2018

A systems approach to sustainability in space

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The Cosmic Calling

Why Space Debris?

Out of sight
Out of mind

What is
Space Debris ?

What makes it a
Wicked Problem?
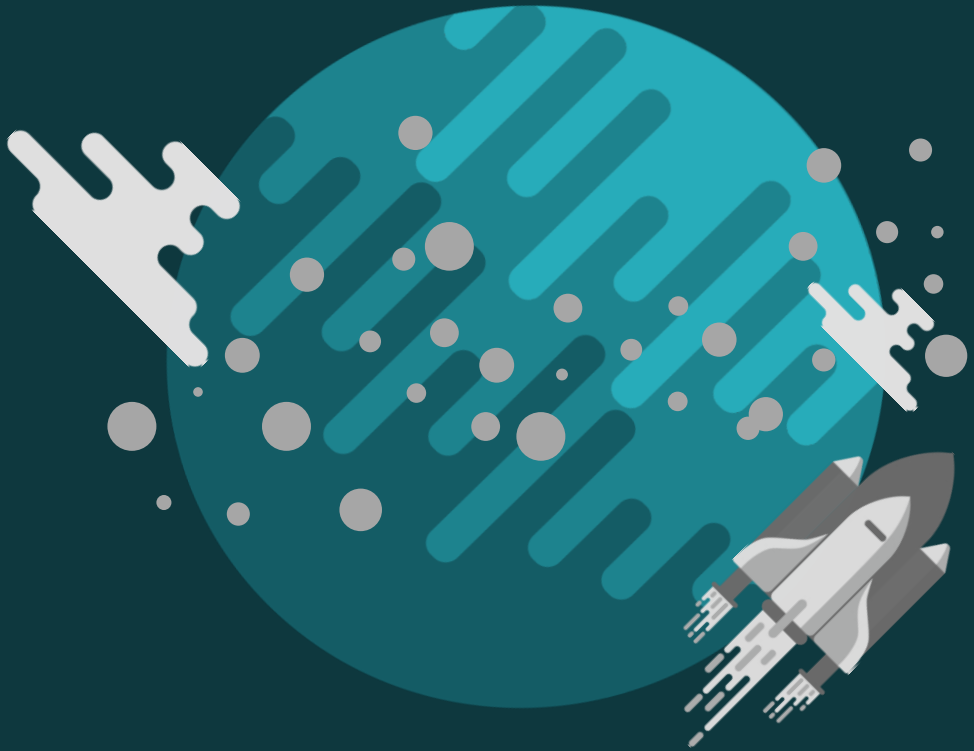
23,000 regularly tracked

7500 tn of space debris

750,000 debris between the size of 1cm to 10cm
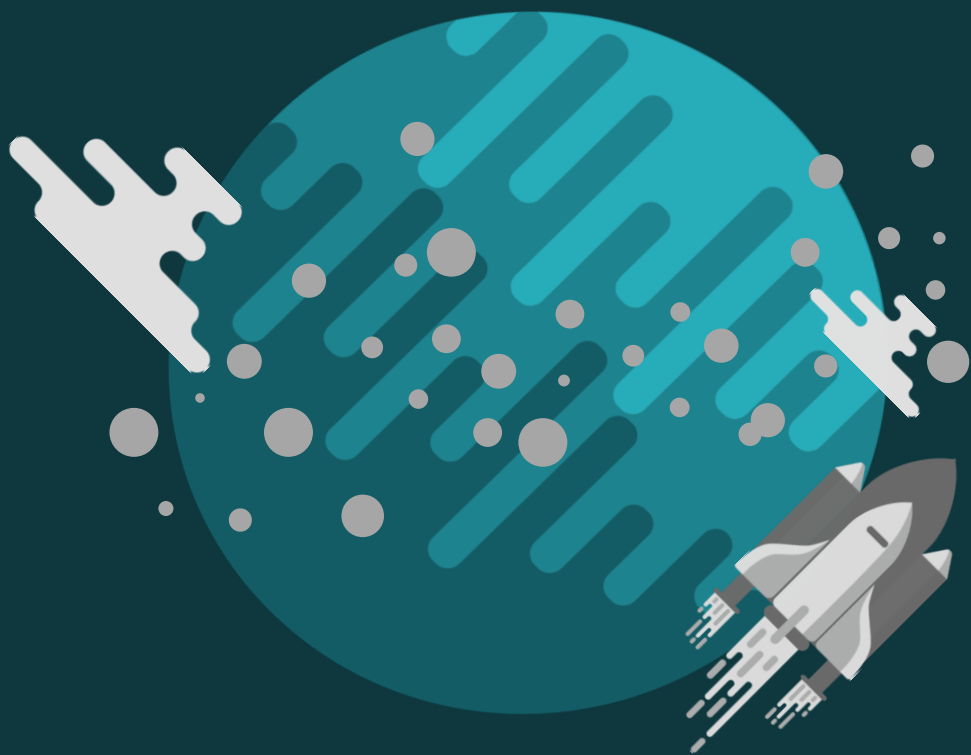
Research

