

**COS DCE BOOT FSW v1.09 Component Test Results  
Requirement 5.1.1.5b Code in PROM**

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## 1. INTRODUCTION

### 1.1 PURPOSE

This document presents the Cosmic Origins Spectrograph (COS) Device Control Electronics (DCE) Flight Software (FSW) certification procedure. The purpose of this procedure is to verify that the FSW satisfies Software Requirements according to the method specified in the DCE FSW Test Plan (STP).

### 1.2 SCOPE

This test procedure comprises the steps necessary to verify that the FSW satisfies Software Requirements Document (SRD) paragraph 5.1.1.5 — Initialize to Boot State after Reset: verify that it processes interrupts.

### 1.3 LIMITATIONS AND CONSTRAINTS

This test cannot be run in parallel with any other commanding activity directed at the DCE FSW (such as, for example, the periodic transmission of NOOP commands). Test hardware shall be visually inspected, and its configuration noted, prior to conducting this test.

### 1.4 PROCEDURE OVERVIEW

The procedure requires the `hks` tools running on the Sun SparcStation Electronic Ground Support Equipment (EGSE) whose network IP address is one of

**shorty.ssl.berkeley.edu**  
**taiyo.ssl.berkeley.edu**  
**ginger.ssl.berkeley.edu.**

Test time shall be scheduled in advance. The Test Conductor must be logged into the Unix system as user `eagcos`, and be commanding from the appropriate directory. This directory contains both the test script file and the shell script file; these two files control test execution. The test is conducted by invoking the shell script. This shell script in turn invokes the Perl 5 program `UniScript.pl`, which resides in its own distinct directory. The test procedure steps have been pre-recorded in the test script file, and are executed interpretively by the `UniScript` program. The shell script and test script are attached to this document as appendices. As `UniScript` executes the test script it sends results to the operator console and to two report files, which are also placed in the current directory. After completion of the test script, the Test Conductor can certify successful test

execution by examining the contents of the report files and determining that required outputs are present in them. Printed copies of the report files are attached to the manually completed checklist (Paragraph 4 below) as documentation of the test.

1.5 THEORY OF TEST

It may be inferred from the fact that the Boot State FSW processes commands and returns HK data that the program processes interrupts, since these are interrupt-driven processes. Hence the test is essentially redundant if the above fact is taken into account. However, the test inspects the EA (enable all interrupts) bit in the Interrupt Enable (IE) Special Function 8051 Register (FSR). This bit should be set to 1, indicating that all interrupts are enabled; if it is, the test succeeds.

1.6 TEST SCRIPT IMPLEMENTATION

1.6.1 Test Script Arguments

The script is parameterized as shown in the following Table:

**Table 1-1: Parameters/Arguments for stp5\_1\_1\_5b.tst**

Parameter	Meaning	Correct Argument for Version 1.09
#0	Absolute hex storage address of "scratch" buffer for special 8051 code	C000
#1	Absolute hex offset of SLOT byte from origin of scratch area	0013

These parameters must be encoded into the shell script `u` (see Appendix A). The value of the IE 8051 SFR (address 0xA8 in 8051 "internal" memory) is not normally reported in HK; hence the test obtains this value by means of special 8051 machine code uploaded to a scratch area at location 0xC000. The `LFDGOTO` command is used to force execution of this special code. Once the code has executed (and returned control to FSW Boot State) the scratch area, into which the value of the IE register has been copied, is downloaded back to a UniScript buffer and inspected. Bit 7 (EA) of this byte should be 1. The special program is listed below:

```

C000 C0E0    PUSH ACC    ; save registers
C002 C083    PUSH DPH    ; used in this
C004 C082    PUSH DPL    ; code sequence
C006 90C013  MOV DPTR,#SLOT ; set up location in scratch
    
```

C009 E5A8    MOV A,0A8h   ; get contents of IE  
C00B F0       MOVX @DPTR,A   ; move to scratch area  
C00C D082    POP DPL       ; restore  
C00E D083    POP DPH       ; working  
C010 D0E0    POP ACC       ; registers  
C012 22       RET           ; return to DCE FSW  
C013 00    SLOT: DB 0       ; slot for temporary storage of IE

## 2. SPECIAL INSTRUCTIONS

### 2.1 QUALITY ASSURANCE

QA support is required to verify the configuration and setup environment as well as monitoring test steps and verifying results.

