
NASA

1
00:00:17,349 --> 00:00:15,509
space launch system is the next newest

2
00:00:19,109 --> 00:00:17,359
biggest rocket that we're going to build

3
00:00:20,630 --> 00:00:19,119
and it's not just a replacement for the

4
00:00:22,230 --> 00:00:20,640
space shuttle this rocket is going to

5
00:00:23,429 --> 00:00:22,240
carry us much further than the shuttle

6
00:00:26,070 --> 00:00:23,439
would go

7
00:00:28,150 --> 00:00:26,080
it's nasa's next big rocket for deep

8
00:00:30,870 --> 00:00:28,160
space exploration

9
00:00:32,069 --> 00:00:30,880
the sls is a national capability that

10
00:00:33,350 --> 00:00:32,079
provides

11
00:00:36,950 --> 00:00:33,360
a unique

12
00:00:39,430 --> 00:00:36,960
access to space that america has not had

13
00:00:43,190 --> 00:00:39,440

in 40 years

14
00:00:48,549 --> 00:00:45,910
really opens the door to destinations

15
00:00:55,510 --> 00:00:48,559
beyond it's not limited by destination

16
00:00:59,750 --> 00:00:56,869
what we're focused on here at this

17
00:01:01,910 --> 00:00:59,760
center is the propulsion system and that

18
00:01:04,310 --> 00:01:01,920
consists of two solid rocket boosters

19
00:01:06,390 --> 00:01:04,320
and a core with some tanks that feed

20
00:01:08,550 --> 00:01:06,400
some liquid rocket engines in the middle

21
00:01:10,230 --> 00:01:08,560
and then the astronauts sit on the top

22
00:01:11,750 --> 00:01:10,240
in the orion

23
00:01:14,710 --> 00:01:11,760
spacecraft

24
00:01:17,190 --> 00:01:14,720
one of the things we recognized for sls

25
00:01:19,910 --> 00:01:17,200
is we had to be affordable so

26
00:01:22,469 --> 00:01:19,920
we had to do things differently more

27
00:01:25,350 --> 00:01:22,479
efficiently and smarter we're all

28
00:01:27,429 --> 00:01:25,360
conscious about saving money doing it

29
00:01:29,510 --> 00:01:27,439
more affordable than we have in the past

30
00:01:32,550 --> 00:01:29,520
but at the same time we can't sacrifice

31
00:01:34,789 --> 00:01:32,560
reliability or safety the system uses a

32
00:01:36,550 --> 00:01:34,799
significant amount of heritage hardware

33
00:01:38,789 --> 00:01:36,560
which is things that we've evolved from

34
00:01:40,390 --> 00:01:38,799
the space shuttle program the space

35
00:01:42,310 --> 00:01:40,400
shuttle had two

36
00:01:43,910 --> 00:01:42,320
kind of candle looking things which are

37
00:01:46,149 --> 00:01:43,920
the solid rockets

38
00:01:49,270 --> 00:01:46,159

those are kept

39
00:01:51,590 --> 00:01:49,280
and those are used on sls

40
00:01:53,270 --> 00:01:51,600
we've added a segment to the four

41
00:01:55,510 --> 00:01:53,280
segment solid rocket boosters that we

42
00:01:57,670 --> 00:01:55,520
had on shuttle that gives it more power

43
00:01:59,429 --> 00:01:57,680
more thrust and it helps this larger

44
00:02:01,030 --> 00:01:59,439
rocket get off the ground what those

45
00:02:02,950 --> 00:02:01,040
boosters are for is just to get you

46
00:02:05,510 --> 00:02:02,960
going they burn for a couple of minutes

47
00:02:07,190 --> 00:02:05,520
and then they fall to the ground

48
00:02:08,790 --> 00:02:07,200
then your liquid engines you're up high

49
00:02:10,630 --> 00:02:08,800
enough your liquid needs to carry your

50
00:02:11,990 --> 00:02:10,640
vehicle to as high as you want to go and

51
00:02:13,510 --> 00:02:12,000
if you have additional stages like we're

52
00:02:15,589 --> 00:02:13,520
going to have one then you can go

53
00:02:18,470 --> 00:02:15,599
further out into space right now the

54
00:02:20,630 --> 00:02:18,480
inventory that we've got consists of 14

55
00:02:23,430 --> 00:02:20,640
engines that flown on shuttle we've got

56