Widening our Knowledge base.

Sustainability

Lifecycle Assessment

Effect on Environment

Manufacturing

Material Selection

Policies

Binding Rules

Iinternational Co-operation

Revision of Treaties

Economics

Privatization

Democratization

New Business Models

Sharing our Journey

Blog, Booklet and Abstract

Secondary Research

- *Current Policies around Space Debris*
- *Guidelines*
- *Dual Use Technologies*
- *Checks & Balances*
- *Use of Space Tech on Earth*
- *Spin-Off Tech*
- *Commercialisation*

Case Studies

- Impact of Gender on Space Exploration
- Impact of Space on UK Economy
- Space Elevator Sustainability
- Handbook of New actors in Space

Idea Generation
Process Reversal
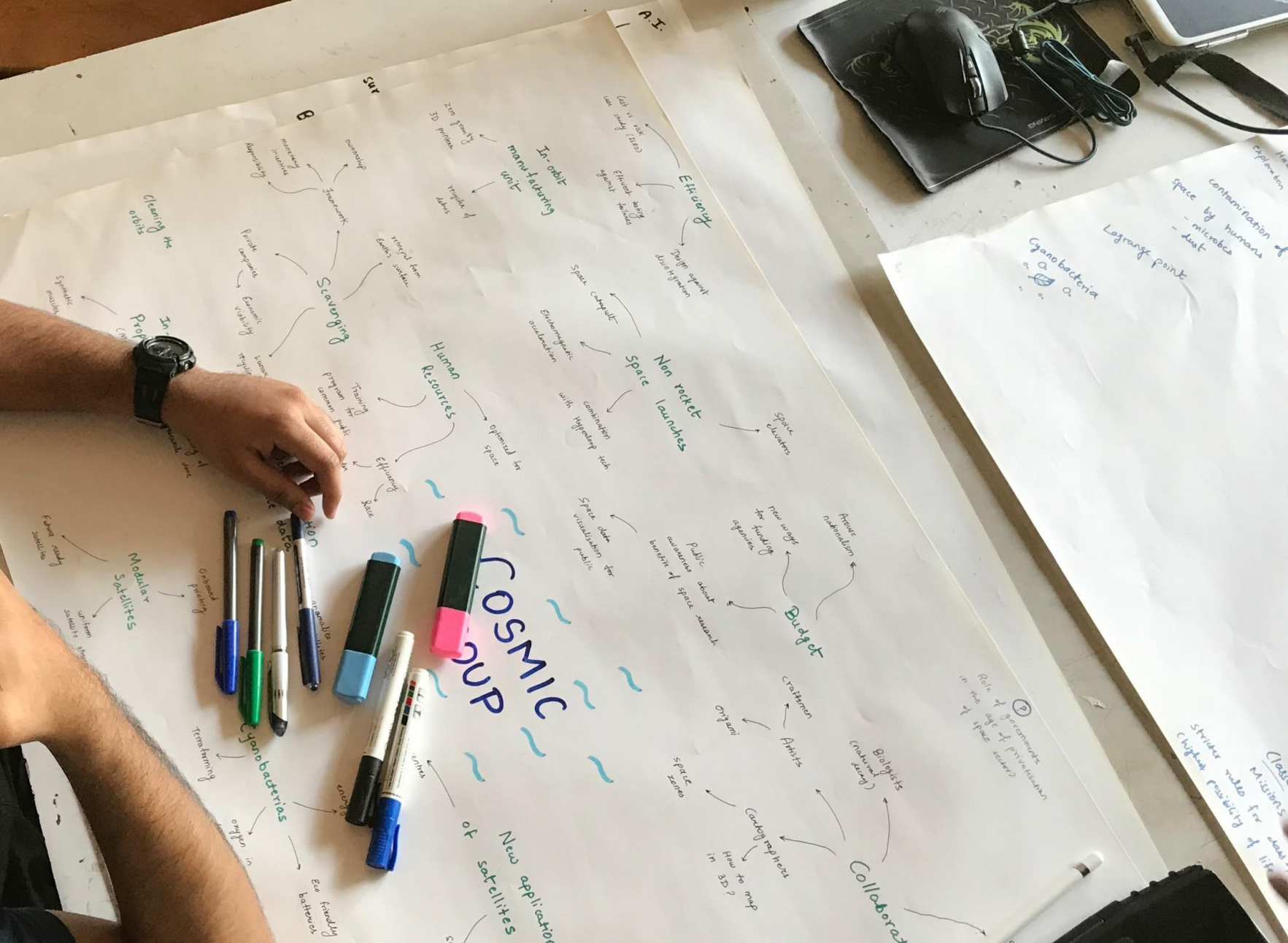
Approaches

