CHANGE NOTICE

Affected Document: ICD-GPS-870 Rev E	**IRN/SCN Number** XXX-XXXX-XXX	**Date:** DD-MMM-YYYY
Authority: RFC-000544	**Proposed Change Notice** PCN_ICD-870E_RFC544	**Date:** 18-MAR-2026

Document Title: NAVSTAR Next Generation GPS Control Segment (OCX) to User Support Community Interface

RFC Title: Eccentric Anomaly Rate Fix and No Cost Items

Reason For Change (Driver):

1. The Eccentric Anomaly Rate formula in all documents that describe this CNAV formula are incorrect
2. There are requirements and description changes from RFC-495A and RFC-502 which did not make it into the requirements baseline but are still correct and would help civil user equipment engineers make better civil receivers. This includes a number of Core CEI description changes that were worked out, but did not make it into RFC-502.
3. PRAT Item 2020-03 to normalize the use of scientific notation across the Public GPS interface documents has only been partially implemented
4. During the last Public ICWG, it became apparent that the Public interface documents do not use a uniform method of documenting multiplication in formulas
5. RFC-515 made a number of changes to XML which still need to be made to ICD-GPS-870 to ensure that Public users of XML are executing XML correctly

Description of Change:

1. The Eccentric Anomaly Rate formula will be corrected in all CNAV Public documents (PRAT 2025-02, Pre-RFC-1445)
2. The changes from RFCs-495A and 502 would be added into the requirements baseline (PRAT 2021-03)
3. The changes needed to normalize the use of scientific notation in the Public GPS interface documents will be completed (PRAT 2020-03)
4. The few places that use "*" or "x" to denote multiplication of scalar values will be normalized to what is used across the Public Signal-In-Space documents
5. The XML to ICD-GPS-870 would be completed so it describes the as-built XML system (Pre-RFC-1354, promulgates and completes the work started in RFC-515)

Authored By: RE: Tony Anthony **Checked By: RE:** Sean Gutierrez

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	System Delta 831	
	Mission Delta 31	
	Department of Homeland Security (DHS), United States Coast Guard (USCG) Navigation Center (NAVCEN)	
	Department of Transportation (DoT) Federal Aviation Administration (FAA)	

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THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED.

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CODE IDENT 66RP1

ICD870-727:

Section Number:
30.0-2

WAS:
Following is a list of the rules or protocols for the SOF data.

Usage Rules

1. The SOF always contains fields identifying creation date/time and reference date/time.
2. A new SOF is built each time a NANU is issued.
3. The latency of the SOF initially may be 15-20 minutes, and is driven by operational procedures and workload.

File Naming Convention

The most recently built SOF is given a standard name that contains the creation date/time and the file format version number, 'yyyy_ddd_hhmmss_vnn.sof', where yyyy is the year, ddd is the Jday (day of year starting with 1), hhmmss is the hour/minute/second UTC, and nn is the file format version number. The file format version number will increment sequentially whenever the file format changes.

Dissemination Methods

Unclassified Web Site. The GPSOC maintains a Web site accessible to unclassified military users worldwide. The current SOF is posted at a conspicuous spot on this Web site for download. All other worldwide, civil users may download the SOF from the U.S Coast Guard Navigation Center Web site.

Classification

The SOF is Unclassified and approved for public release. [Reference GPS Security Classification Guide, 30 Sep 2008, Topic Number 700.7.10]

Format

The SOF is formatted in XML according to the format below. The data type definition (DTD), the data format, and the data field definitions are provided.
A sample SOF with an internal DTD is as follows:
SOF DTD

```
<?xml version="1.0"?>
<!DOCTYPE GPSISFILE [
    <!ELEMENT GPSISFILE (CREATION,REFERENCE,(PREDICTED|CURRENT|HISTORICAL)+)>
    <!ELEMENT CREATION EMPTY>
    <!ELEMENT REFERENCE EMPTY>
    <!ELEMENT PREDICTED EMPTY>
    <!ELEMENT CURRENT EMPTY>
    <!ELEMENT HISTORICAL EMPTY>
    <!ATTLIST GPSISFILE FILEID CDATA #FIXED "SOF">
    <!ATTLIST GPSISFILE SYSID CDATA #FIXED "GPS">
    <!ATTLIST GPSISFILE VERSION CDATA #REQUIRED>
    <!ATTLIST CREATION YEAR CDATA #REQUIRED>
    <!ATTLIST CREATION DOY CDATA #REQUIRED>
    <!ATTLIST CREATION HR CDATA #REQUIRED>
    <!ATTLIST CREATION MIN CDATA #REQUIRED>
    <!ATTLIST CREATION SEC CDATA #REQUIRED>
    <!ATTLIST REFERENCE YEAR CDATA #REQUIRED>
    <!ATTLIST REFERENCE DOY CDATA #REQUIRED>
    <!ATTLIST REFERENCE HR CDATA #REQUIRED>
    <!ATTLIST REFERENCE MIN CDATA #REQUIRED>
    <!ATTLIST REFERENCE SEC CDATA #REQUIRED>
    <!ATTLIST PREDICTED SVID CDATA #REQUIRED>
    <!ATTLIST PREDICTED SVN CDATA #REQUIRED>
    <!ATTLIST PREDICTED NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
    <!ATTLIST PREDICTED TYPE (FCSTDV|FCSTMX) #REQUIRED>
```

```
        <!ATTLIST PREDICTED REFERENCE CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_YEAR CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_DOY CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_HR CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_MIN CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_SEC CDATA #REQUIRED>
        <!ATTLIST PREDICTED END_YEAR CDATA #REQUIRED>
        <!ATTLIST PREDICTED END_DOY CDATA #REQUIRED>
        <!ATTLIST PREDICTED END_HR CDATA #REQUIRED>
        <!ATTLIST PREDICTED END_MIN CDATA #REQUIRED>
        <!ATTLIST PREDICTED END_SEC CDATA #REQUIRED>
        <!ATTLIST CURRENT SVID CDATA #REQUIRED>
        <!ATTLIST CURRENT SVN CDATA #REQUIRED>
        <!ATTLIST CURRENT NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST CURRENT TYPE CDATA #FIXED "UNUSUFN">
        <!ATTLIST CURRENT REFERENCE CDATA #REQUIRED>
        <!ATTLIST CURRENT START_YEAR CDATA #REQUIRED>
        <!ATTLIST CURRENT START_DOY CDATA #REQUIRED>
        <!ATTLIST CURRENT START_HR CDATA #REQUIRED>
        <!ATTLIST CURRENT START_MIN CDATA #REQUIRED>
        <!ATTLIST CURRENT START_SEC CDATA #REQUIRED>
        <!ATTLIST HISTORICAL SVID CDATA #REQUIRED>
        <!ATTLIST HISTORICAL SVN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST HISTORICAL TYPE (FCSTSUMM|UNUSABLE|UNUNOREF) #REQUIRED>
        <!ATTLIST HISTORICAL REFERENCE CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_YEAR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_DOY CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_HR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_MIN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_SEC CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_YEAR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_DOY CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_HR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_MIN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_SEC CDATA #REQUIRED>
]>
```