### 2.2 SAFETY

#### 2.2.1 Personal Safety

To ensure the safety of the test personnel during test execution the guidelines contained in Paragraph 3.4, Reference [1] will be adhered to.

#### 2.2.2 Test Article and Equipment Safety

- If access within one (1) meter of COS bench electronics is necessary, wrist straps attached to technical ground shall be used by all personnel involved in handling of any COS test article. Overcurrent and overvoltage shall be set to remove power if nominal limits are exceeded.
- Emergency Power Shutdown — If, during the COS DCE FSW test, power is ON and a severe test equipment failure results in the power system exceeding specified limits, the Test Conductor shall direct or perform shutdown of power.

### 2.3 CONTAMINATION

All flight hardware shall be handled with clean latex gloves; it shall be covered with clean ESD material and/or stored in a clean flow-bench.

## 3. SUPPORT REQUIREMENTS

### 3.1 PERSONNEL

Execution of the COS DCE FSW certification procedure requires the following personnel (to be completed at the Test Readiness Review (TRR)):

Test Director: \_\_\_\_\_  
 Test Conductor: \_\_\_\_\_  
 Test Technician: \_\_\_\_\_  
 QA: \_\_\_\_\_

### 3.2 TOOLS, EQUIPMENT, AND MATERIALS

The following is a list of tools, equipment, or materials required in this test. Record manufacturer and model, metrology, or property numbers of equipment used, where appropriate. Record calibration due dates where appropriate.

Boot Mode ROM: schematic **27C256**

Engineering Ground Support Equipment (see paragraph 1.4). Indicate specific configuration:

EGSE			DCE		
<b>taiyo</b>	<b>shorty</b>	<b>ginger</b>	<b>ETU</b>	<b>DCE #1</b>	<b>DCE #2</b>
	X			X	

### 3.3 DATA/SOFTWARE

The following files must be present:

**Table 3-1: Required Program and Data Files**

EGSE (shorty) Directory	File	Description
\disks\galex\users\galex\tcs\uniscrpt\	<b>UniScript.pl</b>	<b>UniScript</b> interpreter
\disks\galex\users\galex\tcs\uniscrpt\stp5_1_1_5b\	<b>u</b>	Shell script for this procedure
Ditto	<b>stp5_1_1_5b.tst</b>	Test script for this procedure (Appendix B)

In addition, the **hks** tools must be active. Directions for activating **hks** are given in UCB-COS-DOC-1118 (Paragraph 3.4, Reference [4]).

### 3.4 REQUIRED DOCUMENTATION

Reference	Document Number	Title
1	NHB 1700.1(V1-A)	<i>NASA Basic Safety Manual</i>
2	COS-03-0014	<i>DCE FSW Test Procedure 5.1.1.5b</i> (this document)
3	UCB-COS-008	<i>COS FUV Detector Software Test Plan</i>
4	UCB-COS-DOC-1118	<i>COS EGSE Startup Procedure</i>

## 4. PROCEDURE/TASK STEPS

### 4.1 PRE-OPERATION ACTIVITIES

#### 4.1.1 Make Sure that **hks** Tools Are Active

Follow the procedure given in Paragraph 3.4, Reference [4].

#### 4.1.2 Make Sure that the Proper ROM Is Installed

Visually verify that the ROM under test is installed: if EEPROM, in U18; if PROM, in U2 and U7.

