1
00:00:00,036 --> 00:00:03,696
>> Julie Robinson: So for
Expedition 35/36, I'm just going

2
00:00:03,696 --> 00:00:05,206
to give you some
brief highlights

3
00:00:05,206 --> 00:00:06,796
of a few select investigations.

4
00:00:07,296 --> 00:00:10,666
Overall, we have just in
Kibo, Columbus, and Destiny,

5
00:00:10,666 --> 00:00:16,256
we'll have 137 investigations
active during Expedition 35

6
00:00:16,256 --> 00:00:16,976
and 36.

7
00:00:17,366 --> 00:00:20,396
Eighty of those are
led by U.S. funded

8
00:00:20,396 --> 00:00:21,996
or U.S. supported investigators.

9
00:00:22,156 --> 00:00:25,726
About 25 percent of our
investigations are sponsored

10
00:00:26,096 --> 00:00:29,026
under the declaration of ISS
as a national laboratory.

11
00:00:29,396 --> 00:00:31,446
This started back in 2005

12
00:00:31,446 --> 00:00:33,776
when we were declared a
national laboratory by Congress,

13
00:00:33,776 --> 00:00:35,786
and that represents
our users that are

14
00:00:35,786 --> 00:00:38,946
from other government
agencies, commercial companies,

15
00:00:39,006 --> 00:00:41,296
the private sector, and
nonprofit organizations,

16
00:00:41,296 --> 00:00:43,806
so they're not funded by NASA.

17
00:00:43,916 --> 00:00:47,906
We're also serving the needs
of over 400 investigators

18
00:00:48,086 --> 00:00:51,676
from around the world, and
those investigators represent 28

19
00:00:51,676 --> 00:00:52,436
different countries.

20
00:00:52,996 --> 00:00:56,556
And you saw in the
graphic that was up,

21
00:00:56,556 --> 00:00:58,656
those colors represented
the different disciplines,

22

00:00:58,656 --> 00:01:01,796
and so we have biology
and biotechnology,

23
00:01:01,896 --> 00:01:04,016
Earth and space sciences,
education

24
00:01:04,016 --> 00:01:06,496
and cultural activities,
human research focused

25
00:01:06,496 --> 00:01:10,706
on human physiology, and future
exploration, physical sciences,

26
00:01:10,786 --> 00:01:12,766
and technology development
and demonstration.

27
00:01:13,506 --> 00:01:15,376
So with that number
of investigations,

28
00:01:15,376 --> 00:01:18,266
obviously I can't give you a
very detailed rundown of most

29
00:01:18,266 --> 00:01:21,936
of them, what I did was select
five investigations covering

30
00:01:21,936 --> 00:01:24,316
that breadth of disciplines
linked to some

31
00:01:24,316 --> 00:01:28,106
of our past research results,
and that are kind of new

32

00:01:28,106 --> 00:01:30,586
in this -- starting
up in Expedition 35.

33
00:01:31,116 --> 00:01:32,366
So the first thing I
want to talk about is

34
00:01:32,366 --> 00:01:34,856
from the biology area, and
it's called microbiome.

35
00:01:35,286 --> 00:01:37,776
Some recent discoveries
over the last few years

36
00:01:37,836 --> 00:01:41,226
in the microbial sciences have
shown us that bacteria account

37
00:01:41,376 --> 00:01:43,916
for basically 10
times more cells

38
00:01:43,916 --> 00:01:45,986
in our body than our own cells.

39
00:01:46,516 --> 00:01:48,926
So we're out numbered 10
to 1 everywhere we go,

40
00:01:48,926 --> 00:01:50,606
by the bacteria that
we carry with us.

41
00:01:51,196 --> 00:01:52,896
And we know that
in space flight,

42
00:01:52,896 --> 00:01:54,956

bacteria grow quite differently.

43
00:01:54,956 --> 00:01:57,116
We also know that the
human immune system is

44
00:01:57,116 --> 00:01:58,316
affected significantly.

45
00:01:58,866 --> 00:01:59,816
And so what we'll be doing

46
00:01:59,816 --> 00:02:02,066
in this project is
collecting samples

47
00:02:02,066 --> 00:02:05,026
from ISS crew members before,
during, and after their missions

48
00:02:05,026 --> 00:02:09,256
to the ISS, and also looking
at the environment of the ISS

49
00:02:09,256 --> 00:02:10,806
and the diet and other aspects,

50
00:02:10,806 --> 00:02:13,416
other ways that humans
have bacteria come

51
00:02:13,416 --> 00:02:14,186
into their systems.