SOF Structure

```
<?xml version="1.0"?>
<GPSISFILE FILEID="SOF" SYSID="GPS" VERSION=”2”>
<CREATION YEAR="2004" DOY="257" HR="11" MIN="2" SEC="11" />
<REFERENCE YEAR="2004" DOY="257" HR="11" MIN="2" SEC="11" />
<PREDICTED
        SVID="9" SVN="39"
        NAME="NANU" TYPE="FCSTMX" REFERENCE="2004094"
        START_YEAR="2004" START_DOY="229" START_HR="12" START_MIN="0" START_SEC="0"
        END_YEAR="2004" END_DOY="230" END_HR="0" END_MIN="0" END_SEC="0"
        />
<CURRENT
        SVID="31" SVN="31"
        NAME="NANU" TYPE="UNUSUFN" REFERENCE="2004101"
                START_YEAR="2004" START_DOY="257" START_HR="5" START_MIN="50" START_SEC="0"
        />
```

<HISTORICAL
SVID="27" SVN="27"
NAME="NANU" TYPE="UNUSABLE" REFERENCE="2004100"
START_YEAR="2004" START_DOY="242" START_HR="1" START_MIN="32" START_SEC="0"
END_YEAR="2004" END_DOY="243" END_HR="19" END_MIN="12" END_SEC="0"
/>
</GPSISFILE>

All times are UTC TIME (ZULU) unless otherwise specified. DOY is day of year (same as JDAY); 1=1 January, 366 is valid for leap year

'GPSISFILE' FILE INFORMATION

Occurs once per file

FILEID is always 'SOF'

SYSID is always 'GPS'

VERSION is the version number of the file. The version text should be an integer version number. Example: 2

CREATION indicates date/time of file creation. Time is computer time (UTC time zone).

REFERENCE indicates date/time to which SOF data applies. For example, if January 10, 2003 1550Z is the REFERENCE time then Satellite Outage information will be collected up to and including that time, including past, current, and predicted information. The REFERENCE time is set to be the date/time of the most recent NANU incorporated into the SOF.

'SOF_RECORD' INFORMATION

Occurs multiple times per file, once for each predicted, current or historical satellite outage issued by the REFERENCE data/time.

There are three types of SOF records.

PREDICTED identifies predicted outages as of the REFERENCE time.

CURRENT identifies any active outages as of the REFERENCE time, along with the time the outage began.

HISTORICAL identifies actual outages that have taken place prior to the REFERENCE time.

SVID - reusable identifier for each satellite in identified system. For GPS the SVID shall be the PRN.

SVN (Satellite Vehicle Number) – unique sequential number associated with satellite-specific program is an integer. For GPS this is assigned by the US Air Force.

PREDICTED record fields

NAME – Alphanumeric indicator of outage source (currently 'NANU'). GOCGIS used when no NANU has been issued, yet outage is predicted or a GENERAL NANU has been issued that affects this outage.

TYPE – If NAME=NANU, then the choices are FCSTDV, FCSTMX. If a FCSTEXTD, then implemented as original type (FCSTDV or FCSTMX) with start date/time the same as in the FCSTEXTD and end date/time fixed twenty years out. If FCSTRESCD, then implemented as original type with dates/times as in the FCSTRESCD NANU. If a FCSTCANC type NANU is issued, the original type will be deleted from the SOF.

REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a FCSTDV issued with number 2003010, then REFERENCE=2003010. As another example, if there is a FCSTMX issued with number 2003047, followed be a FCSTEXTD with number 2003050, then REFERENCE=2003050.

CURRENT record fields

NAME – Alphanumeric indicator of outage source (currently 'NANU').

TYPE – If NAME=NANU, then the choices are UNUSUFN and GENERAL. If NANU is initially issued as a GENERAL launch message, then it will be implemented in the SOF as a UNUSUFN with the start date/time as 0000Z on the first day the satellite appears in the almanac.

REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a UNUSUFN issued with number 2003049, then REFERENCE=2003049.

HISTORICAL record fields

NAME –Alphanumeric indicator of outage source (currently NANU).

TYPE – If NAME=NANU, then the choices are FCSTSUMM, UNUSABLE, UNUNOREF, USABINIT, and GENERAL. If NANU is initially issued as a GENERAL launch message, then it will be implemented in the SOF as an UNUSABLE with stop dates/times as in the USABINIT and the start date/time as 0000Z on the first day the satellite appears in the almanac. This closes out the UNUSUFN that was implemented earlier for the GENERAL launch message. If the NANU

is initially issued as a GENERAL decommission it will be implemented in the SOF as an UNUSABLE with the decommission date/time as the end date/time. If a GENERAL NANU is issued which cancels a previous NANU, the previous NANU will not appear in the SOF.
REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a FCSTSUMM issued with number 2003051, then REFERENCE=2003051.

Format Changes

Changes to file formats are implemented as follows:

1. Files implementing a new format have the VERSION attribute of the GPSISFILE element incremented. Version 1 files encoded the file version in the filename. For example, a file with a previous format may have a name like 2004_202_145503_v01.sof. Later file versions encode the version both in the filename, and the XML VERSION attribute. The filenames of the new file versions look like 2004_202_145503_v02.sof.
2. If a new file format is implemented, both the old and the new file formats will be posted to the web site location for a transition period.
3. The old file format will be posted for six months, and then be removed. This provides time for users to adapt to the new file format.
4. Notifications of file format changes, with samples of the new format, will be published to www.GPS.gov when they are final.

Redlines:

Following is a list of the rules or protocols for the SOF data.

Usage Rules

1. The SOF always contains fields identifying creation date/time and reference date/time.
2. A new SOF is built each time a NANU is issued.
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        <!ELEMENT PREDICTED EMPTY>
        <!ELEMENT CURRENT EMPTY>
        <!ELEMENT HISTORICAL EMPTY>
        <!ATTLIST GPSISFILE FILEID CDATA #FIXED "SOF">
        <!ATTLIST GPSISFILE SYSID CDATA #FIXED "GPS">
        <!ATTLIST GPSISFILE VERSION CDATA #REQUIRED>
        <!ATTLIST CREATION YEAR CDATA #REQUIRED>
        <!ATTLIST CREATION DOY CDATA #REQUIRED>
        <!ATTLIST CREATION HR CDATA #REQUIRED>
        <!ATTLIST CREATION MIN CDATA #REQUIRED>
        <!ATTLIST CREATION SEC CDATA #REQUIRED>
        <!ATTLIST REFERENCE YEAR CDATA #REQUIRED>
        <!ATTLIST REFERENCE DOY CDATA #REQUIRED>
        <!ATTLIST REFERENCE HR CDATA #REQUIRED>
        <!ATTLIST REFERENCE MIN CDATA #REQUIRED>
        <!ATTLIST REFERENCE SEC CDATA #REQUIRED>
        <!ATTLIST PREDICTED SVID CDATA #REQUIRED>
        <!ATTLIST PREDICTED SVN CDATA #REQUIRED>
        <!ATTLIST PREDICTED NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST PREDICTED TYPE (FCSTDV|FCSTMX|FCSTUUFN) #REQUIRED>
        <!ATTLIST PREDICTED REFERENCE CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_YEAR CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_DOY CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_HR CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_MIN CDATA #REQUIRED>
```

