

**AAM Ecosystem Working Groups
National Campaign Breakout 2**



What are your overall thoughts on the NC Series top-level goals? Improvements to the current language? What is Missing?		
Objectives	Improvements to the current language	What is missing
<p><i>Accelerate Certification and Approval:</i> Establish initial requirements to inform vehicle certification, pilot licensing, and operational approval.</p>	Certification: Develop standards for vehicle airworthiness certification, airman certification and flight operations	Are unauthorized operations being considered?
	No improvements to current language needed	New category for VTOL aircraft will be key component for the success of these operations. This is a concern that has been raised when discussing Concept of Operations with design
	Set a timeline vs. just "accelerate"	Is AAM advanced enough?
	Review existing Pt. 61/91/135 regulations to inform where gaps for eVTOL certification	MFR and airspace provider
	Change "establish" to "recommend" as you earlier said you don't want to step on the FAA's toes, but "establishing" the requirements seems to do just that	Land and heliport developers
	Accelerate [Safe] certification and approval	Insurance constraints, need certified pilots to fly
	Clarify focus is on aircraft. ATM systems should be separate (if at all)	Certification for eVTOL vs. Helicopter. What is the approach?
	Utilize 21.17(b) and accelerate application through resourcing and training Aircraft Certification Offices in the efficient application of the rule	Data security?
	Focus on scaling 14CFR135 to appropriate levels of rigor	The absence of "safety" could be interpreted as a rush to market
	Why initial? How about certification of the UTM provider?	I am not sure how "establishing the initial requirements..." accelerates certification
	What will be the certification basis? Part 23?	How do you cover pilot certification beyond aircraft certification?
	There is currently no baseline for UAM. The certification basis will be handler be the FAA Certification Office (AIR)?	LA seeks industry input through regulatory bodies. Leverage the work these bodies have performed for sUAS and expand to larger vehicles
What does pilot licensing look like? UAM type licenses or something else	Include UTM provider certification	

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<p><i>Accelerate Certification and Approval</i>: Establish initial requirements to inform vehicle certification, pilot licensing, and operational approval.</p>	<p>Certifications shall also embed some land mobility rules and limits, and use as much as possible land signals (somehow)</p>	<p>SDSP certification</p>
	<p>What does accelerate mean? Suggests slipping of existing safety standards</p>	<p>Develop standards for electric and distributed propulsion taking into account thrust to weight ratio to provide sufficient safety factors in case of propulsion system failure</p>
	<p>Are the existing certification processes still valid? These should be utilized as much as practicable</p>	<p>EASA looking to certify pilots</p>
	<p>Incremental/phased approach autonomy levels by subsystems</p>	<p>Establish requirements for vehicle certification, pilot licensing, and operational approval</p>
	<p>This makes sense. Do not need to add anything here</p>	<p>What is the scope/objective for certification - aircraft vs. airspace vs. operations?</p>
	<p>Streamline and improve rather than accelerate</p>	<p>Certification and approval scope: does it include ground infrastructure and ATC?</p>
	<p>Vehicle airworthiness (add clarity)</p>	<p>Testing...?</p>
	<p>Operational approval (not clear). Is it operator certification?</p>	<p>Pilot training pipeline. sUAS roll-out was chaotic and there is a pilot shortage (outside of COVID)</p>
	<p>Is it NASA and/or the NC's role to establish any requirements? Seems out of scope and FAA's role</p>	<p>Single or dual pilot license?</p>
	<p>Rather than "requirements", maybe "methods of obtaining compliance"</p>	<p>International STDS to account for. Singapore well positioned here</p>
	<p>More focus on eVTOLs and different airframes. Pilot licensing should focus on scenario-based testing, and not solely an online test (such as Part 107). Pilots must be expecting to go through training and testing and accumulate hours before deployment. Pilots should also have type-rating based on the airframe they are operating</p>	<p>Where does autonomy fit with certification in this statement?</p>
	<p>Remove "inform"</p>	<p>Define user interface guidelines for AAM cockpit design</p>
	<p>Remove "initial"</p>	<p>Allow eVTOL certification processes to be done outside of the U.S. We are offering an ecosystem in Columbia</p>

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<p><i>Accelerate Certification and Approval: Establish initial requirements to inform vehicle certification, pilot licensing, and operational approval.</i></p>	Need both near term, eye on the prize, and far out well defined. Although, far out does not need to be as well defined	What do we do with designs like the Airbus pop-up? There is a cab, airlift system and a ground base
	Remote pilot licensing	Certification of remote pilot workstations should be there, may or may not be considered part of vehicle certification
	Will comfort/ride quality be a factor from a safety standpoint for certification?	"Air Vehicle"
	Type and airworthiness certification (includes conditions and limitation)	Need to qualify operational approval
	The varying degree of automation of the vehicles may have different requirements of the pilot. How do we make that consistent?	Airspace access, pilot requesting access, airframe approval, be more specific
	Can it be more specific? Aircraft certification, aircraft manufacturing, pilot licensing, pilot training...	Waiver guidance
	Unclear for certification and approval if for manned or unmanned vehicles. Anticipate objective FAA TC criteria will be different for each	Autonomy required/limits allowed (similar for cars for vehicle)
	I think this should be separated into two: aircraft certification and pilot licensing requirements	Autonomy for vehicle is separate from components in the vehicle
		Currently looking at 5 levels
		Functional requirements and foundation for testing and certification. This must be a consortium effort, where the entire industry is leveraging the efforts and helping the FAA
		Autonomy
		UML levels - progression may not be feasible as quickly
	NASA has large contributions	

