Research Topics Related to Naval Aviation Crashworthy Systems

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Organizational Background

• Crashworthy and Escape Systems Branch primarily focused on seating systems (rotary wing and fast jet), restraint systems, and other crash protection technologies.

• Crashworthy Seating Systems: Ensure that seating systems provide protection to occupants during a mishap event and also support successful mission tasking and long-term health of aircrew.

• Two Research Categories:
  ▪ Addressing injury risk of long-term exposure to operational environment
  ▪ Improving Mishap Survivability
Qualification Process

- Navy utilizes its own airworthiness process
- Seating Systems typically qualified to tailored versions of seating system Mil-Specs
  - MIL-S-85510 (Cabin/Troop Seats)
  - MIL-S-85095 (Cockpit/Crew Seats)
- Tailoring Considerations:
  - Legacy platform capability
  - Dynamic Performance Requirements (Occupant size, crash pulse/orientations)

Source: MIL-S-85095A
Characterizing the Mishap Environment

- Current characterization of rotary wing mishap environment
  - Based on studies conducted decades ago
  - Based on previous generation of rotorcraft
  - Data based on subjective reconstructions, using limited available quantitative data

- Specifications for Crashworthy technologies based primarily on aforementioned studies

- Existing definition has enabled significant improvements in crash survivability; gaps remain

Mishap Characterization

• Evaluating the utility of Crash Sensing Systems in legacy platforms

• Currently investigating the potential for low-power, high sample rate, event recorders (accelerometers and angular rate sensors) to be deployed throughout the fleet

• Goals:
  ▪ Better reconstruct individual mishaps, with a focus on identifying potential injury mechanisms
  ▪ Build a library of mishap data that enables improved mishap characterization and updated performance specifications for crashworthy seating and other safety systems
  ▪ Enable the application of next-generation crash protective technology
Evaluating Concepts for Improving Occupant Survivability

• In-house Horizontal Accelerator System can produce acceleration pulses representative of mishap

• Used to evaluate and qualify crashworthy seating systems

• Reusable Energy Absorbing Laboratory (REAL) Seat Test Fixture, available at NAS Patuxent River, MD is used to economically evaluate impact of safety improvements
  ▪ Pretensioning Systems
  ▪ Cushion Modifications
  ▪ Novel Restraint Concepts
  ▪ Airbag Systems
Additional Areas of Research

• Restraint Systems
  ▪ Additional survivability gains can be made by improving seat restraint systems
  ▪ Restraint systems currently rely on user to properly adjust belts and to achieve optimal fit
  ▪ Evaluating approaches to minimize workload of seat occupant and accommodate non-ideal restraint adjustment/placement
  ▪ Ensure that ability to safely egress aircraft is not negatively impacted
Summary

• Primary Research Focus Areas:
  ▪ Mitigating pain and musculoskeletal injury associated with long-duration exposure to the operational environment
  ▪ Improved occupant protection during mishaps

• Crash Protection
  ▪ Modern characterization of the mishap environment
  ▪ Improved restraint systems
  ▪ Minimizing workload impacts to seat occupants
  ▪ Maintain ability to quickly egress aircraft in the event of a mishap
Questions?

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