00:02:24,710 --> 00:02:23,440
one engine that was assembled and still

57
00:02:26,550 --> 00:02:24,720
needs green run testing our

58
00:02:29,270 --> 00:02:26,560
certification testing we looked at all

59
00:02:31,030 --> 00:02:29,280
the spares as we collected the spares we

60
00:02:33,110 --> 00:02:31,040
determined that we could assemble a 16th

61
00:02:35,990 --> 00:02:33,120
engine so we'll have 16 engines that

62
00:02:38,229 --> 00:02:36,000
we'll be able to use for flight

63
00:02:40,070 --> 00:02:38,239

we are making tremendous progress we've

64
00:02:41,270 --> 00:02:40,080
got all of our prime contractors on

65
00:02:43,270 --> 00:02:41,280
board

66
00:02:45,350 --> 00:02:43,280
we're testing engines we're testing

67
00:02:49,110 --> 00:02:45,360
solid rocket boosters our avionics

68
00:02:50,949 --> 00:02:49,120
systems j2x has set recently set a

69
00:02:53,190 --> 00:02:50,959
record at stennis

70
00:02:56,470 --> 00:02:53,200
when we were testing it was the first

71
00:02:58,229 --> 00:02:56,480
liquid oxygen engine to get to a full

72
00:02:59,750 --> 00:02:58,239
duration test

73
00:03:03,589 --> 00:02:59,760
in four

74
00:03:07,270 --> 00:03:05,670
we were developing this booster under

75
00:03:09,910 --> 00:03:07,280
the aries program

76
00:03:11,910 --> 00:03:09,920
and and we're moving that into the sls

77
00:03:13,910 --> 00:03:11,920
vehicle the motor itself has been

78
00:03:18,149 --> 00:03:13,920
through three development firings which

79
00:03:19,509 --> 00:03:18,159
are full-scale motors tested out in utah

80
00:03:21,990 --> 00:03:19,519
and we've gotten a lot of good data

81
00:03:23,910 --> 00:03:22,000
engineering data from those tests

82
00:03:25,830 --> 00:03:23,920
this is an adapter that goes between the

83
00:03:27,589 --> 00:03:25,840
bottom of the orion capsule and the top

84
00:03:30,309 --> 00:03:27,599
of the space launch system rocket that

85
00:03:32,470 --> 00:03:30,319
we're developing here at marshall

86
00:03:35,430 --> 00:03:32,480
it's been specifically designed to give

87
00:03:37,270 --> 00:03:35,440
strength to the adapter so that it can

88
00:03:39,830 --> 00:03:37,280

take the loads in flight and still be

89
00:03:41,910 --> 00:03:39,840
lightweight

90
00:03:44,789 --> 00:03:41,920
this shape started out as a series of

91
00:03:46,949 --> 00:03:44,799
flat panels the iso grid pattern was

92
00:03:49,110 --> 00:03:46,959
machined into the surfaces

93
00:03:51,190 --> 00:03:49,120
then they were formed it was called bump

94
00:03:52,869 --> 00:03:51,200
in a process called the bump forming to

95
00:03:53,670 --> 00:03:52,879
make them into the shape that we need

96
00:03:55,429 --> 00:03:53,680
here

97
00:03:57,190 --> 00:03:55,439
and we weld three of these segments

98
00:04:07,750 --> 00:03:57,200
together to form the cone that you see

99
00:04:12,630 --> 00:04:09,030
we just

100
00:04:17,909 --> 00:04:12,640
you know delivered the first crew module

101
00:04:23,590 --> 00:04:20,469
we've started a lot of the parks on to

102
00:04:25,830 --> 00:04:23,600
the outside of the cm and we've actually

103
00:04:27,830 --> 00:04:25,840
put it in what we call the bird cage so

104
00:04:30,230 --> 00:04:27,840
we can locate all those parts you know

105
00:04:31,510 --> 00:04:30,240
within you know thousands of an inch to

106
00:04:35,110 --> 00:04:31,520
make sure that

107
00:04:39,110 --> 00:04:36,790
putting you know wiring inside of it

108
00:04:41,350 --> 00:04:39,120
putting tubes for the you know for the

109
00:04:44,469 --> 00:04:41,360
propulsion system putting valves and

110
00:04:46,550 --> 00:04:44,479
pumps and so all of that happens

111
