



Spaceto**Ground**

1
00:00:00,490 --> 00:00:05,190

[Music]

2
00:00:09,430 --> 00:00:06,950

welcome to space to the ground and

3
00:00:12,070 --> 00:00:09,440

welcome to my house the christopher c

4
00:00:14,430 --> 00:00:12,080

craft mission control center at nasa's

5
00:00:16,470 --> 00:00:14,440

johnson space center

6
00:00:18,950 --> 00:00:16,480

[Music]

7
00:00:21,510 --> 00:00:18,960

in just a few weeks it will be from this

8
00:00:24,230 --> 00:00:21,520

very room that flight controllers will

9
00:00:26,390 --> 00:00:24,240

oversee the artemis one mission the

10
00:00:28,390 --> 00:00:26,400

first of a series of flights that will

11
00:00:31,429 --> 00:00:28,400

lead to the return of humans to the

12
00:00:33,830 --> 00:00:31,439

surface of the moon and lift off

13
00:00:36,229 --> 00:00:33,840

for over 20 years the international

14

00:00:38,310 --> 00:00:36,239

space station has served as a low earth

15

00:00:40,950 --> 00:00:38,320

orbit platform for human space

16

00:00:43,190 --> 00:00:40,960

exploration scientific research and

17

00:00:45,590 --> 00:00:43,200

technological innovation

18

00:00:47,910 --> 00:00:45,600

now the orbiting lavatory is leading the

19

00:00:49,920 --> 00:00:47,920

way for the next generation of space

20

00:00:52,549 --> 00:00:49,930

stations and moonwalkers

21

00:00:54,630 --> 00:00:52,559

[Music]

