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01	32-016	Initial Release for comment	RFGoeke		5/10/05
A	32-020	Initial Controlled Release	RFGoeke	RFFoster	5/23/05

CRaTER
Configuration Management
and Review Process

Dwg. No. 32-01201
 Revision A
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Preface

Rev. 01 is being circulated for comment. This document is loosely derived from the ACIS Configuration Management Plan, though the fundamental process has been in place at MKI for decades. The concept of both controlling and archiving the documents in electronic format with a web interface has been used most recently on the SPIDR program at BU and the VOILA program at MIT.

Rev A is the first controlled release. There are no substantive changes from Rev. 01, though numerous editorial improvements have been made.

1 Introduction

The flight hardware for the Cosmic Ray Telescope for Effects of Radiation (CRaTER) instrument on the Lunar Reconnaissance Orbiter (LRO) is composed of a single assembly incorporating both radiation detector and all associated power, command, data processing, and telemetry electronics. Flight hardware design and fabrication occur at instrument co-investigation partners Aerospace Corporation (Aero) and the MIT Kavli Institute for Astrophysics and Space Research (MKI). Ground data processing will occur at the Boston University Center for Space Physics (CSP).

1.1 Scope

This document describes the CRaTER Instrument Configuration Management (CM) system, through which all significant data items (parts, reports, drawings, *etc.*) are bookmarked and/or controlled. Although three geographically distinct groups are involved with this project, our intent is to operate the Configuration Management as a single, unified process. Implementation details that are unique to the participating institutions will be covered in daughter documents (if required).

This document also describes the review process that governs those documents for which peer or management review is appropriate and necessary.

1.2 Management

The Configuration Management function is implemented through a Configuration Control Board (CCB). The mandatory CCB members consist of the Program Manager, the Reliability and Quality Assurance Manager, the Project Scientist, and the Project Engineer. Additional members of the project will join the board for those matters in which their expertise and/or responsibility is appropriate.

The Program Manager chairs the Configuration Control Board. The Project Engineer is responsible for implementing the configuration management process and for CRaTER serves as the Database Manager.

1.3 ECOs and the Database

The Engineering Change Order (ECO) is the sole process by which data items are entered into the Project database. By “data items” we mean drawings, documents, purchased parts, analyses, reports, software programs or almost anything else that needs to be controlled and/or archived. The existence of an entry in the database enables management of the data item.

2 Structure of the Database

2.1 Records and Fields.

The database is composed of a series of records, one for each data item. Each record, in turn, consists of a set of fields, only one of which is mandatory. That mandatory field is the Identification Number” (commonly referred to as a Drawing Number) in the form ‘32-bccdd.eeff’; this number uniquely identifies each passive component, mechanical fastener, assembly drawing, verification report, *etc., etc.* The numbering scheme is hierarchical. For instance find number “6” on sub-assembly 32-12233.44 would be entered as 32-12233.4406 in the database.. (See the configuration database at <http://snebulos.mit.edu/projects/acis/> for a complex program implementation.) The CRaTER numbering scheme and the translation into file names (whose use is addressed below) is found on the first page of the database at <http://snebulos.mit.edu/projects/crater/> and reprinted here in Appendix A.

2.2 Initial Field Descriptors

The following fields are initially being used for the CRaTER database, but there is no limit on the number a record may have, nor is there any requirement that the any given record utilize any particular set of fields save the Identification Number (though it would be odd not to have a Description field). Field names must be unique across the entire database, however.

Internal Mnemonic	Full Name	Usage Notes
dwg	Drawing Number	Unique identification number. The “32-“ project number is implicit within the database
size	Size	“2D” for a two-sheet ANSI D-size drawing “14T” for a 14 page text document
rev	Revision	01, 02, ... for bookmarked items A, B, for controlled items “>” for purchased parts
quan	Quantity	Used only for physical parts; A/R for “as required”.
desc	Description	Brief description
mfg	Manufacturer	Vendor name
pn	Part Number	Vendor’s part number
date	Date	Date of the last ECO date
ref	Reference	References to a GSFC document number, for instance
xref	Cross-reference	Used to cross-reference to another item within this database
gen	General	Other information

2.3 Field Data Retrieval

The field contents attached to each data item in general extends over many columns; only a limited subset is displayed when browsing the complete on-line database. To retrieve a particular, perhaps full, set of information for a subset of the database, one needs to access the custom Report Writer, selecting a range of drawing numbers and the desired set of field names. The resulting report is available in both HTML and Tab Separated Value format (for use by spreadsheet programs).