```
        <!ATTLIST PREDICTED START_SEC CDATA #REQUIRED>
        <!ATTLIST PREDICTED END_YEAR CDATA #REQUIREDOPTIONAL>
        <!ATTLIST PREDICTED END_DOY CDATA #REQUIRED OPTIONAL>
        <!ATTLIST PREDICTED END_HR CDATA #REQUIRED OPTIONAL>
        <!ATTLIST PREDICTED END_MIN CDATA #REQUIRED OPTIONAL>
        <!ATTLIST PREDICTED END_SEC CDATA #REQUIRED OPTIONAL>
        <!ATTLIST CURRENT SVID CDATA #REQUIRED>
        <!ATTLIST CURRENT SVN CDATA #REQUIRED>
        <!ATTLIST CURRENT NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST CURRENT TYPE CDATA #FIXED "UNUSUFN">
        <!ATTLIST CURRENT REFERENCE CDATA #REQUIRED>
        <!ATTLIST CURRENT START_YEAR CDATA #REQUIRED>
        <!ATTLIST CURRENT START_DOY CDATA #REQUIRED>
        <!ATTLIST CURRENT START_HR CDATA #REQUIRED>
        <!ATTLIST CURRENT START_MIN CDATA #REQUIRED>
        <!ATTLIST CURRENT START_SEC CDATA #REQUIRED>
        <!ATTLIST HISTORICAL SVID CDATA #REQUIRED>
        <!ATTLIST HISTORICAL SVN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST HISTORICAL TYPE (FCSTSUMM|UNUSABLE|UNUNOREF) #REQUIRED>
        <!ATTLIST HISTORICAL REFERENCE CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_YEAR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_DOY CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_HR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_MIN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_SEC CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_YEAR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_DOY CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_HR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_MIN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_SEC CDATA #REQUIRED>
]>
SOF Structure
<?xml version="1.0"?>
<GPSISFILE FILEID="SOF" SYSID="GPS" VERSION=”2”>
<CREATION YEAR="2004" DOY="257" HR="11" MIN="2" SEC="11" />
<REFERENCE YEAR="2004" DOY="257" HR="11" MIN="2" SEC="11" />
<PREDICTED
SVID="9" SVN="39"
NAME="NANU" TYPE="FCSTMX" REFERENCE="2004094"
START_YEAR="2004" START_DOY="229" START_HR="12" START_MIN="0" START_SEC="0"
END_YEAR="2004" END_DOY="230" END_HR="0" END_MIN="0" END_SEC="0"
        />
<CURRENT
SVID="31" SVN="31"
NAME="NANU" TYPE="UNUSUFN" REFERENCE="2004101"
START_YEAR="2004" START_DOY="257" START_HR="5" START_MIN="50" START_SEC="0"
        />
<HISTORICAL
SVID="27" SVN="27"
NAME="NANU" TYPE="UNUSABLE" REFERENCE="2004100"
START_YEAR="2004" START_DOY="242" START_HR="1" START_MIN="32" START_SEC="0"
END_YEAR="2004" END_DOY="243" END_HR="19" END_MIN="12" END_SEC="0"
```

/>
</GPSISFILE>
All times are UTC TIME (ZULU) unless otherwise specified. DOY is day of year (same as JDAY); 1=1 January, 366 is valid for leap year
'GPSISFILE' FILE INFORMATION
Occurs once per file
FILEID is always 'SOF'
SYSID is always 'GPS'
VERSION is the version number of the file. The version text should be an integer version number. Example: 2
CREATION indicates date/time of file creation. Time is computer time (UTC time zone).
REFERENCE indicates date/time to which SOF data applies. For example, if January 10, 2003 1550Z is the REFERENCE time then Satellite Outage information will be collected up to and including that time, including past, current, and predicted information. The REFERENCE time is set to be the date/time of the most recent NANU incorporated into the SOF.
'SOF_RECORD' INFORMATION
Occurs multiple times per file, once for each predicted, current or historical satellite outage issued by the REFERENCE data/time.
There are three types of SOF records.
PREDICTED identifies predicted outages as of the REFERENCE time.
CURRENT identifies any active outages as of the REFERENCE time, along with the time the outage began.
HISTORICAL identifies actual outages that have taken place prior to the REFERENCE time.
SVID - reusable identifier for each satellite in identified system. For GPS the SVID shall be the PRN.
SVN (Satellite Vehicle Number) – unique sequential number associated with satellite-specific program is an integer. For GPS this is assigned by the US Air Force.
PREDICTED record fields
NAME – Alphanumeric indicator of outage source (currently 'NANU'). GOCGIS used when no NANU has been issued, yet outage is predicted or a GENERAL NANU has been issued that affects this outage.
TYPE – If NAME=NANU, then the choices are FCSTDV, FCSTMX, or FCSTUUFN. FCSTUUFN indicates a scheduled outage of indefinite duration not necessarily related to Delta-V or maintenance activities and does not contain END_YEAR/DOY/HR/MIN/SEC. If a FCSTEXTD, then implemented as original type (FCSTDV or FCSTMX) with start date/time the same as in the FCSTEXTD and end date/time fixed twenty years out. If FCSTRESCD, then implemented as original type with dates/times as in the FCSTRESCD NANU. If a FCSTCANC type NANU is issued, the original type will be deleted from the SOF.
REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a FCSTDV issued with number 2003010, then REFERENCE=2003010. As another example, if there is a FCSTMX issued with number 2003047, followed be a FCSTEXTD with number 2003050, then REFERENCE=2003050.
CURRENT record fields
NAME – Alphanumeric indicator of outage source (currently 'NANU').
TYPE – If NAME=NANU, then the choices are UNUSUFN and GENERAL. If NANU is initially issued as a GENERAL launch message, then it will be implemented in the SOF as a UNUSUFN with the start date/time as 0000Z on the first day the satellite appears in the almanac.
REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a UNUSUFN issued with number 2003049, then REFERENCE=2003049.
HISTORICAL record fields
NAME –Alphanumeric indicator of outage source (currently NANU).
TYPE – If NAME=NANU, then the choices are FCSTSUMM, UNUSABLE, UNUNOREF, USABINIT, and GENERAL. If NANU is initially issued as a GENERAL launch message, then it will be implemented in the SOF as an UNUSABLE with stop dates/times as in the USABINIT and the start date/time as 0000Z on the first day the satellite appears in the almanac. This closes out the UNUSUFN that was implemented earlier for the GENERAL launch message. If the NANU is initially issued as a GENERAL decommission it will be implemented in the SOF as an UNUSABLE with the decommission date/time as the end date/time. If a GENERAL NANU is issued which cancels a previous NANU, the previous NANU will not appear in the SOF.

REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a FCSTSUMM issued with number 2003051, then REFERENCE=2003051.

Format Changes

Changes to file formats are implemented as follows:

1. Files implementing a new format have the VERSION attribute of the GPSISFILE element incremented. Version 1 files encoded the file version in the filename. For example, a file with a previous format may have a name like 2004_202_145503_v01.sof. Later file versions encode the version both in the filename, and the XML VERSION attribute. The filenames of the new file versions look like 2004_202_145503_v02.sof.
2. If a new file format is implemented, both the old and the new file formats will be posted to the web site location for a transition period.
3. The old file format will be posted for six months, and then be removed. This provides time for users to adapt to the new file format.
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SOF DTD

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        <!ELEMENT GPSISFILE (CREATION,REFERENCE,(PREDICTED|CURRENT|HISTORICAL)+)>
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        <!ELEMENT REFERENCE EMPTY>
        <!ELEMENT PREDICTED EMPTY>
        <!ELEMENT CURRENT EMPTY>
        <!ELEMENT HISTORICAL EMPTY>
        <!ATTLIST GPSISFILE FILEID CDATA #FIXED "SOF">
        <!ATTLIST GPSISFILE SYSID CDATA #FIXED "GPS">
        <!ATTLIST GPSISFILE VERSION CDATA #REQUIRED>
        <!ATTLIST CREATION YEAR CDATA #REQUIRED>
        <!ATTLIST CREATION DOY CDATA #REQUIRED>
        <!ATTLIST CREATION HR CDATA #REQUIRED>
        <!ATTLIST CREATION MIN CDATA #REQUIRED>
        <!ATTLIST CREATION SEC CDATA #REQUIRED>
        <!ATTLIST REFERENCE YEAR CDATA #REQUIRED>
        <!ATTLIST REFERENCE DOY CDATA #REQUIRED>
        <!ATTLIST REFERENCE HR CDATA #REQUIRED>
        <!ATTLIST REFERENCE MIN CDATA #REQUIRED>
        <!ATTLIST REFERENCE SEC CDATA #REQUIRED>
        <!ATTLIST PREDICTED SVID CDATA #REQUIRED>
        <!ATTLIST PREDICTED SVN CDATA #REQUIRED>
        <!ATTLIST PREDICTED NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST PREDICTED TYPE (FCSTDV|FCSTMX|FCSTUUFN) #REQUIRED>
        <!ATTLIST PREDICTED REFERENCE CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_YEAR CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_DOY CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_HR CDATA #REQUIRED>
```

```
        <!ATTLIST PREDICTED START_MIN CDATA #REQUIRED>
        <!ATTLIST PREDICTED START_SEC CDATA #REQUIRED>
        <!ATTLIST PREDICTED END_YEAR CDATA #OPTIONAL>
        <!ATTLIST PREDICTED END_DOY CDATA # OPTIONAL>
        <!ATTLIST PREDICTED END_HR CDATA # OPTIONAL>
        <!ATTLIST PREDICTED END_MIN CDATA # OPTIONAL>
        <!ATTLIST PREDICTED END_SEC CDATA # OPTIONAL>
        <!ATTLIST CURRENT SVID CDATA #REQUIRED>
        <!ATTLIST CURRENT SVN CDATA #REQUIRED>
        <!ATTLIST CURRENT NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST CURRENT TYPE CDATA #FIXED "UNUSUFN">
        <!ATTLIST CURRENT REFERENCE CDATA #REQUIRED>
        <!ATTLIST CURRENT START_YEAR CDATA #REQUIRED>
        <!ATTLIST CURRENT START_DOY CDATA #REQUIRED>
        <!ATTLIST CURRENT START_HR CDATA #REQUIRED>
        <!ATTLIST CURRENT START_MIN CDATA #REQUIRED>
        <!ATTLIST CURRENT START_SEC CDATA #REQUIRED>
        <!ATTLIST HISTORICAL SVID CDATA #REQUIRED>
        <!ATTLIST HISTORICAL SVN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL NAME (NANU|GOCGIS|USER_DEFINED) #REQUIRED>
        <!ATTLIST HISTORICAL TYPE (FCSTSUMM|UNUSABLE|UNUNOREF) #REQUIRED>
        <!ATTLIST HISTORICAL REFERENCE CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_YEAR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_DOY CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_HR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_MIN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL START_SEC CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_YEAR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_DOY CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_HR CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_MIN CDATA #REQUIRED>
        <!ATTLIST HISTORICAL END_SEC CDATA #REQUIRED>
]>
```

