DE-FOA-0001578 MODULAR CHEMICAL PROCESS INTENSIFICATION INSTITUTE FOR CLEAN ENERGY MANUFACTURING

TEAMING PARTNER LIST

UPDATED JULY 15, 2016

Organization	Contact Name	Organization Type	Area of Technical Expertise	Description of Capabilities	Contact Information
Industrial Microbes	Derek Greenfield	Small business, for-profit	Methane fermentation to chemicals	Metabolic engineering of industrial strains of bacteria and yeast, pathway engineering, enzyme evolution, chemical and fuel production, gas fermentation, combining processes within a single organism.	1250 45th St Ste 150 Emeryville, CA 94608 (650) 731-5499 derek@imicrobes.com
Ultrasonic Technologies, Inc.	Sergei Ostapenko, Ph.D.	Manufacturing R&D	Ultrasonic Technologies (UST) is experienced in the field of flaw detection in electronic materials, including silicon solar cells, solid oxide fuel cells, and various ceramics. Our team offers customized ultrasonic equipment based on proprietary Resonance Ultrasonic Vibrations (RUV) technology.	1. In-line RUV systems for automatic crack detection in Si solar cells and ceramic plates for fuel cells. 2. Crack and delamination inspection in composite body armor plates. 3. Scanning Acoustic Microscopy with resolution down to 5 microns. 4. Inspection system for quality control of diamond wire for sawing tools using Resonance Vibrations. 5. Finite Element Analysis of resonance vibrations.	2664 Cypress Ridge Blvd, Suite 103, Wesley Chapel FL 33544-6325 813-973-1702 support@ultrasonictech.com
Ceramatec, Inc.	Dr. Charles A. Lewinsohn	Private Industry, Technology Innovation	ceramic membranes, microreactors, compact heat exchangers, and electrochemistry	Ceramatec specializes in developing commercially viable products, processes and materials from high-risk, low technical readiness levels. Ceramatec excels in prototype design, fabrication and testing to validate commercial viability and the establishment of pilot line production for turn-key scale-up of manufacturing. Ceramatec has demonstrated success with several technologies now in commercial practice. Ceramatec has approximately 90 employees with almost 40 staff with graduate or post-graduate degrees in multiple areas of science and engineering including materials science, mechanical engineering, chemical engineering and others. Ceramatec has a full suite of design and analysis tools, including commercial modeling software; a materials analytical laboratory; laboratory-scale and commercial-scale manufacturing equipment; and numerous apparatus for testing and verification of product performance. Ceramatec has experience manufacturing modular systems for industrial applications, including microchannel components and microreactors incorporating membranes and catalyst supports. Ceramatec has extensive experience in membranes for transport of oxygen, sodium, lithium and other inorganic cations. Ceramatec has also developed compact, ceramic heat exchangers using ceramic materials for high-temperature or corrosive environments.	2425 South 900 West clewinsohn@ceramatec.com 801-956-1001

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H Quest Vanguard, Inc.	James Strohm	Small Business Technology Developer	Technology developer of the novel Wave Liquefaction™ thermochemical process. Wave Liquefaction applies focused microwave energy to create localized and intense thermochemical reaction zones to promote direct, rapid (sub-second), continuous conversion of coal, coal/biomass blends, and other solid hydrocarbons to value-added fuels, chemicals, and precursors for advanced carbon materials (e.g. carbon fiber and graphite). Wave Liquefaction small-footprint, high-throughput, ambient pressure reactors sharply lower capital costs of coal conversion and eliminate the need for economies of scale, enabling small-scale and/or modular chemical plant deployment. Co-processing of natural gas or other hydrogen-containing gases with the solid hydrocarbons allows co-production of hydrogen necessary for downstream applications, including hydrotreating or other refining processes, eliminating high CO2 emissions, water consumption, and costs typically associated with conventional, enegy intensive hydrogen production (e.g. steam methane reforming).	High-throughput, continuous microwave reactor system for production of hydrogen, chemicals and fuels from various hydrocarbon feedstocks. Supporting process and analytical equipment for product recovery, process control/monitoring, and compositional and elemental analysis of feed and products. Expertise in process and material development for thermochemical and catalytic hydrocarbon conversion to fuels, chemicals, and hydrogen.	750 William Pitt Way, Pittsburgh, PA 15238 james.strohm@h-quest.com 412-444-7028
Compact Membrane Systems, Inc	Ryan Elizabeth Cook		Custom Amorphous Fluoropolymer Membranes with Combination of Excellent Chemical and Thermal Resistance and Stability, Very High Gas Flux and Good Separation Capability.	(1) Commercial membrane Modules for dehydration of a wide range of fluids (eg lubrication/hydraulic fluids, solvents, IPA, and Ionic Liquids. The perfluoronature of the CMS membranes makes them inert to harsh environments and minimizes the contamination of those environments. (2) Custom amorphous fluoropolymer membranes in developmental supply for separations of olefins from paraffins and also carbon dioxide from methane.	335 Water Street Newport, DE 19804 Ryan Cook rcook@compactmembrane.com 302-999-7996