00:04:51,030 --> 00:04:46,560
in stages right there

112
00:04:55,749 --> 00:04:53,749
we have on contract with usa united

113
00:04:57,909 --> 00:04:55,759

space line to build

114
00:05:00,469 --> 00:04:57,919
our harnesses their setup shop in the o

115
00:05:06,390 --> 00:05:00,479
and c and so their little shop delivers

116
00:05:11,189 --> 00:05:08,550
thermal protection is very difficult in

117
00:05:12,870 --> 00:05:11,199
re-entry vehicles to to test and to

118
00:05:14,390 --> 00:05:12,880
model i'm going to really have to you

119
00:05:17,510 --> 00:05:14,400
have to fly it to really understand

120
00:05:20,790 --> 00:05:19,189
we're building ceramic thermal

121
00:05:22,550 --> 00:05:20,800
insulation tiles for the back shell of

122
00:05:23,830 --> 00:05:22,560
the capsule we're building thermal

123
00:05:25,670 --> 00:05:23,840
barriers for the capsule and we're

124
00:05:31,510 --> 00:05:25,680
building multi-layer insulation for that

125
00:05:35,990 --> 00:05:34,070
i'm the heat shield design lead

126
00:05:38,230 --> 00:05:36,000
so we're designing and building the heat

127
00:05:40,550 --> 00:05:38,240
shield for the future orientations the

128
00:05:42,310 --> 00:05:40,560
heat shield right now is in our big 20

129
00:05:45,029 --> 00:05:42,320
by 20 router

130
00:05:46,790 --> 00:05:45,039
it's a 5-axis router and right now it's

131
00:05:48,310 --> 00:05:46,800
machining

132
00:05:50,790 --> 00:05:48,320
the interior bowl if you will of the

133
00:05:53,749 --> 00:05:50,800
heat shield to cut out that heat shield

134
00:05:55,350 --> 00:05:53,759
on the on the router could take weeks of

135
00:05:57,510 --> 00:05:55,360
machine time

136
00:05:58,870 --> 00:05:57,520
running multiple shifts it's the biggest

137
00:06:05,029 --> 00:05:58,880
heat shield

138
00:06:07,350 --> 00:06:05,039

skeleton so that's the piece of the

139
00:06:10,070 --> 00:06:07,360
titanium substructure the backbone that

140
00:06:12,550 --> 00:06:10,080
makes up the carrier structure itself

141
00:06:14,309 --> 00:06:12,560
another unique thing is all the

142
00:06:16,790 --> 00:06:14,319
hand drilling that we're doing so it's

143
00:06:18,870 --> 00:06:16,800
not automated by a router in this case

144
00:06:22,629 --> 00:06:18,880
and it all has to be be hand hand

145
00:06:25,350 --> 00:06:22,639
drilled by technicians on the inside

146
00:06:27,749 --> 00:06:25,360
200 plus titanium parts all match

147
00:06:29,189 --> 00:06:27,759
drilled together so we have a

148
00:06:31,270 --> 00:06:29,199
tool that puts all the pieces in the

149
00:06:37,029 --> 00:06:31,280
right spot and then we drill and high

150
00:06:41,830 --> 00:06:39,670
mcc is transforming from

151
00:06:42,870 --> 00:06:41,840
supporting space shuttle and space

152
00:06:45,029 --> 00:06:42,880
station

153
00:06:48,950 --> 00:06:45,039
to a platform that will support space

154
00:06:51,029 --> 00:06:48,960
station and npcb or orion

155
00:06:53,510 --> 00:06:51,039
in order to adapt for the future we need

156
00:06:55,589 --> 00:06:53,520
to go to a more modern system

157
00:06:57,430 --> 00:06:55,599
ksc will still operate the vehicle all

158
00:06:58,790 --> 00:06:57,440
the way up until launch we'll operate

159
00:07:00,309 --> 00:06:58,800
the vehicle until splashdown and the

160
00:07:07,189 --> 00:07:00,319
recovery forces come in and take over

161
00:07:11,350 --> 00:07:09,430
firearm one is the launch control room

162
00:07:14,309 --> 00:07:11,360
we're going to use for orion sls for

163
00:07:17,749 --> 00:07:15,430

we've been working with the orion

164
00:07:19,670 --> 00:07:17,759
program to get the spacecraft data so we

165
