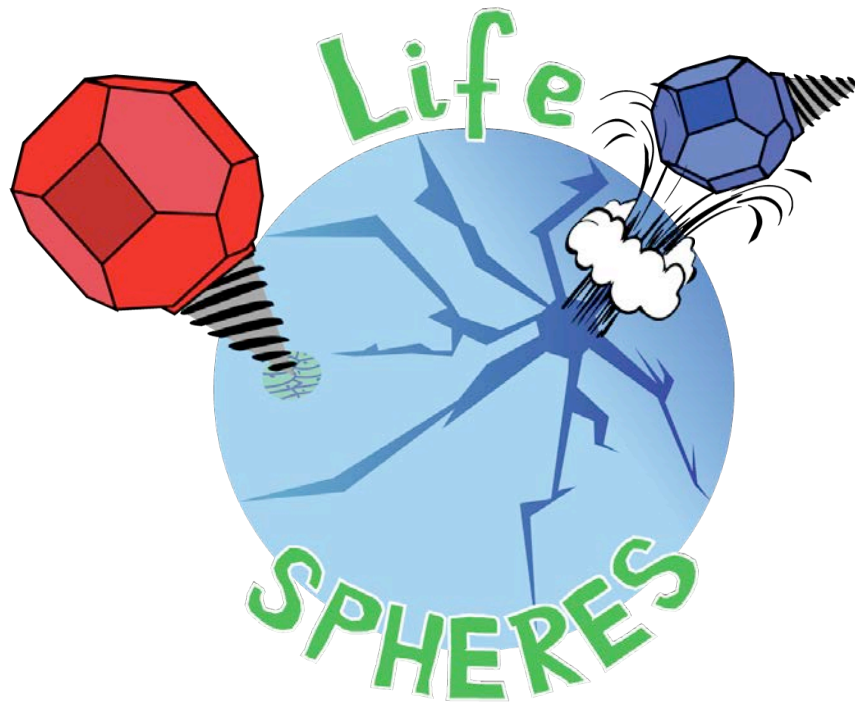




ZERO  
ROBOTICS  
HIGH SCHOOL 2017



# ZERO ROBOTICS HIGH SCHOOL 2017



Championship Tournament  
January 11, 2018





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## Welcome

Dear Zero Robotics Teams,

Congrats on making it to the finals and Welcome to Boston! We are thrilled that you are here with us for the 2017 Zero Robotics championship event! We hope this trip will be exciting and educational.

During this event, you will have the opportunity to tour the various facilities at MIT and participate in a live test session with astronaut **Joe Acaba** and cosmonaut **Alexander “Sasha” Misurkin** as they run your algorithms on the SPHERES test bed on the ISS. You will also get to meet astronaut **Steve Swanson** in person at MIT. To ensure that the entire trip runs smoothly, we ask that you adhere to the following code of conduct.

### Code of Conduct

- Borrowing from the excellent credo of *FIRST* Robotics, please exhibit “Gracious Professionalism.™” at all times.
- In that spirit, refrain from the use of profane, insulting, harassing or otherwise offensive language, especially during the competition.
- Students should make sure their chaperones and/or advisors know where they are, who is with them and when they will return when leaving the general area of the event.

### Contact Information

This event is being organized by the Zero Robotics team. Please don’t hesitate to contact the following members of the ZR team if you have any questions or comments during your stay here.

Wendy Feenstra	<a href="mailto:wfeenstra@aurora.aero">wfeenstra@aurora.aero</a>	(617) 835-6719
Katie Magrane	<a href="mailto:Katie@massilc.com">Katie@massilc.com</a>	(617) 908-7408

Once again, we hope you enjoy your visit.

The SPHERES Zero Robotics Team





## Schedule

All times are Eastern Time (MIT Local time) and 24-hour clock.

### Wednesday, 2018-Jan-10

Time	Event	Location
Any	Teams arrive, no events planned	Cambridge, MA

### Thursday, 2018-Jan-11

Time	Event	Location
06:45-07:15	Arrival – (doors close at 07:15)	26-100
07:15-09:00	Welcome to ZR Finals (MIT, NASA, USydney, Politecnico di Torino) Special Guest Speakers (Biographies included in handout)	26-100
08:40-08:50	Break	26-100
08:50-09:00	Game Introduction	26-100
09:00-1300	ISS Finals live from station*	26-100
13:00-13:15	Closing Remarks	26-100
13:15-14:30	Luncheon	Lobby 13
14:30-18:15	Break  15:00-17:00 MIT Museum free admission with event badge (Museum will close @17:00 and reopen @18:15)	
18:15-21:00	Awards Ceremony and Dessert Reception (dessert avail starting at 18:15, ceremony begins approx. 18:45)	N51, 2 <sup>nd</sup> floor (MIT museum)

NOTES:

\* Times for activities aboard the ISS are approximate.

