Integrated Visual Augmentation System (IVAS)

Executive Summary

- In 1QFY20, the Army executed Soldier Touchpoint (STP) 2 to assess Integrated Visual Augmentation System (IVAS) Capability Set (CS) 2 prototypes in an operational environment.
  - CS 2 prototypes demonstrated increased capability from CS 1, including the ability to integrate GPS, tactical radios, and rapid target acquisition (RTA); fuse low-light and thermal imagery; and simultaneously operate up to 50 systems within squad and platoon exercises.
  - Conventional soldiers and marines responded favorably to the perceived usefulness of CS 2. Special Forces and Army Rangers responded favorably to person of interest identification, text translation, and squad reconnaissance capabilities. They did not consider most CS 2 capabilities to be an improvement over their current thermal, low-light, and GPS equipment and capabilities.
  - Performance problems with GPS, imagery sensors, and RTA integration were noted during STP 2.
- DOT&E observed STP 2 and submitted an evaluation to Congress as requested by the Chairman, Senate Armed Services Committee.
- Due to the coronavirus (COVID-19) pandemic, the Army delayed STP 3 from July to October 2020. The Army will assess CS 3 in STP 3 to support the decision to move from rapid prototyping into rapid fielding. As with the previous capability sets, DOT&E observed STP 3 and will evaluate CS 3.

Capability Set 2

Capability Set 3

System

- IVAS includes a heads-up display (HUD), body-worn computer (puck), networked radio, and three conformal batteries for each soldier. The system includes an advanced battery charger for each platoon and a tactical cloud computing capability, known as Bloodhound, for each company.
- The Army intends for IVAS to increase close combat lethality by providing improved communication, mobility, situational awareness, and marksmanship.
- The Army has structured IVAS as a middle tier of acquisition program with a 2-year prototyping period of four capability sets with software sprints and hardware builds. The Army and Microsoft define each capability set in a design review based on the results from the previous capability set and overarching program goals.
  - The IVAS CS 1 is Microsoft commercial HoloLens 2 with an integrated commercial, thermal sensor, and Tactical Assault Kit (TAK) software and maps. These prototypes operate on an internal battery and require a Wi-Fi network. The Army received 50 systems in March 2019.
  - The IVAS CS 2 included the integration of two low-light cameras, thermal sensor, tactical radio, TAK software and maps, rapid target acquisition, commercial GPS receiver, and conformal battery with Microsoft commercial HoloLens 2. The Army received 300 systems in October 2019.
  - The IVAS CS 3 will be the ruggedized military form factor with integrated low light and thermal sensors, TAK software and maps, and rapid target acquisition. The Army received 600 systems in September 2020.
  - The IVAS CS 4 will be the production-ready end-user device to provide enhanced squad lethality. The Army expects to receive 1,600 systems in April 2021 to support the initial operational test.
- IVAS provides a warfighting training tool through the Squad Immersive Virtual Trainer (SiVT). SiVT provides infantry fire teams the ability to enter and clear a shoot house of virtual combatants and non-combatants.

Mission

- Commanders of Army and Marine Corps close combat formations and Special Operations Forces units will employ IVAS to achieve overmatch against near-peer threats identified in the National Defense Strategy. The Army intends to evolve the concept of operations in coordination with the joint force through experimentation as the system capabilities mature.
- Squads will train with IVAS in the SiVT in a high fidelity, live and mixed reality, immersive environment enabling rapid conduct and repetition of training scenarios.

Major Contractor
Microsoft – software developed in Redmond, Washington, and hardware developed in Mountain View, California

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Activity
- From October 28 through November 21, 2019, the Army executed STP 2 at Fort Pickett, Virginia, to assess CS 2 prototypes in an operational environment and demonstrate improvements from CS 1.
- Soldiers and marines executed squad-level exercises followed by platoon missions conducted against a nominal opposing force.
- DOT&E observed STP 2 and submitted an evaluation to Congress in May 2020 as requested by the Chairman, Senate Armed Services Committee. Since STP 2 was an experiment with prototype systems, the Army did not submit the STP plan to DOT&E for approval.
- STP 2 provided credible data collection opportunities. DOT&E assessed CS 2 using data from observations, focus groups, surveys, and success rates for specific operational subtasks within each task.
- Between STP 2 and STP 3, the Army has conducted multiple software sprint cycles and user juries to address problems found at STP 2.
- The Army delayed STP 3 from July to October 2020 due to the impacts of COVID-19. The Army executed STP 3 to assess CS 3, the first military form factor headset, at Fort Pickett, Virginia, with an Army company-sized unit. DOT&E observed STP 3 and will assess the operational capabilities of CS 3.

