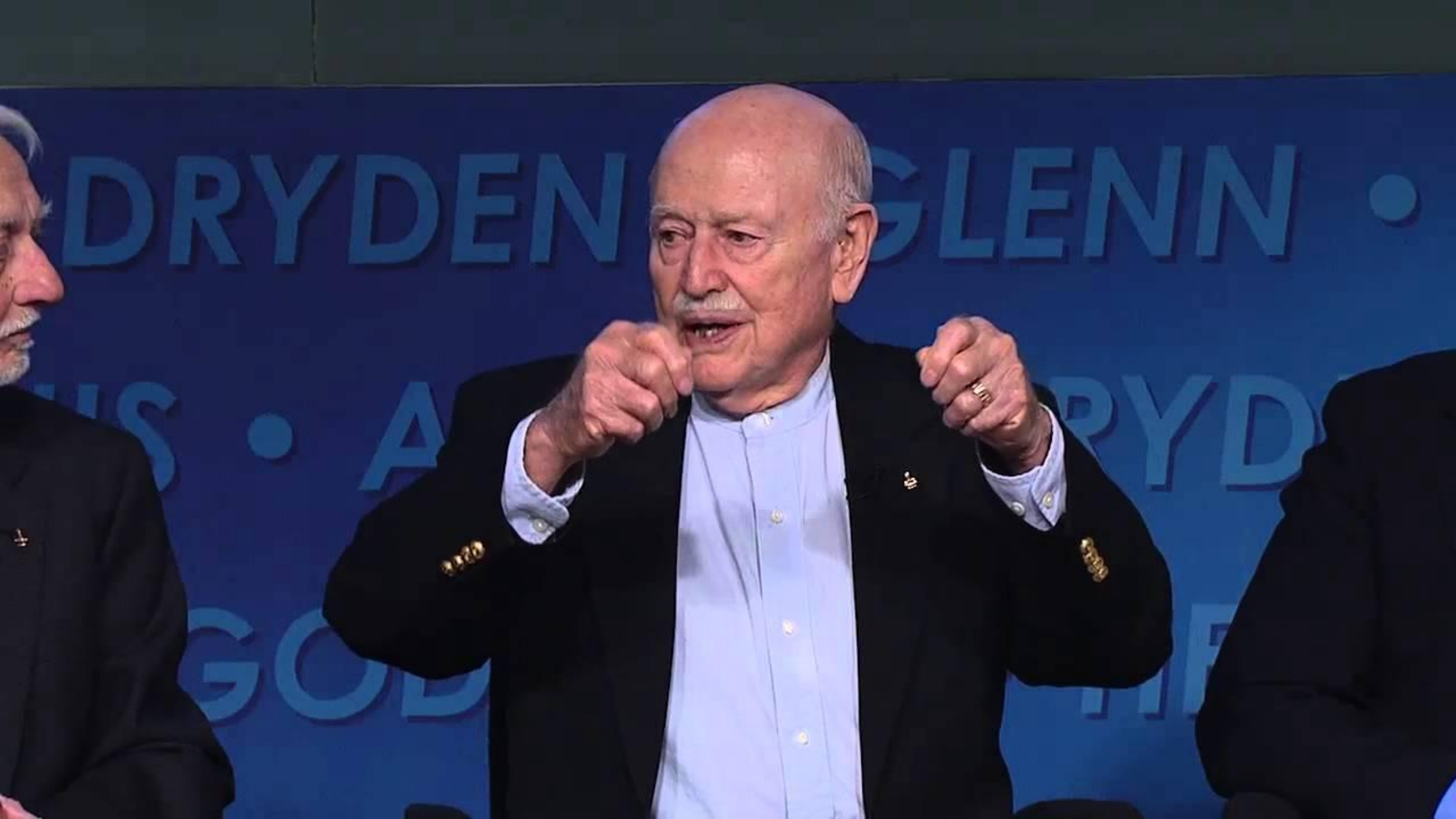
DRYDEN
GLENN

1
00:00:07,369 --> 00:00:04,730
hello and welcome to living off earth

2
00:00:09,950 --> 00:00:07,379
NASA's reflection on Skylab America's

3
00:00:12,259 --> 00:00:09,960
first space station and 40 years of us

4
00:00:13,970 --> 00:00:12,269
long-duration spaceflight I'm Lauren

5
00:00:17,390 --> 00:00:13,980
Worley and I'm your host for today's

6
00:00:19,310 --> 00:00:17,400
lively discussion years before Neil

7
00:00:21,349 --> 00:00:19,320
Armstrong's place one foot on the moon

8
00:00:23,410 --> 00:00:21,359
plans were already in the works for a

9
00:00:27,650 --> 00:00:23,420
long-term habitat in space

10
00:00:29,720 --> 00:00:27,660
Skylab rocketed to orbit in 1973 and the

11
00:00:33,860 --> 00:00:29,730
nine men who comprised the three crews

12
00:00:35,900 --> 00:00:33,870
that that went to space pioneered life

13
00:00:38,959 --> 00:00:35,910

and microgravity performing over 300

14
00:00:41,750 --> 00:00:38,969
experiments during their 171 collective

15
00:00:43,850 --> 00:00:41,760
days in space and all along the way they

16
00:00:46,549 --> 00:00:43,860
broke records not only for long-duration

17
00:00:47,540 --> 00:00:46,559
spaceflight but also for advancements in

18
00:00:50,090 --> 00:00:47,550
scientific and technological

19
00:00:52,819 --> 00:00:50,100
achievements we're joined today by two

20
00:00:55,069 --> 00:00:52,829
of those legendary astronauts astronaut

21
00:00:58,310 --> 00:00:55,079
Owen Garriott who was the science pilot

22
00:01:00,619 --> 00:00:58,320
onboard Skylab 3 and Jerry Carr who had

23
00:01:03,439 --> 00:01:00,629
commanded Skylab for mission we're also

24
00:01:05,509 --> 00:01:03,449
joined by Kevin Ford who's commander of

25
00:01:08,330 --> 00:01:05,519
expedition 34 to the International Space

26
00:01:09,950 --> 00:01:08,340
Station and we have with us two guys who

27
00:01:11,390 --> 00:01:09,960
are working here on the ground but are

28
00:01:13,310 --> 00:01:11,400
helping us get to space everyday

29
00:01:16,249 --> 00:01:13,320
Marshall Porterfield who's the director

30
00:01:18,890 --> 00:01:16,259
of space life and physical sciences here

31
00:01:20,990 --> 00:01:18,900
at NASA headquarters and Jason Cruzan

32
00:01:23,690 --> 00:01:21,000
director of advanced exploration systems

33
00:01:24,830 --> 00:01:23,700
also here at NASA we're gonna get to the

34
00:01:26,240 --> 00:01:24,840
questions of you guys here in the

35
00:01:28,249 --> 00:01:26,250
audience and those folks in our online

36
00:01:30,620 --> 00:01:28,259
community but before we do that we've

37
00:01:37,609 --> 00:01:30,630
got a quick video all about Skylab so

38
00:01:40,010 --> 00:01:37,619

let's let's go to the video Skylab

39
00:01:42,020 --> 00:01:40,020
starts in the dreams of the people who

40
00:01:44,030 --> 00:01:42,030
wanted to go into space for a long time

41
00:01:45,590 --> 00:01:44,040
really in the 20th century we saw people

42
00:01:47,480 --> 00:01:45,600
who were thinking about how do we get

43
00:01:50,780 --> 00:01:47,490
humanity off the planet Earth and into

44
00:01:52,120 --> 00:01:50,790
space there was a vision a long-term

45
00:01:54,730 --> 00:01:52,130
vision humans

46
00:01:56,950 --> 00:01:54,740
of exploring and going beyond higher

47
00:01:58,569 --> 00:01:56,960
farther faster there was a technical

48
00:02:01,810 --> 00:01:58,579
challenge there was the scientific

49
00:02:03,730 --> 00:02:01,820
interest there was the adventure and

50
00:02:06,990 --> 00:02:03,740
there was just simply the demonstration

51
00:02:10,630 --> 00:02:07,000
of managerial and organizational and

52
00:02:12,280 --> 00:02:10,640
industrial economic competence in a

53
00:02:14,949 --> 00:02:12,290
world that was contested

54
00:02:16,420 --> 00:02:14,959
so that was spiraling throughout the

55
00:02:18,759 --> 00:02:16,430
1960's they looked at a number of

56
00:02:21,009 --> 00:02:18,769
different ways in which you could take

57
00:02:25,360 --> 00:02:21,019
the Apollo materials look tickley saturn

58
00:02:27,460 --> 00:02:25,370
v and the apollo spacecraft and do space

59
00:02:30,309 --> 00:02:27,470
station like things with them so by the

60
00:02:31,920 --> 00:02:30,319
end of 1960s 1969 after the successes on

61
00:02:35,380 --> 00:02:31,930
the landing moon the attention turns to

62
00:02:38,259 --> 00:02:35,390
the space station program and Skylab is

63
00:02:40,390 --> 00:02:38,269

really born there being the program for

64
00:02:42,699 --> 00:02:40,400
human spaceflight during the early 1970s

65
00:02:44,979 --> 00:02:42,709
and to build our basis for experience

66
00:02:47,680 --> 00:02:44,989
and to address those important questions

67
00:02:49,930 --> 00:02:47,690
that we had which were could humans

68
00:02:53,229 --> 00:02:49,940
physiologically adapt to long periods of

69
00:02:56,800 --> 00:02:53,239
space early 1973 we ever did launch

70
00:02:58,360 --> 00:02:56,810
Skylab the Skylab Saturn 5 is sitting on

71
00:03:00,610 --> 00:02:58,370
one launch pad that the two blunts pads

72
00:03:02,080 --> 00:03:00,620
we have in the Apollo program Skylab is

73
00:03:04,360 --> 00:03:02,090
sitting on one launch pad just a little

74
00:03:06,460 --> 00:03:04,370
ways away on the other loss pad is this

75
00:03:07,539 --> 00:03:06,470
Saturn one vehicle with the command and

76
00:03:09,819 --> 00:03:07,549
service module because Scott I have

77
00:03:11,500 --> 00:03:09,829
launches one day and the vehicle with

78
00:03:19,980 --> 00:03:11,510
the first clue I was supposed to launch

79
00:03:26,420 --> 00:03:23,170
flipping off the pad now movie

80
00:03:29,480 --> 00:03:26,430
unfortunately when Skylab the laboratory

81
00:03:30,800 --> 00:03:29,490
goes up the micrometeoroids shield that

82
00:03:32,480 --> 00:03:30,810
was on it that also provided heat

83
00:03:34,460 --> 00:03:32,490
protection for the vehicle our rolls

84
00:03:36,320 --> 00:03:34,470
back jams into the solar arrays that

85
00:03:37,340 --> 00:03:36,330
there are two big five kilowatt each

86
00:03:39,290 --> 00:03:37,350
solar arrays that were supposed to

87
00:03:41,720 --> 00:03:39,300
deploy Skylab gets an orbit it's

88
00:03:44,780 --> 00:03:41,730

crippled and we're in big trouble

89
00:03:46,520 --> 00:03:44,790
because God needs that energy from those

90
00:03:48,920 --> 00:03:46,530
big solar arrays to operating for the

91
00:03:51,260 --> 00:03:48,930
mission to be successful and in ten days

92
00:03:54,260 --> 00:03:51,270
they quickly come up with a plan and

93
00:03:57,140 --> 00:03:54,270
people sew together a parasol sunshade

94
00:03:58,400 --> 00:03:57,150
that they can erect outside this station

95
00:04:00,560 --> 00:03:58,410
they came up with some equipment that

96
00:04:03,230 --> 00:04:00,570
the crews could use to try and unstick

97
00:04:05,210 --> 00:04:03,240
the giant solar array that was stuck and

98
00:04:07,400 --> 00:04:05,220
Pete Conrad and his crew this the first

99
00:04:10,490 --> 00:04:07,410
scallop crudo launched ten days later

100
00:04:12,500 --> 00:04:10,500
and save the entire program you have two

101
00:04:15,199 --> 00:04:12,510
and a half million dollar program would

102
00:04:16,370 --> 00:04:15,209
have gone down the drain if the crew

103
00:04:25,240 --> 00:04:16,380
hadn't gone up there and saved the

104
00:04:29,300 --> 00:04:27,650
story of the launch of the guy lab

105
00:04:32,110 --> 00:04:29,310
orbital workshop is one of those great

106
00:04:34,700 --> 00:04:32,120
triumph of things going bad and

107
00:04:36,590 --> 00:04:34,710
engineers and humans and astronauts

108
00:04:38,150 --> 00:04:36,600
working together to fix them they were

109
00:04:42,710 --> 00:04:38,160
very successful almost month-long

110
00:04:45,080 --> 00:04:42,720
mission and proved that in fact first

111
00:04:46,490 --> 00:04:45,090
the Skylab at work that humans are

112
00:04:48,920 --> 00:04:46,500
really important to those things and to

113
00:04:49,939 --> 00:04:48,930

get a lot of good scientific data and of

114
00:04:52,250 --> 00:04:49,949
course we had two more crews that

115
00:04:53,750 --> 00:04:52,260
launched later in the year the second

116
00:04:57,830 --> 00:04:53,760
Skylab crew was up for a longer period

117
00:04:59,300 --> 00:04:57,840
and you know those are lots of earth

118
00:05:01,430 --> 00:04:59,310
science experiments and lots of solar

119
00:05:03,469 --> 00:05:01,440
observations and then the third crew

120
00:05:05,030 --> 00:05:03,479
finally launches at the end of 1973 and

121
00:05:10,280 --> 00:05:05,040
early into 74 they're up for almost

122
00:05:12,080 --> 00:05:10,290
three months and they observe do solar

123
00:05:14,540 --> 00:05:12,090
observations numerous observations we do

124
00:05:16,370 --> 00:05:14,550
experiments with students this isn't the

125
00:05:18,740 --> 00:05:16,380
first NASA suit student experiments go

126
00:05:21,950 --> 00:05:18,750
on during Skylab the last crew leaves

127
00:05:24,560 --> 00:05:21,960
Skylab in early 1974 so a very

128
00:05:26,570 --> 00:05:24,570
successful program overall despite the

129
00:05:29,240 --> 00:05:26,580
fact that it almost on the first minute

130
00:05:31,580 --> 00:05:29,250
of operations almost went in the drink

131
00:05:34,570 --> 00:05:31,590
one of the real triumph of Skylab is

132
00:05:36,950 --> 00:05:34,580
that it basically took a situation

133
00:05:40,430 --> 00:05:36,960
gathering both the limits of what was

134
00:05:42,770 --> 00:05:40,440
possible and the possibilities presented

135
00:05:44,659 --> 00:05:42,780
by incredible technological developments

136
00:05:47,890 --> 00:05:44,669
and put them together in a program that

137
00:05:49,100 --> 00:05:47,900
produce tremendous benefits in science

138
00:05:52,190 --> 00:05:49,110

education

139
00:05:53,690 --> 00:05:52,200
what spaceflight is all about so it's a

140
00:05:56,779 --> 00:05:53,700
stepping stone it was the stepping stone

141
00:05:58,730 --> 00:05:56,789
between the Apollo program and then

142
00:06:01,490 --> 00:05:58,740
later definitions of what face flight

143
00:06:03,710 --> 00:06:01,500
would mean for the United States Skylab

144
00:06:04,629 --> 00:06:03,720
is the first step we'd learn how to

145
00:06:08,390 --> 00:06:04,639
operate in space

146
00:06:10,670 --> 00:06:08,400
we build on that with the ISS we now go

147
00:06:12,460 --> 00:06:10,680
on further beyond low-earth orbit to

148
00:06:15,110 --> 00:06:12,470
visit an asteroid and then on to Mars

149
00:06:39,710 --> 00:06:15,120
that's the plan and that's where we're

150
00:06:44,250 --> 00:06:42,150
all right thank you that was that was

151
00:06:46,650 --> 00:06:44,260
great and thank you to our historian dr.

