

Degradable Taggants & Automated Multi-platform Sensor for Intelligence, Surveillance and Reconnaissance

TIAX LLC

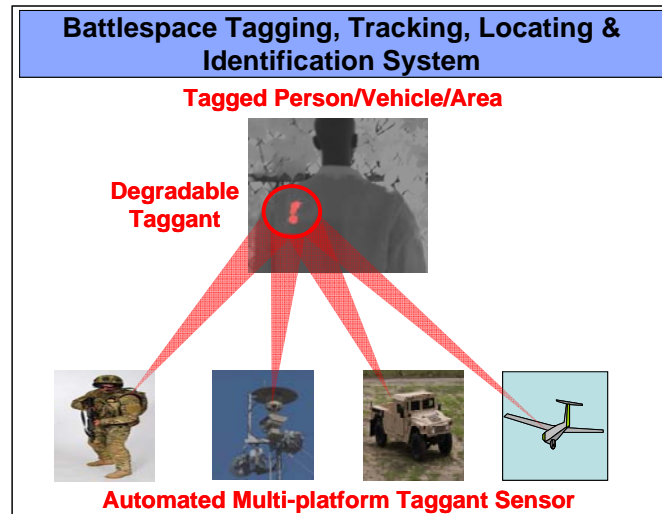
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PROBLEM STATEMENT

There's a strong need for tagging, tracking, and locating (TTL) of a variety of assets/areas/activities for enhanced intelligence acquisition, surveillance and situational/battlespace awareness in order to help address asymmetric and irregular warfare – one of thirteen Naval Science & Technology (S&T) focus areas¹ that also relates directly to Naval Expeditionary Maneuver Warfare, one of ONR's eight selected Future Naval Capabilities (FNC)². Improved taggants and sensors are needed to provide enhanced TTL capabilities that can be customized and integrated according to the rapidly evolving application scenarios and needs of the warfighter.

Current taggants have limited functionality and are non-degradable, i.e., their signal does not diminish over time. Such taggants "pollute" areas of interest with old taggant signatures³, and hamper the ability to detect and distinguish taggants during future TTL operations. Degradable taggants with controllable decay and customizable lifetimes are needed which can "disappear" after serving their purpose. They will prevent "pollution" of tagged areas, and enhance detectability. They can also provide key additional functionality, e.g., a time component to tagging³. Degradation will also enhance their covertness by limiting the enemy's ability to reverse-engineer the taggants. Further, there is a need for customizable multi-platform optical taggant sensors that can provide reliable, automated interrogation, detection, and alerts to the warfighter.

¹ 2009 Naval S&T Strategic Plan, http://www.onr.navy.mil/about/docs/0703_naval_st_strategy.pdf

² Future Naval Capabilities, <http://www.onr.navy.mil/fncs/>

³ Navy SBIR 2007.1, Topic N07-072, http://www.navysbir.com/n07_1/n071-072.htm

WHO CAN BENEFIT?

The TIAX taggant and sensor technology is applicable to Intelligence, Surveillance, and Reconnaissance (ISR) in all areas of the DoD, with an initial thrust in the Expeditionary Maneuver Warfare and Combating Terrorism Department at ONR. The original acquisition program on the solicitation topic is the Marine Corps Intel, Tactical Remote Sensor Systems (TRSS). Our technology will provide several new and enhanced capabilities to the warfighter, will be widely applicable, and can be customized and integrated as per specific warfighter needs and application scenarios. It will benefit USSOCOM PEO-SRSE (Special Reconnaissance, Surveillance, and Exploitation). It will also benefit the US Air Force (USAF), and we are concurrently developing related TTL capabilities for USAF. Further, system integrators such as L-3 Communications, BAE Systems, and Northrop Grumman, Boeing, and Lockheed Martin who are interested in the TTL technology area can also benefit from this technology, and we plan to work with selected prime contractors to take this technology from TRL 6 to TRL 9.

