

# CANFSA: EXPLORING THE PHYSICAL METALLURGY OF NON-FERROUS ALLOYS

**A unique collaboration brings together university and industry stakeholders to conduct basic and applied physical metallurgy research on non-ferrous structural alloys.**

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Members, students, faculty, and guests attending the fall 2015 CANFSA IAB meeting at the Colorado School of Mines.

**T**he Center for Advanced Non-Ferrous Structural Alloys (CANFSA) is a National Science Foundation industry/university cooperative research center that focuses on the physical metallurgy of non-ferrous engineering alloys and systems. It was created based on the historical decline in physical metallurgy research funding, which has resulted in a dramatic decrease in the number of students pursuing a career in this field. This trend has greatly reduced the synergies that previously existed between faculty, students, and the non-ferrous industries, and has potentially weakened the

U.S. dominance of industries that rely on these interactions.

Jointly located at the Colorado School of Mines (CSM) and Iowa State University (ISU), along with an affiliate site at the University of North Texas (UNT), CANFSA was established in 2011 and recently transitioned into its second five-year phase. The center aims to:

- Become the premier location for research in non-ferrous structural alloys
- Bring together university and industry researchers to conduct basic and applied physical metallurgy

research on non-ferrous structural alloys

- Combine computational modeling, processing, and state-of-the-art characterization methods to address projects of interest to industrial members
- Train students to become critical players in industries that develop or use non-ferrous alloys

This article provides a brief overview of CANFSA, summarizes current research efforts, and describes the types of industry-university interactions within CANFSA.

\*Member of ASM International

## CANFSA STRUCTURE

CANFSA is led by director Michael Kaufman, a professor at CSM, and two site directors, Peter Collins and Amy Clarke, associate professors at ISU and CSM, respectively. The directors and center are supported by the NSF-appointed center evaluator, David Meyer.

CANFSA's target members include organizations that research, produce, process, or use non-ferrous structural alloys. It is a member-driven organization, with participants consisting of large corporations, small businesses, government laboratories, and one trade association. At present, CANFSA has the following 14 members: Air Force Research Laboratory, Army Research Laboratory, Allegheny Technologies Inc. (ATI), Boeing, Embraer SA, GE Aviation, Honeywell International Inc., Los Alamos National Laboratory, National Aeronautics and Space Administration (NASA), North American Die Casting Association, Queen City Forging Co., Thermo-Calc Software Inc., Triumph Group Inc., and Weber Metals Inc. Each member has a seat on the industrial advisory board (IAB), which provides guidance to student projects and oversight of the overall research agenda. Two levels of membership are available within CANFSA—full or associate—with the latter available to organizations with less than 500 employees.

The managing director, Steve Midson (research professor, CSM), focuses on event planning, communications, procurement of external research grants, marketing, recruitment of new members, and reporting and other administrative functions.

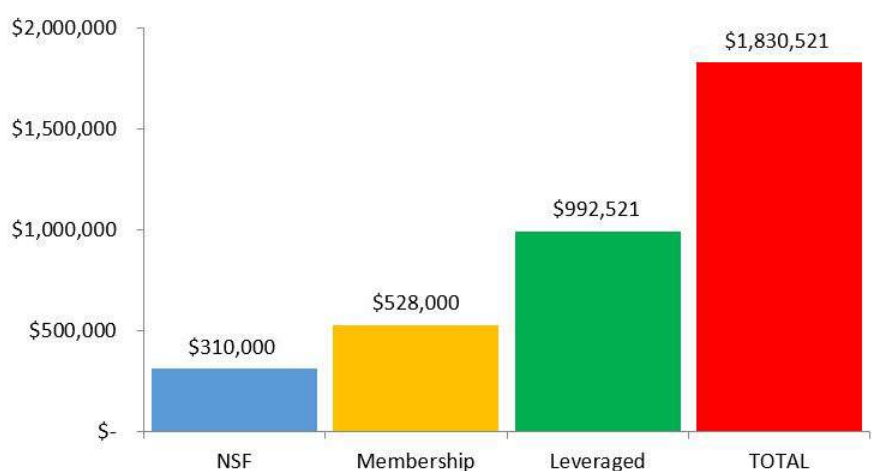
## CURRENT PROJECTS

As shown in Fig. 1, current annual funding for CANFSA is more than \$1.8 million, which originates from three sources including membership dues, National Science Foundation funds, and external, leveraged projects funded outside of CANFSA.

There are 17 ongoing research projects within CANFSA, which are divided into three thrust areas—light-

**TABLE 1—ONGOING CANFSA PROJECTS**

Focus area	Project title
Lightweight non-ferrous alloys	Effects of Strain Variations on Aging Response & Corrosion Properties of 3rd Generation Al-Li Alloys
	High Temperature Stability and Mechanical Properties of Micro-eutectics in Bulk Solidified Al-Fe-Si-V and Related Alloys
	Damage Tolerance/Accumulation in Ultra Fine Grained Magnesium Alloys
High performance non-ferrous alloys	Engineering Fine Scale $\alpha$ -Precipitation for High Strength $\beta$ -Ti Alloys
	Low-Level Hydrogen Effects on Toughness in Titanium Alloys
	Measurement and Modeling of Anisotropy in Ti-6Al-4V Forgings
	Mechanism of Dwell Fatigue Crack Initiation in Ti-7Al Under Biaxial Tension-Tension Loads
	High Temperature Titanium Alloys
	Effect of Grain Size and Precipitate Volume Fraction on Creep and Fatigue in Nickel Alloys
	Characterization of Microstructure Evolution in Nickel-Titanium-Hafnium Intermetallics for Bearing Applications
	Understanding Strengthening of an Aerospace Niobium-Hafnium-Titanium Alloy
	Atomic Ordering in Alloy 690 and its Effect on Long-Term Structural Stability and Stress Corrosion Cracking Susceptibility
Advanced alloys and processes	Collaboration to Accelerate the Discovery of New Alloys for Additive Manufacturing
	PVD Coatings Applied to Die Steel for Lube-Free Die Casting
	Multilayer PVD Coatings for Service Life Extension of Components Used in Aerospace and Manufacturing
	Effects of Thermal Processing Variations on Microstructure and High Cycle Fatigue of Beta-STOA Ti-6Al-4V
	Understanding the Physical Metallurgy of a New Nickel-Based Alloy with a Low Coefficient of Thermal Expansion



