

Minimum Capabilities List (MCL) Ad Hoc Team

NAC Task 21-1 Addendum

To be presented to the NextGen Advisory Committee February, 2023

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Executive Summary

The Aviation industry and the Federal Aviation Administration (FAA) have been working together for nearly 15-years on the NextGen National Airspace modernization initiative. Success will be measured by achieving an agreed upon set of benefits that include safety, schedule reliability/delay reduction, improved capacity, and airport access. This set of benefits includes critical environmental related reductions in emissions, fuel consumption and aircraft noise.

To further this important effort, in early 2020 the NextGen Advisory Committee (NAC) approved the original Minimum Capability List (MCL) based on a review of current equipage and to identify the core capabilities necessary for future NextGen operations. It's mission is summed up in the following question, "what avionics requirements would enable an aircraft being ordered that will be brought into operation in 2025 and beyond to utilize NextGen FAA ATC capabilities?" The recommendations included an annual assessment for updates or changes. This report is the latest effort.

The global COVID pandemic was disruptive, it contributed to setting the FAA behind its schedule for planned modernization and behind budget. While the industry also experienced extreme upheaval, it did lead to U.S. carriers retiring older aircraft and replacing them with new ones, many equipped with MCL listed capabilities. There were also significant investments in equipage to meet requirements of the EnRoute DataComm program and the unexpected retrofit of radar altimeters because of the telecommunication industry's roll out of 5G services.

In this year's review of MCL Baseline and Supplemental items, there was an agreement to add an emerging ADS-B In capability and include SATCOM in the list of supplemental items. There was also discussion about the application of MCL or need to modify it for new entrants such as supersonic jets, electric aircraft, vertical lift, Unmanned Aircraft Systems, and space aircraft. The Working Group did not conduct extensive work in this area but determined for the immediate future any of these vehicles accessing airspace could be accommodated, if appropriately equipped. This is an area that will require future examination.

In conclusion, the Task Group validated the MCL, with the two forementioned additions. The group noted it seems the MCL is guiding air-carrier equipage investments, as originally intended. Furthermore, while the MCL is not intended to drive retrofit requirements, it is recognized as a useful guide for business case driven decisions, and the group anticipates it will foster the installation of aircraft equipage in current aircraft fleets.

Introduction

This addendum is a result of the acceptance of a recommendation in NAC Tasking 19-1 to review the Minimum Capabilities List (MCL):

Finally, the Working Group recommends that if the MCL is successfully adopted, that it be regarded and maintained as a living document. Demands on the NAS will evolve and as they do, some MCL Supplemental capabilities will likely be recharacterized as Baseline. Similarly, newly developed technologies will be identified and should be added to the Supplemental list. Regardless, if Government and Industry continually identify and prioritize common goals for the NAS, we will more successfully implement change together in the future.

The result was NAC Tasking 21-1 which requested the following updates to the MCL:

Task 21-1: NAS Aircraft Minimum Capabilities List (MCL) Annual Review

The NAC is asked to periodically review the MCL, published by the NAC in 2020, and provide any recommendations for updates or changes on an annual basis, including but not limited to:

- Assumptions that need re-evaluation;
- Quick refresher of available technology or op specs and any new technologies announced by industry;
- Changes in scope or changes in views of retrofit by industry;
- Any recommendations on steps to further drive MCL adoption and commitments to equip aircraft with the associated capabilities; and
- Any updates to cost/benefit data provided by the NAC

The MCL group has met throughout 2022 to review the MCL as it applies to the requests above.

Assumptions Needing Re-Evaluation

When thought was given to this topic, three areas of interest surfaced from the group:

- How does MCL support over-arching industry goals like safety, schedule reliability/delay reduction, improved capacity, and airport access
- How do new entrants into the NAS like supersonic jets, electric aircraft and UAS fit into MCL?
- NAS Sustainability What is MCL's relationship with alternative fuels, ATC routing efficiencies, fuel savings, emissions and noise mitigations

The last report touched on the benefits of MCL capabilities, but the group wanted to ensure those specific benefits support over-arching industry goals. There was agreement that safety, schedule reliability/delay reduction, improved capacity and airport access were fundamental industry goals MCL should measure up to.

