
VOICE OF
Dr. Alvar Saenz-Otero
MIT SPHERES LEAD SCIENTIST

1
00:00:01,596 --> 00:00:04,086
>> And this is commentator
Dan Huot here

2
00:00:04,086 --> 00:00:06,786
in mission control while we
continue to look on and see some

3
00:00:06,786 --> 00:00:09,276
of the exciting robotics
activity taking place

4
00:00:09,276 --> 00:00:10,256
on board the station.

5
00:00:10,556 --> 00:00:12,556
We also have some really
exciting stuff that's going

6
00:00:12,556 --> 00:00:14,006
to be take place tomorrow.

7
00:00:14,366 --> 00:00:17,506
Now joining me on
the phone from MIT

8
00:00:17,506 --> 00:00:20,316
up in Massachusetts is
the principle investigator

9
00:00:20,316 --> 00:00:24,516
of the experiment known as
SPHERES, Dr. Alvar Saenz-Otero.

10
00:00:24,926 --> 00:00:26,446
Dr. Alvar, first
of all thank you

11
00:00:26,446 --> 00:00:27,556

so much for being here today.

12
00:00:28,406 --> 00:00:29,336
>> Dan, thank you very much.

13
00:00:29,336 --> 00:00:29,786
Good morning.

14
00:00:30,296 --> 00:00:31,006
>> Yes, good morning.

15
00:00:31,566 --> 00:00:35,646
So SPHERES-Zero-Robotics, first
off SPHERES is an acronym,

16
00:00:35,646 --> 00:00:37,296
tell me what it stands
for real quick?

17
00:00:37,556 --> 00:00:40,106
>> Sure. I don't think many
people will remember it it's the

18
00:00:40,106 --> 00:00:42,906
Synchronized Position
Hold, Engage, Reorient,

19
00:00:42,906 --> 00:00:44,356
Experimental Satellites.

20
00:00:45,196 --> 00:00:48,856
It's a long acronym and the
key word there is synchronized

21
00:00:48,856 --> 00:00:52,206
and position and
reorient basically means

22
00:00:52,206 --> 00:00:54,626

when multiple satellites
are synchronized to work

23
00:00:54,836 --> 00:00:55,846
to do something together.

24
00:00:56,666 --> 00:01:00,036
>> Okay. And these spheres have
been used on board the station

25
00:01:00,036 --> 00:01:02,356
in quite a number of runs,
you know, in the past couple

26
00:01:02,356 --> 00:01:05,036
of months and years
actually and I understand

27
00:01:05,036 --> 00:01:06,266
that you are heavily involved.

28
00:01:06,266 --> 00:01:07,406
Why don't you tell
us a little more

29
00:01:07,406 --> 00:01:09,926
about the history
of this project?

30
00:01:09,926 --> 00:01:11,466
>> Sure. I guess
there's two parts,

31
00:01:11,466 --> 00:01:13,456
let me just summarize
the space station part.

32
00:01:13,456 --> 00:01:15,896
We actually began operations
aboard space station back

33
00:01:15,896 --> 00:01:20,376
in 2006 that's when the
first of the spheres arrived

34
00:01:20,376 --> 00:01:23,306
and the other two followed
shortly thereafter.

35
00:01:23,306 --> 00:01:25,076
Where a distributed
experiment so one

36
00:01:25,076 --> 00:01:28,476
of the good things we could
start doing research even before

37
00:01:28,476 --> 00:01:32,266
all of the three satellites were
there we could already do tests

38
00:01:32,266 --> 00:01:34,366
and check outs and collect
some of the data we needed.

39
00:01:35,116 --> 00:01:40,176
And since then we've
completed 35 test sessions.

40
00:01:40,176 --> 00:01:46,586
So 35 sets of tests to reach
some sort of science objective

41
00:01:47,276 --> 00:01:51,506
and tomorrow is the
36th one, the 36th time

42
00:01:51,506 --> 00:01:53,156
that we complete a test plan

43
00:01:53,156 --> 00:01:55,306
and tomorrow's will be
the zero robotics final.