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<p><i>Accelerate Certification and Approval:</i> Establish initial requirements to inform vehicle certification, pilot licensing, and operational approval.</p>		Altitude indicator - traditional aircraft vs. autonomy - vehicle and operator requirements - blurred lines in unmanned - where pilot acceptable (pilot if autonomous?)? Define initial requirements is important...what role of humans? Safety pilot on-board would ease certification approval - so, I would assume necessary for near term and scope towards autonomy
		Certification of new remote crew
		vehicle + ground station, maintenance certification
		Level of automation, certification for highly automated vehicles...How to certify algorithms.
		End state vs. requirements
		Stay focused on requirements, demo those...
		Less on certification and approval
		Define standards for piloting multiple vehicle simultaneously
		What about certification of ground infrastructure, U4-SS, and/or other aspects besides just vehicle?
		What about minimum platform performance or constraints?
	What about equipage requirements?	
<p><i>Develop Flight Procedure Guidelines:</i> Demonstrate refined flight procedures and related airspace design criteria that address scalability and safety. Develop preliminary guidelines for vertiport designs and implementation.</p>	Connection to other modes of transportation for vertiport	Route based operation with precise 4D trajectories or pretty dynamic evolution of trajectories and flight
	Airport infrastructure requirements will be an important consideration for the operation based at an airport	Details on safety - safety for passengers, users of other modes/pedestrians?
	If not already doing so, talk to/work with EASA, Japanese, and Korean government FAA/NASA equivalents	Community input on vertiport design and implementation process
	Indicate how vertiport design would differ from current standards for heliport design	AFR vs. IFR VFR paradigm?

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<p><i>Develop Flight Procedure Guidelines</i> : Demonstrate refined flight procedures and related airspace design criteria that address scalability and safety. Develop preliminary guidelines for vertiport designs and implementation.</p>	Consider separating flight procedure guidelines from vertiport design guidelines. They are related, but not exclusively	Heliport and vertiport requirements adequate? What is being used?
	Speak with Chuck Clauser at PS&S Warren NJ. He is working on vertiport designs as an architect. Can be contacted through VFS	Including stakeholders?
	Design criteria including the impact of AI and deep machine learning that address traffic management, scalability, etc.	Establish separation standards, and approach speed standards, so that capacity of a given route could be assessed
	Does the phrase "design criteria" apply to both flight procedures and airspace design, or only the latter? It is unclear...	Add "calculate standards for determining obstruction criteria for eVTOL navigation and approaches in cluttered urban spaces"
	May break these into separate objectives. Vertiport design should be different from flight	Altitude references
	Are these pillars - airspace, flight operations, physical infrastructure, and regulatory?	Procedures/airspace design for terminating and reinitiating approach
	Recommend splitting, as "flight procedures" is commonly thought of as TERPS-compliant flight paths. Vertiport designs are currently being pursued by FAA through their Broad Agency Agreement (BAA) solicitation, which I believe will result in a new Advisory Circular (AC) related to	Include potential impact/interaction with controlled airspace
	Seems that the last phrase about "vertiports" is not linked to the "flight procedure guidelines".	Agree with procedures/airspace design addition
	These seem to be 2 different objectives	Is the objective explicitly asking for "new" airspace structure proposals?
	Are we going to assume these aircraft are going to be more like rotorcraft for flight procedures, or will these be flight on wing transitioning or vertical lift capabilities?	Balance operating procedures with airspace design, especially when deciding controller involvement
	There may be a need to reduce speeds when coming into urban areas or in vicinity of vertiport - will have to consider restrictions for the speed	Include minimum equipment list (MEL) as part of flight procedure and airspace operational criteria
Are we assuming a vertiport has no lateral aspect (i.e. a runway of any sort or taxiing procedure?)	Establish requirements for flight missions. They should be standardized	

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<p><i>Develop Flight Procedure Guidelines: Demonstrate refined flight procedures and related airspace design criteria that address scalability and safety. Develop preliminary guidelines for vertiport designs and implementation.</i></p>	Otherwise you have to have Gate-to-Gate transition, denied GPS and procedures for the (i.e. low vis ops)	Include emergency procedures in case of a critical failure during flight
	For IFR/Denied GPS approaches, the approach likely needs to have a defined segment for obstruction	Extend vertiport designs by including actual footprints (parking, rooftops, gardens, etc.)
	...refined flight procedures based on prescribed mission depending on aircraft category/weight etc.	Who will be responsible for vertiport inspections? State?
	public vs. private vertiports	Vertiport funding - mix of federal/state/local vs. private?
	Agree with this top level statement	Does this include manned flight procedures or only UAM flight procedures? How do you delineate?
	Substitute "initial" for "preliminary"	Will there be zoning regulations associated with location of vertiports?
	Recently developed industry standard for vertiport design - use existing standards as a source (ASTM standard in resolution process) WK59317 Vertiport Design (in development)	Noise abatement procedures will likely require defined courses to avoid sensitive areas
	"Implementation" (unclear)	Need to take into account pushback from both residents and legal regarding noise and even the approval of vertiports within communities (needs legal framework)
	Possibly split the two as the second is more vehicle dependent while the first is a person issue	Vertiport design should not be part of flight procedures - it should be its own objective IMHO
	Define airspace design criteria	Understand the information and task requirements for operators to support user interface design
	More focus on VFR/IFR/IMC type operations is required	Allow airspace integration architectures to be evaluated in other countries. We are offering an ecosystem in Colombia
	Urban - loss link (needs to be solves across airspace). Integration into existing airports.	In addition to scalability and safety, consider efficiency

