



1
00:00:02,196 --> 00:00:04,746
>> Josh Byerly: We are going to start with questions here in Houston then we'll go

2
00:00:04,746 --> 00:00:07,726
down to the Kennedy Space Center and then we'll go to the phone lines.

3
00:00:07,756 --> 00:00:11,036
We have quite a number of people, so we're asking that you stay with one question,

4
00:00:11,036 --> 00:00:13,556
one follow up and we'll come back here and go back around one more time.

5
00:00:13,556 --> 00:00:14,226
We'll start off with Mark.

6
00:00:15,216 --> 00:00:15,666
>> Mark: Thanks.

7
00:00:15,756 --> 00:00:20,676
Mark Carreau for Aviation Week and Space Technology and I wanted

8
00:00:20,676 --> 00:00:24,126
to go back to the software validation work.

9
00:00:24,176 --> 00:00:29,996
Could you elaborate some on that and if I understood correctly you'll have a follow

10
00:00:29,996 --> 00:00:33,566
on to this FRR on about the 23rd.

11
00:00:33,836 --> 00:00:41,546
If you could sort of bridge what happens after that to the launch point.

12

00:00:42,696 --> 00:00:44,876

>> Bill Gertsenmaier: I can
do a piece of it and then,

13

00:00:45,086 --> 00:00:48,556

then Mike and the others can also chime in.

14

00:00:48,736 --> 00:00:51,526

There's still some software
work that's, that's going on.

15

00:00:51,776 --> 00:00:55,356

Some activities they're completing in Hawthorne
where they're doing hardware in the loop testing

16

00:00:55,566 --> 00:00:58,516

to make sure that the software
works right with the hardware.

17

00:00:59,086 --> 00:01:02,776

Then when they complete those results they
provide test reports and test analysis

18

00:01:02,776 --> 00:01:06,996

of that activity back to the NASA team and
the NASA team looks at that to make sure

19

00:01:06,996 --> 00:01:10,376

that it all fits and works the
way it was supposed to go work.

20

00:01:10,736 --> 00:01:14,336

They'll also do some testing with
the actual vehicle down in Florida

21

00:01:14,426 --> 00:01:17,066

where they'll do the same kind of thing where
they'll actually run through the software

22
00:01:17,066 --> 00:01:19,566
with the flight vehicle and
again, those reports come back

23
00:01:19,566 --> 00:01:21,316
to the NASA team and we'll take a look at it.

24
00:01:21,316 --> 00:01:25,496
We will not do a formal review
like we did today of that activity.

25
00:01:25,496 --> 00:01:29,566
What we'll do is we think that'll all
be okay, but we'll get a report back

26
00:01:29,606 --> 00:01:33,306
from the individual teams, the safety
folks, the software folks, etcetera.

27
00:01:33,306 --> 00:01:36,106
They'll tell us on the 23rd
that everything went as planned.

28
00:01:36,106 --> 00:01:38,116
There was no surprises; nothing unique there

29
00:01:38,536 --> 00:01:40,906
and then we'll just continue
on then towards the launch.

30
00:01:40,906 --> 00:01:45,466
And some of the activities that occur towards
the launches will be flight readiness firing

31
00:01:45,466 --> 00:01:49,456
of the engines, they'll be hydrazine
loading in the Dragon capsule.

32
00:01:49,456 --> 00:01:52,116

A lot of activities occur
in kind of that final week.

33
00:01:52,606 --> 00:01:56,846
SpaceX also does their own internal flight
readiness review and they'll do that on Sunday,

34
00:01:56,846 --> 00:01:58,816
the 22nd just in front of this review.

35
00:01:58,966 --> 00:02:02,396
That'll be one chance for them to go through
to make sure all their individual components

36
00:02:02,396 --> 00:02:04,466
and systems are ready to go forward.

37
00:02:04,466 --> 00:02:07,386
So, I would say today we had enough assurance

38
00:02:07,386 --> 00:02:09,376
that everything is moving
in the right direction.

39
00:02:09,376 --> 00:02:10,666
We're heading towards the 30th.

40
00:02:11,176 --> 00:02:12,436
We're not completely there.

41
00:02:12,616 --> 00:02:15,866
We want to go ahead and get these
final checks from the SpaceX team.

42
00:02:15,866 --> 00:02:18,786
After those checks are complete and
we understand where they all sit,

43
00:02:18,866 --> 00:02:21,986

then we'll say collectively this
is the right thing to head forward.

44

00:02:21,986 --> 00:02:25,526

So, we got enough assurance today that
the 30th is the right day to head towards,

45

00:02:25,526 --> 00:02:29,236

but we still reserve the right to take a
look at the data, see what the software does

46

00:02:29,236 --> 00:02:32,036

and see what the teams find as
they go do a more in depth review.

47

00:02:32,986 --> 00:02:37,516

>> Eric Berg: Erick Berg
with the Eastern Chronicle.

48

00:02:37,516 --> 00:02:42,006

Quick question for Allen than a follow up
for Elon; first of all, is it accurate to say

49

00:02:42,006 --> 00:02:49,186

that NASA has invested 381 million so far in
the commercial cargo capabilities for SpaceX?

50

00:02:49,496 --> 00:02:49,896

>> Alan Lindenmoyer: Yes.

51

00:02:49,956 --> 00:02:54,806

That is the total of the 37 milestone
payments we've made to SpaceX to date.

52

00:02:55,126 --> 00:02:58,816

>> Eric Berg: And then for Elon,
you're in Texas today and it's possible

53

00:02:58,816 --> 00:03:01,286

that Dragons could launch

from Texas in the future.

54

00:03:01,286 --> 00:03:05,856

I'm curious what the state and maybe the federal congressional officials need to do

55

00:03:05,856 --> 00:03:08,306

to make this an attractive place for you to build a space port?