SOF Structure

```
<?xml version="1.0"?>
<GPSISFILE FILEID="SOF" SYSID="GPS" VERSION=”2”>
<CREATION YEAR="2004" DOY="257" HR="11" MIN="2" SEC="11" />
<REFERENCE YEAR="2004" DOY="257" HR="11" MIN="2" SEC="11" />
<PREDICTED
        SVID="9" SVN="39"
        NAME="NANU" TYPE="FCSTMX" REFERENCE="2004094"
        START_YEAR="2004" START_DOY="229" START_HR="12" START_MIN="0" START_SEC="0"
        END_YEAR="2004" END_DOY="230" END_HR="0" END_MIN="0" END_SEC="0"
        />
<CURRENT
        SVID="31" SVN="31"
        NAME="NANU" TYPE="UNUSUFN" REFERENCE="2004101"
                START_YEAR="2004" START_DOY="257" START_HR="5" START_MIN="50" START_SEC="0"
        />
<HISTORICAL
        SVID="27" SVN="27"
        NAME="NANU" TYPE="UNUSABLE" REFERENCE="2004100"
        START_YEAR="2004" START_DOY="242" START_HR="1" START_MIN="32" START_SEC="0"
```

END_YEAR="2004" END_DOY="243" END_HR="19" END_MIN="12" END_SEC="0"
/>
</GPSISFILE>
All times are UTC TIME (ZULU) unless otherwise specified. DOY is day of year (same as JDAY); 1=1 January, 366 is valid for leap year
'GPSISFILE' FILE INFORMATION
Occurs once per file
FILEID is always 'SOF'
SYSID is always 'GPS'
VERSION is the version number of the file. The version text should be an integer version number. Example: 2
CREATION indicates date/time of file creation. Time is computer time (UTC time zone).
REFERENCE indicates date/time to which SOF data applies. For example, if January 10, 2003 1550Z is the REFERENCE time then Satellite Outage information will be collected up to and including that time, including past, current, and predicted information. The REFERENCE time is set to be the date/time of the most recent NANU incorporated into the SOF.
'SOF_RECORD' INFORMATION
Occurs multiple times per file, once for each predicted, current or historical satellite outage issued by the REFERENCE data/time.
There are three types of SOF records.
PREDICTED identifies predicted outages as of the REFERENCE time.
CURRENT identifies any active outages as of the REFERENCE time, along with the time the outage began.
HISTORICAL identifies actual outages that have taken place prior to the REFERENCE time.
SVID - reusable identifier for each satellite in identified system. For GPS the SVID shall be the PRN.
SVN (Satellite Vehicle Number) – unique sequential number associated with satellite-specific program is an integer. For GPS this is assigned by the US Air Force.
PREDICTED record fields
NAME – Alphanumeric indicator of outage source (currently 'NANU'). GOCGIS used when no NANU has been issued, yet outage is predicted or a GENERAL NANU has been issued that affects this outage.
TYPE – If NAME=NANU, then the choices are FCSTDV, FCSTMX, or FCSTUUFN. FCSTUUFN indicates a scheduled outage of indefinite duration not necessarily related to Delta-V or maintenance activities and does not contain END_YEAR/DOY/HR/MIN/SEC. If a FCSTEXTD, then implemented as original type (FCSTDV or FCSTMX) with start date/time the same as in the FCSTEXTD and end date/time fixed twenty years out. If FCSTRESCD, then implemented as original type with dates/times as in the FCSTRESCD NANU. If a FCSTCANC type NANU is issued, the original type will be deleted from the SOF.
REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a FCSTDV issued with number 2003010, then REFERENCE=2003010. As another example, if there is a FCSTMX issued with number 2003047, followed be a FCSTEXTD with number 2003050, then REFERENCE=2003050.
CURRENT record fields
NAME – Alphanumeric indicator of outage source (currently 'NANU').
TYPE – If NAME=NANU, then the choices are UNUSUFN and GENERAL. If NANU is initially issued as a GENERAL launch message, then it will be implemented in the SOF as a UNUSUFN with the start date/time as 0000Z on the first day the satellite appears in the almanac.
REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a UNUSUFN issued with number 2003049, then REFERENCE=2003049.
HISTORICAL record fields
NAME –Alphanumeric indicator of outage source (currently NANU).
TYPE – If NAME=NANU, then the choices are FCSTSUMM, UNUSABLE, UNUNOREF, USABINIT, and GENERAL. If NANU is initially issued as a GENERAL launch message, then it will be implemented in the SOF as an UNUSABLE with stop dates/times as in the USABINIT and the start date/time as 0000Z on the first day the satellite appears in the almanac. This closes out the UNUSUFN that was implemented earlier for the GENERAL launch message. If the NANU is initially issued as a GENERAL decommission it will be implemented in the SOF as an UNUSABLE with the

decommission date/time as the end date/time. If a GENERAL NANU is issued which cancels a previous NANU, the previous NANU will not appear in the SOF.
REFERENCE – reference info. If NAME=NANU this will be the NANU number of the last valid NANU associated with this outage. For example, if there is a FCSTSUMM issued with number 2003051, then REFERENCE=2003051.