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<p><i>Develop Flight Procedure Guidelines : Demonstrate refined flight procedures and related airspace design criteria that address scalability and safety. Develop preliminary guidelines for vertiport designs and implementation.</i></p>	Need for separation. Explicitly state after airspace design (and separation) criteria - plays into vertiport and airspace approach procedures	Lessons learned from UTM
	Need close separation in higher space operations	Integration of automated procedures for clearance and rerouting
	Clarify flight procedure term - is it performance char and separation from ground/obstacles vs. ATC	The "classical" issue of local control/ownership of airspace to facilitate high-volume ops
	Strengthen guideline with "approved recommendations" or "best practices"	Coordination between AAM/ATM and vertiport
	Use of TERPS or new Standards	And affects transit rights of other aircraft without participation in AAM, perhaps
	Link with #5; noise will be a primary consideration of where a vertiport is sited and where to the routes originate and terminate	ADS-B integration plans
	Building codes for AAM modification	Flight corridors, reliable UTM systems, and integration of UTM and ATM. Development cannot be happening in silos. Rather, testing of systems and subsystems must start at a micro level prior to reaching a macro level. Unit testing is necessary
	Separate minimum in an urban canyon and weather minimums	Vertiport guidelines need to recognize that there may be requirements from the local jurisdiction side as well
	I think there needs to be clarification of how flight procedures will be approved by the FAA/ATO. Will there need to be a full environmental analysis before approval?	Flight procedure for mixed autonomous and piloted-transition (should be noted)
	Will all UAV/UAM follow the same flight procedure requirements?	Level of controller involvement
	What is meant by "Flight Procedures"? Flight procedures are dependent on mission requirements, environmental constraints , vehicle performance...these items need to be developed first	Impact of manned aircraft performance, maneuverability
seems like these are two separate objectives	Flight, + "ground pre flight, operations, and maintenance" procedure guidelines	

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<p><i>Develop Flight Procedure Guidelines:</i> Demonstrate refined flight procedures and related airspace design criteria that address scalability and safety. Develop preliminary guidelines for vertiport designs and implementation.</p>	Separate path for piloted and autonomous certification requirements	Fuel reserves: Destination + 20 minutes may be hard to achieve initially for eVTOL
		Weather minimums
		Should we include "security"?
		Define route width and spacing in urban corridors
<p><i>Evaluate the communication, navigation, and surveillance (CNS) Trade Space:</i> Assess industry supported CNS technology to establish initial requirements.</p>	Navigational accuracy will be critical in high volume airspace	Develop requirements for guidance, navigation, and control during approach, departure, and landing of VTOL vehicles
	Trade space and ensure integration with other manned aircraft including ADS-B, is seamless	Are there other spaces that should be included here? Search and Rescue? Deliveries? Why are CNS singled out?
	Define "Trade Space". Establish industry standards that vendors and manufacturers should follow, so we don't end up with multiple disparate systems	Addition of "gap analysis" in addition to "Trade Space" may provide a better understanding of the goals under this objective
	Probably already in place, but for this and all aspects of AAM - protect our technology developments in all areas from being transferred to hostile foreign governments through sale of an eVTOL company	Define non-cooperative surveillance requirements - Ground, Air, and On-board (i.e. Flash LIDAR, radar, etc.) that would meet safety performance requirements
	Please drop "initial". Also, the requirements should be agnostic of what technologies are currently available	What kind of requirements?
	Define the requirements for a V2V network	What decision support systems are needed and is there a tradeoff between local versus central/cloud-based DSS
	The FAA's certification basis will identify the requirements for CNS	Weather and navigations are layered
	Garmin emergency decent and landing system; used for pilot loss of consciousness and does auto comm's with ATC	Think about contingency management for CNS failures; possibly an automated solution. Can existing infrastructure scale down to this urban environment?
	"Trade Space" sounds like an inaccurate description of a trade-off. What is meant by trade space?	Easy to understand these objectives through simulated environment testing