56

00:03:08,756 --> 00:03:14,426

>> Elon Musk: Well I don't want us to get too off topic but, because I mean this is really

57

00:03:14,426 --> 00:03:16,176

about the upcoming missions of the space station.

58

00:03:16,176 --> 00:03:24,216

But, but we are pretty interested in the possibility of a Texas based launch site

59

00:03:25,046 --> 00:03:32,296

and I think there's a lot of good action being taken by the local authorities

60

00:03:32,296 --> 00:03:33,826

in the Brownsville area in particular.

61

00:03:34,436 --> 00:03:39,736

Not that much at the state level; we'd certainly appreciate more help at the state level

62

00:03:40,296 --> 00:03:44,486

and at the federal level its not really you know--

63

00:03:44,536 --> 00:03:48,746

I think the federal level is relatively different as to what state we launch from.

64
00:03:49,306 --> 00:03:53,616
But we thought it was important to look at
having a third launch site just to make sure

65
00:03:53,616 --> 00:04:00,786
in the future that if we have a lot of missions
taking place for commercial satellite launches

66
00:04:00,946 --> 00:04:06,066
as well as launches to the space
station for cargo and potentially crew

67
00:04:06,556 --> 00:04:10,046
and potentially the defense [Inaudible] missions

68
00:04:10,346 --> 00:04:13,676
that we didn't encounter
a launch site constraint.

69
00:04:14,366 --> 00:04:18,946
But, as you point out also that we're
also looking at potentially using one

70
00:04:18,976 --> 00:04:24,176
of the shuttle pads at the cape for crew flight.

71
00:04:24,466 --> 00:04:30,946
So, we just want to make sure that we don't in
the future encounter launch site constraints.

72
00:04:30,996 --> 00:04:33,726
That's really what we're
after with that element.

73
00:04:34,476 --> 00:04:34,586
So--

74
00:04:35,846 --> 00:04:39,066

>> Kevin Quinn: Hi, Kevin Quinn
with KTRK, ABC 13 here in Houston.

75

00:04:39,116 --> 00:04:42,636

Can, and maybe this is a
question for Elon, I'm not sure.

76

00:04:42,636 --> 00:04:46,386

Maybe it's a NASA question but can you describe
please specifically weather restrictions

77

00:04:46,386 --> 00:04:52,256

that could affect launch, how those
would compare say to that which was

78

00:04:52,256 --> 00:04:53,786

out there for the shuttle program.

79

00:04:53,856 --> 00:04:56,386

Are these tighter restrictions,
are they lesser restrictions?

80

00:04:57,756 --> 00:05:01,026

>> Elon Musk: I think they're
probably comparable.

81

00:05:01,826 --> 00:05:05,626

We are-- we definitely want to err
on the side of caution particularly

82

00:05:05,626 --> 00:05:09,686

since these are initial flights but
I think they are probably comparable.

83

00:05:09,686 --> 00:05:13,946

I'm not entirely certain but
I think they are similar.

84

00:05:14,476 --> 00:05:16,906

>> Bill Gertsenmaier: I would

say they're pretty compatible.

85

00:05:16,906 --> 00:05:19,406

We've seen even their expendable launch vehicles.

86

00:05:19,406 --> 00:05:20,956

We have a lot of triggered lightning rules.

87

00:05:20,956 --> 00:05:22,326

Those rules will be the same.

88

00:05:22,326 --> 00:05:26,076

We have basically the same visibility rules for the ground observers

89

00:05:26,076 --> 00:05:28,036

that are watching the rocket fly, those kinds of things.

90

00:05:28,036 --> 00:05:29,266

So, those are all pretty similar.

91

00:05:29,706 --> 00:05:33,456

The winds aloft might have been a little more restrictive for shuttle than they are

92

00:05:33,576 --> 00:05:40,336

for the Falcon 9, but other than that I think they're pretty comparable overall.

93

00:05:40,976 --> 00:05:42,066

>> Kevin Quinn: Thank you.

94

00:05:43,526 --> 00:05:44,036

>> Jeremy.

95

00:05:44,036 --> 00:05:46,586

>> Jeremy Diesel: Jeremy Diesel

from KHLU, question for Elon.

96

00:05:46,896 --> 00:05:50,606

If this is all successful,
everything goes exactly as planned.

97

00:05:50,686 --> 00:05:51,726

>> Elon Musk: Ah, that would be awesome.

98

00:05:51,726 --> 00:05:51,793

[Laughter]

99

00:05:51,793 --> 00:05:57,916

>> Jeremy Diesel: Right, what becomes
the next step, the next time line,

100

00:05:58,266 --> 00:06:02,126

the possibility of seeing a crewed flight?

101

00:06:02,326 --> 00:06:07,836

>> Elon Musk: Well, assuming this is successful
then we look forward to a steady stream

102

00:06:07,836 --> 00:06:15,006

of cargo flights to the space station under our
Soyuz contract that would be really super great.

103

00:06:15,756 --> 00:06:23,896

And then you know because we designed the space
craft and rocket to be very similar between crew

104

00:06:23,896 --> 00:06:27,946

and cargo, in the process will be
accumulating a lot of knowledge about how,

105

00:06:28,026 --> 00:06:31,486

you know how potential a
potential crewed flight might work

106

00:06:31,486 --> 00:06:35,006

and if there is an issue I think there's you know a good chance we're going to cover it

107

00:06:35,626 --> 00:06:39,986

on a cargo flight rather than potentially put crew at risk which is I think is pretty helpful.

108

00:06:40,826 --> 00:06:45,436

And we do have to have a separate contract with NASA for you know adding

109

00:06:45,436 --> 00:06:49,746

in the elements necessary for crew transport and then there's--

110

00:06:50,926 --> 00:06:54,196

but there are a bunch of additional steps that have to take place there.

111

00:06:54,766 --> 00:07:00,686

But we're optimistic that at some point Dragon will be carrying astronauts

112

00:07:00,686 --> 00:07:01,956

and that will be really great.

