
NASA
John Yembrick
NASA Office of Communications

1
00:00:09,410 --> 00:00:04,660
I

2
00:00:10,700 --> 00:00:09,420
office of communications welcome to the

3
00:00:12,110 --> 00:00:10,710
10th anniversary of the International

4
00:00:14,390 --> 00:00:12,120
Space Station discussion and NASA

5
00:00:16,580 --> 00:00:14,400
headquarters in Washington on November

6
00:00:17,990 --> 00:00:16,590
second 2000 the crew of expedition one

7
00:00:20,060 --> 00:00:18,000
became the first residence of the

8
00:00:22,460 --> 00:00:20,070
National Space Station since then over

9
00:00:25,010 --> 00:00:22,470
two hundred visitors have explored the

10
00:00:29,089 --> 00:00:25,020
International Space Station we've had 15

11
00:00:32,359 --> 00:00:29,099
countries contributed modules and

12
00:00:33,710 --> 00:00:32,369
hardware and 600 experiments have been

13
00:00:36,709 --> 00:00:33,720

conducted over 60 our experiment

14
00:00:38,660 --> 00:00:36,719
conducted on the complex on this Tuesday

15
00:00:40,459 --> 00:00:38,670
we're going to be celebrating 10 years

16
00:00:42,110 --> 00:00:40,469
of permanent human residency aboard the

17
00:00:44,090 --> 00:00:42,120
complex here today discuss that

18
00:00:49,130 --> 00:00:44,100
milestone is the associate minister for

19
00:00:50,630 --> 00:00:49,140
space operations bill Gerstenmaier the

20
00:00:52,549 --> 00:00:50,640
associate administrator for independent

21
00:00:53,509 --> 00:00:52,559
program and cost evaluation and the

22
00:00:58,639 --> 00:00:53,519
former deputy associate administrator

23
00:01:00,380 --> 00:00:58,649
for Space Station my cause deputy

24
00:01:04,910 --> 00:01:00,390
Associate Minister for space operations

25
00:01:06,380 --> 00:01:04,920
Lynn Klein and the associate assistant

26
00:01:09,289 --> 00:01:06,390
associate administrator for a National

27
00:01:10,760 --> 00:01:09,299
Space Station marker and I'm going to

28
00:01:12,289 --> 00:01:10,770
start off by asking the panelist a few

29
00:01:14,749 --> 00:01:12,299
questions and we'll take questions from

30
00:01:16,219 --> 00:01:14,759
the audience later in the program this

31
00:01:17,929 --> 00:01:16,229
question is really for all of you but

32
00:01:19,550 --> 00:01:17,939
we'll start off with mark how did you

33
00:01:23,050 --> 00:01:19,560
first become involved with space station

34
00:01:26,090 --> 00:01:23,060
and how has your role since involved I

35
00:01:29,420 --> 00:01:26,100
see it was 1984 and i was involved in

36
00:01:31,940 --> 00:01:29,430
the renewable energy industry when OPEC

37
00:01:35,300 --> 00:01:31,950
lost its cartel power and I got an

38
00:01:36,980 --> 00:01:35,310

assignment to do a workshop research

39
00:01:38,480 --> 00:01:36,990
requirements for the space station this

40
00:01:41,270 --> 00:01:38,490
was back in the very beginning of Phase

41
00:01:44,149 --> 00:01:41,280
I and I basically worked on those

42
00:01:46,190 --> 00:01:44,159
requirements for a decade and then as

43
00:01:47,870 --> 00:01:46,200
the program became operational and we

44
00:01:51,440 --> 00:01:47,880
started actually implementing the

45
00:01:53,480 --> 00:01:51,450
research I became involved in developing

46
00:01:55,130 --> 00:01:53,490
the uses of the station as a National

47
00:02:00,020 --> 00:01:55,140
Laboratory and that brings us up to

48
00:02:02,300 --> 00:02:00,030
today yeah well when we started the

49
00:02:04,160 --> 00:02:02,310
space station program I was actually

50
00:02:06,319 --> 00:02:04,170
working on space and earth science

51
00:02:07,669 --> 00:02:06,329
activities but I was carpooling with

52
00:02:10,550 --> 00:02:07,679
somebody who is on the space station

53
00:02:12,890 --> 00:02:10,560
negotiating team so my initial role in

54
00:02:14,660 --> 00:02:12,900
space station was vicariously hearing on

55
00:02:15,670 --> 00:02:14,670
the way home all the stories on what was

56
00:02:18,699 --> 00:02:15,680
going on

57
00:02:21,610 --> 00:02:18,709
my own personal role began began when we

58
00:02:23,830 --> 00:02:21,620
invited Russia to join the program and

59
00:02:25,839 --> 00:02:23,840
the my first job on the International

60
00:02:27,940 --> 00:02:25,849
Space Station was to work with our

61
00:02:30,849 --> 00:02:27,950
original partners Canada Europe and

62
00:02:32,979 --> 00:02:30,859
Japan and negotiate the joint invitation

63
00:02:35,530 --> 00:02:32,989

to formally through diplomatic channels

64
00:02:37,240 --> 00:02:35,540
invite Russia to join the program and

65
00:02:39,280 --> 00:02:37,250
then I was asked to lead the

66
00:02:41,830 --> 00:02:39,290
negotiations to bring Russia into the

67
00:02:44,140 --> 00:02:41,840
program and it's changed over time

68
00:02:45,940 --> 00:02:44,150
because at that point I was always

69
00:02:47,679 --> 00:02:45,950
involved in the front end of programs

70
00:02:50,589 --> 00:02:47,689
just putting in place partnerships and

71
00:02:52,539 --> 00:02:50,599
now I find myself on the other end in a

72
00:02:54,399 --> 00:02:52,549
program office where we're responsible

73
00:02:57,099 --> 00:02:54,409
for implementing those things that we

74
00:03:00,580 --> 00:02:57,109
put into the agreements years ago okay

75
00:03:05,770 --> 00:03:00,590
great Mike I was at Johnson Space Center

76
00:03:07,780 --> 00:03:05,780
and in 1986 working within the mission

77
00:03:10,509 --> 00:03:07,790
ops Directorate gene Kranz decided that

78
00:03:12,789 --> 00:03:10,519
I needed to try something new and assign

79
00:03:14,789 --> 00:03:12,799
me to one of a group of space station

80
00:03:17,979 --> 00:03:14,799
sections that we set up an mo d and that

81
00:03:19,629 --> 00:03:17,989
got me started and then I spent all six

82
00:03:23,740 --> 00:03:19,639
years of their arrested and freedom

83
00:03:25,659 --> 00:03:23,750
program office and downtown and you know

84
00:03:27,819 --> 00:03:25,669
up until when I left space ops a couple

85
00:03:31,899 --> 00:03:27,829
years ago to do all the cross agency

86
00:03:36,189 --> 00:03:31,909
stuff in ipce I've spent a lawful lot of

87
00:03:39,520 --> 00:03:36,199
time on Space Station okay I actually

88
00:03:42,729 --> 00:03:39,530

started with space station in 1989 down

89
00:03:44,800 --> 00:03:42,739
at the Johnson Space Center my job was I

90
00:03:47,140 --> 00:03:44,810
was on the shuttle side and our job was

91
00:03:49,030 --> 00:03:47,150
essentially to figure out how to put

92
00:03:51,969 --> 00:03:49,040
together space station in the very

93
00:03:53,949 --> 00:03:51,979
beginning it started out with the trust

94
00:03:56,439 --> 00:03:53,959
being actually built itself from scratch

95
00:03:58,179 --> 00:03:56,449
we call it sticks and balls Space

96
00:03:59,589 --> 00:03:58,189
Station where we actually assembled the

97
00:04:01,659 --> 00:03:59,599
various we're going to assemble the

98
00:04:03,580 --> 00:04:01,669
various trust members and actually

99
00:04:05,499 --> 00:04:03,590
string the wiring in the trust and then

100
00:04:07,270 --> 00:04:05,509
actually put all the electronics and

101
00:04:09,759 --> 00:04:07,280
avionics components in the trust so that

102
00:04:12,249 --> 00:04:09,769
was the first activity i had and

103
00:04:14,259 --> 00:04:12,259
supported it in 1989 and then then we

104
00:04:15,819 --> 00:04:14,269
went to pre-integrated trusts and and

105
00:04:18,819 --> 00:04:15,829
then I continued to work with the

106
00:04:20,349 --> 00:04:18,829
program until nineteen ninety two then I

107
00:04:22,420 --> 00:04:20,359
went away to school when the Russians

108
00:04:25,839 --> 00:04:22,430
got added then I came back to the

109
00:04:27,530 --> 00:04:25,849
shuttle program I guess after I got back

110
00:04:30,410 --> 00:04:27,540
from school and

111
00:04:32,750 --> 00:04:30,420
then eventually became deputy station

112
00:04:35,060 --> 00:04:32,760
program manager at the end so I was

113
00:04:38,150 --> 00:04:35,070

there put together most of the original

114
00:04:39,530 --> 00:04:38,160
assembly sequences that were used prior

115
00:04:41,390 --> 00:04:39,540
to the addition to the Russians and

116
00:04:43,160 --> 00:04:41,400
somehow those assembly sequences really

117
00:04:45,560 --> 00:04:43,170
held together throughout the entire

118
00:04:47,210 --> 00:04:45,570
period and I got to see him actually get

119
00:04:49,460 --> 00:04:47,220
implemented by the shuttle team and in

120
00:04:50,900 --> 00:04:49,470
later years so I've been kind of on and

121
00:04:52,790 --> 00:04:50,910
off the program between shuttle and

122
00:04:53,690 --> 00:04:52,800
station throughout the entire period of

123
00:04:56,330 --> 00:04:53,700
time I wasn't there from the very

124
00:04:58,970 --> 00:04:56,340
beginning but started in 1989 I think

125
00:05:03,110 --> 00:04:58,980
right after Mike in his area town of

126
00:05:04,250 --> 00:05:03,120
Johnson right in 1984 then President

127
00:05:06,890 --> 00:05:04,260
Ronald Reagan announced the development

128
00:05:08,480 --> 00:05:06,900
of a permanent manned space station how

129
00:05:10,910 --> 00:05:08,490
have we gone and which was dub Space

130
00:05:12,800 --> 00:05:10,920
Station freedom how have we gone from

131
00:05:14,870 --> 00:05:12,810
freedom to where we are today with

132
00:05:16,580 --> 00:05:14,880
international space station how did that

133
00:05:18,320 --> 00:05:16,590
process happen and how was the station

134
00:05:21,500 --> 00:05:18,330
different today it's originally

135
00:05:23,920 --> 00:05:21,510
conceived we all take the first shot and

136
00:05:25,940 --> 00:05:23,930
see where folks want to go with it so

137
00:05:31,220 --> 00:05:25,950
fundamentally we worked on Space Station

138
00:05:32,990 --> 00:05:31,230

freedom once we establish the rest in

139
00:05:35,300 --> 00:05:33,000
program office as March that has started

140
00:05:39,320 --> 00:05:35,310
in phase a actually in that 84 timeframe

141
00:05:41,420 --> 00:05:39,330
so for maybe four till about 92 and we

142
00:05:43,610 --> 00:05:41,430
were working with the Japanese the

143
00:05:46,310 --> 00:05:43,620
Europeans and the Canadians as partners

144
00:05:49,730 --> 00:05:46,320
already in the endeavor when we went

145
00:05:51,170 --> 00:05:49,740
through the redesign in 92 93 we were

146
00:05:52,840 --> 00:05:51,180
then asked to look at adding the

147
00:05:56,360 --> 00:05:52,850
Russians to the configuration that

148
00:05:59,060 --> 00:05:56,370
allowed us to simplify some of the u.s.

