Global Positioning Systems (GPS) Directorate

2018 Public Interface Control Working Group (ICWG) Meeting Minutes

Date:	12 September 2018
Meeting Time:	0830 – 1600 HRS (Pacific Time)
Location:	PCT Facility (100 N. Pacific Coast Hwy El Segundo, CA 90245), Bldg 100
Dial In:	1-310-653-2663; Meeting ID: 8337375 Passcode: 123456
DCS:	https://conference.apps.mil/webconf/gpspublicmeeting
Meeting started:	0830 HRS (Pacific Time)
Meeting ended:	1600 HRS (Pacific Time)
Links:	https://www.gps.gov/technical/icwg/meetings/2018/

Agenda:

Part 1 (Public ICWG) – 0830 – 1155 HRS (Pacific Time)
Opening Remarks
Roll Call
Agenda Overview
Meeting Logistics
Rules of Engagement & Meeting Purpose
GPS Technical Baseline Configuration Management Process
- RFC374 – 2018 Public Document Proposed Changes:
    - Operational Advisory
    - Leap Second and Earth Orientation Parameters
    - Clean-up and Health Bit Clarification
Open RFC Discussion Session
Action Item Review
- Past years
- 2018
Adjourn

Part 2 (Public Forum) – 1315 – 1600 HRS (Pacific Time)
Reconvene
Roll Call
Special Topic Presentations
- GPS III Signal in Space (Presented by Lockheed Martin)
- Status of GPS Spectrum & Adjacent Band Compatibility (Presented by GPS Program Office)
- Navigation Correction Message Table (NMCT) Clarity – SV ID 32 (Presented by GPS Program Office)
- MT 38, 39, 40 Integrity Support Messages (ISMs) (Presented by GPS Program Office)
- Walk-On Topic – Recommended Changes to Broadcast Navigation User Equations in IS-GPS-200, IS-GPS-705, and IS-GPS-800: Eccentric and True Anomaly (Presented by AF Reserve National Space Security Institute)
Open Discussion
Action Item Review
Closing Remarks
Adjourn

Opening Remarks:

GPS Chief Engineer Mr. James Horejsi (GPS Program Office) addressed the public for opening remarks:

Welcome to Southern California! One major RFC up for debate today, 374. Make sure to provide comments – this is meant to be a working group so we all understand what's going on and agree to what's there. Currently in process of modifying and updating Change management process. As chief engineer, we want to make sure we're complying with requirements, have transparency, and go through the rule making process. We're all about clarity and transparency, so please feel free to ask questions as we go through.

Mr. Daniel Godwin spoke briefly about changes to the Technical Baseline Configuration Management Process.

RFC-374 – Operational Advisory

The purpose of this topic was to update the Operational Advisories (OAs) that are currently published and archived as they contain plane/slot descriptions that are not in the constellation definition provided to the public in the GPS Standard Positioning Service (SPS) Performance Standard (PS). The OA does not currently publish accurate fore/aft position information since moving to the expanded slot constellation. Additionally, Points of Contact for the OA and Notice Advisory to NAVSTAR Users (NANU) were updated for accuracy. Proceeded with briefing slides. No comments or discussions.

Break (0920 – 0930)

RFC-374 – Leap Second and Earth Orientation Parameters
*Note: This topic has been deferred as of November 2018. It will be included in RFC-400 and briefed at a future PICWG.

The purpose of this topic was to define the linkage between different timing systems in the current technical baseline. With the current documentation, CNAV users will calculate the wrong UT1 time immediately following a leap second change. Since release of the original PIRNs in July, the initial solution was changed significantly. Updated PIRNs will be released in light of this and the public will have a 2 week review period following the conclusion of this year's PICWG.

Slides 60-70 describe the original solution that has been overcome by events (OBE). The new solution was discussed in slides 52 – 59. There was an additional statement added to the last paragraph of IS200-618 that was discussed at the PICWG (slide 53). Steven Hutsell (2SOPS) pointed out that new user equipment manufacturers might be confused by the additional proposed wording. Philip Kwan (GPS SE&I) sent new proposed wording to Roger Kirpes (Rockwell Collins) for review.

