Minutes of 23rd Meeting
RTCA Special Committee 227
18-19 June 2020
Virtual

Agenda
Thursday

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2. Introduction
3. Agenda Overview
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    b. Working Discussion of Proposed Tasks
4. Meeting and Schedule

5. Committee Organization Options
6. Working Relationship with EUROCAE WG-85 & 107

Friday

1. Discuss & Prioritize Proposed Tasks
2. Next Steps
3. Adjourn

Chairman:	Mike Cramer, Mitre
GAR:	Barry Miller, FAA
Secretary:	Dave Nakamura, Mitre
Program Director:	Rebecca Morrison

Thursday

Welcome and Administrative Remarks

Mike Cramer opened the kickoff plenary Webex session for the RTCA reactivated SC-227 at 9:00 am on 18 June 2020. Mike introduced himself, Dave, Barry and Rebecca. Rebecca reviewed the RTCA Anti-Trust, Proprietary, and Committee Membership Participation policies. Due to the fact this was a virtual meeting, the typical individual introductions were not made. It was suggested that members do that when they raise their hands to speak. Barry Miller, member since 1997, pointed out that his participation in the Government Affairs Representative role is different from the past.

Attendees

Name	Company/Organization
Alex Capodicasa (CMC)	CMC
Alex Engel (EUROCAE)	EUROCAE
Andrew McKenzie (CANADA)	NAV CANADA
Barry Miller	FAA
Tiziano Bernard	Garmin
Bill Forstie	Honeywell
Bill Tuccio	Garmin
Bob Gaul	Garmin
Brad Miller	FAA
Brian Hint	FAA
Christina Clausnitzer	FAA
Christine Haissig	NETCOM
Chuck Stewart	United Airlines
Darrell Pennington	ALPA
David Jordan	UASC
David De Smedt	EUROCONTROL
Dinesh Kumar Kushwaha	Collins
DIVYA CHANDRA	DOT
Doug Phifer	FAA
Eric Morse	Delta
Erik Ringnes	Honeywell
Frank Wigold	Lufthansa Systems
Gang Feng	Boeing
Gary Petty	FAA
Gerard Berz	EUROCONTROL
Grant Clow	PSA Airlines
Greg Comstock	STRATMACH
Guy Deker	Thales
Steve Horvath	Garmin
Jason Hewes	Garmin
Jeff Kerr	FAA

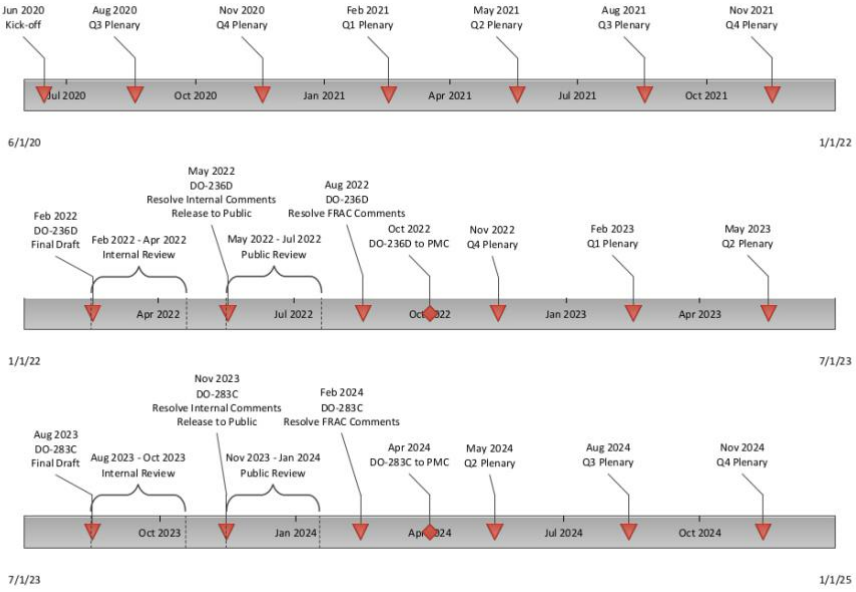
Jeff Meyers	FAA
Jennifer K Ledford	FAA
Joel Dickinson	FAA
John Barry	FAA
Kendal Hershberger	Garmin
Kevin Sivits - Leonardo/Selex ES	Leonardo Co
Kirk Kolek	Collins
Lesley Weitz	MITRE
Michael Cramer	MITRE
Michelle Yeh	FAA
Mike Jackson	Honeywell
Dave Nakamura	MITRE
Nick Tallman	FAA
Okuary Osechas	German Aerospace Center
Rebecca Morrison	RTCA
Ronald Renk	United Airlines
Russ Ramaker	GE
Ryan Howe-Veenstra	Honeywell
Ruth Hirt	FAA
Silviu Ceparu	Bombardier
Stuart Bowman	MITRE
Tim Geels	Collins
Wes Googe	American Airlines