152
00:06:48,720 --> 00:06:46,660
bill berry who's here with us today who

153
00:06:50,670 --> 00:06:48,730
for participating that so we're gonna

154
00:06:52,140 --> 00:06:50,680
get into the discussion now as we

155
00:06:54,720 --> 00:06:52,150
mentioned earlier if you're following

156
00:06:56,520 --> 00:06:54,730
along with us at Twitter you can send us

157
00:06:59,070 --> 00:06:56,530
your questions using the hashtag ask

158
00:07:01,560 --> 00:06:59,080
NASA and the discussion will be followed

159
00:07:04,230 --> 00:07:01,570
at hashtag Skylab we're also taking your

160
00:07:05,879 --> 00:07:04,240
questions at Google+ and Facebook but

161
00:07:07,409 --> 00:07:05,889
before we get started with our audience

162
00:07:09,150 --> 00:07:07,419
questions as well I have a couple

163
00:07:11,520 --> 00:07:09,160

questions for the panelists and I'd like

164
00:07:12,930 --> 00:07:11,530
first to start with with Owen and Gerry

165
00:07:14,850 --> 00:07:12,940
because we just watched this great video

166
00:07:17,490 --> 00:07:14,860
they told us a little bit about the

167
00:07:18,960 --> 00:07:17,500
official history of Skylab I was hoping

168
00:07:20,879 --> 00:07:18,970
starting with Owen you could tell us a

169
00:07:22,350 --> 00:07:20,889
little bit about your impressions and

170
00:07:23,580 --> 00:07:22,360
what we should know about it well

171
00:07:25,740 --> 00:07:23,590
there's so many things as a matter of

172
00:07:28,320 --> 00:07:25,750
fact if you're asking about basic

173
00:07:30,510 --> 00:07:28,330
materials there's a 500 page book that

174
00:07:32,460 --> 00:07:30,520
David hid myself and Joe Kerwin

175
00:07:35,100 --> 00:07:32,470
published about four or five years ago

176
00:07:37,050 --> 00:07:35,110
and that will tell you far more detail

177
00:07:39,600 --> 00:07:37,060
and we will be able to accommodate here

178
00:07:41,640 --> 00:07:39,610
this afternoon but I think it did take

179
00:07:44,520 --> 00:07:41,650
the first step into living in space

180
00:07:45,990 --> 00:07:44,530
homesteading space we call it here and I

181
00:07:49,350 --> 00:07:46,000
think that's essentially what the

182
00:07:51,300 --> 00:07:49,360
program provided but verified the fact

183
00:07:53,670 --> 00:07:51,310
that people could live work do

184
00:07:56,130 --> 00:07:53,680
productive things for long durations and

185
00:07:58,050 --> 00:07:56,140
then it also took the first steps into

186
00:08:00,900 --> 00:07:58,060
the science that we also wanted to have

187
00:08:03,090 --> 00:08:00,910
on board so that's a nutshell the kinds

188
00:08:04,920 --> 00:08:03,100

of things long-duration and and useful

189
00:08:07,110 --> 00:08:04,930
science that were above the atmosphere

190
00:08:08,730 --> 00:08:07,120
so we can see in ultraviolet x-ray

191
00:08:13,020 --> 00:08:08,740
wavelengths which we cannot see from the

192
00:08:14,010 --> 00:08:13,030
ground well I think some of the other

193
00:08:17,159 --> 00:08:14,020
things that were accomplished

194
00:08:18,900 --> 00:08:17,169
operationally on Skylab was that we we

195
00:08:22,770 --> 00:08:18,910
dealt with problems having to do with

196
00:08:24,690 --> 00:08:22,780
scheduling and productivity and we came

197
00:08:27,750 --> 00:08:24,700
to some solutions that work very well it

198
00:08:30,870 --> 00:08:27,760
took a while to get there but those

199
00:08:33,240 --> 00:08:30,880
solutions that we came across were were

200
00:08:35,399 --> 00:08:33,250
used on subsequent missions to some

201
00:08:38,010 --> 00:08:35,409
degree and some of the lessons had to be

202
00:08:40,680 --> 00:08:38,020
learned all over again but that's the

203
00:08:43,199 --> 00:08:40,690
nature of the space business I think and

204
00:08:45,930 --> 00:08:43,209
the the productivity is the most

205
00:08:47,400 --> 00:08:45,940
important thing you've got to be able to

206
00:08:48,330 --> 00:08:47,410
get things done up there if you don't

207
00:08:50,040 --> 00:08:48,340
get things done

208
00:08:53,640 --> 00:08:50,050
then you know public money is being

209
00:08:55,680 --> 00:08:53,650
wasted well and speaking of continuity

210
00:08:57,600 --> 00:08:55,690
we've now had folks on the international

211
00:08:59,790 --> 00:08:57,610
space station for 13 years and one of

212
00:09:01,200 --> 00:08:59,800
those individuals is Kevin Ford and so

213
00:09:02,880 --> 00:09:01,210

Kevin I was wondering if you could share

214
00:09:04,650 --> 00:09:02,890
with me and all of our audience here a

215
00:09:06,420 --> 00:09:04,660
little bit about your training and maybe

216
00:09:07,880 --> 00:09:06,430
how it compared to the Skylab folks and

217
00:09:09,750 --> 00:09:07,890
how you got ready to go to space

218
00:09:11,580 --> 00:09:09,760
absolutely well first let me just say

219
00:09:12,810 --> 00:09:11,590
what an honor it is to be here with

220
00:09:16,170 --> 00:09:12,820
these two gentlemen

221
00:09:18,270 --> 00:09:16,180
Skylab really represents something to us

222
00:09:19,650 --> 00:09:18,280
which was the first long-duration you

223
00:09:21,450 --> 00:09:19,660
know stays in space and there's a lot of

224
00:09:23,640 --> 00:09:21,460
uncertainty when you go you know

225
00:09:25,560 --> 00:09:23,650
everybody has has a little bit of angst

226
00:09:27,390 --> 00:09:25,570
I suppose how am I going to stay there

227
00:09:28,710 --> 00:09:27,400
for a long time in my case I was

228
00:09:29,910 --> 00:09:28,720
expected to stay about four and a half

229
00:09:32,700 --> 00:09:29,920
months and you have some butterflies

230
00:09:35,220 --> 00:09:32,710
involved with with doing that but when

231
00:09:36,750 --> 00:09:35,230
you get up there you know that people

232
00:09:38,370 --> 00:09:36,760
have been here before and other crews

233
00:09:40,380 --> 00:09:38,380
even before me of course when space

234
00:09:41,730 --> 00:09:40,390
station had been there and and had a lot

235
00:09:42,920 --> 00:09:41,740
of things that they could tell me but

236
00:09:46,200 --> 00:09:42,930
really the space station was built

237
00:09:48,120 --> 00:09:46,210
around what we learned from Skylab what

238
00:09:49,800 --> 00:09:48,130

they put up there for us the way the

239
00:09:51,510 --> 00:09:49,810
modules were sized and the way they were

240
00:09:53,010 --> 00:09:51,520
constructed in space and all that kind

241
00:09:55,650 --> 00:09:53,020
of stuff came came out of well we

242
00:09:57,300 --> 00:09:55,660
learned from Skylab the training the

243
00:09:58,650 --> 00:09:57,310
training now involves just so much and

244
00:10:00,300 --> 00:09:58,660
I'm sure they had the same types of

245
00:10:01,950 --> 00:10:00,310
things a lot of you know you have to

246
00:10:04,740 --> 00:10:01,960
think about the basics first

247
00:10:06,660 --> 00:10:04,750
just just living in space and medical

248
00:10:08,640 --> 00:10:06,670
operations we were our own doctors for

249
00:10:09,690 --> 00:10:08,650
example in space all that stuff is

250
00:10:11,760 --> 00:10:09,700
important it takes a lot of training

251
00:10:13,170 --> 00:10:11,770
especially for somebody like a pilot you

252
00:10:14,460 --> 00:10:13,180
know if you're gonna teach me how to

253
00:10:16,620 --> 00:10:14,470
pull a tooth that you're gonna need some

254
00:10:18,240 --> 00:10:16,630
time to do it so there's a lot of a lot

255
00:10:19,650 --> 00:10:18,250
of training involved for the basics but

256
00:10:21,780 --> 00:10:19,660
then also of course we're up there for

257
00:10:24,080 --> 00:10:21,790
the science and and we get to go to all

258
00:10:26,250 --> 00:10:24,090
the centers not only in the US but

259
00:10:28,230 --> 00:10:26,260
overseas as well to learn about the

260
00:10:30,210 --> 00:10:28,240
science and how to do that and and take

261
00:10:31,500 --> 00:10:30,220
care of the assets we have on board and

262
00:10:33,930 --> 00:10:31,510
of course take care of the space station

263
00:10:35,760 --> 00:10:33,940

so a lot of elements to the training

264
00:10:37,710 --> 00:10:35,770
it's about two and a half years involved

265
00:10:40,080 --> 00:10:37,720
in it now for a four of five to six

266
00:10:42,570 --> 00:10:40,090
months day and speaking of that science

267
00:10:45,750 --> 00:10:42,580
that was that was perfect like we have a

268
00:10:47,220 --> 00:10:45,760
show going here Marshall Porterfield can

269
00:10:49,320 --> 00:10:47,230
tell us a lot about that science and I

270
00:10:51,510 --> 00:10:49,330
think he had a fairly similar job to a

271
00:10:54,090 --> 00:10:51,520
job that Owen also had it at NASA in

272
00:10:55,410 --> 00:10:54,100
terms of space exploration tell us a

273
00:10:58,020 --> 00:10:55,420
little bit about the experiments we're

274
00:10:59,280 --> 00:10:58,030
doing on station now and and how that

275
00:11:00,030 --> 00:10:59,290
relates to some of the history what we

276
00:11:02,400 --> 00:11:00,040
learned the sky

277
00:11:06,690 --> 00:11:02,410
well in terms of they hit the link to

278
00:11:08,460 --> 00:11:06,700
the history of Skylab and really the

279
00:11:10,410 --> 00:11:08,470
productivity that they had during that

280
00:11:12,600 --> 00:11:10,420
time period is noteworthy they conducted

281
00:11:14,400 --> 00:11:12,610
over 2,500 separate individual

282
00:11:18,800 --> 00:11:14,410
investigations in the area of Helio

283
00:11:21,630 --> 00:11:18,810
physics astrophysics earth observation

284
00:11:24,270 --> 00:11:21,640
in engineering technology development

285
00:11:27,090 --> 00:11:24,280
life sciences and also did student

286
00:11:29,970 --> 00:11:27,100
experiments on Skylab and that's over

287
00:11:31,560 --> 00:11:29,980
three three Skylab missions over 170 one

288
00:11:34,650 --> 00:11:31,570

day so incredible level of productivity

289
00:11:37,050 --> 00:11:34,660
that we are working towards matching

290
00:11:39,420 --> 00:11:37,060
right now in terms of ISS utilization so

291
00:11:42,210 --> 00:11:39,430
we that crew up there for almost 13

292
00:11:45,210 --> 00:11:42,220
years we have already a great portfolio

293
00:11:46,260 --> 00:11:45,220
of research that's being done a lot of

294
00:11:48,780 --> 00:11:46,270
the things that were discovered during

295
00:11:50,660 --> 00:11:48,790
the Skylab error like bone wasting these

296
00:11:53,670 --> 00:11:50,670
were the first studies that documented

297
00:11:56,160 --> 00:11:53,680
calcium loss and bone and astronauts

298
00:11:58,170 --> 00:11:56,170
over long-duration periods of time and

299
00:11:59,880 --> 00:11:58,180
space we're still doing research in

300
00:12:01,740 --> 00:11:59,890
those areas down on International Space

301
00:12:04,530 --> 00:12:01,750
Station so there's a very strong link

302
00:12:06,150 --> 00:12:04,540
between what the foundational study said

303
00:12:08,790 --> 00:12:06,160
in some cases actually wrote the

304
00:12:11,010 --> 00:12:08,800
textbook on some Space Science

305
00:12:12,960 --> 00:12:11,020
phenomenon and those are the Erika

306
00:12:15,540 --> 00:12:12,970
continuing on today on the International

307
00:12:17,840 --> 00:12:15,550
Space Station thank you and so we're

308
00:12:19,770 --> 00:12:17,850
looking to go further into space and

309
00:12:21,050 --> 00:12:19,780
Jason who's here from our advanced

310
00:12:23,700 --> 00:12:21,060
exploration

311
00:12:26,010 --> 00:12:23,710
work you know right now it takes it

312
00:12:28,500 --> 00:12:26,020
takes 14 minutes to get a signal to Mars

313
00:12:30,270 --> 00:12:28,510

right so some of what we're learning the

314
00:12:33,060 --> 00:12:30,280
communications work that went from

315
00:12:34,260 --> 00:12:33,070
Skylab to Earth from ISS to Earth now

316
00:12:35,940 --> 00:12:34,270
we're working on these systems that

317
00:12:37,650 --> 00:12:35,950
we'll be able to get us even further can

318
00:12:39,030 --> 00:12:37,660
