NMIMS in Space

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NMIMS in Space is a research project started by an interdisciplinary team of students & alumni from NMIMS MPSTME. Most of us are aspiring researchers who are looking forward to creating our own mark in the research & academia world & are humbled to have accepted this opportunity by Satellize & ISRO.

The **NRT-1** or **NMIMS Robotics Testbed-1** is our foray into desiging and building space-grade robotic components.

CHAPTER

ONE

NMIMS ROBOTICS TESTBED-1 (NRT-1)

The versatility of MSMAs/FSMAs makes them unique for our use-case. General-purpose Shape Memory Alloys (SMAs) are already used in multiple space applications; proving their worthiness & efficiency over classical sensors & actuators time & time again. Proposed MSMAs allow a new breed of space equipment — imagine a chassis that can change its shape, act as a sensor & does not require any real actuator for movement.

With our research, we wish to bring new materials, soft robotics & underactuated robotics and all their benefits in terms of efficiency, cost-effectiveness & versatility to the New Space revolution in India & to ISRO. Further down the line, we also wish to research upcoming soft-robotics applications & attempt to retrofit the same in space-based applications. Based on the results we provide, we also expect future space missions to have improved efficiency, longer fatigue life, and lower costs on switching to MSMAs instead of traditional sensors (like magnetometers) or actuators (like a BLDC) or structural components (like cable nets used for deployment in Cubesats).

1.1 The Opportunity

1.1.1 Satellize - SpaceShare

Satellize (previously exceed space) is India's first private company in space. After succesfully launching two saatellites in orbit, in 2019 Satellite presented the Spaceshare program. A joint venture of Satellize and ISRO, Spaceshare provides University students, college students and NGOs an opportunity to launch their payloads in space for free. Upto 10 payloads are selected to be integrated onboard the Polar Satellite Launch Vehicle.

1.1.2 4th stage of PSLV (PS4)

PSLV, known as the workhouse of ISRO, boasts numerous successful multi-satellite deployment as a rideshare service for small satellites. The fourth stage is the uppermost stage of the PSLV is capable of its own power generation with an array of solar cells. The spaceshare module is intended to be a static part of this phase, drawing energy from the solar cells and communicating with the Satellize HQ.

1.1.3 Technical Requirements

specific dimensions; restrictions on sensors/ components *Conference Plan Table*

1.2 The Experiment

1.2.1 The Idea

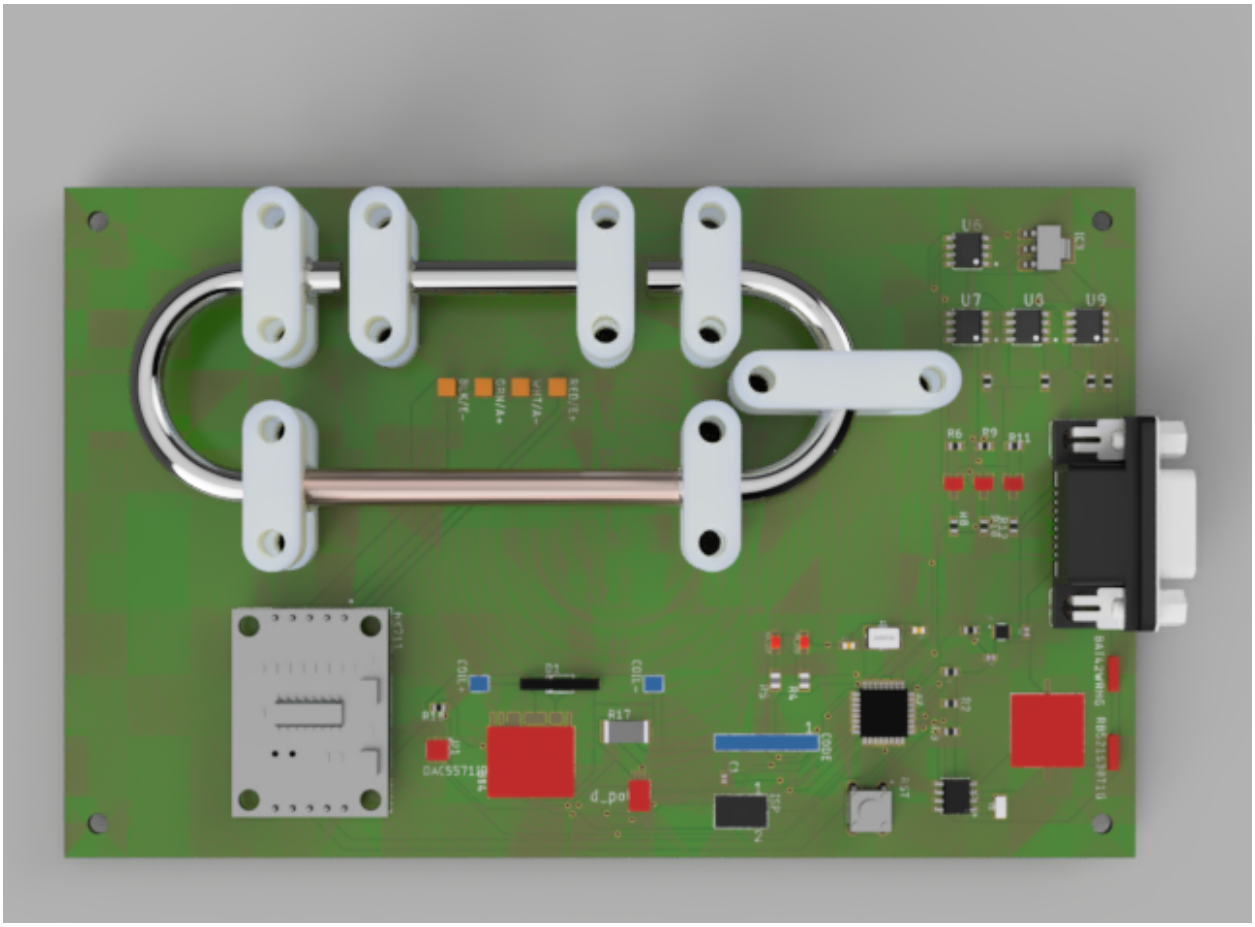
Smart materials?

