Research, Engineering and Development Advisory Committee (REDAC)

NAS Operations Subcommittee | MINUTES

Date: *March 21-22, 2017*
Location: *Washington DC (Conference Room varies by date)*
Purpose: *Review of FY18-19 Proposed Portfolio; Provide Guidance & Recommendations; Program Deep Dives*
Facilitator: *Maureen Molz, DFO*
Note Taker: *Anton Koros*
Upcoming Meetings:

- *September 12-14, 2017, Washington, DC*
- *March 27-29, 2018, TBD (Washington, DC or Charlotte, NC)*

Day 1 – March 21, 2017 (CSSI Conference Room)

Review of REDAC Recommendations, Responses and Open Actions

Presenter *Steve Bussolari/Maureen Molz*

Summary: The Chairman, Mr. Bussolari, opened the NAS Operations (NASOPs) meeting reporting that at the conclusion of the meeting he would be relinquishing the Chair to Mr. Leo Prusak. He also informed the subcommittee that Ms. Molz's DFO title would be transferred to another, yet to be identified, FAA employee.

Mr. Bussolari then led a review of pending action items. The Fall 2015 open item regarding Weather (Wx) Requirements Management Board membership was postponed pending the presentation by Mr. Abelman. The Spring 2016 Action to demonstrate aviation Wx products was closed as this was scheduled in the current agenda. The Fall 2016 subcommittee Actions for presentations on six key topics were closed as they were also included in this meeting's agenda (Terminal Sequencing and Spacing (TSAS) projected benefits, Trajectory Based Operations (TBO), Unmanned Aircraft Systems (UAS) Research Plans, Runway Incursion Reduction Program (RIRP) Benefits Analysis, UAS Traffic Management (UTM) update, and REDAC/NARP update). Two Fall 2016 Actions were closed as the FAA furnished the requested information on Human Factors Roundtable membership and a copy of the MITRE *Runway Incursion Report*. The remaining Fall 2016 request pertained to the *UAS Implementation Plan*. The FAA reported that this document is undergoing significant revision, but that the *UAS Research and Development Plan* may provide the relevant information and will be released mid-summer. The subcommittee kept the action open, adding Sabrina Saunders-Hodges, the lead contact for this document, to the assignees.

The subcommittee reviewed the two open Findings and Recommendations (F&Rs). The Spring F&R (Spring_2016_1), which focused on UAS integration in the National Airspace System (NAS), was closed in response to acceptance of the FAAs formal response. The subcommittee postponed a decision on the second, more specific, UAS - NAS integration F&R (Fall_2016_1) until after the UAS presentation scheduled for this meeting.

Presentation Budget Briefing
Presenter *Mike Gallivan*

Summary: Mr. Gallivan reported that the FAA requested a FY17 Research, Engineering and Development (RE&D) budget of $167.5M. The FAA continues to be under a Continuing Resolution through April 2017, therefore the budget is capped at the FY16 level of $166M and no new project starts are permitted. The original OMB FY18 RE&D target of $171M is currently under review by the new administration. Without an FY18 legislative funding agreement, Sequester Caps will be implemented. These funding impacts have not been propagated below the Department of Transportation (DOT) to the agency level. Currently no FY18 budget has been submitted to CONGRESS and therefore no Congressional Report language is available. The FY19 target is delayed until the FY18 Presidents Submission. Out year budget targets increase approximately $3M per year; beginning in FY18 at $171M and reaching $185M by FY22 but are expected to change to a reduced level.

Presentation 1A10D NextGen – New Air Traffic Management Requirements
Presenter *Francisco Bermudez*

Summary: Mr. Bermudez presented an update on plans for the New Air Traffic Management (ATM) Requirements line item. This program encompasses ATM requirements for international harmonization and standards, collision avoidance systems (e.g., ACAS-Xu), advanced ground and air communication technologies, and common displays in the NAS. Among the key activities planned for FY18 are: interoperability requirements for collision avoidance systems, operational scenarios for synchronization of air/ground procedures, Internet Protocol Suite (IPS) prototype measurements to support the development of Minimum Operational Performance Specifications and International Civil Aviation Organization Standards and Recommended Practices (SARPS), cloud computing, and performance requirements for NAS information systems displays. In response to a subcommittee inquiry, the FAA reported that an engineering study is planned into the potential feasibility of leveraging a command & control capability for NAS Systems in a cloud environment. In FY19 the following will be completed: Air/Ground Trajectory Synchronization validation activities, development of the ICAO Class B Satellite SARPS to support Data Communications in domestic airspace, and development of IP Standards to support the FAA's Data Comm Segment 2 and Future Communication Systems.

