Next Generation GPS - OCX Public Release Data Products

Public Interface Configuration Working Group

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The materials for this review are contained within several zip archives as well as individual files:

- **870-IEPDs.zip**
  - **Contains signed zip archives for each of the three ICD-GPS-870 IEPDs**
  - **The contents of each IEPD is described in detail later in this briefing**

- **ValidateTransformUtility.zip**
  - **Contains Validate And Transform Utility (VATU) as well as the VATU User Guide**
  - **The VATU executable can be found within the ValidateAndTransformUtility sub-directory**
    - **"ValidateAndTransformUtility.exe"**
  - **The VATU is a stand-alone utility intended to function on Windows and Linux platforms per Section 3.3 of ICD-GPS-870**

- **Cert_PEM_Files.zip**
  - **Contains the *.pem files for two certificates**
  - **Both certs are provided to support validation of the signed files, either using the provided VATU or through independent means**
    - **"product.pem" – signing cert for the IEPD and Transform Utility zip archives as well as the sample GGA XML files provided within each IEPD**
    - **"productNegativeTest.pem" – provided so a failure can be observed when using the incorrect cert to attempt validation of the digital signatures**

Review materials continued:

- **Sample products provided for this review are signed using a Raytheon generated certificate with a 10-year validity. In operations, these products will be signed using a standard DoD PKI certificate.**

- **In operations the IEPDs, VATU, and *.pem files corresponding to the signing certificates will be made available to the public via the USCG Navigation Center (NAVCEN) web site**
  - **Details of the NAVEN distribution front-end are in work and will be made available in future.**

GPS Control Segment (CS) currently distributes four data products as defined in ICD-GPS-240 via the USCG Navigation Center:

- **Notice Advisory to Navstar Users (NANU)**
- **Operational Advisory (OA)**
- **Almanac (SEM & YUMA)**
- **Satellite Outage File (SOF)**
- **See: https://www.navcen.uscg.gov/?pageName=gpsAlmanacs**

The 2d Space Operations Squadron (2SOPS) also makes these products available as well as the Anti-Spoof (A-S) file.

- **See: https://gps.afspc.af.mil/gps/conststatus.html**

In the OCX era, all five data products will be consolidated into four schema-based XML Information Products defined in ICD-GPS-870 and distributed via the USCG Navigation Center:

- **GPS Advisory (equivalent NANU content)**
- **GPS Advisory Collection (equivalent SOF content)**
- **Ops Status (equivalent Ops Advisory content)**
- **Public Common Almanac (equivalent SEM, YUMA, and A-S content)**

OCX-Era Product Design

The OCX-era Information Products were designed to conform with the National Information Exchange Model (NIEM)

- "NIEM is a common vocabulary that enables efficient information exchange across diverse public and private organizations"
- The OCX-era products are compliant with NIEM Version 2.1
- See: **https://www.niem.gov/**

IAW NIEM, each OCX-era product has an associated Information Exchange Package Documentation (IEPD)

- "A NIEM IEPD is a package that describes the construction and content of a NIEM information exchange"
- For the OCX-era products, each IEPD will be provided in the form of a digitally signed zip file containing a pre-defined directory structure with:
    - XML Schema
    - XML Sample Product/s
    - XSLT Stylesheet/s
    - Legacy (AEP-era) Sample Product/s
    - Documentation

All OCX-era products will be digitally signed using DoD PKI

OCX-Era Product High Level Ontology
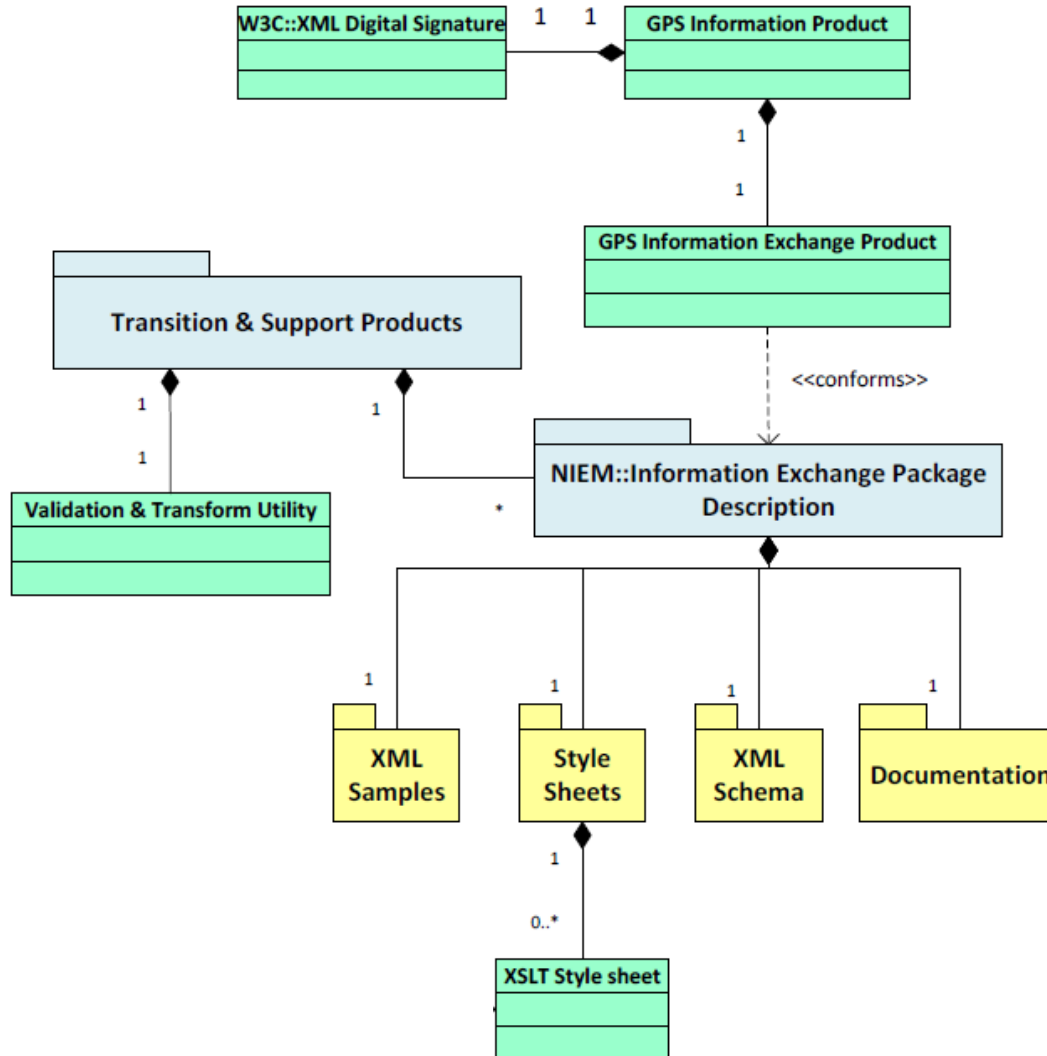
All OCX-era Information Products will contain a digital signature conforming to W3C standards to provide data integrity in transit and at rest