44
00:01:55,886 --> 00:01:58,466
But another really interesting
part about SPHERES is

45
00:01:58,466 --> 00:02:01,036
that it was the first
on what is now a series

46
00:02:01,036 --> 00:02:03,316
of I believe 9 classes at MIT

47
00:02:04,066 --> 00:02:08,706
where undergraduate students
design what will ultimately be

48
00:02:08,706 --> 00:02:09,526
space hardware.

49
00:02:10,056 --> 00:02:14,126
So instead of giving students
an individual thesis project

50
00:02:14,126 --> 00:02:19,276
at the end we gave the
whole group the jointly --

51
00:02:19,676 --> 00:02:22,696
the joint responsibility
for their thesis as a whole

52
00:02:23,066 --> 00:02:25,826
to design SPHERES and that
was a great experience

53
00:02:25,826 --> 00:02:30,556

and now fortunately
[inaudible] copying that format

54
00:02:30,556 --> 00:02:31,906
so I guess we did a good job.

55
00:02:32,816 --> 00:02:34,646
>> And I mean that
sounds really exciting.

56
00:02:34,776 --> 00:02:36,556
Any time we can get
students involved

57
00:02:36,556 --> 00:02:38,406
and especially giving
students the chance

58
00:02:38,406 --> 00:02:40,406
to have something actually
flying up on station

59
00:02:40,406 --> 00:02:42,356
that they're controlling
or involved in has got

60
00:02:42,356 --> 00:02:43,736
to be really exciting for them.

61
00:02:43,736 --> 00:02:46,286
Now tomorrow's activity
I understand is

62
00:02:46,286 --> 00:02:47,306
with high school students?

63
00:02:47,566 --> 00:02:48,416
>> That's right.

64

00:02:48,416 --> 00:02:49,086
That's right.

65
00:02:49,086 --> 00:02:53,566
A couple years ago, back
when we were doing training

66
00:02:53,566 --> 00:02:56,416
with astronaut Greg [inaudible]
who himself is an MIT alum

67
00:02:56,896 --> 00:03:00,566
and more importantly who is

68
00:03:00,566 --> 00:03:02,606
for his speech deeded
control systems.

69
00:03:02,656 --> 00:03:05,526
So he knew all about how
to control satellites

70
00:03:05,526 --> 00:03:07,476
and basically the
purpose of SPHERES.

71
00:03:08,116 --> 00:03:10,676
And he asked us a
very simple question,

72
00:03:11,766 --> 00:03:14,876
the way we design
SPHERES is very safe,

73
00:03:14,876 --> 00:03:17,346
there's nothing we can
program SPHERES to do

74
00:03:17,866 --> 00:03:22,006
that presents any safety

concerns to obviously the crew,

75
00:03:22,216 --> 00:03:24,486
most importantly to
space station or even

76
00:03:24,486 --> 00:03:25,646
to the satellites themselves.

77
00:03:26,626 --> 00:03:28,096
So no matter what people program

78
00:03:28,096 --> 00:03:32,776
on SPHERES the satellites are
safe and from every perspective.

79
00:03:33,326 --> 00:03:35,296
So since there's no restrictions
there he asked us well,

80
00:03:35,296 --> 00:03:38,356
while you're restricting
that to college students why

81
00:03:38,356 --> 00:03:40,506
to only college and
not younger students.

82
00:03:41,356 --> 00:03:44,326
And usually when you ask
an engineer a question

83
00:03:44,326 --> 00:03:48,096
and they cannot answer why
not they have to do it.

84
00:03:48,486 --> 00:03:52,076
So we designed this
competition we looked

85
00:03:52,076 --> 00:03:53,846
around and we learned a lot.

86
00:03:54,366 --> 00:03:56,296
As the name suggests
we got inspired

87
00:03:56,296 --> 00:03:58,886
by first robotics we
actually contacted them

88
00:03:58,886 --> 00:04:01,136
and got permission to use the
name zero robotics they said it

89
00:04:01,136 --> 00:04:01,896
was not a problem.