you tell us a little bit about them how

319
00:12:40,680 --> 00:12:39,040
what this work that we've done is

320
00:12:42,210 --> 00:12:40,690
informed what we're going to do to get

321
00:12:44,310 --> 00:12:42,220
to an asteroid and on to Mars yes

322
00:12:47,520 --> 00:12:44,320
starting I mean even Skylab period of

323
00:12:49,350 --> 00:12:47,530
times we had real loss of signal we

324
00:12:50,910 --> 00:12:49,360
didn't have continuous comm you go to

325
00:12:53,820 --> 00:12:50,920
something like this weekend when we're

326
00:12:55,050 --> 00:12:53,830
doing an e VA and we have not only near

327
00:12:56,760 --> 00:12:55,060
commit you know tenuous comm

328
00:12:59,460 --> 00:12:56,770
communications but we also have near

329
00:13:01,620 --> 00:12:59,470
continuous video things as the operation

330
00:13:03,570 --> 00:13:01,630
is going on but we're actually as we go

331
00:13:05,070 --> 00:13:03,580
further and further from Earth

332
00:13:06,600 --> 00:13:05,080
we're then actually revert back to

333
00:13:09,300 --> 00:13:06,610
actually the loss of signal kind of

334
00:13:10,620 --> 00:13:09,310
style of communications where those time

335
00:13:12,960 --> 00:13:10,630
delays will increase to a point that

336
00:13:13,260 --> 00:13:12,970
real-time communications doesn't doesn't

337
00:13:15,360 --> 00:13:13,270
make

338
00:13:16,920 --> 00:13:15,370

sense that that planning and the

339
00:13:19,230 --> 00:13:16,930
orchestrating of the mission challenges

340
00:13:21,270 --> 00:13:19,240
becomes even more important you don't

341
00:13:22,590 --> 00:13:21,280
have the the ground support crew every

342
00:13:24,930 --> 00:13:22,600
day right right on the comm loop with

343
00:13:26,130 --> 00:13:24,940
you or you would be slightly delayed or

344
00:13:28,140 --> 00:13:26,140
offset so you have to have more

345
00:13:30,210 --> 00:13:28,150
autonomous systems you have to have the

346
00:13:32,580 --> 00:13:30,220
crew and be able to re plan events in a

347
00:13:34,170 --> 00:13:32,590
more autonomous way or automatically by

348
00:13:35,340 --> 00:13:34,180
themselves as the crew so see something

349
00:13:37,790 --> 00:13:35,350
happened they can replay in their day

350
00:13:39,960 --> 00:13:37,800
right away to try to minimize that

351
00:13:42,060 --> 00:13:39,970
communication lost in order to keep the

352
00:13:43,590 --> 00:13:42,070
productivity up at the same time so that

353
00:13:44,820 --> 00:13:43,600
communications delay is going to be one

354
00:13:47,520 --> 00:13:44,830
of the biggest challenges of how we

355
00:13:49,020 --> 00:13:47,530
change our operational paradigm in some

356
00:13:52,350 --> 00:13:49,030
ways we can actually look back at Skylab

357
00:13:53,910 --> 00:13:52,360
as a reference to how that was done and

358
00:13:55,590 --> 00:13:53,920
and actually learned from that going

359
00:13:57,870 --> 00:13:55,600
forward versus actually we do a station

360
00:14:01,020 --> 00:13:57,880
today which is very very continuous

361
00:14:02,070 --> 00:14:01,030
communications so we're gonna get ready

362
00:14:05,040 --> 00:14:02,080
to take some questions from the audience

363
00:14:07,020 --> 00:14:05,050

but I have one more for Jerry and Owen

364
00:14:08,760 --> 00:14:07,030
because you know we're we're exploring

365
00:14:09,270 --> 00:14:08,770
space but we think we're alone in this

366
00:14:11,670 --> 00:14:09,280
universe

367
00:14:14,940 --> 00:14:11,680
but when you got to Skylab you found out

368
00:14:16,020 --> 00:14:14,950
we're not alone and I wanted to see if

369
00:14:17,940 --> 00:14:16,030
you could tell us a little bit about

370
00:14:20,190 --> 00:14:17,950
what you found when you when you arrived

371
00:14:22,680 --> 00:14:20,200
for Skylab for mission and what the

372
00:14:25,200 --> 00:14:22,690
folks on owns crew left for you well we

373
00:14:28,530 --> 00:14:25,210
finished talking with the Skylab vehicle

374
00:14:30,510 --> 00:14:28,540
with the lab of course with Mission

375
00:14:32,940 --> 00:14:30,520
Control would let us get out and go in

376
00:14:34,950 --> 00:14:32,950
we had to spend the night in the command

377
00:14:37,310 --> 00:14:34,960
module so by the next morning we were

378
00:14:40,620 --> 00:14:37,320
clawing at the door ready to go to work

379
00:14:42,600 --> 00:14:40,630
we went in there and Ed went in first as

380
00:14:45,960 --> 00:14:42,610
I remember and he said hey Jerry come

381
00:14:50,120 --> 00:14:45,970
and look at this I said what did come

382
00:14:53,460 --> 00:14:50,130
and look well we went down to the the

383
00:14:56,250 --> 00:14:53,470
living area and sure enough sitting on

384
00:14:58,890 --> 00:14:56,260
the pot was a dummy with what I don't

385
00:15:00,510 --> 00:14:58,900
remember who's I don't know whose name

386
00:15:04,590 --> 00:15:00,520
was on it but one of our names was on

387
00:15:08,220 --> 00:15:04,600
another one was on a bicycle and had his

388
00:15:10,200 --> 00:15:08,230

feet attached to the bicycle and the

389
00:15:13,010 --> 00:15:10,210
third one was as I remember in the

390
00:15:17,700 --> 00:15:13,020
wardroom standing behind the the table

391
00:15:19,020 --> 00:15:17,710
eating so we said okay those guys did it

392
00:15:22,920 --> 00:15:19,030
to us we've got to find a way to get

393
00:15:28,509 --> 00:15:25,329
let's but let's take some questions from

394
00:15:32,410 --> 00:15:28,519
the audience thank you guys and we've

395
00:15:35,650 --> 00:15:32,420
got one right down right down here hi

396
00:15:38,579 --> 00:15:35,660
Jeff Wallace Rocket Man Rocket Man five

397
00:15:41,199 --> 00:15:38,589
twenty haight on Twitter I've met your

398
00:15:42,639 --> 00:15:41,209
your son at another at South by

399
00:15:44,679 --> 00:15:42,649
Southwest or rather entertaining

400
00:15:46,929 --> 00:15:44,689
character can you talk a little bit

401
00:15:48,040 --> 00:15:46,939
about how you inspired want to go to the

402
00:15:51,220 --> 00:15:48,050
space Owen

403
00:15:53,829 --> 00:15:51,230
well referring to the fact that my son

404
00:15:55,329 --> 00:15:53,839
richard has also had the opportunity to

405
00:15:58,569 --> 00:15:55,339
go to space we're in fact the only

406
00:16:01,210 --> 00:15:58,579
father-son pair in the u.s. who said

407
00:16:03,400 --> 00:16:01,220
that opportunity and so I did not know I

408
00:16:05,139 --> 00:16:03,410
was doing it at the time for one thing

409
00:16:08,139 --> 00:16:05,149
it is so unusual to have this

410
00:16:10,299 --> 00:16:08,149
opportunity to to to go to space in

411
00:16:13,269 --> 00:16:10,309
whatever capacity as a pilot as a

412
00:16:15,129 --> 00:16:13,279
scientist or whatever I didn't to push

413
00:16:17,019 --> 00:16:15,139

you in that direction at all I knew he

414
00:16:20,079 --> 00:16:17,029
was interested in it but I had no idea

415
00:16:20,739 --> 00:16:20,089
that he really had that as a objective

416
00:16:23,439 --> 00:16:20,749
in his life

417
00:16:27,069 --> 00:16:23,449
and I was surprised some years later to

418
00:16:29,019 --> 00:16:27,079
find that he had indeed worked with

419
00:16:31,030 --> 00:16:29,029
companies and he was one of those people

420
00:16:35,139 --> 00:16:31,040
who would be able to fly with the

421
00:16:36,879 --> 00:16:35,149
Russians on the Soyuz up to the ISS and

422
00:16:39,369 --> 00:16:36,889
so Akeem was a surprise to me actually

423
00:16:41,769 --> 00:16:39,379
when I found out that he had acted upon

424
00:16:43,900 --> 00:16:41,779
his wishes which I had not particularly

425
00:16:46,090 --> 00:16:43,910
encouraged not I certainly didn't

426
00:16:47,379 --> 00:16:46,100
discourage it but I didn't encourage it

427
00:16:49,360 --> 00:16:47,389
because it was such a remote possibility

428
00:16:51,489 --> 00:16:49,370
and so it was really something that

429
00:16:53,470 --> 00:16:51,499
Richard pretty much did on his own and I

430
00:16:55,660 --> 00:16:53,480
was very pleased to a sister contribute

431
00:16:59,530 --> 00:16:55,670
to it his success on that program

432
00:17:01,299 --> 00:16:59,540
whenever I could great I think we've got

433
00:17:04,269 --> 00:17:01,309
a question coming to us from social

434
00:17:05,710 --> 00:17:04,279
media here why don't you go ahead cheers

435
00:17:07,269 --> 00:17:05,720
thanks Lauren okay so we have a similar

436
00:17:10,480 --> 00:17:07,279
question that came in to both Google+

437
00:17:12,399 --> 00:17:10,490
and Twitter and it's basically post onto

438
00:17:13,689 --> 00:17:12,409

it in dr. Porter field started to touch

439
00:17:15,010 --> 00:17:13,699
on the legacy a little bit but is there

440
00:17:17,199 --> 00:17:15,020
a big difference between the type of

441
00:17:18,579 --> 00:17:17,209
science that was conducted aboard the

442
00:17:26,130 --> 00:17:18,589
International Space Station compared to

443
00:17:33,510 --> 00:17:29,310
who's that for maybe maybe start with

444
00:17:38,900 --> 00:17:33,520
you Google+ was there a big difference

445
00:17:45,270 --> 00:17:42,660
prospect we did the solar physics for

446
00:17:47,910 --> 00:17:45,280
example but you now can do the steps on

447
00:17:51,090 --> 00:17:47,920
beyond what we did on Skylab and in some

448
00:17:53,280 --> 00:17:51,100
ways you've completed some of the work

449
00:17:55,590 --> 00:17:53,290
but you go to the next step and so I

450
00:17:57,660 --> 00:17:55,600
would say the same general research

451
00:17:59,340 --> 00:17:57,670
areas are still there but it's a more

452
00:18:02,340 --> 00:17:59,350
advanced techniques that are now

453
00:18:04,560 --> 00:18:02,350
available with the longer durations and

454
00:18:06,960 --> 00:18:04,570
the improved hardware that we now have

455
00:18:09,330 --> 00:18:06,970
available after some 40 years after as

456
00:18:10,890 --> 00:18:09,340
you would expect you oughta do it well I

457
00:18:14,490 --> 00:18:10,900
just might add that you know it was

458
00:18:16,470 --> 00:18:14,500
built from the ground up International

459
00:18:19,530 --> 00:18:16,480
Space Station you know to accommodate

460
00:18:21,870 --> 00:18:19,540
Express type payloads and new ideas with

461
00:18:24,500 --> 00:18:21,880
all kinds of plumbing you know for for

462
00:18:27,480 --> 00:18:24,510
vacuums and gases and power and cooling

463
00:18:31,110 --> 00:18:27,490

just so that people could come in with

464
00:18:33,810 --> 00:18:31,120
ideas even downstream and still get them

465
00:18:36,570 --> 00:18:33,820
aboard and today regularly we install

466
00:18:38,480 --> 00:18:36,580
few modules and new racks and new

467
00:18:40,740 --> 00:18:38,490
drawers and that sort of thing that are

468
00:18:41,700 --> 00:18:40,750
accommodated easily by the construction

469
00:18:44,340 --> 00:18:41,710
of the International Space Station

470
00:18:46,290 --> 00:18:44,350
modules just to take take on new science

471
00:18:48,630 --> 00:18:46,300
and ideas and so far we've done really

472
00:18:50,460 --> 00:18:48,640
well with when people came and said man

473
00:18:52,770 --> 00:18:50,470
here's here's what I would like to do on

474
00:18:54,960 --> 00:18:52,780
the space station usually the provisions

475
00:18:56,910 --> 00:18:54,970
are there to get that done so it's very

476
00:18:58,260 --> 00:18:56,920
very capable just just to get the

477
00:19:00,540 --> 00:18:58,270
different types of science there are

478
00:19:02,790 --> 00:19:00,550
also external platforms and you know

479
00:19:04,920 --> 00:19:02,800
that express logistics carriers on the

480
00:19:07,020 --> 00:19:04,930
outside like we put AMS on the outside

481
00:19:08,940 --> 00:19:07,030
kind of you know later on it was able to

482
00:19:11,220 --> 00:19:08,950
accommodate the Alpha the Magnetic

483
00:19:12,720 --> 00:19:11,230
Spectrometer for example at a later date

484
00:19:15,750 --> 00:19:12,730
so it was it was really built to