- The digital signature element of each product will include the x509 certificate corresponding to the digital signature
- See **https://www.w3.org/TR/xmldsig-core1/**
- Validation of digital signatures is not required to use the products, but it is strongly encouraged

```xml
<gpsocxmetadata:Header>
    <Signature xmlns="http://www.w3.org/2000/09/xmldsig#">
        <SignedInfo>
            <CanonicalizationMethod Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315"/>
            <SignatureMethod Algorithm="http://www.w3.org/2001/04/xmldsig-more#rsa-sha256"/>
            <Reference URI="">
                <Transforms>
                    <Transform Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-signature"/>
                </Transforms>
                <DigestMethod Algorithm="http://www.w3.org/2001/04/xmlenc#sha256"/>
                <DigestValue>digest value</DigestValue>
            </Reference>
        </SignedInfo>
        <SignatureValue>signature</SignatureValue>
        <KeyInfo><X509Data><X509Certificate>certificate</X509Certificate></X509Data></KeyInfo>
    </Signature>
</gpsocxmetadata:Header>
```

The VATU and IEPD archives (zip files) are signed separately using Oracle's jarsigner

- See **https://docs.oracle.com/en/java/javase/13/docs/specs/man/jarsigner.html**
- See **https://docs.oracle.com/en/java/javase/13/docs/specs/jar/jar.html**
- Per the jarsigner standard, each archive contains a META-INF directory with the following files:
  - **MANIFEST.MF**
    - Contains two lines for each file found within the archive:
      - Line 1 – Filename
      - Line 2 – Name of the digest algorithm (ex SHA) followed by the digest (hash) of the binary data within the file
  - **PRODUCT.SF**
    - Contains two lines for each file found within the archive:
      - Line 1 – Filename
      - Line 2 – Name of the digest algorithm (ex SHA) followed by the digest (hash) value of the two lines for the corresponding source file in the manifest file
  - **PRODUCT.RSA**
    - Contains the signature of the PRODUCT.SF file
    - This file also contains, encoded inside it, the certificate or certificate chain from the keystore that authenticates the public key corresponding to the private key used for signing

For systems that will not be updated to process the directly-distributed XML files, XSLT Stylesheets are provided for each OCX-era product that has one or more corresponding AEP-era products

- **Directly distributed products (Information Products) include the GPS Advisory, GPS Advisory Collection, Ops Status, and Public Common Almanac XML files**
- **The Stylesheets allow for transformation of the directly-distributed XML products into the AEP-era ASCII text formats (or legacy XML in the case of the SOF file)**
  - **Stylesheets conform to W3C standard XSL Transformations 2.0.**

For those users without the knowledge or resources to directly utilize the XSLT Stylesheets, GPS will provide a downloadable utility which will ingest an XML product and relevant XSLT Stylesheet, and then output the desired AEP-era formatted file

- **The Validate and Transform Utility (VATU) is a stand-alone application that can be installed and used on local workstations**
- **A User Guide is included with the VATU to provide instructions on the tool's use**

The VATU is provided with no warranty implied and is not intended as a long-term solution - users are encouraged to migrate to direct use of the XML and/or XSLT files as soon as practical

Once the ValidateTransformUtility.zip file is extracted, you will see the following:

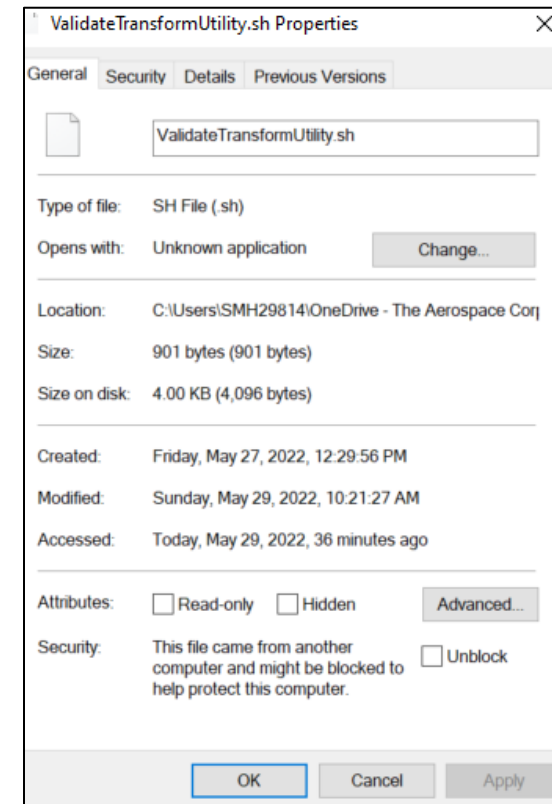| Name |
|------|
| 📁 META-INF |
| 📄 GGA Validate and Transform Utility User Guide.docx |
| 📄 ValidateTransformUtility.cmd |
| 📄 ValidateTransformUtility.jar |
| 📄 ValidateTransformUtility.sh |
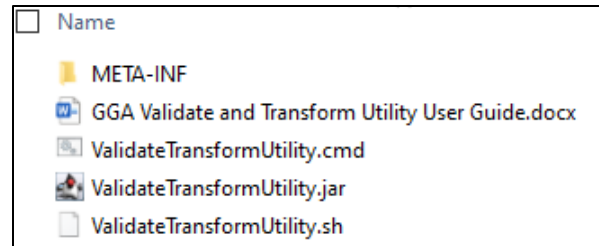
- As noted in Data Integrity, the META-INF folder contains digital signature information for the files contained in the ValidateTransformUtility.zip file

- The GGA Validate and Transform Utility User Guide.docx contains requirements and instructions for running the utility

- The ValidateTransformUtility.cmd and ValidateTransformUtility.sh files are scripts provided to assist with running the utility

- The ValidateTransformUtility.jar file is the utility itself and can be extracted in the same manner as a zip file in order to see additional information such as 3rd Party licenses and the government warranty statement

  - The utility may also be run by simply double-clicking on the jar file itself

There is a known issue with Windows Smartscreen blocking execution of the scripts depending on the configuration of the user's computer

The following fix action is one possible solution, but results may vary depending on user configuration

- **Right-click on the file that will not execute and then select Properties to bring up the pop-up shown**

- **If available, select the Unblock check box on the bottom-right, select Apply, and then OK**

The Validate & Transform Utility (VATU) provides users with the option to validate a product's digital signature in addition to performing any transforms

- **The VATU ingests an Information Product and that Product's IEPD zip file**
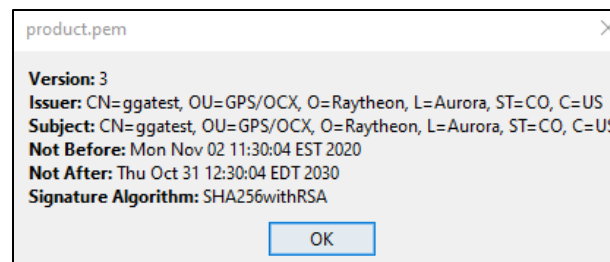
- **If the *.pem files for the certificates used to sign the Information Product & IEPD are provided, the VATU will attempt to validate their digital signatures**
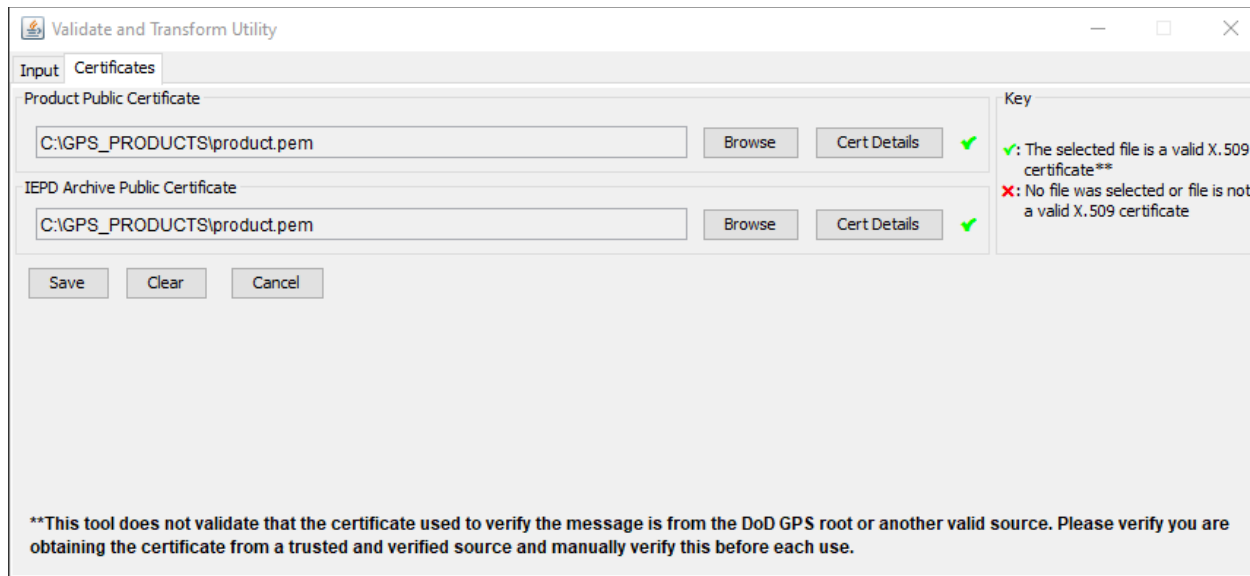
- **The VATU also provides an ability for the user to examine details of the loaded certificate if desired**