113

00:07:02,386 --> 00:07:03,986

>> Jeremy Diesel: Two years, three years, five years?

114

00:07:04,236 --> 00:07:04,956

[Laughter] Eight years?

115

00:07:05,676 --> 00:07:09,506

>> Elon Musk: Well, yea there's a lot of variables between here and there.

116

00:07:09,766 --> 00:07:11,416

>> Jeremy Diesel: Perfect world?

117

00:07:11,416 --> 00:07:14,756

>> Elon Musk: Oh, perfect world, well it's probably like three years.

118

00:07:15,456 --> 00:07:15,536

Yea.

119

00:07:16,126 --> 00:07:16,236

>> Josh Byerly: Okay.

120

00:07:18,016 --> 00:07:18,196

David.

121

00:07:21,666 --> 00:07:24,376

>> David Hirsh: David Hirsh, NHA, and Mike Suffredini first,

122

00:07:24,456 --> 00:07:27,386

given that the ISS is an international collaboration,

123

00:07:27,386 --> 00:07:32,286

I wonder if you could give us a sense of what the importance of the international partnership

124

00:07:32,406 --> 00:07:39,116

as far as this entire project and the role of international partners in the FRR today?

125

00:07:39,636 --> 00:07:40,336

>> Mike Suffredini: It's two fold.

126

00:07:40,336 --> 00:07:48,946

One is the partnership, the entire partnership does benefit from these vehicles and, in fact,

127

00:07:49,136 --> 00:07:51,906

all but our Russian colleagues rely on it.

128

00:07:52,536 --> 00:08:01,446

We utilize a suite of vehicles in the future to provide up mass to ISS and its progress,

129

00:08:01,556 --> 00:08:06,276

the JAXA of HTV, the ESA, ATB and the two commercial vehicles

130

00:08:06,276 --> 00:08:07,496

that we're talking about here today.

131

00:08:08,066 --> 00:08:12,056

And the Lion share of the up mass will be provided for the USOS segment.

132

00:08:12,056 --> 00:08:14,836

The Lion share of the up mass will be provided by this commercial vehicle.

133

00:08:14,836 --> 00:08:17,166

So, it's very important to the partnership.

134

00:08:17,536 --> 00:08:22,506

This FR just like every FR has all the partner agencies are represented.

135

00:08:22,506 --> 00:08:27,026

And so it's important to them and they worry about not only the fact will it bring it up

136

00:08:27,026 --> 00:08:30,586

but there are safety implications; there's plume impingement issues.

137

00:08:30,586 --> 00:08:34,326

There's EMI, there's all sorts of things that we have to prove

138

00:08:34,356 --> 00:08:37,956

to the entire partnership that
we meet those requirements.

139

00:08:37,956 --> 00:08:41,246

And all of our requirements are
meant to protect us from that.

140

00:08:41,836 --> 00:08:47,966

And our partners participate in the safety
review boards and the analytical process

141

00:08:47,966 --> 00:08:52,996

of determining that we were-- that we're not
causing any harm to the rest of the space craft.

142

00:08:52,996 --> 00:08:56,986

And, in fact, part of the
responsibility of the US is

143

00:08:56,986 --> 00:08:59,256

to ensure the integrated space craft is okay.

144

00:08:59,636 --> 00:09:04,346

But, they would like to see the data and
so we provide the data that's necessary

145

00:09:04,346 --> 00:09:09,446

to make them feel comfortable, that they're
element is also safe from those aspects.

146

00:09:10,066 --> 00:09:12,306

>> Josh Byerly: Down here.

147

00:09:12,536 --> 00:09:14,966

No question, okay.

148

00:09:15,176 --> 00:09:15,726

Let's come over here.

149

00:09:19,936 --> 00:09:22,586

>> Hi. My name is Ken [Inaudible] from NHK.

150

00:09:22,586 --> 00:09:27,166

I hope I can make myself understandable in English but I would like to ask a question

151

00:09:27,166 --> 00:09:29,536

to Mr. Gertsenmaier and Mr. Musk.

152

00:09:29,946 --> 00:09:35,866

Everything pretty much seems familiar for a reporter reporting for HTV and I would really

153

00:09:35,866 --> 00:09:40,826

like to ask what is the connection between this new challenge of SpaceX

154

00:09:41,256 --> 00:09:44,086

with the Japanese HTV approach and rendezvous docking?

155

00:09:44,476 --> 00:09:47,116

In other words was there any improvements or what kind

156

00:09:47,116 --> 00:09:51,296

of implications have you added to this approach for SpaceX?

157

00:09:51,696 --> 00:09:58,356

And to Mr. Musk is I think safety is a priority, but as a commercial company what kind

158

00:09:58,356 --> 00:10:03,006

of aims have you tried to implicate into SpaceX's new launch vehicle

159

00:10:03,226 --> 00:10:11,536

and how would this challenge,
this new challenge in a sense add

160

00:10:11,616 --> 00:10:16,216

to your overall I would say
pursuit for that aim?

161

00:10:18,906 --> 00:10:19,596

>> Bill Gertsenmaier: First of all

162

00:10:19,676 --> 00:10:24,116

for your first question I think we
learned a lot from the HTV activities.

163

00:10:24,116 --> 00:10:28,356

We did a very similar approach
when HTV flew the first time.

164

00:10:28,356 --> 00:10:31,616

It flew it up and it did a
series of gates very similar

165

00:10:31,616 --> 00:10:34,796

to what Holly described in a
lot of detail here earlier.

166

00:10:35,156 --> 00:10:39,476

So that same kind of approach where we
verify a capability before we commit to using

167

00:10:39,476 --> 00:10:43,746

that capability that was done with the
HTV and it was a good chance to see how

168

00:10:43,746 --> 00:10:46,676

that process worked, how it worked as a team.

