flats and ~~WPF~~. Wallops
01.02.01.03	F	McMurdo Ground Station	McMurdo shall provide back-up ground station support during L&EO and manuvers during the mission.
01.02.01.04	F	TDRSS	TDRSS shall provide downlink telemetary support during L&EO.
01.02.02	FC	Ground Station Functions	Ground Stations shall provide the functions listed below.
01.02.02.01	F	Telemetry	The ground stations shall be capable of receiving both X-band and S-band telemetry.
01.02.02.02	F	Commands	Commands shall be throughput to the spacecraft upon receipt at the
01.02.02.03	F	Tracking 2 way data & Angles data	Shall provide doppler ~~and/or ranging~~ support. 2 way and angle
01.02.02.04	F	Data Recording and Processing	The ground stations shall be capable of recording ~~and processing data~~ on site for transfer to the MOC
01.02.02.05	F	Data Transfer	Ground stations shall transfer telemetry data electronically upon receipt, and science data via storage media to the MOC.

? →

Missing words

Requirement ID	Requirement Type	Requirement Title	Requirement Statement
01.03	H	NMP EO-1 Mission Science Office	The NMP EO-1 Mission Science Office shall support all phases (pre-launch testing through disposal) of the EO-1 Mission.
01.03.01	FC	Mission Planning	The Mission Science Office shall ~~support~~ conduct mission planning.
01.03.01.01	F	Science Plans	The Mission Science Office shall plan image taking based upon interaction with the Landsat 7 science team.
01.03.01.02	F	Spacecraft Command Generation	The Mission Science Office shall provide agreed to science plans as needed for command generation to the ~~MOC~~.
01.03.02	FC	Science Validation Facility (SVF)	The SVF shall receive data from the ~~LZP~~.
01.03.02.01	F	~~Level-0~~ Files	The SVF shall receive, process, and archive science and housekeeping level-0 files from ~~LZP~~.
01.03.02.02	F	Scene Assessment	The SVF shall assess quality of imager scenes.
01.03.02.03	F	Scene Processing	The SVF shall generate Level-1 EO-1 imager scenes as required.
01.03.02.04	F	~~Paired~~ Scene ~~Archiving~~ and Distributing	The SVF shall ~~archive and~~ distribute science data.
01.03.02.05	F	Instrument ~~Boresite~~	The SVF shall refine instrument to ACS alignment estimate.

Support the MOC in

and The EO-1 science team.

MOC

Data Processing System

Level-0 Files

Data Processing System

DPS

the

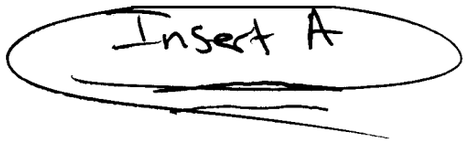
archiving in a previous requirement (01.01.02.03) which is to be moved back here.

alignment

with The Flight Dynamics System

Insert A here (See attached sheet)

800 scenes



The Mission Science Office shall plan and assess periodic lunar and solar scanning calibration with a goal of 5% absolute radiometric accuracy.

The Mission Science Office shall gather a representative sample of multispectral terrain images that capture the seasonal variations encompassing one entire growing season (March through October) in the Northern Hemisphere.

The Mission Science Office shall perform a minimum of 200 paired-scene comparisons with Landsat 7(ETM+) comparing the spectral reflectance of known surface features within the cross track pointing capability of the spacecraft.

The Mission Science Office shall assess the optical performance of the AL1 Wide field, Silicon Carbide Optics.

The Mission Science Office shall assess the use of the Atmospheric Corrector data to determine atmospheric water vapor, aerosols, and clouds.

The Mission Science Office shall assess the use of Atmospheric Corrector data from cloud-free scenes to correct paired Landsat 7 and AL1 images for the effects of atmospheric extinction.

Date: Fri, 27 Mar 1998 10:03:00 -0500 (Eastern Standard Time)
From: Administrator@hst-nic.hst.nasa.gov
Reply-to: (Steve Kempler/586)
Subject: CCR:0011 - DUE: 03/20/98 URGEN Level-2 Steve Kempler/58 WWW-COMMENTS

USER : (Steve Kempler/586) sent the following comments on :

Date: 03/27/1998
CCR Number: 0011
Sponsor: R. CARTER
Due Date: 03/20/98

CCR Title: B/L EO-1 GROUND SEGMENT LEVEL II REQUIREMENTS DOC.

