

UNISEC-Global Challenge: How can we contribute to Sustainable Space Development?



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UNISEC-Global

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United Nations/South Africa Symposium on Basic Space Technology
"Small satellite missions for scientific and technological advancement"

Outline

- What is UNISEC-Global?
 - Vision 2020-100
 - Activities
- The 2030 Agenda and Vision 2030
- Space Debris issues
 - UNISEC-Global's possible contribution
- Conclusion
(How to join UNISEC-Global)

What is UNISEC-Global?

- **UNISEC-Global** is an **international nonprofit, non-government organization**, consisting of local-chapters across the world.
- Since its **establishment in November 2013**, it has provided an annual forum, training programs, competitions.
- In 2017, it was accepted as **permanent observer by UNCOPUOS**.
- Its **primary objective** is to help create a world where space science and technology is used by individuals and institutions in every country, rich or poor for peaceful purposes and for the benefit of humankind.

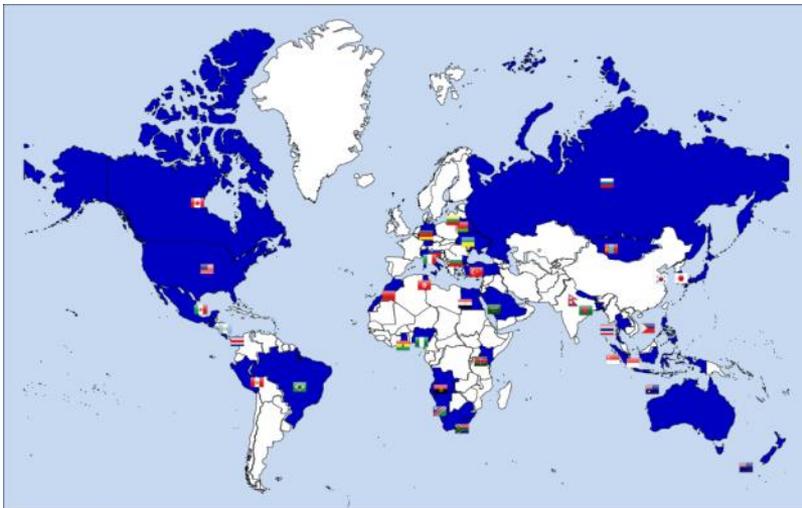


UNISEC stands for
University Space
Engineering
Consortium

UNISEC Local Chapters

POC in 44 regions: Australia, **Bangladesh**, Belarus, Bolivia, Brazil, **Bulgaria**, Canada, Chile, Costa Rica, **Egypt**, El Salvador, **Germany**, Ghana, Guatemala, Indonesia, **Italy**, **Japan**, Kenya, **Lithuania**, Malaysia, **Mexico**, **Mongolia**, Morocco, Nepal, New Zealand, **Nigeria**, **Peru**, the Philippines, Saudi Arabia, Singapore, **Samara (Russia)**, Slovenia, South Korea, Spain, **South Africa/Angola/Namibia**, Taiwan, Thailand, **Tunisia**, **Turkey**, Ukraine, USA and Vietnam

(Local Chapter in Red)



15 Local Chapters and
1 Association of Local
Chapters have been
acknowledged.

Vision 2020-100

“By the end of 2020, let’s create a world where university students can participate in practical space projects in more than 100 countries.”



Accepted as permanent observer to the United Nations’ Committee on Peaceful Uses of Outer Space (UNCOPUOS) in 2017

History of Activities

Year/Activity	CLTP 	DMC/DDC 	MIC 	Nano-satellite Symposium 	UNISEC-Global Meeting 
2010				1 st	
2011	1 st and 2 nd		1 st	2 nd and 3 rd	
2012	3 rd		2 nd	4 th	
2013 	4th		Pre 3rd	5th	1st
2014	5 th		3 rd		2 nd
2015	6 th		Pre 4 th	6 th (ISTS30)	3 rd
2016	7 th	1 st	4 th	7 th	4 th
2017	8th	2nd	Pre 5th	8th (ISTS31)	5th

