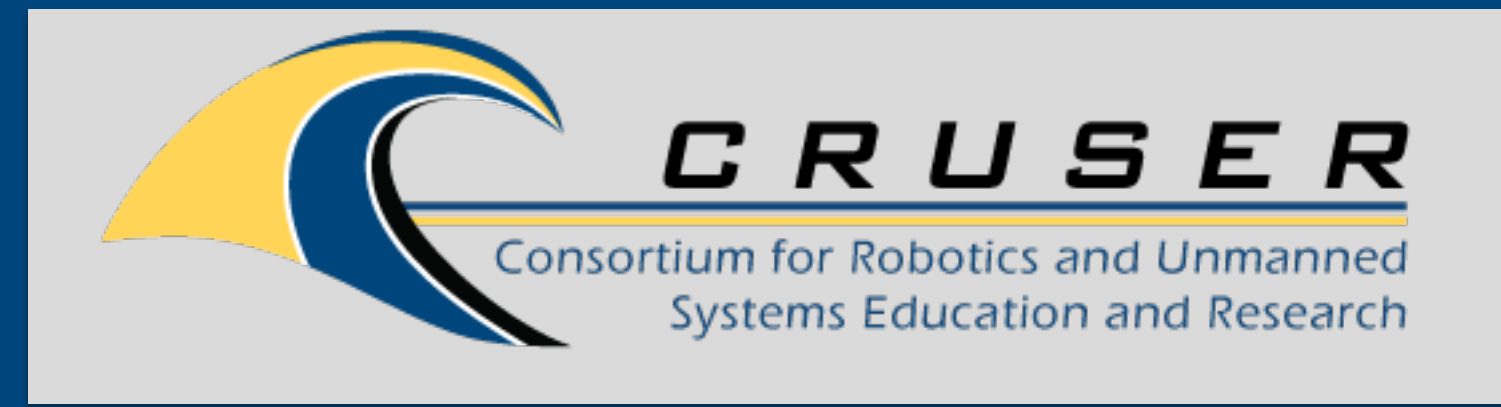


# Development of Autonomous Capabilities for MC3 Satellites and Groundstations



Station / Device Name	IP	ICMP Ping	MC3 Status	Actions
▶ NPS	192.168.101.*	Warning	Nominal	Naval Postgraduate School Ground Station
▶ PTSUR	192.168.101.*	Nominal		Point Sur Ground Station
▶ AFIT	192.168.102.*	Warning		Air Force Institute of Technology Ground Station
▶ SDL	192.168.103.*	Nominal		Space Dynamics Laboratory Ground Station
USNA	192.168.106.*			US Naval Academy Ground Station
▶ MLB	192.168.107.*	Warning		Malabar Satellite Operations Center Ground Station
▶ UAF	192.168.108.*	Nominal		University of Alaska Fairbanks Ground Station
▶ USCGA	192.168.109.*	Nominal		US Coast Guard Academy Ground Station
▶ HSFL	192.168.154.*			Hawaii Space Flight Laboratory Ground Station
▶ UNM	192.168.155.*			University of New Mexico Ground Station
TAMU	192.168.200.*			Texas A&M Ground Station
SMDC	192.168.201.*			Space & Missile Defense Command Ground Station
KWAJ	192.168.202.*			Kwajalein Ground Station

Ground Station Network Autonomous Health and Security Monitoring Product (Security beta)

## How

- Develop autonomous, optimized satellite commanding and data exfiltration capability and incorporate into baseline pass scheduling for implementation at each ground station.
- Develop a specification of standardized commands and data formats to simplify new satellite automation for generic satellite tasking.
- Identify and procure hardware components for single station testing that can be autonomously controlled, develop drivers for these components, and test for possible future network-wide implementation.
- Collect, organize, and subject to analysis ground station data that contributes to ground station health and security monitoring. Investigate using machine learning algorithms such as NASA's Inductive Monitoring System for applicability.

## What / Deliverables

- Programs using scripting language structures for automated, "lights-out" satellite command and control.
- Satellite Python objects capturing the commands and telemetry feedback for PropCube Satellites as a model for standardized satellite command and control.
- Computer and mobile device applications permitting human-in-the-loop monitoring of the autonomous systems from any location;
- Autonomous health and security monitoring programs and applicability for machine learning; and
- Thesis work, Directed Study reports, and other documentation.

## Why / Objective

- The number of very small satellites is rapidly proliferating and the ground stations that control them need to be treated as autonomous entities.
- Develop data gathering capabilities for the Mobile CubeSat Command and Control (MC3) ground station and satellite system.
- Look at ground stations as autonomous, remote entities that can be better understood and managed by collecting health and security information. Subject this to Autonomous Health and Security Monitoring using machine learning such as NASA's Inductive Monitoring System (IMS).



FY20 Call for Proposals

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