- *Space Debris*
- *Democratization of Space*
- *Economics of Space*
- *Design Approach in Space Industry*
- *International Policy Framework*
- *Space & Relatability*
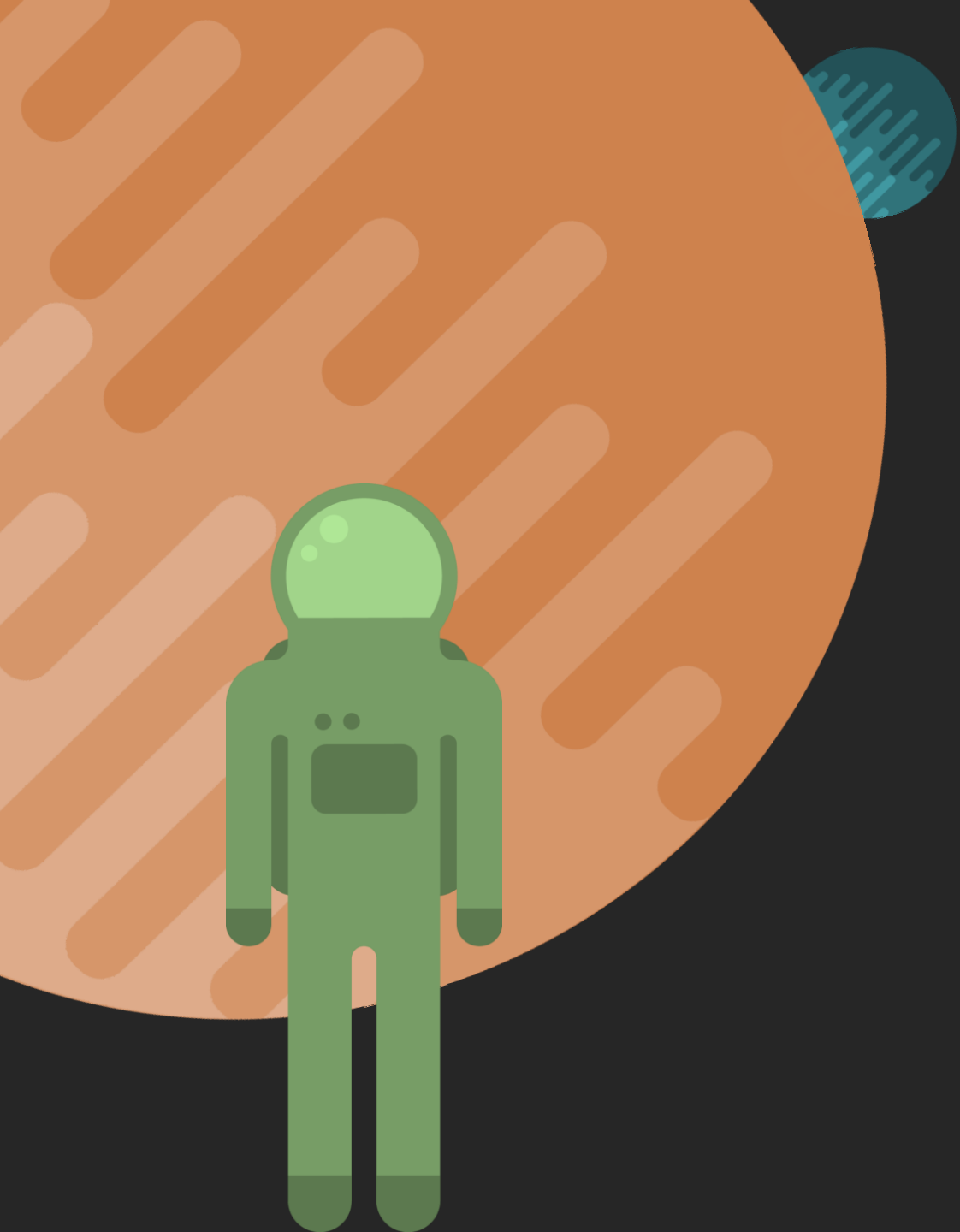
Narrowing down