UNISEC-JAPAN

UNISEC-GLOBAL

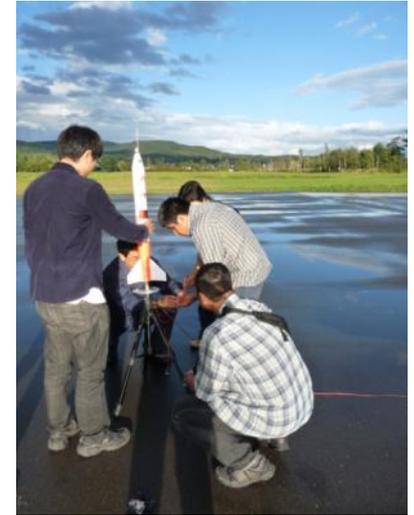
CanSat Leader Training Program (CLTP)

Objective: CLTP is a training program for professors/instructors to learn how to conduct CanSat training by experience. Participants are expected to teach their students after training. It has contributed to capacity building in basic space engineering and technology.

Launched: October 2010

Offered: Annually

Graduated: 73 participants from 34 countries



Launch Experiment



CanSat Manufacturing



Vibration Test



Paper craft Rocket

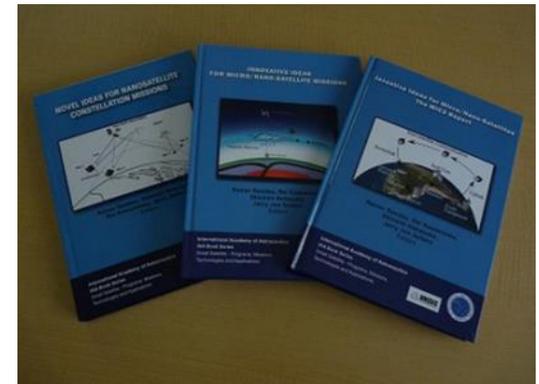
Mission Idea Contest (MIC) for Micro/Nano Satellite Utilization

Objective: The Mission Idea Contest (MIC) is encouraging aerospace engineers, college students, consultants, and anybody interested in space to share their ideas on how to use micro/nano/pico satellites, and provides opportunities to present their ideas and gain attention internationally.

Launched: June 2010

Conducted: Annually as PreMIC or MIC

- Regional coordinators from 41 countries
- Four books were published as a part of the IAA book series.



UNISEC-Global Meeting

- **Objective:** The UNISEC-Global Meeting is an annual gathering to expand university community beyond Japan which intends to promote practical space projects at university level. The meeting includes Local Chapter activities report, Group discussion, Student Session, Competitions and Acknowledgement of new local chapter.
- **Launched:** November 2013
- **Conducted:** Annually

The 5th UNISEC-Global Meeting was held in Rome, Italy in Dec 2-4, 2017



Debris Mitigation Competition(DMC)

- **Objective:** To facilitate the sharing of innovative solutions for debris mitigation and developing effective deorbit devices that can be demonstrated and validated with Micro/Nano-Satellites. It is also expected to increase awareness of debris problems among satellite developers and university students.
- **Launched:** November 2015
- **Conducted:** Annually



The 2030 Agenda for Sustainable Development

SUSTAINABLE DEVELOPMENT GOALS 17 GOALS TO TRANSFORM OUR WORLD



Key principle: No one will be left behind.