Agenda Overview

Mike reviewed the agenda. He stated that the purpose of this meeting was to develop updated standards for the RNP RNAV MASPS and MOPS based upon the approved terms of reference.

Timeline & Organization

Mike showed and reviewed a timeline for the committee activities. This extends to 2024 but may not go that long. There will be quarterly plenary meetings. Alex (EUROCAE) pointed out that DO-236 is a joint activity with EUROCAE, DO-283 is not. Not shown is the work on the data driven charts since it is the responsibility of SC-217 SC-227 will stay coordinated with SC-217. Brad Miller (FAA) is the GAR for SC-217



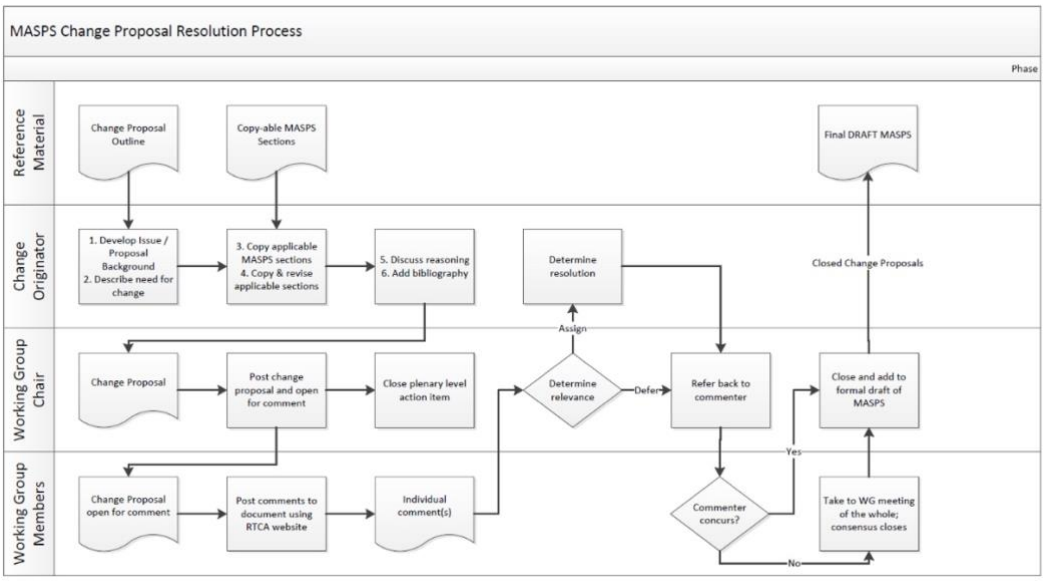
SC-227 TIMELINE

Mike stated that there will be four working groups. WG1 for RNP RNAV MASPS. WG2 for the RNP RNAV MOPS. WG3 for the Electronic Map. WG4 for Data Driven Charts. Within the groups, change proposals may be written by either small teams or individuals. The working groups will have their own area in the SC-227 workspace. Example topics are DME navigation, multi-sensor integrations including inertial, and general clarifications. The working groups can decide if proposals are developed by the whole working group or small teams. The plenary will meet quarterly to review and approve proposals. When approved, the material will be incorporated into the draft MASPS/MOPS as appropriate. Alex indicated that EUROCAE WG-44 may be a joint effort with SC-217.

