Global Positioning Systems (GPS)
2020 Public Interface Control Working Group (ICWG) Meeting Minutes

Date: 30 September 2020
Meeting Time: 0830 – 1130 HRS (Pacific Time)
Location: Virtual
Dial In: 646-828-7666 or 833-568-8864;
Meeting ID: 161 1734 2565;
Password: 12345
Zoom:
https://saicwebconferencing.zoomgov.com/j/16117342565?pwd=Njg5TVBTbXpKMVVndzNoL0pPMkhTZz09

Meeting started: 0830 HRS (Pacific Time)
Meeting ended: 1130 HRS (Pacific Time)

Agenda:

Part 1 (Public ICWG): 0830 – 1100 HRS (Pacific Time)

Roll Call
Agenda Overview
Opening Remarks
Rules of Engagement & Meeting Purpose
GPS Technical Baseline Change Management Process

- RFC-413: Integrity Support Messages
- RFC-442: 2020 Public Document Proposed Changes

Open RFC Discussion Session

Action Item Review

- Past Years
- 2020

Part 2 Public Forum: 1100 – 1130 HRS (Pacific Time)

Special Topic Presentations

- Eliminate 7-Day Non-Repeat Rule for issue of Data, Clock (IODC)

Walk-on Topics, Open Discussion

Action Item Review

Closing Remarks

Opening Remarks (Briefer: Major Robert B. Van Roekel, Deputy Chief, Positioning, Navigation and Timing Integration):

"Good morning, good afternoon or good evening depending on your time zone, it is truly an honor to be with you today and speak on behalf of the United States Space Force's Space and Missile Systems Center. Lt. Corton, thank you for the introduction and giving me this opportunity to provide an update on some activities and development efforts happening across the GPS enterprise, and thank you to the other briefers and the event organizers for making this event happen today so we can continue this discussion online and across the globe. It is truly an honor to be a part of this team and share time with such esteemed members of the global Public PNT (Position, Navigation, and Timing) community. My opportunity today is to give you the program office perspective of the GPS, and there is a lot to talk about because we are significantly modernizing all segments of the GPS enterprise…"

For specific details on the introduction, please see the Attachment #1 at the end of the document.

RFC-413 Integrity Support Messages (Briefer: Mr. Anthony Flores, SAIC)

Mr. Anthony Flores introduces himself and the topics he will be covering, RFC-413's background and comment overview.

Mr. Anthony Flores names the main POC's (Point of Contact) who worked RFC-413 as, Dr Andrew Hansen (Department of Transportation), Mr. Karl Kovach (Aerospace Corporation), Mr. Anthony Flores, and Mr. Albert Hayden (SAIC). He also points out the link shown on slide 18 should be used to access the PCN's (Proposed Change Notice) and CRM (Conflict Resolution Matrix) as they will be routinely referenced throughout this presentation.

Mr. Anthony Flores gives an overview of RFC-413, stating the status of obtaining navigation integrity for GPS, GNSS (Global Navigation Satellite System) receivers must manually extract integrity information from performance standards and encode it into their receivers which can have two negative effects. First, receivers cannot automatically update their integrity solution when the information changes and second, receivers rely on foreign entities documentation for GNSS integrity solutions. We can ameliorate these two negative consequences by introducing a new CNAV/CNAV-2 (Civil Navigation) message just for integrity navigation in IS200 (Interface Specification), IS705, and IS800.

RFC Summary of Changes (Slide 20)

Mr. Anthony Flores speaks on how RFC-413 defines MT (Message Type) 40 in CNAV and S3P8 (Sub frame 3, page 8) in CNAV-2 for Integrity Support in reference to the diagram shown in slide 20. He remarks that each parameter is contained within the PCNs and specific details are found in the future TSO (Technical Standard Order) and MSO (Military Standard Order).

RFC-413 Comments Resolution Matrix (CRM) Status (Slide 22)

Mr. Anthony Flores shows the total number of comments on slide 22 within their respective categories of critical, substantive and administrative. He mentions administrative comments that where accepted/accepted with comments will not be covered, however all critical, substantive, and rejected admin comments will be covered. He notes he reached out to all relevant stakeholders regarding their comments on RFC-413 and obtained concurrence for all their administrative comments.

Template for Comment Adjudication (Slide 23)

Mr. Anthony Flores presents the template for comment adjudication on slide 23 noting there is no baseline text column since most of RFC-413 is new and the presentation order of comments will be critical, substantive, and finally administrative comments.

