

# Modeling Algorithms for Unmanned Aircraft/Weapons Management Systems

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**Command: NAVAIR**  
**Topic: N07-009**

## PROBLEM STATEMENT

Accurate modeling of hardware and software components and their interaction as a system are time intensive and therefore expensive endeavors. What is needed is research that demonstrates innovative modeling algorithms for embedded real-time and safety critical processes that enable more rapid and less expensive integration of new systems or components.

## WHO CAN BENEFIT?

Payload intensive platforms that include sensor, weapon and communication systems, such as Unmanned Air Systems (UAS), should benefit significantly from demonstration that the modeling algorithms are effective in a system of systems that includes hardware and software, modeling algorithms and real-time communications. Weapons control from unmanned air platforms requires an extreme degree of confidence in the control systems when prosecuting targets with strict rules of engagement and when returning with weapons to the ship. Therefore real-time, safety critical systems are required to be highly reliable. Army Aviation, Navy Aviation, and USAF Aviation all of which have UAS components deal with identical problems.

## BASELINE TECHNOLOGY

The use of unmanned air systems (UAS) such as the Fire Scout for a wide diversity of missions is rapidly increasing. Emerging Model Driven Architecture (MDA) technologies

offer the promise of being able to accomplish accurate modeling of hardware and software components and their interaction as a system.

## TECHNOLOGY DESCRIPTION

Torch's technology uses models to explicitly show the interactions and behavior of a system that can control and effectively employ weapons independent of any implementing platform. It is consistent with a UAS architecture in that it has both unmanned control and air vehicle elements. The system software is produced managed directly from the models. With the business logic being captured in the platform independent models, it provides a higher degree of quality and predictability. The code is also more easily implemented on different platforms. The technology facilitates portability and reuse, which can greatly reduce lifecycle costs.

Two additional design features have also been included in the technology demonstration, which target lifecycle issues associated with payload intensive platforms. The design has the additional advantage of being consistent with the emerging Department of Defense Open Architecture for unmanned control systems. This results in a system that is easier to integrate because the interfaces and behavior to it are published. The system has also been designed for reconfiguration. Platforms that employ weapons, typically, implement multiple weapons over their life cycle. The design for reconfiguration directly offsets the expense and reduces the time required for implementing multiple weapons.

Feature	Advantage	Benefit
Model Driven Design	Early insight into system behavior independent of targeted architecture	Preserves business logic of the system independent of the targeted processing architecture making it portable
Open Architecture	Easily communicate to third parties how to interface	Shortens integration timeframe and reduces cost and risk
Reconfigurable	Integrated subsystem not tied to a specific weapon or interface	Weapons Agnostic and easily adapts to new weapons

This approach to weapons integration solves a variety of expensive problems encountered by a system life over its lifecycle.

## CURRENT STATE OF DEVELOPMENT

The technology has been demonstrated in a lab environment using a combination of personal computers, embedded controllers, and weapon emulators. The system will be demonstrated with a surrogate unmanned system and a laser guided weapon in the Spring on 2010 placing it at a technology readiness level of 6. Additional planning is on-going

to demonstrate on the targeted system in the summer of 2010 placing it at TRL 7. The base technology is proven and additional functionality can easily be added over time to accommodate additional weapons in the industry and additional safety requirements that may vary across the services .

## REFERENCES

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## ABOUT THE COMPANY

Torch Technologies, with headquarters in Huntsville, Alabama was founded in 2002. This employee owned company has rapidly grown to a firm that in 2008 had \$26.9M in revenues, primarily through its services to the Department of Defense. The companies core capabilities include systems engineering, software development, modeling and simulation, test and evaluation, information technologies, and logistics. The company has been the recipient of many awards including being in the Top 100 Defense Contractors as indicated by Inc 5000 for three years running. In 2008, it also received an award as one of the best mid-sized employers in Huntsville, AL.