
Four Satellites, One University

Programs at the University of Texas at Austin

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CubeSat Developers Workshop

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THE UNIVERSITY OF
TEXAS
AT AUSTIN

Building on success

To all satellite programs, the ultimate goal is to have a vehicle carry out mission objectives on-orbit. This is the criteria for **mission success**. For programs still in the design and build phase, we cannot declare success by this definition... But we can achieve **program success** at any and all points of vehicle development.

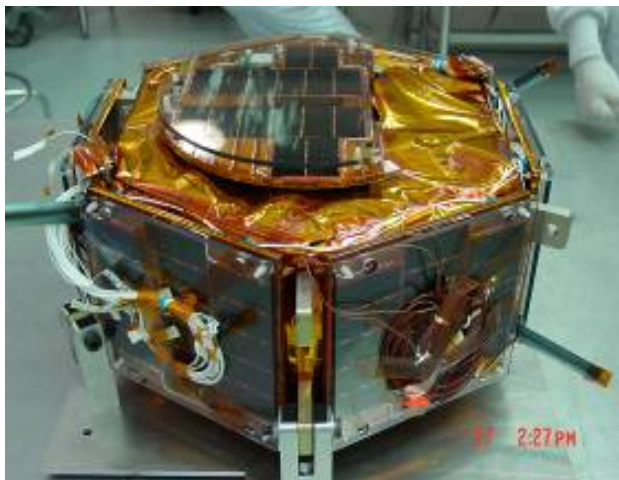
This identifies two key areas that programs can be successful in:

1. Vehicle Flight (the ultimate goal!)
2. Education process

The UT-Austin Satellite Design Lab is nearing completion of one of our program (vehicle has been delivered to AFRL). The remaining programs can use the knowledge learned and structure created from this program as a building point for our future endeavors.

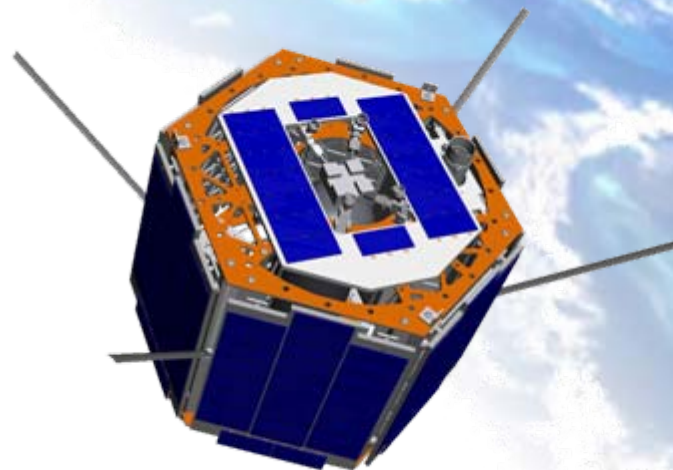
Satellite programs at UT-Austin

Nanosatellites



FASTRAC

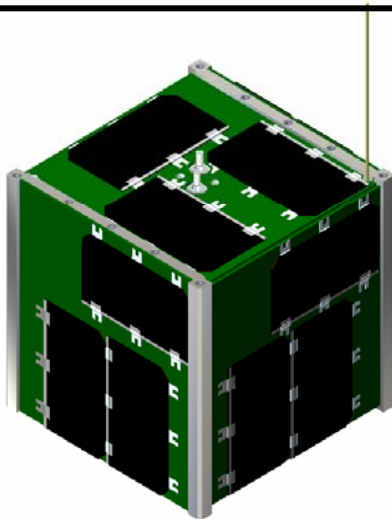
Formation Autonomy Spacecraft with Thrust, Relnav, Attitude and Crosslink



Texas 2-STEP

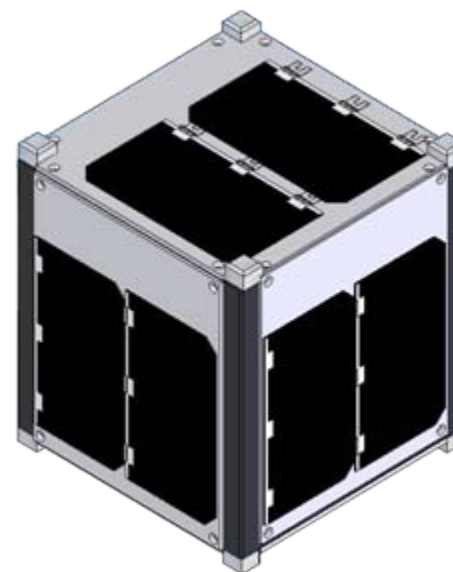
2 Satellite Targeting Experimental Platform

Picosatellites



PARADIGM

Platform for Autonomous Rendezvous and Docking with Innovative GN&C Methods



CubeSat

Success: Vehicle Flight

We have had no success in the flight of our vehicles, though we are getting close!