Vision 2030

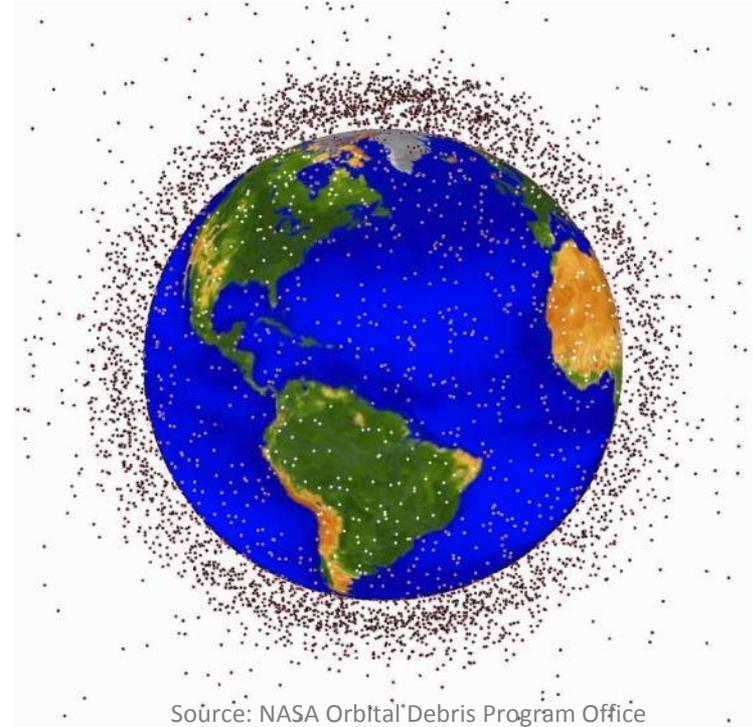
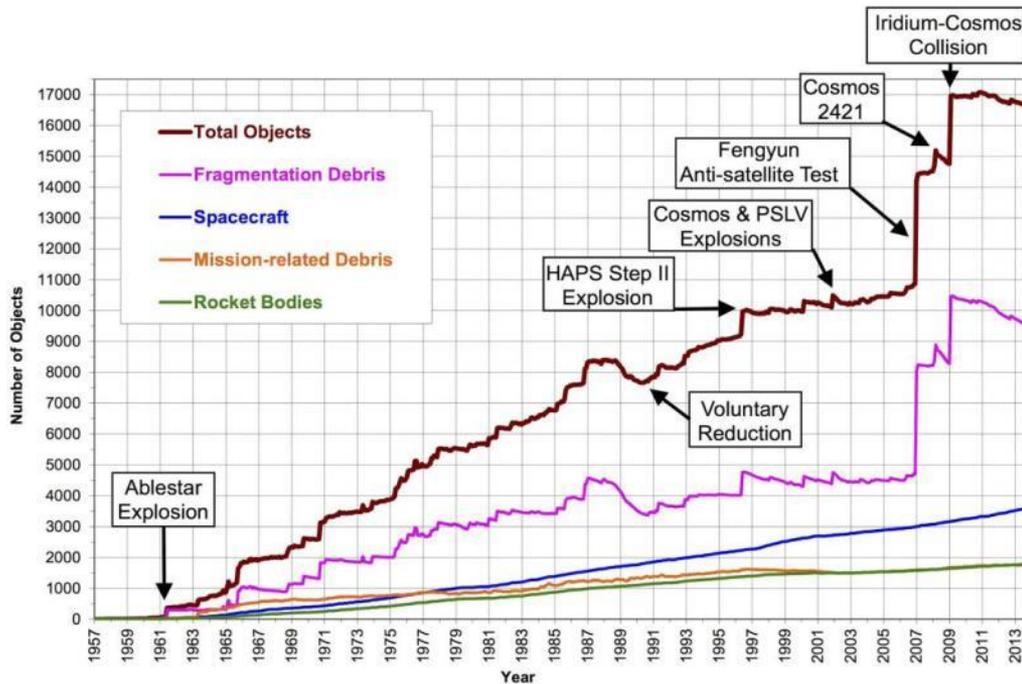
*“By the end of 2030, let’s create a world where university students can participate in practical space projects in **all** countries.”*

- How can we achieve it..?
 - Each of us should think what we can do for it.
- How can we solve potential problems?
 - Debris issues, lack of radio frequencies, and..?
 - Once we can identify a problem, we can find a way.

Let’s start thinking...

Your thoughts and inputs are important!

More and more satellites will be launched? Debris problem?