Assessment
- During STP 2, warfighters equipped with IVAS CS 2 demonstrated the following:
  - Dismounted navigation along a planned route during day and night. In daylight, warfighters reported increased speed of movement. The integrated GPS eliminated the need to self-locate and self-orient. At times, issues with commercial GPS accuracy led to inaccurate position location information. At night, poor low light and thermal sensor performance prevented some operational navigation activities.
  - Live target shooting on a static range during day and night using a rifle paired with the RTA capability, which makes the weapon's sight picture visible in a warfighter's headset. Warfighters were able to rapidly detect and engage targets from different shooting positions. At times, the headset limited the shooter's field of view and concussive forces from weapon firing caused the IVAS screen to blank out or freeze and return to normal without user intervention.
  - Mission planning and squad area reconnaissance during daylight conditions. Squad and team leaders developed and transferred mission plans, with the help of IVAS trainers, to each squad member in their headset prior to conducting mission rehearsals. Throughout reconnaissance activities, IVAS provided the squad with increased situational awareness and navigational capabilities. At the completion of a mission, squad leaders used the IVAS after-action review feature to playback the mission to the squad.
  - Stationary human target detection at night using the low-light and thermal sensors. At high moon illumination levels, soldiers could detect human targets in the open with low-light sensors. Warfighters' ability to detect human targets decreased with decreasing illumination from the moon. Warfighters used IVAS thermal capabilities to improve situational awareness. Thermal sensors experienced latency making movement challenging.
  - Platoon maneuvers during daylight and twilight conditions. A platoon-sized element of 49 warfighters conducted ambush and attack missions against a squad of threat forces. During these activities, IVAS proved most useful during maneuver to maintain formation and improve situational awareness, including detection of opposing forces that would have otherwise remained hidden. IVAS was least useful indoors, at night, and when in close contact with the enemy.
  - Clearing a building of reactive virtual SiVT targets and content using synthetic M4 weapons. Each squad repeated this activity multiple times under different configurations of civilians, hostages, and enemies who exhibited basic human actions and reactions. Following each run-through, warfighters received feedback in the after action reviews about their performance, including shots taken, kills, and shots received.
- Warfighters responded to surveys about overall user acceptance, contribution of IVAS to various test activities, and satisfaction.
  - User acceptance was unit-dependent and generally favorable for conventional Army forces from the 82nd Airborne and the Marines. Special Forces and Army Rangers responded favorably to person of interest identification, text translation, and squad reconnaissance capabilities. They did not consider most CS 2 capabilities to be an improvement over their current thermal, low-light, and GPS equipment and capabilities.
  - Problems with rapid target acquisition integration, low-light and thermal sensors, and GPS accuracy are reflected in low scores for IVAS support of shooting and land navigation activities.

- Warfighters commented on suitability issues with CS 2 IVAS prototypes to include: light discipline, lens fogging, discomfort during extended usage, and poor interoperability with current tactical combat gear were noted in warfighter comments.
- DOT&E, in concert with Army Test and Evaluation Command, Soldier Lethality Cross-Functional Team, and Program Manager IVAS, developed an early concept for testing IVAS in an initial operational test to support full-rate production.
  - DOT&E plans to use data from company-level force-on-force operations and squad-level live fire to evaluate whether a unit equipped with IVAS is more lethal than a unit that does not have IVAS.
  - DOT&E will rely on data collected from real-time casualty assessment instrumentation, IVAS-embedded instrumentation, surveys, and field observations to support the evaluation.
- The Army is working to determine how to integrate Multiple Integrated Laser Engagement System (MILES) onto IVAS-equipped soldiers.
- The Army Test and Evaluation Strategy is in draft. The Army intends to submit the Test and Evaluation Strategy to DOT&E for approval.

Recommendations

The Army should:

1. Complete a Test and Evaluation Strategy to outline what information is required to support full-rate production and rapid fielding decisions. Determine which developmental and operational test efforts are required to supply data for an evaluation.
2. Improve HUD light emissions, low-light cameras, thermal sensors, GPS accuracy, software reliability, rapid target acquisition integration, and TAK software integration.
3. Determine how IVAS and rapid target acquisition can integrate into existing training and testing instrumentation.
4. Work with Microsoft to determine how embedded IVAS instrumentation can be used to support test and evaluation efforts.
5. Determine how IVAS and the RTA capability can integrate into or replace existing real time casualty assessment instrumentation for training and testing (i.e., MILES).