

Singapore Space Challenge 2011

Version 1.0

ENGINEERING COMPETITION GUIDELINES

CONTENTS

INTRODUCTION & OVERVIEW OF SINGAPORE SPACE CHALLENGE	Section 01	Page 01
TIMELINE	Section 02	Page 02
RULES		
RULES, TERMS AND CONDITIONS	Section 03	Page 02
REGISTRATION	Section 04	Page 02
PRIZES	Section 05	Page 02
MISSION OVERVIEW	Section 06	Page 03
MISSION BACKGROUND	Section 07	Page 03
MISSION SPECIFICATIONS	Section 08	Page 03
DELIVERABLES	Section 09	Page 04
SPECIFICATIONS		
MISSION DESIGN	Section 10	Page 04
COMMUNICATION PAYLOAD	Section 11	Page 04
JUDGING	Section 12	Page 05
OTHER CONSIDERATIONS	Section 13	Page 05
ACRONYM GLOSSARY	Section 14	Page 05
FREQUENTLY ASKED QUESTIONS	Section 15	Page 05
ANKNOWLEDGEMENT	Section 16	Page 05
CONTACTS		Page 05

INTRODUCTION & OVERVIEW OF SINGAPORE SPACE CHALLENGE

- 1. This Engineering Competition is designed and organized by the Singapore Space and Technology Association.**
2010/11 marks the launch of the fourth Singapore Space Challenge.
 - 1.1. The aim of the Competition is to inspire space interests among the tertiary-education students and encourage participation in space related activities.
 - 1.2. SSTA also hopes to educate the public on the issues of space technology and exploration through this Competition.
 - 1.3. It is the primary goal of the Competition is to promote technical and industrial research, challenge the thinking process and creativity of students, and at the same time, proving practicality as well as simplicity in engineering concept and design.
 - 1.4. The Competition also aspires to provide beneficial, practical and feasible solutions to the space industry in general.

TIMELINE

- 2. TIMELINE**
 - 2.1. This Competition is open from 1 September 2010.
 - 2.2. All teams and entries must be registered with SSTA. Registration for this competition will be closed on 29 October 2010.
 - 2.3. The final submission of entries must be delivered to SSTA by 31 March 2011.
 - 2.4. Results will be published on the Competition website.
 - 2.4.1. Winners will be notified by mail.

Singapore Space Challenge 2011

Version 1.0

RULES

3. RULES, TERMS AND CONDITIONS

- 3.1. This Competition is open globally to all tertiary-education¹ students, with the exception of the members of the Executive Committee of SSTA.
- 3.2. Team submissions are limited to seven team members including one Team Manager. A minimum of 3 members are required to form a team.
 - 3.2.1. As the goal is to encourage awareness and interests in the space industry as well as to promote participation within the Singapore communities, the Team Manager must be a Singapore citizen or Singapore permanent resident.
- 3.3. The teams do not have to be affiliated with an educational institution to participate.
 - 3.3.1. For teams associated to educational institutions, there is no limit to the number of entries from any educational institution.
- 3.4. All submitted entries are the property of SSTA.
 - 3.4.1. SSTA may elect to exhibit these entries at any events at its discretion, without a prior, written approval of the participating teams.
- 3.5. All decisions shall be deemed final and binding by SSTA.

REGISTRATION

4. REGISTRATION

- 4.1. All teams and entries must be registered with SSTA. Registration forms can be found at <http://www.space.org.sg/ssc2011.html>.
- 4.2. There is a nominal registration fee of \$15 per person to compete in this challenge.
- 4.3. Registration to this competition will close on 29 October 2010.
- 4.4. All registered entries will be published on the SSC website.

PRIZES

5. PRIZES

- 5.1. There will be one Grand Prize and up to two Merit Prizes on top of the global recognition, public exposure and media publicity.
- 5.2. The prizes are as follows:
 - Grand Prize: S\$8,000.00
 - Merit Prizes:
 - 1st runner-up: S\$5,000.00
 - 2nd runner-up: S\$2,500.00
- 5.3. All entries will be presented with a certificate of participation.
- 5.4. SSTA is the final authority on the judging, section [13], and the award of prizes in this competition.

¹ Students within the age group of 15 to 25, but not exhaustively limited to this range. Please check with the organizers for competition eligibility.

Singapore Space Challenge 2011

Version 1.0

MISSION OVERVIEW

6. MISSION OVERVIEW

- 6.1. The main objective of this Competition is to design and deploy a Space-based navigation and tracking system for air traffic control and monitoring.
- 6.2. The aim is to launch a satellite system (single or constellation) to manage Singapore air traffic, coping more efficiently with current traffic levels, and the increased traffic levels anticipated in the future.
- 6.3. The system will be used to monitor and control aircrafts movements.
- 6.4. The system will also be used to interrogate and determine the latitude, longitude, altitude and direction of aircrafts approaching Singapore, within the Southeast Asia air-space. Information will be transmitted to the flight crew and the ground control staff in Singapore and South-East Asia, in a timely manner.
- 6.5. The system should seamlessly integrate into existing/ proposed concepts by other countries (USA, Europe, Japan, India etc.)
One other use of the system is to pick up emergency SOS signals of aircraft outside territorial airspace, and support search-and-rescue operations.

MISSION BACKGROUND

7. MISSION BACKGROUND

- 7.1. Singapore Changi Airport is an important air hub, handling 37.2 million of passengers and 1.66 million tons of cargo in 2009. The airport is one of the busiest airports in the world.
- 7.2. With growing air traffic, a space-based system for handling traffic which will ensure safe conditions for airplanes and timely information to flight crew will be optimum.
- 7.3. To promote international cooperation in search and rescue operations, the system will come in useful to provide information on distressed aircrafts.

