ZERO ROBOTICS HIGH SCHOOL 2016

Championship Tournament

January 27, 2017

Version 1.1

ZERO ROBOTICS
HIGH SCHOOL 2016

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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 2016 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 Cosmonaut **Andrei Borisenko,** NASA Astronaut **Peggy Whitson,** and European Astronaut **Thomas Pesquet** as they run your algorithms on the SPHERES test bed on the ISS. You will also get to meet retired astronauts **Catherine "Cady" Coleman** (MIT alum) and Jeff Hoffman (MIT alum) in person at MIT. Finally, you will join us in a few special presentations by **Pedro Duque**, a current European Astronaut and by **Steve Sell, Julie Wertz Chen, and Allen Chen,** who were members of the original SPHERES team and now are supporting Mars missions at JPL. 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	wfeenstra@aurora.aero	(617) 835-6719
Katie Magrane	Katie@massilc.com	(617) 908-7408
Mizanul Chowdhury	mizanul@mit.edu	(469) 734-1058

Once again, we hope you enjoy your visit.

The SPHERES Zero Robotics Staff Team

Schedule

All times are Eastern Time (MIT Local time).

Thursday, 2017-Jan-26

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

Friday, 2017-Jan-27 (ISS Finals)

Time	Event	Location
07:15-07:45	Arrival (doors close at 07:45)	10-250
07:45-8:55	Welcome to ZR Finals by MIT, ESA, USydney, NASA and Special Guests	10-250
08:55-13:15	ISS Finals live from station*	10-250
13:15-13:25	Closing Remarks	10-250
13:25-14:30	Luncheon	Lobby 13
14:30-15:30	Team interviews (optional)	10-250
15:30-18:00	Break 15:00-17:00 MIT Museum free admission with pass (museum will close @17:00 and reopen @18:00)	N51 (MIT Museum)
18:15-21:00	Awards Ceremony and Dessert Reception	N51 (MIT Museum)

NOTES:
* Times for activities aboard the ISS are approximate.

Saturday, 2017-Jan-28

Time	Event	Location
10:00-11:00	MIT Admissions Info-Session	6-120
11:00-12:30	MIT Official Tour	6-120
12:30-13:30	Lunch (on your own)	
13:30-14:30	SSL Tour	37-372

MIT MAP

Buildings locations are shown on the map below.

Link to interactive map: **http://tinyurl.com/jlljg9e**

All rooms in MIT are numbered in the format Building-FloorRoom.

For example, 10-250 corresponds to Building 10, Floor 2, Room 250.