149
00:06:03,350 --> 00:05:59,070
capabilities we no longer had us

150
00:06:04,460 --> 00:06:03,360
propulsion for an example but it it was

151
00:06:07,400 --> 00:06:04,470
an incredible learning experience

152
00:06:09,590 --> 00:06:07,410
because that 10 years that we had spent

153
00:06:12,380 --> 00:06:09,600
with the other partners kind of forming

154
00:06:14,030 --> 00:06:12,390
a team and agreeing on technical

155
00:06:16,580 --> 00:06:14,040
standards for all of these different

156
00:06:17,660 --> 00:06:16,590
functions we now had to figure out how

157
00:06:21,320 --> 00:06:17,670
to do that very quickly with the

158
00:06:22,630 --> 00:06:21,330
Russians the main trust backbone and

159
00:06:25,310 --> 00:06:22,640
everything of the space station is

160
00:06:27,110 --> 00:06:25,320
pretty much as it's been since the

161
00:06:29,390 --> 00:06:27,120
earlier so a lot of the configuration is

162
00:06:32,240 --> 00:06:29,400
pretty much as we had planned it since

163
00:06:34,070 --> 00:06:32,250

the earliest time how about the missions

164
00:06:36,470 --> 00:06:34,080
I've read things before the freedom was

165
00:06:37,580 --> 00:06:36,480
supposed to service satellites and do

166
00:06:38,990 --> 00:06:37,590
some things that the space station now

167
00:06:39,950 --> 00:06:39,000
does and how has that changed why did

168
00:06:43,290 --> 00:06:39,960
that change

169
00:06:44,970 --> 00:06:43,300
is any well there were originally eight

170
00:06:47,730 --> 00:06:44,980
missions for the space station

171
00:06:49,740 --> 00:06:47,740
envisioned and I would argue that today

172
00:06:51,510 --> 00:06:49,750
we really see the remnants of all eight

173
00:06:54,540 --> 00:06:51,520
of those missions and even satellite

174
00:06:56,850 --> 00:06:54,550
servicing the technology's changed so

175
00:06:58,440 --> 00:06:56,860
dramatically over 25 years that there

176
00:07:00,630 --> 00:06:58,450
are opportunities to do things

177
00:07:03,090 --> 00:07:00,640
differently than they were envisioned 20

178
00:07:05,850 --> 00:07:03,100
years ago so you know we're starting to

179
00:07:08,100 --> 00:07:05,860
look at deployments and retrievals of

180
00:07:10,800 --> 00:07:08,110
potentially nano satellites from the

181
00:07:12,930 --> 00:07:10,810
station we're looking at satellite

182
00:07:14,850 --> 00:07:12,940
servicing demonstrations on the station

183
00:07:18,020 --> 00:07:14,860
so many of the original eight missions

184
00:07:20,580 --> 00:07:18,030
are still applicable in varying degrees

185
00:07:22,500 --> 00:07:20,590
Liana folks tended to associate those

186
00:07:24,900 --> 00:07:22,510
missions with a unique component of the

187
00:07:26,460 --> 00:07:24,910
space station so during redesigns as

188
00:07:29,580 --> 00:07:26,470

those components may have been deleted

189
00:07:31,560 --> 00:07:29,590
or changed a lot of folks presumed that

190
00:07:35,550 --> 00:07:31,570
that mission was no longer supported but

191
00:07:37,530 --> 00:07:35,560
I really agree with mark I see ability

192
00:07:39,710 --> 00:07:37,540
to do pieces of all of those missions in

193
00:07:42,540 --> 00:07:39,720
the space station that we have today

194
00:07:43,800 --> 00:07:42,550
today there's 15 partner nations to

195
00:07:45,840 --> 00:07:43,810
contribute International Space Station

196
00:07:47,070 --> 00:07:45,850
Lynn could you explain with the process

197
00:07:49,110 --> 00:07:47,080
how that came to be and how the

198
00:07:51,210 --> 00:07:49,120
agreements were put together well we

199
00:07:53,010 --> 00:07:51,220
already had a lot of experience on the

200
00:07:55,110 --> 00:07:53,020
shuttle with what I'll call our

201
00:07:59,010 --> 00:07:55,120
traditional partners Canada Europe and

202
00:08:01,290 --> 00:07:59,020
Japan and with Canada we had the remote

203
00:08:03,480 --> 00:08:01,300
manipulator system on the arm on the

204
00:08:06,930 --> 00:08:03,490
shuttle with Europe we had the space lab

205
00:08:10,680 --> 00:08:06,940
experience Japan had not contributed an

206
00:08:12,180 --> 00:08:10,690
element to the shuttle and so when we

207
00:08:15,120 --> 00:08:12,190
started talking with them they were very

208
00:08:18,000 --> 00:08:15,130
interested in doing so in our next human

209
00:08:20,730 --> 00:08:18,010
space flight endeavour so we had looked

210
00:08:22,710 --> 00:08:20,740
at what were our past experiences what

211
00:08:27,060 --> 00:08:22,720
were their capabilities we had studies

212
00:08:28,860 --> 00:08:27,070
going on for years on what we might come

213
00:08:31,260 --> 00:08:28,870

up with in terms of a design and what

214
00:08:34,050 --> 00:08:31,270
partners wanted to do so we really knew

215
00:08:35,969 --> 00:08:34,060
who those partners were going to be when

216
00:08:37,650 --> 00:08:35,979
the when the program was announced and

217
00:08:40,560 --> 00:08:37,660
then we had to go through the formal

218
00:08:43,860 --> 00:08:40,570
process to to invite them and work the

219
00:08:46,140 --> 00:08:43,870
negotiations but it was really built on

220
00:08:49,580 --> 00:08:46,150
a long history of collaboration with

221
00:08:53,030 --> 00:08:51,560
would add and I think that the thing

222
00:08:55,220 --> 00:08:53,040
that's kind of interesting about all

223
00:08:57,380 --> 00:08:55,230
this histories we look back is we put

224
00:08:59,420 --> 00:08:57,390
together a basic framework from both the

225
00:09:01,190 --> 00:08:59,430
hardware standpoint and even from a like

226
00:09:03,920 --> 00:09:01,200
an international partner standpoint that

227
00:09:06,230 --> 00:09:03,930
was pretty flexible so as things changed

228
00:09:08,300 --> 00:09:06,240
and missions change the hardware was

229
00:09:10,820 --> 00:09:08,310
able to adapt to a kind of a changing

230
00:09:13,580 --> 00:09:10,830
mission a changing role the the

231
00:09:15,200 --> 00:09:13,590
agreements the mo used the the

232
00:09:17,450 --> 00:09:15,210
intergovernmental agreements those

233
00:09:19,400 --> 00:09:17,460
things they're flexible enough that we

234
00:09:21,170 --> 00:09:19,410
could adapt those and morph those as we

235
00:09:22,520 --> 00:09:21,180
added other partners and we did things

236
00:09:24,290 --> 00:09:22,530
that weren't really envisioned in the

237
00:09:25,940 --> 00:09:24,300
beginning but they gave us enough of a

238
00:09:28,070 --> 00:09:25,950

structure that we could hang together as

239
00:09:31,940 --> 00:09:28,080
a team and continue to move forward so I

240
00:09:34,190 --> 00:09:31,950
think the big kind of lesson learned is

241
00:09:36,020 --> 00:09:34,200
that you when you start out a project is

242
00:09:37,700 --> 00:09:36,030
make sure you got the right flexibility

243
00:09:39,230 --> 00:09:37,710
inherent in the design because you may

244
00:09:40,790 --> 00:09:39,240
not end up with exactly what you

245
00:09:42,260 --> 00:09:40,800
envisioned when you first put the

246
00:09:44,360 --> 00:09:42,270
concept together but you need that

247
00:09:47,090 --> 00:09:44,370
framework put together that you can

248
00:09:48,890 --> 00:09:47,100
operate in it in a different way yeah

249
00:09:51,400 --> 00:09:48,900
one of the interesting things to me is

250
00:09:53,990 --> 00:09:51,410
when we started design and development

251
00:09:55,910 --> 00:09:54,000
we operated under a structure that we

252
00:10:00,200 --> 00:09:55,920
referred to as being bilateral where it

253
00:10:02,600 --> 00:10:00,210
was the us to Japan the u.s. to east of

254
00:10:05,600 --> 00:10:02,610
the US to canada and then ultimately

255
00:10:07,490 --> 00:10:05,610
russia and that was to try to ensure

256
00:10:09,410 --> 00:10:07,500
that we weren't in each other's critical

257
00:10:11,030 --> 00:10:09,420
path and we always envisioned that we

258
00:10:13,250 --> 00:10:11,040
would get to this operational time frame

259
00:10:16,040 --> 00:10:13,260
that would be fully multilateral where

260
00:10:17,810 --> 00:10:16,050
the full team was working together and I

261
00:10:19,340 --> 00:10:17,820
remember going through those years and

262
00:10:22,220 --> 00:10:19,350
never thinking we were ever going to get

263
00:10:24,710 --> 00:10:22,230

to that multilateral point and that's

264
00:10:26,090 --> 00:10:24,720
what we do every day now I mean that's

265
00:10:27,950 --> 00:10:26,100
what gerse does every day that's what

266
00:10:30,560 --> 00:10:27,960
the mission management team does every

267
00:10:32,420 --> 00:10:30,570
day is work in that fully multilateral

268
00:10:34,790 --> 00:10:32,430
mode with all partners present all

269
00:10:38,750 --> 00:10:34,800
partners work in their issues and coming

270
00:10:40,880 --> 00:10:38,760
up with totally joint solutions did the

271
00:10:42,740 --> 00:10:40,890
ideas that the the development change or

272
00:10:45,440 --> 00:10:42,750
did the structure change at all when you

273
00:10:46,730 --> 00:10:45,450
decided to make Russia a partner in the

274
00:10:47,810 --> 00:10:46,740
space stations I know originally wasn't

275
00:10:49,040 --> 00:10:47,820
conceived they weren't originally

276
00:10:51,530 --> 00:10:49,050
conceived to be a partner of space

277
00:10:55,430 --> 00:10:51,540
station what changed when they became

278
00:10:57,770 --> 00:10:55,440
involved from a physical configuration

279
00:10:59,360 --> 00:10:57,780
like I said we dropped propulsion

280
00:11:03,410 --> 00:10:59,370
modules that we had planned on the US

281
00:11:05,180 --> 00:11:03,420
side we we went to a different module

282
00:11:08,330 --> 00:11:05,190
configuration we used to have what we

283
00:11:11,210 --> 00:11:08,340
call a racetrack configuration of nodes

284
00:11:13,670 --> 00:11:11,220
in the lab and have idols and we

285
00:11:17,770 --> 00:11:13,680
incorporated what the Russians felt that

286
00:11:19,970 --> 00:11:17,780
they could contribute to the program and

287
00:11:22,250 --> 00:11:19,980
worked on what that central core

288
00:11:26,870 --> 00:11:22,260

configuration was with the FGB and then

289
00:11:29,960 --> 00:11:26,880
the service module provided through the

290
00:11:31,250 --> 00:11:29,970
Russians and so we had to do some things

291
00:11:32,450 --> 00:11:31,260
in the interfaces that were a little

292
00:11:36,410 --> 00:11:32,460
different than we did with the other

293
00:11:38,210 --> 00:11:36,420
partners but we did bring the Russians

294
00:11:40,100 --> 00:11:38,220
into that full multilateral partnership

295
00:11:41,930 --> 00:11:40,110
still had some aspects of the

296
00:11:44,830 --> 00:11:41,940
relationship which were bilateral and

297
00:11:47,810 --> 00:11:44,840
others that were fully multilateral

298
00:11:50,270 --> 00:11:47,820
another thing that changed was a partner

299
00:11:51,980 --> 00:11:50,280
roles in transportation so in the

300
00:11:53,840 --> 00:11:51,990
original agreements it always had

301
00:11:56,210 --> 00:11:53,850
provided that other partners could bring

302
00:11:58,580 --> 00:11:56,220
their their transportation systems up to

303
00:12:01,490 --> 00:11:58,590
the station but when we brought Russia

304
00:12:04,160 --> 00:12:01,500
into the program Europe and Japan also

305
00:12:06,500 --> 00:12:04,170
asked for a greater role for their

306
00:12:09,350 --> 00:12:06,510
transportation systems and so we ended

307
00:12:11,510 --> 00:12:09,360
up as we renegotiated the agreements

308
00:12:14,360 --> 00:12:11,520
putting in offset arrangements to use

309
00:12:17,780 --> 00:12:14,370
the aryan and the h2 for the cargo

310
00:12:20,180 --> 00:12:17,790
capability and reboost things like that

311
00:12:22,270 --> 00:12:20,190
and those were to offset their common

312
00:12:25,460 --> 00:12:22,280
systems operations costs that were also

313
00:12:27,170 --> 00:12:25,470

always there in the agreement but there

314
00:12:29,450 --> 00:12:27,180
was a preference for trading goods and

315
00:12:32,960 --> 00:12:29,460
services rather than paying in cash and

316
00:12:35,270 --> 00:12:32,970
so cementing those into specific

317
00:12:37,190 --> 00:12:35,280
obligations in the agreement that

318
00:12:39,650 --> 00:12:37,200
changed when we went through that second

319
00:12:40,970 --> 00:12:39,660
round of negotiations and obviously

320
00:12:43,100 --> 00:12:40,980
without the Russians we had no

321
00:12:44,870 --> 00:12:43,110
alternative crew transport to the space

322
00:12:47,300 --> 00:12:44,880
station it was all envisioned on the

323
00:12:49,490 --> 00:12:47,310
space shuttle and before there was the

324
00:12:51,290 --> 00:12:49,500
space station there was the Russian

325
00:12:54,470 --> 00:12:51,300
space station Mir did we learning

326
00:12:56,150 --> 00:12:54,480
lessons from you know the over a decade

327
00:12:57,530 --> 00:12:56,160
of use of space the space station Mir

328
00:13:01,040 --> 00:12:57,540
before the space station was developed

329
00:13:03,110 --> 00:13:01,050
and implemented I think the face one

330
00:13:05,440 --> 00:13:03,120
program we had where we actually used

331
00:13:07,700 --> 00:13:05,450
the shuttle to go to mirror was

332
00:13:08,990 --> 00:13:07,710
unbelievably beneficial for us and

333
00:13:10,310 --> 00:13:09,000
learning how to operate with the

334
00:13:13,220 --> 00:13:10,320
Russians and how to operate

335
00:13:15,020 --> 00:13:13,230
long-duration spaceflight you know we

336
00:13:16,879 --> 00:13:15,030
were very good at shuttle missions you

337
00:13:19,789 --> 00:13:16,889
know a week or two weeks of varied

338
00:13:21,889 --> 00:13:19,799

dedicated very focused activities we had

339
00:13:24,590 --> 00:13:21,899
not had much experience at doing long

340
00:13:26,900 --> 00:13:24,600
duration multiple month activities and

341
00:13:28,340 --> 00:13:26,910
we were fairly inexperienced in some of

342
00:13:30,169 --> 00:13:28,350
that so I think we learned a lot from

343
00:13:32,059 --> 00:13:30,179
the Russians and our inter phase one

344
00:13:35,239 --> 00:13:32,069
program that we carried in to the