Comment #6 (Slide 24-26)

Mr. Anthony Flores presents comment #6, where Mr. Denis Bouvet (Thales) notes that the safety criticality level does not completely match with the Service Level found in the table. Mr. Denis Bouvet provides an example that in some cases a solution monitored by H-ARAIM (Horizontal Advanced Autonomous Integrity Monitoring) algorithm can be considered as a Hazardous level and not major as the table states. The disposition is accepted with comments, in which the table must show that the ISM (Integrity Support Message) parameter will be validated with respect to ARAIM (Advanced Receiver Autonomous Integrity Monitoring) service as shown in the following slides.

Mr. Anthony Flores presents table, "30-Xlb- Service Levels" on slide 25 noting there is no BASELINE Text to show.

Mr. Anthony Flores presents modified table, "30-Xlb- Service Levels" on slide 26 noting the removal of the safety critical levels and information regarding the levels will maintain in the ARAIM MSO and TSO. Mr. Denis Bouvet takes the floor for comments and questions.

Mr. Denis Bouvet has no comments and concurs with the disposition.

Comment #1 (Slide 27-28)

Mr. Anthony Flores presents comment #1 in which Mr. Denis Bouvet asks for clarification on the validity and expiration of the ISM. The disposition is accepted with comments, where Mr. Anthony Flores notes a statement addressing the user to use the latest ISM is still lacking.

Mr. James P. Fernow (MITRE) comments that the ISM will likely have a valid time and the IS (Interface Specifications) document does not have an expiration date. The IS has an expiration date and will not put in the message itself.

Dr. Andrew Hansen clarifies that the IS will not contain the expiration date of the ISM. Instead, the expiration of the ISM will be catalogued in a separate document.

Mr. James P. Fernow concurs with Dr. Andrew Hanson's response.

Mr. Anthony Flores presents slide 28 showing the new text that will be inserted into the specified documents.

Comment #19 (Slide 29)

Mr. Anthony Flores presents comment #19, in which Mr. Steven Brown (Lockheed Martin/Infinity) asks if a time stamp can go into the future and what would happen if two different SV's (Space Vehicle) have different time stamps. The disposition is accepted with comments, where it states the time stamp cannot be from the future and, if two different SV's have different time stamps then the user will be recommended to use the message with the latest time stamp.

Mr. Steven Brown states that a requirement is needed to tell user what to do if time is in the future.

Dr. Andrew Hanson responds to Mr. Steven Brown by clarifying where the requirement of utilizing future time is coming from and it is not from the enterprise.

Mr. Steven Brown continues to express concerns about using the time in the future.

Dr. Andrew Hanson understands Mr. Steven Brown's concerns, and Dr. Andrew Hansen will change the PCN in response to the comment.

Action: Mr. Anthony Flores will work with Dr. Andrew Hanson on a modification to the requirement that was added to the concern regarding future time within the ISM text.

Action: Upon further offline discussion, LM had a new comment to add a new bit to the parameters (t_{correl}, b_{nom}, γ_{nom}, R_{sat}, P_{const}, and MFD) for better resolution. Each of these parameters will have 4 bits instead of 3 bits.

Comment #2 (Slide 30)

Mr. Anthony Flores presents comment #2 which asks for clarification of the parameter (t_{correl}) that was inadequately discussed in *Working Group C, the parameter was introduced in the process of RFC-413 where the MSO and TSO documents will go into further detail.

Comment #3 (Slide 31)

Mr. Anthony Flores notes comment #3 has the same predicament as comment #2 except for the parameter here being (b_{nom}).

Comment #7 (Slide 32)

Mr. Anthony Flores notes this comment is asking for the correlation between the ISF (Integrity Support Flag) and the new P_{sat} parameter found in the ISM, to which the correlation between them is that when P_{sat} is greater than 10^{-8} then the IS would be 0 and less than 10^{-8} , then ISF will be 1. Mr. Anthony Flores also verifies that the ISM and ISF will still be applicable for safety of life.

Mr. Denis Bouvet asks about aligning the ISF with the P_{const} values and the P_{sat} values.

Dr. Andrew Hanson responds to Mr. Denis Bouvet's comments by speaking to what the ISF can represent and what the ISM cannot by stating that P_{const} we have as well, the situation the 10^{-8} binary is related but not the same purpose. Additionally, ISF is not meant to address the integrity of the constellation.

Mr. Denis Bouvet responds with only keeping 1 bias, and wants to see how this is being done. Mr. Denis Bouvet asks about the nominal bias. Mr. Karl Kovach affirms that the bias has no tie to the ISF. Mr. Denis Bouvet acknowledges the clarification by Mr. Karl Kovach.

Action: Mr. Karl Kovach clarifies that P_{sat} is unit less and P_{sat} should be changed to R_{sat} on the PCN's.

Mr. Donald Latterman (SAIC) suggested a NOTE to clarify the difference between ISF and ISM.

Dr. Andrew Hanson does not think a note is necessary, and Mr. Donald Latterman concurs. Note will not be added.

