A-P-T RESEARCH, INC.

UNMANNED SYSTEMS

Safety in Unmanned Systems

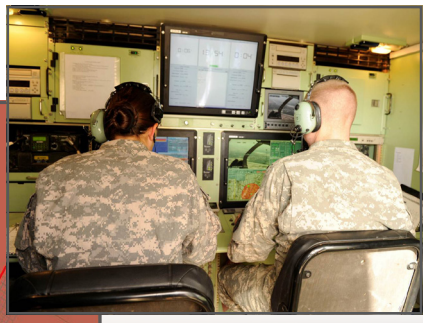
Unmanned Systems run the full gamut in size, shape, and operational domain. They range from micro, tele-operated ground vehicles to multi-thousand pound, semi-autonomous aircraft. While the size and functions may vary, the concern for all systems to operate safely persists and is actually increasing as these systems transition from the military domain into the civilian arena.

APT has the personnel and experience to support the safety and risk analyses associated with current military systems and future civilian applications.

APT applies our experience of system safety, range safety, and standards development to the area of unmanned systems. System safety is applied to unmanned systems by assisting with software safety and airworthiness for Unmanned Aerial Systems (UASs) and System/ Software Safety for Unmanned Ground Vehicles (UGVs). Moreover, our experience with standards has allowed us to contribute to the development of AMCOM Regulation 385-17, *AMCOM Software System Safety Policy*; the first OSD *Unmanned Systems Safety Guide For DoD Acquisition;* and the UAS update to MIL-HDBK-516.

During the development of the *Unmanned Systems Safety Guide For DoD Acquisition,* APT helped identify and scope the safety precepts in three key areas:

- Programmatic Safety Precepts (PSPs)
- Operational Safety Precepts (OSPs)
- Design Safety Precepts (DSPs)



Capabilities

- Software Airworthiness
  - DO-178
  - DO-278
- Range Safety
- Standards Development
- Certificate of Authorization for UAS
- FMEA/FHA
- Safety Confirmation Release
- System Safety/Software Safety
  - MIL-STD-882
  - GEIA-STD-0010
  - AMCOM 385-17
- Reliability
- Software Safety Training
- Risk Assessments
- Full Life Cycle Support
- Static and Dynamic Code Analysis
- Web-based Hazard Tracking System (HTS)

Current Projects

- Range/Airport Safety Analysis
- Software Airworthiness
  - Ground Based Sense and Avoid (GBSAA)
  - Army Unmanned Ground Control Station (UGCS)
  - Shadow™ 200
  - UAS Weaponization
- Safety Confirmation Recommendations

APT has provided all aspects of safety support to multiple UGV programs. This support includes development and review of safety documentation for multiple programs, including Safety Assessment Reports (SARs) and various types of hazard analyses. In addition, APT has provided system safety program planning support to include reviewing and/or developing design contractor/ subcontractor Statements of Work (SOW), control data requirements lists, safety management plans, and Programmatic Environmental, Safety and Occupational Health Evaluations (PESHEs).

APT has provided support for numerous Safety Confirmations, including several on UAV, UGV, and supporting systems. Our efforts include system safety review, risk assessment (high, medium, or low), and recommended risk mitigation. Examples of systems for which APT has provided Safety Confirmations support include:

- Raven UAV (RQ-11)
- Northrop HART (Heterogeneous Airborne Reconnaissance Team) System
- Project Workhorse UGV for US Army Rapid Equipping Force

During Project Workhorse, APT evaluated several UGV concepts, including the Squad Mission Support System (SMSS) which is to deploy to Afghanistan.

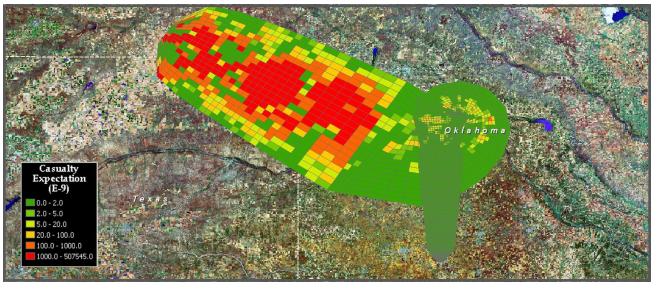
Flight & Range Safety Support

Flight testing requires the evaluation and acceptance of risks from a variety of hazards. These hazards may result from premature function of explosive components, flight deviations of malfunctioning vehicles, falling debris, and high energy impacts.

Range safety incorporates a multitude of disciplines to minimize risks and provide protection from potential hazards. At the most detailed level, range safety support involves the generation of footprints and expected fatalities, expected casualties, expected injuries, and other potential damage parameters.

APT supports the full life cycle of flight and test range safety operations:

- Range Safety Data Package
- Vehicle Analysis
- Assembly and Ground Handling Procedure Validation
- Flight Termination System Installation Verification
- Launch Commit Criteria
- Debris Hazard Analysis



APT Points of Contact

Mike Wesoloski
256.327.3373
aptinfo@apt-research.com

A-P-T RESEARCH, INC.

4950 Research Drive
Huntsville, AL 35805
www.apt-research.com

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