2.4 Primary Data Item Retrieval

The HTML displayed database has embedded links which allow the user to retrieve a Portable Document Format (PDF) version of the referenced drawing or document by clicking on the drawing number. Clicking on the revision letter will allow the user to access the directory in which the source document has been stored – a *.dwg file in the case of an AutoCad drawing, for instance.

2.5 Archives

All documents recorded in the database are permanently archived in both their native format and in PDF. These archives are linked to the database so that the entire historical record is maintained and accessible. The database thus serves the function of the “controlled print file” in maintaining all project originals. Only the Database Manager has write access to the database and archives.

2.6 Engineering Change Orders

The Engineering Change Order (ECO) is the sole method by which data items are entered into or changed within the database. At a minimum, the ECO cover sheet lists the item, its number and revision level, the reason for this release, and the author’s name. The full ECO is composed of the cover sheet, a list of the filed entries to be put into the database, and both the original and a Portable Document Format (PDF) version of the data item itself. The current CRaTER ECO form is shown in Appendix B.

2.6.1 Bookmarking Data Items

If the purpose of the data item entry into the database is to make available a preliminary design for comment, or to record the details of a specification being sent to a vendor for preliminary quotation, or simply to archive the state of progress on a document on a particular day – that ECO with its accompanying documentation creates a Bookmark entry into the database. Any member of the Project can, on their sole authority, create a Bookmark entry. Bookmark entries are given numerical revision designators starting with 01.

2.6.2 Controlled Data Items

Data items which are subject to review and approval by the Configuration Control Board are considered Controlled entries. Controlled entries are given alphabetic revision designators starting with A. Purchased parts (e.g.: bolts) which appear, for instance, as find numbers in assemblies, are given a “>” symbol as a revision designator when the document which calls them out is controlled.

3 Review Process

The review process, which leads to the release of a Controlled document, is composed of a number of phases: distribution, review and comment, approval, and release.

3.1 Distribution

The review process starts with the originator signing out an ECO number and a document number (if applicable) in the ECO log. The ECO sheet will list one or more related documents and the reason for the current proposed release and the principal changes that have occurred since the previous release. If a Bookmark release, the ECO together with the document itself is delivered to the Database Manager for incorporation into the database. If a Controlled release, the document is delivered to the Database Manager for distribution to the CCB. The Project Engineer will assign appropriate individuals to the Board to supplement the mandatory members.

3.2 Review and Comment

For all engineering documents the review process is, in fact, a peer review in which the membership of the CCB is augmented with individuals of appropriate technical competence. In this way the CCB serves to implement an incremental peer review as designs are progressing, rather than having larger and less frequent peer reviews separate from the configuration management process.

So that review members may have time to prepare for a meeting, no data item can be presented to the CCB unless it has been distributed at least two full working days prior to that meeting. (Current rules call for delivery of the ECO to the Database Manager prior to Friday noon for CCB action the following Wednesday.)

Each reviewer signs the ECO sheet indicating his agreement with the document as amended by his comments. If the document is passed around electronically – from MIT to Aerospace, for instance – the Project Engineer is responsible for ensuring that the originator receives those comments and initials the physical ECO sheet to indicate completion of this phase.

3.3 Approval

Following the peer review there will, in general, be a number of actions, corrections or even negotiations required of the author. When that correction process is completed to the satisfaction of the Project Engineer, the document is Checked by an independent reader, Approved by the Chair of the CCB, and released by the Database Manager; the signatures are entered on the ECO sheet.

3.4 Release

The document is submitted in both source and PDF format to the Database Manager for filing (and formal closeout of the ECO). The Database Manager files the document in the archive and updates the database, thus completing the release process. Both PDF and source are now publicly accessible on the web.

Cosmic Ray Telescope for the Effects of Radiation

Last Database Update: Mon May 9 12:14:01 US/Eastern 2005

[The Nebulos Homepage](#)

[The CRaTER e-File](#)

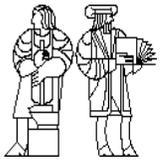
What do all these funny numbers mean?