169

00:10:47,076 --> 00:10:51,446

I would say also Holly's team and the flight
controllers they got familiar with getting

170

00:10:51,446 --> 00:10:57,496

that data from a, from an international partner
in the case of JAXA they took that information,

171

00:10:57,496 --> 00:11:00,856

they could then digest and analyze
it and compare it and work with them.

172

00:11:00,856 --> 00:11:05,436

So, I think working with the international
partners gave us a lot of experience of working

173

00:11:05,436 --> 00:11:10,756

with a different community that we don't work
with everyday that allowed us to learn how

174

00:11:10,756 --> 00:11:13,136

to exchange data back and
forth, how to communicate

175

00:11:13,136 --> 00:11:17,456

and how to develop the basic procedure
that allows us to learn incrementally

176

00:11:17,456 --> 00:11:21,846

and it allows us to get into the birthing
box to be picked up with the SSRMS.

177

00:11:21,846 --> 00:11:28,266

And I think also that the birthing box concept
and using the SSRMS to pick up the Dragon,

178

00:11:28,566 --> 00:11:30,906

that's very similar to what we did with HTV.

179

00:11:30,906 --> 00:11:36,126

And again, that HTV kind of paved the way
of seeing how the crew would use the arm,

180

00:11:36,126 --> 00:11:38,836

the overlays they used, the camera ops they use.

181

00:11:39,086 --> 00:11:43,576

A lot of that was kind of proven the first time through with the HTV flights that are coming up.

182

00:11:43,576 --> 00:11:46,646

So, we learned a lot from our international partners and we applied it

183

00:11:46,696 --> 00:11:48,576

to the commercial sector and to Dragon

184

00:11:48,576 --> 00:11:51,266

and it made it a lot easier when we come into this flight.

185

00:11:51,266 --> 00:11:54,096

It wasn't the first time around we've seen this stuff.

186

00:11:54,156 --> 00:11:58,016

We've seen the basic process and procedure, although the vehicle is very different

187

00:11:58,336 --> 00:12:00,236

than the Japanese transfer vehicle.

188

00:12:03,336 --> 00:12:08,466

>> Elon Musk: So then I think we're grateful for the prior work of HTV as well.

189

00:12:08,466 --> 00:12:15,616

You know because it made things easier for SpaceX to you know approach the space station

190

00:12:15,616 --> 00:12:18,636

because of some similarities

in the way things are done.

191

00:12:19,406 --> 00:12:20,976

So, that was, that was quite helpful.

192

00:12:21,426 --> 00:12:29,036

The way in which Dragon is most significantly different is that it returns to a rather intact.

193

00:12:29,886 --> 00:12:34,306

You know it's got a heat shield and everything, so you can return cargo to it.

194

00:12:34,306 --> 00:12:37,186

So, that's clearly the biggest difference.

195

00:12:38,166 --> 00:12:46,166

And the-- I touched on this briefly earlier but because of some of the similarities

196

00:12:46,226 --> 00:12:50,726

between the cargo version of Dragon and the crew version of Dragon we're learning a great deal

197

00:12:50,906 --> 00:12:56,696

about crew transport when we do a cargo mission.

198

00:12:56,696 --> 00:13:00,616

Technically, if you've got a little oxygen bottle and you stow it away

199

00:13:00,616 --> 00:13:03,046

on Dragon you in theory would be okay.

200

00:13:03,256 --> 00:13:10,256

You could go to the space station if you tucked away in there and so it's kind of neat

201

00:13:10,676 --> 00:13:14,816

in that respect and had come back too.

202

00:13:14,926 --> 00:13:21,876

So, and then there's sort of a larger context of SpaceX where we want

203

00:13:22,176 --> 00:13:25,726

to keep upgrading the technology and making improvements

204

00:13:26,406 --> 00:13:31,086

so that ultimately there can be journeys beyond the space station.

205

00:13:31,286 --> 00:13:38,106

So, that's, that's obviously a topic for another day, but I think there's a lot of excitement

206

00:13:38,106 --> 00:13:40,866

about that and we're going to keep improving the Dragon technology.

207

00:13:41,126 --> 00:13:44,706

We have an upgrade planned and everything, so--

208

00:13:46,426 --> 00:13:48,366

>> Josh Byerly: Okay, I think that's it from here for now.

209

00:13:48,366 --> 00:13:52,676

Let's go down to the Kennedy Space Center in Florida and take questions from there.

210

00:13:53,216 --> 00:13:53,516

>> Marsha Dunn: Hello.

211

00:13:53,516 --> 00:13:57,436

This is Marsha Dunn of the Associated Press with a question for Mr. Musk.

212

00:13:58,066 --> 00:14:01,706

There's still a fair number of people
not totally on board with commercial,

213

00:14:01,706 --> 00:14:07,126

the commercial side, especially regarding crew
transport and I'm wondering if you feel a lot

214

00:14:07,126 --> 00:14:13,236

of pressure as you go into this last two weeks
before launch to succeed and how important is it

215

00:14:13,236 --> 00:14:18,886

in your mind to launch successfully
into birth on this flight?

216

00:14:18,886 --> 00:14:23,206

>> Elon Musk: There's no question
that there is going to be some people

217

00:14:23,206 --> 00:14:28,996

who we're putting too much weight on this
flight, because it is explicitly a test flight

218

00:14:29,646 --> 00:14:33,906

and indeed it-- we may not
succeed in getting all the way

219

00:14:34,036 --> 00:14:36,996

to the space station as I articulated earlier.

220

00:14:37,856 --> 00:14:41,186

But, I think it would be a mistake
to put too much weight on this flight

221

00:14:41,266 --> 00:14:46,186

because there are hopefully going to be two more
flights later this year to the space station

222

00:14:46,186 --> 00:14:49,406
which will be an almost identical configuration.

223

00:14:49,476 --> 00:14:51,256
So, if this one doesn't succeed in getting

224

00:14:51,256 --> 00:14:54,826
to the space station I am confident
that one of the other two will.