#### 4.1.3 Log In to the EGSE

Step	QA	Operator Entry/System Response	Description
1		C:\tcs\us> <b>telnet shorty.ssl.berkeley.edu</b>	Establish connection to shorty via Telnet client program
2		Login: <b>tcs</b> Password:	Using telnet window, login as user <b>tcs</b>

#### 4.1.4 Set Current Directory

Step	QA	Operator Entry/System Response	Description
3		tcs@shorty% <b>cd ~galex/tcs</b> tcs@shorty% <b>pwd</b> /disks/galex/users/galex/tcs	Change current directory as shown



## 4.1.5 Slogin as eagcos

Step	QA	Operator Entry/System Response	Description
4		<pre>tcs@shorty% <b>slogin -l eagcos</b> <b>shorty.ssl.berkeley.edu</b> eagcos@shorty.ssl.berkeley.edu's password: (<i>get from SSL personnel</i>) Last login: Sat Oct 7 10:41:05 2000 from auntem.ssl.berke Sun Microsystems Inc. SunOS 5.8 Generic February 2000 You have mail. COS EGSE software version: devel</pre>	slogin as <b>eagcos</b> ; get password from SSL personnel

## 4.1.6 Set Current Directory

Step	QA	Operator Entry/System Response	Description
5		<pre>eagcos:shorty% <b>cd</b> <b>/disks/galex/users/galex/tcs/uniscript/stp5_1_1_1</b> eagcos:shorty% <b>pwd</b> <b>/disks/galex/users/galex/tcs/uniscript/stp5_1_1_1</b></pre>	Change current directory as shown

## 4.1.7 Ensure that Proper Files are Present

Step	QA	Operator Entry/System Response	Description
6		<pre>eagcos@shorty% <b>ls -l</b> Total 12 -rw-r--r-- 1 tcs eag 1398 Oct 8 18:03 stp5_1_1_1b.tst -rw-r--r-- 1 tcs eag 62 Oct 9 17:44 u eagcos@shorty% <b>more &lt; u</b> #!/bin/sh perl ../UniScript.pl stp5_1_1_1b "0,0,0,0,0,0,0"</pre>	List files; the <b>.tst</b> file and the shell script <b>u</b> should be present

4.2 OPERATION EXECUTION

4.2.1 Establish Initial Test Conditions

Step	QA	Operator Entry/System Response	Description
7		eagcos:shorty% <b>set path=(\$path ~dbb/scripts/bin)</b>	Set path as shown to enable access to hks tools

4.2.2 Execute the Script

Step	QA	Operator Entry/System Response	Description
8		<p>eagcos:shorty% <b>sh u</b>                      \$pstring=0,0,0,0,0,0,0,0                      Parameters are: Script File: stp5_1_1_1b                                        #0: 0                                        #1: 0                                        #2: 0                                        #3: 0                                        #4: 0                                        #5: 0                                        #6: 0                                        #7: 0</p> <p>Report file</p> <p>&gt;/disks/galex/users/galex/tcs/uniscript/stp5_1_1_1b                      /stp5_1_1_1b.rp1                      successfully opened.                      Report file</p> <p>&gt;/disks/galex/users/galex/tcs/uniscript/stp5_1_1_1b                      /stp5_1_1_1b.rp2                      successfully opened.                      Script file</p> <p>/disks/galex/users/galex/tcs/uniscript/stp5_1_1_1b/s                      tp5_1_1_1b.tst                      successfully opened at level 0.</p> <p>"First 10-second wait ..."</p>	<p>Shell to <b>u</b>. You should see the accompanying output as <b>UniScript</b> executes</p>

---

		LFDRSTP "Second 10-second wait ..." "Test 5.1.1.1b Succeeded"	
--	--	---	--

4.3 POST-OPERATION ACTIVITIES

4.3.1 Copy Reports to PC Files and Print Them

Using an FTP client, copy the **u**, **stp5\_1\_1\_1b.tst**, **stp5\_1\_1\_1b.rp1**, and **stp5\_1\_1\_1b.rp2** files to appropriate PC files. Include these files as Appendices A, B, C, and D with this completed form.