### Friday, 2018-Jan-12

Time	Event	Location
10:00-12:30	MIT Admissions Info-Session	54-100
	MIT Official Tours (immediately following MIT Admissions Info Session)	Leave from 54-100
	Lunch (on your own)	
13:30-15:30	SSL Tours -- sign up for 20-minute tour time slots during registration on Thursday.	37-372





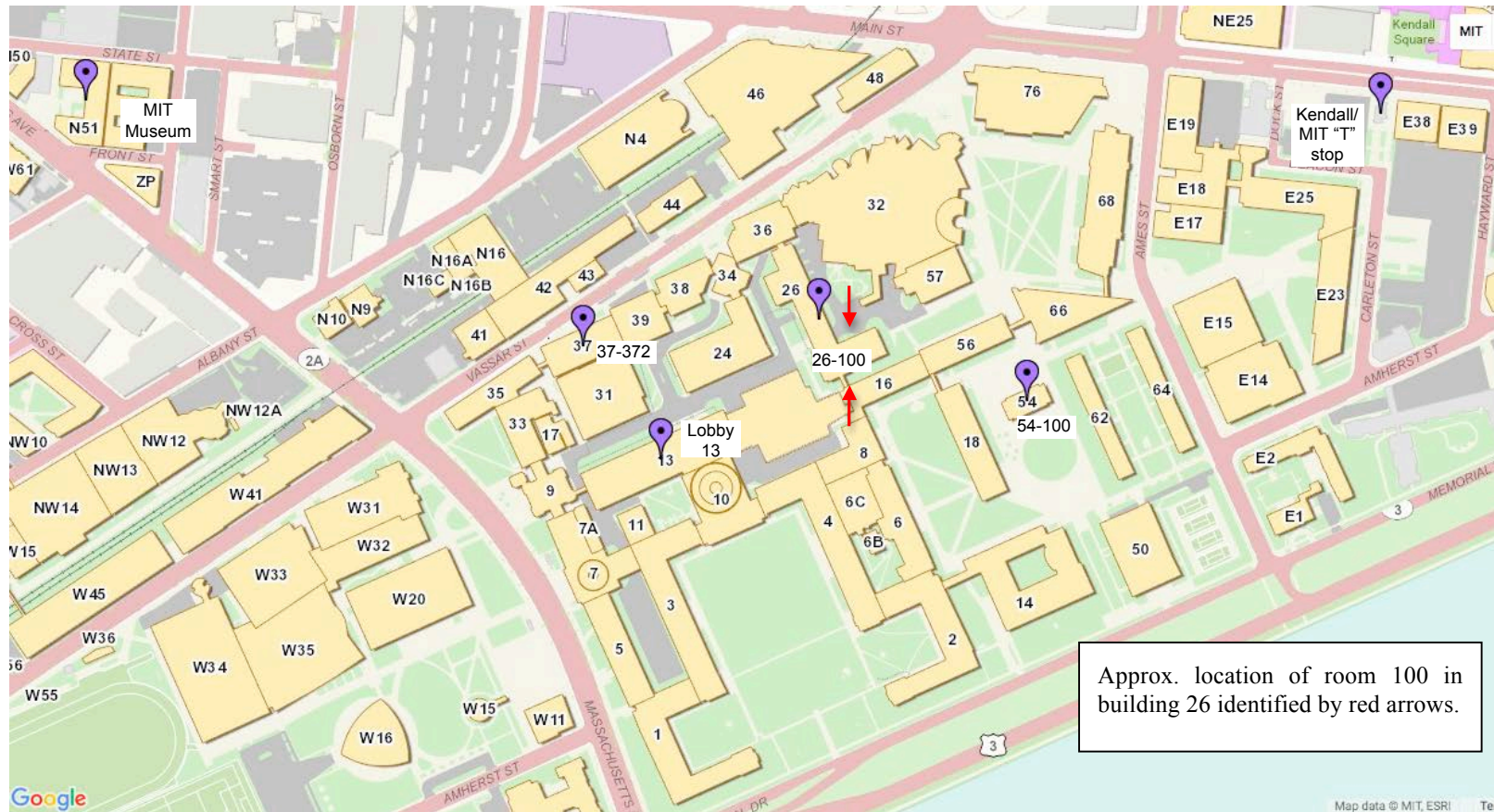
## MIT Map

Buildings locations are shown on the map below. Link to interactive map: <https://tinyurl.com/y7egtfrr>

All rooms in MIT are numbered in the format Building-FloorRoom. For example, 26-100 corresponds to Building 26, Floor 1, Room 100.