345
00:13:37,069 --> 00:13:35,249
station operations piece I think the

346
00:13:39,199 --> 00:13:37,079
mirror also benefited tremendously from

347
00:13:40,970 --> 00:13:39,209
the shuttle being there I think mayor's

348
00:13:42,619 --> 00:13:40,980
life was actually extended by the fact

349
00:13:45,109 --> 00:13:42,629
that we had the ability to bring large

350
00:13:47,869 --> 00:13:45,119
components up to up to mirror and return

351
00:13:49,549 --> 00:13:47,879
components from mere down so I think it

352
00:13:51,559 --> 00:13:49,559
was a good learning experience that also

353
00:13:53,329 --> 00:13:51,569
allowed us to learn to work bilaterally

354
00:13:55,159 --> 00:13:53,339
with the Russians I think it would have

355
00:13:56,780 --> 00:13:55,169
been tough to step right up to space

356
00:13:59,689 --> 00:13:56,790
station operations without some

357
00:14:02,239 --> 00:13:59,699
experience of operating with them on the

358
00:14:03,949 --> 00:14:02,249
MIR program so it was kind of a it was a

359
00:14:05,749 --> 00:14:03,959
good chance for us to learn developed

360
00:14:07,849 --> 00:14:05,759
techniques and learn to operate together

361
00:14:10,220 --> 00:14:07,859
bilaterally and then get ready to move

362
00:14:11,869 --> 00:14:10,230
in to the station stuff and what Mike

363
00:14:14,119 --> 00:14:11,879

brought up was very interesting you know

364
00:14:15,889 --> 00:14:14,129
we worked pretty strongly bilaterally

365
00:14:17,869 --> 00:14:15,899
with the Russians because the FGB was

366
00:14:19,400 --> 00:14:17,879
there our modules were there you know

367
00:14:21,169 --> 00:14:19,410
then we started bringing up the other

368
00:14:23,150 --> 00:14:21,179
partner modules Columbus and the

369
00:14:24,889 --> 00:14:23,160
Japanese and then we had to add them in

370
00:14:26,720 --> 00:14:24,899
and then that really forced us to start

371
00:14:28,549 --> 00:14:26,730
really working in a true multilateral

372
00:14:31,519 --> 00:14:28,559
environment but I don't think we could

373
00:14:33,739 --> 00:14:31,529
have gotten there as easily it really

374
00:14:35,569 --> 00:14:33,749
helped to do the bilateral pieces first

375
00:14:36,979 --> 00:14:35,579
and establish those relationships that

376
00:14:38,720 --> 00:14:36,989
you had something to build off before

377
00:14:42,799 --> 00:14:38,730
you step to the more integrated

378
00:14:44,629 --> 00:14:42,809
multilateral program okay fast forward

379
00:14:45,949 --> 00:14:44,639
in a space station we are today mark one

380
00:14:47,479 --> 00:14:45,959
of the things that you know we have

381
00:14:48,829 --> 00:14:47,489
trouble communicating to the outside

382
00:14:50,900 --> 00:14:48,839
world we kind understand the potential

383
00:14:52,400 --> 00:14:50,910
for scientific research for Space

384
00:14:54,470 --> 00:14:52,410
Station inside NASA but sometimes that's

385
00:14:56,479 --> 00:14:54,480
hard to to communicate to others that

386
00:14:57,829 --> 00:14:56,489
don't quite get it what would you say

387
00:15:00,619 --> 00:14:57,839
how would you describe the unique

388
00:15:03,529 --> 00:15:00,629

environment of space station and why

389
00:15:05,809 --> 00:15:03,539
that's important to researchers well

390
00:15:07,879 --> 00:15:05,819
when you take gravity out of equations

391
00:15:10,159 --> 00:15:07,889
of motion you fundamentally change the

392
00:15:12,650 --> 00:15:10,169
way particles interact at the cellular

393
00:15:14,659 --> 00:15:12,660
or the molecular level whether you're

394
00:15:17,210 --> 00:15:14,669
looking at in organic systems like

395
00:15:20,449 --> 00:15:17,220
metals and alloys that are undergoing a

396
00:15:22,130 --> 00:15:20,459
change of state or biological systems

397
00:15:24,500 --> 00:15:22,140
like cells and

398
00:15:27,620 --> 00:15:24,510
and molecular structures they all have

399
00:15:29,420 --> 00:15:27,630
motion of them and those that motion

400
00:15:31,490 --> 00:15:29,430
follows laws of motion that we

401
00:15:33,680 --> 00:15:31,500
understand very well on the ground in a

402
00:15:35,750 --> 00:15:33,690
1g environment but you put it up in

403
00:15:37,130 --> 00:15:35,760
space and you take gravity out of that

404
00:15:39,470 --> 00:15:37,140
equation of motion and you get a

405
00:15:41,090 --> 00:15:39,480
different answer and sometimes those

406
00:15:44,390 --> 00:15:41,100
different answers can really lead to

407
00:15:45,620 --> 00:15:44,400
some provocative results ok well the

408
00:15:47,390 --> 00:15:45,630
milestone we're celebrating in today is

409
00:15:50,930 --> 00:15:47,400
10 years of human occupancy on Space

410
00:15:52,970 --> 00:15:50,940
Station mr. Gerstenmaier was over time

411
00:15:54,770 --> 00:15:52,980
when you felt that the space station

412
00:15:57,440 --> 00:15:54,780
might have to be demand was there either

413
00:15:58,970 --> 00:15:57,450

technical reason or a logistical reason

414
00:16:02,600 --> 00:15:58,980
why you Nala no longer be able to keeps

415
00:16:03,920 --> 00:16:02,610
people on station do is you know if we

416
00:16:06,860 --> 00:16:03,930
kind of started back at the very

417
00:16:08,840 --> 00:16:06,870
beginning it was it was interesting

418
00:16:13,400 --> 00:16:08,850
because station we used to build from

419
00:16:15,170 --> 00:16:13,410
the solar arrays in board and that made

420
00:16:16,820 --> 00:16:15,180
sense because we had power up first and

421
00:16:19,160 --> 00:16:16,830
in communication systems and then we

422
00:16:20,840 --> 00:16:19,170
built essentially the support structure

423
00:16:22,280 --> 00:16:20,850
and then we hung the pressurized modules

424
00:16:24,920 --> 00:16:22,290
underneath and then we were going to add

425
00:16:26,540 --> 00:16:24,930
the crew right well that and I have

426
00:16:27,950 --> 00:16:26,550
documentation where that's the way we

427
00:16:29,300 --> 00:16:27,960
had put the plan together and then we

428
00:16:30,710 --> 00:16:29,310
were told that that wasn't going to cut

429
00:16:32,480 --> 00:16:30,720
it because we needed to get crew there

430
00:16:34,040 --> 00:16:32,490
earlier so we needed to build the other

431
00:16:35,600 --> 00:16:34,050
way out we need to start with the

432
00:16:38,570 --> 00:16:35,610
pressurized modules and then build

433
00:16:40,790 --> 00:16:38,580
outward so so we had to redo the entire

434
00:16:43,850 --> 00:16:40,800
sequence that forced us to put the p6

435
00:16:45,800 --> 00:16:43,860
temporary trust that's the port 6 solar

436
00:16:48,320 --> 00:16:45,810
array up on top to write temporary power

437
00:16:50,060 --> 00:16:48,330
we were lucky we had the FGB so we could

438
00:16:51,530 --> 00:16:50,070

use it as a power source and provide

439
00:16:53,870 --> 00:16:51,540
life support for us it provided those

440
00:16:55,940 --> 00:16:53,880
basic functions on station and then we

441
00:16:58,670 --> 00:16:55,950
could build outward so I think the first

442
00:16:59,930 --> 00:16:58,680
thing was that we got told to do it a

443
00:17:01,340 --> 00:16:59,940
different way than we would have done it

444
00:17:02,870 --> 00:17:01,350
technically because it was important to

445
00:17:04,490 --> 00:17:02,880
get crew on orbit to actually start

446
00:17:07,069 --> 00:17:04,500
doing some research and utilize the

447
00:17:08,540 --> 00:17:07,079
facility and not wait seven years until

448
00:17:10,400 --> 00:17:08,550
everything got built out and then you

449
00:17:12,140 --> 00:17:10,410
were ready to bring the crew up so that

450
00:17:14,090 --> 00:17:12,150
was an important first consideration I

451
00:17:15,829 --> 00:17:14,100
was in the shuttle program at the time

452
00:17:18,980 --> 00:17:15,839
when we decided to bring the first crew

453
00:17:20,689 --> 00:17:18,990
up we had not really even brought the

454
00:17:23,270 --> 00:17:20,699
First Solar ray up I believe when we

455
00:17:24,590 --> 00:17:23,280
when we added the crew I probably from

456
00:17:26,090 --> 00:17:24,600
again from a technical standpoint I

457
00:17:28,580 --> 00:17:26,100
would have waited maybe one more flight

458
00:17:30,050 --> 00:17:28,590
before we added crew and I remember

459
00:17:32,000 --> 00:17:30,060
having some discussions with Tommy

460
00:17:33,920 --> 00:17:32,010
Holloway again I was the evil shuttle

461
00:17:34,510 --> 00:17:33,930
side and he was the station side at the

462
00:17:36,190 --> 00:17:34,520
time and

463
00:17:37,840 --> 00:17:36,200

and I told him we had to wait one more

464
00:17:39,010 --> 00:17:37,850
flight and he told me there's no way we

465
00:17:40,570 --> 00:17:39,020
wait one more flight we're going to

466
00:17:42,640 --> 00:17:40,580
bring the crew up now the station is

467
00:17:43,930 --> 00:17:42,650
ready for him so I would tell you again

468
00:17:45,340 --> 00:17:43,940
from my conservative technical

469
00:17:46,780 --> 00:17:45,350
standpoint I might have waited another

470
00:17:48,820 --> 00:17:46,790
flight before we brought the crew on

471
00:17:50,410 --> 00:17:48,830
orbit but we did and it was fine there

472
00:17:52,630 --> 00:17:50,420
was the you know the station worked well

473
00:17:54,220 --> 00:17:52,640
and things went forward I think when we

474
00:17:56,590 --> 00:17:54,230
had to Columbia tragedy that was

475
00:18:00,040 --> 00:17:56,600
probably the closest we came to really

476
00:18:01,480 --> 00:18:00,050
happen to remove the crew you know we

477
00:18:03,400 --> 00:18:01,490
looked at what it would take to keep

478
00:18:05,500 --> 00:18:03,410
three crew members on station without

479
00:18:07,330 --> 00:18:05,510
the shuttle capability and there was

480
00:18:09,820 --> 00:18:07,340
just no way we could support the full

481
00:18:11,920 --> 00:18:09,830
complement of three crew and so we had a

482
00:18:13,690 --> 00:18:11,930
choice to go back and recommend a get

483
00:18:15,760 --> 00:18:13,700
additional so use in progress vehicles

484
00:18:18,640 --> 00:18:15,770
but we were prohibited because of the I

485
00:18:20,530 --> 00:18:18,650
Ron non North Korea Syria

486
00:18:22,120 --> 00:18:20,540
non-proliferation act of getting those

487
00:18:24,700 --> 00:18:22,130
extra modules so we really had no choice

488
00:18:26,290 --> 00:18:24,710

but to drop the crew size and then when

489
00:18:27,820 --> 00:18:26,300
we drop the crew size it wasn't

490
00:18:29,740 --> 00:18:27,830
guaranteed that we could actually make

491
00:18:31,660 --> 00:18:29,750
it through that first summer in fact we

492
00:18:33,250 --> 00:18:31,670
were going to be short of water on the

493
00:18:35,680 --> 00:18:33,260
shuttle because of its fuel cells

494
00:18:38,080 --> 00:18:35,690
generates a lot of water we had worried

495
00:18:39,640 --> 00:18:38,090
about water it was a very plentiful

496
00:18:41,020 --> 00:18:39,650
source because the shuttle was always

497
00:18:42,610 --> 00:18:41,030
there but when the shuttle was pulled

498
00:18:44,050 --> 00:18:42,620
away we didn't have enough water to

499
00:18:46,330 --> 00:18:44,060
really make it through that summer and

500
00:18:48,460 --> 00:18:46,340
we really needed a way to get water at a

501
00:18:50,140 --> 00:18:48,470
station we wanted to make a mod to the

502
00:18:53,110 --> 00:18:50,150
progress vehicle to add additional water

503
00:18:54,670 --> 00:18:53,120
tanks but we couldn't do that because we

504
00:18:57,250 --> 00:18:54,680
didn't have the ability to spend money

505
00:18:58,990 --> 00:18:57,260
with the Russians the Russians didn't

506
00:19:01,960 --> 00:18:59,000
want to do it without us spending money

507
00:19:03,910 --> 00:19:01,970
to do the tank so we spent many

508
00:19:05,980 --> 00:19:03,920
wonderful meetings throughout that

509
00:19:08,620 --> 00:19:05,990
spring trying to figure out how we were

510
00:19:11,080 --> 00:19:08,630
going to keep the crew on orbit and then

511
00:19:12,550 --> 00:19:11,090
I went over to Russia for her series of

512
00:19:14,770 --> 00:19:12,560
meetings and they were showing me around

513
00:19:16,360 --> 00:19:14,780

the floor where they build the solution

514
00:19:18,340 --> 00:19:16,370
of progress vehicles and they told me to

515
00:19:19,930 --> 00:19:18,350
stick my head in a progress vehicle and

516
00:19:21,790 --> 00:19:19,940
I did and right in the middle of

517
00:19:24,550 --> 00:19:21,800
progress vehicle was welded a water tank

518
00:19:26,290 --> 00:19:24,560
and so then they told me that you know

519
00:19:28,920 --> 00:19:26,300
we do what we need to do when it's time

520
00:19:31,360 --> 00:19:28,930
to go do it but not before and so they

521
00:19:32,890 --> 00:19:31,370
put the water tank in which allowed us

522
00:19:35,560 --> 00:19:32,900
to make it through the summer with the

523
00:19:37,540 --> 00:19:35,570
two-person crew and we had not done very

524
00:19:40,030 --> 00:19:37,550
good in keeping track of food and

525
00:19:42,010 --> 00:19:40,040
supplies and cargo we then implemented

526
00:19:44,290 --> 00:19:42,020
all these things to keep track of all

527
00:19:46,450 --> 00:19:44,300
these supplies and we built essentially

528
00:19:47,919 --> 00:19:46,460
a timeline that was a variable we didn't

529
00:19:49,509 --> 00:19:47,929
know exactly when the shuttle

530
00:19:51,639 --> 00:19:49,519
kind of return to flight so we had to

531
00:19:53,350 --> 00:19:51,649
just do the best to kind of fly from

532
00:19:54,909 --> 00:19:53,360
milestone the milestone know when we had

533
00:19:57,279 --> 00:19:54,919
to make decisions when we had to fly

534
00:19:59,200 --> 00:19:57,289
hardware up so there was no guarantee i

535
00:20:00,580 --> 00:19:59,210
used to tell the station team that you

536
00:20:02,919 --> 00:20:00,590
know our job is to return the crew

537
00:20:05,259 --> 00:20:02,929
safely you know if we can keep them on

538
00:20:07,749 --> 00:20:05,269

orbit great but if we need to know it

539
00:20:09,399 --> 00:20:07,759
advance that enough 40 days in advance

540
00:20:10,989 --> 00:20:09,409