Presentation Deep Dive – TBO/Data Comm Strategy
Presenter *Steve Bradford*

Summary: Mr. Bradford reported that the Data Comm strategy document will be delivered in June in support of an FAA decision to be made in July. The document will encompass harmonization with Europe, timeframe, technical operations, and other critical aspects. Data Comm is comprised of a “pipeline” (physical link such as VDL/2), services (e.g., CPDLC), and networking (e.g., FANS, ATN). Mr. Bradford reported that the US would likely remain on VDL/2 until around 2040. The FAA also plans to move from the ATN & FANS1/A networks to the ATN/Internet Protocol Suite (IPS). Research

on IPS is currently being planned. ATN Build 2 will add dynamic RNAV and advanced interval management around the 2025 timeframe. Research is also being initiated by the US and Europe on the potential use of SATCOM. TBO leverages Data Comm to enable aircraft to fly efficient paths in metroplex environments where structure is needed. In addition, Data Comm will be required to support time based clearances such as required time of arrival (RTAs) through Ground Based Interval Management-Spacing (GIM-S) and/or flying to an RTA. The subcommittee then inquired regarding the benefits assessed during the joint NASA/FAA Airspace Technology Demonstration 2 (ATD-2). Mr. Bradford reported that as an early research effort, the activity demonstrated that there is sufficient benefit to proceed, but it was outside the scope to identify and quantify all benefits expected when implemented in the NAS. The subcommittee was informed that Mr. Hunt's upcoming TSAS benefit presentation describes the methodology, benefit areas, and projected cost savings. The subcommittee expressed the importance of effective integration of NextGen technology into the NAS and realistic operational benefit projections; therefore, the subcommittee will look into the possibility of holding a future NASOPs meeting in Charlotte, NC to attend ATD-2 University.

Presentation UAS Research Plans for the next 2 years
Presenter *Sherri Magyarits/Steve Bradford*

Summary: Ms. Magyarits presented an overview of the joint FAA/NASA UAS Traffic Management (UTM) project including upcoming research. UTM addresses critical gaps associated with multiple uncontrolled beyond visual line of sight (BVLOS) operations in low-altitude airspace. UTM is a separate, but complementary system to the ATM system that leverages industry's ability to supply services, under FAA's regulatory authority. The subcommittee inquired about safety considerations. Ms. Magyarits noted that the current effort, being managed via the UTM Research Transition Team (RTT), is currently in the first phase of research - investigating preliminary requirements. Safety will play a key role in subsequent phases. The initial focus is on G class airspace at or below 400' AGL. The UTM project demonstrates four increasingly complex Technical Capability Levels (TCLs) ranging from multiple operations over unpopulated areas (TCL1) and culminating in multiple high density urban operations (TCL4). In response to a subcommittee inquiry, Ms. Magyarits confirmed that lessons learned from the Pathfinder activities will be leveraged into the UTM products for technical transfer to the FAA and industry. Mr. Bradford noted that a key requirement of the UTM architecture is the ability to seamlessly transition management of airspace (potentially including Class B, C & D airspace) between UTM operations and FAA ATM operations. When asked, the FAA confirmed that "UAS operator" in the notional UTM architecture figure refers to commercial operations and not hobbyists. A member of the subcommittee underscored that it is unrealistic for UAS operators to have complete awareness of operations in the airspace. The subcommittee then briefly reviewed the FY16-19 UAS Concept Requirements Program Implementation Plan for FY16-FY22. Mr. Bradford noted that the FAA is initiating research for UAS operations in the airspace between FL320 and 60,000'. The Chair of the subcommittee noted appreciation for the information provided by the FAA regarding engagement with the UAS community and planned research and indicated that the subcommittee would discuss the open UAS F&R later in the agenda.

Presentation Commercial Space Transportation (CST)
Presenter *Mike Romanowski*

Summary: The CST RE&D portfolio matures concepts, methods, systems, operations, and the regulatory framework to accommodate safe and efficient integration of increased commercial space launch and reentry activity into the NAS. This portfolio also sustains innovative research within the FAAs Commercial Space Center of Excellence (COE). Critical research is focused on improving integration of spaceports in the NAS, enhancing noise models, and developing appropriate separation standards. The CST program has developed an exploratory tool to support spaceport siting based on factors such as proximity to the coast, airports, and infrastructure; local airspace; and local population density. Spaceports offer economic benefits, however they are not suitable everywhere – appropriate siting is key. When initiating space operations at a new site, critical consideration is given to addressing environmental considerations including educating the public regarding the potential accompanying phenomenon of sonic booms. The FAA has embraced management of space vehicle operations, adding representation on the "New Entrants Board" which is chaired by the Deputy Administrator, and initiating development of a coordinated Agency space operations plan. The subcommittee recommended that the CST program meet with representatives of the space and aviation industry. Mr. Romanowski noted that representative stakeholders are being identified and will be engaged in the effort to update the Space Vehicle Operations ConOps. The subcommittee noted that key upcoming considerations will be structuring user fees and equitable access to airspace.