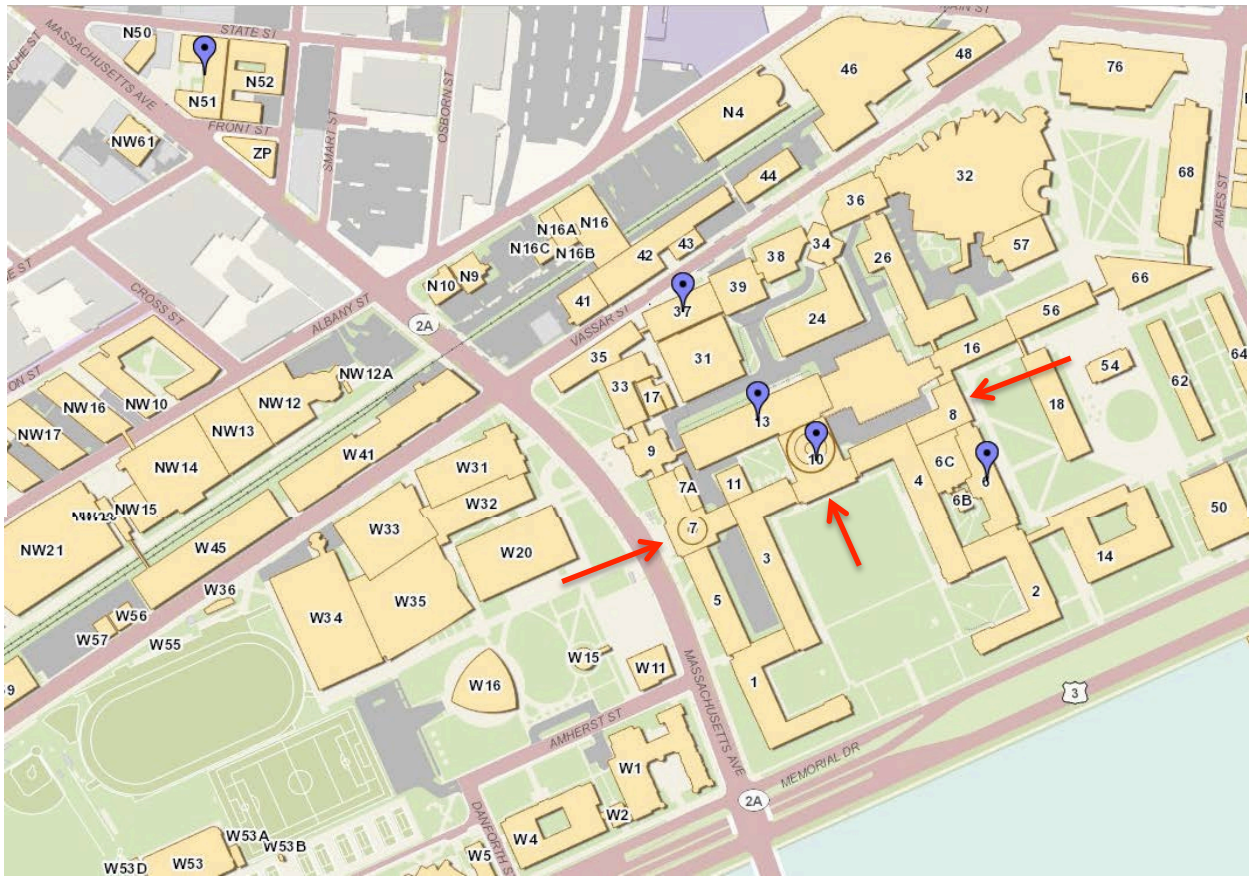
ISS Finals: 10-250 (enter through buildings 7, 8, or 10 -entrances shown by red arrows, below)

Luncheon: Lobby 13

Awards Ceremony and Dessert Reception: MIT Museum: N51

MIT Admissions Info. Session and Tour: 6-120

SSL Tours: 37-372



ISS Finalists (in seeding order)

Alliance / Teams	School/Organization	City/State	Country
Alliance 1: **SpaceLinguine**			
ZRighi	ITI "Augusto Righi"	Napoli	Italy
OverExtendedProgramming(OEP)	Centennial High School, Peoria	AZ	USA
LSA Robotics Team	Liceo Scientifico Avogadro	Vercelli	Italy
Alliance 2: **P.R.O.**			
Proxima Centauri	Liceo scientifico F. Cecioni	Livorno	Italy
Rock Rovers	Council Rock High School South, Holland	PA	USA
@Override	EIB - The Victor Hugo School	Paris	France
Alliance 3: **Team SANTA**			
Singularity	Mission San Jose High School, Fremont	CA	USA
AachenerNerds	BWV-Aachen	Aachen	Germany
Team Appreciate (2468)	Westlake High School, Austin	TX	USA
Alliance 4: **Zanneio Gunn Pointers**			
Zanneio Stardust	Zanneio Model Experimental Lyceum	Piraeus	Greece
Gunn Zero Robotics	Gunn High School, Palo Alto	CA	USA
NullPointerException	Wissahickon High School, Ambler	PA	USA
Alliance 5: **ProgNaughtical**			
Stuy-Naught	Stuyvesant High School, New York	NY	USA
Zagle	Zagle School	Warsaw	Poland
Lville Prog	The Lawrenceville School, Lawrenceville	NJ	USA
Alliance 6: **Keppler Hubble heROes**			
The Mach Kepplerians	Mark Keppel High School, Alhambra	CA	USA
Hubble	I.T.I. "A. Righi" Napoli	Napoli	Italy
heRObotics	Liceul Pedagogic "Carmen Sylva"	Timisoara	Romania
Alliance 7: **Wormhole**			
Zero Work Ethic	Westlake High School, Westlake Village	CA	USA
Quantum Entanglement	I.I.S. Giulio Natta	Rivoli	Italy
99.95 Robotics	Fort Street High School	Sydney	Australia
Alliance 8: **CrabNebulaWaherlTeamAnomaly**			
Crab Nebula	Liceo Cecioni	Livorno	Italy
Waherl	Tech for kids club, Portland	OR	USA
Team Anomaly	American School of Grenoble	Grenoble	France
Alliance 9: **BACON-Cranbrery Pie**			
BACON	Charlottesville High School, Charlottesville	VA	USA
Vectory	James Ruse Agricultural High School	Sydney	Australia
Cranbrook School	Cranbrook School	Cranbrook	UK
Alliance 10: **FermiAsteroidsCraig**			
The Fermi Floating Team	Liceo Scientifico Statale "E.Fermi"	Padova	Italy
ASIJ Asteroids	American School In Japan	Tokyo	USA
Rock 'n' Robots Craig	Craig HS, Janesville	WI	USA
Alliance 11: **Vinci-NCSSM-ZRM !!!**			
Da Vinci Boys	ITI L. Da Vinci	Trapani	Italy
NCSSM Zero Robotics	North Carolina School of Science and Mathematics, Durham	NC	USA
ZiRconiuM	IIS Pacinotti-Archimede	Roma	Italy