485
00:19:18,120 --> 00:19:15,760
accommodate all this and again that was

486
00:19:20,370 --> 00:19:18,130
a bit of the legacy that they brought to

487
00:19:22,350 --> 00:19:20,380
us I just want to make a couple comments

488
00:19:23,760 --> 00:19:22,360

that the hardware that we have available

489
00:19:25,260 --> 00:19:23,770
now to do the science on the

490
00:19:28,560 --> 00:19:25,270
International Space Station is much more

491
00:19:31,620 --> 00:19:28,570
advanced just because of the advancement

492
00:19:33,240 --> 00:19:31,630
of science in general so and we do have

493
00:19:35,430 --> 00:19:33,250
significant investment in hardware

494
00:19:36,930 --> 00:19:35,440
capabilities to do life and physical

495
00:19:39,630 --> 00:19:36,940
sciences research on the Internet

496
00:19:42,390 --> 00:19:39,640
Space Station just one example is that

497
00:19:45,020 --> 00:19:42,400
some fairly rudimentary experiments were

498
00:19:47,010 --> 00:19:45,030
done on Skylab with rice seedlings on

499
00:19:48,810 --> 00:19:47,020
International Space Station using the

500
00:19:50,880 --> 00:19:48,820
European cultivation module we grow

501
00:19:54,060 --> 00:19:50,890
plants from seed to seed the complete

502
00:19:56,010 --> 00:19:54,070
life cycle and we also can do we have a

503
00:19:58,860 --> 00:19:56,020
centrifuge for controls so we actually

504
00:20:00,480 --> 00:19:58,870
have a 1g control in space for those

505
00:20:02,370 --> 00:20:00,490
types of experiments right now so we do

506
00:20:04,110 --> 00:20:02,380
have much more in terms of advanced

507
00:20:05,550 --> 00:20:04,120
capability to do a better job of doing

508
00:20:09,330 --> 00:20:05,560
good science on the International Space

509
00:20:11,190 --> 00:20:09,340
Station I'd like to point out that one

510
00:20:12,990 --> 00:20:11,200
of the big differences between Skylab

511
00:20:16,650 --> 00:20:13,000
and the International Space Station is

512
00:20:20,280 --> 00:20:16,660
that our in our life sciences work the

513
00:20:22,340 --> 00:20:20,290

the metabolic analysis and those kinds

514
00:20:25,050 --> 00:20:22,350
of experiments that we did on Skylab

515
00:20:28,170 --> 00:20:25,060
required us to be on a very very strict

516
00:20:29,340 --> 00:20:28,180
diet we worked with the nutritionists

517
00:20:31,950 --> 00:20:29,350
before we left

518
00:20:33,450 --> 00:20:31,960
set the diet and then we could not vary

519
00:20:38,100 --> 00:20:33,460
from that diet and that's a big

520
00:20:43,860 --> 00:20:38,110
difference from these these lucky guys

521
00:20:45,600 --> 00:20:43,870
get all state up there but I wanted to

522
00:20:47,550 --> 00:20:45,610
met tell give you a little vignette here

523
00:20:49,950 --> 00:20:47,560
and that is that I went to a meeting in

524
00:20:52,800 --> 00:20:49,960
Berlin of the association of a space

525
00:20:56,910 --> 00:20:52,810
explorers and one of the cosmonauts is

526
00:20:58,890 --> 00:20:56,920
there a name manner of told me how

527
00:21:00,630 --> 00:20:58,900
grateful the Russians were that we did

528
00:21:02,760 --> 00:21:00,640
those experiments because it helped them

529
00:21:05,100 --> 00:21:02,770
very much in the planning of their own

530
00:21:07,590 --> 00:21:05,110
experiments so here's another point

531
00:21:10,440 --> 00:21:07,600
where all of our data is free to the

532
00:21:12,990 --> 00:21:10,450
world and I think that's something for

533
00:21:14,670 --> 00:21:13,000
which we should be very proud alright

534
00:21:16,680 --> 00:21:14,680
we've got a question from the phone line

535
00:21:21,830 --> 00:21:16,690
from Robert Perlman at collect space

536
00:21:26,880 --> 00:21:21,840
comm Roberts please ask your questions I

537
00:21:29,910 --> 00:21:26,890
think for Owen carrion and Kevin from

538
00:21:31,440 --> 00:21:29,920

crew members perspective realizing that

539
00:21:34,410 --> 00:21:31,450
you can only talk to your experience

540
00:21:37,110 --> 00:21:34,420
which Space Station design felt better

541
00:21:40,020 --> 00:21:37,120
to a long-duration outpost one very

542
00:21:41,640 --> 00:21:40,030
large room like was on a lab or a small

543
00:21:46,010 --> 00:21:41,650
self-contained modules like that on the

544
00:21:51,419 --> 00:21:48,930
like the large-volume better than a

545
00:21:53,960 --> 00:21:51,429
smaller box my preference would be for

546
00:21:56,970 --> 00:21:53,970
the larger volume but I'm biased in that

547
00:21:58,650 --> 00:21:56,980
perspective of course because you can do

548
00:22:00,240 --> 00:21:58,660
so much more with it for example the

549
00:22:02,760 --> 00:22:00,250
manned maneuvering unit which we first

550
00:22:05,280 --> 00:22:02,770
tested out on Skylab could be done with

551
00:22:07,830 --> 00:22:05,290
cold gas nitrogen thrusters on the

552
00:22:10,140 --> 00:22:07,840
inside of Skylab before we ever had to

553
00:22:12,660 --> 00:22:10,150
venture outside and face the hard vacuum

554
00:22:14,460 --> 00:22:12,670
that we would when we had verified that

555
00:22:16,440 --> 00:22:14,470
the hardware was all working correctly

556
00:22:18,120 --> 00:22:16,450
and so that was one advantage that was

557
00:22:20,430 --> 00:22:18,130
only available because we had a large

558
00:22:22,380 --> 00:22:20,440
volume in which to test it and so I

559
00:22:25,020 --> 00:22:22,390
think bad and a few other examples

560
00:22:26,669 --> 00:22:25,030
really demonstrate the value of having a

561
00:22:28,590 --> 00:22:26,679
large volume for the times that you

562
00:22:31,470 --> 00:22:28,600
really need it and of course with my

563
00:22:35,370 --> 00:22:31,480

bias already accounting for that would

564
00:22:38,580 --> 00:22:35,380
be my preference yeah you know I would

565
00:22:40,440 --> 00:22:38,590
say in general it's nice to be able to

566
00:22:41,909 --> 00:22:40,450
reach your wall and that sort of thing

567
00:22:44,669 --> 00:22:41,919
from maneuvering around and working

568
00:22:47,430 --> 00:22:44,679
across volumes and stuff but I I'm very

569
00:22:49,140 --> 00:22:47,440
jealous when I see that film of the the

570
00:22:51,419 --> 00:22:49,150
acrobatics we're seeing the tumbling

571
00:22:54,360 --> 00:22:51,429
inside so somewhere up there on Space

572
00:22:58,140 --> 00:22:54,370
Station we need a big ballroom you know

573
00:23:01,020 --> 00:22:58,150
that we could dancing we do dream of

574
00:23:03,390 --> 00:23:01,030
that we have a pretty open area keepo is

575
00:23:05,700 --> 00:23:03,400
pretty big module and that's where we do

576
00:23:07,500 --> 00:23:05,710
some of our experiments that require a

577
00:23:10,500 --> 00:23:07,510
large volume like Speers you might know

578
00:23:12,090 --> 00:23:10,510
about the small satellites that can fly

579
00:23:14,250 --> 00:23:12,100
around and do maneuvers relative to each

580
00:23:17,700 --> 00:23:14,260
other and so sometimes you do need a big

581
00:23:19,500 --> 00:23:17,710
volume onboard and we you know we have a

582
00:23:21,539 --> 00:23:19,510
kind of a trade-off there because we had

583
00:23:23,600 --> 00:23:21,549
to get these components up and in the

584
00:23:25,500 --> 00:23:23,610
payload Bay of the Space Shuttle so

585
00:23:27,930 --> 00:23:25,510
maybe in the future we'll find another

586
00:23:30,690 --> 00:23:27,940
way all right I think we have a question

587
00:23:33,570 --> 00:23:30,700
up here in this area go ahead and I

588
00:23:39,750 --> 00:23:33,580

think I think it's the PG on Twitter go

589
00:23:42,780 --> 00:23:39,760
ahead yes hi I'm Glenn Gonzales from

590
00:23:46,110 --> 00:23:42,790
Baltimore Maryland Zeb eg2 on Twitter my

591
00:23:50,100 --> 00:23:46,120
question is not mine but it's from James

592
00:23:52,280 --> 00:23:50,110
3 to 94 in Michigan it's for Owen and

593
00:23:55,200 --> 00:23:52,290
for Gerald

594
00:24:00,990 --> 00:23:55,210
what was the material used to cover the

595
00:24:06,720 --> 00:24:01,000
exposed area of Skylab what was the

596
00:24:12,950 --> 00:24:06,730
material that we had are you talking

597
00:24:18,900 --> 00:24:16,950
parasol yeah and the sail yes parasol I

598
00:24:21,540 --> 00:24:18,910
say I don't know exactly but I think it

599
00:24:23,720 --> 00:24:21,550
was nylon but it was had some of the

600
00:24:27,390 --> 00:24:23,730
material impregnated in that as well and

601
00:24:29,160 --> 00:24:27,400
there were two kinds one was the parasol

602
00:24:31,320 --> 00:24:29,170
on the first crew and then the second

603
00:24:34,260 --> 00:24:31,330
crew had a sail which laid down on top

604
00:24:36,150 --> 00:24:34,270
of that because the first parasol was

605
00:24:38,970 --> 00:24:36,160
beginning to deteriorate you have to

606
00:24:42,000 --> 00:24:38,980
remember that it was a designed built

607
00:24:43,710 --> 00:24:42,010
tested folded-up everything within ten

608
00:24:45,090 --> 00:24:43,720
days and so they had a little bit longer

609
00:24:47,280 --> 00:24:45,100
to think about what they're really the

610
00:24:49,230 --> 00:24:47,290
best material would be for the second

611
00:24:51,690 --> 00:24:49,240
mission and so if maybe the the

612
00:24:54,060 --> 00:24:51,700
surfacing or the material that was on

613
00:24:55,530 --> 00:24:54,070

the nylon was a little different but I

614
00:24:57,420 --> 00:24:55,540
can't go into any more detail because I

615
00:25:00,180 --> 00:24:57,430
don't know the answer in more detail

616
00:25:02,520 --> 00:25:00,190
than that Dybbuk as far as I knew it was

617
00:25:07,170 --> 00:25:02,530
it was sheets Multi sheets of gold flat

618
00:25:09,330 --> 00:25:07,180
gold mylar and many many sheets in order

619
00:25:13,380 --> 00:25:09,340
to to get the insulation effect that

620
00:25:15,180 --> 00:25:13,390
you're looking for Tripp do we have any

621
00:25:17,580 --> 00:25:15,190
more questions coming in from social

622
00:25:18,990 --> 00:25:17,590
media yeah from Twitter how much

623
00:25:21,150 --> 00:25:19,000
training do you have to do before you

624
00:25:26,670 --> 00:25:21,160
actually go up into space and what does

625
00:25:30,150 --> 00:25:26,680
it feel like the first time well I'll go

626
00:25:31,980 --> 00:25:30,160
for that one there Doug yeah when you

627
00:25:35,040 --> 00:25:31,990
first get to NASA you've got to go

628
00:25:37,830 --> 00:25:35,050
through astronaut basic training back in

629
00:25:39,420 --> 00:25:37,840
an AR day you were considered to be an

630
00:25:41,370 --> 00:25:39,430
astronaut when you showed up at the

631
00:25:44,700 --> 00:25:41,380
front door and when you finish training

632
00:25:46,920 --> 00:25:44,710
then you were qualified to fly for the

633
00:25:50,430 --> 00:25:46,930
the later on when you got into the

634
00:25:54,170 --> 00:25:50,440
shuttle era the the people who came as

635
00:25:56,670 --> 00:25:54,180
they were astronaut candidates and

636
00:25:58,740 --> 00:25:56,680
they've required about the same amount

637
00:26:00,630 --> 00:25:58,750
of time about a year or so basic

638
00:26:03,420 --> 00:26:00,640

training and then they were considered

639
00:26:05,260 --> 00:26:03,430
ready to be assigned now once you get a

640
00:26:07,150 --> 00:26:05,270
mission you start a whole new

641
00:26:08,650 --> 00:26:07,160
training cycle and that whole new

642
00:26:12,310 --> 00:26:08,660
training cycle can last anywhere from

643
00:26:14,590 --> 00:26:12,320
from one to two and a half years my

644
00:26:16,270 --> 00:26:14,600
particular crew on Skylab since we were

645
00:26:19,000 --> 00:26:16,280
the last to fly we ended up with three

646
00:26:20,410 --> 00:26:19,010
years of training but the first two

647
00:26:22,150 --> 00:26:20,420
years of our training was helping the

648
00:26:24,280 --> 00:26:22,160
other two crews get their training plans

649
00:26:28,480 --> 00:26:24,290
put together and so we were kind of the