Break (0955 – 1010)

Karl Kovach (Aerospace Corp) agreed with Steven Hutsell's comment and proposed that there should be a new unambiguous term for full GPS time – week number, time of week, and time that is seconds since epoch. Brent Renfro (Aerospace Research Laboratory, University of Texas) agreed a standardized term for data reference times needs to be applied across all ICDs. Karl clarified that no equations are to be changed, just a new term needs to be defined. General concurrence from public in room and online for new sentence to be added to paragraph and for a new concern to be opened for new term "fully qualified GPS time." Roger Kirpes pointed out the new proposed text would benefit from additional clarification – especially for t_{EOP}, which seems to be used in several contexts and it is not clear in what context it is supposed to be used. Karl agreed and stated Brent would assist with clarification of solution by using time since epoch. It was also proposed to

add a similar note to Table 20-VIII in the notes section (IS200-623 and IS705-324 – Table 30-VIII) with concurrence from the public. Steven Brown (Lockheed Martin) also suggested looking at the phrase "leap second adjustment", which can be interpreted in different ways. Karl Kovach agreed and will look into rewording.

RFC-374 – Clean-up and Health Bit Clarification

The purpose of this topic was to clarify signal-in-space topics, encompass general document clean-up (e.g. administrative changes and/or typographical errors) found during the UpRev process, and remove required contractor signatories from government-controlled documents. An update on the Health Bit Clarification topic was presented; this topic has been deferred to the 2019 PICWG as it has expanded to include many more changes than initially presented in the initial PIRN release. Any changes relating to the health bit clarification topic were reverted as shown in slide 93.

For slide 100 (IS200-343), Roger Kirpes pointed out that he did not agree with the last two redlines as this section specifically refers to L2 P(Y). This comment was accepted and will be incorporated into this RFC.

For slide 110 (IS200-1282), Dr. Rhonda Slattery (Aerospace Corp) proposed adding clarifying wording to the note in the table to specify "initial G2 settings" instead of "initial settings". Anne Kastenholz (Boeing) concurred. The disposition for this comment will be updated from "Rejected" to "Accepted with Comments" due to this discussion.

Regarding a deferred comment from CWO Rebecca Ruch (US Coast Guard). She suggested to update legacy GPS products to modernized GPS products in ICD-GPS-870. This comment will be added as a concern for the 2019 PICWG as it is out of scope of this RFC.

In regards to slide 127, Karl Kovach confirmed that the SATZAP procedure applies to L5 signals and that the Pseudorandom Number (PRN) for a faulty satellite is set to 37 when the SATZAP procedure is activated. Karl Kovach asked to confirm with Anne Kastenholz about this for GPS IIF (AI 2018-06). Dr. Slattery clarified that if this is not true for CNAV the disposition on the comment should be changed, however no change will occur for this year.

Steven Brown concurred with changes in slides 129-137, however he pointed out that these comments were made last year and again for this year. He would like to make sure that these items are included in future UpRevs. Daniel Godwin (GPS Program Office) clarified that previous UpRevs sent out were a courtesy review; continued discussions with Steven Brown offline.

Break (1102 – 1110)

Open RFC Discussion

FAA representative Andrew Hansen brought up an issue with the midi-almanac definition in IS-GPS-705. Previously the midi almanac was required on L5 however the language was changed to optional. The concern from the FAA was that they would need an L1 link to get the almanac from L1 C/A or L1C instead of having it on L5 (basically dual-frequency on L1 and L5). PICWG proposes to remove optional asterisk for midi-almanac on L5 (IS-GPS-705 – Table 20-XII). Karl Kovach cheerfully acceded to changing IS-GPS-705, but not IS-GPS-200. IS-GPS-200 will remain the same. Steven Brown asked about AEP impact due to this change. Karl replied that AEP is pre-operational for CNAV. Steven Brown accepted this comment.

Note: As of November 2018, presentation materials have been updated to reflect post-PICWG review. Changes are noted in presentation slides 52 and 145 through 157.

Action Item Review

Reviewed action items from past years and then this year. Detailed notes on AIs can be found in the Action Item Review tables that follow later in these minutes.

2014: Discussed items for closure and/or deferral to 2019 PICWG.

2015: Discussed items for closure and/or deferral to 2019 PICWG. There was discussion in regards to AI 2015-41. After discussion, it was agreed that this action items should be closed. It was suggested that Denis Bouvet should show that ionospheric update rates are insufficient and present a special topic at the 2019 PICWG if needed to explain his position.

2016: Discussed items for closure.

2017: Discussed items for closure and/or deferral to 2019 PICWG. For AI 2017-05, the changes will be deferred to the 2019 PICWG. There was also discussion in regards to AI 2017-06 which was closed. Further information can be found in AI 2018-07.