52
00:02:14,636 --> 00:02:16,886
And we'll be looking
at their stress levels

53
00:02:16,886 --> 00:02:18,486

and their immune system
function, as well.

54
00:02:19,036 --> 00:02:21,216
It's important from an
exploration perspective,

55
00:02:21,406 --> 00:02:24,536
because this research will help
us predict how long-term space

56
00:02:24,536 --> 00:02:27,686
travel, which is basically
humans and the microbes that go

57
00:02:27,686 --> 00:02:30,236
with us, is going to
affect those communities,

58
00:02:30,236 --> 00:02:31,516
those ecological communities.

59
00:02:31,856 --> 00:02:33,446
But also, it's really important

60
00:02:33,446 --> 00:02:36,606
because it's addressing
the top recommendation

61
00:02:36,606 --> 00:02:38,826
of the National Academies
of Sciences last year

62
00:02:39,136 --> 00:02:41,446
when they suggested that
ISS needed to be developed

63
00:02:41,446 --> 00:02:44,146
as a microbial observatory
to address some

64
00:02:44,146 --> 00:02:45,566
of these new findings
that have been made

65
00:02:45,566 --> 00:02:46,876
across the scientific community.

66
00:02:46,876 --> 00:02:48,256
And so this is one
of the first studies

67
00:02:48,286 --> 00:02:50,686
that really starts
addressing that recommendation.

68
00:02:50,686 --> 00:02:53,496
And that's important, because of
the benefits back here on Earth.

69
00:02:53,496 --> 00:02:56,236
If we can understand how
microbial communities work

70
00:02:56,266 --> 00:02:57,636
and take advantage of the ISS

71
00:02:57,686 --> 00:03:00,546
as a relatively isolated
environment, there's a lot

72
00:03:00,546 --> 00:03:02,896
of basic science and then
improvements in health

73
00:03:02,896 --> 00:03:03,956
on Earth that we can make.

74
00:03:05,296 --> 00:03:06,896

Moving to human physiology,

75
00:03:07,226 --> 00:03:09,066
we have a new investigation
starting

76
00:03:09,066 --> 00:03:11,086
in Expedition 35
called ocular health.

77
00:03:11,676 --> 00:03:13,696
And this is an important
investigation,

78
00:03:13,696 --> 00:03:15,706
because it builds
off a discovery made

79
00:03:16,076 --> 00:03:18,226
through our space medicine
about two years ago.

80
00:03:18,716 --> 00:03:21,666
It will be the first experiment
to characterize the risk

81
00:03:21,766 --> 00:03:24,906
of what we're now calling
microgravity-induced visual

82
00:03:24,906 --> 00:03:26,756
impairment and intracranial
pressure.

83
00:03:27,306 --> 00:03:29,776
Essentially, what we've
discovered is that astronauts,

84
00:03:29,836 --> 00:03:32,336
some astronauts on

orbit, not all of them,

85
00:03:32,366 --> 00:03:35,116
but they have real changes in
fluid shifts in their bodies,

86
00:03:35,476 --> 00:03:40,086
and that that leads them to both
have changes in their vision,

87
00:03:40,086 --> 00:03:42,696
and also changes in the pressure
in their central nervous system.

88
00:03:43,136 --> 00:03:45,106
About 20 percent of the
astronauts that have flown

89
00:03:45,106 --> 00:03:47,196
to the International Space
Station have reported these

90
00:03:47,236 --> 00:03:48,256
kinds of vision changes.

91
00:03:48,906 --> 00:03:51,126
So what we're going to be
doing is taking detailed

92
00:03:51,156 --> 00:03:52,266
scientific measurements.

93
00:03:52,266 --> 00:03:56,336
Here you see Suni having some
tomography measurements taken

94
00:03:56,336 --> 00:03:56,836
of her eye.

95

00:03:56,836 --> 00:03:59,026
You may have had something
like this in a doctor 's office

96
00:03:59,026 --> 00:04:01,086
where you have some
anesthetizing eyedrops,

97
00:04:01,566 --> 00:04:03,836
and then they use that
direct contact to tap

98
00:04:04,026 --> 00:04:05,486
and actually measure
the pressure

99
00:04:05,486 --> 00:04:07,556
of the fluid that's
inside the eye.

100
00:04:07,556 --> 00:04:10,936
You also saw some
video of ultrasounds,

101
00:04:10,936 --> 00:04:12,626
and here's another
instrument being used

102
00:04:12,626 --> 00:04:13,556
to characterize the eye.

103
00:04:13,666 --> 00:04:16,686
So we'll be taking systematic
measurements to really try

104
00:04:16,686 --> 00:04:18,706
and understand this
process for the first time.