Alliance 12: **Kuhl-Wall-Knights**			
Team Kuhlschrank	Pope John XXIII High School, Sparta	NJ	USA
Wall-E 4.0	I.I.S. "Verona Trento"	Messina	Italy
BB&N Knights	Buckingham Browne & Nichols, Cambridge	MA	USA
Alliance 13: **CosmicSparTech**			
Cosmic Vikings	Downey High School, Downey	CA	USA
Spartar	Gosford High School	Gosford	Australia
DevilTech	West Lafayette Jr/Sr High School, West Lafayette	IN	USA
Alliance 14: **FlyingFalconsTheQuarkCharmCode::Space**			
Flying Falcons	North Sydney Boys High School	Sydney	Australia
The Quark Charm	Storming Robots	NJ	USA
Code::Space	National College of Computer Science	Piatra-Neamt	Romania

Virtual Finalists (in seeding order)

Alliance / Teams	School/Organization	City/State	Country
Alliance 1: **CYS BURGER**			
Team y0b0tics!	Montclair Community, Montclair	NJ	USA
Cassiopeia	Grigore Moisil Theoretical Highschool	Timisoara	Romania
tE@m Segfault	Prospect Hill Academy, Cambridge	MA	USA
Alliance 2: **Joined Unique International Coding Experts (J.U.I.C.E.)**			
SetFermiForce	Liceo Scientifico Statale "E.Fermi"	Padova	Italy
Tachyons	Saratoga High School, Saratoga	CA	USA
RedShift	Barker College	Sydney	Australia

Space SPHERES (SPACE-S) Game Parameters

Satellite Positioning and Constructing Entities (SPACE)- SPHERES

This year's challenge called SPACE SPHERES centers around the idea setting up a Global Positioning System (GPS) around Mars to enable successful navigation of the *red planet.* Students are tasked to build surveying satellites to orbit Mars. The satellite pieces have already been launched into orbit and teams must collect these pieces into "assembly zones" to earn points. However, coordinates of the assembly zones are unknown until teams place their three Satellite Positioning System (SPS) devices. During the game students must also be alert to rival teams that may want the satellite pieces their team has already collected.

Item Locations for Conference A and B

Item and Zone locations are selected randomly and fixed for all Conference A and B matches as follows:

Item	X (m)	Y (m)	Z (m)		Item	X (m)	Y (m)	Z (m)
0	0.2810	0.3853	0.1277		7	0.0671	0.0186	0.2864
1	-0.2810	-0.3853	-0.1277		8	-0.0671	-0.0186	-0.2864
2	0.1389	0.1210	0.1995					
3	-0.1389	-0.1210	-0.1995					
4	0.1791	0.0735	0.3972					
5	-0.1791	-0.0735	-0.3972					

Zone Center Locations for Conference A and B

Zone	X (m)	Y (m)	Z (m)
Blue	0.2216	0.2770	0.3318
Orange	-0.2216	-0.2770	-0.3318

Item Locations for Championship Matches

Item and Zone locations are selected randomly and fixed for all Championship matches as follows:

