



FAA UAS SYMPOSIUM

Understanding Safety Risk Management

Lead: Wes Ryan

UAS Certification Policy Lead, Aircraft
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Directorate



Federal Aviation
Administration



#UAS2017

Workshop 8: Understanding Safety Risk Management



- **Lead: Wes Ryan**, Manager, Programs and Procedures (Advanced Technology), FAA Small Airplane Directorate
- **Gerald Pilj**, Aviation Safety Engineer, Safety Engineering Team, FAA Safety and Technical Training Services
- **Rob Pappas**, Manager, Program and Data Management, FAA UAS Integration Office
- **Jeffrey Smith**, Aviation Safety Inspector, Compliance Philosophy Focus Team, FAA Flight Standards Service
- **Jenn Player**, Director of UAS Technologies, Bihrl Applied Research Inc.

Goals & Expectations



- An open dialogue on Safety Risk Management for UAS
- What is Safety Risk Management, and how the concepts apply to UAS
- Goal – FAA and industry to identify appropriate UAS safety expectations, requirements, and evaluation methods

Must Consider “Total Safety Equation”



- Not only “what could go wrong,” but what net safety improvement could come from using UAS vs. manned operation
- Infrastructure surveillance puts people at significant risk



Focus on Net Safety Gain



- Every new technology introduces risk with its benefits
- Example: Capstone Program in Alaska
 - Introduced glass displays into GA at lower design assurance levels
 - Resulted in a 40% reduction in fatal accidents
 - Initial resistance
- UAS
 - Will provide societal benefits
 - Risk-based, step-wise integration will manage risk



Safety is the FAA's Primary Goal



- What is Safety Risk Management?
 - Active management and mitigation of reasonably foreseeable risks the UAS may cause or encounter
- What is Safety Assurance?
 - The process by which the FAA gains confidence that a particular system/operation meets our expected level of safety
 - Includes assurances from design, operational limitation, pilot action, or geographic/airspace restriction



Our Challenge



- Well-proven design techniques to evaluate risk for system failure may not translate well to operational risk assessment
 - Probabilistic analysis and availability of accurate data on new designs, or for non-design related facets of the analysis
- Consider reasonably foreseeable issues
 - Design, operations, pilot error, weather, maintenance, geographic area, airspace and how they influence safety

Risk Sources



- Vehicle Design/Systems – What is it?
- Operational Risk – How will it be used?
- Area of Operation/Airspace – Where will it be flown?
- Human vs. Automation Error

Risk Controls – “Safety Assurance”



- Comes from combination of factors
 - **Airworthiness** – Condition for safe flight for its intended use
 - **Design** – Verify design, engineering, construction, etc. meet applicable requirements in certification basis
 - **Pilot** – Train for aircraft and level of risk
 - **Maintenance** – Repair/replace prior to failure
 - **Operation** – Limitations sufficient for the expected/acceptable level or risk
 - **Airspace** – Level of integration, traffic exposure, controller involvement, and equipage



Regulations and Safety Management

- Regulations are intended to control for risks that are common to all, or large portions, of NAS participants
 - Designed to address potential for damage or harm
 - Operations contrary to the regulations represent an unacceptable level of risk
- Safety Risk Management
 - Can be used to ensure regulatory compliance
 - Also used to identify, assess, and address unique risks that are not covered by regulation

References



- Order 8040.4A – Overarching Safety Risk Management Policy
<http://www.faa.gov/documentLibrary/media/Order/8040.4A%20.pdf>
- SAE ARP 4761 - *Guidelines And Methods For Conducting The Safety Assessment Process On Civil Airborne Systems And Equipment*
<http://standards.sae.org/arp4761/>
- Safety Risk Management Document – ATO SMS Manual
https://www.faa.gov/air_traffic/publications/media/faa_ato_sms_manual_v4_20140901.pdf
- Operational Safety Compliance Philosophy
<http://www.faa.gov/about/initiatives/cp/>
http://www.faa.gov/news/safety_briefing/2017/media/JanFeb2017.pdf
- JARUS – SORA (Specific Operations Risk Assessment)
- “Bowtie” Method of Risk Analysis and Mitigation
<http://www.cgerisk.com/knowledge-base/risk-assessment/thebowtiemethod>

Questions/Discussion



- How is SRM applied to your design vs. your operation?
 - They are not the same analysis
- Does the same SRM apply to every UAS and operation?
 - Requirements must be scalable