- **Once the product, IEPD, and pem files are loaded, the tool will indicate whether the product and/or IEPD signatures validate and will present a dropdown of transformation options for the given product**
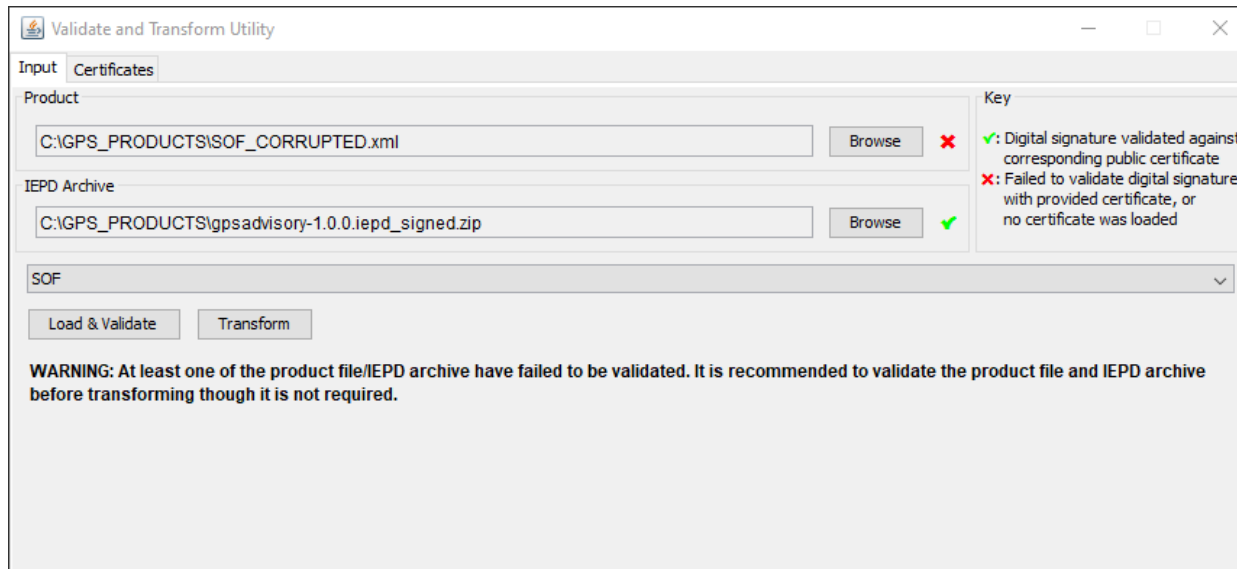
See GGA Validate and Transform Utility User Guide.docx for full details

There is a known issue on some platforms where after entering the desired product and IEPD Archive – *with no certificates loaded* – the below may result:

The fix action is to click on the bottom border of the window and drag it down to increase its vertical size until you see the problem is corrected

The software developer has an action to correct this issue prior to the tool being posted for operational use

On the following slide is an example of the general organization and content of the IEPDs provided by GPS within the 870-IEPDs.zip file

- This example is based on the Ops Status Information Product IEPD, but all GPS IEPDs follow the same basic structure and conform to the same standards

Schema is provided to simplify adoption of the NIEM-compliant XML products

Mapping from NIEM-compliant XML data elements to the legacy text product can be found in the XSLT Stylesheet

The GPS program acknowledges not all users will be familiar with schema or XSLT standards, so the previously mentioned Validate and Transform Utility (VATU) is provided

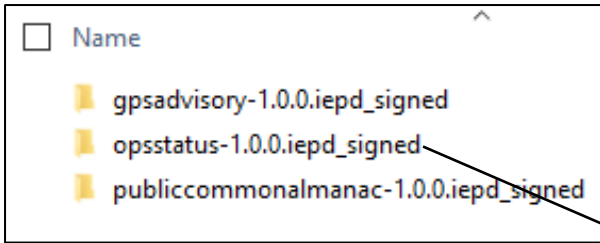*Sample products provided for this review do not contain operationally realistic data*

Figure 1
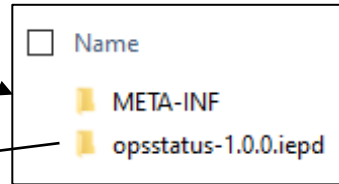
Figure 2
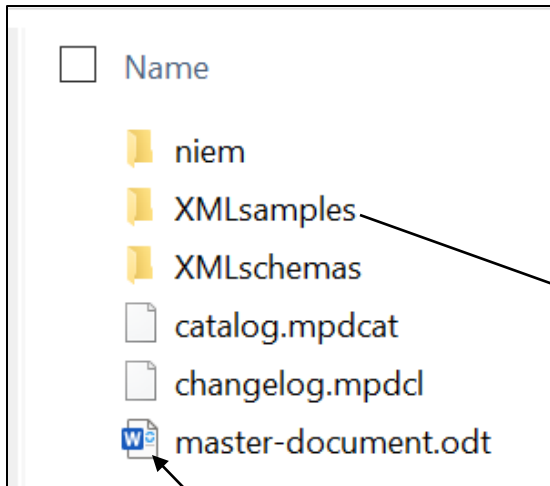
Figure 3