Mike asked for those interested in being a work group chairs to make it known, along with why, and a bio to Mike, Dave or Barry. Barry noted there are many new people and previous working group chairs are not active in the committee except Mike. The Working Groups could meet monthly as they see the need.

Proposed Tasks

Mike reviewed the change proposal process. The committee will maintain a change proposal log to track the proposals and status.



Meeting and Schedule

The committee meetings and general schedule are as shown on the timeline.

Committee Organization Options

Mike did not present any options.

Working Relationship with EUROCAE WG-85 & 107

Mike pointed out that SC-227 will be operating as a joint committee with EUROCAE WG-85, which was reactivated as of June 9, 2020. Both will follow the same terms of reference. EUROCAE WG-107 whose work is on a DME MOPS will not operate jointly. There will be coordination between the SC227 and WG107 at a subgroup level. The reason for the coordination will be with regard to applicable assumptions that each committee will be using and including in their respective standards. Alex (EUROCAE) stated that WG-85 was reactivated June 9th. They have a call for participation due July 17th. A July 28 kickoff meeting is intended. By August 1st, they will plan their joint work.

It was pointed out that WG107 has been in progress for two years. This has been a coordinated activity and complementary to SC227. Valeriu Vitan from WG-107 stated they are working the infrastructure side in support of RNP applications. They need to know the infrastructure assumptions from SC-227. Barry stated that there is a fine line in the MASPS/MOPS with regard to the specifications and their association with regulatory guidance.

Working Discussion of Proposed Tasks & Issues

Mike welcomed items not shown on the list. The list was revised during the meeting discussions.

REF #	MASPS REF	SOURCE	ISSUE/TASK DESC	DISCUSSION/ACTION
M1-01		TOR	Merge Change 1 into DO-236C	This will be handled editorially by leadership
M1-02	Appendix C, new sections in main document	TOR	Develop new guidance for the use of DME for position estimation, e.g., use all in view, reasonableness testing requirements, and	In coordination with EUROCAE WG-107. It was pointed out that DME navigation is not new and can be robust. What we're addressing is a new minimum requirement

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			considerations for assuring the integrity of a DME based solution.	at the aircraft level, to allow use of DME following loss of GNSS in the continuation of PBN/RNP operations including the approach domain. There is some published guidance for this. Vali highlighted the two way street with the service provider for RNP operations, they need to know how to determine the minimum infrastructure baseline to make it work for all aircraft FMS through their WG-107 MASPS. This is one of the bigger tasks for 227. The FAA is trying to embrace current equipage capability e.g. DME antenna, receiver, etc. and facilities, and are not trying to alter facility standards. The are aiming at optimizing for NextGen plans while minimizing impact to aircraft and infrastructure. This task is linked to the next one on multi-sensor and inertial integration.
M1-03		TOR	Develop expanded guidance on multi-sensor navigation and inertial integration	A question from some was do we need standards/models for inertial coasting with GPS loss. Are there categories for performance? How long is the coasting position good? What kind of assumptions can be made? Barry Miller pointed out that the FAA supports this task. There is confusion about credit for inertial integration, old inertial performance standards in Appendix G to Part 121. IRS is good because it supports robustness and resiliency. MASPS and MOPS criteria could help for GPS loss case. However, AHRS is not an inertial system. Eric M Delta, suggest coordinating SC-159 on coasting. Supports the 737 style sensor integration as a path to take. Grant, PSA, noted that multisensor integration requiring inertial would exclude regional