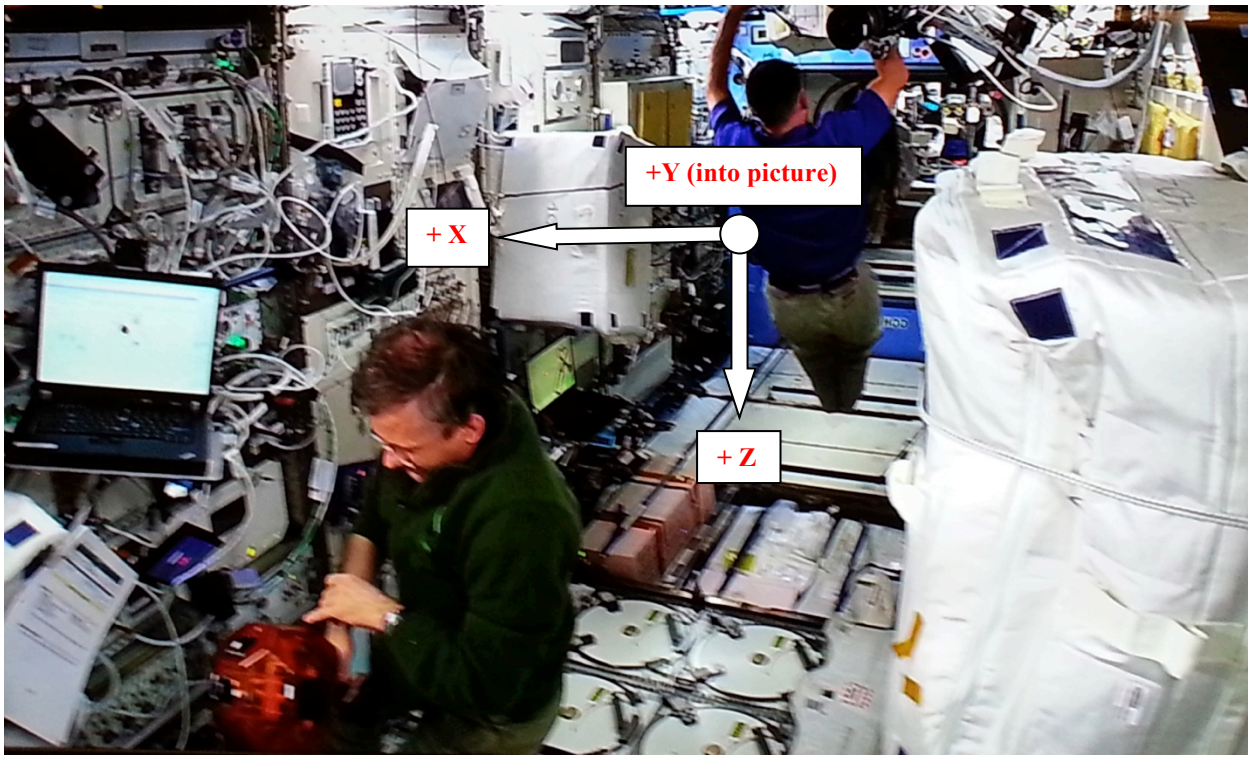
Item	X (m)	Y (m)	Z (m)		Item	X (m)	Y (m)	Z (m)
0	0.2810	0.3853	0.1877		7	0.1171	0.0186	0.1864
1	-0.2810	-0.3853	-0.1877		8	-0.1171	-0.0186	-0.1864
2	0.2389	0.4210	0.0395					
3	-0.2389	-0.4210	-0.0395					
4	0.1791	0.0735	0.3972					
5	-0.1791	-0.0735	-0.3972					

Zone Center Locations for Championship Matches

Zone	X (m)	Y (m)	Z (m)
Blue	0.1516	0.1770	-0.2818
Red	-0.1516	-0.1770	+0.2818

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_2 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 2nd place.