Three of our four programs have scheduled launch opportunities:

- FASTRAC is scheduled to be launched in October 2009
- PARADIGM is scheduled to be launched onboard STS-127 in February 2009
- UT CubeSat is scheduled to be launched sometime in 2008

UT-Austin could potentially have three operational vehicles on-orbit at the same time!

Success: Education Process

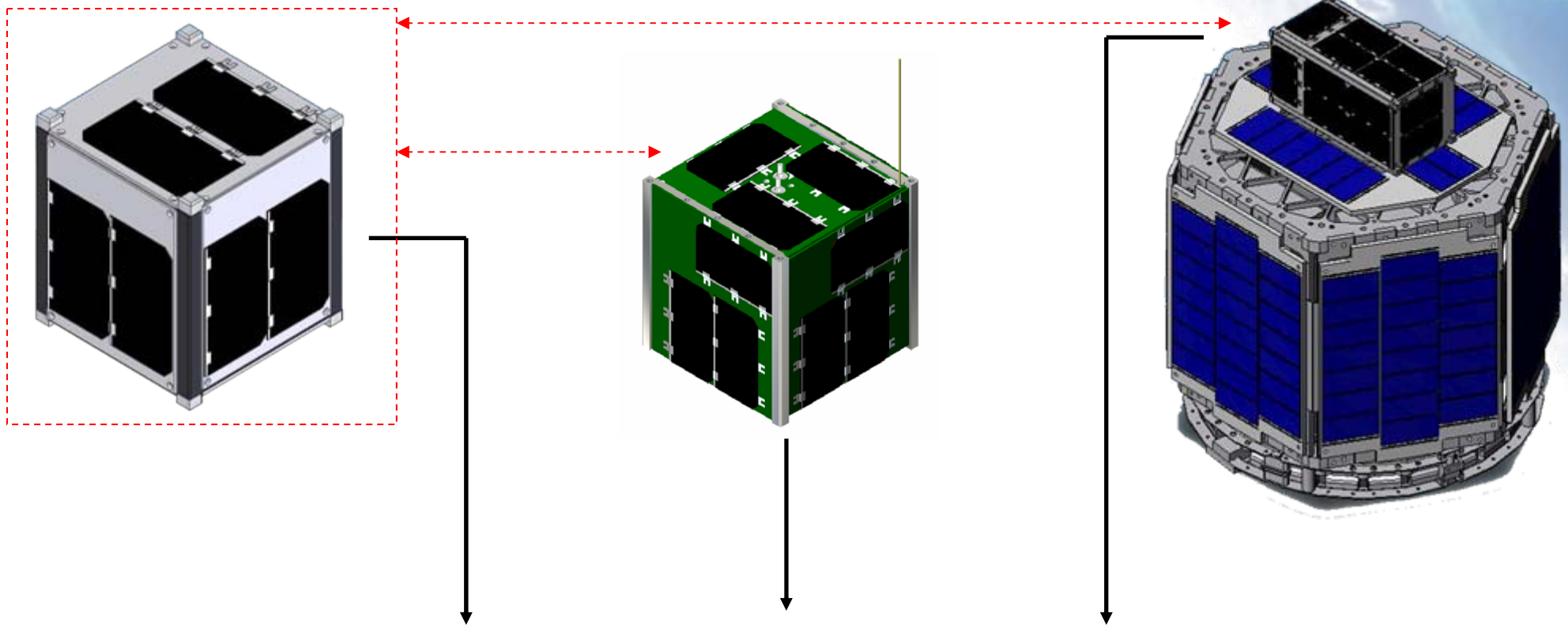
Because flight opportunities are staggered over the next two years, each program will have the ability to build on the success of the previous program

- Assembly procedure
- Ground station training
- Increased program interest and visibility

The teams are able to build upon the successes (and setbacks) of the other programs in the Satellite Design Laboratory. We are best able to share in this success by working together on future projects

How do we relate to the CubeSat Community?

Only **one** of our vehicles is a true CubeSat! We are cooperatively designing the CubeSat vehicle with PARADIGM and with the Texas 2-STEP Target vehicle to develop a common platform that can be applied to three unique programs.