Current MCL Baseline and Supplemental items meet this objective, and the group recommends these industry goals continue to be a guiding principle for future decisions to amend the MCL Matrix with any new capabilities. Further, the NAC could also use these goals to help prioritize implementation of MCL capabilities.

As traffic in the NAS grows exponentially with new entrants like supersonic jets, electric aircraft, UAS, and space aircraft. How will these new participants affect MCL?

We believe no changes are needed to the previous MCL scope. If new entrants want to fly to airports in Scope, they should equip. For example, if new participants wish to serve an NSG 1 airport and want to mix with the current flow of traffic, they should equip. If they will only fly to an NSG 3 airport, it is out of scope, and while they may equip, mixed equipment was not deemed a problem for these airports.

One area that potentially warrants additional study in the future will be small electric powered "air-taxis". The group did not have time to get detailed briefings from this new segment of the industry, but it did raise concerns. These small aircraft will likely bring air-carrier passengers into larger NSG-1 and NSG-2 airports but not while flying traditional arrivals/departures or approaches. It is unknown at this time how these aircraft will integrate and share airspace. The group felt if they didn't contribute to "the mixed-equipage problem" or prevent current aircraft participating in the MCL from deriving the benefits of common equipage, they could be scoped out.

Finally, while there are activities looking at NAS Sustainability and MCL capabilities could play a role, the group remained focused on the over-arching goals listed above. Investment in MCL capabilities that meet those goals should also have positive effect on NAS Sustainability. There may be opportunities to explore this further in future NAC Tasks.

Refresher of Available Technology or OPS SPECs and Any New Technologies

A review of the MCL Matrix was done during this activity and the following considerations were given:

- Reviewed PBN Baseline capabilities for any needed changes where RNP AR 0.3 and Advanced RNP are concerned.
- Reviewed the need for ADS-B Out to continue to be a Baseline capability.
- Added ADS-B In CAS/CAVS as a separate Supplemental capability from the entire ADS-B In full-suite of technologies.
- Added SATCOM as a Supplemental capability.
- Updated the DME Navigation Supplemental capability to reflect updates from the new MASPS published by RTCA SC-227.

The updated MCL Matrix is attached as an Appendix, but we should review the main discussions and changes.

From the Baseline Capabilities tab, the group reviewed the requirement for RNP AR 0.3 **or** Advanced RNP (A-RNP). The reason this was originally an "or" statement was because while we ultimately regarded A-RNP as the <u>minimum</u> capability, it was not a uniquely offered capability for new aircraft orders and the FAA had no approaches designed in the NAS for this capability.

In discussing whether to update this requirement, we still have not seen sufficient progress toward either issue described above, and so this will continue to put a need for RNP AR 0.3 in the Matrix. We also considered removing the A-RNP requirement but since there is work being done to progress A-RNP, the group felt like it deserved more time to develop.

Next considered was ADS-B Out capability. As we did in initial MCL meetings years ago, there was another discussion about having ADS-B Out on the MCL since it is an FAA mandated capability. It was again decided to leave this capability since it is a fair reminder not to forget this NextGen equipment when purchasing new aircraft.

Moving to the Supplemental Capabilities tab, the group looked at ADS-In Technologies. In the initial version of the MCL Matrix, all ADS-B In applications were lumped into a group. This was because while all the capabilities were developing, few were available for purchase on new aircraft.

Since then, the NAC was tasked with Task 21-2: ADS-B In Commercial Application Technologies, which studied all the various applications which the industry was likely to equip. Out of thirteen capabilities, ADS-B In CDTI-Assisted Separation (CAS) rose to the top of the industry interest list. For this reason, in early MCL meetings the notion was too possibly elevate CAS to a Baseline Capability.

During the MCL review process, another NAC tasking (22-1: Prioritize NextGen Programs for Implementation) was started and completed, ranking ADS-B In as the lowest of 5 technologies to implement. ADS-B In was ranked lowest, in part because out of the 5 technologies ranked, it was the least ready (lack of equipage).