Comment #8 (Slide 33)

Mr. Anthony Flores presents comment #8, which asks if the ISM is applicable for LNAV (Legacy Navigation), where the disposition states the ISM can be used for LNAV and further information can be found in the TSO.

Comment #10 (Slide 34-36)

Mr. Anthony Flores notes this comment is a result of a typo in the message figure shown in slide 35 and corrected on slide 36.

Comment #18 (Slide 37)

Mr. Anthony Flores notes this comment is a result of a typo where MT 40 is supposed to be S3P8.

** Working Group C (WG-C) is the joint European Community (EC) and United States (US) body promoting bi-lateral cooperation on the design and development of the next generation of civil satellite-based navigation and timing systems established pursuant to item (c) in Article 13 of the EC-US AGREEMENT ON AGREEMENT ON THE PROMOTION, PROVISION AND USE OF GALILEO AND GPS SATELLITE-BASED NAVIGATION SYSTEMS AND RELATED APPLICATIONS effective 26 June 2004.*

Comment #25, 32, and 42 (Slide 38-40)

Mr. Anthony Flores presents the following comments from Mr. Jim Selmer (L3 Harris) who states the value of 1e-5 is incorrect, and as a result will be changed to 1 $x10^{-1}$ as the commenter suggests. Mr. Anthony Flores notes that this notation is inconsistent throughout the document and an action item will be opened to explore a consistent solution.

Action 2020-03: Make documents consistent between using the notation "$x10^{-1}$" and "1E-1". Choose one option and make all other occasions consistent.

Comment #28 and 38 (Slide 41-44)

Mr. Anthony Flores presents these comments from Mr. Jim Selmer where he asks for clarification to a note added in the maximum broadcast interval table shown in slide 43. A new proposed text was presented to the group in which the commenter concurred.

Mr. Jason Bolger (SAIC) asks if TSO and MSO are defined when they are first used in the document.

Action: Add the word “future” before MSO and TSO to IS-GPS-200 Table 30-XII.

Comment# 23, 26, 27, 33, 34, 35, 36, 37, 43, 44, 45, 46, 47, 48 (Slide 45)

Mr. Anthony Flores presents several administrative comments which are questioning the usage of specific words such as “hours” vs “hour” as shown on slide 45. The disposition states the units in decimals can be expressed as singular or plural, therefore these comments are rejected.

Comment #24, 31, 41 (Slide 46)

Mr. Anthony Flores presents several administrative comments asking if TSO and MSO should be written as TSOs and MSOs, however the disposition states these are singular and therefore rejects these comments.

Mr. Anthony Flores asks for any questions or comments before the scheduled break.

No questions or comments.

Scheduled break begins at 0950 PDT

Meeting resumes at 1003 PDT

RFC-442 – 2020 Public Document Proposed Changes (Briefer: Mr. Dylan T. Nicholas, SAIC)

Mr. Dylan T. Nicholas presents the problem statements and proposed solutions contained within RFC-442 Public Document Proposed Changes as shown on slide 49.

Mr. Dylan T. Nicholas presents a summary of changes for RFC 442 beginning with the first, Optional Clock Error Rate Equation shown in slide 50, which ads a reference note to the affected documents as shown in slide 51. The second topic is presented, "UTC (Coordinated Universal Time) Leap Second Announcement Alignment" which specifies that WN_{LSF} (Week Number Leap Second) and DN (Day Number) are times on the GPS and not the UTC timescale. The slide shown corrects the language by stating the parameter becomes effective near, and not at the end of the GPS day indicated by WN_{LSF} and DN. Furthermore, he notes on slide 53 that if Δt_{LS} is equal to Δt_{LSF}, then WN_{LSF} and DN are not relevant to the conversion of GPS time to UTC, therefore the user may neglect WN_{LSF} and DN when this condition holds. The third topic is presented on slide 54, "LNAV vs CNAV T_{GD} Value" which removes language referencing the status of an unavailable group delay value, however LNAV does not check for unavailable group delay values and thus will be deleted. The fourth topic, "Administrative clarification and clean-up", is presented where the equation for Corrected Radius Rate is being removed and replaced with the equation for Corrected Radius Rate for CNAV in order to account for the changing variable (A) shown on slide 55.

Mr. Dylan T. Nicholas shows the total number of substantive and rejected comments on slide 59 that will be presented while noting accepted, accepted with comments, and administrative comments will not be presented.

Comment #2, 3, 5 (Slide 60-63)

Mr. Dylan T. Nicholas presents comment #2, by Mr. Denis Bouvet, noting that this comment is regarding the latest Up Rev; however, any changes that come from this comment will be placed in this RFC. This comment addresses the difference between the SPS PS 2020 (Standard Positioning Service Performance Standard) and IS200 interpretation of the marginal conditions. Mr. Dylan T. Nicholas explains that while the SPS PS states that a URA (User Range Accuracy) ≥ 8 meets the marginal condition, the IS200 states that a URA = 15 meets the marginal condition and this comment recommends that the IS200 language match the SPS PS 2020.