Presentation 1A11 NextGen – Ops Concepts Validation Modeling (OCVM)
Presenter *Jason Coon*

Summary: Beginning in FY16 all new operational concept development activity starts were initiated under a portfolio structure. Ongoing OCVM concepts will continue to be reported under this line until the funds are expended. Mr. Coon reported that the FAA is currently considering realigning all concepts within the ATO and NextGen organizations based on the concepts acquisition phase and maturity; however, a final decision has not been made. The OCVM Statistical Methods for Departure Predictability (SMDP) project was completed with delivery of the Core 30 Phase 2 Models and the Final Report. A member of the subcommittee noted that the European community is also researching the application of Bayesian methods to improve air traffic operations predictability. The FAA has scheduled meetings to initiate the transfer of this concept to AJV-7. The subcommittee expressed interest in gaining additional information on the results of the SMDP project. The FAA will coordinate a teleconference for this purpose. Work is proceeding on the TMI Attribute Standardization (TAS), Space Vehicle Operations (SVO), and Vertical Conformance Verification (VCV) concepts. All three are expected to be completed before the next NASOPs meeting. AJV-7 is considering leveraging the TAS common ontology for traffic management systems such as the National Traffic Management Log (NTML). The SVO project is conducting dynamic demonstrations of the SVO concept to high level FAA management—initial feedback has been very positive.

Presentation Review Findings and Recommendations/New Actions
Presenter *Steve Bussolari*

Discussion: Mr. Bussolari led the subcommittee in a discussion of the open UAS F&R (Fall_2016_1-UAS). Members noted that the FAA had demonstrated progress related to engaging the UAS user community and leveraging the new FAA UAS leadership structure to prioritize and plan UAS research and development across agency budget elements and organizations. Based on the official FAA response and demonstrated success, the subcommittee closed F&R Fall_2016_1. Integration of UAS into the NAS still poses a significant challenge and so the subcommittee requested UAS deep dives be added to the next NASOPs agenda. Requested topics include air traffic management considerations, UTM, and the Pathfinder Program. The intent of that session will be to review lessons learned, identify additional research needs, and to identify opportunities to leverage this early research. The subcommittee selected March 27-29, 2018 for the Spring 2018 NASOPs meeting. A determination will be made as to whether it will be conducted at Washington, DC or Charlotte, NC. The subcommittee then discussed the OCVM program and noted that when OCVM funding was moved from the NextGen portfolio it became subject to competition with implementation pressures. The group stressed the importance of early concept development activities as key programmatic risk mitigation investment tools. The subcommittee identified this as a topic for an F&R (Spring_2017_1-OCV) along with a recommendation that the FAA assign high priority for operational concept validation investments to mitigate risks for programs nearing implementation.

Presentation Update – National Aviation Research Plan (NARP) Redesign
Presenter *Shelley Yak, FAA Technical Center Director*

Summary: Ms. Yak provided an update on the effort she is leading to improve FAA's NARP structure and content to more effectively communicate the agencies Research & Development strategy and priorities. The NARP, which provides a 5 year R&D planning outlook, is submitted to Congress annually in compliance with the United States Code. Although legislatively mandated, there is some latitude in its specific structure and content. As key advisors on FAA R&D efforts, Ms. Yak is presenting her plan to the REDAC subcommittees to request feedback and guidance. Ms. Yak noted that the new version is expected to include driving forces, overall research strategy, prioritized research needs, what resources are aligned to each activity, and relevant emerging technologies. Together this information will communicate budget decision impacts, mitigations, and research alternatives. Members of the subcommittee suggested clearly identifying research gaps, maintaining a portfolio of projects that can be selected based on the amount of acceptable project risk, and fostering industry collaboration. The subcommittee took the action to compile their feedback and provide it to the NARP redesign team.