As you can imagine, this creates a conundrum for MCL. While the group was originally prepared to discuss making ADS-B In CAS a Baseline Capability, now knowing the FAA will likely delay implementation of ADS-B In makes it harder to ask operators to buy this equipment on new aircraft deliveries. A major tenet of MCL is to not list equipment not showing a return on investment.

So, for the reasons listed above, ultimately it was decided since ADS-B In CAS was considered of high interest for operators, we break out ADS-B In CAS as a separate Supplemental Capability. This helps highlight the industry interest, without making it Baseline and required on new aircraft purchase.

The next change was the addition of SATCOM to the list of Supplemental Capabilities. Most of the larger operators that fly overwater are already equipping this capability, but we didn't add this capability last round and found there was interest this time. SATCOM offers the ability to maintain voice and data communications with aircraft when they venture into remote areas. While there are not vast places in the US, we consider remote, we do have some over-water routes that could benefit from reduced spacing if we grow the ability of the aircraft to communicate in these regions.

Lastly, we did a review of the Supplemental Capability – DME Navigation. This was of high interest with most operators as it offers better resiliency to GPS outages or equipment failures. While significant progress has been made since the first MCL report (MOPS and MASPs complete), it's just now making its way to OEMs for onboard systems requirements. While there is interest in getting this to the Baseline Capabilities list to replace the more costly DME/DME/IRU, it's just not quite ready yet. We imagine most operators will start to equip this however, when available even without it being on the MCL Baseline this round.

Changes in scope or changes in views of retrofit by industry

There were no changes in scope identified during the group's discussions. We believe the scope set forth in the original recommendation is still adequate for this update.

Furthermore, as the industry was still reeling from the negative financial effects of COVID-19, no changes were made to recommendations around a retrofit program for MCL. The industry has seen some retrofit activity relating to both Baseline and Supplementary Capabilities, but these have been strictly voluntary and on a basis that the capabilities will have a Return on Investment (ROI). Examples of some known investment occurred for:

- RNP AR equipage
- Enroute DataComm (mostly investments in software updates)
- ADS-B In CAS

Recommendations to Further Drive MCL Adoption

When reflecting on this topic, two primary concepts emerged:

- Having more data to provide a more robust cost/benefit case. Using the example of winglets always comes to mind. When you can show, an investment will start making money the instant it's installed, it is a "no-brainer" to spend the money.
- Working with aircraft OEMs to make ordering aircraft with Baseline Capabilities easier.

We won't discuss much about the first topic in this section since the next section will cover that in more detail.

As for the second topic, we discussed the ways it could be easier for operators to get MCL Baseline Capabilities on new aircraft orders. The most obvious, but difficult, solution is to ask OEMs to make all Baseline Capabilities standard equipment. While a sure-fire way to have all aircraft in the NAS equipped, OEMs support operators worldwide and since MCL is a US product at this time, it would be complicated for OEMs to make all these diverse operators bear the expense of having this equipment standard.

The solution we were able to settle on however, was to ask the OEMs to come up with a better way to highlight MCL equipage in their option catalogs when a Baseline Capability is not standard equipment on that aircraft. For some OEMs, this may manifest as a note next to the item, for others it may be bundled packages.

The three OEMs represented on the MCL group (Airbus, Boeing, and Embraer) all took actions to discuss this internally and to find ways in their specific ordering process to help highlight MCL Baseline Capabilities.

Updates to Cost/Benefit Data

To stimulate equipage by operators, the MCL Group has developed material in support of an operator's determination of equipage business cases. Although gaps between actual aircraft equipage and the MCL are expected, and no two operators will use the same approach in determining specific business case decisions for equipping via the MCL, it was felt any common information would result in further adoption of MCL compliant avionics.

Our initial goal for this update was to try to come up with standardized formulas that an operator could plug in numbers and get an idea of what their benefit dollars would be. Discussions on the best way to accomplish this task probably contributed to the majority of time this group spent together this round.

