Modular Rapidly Manufactured SmallSat: Using Advanced Manufacturing Processes for CubeSats

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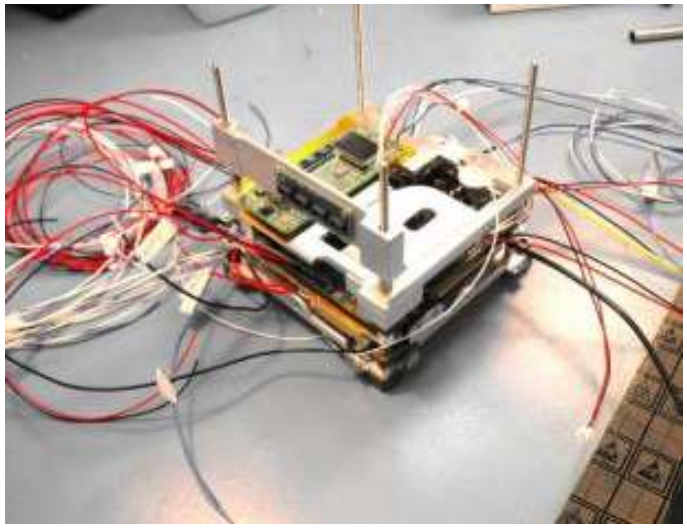
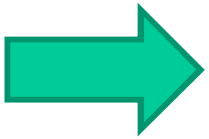
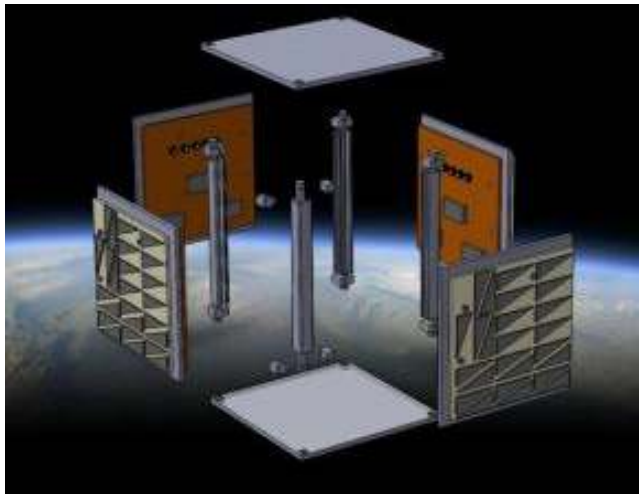
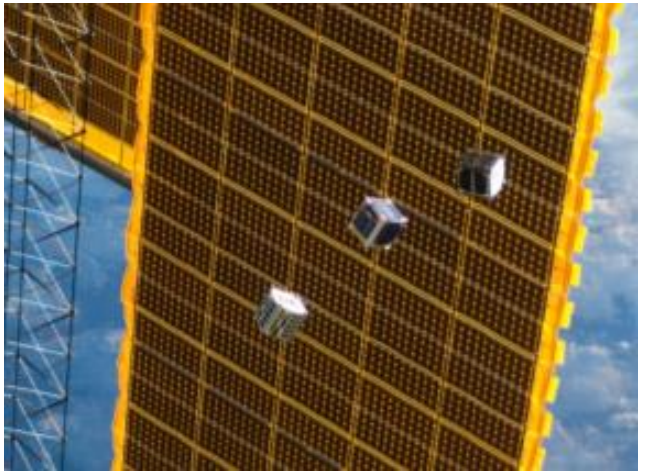