90
00:04:02,586 --> 00:04:05,796
So we made zero robotics
and what zero stands

91
00:04:05,796 --> 00:04:09,076
for is zero [inaudible]
although we all know

92
00:04:09,076 --> 00:04:11,416
that space station is actually
micro gravity not true zero

93
00:04:11,416 --> 00:04:14,616
gravity but close enough in
the engineering approximation

94
00:04:14,616 --> 00:04:15,956
for our objectives here.

95
00:04:17,016 --> 00:04:22,106
And the other zero

is also zero cost.

96
00:04:22,556 --> 00:04:25,346
We wanted to make
this a possibility

97
00:04:25,416 --> 00:04:28,356
for high school students
at no cost to them except

98
00:04:28,356 --> 00:04:32,826
for their effort and time to be
able to work with space station.

99
00:04:33,516 --> 00:04:37,426
So modeling -- using
SPHERES robotics

100
00:04:37,426 --> 00:04:40,616
as a model we created
a competition

101
00:04:40,616 --> 00:04:42,796
for high school students
and later

102
00:04:42,796 --> 00:04:45,636
on for middle school students
so in 2013 we're going

103
00:04:45,636 --> 00:04:52,126
to do middle school students
too where we design a game just

104
00:04:52,496 --> 00:04:54,366
like first robotics
does but instead

105
00:04:54,366 --> 00:04:58,236
of the students building robots

they're going to program robots.

106
00:04:58,686 --> 00:05:01,946
So I like to call ourselves
the software complement

107
00:05:02,076 --> 00:05:03,166
to first robotics.

108
00:05:03,636 --> 00:05:06,756
First robotics is mostly about
hardware we are pretty much all

109
00:05:06,826 --> 00:05:10,876
about software, but
with that way

110
00:05:10,876 --> 00:05:13,716
because it's all software
we designed a website

111
00:05:13,716 --> 00:05:16,546
that online everything
is done online.

112
00:05:16,976 --> 00:05:19,216
The students online
do the programming,

113
00:05:19,216 --> 00:05:22,316
they view simulations they
interpret the results they see

114
00:05:22,316 --> 00:05:23,596
how they're doing
in the competition.

115
00:05:24,446 --> 00:05:28,776
So basically zero robotics is a
software competition it's a way

116
00:05:28,776 --> 00:05:32,016
for students to learn
about programming and how

117
00:05:32,016 --> 00:05:36,196
to control satellites and the
finalists, the very best ones,

118
00:05:36,196 --> 00:05:39,256
and that's what we're going
to see tomorrow they get

119
00:05:39,256 --> 00:05:42,576
to test their code on our
hardware aboard space station.

120
00:05:42,576 --> 00:05:45,236
So they've already went
through three rounds

121
00:05:45,236 --> 00:05:48,506
of simulations they already did
the whole semester they began

122
00:05:48,506 --> 00:05:51,916
back in September and they
did all the simulations

123
00:05:51,916 --> 00:05:54,656
and tomorrow they're
really go their code is now

124
00:05:54,656 --> 00:05:56,806
in space station and it's just
waiting for the astronauts

125
00:05:56,806 --> 00:06:01,386
to turn satellites on tomorrow
and we're going to see who wins

126
00:06:01,386 --> 00:06:03,196
in the real world
instead of in simulation.

127
00:06:03,376 --> 00:06:06,176
>> That's right and it
will be really exciting.

128
00:06:06,296 --> 00:06:09,306
We're certainly looking forward
and we'll be following along.

129
00:06:09,306 --> 00:06:13,656
And just real quick I mean
this is such an amazing tool,

130
00:06:13,656 --> 00:06:15,996
can you tell me the kind of
response you generally get,

131
00:06:15,996 --> 00:06:17,686
like how excited
are these students

132
00:06:17,686 --> 00:06:20,896
that they're manipulating
something that's flying 250

133
00:06:20,896 --> 00:06:21,676
miles above them.