Space Debris
- Is burning on re-entry the best way to end a satellites life

Democratisation of Space
- Who keeps check on how data from satellites are processed?
- How can treaties be revised for the new Space age?

Space & relatability
- How can common man relate more to Space?
- How do you kindle interest and fascination on a larger scale towards Space?

Research & Mapping

- *Structured view of the Space industry.*

- *Finding new problems, opportunity areas and intervention points*

- *Understanding Upstream and Downstream of the Industry*

Houston! We've made Contact

Primary Research

Team Anant

1

Team Anant is a group of undergraduate students from BITS Pilani, who are working on their first indigenously built nanosatellite. We had the opportunity to speak with them about our project. We got a lot of information and insights. We understood the cubesat scenario in India, and the entire process an individual has to follow in order to put a satellite in orbit.

Common Public.

2

We decided to step out and ask the common people how much they knew about Space, satellites and ISRO in general. We asked rickshaw drivers, shopkeepers, students and evening time joggers. We got many interesting insights about how aware the general citizens are about space missions, and how they feel about them.

Physical Research Lab Exhibition.

3

PRL hosted an Astronomy exhibition on its premises on the 27th of February, 2018. We learnt details about India's moon mission, Chandrayaan II, which is currently in progress and is slated to launch in October 2018. We gained useful insights about the kind of work that is done by people in the Space industry, and what different fields are included in it.