that we can schedule a return so we can

541
00:20:12,580 --> 00:20:10,999
get them into sois we can schedule the

542
00:20:14,560 --> 00:20:12,590
right rescue forces to be there to pick

543
00:20:16,119 --> 00:20:14,570
them up so it's just like a nominal end

544
00:20:17,529 --> 00:20:16,129
of mission so it would be a little bit

545
00:20:18,789 --> 00:20:17,539
early but it would be a normal n de

546
00:20:20,560 --> 00:20:18,799
mission for the crew so the crew would

547
00:20:22,629 --> 00:20:20,570
be a no additional safety risk but our

548
00:20:24,369 --> 00:20:22,639
job was to anticipate with enough

549
00:20:26,019 --> 00:20:24,379
knowledge we were 40 days from afton

550
00:20:28,180 --> 00:20:26,029
returned to cruise so we kind of kept a

551
00:20:29,980 --> 00:20:28,190
running time line of where we that many

552
00:20:31,840 --> 00:20:29,990
days away from half to return the crew

553
00:20:33,369 --> 00:20:31,850
and if the wrong components would have

554
00:20:35,019 --> 00:20:33,379
broke at the wrong time in the wrong

555
00:20:36,609 --> 00:20:35,029
sequence we probably would have had to

556
00:20:38,470 --> 00:20:36,619
return the crew but we were lucky during

557
00:20:39,970 --> 00:20:38,480
the whole down time that that all the

558
00:20:41,739 --> 00:20:39,980
hardware stayed together we had some

559
00:20:43,210 --> 00:20:41,749
pumps that failed and some other

560
00:20:45,879 --> 00:20:43,220
components that fail but we had enough

561
00:20:48,580 --> 00:20:45,889
time to bring them up so it was a it was

562
00:20:50,289 --> 00:20:48,590
a tight period through that point but

563
00:20:52,119 --> 00:20:50,299

again the teams did a phenomenal job of

564
00:20:54,909 --> 00:20:52,129
handle and uncertainty and figuring out

565
00:20:56,950 --> 00:20:54,919
a way to deal and operate in that manner

566
00:20:58,629 --> 00:20:56,960
so again I think we learned tremendous

567
00:21:01,090 --> 00:20:58,639
lessons about what you can do and and

568
00:21:02,980 --> 00:21:01,100
how with the right overall overarching

569
00:21:06,279 --> 00:21:02,990
goals you can accomplish amazing things

570
00:21:07,539 --> 00:21:06,289
if you set your set your targets the

571
00:21:09,789 --> 00:21:07,549
right way and you remain flexible

572
00:21:12,850 --> 00:21:09,799
throughout the period to get done what

573
00:21:14,470 --> 00:21:12,860
you need to go do so it was it was a it

574
00:21:17,529 --> 00:21:14,480
was an interesting period to get through

575
00:21:19,480 --> 00:21:17,539
and it worked out very well in hindsight

576
00:21:21,190 --> 00:21:19,490
but there sure were no guarantees as we

577
00:21:22,269 --> 00:21:21,200
were going through this whole period you

578
00:21:24,220 --> 00:21:22,279
know one of the interesting things

579
00:21:27,759 --> 00:21:24,230
engrossed raised earlier in terms of

580
00:21:29,950 --> 00:21:27,769
this the shuttle mentality we had versus

581
00:21:33,519 --> 00:21:29,960
the long-duration spaceflight mentality

582
00:21:35,230 --> 00:21:33,529
that the Russians had and we had

583
00:21:37,149 --> 00:21:35,240
intellectual discussions i would say

584
00:21:40,359 --> 00:21:37,159
about that difference for a long time

585
00:21:43,899 --> 00:21:40,369
and you know also in your reaction to

586
00:21:46,180 --> 00:21:43,909
crises on the shuttle side you know we

587
00:21:47,830 --> 00:21:46,190
have all kinds of rules about this

588
00:21:50,259 --> 00:21:47,840

failure that fell you you come home and

589
00:21:53,409 --> 00:21:50,269
how quickly do you come home well in a

590
00:21:56,560 --> 00:21:53,419
space station kind of scenario it's what

591
00:21:58,659 --> 00:21:56,570
do you do to stay there and deal with

592
00:22:01,799 --> 00:21:58,669
your situation and

593
00:22:04,330 --> 00:22:01,809
keep the ship line you know more akin to

594
00:22:07,330 --> 00:22:04,340
an accident an issue that you would have

595
00:22:09,639 --> 00:22:07,340
out on a ship somewhere in the ocean and

596
00:22:12,249 --> 00:22:09,649
now having lives through not just the

597
00:22:14,139 --> 00:22:12,259
the Columbia timeframe that girls talked

598
00:22:15,999 --> 00:22:14,149
about but there have been all kinds of

599
00:22:19,210 --> 00:22:16,009
issues where equipment has failed and

600
00:22:20,979 --> 00:22:19,220
and we've been down tracking margins

601
00:22:23,739 --> 00:22:20,989
really carefully tag to get through this

602
00:22:25,029 --> 00:22:23,749
month but that's that's what we ought to

603
00:22:27,759 --> 00:22:25,039
be learning and that's what we have to

604
00:22:30,580 --> 00:22:27,769
learn to explore because we're not

605
00:22:34,119 --> 00:22:30,590
coming home you know we're celebrating

606
00:22:36,999 --> 00:22:34,129
10 years that not every human has lived

607
00:22:39,489 --> 00:22:37,009
on the planet and if we're going to go

608
00:22:41,710 --> 00:22:39,499
beyond our biggest strategic goal number

609
00:22:44,529 --> 00:22:41,720
one is expand human presence beyond

610
00:22:47,349 --> 00:22:44,539
low-earth orbit those are the things we

611
00:22:49,960 --> 00:22:47,359
have to learn how do you continue to get

612
00:22:52,659 --> 00:22:49,970
further in distance and time from our

613
00:22:54,220 --> 00:22:52,669

home planet yet be able to deal with all

614
00:22:57,599 --> 00:22:54,230
of those challenges that we have in

615
00:23:00,009 --> 00:22:57,609
spaceflight that's what space station is

616
00:23:01,330 --> 00:23:00,019
maybe it'd be nice if each of you can

617
00:23:03,519 --> 00:23:01,340
answer this question what do you the

618
00:23:05,440 --> 00:23:03,529
past decade would you describe as the

619
00:23:07,119 --> 00:23:05,450
biggest large-scale and small-scale

620
00:23:11,019 --> 00:23:07,129
challenge you faced or the space

621
00:23:14,349 --> 00:23:11,029
stations based mark on a large scale

622
00:23:16,359 --> 00:23:14,359
when I reflect back on the 1980s the

623
00:23:19,539 --> 00:23:16,369
late 80s as the first partners were

624
00:23:22,690 --> 00:23:19,549
coming on board it really began as a

625
00:23:25,180 --> 00:23:22,700
tower of babel it was very difficult at

626
00:23:28,570 --> 00:23:25,190
the beginning but within two to three

627
00:23:31,239 --> 00:23:28,580
years it came together and then over a

628
00:23:32,859 --> 00:23:31,249
decade we we have families we had people

629
00:23:35,499 --> 00:23:32,869
getting married between partners

630
00:23:37,899 --> 00:23:35,509
children being born so that the

631
00:23:41,440 --> 00:23:37,909
challenge was fusing that team and once

632
00:23:44,379 --> 00:23:41,450
that team was fused it's an incredible

633
00:23:46,239 --> 00:23:44,389
performance and I don't really think

634
00:23:47,560 --> 00:23:46,249
there were any small challenges I mean

635
00:23:51,519 --> 00:23:47,570
the way I look back on the station

636
00:23:52,989 --> 00:23:51,529
program we lurched from what what at the

637
00:23:56,379 --> 00:23:52,999
time seemed like insurmountable

638
00:24:01,149 --> 00:23:56,389

challenges that were eventually every

639
00:24:03,909 --> 00:24:01,159
single one of them overcome okay when

640
00:24:05,859 --> 00:24:03,919
yeah I from my personal experience the

641
00:24:09,909 --> 00:24:05,869
biggest challenge was bringing Russia

642
00:24:11,560 --> 00:24:09,919
into the program no I'm haven't been

643
00:24:13,390 --> 00:24:11,570
working down in the technical

644
00:24:18,190 --> 00:24:13,400
details but up at that at that sort of

645
00:24:21,490 --> 00:24:18,200
big-picture policy level and it was it

646
00:24:23,410 --> 00:24:21,500
was driven by budget pressures political

647
00:24:26,980 --> 00:24:23,420
pressures a whole lot of external

648
00:24:31,780 --> 00:24:26,990
factors beyond NASA that forced it it

649
00:24:34,930 --> 00:24:31,790
really tested our original partnership I

650
00:24:37,540 --> 00:24:34,940
think there was a concern by Canada

651
00:24:41,350 --> 00:24:37,550
Europe and Japan that somehow they would

652
00:24:42,940 --> 00:24:41,360
be not viewed as as important because

653
00:24:46,840 --> 00:24:42,950
the Russians came with so much

654
00:24:49,270 --> 00:24:46,850
capability and and we've heard a little

655
00:24:50,800 --> 00:24:49,280
bit about the differences in how we were

656
00:24:53,380 --> 00:24:50,810
doing human spaceflight and how the

657
00:24:56,890 --> 00:24:53,390
Russians were merging those two

658
00:24:59,200 --> 00:24:56,900
different philosophical approaches and

659
00:25:02,590 --> 00:24:59,210
and coming to the point now where it is

660
00:25:06,460 --> 00:25:02,600
a partnership that that is a single

661
00:25:08,920 --> 00:25:06,470
partnership and not us versus them kind

662
00:25:13,180 --> 00:25:08,930
of an attitude i think was a really big

663
00:25:14,560 --> 00:25:13,190

challenge that we've overcome great you

664
00:25:19,810 --> 00:25:14,570
know the early years of space station

665
00:25:23,790 --> 00:25:19,820
for me were just a continuum of budget

666
00:25:26,110 --> 00:25:23,800
cuts and redesigns and redesigns and and

667
00:25:28,120 --> 00:25:26,120
going through the transition that bill

668
00:25:29,290 --> 00:25:28,130
described where we actually convinced

669
00:25:30,970 --> 00:25:29,300
ourselves that we weren't going to be

670
00:25:32,410 --> 00:25:30,980
able to build a space station and we had

671
00:25:34,390 --> 00:25:32,420
to go with what we call pre-integrated

672
00:25:39,310 --> 00:25:34,400
trust with everything built and

673
00:25:43,540 --> 00:25:39,320
assembled on the ground you know and

674
00:25:46,570 --> 00:25:43,550
then you have the 92 93 redesign and the

675
00:25:49,840 --> 00:25:46,580
addition of the Russians and you know

676
00:25:51,400 --> 00:25:49,850
every one of those was a big challenge

677
00:25:55,000 --> 00:25:51,410
and tough and it was tough to hold the

678
00:25:57,790 --> 00:25:55,010
team together on the small side you know

679
00:26:00,070 --> 00:25:57,800
i can remember having arguments probably

680
00:26:02,170 --> 00:26:00,080
just as passionate as those big moments

681
00:26:05,950 --> 00:26:02,180
about what a specific requirement said

682
00:26:07,360 --> 00:26:05,960
in a particular requirements document

683
00:26:09,820 --> 00:26:07,370
that you know in the rearview mirror

684
00:26:13,720 --> 00:26:09,830
looks a whole lot less important than

685
00:26:19,810 --> 00:26:17,950
yeah boy I think back their word it's

686
00:26:22,390 --> 00:26:19,820
amazing the things that we've been

687
00:26:24,790 --> 00:26:22,400
through it's you know we started out

688
00:26:26,260 --> 00:26:24,800

with the station that was like I talked

689
00:26:30,070 --> 00:26:26,270
about that was essentially assembled

690
00:26:31,570 --> 00:26:30,080
from scratch that we we did a huge study

691
00:26:33,310 --> 00:26:31,580
up here where we looked at all kinds of

692
00:26:35,920 --> 00:26:33,320
different options of rebuilding Space

693
00:26:39,670 --> 00:26:35,930
Station we must have had 15 different

694
00:26:41,470 --> 00:26:39,680
concepts come together of different ways

695
00:26:43,840 --> 00:26:41,480
to build station then we ended up with

696
00:26:46,660 --> 00:26:43,850
the pre-integrated trusts and then the

697
00:26:48,280 --> 00:26:46,670
reston team it was getting started and

698
00:26:50,290 --> 00:26:48,290
that was a tough thing for us to

699
00:26:52,990 --> 00:26:50,300
centralize program management away from

700
00:26:55,480 --> 00:26:53,000
a field center up here at Washington and

701
00:26:57,100 --> 00:26:55,490
then we just about got rest and

702
00:26:59,170 --> 00:26:57,110
functional and then we decided that

703
00:27:01,420 --> 00:26:59,180
wasn't a good idea so let's break apart

704
00:27:02,890 --> 00:27:01,430
rest and then let's get rid of the work

705
00:27:06,130 --> 00:27:02,900
packages and let's hire a prime

706
00:27:08,260 --> 00:27:06,140
contractor and all these things are any

707
00:27:10,600 --> 00:27:08,270
one of them could have ended the program

708
00:27:13,900 --> 00:27:10,610
you know we then we had the famous one

709
00:27:16,360 --> 00:27:13,910
vote that kept station alive which was a

710
00:27:19,840 --> 00:27:16,370
huge thing at or stationed was going to

711
00:27:21,730 --> 00:27:19,850
be gone we had in two thousand we were

712
00:27:24,220 --> 00:27:21,740
five billion dollars over budget they

713
00:27:26,200 --> 00:27:24,230

came in and told us essentially node 3

714
00:27:28,270 --> 00:27:26,210
was not going to fly the habitation

715
00:27:30,190 --> 00:27:28,280
module wasn't going to fly kupil wasn't

716
00:27:32,230 --> 00:27:30,200
going to fly regenerative equalist

717
00:27:33,970 --> 00:27:32,240
wasn't going to be there spit him wasn't

718
00:27:36,220 --> 00:27:33,980
god Dexter wasn't going to be there and

719
00:27:38,920 --> 00:27:36,230
then somehow all those things are still

720
00:27:40,630 --> 00:27:38,930
on station and we still somehow cut 5

721
00:27:43,330 --> 00:27:40,640
billion dollars out of our budget which

722
00:27:45,490 --> 00:27:43,340
was not the most pleasant thing in the

723
00:27:48,070 --> 00:27:45,500
world so you look at all those things

724
00:27:51,490 --> 00:27:48,080
and and any one of them you could have

725
00:27:53,170 --> 00:27:51,500
just thrown in the towel and and and and

726
00:27:55,150 --> 00:27:53,180
quit but I think the spirit of the

727
00:27:58,030 --> 00:27:55,160
partnership was we became dependent upon

728
00:28:00,310 --> 00:27:58,040
each other we recognized a potential of

729
00:28:02,740 --> 00:28:00,320
station and so we kept moving forward so

730
00:28:04,240 --> 00:28:02,750
now I think the big challenge is you

731
00:28:05,860 --> 00:28:04,250
know we've been through this 10 years of

732
00:28:07,560 --> 00:28:05,870
human presence now we need to look

733
00:28:09,790 --> 00:28:07,570
forward to that next 10 years of

734
00:28:11,710 --> 00:28:09,800
research and actually reap and some

735