Thursday: ISS Finals: 26-100; Luncheon: Lobby 13; Awards Ceremony and Dessert Reception: MIT Museum: N51

Friday: MIT Admissions Info Session and Tour: 54-100; SSL Tours: 37-372





## ISS Finalists (in seeding order)

Alliance / Teams	School/Organization	City/State	Country
<b>Alliance 1: BeachPin1701</b>			
Beachbotics	Hilton Head Island High School	SC	United States
ZeroZeroPinin	ITIS G.B. Pininfarina	Moncalieri	Italy
ENTERPRISE	ITIS "G. Galilei"	Livorno	Italy
<b>Alliance 2: Naughty Prions and Lions</b>			
Space Lions	L.S.S Leonardo Da Vinci	Treviso	Italy
Stuy-Naught	Stuyvesant High School	NY	United States
PR1SM5	Princeton International School of Mathematics and Science	NJ	United States
<b>Alliance 3: ZaRoSphere</b>			
Zagle	Zagle School	Warsaw	Poland
Rock Rovers	Council Rock High School South	PA	United States
Spherobotics	Staufer-Gymnasium Waiblingen	Waiblingen	Germany
<b>Alliance 4: MachCranberrianSpaghetti</b>			
The Mach Kepplerians	Mark Keppel High School	CA	United States
Cranberry Pie	Cranbrook School	Cranbrook	United Kingdom
Spaghetti Code	Cedarburg High School	WI	United States
<b>Alliance 5: S.H.M.</b>			
Singularity	Mission San Jose High School	CA	United States
House of Coders	Liceo Scientifico Francesco Vercelli	Asti	Italy
Mosman High School	Mosman High School	Sydney	Australia
<b>Alliance 6: ZanneioTeamRocketint(roverts)</b>			
Zanneio Stardust	Zanneio Model Experimental Lyceum	Piraeus	Greece
Team Rocket	River Hill High School	MD	United States
int(roverts)	Sydney Boys High School	Sydney	Australia
<b>Alliance 7: SPACE</b>			
Pioneers	State Budget Educational Institution "Vorobievi gori"	Moscow	Russia
Spatar	Gosford High School	Gosford	Australia
CodeWarriors	Tudor Vianu National High School of Computer Science	Bucharest	Romania
<b>Alliance 8: AstronomyDomine</b>			
ZRighi	ITI "Augusto Righi"	Napoli	Italy
Clements Rangers	Clements High School	TX	United States
Tech Support	Sydney Technical High School	Bexley	Australia
<b>Alliance 9: COLA (Catchers Of Life Alliance)</b>			
SetFermiForce	Liceo Scientifico Statale "E.Fermi"	Padova	Italy
Westlake ZRHS	Westlake High School	TX	United States
Major-Antlia	IISS Ettore Majorana	Seriate	Italy
<b>Alliance 10: FISH AND CYPs</b>			
Team yOb0tics!	Montclair Community	NJ	United States
Cassiopeia	Grigore Moisil Theoretical Highschool	Timisoara	Romania
Potomac Engineers in Space	The Potomac School	VA	United States
<b>Alliance 11: BACON HORIZON ASP</b>			
BACON	Charlottesville High School	VA	United States
HORIZON	Colegiul National „Gheorghe Lazar”	Sibiu	Romania
ASP Rebel Alliance	American School of Paris	Paris	France
<b>Alliance 12: ZeroVinciWall</b>			
Zero Work Ethic 2017	Westlake High School	CA	United States
Da Vinci Boys	ITI L. Da Vinci	Trapani	Italy
Wall-E 5.1	I.I.S. "Verona Trento"	Messina	Italy





Alliance 13 <b>Cosmic TaCo</b>			
Tachyons	Saratoga High School	CA	United States
Cora's Eleven	Liceo G.B.Brocchi	Bassano del Grappa	Italy
Cosmic Vikings	Downey High School	CA	United States
Alliance 14 <b>CrabNebulaWaherlUnusualProgrammers</b>			
Crab Nebula	Liceo Cecioni	Livorno	Italy
Waherl	Tech for kids club	OR	United States
Unusual Programmers (U.P.)	LSS Enrico Fermi	Padova	Italy

## Virtual Finalists (in seeding order)

Alliance / Teams	School/Organization	State	Country
Alliance 1: OSA			
OverExtendedProgramming(OEP)	Centennial High School	AZ	United States
Sigma Six	Colegiul National Banatean	Timisoara	Romania
AGNELLITRONICS	Istituto Internazionale E. Agnelli	Torino	Italy
Alliance 2: ProximaCentauriTeamLakeVectory			
Proxima Centauri	Liceo Scientifico F. Cecioni	Livorno	Italy
Team Lake	Clear Lake High School	TX	United States
Vectory	James Ruse Agricultural High School	Sydney	Australia





## LIFE-SPHERES Game Description

### Living-microorganisms Investigation of Enceladus SPHERES Program

This year's game called LIFE-SPHERES is tied to the success of the Cassini-Huygens mission and centers around the idea of the SPHERES Satellites having reached "Enceladus" (a moon of Saturn). Students are tasked to drill ice samples from the moon's southern pole in search of life and return the samples to a base station for analysis. The goal of the game is to find and collect the most samples with the richest concentration of microorganisms. In order to be victorious, however, students must be careful to a) avoid contact with the uneven topography of the icy surface and b) beware that beneath the surface of Enceladus's southern pole exist large amounts of high pressure gases so drilling has the potential of activating powerful geysers which can push the Satellites off course and cause loss of collected samples.