225

00:14:55,406 --> 00:15:02,436
And you know we'll work with NASA to resolve
any issues and then you figure those out

226

00:15:02,746 --> 00:15:04,796
and then get to the space station.

227

00:15:05,216 --> 00:15:10,426
But there should be no doubt
about our resolve that we will get

228

00:15:10,776 --> 00:15:14,106
to the space station whether it's
on this mission or on a future one.

229

00:15:14,776 --> 00:15:22,216
And I don't think that if this mission doesn't
get all the way there that it should be taken

230

00:15:22,216 --> 00:15:25,986
as a verdict on commercial crew transport.

231

00:15:26,626 --> 00:15:31,586
I think that would be, that would just wouldn't
be right although there will be some people

232

00:15:31,586 --> 00:15:32,736
who try to do that.

233

00:15:35,006 --> 00:15:37,816

>> Marsha Dunn: Thank you and if this does go well what is your timeline

234

00:15:37,866 --> 00:15:39,146

for those next two flights?

235

00:15:40,756 --> 00:15:44,836

>> Elon Musk: Well, that's something we have to work with NASA on but you know I think it's--

236

00:15:44,836 --> 00:15:49,876

will probably be one in the summer and one at the end of the year,

237

00:15:50,156 --> 00:15:53,896

but that timing remains to be worked out with NASA.

238

00:15:56,626 --> 00:15:59,306

>> This is Phillip Slaus with NASAspaceflight.com.

239

00:15:59,306 --> 00:16:01,106

I believe this is from his writings.

240

00:16:01,556 --> 00:16:08,686

Can you talk about for an April 30th launch, when would the writer that you talked

241

00:16:08,686 --> 00:16:14,636

about on the slide for the racetrack that you're doing about what time after liftoff,

242

00:16:14,726 --> 00:16:16,986

sort of mission off time would that begin?

243

00:16:18,536 --> 00:16:24,646

>> Holly Ridings: Okay for an April 30th launch, the launch is 11:22 a.m. central daylight time

244

00:16:24,996 --> 00:16:31,166

and you get to the-- right before the
red arrow is on the order of 38-39 hours.

245

00:16:31,836 --> 00:16:35,116

So, if you were using subtle nomenclature,

246

00:16:35,116 --> 00:16:41,316

which the NASA folks still do it'd
be flight day three fly under.

247

00:16:41,736 --> 00:16:43,476

So, flight day one launch.

248

00:16:43,476 --> 00:16:46,116

Flight day two is really we
call it far field phasing.

249

00:16:46,416 --> 00:16:51,966

Flight day three fly under, so 38-39 hours;
the fly under itself is on the order of three

250

00:16:51,966 --> 00:16:56,186

or four hours we were gathering that
data and then if you remember kind

251

00:16:56,186 --> 00:16:59,796

of from the red arrow all the
way around roughly 22 hours.

252

00:17:00,566 --> 00:17:03,656

And so, you're coming back the next day really

253

00:17:03,656 --> 00:17:08,156

for a flight day four birthing
rendezvous and birthing.

254

00:17:08,656 --> 00:17:13,176

So, go through it one more time slower:
flight day one launch, flight day two phasing,

255

00:17:13,176 --> 00:17:18,796

flight day three fly under,
which is May 2nd in our scenario

256

00:17:18,796 --> 00:17:24,766

and then flight day four proximity operation
rendezvous and birthing; so May 3rd.

257

00:17:24,766 --> 00:17:32,636

The capture itself, kind of early morning,
central daylight time 7:30, of course,

258

00:17:32,636 --> 00:17:35,276

crew day that's kind of midday crew day.

259

00:17:36,026 --> 00:17:41,796

So, the activities will start pretty early
in the morning Houston time and even earlier

260

00:17:41,796 --> 00:17:48,286

in the morning California time, but
the capture would be about 7:30 a.m.

261

00:17:48,666 --> 00:17:54,246

in the morning is what it would
be planned for on that May 3rd.

262

00:17:55,176 --> 00:17:55,926

>> Phillip Slaus: Thanks.

263

00:17:56,106 --> 00:18:00,116

And I believe, if I understand
this correctly there is a--

264

00:18:00,116 --> 00:18:02,586

that the primary opportunity is on April 30th

265

00:18:03,216 --> 00:18:06,746

and then there is a secondary opportunity on May 3rd.

266

00:18:07,086 --> 00:18:13,086

Can somebody explain why there are not, there isn't a daily launch opportunity

267

00:18:13,166 --> 00:18:17,026

for this mission and is this just a mission specific thing?

268

00:18:17,676 --> 00:18:17,976

Thanks.

269

00:18:20,366 --> 00:18:23,616

>> Holly Ridings: Again, so I'll talk about it a little bit.

270

00:18:23,616 --> 00:18:27,446

So, some of it is, is mission specific because of the demonstration.

271

00:18:27,446 --> 00:18:31,056

You know as Elon talked about this is definitely the demonstration

272

00:18:31,056 --> 00:18:36,006

and so there's a lot more things on this flight that's-- the fly under is one of them,

273

00:18:36,346 --> 00:18:40,446

some of the objectives that we're performing, the analysis that needs to be performed

274

00:18:40,446 --> 00:18:42,326

of the data that's gathered on orbit.

275

00:18:42,676 --> 00:18:50,956

So, the fly under is unique to this demonstration mission and so that really kind

276

00:18:51,406 --> 00:18:54,586

of helps figure out what the launch dates are.

277

00:18:55,376 --> 00:19:00,656

The SpaceX team is also reserving some, some margin on the-- that they can talk about,

278

00:19:00,656 --> 00:19:05,556

that Elon can talk about a little bit, just for contingencies again it's a demonstration

279

00:19:05,556 --> 00:19:10,356

and we want to make sure that they've got enough margin if, if they need it on orbit.