00:28:13,840 --> 00:28:11,720
benefit from this wonderful facility

736
00:28:16,750 --> 00:28:13,850
we've built into space so we needn't now

737
00:28:18,430 --> 00:28:16,760
need to take that same same optimism

738
00:28:20,890 --> 00:28:18,440

that same zeal that we put into that

739
00:28:23,260 --> 00:28:20,900
assembly to get here and throw that into

740
00:28:25,120 --> 00:28:23,270
tinder research and see if we can really

741
00:28:27,340 --> 00:28:25,130
show the true benefit of space so that's

742
00:28:29,560 --> 00:28:27,350
that's our next challenge and

743
00:28:32,289 --> 00:28:29,570
I'm sure it will be full of all these

744
00:28:35,409 --> 00:28:32,299
big challenges that are coming every day

745
00:28:37,480 --> 00:28:35,419
there's something new that's it's a it's

746
00:28:39,940 --> 00:28:37,490
a little tough to work around and and

747
00:28:41,650 --> 00:28:39,950
we'll keep moving forward you know we

748
00:28:43,630 --> 00:28:41,660
got told that that shuttle would be no

749
00:28:45,340 --> 00:28:43,640
longer available to service station that

750
00:28:47,680 --> 00:28:45,350
was tough to figure out how to make all

751
00:28:49,299 --> 00:28:47,690
that work we think we've got plans there

752
00:28:51,220 --> 00:28:49,309
we're going to count on commercial cargo

753
00:28:52,600 --> 00:28:51,230
there's still some learning that will

754
00:28:54,400 --> 00:28:52,610
occur through that so I think there's

755
00:28:56,409 --> 00:28:54,410
lots of challenges coming but the

756
00:28:58,570 --> 00:28:56,419
important thing is to just stay focused

757
00:29:01,870 --> 00:28:58,580
realize now that potential for research

758
00:29:04,659 --> 00:29:01,880
to work internationally to gain and push

759
00:29:06,520 --> 00:29:04,669
that research forward okay I'm going to

760
00:29:09,640 --> 00:29:06,530
ask one more question before seeing if

761
00:29:11,020 --> 00:29:09,650
the audience has any questions the what

762
00:29:13,120 --> 00:29:11,030
is your for the next we've gone ten

763
00:29:14,049 --> 00:29:13,130

years is ten more you know the space

764
00:29:16,240 --> 00:29:14,059
station supposed to fly for at least

765
00:29:18,549 --> 00:29:16,250
another ten what is your hope for the

766
00:29:20,140 --> 00:29:18,559
next decade for the what's the biggest

767
00:29:22,060 --> 00:29:20,150
accomplishment going to be in the years

768
00:29:24,310 --> 00:29:22,070
to come would you say each probably has

769
00:29:26,970 --> 00:29:24,320
a different opinion mark yeah I'll take

770
00:29:31,450 --> 00:29:26,980
a start at that because I can see two

771
00:29:34,180 --> 00:29:31,460
major achievements ahead of us this is a

772
00:29:36,399 --> 00:29:34,190
fantastic platform for doing technology

773
00:29:37,659 --> 00:29:36,409
development and demonstration and we've

774
00:29:40,630 --> 00:29:37,669
never had anything like it before

775
00:29:43,899 --> 00:29:40,640
available to us so I think we have the

776
00:29:45,549 --> 00:29:43,909
opportunity to use it to develop our

777
00:29:47,260 --> 00:29:45,559
next generation systems I mean we're

778
00:29:49,120 --> 00:29:47,270
doing that already today with the

779
00:29:51,940 --> 00:29:49,130
onboard systems like the regenerative

780
00:29:54,460 --> 00:29:51,950
Equus but there's tremendous potential

781
00:29:57,190 --> 00:29:54,470
available to do that and then the second

782
00:30:00,070 --> 00:29:57,200
area the scientific potential as science

783
00:30:04,060 --> 00:30:00,080
is a slow process I mean we are just now

784
00:30:06,220 --> 00:30:04,070
seen results from 10 years ago that were

785
00:30:08,940 --> 00:30:06,230
conducted on shuttle missions that are

786
00:30:10,930 --> 00:30:08,950
turning into products and companies

787
00:30:13,510 --> 00:30:10,940
profitable companies that were being

788
00:30:14,890 --> 00:30:13,520

formed well tell one short story just

789
00:30:17,830 --> 00:30:14,900
because a lot of people may not be aware

790
00:30:20,620 --> 00:30:17,840
of it but just last month Apple computer

791
00:30:24,250 --> 00:30:20,630
bought the exclusive worldwide patent

792
00:30:26,560 --> 00:30:24,260
rights for liquid metals which were

793
00:30:28,750 --> 00:30:26,570
originally discovered on the space

794
00:30:31,360 --> 00:30:28,760
shuttle in 1997 doing thermo physical

795
00:30:33,850 --> 00:30:31,370
property measurements by a p.i at

796
00:30:34,899 --> 00:30:33,860
Caltech and it's not generally well

797
00:30:38,169 --> 00:30:34,909
known but

798
00:30:40,509 --> 00:30:38,179
it's a significant finding and in some

799
00:30:42,549 --> 00:30:40,519
places they characterize liquid metals

800
00:30:45,099 --> 00:30:42,559
as being input as important as plastics

801
00:30:46,989 --> 00:30:45,109
were when they were placed steel I think

802
00:30:49,859 --> 00:30:46,999
we have the opportunity to make more

803
00:30:53,529 --> 00:30:49,869
contributions like that in the ten years

804
00:30:55,810 --> 00:30:53,539
then as folks have said this is a very

805
00:30:57,729 --> 00:30:55,820
capable platform it can be used for many

806
00:31:00,339 --> 00:30:57,739
different things so my hope for the

807
00:31:02,259 --> 00:31:00,349
future is we fully utilize it we use it

808
00:31:03,820 --> 00:31:02,269
in many different ways I think it's

809
00:31:06,330 --> 00:31:03,830
really hard to predict what the research

810
00:31:08,919 --> 00:31:06,340
will show that's a process of discovery

811
00:31:11,409 --> 00:31:08,929
we have a lot of things we can do on

812
00:31:14,349 --> 00:31:11,419
station to prepare for exploration and

813
00:31:17,499 --> 00:31:14,359

we really ought to be doing that I think

814
00:31:21,039 --> 00:31:17,509
that this wallet is in low Earth orbit

815
00:31:24,070 --> 00:31:21,049
it is a foot toward a step towards going

816
00:31:25,629 --> 00:31:24,080
out beyond low-earth orbit and so we

817
00:31:28,419 --> 00:31:25,639
really ought to take advantage of that

818
00:31:31,239 --> 00:31:28,429
and we have such a strong partnership I

819
00:31:33,700 --> 00:31:31,249
would like to see us use this really to

820
00:31:36,519 --> 00:31:33,710
help build the continued partnership for

821
00:31:38,289 --> 00:31:36,529
going beyond working together figuring

822
00:31:41,139 --> 00:31:38,299
out what are those next steps for

823
00:31:45,159 --> 00:31:41,149
exploration and using station to do that

824
00:31:53,680 --> 00:31:45,169
to demonstrate it like it's going to get

825
00:31:56,440 --> 00:31:53,690
repetitive right the I edit this is the

826
00:31:57,820 --> 00:31:56,450
place we have to learn and we've had

827
00:32:00,430 --> 00:31:57,830
that validated now that we're going to

828
00:32:02,379 --> 00:32:00,440
keep flying the space station in and

829
00:32:04,629 --> 00:32:02,389
this is you know we've learned so much

830
00:32:06,279 --> 00:32:04,639
already just about how we operate in

831
00:32:08,499 --> 00:32:06,289
space things that we never planned in

832
00:32:10,359 --> 00:32:08,509
the program things that we never really

833
00:32:13,060 --> 00:32:10,369
thought we're going to accomplish even

834
00:32:15,999 --> 00:32:13,070
to just basics of maintaining this this

835
00:32:18,849 --> 00:32:16,009
facility are all things that we have to

836
00:32:20,799 --> 00:32:18,859
be able to do is we go further out so it

837
00:32:23,469 --> 00:32:20,809
is going to be the platform that drives

838
00:32:25,239 --> 00:32:23,479

us an exploration and we are going to be

839
00:32:26,680 --> 00:32:25,249
in a constrained environment so we're

840
00:32:29,289 --> 00:32:26,690
going to be using everything that we

841
00:32:31,930 --> 00:32:29,299
have today to build from we where we are

842
00:32:35,049 --> 00:32:31,940
out into exploration space station is

843
00:32:37,299 --> 00:32:35,059
going to be a critical part of that and

844
00:32:38,979 --> 00:32:37,309
I guess I would just add that a really

845
00:32:41,229 --> 00:32:38,989
consider station a platform for

846
00:32:42,969 --> 00:32:41,239
discovery and and if but in a whole

847
00:32:44,829 --> 00:32:42,979
variety of different areas that some of

848
00:32:47,049 --> 00:32:44,839
the scientific areas that mark talks

849
00:32:48,700 --> 00:32:47,059
about you know we were able to recently

850
00:32:51,100 --> 00:32:48,710
activate the sabatier system

851
00:32:53,110 --> 00:32:51,110
which is an experiment in us and no in a

852
00:32:54,580 --> 00:32:53,120
new way of procuring hardware we didn't

853
00:32:56,440 --> 00:32:54,590
pay for the development of the hardware

854
00:32:57,970 --> 00:32:56,450
for the first time we let a contractor

855
00:33:01,120 --> 00:32:57,980
pay for the development of the hardware

856
00:33:04,029 --> 00:33:01,130
and then they only receive payments if

857
00:33:05,710 --> 00:33:04,039
the device generates water for us we did

858
00:33:07,779 --> 00:33:05,720
that without any NASA involvement they

859
00:33:10,330 --> 00:33:07,789
did all the design development on there

860
00:33:12,070 --> 00:33:10,340
on their own it fit well because we had

861
00:33:13,779 --> 00:33:12,080
done a lot of pre research on the NASA

862
00:33:15,490 --> 00:33:13,789
site so we knew what the interfaces were

863
00:33:17,500 --> 00:33:15,500

in a technical risk was something that a

864
00:33:19,600 --> 00:33:17,510
contractor could essentially pick up and

865
00:33:21,190 --> 00:33:19,610
go operate so so station is already

866
00:33:23,139 --> 00:33:21,200
proven itself as a platform for

867
00:33:24,789 --> 00:33:23,149
discovery and new ways of contracting

868
00:33:27,370 --> 00:33:24,799
and away new ways of doing development

869
00:33:29,019 --> 00:33:27,380
the partnership has published a very

870
00:33:30,549 --> 00:33:29,029
nice lessons learned document where I

871
00:33:32,799 --> 00:33:30,559
asked each one of the partners to think

872
00:33:35,200 --> 00:33:32,809
about exploration and what lesson did

873
00:33:37,510 --> 00:33:35,210
you learn as an individual country for

874
00:33:39,159 --> 00:33:37,520
the way we should do exploration and we

875
00:33:40,870 --> 00:33:39,169
got a very nice document of the

876
00:33:42,610 --> 00:33:40,880
partnership pulling together to go do

877
00:33:44,730 --> 00:33:42,620
that and then we've also used the

878
00:33:46,870 --> 00:33:44,740
partnership recently to put together the

879
00:33:49,389 --> 00:33:46,880
basis of an international docking

880
00:33:52,060 --> 00:33:49,399
standard so i use the partners to work

881
00:33:54,970 --> 00:33:52,070
together to go essentially put together

882
00:33:57,130 --> 00:33:54,980
the specifications to allow spacecraft

883
00:33:59,080 --> 00:33:57,140
to dock not a specific design but just

884
00:34:01,029 --> 00:33:59,090
the standard so what's the basic

885
00:34:02,649 --> 00:34:01,039
diameter what's the basic hook force

886
00:34:04,480 --> 00:34:02,659
what's the basic loading what's the

887
00:34:07,389 --> 00:34:04,490
mechanism that allows for soft capture

888
00:34:08,980 --> 00:34:07,399

etc but we're not specifying a design so

889
00:34:10,270 --> 00:34:08,990
then individual countries can go ahead

890
00:34:12,220 --> 00:34:10,280
and then if they meet this standard

891
00:34:14,680 --> 00:34:12,230
we'll have compatibility to go doc

892
00:34:16,659 --> 00:34:14,690
things so the station is provided a

893
00:34:19,419 --> 00:34:16,669
multilateral environment so where we can

894
00:34:21,550 --> 00:34:19,429
put together and work as a small group

895
00:34:22,930 --> 00:34:21,560
to put some new standards out there that

896
00:34:24,970 --> 00:34:22,940
maybe the standards that will be used

897
00:34:27,669 --> 00:34:24,980
for exploration systems in the future so

898
00:34:29,770 --> 00:34:27,679
so there's a tremendous amount of

899
00:34:31,419 --> 00:34:29,780
potential to discover new things from a

900
00:34:33,460 --> 00:34:31,429
technology standpoint from a research

901
00:34:35,589 --> 00:34:33,470
standpoint from a contracting standpoint

902
00:34:37,540 --> 00:34:35,599
and from a way of doing new system

903
00:34:39,490 --> 00:34:37,550
standards for new systems needed for

904
00:34:41,050 --> 00:34:39,500
exploration systems in the future so I

905
00:34:42,730 --> 00:34:41,060
think there's a lot of things we

906
00:34:43,839 --> 00:34:42,740
shouldn't constrain ourselves just keep

907
00:34:46,089 --> 00:34:43,849
looking forward to keep challenging

908
00:34:48,750 --> 00:34:46,099
ourselves to do new things and we'll see

909
00:34:50,829 --> 00:34:48,760
what we can get in the next ten years

910
00:34:52,119 --> 00:34:50,839
okay thanks let's see if there's any

911
00:34:54,840 --> 00:34:52,129
questions from the audience for the

912
00:35:00,510 --> 00:34:59,190
out there in the back you've all done a

913
00:35:02,250 --> 00:35:00,520

really good job of pointing out the

914
00:35:06,990 --> 00:35:02,260
challenges that we've had and dealing

915
00:35:08,850 --> 00:35:07,000
with the different partners one of the

916
00:35:10,980 --> 00:35:08,860
other major challenges I think that

917
00:35:13,170 --> 00:35:10,990
we've run into our that we have is

918
00:35:15,600 --> 00:35:13,180
perhaps dealing with that other those

919
00:35:16,970 --> 00:35:15,610
two other big areas the engineering

920
00:35:19,470 --> 00:35:16,980
community and the research community

921
00:35:21,750 --> 00:35:19,480
wondering if you could if you could

922
00:35:23,970 --> 00:35:21,760
share what you think have been the major

923
00:35:25,680 --> 00:35:23,980
obstacles in dealing across those two

924
00:35:27,780 --> 00:35:25,690
populations as well as some of the major

925
00:35:30,770 --> 00:35:27,790
accomplishments that have occurred as a

926
00:35:33,300 --> 00:35:30,780
result of those two working together

927
00:35:35,280 --> 00:35:33,310
I'll have to answer that one John I

928
00:35:36,780 --> 00:35:35,290
think I spent the last 25 years working

929
00:35:40,410 --> 00:35:36,790
on the boundary between those two