The government chooses to add clarification to address the difference between the marginal indications in the SPS PS and the Interface. The same disposition applies to Comment #3 and 5, with the addition that the IS does not supersede the SPS PS.

Comment #4 (Slide 64)

Mr. Dylan T. Nicholas presents comment #4 on slide 64 from Mr. Denis Bouvet regarding the HOW (Hand Over Word) functionality, and asks for an assurance that any future blocks of GPS will use the alert flag in the HOW.

Mr. Denis Bouvet clarifies his comment #4 on slide 64 and Mr. Dylan T. Nicholas acknowledges the clarification and will defer the comment for the next 2021 Public ICWG.

Comment #6, 7, 8 (Slide 67-71)

Mr. Dylan T. Nicholas presents comments #6, 7, and 8, which are all asking eliminate statements about L2/L5 dual frequencies since they are no longer relevant. This was tasked in RFC 395 and the remaining statements will be deleted as shown on slides 68, 69, and 71.

Mr. Dylan T. Nicholas notes there is an extra, “and” in Figure 20-15 shown in slide 71 within the red box and will be deleted.

Comment #12 (Slide 72)

Mr. Dylan T. Nicholas presents comment #12 by Mr. Steven Brown, which asks if it will change how GPS Enterprise does leap second from current operations. The government disposition states this change will not affect current operations as shown on slide 72.

Open RFC Discussion

Mr. Dylan T. Nicholas asks for any questions or comments to which there is none.

Chat Box Discussions

Mr. Denis Bouvet asks about clarifying a concern he had brought up previously in 2019.

Action 2020-02: Mr. Anthony Flores acknowledges Mr. Denis Bouvet’s question and takes the action to look for Denis Bouvet’s previous action item from last year’s Public ICWG cycle.

Action Item Review (Reference Attachment 3 for Itemized list of Action Items)

2014:

- Item 26: -In Progress. PRN expansion still in internal development.

2015:

- Item 1: -In Progress. Topic on-hold; may be considered for a future RFC.

2018:

- Item 1: -In Progress. Government plans to work XML changes or products in new RFC "2021 Public Document Proposed Changes". Scope was removed from RFC-395.
- Item 3: -In Progress. Originator agreed to close. Recommend closure at 2020 Public ICWG. Status will be changed to Closed.
- Item 4: -In Progress. RFC-395 CCB approved. One of the rate equations needed to be adjusted. Adjusted in RFC-442. Item will be closed following RFC-442 CCB approval.
- Item 5: -In Progress. Government, along with the originator's concurrence, decided not to pursue the changes. Recommend closure at 2020 Public ICWG. Status will be changed to Closed.
- Item 7: -In Progress. FAA still wishes to keep the midi-almanac required until further notice.
- Item 8: -In Progress. RFC-395 has been CCB approved. Recommend closure at 2020 Public ICWG. Status to be changed to Closed.
- Item 9: -In Progress. Action item part of RFC-413. Will close out following CCB approval.

2019:

- Item 4: -In Progress. The government has assessed the work and decided not to pursue the admin changes. All attempts were made to get concurrence from originator. Recommend closure at the 2020 Public ICWG. Status will be changed to Closed.
- Item 5: -In Progress. Action Item included in RFC-442. Will close out following CCB approval.
- Item 6: -In Progress. Action Item included in RFC-442. Will close out following CCB approval.

2020 (From 30 Sep 2020 Public ICWG)

- Item 1: -In Progress. RFC-442 deferred comment #4 about the GPS SV Configuration code '101'.
- Item 2: -In Progress. Missed Action Item from 2019 Public ICWG from Mr. Denis Bouvet. IS200 Section 6.4.6.2.1 does not match current safety-of-life equipment implementation.
- Item 3: -In Progress. Make documents consistent between using the notation "$x10^{-1}$" and "1E-1". Choose one option and make all other occasions consistent.

*** End of Part 1. Part 2 began at 1100****

Public Forum

Mr. Anthony Flores introduces the second portion of this meeting beginning with the public forum and revisiting the rules of engagement, then presenting the special topic presentation by Mr. Karl Kovach.