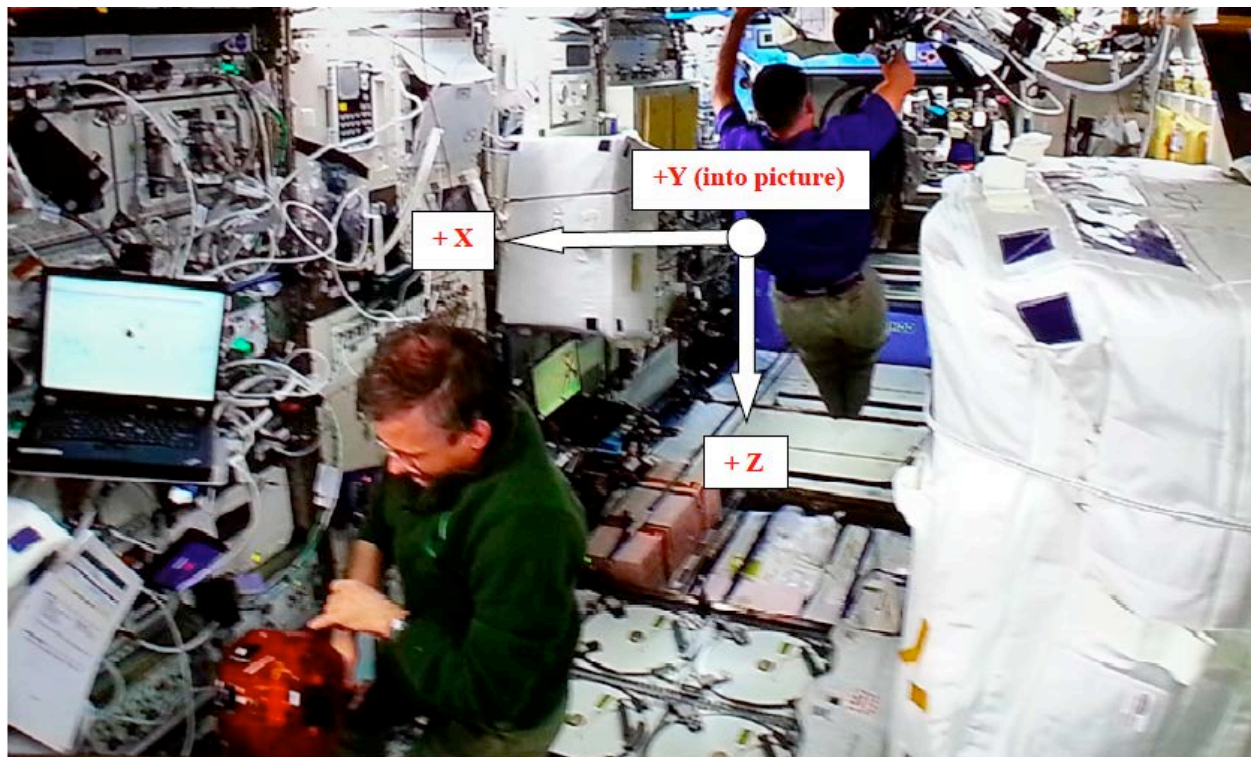
### ISS Game Parameters

Random game elements, including Peak Concentration Zone, as well as sample grid Terrain Height and Geyser Probabilities are identical for all ISS matches and are mirrored about the playing field.

The location of Peak Concentration Zone was randomly selected and fixed @ [2, -4] & [-2, 4].

### ISS Coordinate System

This view shows the Japanese Experiment Module (JEM) looking along the +Y axis of the game.







## ISS Test Session & Rules

Running a live competition with robots in space presents a number of real-world challenges that factor into the rules of the competition. Among many items, the satellites use battery packs and CO<sub>2</sub> tanks that can be exhausted in the middle of a match and the competition must fit in the allocated time. This section establishes several guidelines the Zero Robotics team intends to follow during the competition. Keep in mind, as in any refereed competition, additional real-time judgments may be required. Please respect these decisions and consider them final.

Above all, the final competition is a demonstration all the hard work teams have put forward to make it to the ISS. The ZR staff's highest priority will be making sure every alliance has a chance to run on the satellites. It is also expected that the competition will have several "Loss of Signal" (LOS) periods where the live feed will be unavailable. We will attempt to make sure all teams get to see a live match of their player, but finishing the competition will take priority.

To summarize, time priority will be allocated to:

- 1) Running all submissions aboard the ISS at least once
- 2) Completing the tournament bracket
- 3) Running all submissions during live video

We also hope to complete the tournament using only results from matches run aboard the ISS, but situations may arise that will force us to rely on other measures such as simulated matches.

