1
00:00:01,046 --> 00:00:02,586
>> Brandi Dean: Today we
have with us Tara Ruttley,

2
00:00:02,586 --> 00:00:07,666
who is an ISS Program Scientist,
Associate Program Scientist.

3
00:00:07,666 --> 00:00:10,906
Tell us a little bit about some
work we saw going on yesterday

4
00:00:10,906 --> 00:00:15,256
in the Kibo Laboratory where
engineer [inaudible] was setting

5
00:00:15,256 --> 00:00:16,936
up the aquatic habitat.

6
00:00:17,256 --> 00:00:18,416
Thanks so much for
joining us, Tara.

7
00:00:18,416 --> 00:00:20,726
>> Tara Ruttley: It's
really good to be back.

8
00:00:20,726 --> 00:00:21,646
I love talking to you guys

9
00:00:21,646 --> 00:00:23,606
and sharing the science
that's happening and so, yeah,

10
00:00:23,606 --> 00:00:27,776
it sounds like the JAXA Aquatic
Habitat is making its way

11
00:00:27,776 --> 00:00:30,256

on the station and the
crew is assembling it,

12
00:00:30,716 --> 00:00:34,636
and I really think this
is a really fun facility

13
00:00:34,636 --> 00:00:38,606
for future investigations
because it introduces a new type

14
00:00:38,606 --> 00:00:42,146
of physiological model
and that's a fish.

15
00:00:42,146 --> 00:00:45,956
So, the Space Station will get
its first tank so to speak.

16
00:00:45,956 --> 00:00:47,686
>> Brandi Dean: Is it
basically like an aquarium or?

17
00:00:47,686 --> 00:00:49,836
>> Tara Ruttley: Yeah, the
way the hardware is set up is

18
00:00:49,836 --> 00:00:52,646
that it's a system of two
aquariums and each one is

19
00:00:52,646 --> 00:00:56,086
about half a liter and the
system can support anywhere

20
00:00:56,086 --> 00:01:00,956
from 8 to 12 fish if they're
zebrafish or medaka fish;

21
00:01:00,956 --> 00:01:05,456

those are the two types
that will be studied here.

22
00:01:06,066 --> 00:01:09,656
The system is basically kind
of a lot like what you'd see

23
00:01:09,656 --> 00:01:11,586
on the ground in terms of
keeping your fish healthy.

24
00:01:11,586 --> 00:01:13,706
You've got an environmental
control system

25
00:01:14,136 --> 00:01:16,916
that has a biological filter
that filters out the waste.

26
00:01:17,176 --> 00:01:19,836
There's a lighting control
system and LED version

27
00:01:20,096 --> 00:01:23,686
that gives night and day,
light and dark cycles

28
00:01:23,686 --> 00:01:25,206
so the fish have cues
because you don't get

29
00:01:25,246 --> 00:01:26,736
that on the Space Station.

30
00:01:26,736 --> 00:01:28,666
There's automatic
feeders for the fish

31
00:01:29,016 --> 00:01:30,846
and there's an oxygenation

system

32
00:01:31,046 --> 00:01:32,466
that make sure the
fish get oxygen

33
00:01:32,466 --> 00:01:33,616
and water that they need too.

34
00:01:33,666 --> 00:01:37,076
So, it's a nice big
facility that will be located

35
00:01:37,076 --> 00:01:39,726
in the Kibo module
of the Space Station

36
00:01:39,726 --> 00:01:43,826
and I think the first set of
fish are scheduled to go up here

37
00:01:43,826 --> 00:01:44,876
in the fall on a
[inaudible] flight

38
00:01:44,966 --> 00:01:45,236
>> Brandi Dean: Okay.

39
00:01:45,346 --> 00:01:46,866
>> Tara Ruttley: So
it's pretty exciting.

40
00:01:46,866 --> 00:01:48,836
>> Brandi Dean: For some reason
I'm imagining this, you know,

41
00:01:49,026 --> 00:01:51,286
the little plastic bags that
you carry home from a fair

42
00:01:51,286 --> 00:01:53,226
when you win a gold fish
and probably not like that.

43
00:01:53,226 --> 00:01:53,956
>> Tara Ruttley:
Not exactly, right,

44
00:01:53,956 --> 00:01:56,776
because space flight is a little
bit more complicated than that.