Figure 4

Figure 5

Provides a list of artifacts, schemas, definitions, business rules, and other information found in the IEPD
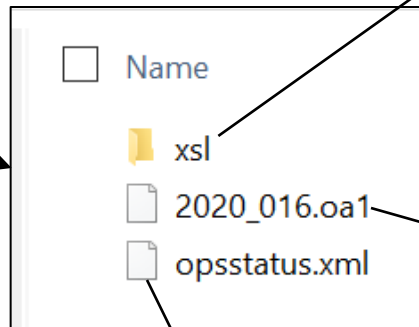
Sample of the directly distributed, NIEM-compliant XML product
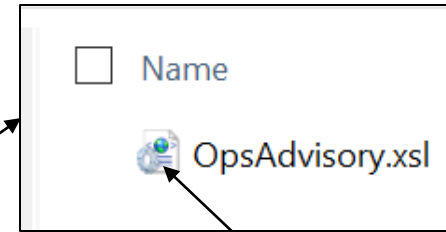
Sample of the legacy text formatted product, generated via the provided XSLT Stylesheet

GPS vs UTC Time

Wherever a Date-Time Group (DTG) is displayed in the standard NIEM format as shown below, that DTG is referenced to UTC

```
<gpspub:CreatedDate>2020-01-16T16:31:09.000Z</gpspub:CreatedDate>
```

If the Legacy (AEP-era) product contained a DTG which is referenced to GPS rather than UTC, it is still shown in the NIEM format, but also includes the SourceGPSTime attribute

```
<gpspub:EffectiveDate gpspub:sourceGPSTime="1263228600" gpspub:timezoneCode="UTC">
    <nc:DateTime>2020-01-16T16:49:42.000Z</nc:DateTime>
</gpspub:EffectiveDate>
```

Sample taken from Effective Date field of GPS Advisory Collection which corresponds to the SOF REFERENCE DTG

This general format is used for any data element whose Legacy counterpart is referenced to the GPS Time Standard

- **SourceGPSTime attribute provides seconds since GPS Epoch, 6 Jan 1980 0000Z**
- **The GPS time is then followed by a NIEM-standard DTG format, which is always in UTC**
- **If only the NIEM-standard DTG format is provided in an element, it will always be referenced to UTC**

The Ops Status product provides the same information as found in the AEP-era Operational Advisory (OA) product, per the definition found in ICD-GPS-870 Rev E, Appendix 2

- **Legacy Ops Advisory Header**
  - **This data is found within the opsstatus:GPSMetadata element under opsstatus:Constellation**

Row 1 – Classification:

```
<gpspub:ICISMMetadata nism:ownerProducer="USA" nism:classification="U">
<gpspub:NoticeList>
<gpspub:Notice>
          <gpspub:NoticeText>DoD-Dist-A</gpspub:NoticeText>
</gpspub:Notice>
</gpspub:NoticeList>
</gpspub:ICISMMetadata>
```

Rows 2 & 3 – Product Description & Date:

```
<gpspub:IdentifierValueText>2020_016.OA1</gpspub:IdentifierValueText>
<gpspub:KeywordValueText>OpsStatus</gpspub:KeywordValueText>
<gpspub:CreatedDate>2020-01-16T16:31:09.000Z</gpspub:CreatedDate>
```

- **Legacy Ops Advisory Section 1 – Plane, Slot, & AFS Assignment**
    - **This data is grouped under opsstatus:Constellation within individual gpspub:SpaceVehicle elements for each PRN as follows**

```
<gpspub:SpaceVehicle xsi:type="gpspub:GPSSpaceVehicleType" s:id="vehref27">
        <gpspub:PseudoRandomNoiseID>27</gpspub:PseudoRandomNoiseID>
        <gpspub:SlotNumeric>3</gpspub:SlotNumeric>
        <gpspub:PlaneText>F</gpspub:PlaneText>
        <gpspub:SVBlockCode>IIR</gpspub:SVBlockCode>
        <gpspub:NavigationPayload>
                <gpspub:Clock>
                        <gpspub:AtomicClockKindCode>rubidium</gpspub:AtomicClockKindCode>
                </gpspub:Clock>
        </gpspub:NavigationPayload>
</gpspub:SpaceVehicle>
```

- **Legacy Ops Advisory Section 2**
  - **Current and recent advisories, forecasts, and general text NANUs**
  - **This data is grouped within individual opsstatus:GPSSpaceEvent elements for each PRN as follows**

```
<opsstatus:GPSSpaceEvent>
   <nc:ActivityDateRange>
      <nc:StartDate>
         <nc:DateTime>2009-01-01T09:15:00.000Z</nc:DateTime>
      </nc:StartDate>
      <nc:EndDate>
         <nc:DateTime>2009-01-01T16:20:00.000Z</nc:DateTime>
      </nc:EndDate>
   </nc:ActivityDateRange>
   <gpspub:SpaceEventKindCode>ForecastMaintenance</gpspub:SpaceEventKindCode>
   <gpspub:GPSSpaceVehicleReference s:ref="vehref15"/>
   <opsstatus:GPSMetadata>
      <nc:EffectiveDate>
         <nc:DateTime>2009-01-02T11:05:00.000Z</nc:DateTime>
      </nc:EffectiveDate>
      <nc:ReportedDate>
         <nc:DateTime>2009-01-02T11:05:00.000Z</nc:DateTime>
      </nc:ReportedDate>
      <gpspub:DESVersionNumeric>9</gpspub:DESVersionNumeric>
      <gpspub:NtkDESVersionNumeric>7</gpspub:NtkDESVersionNumeric>
      <gpspub:ResourceElementIndicator>false</gpspub:ResourceElementIndicator>
      <gpspub:CreatedDate>2020-01-16T16:31:09.000Z</gpspub:CreatedDate>
      <gpspub:IdentifierValueText>2009001</gpspub:IdentifierValueText>
   </opsstatus:GPSMetadata>
</opsstatus:GPSSpaceEvent>
```