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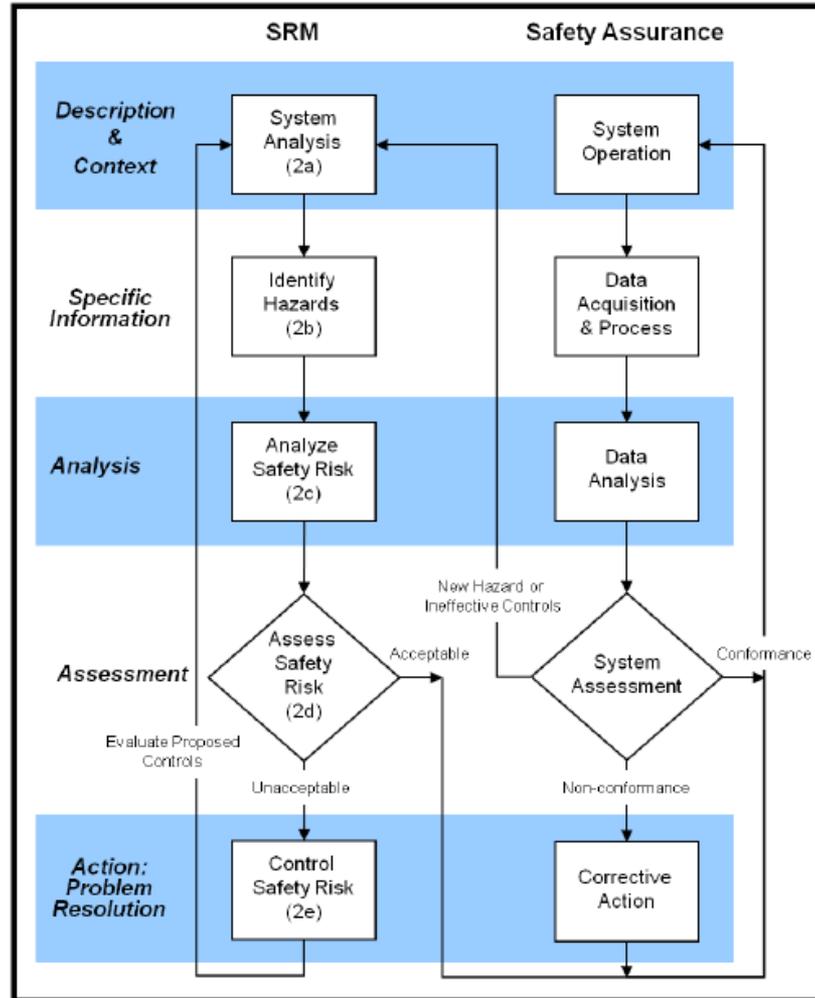
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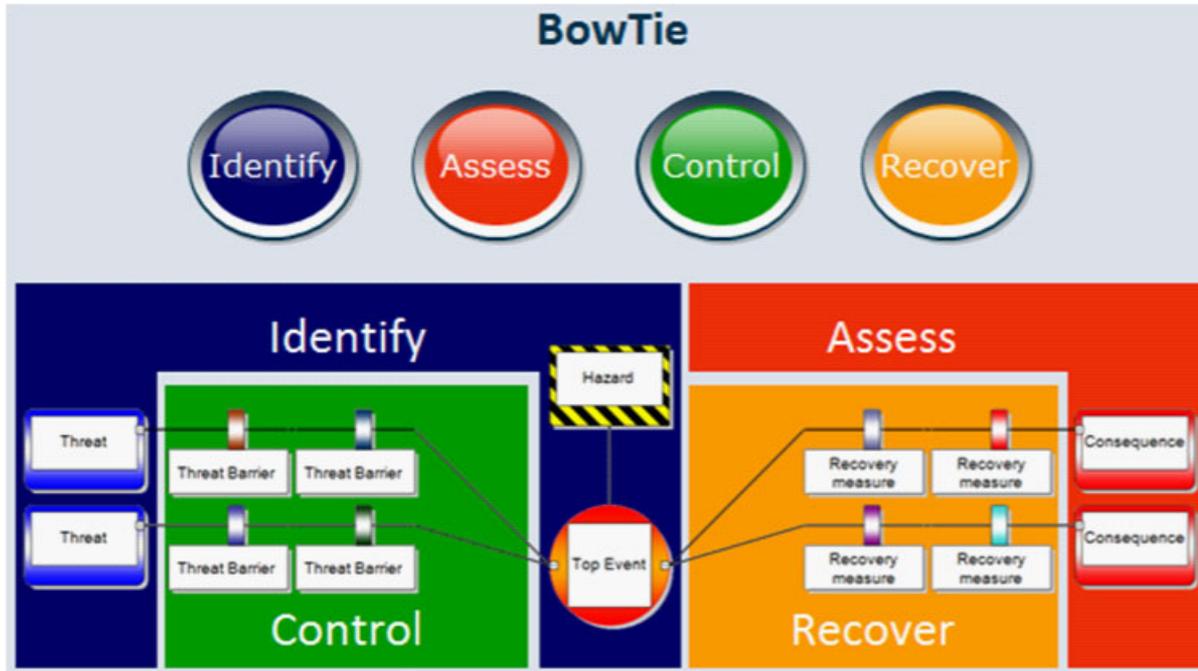
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Supporting slides