105
00:04:19,376 --> 00:04:22,466

This is an example of why we
really need long duration human

106
00:04:22,526 --> 00:04:24,266
space flight with
multiple crew members

107
00:04:24,266 --> 00:04:27,226
to understand all the different
effects on the human body.

108
00:04:27,676 --> 00:04:30,536
But it's also interesting
that this is a process

109
00:04:30,536 --> 00:04:32,156
that was not predicted
from what we know

110
00:04:32,156 --> 00:04:33,316
about human health on Earth.

111
00:04:33,826 --> 00:04:35,656
And we even have some
results now that have come

112
00:04:35,656 --> 00:04:38,456
out that suggest that what
we're seeing in astronauts

113
00:04:38,456 --> 00:04:39,866
in orbit could link to ways

114
00:04:39,866 --> 00:04:42,716
of understanding cardiovascular
disease, high blood pressure,

115
00:04:42,716 --> 00:04:45,886
and other aspects in people on
Earth that might not be quite

116
00:04:45,886 --> 00:04:47,616
as healthy as our
astronauts are in orbit.

117
00:04:48,866 --> 00:04:51,256
And so we're really excited

118
00:04:51,256 --> 00:04:52,846
to have this important
study kicking off.

119
00:04:52,846 --> 00:04:54,636
It will take place
over about two years.

120
00:04:55,936 --> 00:04:58,946
Next, I want to shift from
human physiology focused

121
00:04:58,946 --> 00:05:01,656
on exploration to technology
demonstration focused

122
00:05:01,656 --> 00:05:02,396
on exploration.

123
00:05:02,696 --> 00:05:04,306
And really, just
yesterday on ISS,

124
00:05:04,306 --> 00:05:06,516
we started a study called UBNT,

125
00:05:06,516 --> 00:05:09,096
or Ultrasonic Background
Noise Test.

126
00:05:09,416 --> 00:05:13,366

This test is to observe the
high frequency noise levels

127
00:05:13,416 --> 00:05:15,696
that are background on the
International Space Station,

128
00:05:16,126 --> 00:05:19,416
and develop an understanding
of what those noise levels are,

129
00:05:19,416 --> 00:05:21,126
so that we can then
develop a tool

130
00:05:21,486 --> 00:05:24,036
to automatically detect leaks.

131
00:05:24,116 --> 00:05:26,096
You can think of a leak
as having some kind

132
00:05:26,096 --> 00:05:29,096
of a hissing noise, and
these ultrasonic detectors,

133
00:05:29,096 --> 00:05:30,606
and you see a training
video here

134
00:05:30,906 --> 00:05:33,236
of someone putting the epoxy
on one of these detectors

135
00:05:33,236 --> 00:05:37,356
and actually attaching it
onto the space behind a rack.

136
00:05:37,806 --> 00:05:41,416
And basically what the acoustic

engineers will be doing is

137
00:05:41,456 --> 00:05:43,886
developing a profile of
what normal noises are

138
00:05:43,886 --> 00:05:46,776
like inside the ISS,
and then they'll be able

139
00:05:46,776 --> 00:05:49,606
to start developing algorithms
to detect abnormal noises,

140
00:05:49,606 --> 00:05:51,496
including the kind of
noises you have might get

141
00:05:51,496 --> 00:05:53,606
if there's air leaking
through the pressure wall.

142
00:05:54,076 --> 00:05:56,186
And so this will be an
important advance in the way

143
00:05:56,186 --> 00:05:58,836
that we approach spacecraft
safety and leak detection

144
00:05:58,836 --> 00:06:00,346
for future exploration missions.

145
00:06:02,246 --> 00:06:05,106
Next, I'll shift from
technology demonstration

146
00:06:05,106 --> 00:06:08,586
to a more fundamental physical
process, and that is combustion.

147
00:06:09,186 --> 00:06:11,496
Last year, we had a
really neat discovery

148
00:06:11,496 --> 00:06:15,446
in our combustion
rack, and based on one

149
00:06:15,446 --> 00:06:17,206
of the combustion
experiments we were doing,

150
00:06:17,206 --> 00:06:19,446
where we were burning
very simple fuels,

151
00:06:19,976 --> 00:06:22,256
in this case, heptane drops.

152
00:06:22,256 --> 00:06:24,166
And this was from an
experiment called FLEX.

153
00:06:24,856 --> 00:06:25,636
It was the first time

154
00:06:25,636 --> 00:06:28,286
that scientists had
observed a low temperature,

155
00:06:28,286 --> 00:06:29,746
soot-free, cool flame.

156
00:06:29,976 --> 00:06:31,616
Now, cool flame sounds
kind of strange.