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				operators. Is inertial a minimum standard? Okuary, stated that VOR and other navaids should be explicitly mentioned. Ron, UAL, noted we also need to take a minimum standards approach, e.g. address jumps when switching from one sensor to another for new systems. Bill, Garmin, asked a question about the inclusion of AHRS. FAA sees a distinct line that any inertial system be demonstrated at the aircraft level. Should the minimum standards be for an operation and for when a sensor is lost. Gang, Boeing, re DME, should include multi-sensor integration as well. Mike noted that sensors to consider for this task include DME, VOR, ILS, inertial, etc. Multi-sensor integration is acceptable at the aircraft level. Barry pointed out that SC159 is updating tightly coupled GPS integrating and working on loosely coupled integration for their MOPS. However, he is not sure what will be in the MOPS. The SC-227 MASPS/MOPS are already performance based and not sensor centric, so additional clarity about other sensors and integration is appropriate. Operational consideration for sensor loss re: continuation/extraction may be appropriate.
M1-04	3.9 Datalink Interface	TOR	Develop expanded guidance on datalink considerations for RNP systems	Need to look at SC214 changes with regard to what works and doesn't for RNP operations. SC214 published dynamic RNP material. All we may need to do is tweak what we already have based upon what we know now. Regarding ADS-C reports, there may be something else for the current CNS appendix.
M1-05		TOR	Develop expanded guidance for aircraft	Aircraft performance models are in many systems. There may be

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			performance data utilization for RNP and VNAV	aspects of this that should be considered for RNP and VNAV operations. There are other means of compliance without performance models e.g. with pilot, but the operational application can be confused. Clarify in the MASPS/MOPS? Also, we may need to clarify the operational considerations for VNAV outside of the final approach segment.
M1-06		Member Suggestion	Develop guidance for use of GPS altitude in lieu of barometric?	Erik asked if GPS altitude is ok for VNAV vs Baro in FAS and how far out, with regard to procedures where temperature compensation is in effect. How can they be used together? What are the effects? Not too sure this belongs in MASPS/MOPS. There seems to be insufficient support to include it. If it is addressed, there remains a need to determine where it would go. Is this covered in a GPS MOPS (check Barrys comment)
M1-07a	1.0 Intro & Scope	TOR	Update the introductory material to better reflect today's PBN operations and how the MASPS/MOPS support them	Update to reflect what we did not cover in the last publication and from experience with implementing PBN. Consider TBO, the value of it in an operational concept.
M1-07b	1.7 Definitions	Reactivation Proposal	Clarify terms and definitions for RNP TSE to better explain the relationship to other RNP standards and regulatory guidance using NSE and FTE	We need to acknowledge the difference between MASPS and terminology in use in other guidance and explain why the difference exists. Also, provide greater clarity than what we have today with regard to the means the requirements can be satisfied e.g.TSE alerting vs NSE alerting.
M1-08	2.2 Containment Integrity 2.3 Containment Continuity	Reactivation Proposal	Provide better plain language explanation of RNP containment integrity and continuity requirements as they relate to operational requirements for integrity,	Nothing noted here.