Ultimately though, we may have bit off more than we could chew with this concept and lacked some resources that would have brought this concept to reality. It became apparent while we could all agree defined benefits had value, providing those benefits in a formula like format was too much of a challenge. Benefits can be based on proprietary information, and as such there was a reluctance to share actual figures. However, there are existing reports and information helpful to operators as they assess costs and benefits for NextGen enabling technologies to encourage standardization of aircraft equipment.

In 2011, the RTCA published a Nextgen Advisory Committee report titled "Nextgen Equipage: User Business Case Gaps." This report from the Business Case and Performance Metrics Working Group (BCPWG), although over a decade old, contains valuable insights and information for operators and is likely still relevant today. The focus of the report was on four specific NextGen capabilities which correlate favorably to the current MCL. The four capabilities assessed were: Performance-Based Navigation (RNP 0.3 with RF for commercial Operators), WAAS/LPV for General Aviation, ADS-B Out and ATC Data Link Communications.

Operators looking to build on information provided in the last report can refence this RTCA document for additional support. The report also highlights specific gaps where data or actions need to be taken that if closed, may result in higher uptake rates of MCL capability. If there is further MCL activity in the future, this topic should be revisited and additional resources put to helping ensure all using the MCL can understand how to calculate benefits.

Closing & Recommendations

As this round of MCL discussions come to a close, it ends with mixed feelings. There is still lots of enthusiasm from the various industry and FAA SMEs for this topic and it was good to see how some operators used the original MCL Report from Task 19-1. Overall, the NAS is in a better place when we have a common roadmap for all industry and government stakeholders.

However, we must still work hard to ensure the work accomplished by this body continues a path toward the successful outcome originally envisioned. The most significant hurdle between the original 19-1 task and this one today was the COVID-19 pandemic. Both industry and government dealt with unprecedented issues never seen in modern times. How we recover from this speedbump will define the MCL's ultimate success.

Interestingly, while all the same problems plaguing aviation from moving forward in NextGen still exist, a noticeable shift has become apparent. Prior to the pandemic, the FAA was the leader in investment in NextGen with the MCL bringing the industry together to focus on core capabilities and catch up.

What we see now is growing industry investment while the FAA has experienced a significant budget shortfall and is scaling back implementation of NextGen capabilities. While these shifts are common, now more than ever we need to ensure a collaborative way to guarantee the right investments are being made on both sides to achieve the benefits of NextGen we all deserve.

Thank you to all who participated in the MCL review this year! We look forward to continuing the conversation between all aviation stakeholders and working to achieve benefits for all involved.

Credits and Acknowledgments

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Appendix A

MCL Matrix 2023 Update

NextGen Enabling Category	Aircraft Enabling Capability	Key Missing Components	Benefits	Example Use Cases	Areas Receiving Benefit	Ground Investment
Data Comm	 FANS-1/A with "Push to Load" over VDL Mode 2 with multi- frequency 	CMU/CMF/ATSU VHF Digital Radios FANS 1/A capable FMC/FMGC	 Shorter ground delay for clearances Reduced comm errors Efficient delivery of complex clearances Reduced long voice comms Reduced freq congestion Accurate re-routes Weather avoidance Pilot requested re-routes Enables TBO CTOP/TOS 	 High rate clearances during SWAP Efficient wx re-routes Reduced errors in FMS reroute entries More efficient routing 	NAS ground ops Enroute ops	Development / delivery of Data Comm svcs Enhanced automation and Decision Support tools Controller training
Surveillance	ADS-B Out: Mandate	Transponder Highly accurate position source with integrity	Enables 3NM enroute separation Reduced separation in select situations Improved surveillance in non- radar areas (+ surface) More accurate position; more frequent update rate Improved safety via ATC automation and TFM Decision Support tools Improved Planning and TFM	 3NM enroute separation WATRS operations surveillance Reduced terminal vectoring due to conflict Enhanced SAR 	 Enroute Terminal Non-radar environments Mountainous terrain 	 Ground infrastructure ERAM/STARS enhancements Controller training Reduced Spacing