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Government Contracting Specialists, LLC	Philip W. Winkler	Management Consulting	Proposal Strategy and Proposal Management Services for Government Funded Clean Energy Research, Development, and Demonstration Projects; Developing Strategic Partnerships in the Chemical, Industrial Gas, Petrochemical Industries, and National Laboratories.	Philip W. Winkler formed Government Contracting Specialists, LLC (GCS) to assist businesses and organizations with research, development, and demonstration funding opportunities and commercial item sales with the federal and state governments. Combining GCS's extensive experience and comprehensive abilities across all industries, we collaborate with our clients to help them align their business strategy with federal and state governments to open new sales channels, fund research projects, and accelerate innovation. GCS can identify ways your organization can capture federal and state government funding to leverage in-house research capabilities and accelerate the commercialization of new products. Give your organization a competitive edge by tapping into GCS's experience and knowledge in developing winning strategies to leverage government funding including assistance with proposal development and all aspects of contract administration, as well as access to the right people at various government agencies to achieve a successful match. With more than 40 years of industrial experience Phil has a large network in the Chemical, Industrial Gas, Petrochemical Industries, and National Laboratories that he can use to assist in developing strategic partnerships. GCS will work to understand your firm's technology objectives, developing a strategy to position your technology with R&D funding sources, and then developing and executing a market plan to bring you and the government customer together to achieve your goals. Phil served as Manager, Government Contracting for Air Products and Chemicals, Inc. a global supplier of products, services and solutions that include atmospheric gases, process and specialty gases, performance materials, equipment and services for technology, energy, industrial and healthcare customers. The role combined global, company-wide leadership of leveraging government funding for R&D projects and contract administration as well as providing commercial item sales leadership. During Phil's 30 year career at Air Products he developed a successful strategic process for securing and managing government R&D funding. During his last year (2010) as Manager, Government Contracting Phil was successful in securing $1 billion of new R, D, & D funding from the Department of Energy and Department of Defense. Prior to joining Air Products Phil had experience in chemical engineering, marketing, and project engineering with several pollution control equipment suppliers. Phil earned his Master's Certificate - Government Contracting from George Washington University; Washington, DC. He completed his MBA from Rutgers University in Newark, NJ and his BE, Chemical Engineering from Stevens Institute of Technology, Hoboken, NJ.	2071 Chalmer Terrace, The Villages, FL 32162 philwinkler@gcspecialists.com 484.515.9072

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Southern Research	Dr. Santosh Gangwal	Not-for-Profit Research Institute	clean energy, process intensification, catalysis, process engineering, system integration, lab, bench and pilot testing, process modeling and techno-economic analysis, thermochemical conversion. Additional expertise in combustion testing, waste water treatment and water reuse, sustainable chemistry, solar energy storage, and technology validation.	With 4 locations in Southeastern Unites States and 50 experienced personnel, Southern Research's Environment & Energy Division conducts research and provides technical services in many areas associated with clean energy, chemical process, and environmental technology development and evaluation. Southern has a unique, ISO 9001 certified Clean Technology Development Center in Durham NC where we independently, and in collaboration with partners and clients, develop, optimize and commercialize advanced clean energy technologies. The facility contains 15,000 square feet of high-bay space for building and testing bench- and pilot-scale units and 12,000 square feet of offices and laboratories for catalyst and sorbent development and testing, analytical support of research efforts, and process engineering including process modeling and analysis. Our highly qualified research, engineering, and chemist staff have experience in a wide range of chemical process technology, catalysis, and technology evaluation methods. Southern has developed several technologies and processes that focus on process intensification via optimized system integration, novel catalysis for integrated processes, thermal management, innovative reactor development, and other means. Primary examples of recent work include: Production of bio-acrylonitrile for renewable carbon fiber production, using novel catalysts to complete conversion reactions in a single step; Selective gas to liquids processes to convert syngas to diesel or jet fuel directly without need for additional upgrading; mild biomass liquefaction; integrated water gas shift and CO2 capture with novel thermal management and catalysts; and novel integrated syngas cleanup and tar-hydrocarbon conversion technologies. Our focus has been on developing technologies that can transform the production of bio-derived fuels, chemicals, and products via development of integrated processes that are commercially viable and provide significant environmental and economic benefits. Business development and project teaming activities are led by Dr. Santosh Gangwal. He has over 38 years of experience in various energy technologies and has managed complex multimillion dollar research programs totaling over $50 million for the Government and private industry in biomass and coal conversion to fuels and chemicals, syngas cleaning, integrated gasification combined cycle, solar thermochemical energy storage, hydrogen production, CO2 capture, and waste heat conversion. He is an expert in catalysis and gas-solid reaction and presently leads projects in compact catalytic reforming, selective Fischer-Tropsch synthesis, solar energy storage using alkaline earth metal composites, and simultaneous water gas shift and CO2 capture. He has authored over 13 patents and over 200 peer-reviewed publications and conference proceedings. He works closely with Dr. Andrew Lucero, Manager of Process Development and Dr. Amit Goyal, Manager of Sustainable Chemistry and Catalysis to develop novel approaches to clean energy technology processes and challenges.	5201 International Dr., Durham, NC 27701 gangwal@southernresearch.org 919-282-1053

