| FEATURE |

MISSION SUCCESS IN THE HANDS OF AUTONOMY INNOVATIONS

By METRON

The ability to deliver on the promise of autonomy goes beyond the execution of a single focused, geo-localized application. Rather, autonomous solutions need to be adaptable to different platforms, vehicles, sensors, payloads, and missions. However, until autonomy is proven resilient and reliable, trust in uncrewed assets such as AUVs, UUVs, and ASVs, real world applications will be largely reliant of human supervision.

ESTABLISHING TRUST

Today, there are very few companies that have proven autonomous solutions in the water, but those that do—like Metron—usually have a background in developing safe, reliable, and resilient tech solutions for defense markets. But establishing this trust in the operational efficacy of autonomous systems is a multifaceted challenge and one that is further compounded when we consider the prospect of multiple platforms and vehicles working seamlessly as a network of assets. Ultimately, marine autonomy is a fast paced and emerging market, so traditionally, as with any nascent industry, this is the phase in which technologies can fail.

Mounting regulatory issues have also proven burdensome. As is often the way with breakthrough technologies, regulation often struggles to keep pace with the technological developments it is decreed to govern. Suffice to say, the path to the full integration of autonomous marine operations is cloudy at best and somewhat blurred by the fact that the terminology—autonomous vs. automated—is often misunderstood or used interchangeably.

AUTONOMOUS vs. AUTOMATED

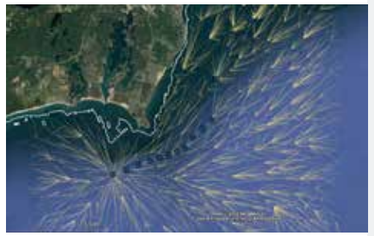
A simple way to distinguish between "autonomy" and "automation" is by the nature of how a control system's action policies are generated and managed. Both autonomous and automated systems work to govern the actions of a system operating in some environment, to accomplish one or more goals. In automated systems, the control system's actions are governed by a set of rules (i.e. action policies) established by the system designer prior to the system being deployed. If the system, environment, or system demands change appreciably, this generally requires the system rules to be updated by a human.

In fully autonomous systems, the control system is bestowed with the ability to adapt its own action policies to better handle unforecasted changes to the environment, system demands, or the system itself. An ideal resilient autonomous system can make optimized adjustments in situ without human intervention. For vehicles, autonomy applies to control systems that make decisions about the vehicle actions in its external environment (i.e. extrospective autonomy for route planning, hazard avoidance, payload usage, etc.), but it also applies to action decisions for the systems driving the platform itself (i.e. introspective autonomy for system alignments, mode changes, etc.).

LESSONS FROM DEFENSE

Understanding the real-time interplay of the internal and external dynamics of autonomy remains a key driver for software development at Metron. What began in 1984 as a defense and national security focused business, has evolved into an award-winning, trusted provider of advanced solutions for government and commercial markets. Today, Metron is developing the next generation of autonomous system software to equip customers with more impactful tools across the sea, air, land, and space programs.

» *ANCC autonomy software will allow uncrewed assets to make non-scripted decision-making to ensure responses like object avoidance rerouting. (Image credits: Metron)*



» *ANCC's autonomy route planning: in situ - planning and pruning. (Image credit: Metron)*

Metron's long history of collaborating with DOD programs—including working on the development of LD-UUV and XL-UUV class vehicles for the US Navy—has afforded the team some unique and extensive involvement with lengthy and dynamic AUV missions. This in-field experience has been fundamental in shaping the company's autonomous vehicle philosophy—one underpinned by the principles of utility, reliability, and adaptability—and multi-domain approach to the fielding of next-generation autonomy.

DEPLOY & FORGET

In the context of present-day offshore exploration, Metron's expertise across AI, machine learning, data analytics, and decision support has triggered a fresh focus on software technologies that significantly increase the reliability and longevity of uncrewed vehicles in some of the planet's most demanding and remote waters.

In an attempt to integrate improved prognostics, intelligent planning, and adaptive decision making, the team launched the Resilient Mission Autonomy™ family of solutions. Sensor, vehicle, and payload agnostic, as well as directly applicable to a wide range of marine survey and inspection programs, Metron created a high level, two-product portfolio defined by the concepts of "Mission Autonomy" and "Introspective Autonomy."

With the first product, ANCC (Autonomy, Navigation, Command, and Control), autonomy maximizes operational success through intelligent, mission-driven, adaptive, non-scripted decision making without the need for human operators present. ANCC was created under the philosophy that each mission or application's success is measured by achieving results of the mission tasks and objectives—in other words, "Mission Autonomy."

While both products were designed to support the needs of offshore survey and inspection service providers and their respective vehicle manufacturers, Metron's "Introspective Autonomy" offering, SAHM-IAMM (Self-Adaptive Health Management via Intelligent Autonomous Monitoring and Mitigation), introduces a further dimension to autonomous operations in which health status monitoring enables system adaptation, preventative maintenance, increases operational availability, reduces sustainment costs, and minimizes critical mission failures.

SAHM-IAMM is able to observe and manage the action policies of the systems that govern all of its inner workings and ultimately detects anomalous behaviors and predicts faults before they occur.

FUTURE IMPLICATIONS

Autonomy of this degree will prove instrumental to establishing a true paradigm shift for offshore activities. Today, as operators increasingly trial, adopt, and integrate uncrewed assets, human engineers are still required to routinely provide intelligent oversight of hardware systems, using automation as an aid to enable fewer humans to control ever larger and more complex hardware systems.

However, SAHM-IAMM autonomy is designed to serve as a genuine stand-in for the cognitive functions of the human operating engineer, working in concert with lower-level automation controllers to make plans, enable tradeoffs, predict and prevent issues, and facilitate any necessary repairs. Coordination between SAHM-IAMM and ANCC autonomy solutions will for the first time provide a holistic Resilient Mission Autonomy solution for industry.

The implications are far-reaching. While the commercial market has fully incorporated the notion of full autonomy into marketing communications, true autonomy—and the promise it must fulfill through genuine performance trust—remains a high bar for uncrewed assets.

The industry has arrived at an inflection point, whereby autonomy can independently consider not only the performance of an asset and mission but run full risk analysis and any subsequent interventions on long-duration deployments. This is the core capability needed to unlock the true potential of uncrewed vehicles, and Metron's capacity to implement custom Resilient Mission Autonomy software brings the offshore exploration community one step closer to this operational reality.

For more information, visit: *www.metsci.com*.