BASELINE TECHNOLOGY

Although taggants have the potential to provide significantly enhanced intelligence, surveillance and situational awareness, their use is currently quite limited. Current taggants have limited functionality and are non-degradable, and hence "pollute" areas of interest with old taggant signatures. This hampers the ability to detect and distinguish taggants during future TTL operations. In addition, current taggants do not provide time information regarding the tagged assets/activities. Further, current taggant sensors (e.g., if night vision goggles are used to detect taggants) do not provide automated interrogation, detection, and alerts to the warfighter. Improved taggant and sensor technologies are needed to provide enhanced capabilities that can meet the rapidly evolving TTL application scenarios and needs of the warfighter.

TECHNOLOGY DESCRIPTION

We are developing customizable degradable taggants, automated taggant sensor, and integrated tagging system. The taggants are designed to degrade (lose optical signal) controllably over time. They can be applied to several types of assets/areas of interest. They are also low in cost (e.g., less than 1/10th to 1/100th of the cost of quantum dot based taggants), and hence can be used for several types of operations including perimeter/area tagging applications. The taggant sensor can provide automated interrogation, detection, and alerts to the warfighter, and is suitable for use on multiple platforms [handheld, tower, ground vehicles, and Uninhabited Aircraft Systems (UAS)].

This technology will provide new and enhanced capabilities to the TTL user community. It will provide a powerful tool for tagging, tracking, locating, and identifying assets (e.g., people, vehicles) and activities of interest. It will enable near-real time detection of movement through, or intrusions into, sensitive areas (digging, foot traffic, vehicular

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tracks, and indications of improvised explosive device threats). It will also provide time information regarding the tagged assets/activities. It will be widely applicable, and will be customizable as per warfighter needs and application scenarios.

Table 1: Features, Advantages, and Benefits

Features	Advantages	Benefits
Degradable taggants	Controlled decay of optical signal over time; No "pollution" of tagged areas with old taggant signatures, unlike current taggants; Customizable taggant lifetimes as per specific operational scenarios	Easier to detect and distinguish targeted assets and activities; Can get time information regarding asset/activity; More effective TTL operations
Covertness	Covert taggant emissions; Need low taggant concentrations to tag object; Taggant degrades over time	Difficult for enemy to detect, defeat, spoof and reverse-engineer taggant
Automated taggant sensor	Sensor provides automated interrogation, detection and alert to warfighter.	No distraction for warfighter; Easy to use; Reliable
Sensor can be stationary or moving	Sensor can be handheld, tower-based, ground vehicle-based, or UAS-based	Several flexible options for designing TTL operations
Sensor has day-night capability	Can detect taggants during the day in spite of solar background	Uninterrupted TTL operations
Customizable and widely applicable technology platform	Taggant, sensor, and tagging system characteristics can be customized and integrated as per rapidly evolving warfighter needs	Can use the same technology for multiple TTL operational scenarios

Further, under a concurrent project, we are using our sensor technology platform to develop a modular taggant sensor for Air Force Research Laboratory (AFRL) that can detect a wide array of biotaggants that are under development. This sensor prototype is designed to be suitable for airborne operation, and will be integrated into a stabilized and flight-tested gimbal. Our technical approach is enabling accelerated detector development at much reduced cost – the extremely high, and rapidly growing, cost of UAS-borne detectors is an issue of major concern⁴.

CURRENT STATE OF DEVELOPMENT

This technology has been developed to Technology Readiness Level (TRL) 4 as of Q3 of calendar year 2009. We have demonstrated taggants that show degradation of optical signal over time. We have also developed a taggant sensor prototype and used it to successfully demonstrate detection of taggants and tagged entities outdoors under natural

⁴ According to DoD's "Unmanned Aircraft Systems Roadmap, 2005 - 2030", sensors are now one of the single largest cost items in unmanned aircraft, and there is a strong need to control cost growth. As an example, Global Hawk's RQ-4 Block 10 Integrated Sensor Suite (ISS) represents over 33% of the aircraft's total cost. Further, there's a high risk of loss of the sensor due to UAS deployments in "dull, dirty, or dangerous" missions.

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sunlight. Some of our results were used in a recent ISR to C2 (Command & Control) field demonstration at the Marine Corps base at Kaneohe bay in Hawaii in September 2009, with the overall goal of demonstrating ONR integrated capabilities to transition partners and to seek constructive warfighter feedback early in the technology development process.

