

WHO

**SYSCOM:** SSP

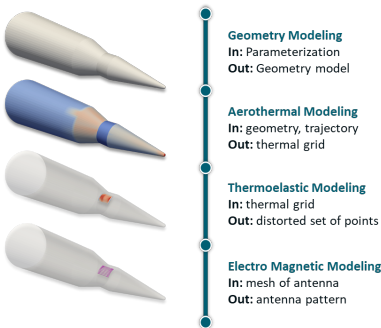
**Sponsoring Program:** Conventional Prompt Strike Program

**Transition Target:** Conventional Prompt Strike Program

**TPOC:** [SSP.SBIR@ssp.navy.mil](mailto:SSP.SBIR@ssp.navy.mil)

**Other Transition Opportunities:** Hypersonic weapon, hypersonic reusable vehicle, and reentry vehicle government and industry programs

**Notes:** Our integrated design environment enables the definition of seeker subsystems. The performance of these systems in hypersonic environments is then characterized using coupled aerothermal, thermoelastic, and electromagnetic modeling tools. The resulting models are then used to simulate performance for system-level objectives.



WHAT

**Operational Need and Improvement:** A high-fidelity design-level modeling environment for radar seeker subsystems that captures the relevant operational and environmental constraints of hypersonic flight for end-to-end integrated performance evaluation is needed. Current workflows simplify the design by neglecting the full set of multiphysics and limiting design to subsystem level objectives.

**Specifications Required:** The Navy desires a design environment for radar seeker subsystems that (1) supports conceptual design through mature validated digital representation of operational seekers; (2) forms digital representations that capture the aerothermal and thermoelastic effects on seekers; (3) deploys models to mission tools for planning of mission compatibility of the seeker technology; (4) is maintainable by the government so that models can be moved between use cases and (5) is adaptable and expandable as technology improves.

**Technology Developed:** The Hypersonic Digital Engineering Testbed for Evaluating Concept Radars (HyDETECTR) is a unique radar seeker design environment that captures the aerothermal, thermoelastic, and electromagnetic multiphysics of the hypersonic environment to perform design tradeoffs.

**Warfighter Value:** An improved hypersonic strike capability can be realized by capturing the aerothermal and thermoelastic impacts of the hypersonic environment on seeker subsystems. Correcting for electromagnetic interference will provide improved estimates of target locations and reduce weapon miss distance.

WHEN

**Contract Number:** N68335-23-C-0237

**Ending on:** Aug 15, 2024

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop Software Architecture	Low	The architecture for integrating the M&S, surrogate modeling, and mission tools was developed	2	4th QTR FY21
Verify M&S components	Low	The accuracy of components verified	3	1st QTR FY22
Integrate M&S tools	Low	The aerothermal, thermoelastic, and electromagnetic software were coupled	3	2nd QTR FY22
M&S Demonstration	Low	The ability to model the impact of the hypersonic environment on an antenna was demonstrated	4	2nd QTR FY22
Steady Surrogates	Low	Surrogate models demonstrated for steady-state processes	4	4th QTR FY22
Transient Surrogates	Medium	Surrogate models demonstrated for transient processes	4	3rd QTR FY23
Deploy Surrogate to 6DOF	Medium	Deployment of the surrogate model to the 6DOF simulation tool will be demonstrated	4	3rd QTR FY23
Demonstrate Radar Design	Medium	Design studies examining antenna shape, material, and placement will be performed	4	3rd QTR FY24
Transition Software	Medium	The radar design environment will be transitioned to the Navy	5	1st QTR FY26

HOW

**Projected Business Model:** The primary product of the proposed effort is a digital engineering framework, capable of integrating multiple, variable fidelity modeling & simulation tools for evaluating radar seeker concepts and designs for hypersonic applications. This technology will be further matured in Phase II and beyond to support the Navy, Air Force, and other DoD as well as industry customers.

Through extensions developed under the Phase II effort, the HyDETECTR framework will support variable fidelity modeling and simulation for evaluating radar seeker concepts. The radar models developed by HyDETECTR can be directly integrated within closed-loop 6DOF simulation workflows and low-level design trade studies. In its final form, HyDETECTR will support multiple applications from early conceptual design through a mature validated digital representation of an operational seeker. The end product will allow evaluation of software changes and planning mission compatibility of the seeker technology.

**Company Objectives:** Our objective is to connect with organizations developing the next generation of seeker subsystems for hypersonic applications, and find a "champion" for this technology in the Navy or broader DoD.

**Potential Commercial Applications:** The developed HyDETECTR tool could find broad use in DoD hypersonic radar seeker analysis, including Navy, Air Force, Army, SMDC, MDA, DARPA, NSA, and the intelligence branches, such as ONI, NASIC, MSIC, NGIC, etc., as well as private industries involved in the development and fielding of next generation hypersonic offensive and defensive programs. Hypersonic weapons and technology programs that could directly benefit from the proposed capability include Navy Conventional Prompt Strike (CPS); Air Force Air-Launched Rapid Response Weapon (ARRW) and Hypersonic Attack Cruise Missile (HACM), Army Long Range Hypersonic Weapon (LRHW), and other emerging programs.

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