134
00:06:22,606 --> 00:06:26,846
>> Well let me tell you
tomorrow in the room we're going

135
00:06:26,846 --> 00:06:33,356
to have 21 -- actually, no,
I believe I think it's 21

136
00:06:33,356 --> 00:06:36,386
or 23 teams I have to double
check the final attendance list,

137
00:06:36,386 --> 00:06:40,036
but it's at least 21 teams
of high school students

138
00:06:40,216 --> 00:06:44,496
who we gave no money to and
they found their own funding

139
00:06:44,496 --> 00:06:46,196
to come to MIT to see it.

140
00:06:47,066 --> 00:06:53,146
So it wasn't just -- it's not
just excitement of working

141
00:06:53,146 --> 00:06:55,676
in the station I love to
see that action, right,

142
00:06:55,676 --> 00:06:58,016
they actually took the action
of going and fundraising

143
00:06:58,016 --> 00:07:00,126
on their own to find
money to come to MIT

144
00:07:00,126 --> 00:07:02,136
to watch these finals.

145
00:07:02,726 --> 00:07:08,946
To me that's an amazing example
of how interested they are

146
00:07:08,946 --> 00:07:11,396

because they're in high school
they don't really do fundraising

147
00:07:11,396 --> 00:07:11,896
very much.

148
00:07:12,976 --> 00:07:16,106
So it's extremely exciting.

149
00:07:16,106 --> 00:07:20,416
In this year our estimate
because we don't force people

150
00:07:20,416 --> 00:07:24,756
to give us full rosters of their
teams that's not our objective,

151
00:07:24,756 --> 00:07:26,456
our objective is to
make sure they have

152
00:07:26,456 --> 00:07:27,986
at least five students
on each team.

153
00:07:28,756 --> 00:07:30,166
But we estimate we have

154
00:07:30,166 --> 00:07:32,816
about 1700 students
participating this year

155
00:07:33,396 --> 00:07:36,666
and it's only our second year of
doing this at a national level.

156
00:07:37,176 --> 00:07:37,946
>> Wow, so --

157

00:07:37,946 --> 00:07:40,786
>> So in two years we're
reaching over 1500 students

158
00:07:40,786 --> 00:07:43,856
for sure and I'm hoping close
to 2000 but I don't want

159
00:07:43,856 --> 00:07:45,466
to quite promise that.

160
00:07:45,466 --> 00:07:47,976
>> Well it certainly
sounds like you guys are off

161
00:07:47,976 --> 00:07:51,036
to a great start and we
hope it can only grow

162
00:07:51,036 --> 00:07:52,776
because it really is,
it's an amazing tool

163
00:07:53,176 --> 00:07:54,466
to get students involved

164
00:07:54,466 --> 00:07:56,896
and stem science technology
engineering and math

165
00:07:57,196 --> 00:07:59,636
and I mean we're certainly going
to be looking forward to it

166
00:07:59,636 --> 00:08:03,166
and we'll be making sure that we
watch the competition tomorrow

167
00:08:03,166 --> 00:08:04,366
and see who wins.

168
00:08:04,366 --> 00:08:08,256
So, Dr. Alvar, thank you so much
for coming on with me real quick

169
00:08:08,256 --> 00:08:09,926
and giving us a look
inside zero robotics,

170
00:08:10,316 --> 00:08:12,326
good luck to all the
teams for mission control

171
00:08:12,326 --> 00:08:13,136
and we'll be watching.

172
00:08:13,546 --> 00:08:16,996
>> Thank you very much, Dan,
and yes we'll be on NASA TV

173
00:08:17,546 --> 00:08:20,556
and we also have a webcast
direct off our website

174
00:08:20,556 --> 00:08:23,956
which is zerorobotics.mit.edu
for anybody who wants

175
00:08:23,956 --> 00:08:26,756
to watch it either on
NASA TV or our website.

176
00:08:27,306 --> 00:08:30,966
Tomorrow we start at 8:30
in the morning and go

177
00:08:30,966 --> 00:08:33,176
until 1:00 there's a lot
of competition to run.

178
00:08:33,546 --> 00:08:35,016
>> Okay. We'll be
following along.