## Competition Format

The alliances will be divided into 2 conferences for the ISS competition. Matches have been seeded based on the ranking from the final alliance competition. All teams ranked with odd numbers will participate in Conference A; all teams ranked with even numbers will participate in Conference B, as shown in Figure 1.

Conference A Alliance ranks	Conference B Alliance ranks
1,3,5,7,9,11,13	2,4,6,8,10,12,14

Figure 1: Division of Teams between Conferences

Each conference will include one "bye" team (alliances ranked #1 and #2 automatically advance to the conference semi-finals) and 2 brackets of 3 alliances each (as shown in Figure 2). Each bracket will play 3 matches in round-robin style: alliance A vs. B, B vs. C, and C vs. A.

After the round-robins are complete, there will be a winner of each bracket (shown as A-1, A-2, B-1, B-2 in Figure 2.) The following rules determine the winner:

1. The alliance with the most wins advances
2. If alliances are tied for wins, the alliance with the highest total score advances
3. If scores are tied, simulation results will be used to break the tie

The semi-final match between the top 2 bracket winners and the "bye" team will also be played in round-robin style. The winner of this match is determined in the same way as the bracket winners:

1. The top 2 alliances with the most wins in their bracket, advance
2. If there is a tie for wins, the alliance(s) with the highest total score in their bracket advance
3. If scores are tied, simulation results will be used to break the tie

The winning alliance from each conference will play a single match to determine the Zero Robotics ISS Champion. The losing alliance will be awarded 2<sup>nd</sup> place.

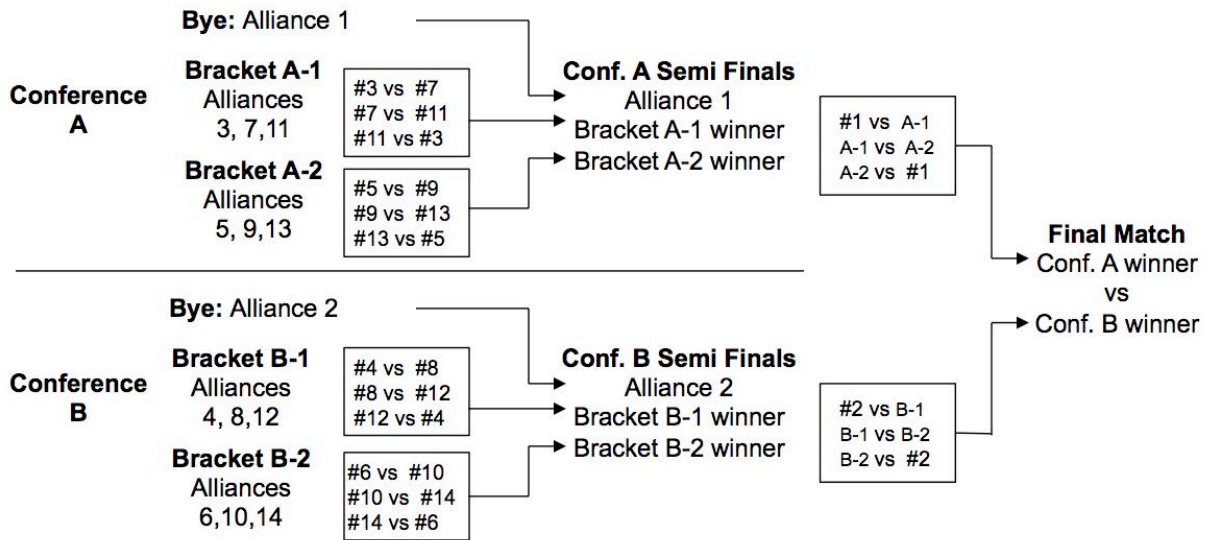


Figure 2: ISS Competition Bracket

**Definition: Successful Match**

- Both satellites move correctly to initial positions
- Both satellites have normal motion throughout the test
- Both satellites return a valid score
- Neither satellite expends its CO<sub>2</sub> tank during a test run

**Definition: Simulated Match**

In advance of the competition, the ZR Team will run a simulated round robin competition between all participating teams. The results from matches in this competition will be used in place of ISS tests if necessary (see below.) The results of a simulated match will only be announced if they are used in the live competition.

**Scoring Matches**

Scores in the scoring matches will be determined according to these rules:

**Case 1:** Successful Match, Both Satellites Return Unique Score (e.g. 130, 151)

- The scores will be recorded as the official score for the match

**Case 2:** Either Satellite Returns an Invalid Score (e.g. 255)

- If the first run of a match is not successful, the match will be re-run (time permitting)
- If the second run of a match is not successful, the results from a simulated match will be used



## Test Result Guide and Brackets

Each satellite will return a test result number at the completion of each test. As in the simulation, these numbers will indicate the result of each race. The crew will use the communications loops to call down these values during the session.