280

00:19:10,516 --> 00:19:16,596

We're also with working on the ISS trajectory, so we've got the--

281

00:19:17,126 --> 00:19:19,316

so we use flights coming and going.

282

00:19:19,316 --> 00:19:21,596

We've got progress flights coming and going.

283

00:19:21,646 --> 00:19:25,896

We've got ATB activities as was articulated earlier

284

00:19:26,116 --> 00:19:29,376

and so the ISS trajectory is influx as well.

285

00:19:29,426 --> 00:19:33,796

So, when you add up all of those different components you end up with these kind

286

00:19:34,376 --> 00:19:38,976

of smattering of launch dates
in the early May time frame.

287

00:19:39,206 --> 00:19:43,656

After the demonstration is complete and we
look at all the data potentially we'll be able

288

00:19:43,656 --> 00:19:47,976

to find the back to back type things
that you were used to with shuttles,

289

00:19:48,156 --> 00:19:51,146

but we've got together a bunch of
data before we can get to the point

290

00:19:51,146 --> 00:19:55,056

where we understand that in detail.

291

00:19:55,286 --> 00:19:58,496

>> Elon Musk: Yea, and I can say in the
future missions they'll probably be more--

292

00:19:58,736 --> 00:20:06,546

is closer to daily opportunities but for this
mission we want to have a really optimal launch.

293

00:20:06,916 --> 00:20:12,756

So, we're minimizing propellant usage,
getting to the space station and that has

294

00:20:12,756 --> 00:20:14,506

to occur roughly every three days.

295

00:20:14,986 --> 00:20:19,536

So, we just want to have as much propellant
available in case something goes wrong

296

00:20:19,536 --> 00:20:23,566

and we need to make adjustments to the mission.

297

00:20:23,566 --> 00:20:27,946

Yea, so that's why three days.

298

00:20:28,776 --> 00:20:33,776

>> James Dean: Hi it's James Dean from Florida Today and just following up on

299

00:20:33,776 --> 00:20:39,646

that topic I wondered if-- I understand I guess that you have April, April 30 and May 3

300

00:20:39,646 --> 00:20:41,366

as the first couple of opportunities.

301

00:20:41,366 --> 00:20:43,156

Just wondered if you can elaborate any further

302

00:20:43,156 --> 00:20:45,666

on if there are any scrubs or anything like that?

303

00:20:46,286 --> 00:20:51,646

Are there any blackouts due to range or the Soyuz launch or any other issues?

304

00:20:51,646 --> 00:20:55,186

And so when do the opportunities fit into the rest of that schedule?

305

00:20:57,136 --> 00:21:00,106

>> Holly Ridings: So, I can, I can go ahead and take that one as well.

306

00:21:00,786 --> 00:21:03,376

So, there's actually a little bit of all of those things.

307

00:21:03,376 --> 00:21:05,006

There are certainly range conflicts.

308

00:21:05,106 --> 00:21:06,676

There are always range conflicts.

309

00:21:07,426 --> 00:21:11,296

There are some beta cutouts
in terms of space station.

310

00:21:11,296 --> 00:21:16,896

There are some ground rule and constraint type
cutouts where we don't want a Soyuz vehicle

311

00:21:16,896 --> 00:21:19,706

and the Dragon vehicle exactly
on top of each other.

312

00:21:19,706 --> 00:21:24,216

We've got to make sure that we get one activity
completed before we start the next one.

313

00:21:24,756 --> 00:21:29,026

The Dragon has some constraints as
well for their recovery where at least

314

00:21:29,026 --> 00:21:32,956

for this demonstration they'd like
to land in daylight to help them

315

00:21:32,956 --> 00:21:34,426

out with the recovery operations.

316

00:21:35,066 --> 00:21:40,546

So, there's multiple constraints on the
table that we need to line up in order

317

00:21:40,546 --> 00:21:45,746

to find an optimized launch
window for this demonstration.

318

00:21:45,746 --> 00:21:52,666

So, the answer to your question is kind of all of the above.

319

00:21:52,856 --> 00:21:53,386

>> James Dean: Okay, thanks.

320

00:21:53,386 --> 00:21:58,466

And then for Elon this flight, of course, of course, not unusual for things

321

00:21:58,466 --> 00:22:01,956

to slip a little bit, but you were targeting November at one point and then February

322

00:22:01,956 --> 00:22:07,926

and just wondering what has proven to be most difficult for you to get to the point

323

00:22:07,926 --> 00:22:11,826

where you're ready to go you know if any aspect

324

00:22:11,826 --> 00:22:14,376

of this was a surprise to you at how hard it was.

325

00:22:14,856 --> 00:22:17,956

And just as a slightly unrelated question I was wondering

326

00:22:17,956 --> 00:22:20,046

if there were any plans to recover the first stage?

327

00:22:20,696 --> 00:22:21,236

>> Elon Musk: Sure.

328

00:22:21,446 --> 00:22:27,616

Well, I should point out that the

rocket is definitely not the constraint.

329

00:22:27,616 --> 00:22:30,976

I mean we could have launched several rockets,

330

00:22:31,556 --> 00:22:36,096

Falcon 9 rockets last year if
it had just been the rocket.

331

00:22:36,166 --> 00:22:39,816

And it obviously wasn't the elements of
the Dragon that have been tested before,

332

00:22:39,946 --> 00:22:43,606

you know like the draco thrusters or the heat
shield or parachutes or anything like that.

333

00:22:44,346 --> 00:22:51,816

But the tricky part was really related to
the proximity operations and birthing system

334

00:22:51,946 --> 00:23:00,506

so that the LIDARs for example, kind
of like laser radar, thermal imagers,

335

00:23:00,626 --> 00:23:06,886

the communication system making sure that we
communicate effectively with the space station,

336

00:23:06,996 --> 00:23:09,356

with the ground and with NASA's heater system.

337

00:23:10,016 --> 00:23:17,166

There were-- so there's a lot of basically
electronics, new electronics on the spacecraft.

