Self-Sustaining Energy for Robotics and Autonomous Systems

S&T Campaign: Sciences for Maneuver
Energy and Propulsion
Power/Energy Conversion

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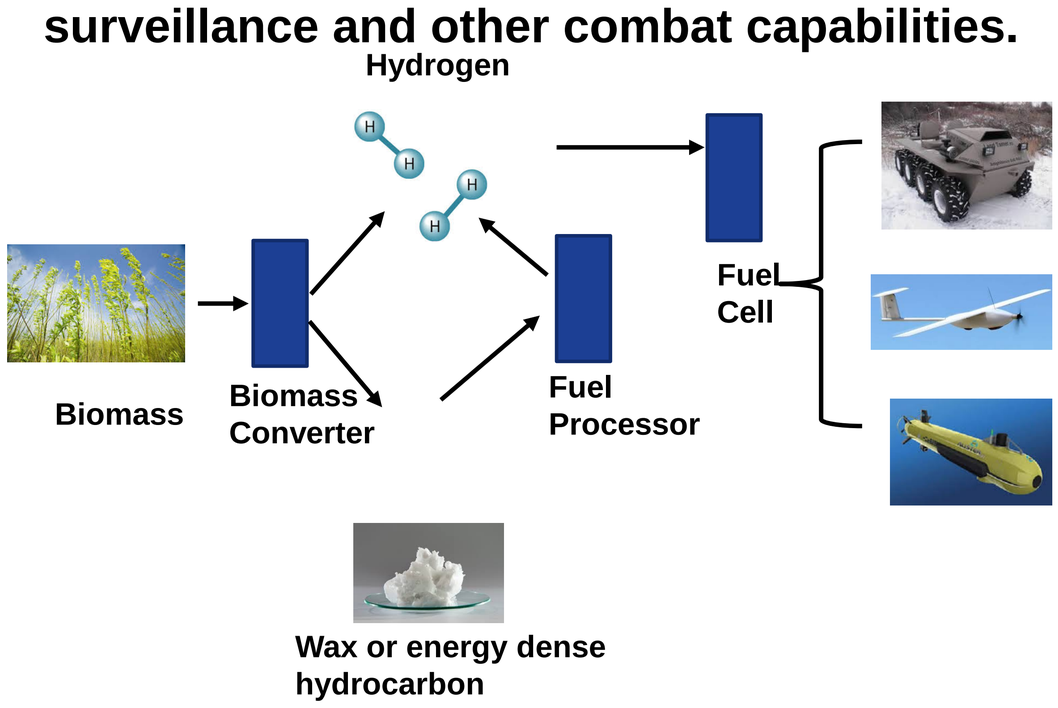
Research Objective

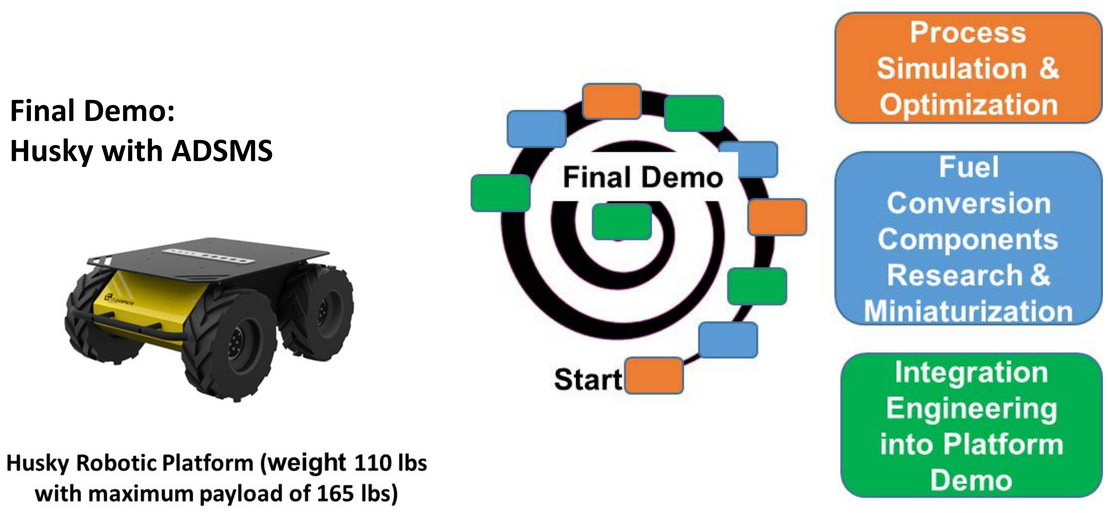
- Explore novel concepts of artificial digestive system with metabolic synthesis (ADSMS), enabling a new generation of autonomous platforms that do not need to be refueled or recharged.
- Develop a disruptive technology for an autonomous platform which fuels itself without coming back to a command post, and such technology opens up unlimited capabilities in surveillance and other combat capabilities.