2018: Discussed new AIs captured during the 2018 PICWG. All deferred topics (i.e., Health Bit Clarification) from the 2018 PICWG were captured as AIs for the 2019 PICWG. PICWG participants will be updated via the PICWG distribution when the updated PIRNs/PCNs are available for a 2-week review. The concern regarding the optional L5 midi almanac is tracked via an internal database. Topic will be a new concern considered for 2019 PICWG (AI 2018-07).

Following review of the AIs, the public was polled to capture interest for discussions on Health Bit Clarification topic and Time since GPS Epoch topic. The following attendees were identified as interested stakeholders in these topics:

Health Bit Clarification: Karl Kovach (Aerospace), Dr. Rhonda Slattery (Aerospace), Gary Okerson (MITRE), Roger Kirpes (Rockwell Collins), Steven Hutsell (2SOPS), Andrew Hansen (DOT), Kevin Pi (RTN), John Dobyne (GPC), Brent Renfro (University of Texas), Steven Brown (Lockheed Martin), Stephen Taft (GPL), Anne Kastenholz (Boeing). POC from RTN and L3 should also be included – TBD.

Time since GPS Epoch: Same stakeholders as above except John Dobyne (GPC). Included Dr. John Berg (Aerospace) in this topic.

LUNCH (1155 – 1315)

Special Topics:

GPS III Signal in Space (Presented by Lockheed Martin) – Steven Brown

The purpose of this presentation was to inform the public about GPS III and the differences in GPS III signal in space broadcast versus previous blocks. GPS III is compliant with all ICDs and generates ephemeris on-board. 3 examples of differences between Block IIs and GPS III during Clock, Ephemeris, Integrity (CEI) data set cutovers were presented. For legacy t_{oe}/t_{oc}, the values are decremented by 16s (1 LSB). For modernized t_{oe}/t_{oc}, the values are decremented by 5 min. GPS III has the exception that it may stay in a 4 hour curve fit, up to 62 days, providing much better accuracy, and helps remove curve fit error.

Status of GPS Spectrum & Adjacent Band Compatibility – Capt. Robyn Anderson

Quick overview of the GPS spectrum and where it is going. Status of spectrum: incorporating in documents for modernized civil signals (L1C, L2C, and L5). Spoke briefly about adjacent band compatibility – the Department of Transportation released a technical report that surveyed an array of GPS receivers to see what type of interference we can tolerate in different bands. This raises questions, such as, how do you regulate a band you do not control and do not reside in? Included contact info on how to stay informed and stay engaged. No questions or discussions.

Navigation Correction Message Table (NMCT) Clarity – SV ID 32 – Philip Kwan

This special topic stemmed from a concern from a past year which could not be incorporated into this year's RFC. The problem is that there are 31 possible Space Vehicle (SV) IDs, but only 30 slots, not including the one transmitting. What would happen for a transmitting SV with SV ID 32? The solution presented was for SV ID 32 to not transmit an NMCT, and have the Availability Indicator (AI) for SV ID 32 set to 10. Added phrase to IS200-425 "and the AI for SV ID 32 shall be set to 10".

Discussion: Steven Hutsell said the addition of the sentence would deprive a degree of freedom in the future. A possible alternate approach would be to state that SV ID 32 is set to either 10 or 11. Karl said, "Point well taken, but we will never get to that point." Online speaker said if it is not necessary to close a door on a degree of freedom, we should not do that. Dr. John Berg supported Steven Hutsell's point. Already have things built with one interpretation; other things may be built that might have value in those other freedoms. Karl Kovach ceded to their point. Topic will be initiated as a concern for the 2019 PICWG.

Break (1418 – 1430)

MT 38, 39, 40 Integrity Support Messages (ISMs) – Karl Kovach

Currently we have Receiver Autonomous Integrity Monitoring (RAIM), which supports horizontal frequency only. It runs at the same rate as PVT solution, and lets you know if something goes wrong within one second. However, if something is wrong, you may get a mismatch. ISM provides proper a priori statistics, allowing for optimum RAIM performance, plus lateral and vertical navigation. Note on international politics – GPS may not broadcast an ISM for Galileo quite yet. Ultimately, ISM responsibility goes to FAA.

Question: Time to first fix? Dr. Slattery is concerned about CNAV message throughput. What is being given up in order to add these messages? There can only be so many CNAV messages broadcast in a given amount of time. Karl Kovach said time to first fix is never going to be changed, and right now, there are no other messages burdening L5. Daniel Godwin asked, "If FAA were to back this, it's something we could work for next year. Has FAA looked at their own architecture for how to address this?" FAA spokesperson said the biggest interest comes from the military…the FAA has to make sure it is safe. Takeaway was that there requires much more government discussion before this were to roll out. Topic will be initiated as a concern, but will not be brought to 2019 PICWG unless it is ready.