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	4.3 General Containment Compliance		continuity and availability, including what's analyzed, tested and demonstrated	
M1-09	3.8 Navigation Database Requirements	Reactivation Proposal	Update MASPS and MOPS navigation database requirements relative to new guidance and criteria in other documents and ACs today	Consider what is in the latest DO-201B along with AC20-153B to determine what updates may be appropriate.
M1-10		Reactivation Proposal	Clarify relationship of VNAV functionality and performance to possible allowed means for operational use	Some more operational considerations notes in appropriate places to link the use of VNAV to operational credit. Do we need to add any standards to allow credit for VNAV in all phases of flight? Or should we? No change to VNAV requirements but to operational considerations for allowed use e.g. FAS vs outside. Clarify what is acceptable and where. Or what is allowed/required for VNAV outside of FAS
M1-11	2.x, 3.2.5.4	Change proposal	Update standards for lateral turn performance to reduce protected areas and provide better airspace utilization.	Address use of RF and FRT as a means to get better airspace utilization vs the protected airspace for the fly-by path. Previous Cramer paper may be updated.
M1-12a	3.7.2.2.2	Change Proposal	Define requirements for the user-defined course to a fix when used to intercept the extended centerline of an RNP approach after radar vectoring	Current requirement allows for many implementations. Clarify or consider greater specificity on the function. There may be operational considerations to add for and possibly more consistent or restrictive implementation standards. It was noted there is a difference between user defined course to fix and systems extended runway center or course to course intercepts. There could be a new operational requirement at the MASPS/MOPS level
M1-13a		Reactivation Proposal	Where appropriate, clarify association of requirements to RNAV	There is the impression that RNAV = RNP, monitoring and alerting is an issue, another group could tag the appropriate

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			systems as much as possible	requirements. May not have the most visibility in the MASPS. The RNP airspace discussion aims at a common RNP capability, this is related. It may be that the mapping is in the TSO, which only calls out the MASPS requirements with exclusions. This doesn't fit into modifying the MASPS/MOPS, and is a big effort. Take this on and disposition it. Suggest it focus on resolving the TSO exceptions e.g. path terminators. It may be a waste of time. RNAV and RNP systems are the same, RNP has a better story. RNAV vs RNP holding is something we should take up. What problem are we solving with RNAV and RNP. A clarification of terminology should be considered. For operators, RNP is focused on specific procedures, would an education piece help clarify this. A MASPS or MOPS may not solve how people understand. An appendix addressing the 5 leg type exceptions in the TSO-C115D might be appropriate. Expand the RNAV and RNP system definitions? RNP is an RNAV system plus. There is confusion about RNP e.g. charts for RNAV(GPS). Write up a change proposal and disposition. Make the TSO leg types a separate action item.
M1-14	2.4, 2.5, 3.4, 3.5	TOR	Coordinate with SC-186/WG-51 to ensure operational compatibility between Flight-deck Interval Management (FIM) and Required Time of Arrival (RTA) / Time of Arrival Control (TOAC) from the RNP system minimum standards in both DO-236C and DO-283B.	We have Mike Jacksons presentation which will be circulated to the group. This was discussed in 2014-2015, the priority of speed constraint vs time constraint. There were complex issues with the types of speed constraints. We left speed constraints as the priority. The expected problem is RTA aircraft won't meet time constraints if there is a speed

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			Develop guidance for managing operational/functional consistency between aircraft speed management/control with and without updated TOAC	constraint. FIM requires the AT speed constraint, with some speed adjustment allowed (10%). An RTA aircraft can slow down more than that, affecting a following FIM aircraft. No official concept of operations at this time and how operations would work. A possible approach is have TOAC be like FIM systems in speed adjustment, only with ATC requirements. Is there value in changing the RTA requirements. SC186 WG4 will be able to support this activity. One challenge is getting the committee up to speed on FIM. Or have a discussion with regard to speed constraints and what this means for FIM. Include the George Ligler ICC paper to the workspace in preparation for discussions. There will be folders on the workspace, associated with the issue.
M1-15		TOR	Coordinate with SC-217/WG-44 to develop new minimum standards for DDC. SC-227 would define the minimum requirements for the RNP system interaction with DDC, while SC-217/WG-44 would define the minimum database requirements to support the charts	There is interest from multiple applicants. Build upon DO-257B and get the working group back together. Need support from the operations community, re: minimum display, build on the current 257 standards?, functional requirements, a separate database. SC-217 develops requirements are in support of a system. For DO-201B, SC-217 extracted all data associated with DDC in PANS-AIM. The work to do is on the systems side in SC-227, with DO-257 as a possible basis, a new appendix or a separate document. Brad, Barry and Mike could work out the initial proposal. What DDC is needs to be clear. There are human factors issues in integrating DDC into the cockpit.
M1-13b		Reactivation Proposal	Expand to address RNAV. E.g. note that except for	See the RNAV discussion above.