45
00:01:56,776 --> 00:01:59,636
These fish will go up in
a small round container

46
00:01:59,636 --> 00:02:03,136
that will be loaded
and they have membranes

47
00:02:03,136 --> 00:02:05,766
that allow exchange of air
for the fish loaded with water

48
00:02:06,286 --> 00:02:07,736
and then launched
up on a [inaudible]

49
00:02:07,736 --> 00:02:10,456
and then automatically
inserted into the habitat.

50
00:02:10,646 --> 00:02:13,166
When this piece of hardware
gets inserted into the habitat,

51
00:02:13,166 --> 00:02:15,396
it will release the
fish into the aquarium.

52
00:02:15,396 --> 00:02:17,766
So, it's pretty exciting.

53
00:02:17,766 --> 00:02:20,026
This isn't the first time that
we've flown a fish in space.

54
00:02:20,536 --> 00:02:23,936
Our JAXA colleagues have had
a history of good experience

55
00:02:23,936 --> 00:02:26,226
with especially zebrafish
and medaka fish;

56
00:02:26,226 --> 00:02:27,136
they've flown in space.

57
00:02:27,136 --> 00:02:28,596
>> Brandi Dean: That's
what's going to be in this.

58
00:02:28,836 --> 00:02:29,036
>> Tara Ruttley: Yes.

59
00:02:29,446 --> 00:02:32,636
Particularly they flew on the
early space shuttle flights,

60
00:02:32,636 --> 00:02:33,886
the space [inaudible] flights,

61
00:02:33,886 --> 00:02:36,716
and they were particularly
looking at changes

62
00:02:36,776 --> 00:02:39,466
in the fish vestibular system
or the system responsible

63
00:02:39,466 --> 00:02:43,216
for balance and that plays a
big role in motion sickness.

64
00:02:43,596 --> 00:02:47,766
So, the longest that they've
ever flown fish were 16 days

65
00:02:47,766 --> 00:02:48,696
on a shuttle flight.

66
00:02:49,006 --> 00:02:51,556
So what we're looking at
now for Space Station is

67
00:02:51,556 --> 00:02:53,476
about a 90-day flight.

68
00:02:54,136 --> 00:02:56,696
So we want to be
able to breed fish

69
00:02:56,696 --> 00:02:58,046
over 3 different generations.

70
00:02:58,086 --> 00:03:00,856
So first set of fish will
be born on the ground;

71
00:03:00,856 --> 00:03:05,706
launched into space; survive
ideally; reproduce in space,

72
00:03:05,836 --> 00:03:08,926
so they'll have children;
and then after that

73
00:03:08,926 --> 00:03:10,846

that generation will
produce more fish

74
00:03:10,846 --> 00:03:13,836
that were pure space
bred and developed.

75
00:03:14,216 --> 00:03:16,666
So the things that the
scientists want to look

76
00:03:16,666 --> 00:03:18,356
at when we're talking about
looking at these fish,

77
00:03:18,356 --> 00:03:19,586
why would you even
want to do that?

78
00:03:19,996 --> 00:03:23,216
Longer exposure to space flight
tells us more about something

79
00:03:23,216 --> 00:03:25,396
that might be applicable
to the crew health.

80
00:03:25,396 --> 00:03:27,496
For example, you
can get a good look

81
00:03:27,546 --> 00:03:30,526
at these particular
fish muscle system,

82
00:03:30,946 --> 00:03:32,886
their skeletal system
and, you know,

83
00:03:32,886 --> 00:03:35,836

crew on long-duration space
flights have a lot of changes

84
00:03:35,836 --> 00:03:38,086
in their muscle and
their bone systems

85
00:03:38,476 --> 00:03:40,736
and so we can get a
little bit of information

86
00:03:40,736 --> 00:03:44,116
from how these fish develop and
the longer they stay as well

87
00:03:44,116 --> 00:03:45,186
through their bone and muscle.

88
00:03:45,566 --> 00:03:47,846
We also can look at
effects of radiation

89
00:03:47,846 --> 00:03:50,346
on these particular fish
as well and, in fact,

90
00:03:50,606 --> 00:03:52,736
we may glean some really
interesting information

91
00:03:52,736 --> 00:03:56,206
about how they develop, early
development, on Space Station

92
00:03:56,206 --> 00:03:58,566
because a lot of the
way even we develop,

93
00:03:58,566 --> 00:03:59,756
everything that develops,

94
00:03:59,756 --> 00:04:02,266
every living organism
has this response

95
00:04:02,326 --> 00:04:05,296
to gravity they develop
based on this gravity vector.