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<p align="center"><i>Evaluate the communication, navigation, and surveillance (CNS) Trade Space: Assess industry supported CNS technology to establish initial requirements.</i></p>	"Current" instead of "industry supported"	Consider established ground based communication like DSRC
	I assume industry supported CNS technology does not "establish initial requirements", but instead contributes to establishing requirements?	How will this impact GA aircraft that are not required currently to broadcast location (e.g. ADS-B)?
	Participation of telecom operators and satellite operators to support BVLOS missions, while leveraging the coverage with 4G/LTE/5G networks with dedicated slicing mechanisms for each aircraft. This is how each aircraft will have its own frequency and call sign for communication	It should be CNS-TW, where "T" is timing and "W" is weather. Both timing and weather are important if the densities get high
	Communication, navigation, surveillance - one can supersede another - know where there are redundancies to other systems. It depends...define initial solution and then iterate from there (start with a solution)... 5G-more security, lower latency...start LTE and collapse solution space for communication and navigation so CAN start designing something...navigation is generally consistent so don't remain in fictitious trade space - iCNS	This needs to include cyber security and data privacy issues
	Need for backup	Reliable systems for BVLOS especially while flying in CTR. Need redundant comms on the aircraft, and possible frequency hopping mechanisms to be able to survive jamming and GPS spoofing
	Strengthen the work "Evaluate" to "Establish common architecture for"?	use of commercial cellular and associated performance requirements
	What CNS is needed that doesn't exist today?	Remote ID
	Requirements for Cooperative Surveillance vs. Non-Cooperative	C2 link listed separately (seems intended for XTM)
	GPS will not meet all requirements, especially in urban canyons	If not controlled by ATC, then is there a need for surveillance?
	Swap "assess" with "advance"	ADS-B: 16,777,442 unique 24 bit addresses, will the technology be available for AAM?

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<p><i>Evaluate the communication, navigation, and surveillance (CNS) Trade Space: Assess industry supported CNS technology to establish initial requirements.</i></p>	Remove "initial"	Vehicle to vehicle communications
	Initial cost estimate for trade space used by UAV/UAM?	CNS technology requirements will be different for manned vs. unmanned and/or autonomous. It is important to differentiate across NC
	Cost in terms of using airspace above specific city/county?	Assess industry supported and existing CNS technologies
	What does "industry-supported technologies" mean? Why not just "CNS technologies" or "commercially available CNS technologies"?	What is the scope of the CNS trade space? Vehicles, ATM, vertiports, multi-modal support, etc.?
	Is the objective to establish validated technical requirements for commercially available CNS technologies?	
	Clarify "industry supported". Is it "industry solutions"?	
<p><i>Demonstrate an Airspace Management Architecture: Demonstrate and document a refined airspace system architecture capable of safely and reliably managing scalable AAM operations without burdening the current air traffic management system.</i></p>	It would be difficult or impossible not to burden the current ATM system. Recommend changing the verbiage to integrating with current ATM system	Which densities of operations are considered for the first demos? How many vehicles will be "vehicles"?
	An airspace management system that can manage AAM traffic within UTM trade space	Details of architecture: software and infrastructure
	A new system independent of the current ATM> What is the objective?	Define roles. Who/What agencies/entities will manage airspace in different jurisdictions, altitudes, geographies, etc. to assess impacts?
	Interoperability/interaction with the UTM?	Securely
	Move from segregated airspace to integrated airspace	Whether the Airspace Management system needs to also integrate with UTM
	change to "undue burden"	Define through regulation where UTM and ATM meet. Working group including NASA and FAA and industry that poses the question in concert with technical solutions
	"Integration" rather than "burdening" air traffic system necessary for future volume	What is the handoff going to look at between UTM (sub 400AGL) to higher altitudes where you have traditional ETC services?
	Global harmonization of terms	Create UVRs for normal

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<p><i>Demonstrate an Airspace Management Architecture:</i> Demonstrate and document a refined airspace system architecture capable of safely and reliably managing scalable AAM operations without burdening the current air traffic management system.</p>	Should it be "interoperable" versus "burdening"?	Considerations of traditional ATM, as well as UTM, and grey area in between (AAM). Looking at 91.119 for basis
	Scalability - sheer numbers / aircraft density, transportation provider coordination (multi companies)	Regulatory framework needed for the safe and reliable airspace management
	Need scalability to address provider coordination in addition to just traffic	Allowing for all operators to access the airspace management system. Equitable access.
	Need a central repository for all airspace data to all providers. Provider agreement to supply data and how much data each provider will share needs discussion	Maybe a certain level of burdening the current air traffic management system is acceptable, particularly in emergencies?
	Data sharing may get into the various UTM data exchange issues - and nuance in a federated environment. There are also issues of open source protocols that appear to be getting more traction	Think about more than one solution, not just UTM type system?
	Collaboration and co-creation with other agencies like EASA, SESAR JU, etc. the U-space has proven to be a very effective mechanism and architecture for UTM and not efforts are made to integrate UTM with ATM with an eye in AIM to SWIM conversion as well	Make sure we have a solution if weather changes to IMC unexpectedly
	Good	What about deconfliction when the AAM and ATC functions overlap?
	We use terms air corridors long, lat alt separation	5G up to 400 feet and full communication automation between vehicles and infrastructure
	This implies segregation and not integration	Do we need to address UTM and UAS operations as well?
	Flexible use of airspace, need to have dynamic airspace usage	Airspace integration architectures for UAM. AAM should be thought out of the box and not the traditional aviation way
IFR-like? Until the sensors are sophisticated enough to guarantee separation from clouds, how do we ensure flight will be visible to VMC ops and stays clear of icing?	Evaluate AAM operations concepts in real-time simulations to ensure humans and automation can manage the traffic	

