NASA / FAA eVTOL Crashworthiness Workshop Series: Virtual Meeting #3:
*DoD Considerations for Crashworthiness of eVTOL Vehicles – Purpose and Need*

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Introduction

• Third in a series of workshops
  – The first provided the historical perspective and overall regulatory considerations
  – The second provided an in depth review of certification strategies from regulators and standards development organizations

• This installment will review the considerations for vehicle crashworthiness from the perspective of various agencies within the U.S. Department of Defense
Meeting Logistics

- Speakers and Moderators are on TEAMS meeting
- Participants will be using YouTube link available on website
- Participants can ask questions using ConferenceIO link available on website
- NASA or FAA will introduce each speaker and ask questions to that speaker at the end of their presentation
- Speakers will screen-share their presentation on the TEAMS meeting

- Meeting website: https://nari.arc.nasa.gov/crashworthiness
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<tr>
<th>Speaker</th>
<th>Organization</th>
<th>Time (Eastern)</th>
<th>Presentation Title</th>
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<tr>
<td>Justin Littell / Joseph Pellettiere</td>
<td>NASA / FAA</td>
<td>12:00 – 12:15</td>
<td>Introduction and the DoD Crashworthiness background</td>
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<tr>
<td>Col. Nathan Diller</td>
<td>AFWERX</td>
<td>12:15 - 12:45</td>
<td>Agility Prime</td>
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<td>Brandon Hall</td>
<td>NAVAIR</td>
<td>12:45 – 13:15</td>
<td>Research Topics Related to Naval Aviation Crashworthy Systems</td>
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<td>Lindley Bark</td>
<td>NAVAIR</td>
<td>13:15 - 13:45</td>
<td>Crashworthiness and Qualification of Rotorcraft Seats by Modeling and Simulation</td>
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The Need for Crashworthiness in eVTOL Vehicles: Historical and Ongoing DoD test campaigns

- DoD first to consider crashworthiness in vehicles particularly for rotorcraft
- Hugh DeHaven – considered father of crashworthiness
- Col. Stapp – human g force limit testing
- AFRL sled testing
- 1970 first crashworthy fuel systems installed on Army helicopters
- UH-60 Blackhawk one of first helicopters designed with MIL-STD-1290 guidelines
- NASA LaRC – Full-scale rotorcraft testing
  - AH-1, UH-1, CH-46, CH-47, ACAP, F-111
The Need for Crashworthiness in eVTOL Vehicles:  
*Requirements / Regulations / Documents*

- Long history of DoD crashworthiness requirements resultant from accident data and full-scale testing
- Aircraft Crash Survival Design Guide (ACSDG)  
  - Five part document outlining crashworthiness technology resulting from accident surveys
- MIL-STD-1290A – came out of ACSDG  
  - Light fixed and rotary wing aircraft crashworthiness
- MIL-S-58095A – Military helicopter crashworthy seat criteria
- MIL-S-85510-General specification for seats, helicopter cabin crashworthiness
- MIL-DTL-27244F – Tank, Fuel, Crash Resistant, Aircraft
- RDECOM TR 12-D-12 - Full Spectrum Crashworthiness
The Need for Crashworthiness in eVTOL Vehicles: 
*Market Demand – DoD*

- IN 2020, the USAF initiated Agility Prime in order to jump start the eVTOL market implementation within the DoD
- The aim is to have 30 VTOL aircraft for various missions
- Aims for operational capability by 2023

- Nathan Diller will talk further on this Program and it’s details
The Need for Crashworthiness in eVTOL Vehicles: Why Now?

• Now is the time
  – Early in the vehicle development cycle
  – Will pay great dividends in the future

• Expect that accidents will happen
  – Protect the occupants to ensure continued growth and acceptance

• Current regulatory framework is based upon other designs
  – This may change in the future depending on performance
  – Attention to system level safety now, will prepare for the future
Continued Engagement

- Stay tuned for information on future workshops
  - eVTOL Crashworthiness application focused in the next few months
  - Possibly still on onsite working group meeting/discussion/tour in the spring