

DRG-based CubeSat Inertial Reference Unit (DCIRU), Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

CubeSats currently lack adequate inertial attitude knowledge and control required for future sophisticated science missions. Boeing's Disc Resonator Gyro (DRG) integrated into a DRG-based CubeSat Inertial Reference Unit (DCIRU) in conjunction with a star tracker or sun sensor would provide the Inertial Attitude Knowledge (IAK) and position measurements needed for precision acquisition, pointing, and tracking (APT) control. Accurate attitude and position measurements provided by the DCIRU would also be required for future CubeSat constellation or formation flying missions, and for laser communication between other CubeSat's, other satellites or Earth. There are currently no small Inertial Reference Units (IRU's) suitable for CubeSats exist due to size, weight, and power constraints. The ATA/SNL Team is proposing the development of the DRG for potential integration into the DCIRU in Phase II. The highly symmetrical and scalable DRG disc standing wave design was selected by DARPA and NVESD as the only MEMS design capable of navigation grade performance. The DRG consists of a MEMS disk resonator that provides rotation sensing capable of both tactical and navigation grade precision.

ANTICIPATED BENEFITS

To NASA funded missions:

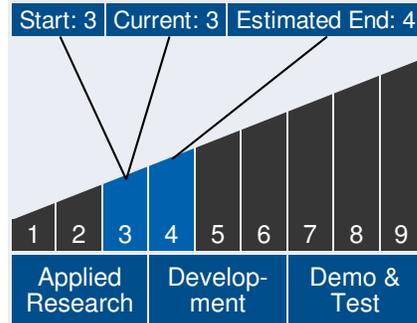
Potential NASA Commercial Applications: ATA has successfully developed and transitioned SBIR innovations into government and commercial programs. One example is our recent success transitioning technologies first developed on the NASA Phase I SBIR, MIRU I. The DRG-based CubeSat Inertial Reference Unit, or DCIRU, will be integrated into an original design that will directly benefit NASA's future GNC systems for future CubeSat missions, i.e., NASA's CubeSat Launch Initiative (CLI) that actively solicits CubeSat opportunities for low cost space exploration. ATA's DCIRU specifically addresses NASA's desire for advanced autonomous navigation and attitude control



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Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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that would facilitate significant advances in independence from Earth supervision by enabling high bandwidth CubeSat inertial attitude knowledge (IAK) and control required for future sophisticated science missions. There are currently no precision space qualified IRUs available for CubeSats today due to SWaP limitations. The proposed DRG/ DCIRU developments will ultimately fulfill the crucial need for a CubeSat compatible IRU.

To the commercial space industry:

Potential Non-NASA Commercial Applications: ATA is working to insert our DCIRU technology into many air and space markets. Potential applications include missions having stringent line-of-sight stabilization (LOSS) and IAK requirements. OIRUs are used in airborne HEL and Intelligence, Surveillance and Reconnaissance (ISR) applications along with space Laser Communications (Laser Communication). ATA anticipates capturing significant market share, as OIRUs are a very specialized product niche in which we own most of the Intellectual Property (IP). We continually work to enhance and improve our OIRU designs and technology to maintain our competitive edge while reaching out to competitors to supply their specific mission needs. Our goal is to be the Number One supplier of DCIRUs worldwide.

Management Team (cont.)

Principal Investigator:

- Darren Laughlin

Technology Areas

Primary Technology Area:

Communications, Navigation, and
Orbital Debris Tracking and
Characterization Systems (TA 5)

└ Position, Navigation, and
Timing (TA 5.4)