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<p><i>Demonstrate an Airspace Management Architecture:</i> Demonstrate and document a refined airspace system architecture capable of safely and reliably managing scalable AAM operations without burdening the current air traffic management system.</p>	Managing both "small UAV and large eVTOL" in scalable AAM	These architectures should be allowed to be tested outside of the U.S., Varon Vehicles is creating an ecosystem for this in Columbia. Offering faster and cheaper processes, from testing and certification, to servicing. This should be allowed
	Air Traffic Supervision vs. Air Traffic Control	This should include the evaluation of a V to V communications capability
	Replace "without burdening" with "integrating into"	For emergency responder, we may need to integrate with the current command and control system
	Is this going to be similar to UTM?	AAM issue - observe lack of notional intent for integration with ATM
	Why start with demo? Does this need a design and simulation first?	Lessons learned from UTM
	Is there going to be a sharp limit between UTM and ATM?	Airspace management architecture: Hopefully (largely) only short-term labor and human-factors constraints on the interop/integration
	Optionally piloted aircraft are going to be under UTM, ATM, or both?	Data used for airspace/air traffic management like fuel available, number of passengers in system for emergency use but not visible to other providers unless needed
	Replace "refined" with "tailored"	The ASTM F38 draft UTM spec's Discovery and Synchronization Service protocol is substantially focused on limiting the need to share proprietary info - and instead serves as more of a phone book
	Very low altitude (0 - 400 ft.) needs specific attention due to much higher traffic density and 0 - 100 ft. close coordination with DOT is recommended	Technology for tactical and strategic policies and procedures for deconflict mechanisms. Separation vs. segregation is still a debate. Happy to go into more details on this point, as this is a topic we are heavily focusing on in EASA, Euro control and SESAR JU meetings
Does "refined airspace system arch." refer to the existing FAA ground automation?	Today separation of operations through airspace, will the future use airspace to separate or technology?	

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<p><i>Demonstrate an Airspace Management Architecture:</i> Demonstrate and document a refined airspace system architecture capable of safely and reliably managing scalable AAM operations without burdening the current air traffic management system.</p>	Rulemaking to allow AAM aircraft to use controlled airspace without additional communication with ATC	Contingency operations
	The architecture will follow from the policies and procedures. Perhaps the objective should emphasize policies/procedures rather than architecture	If technology can ensure separation, can operations be performed without ATC involvement?
		LAX Class B VFR transition routes as a model
		Very unlikely humans will be able to provide separation services
		While ensuring safety, efficiency, and fair/equitable access
		Does the assumed AAM AOM integrate with the current ATM? Unclear. Seems the two will need to be integrated
<p><i>Characterize Community Considerations:</i> Conduct expanded characterization and initial impact assessment of passenger and community considerations through community feedback and measurements such as vehicle ground noise, cabin noise, and on-board ride quality.</p>	Add "safety" ahead of ground noise	Environmental impacts other than noise (i.e. wild-life, etc.)
	Include the AAM Route Design	In NY, community involvement will be a critical aspect of the success. Noise will be a very important issue to tackle. It is never too early to get the community engaged
	Ground safety?	Privacy consideration balancing impacts and ensuring widespread/equitable access to new modes and technology
	Be sure to capture and emphasize (positive) economic impacts to the community. The "trickle-down" economic values to local economies and national economies	Accessibility of vertiports. Can I easily get to/from where I want to go?
	Additionally, quantify reductions in ground traffic, congestion, lost-times/productivity	Need to add community considerations for non-users
	Any survey planned to understand the concerns and needs of the society?	Lots of environmental and community measurements could be included here, suggest a refined, specific list tailored to NASA capabilities/areas of interest

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<p><i>Characterize Community Considerations: Conduct expanded characterization and initial impact assessment of passenger and community considerations through community feedback and measurements such as vehicle ground noise, cabin noise, and on-board ride quality.</i></p>	From passenger point of view, rationale for selection of landing spot and distance to final destination	Investigate the local jurisdiction EXECUTIVE LEADERSHIP economic drivers and their concerns for integrating and managing a new transport capability within their community
	Include recommended maximum G forces for nominal flight (climb, turns, descents)	I do not understand how "community feedback and measurements such as.." will fully cover the passenger considerations area. It appears to define "community" as those outside the vehicle so I recommend adding a feedback channel from the expected passenger base
	Characterization of impacted communities: community surrounding air corridors vs. community right underneath corridors. Concerns might differ	Vary flight altitudes and take off thrust input to reduce noise at night
	Safety measures and how to communicate these to both communities are a very important aspect to consider here	Missing community considerations such as risk to on ground infrastructure/roads. What happens when UAMs need to make emergency landings on roads or rooftops?
	Two communities: 1) The traveling public (customers) and 2) The community living and delivering (activity around these areas)	Need plan for extreme emergencies if the aircraft has partial loss of control
	Define community	Development of testing and research procedures
	How will existing FAA policies apply (e.g. 1050.1, 7400.2, etc.)	Include aircraft noise study research results that have been done in the past
	Is the impact assessment "..of considerations" an assessment of impact on the community or of impact to the deploy-ability of AAM?	What are the use cases that can help define a location?
	Surrounding communities around the affected areas	Cellular radio coverage quality along the flying route
	How is on-board noise related to community benefit?	Assess impacts of UAM communication on networks shared by the community for cell phone and/or internet access
	So, we will split out the user community vs. the flyover community?	Ensure federal and state legal framework supports roll-out of technology in terms of pre-emption, allowable ordinances, etc.

