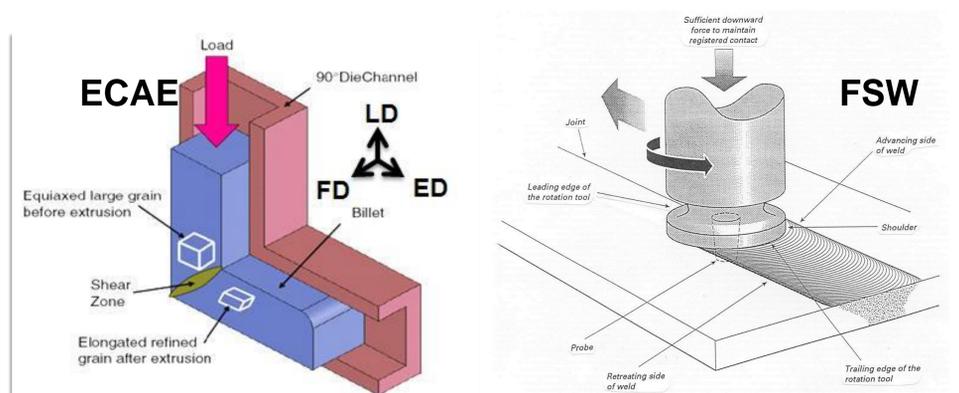


**S&T Campaign: Materials Research**  
*Manufacturing Science*  
*Lightweight & Specialty Metals*

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## Research Objective

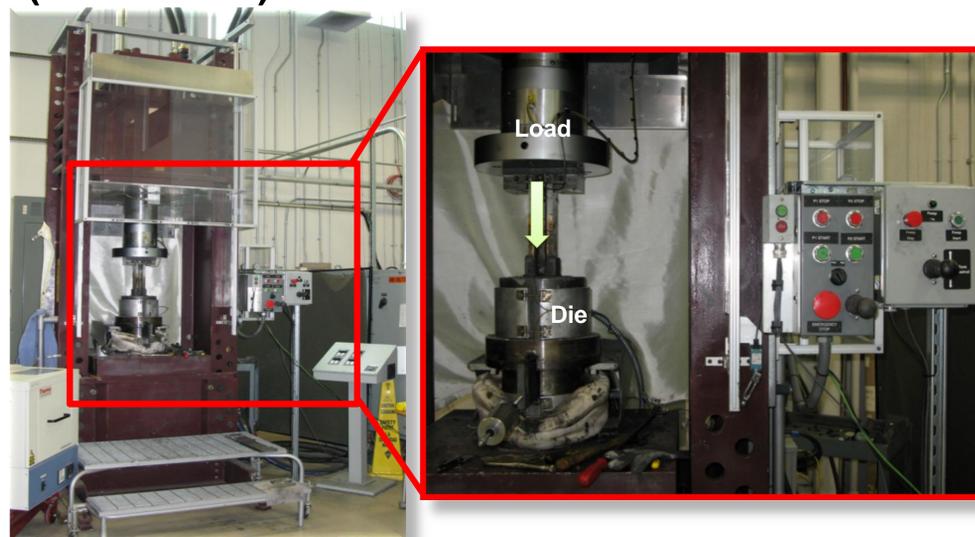
- Investigate and exploit severe plastic deformation processing technologies that allow the control of microstructure and the resulting mechanical properties
- Determine processing/microstructure/properties relationships for high performance, lightweight metals
- The evaluation of deformation processing technologies has pushed the strength levels of different lightweight metal systems to new levels for both structural and protection applications



Scalable severe plastic deformation methods

## ARL Facilities and Capabilities Available to Support Collaborative Research

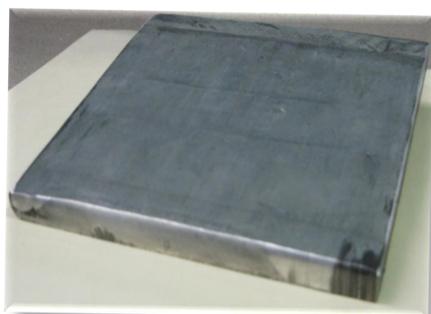
- Equal Channel Angular Extrusion (ECAE) Machine
- Plate and Bar Tooling Geometries
- Thermo-Calc
- Analytical and structural characterization
- Multi-scale material modeling
- Friction Stir Welding (FSW)/Processing Machine (March 2015)