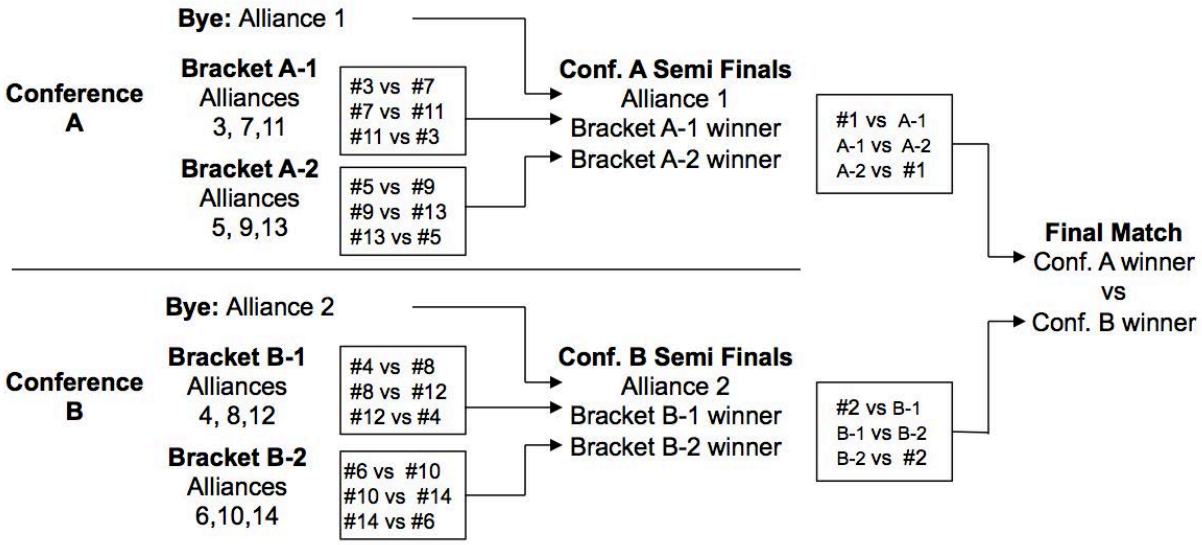


Figure 2: ISS Competition Bracket

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_2 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. 131, 152)

- 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.

ISS Finals Brackets

Conference A

Bye: SpaceLinguine

Bracket #1

Team 1	Team 2	Team 1 Points	Team 2 Points
1. Team Santa (3)	2. Wormhole (7)		
2. Wormhole (7)	3. Vinci-NCSSM-ZRM !!! (11)		
3. Vinci-NCSSM-ZRM !!! (11)	1. Team Santa (3)		

Winner of Bracket A-1: _____

Bracket #2

Team 1	Team 2	Team 1 Points	Team 2 Points
4. ProgNaughtical (5)	5. BACON-Cranbrery Pie (9)		
5. BACON-Cranbrery Pie (9)	6. CosmicSparTech (13)		
6. CosmicSparTech (13)	4. ProgNaughtical (5)		

Winner of Bracket A-2: _____

Conference A Semi Finals (Bracket #3)

Team 1	Team 2	Team 1 Points	Team 2 Points
7. SpaceLinguine (1)	(A-1)		
(A-1)	(A-2)		
(A-2)	7. SpaceLinguine (1)		

Winner of Conference A Semi Finals (A3): _____

Conference B

Bye: P.R.O.

Bracket #4

Team 1	Team 2	Team 1 Points	Team 2 Points
1. Zanneio Gunn Pointers (4)	2.CrabNebulaWaherlTeamAnomaly (8)		
2.CrabNebulaWaherlTeamAnomaly (8)	3. Kuhl-Wall-Knights (12)		
3. Kuhl-Wall-Knights (12)	1. Zanneio Gunn Pointers (4)		

Winner of Bracket B4: _____

Bracket #5

Team 1	Team 2	Team 1 Points	Team 2 Points
4. Keppler Hubble heROes (6)	5. FermiAsteroidsCraig (10)		
5. FermiAsteroidsCraig (10)	6.FlyingFalconsTheQuarkCharmCode::Space (14)		
6.FlyingFalconsTheQuarkCharmCode::Space (14)	4. Keppler Hubble heROes (6)		

Winner of Bracket B5: _____

Conference B Semi Finals (Bracket # 6)

Team 1	Team 2	Team 1 Points	Team 2 Points
7. P.R.O. (2)	(B4)		
(B4)	(B5)		
(B5)	7. P.R.O. (2)		

Winner of Conference B Semi Finals (B6): _____

Virtual Finals Championship Match

Team 1	Team 2	Team 1 Points	Team 2 Points
8. CYS BURGER (V1)	8. Joined Unique International Coding Experts (J.U.I.C.E.) (V2)		

Champion : _____

ISS Finals Championship Match

Team 1	Team 2	Team 1 Points	Team 2 Points
A3	B6		

Champion: _____

How a Class Project Turned into an Experiment Facility in Space

Celebrating 10 Years of SPHERES on Station

Imagine you're sitting in class watching a scene from "Star Wars" and your professor assigns a project meant to fly in space.