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<p><i>Characterize Community Considerations: Conduct expanded characterization and initial impact assessment of passenger and community considerations through community feedback and measurements such as vehicle ground noise, cabin noise, and on-board ride quality.</i></p>	<p>What about non-UAM users outside a vicinity of a vertiport? Would they be consulted about this? Given the costs of UAM ,would they be excluded from such transportation opportunities and potentially hostile?</p>	<p>Any report is published in a non-partisan way, so the results aren't spun pro-UAM</p>
	<p>Spreading, size and placement of vertiports to properly account for noise</p>	<p>Aspects to include: Intramodality, Community added value (i.e. economy, jobs), Air quality (before electric is fully available), Environmental (i.e. water, wildfire), Visual impact</p>
	<p>Identify community liaisons and advocates (Civic Air Patrol? Regional Airports, pilots? Drone pilots?)</p>	<p>Survey the community with different noise levels to get max. acceptability limit</p>
	<p>Might want to add AOPA and EAA to the list on the left.</p>	<p>What is the scope of community benefit, impact and engagement?</p>
	<p>Include privacy and safety considerations</p>	<p>The number of vertiports will likely far exceed the number of airports. How does that impact a community?</p>
	<p>Need separation from participant, on-board and community</p>	<p>Note: On what will the ride quality metrics/criteria be based?</p>
	<p>Not sure that we need to consider on-board ride quality. That is probably a commercial consideration</p>	<p>Not sure how to include this, but the community will be worried about accidents "in my backyard" (falling debris) as well as "visual noise"</p>
	<p>Ground operations need to be considered - safety</p>	<p>Once again, this is definitely something that should be allowed to also be done outside of the U.S., where this leaning curve can be transited faster and cheaper. We are offering an ecosystem for this in Colombia</p>
	<p>Integration with multi-modal transportation</p>	<p>Leverage "Mission for Good" to further community acceptance</p>
	<p>After "measurements", insert "for example" to show that this is not an exhaustive list</p>	<p>Location of vertiports, pathways over the ground need to be addressed, effects of bringing high voltage and hazardous materials storage, community developing/planning issues</p>
<p>Visual pollution - safety consideration</p>	<p>Consider whether "community" / stakeholders should include impact on GA and GA airports</p>	

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<p><i>Characterize Community Considerations: Conduct expanded characterization and initial impact assessment of passenger and community considerations through community feedback and measurements such as vehicle ground noise, cabin noise, and on-board ride quality.</i></p>	<p>More clarity is needed in terms of whether this is a user-centric approach, or is this more focused on business models, sustainability and safety-first approach?</p>	<p>Visual noise</p>
	<p>Non-passenger community members should be included</p>	<p>Needs to have segments and groups of community considerations - GA, residents, developers, airports, etc. (will also vary by location)</p>
	<p>Agree with importance</p>	<p>Include a characterization of vehicle propulsion types relating to vertiport locations in the communities - i.e. all electric (quieter) vs. combustion</p>
	<p>Further development needed to smooth transitions</p>	<p>Modeling of noise propagation for urban environments. This requires collaboration with the OEMS, regulatory authorities, and public members. The point to focus on is public acceptance and social embracement</p>
	<p>Ride quality en route - bounced around (hot, windy)</p>	<p>Community acceptance needs to address noise but also includes much more - integration into the transportation system, socio-economic issues, equity issues, visual pollution, urban sprawl, etc.</p>
	<p>Turbulence damping, high wing loading</p>	<p>Include expanded options for connecting to other modes of transportation</p>
	<p>Noise - will be the one tool communities can use to determine the siting of vertiports and therefore routes</p>	<p>Important to hit early - beyond acoustics...visual pollution and visual noise. To what extent should NASA be involved - what contribution is possible?</p>
	<p>Strengthen the word "characterize" to set recommendations, best practices</p>	<p>Initial - element of continuous monitoring...establish performance requirements</p>
	<p>All the objectives are spawning research studies in the language when direction is needed</p>	<p>Privacy - concern for general public point of view</p>
	<p>Privacy?</p>	<p>Pandemic factors - lingering effects of pandemic that change societal values. Infuse this effort with that...</p>

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National Campaign Breakout 2**



