Helicopter Safety Enhancement (HSE)-90 Use of UAS or OPA in High Risk Environments/Operations	
Safety Enhancement Action:	Technology/Equipment: FAA and industry to encourage the increased use of UAS (Unmanned Aircraft Systems), and continued development and integration of OPA (Optionally Piloted Aircraft) or autonomy-enabled helicopters, to supplement and support manned operations in high-risk operations or environments.
Expected Implementers:	• FAA – UAS Integration Office (AUS) • USHST Outreach Team • Helicopter Association International (HAI) UAS/OPA Committee • Association for Unmanned Vehicle Systems International (AUVSI)
Statement of Work:	In 10 of the 52 LOC-I, UIMC, and LALT fatal accidents from USHST's 2009-2013 dataset, the working group concluded that integrating either UAS or an OPA could have mitigated some of the risks during the operation. Applications that can be performed by UAS or an OPA continue to grow. Given the continued expansion of UAS and OPA (both in sensor and performance) capabilities, their use to supplement and support operations is logical when manned operations are particularly high risk, such as in low level situations, especially near wires. The intent of this H-SE is to mitigate risks in situations in which manned flight puts individuals at unnecessary risks of injury or death, and suitable unmanned or autonomously assisted options exist to support or supplement the operations. The following conditions should be met in order for UAS or OPAs to be a reasonable compliment to existing, conventional manned helicopter flight in higher-risk operations: 1) Easy to obtain. 2) Compliant with security requirements of various customer needs. 3) Cost-efficient for operators to utilize in performing a specific operation. 4) Does not result in any additional risk (to the safety pilot or remote pilot, support personnel, or bystanders) that would not have otherwise been present with the current manned operation. **Analysis:**

	Four (4) out of the ten (10) accident helicopters that spurred this H-SE struck a wire while engaging in low-level activities. This included: photo documentation of the condition of powerlines and their supporting structures, conducting power line surveys or patrol, or pipeline patrol. Small UASs (SUASs) feasibly could be used for these operations (within the limitations listed in *Potential Obstacles* section) instead of manned helicopters. Sense and avoid technologies are available and being enhanced and more widely implemented to prevent collision with obstacles. The team believes it could have an immediate effect on reducing fatal accidents in manned operations. The integration of autonomous systems and collision avoidance into new and existing helicopters is the next logical step in the evolution of helicopter flight. This technology should not be stressed as a replacement for a human pilot, but to assist and lighten the workload for the pilot during missions assessed in higher risk realms. Costs of implementation of these systems may be a challenge for many operators. One immediate benefit of installing a GPS flight logic controller system into an existing or optionally piloted helicopter is pilot workload is reduced. The machine can be put into hover mode so the pilot can concentrate on placing a payload depending on the mission profile. Perfect grid patterns can be flown on a search and rescue mission, and for topographic and magnetometer surveys. Sensors and systems enable target tracking. One example of how this technology would enhance existing operations is that it would allow a police helicopter to maintain observation while safely orbiting over a scene, thus reducing pilot workload and enhancing safety. In the other 6 cases, wire strikes occurred while engaging in aerial application (1), cattle mustering (1), frost protection (1), cherry orchard drying (2), and low altitude law enforcement search mission (1). Until UA develop to a size that can support mission requirements for frost protection and cherry orchard drying, most likely sUAS will not assume these missions, but they could be performed by optionally piloted helicopters currently capable of hovering around fields in most conditions with extremely low human factor threats. Currently available technologies in the UA marketplace are: 1. First person forward and multidirectional simultaneous view. 2. Automatic take-off and landing. 3. Self-level. 4. Altitude hold. 5. Hover/position hold.

