



1
00:00:10,230 --> 00:00:07,110
the conclusion of expedition 42 means

2
00:00:12,950 --> 00:00:10,240
it's time to talk about expedition 4142

3
00:00:14,950 --> 00:00:12,960
science with lead increment scientist dr

4
00:00:17,349 --> 00:00:14,960
vick cooley

5
00:00:19,189 --> 00:00:17,359
in almost six months uh for this crew

6
00:00:21,670 --> 00:00:19,199
plus the one before it how many

7
00:00:25,029 --> 00:00:21,680
experiments did the space station crews

8
00:00:28,470 --> 00:00:25,039
take part in on uh increment 4142 there

9
00:00:30,550 --> 00:00:28,480
were 258 investigations officially

10
00:00:33,270 --> 00:00:30,560
logged and that ranges all the way from

11
00:00:35,430 --> 00:00:33,280
the very simple uh four inch cube type

12
00:00:37,830 --> 00:00:35,440
of experiments that can be plugged into

13
00:00:39,830 --> 00:00:37,840

a usb port for power and data

14

00:00:42,790 --> 00:00:39,840

all the way up to the extremely complex

15

00:00:45,510 --> 00:00:42,800

and massive alpha magnetic spectrometer

16

00:00:47,590 --> 00:00:45,520

there was a group of biology experiments

17

00:00:50,069 --> 00:00:47,600

that go under the the umbrella

18

00:00:52,150 --> 00:00:50,079

designation of gene lab

19

00:00:54,709 --> 00:00:52,160

remind me of what that was and and how

20

00:00:56,310 --> 00:00:54,719

that went well it went well we've had uh

21

00:00:59,670 --> 00:00:56,320

two experiments so far that will

22

00:01:01,830 --> 00:00:59,680

contribute data to the gene lab

23

00:01:04,950 --> 00:01:01,840

the gene lab is is basically a protein

24

00:01:07,670 --> 00:01:04,960

data bank we've had a protein data bank

25

00:01:09,590 --> 00:01:07,680

concept now for about 20 years where

26
00:01:10,950 --> 00:01:09,600
biologists from around the world as they

27
00:01:12,390 --> 00:01:10,960
discover

28
00:01:13,429 --> 00:01:12,400
gene sequences

29
00:01:15,510 --> 00:01:13,439
in

30
00:01:17,749 --> 00:01:15,520
model organisms primarily like fruit

31
00:01:19,749 --> 00:01:17,759
flies fish and worms and

32
00:01:22,950 --> 00:01:19,759
and rodents

33
00:01:24,950 --> 00:01:22,960
will record those gene sequences those

34
00:01:26,710 --> 00:01:24,960
protein sequences and in genes and

35
00:01:29,990 --> 00:01:26,720
proteins are kind of synonymous here

36
00:01:32,630 --> 00:01:30,000
because genes encode proteins

37
00:01:35,030 --> 00:01:32,640
and now the gene lab will be a protein

38
00:01:37,670 --> 00:01:35,040

data bank that's open to the public and

39

00:01:39,190 --> 00:01:37,680

in it will be

40

00:01:42,389 --> 00:01:39,200

data from

41

00:01:43,990 --> 00:01:42,399

organisms and how their genes change in

42

00:01:45,830 --> 00:01:44,000

xero g

43

00:01:47,590 --> 00:01:45,840

so this can be from

44

00:01:49,270 --> 00:01:47,600

genetic mutations that are passed on

45

00:01:52,149 --> 00:01:49,280

from one generation to another or

46

00:01:53,109 --> 00:01:52,159

epigenetic gene mutations that happen

47

00:01:55,109 --> 00:01:53,119

or

48

00:01:58,149 --> 00:01:55,119

that happen outside of the

49

00:02:00,149 --> 00:01:58,159

uh micro rna

50

00:02:01,990 --> 00:02:00,159

transcoding of that genetic material

51
00:02:03,830 --> 00:02:02,000
into proteins and there'll be other

52
00:02:07,030 --> 00:02:03,840
experiments that will contribute to that

53
00:02:09,270 --> 00:02:07,040
gene lab will be an ongoing

54
00:02:11,750 --> 00:02:09,280
you know for the foreseeable future tens

55
00:02:14,309 --> 00:02:11,760
20 types of years uh where we will

56
00:02:16,710 --> 00:02:14,319
constantly add to this this database

57
00:02:20,830 --> 00:02:16,720
this protein data bank if you will

58
00:02:24,309 --> 00:02:20,840
now of organisms that have either been

59
00:02:26,229 --> 00:02:24,319