- Objects in the chart are limited to larger than 10 cm due to limited tracking capabilities

Reference: NASA Orbital Debris Quarterly News, Vol. 16, Issue 1, January 2012.

Two ways to reduce university satellite debris problems

- Seek effective ways for post mission disposal.
 - Debris Mitigation Competition - 2016, 2017
 - IAA study group – 2017-2020
 - Study for Post mission disposal strategies
 - UNISEC-Global will help dissemination the recommendation and other information.
- Increase success rate
 - Training program
 - Review meeting (from Mission Design Review)
 - Guide book for successful satellite project

Deorbit Device Competition (DDC) (1st Debris Mitigation Competition)

- Objectives:
 - Increase awareness of debris problems among nano/micro Satellite developers and university students
 - Facilitate sharing of innovative solutions for debris mitigation and developing effective deorbit devices that can be demonstrated and validated with CubeSats.
- Timeline



DDC: Results

- **22 Abstracts from 15 countries:**
 - Drag sail derivatives - 13
 - Nano-propulsion systems - 6
 - Electrodynamic tethers - 2
 - Unworkable solutions – 1

- **10 Finalists from 8 countries:**
 - France, Italy, Japan (2), Poland, Russia, South Africa (2), Turkey, USA

- **8 applicants** provided the chance to make poster presentations.

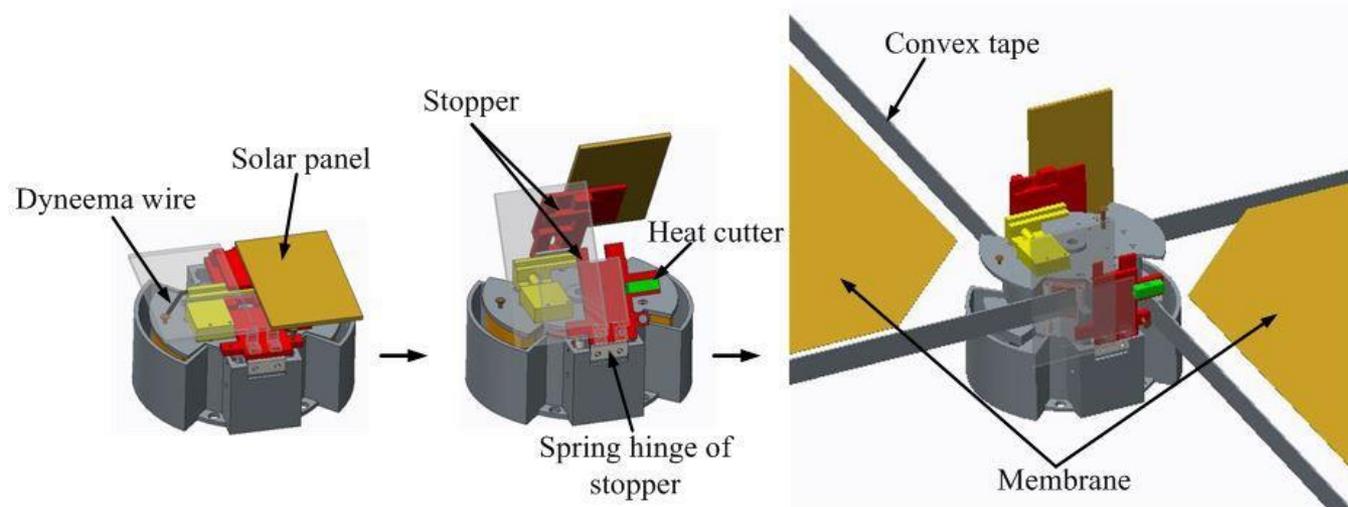
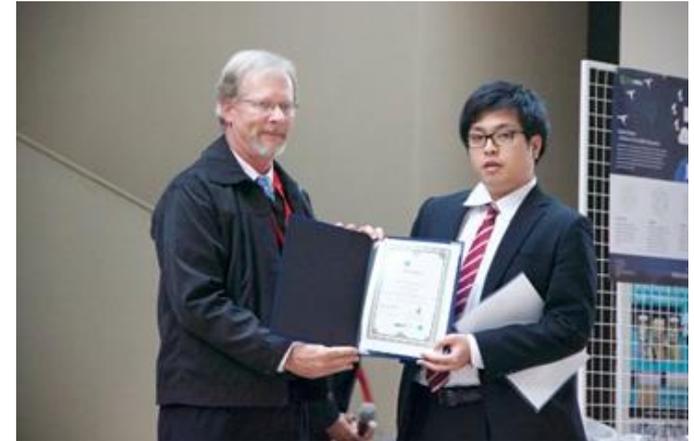
- **8 Withdrawals** due to lack of information to evaluate, unworkable solution or couldn't come for presentation.