	6. Autonomous and semi-autonomous flight with simultaneous data capture. 7. Headless mode: Pitch control relative to the position of the pilot rather than relative to the vehicle's axes. 8. Omni-directional collision avoidance: forward, rearward, sideward and downward. 9. Terrain following: maintaining constant AGL. 10. Automatic roll and yaw control. 11. GPS Waypoint navigation with mapping. 12. Geotagging of collected data 13. Georeferenced orthomosaics 14. 3-Dimensioonal point clouds 15. 3-Dimensioonal models 16. Digital Surface Modeling 17. Multi-spectral imagery 18. NDVI imagery 19. Automatic logging of all flight data parameters. 20. Failsafe: automatic landing or return-to-home. The 2017-2018 work between industry and government under the UAS Integration Pilot Program (IPP) is an effort to evaluate a host of operational concepts, including night operations, flights over people and beyond visual line of sight, package delivery, detect-and-avoid technologies and the reliability and security of data links between pilot and aircraft. These operational capabilities may allow supplementing more manned helicopter operations than previously thought. Action on this program starts in May 2018. This H-SE dovetails nicely with the following H-SEs already being implemented (especially HSE-70 and HSE-82): HSE-70: Stability Augmentation Systems (SAS) HSE-82: Helicopter Flight Data Monitoring HSE-91: Enhanced Helicopter Vision Systems HSE-100: Digital Cockpit **Project:** 1. Industry to identify operations and environments that are more susceptible to high-risk conditions for manned helicopter operations and for which use of a UAS or OPA could be viably integrated to mitigate risks. 2. Industry to consult with FAA regarding existing operating limitations for UAS and OPA and whether any policy/guidance change would be necessary for UAS or

	OPA to operate in the conditions or environments identified in Output 1. 3. USHST Outreach Team to promote increased integration of UAS for the high-risk conditions identified in Output 1 and deemed feasible based on the FAA's feedback provided in Output 2 (must meet both conditions). 4. Industry to work with the FAA to develop standards for integrating autonomous systems and collision avoidance into existing helicopters, and outlining requirements for future OPA still in development. The following 10 fatal accidents prompted this H-SE: WPR13FA343 ERA13GA046 WPR13FA080 ERA13LA057 CEN11FA053 ERA09LA139 WPR11FA350 WPR09FA284 WPR12LA259 ERA10LA348
Relation to Current Aviation Community Initiatives:	• 14 C.F.R. Part 107 allows for commercial UAS operations. • FAA Low Altitude Authorization and Notification Capability (LAANC) Prototype Evaluation (Fall 2017) • UAS Integration Pilot Program lead applicant MOA (May 7, 2018) • FAA UAS Data Exchange • Drone Advisory Committee • Focus Area Pathfinder Program • UAS Detection Initiative • UAS Operations in the Arctic Program
Performance Goal Indicators:	• Continuous technology advancements in the industry • Educational materials developed. • Educational materials distributed and promoted.

Key Milestones:	<table><tr><th></th><th>Total Months</th><th>Start Date</th><th>End Date</th></tr><tr><td>Output 1:</td><td>12</td><td>Jun. 1, 2018</td><td>Jun. 1, 2019</td></tr><tr><td>Output 2:</td><td>12</td><td>Jun. 1, 2019</td><td>Jun. 1, 2020</td></tr><tr><td>Output 3:</td><td>6</td><td>Jun. 1, 2020</td><td>Dec. 1, 2020</td></tr><tr><td>Output 4:</td><td>6</td><td>Dec. 1, 2020</td><td>Jun. 1, 2021</td></tr></table> **Completion: 36 months**
Potential Obstacles:	Currently, the major obstacle to UAS and OPA use for the missions referenced above is the FAA's restriction of flying Beyond Visual Line of Sight (BVLOS) and other operations, however, with the POTUS IPP initiative starting November 2017, this may resolve within the 36-month window. At present, approval of airspace waivers are slow because of backlogs, although with the planned implementation of LAANC in June 2018, airspace waivers will be somewhat instantaneous in many locations. Wide-scale use of UAS for power or rail line patrol will slowly become economically feasible as BVLOS flight is cleared, and sensor technology is improved. Most initiatives relate to UAS under 55 lbs. The integration of OPA is a potentially challenging but relevant issue. Technology is advancing rapidly and the industry could benefit from enhanced safety should a successful completion of the IPP be able to be applied to the OPA platforms.
Detailed Implementation Plan Notes:	Materials should include recommendations for training and mentoring crews to understand and implement the recommended (best) practices. Additional industry standards anticipated in 2018 that will be applicable to this H-SE are the AUVSI Trusted Operator Program and the UAS Pilots Code. Safety processes must also be integrated into the manned flight as an enhancement to existing safety protocols of implemented SMS.
CICTT Code:	LOC, UIMC and LALT
Output 1:	
Description:	Identify operations and environments that are more susceptible to high-risk conditions for manned helicopter operations and for which use of a UAS or OPA could be viably integrated to supplement or support operations to mitigate risks.

