

BREAKOUT SESSION 14.

SAFETY AND INTEGRATED FLIGHT SYSTEMS

Concern: Could you speak about near term/mid term/long term autonomy goals?

Response: Can't go into a lot of depth, but you can go to our website and read the roadmap for all of the details.

Concern: In your presentation refer to 2015 – 2045 plan, any emphasis on those – near term or long term?

Response: Near term is fine, but NexGen is focused towards 2025, 2035, 2045. If there are more things related to autonomy, we would like to look at them.

Concern: What do you see as the technology gaps for reaching full autonomy in air vehicles?

Response: The biggest issue will be confidence and trust in developing those capabilities and on demand mobility. In the UAVs the immediate hurdle is getting permission to fly. Detect and avoid and command and control are hurdles. Safety in the sense that there is a plan in case there is a loss in command and control. Onboard there has to be some contingency plan. V&V and certification of complex system for UAV. Small UAVs use RC parts and quality control could be an issue.

Concern: When dealing with operations and smaller vehicles where traffic may become denser, is there a desire or need for greater awareness of where those air vehicles are?

Response: Yes. There is a UTM project focused on Air Traffic Management. It would fit in V&V for complex systems. UTM (UAS Traffic Management) or UAS is the first attempt at creating a platform for testing UAV operations at low altitudes (under 500 ft). We are developing requirements for what systems like this may need in future, and more automation comes on board, there may be more issues with command and control.

Concern: V&V – focus on autonomous systems, there doesn't seem to be specific call out on cyber security. Someone hijacking into these systems while they are in flight. Is there a gap there? Middleware available today was developed before the levels of cyber security we expect now were established. Is there an interest in highly secure middleware for aviation systems?

Response: Yes. They are taking it seriously and expect to be doing more activity and research in this area – cyber physical system, cyber security. Cyber security is one of the topics - it's part of secure communications, etc.

Concern: You guys are talking about the low altitude UAS, etc. The high-altitude ones are going to become an issue because FAA is not prepared for it. There could be tens of thousands if allowed. Is there any plan for high altitude?

Response: No restrictions on altitudes for SBIR. Already an issue today.

Concern: There is a lot said about situational awareness and autonomy, but is NASA and specifically your area interested in different visualization technologies that integrate with data and intelligent data?

Response: Yes. A lot of the things we are doing are in integration of data prognostic tools and data mining capabilities.

Concern: How would you feel about a proposal to take an existing piece of NASA software and repurposing it for a different application? There are some dynamic flight planning capabilities that NASA has developed which we believe could be repurposed for more efficient NextGen flight planning and dispatch.

Response: Yes. Especially in terms of making it easier for human to interact with the UAS.

Concern: Continuing on human information and autonomy. What is the emphasis on human component – training, performance measurement, interface design, human factors in general, versus actually developing the algorithms, vehicle and platform that can be operated by humans? What gaps are you trying to fill on human factor side?

Response: Human autonomy teaming - looking at both algorithms and human factors, visualization, integrating humans and machines. We want a complete system, the UI as well as algorithms. A commercially deployable system that can be used to control multiple UAS.

Concern: Is software for flight management of UAS available to contractors also?

Response: This is a prototype system. The UTM project accepts partners, they don't give software but you get access to it.

Concern: Is there current interest in advanced flight display concepts for showing 4D flight trajectories within Synthetic/Enhanced Vision displays? e.g., HMI elements

Response: Yes.

Concern: NexGen roadmap has been in motion for quite a while. Is it possible that UAS explosion came about after the roadmap started? For that reason, would you see the UTM technology is a subset or is it being considered to bring it back into the roadmap for next year?

Response: The original forecast showed that they had 1.5-3 time the amount of traffic in 2025 compared to 2004. I think that the small UAS could blow that out the of the water. That is why now there is a work on the UTM aspect, looking at the low altitude operations. There are ongoing activities.

Concern: If tend to be focused more on UTM, would you take a step back and revisit NexGen roadmap?

Response: This is more of proof-of-concept. Need to see how to integrate into broader capabilities, like high altitude operations, but it will have to be done safely.

Concern: What level of redundancy is used for on board power system of spacecraft for safe operation?

Response: As we look at the integration of all these new vehicles in the future, look at commercial space operations. But really out of scope for this discussion.

Concern: Integrated modeling simulation and testing – elaborate more on your need for that type of capability.

Response: We are in process of building up our SMARTNAS Test bed. We first need to integrate some diagnostic and prognostic capabilities where we see it going in a direction of where we can detect analogous events in the near future. Sometime in the future when we build up the capability, we can take that tool and turn it into a real time user decision tool.

Concern: Will you be interested in Hardware-in-loop real time models as a tool for testing, debugging and validating a design both in component and system level?

Response: Yes, we are interested in HW in the loop submissions. We currently have several Phase 1 and 2 human in the loop (HIL) projects under way.

Concern: What is the TRL level of such ongoing hardware-in-loop model activities?

Response: Maybe 4-5 on the TRL level.

Concern: Autonomous detect and avoid systems that inform the UTM are presently out of scope. Will they become in scope for an SBIR?

Response: Yes, it is in scope. It is part of increasing situational awareness on board.

Concern: As historical data and information starts to become available, is this somehow disseminated through those that have interest at this level so that we can gather the visions towards the future? Does that live at the depository level?

Response: NASA does save data. There is a repository of historical data.

Concern: Clarification on earlier Concern Verification & Validation – talk about RC components and parts. Are we talking radio controls?

Response: Yes, V&V is a hot discussion. Thrust 1 – they are looking at avionic systems and ground systems. Thrust 5 – they look at new systems for safety, detection, mitigation of future incidents. Autonomy – more complex algorithms. Cuts through different roadmaps.

Concern: Are you looking at the solution that is trying to look at all of it or maybe a partial system that marries into some other system that is monitoring the ground stations.

Response: Long term vision is to have a prototype that can have an overall view of the entire system. We don't have access to this information as of today. Thrust 5 – build tests, add functionality to build up to full system capability.

Concern: Does the flight dynamics subtopic include algorithms to optimize the pointing of spacecraft?

Response: Our focus is just the normal operations within NASA, not spacecraft, so it is out of scope.

Concern: In the topic area "Safety Management for Emergent Risks" are you open to technologies for loss of control of manned aircraft e.g. VFR into IFR spatial disorientation. Or is the focus on loss of control of unmanned systems.

Response: Currently have work looking at loss of manned control. Scope will increase to cover new vehicles. So Response is yes.

Concern: Cyber physical security – in subtopic it was noted with respect to the communications links between ground and the UAVs, but I'm thinking of software controlled UAV where software update is done where that has malicious code embedded in it.

Response: That is going to become a bigger concern. NASA is being challenged to start addressing these issues.

Concern: Is cybersecurity considered Critical infrastructure? There are things that have critical infrastructure repercussion such as cell towers, telecom networks and things like that.

Response: Not in the business of building cell towers. But in the software we are developing, we need to be looking at cybersecurity. We work on technologies and capabilities but we really rely on our partners,

FAA, stakeholders, airlines and airports to use it. within our program we have research transition teams, we focus on the work with the FAA, and extend RTT membership to other stakeholders.