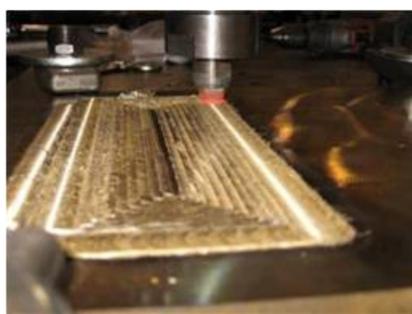
Equal Channel Angular Extrusion Press

## Challenges

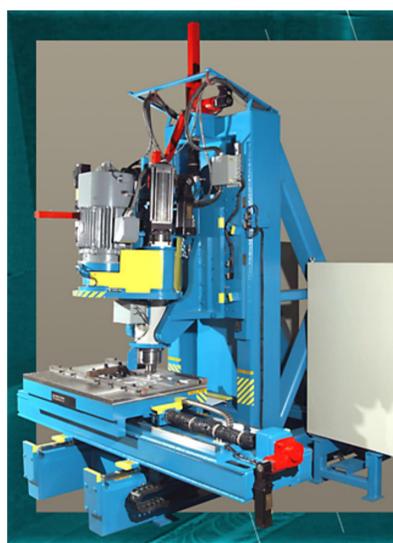
- Determining and applying the relationship between processing/microstructure/properties at multiple rates and different length scales
- Determining and exploiting the similarities and differences in the various lightweight metal systems



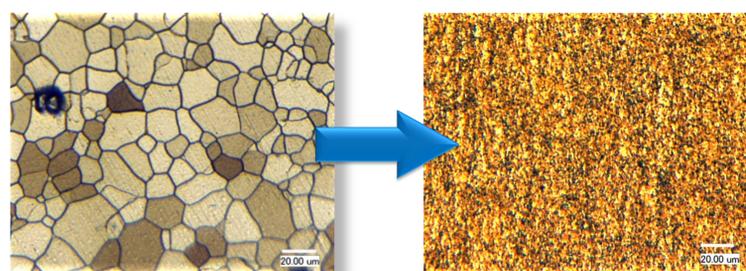
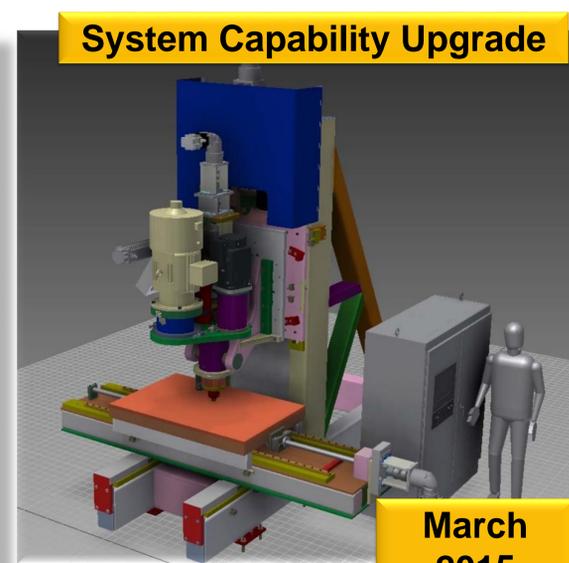
ECAE - 12"x12"x1" Mg Plate



Friction Stir Processing



Friction Stir Welding & Processing



Grain size reduction via severe plastic deformation methods

## Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Multiaxial forging, twist extrusion and other scalable severe plastic deformation manufacturing technologies
- Processing sciences which employ the use of intense fields (acoustic, electro-magnetic and/or magnetic, etc.) for the purpose of controlling phase transformations, grain growth, and/or recovery of strain hardening