Format Changes

Changes to file formats are implemented as follows:

1. Files implementing a new format have the VERSION attribute of the GPSISFILE element incremented. Version 1 files encoded the file version in the filename. For example, a file with a previous format may have a name like 2004_202_145503_v01.sof. Later file versions encode the version both in the filename, and the XML VERSION attribute. The filenames of the new file versions look like 2004_202_145503_v02.sof.
2. If a new file format is implemented, both the old and the new file formats will be posted to the web site location for a transition period.
3. The old file format will be posted for six months, and then be removed. This provides time for users to adapt to the new file format.
4. Notifications of file format changes, with samples of the new format, will be published to www.GPS.gov when they are final.

Rationale:
8/18/2025: added missing period after "contain END_YEAR/DOY/HR/MIN/SEC" (T. Anthony)
Pre-RFC-1354 8/5/20205 Replicate the XML changes from ICD-GPS-875 in ICD-GPS-870 to complete this Pre-RFC. (T. Anthony)

ICD870-234:

Section Number:
40.4.0-6

WAS:

Line No.	Almanac Name	Description	Units	Range	Accuracy	Precision
1	Number of records	The number of satellite Almanac records contained in the file	Records	0 to 32	1	2 significant digits
	Name of Almanac	Descriptive name for the Almanac in the file	N/A	Any combination of valid ASCII characters	N/A	24 significant characters
2	GPS Week Number	The Almanac reference week number (WNa) for all Almanac data in the file	Weeks	0 to 1023 *	1	4 significant digits
	GPS Time of Applicability	The number of seconds since the beginning of the Almanac reference week. The Almanac reference time (t_{oa}) for all Almanac data in the file	Second	0 to 602,112	1	6 significant digits
3	Blank line for format spacing					
Record Format						
R-1	PRN Number	The satellite PRN number. This is a required data item as it is the GPS user's primary means of identifying GPS satellites. It is equivalent to the space vehicle identification (SVID) number of the SV	None	1 to 32	None	2 significant digits
R-2	SVN	The SV reference number. Unique sequential number associated with each satellite	None	0 to 255 (zero denotes that this field is empty)	None	3 significant digits
R-3	Average URA Number	The satellite "average" URA** number. This is not an item in the raw Almanac file but is based on the average URA value transmitted by this satellite in subframe 1. The URA is taken in the range of 730 hours	None	0 to 15	1	2 significant digits
R-4	Eccentricity	This defines the amount of the orbit deviation from a circular orbit (e)**	Unitless	0 to 3.125 E-2	4.77 E-7	7 significant digits

Redlines:

Line No.	Almanac Name	Description	Units	Range	Accuracy	Precision
1	Number of records	The number of satellite Almanac records contained in the file	Records	0 to 32	1	2 significant digits
	Name of Almanac	Descriptive name for the Almanac in the file	N/A	Any combination of valid ASCII characters	N/A	24 significant characters
2	GPS Week Number	The Almanac reference week number (WN~~a~~$_a$) for all Almanac data in the file	Weeks	0 to 1023 * NOTE1	1	4 significant digits
	GPS Time of Applicability	The number of seconds since the beginning of the Almanac reference week. The Almanac reference time (t_{oa}) for all Almanac data in the file	Second	0 to 602,112	1	6 significant digits
3	Blank line for format spacing					
Record Format						
R-1	PRN Number	The satellite PRN number. This is a required data item as it is the GPS user's primary means of identifying GPS satellites. It is equivalent to the space vehicle identification (SVID) number of the SV	None	1 to 32	None	2 significant digits
R-2	SVN	The SV reference number. Unique sequential number associated with each satellite	None	0 to 255 (zero denotes that this field is empty)	None	3 significant digits
R-3	Average URA Number	The satellite "average" URA** NOTE2 number. This is not an item in the raw Almanac file but is based on the average URA value transmitted by this satellite in subframe 1. The URA is taken in the range of 730 hours	None	0 to 15	1	2 significant digits
R-4	Eccentricity	This defines the amount of the orbit deviation from a circular orbit (e)** NOTE2	Unitless	0 to 3.125 × 10^{-2} ~~E-2~~	4.77 × 10^{-7} ~~E-7~~	7 significant digits

IS:

Line No.	Almanac Name	Description	Units	Range	Accuracy	Precision
1	Number of records	The number of satellite Almanac records contained in the file	Records	0 to 32	1	2 significant digits
	Name of Almanac	Descriptive name for the Almanac in the file	N/A	Any combination of valid ASCII characters	N/A	24 significant characters
2	GPS Week Number	The Almanac reference week number (WN_a) for all Almanac data in the file	Weeks	0 to 1023 NOTE1	1	4 significant digits
	GPS Time of Applicability	The number of seconds since the beginning of the Almanac reference week. The Almanac reference time (t_{oa}) for all Almanac data in the file	Second	0 to 602,112	1	6 significant digits
3	Blank line for format spacing					
Record Format						
R-1	PRN Number	The satellite PRN number. This is a required data item as it is the GPS user's primary means of identifying GPS satellites. It is equivalent to the space vehicle identification (SVID) number of the SV	None	1 to 32	None	2 significant digits
R-2	SVN	The SV reference number. Unique sequential number associated with each satellite	None	0 to 255 (zero denotes that this field is empty)	None	3 significant digits
R-3	Average URA Number	The satellite "average" URA NOTE2 number. This is not an item in the raw Almanac file but is based on the average URA value transmitted by this satellite in subframe 1. The URA is taken in the range of 730 hours	None	0 to 15	1	2 significant digits
R-4	Eccentricity	This defines the amount of the orbit deviation from a circular orbit (e) NOTE2	Unitless	0 to 3.125×10^{-2}	4.77×10^{-7}	7 significant digits

Rationale:
2/26/2026 CRM #70 Fixed subscript in Line 2 Description for WNa (T. Anthony)
8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

ICD870-237:

Section Number:
40.4.0-8

WAS:

Line No	Almanac Name	Description	Units	Range	Accuracy	Precision
b	Inclination Offset	Satellite Almanac orbital "inclination angle offset" (δ_i)** This does not include the 0.30 semicircle reference value (i_0)**	Semi circles	-6.25 E-2 to +6.25 E-2	1.91 E-6	7 significant digits
c	Rate of Right Ascension	Rate of change in the measurement of the angle of right ascension (Ω-DOT)**	Semi circles/ second	-1.1921 E-7*** to +1.1921 E-7***	3.64 E-12	7 significant digits
R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$)**	$Meters^{1/2}$	0 to 8,192	4.88 E-04	9 significant digits
d	Geographic Longitude of Orbital Plane	Geographic longitude of the orbital plane at the weekly epoch" (Ω_0)**	Semi circles	-1.0 to +1.0	1.19 E-07	9 significant digits
e	Argument of Perigee	The angle from the equator to perigee (ω)**	Semi circles	-1.0 to +1.0	1.19 E-07	9 significant digits
R-6	Mean Anomaly	The angle which describes the position of the satellite in its orbit, relative to perigee. (M_0)**	Semi circle	-1.0 to +1.0	1.19 E-07	9 significant digits
f	Zeroth Order Clock Correction	The satellite Almanac zeroth order clock correction term (a_{f0})**	Seconds	-9.7657 E-4*** to +9.7657 E-4***	9.54 E-07	5 significant digits
g	First Order Clock Correction	The satellite Almanac first order clock correction term (a_{f1})**	Seconds/ second	-3.7253 E-9*** to +3.7253 E-9***	3.64 E-12	5 significant digits
R-7	Satellite Health	The satellite subframe 4 and 5, page 25 six-bit health code **	None	0 to 63	None	2 significant digits
R-8	Satellite Configuration	The satellite subframe 4, page 25 four-bit configuration code **	None	0 to 15	None	2 significant digits
R-9	Blank line for format spacing					

*GPS Week Number as distributed by the CS is a modulo 1024 (0-1023) decimal number representing the modulo 1024 binary week number broadcast from an SV (see IS-GPS-200). Some user applications (such as the SEM program) may require the user to replace the modulo 1024 week number in this format with the full decimal week number (e.g., 0-65,535) in order to determine the correct calendar date of the Almanac.
**As defined in IS-GPS-200.
***Rounded up from max range of IS-GPS-200 binary format.

Redlines:

Line No	Almanac Name	Description	Units	Range	Accuracy	Precision
b	Inclination Offset	Satellite Almanac orbital "inclination angle offset" (δ_i) ~~**~~ NOTE2 This does not include the 0.30 semicircle reference value (i_0) NOTE2	Semi circles	-6.25 × 10^{-2} ~~E-2~~ to +6.25 × 10^{-2} ~~E-2~~	1.91 × 10^{-6} ~~E-6~~	7 significant digits
c	Rate of Right Ascension	Rate of change in the measurement of the angle of right ascension (Ω-DOT) **NOTE2	Semi circles/ second	-1.1921 × 10^{-7} ~~E-7~~ *** NOTE3 to +1.1921 × 10^{-7} ~~E-7~~ *** NOTE3	3.64 × 10^{-12} ~~E-12~~	7 significant digits
R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$) **NOTE2	Meters$^{1/2}$	0 to 8,192	4.88 × 10^{-4} ~~E-4~~	9 significant digits
d	Geographic Longitude of Orbital Plane	Geographic longitude of the orbital plane at the weekly epoch" (Ω_0) **NOTE2	Semi circles	-1.0 to +1.0	1.19 × 10^{-7} ~~E-7~~	9 significant digits
e	Argument of Perigee	The angle from the equator to perigee (ω) **NOTE2	Semi circles	-1.0 to +1.0	1.19 × 10^{-7} ~~E-7~~	9 significant digits
R-6	Mean Anomaly	The angle which describes the position of the satellite in its orbit, relative to perigee. (M_0) **NOTE2	Semi circle	-1.0 to +1.0	1.19 × 10^{-7} ~~E-7~~	9 significant digits
f	Zeroth Order Clock Correction	The satellite Almanac zeroth order clock correction term (a_{f0}) **NOTE2	Seconds	-9.7657 × 10^{-4} ~~E-4~~ *** NOTE3 to +9.7657 × 10^{-4} ~~E-4~~ *** NOTE3	9.54 × 10^{-7} ~~E-7~~	5 significant digits
g	First Order Clock Correction	The satellite Almanac first order clock correction term (a_{f1}) **NOTE2	Seconds/ second	-3.7253 × 10^{-9} ~~E-9~~ *** NOTE3 to +3.7253 × 10^{-9} ~~E-9~~ *** NOTE3	3.64 × 10^{-12} ~~E-12~~	5 significant digits
R-7	Satellite Health	The satellite subframe 4 and 5, page 25 six-bit health code **NOTE2	None	0 to 63	None	2 significant digits
R-8	Satellite Configuration	The satellite subframe 4, page 25 four-bit configuration code **NOTE2	None	0 to 15	None	2 significant digits
R-9	Blank line for format spacing					

NOTE1:* GPS Week Number as distributed by the CS is a modulo 1024 (0-1023) decimal number representing the modulo 1024 binary week number broadcast from an SV (see IS-GPS-200). Some user applications (such as the SEM program) may require the user to replace the modulo 1024 week number in this format with the full decimal week number (e.g., 0-65,535) in order to determine the correct calendar date of the Almanac.

NOTE2:** As defined in IS-GPS-200.

NOTE3:*** Rounded up from max range of IS-GPS-200 binary format.

IS:

Line No	Almanac Name	Description	Units	Range	Accuracy	Precision
b	Inclination Offset	Satellite Almanac orbital "inclination angle offset" (δ_i) NOTE2 This does not include the 0.30 semicircle reference value (i_0) NOTE2	Semi circles	-6.25×10^{-2} to $+6.25 \times 10^{-2}$	1.91×10^{-6}	7 significant digits
c	Rate of Right Ascension	Rate of change in the measurement of the angle of right ascension (Ω-DOT) NOTE2	Semi circles/ second	-1.1921×10^{-7} NOTE3 to $+1.1921 \times 10^{-7}$ NOTE3	3.64×10^{-12}	7 significant digits
R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$) NOTE2	Meters$^{1/2}$	0 to 8,192	4.88×10^{-4}	9 significant digits
d	Geographic Longitude of Orbital Plane	Geographic longitude of the orbital plane at the weekly epoch" (Ω_0) NOTE2	Semi circles	-1.0 to +1.0	1.19×10^{-7}	9 significant digits
e	Argument of Perigee	The angle from the equator to perigee (ω) NOTE2	Semi circles	-1.0 to +1.0	1.19×10^{-7}	9 significant digits
R-6	Mean Anomaly	The angle which describes the position of the satellite in its orbit, relative to perigee. (M_0) NOTE2	Semi circle	-1.0 to +1.0	1.19×10^{-7}	9 significant digits
f	Zeroth Order Clock Correction	The satellite Almanac zeroth order clock correction term (a_{f0}) NOTE2	Seconds	-9.7657×10^{-4} NOTE3 to $+9.7657 \times 10^{-4}$ NOTE3	9.54×10^{-7}	5 significant digits
g	First Order Clock Correction	The satellite Almanac first order clock correction term (a_{f1}) NOTE2	Seconds/ second	-3.7253×10^{-9} NOTE3 to $+3.7253 \times 10^{-9}$ NOTE3	3.64×10^{-12}	5 significant digits
R-7	Satellite Health	The satellite subframe 4 and 5, page 25 six-bit health code NOTE2	None	0 to 63	None	2 significant digits
R-8	Satellite Configuration	The satellite subframe 4, page 25 four-bit configuration code NOTE2	None	0 to 15	None	2 significant digits
R-9	Blank line for format spacing					

NOTE1: GPS Week Number as distributed by the CS is a modulo 1024 (0-1023) decimal number representing the modulo 1024 binary week number broadcast from an SV (see IS-GPS-200). Some user applications (such as the SEM program) may require the user to replace the modulo 1024 week number in this format with the full decimal week number (e.g., 0-65,535) in order to determine the correct calendar date of the Almanac.
NOTE2: As defined in IS-GPS-200.
NOTE3: Rounded up from max range of IS-GPS-200 binary format.