MISSION SPECIFICATIONS

8. MISSION SPECIFICATIONS

- 8.1. The total cost of the satellite systems shall not exceed S\$1 Billion.
- 8.2. The total lifespan of the system shall be 10 to 15 years, including for replacement satellites and launches.
- 8.3. The cost of designing, deploying and maintaining the system must be stated.
- 8.4. The system shall be capable of providing accurate tracking of airplanes location, with a minimum update rate of once per 5 secs and a tracking error of less than 100m in latitude, longitude and altitude.
- 8.5. The satellite(s) has to provide real time downlink of air traffic data to the Singapore Air Traffic Control Centre.
- 8.6. The system shall provide 24 hours coverage and tracking capabilities of aircrafts equipped with Emergency Position within the Singapore air traffic control space.
- 8.7. The satellites shall be capable of picking up aircraft transponder signals transmitted from the aircrafts. It shall be assumed that the aircrafts are equipped with navigation systems to provide geo-location information.

Singapore Space Challenge 2011

Version 1.0

DELIVERABLES

9. DELIVERABLES

- 9.1. Completed and final entries must include a mission (project) paper, a computer simulation and a scaled 3-D mockup of the designed satellite.
 - 9.1.1. The mission (project) paper is to be not more than 20 pages, inclusive of illustrations, graphics and schematics.
 - 9.1.2. A complete bibliography is also required.
 - 9.1.3. The computer simulation must show the satellite(s) in action, be of good quality simulation and on a commonly-playable format, such as wmv, mov, avi, mpeg, mp4 or qt. Please check with the organizers for other allowable formats.
 - 9.1.4. The recommended length of the simulation is between 120 and 180 seconds.
- 9.2. All final entries must be submitted to SSTA by 29 April 2011.
 - 9.2.1. See section [5.4] on the terms pertaining to the ownership of these deliverables.

SPECIFICATIONS

10. MISSION DESIGN

- 10.1 Mission concept i.e. how it would work
- 10.2 Power source requirements, eg. Data Processing Capability
- 10.3 Size, weight and dimensions of proposed satellite/s
- 10.4 Orbital planes, constellation establishment and maintenance
- 10.5 Revisit Period
- 10.6 Launch Platform and site selection
- 10.7 Estimated cost of system, with breakdown

11. COMMUNICATIONS PAYLOAD

- 11.1 Navigation Augmentation Mode
 - 11.1.1 Concept of operation of the payload
 - 11.1.2 Mass, weight and volume of the payload
 - 11.1.3 Power requirements of the payload
 - 11.1.4 Selection of operating frequency and compatibility with existing aircraft systems
 - 11.1.5 Type of antenna system
 - 11.1.6 Accuracy of system
- 11.2 Position Reporting Mode
 - 11.2.1 Concept of operation of the payload
 - 11.2.2 Mass, weight and volume of the payload
 - 11.2.3 Power requirements of the payload
 - 11.2.4 Selection of operating frequency and compatibility with existing aircraft systems
 - 11.2.5 Type of antenna system
 - 11.2.6 Receiver sensitivity and Transmitter EIRP
 - 11.2.7 System capacity and algorithm for handling multiple aircrafts
- 11.3 Enhanced Mode
 - 11.3.1 Nature of additional service and concept of operation of the payload. Value of the enhanced mode
 - 11.3.2 Mass, weight and volume of the payload
 - 11.3.3 Power requirements of the payload
 - 11.3.4 Selection of operating frequency and compatibility with existing aircraft systems
 - 11.3.5 Type of antenna system
 - 11.3.6 Receiver sensitivity, Transmitter EIRP and system capacity

Singapore Space Challenge 2011

Version 1.0

JUDGING

12. JUDGING

12.1. Judging of the Competition is by a panel of professionals elected by SSTA.

12.2. The judging criterion is as follows:

Mission (Project) Paper

Discussion Content, Idea and Creativity	30.0%
Calculations and Scientific Accuracy	25.0%
Technical Reporting, Illustrations and Graphics	15.0%

Computer Simulation

Graphical Contents	10.0%
Graphical Aesthetics	10.0%

Mockup

3-D mockup satellite	10.0%
----------------------	-------

Total	100.0%
--------------	---------------

12.3. The Judges decision is final.

OTHER CONSIDERATIONS

13. OTHER NON-QUANTIFYABLE SPECIFICATIONS

13.1. The launch and maintenance of the satellite(s) must provide unambiguous considerations to safety, and as far as possible, prevent any harm to the earth and space environment.

ACRONYM GLOSSARY

14. ACRONYM GLOSSARY

SSC	Singapore Space Challenge
SSTA	Singapore Space and Technology Association

FREQUENTLY ASKED QUESTIONS

15. FAQ

15.1. Inquiries from participating teams specific to rules and registration are as follows:

15.1.1. There are no inquiries so far.

ACKNOWLEDGEMENTS

16. ACKNOWLEDGEMENTS

16.1. The Competition organizers would like to express their thanks to SSC 2011 technical judging panel, Mr Chua Ta Wei, Mr Philip Tee Chee Wan, Mr Koh Wee Eng, Dr Nagarajan and Mr Ong Kien Soo.

16.2. Copyrights SSTA 2010/11.

CONTACTS

All questions should be directed to Ms Rachel Loh, Business Development Executive at this email address: rachel.loh@space.org.sg.