650
00:26:30,760 --> 00:26:28,490
guinea pigs I heard I heard Kevin say

651
00:26:32,830 --> 00:26:30,770
that it about what two and a half years

652
00:26:35,680 --> 00:26:32,840
for you guys yeah there's a lot of stuff

653
00:26:38,260 --> 00:26:35,690
to learn not just the operation of the

654
00:26:39,760 --> 00:26:38,270
of the vehicle but all of the science

655
00:26:42,790 --> 00:26:39,770
that you have to learn how to operate it

656
00:26:43,930 --> 00:26:42,800
really takes a long time for those in

657
00:26:45,760 --> 00:26:43,940
the audience to give a question please

658
00:26:47,890 --> 00:26:45,770
go ahead and raise your hand so our able

659
00:26:50,380 --> 00:26:47,900
microphone handler can see you and if

660
00:26:52,810 --> 00:26:50,390
you're following on online you can

661
00:26:54,040 --> 00:26:52,820
follow the hashtag Skylab for the

662
00:26:56,350 --> 00:26:54,050
discussion and if you have a question go

663
00:26:58,870 --> 00:26:56,360

ahead and send it to ask NASA hashtag

664
00:27:00,520 --> 00:26:58,880
ask NASA or on Google+ or Facebook and

665
00:27:03,430 --> 00:27:00,530
speaking of science experiments

666
00:27:05,830 --> 00:27:03,440
astronauts and education Leland Melvin

667
00:27:09,160 --> 00:27:05,840
here who is also a colleague of yours

668
00:27:10,840 --> 00:27:09,170
and another first for Skylab was it was

669
00:27:12,730 --> 00:27:10,850
that the first time student experiments

670
00:27:15,400 --> 00:27:12,740
had gone to space and that was an

671
00:27:17,740 --> 00:27:15,410
original idea in 73 we've continued to

672
00:27:19,030 --> 00:27:17,750
do that and Marshall I was gonna ask you

673
00:27:21,040 --> 00:27:19,040
what if we learned from some of the

674
00:27:22,510 --> 00:27:21,050
student experiments that have that have

675
00:27:25,810 --> 00:27:22,520
gone now onto the International Space

676
00:27:28,210 --> 00:27:25,820
Station I think the thing that was most

677
00:27:31,240 --> 00:27:28,220
important about what happened on Skylab

678
00:27:34,360 --> 00:27:31,250
was the we realized the magnitude of the

679
00:27:40,120 --> 00:27:34,370
impact of the student opportunities and

680
00:27:42,130 --> 00:27:40,130
what that that you really did get deep

681
00:27:44,440 --> 00:27:42,140
penetration into the education systems

682
00:27:47,440 --> 00:27:44,450
because of the imagination that the

683
00:27:49,450 --> 00:27:47,450
students brought to these projects not

684
00:27:53,560 --> 00:27:49,460
all of them work I think it's okay for

685
00:27:56,320 --> 00:27:53,570
the students to learn and and take

686
00:27:57,910 --> 00:27:56,330
chances that we normally wouldn't do I

687
00:28:00,090 --> 00:27:57,920
think some of the interesting things

688
00:28:02,530 --> 00:28:00,100

that were done with spiders were were

689
00:28:04,480 --> 00:28:02,540
innovative at the times they were able

690
00:28:06,310 --> 00:28:04,490
to show that spiders could adapt to

691
00:28:08,140 --> 00:28:06,320
microgravity first they couldn't make

692
00:28:10,810 --> 00:28:08,150
webs but then they would adapt and they

693
00:28:11,770 --> 00:28:10,820
could actually make web so using model

694
00:28:12,520 --> 00:28:11,780
organisms like that was really

695
00:28:14,320 --> 00:28:12,530
innovative

696
00:28:15,880 --> 00:28:14,330
I'm just really extend that question a

697
00:28:18,100 --> 00:28:15,890
little bit how many of the

698
00:28:19,960 --> 00:28:18,110
the name Arabella ringabel within you

699
00:28:22,960 --> 00:28:19,970
seem better said will remember at

700
00:28:24,520 --> 00:28:22,970
Arabella and her cohort Anita who with

701
00:28:26,500 --> 00:28:24,530
two spiders we brought up in a little

702
00:28:27,940 --> 00:28:26,510
container the size of your thumb and we

703
00:28:31,000 --> 00:28:27,950
had him in a box as you were describing

704
00:28:33,640 --> 00:28:31,010
and when they were first released the

705
00:28:36,460 --> 00:28:33,650
first night and night was whenever we

706
00:28:38,289 --> 00:28:36,470
were all asleep the reverse fluffy

707
00:28:40,840 --> 00:28:38,299
looking webs but by the second or third

708
00:28:43,240 --> 00:28:40,850
day they'd begun to spin a web that

709
00:28:46,240 --> 00:28:43,250
would do a good justice to your backyard

710
00:28:49,240 --> 00:28:46,250
or the garden at home and so it really

711
00:28:50,980 --> 00:28:49,250
amazing hell with no foresight no

712
00:28:53,530 --> 00:28:50,990
knowledge about what was coming they

713
00:28:56,740 --> 00:28:53,540

very quickly adjusted and adapted til

714
00:28:58,419 --> 00:28:56,750
weightless isn't pirate and where they

715
00:29:00,400 --> 00:28:58,429
were spun their web was to be walk

716
00:29:02,110 --> 00:29:00,410
around the edge and attach it again walk

717
00:29:03,909 --> 00:29:02,120
around the edge and attach it again and

718
00:29:05,260 --> 00:29:03,919
they do that around enough times we

719
00:29:06,760 --> 00:29:05,270
pretty soon they have a web that just

720
00:29:08,740 --> 00:29:06,770
like they had at home although they've

721
00:29:11,140 --> 00:29:08,750
never spun a web like this before so

722
00:29:13,419 --> 00:29:11,150
it's a remarkable job that the spiders

723
00:29:15,669 --> 00:29:13,429
they were cross the spiders they were

724
00:29:18,130 --> 00:29:15,679
called because of a little cross on the

725
00:29:20,080 --> 00:29:18,140
back of their shell and so it was really

726
00:29:21,970 --> 00:29:20,090
a fascinating experiment by the way

727
00:29:24,370 --> 00:29:21,980
Marshall Space Flight Center who put

728
00:29:26,909 --> 00:29:24,380
this program together still followed us

729
00:29:29,560 --> 00:29:26,919
most of those I think it was 40 total

730
00:29:32,080 --> 00:29:29,570
experimenters that and they occasionally

731
00:29:35,320 --> 00:29:32,090
have had a reunion back in Huntsville

732
00:29:37,120 --> 00:29:35,330
for Lois students and the young lady I

733
00:29:39,430 --> 00:29:37,130
think blended into life sciences to some

734
00:29:41,200 --> 00:29:39,440
sort after she graduated from college

735
00:29:43,659 --> 00:29:41,210
she was a high school student at the

736
00:29:44,500 --> 00:29:43,669
time are they still doing it high school

737
00:29:46,240 --> 00:29:44,510
experiments today

738
00:29:47,740 --> 00:29:46,250

I think there's multiple different

739
00:29:50,049 --> 00:29:47,750
mechanisms for students to do

740
00:29:52,890 --> 00:29:50,059
space-based research right now part of

741
00:29:55,060 --> 00:29:52,900
that is we're leveraging our

742
00:29:56,860 --> 00:29:55,070
relationship with nanorack so we have

743
00:29:58,450 --> 00:29:56,870
commercial hardware providers that are

744
00:30:01,650 --> 00:29:58,460
actually facilitating a lot of under

745
00:30:04,630 --> 00:30:01,660
student research and we also have our

746
00:30:06,610 --> 00:30:04,640
working with ISS program right now to

747
00:30:10,299 --> 00:30:06,620
develop a program called post graduate

748
00:30:14,440 --> 00:30:10,309
Innovation Awards to allow students to

749
00:30:15,730 --> 00:30:14,450
do their thesis research and research at

750
00:30:18,520 --> 00:30:15,740
that level on the international space

751
00:30:20,230 --> 00:30:18,530
station so yes we it's a tradition we're

752
00:30:21,610 --> 00:30:20,240
carrying on and the only other comment

753
00:30:22,720 --> 00:30:21,620
I'm making about the spiders is they

754
00:30:25,850 --> 00:30:22,730
were they were able to adapt to

755
00:30:31,310 --> 00:30:25,860
microgravity without training

756
00:30:34,519 --> 00:30:31,320
that's not right all right well what

757
00:30:37,100 --> 00:30:34,529
impressed me was the way NASA treated

758
00:30:40,639 --> 00:30:37,110
the students who did these experiments

759
00:30:43,070 --> 00:30:40,649
they were treated as full pis and and

760
00:30:44,600 --> 00:30:43,080
they were they knew right off the bat

761
00:30:45,919 --> 00:30:44,610
that when they got the data back they

762
00:30:49,039 --> 00:30:45,929
were going to have to write a technical

763
00:30:50,840 --> 00:30:49,049

NASA paper and report their science so

764
00:30:52,759 --> 00:30:50,850
they were treated like adults scientists

765
00:30:55,279 --> 00:30:52,769
and I think that was a very very good

766
00:30:57,200 --> 00:30:55,289
thing to do and I hope that they can

767
00:30:59,240 --> 00:30:57,210
continue doing something like that I

768
00:31:02,600 --> 00:30:59,250
might mention that we had goldfish on

769
00:31:05,480 --> 00:31:02,610
our missions out of the car should I ask

770
00:31:06,980 --> 00:31:05,490
a couple of them were pregnant and so we

771
00:31:08,840 --> 00:31:06,990
had them in a little plastic bag you

772
00:31:11,889 --> 00:31:08,850
could hold them up and the goldfish were

773
00:31:14,000 --> 00:31:11,899
all swimming around on outside loops and

774
00:31:15,620 --> 00:31:14,010
because apparently they needed that

775
00:31:18,139 --> 00:31:15,630
gravity vector through their belly don't

776
00:31:19,820 --> 00:31:18,149
know which way to swim so they swam

777
00:31:21,830 --> 00:31:19,830
around in loops but when they Lake when

778
00:31:24,019 --> 00:31:21,840
the eggs hatched the little bitty ones

779
00:31:25,730 --> 00:31:24,029
that look like two eyes in a tail came

780
00:31:27,409 --> 00:31:25,740
out and they looked at their parents

781
00:31:29,360 --> 00:31:27,419
going like that and couldn't figure out

782
00:31:32,570 --> 00:31:29,370
because they they were perfectly at home

783
00:31:35,240 --> 00:31:32,580
in their new environment they didn't had

784
00:31:36,289 --> 00:31:35,250
to learn any bad habits and so they were

785
00:31:44,889 --> 00:31:36,299
very comfortable in a weightless

786
00:31:48,019 --> 00:31:44,899
environment testing Frank for our two

787
00:31:50,899 --> 00:31:48,029
station commanders commander Cara I was

788
00:31:53,750 --> 00:31:50,909

interested in your remarks about lessons

789
00:31:54,919 --> 00:31:53,760
learned for crew productivity I wonder

790
00:31:57,259 --> 00:31:54,929
if you could give us a few first

791
00:31:59,480 --> 00:31:57,269
principles that didn't work and that

792
00:32:02,000 --> 00:31:59,490
you've figured out a better way to do it

793
00:32:06,080 --> 00:32:02,010
that to your knowledge have been passed

794
00:32:09,409 --> 00:32:06,090
on to ISS crews and for Kevin Ford I'd

795
00:32:12,110 --> 00:32:09,419
like to ask you if the crew on the space

796
00:32:13,310 --> 00:32:12,120
station today is maxed out or if there

797
00:32:15,080 --> 00:32:13,320
are ways that you can get more

798
00:32:16,970 --> 00:32:15,090
productivity out of the crew size that

799
00:32:18,289 --> 00:32:16,980
we have now and perhaps with some help

800
00:32:22,580 --> 00:32:18,299
from Russians or maybe even another

801
00:32:25,060 --> 00:32:22,590
crewman okay well on Skylab we started

802
00:32:29,029 --> 00:32:25,070
the mission with a tacit agreement to

803
00:32:32,149 --> 00:32:29,039
pick up the pace that was being run by

804
00:32:34,580 --> 00:32:32,159
the crew that was ahead of us and that

805
00:32:36,019 --> 00:32:34,590
was a bad decision because we fail to

806
00:32:37,669 --> 00:32:36,029
take into account that you need a

807
00:32:39,000 --> 00:32:37,679
certain amount of time to accommodate to

808
00:32:40,530 --> 00:32:39,010
your new environment

809
00:32:42,630 --> 00:32:40,540
and so we spent a good chunk of the

810
00:32:44,549 --> 00:32:42,640
mission running behind and making

811
00:32:48,150 --> 00:32:44,559
mistakes because we were being so rushed

812
00:32:51,260 --> 00:32:48,160
and we finally had what I like to call

813
00:32:54,360 --> 00:32:51,270

the first sensitivity session in space

814
00:32:57,320 --> 00:32:54,370
we we agreed that we would talk about

815
00:33:01,049 --> 00:32:57,330
the problem so on one pass over the u.s.