930
00:35:42,120 --> 00:35:40,420
communities both of them have advantages

931
00:35:44,910 --> 00:35:42,130
and disadvantages and the positions they

932
00:35:47,820 --> 00:35:44,920
take and success comes when they work

933
00:35:51,900 --> 00:35:47,830
together you know that we've gone a long

934
00:35:55,080 --> 00:35:51,910
way over the past 25 years probably most

935
00:35:57,390 --> 00:35:55,090
emblematic of that is the fact that we

936
00:35:59,130 --> 00:35:57,400
delayed much of the utilization in order

937
00:36:01,200 --> 00:35:59,140
to complete the assembly process that

938
00:36:03,170 --> 00:36:01,210

was an extremely controversial issue

939
00:36:05,310 --> 00:36:03,180
that was even debated in the

940
00:36:07,590 --> 00:36:05,320
Congressional hallways back in the early

941
00:36:09,840 --> 00:36:07,600
90s but you know when I look back on in

942
00:36:12,660 --> 00:36:09,850
retrospect it was the right thing to do

943
00:36:14,970 --> 00:36:12,670
because now we've got a completed Space

944
00:36:17,700 --> 00:36:14,980
Station we didn't put it at risk during

945
00:36:20,070 --> 00:36:17,710
that assembly phase and were positioned

946
00:36:22,050 --> 00:36:20,080
to have a decade a useful utilization

947
00:36:24,390 --> 00:36:22,060
coming out of it and i think the

948
00:36:27,510 --> 00:36:24,400
research team distributed across the

949
00:36:29,460 --> 00:36:27,520
nasa centers as well as out in the

950
00:36:32,070 --> 00:36:29,470
academic and the industrial community

951
00:36:34,500 --> 00:36:32,080
are willing to step forward now that we

952
00:36:36,750 --> 00:36:34,510
have the completed Space Station so I

953
00:36:42,390 --> 00:36:36,760
see the next ten years as being nothing

954
00:36:47,740 --> 00:36:42,400
but opportunity for us get a questions

955
00:36:56,190 --> 00:36:50,170
what is the likelihood that private

956
00:37:02,370 --> 00:36:59,280
we're we've got it for cargo delivery

957
00:37:05,250 --> 00:37:02,380
where we've issued some fixed price

958
00:37:07,109 --> 00:37:05,260
contracts with orbital and SpaceX to

959
00:37:08,760 --> 00:37:07,119
deliver cargo to space station so

960
00:37:11,190 --> 00:37:08,770
they're going to be a private entity

961
00:37:13,500 --> 00:37:11,200
that will bring cargo for us to space

962
00:37:16,319 --> 00:37:13,510
station under a contract to NASA so I

963
00:37:19,829 --> 00:37:16,329

think they're deck pieces is clearly

964
00:37:21,450 --> 00:37:19,839
there through the National Lab mark can

965
00:37:23,550 --> 00:37:21,460
talk a little bit about that but I think

966
00:37:24,780 --> 00:37:23,560
there'll be some some opportunities for

967
00:37:26,250 --> 00:37:24,790
commercial companies in fact there are

968
00:37:28,230 --> 00:37:26,260
some now that are actually even

969
00:37:30,510 --> 00:37:28,240
utilizing station for some research and

970
00:37:33,720 --> 00:37:30,520
we need to figure out more ways of

971
00:37:36,839 --> 00:37:33,730
letting letting folks go ahead and use

972
00:37:39,930 --> 00:37:36,849
station and Mark you my wife yeah we

973
00:37:42,150 --> 00:37:39,940
began at work actually ten years ago

974
00:37:44,839 --> 00:37:42,160
working partnerships out with private

975
00:37:47,490 --> 00:37:44,849
firms for even use of the spacecraft and

976
00:37:49,200 --> 00:37:47,500
and now the assembly is done we're going

977
00:37:50,880 --> 00:37:49,210
to be growing that whole area I mean

978
00:37:54,270 --> 00:37:50,890
most people are familiar i think with

979
00:37:56,970 --> 00:37:54,280
the fact that we're literally just a few

980
00:37:59,310 --> 00:37:56,980
weeks away from announcing a competitive

981
00:38:01,349 --> 00:37:59,320
procurement to establish a cooperative

982
00:38:04,140 --> 00:38:01,359
agreement with a nonprofit organization

983
00:38:07,109 --> 00:38:04,150
to manage uses of the space station by

984
00:38:08,630 --> 00:38:07,119
organizations other than NASA so I think

985
00:38:12,150 --> 00:38:08,640
you're going to see all that activity

986
00:38:16,050 --> 00:38:12,160
ramping up in the future and we've got

987
00:38:18,660 --> 00:38:16,060
the perfect platform to do it with you

988
00:38:20,339 --> 00:38:18,670

know I think it's also interesting to to

989
00:38:21,630 --> 00:38:20,349
see how we got pushed to do some things

990
00:38:23,280 --> 00:38:21,640
a little differently than we would have

991
00:38:25,500 --> 00:38:23,290
probably on our own like the whole space

992
00:38:27,450 --> 00:38:25,510
flight participant thing you know the

993
00:38:30,059 --> 00:38:27,460
Russians were very aggressive in getting

994
00:38:32,069 --> 00:38:30,069
selling so you seats to get space flight

995
00:38:33,990 --> 00:38:32,079
participants up the station I don't

996
00:38:36,180 --> 00:38:34,000
think we NASA would have done that on

997
00:38:38,400 --> 00:38:36,190
our own but then the Russians have kind

998
00:38:39,859 --> 00:38:38,410
of pushed this in an area that that I

999
00:38:43,050 --> 00:38:39,869
think there's some potential there that

1000
00:38:45,059 --> 00:38:43,060
it moves forward even in their control

1001
00:38:46,800 --> 00:38:45,069
center they have a lot of if you look at

1002
00:38:48,510 --> 00:38:46,810
the you know the bottom floor below

1003
00:38:50,309 --> 00:38:48,520
their screen there's advertisements from

1004
00:38:51,720 --> 00:38:50,319
all the major vendors out there that

1005
00:38:54,240 --> 00:38:51,730
provide equipment to their control

1006
00:38:56,490 --> 00:38:54,250
center that's a little far for us to go

1007
00:39:00,720 --> 00:38:56,500
but but there they somehow have gather

1008
00:39:03,150 --> 00:39:00,730
are captured the maybe the capitalistic

1009
00:39:05,550 --> 00:39:03,160
process is better than we have in a

1010
00:39:06,780 --> 00:39:05,560
sense so we again need to learn from

1011
00:39:09,100 --> 00:39:06,790
them but there's a there's a real

1012
00:39:12,910 --> 00:39:09,110
advantage of doing things internet

1013
00:39:14,770 --> 00:39:12,920

and learning from others so we need to

1014
00:39:16,120 --> 00:39:14,780
to see what works see what other

1015
00:39:18,280 --> 00:39:16,130
countries are pushing see how they're

1016
00:39:20,050 --> 00:39:18,290
pursuing things and then likewise open

1017
00:39:21,580 --> 00:39:20,060
up our envelope a little bit to be a

1018
00:39:23,920 --> 00:39:21,590
little more flexible than we would be

1019
00:39:25,750 --> 00:39:23,930
naturally so I think the partnership has

1020
00:39:27,790 --> 00:39:25,760
brought a unique dimension to us that

1021
00:39:29,020 --> 00:39:27,800
has really really helped us look in

1022
00:39:30,820 --> 00:39:29,030
different ways the way we think about

1023
00:39:33,070 --> 00:39:30,830
space flight and I think typically we

1024
00:39:34,990 --> 00:39:33,080
find the partners are each at different

1025
00:39:37,720 --> 00:39:35,000
points along that spectrum they all have

1026
00:39:40,930 --> 00:39:37,730
different views and and having to

1027
00:39:42,520 --> 00:39:40,940
integrate all of that I think is even

1028
00:39:44,020 --> 00:39:42,530
more thoughtful than just having to look

1029
00:39:45,820 --> 00:39:44,030
at one extreme position or another

1030
00:39:49,090 --> 00:39:45,830
extreme position the recognition that

1031
00:39:55,630 --> 00:39:49,100
that we really are a continuum helps us

1032
00:39:57,340 --> 00:39:55,640
I think be open-minded my question is

1033
00:39:58,990 --> 00:39:57,350
for Bill but any of you all can answer

1034
00:40:01,660 --> 00:39:59,000
this it's well it's really interesting

1035
00:40:03,310 --> 00:40:01,670
to hear sort of your take on the spirit

1036
00:40:05,140 --> 00:40:03,320
of creativity and innovation that comes

1037
00:40:07,720 --> 00:40:05,150
about when you leave things sort of wide

1038
00:40:09,250 --> 00:40:07,730

open and let people sort of take

1039
00:40:11,530 --> 00:40:09,260
advantage of the open parameters you

1040
00:40:13,210 --> 00:40:11,540
spoke earlier to making sure that you

1041
00:40:15,010 --> 00:40:13,220
know in the future we have some of that

1042
00:40:17,440 --> 00:40:15,020
ability with mo use and agreements that

1043
00:40:19,960 --> 00:40:17,450
are really flexible so I was wondering

1044
00:40:22,180 --> 00:40:19,970
you said that at each stage of the

1045
00:40:25,000 --> 00:40:22,190
station and the development you said

1046
00:40:27,220 --> 00:40:25,010
that you know things were things happen

1047
00:40:29,470 --> 00:40:27,230
that you know made the space station be

1048
00:40:31,330 --> 00:40:29,480
able to be used not as designed what

1049
00:40:32,740 --> 00:40:31,340
what were some of those things that you

1050
00:40:35,410 --> 00:40:32,750
know came about as a result of that

1051
00:40:37,510 --> 00:40:35,420
spirit of innovation creativity that you

1052
00:40:39,130 --> 00:40:37,520
really never thought would be used or

1053
00:40:43,690 --> 00:40:39,140
done on the space station that created a

1054
00:40:49,370 --> 00:40:47,660
yeah why we never anticipated the

1055
00:40:51,740 --> 00:40:49,380
Russians bringing tourists to the space

1056
00:40:56,360 --> 00:40:51,750
station and obviously the very first one

1057
00:41:00,350 --> 00:40:56,370
was a pretty dramatic moment in time but

1058
00:41:04,370 --> 00:41:00,360
we became used to it and it didn't cause

1059
00:41:07,400 --> 00:41:04,380
us any problems ultimately yeah I would

1060
00:41:10,060 --> 00:41:07,410
get you know I just see the crew with

1061
00:41:12,530 --> 00:41:10,070
clown noses in space was probably a

1062
00:41:16,880 --> 00:41:12,540
unique thing that I would not have ever

1063
00:41:19,940 --> 00:41:16,890

envisioned I would say we also did an

1064
00:41:22,520 --> 00:41:19,950
activity with the band u2 throughout the

1065
00:41:24,890 --> 00:41:22,530
world and they featured the space

1066
00:41:27,890 --> 00:41:24,900
station crew and several venues and in

1067
00:41:29,780 --> 00:41:27,900
various various countries around the

1068
00:41:32,690 --> 00:41:29,790
world and that was an interesting

1069
00:41:35,600 --> 00:41:32,700
experience to be called by the devant

1070
00:41:37,310 --> 00:41:35,610
personally and and congratulated on the

1071
00:41:39,590 --> 00:41:37,320
crew talking to them at some concert

1072
00:41:41,840 --> 00:41:39,600
some place which was very interesting

1073
00:41:45,440 --> 00:41:41,850
and unique which I would have not have

1074
00:41:47,120 --> 00:41:45,450
guessed you know developing the combined

1075
00:41:51,620 --> 00:41:47,130
operational load-bearing external

1076
00:41:53,990 --> 00:41:51,630
resistive treadmill for tougher for the

1077
00:41:56,270 --> 00:41:54,000
note 3 tranquility was a unique

1078
00:41:59,690 --> 00:41:56,280
experience for us you know we put

1079
00:42:02,540 --> 00:41:59,700
together a very well thought-out media

1080
00:42:04,430 --> 00:42:02,550
plan to get the name to node contest

1081
00:42:05,720 --> 00:42:04,440
with all the right legal arguments in

1082
00:42:08,180 --> 00:42:05,730
there that allowed us to name it

1083
00:42:09,770 --> 00:42:08,190
whatever we wanted to name it and then

1084
00:42:11,390 --> 00:42:09,780
we kind of lost control of the whole

1085
00:42:14,290 --> 00:42:11,400
process when Xena the warrior princess

1086
00:42:16,940 --> 00:42:14,300
was winning for a while and and then

1087
00:42:19,100 --> 00:42:16,950
myyearbook kind of came in later and

1088
00:42:20,660 --> 00:42:19,110

then the colbert show took over so and

1089
00:42:23,870 --> 00:42:20,670
then we determined that it didn't matter

1090
00:42:25,520 --> 00:42:23,880
what our legal statement said people in

1091
00:42:27,320 --> 00:42:25,530
general were going to dictate what how

1092
00:42:28,820 --> 00:42:27,330
he named the note and what criteria were

1093
00:42:30,770 --> 00:42:28,830
used and even though we had the legal

1094
00:42:32,780 --> 00:42:30,780
authority to do things we then had to

1095
00:42:36,020 --> 00:42:32,790
get kind of creative to come up with the

1096
00:42:37,670 --> 00:42:36,030
the combined operational load-bearing

1097
00:42:39,830 --> 00:42:37,680
external resistive treadmill so we

1098
00:42:42,020 --> 00:42:39,840
learned a lot through all that so I so I

1099
00:42:44,240 --> 00:42:42,030
think that the thing is by by

1100
00:42:46,370 --> 00:42:44,250
challenging folks to do things and think

1101
00:42:48,620 --> 00:42:46,380
in different ways you get different

1102
00:42:50,720 --> 00:42:48,630
results and and you know I've gotten a

1103
00:42:52,820 --> 00:42:50,730
lot of positive comments we've exposed

1104
00:42:55,310 --> 00:42:52,830
station to a broader community by doing

1105
00:42:57,020 --> 00:42:55,320
things along those lines and and I think

1106
00:42:57,300 --> 00:42:57,030
it gets some of our people excited you

1107
00:42:58,710 --> 00:42:57,310
can't

1108
00:43:01,530 --> 00:42:58,720
do too much of that but you got to

1109
00:43:03,120 --> 00:43:01,540
figure out where the serious scientific

1110
00:43:05,010 --> 00:43:03,130
work is done and then where there's a

1111
00:43:07,380 --> 00:43:05,020
little bit of a lighter side that keeps

1112
00:43:10,140 --> 00:43:07,390
things moving forward so bill talked

1113
00:43:13,290 --> 00:43:10,150

about the body a as well and you know

1114
00:43:16,230 --> 00:43:13,300
when he and I were commiserating even 10

1115
00:43:20,570 --> 00:43:16,240
years ago or 15 years ago we never would

1116
00:43:23,160 --> 00:43:20,580
have had a discussion about buying water

1117
00:43:27,030 --> 00:43:23,170
you know not buying the device but

1118
00:43:28,650 --> 00:43:27,040
literally buying water and so as we have

1119
00:43:30,660 --> 00:43:28,660
evolved with the space station as has

1120
00:43:33,210 --> 00:43:30,670
we've understood the maturity of all the

1121
00:43:34,950 --> 00:43:33,220
systems he really can do very very

1122
00:43:38,010 --> 00:43:34,960
different things if you keep your mind

1123