Presenters of the Deorbit Device Competition

DDC: Results

- 1st Place: Mr. **Noboru Tada**, Nihon University, **Japan**.
- Proposal: “*Membrane Deployment de-orbit System by convex tapes*”



2nd Debris Mitigation Competition

- 2nd Competition was held as “Debris Mitigation Competition (MDC)” on Dec 4 during the 5th UNISEC-Global Meeting (Dec 2-4) Rome, Italy.
- The **objective** is to facilitate the sharing of innovative solutions for debris mitigation and developing **effective post-mission disposal (PMD) and/or active debris removal (ADR)** device that can be demonstrated and validated with a micro satellite.
- Timeline

Call for papers
January 27, 2017

Abstracts submission due
July 25, 2017

Notification for
acceptance
August 30, 2017

Full Papers
submission due
October 20, 2017

Final presentation
in Rome, Italy
December 4, 2017

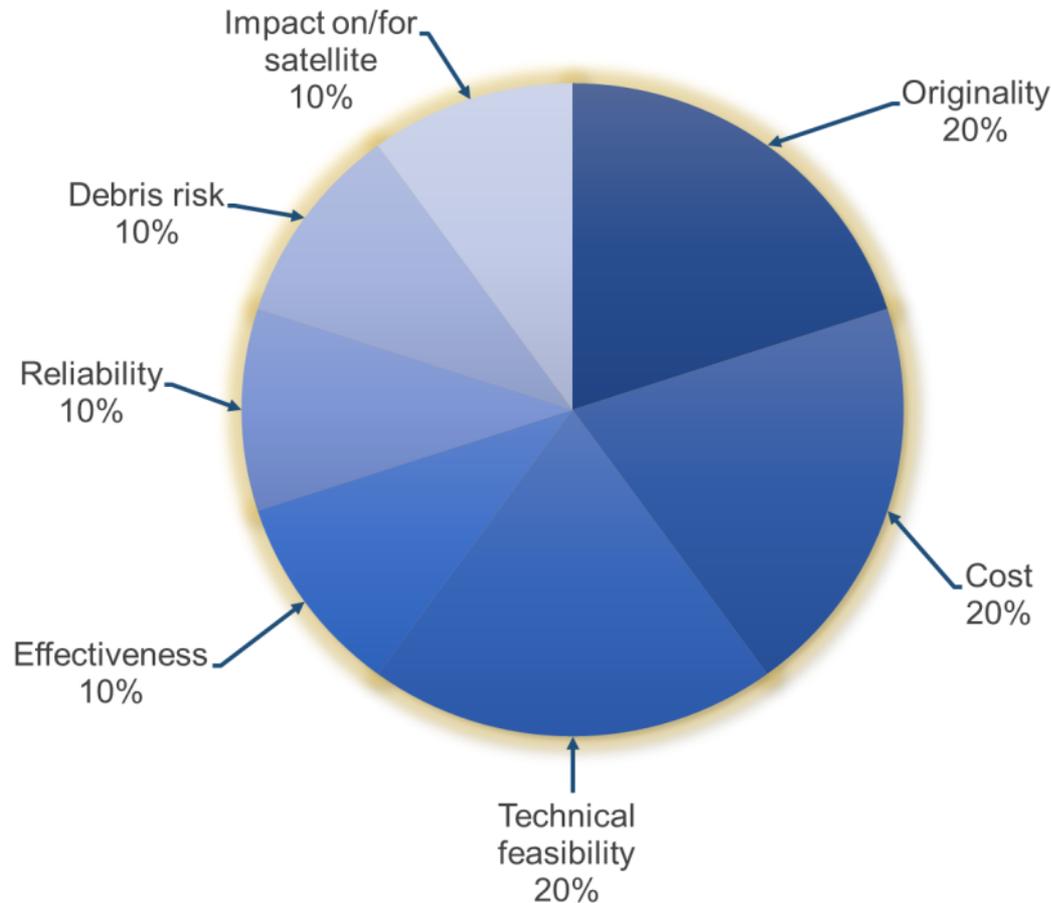
DMC: Requirements

- Propose a post-mission disposal (PMD) or active debris removal (ADR) device that satisfies the following requirements:
- The device must be designed for the removal of a potentially non-cooperative lean satellite of 50 kg mass and maximum dimension of 1 meter. Total mass of a satellite and device can exceed 50 kg.
- The device will enable the satellite to re-entry within 11 years (i.e. one solar cycle) after activating. You can use any systems such as thruster, tether, membrane or electric propulsion.
- The device will be activated at 00:00:00 UTC, January 1, 2020 with the following orbit element:

Semi-major axis	7128 km
Orbital inclination	98.4 degree
Eccentricity	0.001
R.A.A.N	30 degree
Argument of Perigee	210 degree
Mean Anomaly	190 degree

DMC: Evaluation Criteria

The proposed Deorbit Mitigation concept is evaluated according to the following criteria:



2nd DMC: Results

- **11 Abstracts from 7 countries:**

- Drag sail derivatives - 4
- Propulsion systems - 2
- Electrodynamic tethers – 1
- Laser beam – 1
- Unworkable solutions – 3



- **5 Finalists from 5 countries:**

- Argentina, Japan, Russia, South Africa, Turkey

Debris Mitigation Competition 2016-2017



Parameter	DDC(2016)	DMC(2017)
Target Satellite	CubeSat (1-3U)	Micro-Satellite (50kg)
PMD/ADR	PMD	PMD and ADR
Semi-major axis	6930 km	7128 km
Orbital inclination	97.6 deg.	98.4 deg.
Eccentricity	0.002	0.001

**Be a part of solutions,
not a part of problems**

IAA-Study Group

- **Title of Study:** Trade Study for Post-Mission Disposal Devices for Micro and Smaller Satellites
- **Members:**
 - **Chairs:** Darren McKnight (USA), Toshiya Hanada (Japan), Alex da Silva Curie (UK), and Peter Martinez (South Africa)
 - **Secretary:** Rei Kawashima (Japan)
 - **Experts :** IAA members and non IAA members
- **Overall Goal:** Provide framework for a practical implementation to assure compliance with Space Debris Mitigation guidelines for micro and smaller satellites.
- **Target Communities:** Universities, micro/nano/pico-satellite manufacturers, and new spacefaring entities
 - UNISEC-Global will help disseminate the information and recommendation.

