Title: Autonomy Research Center for STEM (ARCS)
Institution: California State University, Northridge
City/State: Northridge, California
PI: Nhut Ho

Summary: California State University, Northridge (CSUN) proposes to establish the Autonomy Research Center for STEM (ARCS), a financially self-sustaining multidisciplinary university center of excellence that will significantly contribute to NASA's research in autonomy for civil aviation and space exploration, while substantially increasing institutional research capacity, developing a STEM workforce, and commercializing research results to address pressing societal needs. In collaboration with NASA Armstrong Flight Research Center (AFRC) and Jet Propulsion Lab (JPL), ARCS will execute a Convergence Research (deep integration of approaches from different fields) agenda consisting of 12 interdisciplinary projects in 3 synergistic thrusts: (1) Assured and Trusted Increasingly Autonomous (IA) Systems; (2) Human Autonomy Teaming with Explainable AI; and (3) Societal and Organizational Impact, Barriers, and Acceptance of IA Systems. These thrusts will be explored in the context of two NASA Concepts of Operations: Urban Air Mobility and Space Construction. Through these projects, ARCS will contribute to NASA capabilities for assuring real-time trustworthiness of IA systems; methods and technologies that support human-IA teaming; and models and guidelines for taking into account technology related and social/cultural factors on public acceptance of IA systems.

A Hispanic and Asian American and Native American Pacific Islander Serving Institution, CSUN is a large comprehensive university, with an enrollment of 39,816 students. However, on average only 2 faculty and 20 students are engaged in NASA-related research activities annually. ARCS will meet MIRO's and CSUN's educational, workforce, and institutional-capacity-building goals through six innovations: (1) pioneering and institutionalizing a Convergence Research model (1 of NSF 10 Best Ideas) that involves deep interdisciplinary integration of the projects of 12 professors (a 600% increase from current number) from six (of nine) CSUN colleges: Engineering and Computer Science; Social and Behavioral Sciences; Science and Math; Arts, Media and Communication; Business and Economics; and Humanities; (2) engaging 150+ undergraduate/graduate students per year in NASA research (a 750% increase from current number); (3) committing CSUN investment to provide ARCS a headquarters space, and leveraging existing technology and technologies supplied by collaborators (NASA and Amazon) to establish a one-of-a-kind integrated research infrastructure supporting live and virtual IA unmanned vehicle operations and a cloud-based Virtual Research Collaboration Environment that can be connected with and replicated at other universities and NASA; (4) leveraging CSUN's Innovation Incubator and NSF-funded I-Corps Program to commercialize research products; (5) growing a thriving ecosystem of multi-collaborator strategic partnerships (NASA, DoD Labs, industry, R1 universities, community colleges, the CSU system); and (6) executing a Sustainability Plan that will help ARCS become a national leader in autonomy research and transition ARCS to an Industry/University Cooperative Research Center, an NSF proven model

for research centers to financially self-sustain. Initial validation of the Sustainability Plan includes committed funding ($50K/yr from Medtronic, $12K/yr from Amazon, $50K from the CSU system, $30K/yr from CSUN), in addition to CSUN's commitment of hiring 5 NASA-aligned professors and $115/yr for hiring a resource development specialist. Broadly, ARCS activities will develop faculty and student knowledge and skills through: a) engagement in NASA-related research; b) professional development in team science, commercialization, and research; and c) curriculum enhancement in the six colleges' senior courses.

While we acknowledge that our goals are ambitious, the PI and External Advisory Committee members have unique hands-on experiences leading large scale projects and have accomplished transformational goals.