Test Result #	Test Outcome	Action
11-239	Valid score values	
254	Second Player not selected	Rerun race
255	Satellite reset	Rerun race

When a score of a match is read from the ISS the score encodes the team number as well as the score for the match.

**Team number** = (Test Result Number % 10)

**Score** = (Test Result Number / 10)

(i.e. if the score read from the ISS is 123 then Team number is =3 and the Score is = 12)

Winning team of each match is awarded an extra point. All scores less than 1 will be recorded as 1 and all scores greater than 22 will be recorded as 22 except when the team earns an extra point for winning a match. For example if a team earns a score greater than 22 and is also the match winner the score read from ISS will be 23.

A blank bracket listing has been provided in the pages below to fill in during the event. You may also view the bracket on one of the projector screens in the auditorium.



## Competition Brackets

### Conference A

**Bye:** BeachPin1701 (1)

#### Bracket A-1

Team 1	Team 2	Team 1 Score	Team 2 Score
1. ZaRoSphere (3)	2. S P A C E (7)		
2. S P A C E (7)	3. BACON HORIZON ASP (11)		
3. BACON HORIZON ASP (11)	1. ZaRoSphere (3)		

**Winner of Bracket A-1:** \_\_\_\_\_

#### Bracket A-2

Team 1	Team 2	Team 1 Score	Team 2 Score
4. S.H.M. (5)	5. COLA (Catchers Of Life Alliance) (9)		
5. COLA (Catchers Of Life Alliance) (9)	6. Cosmic TaCo (13)		
6. Cosmic TaCo (13)	4. S.H.M. (5)		

**Winner of Bracket A-2:** \_\_\_\_\_

### Conference A Semi Finals

Team 1	Team 2	Team 1 Score	Team 2 Score
7. BeachPin1701 (1)	(A-1)		
(A-1)	(A-2)		
(A-2)	7. BeachPin1701 (1)		

**Winner of Conference A Semi Finals:** \_\_\_\_\_



## Conference B

**Bye:** Naughty Prions and Lions (2)

### Bracket B-1

Team 1	Team 2	Team 1 Score	Team 2 Score
1. MachCranberrianSpaghetti (4)	2. AstronomyDomine (8)		
2. AstronomyDomine (8)	3. ZeroVinciWall (12)		
3. ZeroVinciWall (12)	1. MachCranberrianSpaghetti (4)		

**Winner of Bracket B-1:** \_\_\_\_\_

### Bracket B-2

Team 1	Team 2	Team 1 Score	Team 2 Score
4. ZanneioTeamRocketint(roverts) (6)	5. FISH AND CYPs (10)		
5. FISH AND CYPs (10)	6. CrabNebulaWaherlUnusualProgrammers (14)		
6. CrabNebulaWaherlUnusualProgrammers (14)	4. ZanneioTeamRocketint(roverts) (6)		

**Winner of Bracket B-2:** \_\_\_\_\_

### Conference B Semi Finals

Team 1	Team 2	Team 1 Score	Team 2 Score
Naughty Prions and Lions (2)	(B-1)		
(B-1)	(B-2)		
(B-2)	Naughty Prions and Lions (2)		

**Winner of Conference B Semi Finals:** \_\_\_\_\_



### Virtual Finals Championship Match

Team 1	Team 2	Team 1 Score	Team 2 Score
8. OSA	8. ProximaCentauriTeamLakeVectory		

Champion: \_\_\_\_\_

### ISS Finals Championship Match

Team 1	Team 2	Team 1 Score	Team 2 Score
A	B		

Champion: \_\_\_\_\_



## Guest Speakers

### Guest Speaker: Jean-Pierre Lebreton

Jean-Pierre Lebreton graduated at the University of Orléans, France, where he received his Doctorate in space plasma physics in 1978. He then obtained a 2-year fellowship position at the Space Science Department of ESA, located in ESTEC, Noordwijk, The Netherlands. In mid-1980 he was recruited as a Staff Scientist in the same department where he worked until he retired from ESA in 2011. From 1980 to 1996, Jean-Pierre worked on instruments on 3 Space Shuttle missions (Spacelab-1, TSS-1, TSS-1R). In 1984, he started to work on the Joint NASA-ESA Cassini mission study. In 1988, he became the Huygens Project Scientist and in 2001 the Huygens Mission Manager. While working on the Cassini-Huygens mission Jean-Pierre participated to the development of flight instruments for different space missions (Rosetta, Venus Express, Demeter, Proba-2, JUICE). In 2011, after he retired from ESA, he became associated researcher at both LPC2E (CNRS-Université d'Orléans) and LESIA (Observatory de Paris-Meudon). He was PI on Rosetta from 2013 to 2015 and participates since a few years to the development of a new type of mass analyser, named the Cosmorbitrap, in preparation for the next generation of space mass spectrometers for future planetary missions. ***"Cassini-Huygens revealed to us two very exciting, potentially habitable moons of Saturn, Titan and Enceladus. I am looking forward to return to either or both of these worlds in the steps of the wonderful Cassini-Huygens mission for further digging out the secrets hidden into these ocean worlds."***