Presentation 1A01A Runway Incursion Reduction (RIRP)
Presenter *Ben Marple/Firdu Bati*

Summary: In response to the Fall 2015 NAS Ops F&R, the RIRP manager requested Mr. Bati to present a brief overview of the runway safety metric (RDM) which is being leveraged in conjunction with other metrics to assess the safety of RIRP technologies. Unlike existing metrics, it gauges overall safety across the NAS or at a facility level, and is not limited to runway incursion, accident, or excursion count data. It calculates risk weights for all outcomes based on their proximity to a "fatality" and aggregates these into a score for an entire year. The subcommittee inquired whether runway geometry was reflected in the RDM. The FAA responded that only "outcomes" are assessed and not specific contributing factors; however, a separate effort is being conducted to identify causal factors and to perform a "factor analysis." A subcommittee member also suggested towered versus non-towered airports might be included in that analysis. Preliminary RDM results demonstrate a steady decrease in overall risk since 1998, particularly for commercial operations. This systematic and comprehensive approach is expected to be deployed as a standard metric by the AJI organization in FY19. The subcommittee noted that the intent of the F&R was for the RIRP program to estimate site-specific costs associated with runway incursions, and to use this cost index to guide RIRP implementation decisions for each airport. This discussion was the basis for the second F&R opened by the subcommittee during this session. Mr. Marple presented FY18 and FY19 plans. The program intends to select sites and install localized surveillance and annunciation technologies at selected airports based on the right-site, right-size model. In addition, Small Airport Surveillance Sensor (SASS) shadow operations will be performed at MIT Lincoln Lab and the technology transferred to industry. The program will also investigate methods to digitize taxi route instructions in support of runway incursion research for Surface Taxi Conformance Monitoring (STCM).

Presentation 1A01C - Operations Concept Development & Infrastructure
Presenter *Rob Hunt*

Summary: The ongoing NAS modernization efforts are accompanied by significant changes in airspace structure, roles and responsibilities of NAS service providers and pilots, procedures, and training. This program conducts concept development and validation activities for these future ATC systems to ensure NextGen goals are met, to derive operational and technical requirements, and to reduce programmatic risk. To illustrate the broad range of relevant focus areas, Mr. Hunt presented a figure depicting how Performance Based Navigation (PBN) and time, speed, and spacing optimization tools in support of Trajectory Based Operations (TBO). The figure demonstrated how extended metering, arrival metering, path stretch, speed advisories, and PBN procedures combine to provide efficient delivery of air traffic beginning as far as 550 NM (nominal) from a destination airport and continuing all the way to the runway surface. It also distinguished between ground-based and flight deck-based technologies. It is also important to make these tools more robust, particularly with respect to weather constraints, as these become more prevalent as the freeze horizon is extended. Members of the subcommittee noted that the figure effectively conveyed

the interaction of numerous interrelated tools and systems, and underscored the integration challenges. Another challenge that was identified was the requirement for new systems to accommodate a mixed equipage environment, which is anticipated to be the case for several years. The subcommittee inquired if there are opportunities to use IPADs or other mechanisms to leverage new ATC tools in non-equipped aircraft and for spin offs to benefit other users. The FAA reported that efforts have already been initiated to investigate the feasibility of using SWIM for other applications. The program recently initiated an effort to develop a step by step scenario of a day in the NextGen NAS. This detailed product will sequentially describe activities from the flight deck, Airline Operations Center (AOC), airport tower, TRACON, ARTCC, Air Traffic Control System Command Center (ATCSCC), and other essential perspectives. It will drive identification of technical, operational, and human factors risks so they may be mitigated.

Presentation Deep Dive - TSAS Benefit Summary
Presenter *Niamh Lowry/Rob Hunt*

Summary: This presentation was provided at subcommittee request to describe how preliminary benefit estimates were developed for Time-Based Flow Management (TBFM) Work Package 3 (WP3). TSAS, a key TBFM component, addressed the operational need for improved sequencing and spacing in the Terminal airspace. It was matured through "table-top" exercises, fast-time simulations, and HITL simulations. The TSS Simulation 2 (TSS2) was conducted by MITRE at Ames in 2013 and simulated mixed-equipage arrival operations into PHX. PHX was selected because that site had TBFM/TSAS adaptation including RNAV and RNP routes and approaches which were necessary for benefits analysis. The simulation provided metrics on utilization of PBN procedures, flight path efficiency, and management of mixed RNP and non-RNP flights under sustained heavy traffic. The results from this simulation were leveraged to develop operationally representative benefit estimates for TBFM WP3. The TBFM WP3 business analysis demonstrated reduced flight time and fuel burn as a result of reduced vectoring and increased use of radius to fix (RF)-leg approaches. Risk-adjusted benefits across the NAS were estimated to be approximately $1B in FY14 dollars. This total was roughly equally split between airline direct operating costs and passenger value of time.