uh born or hatched in space or flown to

60
00:02:28,470 --> 00:02:26,239
space after they've been born to see how

61
00:02:30,949 --> 00:02:28,480
their genetic material changes how as

62
00:02:32,150 --> 00:02:30,959
their bodies adapt to weightlessness a

63
00:02:33,350 --> 00:02:32,160

couple of other things that happened

64

00:02:34,550 --> 00:02:33,360

during this time that i wanted to get

65

00:02:37,670 --> 00:02:34,560

you to touch on

66

00:02:39,430 --> 00:02:37,680

one of them is a photography not an

67

00:02:41,350 --> 00:02:39,440

experiment with photography it's

68

00:02:43,589 --> 00:02:41,360

involved with crews not taking pictures

69

00:02:46,229 --> 00:02:43,599

of the earth but pictures of the moon

70

00:02:48,070 --> 00:02:46,239

what what is this moon imagery okay so

71

00:02:51,910 --> 00:02:48,080

this is all about navigation and a

72

00:02:54,229 --> 00:02:51,920

backup system for nasa's next manned uh

73

00:02:56,229 --> 00:02:54,239

vehicle known as the orion capsule which

74

00:02:57,830 --> 00:02:56,239

would go to mars

75

00:02:59,509 --> 00:02:57,840

perhaps back to the moon and to an

76
00:03:02,070 --> 00:02:59,519
asteroid

77
00:03:05,030 --> 00:03:02,080
so there's a primary navigation system

78
00:03:05,910 --> 00:03:05,040
but if it should fail um

79
00:03:10,149 --> 00:03:05,920
the

80
00:03:12,229 --> 00:03:10,159
would be have to resort to techniques

81
00:03:14,869 --> 00:03:12,239
that the ancient mariners use just

82
00:03:17,589 --> 00:03:14,879
navigation by stars and the moon

83
00:03:19,509 --> 00:03:17,599
so the moon imagery

84
00:03:21,910 --> 00:03:19,519
requirements that we just did over this

85
00:03:23,509 --> 00:03:21,920
past weekend terry wurtz uh photographed

86
00:03:27,270 --> 00:03:23,519
the moon from

87
00:03:30,149 --> 00:03:27,280
the uh node two zenith window that's in

88
00:03:31,830 --> 00:03:30,159

the hatch for that on that node port but

89

00:03:34,149 --> 00:03:31,840

he also photographed the moon from the

90

00:03:36,630 --> 00:03:34,159

cupola the primary objective was to get

91

00:03:38,390 --> 00:03:36,640

the imagery from the node because it had

92

00:03:39,670 --> 00:03:38,400

the most direct shot it's on the

93

00:03:41,430 --> 00:03:39,680

xenoside

94

00:03:42,869 --> 00:03:41,440

uh so it was facing away from earth

95

00:03:45,509 --> 00:03:42,879

rather than down towards the earth

96

00:03:48,869 --> 00:03:45,519

remember we're only 250 miles so high so

97

00:03:52,789 --> 00:03:48,879

the moon is still very far away

98

00:03:55,110 --> 00:03:52,799

so this purpose was to see how well that

99

00:03:56,630 --> 00:03:55,120

imagery and it's necessary to do this

100

00:03:58,390 --> 00:03:56,640

from low earth orbit to avoid

101
00:04:00,869 --> 00:03:58,400
atmospheric distortion that we would get

102
00:04:03,670 --> 00:04:00,879
if we tried to calibrate this

103
00:04:06,390 --> 00:04:03,680
this it's really a star sensor that

104
00:04:08,869 --> 00:04:06,400
would be used as this backup navigation

105
00:04:10,869 --> 00:04:08,879
system but it has to be calibrated once

106
00:04:13,589 --> 00:04:10,879
it's in space and what you calibrate it

107
00:04:15,589 --> 00:04:13,599
with would be the moon because it's a of

108
00:04:16,789 --> 00:04:15,599
a known brightness and and obviously

109
00:04:20,069 --> 00:04:16,799
it's very big

110
00:04:22,710 --> 00:04:20,079
uh it was made to fill up 60 to 70 uh

111
00:04:24,550 --> 00:04:22,720
pixels in diameter of the moon shot so

112
00:04:27,110 --> 00:04:24,560
it is still quite a bit small in this

113
00:04:29,110 --> 00:04:27,120

picture but it is about 60 to 70 pixels

114

00:04:31,430 --> 00:04:29,120

across and that's enough for an accurate

115

00:04:33,830 --> 00:04:31,440