- **Legacy Ops Advisory Section 2 – Continued**
  - **The following provides a basic mapping between key child elements within the opsstatus:GPSSpaceEvent element and the legacy Ops Advisory format:**

    - **ActivityDate – Event Start/Stop time as seen in the SUMMARY column**
      - **This is an optional element and may not be present if the NANU has no start/stop time information**
      - **ActivityDateRange will be used if the event has both start and stop DTG, with the start and stop DTG contained within the StartDate and EndDate elements**
    - **SpaceEventKindCode – NANU Type**
      - **Enumerations are fully spelled out rather than abbreviations**
      - **Ex, ForecastDeltaV instead of FCSTDV**
    - **GPSSpaceVehicleReference – PRN**
    - **EffectiveDate = ReportedDate – MSG DATE/TIME**
    - **CreatedDate – The creation DTG of the Ops Status product**

- **Legacy Ops Advisory Section 3 - Point of Contact Information**
  - **This data is found within the child elements of opsstatus:GPSMetadata under opsstatus:Constellation**

    - **Individual gpspub:PointOfContact records are provided for each POC as follows**

```
<gpspub:PointOfContact>
        <nc:OrganizationName>NAVCEN</nc:OrganizationName>
        <nc:OrganizationPrimaryContactInformation>
                <nc:ContactTelephoneNumber>
                        <nc:NANPTelephoneNumber>
                                <nc:TelephoneAreaCodeID>703</nc:TelephoneAreaCodeID>
                                <nc:TelephoneExchangeID>313</nc:TelephoneExchangeID>
                                <nc:TelephoneLineID>5900</nc:TelephoneLineID>
                                <nc:TelephoneSuffixID xsi:nil="true"/>
                        </nc:NANPTelephoneNumber>
                </nc:ContactTelephoneNumber>
                <nc:ContactWebsiteURI> HTTPS://WWW.NAVCEN.USCG.GOV
                </nc:ContactWebsiteURI>
        </nc:OrganizationPrimaryContactInformation>
        <gpspub:PointOfContactCategoryCode> CIVIL NON-AVIATION
        </gpspub:PointOfContactCategoryCode>
</gpspub:PointOfContact>
```

The Public Common Almanac product provides the same information as found in the AEP-era SEM and YUMA almanacs as well as the Anti-Spoof and Extended Signals Health Status files, per the definitions found in ICD-GPS-870 Rev E, Appendix 2

The Public Common Almanac also contains classification and point of contact information as previously defined in for the Ops Status product

- The classification and point of contact data can be found within the pubcomalm:GPSMetadata element under pubcomalm:Constellation

Legacy Week Number & Time of Applicability are provided under the pubcomalm:TimeOfApplicabilityDateTime as follows

```
<pubcomalm:TimeOfApplicabilityDateTime>

    <gpspub:GPSWeekNumeric>40</gpspub:GPSWeekNumeric>
    <gpspub:GPSSecondsInWeekNumeric>18400</gpspub:GPSSecondsInWeekNumeric>

</pubcomalm:TimeOfApplicabilityDateTime>
```

The Almanac and Anti-Spoof data is grouped under pubcomalm:Constellation within individual gpspub:SpaceVehicle elements for each PRN as follows

```
<gpspub:SpaceVehicle xsi:type="gpspub:GPSSpaceVehicleType">

    <nc:ItemName>SVN: 68, PRN: 27</nc:ItemName>
    <nc:ItemStatus xsi:nil="true"/>

    <gpspub:OrbitalState xsi:type="gpspub:SupplementalOrbitStateInfoType">

        <gpspub:EccentricityMeasure>0.006045738566963673</gpspub:EccentricityMeasure>
        <gpspub:SquareRootSemiMajorAxisMeasure>5153.6763027527095</gpspub:SquareRootSemiMajorAxisMeasure>
        <gpspub:ArgumentOfPerigeeMeasure>-0.9401327840266962</gpspub:ArgumentOfPerigeeMeasure>
        <gpspub:MeanAnomalyMeasure>0.3921527776300167</gpspub:MeanAnomalyMeasure>
        <gpspub:GeographicLongitudeOfOrbitalPlaneMeasure>
          -0.22369163821016966
        </gpspub:GeographicLongitudeOfOrbitalPlaneMeasure>
        <gpspub:InclinationOffsetMeasure>0.010640977589115507</gpspub:InclinationOffsetMeasure>
        <gpspub:RateOfRightAscensionMeasure>-2.454105210312804E-9</gpspub:RateOfRightAscensionMeasure>
        <gpspub:RightAscensionAngleMeasure>-7.709798899855139E-9</gpspub:RightAscensionAngleMeasure>

    </gpspub:OrbitalState>

    <gpspub:VehicleID>68</gpspub:VehicleID>
    <gpspub:PseudoRandomNoiseID>27</gpspub:PseudoRandomNoiseID>
    <gpspub:SVBlockCode>IIF</gpspub:SVBlockCode>
```