Special Topic: Eliminate 7-Day Non-Repeat Rule for Issue of Data, Clock (IODC) (Briefer: Mr. Karl Kovach, Aerospace Corporation)

Mr. Karl Kovach presents his special topic discussion beginning with slide 86 which contains an overview on the proposal to eliminate the 7-day non-repeat rule for IODC, stating the 7-day non-repeat rule currently serves no useful purpose although it has in the past. He continues to state that currently this 7-day non-repeat rule is just an opportunity for an, "ICD Violation" and that eliminating the rule eliminates potential for ICD violations. He presents the baseline text shown on slide 87 regarding the 7-day non-repeat rule for IODC and the proposed redlines that would eliminate that rule shown on slide 88. Furthermore, the impact assessments of this proposal resulting in no impacts to the Control Systems, Satellites, and GPS Receivers. Mr. Karl Kovach notes the External Monitor Networks will not be able to report the 7-day rule if eliminated as shown on slide 89.

Mr. Karl Kovach asks for any questions or comments to which there are none.

Action 2020- 04: Mr. Anthony Flores notes to follow this special topic with an RFC for the following 2021 Public ICWIG cycle.

Closing Remarks (Briefer: Lt Julia Corton, Positioning, Navigation and Timing Integration)

Lt Julia Corton closed the 2020 Public ICWG and Forum with a summary of post Public ICWG actions and thanking everyone for their participation.

Attachment #1-Opening Remarks

Opening Remarks Continue (Briefer: Major Robert B. Van Roekel, Deputy Chief, Positioning, Navigation and Timing Integration):

…

GPS OVERVIEW

I'll start with a quick overview of the three GPS segments, I'll presume most of you are familiar with these. We've been broadcasting PNT signals since the late 1970's, and in the mid-90's made GPS signals available and free to use by everyone around the globe. Of course satellites are significantly less valuable without a ground system and ours is robust with more than 20 segment components fielded around the world to monitor, control and fine tune the space segment. And finally, we are all part of the user segment whether we are using the signals on our cellphones or are using highly calibrated receivers, the user segment of GPS is vast and varied.

None of this happens without collaboration and cooperation and here you can see a list of just some of our key partners. As we move the responsibilities of the development, fielding, operations and maintenance of the GPS constellation into the Space Force, we will continue these fantastic relationships. We are committed to our domestic and international partners and have a number of agreements and various collaboration efforts with other Defense Departments and Government agencies. The Space Force works very closely with the Federal Aviation Administration, Department of Transportation and our other civil partners to ensure GPS continues to be the gold standard in providing reliable and accurate PNT services. As active participants in the International Committee on GNSS, we are committed to collaboration with our GNSS partners to improve the lives of people around the globe.

In these partnerships, we strive for transparency. The fifth Edition of the Standard Positioning Service Performance Standard (SPSPS) was published in April 2020. Through this document we publish to the world the quality of service you can expect from the GPS in terms of accuracy, continuity, availability and integrity. This new edition contains updated standards across the board, but specifically gave the first accuracy and integrity standards for the new L2C and L5 signals.

GLOBAL IMPACT OF GPS

One of my favorite parts of working in the GPS arena is learning about new ways people are using the GPS signals. As many of you know, GPS is leveraged around the world for a vast array of purposes. It is estimated the GPS has over 4 billion daily users worldwide. Last year, an RTI International report determined the retrospective benefits of GPS from the last 25 years generated $1.4 trillion dollars in economic benefits for the private sector. It is estimated GPS enables the economic benefits on the order of $1 Billion dollars per day.

Let me touch on a few examples. GPS was a key enabler of 4G LTE (Long Term Evolution) networks, enabling over $650 billion dollars in economic value to wireless cell phone subscribers. Many smart phone users know GPS or other GNSS systems are used to help them find their way to their favorite coffee shop, but they often don't realize that when 4G LTE was rolled out, the most accessible timing source was GPS and it is a key enabler of the technology linking their phones to the cellular network. GPS continues this trend by providing this same timing source to 5G networks.

Another example is the Telematics sector. An estimated 9.4 million commercial vehicles in the United States use telematics services and GPS enabled over $50 billion dollars in economic benefits in 2017 alone. In this sector. GPS is used to optimize delivery routes, track movement of freight and manage dispatch efficiency.

I want you to know, the program office is working hard every day to maintain the accuracy, integrity, availability and continuity of GPS so we can all continue to rely on it for personal use, the building of our civil infrastructures and the commercial sectors use and development of GPS enabled technologies and services.

GPS MODERNIZATION

We continue to modernize the GPS systems of systems and this chart outlines the past and future upgrades to each segment. Within the Space Segment, we are currently deploying our GPS III satellites that have the new L1C signal. In addition, these satellites have better clocks, increased accuracy and increased anti-jam capabilities. All GPS III satellites continue to roll out more M-code capabilities to give our military users more robust capabilities. Inherently the signal integrity is improved and we expect longer life from these satellites, which is a tall order considering our oldest IIR is over 23 years young. The 10 GPS III satellites are just the beginning of our modernized constellation. Today we are working to define and develop the follow-on block, the GPS IIIF satellites. The IIIF satellites will have several new capabilities listed here and I will get into them more in a few minutes.