Complex, labor/time intensive

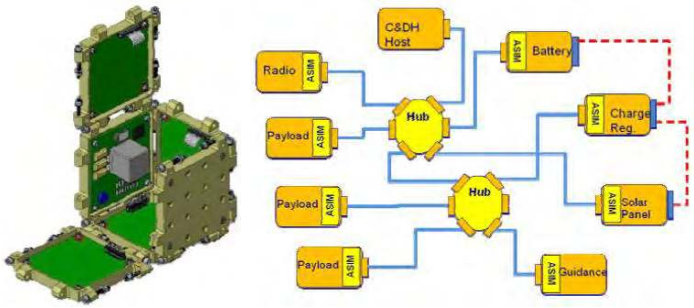




Simple, modular, rapid



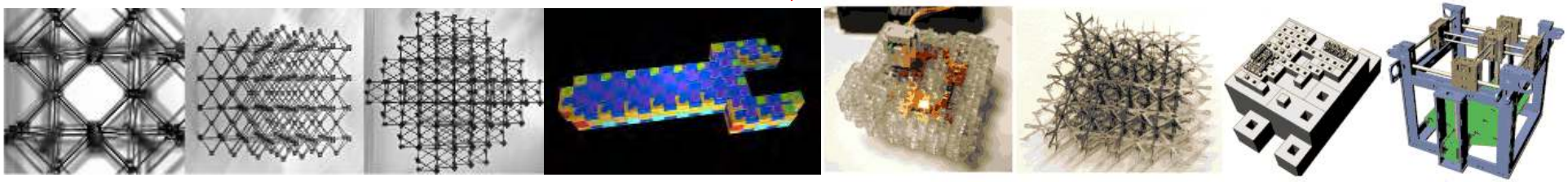
1.0 PROJECT OBJECTIVES



(McNutt ETAL 2009, nano-SPA, AFRL)

(White ETAL 2011, RAMPART)

(Lopes ETAL 2012, COSMIAC, AFRL)



(Cheung ETAL 2013, MIT CBA)

(Ward ETAL 2011, MIT CBA)

TECHNOLOGY MATURATION STORY

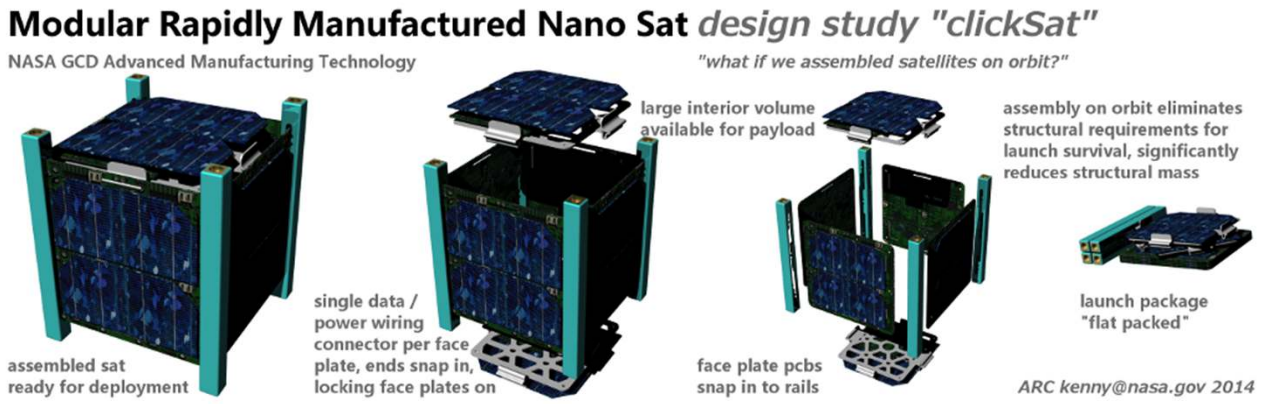
The objective of a Modular Rapidly Manufacture Small Satellite is to bring down the cost, integration and time from start to finish.