00:07:21,189 --> 00:07:19,680
can we can process it with our software

166
00:07:22,150 --> 00:07:21,199
in the firing room and we will be flight

167
00:07:25,670 --> 00:07:22,160
following

168
00:07:30,230 --> 00:07:28,469
we refitted the room we redid it putting

169
00:07:32,150 --> 00:07:30,240
the sound suppression carpeting on the

170
00:07:33,670 --> 00:07:32,160
walls making it kind of a more

171
00:07:36,150 --> 00:07:33,680
comfortable place to work so we're

172
00:07:38,550 --> 00:07:36,160
aiming for about 50 people in fire one

173
00:07:41,990 --> 00:07:38,560
for an em-1 mission we are actually

174
00:07:45,830 --> 00:07:42,000
using firing one right now to test pad b

175
00:07:50,309 --> 00:07:48,070
this part is going to be almost like a

176
00:07:53,589 --> 00:07:50,319
complete new pack because we will have

177
00:07:55,990 --> 00:07:53,599
refurbished each and every system

178
00:07:57,830 --> 00:07:56,000
that it's inside the pack we're going to

179
00:07:59,189 --> 00:07:57,840
have the vehicle

180
00:08:01,589 --> 00:07:59,199
launched from

181
00:08:03,189 --> 00:08:01,599
the mobile launcher and not only launch

182
00:08:05,909 --> 00:08:03,199
from the mobile launcher but have a

183
00:08:09,350 --> 00:08:05,919
tower that that will have all the

184
00:08:11,909 --> 00:08:09,360
services attached to the vehicle

185
00:08:14,790 --> 00:08:11,919
the tower is going to be on the mobile

186
00:08:19,270 --> 00:08:14,800
launcher the vehicle will be assembled

187
00:08:24,070 --> 00:08:21,909
it's a return to a concept that we knew

188
00:08:26,550 --> 00:08:24,080

that worked very well during the apollo

189
00:08:28,309 --> 00:08:26,560
years when the mobile launch platform

190
00:08:31,110 --> 00:08:28,319
had a tower on it

191
00:08:34,230 --> 00:08:31,120
we knew that the vab was designed to

192
00:08:36,469 --> 00:08:34,240
accommodate a launch tower on a mobile

193
00:08:39,670 --> 00:08:36,479
launch platform

194
00:08:41,509 --> 00:08:39,680
we have to make sure that the vab can

195
00:08:43,269 --> 00:08:41,519
remain adaptable

196
00:08:45,590 --> 00:08:43,279
and accommodate different vehicle

197
00:08:48,070 --> 00:08:45,600
architectures

198
00:08:51,110 --> 00:08:48,080
and now we have a clean vap

199
00:08:53,110 --> 00:08:51,120
uh shell per se the infrastructure so

200
00:08:54,710 --> 00:08:53,120
that we can accommodate

201
00:08:56,470 --> 00:08:54,720
the the new

202
00:08:58,230 --> 00:08:56,480
hardware the new

203
00:09:01,350 --> 00:08:58,240
vehicle access

204
00:09:03,509 --> 00:09:01,360
with new platforms and that is the first

205
00:09:05,829 --> 00:09:03,519
phase that we're doing now

206
00:09:07,990 --> 00:09:05,839
and once the vehicle is ready with all

207
00:09:10,389 --> 00:09:08,000
the connections the only thing we got to

208
00:09:12,389 --> 00:09:10,399
do is move the vehicle to the pad do the

209
00:09:14,230 --> 00:09:12,399
connections to the mobile launcher and

210
00:09:16,470 --> 00:09:14,240
once we do those connections we're ready

211
00:09:17,670 --> 00:09:16,480
to launch

212
00:09:19,590 --> 00:09:17,680
there was a time where i had to explain

213
00:09:21,269 --> 00:09:19,600

what a crawler was if you didn't work

214
00:09:22,550 --> 00:09:21,279
out here at the space center or if you

215
00:09:24,550 --> 00:09:22,560
weren't in the central florida area a

216
00:09:27,269 --> 00:09:24,560
lot of people just you know somehow the

217
00:09:29,030 --> 00:09:27,279
vehicle got out to the pad

218
00:09:30,389 --> 00:09:29,040
we knew what to expect from a load

219
00:09:31,910 --> 00:09:30,399
perspective with the new vehicle the

220