Lead Organization:	HAI – UAS/OPA Committee
Supporting Organizations:	• FAA (*e.g.*, AUS) • USHST • AUVSI
Actions:	1. HAI UAS/OPA Committee and USHST to establish a small team of UAS/OPA SMEs (H-SE 90 SME Team) to research operations and environments that are more susceptible to high-risk conditions for manned operations and for which a UAS or OPA could be a viable to support or supplement operations. 2. H-SE 90 SME Team to conduct a basic review or analysis of the fatal accidents where the working group recommended H-SE 90 as a solution is outlined above in the Statement of Work. The Team should use the USHST's working group data from these LOC-I, UIMC, and LALT fatal accidents as a starting point for further research. They should also consider any recent studies from academia on the subject. 3. H-SE 90 Team to organize the results of the analysis in Output 1 into a brief, formal report to submit to the USHST Outreach Team. The report should also have enough structure and formality to be submitted to the FAA such that any issues involving proposed new use of UASs or OPA can be clearly communicated, addressed, and resolved.
Output Notes:	A dedicated UAS/OPA subgroup/team within the USHST may be necessary in the future.
Time Line:	12 months
Target Completion Date:	Jun. 1, 2019
Output 2:	
Description:	USHST Outreach Team to consult with FAA regarding existing operating limitations for UAS and OPA and whether any policy/guidance change would be necessary for UAS and OPA to be integrated and operate in the conditions or environments identified in Output 1.
Lead Organization:	USHST Outreach Team
Supporting Organizations:	• FAA – AUS • HAI – UAS/OPA Committee • UAS SME Team (formed in Output 1) • AUVSI
Actions:	USHST Outreach Team will submit findings of the H-SE 90 Team to FAA – AUS. The purpose is for FAA – AUS to identify whether

	any of the conditions or operations identified in Output 1 would require any policy/guidance change(s) prior to implementation. The USHST Outreach Team will coordinate a meeting to receive feedback from the FAA after the FAA's review.
Output Notes:	It is possible that some of the conditions/environments identified by the H-SE 90 Team will be acceptable to the FAA under the current policy/guidance, while others will not. For those that are already acceptable without any policy/guidance change, the USHST Outreach Team should not delay in engaging industry.
Time Line:	12 months
Target Completion Date:	Jun. 1, 2020
Output 3	
Description:	USHST Outreach Team to promote increased integration of UAS for the high-risk conditions identified in Output 1 and deemed feasible based on the FAA's feedback provided in Output 2 (must meet both conditions).
Lead Organization:	USHST Outreach Team
Supporting Organizations:	HAI – UAS/OPA Committee
Actions:	USHST Outreach Team will use face-to-face opportunities, social media, website presence, and other forms of media to communicate the findings of the UAS/OPA SME Team and encourage operators to use UASs or OPAs in cases of the conditions or environments identified in Output 1 and acceptable under current FAA regulation, policy, and guidance.
Output Notes:	
Time Line:	6 months *(for initial outreach, ongoing after that time)*
Target Completion Date:	Dec. 1, 2020
Output 4	
Description:	Industry to work with the FAA to develop standards for integrating autonomous systems and collision avoidance into existing helicopters, and outlining requirements for future OPA still in development
Lead Organization:	H-SE 90 SME Team
Supporting Organizations:	HAI – UAS/OPA Committee
Actions:	The H-SE 90 Team shall explore mechanisms to encourage manufacturers and the FAA to invest in R&D and develop standards for integrating this technology into new and existing helicopter airframes, including drafting a white paper and or coordinating meetings to highlight the value and need.

Output Notes:	It is possible that some of the technologies identified by the UAS/OPA SME team will be acceptable to the FAA under the current policy/guidance, while others will not. For those that are already acceptable without any policy/guidance change, the USHST Outreach Team should not delay in engaging industry. The issues that do require policy/guidance revision would obviously need to wait for engagement with industry.
Time Line:	6 months
Target Completion Date:	Jun. 1, 2021