157
00:06:31,896 --> 00:06:34,216

A normal flame is about
1400 degrees Celsius,

158
00:06:34,216 --> 00:06:36,536
and a cool flame is about
600-degrees Celsius.

159
00:06:37,056 --> 00:06:40,036
We have a video to show
you from the inside

160
00:06:40,036 --> 00:06:40,656
of the combustion rack

161
00:06:40,656 --> 00:06:42,396
that shows you what
this observation is.

162
00:06:42,446 --> 00:06:44,846
So you see the droplet,
the droplet is ignited,

163
00:06:45,026 --> 00:06:46,356
and you see the burning go on.

164
00:06:46,546 --> 00:06:50,356
Then you'll see an extinction
where it gets dark, it goes out.

165
00:06:50,436 --> 00:06:52,796
But the flame, the
burning actually continues,

166
00:06:52,796 --> 00:06:54,346
and then in the end you can see

167
00:06:54,346 --> 00:06:56,716
that through a chemiluminescent
afterglow

168
00:06:57,276 --> 00:06:59,636
that comes back afterwards, and
so that's how scientists know

169
00:06:59,636 --> 00:07:01,056
that the flame continued
to burn.

170
00:07:01,846 --> 00:07:04,826
So this has really important
applications on Earth,

171
00:07:04,826 --> 00:07:07,986
because this is something you
just can't study any other way.

172
00:07:07,986 --> 00:07:10,936
This kind of droplet staying in
one place and being controllable

173
00:07:10,936 --> 00:07:14,176
and measurable without having
convention drawing a flame

174
00:07:14,176 --> 00:07:16,086
upward in the point
that we normally see,

175
00:07:16,126 --> 00:07:17,576
say when we're burning
a candle on Earth,

176
00:07:17,946 --> 00:07:19,516
this is a fundamental property

177
00:07:19,516 --> 00:07:21,366
of combustion you can
only study in space.

178

00:07:21,916 --> 00:07:24,316
And this gives us some
insights and some ways

179
00:07:24,396 --> 00:07:27,176
to improve internal combustion
engines, because this kind

180
00:07:27,176 --> 00:07:29,906
of cool flame property, if you
can control it better on Earth,

181
00:07:30,366 --> 00:07:32,176
would help you to control
combustion in a way

182
00:07:32,176 --> 00:07:34,046
that could make engines
more fuel efficient.

183
00:07:34,996 --> 00:07:37,226
The experiment that
we'll be starting

184
00:07:37,226 --> 00:07:39,506
in Expedition 35 is a follow

185
00:07:39,506 --> 00:07:42,036
on to the FLEX investigation
data I just showed you.

186
00:07:42,476 --> 00:07:44,636
It's called the Italian
Combustion Experiment

187
00:07:44,636 --> 00:07:46,886
for Green Air, or
ICE-GA for short,

188
00:07:46,886 --> 00:07:50,926

and here you can see a picture
in front of the combustion rack

189
00:07:51,006 --> 00:07:52,676
as a gas bottle is being put in.

190
00:07:53,206 --> 00:07:55,626
And it's a collaboration with
the Italian space agency.

191
00:07:55,866 --> 00:07:59,666
Instead of burning things like
heptane, decane, or octane,

192
00:08:00,146 --> 00:08:03,376
we'll be looking at second
and third generation biofuels.

193
00:08:03,626 --> 00:08:05,996
Second generation biofuels,
instead of being made from corn

194
00:08:05,996 --> 00:08:09,656
or soy beans, they're made from
any kind of excess biomass,

195
00:08:09,846 --> 00:08:12,146
so they're not competing
with food production.

196
00:08:12,146 --> 00:08:13,896
And third generation
biofuels are the ones

197
00:08:13,896 --> 00:08:14,816
that are made from algae.

198
00:08:14,996 --> 00:08:16,916
So we'll be testing combustion

199
00:08:16,916 --> 00:08:19,556
in the combustion rack using
these different biofuels.

200
00:08:19,976 --> 00:08:23,136
And this is obviously very
applied at getting insights

201
00:08:23,186 --> 00:08:25,016
that will help us to
improve the efficiency

202
00:08:25,016 --> 00:08:27,006
of combustion with biofuels.

203
00:08:28,246 --> 00:08:31,036
Finally, I'd like to shift to
the Earth sciences and talk

204
00:08:31,036 --> 00:08:34,426
about an important Earth science
remote sensing instrument

205
00:08:34,426 --> 00:08:37,456
on ISS, the HICO, or
Hyperspectral Imager

206
00:08:37,456 --> 00:08:38,456
for the Coastal Ocean.

