# **STEREO** *IMPACT*

IDPU Command Verification System

CmdVerification\_A.doc Version A – 2002-May-29

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# **Document Revision Record**

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# **Distribution List**

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# 1. Introduction

This document describes the command verification scheme to be used by the STEREO IMPACT IDPU, and how the GSE/POCC should handle command verification. The idea is that the GSE should keep track of what commands have been verified by the IDPU and report a warning if a command is dropped or an extra command is received.

### 1.1. Document Conventions

In this document, TBD (To Be Determined) means that no data currently exists. A value followed by TBR (To Be Resolved) means that this value is preliminary. In either case, the value is typically followed by UCB, indicating who is responsible for providing the data, and a unique reference number.

### 1.2. Applicable Documents

The following documents include drawings and STEREO Project policies, and are part of this specification. In the event of a conflict between this Specification and the following documents, this Specification takes precedence. Most documents and drawings can be found on the Berkeley STEREO/IMPACT FTP site:

http://sprg.ssl.berkeley.edu/impact/dwc/

Or on the APL STEREO web site at:

https://sd-forum.jhuapl.edu/stereo/

- 1. IMPACT\_ICD\_revd\_11-16-01 Spacecraft to IMPACT ICD
- 2. MOC-POC\_ICD\_update\_209-10-01 MOC to POC ICD
- 3. Specifications/CmdFMT\_A IMPACT Command Formats

# 2. STEREO IMPACT/PLASTIC Command Routing

All STEREO commands are formatted into CCSDS packets as described in Reference 2 and 3. IMPACT and PLASTIC GSE/POCC send commands to the IDPU via the MOC and spacecraft (or via the APL Spacecraft Emulator). Each command contains a CCSDS header that includes an ApID and a sequence counter. The ApID for IMPACT must be in the range 200-27F hex, and for PLASTIC in the range 300-37F hex. Different ApIDs are routed to different tasks in the IDPU, as described in reference 3. The command sequence counter shall be generated by the GSE/POCC, and shall increment by one for each command sent, irrespective of ApID (note that separate sequence counters shall be used for time-tagged and delayed commands).

# 3. IDPU Command Verification

The IDPU responds to received commands with three parameters in the housekeeping packet:

- <u>CommandCount</u> a count of commands received since IDPU reset, modulo 256
- <u>CommandLastID</u> the coded ApID from the latest command received by the IDPU
- <u>CommandLastSeq</u> the 8LSB of the sequence counter from the last command received by the IDPU

The CommandLastID is an 8-bit quantity related to the ApID as follows:

Bits 6:0 of CommandLastID = Bits6:0 of the command ApID

Bit 7 of CommandLastID = Bit 8 of the command ApID

Thus PLASTIC commands will have bit 7 if CommandLastID set, and IMPACT will have that bit reset.

The IDPU does not differentiate between time-tagged and real-time commands. Further, it is possible that commands may be received by the IDPU from more than one POCC/GSE (IMPACT or PLASTIC). So there it is possible that command verification will be confused by commands in the IDPU verification not recently sent by the POCC/GSE. However, most of the time, at least during ground test and commissioning, there will be very few time-tagged commands and only one POCC/GSE will command at a time. The verification scheme needs to handle the special cases when unexpected commands are verified.

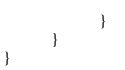
# 4. GSE Command Verification

The GSE shall maintain a FIFO containing all real-time commands sent (and verified by the MOC or Emulator ARR message), including the ApID and sequence counter. A GSE display shall indicate how many commands are in the verification FIFO at any time, and a display listing the contents of the FIFO shall be available.

When a housekeeping packet containing the IDPU command verification is received, the following will be performed by the GSE:

```
NumCommands = CommandCount - PreviousCommandCount
If ( NumCommads == 0 ) then {
    If (( CommandLastSeq == PreviousCommandSeq ) AND
        (CommandLastID == PreviousCommandID)) then
        Do Nothing - no commands received.
    Else {
        /* Assuming the command counter has over-flowed, look in command
        queue back 256*N commands, up to the size of the FIFO. */
        If (( FIFOSeq[256*N] == CommandLastSeq) AND
            (FIFOID[256*N] == CommandLastID)) then {
            Release 256*N commands from the FIFO
            Display 256*N commands verified.
        }
        Else call VerificationError
    }
}
```

```
}
Else {
      /* Look in command queue for command (check every 256 commands in case of
      counter over-flow) */
      If (NumCommands < 0) then NumCommands = NumCommands+256
      If (( CommandLastSeq == FIFOSeq[NumCommands + 256*N]) AND
        (CommandLastID == FIFOID[NumCommands + 256*N])) then
             Release NumCommands + 256*N commands from the FIFO
             Display NumCommands + 256*N commands verified
      }
      Else call VerificationError
}
Display CommandLastID, CommandLastSeq, and CommandCount
      (use the command database to decode the Command ID)
PreviousCommandCount = CommandCount
PreviousSeq = CommandLastSeq
PreviousID = CommandLastID
VerificationError Handler {
      If (Verification FIFO is empty) then {
             Report Warning: NumCommands Unexpected Commands; append the
             decoded CommandlastID, CommandLastSeq and CommandCount in the
             error message.
      }
      Else {
             /* Search the whole queue (starting with the oldest command) for a
             command matching CommandLastSeq and CommandLastID. */
             If (( CommandLastSeq == FIFOSeq[N]) AND
              (CommandLastID == FIFOID[N])) then {
                   Release N commands from the Verification FIFO
                   Display N commands Verified
                   Report Warning: N-NumCommands Unexpected Commands (or if
                   N-NumCommands is negative, report NumCommands-N
                   commands dropped); append the decoded CommandlastID,
                   CommandLastSeq and CommandCount in the error message.
             }
             Else {
                   /* Here we have a problem. We don't know how many of the
                   commands in the verification FIFO are included in
                   NumCommands. Assume none and report extra commands; if
                   some were included, we will get a "commands dropped" warning
                   in the future. */
                   Report Warning: NumCommands Unexpected Commands;
                   append the decoded CommandlastID, CommandLastSeq and
                   CommandCount in the error message.
```



Here I use FIFO[n] to indicate the nth command from the top of the FIFO, so that FIFO[1] is the oldest unverified command. Also I don't explicitly call out the loop over N through the FIFO.