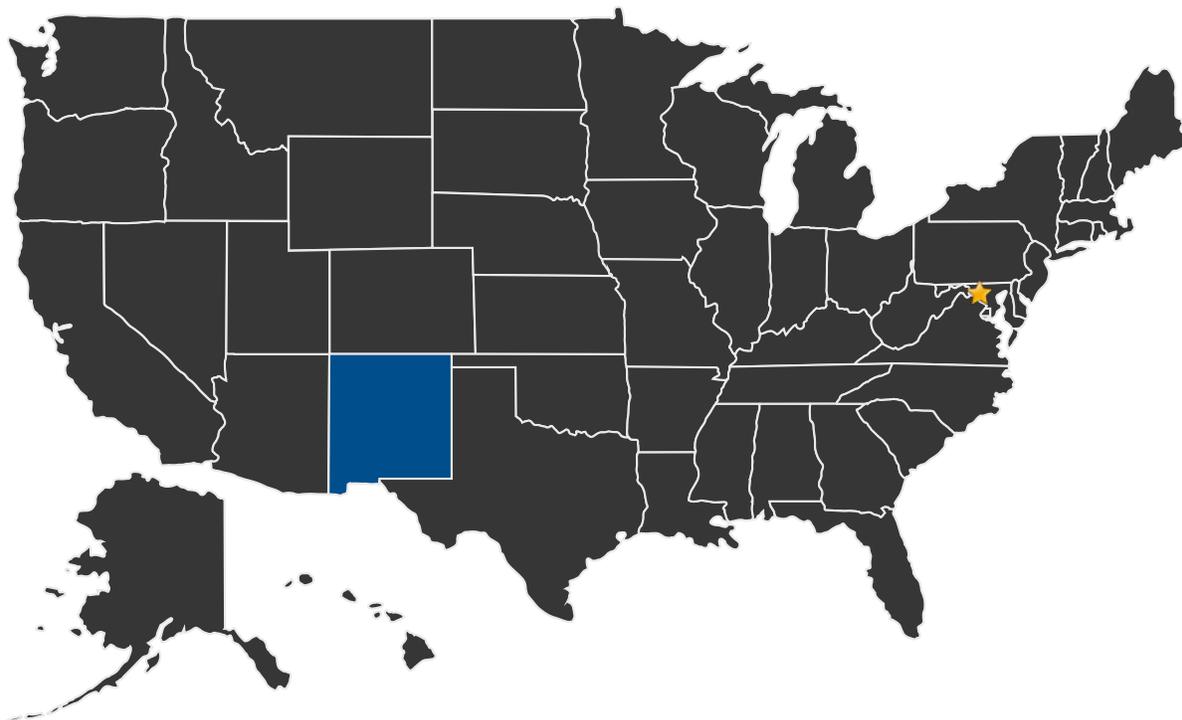
└ Sensors and Vision
Processing Systems (TA
5.4.3)

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U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States With Work

★ **Lead Center:**
Goddard Space Flight Center

Other Organizations Performing Work:

- Applied Technology Associates (Albuquerque, NM)

PROJECT LIBRARY

Presentations

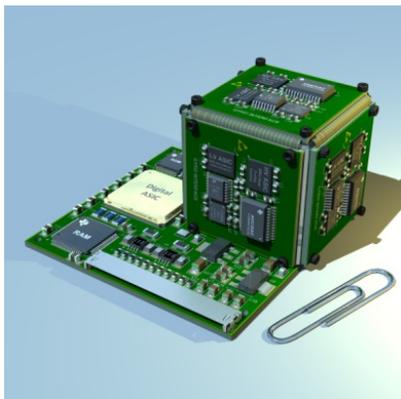
- Briefing Chart
 - (<http://techport.nasa.gov:80/file/23536>)

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IMAGE GALLERY



*DRG-based CubeSat Inertial
Reference Unit (DCIRU), Phase I*

DETAILS FOR TECHNOLOGY 1

Technology Title

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Potential Applications

ATA has successfully developed and transitioned SBIR innovations into government and commercial programs. One example is our recent success transitioning technologies first developed on the NASA Phase I SBIR, MIRU I. The DRG-based CubeSat Inertial Reference Unit, or DCIRU, will be integrated into an original design that will directly benefit NASA's future GNC systems for future CubeSat missions, i.e., NASA's CubeSat Launch Initiative (CLI) that actively solicits CubeSat opportunities for low cost space exploration. ATA's DCIRU specifically addresses NASA's desire for advanced autonomous navigation and attitude control that would facilitate significant advances in independence from Earth supervision by enabling high bandwidth CubeSat inertial attitude knowledge (IAK) and control required for future sophisticated science missions. There are currently no precision space qualified IRUs available for CubeSats today due to SWaP limitations. The proposed DRG/ DCIRU developments will ultimately fulfill the crucial need for a CubeSat compatible IRU.