816
00:33:03,240 --> 00:33:01,059
from Northwest to southeast we were

817
00:33:04,830 --> 00:33:03,250
invited to tell the people on the ground

818
00:33:08,460 --> 00:33:04,840
everything they were doing to make our

819
00:33:10,799 --> 00:33:08,470
life miserable and why we needed we

820
00:33:13,080 --> 00:33:10,809
needed to do something and then on the

821
00:33:15,750 --> 00:33:13,090
next pass which was if I remember Brad

822
00:33:17,580 --> 00:33:15,760
Southwest to Northeast the people on the

823
00:33:19,409 --> 00:33:17,590
ground got a chat got a whack at us and

824
00:33:21,539 --> 00:33:19,419
told us about all the things we were

825
00:33:23,940 --> 00:33:21,549
doing to screw up their schedule and

826
00:33:26,520 --> 00:33:23,950
then we finally agreed ok we both got a

827
00:33:28,020 --> 00:33:26,530
problem we've got a deal with it so we

828
00:33:31,140 --> 00:33:28,030
need to change the way we schedule

829
00:33:35,190 --> 00:33:31,150
things and the first the first part of

830
00:33:36,960 --> 00:33:35,200
the mission we had a checklist that had

831
00:33:39,720 --> 00:33:36,970
every single move we were supposed to

832
00:33:42,690 --> 00:33:39,730
make charted every we were like a bunch

833
00:33:46,770 --> 00:33:42,700
of donkeys following a carrot and that

834
00:33:48,870 --> 00:33:46,780
doesn't do much for your initiative we

835
00:33:51,480 --> 00:33:48,880
decided after this little session that

836
00:33:53,520 --> 00:33:51,490
we would put a lot of the routine stuff

837
00:33:55,860 --> 00:33:53,530
that that really didn't matter when you

838
00:33:57,419 --> 00:33:55,870

did it just that it gets done that day

839
00:34:00,600 --> 00:33:57,429
we put it in what we called a shopping

840
00:34:01,890 --> 00:34:00,610
list and each one of us got our shopping

841
00:34:03,180 --> 00:34:01,900
list every day and there were lots of

842
00:34:06,690 --> 00:34:03,190
little things on there that we had to

843
00:34:08,280 --> 00:34:06,700
get done sometime during the day and the

844
00:34:09,810 --> 00:34:08,290
only things that we're on the schedule

845
00:34:12,119 --> 00:34:09,820
were those things that were precisely

846
00:34:13,500 --> 00:34:12,129
tied to a place in the trajectory where

847
00:34:15,570 --> 00:34:13,510
we were going to be where you had to do

848
00:34:17,639 --> 00:34:15,580
it at that instant and boy did that

849
00:34:19,530 --> 00:34:17,649
loosen up the schedule and make us more

850
00:34:20,280 --> 00:34:19,540
productive our productive level went

851
00:34:25,020 --> 00:34:20,290
just like that

852
00:34:27,899 --> 00:34:25,030
almost instantly and I think that got

853
00:34:29,820 --> 00:34:27,909
passed on I know when when I was working

854
00:34:33,119 --> 00:34:29,830
with Boeing but Bill Pogue with Boeing

855
00:34:35,250 --> 00:34:33,129
we we tried to make sure that that got

856
00:34:37,440 --> 00:34:35,260
into the planning for operations on the

857
00:34:42,119 --> 00:34:37,450
international space station and on the

858
00:34:45,020 --> 00:34:42,129
shuttle and I think a lot of that got in

859
00:34:49,010 --> 00:34:45,030
there but it's just very important that

860
00:34:51,419 --> 00:34:49,020
we found that you've got to be able to

861
00:34:52,230 --> 00:34:51,429
have looseness in the schedule so that

862
00:34:54,909 --> 00:34:52,240
assert

863
00:34:57,040 --> 00:34:54,919

autonomy in the schedule to do things

864
00:35:01,120 --> 00:34:57,050
that really don't have to be done at a

865
00:35:04,000 --> 00:35:01,130
precise time I think we're still working

866
00:35:06,609 --> 00:35:04,010
working that issue first of all let me

867
00:35:09,250 --> 00:35:06,619
say I just found working in space to be

868
00:35:10,599 --> 00:35:09,260
very difficult I came from a shuttle

869
00:35:12,520 --> 00:35:10,609
flight before so I've flown two times

870
00:35:15,370 --> 00:35:12,530
first time was a shuttle flight very

871
00:35:16,839 --> 00:35:15,380
choreographed shuttle flight I have seen

872
00:35:19,329 --> 00:35:16,849
everything I was going to do in that

873
00:35:21,309 --> 00:35:19,339
flight for two weeks on the ground

874
00:35:22,599 --> 00:35:21,319
multiple times and simulations never did

875
00:35:24,940 --> 00:35:22,609
I pick up a checklist that I already

876
00:35:26,380 --> 00:35:24,950
hadn't made notes in when I worked in

877
00:35:29,500 --> 00:35:26,390
space on the space station

878
00:35:32,170 --> 00:35:29,510
from day one I was doing things that I

879
00:35:34,059 --> 00:35:32,180
had never seen before many cases you've

880
00:35:35,410 --> 00:35:34,069
never been trained on because something

881
00:35:36,520 --> 00:35:35,420
broke that they didn't think would broke

882
00:35:39,130 --> 00:35:36,530
and you're you're going to be going to

883
00:35:40,900 --> 00:35:39,140
take a look so working up there is a

884
00:35:42,700 --> 00:35:40,910
very very challenging environment so

885
00:35:44,140 --> 00:35:42,710
very hard for the ground to estimate for

886
00:35:47,140 --> 00:35:44,150
example how long something might take

887
00:35:49,630 --> 00:35:47,150
you to do we still have a system that

888
00:35:53,589 --> 00:35:49,640

that's basically a day laid out for you

889
00:35:55,270 --> 00:35:53,599
and a short-term plan and many of those

890
00:35:57,339 --> 00:35:55,280
things are tied to ground control

891
00:35:58,270 --> 00:35:57,349
because maybe a specialist will be in

892
00:36:01,960 --> 00:35:58,280
you might need

893
00:36:03,730 --> 00:36:01,970
kayuu high rate comm system to be

894
00:36:06,040 --> 00:36:03,740
available while you're doing those tasks

895
00:36:07,809 --> 00:36:06,050
and that sort of thing so so many things

896
00:36:09,839 --> 00:36:07,819
are still tied to that and and it does

897
00:36:12,910 --> 00:36:09,849
actually make for a very stressful

898
00:36:15,550 --> 00:36:12,920
system and they they now have for us

899
00:36:17,740 --> 00:36:15,560
some flexible tasks during the day so

900
00:36:19,540 --> 00:36:17,750
that if you have you've made a call to

901
00:36:21,339 --> 00:36:19,550
ground hey I have this problem and they

902
00:36:23,920 --> 00:36:21,349
can't answer the question for you for 15

903
00:36:25,599 --> 00:36:23,930
minutes well that's going to put you 15

904
00:36:27,099 --> 00:36:25,609
minutes down on your task unless you can

905
00:36:28,630 --> 00:36:27,109
go do something else and pick up another

906
00:36:30,460 --> 00:36:28,640
task and so they've added some of these

907
00:36:32,770 --> 00:36:30,470
kinds of things in for us and it really

908
00:36:34,900 --> 00:36:32,780
does one of the things that's just fun

909
00:36:37,599 --> 00:36:34,910
to do on board is to try to get ahead on

910
00:36:39,190 --> 00:36:37,609
some of those tasks to make to make your

911
00:36:40,680 --> 00:36:39,200
day end up at the end of the day so

912
00:36:44,109 --> 00:36:40,690
you've got all the work done if you can

913
00:36:46,630 --> 00:36:44,119

we've we've gotten a much better feeling

914
00:36:48,160 --> 00:36:46,640
I think now that we're up there to do

915
00:36:50,050 --> 00:36:48,170
work that the ground can't necessarily

916
00:36:52,750 --> 00:36:50,060
figure out how long it's going to take

917
00:36:54,880 --> 00:36:52,760
you to do everything you just are doing

918
00:36:56,200 --> 00:36:54,890
your own time study at the end of the

919
00:36:57,700 --> 00:36:56,210
day if you can't get everything done on

920
00:36:59,950 --> 00:36:57,710
your time line then you just call down

921
00:37:02,140 --> 00:36:59,960
and say hey it took me this long to do

922
00:37:05,109 --> 00:37:02,150
that task and they write it down for the

923
00:37:05,989 --> 00:37:05,119
next time and I echo for the first 30

924
00:37:07,339 --> 00:37:05,999
days

925
00:37:08,899 --> 00:37:07,349
you're not getting anything done on time

926
00:37:10,699 --> 00:37:08,909
I can tell you that right now it's a

927
00:37:13,789 --> 00:37:10,709
very stressful place to be just because

928
00:37:15,549 --> 00:37:13,799
just just getting things going for the

929
00:37:17,719 --> 00:37:15,559
first time finding things in stowage

930
00:37:20,209 --> 00:37:17,729
recognizing what a part looks like that

931
00:37:21,619 --> 00:37:20,219
you might use multiple times but maybe

932
00:37:23,569 --> 00:37:21,629
maybe you're not used to what it looks

933
00:37:25,339 --> 00:37:23,579
like in space and where to find it can

934
00:37:27,679 --> 00:37:25,349
make it difficult so takes a little

935
00:37:28,999 --> 00:37:27,689
while to get rolling and and we're

936
00:37:30,769 --> 00:37:29,009
working on that as the psychological

937
00:37:34,149 --> 00:37:30,779
aspect it's kind of it's going to be

938
00:37:36,829 --> 00:37:34,159

important forever in Space Flight I

939
00:37:39,319 --> 00:37:36,839
would say I was working as hard as I

940
00:37:41,899 --> 00:37:39,329
could yeah I guess that's the same thing

941
00:37:43,579 --> 00:37:41,909
huh we're gonna we're gonna take another

942
00:37:45,049 --> 00:37:43,589
quest but I use but I wouldn't ask Jason

943
00:37:46,849 --> 00:37:45,059
to follow up on that a little bit for

944
00:37:48,889 --> 00:37:46,859
those of us who don't do this as work

945
00:37:51,349 --> 00:37:48,899
how do we keep how do we keep track of

946
00:37:51,979 --> 00:37:51,359
what the astronauts are doing in there

947
00:37:53,209 --> 00:37:51,989
are there

948
00:37:55,849 --> 00:37:53,219
spreadsheets there's someone's writing

949
00:37:56,959 --> 00:37:55,859
it down they're reporting to us yeah

950
00:37:58,939 --> 00:37:56,969
there's there's actually a whole

951
00:38:00,739 --> 00:37:58,949
multitude of folks on the ground that

952
00:38:02,599 --> 00:38:00,749
are tracking all the tasks there's a

953
00:38:04,429 --> 00:38:02,609
custom software that people have written

954
00:38:06,049 --> 00:38:04,439
to manage all the tasks that are being

955
00:38:07,549 --> 00:38:06,059
done and that's one of the things

956
00:38:09,349 --> 00:38:07,559
there's procedures behind each one of

957
00:38:10,729 --> 00:38:09,359
those tasks and such so when everything

958
00:38:11,959 --> 00:38:10,739
when they're talking about how

959
00:38:13,369 --> 00:38:11,969
everything that's kind of scripted

960
00:38:15,409 --> 00:38:13,379
there's procedures that go along with it

961
00:38:17,839 --> 00:38:15,419
so when we talk about those time delays

962
00:38:19,549 --> 00:38:17,849
and things increasing not only is it

963
00:38:21,289 --> 00:38:19,559

just rescheduling what you want but then

964
00:38:23,059 --> 00:38:21,299
how do you actually rewrite procedures

965
00:38:24,589 --> 00:38:23,069
on the fly so if you look at a piece of

966
00:38:26,659 --> 00:38:24,599
equipment or an experiment that you have

967
00:38:28,069 --> 00:38:26,669
never actually interactivo before can

968
00:38:30,139 --> 00:38:28,079
you actually have the procedures

969
00:38:32,269 --> 00:38:30,149
autonomously written and rewritten based

970
00:38:35,209 --> 00:38:32,279
on whatever the outcome was that the the

971
00:38:36,349 --> 00:38:35,219
crew member saw before so it's a little

972
00:38:39,259 --> 00:38:36,359
more complex than just a simple

973
00:38:41,419 --> 00:38:39,269
spreadsheet and it reads to get even

974
00:38:43,819 --> 00:38:41,429
more autonomous so that we can we can

975
00:38:45,949 --> 00:38:43,829
maximize this these efficiencies and

976
00:38:48,469 --> 00:38:45,959
minimize the downtime and then and give

977
00:38:49,849 --> 00:38:48,479
the crew the most autonomy we can so

978
00:38:52,909 --> 00:38:49,859
that they can make the right choices to

979
00:38:55,759 --> 00:38:52,919
make the best of their day all right we

980
00:38:59,419 --> 00:38:55,769
got a question out here hello my hashtag

981
00:39:05,329 --> 00:38:59,429
is Maryland space alright I have a a

982
00:39:08,689 --> 00:39:05,339
post Skylab question for w5 lkl did you

983
00:39:10,459 --> 00:39:08,699
make it many qsos in the space and are

984
00:39:13,680 --> 00:39:10,469
you still active on a particular band

985
00:39:15,660 --> 00:39:13,690
today w5 LFL

986
00:39:17,970 --> 00:39:15,670
I'm the only one with that cosine so it

987
00:39:20,360 --> 00:39:17,980
has to be addressed to me apparently and

988
00:39:23,100 --> 00:39:20,370

no I'm not really active at the moment

989
00:39:25,200 --> 00:39:23,110
but I have been a ham for gosh ever

990
00:39:28,440 --> 00:39:25,210
since I was in high school so that's

991
00:39:33,930 --> 00:39:28,450
been 65 years at least some like that

992
00:39:36,480 --> 00:39:33,940
and so I did count up I think I probably

993
00:39:38,190 --> 00:39:36,490
had four or five hundred contacts

994
00:39:41,250 --> 00:39:38,200
separate contacts while I was in space

995
00:39:42,960 --> 00:39:41,260
on the Space Lab mission and the way

996
00:39:45,060 --> 00:39:42,970
that I did that was by having a tape

997
00:39:46,440 --> 00:39:45,070
recorder and recorded everything that

998