Presentation Review Findings and Recommendations/New Actions
Presenter *Steve Bussolari*

Discussion: Mr. Bussolari led the discussion which focused on F&Rs and action items. The subcommittee confirmed the need to open an F&R regarding FAA OCV initiatives. The focus of this F&R will be to encourage the FAA to place high value on OCV activities as they are inherently less costly than later phases and are among the most effective mechanisms for reducing programmatic risk. The committee also determined that an F&R was appropriate for RIRP. This artifact will recommend that the RIRP estimate the cost of runway incursions by specific airport (benefits pool) and then use this information when selecting suitable RIRP technologies. Next, the subcommittee took the action to compile formal feedback on the NARP redesign effort

and deliver it to Ms. Yak by April 3rd. Before convening, the committee opened an action to add a UAS deep dive on UTM, ATC, and Pathfinder to the agenda for the next NASOPs meeting.

Day 2 – March 22, 2017 (CSSI Conference Room)

Presentation Review Findings and Recommendations/New Actions
Presenter *Steve Bussolari*

Discussion: Mr. Bussolari led the subcommittee in a review of the draft RIRP F&R. The subcommittee continued to discuss content for the OCV F&R before convening the meeting.

Presentation 1A07A0NextGen – ATC/Tech Ops HF
Presenter *Stephanie Kreseen (for Paul Krois)*

Summary: NextGen ATC human factors (HF) tasking is structured in two consecutive phases: modernization (infrastructure focused) and transformation (transition focused). The modernization phase concludes this fiscal year as systems have reached implementation maturity. The enterprise HF budget line item (BLI) for FY18 and FY19 will be used to provide guidance to OCV teams and help proactively identify human performance risks and mitigation strategies for NG systems. Benefits will include improved tools and techniques which will translate to reduced controller workload, increased levels of user acceptance and system utilization, and increased safety. The subcommittee asked if individual programs consulted directly with the HF organization. The FAA reported that this does not typically occur for several reasons. NextGen HF staffing does not have the resources to provide support beyond guidance and, if additional work is needed, sponsors must provide the funding. Additional HF personnel are on staff within the Air Traffic Program Management Organization. The subcommittee noted the importance of change management as NextGen moves forward and the need for HF participation soon after new technology and procedures are deployed. In FY18 and FY19 the NextGen Enterprise projects will include HF guidance for the integration of ATC spacing tools, user trust in automation, and contingency operations in a degraded NextGen environment. When asked, the FAA reported that projects typically follow a 3 phased approach: 1) Literature review study design, 2) Field data collection or HITL, 3) Guidance. The subcommittee suggested one way to maximize HF support might be to participate in program-funded HITLs. FY16 and FY17 Integrated NAS Design and Procedures (INDP) funds will support PBN human performance metrics as well as human factors considerations for established on RNP, integration of ATC spacing tools, and contingency operations. Remaining funds from the controller efficiency BLI (i.e., prior to FY16) will support HF system level guidance to display of information on ATC time-based system, procedures guidebook, a traffic flow management tool assessment, technical operations HF, airport and weather information integration, and human-automation system resiliency. One committee member suggested that it might be appropriate for the FAA to assign a Chief Scientific and Technical Advisor for NextGen Human Factors, as AVS has done for flight deck human factors.

Presentation A11.i Air Traffic Control/Technical Operations Human Factors
Presenter *Dan Herschler*

Summary: This BLI provides R&D products and consultation services to improve the safety and efficiency of ATC systems being developed under FAA acquisition programs. Eligible programs are determined by prioritization assigned by the ATO HF R&D Roundtable and ANG-C management. The HF Roundtable is sponsored by five cross-functional organizations: Management Services (AJG), Safety and Technical Training (AJI), Program Management Office (AJM), Air Traffic Services (AJT), and Technical Operations Services (AJW). Key activities include measurement of controller and technical operations (tech ops) specialist performance, HF recommendations to improve systems and procedures, and HF acquisition support via the In-Service Review (ISR) checklist. Plans for FY18 and FY19 include Display Design Standards & Guidance for ATC and Tech Ops, Tech Ops Workforce Transition Job Analysis, HF Considerations of NAS ATC Capability and Equipment Utilization, ATCS Training and Selection, and Runway Safety Analysis. A member of the subcommittee appreciated the importance of the ATC selection task, noting that controller staffing is one of the most critical issues facing the FAA and that attrition will only add more pressure. When asked, Mr. Herschler provided details on the ongoing N90 OJTI Training task. Out year products will include a Tech Ops GUI style guide, an ATC standard color palette for color vision deficient users, and recommendations to support the policy decision on the use of the Radar Vectoring Aptitude Test (RVAT) for job placement. This BLI is supported by approximately 30 federal employees. Although no contractor funds are designated for this program, unused Personnel, Compensation, Benefits and Travel (PCB&T) funds from previous FYs are carried over. This year these funds are sufficient to provide funding to the FAA Technical Center and Civil Aeromedical Institute research performers for required contract support for the nearly 20 FY17 priority projects selected by the HF Roundtable.