The ground system is evolving as well. Architecture Evolution Plan, or AEP, has been the stalwart of the GPS Operational Control Segment for many years. We have recently released several software upgrades to enable AEP to control our new GPS III satellites. In the next few years, we will replace AEP with the Operational Control System or OCX. OCX will bring with it the next generation of C2 and cyber defense to GPS as well as let us take full advantage of the GPS III satellite capabilities. Looking into the late 2020's, we will upgrade OCX with block 3F so it is ready for the fielding of our GPS IIIF satellites.

Let me take a moment to talk about modernized signal status:

Nothing has changed with the legacy signals and they are certified and available for use as they have been for some time. But you are probably wondering the status of L1C, L2C and L5 and are interested to know when you will be able to use them. Our second civil signal, L2C, is broadcasting with over 20 satellites on orbit. L2C is set healthy but is not yet certified and is considered "use at your own risk", it is really set this way for pre-operational and test purposes. It will not be ops accepted until we have full closed loop monitoring in place. Initial Operational Capability (IOC) for L2C is estimated in the 2024/2025. IOC for our Third civil signal, L5, is also targeted for the 2024/25 timeframe. L5 currently has 14 satellites broadcasting and is set to unhealthy. L5 gives us our most advanced civil signals and is intended to be used for safety of life purposes, which is a very high standard. The Federal Aviation Administration will accomplish that certification. We are working with the DOT to use offline monitoring capabilities and data analysis to get a jump start on this work. IOC for L5 is targeted in 2024/25 timeframe and FOC (Final Operational Capability) should be in the 2027/28 timeframe once we have 24 satellites on orbit. The number of satellites broadcasting our fourth civil signal, L1C, continue to increase and we expect IOC in 2029/2030 and FOC a few years later.

GPS CONSTELLATION STATUS

This chart provides the current status of the GPS constellation and our Signal in Space performance numbers.

You can see the next generation of GPS is here and GPS IIIs are in the active constellation. Thanks to the recent launch of GPS III SV03, we now have 35 PNT capable satellites on orbit in four different flavors. Of note, there are no longer any IIA's in the active constellation. We currently have 31 satellites as part of the active constellation, with the rest in preparation for operations or in a backup status. The table shows the quantity of satellites in operation (with backups in parentheses), and the average age of each block. You will see we have the wonderful problem that our satellites are outliving their design life, and we expect we'll see a similar trend with our new generation of vehicles. Overall, the constellation continues to provide a signal-in-space performance at right around half a meter.

GPS III Status

It's an exciting time for the GPS III program! Our new satellites are more capable than the IIRs and IIF's and add additional signals for the civil community. GPS III satellites will provide increased accuracy and signal power, improved signal integrity, a longer design life and a new L1C signal.

SV01 and SV02 are on-orbit and operational, available for users. We launched our third satellite in June, and it's getting ready to be made available for users over the next few months. SV04 is planned to be launched in just a few days, on 29 Sep, and it will be the second national security space launch on a recoverable Falcon 9, which is a huge accomplishment for the Space Force and the DOD. SV05 has completed production and was declared available for launch back in May.

We expect to launch it sometime in 2021. And the production line continues to churn away on SV's 6 through 10, all of which are in different stages of production.

GPS IIIF Status

In 2018, we awarded Lockheed Martin a contract to build 22 GPS IIIF satellites. The design phase and Critical Design Review completed in February. At this point, early production is under way on vehicles 11 and 12, which are considered our R and D spacecraft. In the next few months, we will exercise the first contract option for the IIIF program and kick off production of SV's 13 and 14.

The first GPS IIIF, SV11, is forecasted for a 2026 launch. We are looking forward to capitalizing on lessons learned from GPS III production to gain efficiencies and benefits in GPS IIIF era. GPS IIIF will have all the signals provided by GPS III, namely L1 C/A, L1C, L2C, and more L5 and M-code capability. It will also include some additional features like the Search and Rescue Payload. The SAR payload will enable faster detection and broader coverage of distress signal sources. This allows our Search and Rescue operations to get to victims faster. We're happy to be able to collaborate with Canada on this effort. GPS IIIF will also have a laser retroreflector which enables better ranging. The LRA allows us to more accurately determine the position of our satellite, which will lead to better GPS accuracy overall for what will be a majority of our modernized constellation.

We are also partnering with Air Force Research Laboratory on future technologies and the Navigation Technology Satellite Three, or NTS-3, program. SMC's Development and Production Corps are partnering with AFRL on things like digital reprogrammable payloads, real time directional crosslinks and advanced atomic clocks. This is of course in conjunction with our Federally Funded Research and Development Centers and Industry partners to help us move advanced capabilities in to our PNT backbone of GPS III and IIIF satellites and ground systems.