In 1999, that is exactly what happened for engineering students at the Massachusetts Institute of Technology in Cambridge, Massachusetts.

"On the first day of class, I showed the students the clip where Luke Skywalker learns to channel the Force using the free-floating practice droid on the Millennium Falcon spacecraft," explained David Miller, the professor and creator of the course. "I said that I want three of these droids to fly on the shuttle or International Space Station, except without the lasers blasts," said Miller. "And the rest is history."

Seventeen years later, that class project, called **SPHERES** -- Synchronized Position Hold, Engage, Reorient, Experimental Satellites -- is celebrating a rare milestone: 10 years of investigation aboard the **International Space Station**. The course was a three-semester class that used the Concieve, Design, Implement, Operate (CDIO) model and students took the project from the initial idea through the entire design and build process and in the process received hands on experience producing an aerospace system.

To celebrate 10 years of SPHERES on Station we invited three members of the original 1999-2003 SPHERES team: Julie Wertz, Al Chen, and Steve Sell (Julie & Al were students, Steve worked at Payload System Inc). What makes their visit even more appropriate this year is that each of them have worked on Mars projects @ JPL and with this year's game premise focused on setting up a Global Positioning System (GPS) for Mars – we couldn't resist having them here for the 2016-2017 Zero Robotics final competition.

Each of them will talk about their experiences working with SPHERES and on Mars research and missions. We encourage you to read their bios and ask them questions either in person or via twitter @ZeroRobotics.

Guest Speaker: Steve Sell

Steve Sell received a B.S. in Aerospace Engineering from Florida Institute of Technology in 1992 and a M.S. in aerospace engineering from University of Maryland in 1996. From 1997 to 2006, Steve worked Space Shuttle and Space Station payload development at Payload Systems Inc. including assisting with the SPHERES CDIO class at MIT and the Project Manager for the SPHERES flight experiment through its first ISS operations in 2006. Since 2006, Steve is an Entry, Descent, and Landing senior systems engineer at the Jet Propulsion Laboratory in Pasadena, CA. He was the Systems Engineer for the Sky Crane system on the Curiosity Mars Rover mission which landed on Mars in 2012. He was the lead Flight System Engineer for the Low-Density Supersonic Decelerator project with two successful launches. Currently, he is the lead Flight System Engineer for the Europa Lander project. ***"Working with the SPHERES team showed that a very small team could produce an enormously useful experiment with huge gains. In the span of a few short years, what started as an idea for a senior design class was pioneering the use the ISS for interactive experiments. The fact that there's no go-between from the student to the astronaut is amazing***."

Guest Speaker: Julie Wertz Chen

Julie Wertz is a systems engineer at JPL. She is currently on the Project Systems Engineering Team for the SWOT project. Previously, she was the Entry, Descent, and Landing Verification and Validation lead for the next Mars mission, InSight. She has also been the Fault Protection Verification and Validation lead for the SMAP mission, as well as a fault protection engineer on both the SMAP and Cassini missions. She graduated from MIT with her SB in 2000, SM in 2002, and PhD in 2006 - all from course 16. ***"SPHERES was the first real project that I ever worked on - it gave me my first experience in having to build something that I had designed. You learn things when you have to actually implement a plan that you just can't possibly learn in a normal class room environment - and that practical experience was invaluable when I was looking for a job and first starting out at JPL. It also led to countless memories and friendships that I treasure to this day. The SPHERES CDIO class was definitely the most rewarding, and most valuable, class experience that I had in my decade at MIT."***