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			containment integrity, continuity, RF, holding and parallel offset, the rest is consistent with RNAV systems. Manufacturers urged to evolve systems to these capabilities.	
M1-16		Reactivation Proposal	Simplify Section 4? In some ways it leans toward RNP AR.	Section 4 addresses safety management, and sets a foundation. It may be OK as is but we could look at it to see if there's a better way to say things. Interested committee members should look at Section 4 and provide feedback on this.
M1-?		Reactivation Proposal	Should we provide more guidance with regard to the inclusion of aircraft performance models as related to TOAC and FIM? Address functionality and model data?	Include with the above FIM item, or keep separate for TOAC. The pilot shouldn't have to monitor speed. Should there be an alert. The top level performance requirements may make this unnecessary. No action is needed.
M1-13c		Reactivation Proposal	Review RNP holding, make sure that it is clear that size is driven by actual wind. Does RNP on the hold and alerting make sense?	Include with the other proposed holding task.
M1-17		Member Suggestion	Circling Approaches: Ensure standards and/or testing address the manner in which the aircraft and an RNP system respects differences between TERPS-defined circling approaches and PANS-OPS-defined circling approaches. New standards should address the significant circling procedure design differences in the available circling obstruction clearance area to ensure the resulting flight guidance from the RNP is wholly consistent with each design standard. This is an	Are additional standards needed for ensuring that RNP system functional capability requirements consider its use as advisory guidance by the flight crew re:TERPS and PANS-OP criteria for circling maneuvers.

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			optional function for the aircraft and RNP system. Reference multiple mishaps/incidents where flight crew used FMS advisory guidance during circling approaches and desire to represent circling approaches as "RNAV visual procedures" and include them in the onboard navigation database.	
M1-13d		Member Suggestion	RNP Holding: Consider updating the RNP holding standards to allow for the first time procedural development and implementation of RNP holding that do not require the expansive airspace provided by today's traditional holding patterns. These new standards can be beneficial by allowing more efficient use of airspace and, in some unique locations, the RNP holding pattern can provide a standardized alignment maneuver for an RNP approach procedure.	Review the basis for RNP holding area with regard to airspace and assumptions. It was noted that the current requirements were based on known differences with holding airspace criteria, e.g. non-holding side
M1-18a		Member Suggestion	Lateral Path Discontinuities & Advisory Vertical Guidance: Provide new standards for the implementation of advisory vertical guidance such that when an RNP system flight plan includes a lateral path discontinuity the new standards require "flagging" or "pulling" the vertical guidance cue (i.e. the vertical deviation indicator) when the flight sequences a fix and a lateral path discontinuity	This is based upon an NTSB recommendation. What is the appropriate functionality?

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			begins (reference NTSB SR A-14-086).	
M1-19		Member Suggestion	AIRAC Cycle Changes & Carriage of Multiple Onboard Navigation Database Products: Provide new standards for aircraft and RNP systems carrying multiple onboard navigation database products to ensure the implementation properly respects the differences in the implementation of the AIRAC cycle by individual States and Air Traffic Management authorities. The aircraft and RNP system should not arbitrarily load a new navigation database at an arbitrary, fixed time (e.g. 0000Z). This is an optional function, as is carriage of multiple navigation database products.	There was support for this from Barry Miller, Ron Renk, Wes Googe and others.
M1-20		Member Suggestion	Reaction to manual flight plan updates by the flight crew: Develop new standard to ensure the aircraft and RNP system retains the definition and turn attributes of an RNP procedure when the flight crew updates the active flight plan with a new ATC clearance. Specifically, the new standards should address how the aircraft and RNP system reacts when the flight crew closes a discontinuity at the end of an active RNP procedure, currently in use by the aircraft and RNP system. The new	This problem can result in a violation. Perhaps additional test requirements would address this. The pilots should not be in a situation where flight path attributes are changed.