00:39:48,450 --> 00:39:46,450
came over the trench two-way

999
00:39:51,510 --> 00:39:48,460
transmission because there were so many

1000
00:39:53,070 --> 00:39:51,520
people calling dozens at a time and I

1001
00:39:55,110 --> 00:39:53,080
couldn't get them all written down would

1002
00:39:57,150 --> 00:39:55,120
take too long to do it anyway only after

1003
00:39:58,800 --> 00:39:57,160
coming back home did I and others then

1004
00:40:01,140 --> 00:39:58,810
go through this and pull out all of

1005
00:40:04,920 --> 00:40:01,150
those call signs that with whom I had

1006
00:40:07,140 --> 00:40:04,930
communicated and as it turns out my son

1007
00:40:09,030 --> 00:40:07,150
also got his amateur radio license

1008
00:40:10,740 --> 00:40:09,040
before he went up he did a much better

1009
00:40:13,890 --> 00:40:10,750
job than I did as a matter of fact

1010
00:40:15,870 --> 00:40:13,900
because he did record more people he

1011
00:40:17,610 --> 00:40:15,880
somehow had it organized better than I

1012
00:40:19,920 --> 00:40:17,620
did and so he ended up with more

1013
00:40:22,140 --> 00:40:19,930

contacts and did much better than I did

1014
00:40:25,200 --> 00:40:22,150
for the amateur radio community

1015
00:40:28,380 --> 00:40:25,210
otherwise known as hams and so that's

1016
00:40:30,390 --> 00:40:28,390
the perhaps the answers to the question

1017
00:40:32,850 --> 00:40:30,400
that you had now and you use this tape

1018
00:40:37,650 --> 00:40:32,860
recorder a lot I think because at some

1019
00:40:41,430 --> 00:40:37,660
point your wife on Skylab okay that that

1020
00:40:44,940 --> 00:40:41,440
is another story but I think most people

1021
00:40:47,400 --> 00:40:44,950
enjoyed the question because before we

1022
00:40:49,260 --> 00:40:47,410
launched like a month or two before we

1023
00:40:52,710 --> 00:40:49,270
launched we worked out an arrangement

1024
00:40:56,360 --> 00:40:52,720
with about three potential Capcom's Bob

1025
00:40:58,890 --> 00:40:56,370
Crippen Carl Henn eyes and third one and

1026
00:41:01,410 --> 00:40:58,900
we worked out a short script there only

1027
00:41:03,750 --> 00:41:01,420
lasts about 30 or 45 seconds as if there

1028
00:41:05,730 --> 00:41:03,760
were a female namely my wife on board

1029
00:41:08,130 --> 00:41:05,740
the spacecraft communicating with the

1030
00:41:09,000 --> 00:41:08,140
ground well only these three people knew

1031
00:41:11,940 --> 00:41:09,010
what to expect

1032
00:41:13,800 --> 00:41:11,950
and so when there was a fairly quiet

1033
00:41:15,510 --> 00:41:13,810
pass coming up I mentioned to Bob

1034
00:41:17,010 --> 00:41:15,520
Crippen who was the Capcom with the time

1035
00:41:19,860 --> 00:41:17,020
I left something for you on the next

1036
00:41:21,870 --> 00:41:19,870
pass Bob he said I'll be ready that's

1037
00:41:24,390 --> 00:41:21,880
all he knew what I was talking about and

1038
00:41:26,840 --> 00:41:24,400

so when we came around the next time I

1039
00:41:28,520 --> 00:41:26,850
simply paid played back

1040
00:41:31,340 --> 00:41:28,530
this tape recording with my wife's voice

1041
00:41:33,950 --> 00:41:31,350
on it and this dialogue which required

1042
00:41:36,380 --> 00:41:33,960
Bob Crippen the Capcom to answer a

1043
00:41:38,000 --> 00:41:36,390
certain length of sins and so when she

1044
00:41:40,010 --> 00:41:38,010
asked him a question he wasn't ready

1045
00:41:41,750 --> 00:41:40,020
with the response and this went back and

1046
00:41:44,420 --> 00:41:41,760
forth for two or three exchanges and

1047
00:41:47,950 --> 00:41:44,430
ascended as normal as can be and the

1048
00:41:51,920 --> 00:41:47,960
people in the space on the ground in the

1049
00:41:54,140 --> 00:41:51,930
in the communication center were amazed

1050
00:41:56,570 --> 00:41:54,150
he was that coming down but it's coming

1051
00:41:58,580 --> 00:41:56,580
clearly coming down at the ground one I

1052
00:41:59,720 --> 00:41:58,590
know that voice is coming from up there

1053
00:42:01,040 --> 00:41:59,730
and it's female

1054
00:42:05,120 --> 00:42:01,050
there aren't any females there I don't

1055
00:42:07,850 --> 00:42:05,130
think and so they never figured out how

1056
00:42:10,910 --> 00:42:07,860
that was done it was only about 15 or 20

1057
00:42:12,740 --> 00:42:10,920
years later at a reunion at the Johnson

1058
00:42:15,800 --> 00:42:12,750
Space Center that I finally explained it

1059
00:42:28,900 --> 00:42:15,810
to the to the controllers now was that I

1060
00:42:37,760 --> 00:42:33,020
completely in the dark we've got a

1061
00:42:42,430 --> 00:42:37,770
question up here from our audience at

1062
00:42:45,590 --> 00:42:42,440
miss Linda 22 what was the single most

1063
00:42:50,150 --> 00:42:45,600

important discovery result observed on

1064
00:42:54,650 --> 00:42:50,160
Skylab relating to the human anatomy the

1065
00:42:56,810 --> 00:42:54,660
human anatomy what's the most important

1066
00:42:59,540 --> 00:42:56,820
thing related to human anatomy I don't

1067
00:43:03,140 --> 00:42:59,550
know it probably depends on your

1068
00:43:04,880 --> 00:43:03,150
perspective what is your basic interest

1069
00:43:07,370 --> 00:43:04,890
what is your background

1070
00:43:10,910 --> 00:43:07,380
you might say that it's I know so much

1071
00:43:15,620 --> 00:43:10,920
more about adaptation physical exercise

1072
00:43:18,410 --> 00:43:15,630
or the way a food is consumed and we did

1073
00:43:19,940 --> 00:43:18,420
a lot of work on that in fact I've

1074
00:43:21,920 --> 00:43:19,950
mentioned Kevin and a couple others

1075
00:43:23,420 --> 00:43:21,930
before we had some of the best food in

1076
00:43:25,910 --> 00:43:23,430
fact the best food that's ever been

1077
00:43:28,250 --> 00:43:25,920
provided in the space program on Skylab

1078
00:43:30,800 --> 00:43:28,260
40 years ago and that's because it was

1079
00:43:33,290 --> 00:43:30,810
one of the science experiments and so we

1080
00:43:35,480 --> 00:43:33,300
had a selection of about 65 or 70

1081
00:43:38,660 --> 00:43:35,490
different kinds of food and drink that

1082
00:43:40,900 --> 00:43:38,670
we could select for our own menu

1083
00:43:43,880 --> 00:43:40,910
which recycled over six days the only

1084
00:43:47,720 --> 00:43:43,890
constraint was we had to make this list

1085
00:43:49,520 --> 00:43:47,730
one year ahead of time and so we made

1086
00:43:53,210 --> 00:43:49,530
out a list of what we wanted to make and

1087
00:43:54,890 --> 00:43:53,220
then our contractor who is horrible we

1088
00:43:56,480 --> 00:43:54,900

kind of had joked at the time about we

1089
00:43:58,040 --> 00:43:56,490
think maybe they stirred it all up in a

1090
00:44:00,650 --> 00:43:58,050
washing machine before the infected in

1091
00:44:02,150 --> 00:44:00,660
the gym in the containers but actually

1092
00:44:03,650 --> 00:44:02,160
with very good food it's the best food

1093
00:44:04,070 --> 00:44:03,660
that's ever been provided in the space

1094
00:44:07,940 --> 00:44:04,080
program

1095
00:44:10,240 --> 00:44:07,950
I believe and so that's how the food was

1096
00:44:13,910 --> 00:44:10,250
sampled I think that was one of the

1097
00:44:28,250 --> 00:44:13,920
primary things that was learned from the

1098
00:44:30,410 --> 00:44:28,260
Skylab sagen oh yes both on the Space

1099
00:44:33,740 --> 00:44:30,420
Lab as well as on Space Shuttle the

1100
00:44:36,260 --> 00:44:33,750
Space Shuttle is in space lab as well as

1101
00:44:41,510 --> 00:44:36,270
Scylla even I get these terms confusing

1102
00:44:44,720 --> 00:44:41,520
time but at the moment it's a largely

1103
00:44:47,810 --> 00:44:44,730
done by whatever costs the least now

1104
00:44:49,610 --> 00:44:47,820
when Skylab they did things that tasted

1105
00:44:51,260 --> 00:44:49,620
the best for the crew members and you

1106
00:44:55,610 --> 00:44:51,270
picked the things out that you wanted to

1107
00:44:58,580 --> 00:44:55,620
eat its integer your tastes as the

1108
00:45:03,230 --> 00:44:58,590
primary consideration so we really had

1109
00:45:05,330 --> 00:45:03,240
good food Jerry was inhibited because he

1110
00:45:07,070 --> 00:45:05,340
his flight was extended from two months

1111
00:45:09,170 --> 00:45:07,080
to three months approximately so

1112
00:45:11,180 --> 00:45:09,180
therefore he only had food packed for

1113
00:45:13,070 --> 00:45:11,190

two months on this flight and every

1114
00:45:24,050 --> 00:45:13,080
third day they had to be K rations or

1115
00:45:25,280 --> 00:45:24,060
something all the sugar cookies you know

1116
00:45:27,080 --> 00:45:25,290
a dollar bill doesn't make much

1117
00:45:27,620 --> 00:45:27,090
difference but sugar cookies that's

1118
00:45:29,720 --> 00:45:27,630
different

1119
00:45:33,200 --> 00:45:29,730
that was currency that was the currency

1120
00:45:40,280 --> 00:45:33,210
on board day Skylab that so

1121
00:45:42,410 --> 00:45:40,290
that's thanks okay this comes to us from

1122
00:45:44,420 --> 00:45:42,420
Twitter and it's how does NASA plan to

1123
00:45:45,740 --> 00:45:44,430
work with collaborators to improve the

1124
00:45:49,020 --> 00:45:45,750
International Space Station for the

1125
00:45:51,430 --> 00:45:49,030
future how do you improve it

1126
00:45:53,530 --> 00:45:51,440
the idea that can start it off I mean

1127
00:45:55,690 --> 00:45:53,540
right now I mean we're working with a

1128
00:45:57,070 --> 00:45:55,700
number of our partners our commercial

1129
00:45:59,320 --> 00:45:57,080
partners that we have onboard station

1130
00:46:00,910 --> 00:45:59,330
today you see us running experiments

1131
00:46:03,100 --> 00:46:00,920
with companies like Bigelow Aerospace

1132
00:46:05,590 --> 00:46:03,110
where we're actually flying a large

1133
00:46:06,970 --> 00:46:05,600
inflatable module large but in the in

1134
00:46:08,380 --> 00:46:06,980
that it's the first inflatable module

1135
00:46:08,920 --> 00:46:08,390
that we've flown onboard the space

1136
00:46:12,970 --> 00:46:08,930
station

1137
00:46:14,020 --> 00:46:12,980
we're making improvements to our dis

1138
00:46:16,120 --> 00:46:14,030

life-support equipment

1139
00:46:18,400 --> 00:46:16,130
clothes looping the water in order to

1140
00:46:20,770 --> 00:46:18,410
have more water supplies that Skylab had

1141
00:46:23,230 --> 00:46:20,780
the luxury of fairly large water tanks

1142
00:46:25,930 --> 00:46:23,240
and a very fairly large wastewater

1143
00:46:27,670 --> 00:46:25,940
system as well but it was all open loop

1144
00:46:29,530 --> 00:46:27,680
meetings just used once and primarily

1145
00:46:30,850 --> 00:46:29,540
thrown away at that point what we're

1146
00:46:32,440 --> 00:46:30,860
trying to do is increase that water

1147
00:46:35,470 --> 00:46:32,450
reuse that allow the crew to have more

1148
00:46:37,120 --> 00:46:35,480
water resources on their way have better

1149
00:46:39,160 --> 00:46:37,130
environmental control systems that are

1150
00:46:41,140 --> 00:46:39,170
more reliable as we're increasing the

1151
00:46:43,180 --> 00:46:41,150
reliability on station today hopefully

1152
00:46:44,380 --> 00:46:43,190
then freedom even more time for science

1153
00:46:46,780 --> 00:46:44,390
to be done instead of just maintenance

1154
00:46:49,090 --> 00:46:46,790
of the vehicle itself so we can

1155
00:46:50,440 --> 00:46:49,100
continuously doing that not just by

1156
00:46:52,930 --> 00:46:50,450
ourselves with all but with all of our

1157
00:46:55,180 --> 00:46:52,940
collaborators as well in the private

1158
00:46:58,480 --> 00:46:55,190
sector and our contractor basis to help

1159
00:47:00,220 --> 00:46:58,490
NASA along the way in terms of the

1160
00:47:02,050 --> 00:47:00,230
research that we're doing now we we

1161
00:47:03,460 --> 00:47:02,060
coordinate our research very closely

1162
00:47:05,500 --> 00:47:03,470
with our international partners so we

1163
00:47:06,820 --> 00:47:05,510

regularly meet with international

1164
00:47:09,120 --> 00:47:06,830
partners involved International Space

1165
00:47:11,950 --> 00:47:09,130
Station and and coordinate our research

1166
00:47:14,080 --> 00:47:11,960
perspectives so that we don't have

1167
00:47:16,120 --> 00:47:14,090
duplication so we do the right we're

1168
00:47:17,380 --> 00:47:16,130
doing the right research to answer the

1169
00:47:19,960 --> 00:47:17,390
questions that we need to answer to

1170
00:47:22,120 --> 00:47:19,970
extend human exploration and attempt to

1171
00:47:24,580 --> 00:47:22,130
be able to do things with like exploring

1172
00:47:25,990 --> 00:47:24,590
Mars which is really the foundation of

1173
00:47:28,540 --> 00:47:26,000
what we're using that International

1174
00:47:30,480 --> 00:47:28,550
Space Station right now for and in line

1175
00:47:33,400 --> 00:47:30,490
with that we're coordinating with our

1176
00:47:36,720 --> 00:47:33,410
Russian colleagues now and planning a

1177
00:47:39,580 --> 00:47:36,730
one-year increment so we're doing more

1178
00:47:42,100 --> 00:47:39,590
extensive studies in terms of the

1179