22

00:00:57,029 --> 00:00:54,640

nasa is looking towards a return to the

23

00:00:59,110 --> 00:00:57,039

moon through artemis where we will

24

00:01:00,389 --> 00:00:59,120

explore more of the lunar surface than

25

00:01:02,389 --> 00:01:00,399

ever before

26

00:01:04,390 --> 00:01:02,399

building on a history of operating a

27

00:01:06,469 --> 00:01:04,400

space station in low earth orbit and

28

00:01:08,390 --> 00:01:06,479

with collaboration with commercial and

29

00:01:11,190 --> 00:01:08,400

international partners artemis will

30

00:01:13,590 --> 00:01:11,200

establish the first long-term presence

31

00:01:16,230 --> 00:01:13,600

on and around the moon

32

00:01:18,390 --> 00:01:16,240

a vital component of artemis is a new

33

00:01:19,590 --> 00:01:18,400

state-of-the-art space station dubbed

34

00:01:24,230 --> 00:01:19,600

gateway

35

00:01:27,350 --> 00:01:24,240

astronauts as they go between lunar

36

00:01:29,749 --> 00:01:27,360

orbit and the lunar surface

37

00:01:32,390 --> 00:01:29,759

gateway will also allow for the remote

38

00:01:34,789 --> 00:01:32,400

support of the artemis base camp as our

39

00:01:37,109 --> 00:01:34,799

future robots and astronauts explore

40

00:01:38,550 --> 00:01:37,119

further and conduct more science than

41

00:01:40,710 --> 00:01:38,560

ever before

42

00:01:43,350 --> 00:01:40,720

gateway will remain in orbit for more

43

00:01:45,670 --> 00:01:43,360

than a decade providing a place to live

44

00:01:48,149 --> 00:01:45,680

and work and supporting long-term

45

00:01:50,069 --> 00:01:48,159

science and human exploration on and

46

00:01:51,830 --> 00:01:50,079

around the moon

47

00:01:53,990 --> 00:01:51,840

to learn more about the gateway space

48

00:01:55,590 --> 00:01:54,000

station and how it has grown from the

49

00:01:58,069 --> 00:01:55,600

lessons learned with the international

50

00:02:00,469 --> 00:01:58,079

space station we are joined by sean

51
00:02:02,550 --> 00:02:00,479
fuller the international partner manager

52
00:02:05,429 --> 00:02:02,560
for the gateway program at nasa's

53
00:02:07,270 --> 00:02:05,439
johnson space center

54
00:02:08,710 --> 00:02:07,280
so one of the things about gateway is

55
00:02:10,790 --> 00:02:08,720
that it's building on the international

56
00:02:13,110 --> 00:02:10,800
space station what kind of lessons

57
00:02:14,949 --> 00:02:13,120
learned are you taking from the iss for

58
00:02:16,390 --> 00:02:14,959
gateway today yeah that's great we got a

59
00:02:18,150 --> 00:02:16,400
lot of folks working in the gateway

60
00:02:19,430 --> 00:02:18,160
program like myself that have a history

61
00:02:21,830 --> 00:02:19,440
in iss

62
00:02:23,510 --> 00:02:21,840
also have our crews so it's great that

63
00:02:26,470 --> 00:02:23,520

the crews that have spent time living on

64

00:02:28,550 --> 00:02:26,480

iss that can translate that into a into

65

00:02:30,070 --> 00:02:28,560

gateway for us to think about it so

66

00:02:31,990 --> 00:02:30,080

lessons learned we have in there when we

67

00:02:34,309 --> 00:02:32,000

really think about the layout inside of

68

00:02:36,229 --> 00:02:34,319

gateway it goes into the small things

69

00:02:38,710 --> 00:02:36,239

the computers that the crew uses how can

70

00:02:41,270 --> 00:02:38,720

we condense that down to the numbers of

71

00:02:43,670 --> 00:02:41,280

laptops and interfaces on gateway we see

72

00:02:45,110 --> 00:02:43,680

a lot of equipment externally

73

00:02:46,869 --> 00:02:45,120

on iss

74

00:02:49,190 --> 00:02:46,879

that would be a harsher radiation

75

00:02:51,190 --> 00:02:49,200

environment for us in gateway different

76

00:02:53,589 --> 00:02:51,200

design concepts a lot of ours is

77

00:02:55,990 --> 00:02:53,599

internal in equipment computers for

78

00:02:57,670 --> 00:02:56,000

example are all internal we bring a lot

79

00:02:59,270 --> 00:02:57,680

of that stuff inside and so we take

80

00:03:00,790 --> 00:02:59,280

those lessons learned

81

00:03:02,869 --> 00:03:00,800

probably one of the biggest areas we

82

00:03:04,949 --> 00:03:02,879

apply to it though because it's crew

83

00:03:07,190 --> 00:03:04,959

tended is think about reliability and

84

00:03:08,949 --> 00:03:07,200

maintainability because the crew is not

85

00:03:12,070 --> 00:03:08,959

there we've learned a lot of great

86

00:03:13,750 --> 00:03:12,080

lessons on iss we often reference ams we

87

00:03:15,910 --> 00:03:13,760