determination so that the sensor which

116

00:04:36,629 --> 00:04:33,840

would then look at stars

117

00:04:38,390 --> 00:04:36,639

could very accurately tell how bright

118

00:04:40,310 --> 00:04:38,400

each of those stars is using this as a

119

00:04:42,310 --> 00:04:40,320

reference using this as a reference and

120

00:04:44,390 --> 00:04:42,320

it's the brightness of the stars in

121

00:04:46,550 --> 00:04:44,400

addition to the star pattern it's really

122

00:04:47,990 --> 00:04:46,560

the brightness that that

123

00:04:49,990 --> 00:04:48,000

gives you certainty that you've

124

00:04:51,830 --> 00:04:50,000

identified your location and more

125

00:04:52,870 --> 00:04:51,840

importantly which way is it back to

126
00:04:55,430 --> 00:04:52,880
earth

127
00:04:57,909 --> 00:04:55,440
also in the last couple of weeks we saw

128
00:04:59,189 --> 00:04:57,919
more than a dozen small satellites

129
00:05:01,110 --> 00:04:59,199
deployed

130
00:05:03,830 --> 00:05:01,120
from the space station

131
00:05:05,430 --> 00:05:03,840
tell me about this cubesats uh program

132
00:05:07,189 --> 00:05:05,440
and how well that's working

133
00:05:09,430 --> 00:05:07,199
it's working extremely well there's uh

134
00:05:11,350 --> 00:05:09,440
there's so much demand for these cubesat

135
00:05:13,189 --> 00:05:11,360
launches that we simply can't keep up

136
00:05:15,430 --> 00:05:13,199
with it at this point so we're expanding

137
00:05:18,310 --> 00:05:15,440
our capability to do that right now we

138
00:05:20,150 --> 00:05:18,320

can launch cubesats uh once per month

139

00:05:22,790 --> 00:05:20,160

through the japanese airlock and there

140

00:05:26,230 --> 00:05:22,800

you see two satellites just display

141

00:05:29,110 --> 00:05:26,240

deployed from one of the silos there are

142

00:05:30,950 --> 00:05:29,120

16 silos in that particular case

143

00:05:33,909 --> 00:05:30,960

so

144

00:05:36,550 --> 00:05:33,919

over the past 10 days we deployed 16

145

00:05:39,029 --> 00:05:36,560

satellites total 12 of them were from a

146

00:05:41,270 --> 00:05:39,039

company called planet doves they're

147

00:05:43,510 --> 00:05:41,280

called dove sats and as you see how

148

00:05:46,629 --> 00:05:43,520

small they are they're those cases they

149

00:05:47,670 --> 00:05:46,639

were four inch by four inch by 12 inches

150

00:05:49,909 --> 00:05:47,680

long

151

00:05:52,310 --> 00:05:49,919

so each of those satellites

152

00:05:55,189 --> 00:05:52,320

there are 28 of them that will make up a

153

00:05:57,270 --> 00:05:55,199

flock that will cover the in at least

154

00:05:58,790 --> 00:05:57,280

the earth through plus and minus 58

155

00:06:00,629 --> 00:05:58,800

degrees latitude

156

00:06:02,950 --> 00:06:00,639

and can provide

157

00:06:05,670 --> 00:06:02,960

near real-time imagery whereas the

158

00:06:07,909 --> 00:06:05,680

current capability from uh

159

00:06:09,990 --> 00:06:07,919

very expensive satellite services that

160

00:06:11,990 --> 00:06:10,000

provide imagery it takes about two or

161

00:06:14,790 --> 00:06:12,000

three weeks to make a request and

162

00:06:16,790 --> 00:06:14,800

actually get the product because there's

163

00:06:19,670 --> 00:06:16,800

only one satellite in that case maybe

164

00:06:21,670 --> 00:06:19,680

two and there don't fly over that part

165

00:06:24,710 --> 00:06:21,680

of the earth that frequently but with a

166

00:06:26,790 --> 00:06:24,720

big flock of 28 of these small very exp

167

00:06:28,309 --> 00:06:26,800

inexpensive satellites

168

00:06:31,350 --> 00:06:28,319

uh you can get

169

00:06:33,029 --> 00:06:31,360

a 24-hour turnaround that's the goal of

170

00:06:35,830 --> 00:06:33,039

the company called planet doves is to

171

00:06:38,629 --> 00:06:35,840