### Guest Speaker: Ralph D Lorenz

Ralph D Lorenz graduated from University of Kent, UK where he received his doctorate in Space Sciences in 1994. His background includes broad scientific and engineering experience, especially relating to planetary science (with an emphasis on surface/atmosphere interactions on Titan, Venus and Mars), and doing science from small spacecraft and innovative sensor platforms such as probes, landers, balloons, penetrators, and boats. He has been involved in the life cycle of flight investigations including concept formulation, mission and system design, science planning, observation design, instrument development, data analysis, and publication of results. His experience includes radar remote sensing, in-situ instrumentation, geomorphology, meteorology, oceanography, vehicle dynamics and trajectory measurements, and astrobiology. He has authored several hundred technical and popular publications, including several books. Among these are "Spinning Flight: Dynamics of Frisbees, Boomerangs and Skipping Stones", "Space Systems Failures", and "Cassini/Huygens Owners Workshop Manual"





**Guest Speaker: Steven R Swanson**

NASA ASTRONAUT (FORMER)

Steven Swanson received his doctorate in Computer Science from Texas A&M University. He was selected as mission specialist by NASA in May 1998. His space flight experience includes space shuttle missions STS-117 (2007) and STS-119 (2009) to the International Space Station delivering, installing and deploying the second starboard truss segment and third set of United States solar arrays and then the final starboard truss segment, and the fourth and final set of U.S. solar arrays, batteries and associated equipment. In 2014, Swanson and fellow crewmates launched aboard a Russian Soyuz rocket from Baikonur, Kazakhstan as members of Expedition 39. During his six-month tour of duty aboard the orbiting laboratory, Swanson performed various Earth remote sensing and biology, bone and muscle physiology studies then assumed command of the station during Expedition 40. During his NASA career, Swanson has completed four spacewalks totaling 26 hours, 22 minutes and accumulated 195 days, 15 hours, 41 minutes in space. He enjoys mountain biking, basketball, skiing, weight lifting, trail running, woodworking and spending time with his wife and three children.



**Special Guest: Gregory Errol Chamitoff**

NASA ASTRONAUT (FORMER)

Twitter: @Astro\_Taz

Greg, an alumnus of MIT (Doctorate in Aeronautics and Astronautics, 1992) is an engineer and former NASA Astronaut. He was assigned to Expedition 17 and flew to the International Space Station on STS-124, launching 31 May 2008. He was in space 198 days, joining Expedition 18 after Expedition 17 left the station, and returned to Earth 30 November 2008 on STS-126. Chamitoff served as a mission specialist on the STS-134 mission, which was the last flight of Endeavour and delivered the Alpha Magnetic Spectrometer. He is the Director of the AeroSpace Technology, Research & Operations (ASTRO) Center at Texas A&M University College of Engineering. Additionally, Chamitoff is a professor of Engineering and Information Technologies at the University of Sydney. Greg Chamitoff has been a champion of the Zero Robotics program since its inception. After conducting SPHERES research on station, he challenged MIT to develop a platform for engaging high school students to use the SPHERES. Chamitoff has refereed multiple ZR competitions and in addition to inspiring the start of the competition, he has supported the start up of Zero Robotics programs throughout Texas and in Australia. Thank you Greg for your support and leadership.







## 2018 LIFE SPHERES International Space Station Referees



**Aleksandr Misurkin (Sasha) – Commander  
Russian Cosmonaut**

Born: Yershichi, Smolensk Region, Russia

Interests: badminton, basketball, downhill skiing, carting

Spaceflights: Expeditions 35/36, 53/54

Bio: <https://go.nasa.gov/2vAiNdr>; <http://www.gctc.ru/main.php?id=192>

Aleksandr Aleksandrovich Misurkin was enlisted as a cosmonaut in 2006. In 2013 he flew as a flight engineer aboard the Soyuz TMA-08M and ISS-35/36 spacecraft together with cosmonaut Pavel Vinogradov and astronaut Christopher Cassidy. During the flight he made three spacewalks with a total duration of 20 hours 02 minutes. The total flight duration was 166 days 06 hours 16 minutes 10 seconds. In 2016 he was awarded the title of “Hero of the Russian Federation” and “Pilot-Cosmonaut of the Russian Federation”. Since July 2017 he has been trained in the ISS-53/54 main crew as the commander of the Soyuz MS-06 TPK, the ISS-53 flight engineer and ISS-54 commander.