……Continued on next slide

```xml
<gpspub:SpaceVehicle xsi:type="gpspub:GPSSpaceVehicleType">

    <gpspub:NavigationPayload xsi:type="gpscomalm:ModernizedNavigationPayloadType">

        <gpspub:AverageUserRangeAccuracyNumeric>0</gpspub:AverageUserRangeAccuracyNumeric>
        <gpspub:Anti-SpoofStatusCode>OFF</gpspub:Anti-SpoofStatusCode>
        <gpspub:SatelliteConfigurationNumeric>3</gpspub:SatelliteConfigurationNumeric>
        <gpspub:NAVHealthSummaryCode>all NAV data are OK</gpspub:NAVHealthSummaryCode>
        <gpspub:HealthOfSvSignalComponentsCode>All Signals OK</gpspub:HealthOfSvSignalComponentsCode>

        <gpspub:Clock>
            <gpspub:ClockBiasMeasure>1.3639616230718497E-4</gpspub:ClockBiasMeasure>
            <gpspub:ClockDriftMeasure>4.090584069820737E-12</gpspub:ClockDriftMeasure>
        </gpspub:Clock>

        <gpscomalm:L1>
            <gpspub:SignalCode>L1C</gpspub:SignalCode>
            <gpspub:SignalHealthCode>Signal bad or unavailable</gpspub:SignalHealthCode>
        </gpscomalm:L1>
        <gpscomalm:L2>
            <gpspub:SignalCode>L2C</gpspub:SignalCode>
            <gpspub:SignalHealthCode>Signal OK</gpspub:SignalHealthCode>
        </gpscomalm:L2>
        <gpscomalm:L5>
            <gpspub:SignalCode>L5</gpspub:SignalCode>
            <gpspub:SignalHealthCode>Signal OK</gpspub:SignalHealthCode>
        </gpscomalm:L5>

    </gpspub:NavigationPayload>

</gpspub:SpaceVehicle>
```

- **NAVHealthSummaryCode** per IS-GPS-200 section 20.3.3.3.1.4 SV Health
- **HealthOfSvSignalComponentsCode** per IS-GPS-200 Table 20-VIII
- **SignalHealthCode** per IS-GPS-200 section 30.3.3.1.1.2 Signal Health (L1/L2/L5).

There are two general types of GPS Advisory which can be differentiated based on the gpsadvisory:GpsAdvisoryKindCode element

- **GPS Advisory – Corresponds to individual legacy NANUs**
  - `<gpsadvisory:GpsAdvisoryKindCode>NoticeAdvisoryToNavstarUsers</gpsadvisory:GpsAdvisoryKindCode>`
- **GPS Advisory Collection – Corresponds to the legacy Satellite Outage File**
  - `<gpsadvisory:GpsAdvisoryKindCode>SatelliteOutageFile</gpsadvisory:GpsAdvisoryKindCode>`

Both types of GPS Advisory contain classification and point of contact information as previously defined in for the Ops Status product

- **The classification and point of contact data can be found within the gpsadvisory:GPSMetadata element under gpsadvisory:GpsAdvisory**

Similar to the Ops Status product, the GPS Advisory contains Created, Reported, and Effective date/time stamps within the gpsadvisory:GPSMetadata element under gpsadvisory:GpsAdvisory, though there is some difference between how ReportedDate is used between the GPS Advisory vs the GPS Advisory Collection

- **CreatedDate – DTG of product creation**
- **ReportedDate –**
  - **GPS Advisory = NANU DTG (or REF NANU DTG as appropriate, see slide 3 of 4)**
  - **GPS Advisory Collection = DTG of product creation**
- **EffectiveDate – Internal system time to which the data is referenced, does not correlated to any DTG provided in the legacy NANUs**

Data for the GPS Advisory can be found within the gpsadvisory:GPSSpaceEvent element under gpsadvisory:GpsAdvisory as well as within the gpsadvisory:GPSSpaceVehicle element

```xml
<gpsadvisory:GpsAdvisory>

  <gpsadvisory:GpsAdvisoryKindCode>NoticeAdvisoryToNavstarUsers</gpsadvisory:GpsAdvisoryKindCode>

  <gpsadvisory:GPSSpaceEvent>
    <nc:ActivityIdentification>
      <nc:IdentificationID>NANU2982127</nc:IdentificationID>
    </nc:ActivityIdentification>
    <nc:ActivityDateRange>
      <nc:StartDate>
        <nc:DateTime>2051-05-09T06:51:00.000Z</nc:DateTime>
      </nc:StartDate>
      <nc:EndDate>
        <nc:DateTime>2709-10-24T22:41:00.000Z</nc:DateTime>
      </nc:EndDate>
    </nc:ActivityDateRange>
    <gpspub:SpaceEventKindCode>ForecastMaintenance</gpspub:SpaceEventKindCode>
    <gpspub:GPSSpaceVehicleReference xmlns:s="http://niem.gov/niem/structures/2.0" s:ref="vehref72"/>
  </gpsadvisory:GPSSpaceEvent>

</gpsadvisory:GpsAdvisory>

<gpsadvisory:GPSSpaceVehicle xmlns:s="http://niem.gov/niem/structures/2.0" s:id="vehref72">
  <gpspub:VehicleID>72</gpspub:VehicleID>
  <gpspub:PseudoRandomNoiseID>45</gpspub:PseudoRandomNoiseID>
</gpsadvisory:GPSSpaceVehicle>
```

