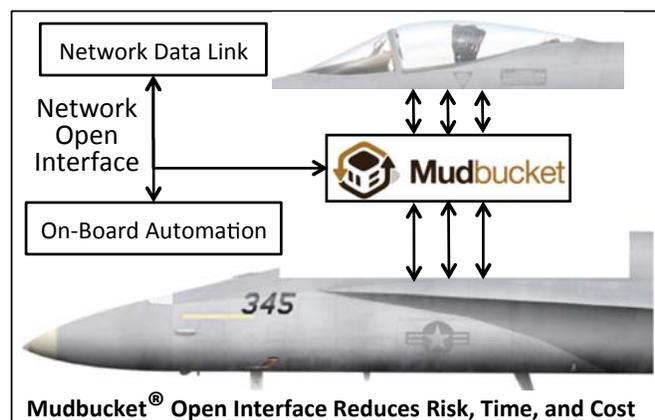# The Value of a Comprehensive Surrogate
The Time is Now

CTSi has been supporting aviation customer's use of surrogates to save precious money and time when developing and testing multiple aviation systems. Recent breakthroughs in surrogate technology show even greater promise and have drawn interest DoD-wide, yet follow-through in the current fiscal environment has been slow, placing customers at risk. We are asking current and potential customers to express their interest to the community and to commit new investment before the value of these breakthroughs are lost.

The aviation community has a long and successful history of using surrogates to test aircraft systems. Most recently the Navy UCAS program employed an F/A-18 as a surrogate aircraft to test Precision GPS for shipboard landing and related functions. Testing with the surrogate during landing, arrestment, bolter, and catapult launch revealed important problems and potential enhancements to the navigation and landing solution. These problems would have gone undetected without a surrogate capable of on-deck operations at the ship. Early detection and repair of these problems contributed materially to the success of the recent UCAS X-47B shipboard landing demonstration.

Yet the Navy still lacks a surrogate that can be controlled through every phase of flight including the carrier control zone, automated aerial refueling, automatic landing and bolter, and deck handling. As a result only a small fraction of the planned shipboard functionality of the X-47B was demonstrated. For automated refueling, significant time and money was consumed adding a dry refueling probe to a commercial experimental aircraft; the probe had to be rebuilt several times and still faces significant flight clearance issues. The lost money and time derives from an inability to develop and test in parallel the functions that are predominately aircraft-independent, yet necessary for continuous, reliable operation aboard ship and in close proximity to a tanker aircraft.

Lack of a "comprehensive surrogate" – a single aircraft that can validate the integration of a large number of critical functions needed aboard ship – hinders the detection of performance, integration and technical problems, resulting in significantly increased cost and schedule.

The Comprehensive Surrogate solves all of these problems at a fraction of the cost by taking existing surrogates to their ultimate logical destination: optionally piloted aircraft. The ability for an organization of third-party vendors to turn an F/A-18 aircraft into an optionally piloted aircraft, at minimum cost, exists right now. The technology needed for controlling an F/A-18 in every phase of flight, while keeping the mission systems and flight controls intact, and while maintaining safety standards, has been demonstrated in the

Mudbucket® Open Interface Reduces Risk, Time, and Cost

NAVAIR Manned Flight Simulator. This technology allows multiple third-party developers, including a UAS aircraft prime contractor, to test and validate critical functions before finalizing system hardware and software builds, thus saving the Navy huge amounts of time and money.

The Comprehensive Surrogate includes a "virtualization" technology that allows software, and in some cases firmware and hardware, to be tested in a flight environment that cannot be distinguished from that of the target aircraft. This virtualization environment is consistent with the Future Avionics Computing Environment (FACE) initiative. The result is a reconfigurable aircraft – an "air truck" – that can fully and safely demonstrate all of the capabilities needed to operate a large UAS aboard ship, at a fraction of the cost and time. The ultimate result is that programs and prime contractors can focus on those physical elements unique to operating their aircraft in the shipboard environment, while allowing their suppliers (and other associated Navy programs and suppliers) to test and validate major systems long before the prime aircraft is ready for shipboard operations – at much less risk and cost.

The breakthrough technology used on Comprehensive Surrogate takes this third-party integration capability to an entirely new level, allowing seamless integration of supplier applications and components onto aircraft for testing. The result is increased competition among suppliers, more opportunities for alternate suppliers, and better prices and delivery times for program managers.

The open-source Mudbucket® product is the breakthrough enabling Comprehensive Surrogate at a fraction of cost and time. A former Chief Engineer for the UCAS program called Mudbucket® "the iPhone" for complex vehicle systems. The method allows signals on any wire to be manipulated in real time to repurpose existing interfaces. Critically, nodes on each end of the wire are unaware that the signals are being modified. For example, an air data sensor may transmit a value of 50 knots, and be changed so the destination sees a signal of 100 knots. This ability to "overdrive" existing signals and interfaces creates a pathway for testing within integrated systems that has not existed before now, and creates a means to integrate future

Mudbucket® Repurposes Existing Interfaces, Saving Time And Money
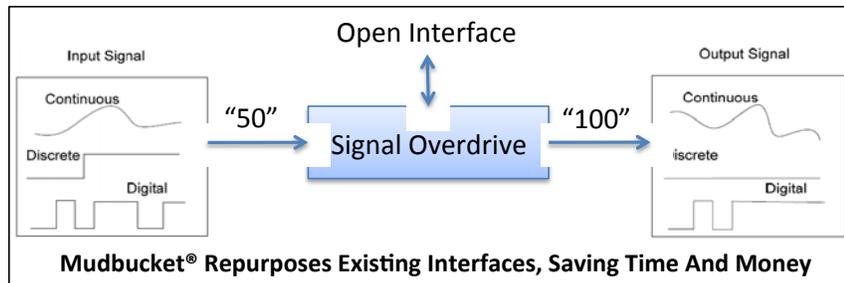
capabilities more quickly at lower cost. These pathways represent access points that turn any vehicle into an open system, enabling multiple vendors to develop and test vehicle applications in parallel, with corresponding benefits to cost, schedule, and performance. Vendors access these emulation and control pathways using the Mudbucket FACE-compliant open source processing environment. This processing environment is similar to that found on modern commercial aircraft such as the Boeing 777, which distributes mission software among numerous vendors, a capability and benefit not achieved to date in military vehicles. Finally, safety is ensured because the Mudbucket® mirrors any redundancy in the host system and does not interfere with existing safety interlocks.

There are multiple near-term programs that can take advantage of the Navy's F/A-18 Comprehensive Surrogate and its technology. By working in combination, these programs can reduce overall costs, and see even greater return on investment. Any program that has a requirement, or can benefit from early testing, more rapid integration, or the use of 3rd party applications can benefit from the Comprehensive Surrogate.

Mudbucket performance, cost, and schedule benefits are available on any vehicle. However, coordinating investment across multiple programs in the current fiscal environment has proven to be a challenge. The team delivering Mudbucket® and Comprehensive Surrogate technologies is at risk. To help us help you, we are asking current and potential customers let the community know of your needs for these technologies, and to fund continued efforts in support of the larger Navy objectives.

For more information, please contact Tom Sanders at 301-880-3341 or Tom.Sanders@goCTSi.com.

Keeping *all* of your hardware-in-the-loop