Presentation Aviation Weather Research Program (AWRP)
Presenter *Steve Abelman*

Summary: As requested by the subcommittee during the Fall meeting, Mr. Abelman conducted a deep dive into aviation weather products. This included a live demonstration of operational and experimental weather applications from the aviationweather.gov website. Among the key products demonstrated were: Graphical Turbulence Guidance (GTG), Current and Forecast Icing Potential (CIP/FIP), Helicopter Emergency Medical Services (HEMS) Tool, and Aviation weather Testbed. The weather group is currently researching how best to integrate and distribute GOES-16 lightning data—a major challenge is the bandwidth demands for this frequently updated data source (2-5 mins). Mr. Abelman reported that the Aviation Weather Division (ANG-C6) is managing development of the Common Support Services-Weather (CSS-Wx) WP2 through the Investment Analysis Readiness Decision (IARD). CSS-Wx uses international data access and format standards to provide a common web-based service for NOAA (National Oceanic and Atmospheric Administration) and FAA NWP (NextGen Weather Processor) products. Following IARD, the Wx division will continue to provide SME input until the capability is transferred to the field. When asked by the

subcommittee if new Wx products were being integrated into the platform, the FAA reported they were and identified recent wind products as an example. Mr. Abelman then provided information in response to the subcommittee's open action item on the Wx Requirements Management Board. The CSS-Wx/NWP Requirements Working Group is currently finalizing system-level requirements in support of a Final Investment Decision (FID). The board is led by the weather program within the ATO program management organization (AJM-33) and includes support from ANG-6 and AJV-7. The subcommittee then noted the importance of wind data for UAS operations particularly standards on how good that data needs to be. Lincoln Labs has completed a gap analysis which is being socialized. Due to subcommittee interest, Mr. Abelman will demonstrate UAS weather products to the subcommittee in an upcoming meeting.

Presentation Review Findings and Recommendations/New Actions
Presenter *Steve Bussolari*

Discussion: The subcommittee briefly discussed the two F&Rs that were being prepared and confirmed that an action item would be added for a deep dive on UAS Wx products.

Presentation NASA Topics - Unmanned Aerial System Traffic Management Concept (UTM) Update
Presenter *Joey Rios*

Summary: The FAA and NASA are closely collaborating on the UTM project. The FAA provided details earlier in the meeting on agency guidance to the UTM architecture and approach. In this presentation, Mr. Rios focused on technical aspects with respect to the conduct and results of the TCL1 and TCL 2 demonstrations. The 2015 TCL 1 demonstrated multiple VLOS operations at 2 locations. The key objective was to demonstrate UTM prototype features. Supplemental data was collected on UAS navigation performance, tracking UAS, weather impact, and UAS noise signatures. When asked by the subcommittee regarding the capture of latency, NASA reported that send and receive times were captured in TCL 2. The team learned that ground equipment is susceptible to high temperatures, spectrum interference will result in lost link, GPS can be degraded, winds on the ground were not indicative of those aloft, and LOS is difficult to maintain in the presence of other UAS. In addition, all airspace users should have a common picture of the operating environment as lack of airspace and operations information caused conflicting planned operations. In 2016 the team conducted a demonstration management of geographically dispersed operations using the 6 FAA UAS test sites. During this activity the UTM successfully managed 100 real flights and as many as 43 simultaneous operations (17 real and 26 manually injected flights). In 2016 TCL 2 demonstrated multiple BVLOS operations at 5 locations at a remote Nevada test site. Four operational scenarios were performed: an agricultural application, search for a lost hiker, oceanic data collection, and damage assessment after an earthquake. The subcommittee inquired into how violations of geofenced airspace were handled. In this study, UTM manager verbally announced the alert to the UAS operator who then returned to base. NASA noted that these initial demonstrations were a starting point and will evolve. The demonstration resulted in observations on