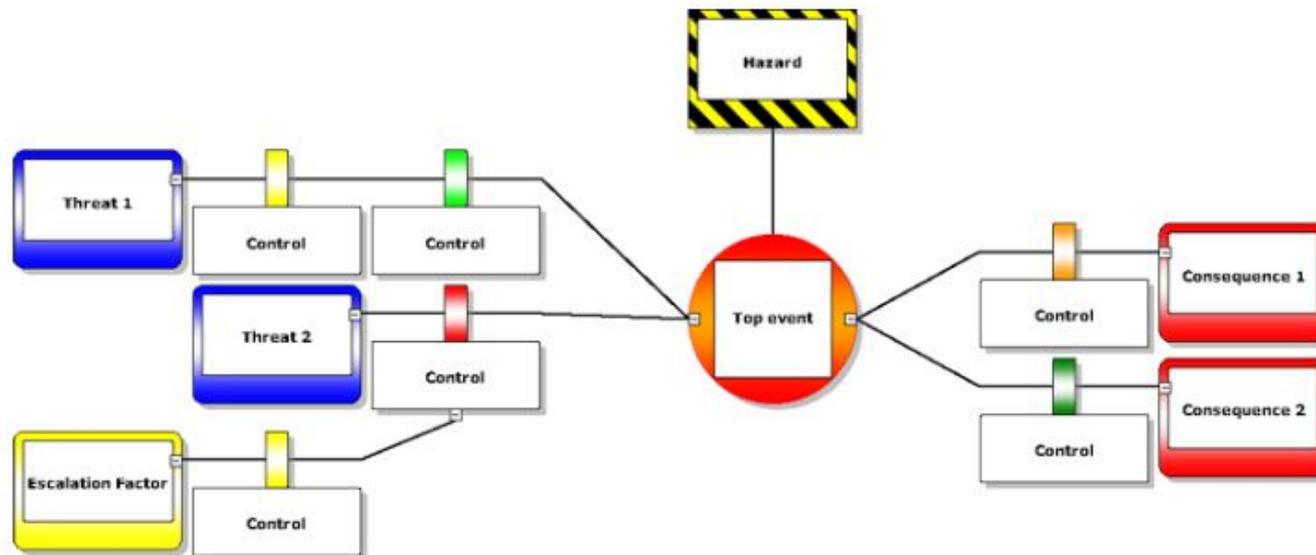
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Bow Tie Structure