96
00:04:05,296 --> 00:04:06,876
So it would be really
interesting

97
00:04:06,876 --> 00:04:09,736
to see the development
progression in a situation

98
00:04:09,736 --> 00:04:12,116
where you take that microgravity
environment away how will these

99
00:04:12,116 --> 00:04:12,906
fish turn out?

100
00:04:13,526 --> 00:04:17,296
So, I know the crew that
gets these fish are excited.

101
00:04:17,296 --> 00:04:18,346
I've talked to them about it

102
00:04:18,346 --> 00:04:20,496
and they're anxious
to get going on it.

103
00:04:20,496 --> 00:04:24,016
It sounds like the
development is progressing along

104

00:04:24,086 --> 00:04:27,126
and so the first set
of experiments is going

105
00:04:27,126 --> 00:04:30,926
to be called Medaka osteo class
and that will start in the fall

106
00:04:31,196 --> 00:04:34,526
when these fish go up
and osteo class is a type

107
00:04:34,526 --> 00:04:37,846
of cell that's very active
in breaking down the bone,

108
00:04:37,846 --> 00:04:41,586
it's normal, and microgravity
there seems to be process

109
00:04:41,586 --> 00:04:44,666
by which they prevail
and go kind

110
00:04:44,666 --> 00:04:46,256
of a little bit in
hyperactive mode.

111
00:04:46,436 --> 00:04:48,456
As a result, you tend
to break down more bone.

112
00:04:48,886 --> 00:04:51,996
So, the investigators
will look at the activity

113
00:04:51,996 --> 00:04:53,886
of the osteo class in these fish

114
00:04:53,886 --> 00:04:55,846

after their long duration
stay on microgravity.

115
00:04:56,466 --> 00:04:56,646
>> Brandi Dean: Okay.

116
00:04:56,646 --> 00:04:57,906
Well, a couple of things.

117
00:04:57,906 --> 00:05:01,316
You mentioned that breeding
them in the Space Station.

118
00:05:01,736 --> 00:05:07,096
I know we brought up before
on purpose mice and spiders

119
00:05:07,096 --> 00:05:09,896
and butterflies, but
have we don't anything

120
00:05:09,896 --> 00:05:11,716
that we have had
several generations of?

121
00:05:12,256 --> 00:05:14,416
>> Tara Ruttley: No, nothing
that's been this long term

122
00:05:14,416 --> 00:05:15,576
in terms of generational.

123
00:05:15,576 --> 00:05:18,556
We've sent up, actually
we've sent up seedlings,

124
00:05:18,556 --> 00:05:21,946
I think plants might be a good
way to think about it and so one

125
00:05:21,946 --> 00:05:23,196
of the challenges
of plant growth is

126
00:05:23,196 --> 00:05:26,416
to just get multi-generations
of seed-to-seed formation.

127
00:05:26,706 --> 00:05:31,206
So, this will be I think the
longest going investigation set

128
00:05:31,286 --> 00:05:33,716
in terms of generational
producing of living organisms.

129
00:05:33,716 --> 00:05:36,466
>> Brandi Dean: So not only
how the ones that started

130
00:05:36,466 --> 00:05:39,256
on earth adapt to
microgravity but also the ones

131
00:05:39,256 --> 00:05:41,086
who have never experienced
gravity at all.

132
00:05:41,086 --> 00:05:41,786
>> Tara Ruttley:
You got that right.

133
00:05:42,066 --> 00:05:42,306
Yeah.

134
00:05:42,606 --> 00:05:43,966
>> Brandi Dean: Interesting.

135
00:05:44,316 --> 00:05:48,686

Let's see you also said I think
that it's going to last 90 days

136
00:05:48,796 --> 00:05:53,346
so that gives us a few
crew that will be involved.

137
00:05:53,346 --> 00:05:56,956
So they get special training
for it or is it just throw

138
00:05:56,956 --> 00:05:58,196
in some fish flakes or?