338

00:23:17,486 --> 00:23:25,516

And so it's the first time we're flying
the solar rays and the radiator system.

339

00:23:25,746 --> 00:23:31,086

So it's, those are new elements to, to mix,

340

00:23:31,456 --> 00:23:41,026

but the thing that really drives the schedule is
the software testing, the developmental testing

341

00:23:41,366 --> 00:23:47,586

and how that interacts with the hardware,
when we're testing that's what it refers to.

342

00:23:48,636 --> 00:23:53,146

When-- does the software
always do the right thing

343

00:23:53,406 --> 00:23:55,836

in the right, in a particular circumstance?

344

00:23:55,836 --> 00:24:01,616

And when you've got eighteen engines and you've
got at least sort of six flight computers

345

00:24:01,616 --> 00:24:08,106

and a whole bunch of other systems just
that the test matrix of that is enormous.

346

00:24:08,706 --> 00:24:13,146

And luckily they realized that Dragon
is autonomous and I mean its really--

347

00:24:13,596 --> 00:24:19,306

it's a robotic space ship and it's going
to go and do this complicated maneuver

348

00:24:19,736 --> 00:24:23,076

where its going to-- in growth
with the space station.

349

00:24:23,196 --> 00:24:27,986

It's not as though there's somebody flying it with a joystick or that's somebody on board

350

00:24:27,986 --> 00:24:30,126

that can make real time corrections.

351

00:24:30,576 --> 00:24:34,246

Dragon is kind of making, it's making lots of decisions all the time

352

00:24:34,446 --> 00:24:36,896

to optimize the probability of success.

353

00:24:37,526 --> 00:24:41,086

So, it's, there's quite a lot of-- there's a lot of intelligence on board,

354

00:24:41,366 --> 00:24:45,836

on board the space craft and all of that has to be tested thoroughly and that's,

355

00:24:45,956 --> 00:24:48,336

that's the biggest driver for the timeline.

356

00:24:48,336 --> 00:24:51,806

>> Josh Byerly: Okay, I think that's it at Kennedy Space Center.

357

00:24:51,806 --> 00:24:53,836

I think we're going to the phone lines now.

358

00:24:53,836 --> 00:24:56,006

Let's start off with the Washington Post and Ryan Vastag.

359

00:24:56,006 --> 00:24:57,366

Are you there?

360

00:24:58,516 --> 00:25:04,736

[Music]

361

00:25:05,236 --> 00:25:05,436

>> Josh Byerly: Alright.

362

00:25:05,896 --> 00:25:08,136

Let's try Wired Magazine with Jason Parr.

363

00:25:09,626 --> 00:25:13,686

>> Jason Parr: Yes, I don't know,
this might be for a colleague.

364

00:25:13,686 --> 00:25:16,556

Early on we talked about some of the
work that is being done or the training

365

00:25:16,556 --> 00:25:17,916

that was being done for the crew on Orbit.

366

00:25:19,396 --> 00:25:21,816

So, while that took place
on the ground I'm curious,

367

00:25:21,876 --> 00:25:25,726

what sort of preparations are
being done while in orbit.

368

00:25:25,726 --> 00:25:28,686

I mean, is there any way for them
to practice any of the maneuvers.

369

00:25:28,866 --> 00:25:33,266

I mean what type of, I guess what type of
training is done while they're on orbit?

370

00:25:35,036 --> 00:25:38,506

>> Holly Ridings: Okay, so the
answer is yes there is the capability

371

00:25:38,506 --> 00:25:40,316
for them to practice on orbit.

372

00:25:40,366 --> 00:25:45,186
They practice with the actual robotic arm.

373

00:25:45,496 --> 00:25:50,416
So, the SSRMS they do some grappling practice.

374

00:25:50,776 --> 00:25:55,016
Again, sort of line up and
pretend that the Dragon is there

375

00:25:55,016 --> 00:25:58,086
and so they know exactly you know
looking out the window and looking

376

00:25:58,086 --> 00:26:01,526
at their computer screens what the arm half

377

00:26:01,526 --> 00:26:05,856
of that equation is going to
look when the Dragon arrives.

378

00:26:06,046 --> 00:26:09,216
They also have a simulator that they practice

379

00:26:09,276 --> 00:26:14,366
with because certainly the robotic
arm is a significant resource

380

00:26:14,596 --> 00:26:22,066
and so we do have an internal simulator that
they can practice so they can do multiple runs,

381

00:26:22,126 --> 00:26:28,176
some very complicated contingencies we wouldn't
want to put our robotic arm in or that came

382

00:26:28,176 --> 00:26:30,316

to be done without the Dragon actually there.

383

00:26:30,626 --> 00:26:35,246

Some abort type scenarios so again they know exactly how to react.

384

00:26:35,356 --> 00:26:38,116

So, those are their two primary methods of training.

385

00:26:38,616 --> 00:26:43,156

They also do some scenarios where they set up all their computers and all their cameras,

386

00:26:43,546 --> 00:26:49,056

more of a familiarization type training to make sure they have quick reference marks.

387

00:26:49,116 --> 00:26:54,286

They can find all the data they need rapidly and then they do some self study as well.

388

00:26:54,366 --> 00:27:01,706

So, again kind of that building block approach to hardware use all the way to the self study

389

00:27:01,706 --> 00:27:09,386

with the procedures and talking to the folks on the ground.

390

00:27:09,386 --> 00:27:14,706

>> Jason Parr: The demonstration maneuvers and the graphic you showed with the Dragon going

391

00:27:14,706 --> 00:27:19,836

from 250 to 220 and then 230 [Inaudible] if any

392

00:27:19,836 --> 00:27:25,676

of those particular rehearsal maneuvers don't

go correct the first time, is there the ability

393

00:27:25,676 --> 00:27:30,196

to retry the demonstration or is it sort of a one shot attempt?

394

00:27:30,756 --> 00:27:36,146

>> Holly Ridings: So, the answer is a little, a little bit of both.