Guest Speaker: Allen Chen

Allen Chen is a systems engineer in the Entry, Descent, and Landing Systems and Advanced Technologies group at the Jet Propulsion Laboratory. He is currently the EDL Phase Lead for the Mars 2020 project. Prior to that, he spent a really long time working on the Mars Science Laboratory mission. He holds S.B. and S.M. degrees in Aeronautics and Astronautics from the Massachusetts Institute of Technology and an M.B.A. from the University of California, Los Angeles. ***"SPHERES was the first project that I had the opportunity to be a part of all the way from conception through operations (it was also the first project I worked on that went to space). My experience on SPHERES helped pave the way to a job at NASA's Jet Propulsion Laboratory, where I've had the good fortune of seeing another project, Mars Science Laboratory, all the way from conception to operations - but this time on Mars. Curiosity's successful landing owes some small part to the formative and fun experiences I had working on SPHERES."***

Guest Speaker: Pedro Duque

EUROPEAN ASTRONAUT

Twitter: *@astro_duque*

Born March 14, 1963 in Madrid, Spain. He is married and has 3 children. Pedro graduated from Escuela Tecnica Superior de Ingenieros Aeronauticos, Universidad Politechnica, Madrid, 1986; was assigned to train at NASA's Johnson Space Center in Houston, Texas and entered the 1996 Class as a mission specialist; in April 2001 he was assigned to the first ISS advanced training class and underwent preparation until 2003 that qualified him for one of the first European long-term flights on board ISS; was seconded by ESA as Director of Operations of the Spanish User Support and Operations Centre (USOC) in Madrid, which is managed by the Instituto da Riva/Universidad Politécnica de Madrid (IDR/UPM); hobbies: swimming, diving, cycling. In October 2011 Duque returned to ESA after his special leave as a member of ESA's European Astronaut Corps.. Early in 2015 Pedro returned to astronaut duties and to full flight status, and among the astronauts he is responsible for the control and review of future ESA projects. Space missions: STS-95, Soyuz TMA-2, Soyuz TMA-3

Special Guest: Gregory Errol Chamitoff

NASA ASTRONAUT (FORMER)

Twitter: *@Astro_Taz*

Greg 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.

Special Guest: Catherine "Cady" Coleman

NASA ASTRONAUT (FORMER)
Twitter: @Astro_Cady
Catherine Grace "Cady" Coleman is an American chemist, a former United States Air Force officer, and a former NASA astronaut. She is a veteran of two Space Shuttle missions, and departed the International Space Station on May 23, 2011, as a crew member of Expedition 27 after logging 159 days in space. Coleman has logged more than 4,330 hours in space aboard the Space Shuttle Columbia and the International Space Station. Cady is an overall Rock Star and one of the best voices for the importance of Zero Robotics. THANK YOU Cady! Learn more about her schooling and NASA career by visiting www.jsc.nasa.gov/Bios/htmlbios/coleman.pdf. **#MakeSpaceForWomen #OurFutureIsBright**

Special Guest: Jeffrey A. Hoffman (Ph.D.)

NASA ASTRONAUT (FORMER)
Twitter: @MITAeroAstro Twitter: @MITMVL
Jeffrey Alan Hoffman, Ph.D. is an American former NASA astronaut and currently a professor of aeronautics and astronautics at MIT. Hoffman made five flights as a space shuttle astronaut, including the first mission to repair the Hubble Space Telescope in 1993, when the orbiting telescope's flawed optical system was corrected. Trained as an astrophysicist, he also flew on 1990 Spacelab shuttle mission that featured the ASTRO-1 ultraviolet astronomical observatory in the shuttle's payload bay. With the completion of his fifth space flight, Dr. Hoffman has logged more than 1,211 hours and 21.5 million miles in space. He was also the first Jewish male astronaut. Professor Hoffman is interested in the future of human spaceflight and in the use of the International Space Station as a testbed for future aerospace technology. He is the Director of MIT's Man Vehicle Laboratory (MVL) at MIT which is a research group within the MIT Department of Aeronautics and Astronautics. Founded in 1962, MVL's goal is to better define the physiological and cognitive limitations of pilots and passengers of aircraft and spacecraft, and to optimize overall human-vehicle system effectiveness and safety. Hoffman was most recently appointed as a Development Specialist for the ***Translational Research Institute*** charged with leading a national effort to translating cutting-edge, emerging terrestrial research into applied space flight, human risk mitigation strategies for exploration missions. Hoffman was instrumental in the formation of the Middle School Zero Robotics Competition in 2010. Learn more about him by visiting https://en.wikipedia.org/wiki/Jeffrey_A._Hoffman. **#HubbleRepairMan**