**Joseph Acaba– Flight Engineer  
NASA Astronaut**

Born: Inglewood, California

Interests: camping, hiking, biking, kayaking and scuba diving

Spaceflights: STS-119, Expeditions 31/32, 53/54

Bio: <https://go.nasa.gov/2vA7vWu>

Twitter: @AstroAcaba

Joseph M. Acaba was selected by NASA in 2004. The California native has logged a total of 138 days in space during two missions. In 2009, Acaba flew aboard STS-119 on the Space Shuttle Discovery to the International Space Station. During this mission, he conducted two spacewalks. In 2012, Acaba flew aboard a Soyuz spacecraft to the space station where he worked as Flight Engineer for the Expedition 31/32. Acaba recently served as Director of Operations Russia in Star City supporting crew training in Soyuz and Russian Segment systems. He is currently a part of the Expedition 53/54 crew that launched to the International Space Station in September 2017.

**Current Crew on Station:** Expedition 54 began in December 2017 and ends in February 2018. This expedition includes biology and biotechnology, technology demonstrations, astrophysics, and materials science. Three spacewalks are tentatively planned during Expedition 54. During Expedition 54, researchers will study bacteria, manufacture fiber optics in microgravity, measure the total amount of sunlight Earth receives, gather data on space debris in low-Earth orbit, and study self-replicating materials. Thank you to the crew of Expedition 54 for your research and for refereeing the 2017 High School Zero Robotics Competition – LIFE SPHERES! (Learn more about the crew by visiting [ww.nasa.gov](http://ww.nasa.gov))





## MIT/NASA Communications During Test Sessions

The communications flow during a SPHERES test session involves several NASA-affiliated groups all over the country. Each can see and hear the crew through audio and video downlink.

PAYCOM is located at NASA Marshall Space Flight Center in Huntsville. The Payload Operations Director (POD), also at Marshall, manages PAYCOM.

The SPHERES team is located at Ames Research Center (ARC) in Moffett Field, CA.

### Acronym & Common Phrases Guide

POD	Payload Operations Director
PAYCOM	Payload Communications Officer
“SPHERES”	Call sign of the SPHERES research team at Ames
“MIT”	Call sign of the SPHERES research team at MIT
GUI	Graphical User Interface
Huntsville	Location of Payload Operations, at NASA Marshall Space Flight Center
Space to Ground	Communication loop that NASA uses to talk to ISS
SSC	Standard Station Computer (laptop)
LOS	Loss of Signal
AOS	Acquisition of Signal
JEM	Japanese Experiment Module, a.k.a Kibo



## USING SOCIAL MEDIA DURING FINALS

*We strongly encourage you to use social media during the ISS Finals. Share your pictures, ask questions and post your story and accomplishments! During speeches, we encourage students around the world to ask questions via twitter. We will do our best to get all of them answered.*

Tag posts & photos with **#ZeroRobotics #CodeForSpace #NothingToSPHERE**

### INSTAGRAM



**Zero.Robotics**

politecnicoeditorino

### FACEBOOK



**facebook/zerorobotics**

facebook/ESAEducation

facebook/PaxiESAKids

facebook/Engineering.IT.Sydney.University

facebook/zeroroboticsAustralia

facebook/sydneyuni

facebook.com/politecnicoeditorino

### TWITTER



**@ZeroRobotics**

@ESA\_Education

@Paxi\_ESAKids

@Eng\_IT\_Sydney

@ZR\_Australia

@Sydney\_Uni

@PoliTONews

@MIT

Tag our ZR friends, partners and referees in your social media posts:

@NASA\_SPHERES

@AuroraFlightSci

@Mass\_ILC

@northropgrumman

@AstroAcaba

@Astro\_Taz

@ISS\_CASIS

@Astro\_Cady

Tweet questions to **@ZeroRobotics**





## Things to see in Boston/Cambridge

### **Tours**

Historic Freedom Trail

<http://www.thefreedomtrail.org/>

Boston Trolley Tours.

<https://www.trolleytours.com/boston>

### **Museums**

MIT Museum

<http://web.mit.edu/museum/>

Museum of Science/Imax

<https://www.mos.org/>; <https://www.mos.org/imax>

Museum of Fine Arts

<http://www.mfa.org/>

Skywalk Observatory

<http://skywalkboston.com/>

Isabella Steward Gardner Museum

<https://www.gardnermuseum.org/>

New England Aquarium

<http://www.neaq.org>

### **Areas**

Harvard Square

Red Line, Harvard Sq. T-stop

Boston Commons

Red/Green Line, Park Street T-stop

Newbury Street

Green Line, Hynes ICA T-stop

Faneuil Hall Market Place

<http://www.faneuilhallmarketplace.com/>

### **Public Transportation**

Mass Bay Transportation Authority

<http://www.mbta.com/>

### **Universities (other than MIT)**

Harvard University

<http://www.harvard.edu/>

Boston University

<http://www.bu.edu/>

Berkley College of Music

<https://www.berklee.edu/>

Tufts University

<http://www.tufts.edu/>

Wellesley College

<http://www.wellesley.edu/>

Northeastern University

<http://www.northeastern.edu/>