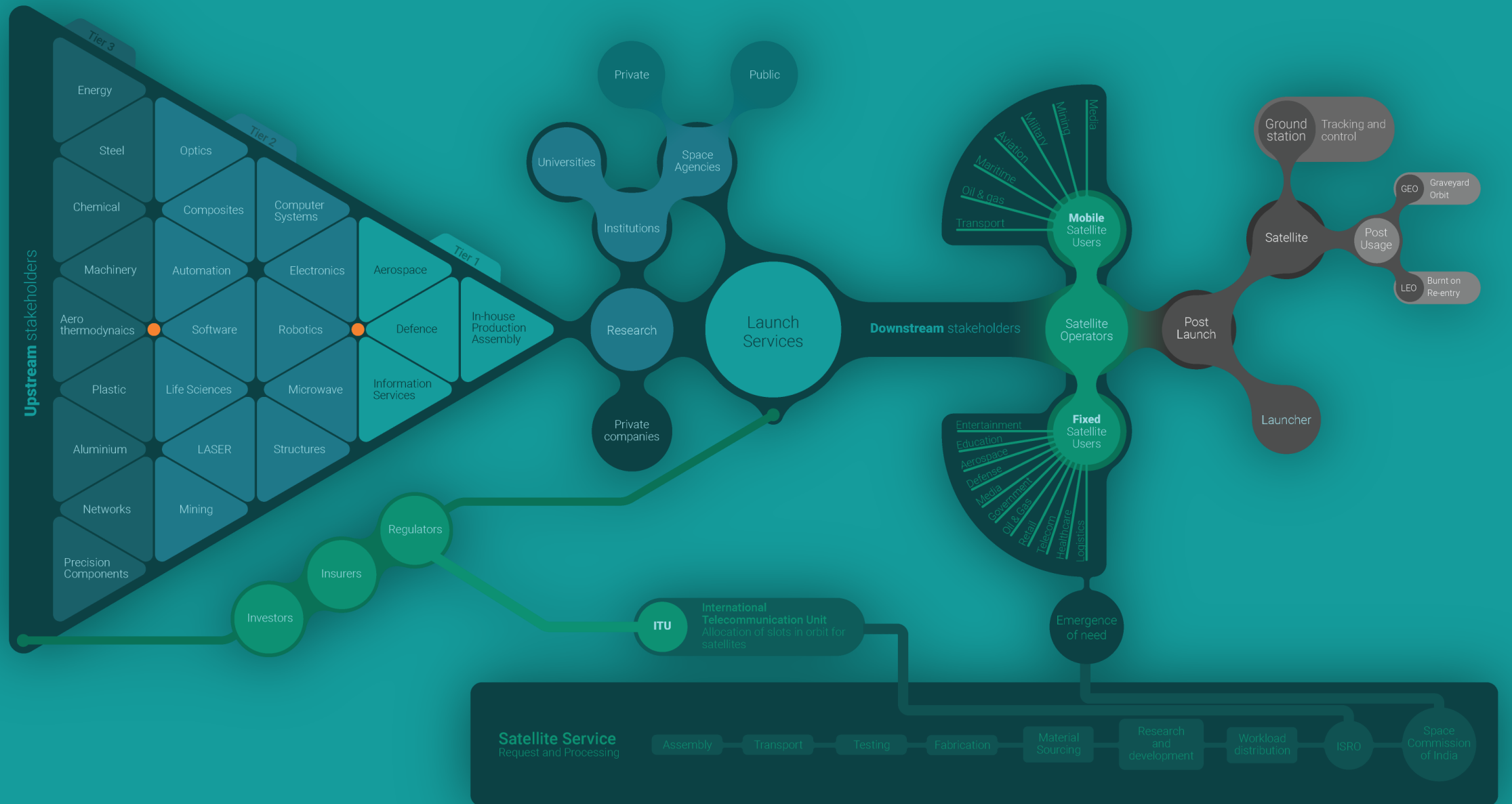**Vikram Sarabhai Space Exhibition.**

4

As part of our primary research exploration, we visited the space exhibition maintained by SAC, Ahmedabad. The exhibition is an information centre for all ISRO activities.The purpose of the visit was to familiarize ourselves with the Indian space program and how it functions.

Space Applications Centre, Director.

5

The SAC director showed great interest in our topic and directed us to the Associate director, D.K. Das. We interviewed different professionals and understood how SAC functions. We learnt how satellites are made, manufactured and launched into orbit. The AD extended full support for our project and agreed to facilitate our workshop at the institute.

Space Applications Centre, Professionals

9

As a follow up to our meeting with the SAC director, we went to meet some professionals at SAC. We interviewed four top scientists from various departments. This visit was crucial for our project as we got first hand information about how ISRO works, which eventually helped a lot in developing our design solutions and policies.

Gujarat National Law University.

8

To intervene in the policy framework aspect of space debris, we met the Director of Gujarat National Law University. We understood the intricacies of the law and policy of the space industry. We learnt the need for a national space law, and how to draft one. We had the opportunity to explore how law can make a difference in a problem as huge as this.

Gujarat University.

7

M.E. James currently works as a professor at the Department of Physics, Electronics & Space Science, Gujarat University, Ahmedabad, India. He told us about some projects in the university that were dealing with Space laws. He gave good insights about the effect of re-entry of debris on the atmosphere, and manufacturing materials that automatically degrade.

Physical Research Lab, Director.