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			standards should ensure the aircraft and RNP system do not alter the procedure definition and any attributes associated with any remaining fix attributes (e.g. a fly-over fix attribute). Attention to this requirement should ensure aircraft and RNP system retains the attributes of a termination fix of RNP procedure when the flight closes a lateral path discontinuity beyond the termination fix. Reference recent flight crew violations at PHX.	
M1-21		Member Suggestion	Turns in the Final Approach Segment of an RNP Approach: Consider developing new standards to require and support turns in the final approach segment of an RNP approach procedure.	For RNAV(GPS), procedure criteria currently prohibit RF legs iin the FAS. The MASPS/MOPS does not address this aspect of implementation. Systems with RF capability support the need for AR and could support the application in final for RNAV(GPS) if the criteria changes. It was pointed out that this may not be appropriate detail for the MASPS/MOPS but DO-201B could provide guidance on RF leg application. No action will be taken for MASPS/MOPS. Requiring A-RNP is not desired.
M1-18b		Member Suggestion	Continuous Advisory LNAV and VNAV: Consider developing new standards to better enable a continuous descent final approach (CDFA) operation during nonprecision approach operations and enable continuous presentation of advisory lateral and vertical guidance beyond a	Public procedure design standards do not address all situations or locations. What added RNP system capability is possible to enable the desired operation.

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			visual descent point (VDP) and below a minimum descent altitude (MDA).	
M1-12b		Member Suggestion	Direct Clearances: Consider requiring the aircraft and RNP system be able to execute a direct-to clearance to any segment or waypoint of an RNP procedure or route, and automatically sequence onto the procedure or route without the need for flight crew action. This requirement should not attempt to embrace intercept of an RF leg segment, nor the procedural final approach fix (FAFA or PFAF). Also, consider addressing intercepting a straight, intermediate leg segment (at other than a defined fix) and then sequencing onto an RNP procedure in response to an ATC clearance	While the MASPS requires direct capability for any fix, and a course to fix capability, this is a need for the ability to have a direct path to any segment as well as for any fix. Combine with the user-defined course to a course intercept.
TBD	Para 3.2.8.2	Member Suggestion	Add minimum requirements for speed constraints in cruise phase.	Operational conditions are anticipated that affect RNP system performance for speed constraints that may appear in the cruise phase. Currently, the MASPS, MOPS and supporting standards such as DO-201B, and ARINC 424 only support the specification of speed restrictions in terminal procedures for departure and arrival operations. Relevant datalink standards including those in DO-353 and DO-352 may also be affected. For operations today where the cruise altitude is lowered, a descent speed restriction could

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				move into the cruise phase along with the fix associated with it. In this case, some RNP systems that are based upon the MASPS and MOPS, ranging from the original version to the latest, do not accept cruise speed restriction, and follow their own performance speed schedule for cruise. Future operations such as those for interval management are expected to establish speed restrictions in that could be with any fix in descent. This could increase the likelihood that a descent fix with a speed restriction the aircraft is expected to meet could potentially move into the cruise phase if the cruise altitude is lowered

Friday

Discussion continuted on proposed Tasks as noted in the table above.

Next Steps

- Members were reminded to express their desire to be chair, along with why and a short bio.
- Members were asked to identify in what working groups they will participate. **Provide by July 1st**
- Mike and Dave will add reference numbers to the task list, and **provide to members by July 1st**
- Members will vote on their task priorities using multi-voting. There is no need to vote on TOR tasks, just the proposals and suggested items. Members get 10 votes each and may put all votes on one item or distribute them as desired. **Provide the voting choices to Mike and Dave by July 1st**
- Mike will email date options for the next three meetings. Members will identify their choices and **provide feedback by July 1st.**
- Mike will add the reference numbers for the task list.

Webex Meeting Adjourned