00:43:40,680 --> 00:43:38,020
open to it I don't think anybody ever

1124
00:43:42,690 --> 00:43:40,690
anticipated this global mixed fleet that

1125
00:43:46,050 --> 00:43:42,700
we're working with today either when we

1126
00:43:48,480 --> 00:43:46,060
started this program before the Russians

1127
00:43:51,210 --> 00:43:48,490
were on board it was all shuttle based

1128
00:43:53,580 --> 00:43:51,220
transportation and it was designed to be

1129
00:43:56,910 --> 00:43:53,590
serviced by the shuttle but then the

1130
00:43:58,380 --> 00:43:56,920
European ATV the Japanese a TV then the

1131
00:44:01,770 --> 00:43:58,390
Russian partnership with the progress

1132
00:44:03,720 --> 00:44:01,780
it's a really a pretty impressive global

1133
00:44:06,990 --> 00:44:03,730
fleet of vehicles that we've got coming

1134
00:44:08,820 --> 00:44:07,000
and going today and more to come if you

1135
00:44:11,240 --> 00:44:08,830
look next year I think we have 17

1136
00:44:13,620 --> 00:44:11,250
flights to space station next year and

1137
00:44:16,470 --> 00:44:13,630
two of those are shuttle and then the

1138
00:44:18,540 --> 00:44:16,480

rest are our ATV and progress and Soyuz

1139
00:44:20,430 --> 00:44:18,550
and also some of our commercial cargo

1140
00:44:23,610 --> 00:44:20,440
providers will be there next year too so

1141
00:44:26,040 --> 00:44:23,620
so we've really created a much more

1142
00:44:28,500 --> 00:44:26,050
dynamic and diverse transportation plan

1143
00:44:34,720 --> 00:44:28,510
than I think we ever envisioned little

1144
00:44:39,380 --> 00:44:36,890
we have a lot of aging infrastructure

1145
00:44:41,660 --> 00:44:39,390
down here on the ground and some aging

1146
00:44:43,990 --> 00:44:41,670
bodies as well I have an eight-year-old

1147
00:44:46,310 --> 00:44:44,000
at home though that would be interested

1148
00:44:48,770 --> 00:44:46,320
someday and flying on the space station

1149
00:44:51,800 --> 00:44:48,780
what's the likelihood of the space

1150
00:44:56,150 --> 00:44:51,810
stations having a unit of further

1151
00:45:00,590 --> 00:44:56,160
extended period of operations beyond the

1152
00:45:02,960 --> 00:45:00,600
2020 time frame that's yours well we've

1153
00:45:05,240 --> 00:45:02,970
been looking we go to 2020 and then I

1154
00:45:08,120 --> 00:45:05,250
think we've looked at going I think all

1155
00:45:10,310 --> 00:45:08,130
the way out to 20 28 and and that's

1156
00:45:12,500 --> 00:45:10,320
based on I think a 30 year lifetime from

1157
00:45:14,240 --> 00:45:12,510
when the first module was was taken up

1158
00:45:16,130 --> 00:45:14,250
so so we're looking at that to see if

1159
00:45:18,320 --> 00:45:16,140
there's any technical considerations I

1160
00:45:19,670 --> 00:45:18,330
think that the bigger driver is not so

1161
00:45:21,980 --> 00:45:19,680
much to hardware in the robustness of

1162
00:45:23,780 --> 00:45:21,990
the hardware but do we find a real need

1163
00:45:25,670 --> 00:45:23,790

for station in a real compelling

1164
00:45:28,310 --> 00:45:25,680
research environment a real commercial

1165
00:45:30,050 --> 00:45:28,320
aspect debt station is viable for and

1166
00:45:31,970 --> 00:45:30,060
that will keep space station flying if

1167
00:45:33,350 --> 00:45:31,980
we can see that that other piece but i

1168
00:45:35,930 --> 00:45:33,360
think the physical hardware could be

1169
00:45:38,330 --> 00:45:35,940
there until until 20 28 or may be

1170
00:45:40,640 --> 00:45:38,340
upgraded or pieces could could be it

1171
00:45:41,960 --> 00:45:40,650
could be done off of station but i think

1172
00:45:44,000 --> 00:45:41,970
our challenge is in the next couple

1173
00:45:45,110 --> 00:45:44,010
years is just kind of submit that future

1174
00:45:46,940 --> 00:45:45,120
and figure out how we can really

1175
00:45:48,590 --> 00:45:46,950
effectively utilize station for

1176
00:45:50,090 --> 00:45:48,600
exploration and and other activities

1177
00:45:51,590 --> 00:45:50,100
that some of the things mark talked

1178
00:45:54,230 --> 00:45:51,600
about you know if we can put together

1179
00:45:56,810 --> 00:45:54,240
some spacecraft from station deploy them

1180
00:45:59,030 --> 00:45:56,820
to go different places that's a pretty

1181
00:46:01,520 --> 00:45:59,040
exciting future you know how can we use

1182
00:46:04,070 --> 00:46:01,530
station and more of a testbed mode we've

1183
00:46:05,990 --> 00:46:04,080
got a hyperspectral imager onboard

1184
00:46:07,820 --> 00:46:06,000
station which is really nice that was

1185
00:46:10,880 --> 00:46:07,830
put together by the Naval Research Lab

1186
00:46:12,410 --> 00:46:10,890
and a very short period of time it's not

1187
00:46:14,810 --> 00:46:12,420
an operational instrument but it's a

1188
00:46:16,100 --> 00:46:14,820

great test bed to look at ways that they

1189
00:46:18,290 --> 00:46:16,110
can be creative and putting together

1190
00:46:20,120 --> 00:46:18,300
hardware so we need to keep reaching out

1191
00:46:21,800 --> 00:46:20,130
to these other folks that can utilize

1192
00:46:23,210 --> 00:46:21,810
station and show that station is really

1193
00:46:26,030 --> 00:46:23,220
viable and then I think it could be

1194
00:46:27,650 --> 00:46:26,040
there potentially for future future

1195
00:46:29,000 --> 00:46:27,660
reviews yeah and gross touch on

1196
00:46:31,640 --> 00:46:29,010
something we really didn't mention in

1197
00:46:34,250 --> 00:46:31,650
that freedom to ISS transition freedom

1198
00:46:39,110 --> 00:46:34,260
actually had a 30 year design life that

1199
00:46:40,820 --> 00:46:39,120
we you know drop down to save some money

1200
00:46:43,430 --> 00:46:40,830
and and try to do things a little

1201
00:46:45,620 --> 00:46:43,440
different in that transition but most of

1202
00:46:47,240 --> 00:46:45,630
the designs were set on the US side so

1203
00:46:47,720 --> 00:46:47,250
we really didn't change how we were

1204
00:46:50,359 --> 00:46:47,730
building

1205
00:46:52,609 --> 00:46:50,369
the components of the space station we

1206
00:46:54,170 --> 00:46:52,619
probably simplified the test program

1207
00:46:56,150 --> 00:46:54,180
because we didn't have to demonstrate as

1208
00:46:58,130 --> 00:46:56,160
long a lifetime and there were a couple

1209
00:47:00,710 --> 00:46:58,140
sticky problems about maintenance that

1210
00:47:03,530 --> 00:47:00,720
we didn't have to solve that you know

1211
00:47:05,180 --> 00:47:03,540
will still face over time but by and

1212
00:47:08,330 --> 00:47:05,190
large the systems we're still defined

1213
00:47:10,670 --> 00:47:08,340

for that much longer lifetime the

1214
00:47:12,230 --> 00:47:10,680
benefit cost point that bill breaks do

1215
00:47:15,310 --> 00:47:12,240
brings up is really important because

1216
00:47:17,359 --> 00:47:15,320
that will ultimately determine it and

1217
00:47:19,640 --> 00:47:17,369
everybody should know that they're there

1218
00:47:22,460 --> 00:47:19,650
is a real opportunity to reach a tipping

1219
00:47:24,320 --> 00:47:22,470
point here in the next five years or so

1220
00:47:27,410 --> 00:47:24,330
where these laboratories become so

1221
00:47:29,030 --> 00:47:27,420
productive that they'll draw users to

1222
00:47:30,950 --> 00:47:29,040
them from the private sector from the

1223
00:47:32,180 --> 00:47:30,960
government sector from all the way

1224
00:47:34,520 --> 00:47:32,190
around and that that's going to change

1225
00:47:36,140 --> 00:47:34,530
the whole prescription by the end of the

1226
00:47:38,450 --> 00:47:36,150
decade and provided that we get the

1227
00:47:40,849 --> 00:47:38,460
transportation resources in place in the

1228
00:47:46,060 --> 00:47:40,859
in the near future there's every reason

1229
00:47:53,180 --> 00:47:50,990
I just add one thing you know when I sit

1230
00:47:55,580 --> 00:47:53,190
here today and I kind of reflect back

1231
00:47:58,280 --> 00:47:55,590
and I look at this picture behind us and

1232
00:48:01,400 --> 00:47:58,290
all this is in orbit it's some kind of

1233
00:48:03,530 --> 00:48:01,410
miracle I mean we had so many

1234
00:48:05,960 --> 00:48:03,540
opportunities along the way that this

1235
00:48:08,960 --> 00:48:05,970
Hardware wouldn't be in orbit it's it's

1236
00:48:11,780 --> 00:48:08,970
phenomenal and so I think there's no I

1237
00:48:13,880 --> 00:48:11,790
mean if the Spirit is set right and we

1238
00:48:15,530 --> 00:48:13,890

keep the longer-term vision and I think

1239
00:48:17,720 --> 00:48:15,540
you clearly see it in a Russian culture

1240
00:48:19,580 --> 00:48:17,730
that they you know they'll get diverted

1241
00:48:21,710 --> 00:48:19,590
whichever which way they can but they

1242
00:48:23,270 --> 00:48:21,720
keep focused on some long-term goal and

1243
00:48:25,580 --> 00:48:23,280
I think if we can keep that long-term

1244
00:48:27,830 --> 00:48:25,590
goal there's no limit to what we can

1245
00:48:29,540 --> 00:48:27,840
accomplish in we really are working

1246
00:48:31,400 --> 00:48:29,550
better together multilaterally there

1247
00:48:33,710 --> 00:48:31,410
were times when I thought we might not

1248
00:48:35,720 --> 00:48:33,720
ever work together multilaterally I mean

1249
00:48:37,340 --> 00:48:35,730
we didn't want to exchange data we

1250
00:48:39,770 --> 00:48:37,350
didn't want to talk about things you

1251
00:48:42,109 --> 00:48:39,780
know we did US air samples the Russians

1252
00:48:43,880 --> 00:48:42,119
did russian air samples and we would get

1253
00:48:45,830 --> 00:48:43,890
two separate sets of data about what the

1254
00:48:48,109 --> 00:48:45,840
same atmosphere really was and they

1255
00:48:49,490 --> 00:48:48,119
would not share data back and forth and

1256
00:48:51,349 --> 00:48:49,500
then when we had Columbia we had no

1257
00:48:52,760 --> 00:48:51,359
choice but to share samples and actually

1258
00:48:54,170 --> 00:48:52,770
force researchers to look at other

1259
00:48:57,980 --> 00:48:54,180
researchers how they actually do

1260
00:49:00,349 --> 00:48:57,990
analysis so I think we need to just

1261
00:49:01,580 --> 00:49:00,359
recognize that it's hard to predict the

1262
00:49:03,530 --> 00:49:01,590
future but if you

1263
00:49:05,060 --> 00:49:03,540

focused and you keep moving and you keep

1264
00:49:07,820 --> 00:49:05,070
the right vision you can accomplish

1265
00:49:10,040 --> 00:49:07,830
amazing things and this is truly an

1266
00:49:12,500 --> 00:49:10,050
amazing engineering feat that's here and

1267
00:49:14,390 --> 00:49:12,510
now our challenge is to take that same

1268
00:49:16,130 --> 00:49:14,400
zeal and put it into the research arena

1269
00:49:18,080 --> 00:49:16,140
and to see if we can reach that tipping

1270
00:49:20,270 --> 00:49:18,090
point that mark talks about where this

1271
00:49:22,370 --> 00:49:20,280
thing is is really a benefit to us it

1272
00:49:24,110 --> 00:49:22,380
shows us that space has a real benefit

1273
00:49:26,240 --> 00:49:24,120
to everyday people on the earth and

1274
00:49:28,160 --> 00:49:26,250
their unique research environment of

1275
00:49:30,110 --> 00:49:28,170
space station pays dividends to the

1276
00:49:32,450 --> 00:49:30,120
elderly and pays dividends to our people

1277
00:49:34,100 --> 00:49:32,460
here on the earth as well allows us to

1278
00:49:36,650 --> 00:49:34,110
learn how to explore and go beyond

1279
00:49:41,210 --> 00:49:36,660
low-earth orbit there was a reason that

1280
00:49:43,390 --> 00:49:41,220
first lab was named destiny you know

1281
00:49:46,310 --> 00:49:43,400
looking at the room most people in here

1282
00:49:47,750 --> 00:49:46,320
work at NASA and have some sort of

1283
00:49:50,870 --> 00:49:47,760
interest in the National Space Station

1284
00:49:53,540 --> 00:49:50,880
but outside of this building and outside

1285
00:49:55,520 --> 00:49:53,550
of the agency why does the space station

1286
00:49:56,960 --> 00:49:55,530
matter what would be what would you tell

1287
00:49:58,580 --> 00:49:56,970
someone that didn't even know what the

1288
00:50:03,580 --> 00:49:58,590

space station was why was important and

1289
00:50:06,500 --> 00:50:03,590
how can affect their lives any of you I

1290
00:50:08,150 --> 00:50:06,510
had a discussion years ago with a friend

1291
00:50:10,490 --> 00:50:08,160
of mine from from high school and I was

1292
00:50:14,030 --> 00:50:10,500
raised in a pretty small fairly rural

1293
00:50:15,950 --> 00:50:14,040
part of Northwest Pennsylvania and I was

1294
00:50:17,570 --> 00:50:15,960
describing the space station from kind

1295
00:50:20,060 --> 00:50:17,580
of all the challenge and hassles of the

1296
00:50:23,120 --> 00:50:20,070
international partnership and and after

1297
00:50:24,530 --> 00:50:23,130
listen to me rant for a while I think

1298
00:50:25,730 --> 00:50:24,540
she summed it up pretty well when she

1299
00:50:27,970 --> 00:50:25,740
said oh so what you're really trying to

1300
00:50:31,370 --> 00:50:27,980
say is is it's just good for the globe

1301
00:50:33,020 --> 00:50:31,380
and from that partnership standpoint you

1302
00:50:35,360 --> 00:50:33,030
know that's that's pretty much it it's

1303
00:50:37,400 --> 00:50:35,370
good for the globe that that's what I

1304
00:50:39,470 --> 00:50:37,410
tell people this this is the largest

1305
00:50:42,620 --> 00:50:39,480
international cooperative endeavor and

1306
00:50:44,480 --> 00:50:42,630
science and technology in history and we

1307
00:50:46,100 --> 00:50:44,490
have the results to prove that it can be

1308
00:50:48,980 --> 00:50:46,110
done and we're halfway through the

1309
00:50:52,550 --> 00:50:48,990
process the assembly is over and the

1310
00:50:54,830 --> 00:50:52,560
best ten years are in front of us and I

1311
00:50:57,770 --> 00:50:54,840
think the scientific research aspect is

1312
00:50:59,240 --> 00:50:57,780
also very intriguing to us that is Mark

1313
00:51:01,930 --> 00:50:59,250

said at the very beginning when you

1314
00:51:05,360 --> 00:51:01,940
remove gravity from the equation

1315
00:51:09,740 --> 00:51:05,370