Bow-Tie Graphic



Simple Example – BVLOS



Threat

Lost Link

Hazard

Fly – Away

Consequence

Mid-Air

Risk Controls

Certification Requirements of C2 Link

Pre-flight Test Procedures - Redundancy

Risk Recovery Efforts

Remote Operations

NOTAMs – Coordination with Local Pilots/Airports

Observers Talking on Local Radio

Compliance and Risk Management

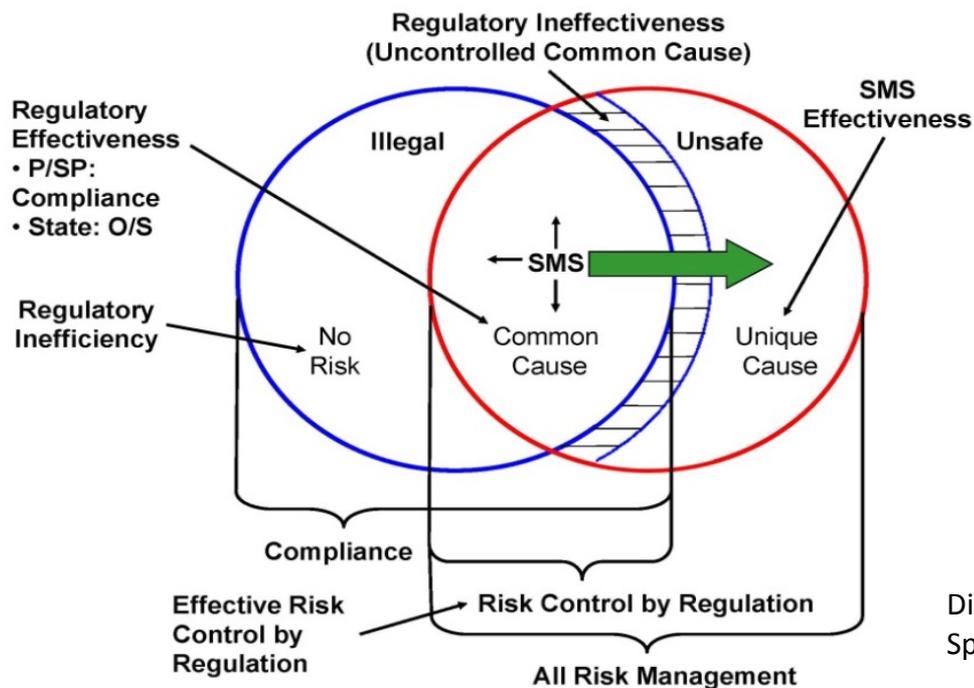


Diagram adapted from work of Dr. Malcom Sparrow

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Wes Ryan, Manager, Programs and Procedures (Advanced Technology), FAA Aircraft Certification Service



Wes Ryan has been with the Federal Aviation Administration (FAA) for 15 years and manages the Technology Programs & Procedures Branch in the Small Airplane Directorate in Kansas City. He has helped lead emerging technology initiatives for the FAA in avionics, light sport aircraft, electric propulsion, and unmanned aircraft, and was instrumental in bringing safety enhancing glass displays, GPS moving maps, and envelope protection autopilot technology into light GA aircraft.

Mr. Ryan is currently the certification policy lead for the Aircraft Certification service for UAS design requirements and the type certification process. His goal is to see the safe integration of UAS into the NAS, and to leverage UAS technology to improve safety of manned GA aircraft through transformational flight concepts in the next decade.



Gerald Pilj, Aviation Safety Engineer, Safety Engineering Team, FAA Safety and Technical Training Services



Gerald Pilj is the Air Traffic Organization safety case lead responsible for UAS related changes to the national airspace system (NAS), as well as software design assurance on NAS acquisitions.

His prior experience includes instructor at the FAA Academy teaching Part 21, 23, 25, 27, 29, and 33 compliance for systems engineering, safety analysis, software and complex hardware design assurance; aviation safety engineer at the Wichita ACO, Software DER for Learjet, and a Gunnery Sergeant in the Marine Corps.

Mr. Pilj has a master's degree in physics and is an author.



Rob Pappas, Manager, Program and Data Management, FAA UAS Integration Office

Robert Pappas is the Manager of the Program and Data Management Branch in the FAA's UAS Integration Office. In this capacity, Mr. Pappas oversees management of special projects, including the planning, organization and execution of all project activities. He facilitates collaboration and coordination of project activities with appropriate policy organizations, and performs all management responsibilities. Working with stakeholders inside and outside the FAA, he ensures special projects are aligned to best support the myriad of ongoing activities to integrate UAS into the NAS, including regulatory, policy, and standards development.



Mr. Pappas joined the UAS Integration Office in 2014 as the Special Rules Coordinator. He managed implementation of Section 333, paving the way to granting authorizations to thousands of small UAS operators. More recently, Mr. Pappas has managed the UAS Focus Area Pathfinder Program. This innovative program is critical to the implementation of additional UAS integration firsts, such as extended visual line of sight and beyond visual line of sight operations. In his current role, he continues to oversee the Section 333 and Pathfinder Programs and is also responsible for managing other special projects such as UAS Detection and Mitigation at Airports, the UAS Test Site Program, and UAS Data Management.

Jeffrey Smith, Aviation Safety Inspector, Compliance Philosophy Focus Team, FAA Flight Standards Service



Jeffrey Smith is the manager of the FAA's Airman Certification and Training Branch.

He is currently on detail to the Director of Flight Standards as part of the Compliance Philosophy Focus Team.

Mr. Smith holds an ATP certificate, is a flight and ground instructor, and is certificated as an airframe and power plant mechanic. He is a cadet-orientation pilot, mission pilot, instructor, and check pilot for the Civil Air Patrol.



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Jenn Player, Director of UAS Technologies, Bihrl Applied Research Inc.



Jennifer Player is Director of UAS Technologies for Bihrl Applied Research, Inc. and has been serving as a Senior Advisor to the BNSF Railway UAS Program since 2014.

Ms. Player has 20 years of experience in the aerospace sector, both in government and in industry, working in engineering, technology development, and R&D project management for NAVAIR, NASA, Cessna Aircraft Company, and Bihrl. She has been leading UAS related projects since 2011 and is currently participating in efforts to find technology and regulatory solutions to enable BVLOS operations in the U.S. National Airspace System with a focus on use of sUAS for linear infrastructure inspection. Her projects include intelligent flight planning, UA collision avoidance, engineering inspection via machine vision, and machine vision aided air navigation.



Ms. Player received a Bachelor of Science in aerospace engineering from The Pennsylvania State University. She holds an FAA Private Pilot certificate with ratings in single engine aircraft and gliders.

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