did some great evas did some stuff on

88

00:03:17,750 --> 00:03:15,920

there that when we launched ams never

89

00:03:20,229 --> 00:03:17,760

envisioned

90

00:03:22,790 --> 00:03:20,239

all right gentlemen luca if you need it

91

00:03:25,270 --> 00:03:22,800

it's a clocking of six when you get back

92

00:03:26,630 --> 00:03:25,280

that is a big lesson learned out of iss

93

00:03:28,630 --> 00:03:26,640

so in other words in the beginning it

94

00:03:31,430 --> 00:03:28,640

doesn't necessarily need to be fully

95

00:03:33,589 --> 00:03:31,440

designed to be replaceable but give us

96

00:03:35,589 --> 00:03:33,599

those tools those interfaces and with

97

00:03:37,110 --> 00:03:35,599

this great team we'll figure out a way

98

00:03:38,949 --> 00:03:37,120

to do that in the future

99

00:03:41,030 --> 00:03:38,959

so i know with the international space

100

00:03:43,270 --> 00:03:41,040

station we do have mission control

101
00:03:45,110 --> 00:03:43,280
centers all over the world and we have

102
00:03:46,390 --> 00:03:45,120
international partners so how many

103
00:03:48,470 --> 00:03:46,400
countries are we working with with

104
00:03:49,910 --> 00:03:48,480
gateway gateway is really building off

105
00:03:52,229 --> 00:03:49,920
of international space station and that

106
00:03:54,149 --> 00:03:52,239
cooperation so we have on gateway today

107
00:03:55,750 --> 00:03:54,159
is nasa where we're leading that our

108
00:03:58,309 --> 00:03:55,760
european colleagues are with us building

109
00:04:00,789 --> 00:03:58,319
a couple very important elements for

110
00:04:02,789 --> 00:04:00,799
gateway both habitation as well as a

111
00:04:05,350 --> 00:04:02,799
module that will provide refueling on

112
00:04:07,110 --> 00:04:05,360
orbit stowage very important for us crew

113
00:04:08,630 --> 00:04:07,120

viewing so they'll be able to look out

114

00:04:10,630 --> 00:04:08,640

see the earth see the moon that's where

115

00:04:12,309 --> 00:04:10,640

it'll happen on a european module as

116

00:04:15,110 --> 00:04:12,319

well as a com system that will launch

117

00:04:17,349 --> 00:04:15,120

early on gateway is from our european

118

00:04:19,509 --> 00:04:17,359

colleagues canadians big surprise

119

00:04:21,909 --> 00:04:19,519

canadarm3 so building off of the first

120

00:04:24,390 --> 00:04:21,919

candid arm on the space shuttle can arm

121

00:04:26,230 --> 00:04:24,400

2 that's doing so well on iss today the

122

00:04:28,550 --> 00:04:26,240

third evolution of that on gateway

123

00:04:30,550 --> 00:04:28,560

canadarm3 along with all the great

124

00:04:32,950 --> 00:04:30,560

external robotic fixtures it'll have our

125

00:04:34,710 --> 00:04:32,960

science on it'll have orus across

126

00:04:37,030 --> 00:04:34,720

gateway so very similar to iss kind of

127

00:04:39,270 --> 00:04:37,040

expanding that to gateway and then our

128

00:04:42,150 --> 00:04:39,280

japanese colleagues at jaxa they'll be

129

00:04:45,350 --> 00:04:42,160

building the life support system within

130

00:04:47,670 --> 00:04:45,360

the european esa ihab module and also

131

00:04:50,230 --> 00:04:47,680

looking we're about to launch htv x uh

132

00:04:51,749 --> 00:04:50,240

next year for iss the first one of those

133

00:04:54,950 --> 00:04:51,759

we're looking at that evolution to an

134

00:04:57,430 --> 00:04:54,960

htv x g gateway version

135

00:04:59,350 --> 00:04:57,440

also as logistics resupply like you said

136

00:05:00,790 --> 00:04:59,360

on iss we've got control centers around

137

00:05:02,710 --> 00:05:00,800

the world we're going to have centers

138

00:05:03,990 --> 00:05:02,720

around the world we're building hardware

139

00:05:05,189 --> 00:05:04,000

around the world today we're going to

140

00:05:08,710 --> 00:05:05,199

operate gateway a little differently

141

00:05:10,790 --> 00:05:08,720

though we're not 365 24 7 with crew on

142

00:05:12,550 --> 00:05:10,800

gateway uh we're doing that with crews

143

00:05:15,590 --> 00:05:12,560

that come up on orion for the landing

144

00:05:17,990 --> 00:05:15,600

missions so we look at about 30 to 60

145

00:05:20,310 --> 00:05:18,000

plus days depending on a logistics train

146

00:05:21,670 --> 00:05:20,320

of crews there so we'll have uh centers

147

00:05:23,830 --> 00:05:21,680

of those places that i mentioned

148

00:05:26,310 --> 00:05:23,840

supporting during the crude time frames

149

00:05:28,950 --> 00:05:26,320