139
00:05:58,196 --> 00:05:59,926
>> Tara Ruttley: I think the
training they get is specific

140
00:05:59,926 --> 00:06:04,896
to injecting the fish into their
home and then removing them

141
00:06:04,896 --> 00:06:07,176
when the investigation
is over as well

142
00:06:07,176 --> 00:06:10,316
as they may add some flakes
to the automatic feeder

143
00:06:10,316 --> 00:06:11,976
but otherwise it's
a see through tank

144
00:06:11,976 --> 00:06:17,046
so they can watch the activity,
these fish swim around,

145
00:06:17,046 --> 00:06:19,486
so it will be interesting to

see what their perspective is

146
00:06:19,486 --> 00:06:21,396
of behavior, you know,
what the crew thinks

147
00:06:21,446 --> 00:06:24,126
about having fish on orbit.

148
00:06:24,946 --> 00:06:27,096
>> Brandi Dean: Well, this
may reveal my ignorance,

149
00:06:27,096 --> 00:06:31,276
but I guess we practice
for space walks in water

150
00:06:31,836 --> 00:06:33,216
to simulate microgravity.

151
00:06:33,216 --> 00:06:34,876
The fish are already in water.

152
00:06:34,876 --> 00:06:37,596
Will it feel very
different to them or?

153
00:06:37,596 --> 00:06:39,936
>> Tara Ruttley: I guess
we'll find out, you know,

154
00:06:39,936 --> 00:06:43,516
the vestibular study showed
some changes in their inner ear

155
00:06:43,516 --> 00:06:46,066
so there's definitely
something going on in terms

156

00:06:46,066 --> 00:06:49,016
of their physiology I
guess you could say.

157
00:06:49,476 --> 00:06:54,446
So, it will be interesting
to see how that manifests

158
00:06:54,446 --> 00:06:57,886
and especially with that
third generation, you know,

159
00:06:57,886 --> 00:07:00,126
it's hard to say since we
haven't gone that far before.

160
00:07:00,466 --> 00:07:00,786
>> Brandi Dean: Okay.

161
00:07:00,876 --> 00:07:03,246
I guess also this could
eventually be used

162
00:07:03,246 --> 00:07:05,846
for amphibians possibly as well?

163
00:07:06,046 --> 00:07:06,296
>> Tara Ruttley: Yeah.

164
00:07:06,296 --> 00:07:08,896
The tank is pretty versatile.

165
00:07:09,146 --> 00:07:10,886
Just imagine what you
could put in your tank

166
00:07:10,886 --> 00:07:12,126
at home that could survive.

167

00:07:12,126 --> 00:07:13,306
Maybe frogs, right?

168
00:07:13,306 --> 00:07:14,946
Or snails or eels even.

169
00:07:14,946 --> 00:07:20,016
[laughter] I was just at
the aquarium a few days ago

170
00:07:20,016 --> 00:07:21,626
with my daughter and
we were looking at fish

171
00:07:21,626 --> 00:07:24,306
and I'm going what could
survive in that aquatic?

172
00:07:24,306 --> 00:07:26,886
I was wondering the same
thing myself so who knows.

173
00:07:26,886 --> 00:07:28,106
We have a long time
on Space Station.

174
00:07:28,106 --> 00:07:29,846
>> Brandi Dean: Have a
menagerie up there eventually.

175
00:07:30,086 --> 00:07:30,496
>> Tara Ruttley: That's right.

176
00:07:30,496 --> 00:07:30,846
Never know.

177
00:07:32,106 --> 00:07:32,536
>> Brandi Dean: All right.

178

00:07:32,536 --> 00:07:34,236
Thank you so much for
coming and talking with us.

179
00:07:34,236 --> 00:07:34,516
>> Tara Ruttley: You're welcome.

180
00:07:34,516 --> 00:07:35,336
>> Brandi Dean: I
really appreciate it.

181
00:07:35,336 --> 00:07:36,106
>> Tara Ruttley: It
was good to be here.

182
00:07:36,136 --> 00:07:37,526
>> Brandi Dean: Again,
this is Tara Ruttley,

183
00:07:37,586 --> 00:07:40,146
the Associate Program Scientist
for the Space Station talking

184
00:07:40,146 --> 00:07:41,996
with us about the
aquatic habitat

185
00:07:41,996 --> 00:07:45,316
that astronaut [inaudible]
put together yesterday