6

We visited the Director of Physics Research Lab to learn more about our subject and get a professional view. He gave critical insights and feedback on our project, which helped us develop our research further. He guided us to many case studies and examples which would be related to our topic of interest.
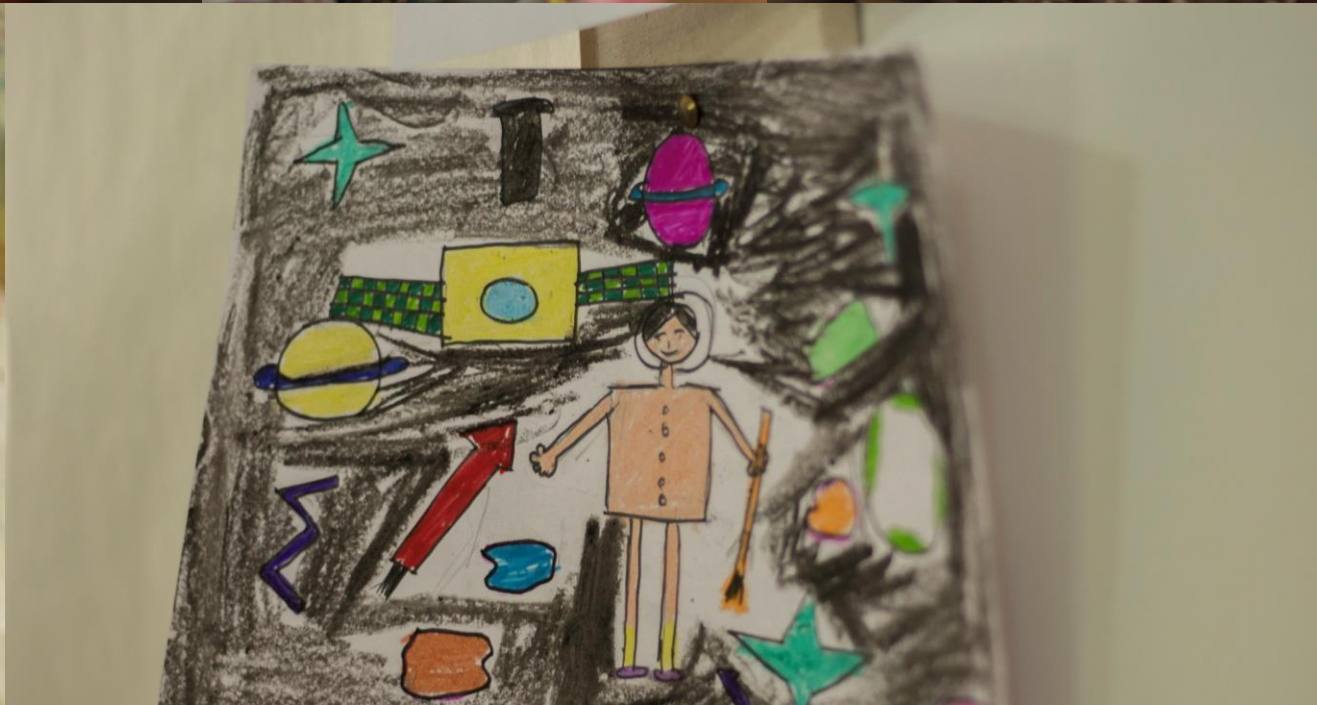
Harnessing Wisdom

Why conduct a workshop with **kids**?

Idea Generation & Awareness
Unhindered Creativity

Flow of the **workshop**

Write down facts about Space and fact about Earth.

Presentation

Make your own superhero/super-heroin

Humanising a Satellite

Teaching them the parts of a Satellite

Make your own Satellite

Workshop with the **professionals**

Scenario

Based idea generation

The Past: Restart the Space Age with your current understanding.

The Present: Deal with present space debris.

The Future: How can we mitigate Debris creation?

Triggers

For idea generation

Design for **Collision**

Design for **Modularity**

Design for **Trackability**

Design for **demise**

Design for **Re-use**

Design for **Secondary use**

Design for **Transformation**

Design inspired from **Nature**

Outcomes

Of the idea generation

Past group:-
- Disallowed launching of satellites into the Geostationary orbit.
- Standardisation of satellite parts, and creation of modular buses which could be repaired or replaced easily

Present group:-
- Mitigating space debris using nets
- Increased global co-operation
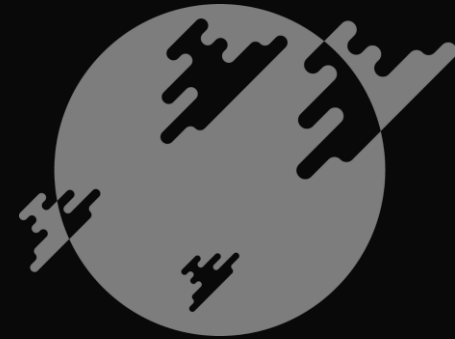- Better ground segments to track the orbital debris.