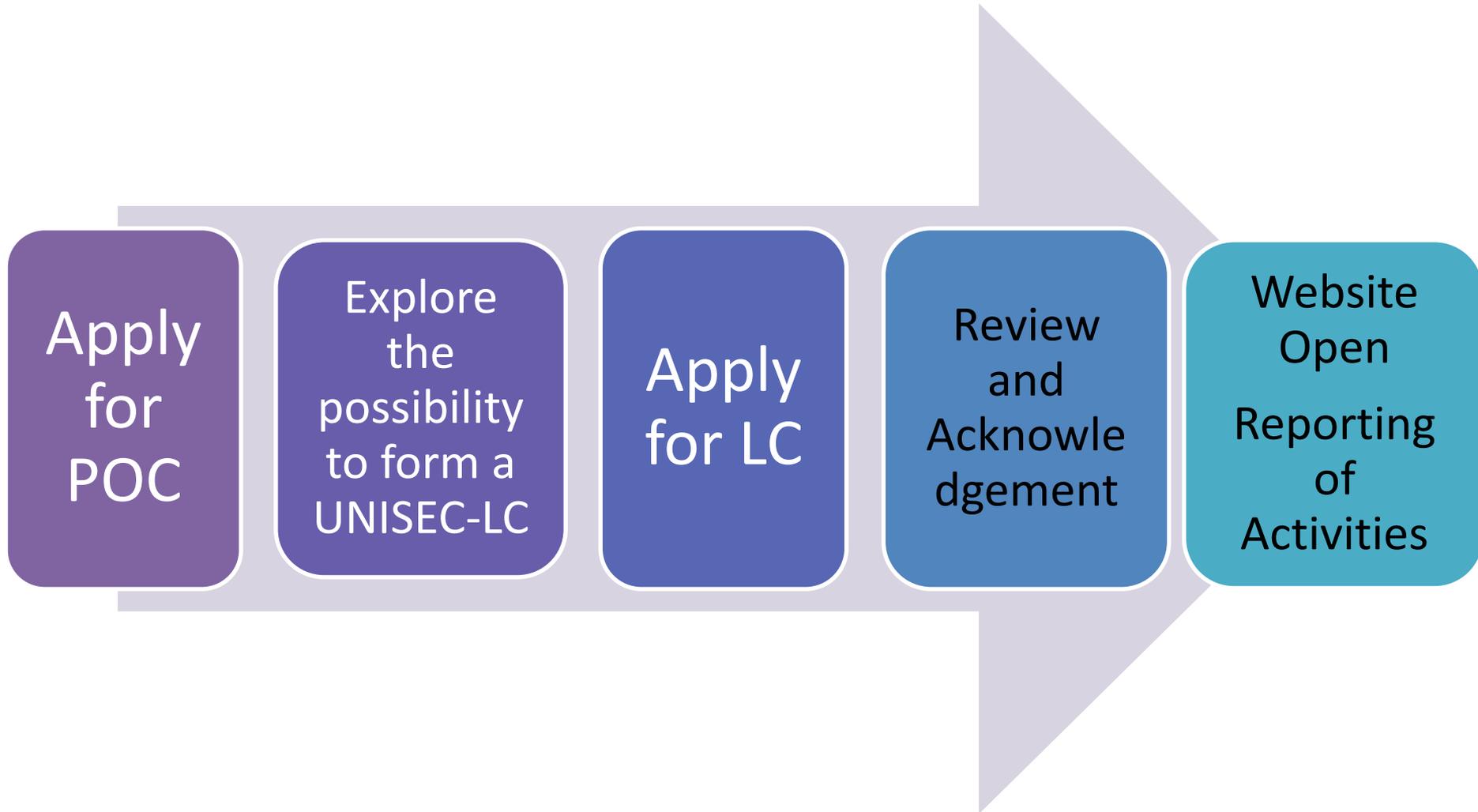
Conclusion

- UNISEC-Global was established to promote practical space projects at university level worldwide, and provided training programs, conferences and technical competitions.
- To increase awareness of debris problems and facilitate sharing of innovative solutions for debris mitigation, the Deorbit Device Competition (DDC) which was renamed the 1st Debris Mitigation Competition and 2nd Debris Mitigation Competition were conducted in 2016 and 2017 respectively.
- If it is a right direction to realize the world where university students can participate in practical space projects in all countries in 2030, we need to prepare and start thinking what to do.

How to join UNISEC-Global?

- Join an existing local chapter.
- No local chapter in your region? Then establish it.
 - 2 or more universities that work for/promote practical space projects
 - Attend annual meeting and report your activities
- “*UNISEC-Africa*” is not a dream....(2 or more local chapters in Africa)
 - UNISEC-Egypt, Tunisia, Nigeria, South Africa Region...

Process to Establish LC



***If you want to go faster,
go alone.***

***If you want to go further,
go together.***