Rationale:
2/26/2026 CRM #71 Fixed the A1/2 superscript and Precision was accidentally changed and is now properly set to "9 significant digits" (T. Anthony)
8/27/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

ICD870-239:

Section Number:
40.4.0-10

WAS:

Line No.	Almanac Name	Description	Units	Range	Accuracy	Precision
1	Number of records	The number of satellite Almanac records contained in the file	Records	00 to 63	1	2 significant digits
	Blank space for format spacing					
	Name of Almanac	Descriptive name for the Almanac in the file	N/A	Any combination of valid ASCII characters	N/A	24 significant characters
2	GPS Week Number	The Almanac reference week number (WNa) for all Almanac data in the file	Weeks	0 to 1023 *	1	4 significant digits
	Blank space for format spacing					
	GPS Time of Applicability	The number of seconds since the beginning of the Almanac reference week. The Almanac reference time (t_{oa}) for all Almanac data in the file	Second	0 to 602,112	1	6 significant digits
3	Blank line for format spacing					
Record Format						
R-1	PRN Number	The satellite PRN number. This is a required data item as it is the GPS user's primary means of identifying GPS satellites. It is equivalent to the space vehicle identification (SVID) number of the SV	None	01 to 63	None	2 significant digits
R-2	SVN	The SV reference number. Unique sequential number associated with each satellite**	None	000 to 255 (000 denotes that this field is empty)	None	3 significant digits
R-3	Average URA Number	The satellite "average" URA*** number. This is not an item in the raw Almanac file but is based on the average URA value transmitted by this satellite in subframe 1. The URA is taken in the range of 730 hours	None	0 to 15	1	2 significant digits
R-4	Eccentricity	This defines the amount of the orbit deviation from a circular orbit (e)***	Unitless	0 to 3.125 E-2	4.77 E-7	7 significant digits

Redlines:

Line No.	Almanac Name	Description	Units	Range	Accuracy	Precision
1	Number of records	The number of satellite Almanac records contained in the file	Records	00 to 63	1	2 significant digits
	Blank space for format spacing					
	Name of Almanac	Descriptive name for the Almanac in the file	N/A	Any combination of valid ASCII characters	N/A	24 significant characters
2	GPS Week Number	The Almanac reference week number (WN~~a~~$_a$) for all Almanac data in the file	Weeks	0 to 1023 * NOTE1	1	4 significant digits
	Blank space for format spacing					
	GPS Time of Applicability	The number of seconds since the beginning of the Almanac reference week. The Almanac reference time (t_{oa}) for all Almanac data in the file	Second	0 to 602,112	1	6 significant digits
3	Blank line for format spacing					
Record Format						
R-1	PRN Number	The satellite PRN number. This is a required data item as it is the GPS user's primary means of identifying GPS satellites. It is equivalent to the space vehicle identification (SVID) number of the SV	None	01 to 63	None	2 significant digits
R-2	SVN	The SV reference number. Unique sequential number associated with each satellite** NOTE2	None	000 to 255 (000 denotes that this field is empty)	None	3 significant digits
R-3	Average URA Number	The satellite "average" URA*** NOTE3 number. This is not an item in the raw Almanac file but is based on the average URA value transmitted by this satellite in subframe 1. The URA is taken in the range of 730 hours	None	0 to 15	1	2 significant digits
R-4	Eccentricity	This defines the amount of the orbit deviation from a circular orbit (e)*** NOTE3	Unitless	0 to 3.125 × 10^{-2} ~~E-2~~	4.77 × 10^{-7} ~~E-7~~	7 significant digits

IS:

Line No.	Almanac Name	Description	Units	Range	Accuracy	Precision
1	Number of records	The number of satellite Almanac records contained in the file	Records	00 to 63	1	2 significant digits
	Blank space for format spacing					
	Name of Almanac	Descriptive name for the Almanac in the file	N/A	Any combination of valid ASCII characters	N/A	24 significant characters
2	GPS Week Number	The Almanac reference week number (WN_a) for all Almanac data in the file	Weeks	0 to 1023 NOTE1	1	4 significant digits
	Blank space for format spacing					
	GPS Time of Applicability	The number of seconds since the beginning of the Almanac reference week. The Almanac reference time (t_{oa}) for all Almanac data in the file	Second	0 to 602,112	1	6 significant digits
3	Blank line for format spacing					
Record Format						
R-1	PRN Number	The satellite PRN number. This is a required data item as it is the GPS user's primary means of identifying GPS satellites. It is equivalent to the space vehicle identification (SVID) number of the SV	None	01 to 63	None	2 significant digits
R-2	SVN	The SV reference number. Unique sequential number associated with each satellite NOTE2	None	000 to 255 (000 denotes that this field is empty)	None	3 significant digits
R-3	Average URA Number	The satellite "average" URA NOTE3 number. This is not an item in the raw Almanac file but is based on the average URA value transmitted by this satellite in subframe 1. The URA is taken in the range of 730 hours	None	0 to 15	1	2 significant digits
R-4	Eccentricity	This defines the amount of the orbit deviation from a circular orbit (e) NOTE3	Unitless	0 to 3.125×10^{-2}	4.77×10^{-7}	7 significant digits

Rationale:
2/26/2023 CRM #72 Correct the subscript on line 2's Description for WNa (T. Anthony)
8/27/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

ICD870-307:

Section Number:
40.4.0-12

WAS:

Line No	Almanac Name	Description	Units	Range	Accuracy	Precision
b	Inclination Offset	Satellite Almanac orbital "inclination angle offset" (δ_i)*** This does not include the 0.30 semicircle reference value (i_0)***	Semi circles	-6.25 E-2 to +6.25 E-2	1.91 E-6	7 significant digits
c	Rate of Right Ascension	Rate of change in the measurement of the angle of right ascension (Ω-DOT)***	Semi circles/ second	-1.1921 E-7**** to +1.1921 E-7****	3.64 E-12	7 significant digits
R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$)***	Meters$^{1/2}$	0 to 8,192	4.88 E-04	9 significant digits
d	Geographic Longitude of Orbital Plane	Geographic longitude of the orbital plane at the weekly epoch" (Ω_0)***	Semi circles	-1.0 to +1.0	1.19 E-07	9 significant digits
e	Argument of Perigee	The angle from the equator to perigee (ω)***	Semi circles	-1.0 to +1.0	1.19 E-07	9 significant digits
R-6	Mean Anomaly	The angle which describes the position of the satellite in its orbit, relative to perigee. (M_0)***	Semi circle	-1.0 to +1.0	1.19 E-07	9 significant digits
f	Zeroth Order Clock Correction	The satellite Almanac zeroth order clock correction term (a_{f0})***	Seconds	-9.7657 E-4**** to +9.7657 E-4****	9.54 E-07	5 significant digits
g	First Order Clock Correction	The satellite Almanac first order clock correction term (a_{f1})***	Seconds/ second	-3.7253 E-9**** to +3.7253 E-9****	3.64 E-12	5 significant digits
R-7	Satellite Health	The satellite subframe 4 and 5, page 25 six-bit health code ***	None	0 to 63	None	2 significant digits
R-8	Satellite Configuration	The satellite subframe 4, page 25 four-bit configuration code ***	None	0 to 15	None	2 significant digits
R-9	Blank line for format spacing					

*GPS Week Number as distributed by the CS is a modulo 1024 (0-1023) decimal number representing the modulo 1024 binary week number broadcast from an SV (see IS-GPS-200). Some user applications (such as the SEM program) may require the user to replace the modulo 1024 week number in this format with the full decimal week number (e.g., 0-65,535) in order to determine the correct calendar date of the Almanac.
** SVN Number as distributed by the CS is a modulo 256 (000-255) filled with leading zeros.
***As defined in IS-GPS-200.
****Rounded up from max range of IS-GPS-200 binary format.