but as during the uncrewed phases

150

00:05:30,390 --> 00:05:28,960

i don't foresee uh on teams on console

151
00:05:33,029 --> 00:05:30,400
around the world probably more of like

152
00:05:34,469 --> 00:05:33,039
an on-call type situation a lot of stuff

153
00:05:35,830 --> 00:05:34,479
can be going on on gateway but we won't

154
00:05:37,670 --> 00:05:35,840
have the crew there so that lets us

155
00:05:40,390 --> 00:05:37,680
operate in a little different realm

156
00:05:43,110 --> 00:05:40,400
when it's dormant uh are we getting any

157
00:05:45,110 --> 00:05:43,120
telemetry or you know yeah we'll have

158
00:05:48,310 --> 00:05:45,120
great capabilities and so we'll flush

159
00:05:49,990 --> 00:05:48,320
out exactly what that ops concept is so

160
00:05:51,430 --> 00:05:50,000
early on right we launched the first

161
00:05:52,390 --> 00:05:51,440
elements called the co-manifested

162
00:05:54,710 --> 00:05:52,400
vehicle

163
00:05:56,550 --> 00:05:54,720

pp and halo will launch together we'll

164

00:05:58,390 --> 00:05:56,560

go through a checkout phase that's a

165

00:06:00,550 --> 00:05:58,400

more intense operations team and

166

00:06:02,469 --> 00:06:00,560

engineering team as we check it out then

167

00:06:04,710 --> 00:06:02,479

as it spends about a year getting out

168

00:06:07,029 --> 00:06:04,720

using the solar electric propulsion new

169

00:06:08,710 --> 00:06:07,039

technology to get us out there

170

00:06:11,350 --> 00:06:08,720

we'll look at it and do more of a

171

00:06:13,590 --> 00:06:11,360

skeleton crew type things one of the

172

00:06:15,510 --> 00:06:13,600

things we're also baking into gateway

173

00:06:17,189 --> 00:06:15,520

early on is our software and software

174

00:06:19,830 --> 00:06:17,199

management we call it the vehicle

175

00:06:21,590 --> 00:06:19,840

systems manager it'll have opportunities

176
00:06:23,749 --> 00:06:21,600
in the future to look at autonomy and

177
00:06:26,390 --> 00:06:23,759
and factor autonomy in there kind of a

178
00:06:28,550 --> 00:06:26,400
crawl walk run type scenario and so you

179
00:06:30,629 --> 00:06:28,560
start out with with small pieces and we

180
00:06:33,270 --> 00:06:30,639
look at that to evolutionize in the

181
00:06:35,029 --> 00:06:33,280
future so we can minimize uh the on

182
00:06:36,629 --> 00:06:35,039
console demand if you will i don't know

183
00:06:38,309 --> 00:06:36,639
that it'll ever go to zero but we'll

184
00:06:39,909 --> 00:06:38,319
have great systems that will alert us

185
00:06:41,749 --> 00:06:39,919
we'll have com coverage with our deep

186
00:06:44,390 --> 00:06:41,759
space network actually one of the unique

187
00:06:45,990 --> 00:06:44,400
things about gateway and its orbit nrho

188
00:06:47,350 --> 00:06:46,000

we're kind of always looking back at the

189

00:06:48,390 --> 00:06:47,360

earth and so we'll have those com

190

00:06:50,150 --> 00:06:48,400

opportunities

191

00:06:51,670 --> 00:06:50,160

quite frequently that'd be great because

192

00:06:53,830 --> 00:06:51,680

that's also going to give us a lot of

193

00:06:56,150 --> 00:06:53,840

information about how to do this when we

194

00:06:58,150 --> 00:06:56,160

go even further maybe on to mars and

195

00:07:00,150 --> 00:06:58,160

have mission control support those

196

00:07:01,589 --> 00:07:00,160

missions that's exactly right and i'm

197

00:07:03,749 --> 00:07:01,599

glad you mentioned that this is kind of

198

00:07:05,510 --> 00:07:03,759

our stepping stones for it right so

199

00:07:07,589 --> 00:07:05,520

we're building and doing it in a

200

00:07:09,909 --> 00:07:07,599

sustained manner for lunar exploration

201
00:07:11,749 --> 00:07:09,919
and so that's what gateway lets us do

202
00:07:13,510 --> 00:07:11,759
gateway is that hub it's kind of that

203
00:07:14,830 --> 00:07:13,520
last outpost before you go off on your

204
00:07:16,950 --> 00:07:14,840
hike and you come back to and get

205
00:07:19,270 --> 00:07:16,960
resupplied but then we'll also look

206
00:07:21,029 --> 00:07:19,280
farther right this is moon to mars what

207
00:07:22,790 --> 00:07:21,039
are we doing on the moon to help us for

208
00:07:31,110 --> 00:07:22,800
that mars exploration and gateway is

209
00:07:34,950 --> 00:07:33,430
as we look at iss today it's a lot

210
00:07:37,110 --> 00:07:34,960
different than when we launch that first

211
00:07:39,510 --> 00:07:37,120
element doing a lot of things on iss

212
00:07:41,270 --> 00:07:39,520