If the GPS Advisory references an earlier Advisory (ex, summary, cancel, extend, reschedule, etc), a second gpsadvisory:GpsAdvisory element with information on the referenced Advisory will be provided as follows

```xml
<gpsadvisory:GpsAdvisory xmlns:s="http://niem.gov/niem/structures/2.0" s:id="REF2982127">

  <gpsadvisory:GpsAdvisoryKindCode>NoticeAdvisoryToNavstarUsers</gpsadvisory:GpsAdvisoryKindCode>

 <gpsadvisory:GPSSpaceEvent>
    <nc:ActivityIdentification>
       <nc:IdentificationID>NANU2982127</nc:IdentificationID>
    </nc:ActivityIdentification>
 </gpsadvisory:GPSSpaceEvent>

 <gpsadvisory:GPSMetadata>
    <nc:ReportedDate>
       <nc:DateTime> 2323-01-13T04:26:00.000Z </nc:DateTime>
    </nc:ReportedDate>
    <gpspub:IdentifierValueText>NANU2982127</gpspub:IdentifierValueText>
    <gpspub:KeywordValueText>NoticeAdvisoryToNavstarUsers</gpspub:KeywordValueText>
 </gpsadvisory:GPSMetadata>

</gpsadvisory:GpsAdvisory>
```

The GPS Advisory Collection is constructed similarly to the GPS Advisory but it contains multiple gpsadvisory:GPSSpaceEvent elements, one for each NANU recorded in the Collection

The Collection also contains multiple gpsadvisory:GPSSpaceVehicle elements, one for each PRN/SVN pair referenced in the recorded NANUs
- Note, the primary key used for each NANU is gpspub:GPSSpaceVehicleReference within gpsadvisory:GPSSpaceEvent , which is the SVN
- gpsadvisory:GPSSpaceVehicle maps the SVN to the PRN

Otherwise, the structure of the data elements remains the same as shown previously for the GPS Advisory

QUESTIONS?

BACKUP

Map of Date/Time Fields from Modern to Legacy Product Types

GGA Product	GGA DateTime Element (UTC)	GGA xsd Type	Legacy Product	Legacy DateTime	Legacy Time Typ
GPS Advisory	GpsAdvisory[not(@s:id)]/GPSMetadata/ReportedDate	gpspub:UTCDateType	NANU	1. NANU DTG: <ddhhmmZ MMM yyyy>	UTC
GPS Advisory	GpsAdvisory[@s:id]/GPSMetadata/ReportedDate	gpspub:UTCDateType	NANU	1. REF NANU DTG: 2. DTG <ddhhmmZ MMM yyyy>	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/StartDate	gpspub:UTCDateType	NANU	UNUSABLE START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/EndDate	gpspub:UTCDateType	NANU	DECOMMISSIONING START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDate	gpspub:UTCDateType	NANU	LAUNCH TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDate (when no STOP)	gpspub:UTCDateType	NANU	START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/StartDate	gpspub:UTCDateType	NANU	START TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDateRange/EndDate	gpspub:UTCDateType	NANU	STOP TIME ZULU / CALENDAR DATE	UTC
GPS Advisory	GPSSpaceEvent/ActivityDate	gpspub:UTCDateType	NANU	COORDINATED UNIVERSAL TIME (UTC) WILL SEQUENCE AS FOLLOWS:	UTC
GPS Advisory Collection	GPSMetadata/CreatedDate	niem-xsd:dateTime	Satellite Outage File	CREATION/@[YEAR|DOY|HR|MIN|SEC]	UTC
GPS Advisory Collection	GPSMetadata/EffectiveDate	gpspub:UTCDateType	Satellite Outage File	REFERENCE/@[YEAR|DOY|HR|MIN|SEC]	GPS
GPS Advisory Collection	ActivityDate	gpspub:UTCDateType	Satellite Outage File	CURRENT /@START_[YEAR|DOY|HR|MIN|SEC]	UTC
GPS Advisory Collection	ActivityDateRange/StartDate	gpspub:UTCDateType	Satellite Outage File	PREDICTED /@START_[YEAR|DOY|HR|MIN|SEC]	UTC
GPS Advisory Collection	ActivityDateRange/EndDate	gpspub:UTCDateType	Satellite Outage File	PREDICTED /@END_[YEAR|DOY|HR|MIN|SEC]	UTC
GPS Advisory Collection	ActivityDateRange/StartDate	gpspub:UTCDateType	Satellite Outage File	HISTORICAL /@START_[YEAR|DOY|HR|MIN|SEC]	UTC
GPS Advisory Collection	ActivityDateRange/EndDate	gpspub:UTCDateType	Satellite Outage File	HISTORICAL /@END_[YEAR|DOY|HR|MIN|SEC]	UTC
Ops Status	Constellation/GPSMetadata/CreatedDate	niem-xsd:dateTime	Ops Advisory	SUBJ: GPS STATUS <dd MMM yyyy>	UTC
Ops Status	GPSSpaceEvent/ActivityDate (when no STOP)	gpspub:UTCDateType	Ops Advisory	SUMMARY (JDAY/ZULU TIME START - STOP)	UTC
Ops Status	GPSSpaceEvent/ActivityDateRange/StartDate	gpspub:UTCDateType	Ops Advisory	SUMMARY (JDAY/ZULU TIME START - STOP)	UTC
Ops Status	GPSSpaceEvent/ActivityDateRange/EndDate	gpspub:UTCDateType	Ops Advisory	SUMMARY (JDAY/ZULU TIME START - STOP)	UTC
Ops Status	GPSSpaceEvent/GPSMetadata/ReportedDate	gpspub:UTCDateType	Ops Advisory	MSG DATE/TIME <dd MMM yyyy>	UTC
Public Common Almanac	TimeOfApplicabilityDateTime/GPSWeekNumeric	gpspub:GPSWeekSimpleType	Almanac (Any Format)	Week Number (WN)	GPS
Public Common Almanac	TimeOfApplicabilityDateTime/GPSSecondsInWeekNumeric	gpspub:GPSSecondsInWeekSimpleType	Almanac (Any Format)	Time of Applicability (TOA)	GPS