We are working towards a TRL 6 prototype of the taggant and automated taggant sensor, and expect to reach this milestone at the end of calendar year 2010. In Q4 of calendar year 2010, we plan to conduct an outdoor demonstration of taggant detection and change detection at medium- to long-range under realistic outdoor conditions in daylight. We plan to invite representatives from the Marine Corps as well as USSOCOM PEO-SRSE to this demonstration. We also plan to conduct an outdoor demonstration of our stabilized gimbal-integrated taggant sensor prototype (TRL 6) on a moving ground-based platform during Q4 of calendar year 2010 under our project for AFRL.

TIAX will license this technology to system integrators and support them in developing customized and integrated system solutions, getting the technology qualified through testing and demonstration, and transitioning it to the field. TIAX is an ISO 9001 certified company and has extensive experience in working with government agencies in both, prime contractor and sub-contractor roles.

REFERENCES

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ABOUT THE COMPANY

TIAX is a technology processingSM company. We transform emerging innovations into robust technology platforms ready for hand-off. Leveraging our technologies, laboratories, and links to external innovation sources, we collaborate with our customers in industry and government to create new business opportunities and achieve mission objectives. Founded in 2002 with the acquisition of the assets of the former Arthur D. Little's 116-year-old Technology & Innovation Business, TIAX is a 125-person company with offices in Massachusetts and California. We are ISO 9001 certified and maintain a Top Secret DoD facility clearance. TIAX was named a Technology Pioneer in 2003 and a Global Growth Company in 2006 by the World Economic Forum.

Today, many companies face the challenge of rapidly creating profitable growth. We offer an alternative to complex mergers and acquisitions, risky internal development programs, and costly technology licensing arrangements. Our two primary approaches are designed to accelerate the implementation of innovation for sustainable growth, while also reducing time to market and total expense.

- **Technology Transformation:** We offer Technology Platforms that have been developed to a demonstrable hand-off point at attractive prices for access and commercialization. Through tight collaboration with our partners, we customize these platforms to their markets and products.
- **Interactive Development:** We combine our knowledge of markets, applications, and surrounding industries with our proven databases, models, and intellectual property into Development Environments that provide technical input to the client's internal development teams.

Our technologies are clustered into five business areas: Advanced Battery Systems, Building Systems & Efficiency, Clean Energy & Transportation, Materials & Chemicals, and Enhanced Security. Selected technology examples include the following:

Stirling engine/generator: Building on pre-existing investment by TIAX and commercial partners, DoD has invested nearly \$6 million since FY06 for the development of a Stirling engine- based electric power generator. This DoD investment includes two current SBIR Phase III contracts totaling \$1.8 million for the continued development of the generator. This clean, quiet, fuel-flexible power source is targeted at the needs of soldiers, marines, and special operations forces in the "power gap" around 1kW, where there is no solution available at present.



Pilot flight equipment: TIAX has licensed our Integrated Aircrew Protection Technology to leading manufacturers of protective clothing and survival equipment, as part of an agreement to commercialize the technology. This TIAX-led team is awaiting decision on a multi- million dollar proposal to the Air Force for System Development & Demonstration and Low Rate Initial Production of an Integrated Aircrew Ensemble based on



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this technology. If successful, this program will be designated an SBIR Phase III.

Li Ion Batteries: TIAX has developed and licensed advanced lithium ion battery technologies to several major international firms - most recently to Vale Inco, one of the world's largest nickel producers. Vale is building a facility to produce cathode materials for portable electronics applications. TIAX is currently in discussions with automakers and battery manufacturers about licensing a similar material for hybrid electric vehicle (HEV) and plug-in HEV applications. In recent years, we have received over \$5 million in license fees for our battery materials technologies.



Specialty Products: TIAX also manufactures, sells, and supports a high-value/low-volume product line: the 90 North™ line of magnetic heading sensors. We have been the sole source of heading sensors for the U.S. Navy's towed sonar arrays for over 15 years. These sensors are a critical component of the towed sonar arrays used by submarines and surface ships to detect waterborne, manmade objects such as ships or submarines.