Remote host: 128.183.166.16 Email Address: steven.kempler@gsfc.nasa.gov
---
APPROVAL STATUS: APPROVED WITH COMMENTS
Note:

COMMENTS: Comments on Baseline EO-1 Gound Segment Level 2 Requirements Document (CCR 0011)
- Steve Kempler - 3/27/98

1. It would be very helpful (and appropriate) to have a column that lists the Level 1 requirement that traces to each Level 2 requirement.

2. The following clarifications would be very helpful:

a. Requirement ID 01.01.01.01: Replace the word: “created” with “performed”.

b. Requirement ID 01.01.01.03: Define “OGS”

c. Requirement ID 01.01.02: Add: “all” before the word “science”; Add: “(i.e., ALI, AC)” at the end of the sentence; Define: “SDC”.

d. Requirement ID 01.02.02.02: The word: “station” was left off the end. However, “ground station” would be better.

e. Requirement ID 01.02.02.03: This requirement needs to be clarified: “Shall provide doppler and/or ranging support”. We need to add what is is that will be providing the “support”. (i.e., Who will be providing the suppoer.); Also, the kind of “support” that is required should be provided. This will ensure that the right “support” is being provided, and that the requirement is testable

f. Requirement ID 01.03.02.03: Add: “(i.e., ALI, AC)” to end of statement.

g. Requirement ID 01.03.02.04: Add: “to EO-1 investigators” to end of sentence.

3. The Cover page, Introduction (Section 1), and Requirement Type Definition (Section 3) state performance specifications are addressed, however there are none. Performance requirements are proposed below.

4. The following additional requirements are proposed in the appropriate areas (note: some DPS requirements actually may be SVF requirements):

a. The DPS shall provide Level 0 data to the SVF within 12 hours of completed Level 0 data processing.

b. The DPS shall assess and report on the quality of received science and housekeeping data

c. The DPS shall assess and report on the quality of processed level 0 data.

d. The DPS shall provide metadata associated with processed Level 0 data, to facilitate

data access and to describe data (i.e., index to paired LANDSAT 7 data)

e. The DPS shall provide tools for accessing EO-1 MSI and LANDSAT 7 ETM+ paired scenes.

f. The DPS shall provide tools for comparing EO-1 MSI and LANDSAT 7 ETM+ paired scenes.

g. The DPS shall have the capabilty to apply on Atmospheric Correction (AC) data to ALI images.

h. The DPS shall have the capability to ingest, process, and distribute up to 4 ALI and AC scenes of Level 0 data in a 24 hour period.

i. The DPS shall have the capability to produce Level 0 data within 24 hours of receipt of the last input parameter required for processing.

j. The MCC shall have the capability to develop a daily and/or weekly plan that reflects all requested activities to be performed.

k. The MCC shall have the capability to schedule the performance of Flighjt Operations activities into a daily plan within 24 hours of request receipt.

l. The SVF shall provide EO-1 science data to a DAAC for permanant archive and distribution.

5. Run spelling checker.

Date: Mon, 06 Apr 1998 09:10:41 -0400 (Eastern Daylight Time)
From: Administrator@hst-nic.hst.nasa.gov
Reply-to: (Steve Kempler)
Subject: CCR:0011 - DUE: 03/20/98   URGEN Level-2 Steve Kemple WWW-COMMENTS

USER :   (Steve Kempler) sent the following comments on :

Date: 04/03/98
CCR Number: 0011
Sponsor: R. CARTER
Due Date: 03/20/98

CCR Title: B/L EO-1 GROUND SEGMENT LEVEL II REQUIREMENTS DOC.

Remote host: 198.118.115.72 Email Address:

APPROVAL STATUS: APPROVED WITH COMMENTS
Note:

COMMENTS: Need to amend Requirement 01.01.01.01, as follows: "... based on inputs
> >that facilitate the vaidation of new technology requirements, ..."
> >

CCR SPONSOR RECOMMENDATION FORM

CCR NUMBER: 0011

CCR TITLE: B/L EO-1 GROUND SEGMENT LEVEL II REQUIREMENTS

CCR SPONSOR: Ruth Carter/GSFC

SUMMARY OF COMMENTS RECEIVED: (list Level 4 CCB and internal reviewers who had comments and address those comments)

Pete Spidaliere: See hard copy red lines.

Steve Kempler: Need to amend Requirement 01.01.01.01 as follows: “based on inputs that facilitate the validation of new technology requirements,…”

Sponsor Recommendation: Incorporate all of the recommended changes to document including the attached red lines.

SPONSOR/ORGANIZATION: Ruth Carter/GSFC

DATE: 5/14/98