00:09:33,190 --> 00:09:31,920
larger rocket and things along those

221
00:09:34,550 --> 00:09:33,200
lines

222
00:09:36,310 --> 00:09:34,560
and that goes from the crawler lifted

223
00:09:38,070 --> 00:09:36,320
load the hydraulics also to the crawler

224
00:09:39,829 --> 00:09:38,080
way we're going to have to increase the

225
00:09:42,310 --> 00:09:39,839
load and capability for the crawler way

226
00:09:43,750 --> 00:09:42,320
itself with the rock

227
00:09:45,750 --> 00:09:43,760
what we've essentially done is keep all

228
00:09:47,030 --> 00:09:45,760
the same hydraulic components but just

229
00:09:48,710 --> 00:09:47,040
increase the size the diameter of the

230
00:09:50,470 --> 00:09:48,720
hydraulic cylinders

231
00:09:52,070 --> 00:09:50,480
last november we actually took a took a

232
00:09:53,829 --> 00:09:52,080
ride out with the completed crawler two

233
00:09:55,910 --> 00:09:53,839
out to the pad and tested out the

234
00:09:58,389 --> 00:09:55,920
systems and a couple punchless items but

235
00:10:00,150 --> 00:09:58,399
everything worked great

236
00:10:02,389 --> 00:10:00,160
the control system had been upgraded the

237
00:10:03,990 --> 00:10:02,399
uh the cab the driver's cab consoles had

238
00:10:06,870 --> 00:10:04,000

all been replaced the brakes had all

239
00:10:08,710 --> 00:10:06,880
been replaced nearly every subsystem had

240
00:10:10,550 --> 00:10:08,720
some kind of work done to it

241
00:10:13,670 --> 00:10:10,560
the traction support elements each of

242
00:10:15,030 --> 00:10:13,680
the the four corners has 22 rollers that

243
00:10:16,790 --> 00:10:15,040
are about the size of a car to be honest

244
00:10:20,470 --> 00:10:16,800
with you and we're changing out all of

245
00:10:25,269 --> 00:10:23,030
what i love doing is reminding the

246
00:10:27,590 --> 00:10:25,279
outside world whether it's within our

247
00:10:29,990 --> 00:10:27,600
government or especially the media that

248
00:10:32,550 --> 00:10:30,000
has a perception that we're in a law

249
00:10:34,550 --> 00:10:32,560
that's nothing going on that you know

250
00:10:36,710 --> 00:10:34,560
the space program shutting down to kind

251
00:10:38,790 --> 00:10:36,720
of dispel that rumor and say no this is

252
00:10:42,550 --> 00:10:38,800
the the far opposite for us we are

253
00:10:46,310 --> 00:10:42,560
utilizing this inter-program time frame

254
00:10:48,230 --> 00:10:46,320
to make all the modifications and all

255
00:10:50,710 --> 00:10:48,240
the infrastructure changes that it will

256
00:10:51,910 --> 00:10:50,720
help bring that agency vision into

257
00:10:54,470 --> 00:10:51,920
reality

258
00:10:56,790 --> 00:10:54,480
many of us feel the country

259
00:10:58,470 --> 00:10:56,800
wants to go forward and and nasa has a

260
00:11:00,550 --> 00:10:58,480
big following and every time i talk to

261
00:11:03,110 --> 00:11:00,560
people they're excited about nasa

262
00:11:05,269 --> 00:11:03,120
enabling people to go beyond where they

263
00:11:07,430 --> 00:11:05,279

have ever gone before and look and

264
00:11:10,310 --> 00:11:07,440
discover things that they

265
00:11:11,990 --> 00:11:10,320
didn't even know existed is just it's

266
00:11:13,269 --> 00:11:12,000
just a real honor

267
00:11:15,110 --> 00:11:13,279
it's been a pleasure to be involved with

268
00:11:17,110 --> 00:11:15,120
this project and i can't say enough for

269
00:11:19,030 --> 00:11:17,120
the team to put this together i'm

270
00:11:20,470 --> 00:11:19,040
privileged to work this program i think

271
00:11:22,150 --> 00:11:20,480
most people who are working it today

272
00:11:24,069 --> 00:11:22,160
feel the same way i can't believe they