NTS-3 is planned to launch no earlier than 2022.

OCX Status

Our Next Generation Operational Control System, or OCX, is in incremental development OCX Block 0, also known as the GPS III Launch and Checkout System, successfully supports GPS III space vehicle launch and checkout, and will continue to do so for the next several launches. The next increment, OCX Block 1 and 2, which will be a single delivery, will have a modernized architecture, advanced cyber security capabilities and enhanced command and control. The most significant capability of OCX Blocks 1 and 2 will be its ability to control and monitor all the modernized signals. As I mentioned, we are broadcasting many new signals today and OCX will give us the ability to fully monitor them. The great news is that Block 1 and 2 development is complete, and after some very extensive and robust testing, it should be ready to transition to operations in late 2022.

Lt Corton and Team, thank you again for giving me the opportunity to provide the opening remarks. That is what I wanted to cover for our audience today. I want to express my thanks in advance for all of your attendance and I hope to hear some great discussions between our Public community. I want to remind every Public user that this meeting does not have to be the only avenue for discussion between the Public stakeholders and the Program Office, feel free to reach out to the GPS Requirements Team at any time, Lt Corton back you for slide 9.

Attachment #2 – Attendance List:

Name	Org	Present
Stephan Hillman	Aerospace	X
Michael H Cole	Aerospace	X
Walid A Al-Masyabi	Aerospace	X
Karl Kovach	Aerospace	X
Rhonda Slattery	Aerospace Corp	X
Chris Ishisoko	ARC-IO	X
Brent A. Renfro	ARLUT	X
Miquela Stein	ARLUT	X
Roger Kirpes	BAE/Collins	X
John McCanless	BAH	X
John Dobyne	BAH	X
Anne Kastenholz	Boeing	X
Bill Brooks	Boeing	X
James Lake	Canyon	X
Shah Nejad	Canyon-US	X
Shah Nejad	Canyon-US	X
Nathan Anderson	DOT	X
Nathan Anderson	DOT	X
Darren L. Scholes	ECPG	X
Darren L. Scoles	ECPG	X
Joseph Dennis	FAA	X
Jason Burns	FAA	X
Calvin Miles	FAA	X
Ha Nguyen	FAA	X
Hamza	FAA	X
Joseph Dennis	FAA	X
Steven Hutsell	Government (2SOPS)	X
Todd Kawakami	Government (NGA)	X
Jim Selmer	L3 Harris	X
Steven Brown	Lockheed Martin	X
Nancy Morrison	Lockheed Martin	X
Chris Hegarty	MITRE	X
James P Fernow	MITRE	X
Chris Hegarty	MITRE	X
Charles Pocher	PCA	X
Roger Knobbe	PCCC	X
Major Van Roekel	PCE	X
Lt Adam Barnette	PCE	X
Lt Julia Corton	PCE	X
Garrett Shook	PCN	X
Commander Sinnokrak	PCN	X
Francois Guay	Quantom Avionics	X
Adriana Fukuzato	SAIC	X

Vince Quan	SAIC	X
Jacob Jost	SAIC	X
Josh Fofrich	SAIC	X
Adrienne Harrington	SAIC	X
Kevin Cano	SAIC	X
Anthony Flores	SAIC	X
Gregory Serrien	SAIC	X
Albert Hayden	SAIC	X
Dylan Nicholas	SAIC	X
Barbara Hemmerich Shaw	SAIC	X
Ben Melendy	SAIC	X
Claudina Tiznado	SAIC	X
Wayne Su	SAIC	X
Jason Bolger	SAIC	X
Don Latterman	SAIC	X
Estela Azevedo	SAIC	X
Al Sicam	SAIC	X
JR Marquez..	SAIC	X
Tony Anthony	SAIC	X
William Stroud	SAIC	X
Warren Helwig	SAIC	X
Surrender Gupta	SAIC	X
Nina Faustino	SAIC	X
Tim Yoshinga	SAIC	X
Justin Charboneau	SAIC	X
Reggie Pollard	SAIC	X
Dan Farthing	SAIC	X
Randy Grossman	SAIC	X
Alex DiazLapham	SAIC	X
Veronica Quebedeaux	SAIC	X
Edith O’ Brien	SAIC	X
Tony Anthony	SAIC	X
Adriana Fukuzato	SAIC	X
Vince Quan	SAIC	X
Jacob Jost	SAIC	X
Frank Czopek	SMAD	X
Denis Bouvet	Thales	X
Alan Hamilton	USCG	X
Dr. Andrew Hansen	Volpe/DOT	X

Attachment #3- Action Item Review

Year	Action Item #	Status	Originator	Description	Notes
2014	26	In Progress	Karl Kovach (Aerospace)	Provide an informational briefing to remind the ICWG members that PRN expansion is coming.	Topic on Hold. PRN expansion still in internal development.