00:47:44,260 --> 00:47:42,110
duration of the experiments on the

1180
00:47:47,500 --> 00:47:44,270
biomedical perspective to be able to

1181
00:47:49,780 --> 00:47:47,510
enable the human exploration and it

1182
00:47:51,610 --> 00:47:49,790
needs even longer durations in the

1183
00:47:56,460 --> 00:47:51,620
future I think we've got another

1184
00:47:59,130 --> 00:47:56,470
question up here go right on ahead

1185
00:48:01,589 --> 00:47:59,140
hi my name is Ken Johnson I was

1186
00:48:08,940 --> 00:48:01,599
wondering for these fees I've been to

1187
00:48:11,250 --> 00:48:08,950
space would you go back to space and I

1188
00:48:12,859 --> 00:48:11,260

would do it again if I had a chance I've

1189
00:48:15,780 --> 00:48:12,869
been more than pleased to accept that

1190
00:48:16,950 --> 00:48:15,790
invitation however I don't think

1191
00:48:18,809 --> 00:48:16,960
anyone's going to provide that

1192
00:48:20,970 --> 00:48:18,819
invitation because there's so many other

1193
00:48:21,990 --> 00:48:20,980
more capable people now like Kevin who

1194
00:48:24,210 --> 00:48:22,000
could do a much better and more

1195
00:48:26,190 --> 00:48:24,220
extensive job so I don't expect to do it

1196
00:48:28,710 --> 00:48:26,200
expect that out an opportunity but

1197
00:48:30,780 --> 00:48:28,720
certainly just if you would if you asked

1198
00:48:32,400 --> 00:48:30,790
what I like to go back or would would I

1199
00:48:38,609 --> 00:48:32,410
do it the answer would certainly be yes

1200
00:48:41,760 --> 00:48:38,619
I'd go but my wife won't let me I would

1201
00:48:44,609 --> 00:48:41,770
hop right back on the when you finally

1202
00:48:46,559 --> 00:48:44,619
walk to the rocket and climb in it's

1203
00:48:50,130 --> 00:48:46,569
it's one of the most amazing feelings

1204
00:48:51,870 --> 00:48:50,140
because the kind of the price you pay to

1205
00:48:54,750 --> 00:48:51,880
get there is the the long and arduous

1206
00:48:56,730 --> 00:48:54,760
training track to get there and it's

1207
00:48:59,099 --> 00:48:56,740
really it's really nice to know you have

1208
00:49:00,480 --> 00:48:59,109
a rocket seat with your name on it then

1209
00:49:02,550 --> 00:49:00,490
that you get a chance to get out there

1210
00:49:04,290 --> 00:49:02,560
and fly up there we all we all know what

1211
00:49:06,059 --> 00:49:04,300
a privilege it as a course in that we

1212
00:49:08,579 --> 00:49:06,069
love being there when we're there I can

1213
00:49:10,530 --> 00:49:08,589

say when I came home after 144 days I

1214
00:49:14,099 --> 00:49:10,540
was really really kind of happy to come

1215
00:49:15,750 --> 00:49:14,109
home again and be out in open space and

1216
00:49:17,280 --> 00:49:15,760
feel the breeze in my face and even walk

1217
00:49:20,190 --> 00:49:17,290
in the rain and those sorts of things so

1218
00:49:22,109 --> 00:49:20,200
I think most of us are made for earth

1219
00:49:24,390 --> 00:49:22,119
and we really love Earth a lot but we

1220
00:49:26,790 --> 00:49:24,400
really like that magic place that space

1221
00:49:28,890 --> 00:49:26,800
also so we'd love to see a lot more

1222
00:49:30,720 --> 00:49:28,900
people get to go someday and I would I

1223
00:49:32,390 --> 00:49:30,730
would certainly go back again it's a

1224
00:49:35,790 --> 00:49:32,400
long ways back though it's probably

1225
00:49:36,960 --> 00:49:35,800
probably never so very funny

1226
00:49:38,460 --> 00:49:36,970
well guys we could keep this

1227
00:49:40,230 --> 00:49:38,470
conversation I think right we could keep

1228
00:49:42,210 --> 00:49:40,240
this going for a few more hours or a

1229
00:49:43,800 --> 00:49:42,220
couple days but we do have something

1230
00:49:46,650 --> 00:49:43,810
that I think Kevin has a presentation

1231
00:49:48,359 --> 00:49:46,660
that he would like to thank you to our

1232
00:49:50,339 --> 00:49:48,369
to our fantastic

1233
00:49:54,569 --> 00:49:50,349
Skylab crew that's a little bit's okay

1234
00:49:56,190 --> 00:49:54,579
well clearly when these guys went to

1235
00:49:59,520 --> 00:49:56,200
that final frontier to stay for a long

1236
00:50:01,950 --> 00:49:59,530
time they did it as the first one the

1237
00:50:03,690 --> 00:50:01,960
ones who are entering the unknown and to

1238
00:50:06,359 --> 00:50:03,700

see what it was going to be like and set

1239
00:50:07,710 --> 00:50:06,369
the stage for us and so it's a pleasure

1240
00:50:09,120 --> 00:50:07,720
for me to be here on the 40th

1241
00:50:11,609 --> 00:50:09,130
anniversary with you guys in

1242
00:50:14,609 --> 00:50:11,619
meet you both so it's a very big honor

1243
00:50:17,460 --> 00:50:14,619
and on behalf of NASA I'm given the

1244
00:50:19,440 --> 00:50:17,470
privilege of presenting you these and

1245
00:50:21,839 --> 00:50:19,450
remembrance let's see if I got it yes

1246
00:50:23,789 --> 00:50:21,849
that one's for you Owen and maybe you

1247
00:50:44,450 --> 00:50:23,799
can hold those up and then for perjury

1248
00:50:49,019 --> 00:50:46,440
they've learned how to make it easier

1249
00:50:51,120 --> 00:50:49,029
for us thanks to you we've got a few

1250
00:50:53,730 --> 00:50:51,130
more minutes and I wanted to first turn

1251
00:50:56,190 --> 00:50:53,740
to Owen into Jerry to to give us some

1252
00:50:57,839 --> 00:50:56,200
some last thoughts about wait wait what

1253
00:50:59,789 --> 00:50:57,849
you want this audience and the audience

1254
00:51:02,720 --> 00:50:59,799
watching on NASA TV to be left with what

1255
00:51:09,180 --> 00:51:02,730
should we remember about Scylla

1256
00:51:10,890 --> 00:51:09,190
mmm-hmm first well I guess what I would

1257
00:51:12,450 --> 00:51:10,900
ask you to remember is that we may have

1258
00:51:14,759 --> 00:51:12,460
done it first but these guys are doing

1259
00:51:16,289 --> 00:51:14,769
it better and that people need to

1260
00:51:18,809 --> 00:51:16,299
continue to do it better and better

1261
00:51:21,749 --> 00:51:18,819
because we learn more and more as we do

1262
00:51:23,450 --> 00:51:21,759
this thing and we just took the first

1263
00:51:26,279 --> 00:51:23,460

step and the rest of the steps are

1264
00:51:30,210 --> 00:51:26,289
having have been taken and are being

1265
00:51:30,990 --> 00:51:30,220
taken right now I think NASA is headed

1266
00:51:33,660 --> 00:51:31,000
in the right direction

1267
00:51:35,670 --> 00:51:33,670
you know we've very recently had a

1268
00:51:38,420 --> 00:51:35,680
description of how we might go beyond

1269
00:51:41,339 --> 00:51:38,430
the earth-moon system and begin to find

1270
00:51:43,769 --> 00:51:41,349
meteoroids or asteroids in space and

1271
00:51:45,690 --> 00:51:43,779
bring those back to the earth lunar

1272
00:51:47,069 --> 00:51:45,700
environment and make a use of an

1273
00:51:49,349 --> 00:51:47,079
advantage of that for several different

1274
00:51:52,170 --> 00:51:49,359
purposes I think that's a great concept

1275
00:51:55,319 --> 00:51:52,180
and I think that it's one that if we're

1276
00:51:57,059 --> 00:51:55,329
NASA is allowed to continue and persist

1277
00:51:58,799 --> 00:51:57,069
in this direction and with the proper

1278
00:52:00,749 --> 00:51:58,809
funding to do it then NASA will continue

1279
00:52:02,640 --> 00:52:00,759
to be as successful as they have been

1280
00:52:04,650 --> 00:52:02,650
all the way from Skylab shuttle and

1281
00:52:06,930 --> 00:52:04,660
Space Station as well so I've been very

1282
00:52:11,099 --> 00:52:06,940
encouraged by these new directions that

1283
00:52:13,319 --> 00:52:11,109
that nASA has appointed to the agency

1284
00:52:17,099 --> 00:52:13,329
and and I'm looking forward I hope I'm

1285
00:52:19,410 --> 00:52:17,109
around for another 15 or 20 years to see

1286
00:52:21,269 --> 00:52:19,420
to see some of these things develop for

1287
00:52:22,510 --> 00:52:21,279
Jason and Marshall kind of the same

1288
00:52:24,070 --> 00:52:22,520

question but what can we

1289
00:52:26,110 --> 00:52:24,080
leave our great audience here and the

1290
00:52:27,400 --> 00:52:26,120
folks watching about about where it what

1291
00:52:28,480 --> 00:52:27,410
we're learning from what we've learned

1292
00:52:30,190 --> 00:52:28,490
from Skylab what we're learning on

1293
00:52:32,380 --> 00:52:30,200
station how it's going to take us to

1294
00:52:33,760 --> 00:52:32,390
even further destinations it's great to

1295
00:52:35,740 --> 00:52:33,770
see that kind of the beginnings of

1296
00:52:37,570 --> 00:52:35,750
long-term spaceflight on the 40th

1297
00:52:38,830 --> 00:52:37,580
anniversary remembering that but we're

1298
00:52:40,780 --> 00:52:38,840
going to go further and further into

1299
00:52:42,310 --> 00:52:40,790
space and how do we go those longer and

1300
00:52:44,740 --> 00:52:42,320
longer durations how do we build those

1301
00:52:46,600 --> 00:52:44,750
systems how do we how do we find the

1302
00:52:48,880 --> 00:52:46,610
crew members they can actually fly these

1303
00:52:50,890 --> 00:52:48,890
long-duration missions and train them to

1304
00:52:52,480 --> 00:52:50,900
be it folks that are in the audience the

1305
00:52:53,650 --> 00:52:52,490
students listening and such those are

1306
00:52:55,510 --> 00:52:53,660
the folks who helped build these systems

1307
00:52:57,490 --> 00:52:55,520
they're the folks that will be going on

1308
00:52:58,930 --> 00:52:57,500
that so we need all them to help us

1309
00:53:01,150 --> 00:52:58,940
build these systems and come along with

1310
00:53:02,920 --> 00:53:01,160
us so I think it's really important as

1311
00:53:04,360 --> 00:53:02,930
we go further and further it's not about

1312
00:53:06,370 --> 00:53:04,370
the destination it's always about what's

1313
00:53:08,620 --> 00:53:06,380

the next destination and as soon as we

1314
00:53:10,420 --> 00:53:08,630
want to go to point X or stay in space

1315
00:53:11,500 --> 00:53:10,430
for a certain long period of time the

1316
00:53:14,230 --> 00:53:11,510
next thing we want to do is go longer

1317
00:53:16,420 --> 00:53:14,240
and go further so it's always important

1318
00:53:21,220 --> 00:53:16,430
to keep on keep on pushing further into

1319
00:53:23,350 --> 00:53:21,230
the for exploration yesterday I received

1320
00:53:24,220 --> 00:53:23,360
an email with a picture of a

1321
00:53:25,630 --> 00:53:24,230
one-year-old

1322
00:53:28,570 --> 00:53:25,640
little girl who happens to be my

1323
00:53:31,840 --> 00:53:28,580
granddaughter sent to me by Richards

1324
00:53:33,960 --> 00:53:31,850
wife and the common daughter was I could

1325
00:53:39,220 --> 00:53:33,970
see she was in her NASA flight suit and

1326
00:53:43,570 --> 00:53:39,230
they say her next flight or for her

1327
00:53:45,820 --> 00:53:43,580
first flight will this suit and her

1328
00:53:47,650 --> 00:53:45,830
background fitting be adequate and so

1329
00:53:49,600 --> 00:53:47,660
I'm already very pleased to see that

1330
00:53:51,310 --> 00:53:49,610
some very young people are either

1331
00:53:53,200 --> 00:53:51,320
thinking about it themselves or their

1332
00:53:55,120 --> 00:53:53,210
parents are thinking about what they

1333
00:53:57,820 --> 00:53:55,130
will do for the third generation and so

1334
00:54:00,280 --> 00:53:57,830
I think that there is a good opportunity

1335
00:54:01,930 --> 00:54:00,290
for these very young people to come

1336
00:54:04,150 --> 00:54:01,940
along when we begin to think about the

1337
00:54:07,540 --> 00:54:04,160
rest of the solar system and think about

1338
00:54:08,080 --> 00:54:07,550

Mars and moons of Mars well our time has

1339
00:54:09,940 --> 00:54:08,090
come

1340
00:54:10,990 --> 00:54:09,950
took clothes I hate that because again I

1341
00:54:13,030 --> 00:54:11,000
could keep this conversation going

1342
00:54:15,460 --> 00:54:13,040
forever and ever but it doesn't have to

1343
00:54:18,340 --> 00:54:15,470
end here keep following us on Google+ on

1344
00:54:19,630 --> 00:54:18,350
Facebook and on Twitter at NASA we want

1345
00:54:20,110 --> 00:54:19,640
to hear your questions and hear from you

1346
00:54:21,970 --> 00:54:20,120
again

1347
00:54:24,100 --> 00:54:21,980
Owen and Jerry thank you I mean this is

1348
00:54:26,860 --> 00:54:24,110
an amazing the legacy of Skylab is

1349
00:54:29,170 --> 00:54:26,870
obviously a huge impact not only on us

1350
00:54:31,900 --> 00:54:29,180
but but on the entire world and Kevin

1351
00:54:33,910 --> 00:54:31,910
thank you and your colleagues for for

1352
00:54:36,180 --> 00:54:33,920
all of that and to Marshall and Jason

1353
00:54:38,460 --> 00:54:36,190
for keep pushing us further

1354
00:54:40,859 --> 00:54:38,470
and on behalf of the whole team here at

1355
00:54:43,050 --> 00:54:40,869
NASA I want to thank you all and we'll

1356
00:54:45,540 --> 00:54:43,060
see you all soon thanks a lot and we

1357
00:54:47,160 --> 00:54:45,550
want you to stay tuned to NASA TV for

1358
00:54:50,579 --> 00:54:47,170
coverage of hatch opening of expedition

1359
00:54:52,740 --> 00:54:50,589
35 and the return of Tom Mashburn Roman