make this type of imagery available

172

00:06:39,990 --> 00:06:38,639

its resolution is about 10 to 15 feet

173

00:06:42,150 --> 00:06:40,000

per pixel

174

00:06:43,909 --> 00:06:42,160

right so you can identify for example a

175

00:06:46,309 --> 00:06:43,919

tree canopy

176
00:06:48,950 --> 00:06:46,319
and cubesats are launching satellites

177
00:06:51,270 --> 00:06:48,960
for private companies and student groups

178
00:06:54,150 --> 00:06:51,280
and lots of different uh organizations

179
00:06:56,070 --> 00:06:54,160
yes the uh as i mentioned we launched 16

180
00:06:57,909 --> 00:06:56,080
12 of those were for planet doves the

181
00:06:59,749 --> 00:06:57,919
other four were one was for

182
00:07:02,950 --> 00:06:59,759
massachusetts institute of technology

183
00:07:05,029 --> 00:07:02,960
there were some companies that launched

184
00:07:07,189 --> 00:07:05,039
another satellite to test the global

185
00:07:09,830 --> 00:07:07,199
star navigation system which is

186
00:07:12,629 --> 00:07:09,840
different from gps

187
00:07:13,749 --> 00:07:12,639
and tdrs but it it's another space

188
00:07:15,430 --> 00:07:13,759

network

189

00:07:18,309 --> 00:07:15,440

it was testing to see if it could use

190

00:07:20,309 --> 00:07:18,319

that network to do command and data

191

00:07:21,670 --> 00:07:20,319

transfer

192

00:07:22,790 --> 00:07:21,680

one of the other very interesting

193

00:07:26,629 --> 00:07:22,800

experiments

194

00:07:29,589 --> 00:07:26,639

uh attempts to return samples from the

195

00:07:30,870 --> 00:07:29,599

space station in as little as 18 hours

196

00:07:33,430 --> 00:07:30,880

so

197

00:07:34,469 --> 00:07:33,440

we know that we just saw in the previous

198

00:07:36,230 --> 00:07:34,479

footage

199

00:07:39,189 --> 00:07:36,240

of the soyuz that just returned how

200

00:07:40,629 --> 00:07:39,199

scorched the surface of that capsule was

201
00:07:42,230 --> 00:07:40,639
because it returned through the earth's

202
00:07:43,270 --> 00:07:42,240
atmosphere in a matter of about four

203
00:07:44,950 --> 00:07:43,280
hours

204
00:07:46,309 --> 00:07:44,960
so you don't want to come in that quick

205
00:07:47,909 --> 00:07:46,319
but you want to come in as quick as

206
00:07:50,150 --> 00:07:47,919
possible because you're trying to return

207
00:07:52,230 --> 00:07:50,160
biological samples and they're probably

208
00:07:54,230 --> 00:07:52,240
passively refrigerated so you know

209
00:07:56,869 --> 00:07:54,240
getting them back within 18 to 24 hours

210
00:07:59,029 --> 00:07:56,879
is is kind of the goal and that's where

211
00:08:00,869 --> 00:07:59,039
tech edsat is headed that was a

212
00:08:03,430 --> 00:08:00,879
similarly sized

213
00:08:06,309 --> 00:08:03,440

uh satellite as the ones we saw

214

00:08:08,790 --> 00:08:06,319

it had a deployable aero break which is

215

00:08:09,510 --> 00:08:08,800

you can think of it as a parachute but

216

00:08:13,270 --> 00:08:09,520

when

217

00:08:16,309 --> 00:08:13,280

that much atmosphere to

218

00:08:18,629 --> 00:08:16,319

grab a hold of and and produce drag but

219

00:08:20,309 --> 00:08:18,639

even a small aero break which is kind of

220

00:08:23,510 --> 00:08:20,319

looks like a parachute does produce

221

00:08:24,550 --> 00:08:23,520

enough drag to allow it to re-enter not

222

00:08:26,710 --> 00:08:24,560

quite as

223

00:08:28,869 --> 00:08:26,720

quickly as the soyuz but over an 18 to

224

00:08:30,550 --> 00:08:28,879

24-hour period to return biological

225

00:08:31,990 --> 00:08:30,560

samples be interesting to see how all of

226

00:08:34,469 --> 00:08:32,000

these things come out vic thanks very

227

00:08:36,709 --> 00:08:34,479

much for sharing the information dr vic

228

00:08:38,310 --> 00:08:36,719

cooley is the lead increment scientist