SPACE-SPHERES International Space Station Referee's

Andrei Ivanovich Borisenko, Flight Engineer

Russian Cosmonaut

Andrei Ivanovich Borisenko (Андрей Иванович Борисенко) born April 17, 1964 in Leningrad, Russia) is a Russian cosmonaut. He was selected to be a cosmonaut in May 2003, and since 2008 he has been training as a back-up crew member for a long-duration mission to the International Space Station. In particular, he was listed as a back-up Flight Engineer for Soyuz TMA-18, which launched the crew of Expedition 23/24 in April 2010. Borisenko currently serves as Flight Engineer 2 on Expedition 50. He has served as a flight engineer with the Expedition 27, the 27th long-duration mission to the International Space Station (ISS). He also served as the commander of Expedition 28.

Peggy A. Whitson, Flight Engineer

NASA Astronaut

Expedition 50/51 is Peggy Whitson's third long-duration mission to the International Space Station. The Iowa native completed two six-month tours of duty aboard the station for Expedition 5 in 2002, and as the station commander for Expedition 16 in 2008. She has accumulated 377 days in space between the two missions, the most for any U.S. woman at the time of her return to Earth. Whitson has also performed six spacewalks, totaling 39 hours and 46 minutes. She received her Bachelor of Science in Biology/Chemistry from Iowa Wesleyan College and her Doctorate in Biochemistry from Rice University.

Thomas Pesquet, Flight Engineer

European Astronaut

Thomas Pesquet (born 27 February 1978) is a French aerospace engineer, pilot, and European Space Agency astronaut. Pesquet was selected by ESA as a candidate in May 2009 and he successfully completed his basic training in November 2010. From 19 November 2016, Pesquet is part of the International Space Station as a crew member for Expedition 50 and Expedition 51.

Current Crew on Station: Expedition 50 began October 30, 2016 and ends March 4, 2017. This expedition includes biotechnological research, human research and Earth and space science. Two spacewalks are tentatively planned during Expedition 50. During Expedition 50, researchers will investigate how lighting can change the overall health and well-being of crew members, how microgravity can affect the genetic properties of space-grown plants, and how microgravity impacts tissue regeneration in humans. Thank you to the crew of Expedition 50 for your research and for refereeing the 2016 High School Zero Robotics Competition – SPACE: SPHERES! (Learn more about the crew by visiting 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, AL. PAYCOM is managed by the Payload Operations Director (POD), also at Marshall.

SPHERES team is located at NASA 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!

Tweet to **@ZeroRobotics**

Tag all posts and photos with **#ZeroRobotics** & **#CodeForSpace**

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Special Guests: Zero Robotics is fortunate to have supporters that value Science Technology Engineering and Math education and serve as ambassadors for the Zero Robotics program around the globe. Thank you for being at ZR events across the world to celebrate the accomplishments of our talented and driven students.

Jackie Slaviero (*@JackieSlav***)** is the international Ambassador of the Space Camp program. "Just be brave enough to take the first step. I didn't realize who I was until I went to Space Camp and was challenged."

Center For The Advancement of Science and Space (*@ISS_CASIS***)** is the sole manager of the International Space Station U.S. National Laboratory. The mission of CASIS is to maximize use of this unparalleled platform for innovation, which can benefit all humankind and inspire a new generation to look to the stars.

@NASA_SPHERES @NatGeoChannel @AuroraFlightSci @Mass_ILC @northropgrumman

Things to see in Boston/Cambridge

Tours

Historic Freedom Trail	http://www.thefreedomtrail.org/
Boston Trolley Tours	http://www.trolleytours.com/boston/

Museums

MIT Museum	http://web.mit.edu/museum/
Museum of Science	http://www.mos.org/
Museum of Fine Arts	http://www.mfa.org/
Skywalk Observatory	http://skywalkboston.com/
Isabella Steward Gardner Museum	http://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	Red/Orange Line, Downtown Crossing

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/