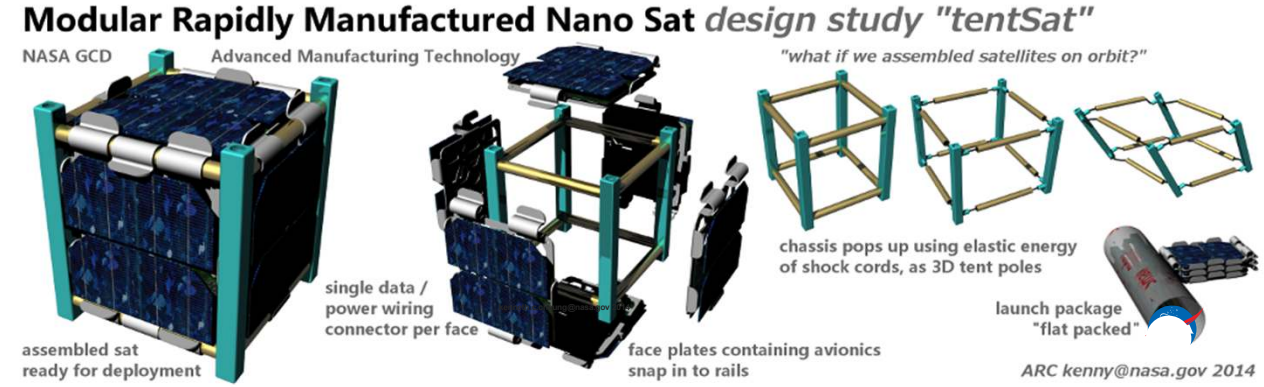
A slid-fit card technology for spacecraft subsystems and components to maximize payload

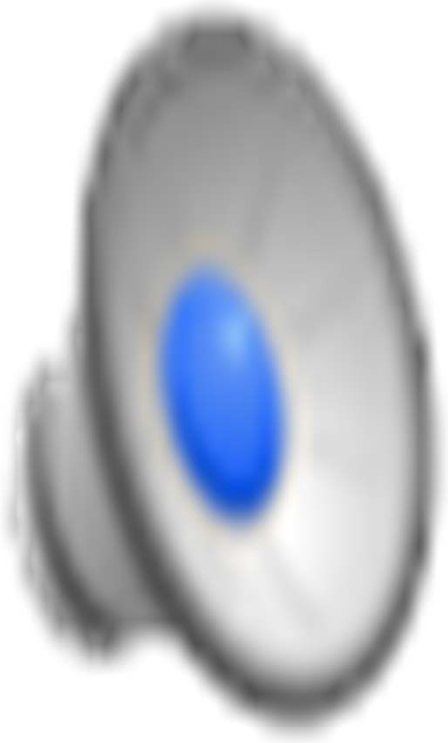
The MRMSS Project will be using state of the art and advance manufacturing technologies, techniques and materials

- **Expertise from MIT and NASA ARC**

Demonstration of MRMSS will bring the TRL to 6







Project Element / Subtask	FY14 Event or Achievement	Performance (on Target?)	TRL Indicator (TRL of Element at Event Completion)
MRMSS prototype	Develop in process for 1st proto type cubesat	T C S	3 4 5

TRL at Project Start

TRL at Project End and Milestone Achievement

MRMSS proto type

Subsystems

Main board:

Initial prototypes being built using Raspberry Pi and BeagleBone Black (low cost, low power, can run Linux)

I2C/UART breakout boards

Hardware interfaces:

RJ45 connectors to connect side panels

Communications:

Looking at using Iridium and StenSat

Other:

Potential use of a camera is being investigated

FY14 Accomplishments To Date

FY14 Accomplishments:

Possible prototypes of designs are being built

Talked to JSC for possible material and design selections

Destructive testing for connections addressing Human Factors

Established conversation with NanoRacks

- **Nanoracks already are aware of the concept and will work us to investigate what it takes to certify the deployer to be integrated on ISS.**

Established collaboration with TechEdSat team for Communication system

- **PM/IP are being successful in deploying cubesat from ISS using different communication Systems (Iridium, ORBCOMM, FM Radio)**
- **There is a interest to use Iridium for this project**

Technology Firsts

Will demonstrate the rapidly fabricated, modular and integrated small satellite systems in the International Space Station using the advanced manufacturing technologies, techniques and materials

Challenges and Future Work

Challenges

Successful demonstration of Modular Rapidly Manufactured SmallSat goals requires close collaboration with multiple Centers and groups within NASA and MIT that are working to their own timelines and requirements

New turn around of employees and training

NanoRacks deployer will need to be certified by JSC Safety panel to deploy the MRMSS

Need to start talking to PSRP to initiate a TIM to introduce the concept to the ISS

Future Work

Specific subsystems and payloads need to be identified

Continued testing of structure expected to be completed by end of FY14

Investigation of structural modularity for additional U's

Special Thanks

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Zac Manchester

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