Future group:-
- Artificial envelope of gases that reflect communication signals
- Developing microwave and infrared waves to carry out the function of broadband communication
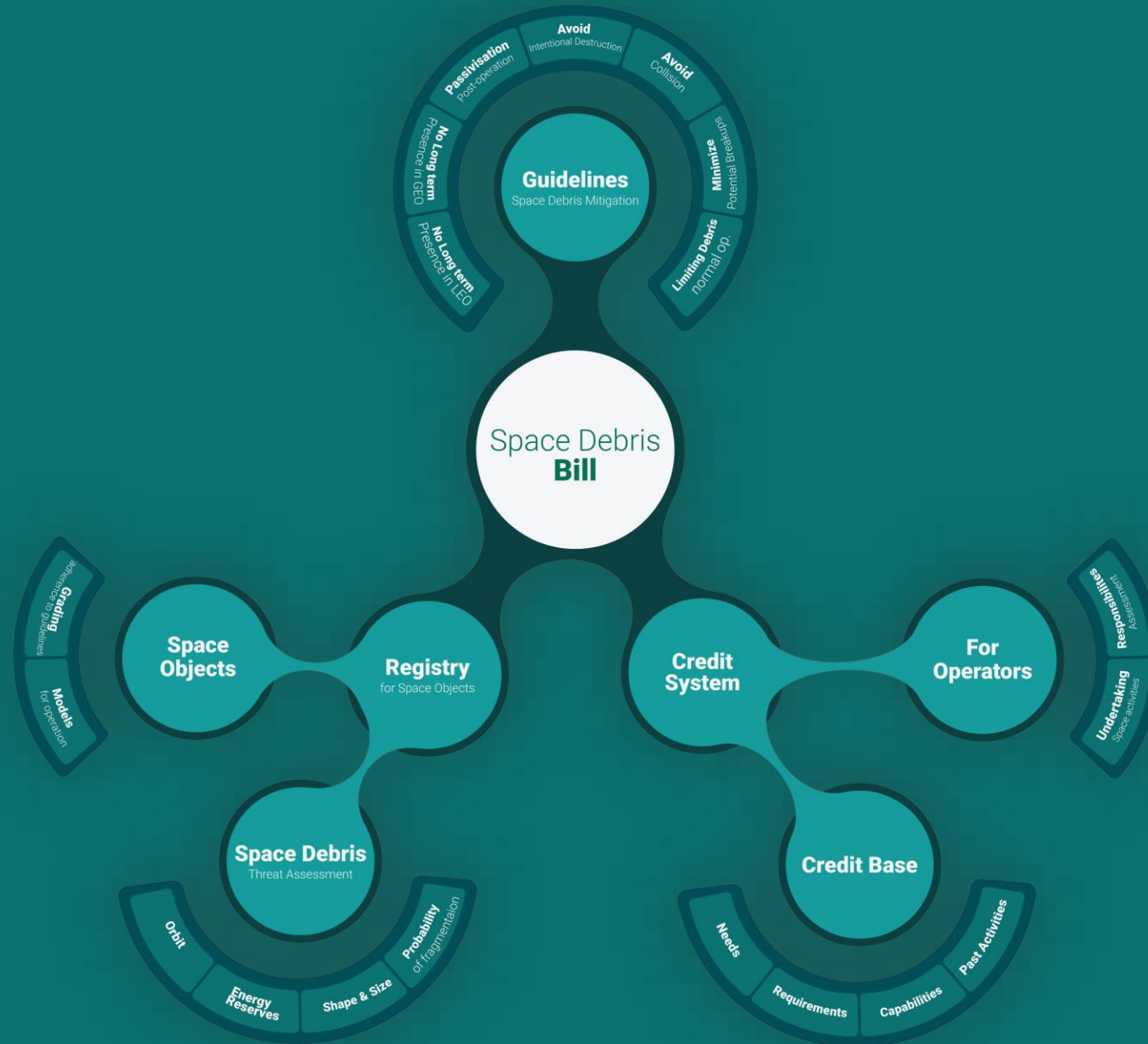
Frameworks

LCA

Policy

Design Octaves

Awareness

Time capsules

Comic

Solutions

Developing concepts based on the

workshop

Satellite designs