Year	Action Item #	Status	Originator	Description	Notes
2015	1	In Progress	Karl Kovach (Aerospace)	Remove the UTC offset error (UTCOE) accuracy performance numbers from all ICDs and put it into the MGUE technical requirements documents.	Topic remains on hold.

Year	Action Item #	Status	Originator	Description	Notes
2018	1	In Progress	CWO Rebecca Ruch/Rick Hamilton (USCG)	Consider updating GPS product depicted in ICD-GPS-870 to reflect the modernized formats described in ICD-GPS-870, Table 3-I.	Government plans to work XML changes or products in new RFC. Scope was removed from RFC-395
	3	Closed	Kanwaljit Sandhoo (FAA)	It is beneficial to the public user community if the space vehicle (SV) could broadcast actual received carrier power values based on ICD/IS assumptions.	Closed in 2020 Public ICWG.
	4	In Progress	RNSSI folks; Lt Col Thompson, Lt Col Steven Lewis, Lt Col Steven Brown, CMSgt Todd Scott	Eccentric anomaly & true anomaly: Suggest simpler methods for solving Kepler's equations and removing redundant, unnecessary equations.	RFC-395 has been CCB approved. However one of the rate equations needed to be adjusted. Will adjust in RFC-442 and item will close following CCB approval.
	5	Closed	Karl Kovach (Aerospace)/Brent Renfro (ARLUT)	Define a new quantity "Time since GPS Epoch" with a new symbol because clarity may be needed for text that is associated with handling GPS week rollovers.	Government, along, with originator's concurrence, decided not to pursue the changes. Closed in 2020 Public ICWG.
	7	In Progress	Dr. Andrew Hansen (FAA)	Recall that L5 midi almanac may become optional in future use, but for FAA purpose, it is required (for now).	FAA still wishes to keep the midi-almanac until further notice.

	8	Closed	Steven Hutsell (2SOPS)	For the NMCT clarification for SV ID/PRN 32, make the clarity that the availability indicator for a transmitting SV with ID/PRN 32 will be 10 or 11.	RFC-395 has been CCB approved. Closed in 2020 Public ICWG.
	9	In Progress	Karl Kovach (Aerospace)/Dr. Andrew Hansen (FAA)	Consider the addition of MT 38, 39, and 40 while taking into consideration throughout other CNAV messages (applies to L2 CNAV and L5 CNAV).	Action Item in RFC-413. Will close out following CCB approval.

Year	Action Item #	Status	Originator	Description	Notes
2019	4	Closed	Frank Czopeck	Originated from the RFC-400 Public ICWG: Add spacing such that "DIRECTION OF DATA FLOW FROM SV" and "MSB FIRST" are not connected to the arrows in Figure 3.5-3 of IS-GPS-200.	The government has assessed the work and decided not to pursue the admin changes. All attempts were made to get concurrence from originator. Closed in 2020 Public ICWG.
	5	In Progress	Roger Kirpes (BAE/Collins)	When the CNAV T_{GD} is '1000000000000', then the group delay is unavailable; however, there is no clarification for the LNAV.	Action Item included in RFC-442. Closed in 2020 Public ICWG.
	6	In Progress	Karl Kovach (Aerospace)	Recommend GPS follow US Naval Observatory that follows and contributes to International Earth Rotation Services for UTC and UTC Leap Second. Change in GPS technical baseline IS-GPS-200.	Action Item included in RFC-442. Closed in 2020 Public ICWG.

Year	Action Item #	Status	Originator	Description	Notes
2020	1	In Progress	Denis Bouvet (Thales)	The new code value '101' in the SV Configuration Code (IS200 20.3.3.5.1.4) associated with IIIF SVs confirms that the "alert" in the HOW is still applicable. However, this is not sufficient for safety-of-life equipment.	Deferred comment from RFC-442.
	2	In Progress	Denis Thales (Thales)	IS200 Section 6.4.6.2.1 doesn't match current safety-of-life equipment implementation. If the signal transitions to NSC, with a correlation loss of less than 30db Hz, the receiver will continue tracking it, bringing integrity issues.	Missed deferred comment from RFC-403.
	3	In Progress	Dr. Rhonda Slattery (Aerospace Corps)	Make documents consistent between using the notation "$x10^{-1}$" and "1E-1". Choose one option and make all other occasions consistent.	Action derived from RFC-413 comment. Will explore how many objects are affected.
	4	In Progress	Karl Kovach (Aerospace Corps)	Proposal to remove the 7-day no-repeat rule for the IODC.	Special Topic presented for the 2020 Public ICWG. Will proceed to the next 2021 Public ICWG cycle.