<p><i>Characterize Community Considerations: Conduct expanded characterization and initial impact assessment of passenger and community considerations through community feedback and measurements such as vehicle ground noise, cabin noise, and on-board ride quality.</i></p>	Does this address the marketability as well? (i.e. Affordability, etc.)	Safety of non-participants (people on the ground)
	Complicated topic. Community acceptance adjusted based on value-added (i.e. ambulance sirens are not considered a nuisance, yet a neighbor's lawnmower is). Can this objective also capture the "value"?	Integrated transportation model
	Conduct town-hall like meetings in candidate NC host cities to discuss and gain feedback on infrastructure related issues born by the community: Battery re-charging stations, impact on multi-modal transportation, transportation logistics, etc.	Ecosystem regulations?
	Social engagement is key to making this work. Airports have been closed or had to limit/change operations due to community complaints. Each community is slightly different with different acceptance and tolerance levels	Transportation over populated areas
	Consider separate objectives for users vs. third parties	"Air" traffic jams?
	Change "vehicle ground noise" to "vehicle operational noise"	Commuters?
		Numbers of ground operations facilities vs. numbers of UAV/UAM in airspace
		Environmental impact of vertipad/charging/maintenance facilities
		Impact of visual pollution/airborne noise
		Security screening (if any)
		Community willingness to fly in AAM
		Clarification of where multimodal would be addressed or dealt with, if necessary
		Can we clarify how we plan to set requirements for noise? By vehicle or by fleet?
	Do we intend to measure emissions too?	
Other	Look to ADS-B expansion to include all civil registered aircraft	International alignment, collaboration, harmonization

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National Campaign Breakout 2**



Other	Allow testing interactions between players	International threats to infrastructure
	Drone testing in virtual environments for better maneuverability amongst large cities	How do we approach security of the airspace? Radical change in use. Industry moving fast
	Weather impacts. Vehicle constraints (such as retreating blade stall)	<u>Comment/Lesson learned:</u> During flight testing, "back door" was discovered in FIRMWARE which allowed take over of vehicle control. So, the takeaway question is what level of security is needed for these types of subsystem vulnerabilities?
	Establish power design to recharge/refuel aircraft	Equity issues, ADA access
	Adverse effects of precision navigation	Data sharing and privacy issues
	Impacts of power demand at vertiports - grid distribution, etc.	Cyber security/AI
	Distance between vertiports and nodal operation areas (of nodes) to determine visualization requirements	Emphasize "safety" measurements and how they will be better than Tesla (self-driving) accidents going forward
	Amount of data to display nodal information	Apply human factors guidelines and research to mitigate risk of human errors, excessive workload, poor control/display design, etc.
	Advanced sense and modeling for automated PIREP, ground infrastructure sensing key	Performance based navigation implementation in major metro areas - capture lessons. See FAA studies.
	Vehicle in-situ measurements "u-reps"	Weather - navigation, airworthiness (extra power margin to disturbances), additional separation given wx, turbulence, vortices
	Federal market business model given air space will likely be a limited and licensed resource in many urban areas	Tightly bound with interaction of all systems
	Access or lack thereof due to weather impacts, ride quality will be impacted due to adverse weather	Sustainability - current events indicate the need to have foresight to ensure the industry is successful
	Each urban region will need a dedicated study and architecture/design of local airspace and routes/operations - doubt a national cookie cutter solution will work when operating so close to local population	Economic model, equitable access to airspace, impact to other operations
		System capacity - need to model early

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Other		Market study and tailored route structure for intermodal/multimodal integration. What works for one city may not work for the next
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**AAM Ecosystem Working Groups
National Campaign Breakout 2**



Is there an alternative approach that you would recommend for the series?
Vehicle developers should consider: low speed handling qualities, vertical performance (hover and low speed climb), field of view from the cockpit, and guidance available to the on-board or remote pilot
Consideration will also be needed for the varying performance of these aircraft to establish criteria. Use of elevated vertiports are a consideration for us in NY to maximize the use of available space
Build up to a full scale demonstration should include: tabletop exercise, low fidelity simulation, high fidelity simulation, single vehicle scenarios, and then a full scale demo of a structured scenario with multiple vehicles in a controlled environment
Mixed capability of VTOL aircraft. We will have aircraft with 60 mile range and others with 200 mile range. This will be an important consideration when operating in the same airspace as manned aircraft
Since manned vehicles have lower acceleration limits, unmanned vehicles with higher maneuverability can play a decisive role in collision avoidance
We have run a few low fidelity simulations which did provide very valuable information on the potential conflict points. I agree with Mir that these aircraft should and will need superior capability than the manned fleet
Provide context for stakeholders new to this industry with planned use cases and options to suggest/brainstorm additional use cases. This will help envision how the technology will actually be used and opportunities for it to solve existing problems
Have some outreach in local fairs, events, etc.
I advocate taking a more "ground-up" approach. Take what currently works in our existing system and work on a pragmatic integration based upon current regulations and then systematically make changes or additions
Will there be a funding discussion from communities to apply for state/federal grants/loans to afford needed infrastructure?
Plan for adoption into multi-modal infrastructure. Takes years to plan. Need table top exercises with states on how they'll support the implementation
Recommend strong emphasis on community acceptance. The technical challenges are many, but can be overcome with industry commitment (which already exists). The most likely showstoppers are social and political. This is an area where NASA can provide leadership and community outreach early, not only by engaging the airspace user community, but also (and more importantly) state and local government and community groups
For community related aspects, I would recommend conducting some more surveys and analyze the feedback on all different areas of impact
How will security be handled (i.e. metro police)? - Personal safety and aircraft safety

AAM Ecosystem Working Groups National Campaign Breakout 2



My thoughts are that in a future world where UAM already exists, having a place for them to engage as a connectivity point as a transport hubs is key. So, if that's a problem, how and where do you put vertiports but crucially how do you bring the public on board now? This discussion is currently industry only, but how do you engage with the public with a vision of what that looks like beyond videos or static eVTOLS. Should we be setting up pseudo vertiports to sensitize people to what they can expect from a physical perspective. The infrastructure can come before UAMs

If there's a potential for funding, we can also extend the outreach with the local communities

Using university students as on-board stewards to help the transition from manned to unmanned

How does this pandemic impact the transportation needs, including AAM?