Walk-On Topics

One topic was brought forth by Steven Brown for discussion – **Recommended Changes to Broadcast Navigation user Equations in IS-GPS-200J, IS-GPS-705E & IS-GPS-800E: Eccentric and True Anomaly**. Steven Brown presented simplified equations for eccentric and true anomaly that would have very low risk and cost impacts to government/users. Presented redlines referenced in RNSSI white paper (links to paper included in 2018 PICWG slides). Dr. John Berg (Aerospace Corp) applauds the effort towards this clean up. A new concern will be initiated for this topic for the 2019 PICWG.

<u>Closing Remarks:</u>

Mr. Horejsi addressed the public for closing remarks:

I fully expect to have to battle in space in the future – space is no longer benign. We must be prepared to defend GPS in space. When we look at the threat we are facing, we are being outpaced by the threat. Guys, let's do quick discussions, reach a decision, and decide to do or not do. If not, we will not be able to stay ahead of the threat. While we may have a Legacy of success, that does not guarantee we will be the gold standard for the future. Let's kick things into high gear – I'm pushing not just the military, but also the civil side to get things done. We're going to look at leaning forward at what capabilities we can roll out. I challenge this entire body to accelerate and get things done. When 2019 PICWG rolls around, we will have a GPS III satellite up. The public has to be prepared to deal with and understand that things change along with their use of GPS. You'll see a LOT of things change this next year – we need to make sure everyone understands that GPS is changing and evolving. We HAVE to move ahead, the threat is not waiting for us – we have no choice. If we have to make a decision early, I'm okay with doing more than one PICWG per year. I don't want the slow methodical pace of the way we've been doing things hold us back. We live in strange and interesting times. Thank you.

Attendance List:

Name	Organization	Present	On-line
Alexander Ken	FAA	X	
Avon, Suzanne E	Boeing		X
Berg, John	Aerospace Corporation		X
Bongir, Chandu	SMC/GPGX	X	
Brown, Kenneth	GPS SE&I	X	
Brown, Steven A	Lockheed Martin	X	
Czopek, Frank	Microcosm Inc	X	
Dobyne, John	Booz Allen (SMC/GPC)	X	
Godwin, Daniel	GPE	X	
Hansen, Andrew	DOT	X	
Horejsi, James R	GPE	X	
Hutsell, Steven T	2SOPS/DOAN		X
Kastenholz, Anne	Boeing		X
Kawaguchi, Y			X
Kawakami, Todd M.	GPD	X	
Kim, Willis	Mitre	X	
Kirpes, Roger	RCI		X
Kovach, Karl	Aerospace Corporation	X	
Kwan, Philip	Engility/SE&I	X	
Lemus, Jennifer	Engility/SE&I	X	
Meares, Jason	Sandia National Laboratories		X
Miles, Calvin	FAA	X	
Naick, Purvis D.	GPC	X	
Nguyen, Ha	GPC	X	
Nguyenhuu, Huey	Engility/SE&I	X	
Okerson, Gary	Mitre	X	
O'Laughlin, Daniel	Mitre	X	
Patel, Ashish B	GPGX	X	
Pi, Kevin	Raytheon	X	
Ratner, Benjamin 2d Lt	GPE	X	
Renfro, Brent	University of Texas	X	
Richardson, Shelly	Engility/SE&I	X	
Rodriguez, Carlos	FAA	X	
Rosen, Noah	FAA	X	
Ruch, Rebecca	U.S. Coast Guard		X
Semwal, Indira	Mitre	X	
Slattery, Rhonda	Aerospace Corporation	X	
Stein, Miquela	ARLUT	X	
Telcide, Michael 1st Lt	GPE	X	
VonBibra, Samantha	Engility/SE&I	X	
Wesson, Kyle	Zeta Associates	X	
Woodard, Kyle Capt	GPE	X	

Action Item Review Table:

Year	Action Item #	Short Title	Status	Comments	Remaining Actions
2014	26	PRN Expansion	Deferred	Deferring for the 2019 PICWG	
2015	1	Removing UTC offset error (UTCOE) performance numbers	Deferred	Deferring for the 2019 PICWG	
	41	Investgate suitability of current iono update rates	Closing	Recommended for closure at 2018 PICWG pending updated response to Mr. Denis Bouvet. Mr. Bouvet will need to explain his position and show that ionospheric conditions are insufficient. Provide a special topic briefing for 2019 PICWG if needed	Send Mr. Denis Bouvet an updated response
	43	Clarifications; L5 Extended Navigation, User Range Accuracy (URA)	Closing	Resolved via email and RFC-374. Recommended for closure at 2018 PICWG	
2016	4	Satellite Outage File (SOF) – RFC-351	Closing	Recommended for closure at 2018 PICWG	
	20	Public Document UpRevs	Closing	Recommended for closure at 2018 PICWG	
	25	Operational Advisory – RFC-374	Closing	Updates included in RFC-374. Recommended for closure at 2018 PICWG	

Year	Action Item #	Short Title	Status	Comments	Remaining Actions
2017	1	Rate of change "Dot" Convention and Size	Closing	Recommended for closure at 2018 PICWG. SE&I to ensure administrative comments are rolled up for 2018 Public Document UpRevs	
	2	Public inputs on Standard Positioning Service Performance Standard (SPS PS)	Closing	Recommended for closure at 2018 PICWG	
	3	L5 Extended Operations	Closing	Resolved via email with Mr. Denis Bouvet. Recommended for closure at the 2018 PICWG	
	4	CEI Data Set Cutovers	Closing	Resolved via email with Mr. Denis Bouvet. Recommended for closure at the 2018 PICWG	
	5	L5 Signal Health for Satellites Without L5 Capability	In Progress	Updates included in RFC-374. Changes deferred to 2019 PICWG	Send Mr. Denis Bouvet an updated response
	6	L5 Midi Almanac: Required or Optional?	Closing	Closed at 2018 PICWG -- see 2018 AI #7 for follow-up. Confirmed that it is NOT optional and relayed information to the reviewer.	
	7	CNAV Message Type (MT) 38, 39	Closing	Resolved via email with Denis Bouvet. Recommended for closure at the 2018 PICWG. Karl Kovach briefed special topic for this (MT 38, 39, 40 Integrity Support Messages (ISMs))	
	8	Clarify Current LNAV URA Definition	Closing	Resolved at 2017 PICWG per Mr. Karl Kovach's redlines. Recommended for closure at 2018 PICWG	

Year	Action Item #	Short Title	Status	Comments	Remaining Actions
2018	1	Update ICD-GPS-870 to Include Modernized GPS Products Provided by the Next Generation Operational Control Segment (OCX)	New	Consider updating GPS products depicted in ICD-GPS-870 to reflect the modernized formats described in ICD-GPS-870, Table 3-I. Topic will be a new concern considered for 2019 PICWG	
	2	Operational Advisories for Dual-Frequency Operations with L5	New	Update the Operational Advisory or other documentation to accommodate dual-frequency operations involving the L5 signal in preparation for Full Operational Capability (FOC). Topic will be a new concern considered for 2019 PICWG	
	3	Consider Broadcast of Carrier Power Values	New	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. Topic will be a new concern considered for 2019 PICWG	
	4	Eccentric Anomaly, True Anomaly	New	Eccentric anomaly and true anomaly: Suggest simpler methods for solving Kepler's equations and removing redundant, unnecessary equations. This topic was briefed as a special topic at 2018 PICWG. Topic will be a new concern considered for 2019 PICWG	
	5	Define Time Since GPS Epoch	New	Define a new quantity "Time since GPS epoch" with a new symbol (TBD) because clarity may be needed for test that is associated with handling GPS week rollovers. Topic will be a new concern considered for 2019 PICWG	
	6	SATZAP for GPS IIF	New	Investigate SATZAP and how GPS IIF satellites are handling this procedure. Additional POC includes Anne Kastenholz (Boeing)	
	7	L5 Midi Almanac: Required but will be Optional	New	Ties back to AI 2017-06. Recall that L5 midi almanac may become optional in future use (few years from 2018), but for FAA purposes it is required (for now). Topic will be a new concern considered for 2019 PICWG	Close when FAA determines L5 midi almanac can be optional
	8	Navigation Message Correction Table (NMCT) for Transmitting SV with ID and Pseudorandom Number (PRN) 32	New	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. Topic will be a new concern considered for 2019 PICWG	
	9	Implement MT 38, 39, and 40 for Integrity Support Messages	New	Consider the addition of the MT 38, 39, and 40 while taking into consideration throughput of other CNAV messages (applies to L2 CNAV and L5 CNAV). Topic will be a new concern considered for 2019 PICWG	