With the increasing interest in Smart Materials and their applications, reasearchers have been gravitated towards materials that can pose as a possible substitute for alloys used in payloads. Materials that can achieve similar results with compact designs, lighter weight and modular structures are prefered. With these considerations Magnetostrictive materials prove as a valid alternative. Terfenol-D, composed of Terbium, Dysprosium and Iron, exhibits the capability of changing its shape and/or dimension during the process of magnetization. This opens up oppotunities of smaller satellites that can expand, dilate or adapt.

Terfenol-D

Terfenol D exhibits the highest magnetostriction out of any alloy, with upto 0.002 m/m at saturation. They have shown promising results when used for low frequency acoustic devices. Space Robotics/ COTS for space usage Designing better components for space Design The payload had to be designed to test as many material properties as possible while considering the general limitations of an object launched in space, such as restrictions of potentially hazardous materials, as well as the oppotunities provided to us by the spaceshare module, such as maximum current drawn, restrictions on moving parts etc. Keeping these in mind “Insert Conference Plan Table here” Simulation I did modal analysis for some reason:

CAD Design



Electronics - PCB Design (not the actual design right? Maybe a simplified block diagram?) Validation 1st prototype implemented Modular software architecture Testing Vibration Tests Thermovac ??? Test Data Understanding the material stress; transition effects; durability? Basic plots (offline/ground data) Results Awaiting launch Future Improvements Ground Station Design optimization Other smart materials to look into - NiMnGa

CHAPTER

TWO

OUR TEAM

A close-knit, inter-disciplinary (ex-) Student team from NMIMS MPSTME. The only thing common about us, is *a passion for building robots* & the drive to see it through.

2.1 Technical Team

2.2 Administrative Team

2.3 Our Mentors

CHAPTER

THREE

PRESS KIT

Information for the Press/Media is detailed in this page; as well as in a downloadable *PDF*. Kindly go throught it before getting in touch with us.

3.1 Overview

We are a group of students and alumni from the NMIMS University. Robotics enthusiasts at heart, we were given the generous opportunity from Satellize and ISRO and we have been selected to launch our payload into Low Earth Orbit. We are taking this opportunity to test the properties of a Smart Material called Terfenol - D in orbit and assessing its potential to create advanced payloads as Commercial-off-the-shelf modules.

3.1.1 About the Project

The payload is a test-bed containing the Terfenol-D sample strapped with strain gauges. The alloy is energized by a solenoid wrapped around a iron core to create a magnetic field. The magnetic fields cause a change in the dimensions of the alloy. This opens up a plethora of possibilities for payloads with lighter weight and compact designs.

The payload will be launched from the Polar Satellite Launch Vehicle of the Indian Space Research Organization and communicated from the Satellize Spaceshare module.

3.1.2 Unique Points

Modular test bed design allows for testing of multiple properties of any magnetostrictive materials Terfenol D boasts one of the highest strain values of 0.002 m/m at saturation

3.2 People

To learn more or to reach a particular person, please use our directory at the Team Page.

3.3 Featured in

Inexhaustive list of articles/ news we are featured in so far:

3.4 Sample Article

Thinking of writing about us? Here's a sample article to get you started: *Word Document*, also available as a *PDF*.

3.5 Images, captions & license information

3.5.1 Downloadable Images

You can refer to this Google Photos Album for any image you would require - all of which are shared here for the purpose of marketing.

3.5.2 Captions

Following precedence is requested for purposes of captioning the team/ work (from highest preference to lowest):

- Narsee Monjee Institute of Management of Studies
- NMIMS Robotics Testbed-1 (NRT-1)
- NMIMS Robotics Testbed-1
- NMIMS
- Mukesh Patel School of Technology Management & Engineering
- NMIMS In Space

3.5.3 Licensing

All data (text, images, videos) provided (either directly or hosted externally on Google Photos) here are royalty free (free of any license), so as to enable ease of publication.

3.6 Contact

If you have already browsed through the given press kit & still have questions, feel free to get in touch with Kashish:

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or Aditya:

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CHAPTER

FOUR

CONTACT US

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