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Infologic, Inc.	Has Patel	Small Business; Technology Consultancy and Training Services Provider	(1) Technology & Manufacturing Readiness Levels (TRLs/MRLs) Assessments, (2) Research projects and technology road-mapping and due diligence, and (3) STEM/Technicians Workforce Development.	1: TRLs/MRLs Assessments - Conduct these analyses for research projects, Project Call proposals, and technologies to be developed by NNMI and its stakeholders. Past performance – (a) Using the DoD TRL Calculator, conducted TRLs/MRLs assessments for two DoD S&T projects, and (b) Developed a workshop on conducting the MRLs/TRLs assessments for R&D proposal preparation, research due diligence, and research project management. 2: Research Projects & Technology Road-mapping and Due Diligence - Provide consulting services to develop roadmaps using industry best practices. These include: Technology Hype Cycle, Innovation Cash Curve, CMMI™-based Innovation Maturity Analysis, and Infologic-developed Technology Due Diligence methodology (TechIP™). Past performance - Conducted independent R&D (IR&D) to incorporate industry best practices in the DoD S&T Program, and published a number of papers at DoD and industry conferences. 3: Technical Education and Workforce Development - Provide training services to develop and deliver courses for the STEM workforce and technicians, focusing on the IP and technologies developed by NNMIs and their stakeholders. Past performance - Developed a three-credit, hybrid (on-site/on-line) industry course, titled: “Successfully Transitioning R&D Projects to Commercial Products”.	25 Palatine # 212, Irvine, CA 92612 has.patel@infologic.com (888) 325 0500 ext. 100
Los Alamos National Laboratory	James Coons	FFRDC	Low-energy ultrasonic separation (LEUS)	LEUS applies ultrasound at > 1 MHz to separate solid particles in liquid media or phase-separate liquids in liquid media. The technology works by creating standing waves in the liquid media that drive particles or liquid droplets to nearby nodes where they meet up with other particles or droplets. Particles form large aggregates and small liquid droplets coalesce to form much larger liquid droplets. Depending on their buoyancy, they either settle or rise to form a zone of concentrated particles at the vessel bottom or a phase separate liquid layer at the top surface of the vessel. By moving only the phase separate particle or droplet a short distance, separation can be achieved using orders of magnitude less energy than conventional separation technologies. We have designed, assembled, and tested ultrasonic separators operating as batch (4 ml to 10 liters) and flow-through (5 to 50 l/hr) devices, incorporating both scale-up and scale-out approaches to achieve higher capacities. Our laboratory is stocked with a suite of National Instruments hardware and we have developed LabView software to characterize and drive single-transducer devices, along with a suite of RF amplifiers ranging from a few Watts up to 1 kW in power output. Unlike ultrasonic sonication, which uses cavitation to breakup particles in solution, ultrasonic separation is being developed in our laboratory as a low-energy process that utilizes radiation forces generated in a standing wave to achieve separation. Scale-up of LEUS technology is an active area of research and is capable of replacing many conventional technologies that are intrinsically less energy efficient.	PO Box 1663, MS J964, Los Alamos NM 87545 jimc@lanl.gov 505.667.6362

