

At a Glance

What is it?

■ The Structural Metals and Processing (SM&P) Discovery & Invention (D&I) program is focused on delivering the knowledge and early technology development needed to enable the production of lighter weight, higher strength, higher performance, more damage tolerant, affordable metal alloys for naval structures.

How does it work?

■ The SM&P D&I program invests in promising basic and applied research that will further the understanding of processing–composition–microstructure–property relationships for design and performance prediction across the continuum of length and time scales necessary to enable exploitation of this knowledge for the development of robust naval structures.

What will it accomplish?

■ The SM&P D&I program will develop and deliver naval structural materials and processes that enable increased platform survivability, structural reliability, agility, fuel efficiency, payload fraction and readiness, while reducing platform acquisition, operations, and maintenance costs.

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The SM&P D&I program emphasizes anticipating and developing the fundamental understanding needed to establish the technical feasibility that enables the design and production of higher strength structural metals for platforms and systems with increased performance, reduced weight and reduced cost. Most recently, this program was responsible for the identification, development, and processing qualification of HSLA-65, a high-strength steel alloy that significantly reduced the structural weight of the aircraft carriers currently under construction



Friction stir welding of steel

Currently, the SM&P D&I program investments are focused on promising basic and applied research in the areas of advanced naval steel design and production, affordable titanium alloy design and production, and robust, affordable processing and joining technology. The intent of these investments is to enable:

- *Understanding and quantitatively describing the mechanisms that define the evolution of a material's structure as a function of composition and processing*
- *Understanding the complex and dynamic interactions that modify materials structure and behavior as a function of operational demands and loading events*
- *Developing the characterization and modeling tools at appropriate length and time scales, enabling the advancement of materials science, including design and predictive capabilities*
- *Developing technologically feasible transition paths for advanced structural materials and processing, and knowledge bases for the confident design and life prediction of components and systems*

The warfighter payoff of the SM&P D&I program will be the affordable availability of qualified high strength structural metals and the necessary processing techniques to support the production and fabrication of advanced structural metals for improved platform survivability, reduced platform weight and improved platform efficiency at reduced life cycle costs.

Research Challenges and Opportunities:

- *Accelerating the introduction of the Friction Stir Welding process for high strength steel and titanium production lines*
- *Identifying and developing affordable processing techniques including welding for advanced titanium alloys*
- *Accelerating integrated computational materials science and engineering tools to support precision design and exploitation of material properties*
- *Optimizing the ballistic performance of high strength steels through uncovering the relationship between microstructure and behavior under high rate loading*