Conceptual Schematic Diagram of ADSMS

Challenges

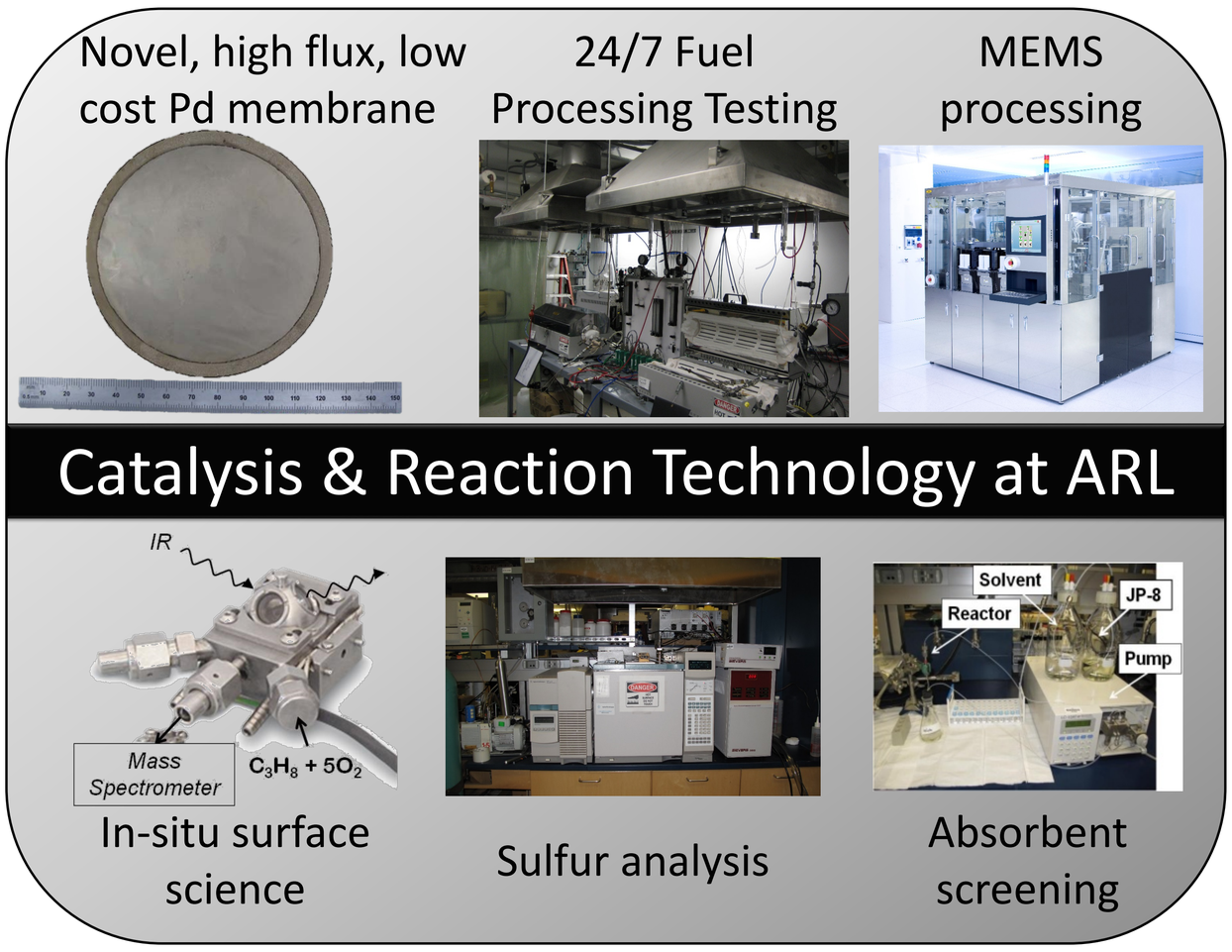
- Individual power & energy technology development is flourishing, but chemical process engineering or system of systems analysis perspective is needed to select a good mix of technology to meet the power & energy requirements and payload constraints of DoD autonomous platforms simultaneously.
- Miniaturization of components through advanced manufacturing technique is not well developed for size and weight reduction.



Spiral Development Cycle of ADSMS

ARL Facilities and Capabilities Available to Support Collaborative Research

- Materials characterization with X-ray diffraction, electron microscopy, UV-vis and vibrational spectroscopy, physisorption-chemisorption analyzer, Hg porosimetry
- Fuel processing laboratory with 24 hour operation capability for long endurance system testing
- LabVIEW controlled catalytic reactors, micro-GC and mass spectrometer; various reaction cells for FTIR spectrometer with in-situ time-resolved capability



Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Identify optimal process design mix of chemical conversion technologies and balance of plant components through process simulation optimization
- Develop methodologies to fabricate miniature fuel conversion components using advanced adaptive manufacturing technology
- Perform integration engineering into platform design through working with robotic communities

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