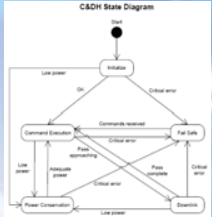



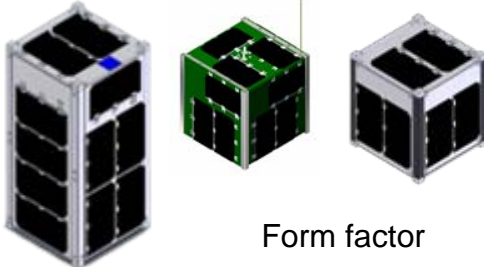
Our goal is to maintain mission objective integrity while jointly using the **same satellite bus** as a central unifier.

Program Cooperation

<i>Laboratory Management</i>	<i>Subsystem Design</i>
<p>Regular interaction between Program Managers and System Engineers from each team</p> <p>Shared facilities</p> <p>Joint Picosatellite group meetings</p>	<p>A design for one vehicle can be modified to apply to all other systems</p> <p>Subsystem engineers can work side-by-side on a task</p> <p>A common set of hardware components (power board, battery packs, radio transceivers, solar panel assemblies, etc) is used to satisfy mission requirements and accomplish mission objectives</p>

The implementation of these concepts quantifies successful cooperation and development among the three teams.

Program Cooperation: Subsystem design

	Same	Different
<p><u>Command and Data Handling</u> Same processor (Blackfin/Tinyboards) Same software (LabVIEW embedded) Same Mission Manager (software)</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Analog Devices Blackfin/Tinyboards</p> </div> <div style="text-align: center;">  <p>LabVIEW Embedded</p> </div> </div>	<div style="text-align: center;">  <p>Mission Manager execution</p> </div>
<p><u>Communications</u> Same transceiver Different antenna design</p>	<div style="text-align: center;">  <p>STENSAT transceiver</p> </div>	<div style="text-align: center;"> <p>Antennas</p> <p>Antenna deployment mechanism</p> </div>
<p><u>Power</u> Same/similar power regulation hardware Different solar panel sizing and orientation</p>	<div style="text-align: center;">  <p>Power Regulation Board</p> </div>	<div style="text-align: center;"> <p>Voltage converters</p> </div>
<p><u>GPS</u> Different receivers Different use of GPS data</p>	<div style="text-align: center;"> <p>GPS receiver</p> </div>	<div style="text-align: center;">  <p>PARADIGM: Dragon Receiver</p> </div>
<p><u>Structure</u> Same/similar analysis Different form factor</p>	<div style="text-align: center;"> <p>Material</p> <p>Internal Connectors and Mounts</p> </div>	<div style="text-align: center;">  <p>Form factor</p> </div>

Program cooperation: Central facilities

The Department of Aerospace Engineering and Engineering Mechanics at UT-Austin has developed four key facilities that are used for the satellite programs:

Satellite Design Laboratory

Founded in 2002; has housed FASTRAC during flight build; houses all four UT satellite programs



Sensors & Actuators Laboratory

Founded in 2006 with grant from National Instruments; used to develop satellite hardware components



WRW Ground Station

Founded in 2006 for FASTRAC communication; will be used for other UT vehicles as well



Controls Laboratory

Laboratory is used for computer facilities and team meetings



Overcoming Obstacles

The success of our past programs, as well as the individual success of current programs, can be combined to create a cooperative and balanced atmosphere. There are many obstacles for individual programs to overcome; working together presents possible solutions.

Obstacle

Possible Solution

Limited Personnel



The work of a single subsystem engineer can be applied to multiple programs

Lack of design knowledge



Documentation and training tools can be used by multiple programs

Restricted Funding



Common laboratory hardware and software licenses can benefit multiple programs

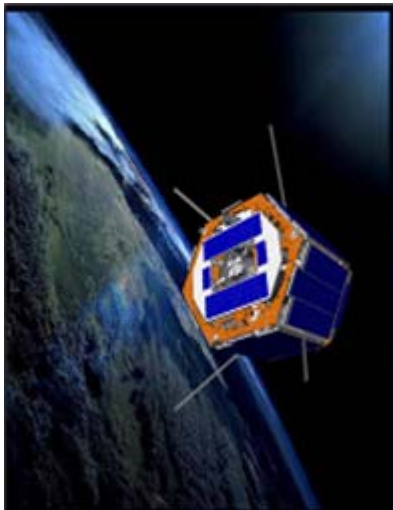
Program Motivation



Having each program in a different stage, with different milestones, helps keep progress at a steady pace

Conclusion

For more information on the UT-Austin programs, see our University exhibit at the Small Satellite Conference (University Exhibit Booth 4U)



Satellite Design Laboratory		
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