1. The drawing number system for this project is described in the following for a typical drawing: *aa-bccdd.eeff*
 1. The **32** in the *aa* position denotes the CRaTER Project.
 2. The first digit after the - denotes a major, complete assembly (see *Table of Contents*).
 3. The second and third digits denote a major subassembly.
 4. The fourth and fifth digits denotes items constituent to the subassemblies.
 5. The first and second digits after the decimal (generally) from a parts list for a lowest level assembly.
 6. The third and fourth digits after the decimal are available if further breakdown is necessary.
2. Drawing size is indicated by prefixing the drawing size letter to the number. A **T** indicates a text document. A number prefix is also used for the number of sheets, (e.g. **2B**). Revisions are shown by a number or letter in the Rev column. Bookmark releases are indicated by a number starting with **01**. Controlled releases are designated as **A**. Controlled purchased parts are indicated by a > in this column.
3. Archives of drawings and documents are kept in the CRaTER file_cabinet directory. The file name is of the form *bccdd_eeffSk_rn.type* and is write-protected from all access but that of the configuration manager.
 1. The first digits (*bccdd_eeff*) are the same as those in the Configuration Database. The *32-* is missing, and the **dot** is replaced with an **underscore**.
 2. In the case of a multi-sheet drawing, a capital **S** followed by a page number *k* preceding the *_rn* suffix.
 3. The revision number *n* of the drawing is an upper-case alphanumeric -- e.g. **01** or **C**. All revisions, past as well as current, are kept on file.

To make the file system more accessible, a directory structure based on the first few digits' meaning is used. For example 32-12345_06_rK.dwg would be found in a directory *./file_cabinet/1/23/45/12345_06* along with all prior revisions.

SIZE	DWG	REV	QUAN	DESC
	32-00000			REFERENCE DOCUMENTS
	32-01000			Mission Requirements and Plans
	32-01001			..Announcement of Opportunity
64T	32-01001.01	A		....Proposal Information Package
46T	32-01001.02	01		....CRaTER Proposal
	32-01002			..Robotic Lunar Exploration Program
155T	32-01002.01	01		....Mission Assurance Requirements
58T	32-01002.02	01		....Generic Instrument PAIP
14T	32-01002.03	01		....Radiation Requirements
37T	32-01002.0301	01		.....Radiation Environments
17T	32-01002.04	01		....Thermal Model Requirements
14T	32-01002.05	01		....Mechanical ICD Requirements
	32-01200			Instrument Requirements, Plans, and Procedures
	32-01201			..Configuration Management Plan
	32-01201.01			....Aerospace Procedure
	32-01201.02			....BU Procedure
	32-01201.03			....MIT Procedure
9T	32-01202	01		..Risk Management Plan
	32-01203			..Contamination Control Plan
	32-02000			Interface Control Documents
14T	32-02001	03		..Spacecraft to CRaTER Data ICD
	32-02002			..Spacecraft to CRaTER Electrical ICD
40T	32-02002.01	01		....Generic LRO EICD
17T	32-02003	02		..Spacecraft to CRaTER Mechanical ICD
17T	32-02003.01	01		....Generic LRO MICD
	32-02004			..Spacecraft to CRaTER Thermal ICD
D	32-02004.01	01		....Outline Drawing
	32-03000			Electrical Drawings
	32-03001			..Block Diagrams
	32-03002			..Cabling
	32-03002.01			....Power Distribution
	32-10000		1	FLIGHT INSTRUMENT, Assembly Drawing
	32-10100		1	Detector, Assembly
	32-10200			Electronics Assemblies
	32-10201		1	..Outline Drawing, Digital Board
	32-10202		1	..Outline Drawing, Analog Board
	32-70000			NON-FLIGHT ASSEMBLIES AND DELIVERABLES
	32-70100			Engineering Unit Instrument
	32-71000			Mechanical Interface Template
	32-71100			Instrument Interface Simulator
	32-71200			Instrument C&DH Simulator
	32-72000			CAD Model
	32-72100			Structural Model
	32-72200			Thermal Model
	32-73000			PDR Package
	32-73100			CDR Package
	32-80000			GROUND SUPPORT EQUIPMENT
	32-80100			Mechanical GSE
	32-80200			Electrical GSE
	32-80300			Shipping

Appendix B – ECO Form

	<h2 style="margin: 0;">CRaTER</h2> <h3 style="margin: 0;">ENGINEERING CHANGE ORDER</h3>		<p><u>ECO NO.</u></p> <p>32-</p>
SIZE	DWG. NO.	NEW REV.	DRAWING TITLE
	32 -		
	32 -		
	32 -		
	32 -		
	32 -		
REASON FOR CHANGE:			
DESCRIPTION OF CHANGE:			
	SIGNATURE	DATE	REMARKS:
ORIGINATOR			
ELECTRICAL			
MECHANICAL			
THERMAL			
GSE			
FABRICATION:			
QUALITY			
PROJ. SCIENCE			
PROJ. ENGINEER			
PROJ. MANAGER			
CHECKED			
APPROVED			
RELEASED			