**Fig. 1** — CANFSA annual funding effective April 1, 2016.

weight non-ferrous alloys, high performance non-ferrous alloys, and advanced alloys and processes. Current project titles are listed in Table 1.

## NEW PROJECT SELECTION

It is common for universities to conduct research that is poorly aligned with industry needs, largely because faculty are unaware of the economic, infrastructural, or pragmatic technical requirements of industry. Thus, it is imperative that members within a consortium such as CANFSA play a pivotal role in project definition, selection, and execution. As shown in the schematic in Fig. 2, CANFSA provides its members with a number of opportunities to influence the direction of center-funded research projects, including setting objectives, participating in strategic planning, defining technology needs by providing project ideas and proposals, and voting on projects that will be undertaken.

CANFSA has developed a comprehensive, multimonth process for selecting new projects, which it has implemented during the past two years. The procedure consists of the following steps:

1. Ideas for new projects, including a title and short description, are submitted by faculty and members.

2. Ideas are distributed to IAB members who rate each topic, and the list is then narrowed to the top 10-14.
3. Members and faculty then discuss each of the ideas in a videoconference. Ideas might be combined, and if they are sufficiently vetted, they will be carried forward.
4. During the videoconference, each idea is assigned industrial and faculty champions who produce a project outline to be presented at the fall IAB meeting.
5. At the IAB meeting, a structured review process solicits further input from members, who ultimately vote to define project priority. Full members receive 30 votes while associate members get 10 votes to distribute among different projects.
6. Projects with the highest votes are then selected as research topics for incoming students depending on available funding levels and student interests.

Since implementing this process in 2014, 81% of new projects selected originated from ideas initially suggested by member organizations—a testament to the member-driven nature of the center.

## CENTER-MEMBER COMMUNICATION

Formal communication between universities and members is critical to the success of CANFSA. This dialogue is accomplished in several ways.

**IAB meetings:** CANFSA hosts two semi-annual IAB meetings where students present research results. Typically, about 50 people attend these meetings, which are invaluable for providing personal interactions and networking among participants. Organizations interested in joining CANFSA are welcome to attend one IAB meeting as a guest.

**Videoconference series:** CANFSA also hosts two videoconference series per year—spaced between the semi-annual IAB meetings. Accordingly, students present project updates to members four times per year. Videoconferences provide an important opportunity for transferring information and enable an essentially unlimited number of employees from each member organization to access research results and provide students with project guidance. For example, one member organization recently had more than 20 employees from across multiple divisions in several states participate in one or more of the sessions.

**Project mentoring:** Project mentoring is another important communication tool between students and members. As such, at least one “industrial mentor” from a member organization is identified for each project. Industrial mentors frequently interact with students and faculty to provide industrial perspectives and research guidance. Written guidelines help define the project mentor role. ~AM&P

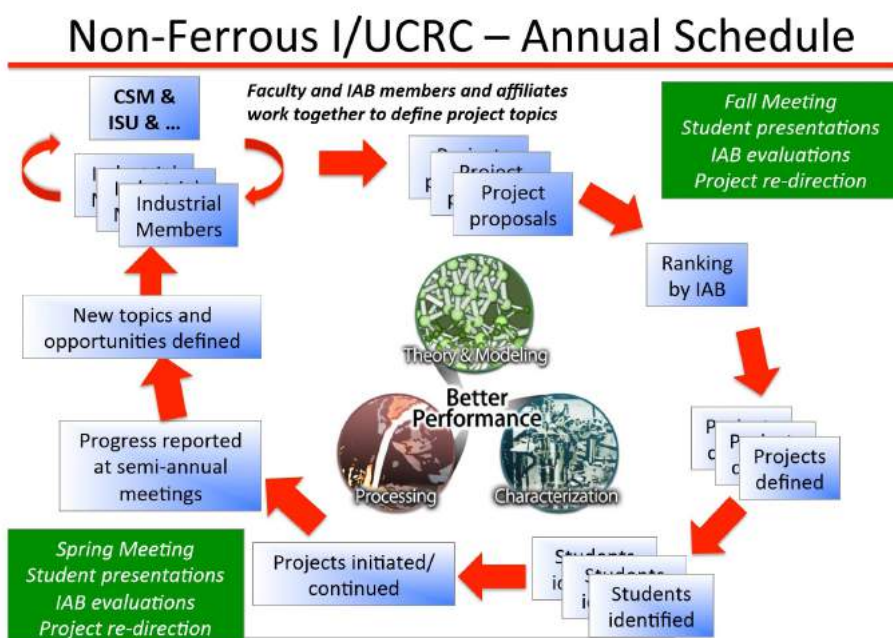


Fig. 2 — Operational practices for CANFSA.

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