207
00:08:38,456 --> 00:08:40,946
You can see a picture
of that here out on the,

208
00:08:41,026 --> 00:08:42,976
mounted externally on
the Kibo laboratory.

209
00:08:43,476 --> 00:08:46,536

Hyperspectral data is
essentially hundreds

210
00:08:46,536 --> 00:08:49,416
of spectral bands instead of
just a few, like Landsat has.

211
00:08:49,806 --> 00:08:52,106
And so this gives you
a lot more information

212
00:08:52,146 --> 00:08:55,436
about what's being
observed and measured

213
00:08:55,436 --> 00:08:56,836
on the Earth below
the instrument.

214
00:08:57,466 --> 00:09:00,126
As of January 1st, the this
instrument has transitioned

215
00:09:00,126 --> 00:09:03,106
from being just a naval
research operated payload

216
00:09:03,296 --> 00:09:06,456
for the naval research
laboratory, to being a facility

217
00:09:06,456 --> 00:09:08,046
on the International
Space Station.

218
00:09:08,496 --> 00:09:11,736
And this opens it up to
a wide array of users,

219
00:09:11,796 --> 00:09:14,266

both national lab users from
other government agencies,

220
00:09:14,346 --> 00:09:16,796
and the private sector,
especially users

221
00:09:16,796 --> 00:09:19,396
that are focused on agribusiness
and oil exploration.

222
00:09:19,776 --> 00:09:22,866
And it also opens the
instrument up to more access

223
00:09:22,946 --> 00:09:24,946
to our NASA users
that are funded

224
00:09:24,946 --> 00:09:27,606
by the Science Mission
Directorate in studies

225
00:09:27,606 --> 00:09:28,536
of the Earth's system.

226
00:09:29,246 --> 00:09:30,986
So we're excited
about that transition.

227
00:09:31,276 --> 00:09:34,416
And I wanted to close by
showing you one example

228
00:09:34,416 --> 00:09:36,516
of what the Environmental
Protection Agency has done

229
00:09:36,516 --> 00:09:37,616
with hyperspectral data.

230
00:09:38,266 --> 00:09:41,216
They had a Pathfinder Innovation
Project Exploratory Grant

231
00:09:41,346 --> 00:09:43,846
from their office of research
and development at EPA,

232
00:09:44,116 --> 00:09:45,446
and this is one of
the results of those.

233
00:09:45,446 --> 00:09:46,806
This is Pensacola Bay, Florida.

234
00:09:47,216 --> 00:09:49,506
And if you see the little
red parts of that image,

235
00:09:49,506 --> 00:09:51,906
they took data from HICO
and they processed it,

236
00:09:51,906 --> 00:09:53,946
and those little
red areas represent

237
00:09:53,946 --> 00:09:57,036
where there is significant
nitrogen coming into the Bay

238
00:09:57,036 --> 00:09:59,986
and causing blooms of
algae, and so they use this

239
00:10:00,126 --> 00:10:02,446
by combining their
in-water measurements

240
00:10:02,446 --> 00:10:03,996
with the remote sensing
measurements.

241
00:10:03,996 --> 00:10:05,986
They've used it to
develop a predictive system

242
00:10:06,336 --> 00:10:08,536
that they can use for
monitoring the water quality

243
00:10:08,816 --> 00:10:09,786
in Pensacola Bay.

244
00:10:10,186 --> 00:10:12,756
They're now working to
expand this to more bays

245
00:10:12,756 --> 00:10:14,986
around the Gulf Coast
region, and even to look

246
00:10:14,986 --> 00:10:19,916
at other EPA regions, and
see if they can extend this.

247
00:10:20,356 --> 00:10:24,136
So both the research
oceanographers at EPA,

248
00:10:24,136 --> 00:10:27,036
as well as their Office
of Research, is continuing

249
00:10:27,036 --> 00:10:28,246
to support expanded use.

250
00:10:28,736 --> 00:10:30,936

So this is the kind
of use of HICO

251
00:10:31,256 --> 00:10:34,266
as a national laboratory
facility

252
00:10:34,266 --> 00:10:36,586
that really benefits
our life here on Earth,

253
00:10:36,586 --> 00:10:39,786
and will also be extended
to additional users

254
00:10:39,786 --> 00:10:41,856
because of HICO becoming
an ISS facility.

255
00:10:42,926 --> 00:10:45,746
So that summary really
just touches the surface.

256
00:10:45,926 --> 00:10:49,296
I urge you to look at the press
kit on NASA.gov to see all

257
00:10:49,296 --> 00:10:51,656
of those hundreds of
investigations going on.