nominal aircraft endurance, impact of atmospheric conditions on UAS, and findings that altitude reporting is inconsistent between UAS. Key findings included that a common awareness of all airspace constraints and hazards is essential for safe BVLOS operations and that industry standardization can reduce the risk for BVLOS operations. A member of the subcommittee suggested that preliminary requirements might be drafted based on what was learned from TCL1 and 2 (e.g., standards for UAS altitude reporting and alerting methods). In 2017 multiple BVLOS test will be conducted at all FAA test sites and will focus on geofencing technologies, ground- and air-based sense and avoid, HF and other considerations.

Presentation Complete Recommendations/ Wrap up
Presenter *Steve Bussolari*

Summary: The subcommittee convened to finalize actions and F&Rs. The group noted that UTM TCL1 & 2 made important preliminary steps in the implementation of UAS operations and that significant research remains. The subcommittee requested the following be presented at the next meeting: 1) UAS update (Pathfinder Program, DAC), 2) Joint FAA/NASA deep dive on UTM, 3) UAS weather products. Two F&Rs were opened by the NASOPs subcommittee. The first underscored the importance of operations concept validation activities as a risk mitigation tool (Spring_2017_1). The second recommended that the RIRP estimate the benefits tool before proceeding with implementation decisions for runway incursion prevention technologies (Spring_2017_2). The subcommittee confirmed the next two meeting dates as September 12-14, 2017 and March 27-29, 2018. Mr. Bussolari adjourned the meeting.

PRIOR ACTION ITEMS

August 2015 NAS Ops Meeting

Action	Assigned	Status
1) Inspect the FAA process to move weather concepts from requirements to implementation. Determine if the required elements are in place and if there are disconnects. Consider logistic and level of participation of members on the Requirements Management Board. Provide recommendations to the subcommittee.	M. Weber J. Kuchar	Open

August 2016 NAS Ops Meeting

Action	Assigned	Status
1) Who is part of the Human Factors Roundtable? The subcommittee would like a list.	N. Lento	Closed 9/7/16
2) ***Add to the March agenda:*** TSAS Projected Benefits Follow-Up • What are the projected benefits of TSAS? • Describe the FAAs validation strategy for the ATDs (Ops Concept Validation ATD)	R. Hunt	Closed 3/21/17
3) Provide the subcommittee the *UAS Implementation plan*. Update – the ***UAS Research and Development Plan*** will be available first and delivered ~ mid-2017	S. Magyarits S. Saunders-Hodge	Open
4) ***Add to the March agenda:*** Deep Dive – TBO • How does the Datacomm strategy fit into the TBO holistic strategy? • Technical brief on what was learned from the 4DT study. What metrics were selected?	S. Bradford	Closed 3/21/17
5) ***Add to the March agenda:*** UAS Research Plans • What are the plans for UAS research in the next two years?	S. Bradford S. Magyarits	Closed 3/21/17
6) ***Add to the March agenda:*** RIRP • RIRP benefits analysis, overview of strategy runway incursion cost estimates.	B. Marple	Closed 3/21/17
7) ***Add to the March agenda:*** UTM update • Outcome of NASA October 2017 UTM meeting	P. Kopardekar J. Rios	Closed 3/22/17
8) ***Add to the March agenda:*** REDAC Update • Update on REDAC/NARP Redesign	S. Yak	Closed 3/21/17

Action	Assigned	Status
9) Provide the subcommittee a copy of the Runway Incursion report prepared by MITRE	B. Marple	Closed 9/7/16

CURRENT ACTION ITEMS

March 2017 NAS Ops Meeting

Action	Assigned	Status
1) Provide subcommittee feedback to S. Yak on NARP Redesign	D. Zellwegger	Closed 3/27/17
2) Set up a telcon to brief SMDP results to subcommittee	M. Molz	Open
3) Add to Agenda: Deep Dive - UAS Topics a. UAS in the NAS & UTM/DAC interaction with RTTs (S. Bradford/J.Cavolowsky) b. Pathfinder Program Updates/Organizational Mapping (S. Bradford) c. UAS Weather Products (S. Abelman) (30 minutes)	M. Molz	Open
4) Add to Agenda: RIRP Update – Progress of RIRP benefits analysis (B. Marple)	M. Molz	Open