4.3.2 Complete The Test Procedure Form

Ensure that all blank fields in this report are completed correctly and submit the completed report to QA.

---

SUMMARY SHEET

OPERATION TITLE: \_\_\_\_\_ WOA# \_\_\_\_\_

TEST ARTICLES IDENTIFICATION (including serial and/or part numbers):

\_\_\_\_\_

TASKS/STEPS COMPLETED: \_\_\_\_\_

\_\_\_\_\_

LOCATION: \_\_\_\_\_

TEST STARTED:

TEST TERMINATED

TIME: \_\_\_\_\_ Hr/Min

TIME: \_\_\_\_\_ Hr/Min

DATE: \_\_\_\_\_

DATE: \_\_\_\_\_

LOGS USED: \_\_\_\_\_

ANOMALY REPORTS GENERATED: \_\_\_\_\_

\_\_\_\_\_

COMMENTS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

TEST CONDUCTOR: \_\_\_\_\_

Signature/Date

QA REPRESENTATIVE: \_\_\_\_\_

Signature/Date

## Appendix A. Shell Script u

```
#!/bin/sh  
kill noopy  
perl ../UniScript.pl stp5_1_1_5b "C000,0013,0,0,0,0,0,0"  
cosnoopy
```

## Appendix B. Test Script stp5\_1\_1\_1b.tst

```

; *****
; * DCE FSW Requirement 5.1.1.5b -- Code in PROM *
; * ----- *
; * Verify that it services interrupts *
; * ----- *
; * Arguments: #0 = DCE "Scratch Area" = C000 in v1.07 *
; *             #1 = offset in Scratch Area of IE byte *
; *             = 0x0013 *
; *****
;
ECHO      2
;
SYM      SCRATCH=0x#0
SYM      NSEC      =5
SYM      OFFSET   =0x#1
SYM      SLOT     =SCRATCH+OFFSET
SYM      NBYTES   =OFFSET+1
;
; *****
; * Acquire the value of the 8051 IE (Interrupt Enable) SFR. *
; * ----- *
; * C000 C0E0      PUSH ACC      ; save registers *
; * C002 C083      PUSH DPH      ; used in this *
; * C004 C082      PUSH DPL      ; code sequence *
; * C006 90C013     MOV  DPTR,#SLOT ; set up location in scratch *
; * C009 E5A8      MOV  A,0A8h    ; get contents of IE *
; * C00B F0        MOVX @DPTR,A   ; move to scratch area *
; * C00C D082      POP  DPL      ; restore *
; * C00E D083      POP  DPH      ; working *
; * C010 D0E0      POP  ACC      ; registers *
; * C012 22        RET           ; return to DCE FSW *
; * C013 00        SLOT: DB 0     ; slot for temporary storage of IE *
; *****
;
DATA      1, 0,0,EMPTY
DATA      1, 0,7,CONST=0xC0E0_C083_C082_90
DATA      1, 7,2,CONST=SLOT
DATA      1, 9,2,CONST=0xE5A8
DATA      1,11,9,CONST=0xF0_D082_D083_D0E0_22_00
;
LOG       1,1
;
; *****
; * Upload IE-extraction code to scratch area *
; *****
;
DTG       3,"(0) Uploading code to scratch area"
WTO       "Uploading code to scratch area"
;
XMIT      1,NBYTES
LFDUPLD   SCRATCH,NBYTES
WAIT      1
;
; *****
; * Execute code *
; *****
;
DTG       3,"(1) Sending LFDGOTO"
WTO       "Sending LFDGOTO"
;
LFDGOTO   SCRATCH
WAIT      NSEC,HK
;
; *****
; * Download code area with IE value *
; *****
;

```

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```
DTG      3,"(2) Downloading scratch area"  
WTO      "Downloading scratch area"  
;  
LFDDNLOD SCRATCH,NBYTES  
RECV     2,0,NBYTES  
LOG      1,2  
;  
; *****  
; * Test EA bit *  
; *****  
;  
CHECK    1, (($ie = hex(substr($B2,hex(0x#1),1))) & hex("80") != 0)  
;  
DTG      3,"(3) Test 5.1.1.b completed successfully"  
WTO      "Test 5.1.1.b completed successfully"
```

Appendix C. Test Report stp5\_1\_1\_1b.rp1