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Guild Associates, Inc.	Phil Weisenbach	Small business, for-profit	• Chemical engineering supplemented with requisite Mechanical, and Electrical engineering • Many years of experience in Research, Design, Development, Integration, and Deployment of complex technology based systems • Temperature Swing Adsorption (TSA) and Pressure Swing Adsorption (PSA) natural gas/ biogas upgrading plants • Adsorbent materials • Catalyst materials • Containerized and Open-skid processing plants for military and commercial applications • Sustainment Support including: Field Service, Spare Parts, Operator and Maintenance instructions, Training manuals, Instructor training, Interactiv training systems and software	Guild Associates is a chemical engineering company with a strong history of turning research into highly integrated commercial and military products. • Experienced with integrating commercial-off-the-shelf technology (COTS) into complex processes and products that meet military specification transportability and climatic conditions in tactical theatres and intermodal shipment requirements. • Designed, qualified, deployed, and maintained 370 containerized systems used to support field laundry and Mortuary Affairs operations which utilize water recycling, thermal fluid heating, refrigeration, pneumatic, hydraulic, and electrical processes. • Over 40 commercial TSA/PSA systems built to industry standards, with direct experience meeting worldwide safety and operational codes in operation at landfills, waste water treatment plants, lagoon digesters, and other facilities where the biogas is purified to either pipeline or LNG specifications. • Over 70 containerized Compressed Natural Gas (CNG) vehicle filling stations tailored for plug-and-play installation both in urban and remote locations. • Over 20 natural gas treatment plants supplied for use to upgrade pipeline natural gas for Liquefied Natural Gas applications. • Developed and manufactured custom adsorbents for use in military chemical defense and commercial Waste Water Treatment Plant (WWTP) applications.	5750 Shier-Rings Rd Dublin, OH 43016 pweisenbach@guildassociates.com 614-798-8215
University of Maryland, Advanced Heat/Mass Exchangers and Process Intensification Laboratory	Professor Michael Ohadi	University (Academic and Research Institution)	1. Next generation heat/mass transfer surfaces and fluid delivery systems for process intensification 2. Process control and intensification with applications in enhanced thermal/fluid transport, microreactors, and separation/purification processes 3. Alternative materials, working fluids, and manufacturing techniques for process intensification	Our research lab represents extensive experience in research involving process control and intensification. We have an active industrial consortium in advanced heat/mass exchangers and process intensification, with member companies from both the U.S. and abroad. Our research is of particular significance to applications in advanced energy conversion, advanced heat/mass exchangers, process intensification, and innovative design and manufacturing of components for energy conversion systems. We have substantial expertise in developing and optimizing active electrostatic separators, high-efficiency clog-free absorbers, polymerization in microreactors, gas separation/purification, moisture separation, additively manufactured polymer and metal composite heat exchangers, and rotary reactors for heat/mass transfer enhancement. Using a micro-absorption system, our team has enhanced absorption/desorption rates over those of conventional systems in the range of two to four orders of magnitude. We welcome opportunities to partner with collaborators to augment rates of achievement in areas of mutual interest.	4298 Campus Drive, College Park, MD 20742 301-405-5263 ohadi@umd.edu

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School of Chemical Engineering, Purdue University	Professor Nien-Hwa Linda Wang	Public University	Advanced Separation Technologies, which include mixed solvent extraction, adsorption, ion exchange, multi-component chromatography, reaction in chromatography systems, simulated moving bed chromatography, applied to the purification or separation of complex mixtures.	We have developed advanced separation and purification technologies for separating complex mixtures, including advanced simulation tools for multi-component chromatography systems with or without reactions and design and optimization tools for simulated moving bed (SMB) chromatography for the separation of three or more components. We developed the first SMB for insulin purification from a ternary mixture, the first five-zone SMB to recover six sugars from biomass hydrolysates (a complex mixture of 10 components), and the first SMB to separate two flame retardants from a polymer. These SMB processes are an order of magnitude more efficient and more economical than corresponding batch chromatography processes for large scale separation. We also collaborated with the Argonne National Lab in developing a new affinity adsorption process to capture Mo99 from the fission products of low-enriched uranium. Mo99 is the parent of Tc 99m, which is the most widely used medical isotope for diagnosis. This separation process will be used in the first medical isotope plant in the US to produce this isotope by 2019. We have also collaborated with industry in developing new separation processes to recover high-purity polycarbonates, flame retardants, and other polymers from electronic wastes. The separation methods are applicable to the recovery of high purity polymers and chemicals from other polymer wastes. For each polymer recovered from the polymer waste, we save raw materials for synthesis, reduce the energy of producing the polymer by 84%, and reduce CO2 emission by 3 to 6 tons per ton of polymer. We also developed economical ligand-assisted chromatography methods to purify rare earth elements. This new method uses recyclable, safe ligands. This method potentially can reduce the footprint of the purification process by two orders of magnitude and eliminate the environmental risk of disposal of toxic solvents used in conventional purification of rare earth elements. We are developing economical SMB methods to recover high-purity rare sugars with high yield from a waste from paper mills. We are also developing new separation methods for recovering valuable chemicals from coal byproducts and coal ash.	480 Stadium Mall Drive West Lafayette, IN 47907-2100 (765) 494-4081, (765) 494-0550 wangn@purdue.edu