that we didn't dream of back then

213
00:07:43,270 --> 00:07:41,280

we keep that in mind with gateway

214

00:07:46,150 --> 00:07:43,280

recognizing we're going to do

215

00:07:48,070 --> 00:07:46,160

lunar surface but also the expanse

216

00:07:50,070 --> 00:07:48,080

to mars and so one of the things we talk

217

00:07:52,869 --> 00:07:50,080

about is the ability and the the

218

00:07:54,070 --> 00:07:52,879

capability within gateway for a mars

219

00:07:55,270 --> 00:07:54,080

transit hab

220

00:07:56,230 --> 00:07:55,280

so that would be on the front end of

221

00:07:57,589 --> 00:07:56,240

gateway

222

00:07:59,189 --> 00:07:57,599

kind of get things checked out you could

223

00:08:02,150 --> 00:07:59,199

do a shakedown run

224

00:08:04,710 --> 00:08:02,160

maybe a year long in a earth moon type

225

00:08:07,029 --> 00:08:04,720

orbit so before you go off to mars shake

226

00:08:08,790 --> 00:08:07,039

that out come back to gateway and then

227

00:08:10,309 --> 00:08:08,800

in the future go on to mars so so we

228

00:08:11,909 --> 00:08:10,319

bake that in from the very beginning

229

00:08:13,909 --> 00:08:11,919

keeping it very open

230

00:08:15,350 --> 00:08:13,919

support our mission and our requirements

231

00:08:17,670 --> 00:08:15,360

objectives today

232

00:08:18,950 --> 00:08:17,680

but open to the future as well sounds

233

00:08:20,790 --> 00:08:18,960

just as complex as building the

234

00:08:23,430 --> 00:08:20,800

international space station

235

00:08:26,070 --> 00:08:23,440

is it going to be bigger or smaller than

236

00:08:28,150 --> 00:08:26,080

what we saw in terms of the construction

237

00:08:29,510 --> 00:08:28,160

of the iss yeah it's going to be quite a

238

00:08:32,949 --> 00:08:29,520

bit smaller and if you think about the

239

00:08:36,550 --> 00:08:32,959

role of gateway it's an outpost iss is

240

00:08:39,350 --> 00:08:36,560

six seven crew 365 days a year gateway

241

00:08:40,870 --> 00:08:39,360

will have four crew visiting from orion

242

00:08:42,550 --> 00:08:40,880

at least the initial missions two of

243

00:08:44,550 --> 00:08:42,560

them will go down to the surface on a

244

00:08:47,269 --> 00:08:44,560

lander perhaps all four in the future

245

00:08:49,590 --> 00:08:47,279

and so it's smaller it's uh about 30 to

246

00:08:51,990 --> 00:08:49,600

60 days with crew there if i look at

247

00:08:54,389 --> 00:08:52,000

comparisons from a pressurized volume

248

00:08:56,550 --> 00:08:54,399

what i like to say is iss

249

00:08:58,870 --> 00:08:56,560

it's about a four maybe five bedroom

250

00:09:00,870 --> 00:08:58,880

nice size very comfortable house

251
00:09:03,030 --> 00:09:00,880
you look at gateway it's probably more

252
00:09:05,190 --> 00:09:03,040
of your studio apartment size in terms

253
00:09:07,190 --> 00:09:05,200
of volume but our overall mission is

254
00:09:09,030 --> 00:09:07,200
different right gateway is supporting

255
00:09:10,949 --> 00:09:09,040
that full mission of the lunar surface

256
00:09:13,590 --> 00:09:10,959
we have crews go down there so we keep

257
00:09:16,470 --> 00:09:13,600
all those things in mind as we build the

258
00:09:18,389 --> 00:09:16,480
complex that's fantastic sean fuller the

259
00:09:20,310 --> 00:09:18,399
international partner manager for the

260
00:09:24,230 --> 00:09:20,320
gateway program thanks again for joining

261
00:09:27,990 --> 00:09:26,310
it's a really exciting time here at nasa

262
00:09:30,150 --> 00:09:28,000
with the international space station

263
00:09:32,710 --> 00:09:30,160

continuing to grow and expand our

264

00:09:35,430 --> 00:09:32,720

knowledge of living and working in space

265

00:09:38,389 --> 00:09:35,440

and now with gateway a next generation

266

00:09:40,630 --> 00:09:38,399

station for lunar orbit in development

267

00:09:43,269 --> 00:09:40,640

we will use what we learn on and around

268

00:09:46,550 --> 00:09:43,279

the moon to take the next giant leap

269

00:09:48,710 --> 00:09:46,560

sending the first astronauts to mars

270

00:09:52,070 --> 00:09:48,720

we invite you to come along as we take

271

00:09:54,550 --> 00:09:52,080

those giant leaps and the small steps

272

00:09:57,990 --> 00:09:54,560

you can follow us on twitter at nasa

273

00:09:59,910 --> 00:09:58,000

artemis and at nasa underscore gateway

274

00:10:02,069 --> 00:09:59,920

and that's face to ground for now i'm

275

00:10:04,230 --> 00:10:02,079

kayla lafrance at mission control in