processes change and as a researcher you

1316
00:51:11,510 --> 00:51:09,750
want to look at a process with differing

1317
00:51:13,190 --> 00:51:11,520
variables or different constraints so to

1318
00:51:15,530 --> 00:51:13,200
remove gravity and then look at a

1319
00:51:17,240 --> 00:51:15,540
process can yield tremendous

1320
00:51:19,400 --> 00:51:17,250
new understandings that we haven't had

1321
00:51:21,350 --> 00:51:19,410
before so you know we know the immune

1322
00:51:23,900 --> 00:51:21,360
system does different things in zero-g

1323
00:51:25,340 --> 00:51:23,910
so we have a model that you know the

1324
00:51:27,380 --> 00:51:25,350
doctors have a model of how the immune

1325
00:51:29,410 --> 00:51:27,390
system operates and works but that's

1326
00:51:32,450 --> 00:51:29,420
based on seeing it through a 1g

1327
00:51:34,100 --> 00:51:32,460
influence you remove zero gravity then

1328
00:51:35,450 --> 00:51:34,110
that model mate doesn't hold up and

1329
00:51:36,830 --> 00:51:35,460
doesn't quite work right so you're going

1330
00:51:38,120 --> 00:51:36,840
to end up with a better model of the

1331
00:51:39,890 --> 00:51:38,130
immune system which can pay real

1332
00:51:42,500 --> 00:51:39,900
benefits back to us here on earth so I

1333
00:51:44,300 --> 00:51:42,510
think there's there's a chance here that

1334
00:51:47,090 --> 00:51:44,310
we can gain some things and learn from

1335
00:51:49,520 --> 00:51:47,100
space that this new environment this new

1336
00:51:51,410 --> 00:51:49,530
test environment just like any new place

1337
00:51:53,510 --> 00:51:51,420
you go you can learn more about things

1338
00:51:55,040 --> 00:51:53,520

back on the earth I think you know one

1339
00:51:57,050 --> 00:51:55,050
of the Apollo astronauts said we went

1340
00:51:58,610 --> 00:51:57,060
all the way to the moon to learn more

1341
00:52:00,620 --> 00:51:58,620
about the earth you know and if you

1342
00:52:02,000 --> 00:52:00,630
think about the lunar activities

1343
00:52:04,790 --> 00:52:02,010
probably some of the most compelling

1344
00:52:06,800 --> 00:52:04,800
things r is the pictures of the you know

1345
00:52:08,690 --> 00:52:06,810
the earth rise from the moon is that's

1346
00:52:11,000 --> 00:52:08,700
really changed our own perception of

1347
00:52:13,460 --> 00:52:11,010
what the earth is you know when you look

1348
00:52:14,900 --> 00:52:13,470
at the images from space station you

1349
00:52:16,700 --> 00:52:14,910
know I always look at that little thin

1350
00:52:18,140 --> 00:52:16,710
blue line that sits there in the

1351
00:52:20,000 --> 00:52:18,150
background and that's our total

1352
00:52:22,220 --> 00:52:20,010
atmosphere that protects us and that we

1353
00:52:24,290 --> 00:52:22,230
live in and if that can't change your

1354
00:52:26,240 --> 00:52:24,300
perception of how we here on the earth

1355
00:52:28,850 --> 00:52:26,250
you know on this little blue marble

1356
00:52:31,910 --> 00:52:28,860
floating in space that's pretty dramatic

1357
00:52:34,550 --> 00:52:31,920
so I think again if we just keep our

1358
00:52:36,620 --> 00:52:34,560
eyes open keep our research moving steak

1359
00:52:38,540 --> 00:52:36,630
stay hungry keep looking at different

1360
00:52:40,760 --> 00:52:38,550
things we can get tremendous benefit

1361
00:52:43,010 --> 00:52:40,770
from from space and space station and we

1362
00:52:44,960 --> 00:52:43,020
need to we need to talk about it with

1363
00:52:47,300 --> 00:52:44,970

with folks get them excited about what

1364
00:52:49,340 --> 00:52:47,310
we're doing and and and let them

1365
00:52:51,560 --> 00:52:49,350
understand of how they can participate

1366
00:52:52,910 --> 00:52:51,570
or how they can even contribute to some

1367
00:52:54,470 --> 00:52:52,920
of the things we're doing and we're

1368
00:52:56,600 --> 00:52:54,480
looking for new ways of doing that with

1369
00:52:58,550 --> 00:52:56,610
and I think there's a lot to be said for

1370
00:53:00,560 --> 00:52:58,560
the human element because we have many

1371
00:53:03,440 --> 00:53:00,570
different space programs and we see a

1372
00:53:05,750 --> 00:53:03,450
lot from space with all kinds of robotic

1373
00:53:09,200 --> 00:53:05,760
spacecraft going throughout the solar

1374
00:53:11,510 --> 00:53:09,210
system but there is something about

1375
00:53:13,340 --> 00:53:11,520
sharing it with other people who've been

1376
00:53:15,530 --> 00:53:13,350
there who can describe it who can feel

1377
00:53:19,640 --> 00:53:15,540
it who can tell us what it's really like

1378
00:53:21,860 --> 00:53:19,650
and and and that is very important for

1379
00:53:25,010 --> 00:53:21,870
us to understand what that environment

1380
00:53:27,170 --> 00:53:25,020
is you know we've had a series of these

1381
00:53:29,270 --> 00:53:27,180
these roundtable discussions about the

1382
00:53:31,370 --> 00:53:29,280
day Marshall Space Flight Center had one

1383
00:53:34,280 --> 00:53:31,380
Kenny Space Center and also Johnson

1384
00:53:36,260 --> 00:53:34,290
Space Center what about can you tell the

1385
00:53:38,090 --> 00:53:36,270
audience and the people watching what's

1386
00:53:40,130 --> 00:53:38,100
your unique perspective from

1387
00:53:41,720 --> 00:53:40,140
headquarters then maybe the other

1388
00:53:43,280 --> 00:53:41,730

centers didn't have I know some of you

1389
00:53:44,930 --> 00:53:43,290
have worked in centers and also

1390
00:53:46,280 --> 00:53:44,940
headquarters I know there's a political

1391
00:53:47,630 --> 00:53:46,290
realm you have to deal with here in DC

1392
00:53:49,130 --> 00:53:47,640
which is a little different how is that

1393
00:53:52,700 --> 00:53:49,140
influenced and affected the National

1394
00:53:56,630 --> 00:53:52,710
Space Station or your job the political

1395
00:54:00,200 --> 00:53:56,640
element is huge and it's and it's not

1396
00:54:02,870 --> 00:54:00,210
just political in terms of our nation's

1397
00:54:04,250 --> 00:54:02,880
politics right it's but we've had that

1398
00:54:06,980 --> 00:54:04,260
as curse said there was the the one

1399
00:54:10,220 --> 00:54:06,990
point right in the summer of 92 where

1400
00:54:15,560 --> 00:54:10,230
the space station was almost cancelled

1401
00:54:18,170 --> 00:54:15,570
by one vote and having gone through and

1402
00:54:19,580 --> 00:54:18,180
no I mean I kind of laughed today right

1403
00:54:21,020 --> 00:54:19,590
people are talking about the nasa

1404
00:54:23,900 --> 00:54:21,030
authorization bill is being very

1405
00:54:27,920 --> 00:54:23,910
prescriptive about what kind of rocket

1406
00:54:30,410 --> 00:54:27,930
or capsule we should build yet in those

1407
00:54:32,120 --> 00:54:30,420
early space station days we were told we

1408
00:54:36,230 --> 00:54:32,130
were going to fly the lab before the

1409
00:54:38,450 --> 00:54:36,240
have 45 kilowatts of power half the

1410
00:54:40,580 --> 00:54:38,460
racks within the 10 to the minus 6 micro

1411
00:54:42,380 --> 00:54:40,590
g range right mark yeah there were a

1412
00:54:44,630 --> 00:54:42,390
whole dozen we in fact we called him

1413
00:54:49,640 --> 00:54:44,640

dick Mallos commandments that were

1414
00:54:53,180 --> 00:54:49,650
captured in law that we had to deal with

1415
00:54:54,650 --> 00:54:53,190
and so the the political environment for

1416
00:54:58,700 --> 00:54:54,660
Space Station has always been very

1417
00:55:00,320 --> 00:54:58,710
highly charged and then that reflects in

1418
00:55:01,520 --> 00:55:00,330
each of the partners not only has the

1419
00:55:04,940 --> 00:55:01,530
partners been an important part of

1420
00:55:06,440 --> 00:55:04,950
maintaining the base political base for

1421
00:55:09,440 --> 00:55:06,450
the space station but they all have had

1422
00:55:11,030 --> 00:55:09,450
their unique politics as well and and I

1423
00:55:13,940 --> 00:55:11,040
know over the years I think all of us

1424
00:55:17,030 --> 00:55:13,950
have been to the different partners

1425
00:55:19,610 --> 00:55:17,040
talking not just to our counterparts but

1426
00:55:22,220 --> 00:55:19,620
to their political sides as well and

1427
00:55:24,590 --> 00:55:22,230
trying to continue to keep that

1428
00:55:27,830 --> 00:55:24,600
coalition strong yeah I think it's

1429
00:55:31,520 --> 00:55:27,840
interesting how often we've had to work

1430
00:55:34,010 --> 00:55:31,530
with our partners to help re advocate

1431
00:55:36,710 --> 00:55:34,020
the program and we seem to each take our

1432
00:55:39,110 --> 00:55:36,720
turn as to when that when that comes up

1433
00:55:41,190 --> 00:55:39,120
in our budget or political cycle after

1434
00:55:44,040 --> 00:55:41,200
elections whatever

1435
00:55:46,050 --> 00:55:44,050
and so to see how how it works what

1436
00:55:47,730 --> 00:55:46,060
arguments are appropriate in all the

1437
00:55:50,490 --> 00:55:47,740
different political systems is is

1438
00:55:53,069 --> 00:55:50,500

interesting as the one that was the most

1439
00:55:56,339 --> 00:55:53,079
eye-opening for me from the Washington

1440
00:55:58,680 --> 00:55:56,349
Policy view is when I had to go up on

1441
00:56:00,750 --> 00:55:58,690
the hill and explain why we wanted an

1442
00:56:03,930 --> 00:56:00,760
exception in law to the Iran North Korea

1443
00:56:06,690 --> 00:56:03,940
Syria non-proliferation act why we

1444
00:56:09,720 --> 00:56:06,700
wanted to be able to have exchanges with

1445
00:56:11,970 --> 00:56:09,730
Russia why we were dependent on Soyuz

1446
00:56:14,069 --> 00:56:11,980
how did we get into that position why

1447
00:56:16,470 --> 00:56:14,079
was it important what was the value to

1448
00:56:19,020 --> 00:56:16,480
NASA and I had to go make that case to

1449
00:56:21,569 --> 00:56:19,030
people in foreign policy committees who

1450
00:56:24,150 --> 00:56:21,579
weren't space advocates didn't really

1451
00:56:26,339 --> 00:56:24,160
follow space weren't looking at it from

1452
00:56:29,490 --> 00:56:26,349
our program perspective but we're just

1453
00:56:32,839 --> 00:56:29,500
looking at it from a foreign policy

1454
00:56:34,859 --> 00:56:32,849
non-proliferation and perspective and

1455
00:56:36,930 --> 00:56:34,869
having to come up with a completely

1456
00:56:38,700 --> 00:56:36,940
different set of arguments that would be

1457
00:56:42,569 --> 00:56:38,710
compelling to them was quite an

1458
00:56:46,980 --> 00:56:42,579
interesting job to have I'm going to

1459
00:56:49,290 --> 00:56:46,990
train you for my hearing I think what's

1460
00:56:51,990 --> 00:56:49,300
what's kind of neat is when you see all

1461
00:56:54,059 --> 00:56:52,000
the different perspectives is we all

1462
00:56:55,710 --> 00:56:54,069
looked at the space station from our own

1463
00:56:57,839 --> 00:56:55,720

individual perspectives where we were

1464
00:56:59,490 --> 00:56:57,849
and even at the Centers and they're all

1465
00:57:01,230 --> 00:56:59,500
slightly different but we're all really

1466
00:57:03,329 --> 00:57:01,240
describing all the challenges each one

1467
00:57:05,760 --> 00:57:03,339
of us individually faced they were all

1468
00:57:07,440 --> 00:57:05,770
different but each one of us worked

1469
00:57:08,970 --> 00:57:07,450
those challenges and pulled together and

1470
00:57:11,250 --> 00:57:08,980
i think is here heard the same thing

1471
00:57:12,660 --> 00:57:11,260
from the other centers today that they

1472
00:57:14,490 --> 00:57:12,670
also have a slightly different

1473
00:57:16,890 --> 00:57:14,500
perspective of where they were when as

1474
00:57:18,569 --> 00:57:16,900
they SAT through this thing sites it's

1475
00:57:20,579 --> 00:57:18,579
neat to get a chance to share and

1476
00:57:22,829 --> 00:57:20,589
understand and see how people saw this

1477
00:57:24,420 --> 00:57:22,839
this thing come together and it's it's

1478
00:57:26,339 --> 00:57:24,430
interesting it's very different

1479
00:57:29,760 --> 00:57:26,349
depending on where folks were sitting at

1480
00:57:31,230 --> 00:57:29,770
what time we ate one more question I

1481
00:57:33,960 --> 00:57:31,240
think I've got for you guys it's it's 10

1482
00:57:35,460 --> 00:57:33,970
plus years in the future and the word

1483
00:57:37,589 --> 00:57:35,470
deorbiting the space station what's the

1484
00:57:40,349 --> 00:57:37,599
headline what is the legacy of this

1485
00:57:41,970 --> 00:57:40,359
orbiting laboratory is it just one sound

1486
00:57:46,370 --> 00:57:41,980
bite that you think would kind of sum it

1487
00:57:51,870 --> 00:57:49,500
this signals the ending of the dawn of

1488
00:57:54,030 --> 00:57:51,880

the next Industrial Revolution in space

1489
00:57:56,460 --> 00:57:54,040
I really do believe that we're going to

1490
00:58:00,329 --> 00:57:56,470
see an industrial revolution this

1491
00:58:04,140 --> 00:58:00,339
platform is a classic disruptive

1492
00:58:06,599 --> 00:58:04,150
technology it changes benchtop biology

1493
00:58:09,540 --> 00:58:06,609
chemistry and physics if we have the

1494
00:58:11,310 --> 00:58:09,550
wisdom to use it right and although

1495
00:58:13,800 --> 00:58:11,320
we've come close to letting it slip

1496
00:58:15,990 --> 00:58:13,810
through our fingers many times over the

1497
00:58:19,890 --> 00:58:16,000
past 20 years I do think we're destined

1498
00:58:22,740 --> 00:58:19,900
to succeed with it ultimately you'll

1499
00:58:25,550 --> 00:58:22,750
agree with that assessment I think the

1500
00:58:27,720 --> 00:58:25,560
headline of space station extended I

1501
00:58:30,329 --> 00:58:27,730
know it's hard to think about it going

1502
00:58:32,460 --> 00:58:30,339
away all right think that's a pretty

1503
00:58:34,260 --> 00:58:32,470
much all the time we have today thank

1504
00:58:35,970 --> 00:58:34,270
you for joining us this program the 10th

1505
00:58:39,540 --> 00:58:35,980
anniversary once again I will officially

1506
00:58:41,220 --> 00:58:39,550
be on no vember second 2010 we have a

1507
00:58:43,560 --> 00:58:41,230
space shuttle launch coming up scheduled