Redlines:

Line No	Almanac Name	Description	Units	Range	Accuracy	Precision
b	Inclination Offset	Satellite Almanac orbital "inclination angle offset" (δ_i)*** NOTE3 This does not include the 0.30 semicircle reference value (i_0)*** NOTE3	Semi circles	-6.25 × 10^{-2} ~~E-2~~ to +6.25 × 10^{-2} ~~E-2~~	1.91 × 10^{-6} ~~E-6~~	7 significant digits
c	Rate of Right Ascension	Rate of change in the measurement of the angle of right ascension (Ω-DOT)*** NOTE3	Semi circles/ second	-1.1921 × 10^{-7} ~~E-7~~ **** NOTE4 to +1.1921 × 10^{-7} ~~E-7~~ **** NOTE4	3.64 × 10^{-12} ~~E-12~~	7 significant digits
R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$)*** NOTE3	Meters$^{1/2}$	0 to 8,192	4.88 × 10^{-4} ~~E-4~~	9 significant digits
d	Geographic Longitude of Orbital Plane	Geographic longitude of the orbital plane at the weekly epoch" (Ω_0)*** NOTE3	Semi circles	-1.0 to +1.0	1.19 × 10^{-7} ~~E-7~~	9 significant digits
e	Argument of Perigee	The angle from the equator to perigee (ω)*** NOTE3	Semi circles	-1.0 to +1.0	1.19 × 10^{-7} ~~E-7~~	9 significant digits
R-6	Mean Anomaly	The angle which describes the position of the satellite in its orbit, relative to perigee. (M_0)*** NOTE3	Semi circle	-1.0 to +1.0	1.19 × 10^{-7} ~~E-7~~	9 significant digits
f	Zeroth Order Clock Correction	The satellite Almanac zeroth order clock correction term (a_{f0})*** NOTE3	Seconds	-9.7657 × 10^{-4} ~~E-4~~ **** NOTE4 to +9.7657 × 10^{-4} ~~E-4~~ **** NOTE4	9.54 × 10^{-7} ~~E-7~~	5 significant digits
g	First Order Clock Correction	The satellite Almanac first order clock correction term (a_{f1})*** NOTE3	Seconds/ second	-3.7253 × 10^{-9} ~~E-9~~ **** NOTE4 to +3.7253 × 10^{-9} ~~E-9~~ **** NOTE4	3.64 × 10^{-12} ~~E-12~~	5 significant digits
R-7	Satellite Health	The satellite subframe 4 and 5, page 25 six-bit health code*** NOTE3	None	0 to 63	None	2 significant digits
R-8	Satellite Configuration	The satellite subframe 4, page 25 four-bit configuration code*** NOTE3	None	0 to 15	None	2 significant digits
R-9	Blank line for format spacing					

NOTE1:* GPS Week Number as distributed by the CS is a modulo 1024 (0-1023) decimal number representing the modulo 1024 binary week number broadcast from an SV (see IS-GPS-200). Some user applications (such as the SEM program) may require the user to replace the modulo 1024 week number in this format with the full decimal week number (e.g., 0-65,535) in order to determine the correct calendar date of the Almanac.

NOTE2:** SVN Number as distributed by the CS is a modulo 256 (000-255) filled with leading zeros.

NOTE3:*** As defined in IS-GPS-200.

NOTE4:****Rounded up from max range of IS-GPS-200 binary format.

IS:

Line No	Almanac Name	Description	Units	Range	Accuracy	Precision
b	Inclination Offset	Satellite Almanac orbital "inclination angle offset" (δ_i) NOTE3 This does not include the 0.30 semicircle reference value (i_0) NOTE3	Semi circles	-6.25×10^{-2} to $+6.25 \times 10^{-2}$	1.91×10^{-6}	7 significant digits
c	Rate of Right Ascension	Rate of change in the measurement of the angle of right ascension (Ω-DOT) NOTE3	Semi circles/ second	-1.1921×10^{-7} NOTE4 to $+1.1921 \times 10^{-7}$ NOTE4	3.64×10^{-12}	7 significant digits
R-5	Square Root of Semi-Major Axis	Measurement from the center of the orbit to either the point of apogee or the point of perigee ($A^{1/2}$) NOTE3	Meters$^{1/2}$	0 to 8,192	4.88×10^{-4}	9 significant digits
d	Geographic Longitude of Orbital Plane	Geographic longitude of the orbital plane at the weekly epoch" (Ω_0) NOTE3	Semi circles	-1.0 to +1.0	1.19×10^{-7}	9 significant digits
e	Argument of Perigee	The angle from the equator to perigee (ω) NOTE3	Semi circles	-1.0 to +1.0	1.19×10^{-7}	9 significant digits
R-6	Mean Anomaly	The angle which describes the position of the satellite in its orbit, relative to perigee. (M_0) NOTE3	Semi circle	-1.0 to +1.0	1.19×10^{-7}	9 significant digits
f	Zeroth Order Clock Correction	The satellite Almanac zeroth order clock correction term (a_{f0}) NOTE3	Seconds	-9.7657×10^{-4} NOTE4 to $+9.7657 \times 10^{-4}$ NOTE4	9.54×10^{-7}	5 significant digits
g	First Order Clock Correction	The satellite Almanac first order clock correction term (a_{f1}) NOTE3	Seconds/ second	-3.7253×10^{-9} NOTE4 to $+3.7253 \times 10^{-9}$ NOTE4	3.64×10^{-12}	5 significant digits
R-7	Satellite Health	The satellite subframe 4 and 5, page 25 six-bit health code NOTE3	None	0 to 63	None	2 significant digits
R-8	Satellite Configuration	The satellite subframe 4, page 25 four-bit configuration code NOTE3	None	0 to 15	None	2 significant digits
R-9	Blank line for format spacing					

NOTE1: GPS Week Number as distributed by the CS is a modulo 1024 (0-1023) decimal number representing the modulo 1024 binary week number broadcast from an SV (see IS-GPS-200). Some user applications (such as the SEM program) may require the user to replace the modulo 1024 week number in this format with the full decimal week number (e.g., 0-65,535) in order to determine the correct calendar date of the Almanac.
NOTE2: SVN Number as distributed by the CS is a modulo 256 (000-255) filled with leading zeros.
NOTE3: As defined in IS-GPS-200.
NOTE4: Rounded up from max range of IS-GPS-200 binary format.

Rationale:
8/27/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

 # CP Status = 'In Review': 5

# of inserted requirements: 0
# of modified requirements: 0
# of deleted requirements: 0
# of TBDs: 0
# of TBRs: 0
of (added/modified) effectivities: 0
of VCRM additions: 0
# of VCRM modifications: 0
# of VCRM deletions: 0
# of descriptive texts: 1
of (added/modified) tables: 4
of (added/modified) figures: 0