Sorry that doesn't make any sense (re: university students). Are they pilot trained or not? I don't see anything in the middle. Cheap does not equal competent

Are the stewards on-board to handle in-flight emergencies? What is their purpose?

Evidence of previous studies and media to see what the state of the art is. Also look to other countries

Be able to summarize the work accomplished to date, not just within this confined group, but having a global vision of what has been accomplished to date

Consider people with disabilities

Mobility as a Service (MAAS)

Consider common envelopes and electric standards. Some common-use systems can be implemented for multi-aircraft facilities. The industry cannot afford having different charging standards and proprietary solutions that are not portable (i.e. Tesla superchargers)

It would be useful for NASA to allow the telemetry (the TLOGS from the UAS) to reside on a publicly-accessible database so those not involved in the NC demo can mine the data for battery drain rates, encounter geometrics, airspeed/groundspeed, etc.

We feel there are very strong reasons to want to implement/test/certify/place into service UAM/ AAM subsystems in locations outside of the U.S., specifically for lower costs and faster times. Such ecosystems are being developed already, we are offering an ecosystem in Columbia, working with the Colombian Aeronautics authority and central government. We want to partner with NASA so that stakeholders and manufacturers join our ecosystem. This should be part of NASA's grander view

Suggest high-fidelity simulations. However, it could be challenging to integrate multiple vendors and concepts into a common simulation architecture. Systems and concepts should be made compatible (as much as possible) prior to participating in a simulation

AAM Ecosystem Working Groups National Campaign Breakout 2



Need to ensure we consider current general aviation, commercial airlines, helicopters as well as future drone deliveries and eVTOL operations together. Some level of autonomy and sense and avoid would be minimum requirements plus active air traffic management
We keep seeing heavy influence from traditional aviation in the creation of UAM/AAM, such as airspace control, altitude minimums, airport use, and others. This is an entirely new concept which requires completely out of the box thinking. We propose that other airspace integration architectures and flight mission concepts are allowed and also fostered. We are proposing our own, which have reasons on the city structures and mobility needs that we see in Latin America, a crucial market for UAM specifically. We propose NASA incorporates these into the overall effort. We, Varon Vehicles, want to partner with NASA to exploit the ecosystem we are running in Columbia
Vertiport operations - ground operations, safe shuttling of passengers, etc.
Broader approach - make sure technology doesn't outpace other considerations. Bring community groups on-board earlier, infrastructure. Build a demand, incorporate that into the UAM system
Micro-weather real-time analysis and impact - both vehicles and vertiports
General note: How has the demand for UAM changed since the outbreak of the coronavirus, since the distribution of where people live and work may change as a result.
What is test and evaluation master plan?
Figure out "equivalent level of safety" is not easy to do technically and especially politically
Does text plan provide for approach angles? Steep to shallow?
Airport specific by approach...same could occur in vertiports...varying degrees of approach
Agree TERPS and approached are critical
Pipeline through to certification - collect in a way that will be valuable for performance-based standards for which regulators will make rules
Don't forget integration into conventional airports
Accelerate small UAV deployments in urban areas as means to prove out
Use the sensors on UAS and cell towers as weather sensors to model potential AAM flight paths to be flown
More scenario simulations, fast time
Framework for testing and validating against performance based requirements
Involve early adopter cities to the later NC series?
Open to international cooperation?
Noise cancelation kits for UAM ambulance patients
There is a great deal of learning in simulation vs. flight demonstration. What can be gained from table top exercises, modeling simulation studies, human-in-the-loop evaluations, etc.?

AAM Ecosystem Working Groups National Campaign Breakout 2



It seems the current approach (understandably) is OEM focused and driven. OEMs may not choose locations that enable the NC to assess some of the CNS and community related issues. Suggest a hybrid approach that looks at both candidate city locations that are likely early AAM adopters that also offer airspace/CNS infrastructure and a supportive community
Simulations of operational scenarios should first demonstrate so-ability of proposed operations
Optimize LVC "gates" for each NC event that enable complex CNS and vehicle to vehicle issues to be simulated and assessed prior to live operations
Simulation study of unmanned air traffic over Oslo has shown serious challenges to address with congestion, visual pollution, noise, etc.
Today's early AAM designs are unlikely to go into mass production - they are demonstrators
Establishment of thresholds from weather perspective (e.g. what wind speeds are too much?)
Models, simulations, then prototype/test vehicles in real-world conditions. Test to failure
Potential reference vehicle/environments for turbulence characterizations/reactions both ground/airborne tests
In there a timeframe in which we expect wind-data infrastructure to be available in the urban setting?
Urban canyons, micro wx capabilities and demonstrations
More explicit connection to standards and safety assessment, including supporting simulations
Micro-weather forecasting is a pre-cursor to all weather related issues