```

                    55555      1      1      55555
                    5      11      11      5
                    555      1      1      555
bbbb      ssss  ttttt  pppp
b  b      s      t  p  p      5      1      1      5
bbbb      ssss  t      pppp      5      1      1      5
b  b      s      t  p      5  5      1      1      5  5
bbbb      ssss  t      p      555      111      111      555

```

```

Len  CRC  Buffer      Data
----  ----  -----  ----
0014 8ECC 1          C0 E0 C0 83 C0 82 90 C0 13 E5 A8 F0 D0 82 D0 83 D0 E0 22 00

```

Ver 01.09 Thu Nov 16 18:25:44 2000 "(0) Uploading code to scratch area"

LFDUPLD SCRATCH,NBYTES,CRC1

Ver 01.09 Thu Nov 16 18:25:45 2000 "(1) Sending LFDGOTO"

LFDGOTO SCRATCH

Ver 01.09 Thu Nov 16 18:25:45 2000 "(2) Downloading scratch area"

LFDDNLOD SCRATCH,NBYTES

```

Len  CRC  Buffer      Data
----  ----  -----  ----
0014 6FA3 2          C0 E0 C0 83 C0 82 90 C0 13 E5 A8 F0 D0 82 D0 83 D0 E0 22 87

```

```

CHECK:  (((($ie = hex(substr($B2,2*hex('0013'),2))) & hex("80")) != 0)
eval:   (((0000 = hex(substr(C0E0...,2*hex('0013'),2))) & hex("80")) != 0)

```

S U C C E S S

Ver 01.09 Thu Nov 16 18:25:45 2000 "(3) Test 5.1.1.b completed successfully"



Appendix D. Test Report stp5\_1\_1\_1b.rp2

```

                    55555      1      1      55555
                    5      11     11     5
bbbb      ssss  ttttt  pppp  555      1      1      555
b   b      s      t   p   p   5      1      1      5
bbbb      ssss  t   pppp      5      1      1      5
b   b      s      t   p   5  5      1      1      5  5
bbbb      ssss  t   p      555      111      111      555

```

Ver 01.09 Thu Nov 16 18:25:44 2000 "(0) Uploading code to scratch area"

U P L O A D P A C K E T

```

0040E0C0 004283C0 004482C0 0046C090 0048E513 004AF0A8 004C82D0 004E83D0
0050E0D0 00520022

```

C O M M A N D P A C K E T

```

          PARM4          PARM3          PARM2          PARM1          PARM0
045AFFFF 04580000 0456FFFF 04540000 04527133 04508ECC 044EFFEB 044C0014 044A3FFF 0448C000
          SN          OPCODE
0446FFFE 04440001 04425252 0440ADAD

```

Ver 01.09 Thu Nov 16 18:25:45 2000 "(1) Sending LFDGOTO"

C O M M A N D P A C K E T

```

          PARM4          PARM3          PARM2          PARM1          PARM0
045AFFFF 04580000 0456FFFF 04540000 0452FFFF 04500000 044EFFFF 044C0000 044A3FFF 0448C000
          SN          OPCODE
0446FFFD 04440002 04421515 0440EAEA

```

Ver 01.09 Thu Nov 16 18:25:45 2000 "(2) Downloading scratch area"

C O M M A N D P A C K E T

```

          PARM4          PARM3          PARM2          PARM1          PARM0
045AFFFF 04580000 0456FFFF 04540000 0452FFFF 04500000 044EFFEB 044C0014 044A3FFF 0448C000
          SN          OPCODE
0446FFFC 04440003 04425151 0440AEAE

```

Ver 01.09 Thu Nov 16 18:25:45 2000 "(3) Test 5.1.1.b completed successfully"