FINDINGS AND RECOMMENDATIONS

August 2015 NAS Ops Meeting

Findings	Status
1) Runway Incursion Reduction Program (Fall_2015_1)	Closed 8/10/16
2) Unmanned Aircraft System (UAS) Integration in the NAS (Fall_2015_2)	Closed 8/10/16

March 2016 NAS Ops Meeting

Findings	Status
1) Unmanned Aircraft System (UAS) - External Stakeholder Integration and System Engineering Leadership (Spring_2016_1)	Closed 3/21/17

August 2016 NAS Ops Meeting

Findings	Status
1) Unmanned Aircraft System (UAS) - Continued momentum, leverage UAS leadership structure (Fall_2016_1)	Closed 3/21/17

March 2017 NAS Ops Meeting

Findings	Status
1) Operations Concept Validation – Programmatic Risk Mitigation (Spring_2017_1)	Open
2) Runway Incursion Reduction Program – Benefits Pool Estimation (Spring_2017_2)	Open

ATTENDEES

Subcommittee Members in Attendance:

Steve Bussolari (Chairman)
Leo Prusak (Incoming Chairman)
Joe Bertapelle
John Cavolowsky
Emily Stelzer
James Kuchar
Andres Zellweger
Mark Weber
Bruce Holmes

Others in Attendance:

Abelman, Steve
Bati, Firdu
Bermudez, Francisco
Bradford, Steven
Choudhri, Amit
Cook, Maamen
Coon, Jason
Figueroa, Jaime
Fitzpatrick, Kim
Gallivan, Mike
Herschler, Dan
Hunt, Rob
Koros, Anton
Kreseen, Stephanie
Kunchulia, Akaki
Lowry, Niamh
Magyarits, Sherri
Marple, Ben
McNeill, Donald
Molz, Maureen (DFO)
Pray, Gregory
Romanowski, Mike
Roundtree-Coleman, Chinita
Smith, Lisa
Wagner, Ross
Wondolowski, Frank
Yak, Shelley

AGENDA

Tuesday, March 21st (CSSI – John Thomas Room)

Topic	Speaker	Time
Welcome/Overview	Steve Bussolari Maureen Molz	0800-0815
Review of REDAC Recommendations, Responses and Open Actions	Steve Bussolari	0815-0845
Budget Briefing	Mike Gallivan	0845-0915
1A10D NextGen – New Air Traffic Management (NATM) Requirements	Steve Bradford Francisco Bermudez	0915-0945
Break		0945-1000
Deep Dive – TBO • How does the Datacomm strategy fit into the TBO holistic strategy? • Technical brief on what was learned from the 4DT study. What metrics were selected?	Steve Bradford	1000-1030
UAS Research Plans for the next 2 years	Steve Bradford Sherri Magyarits Maureen Keegan	1030-1100
Commercial Space Transportation	Mike Romanowski	1100-1130
1A11 NextGen – Ops Concept Validation Modeling/Enterprise Portfolio Proposals FY18	Jason Coon	1130-1200
Lunch		1200-1300
Sub-Committee Discussion	Subcommittee Members	1300-1330
REDAC Update - REDAC/NARP Review effort	Shelley Yak	1330-1400
1A01A Runway Incursion Reduction (RIRP) Benefits Analysis	Ben Marple	1400-1430
1A01C Operations Concept Validation	Rob Hunt	1430-1500
TSAS benefits from the TBFM WP3 Business Case	Rob Hunt	1500-1530
Deep Dive – Operational Integration Analysis Report (OIAs) • The objective of the OIA is to assess interoperability (concept validation)	Rob Hunt	1530-1600
Break		1600-1615
Sub-Committee Discussion	Subcommittee Members	1615-1645
Dinner – location TBD		1800

Wednesday, March 22nd (*CSSI – John Thomas Room)

Topic	Speaker	Time
Review Findings and Recommendations / New Actions	Steve Bussolari	0800-0830
1A07A0 NextGen ATC/Tech Ops Human Factors	Paul Krois	0830-0900
A11.i Air Traffic Control/Technical Operations Human Factors	Dan Herschler	0900-0930
Break		0930-0945
Deep Dive – Aviation Weather Research Program (AWRP) • Demonstrate Aviation Wx Products/NextGen Integration • Status of the Requirements Management Board	Steve Abelman	0945-1045
• Sub-Committee Discussion	Subcommittee Members	1045-1130
Lunch		1130-1230
NASA Topics - Unmanned Aerial System Traffic Management Concept (UTM) Update	Joey Rios	1230-1400
Break		1400-1415
Sub-Committee Discussion	Subcommittee Members	1415-1445