395

00:27:36,606 --> 00:27:40,216

The demonstration some of them occur, you were talking about the ones on the R-bar.

396

00:27:40,216 --> 00:27:44,896

Some of them occur early in the mission shortly after Dragon gets on orbit.

397

00:27:44,896 --> 00:27:47,686

Those activities they will take place.

398

00:27:47,826 --> 00:27:48,826

They will be gathered.

399

00:27:48,826 --> 00:27:52,596

It'll be submitted from this basics team to the NASA team.

400

00:27:53,296 --> 00:27:58,846

Certainly, if we do not see something that everyone agreed

401

00:27:58,896 --> 00:28:04,806

to was acceptable the SpaceX team might have the capability to retry those as part

402

00:28:04,806 --> 00:28:07,286

of their phasing plan that would be somewhat dependent

403

00:28:07,946 --> 00:28:11,696

on the margin they have before they
get close to the space station.

404

00:28:12,336 --> 00:28:17,376

If we were flying under this space station
and we're unable to gather the data we needed,

405

00:28:17,846 --> 00:28:21,816

it could be done again but it would require
going all the way around and flying under again,

406

00:28:22,196 --> 00:28:28,236

but certainly that would be an option
if we had enough propellant to do that.

407

00:28:28,236 --> 00:28:34,206

And the ones on the R-bar that you mentioned,
those in order to complete the birthing

408

00:28:34,206 --> 00:28:37,796

that day need to go pretty quickly, so if they--

409

00:28:38,296 --> 00:28:42,896

mostly because sitting again on the R-bar is
not a very good place to stay for a long time

410

00:28:42,896 --> 00:28:44,216

in terms of your propellant usage.

411

00:28:44,216 --> 00:28:50,786

You use a lot of propellant sitting in that area
holding your position underneath a space station

412

00:28:50,786 --> 00:28:51,976

at about 250.

413

00:28:52,266 --> 00:28:56,366

So, if they didn't go well it would not

immediately mean the mission was over,

414

00:28:56,366 --> 00:28:59,436

but it would definitely mean you could not continue at that point in time.

415

00:28:59,436 --> 00:29:05,526

So, it might be that the Dragon would go off and potentially start another fly round

416

00:29:05,526 --> 00:29:11,536

and we would talk about maybe coming back and trying those demonstrations again the next day.

417

00:29:11,536 --> 00:29:14,096

So, it's absolutely a gate to come on in.

418

00:29:14,446 --> 00:29:19,706

If it did not go well we would look at the consumable resources and work

419

00:29:19,706 --> 00:29:24,526

with the Dragon team and see if there was anything we could do to potentially repeat

420

00:29:24,526 --> 00:29:28,276

or gather additional data that might help us understand the problem

421

00:29:28,276 --> 00:29:29,286

that we'd see the first time.

422

00:29:29,616 --> 00:29:33,026

>> Josh Byerly: Okay, Scott Powers with the Orlando Sentinel.

423

00:29:33,026 --> 00:29:39,976

>> Scott Powers: Actually, I think my question has been resolved, but thank you very much.

424

00:29:39,976 --> 00:29:40,236

>> Josh Byerly: Okay.

425

00:29:40,236 --> 00:29:41,186

>> Scott Powers: Appreciate it.

426

00:29:41,326 --> 00:29:45,586

>> Mike Wall with space.com.

427

00:29:45,686 --> 00:29:46,586

>> Mike Wall: Oh yea hi.

428

00:29:46,786 --> 00:29:49,106

So I was interested in Elon

talked about what some

429

00:29:49,106 --> 00:29:51,586

of the challenges were from

the SpaceX side for this.

430

00:29:51,586 --> 00:29:57,776

I'm just curious, I mean, what have some of
the biggest challenges been on NASA's side

431

00:29:57,776 --> 00:30:01,366

since this is such a new mission for
you guys and you're not responsible

432

00:30:01,366 --> 00:30:03,656

for the entire thing from start to finish.

433

00:30:03,656 --> 00:30:08,316

What, you know like what sort of difference has
that made for you guys and sort of what are some

434

00:30:08,316 --> 00:30:11,586

of the you know biggest hurdles
to overcome with this one.

435

00:30:13,176 --> 00:30:16,026

>> Mike Suffredini: Well, I'll go ahead and answer that one.

436

00:30:16,276 --> 00:30:19,956

To begin with, it's just getting used to the idea that we're not worrying

437

00:30:19,956 --> 00:30:25,186

about the entire phase of the flight is an adjustment to begin with.

438

00:30:25,286 --> 00:30:30,536

Probably the biggest difference once you settle on that aspect of it,

439

00:30:30,536 --> 00:30:37,366

probably the biggest difference is we're verifying a system based on requirements we gave

440

00:30:37,366 --> 00:30:42,106

for performance but in terms of developing the hardware, the design of the hardware,

441

00:30:42,516 --> 00:30:48,556

how individual boxes are laid out, the design concept, the components that were used,

442

00:30:49,076 --> 00:30:52,726

that's not the kind of information we have access to.

443

00:30:52,726 --> 00:30:57,856

And so, it's been kind of an adjustment for our engineers to create requirements

444

00:30:58,336 --> 00:31:03,306

and validation steps that give you confidence in the robust nature

445

00:31:03,306 --> 00:31:05,226

of the design that's being flown.

446

00:31:05,616 --> 00:31:09,096

And so, that was probably the biggest adjustment that we made.

447

00:31:09,676 --> 00:31:16,596

It's been, as I mentioned earlier, it's been, it's been really kind of a fascinating process

448

00:31:17,406 --> 00:31:22,096

because you begin with this group of engineers that have been doing this business

449

00:31:22,096 --> 00:31:28,546

for many years who have gotten information passed on from the engineers before them

450

00:31:28,546 --> 00:31:35,106

that have done this job a certain way with a complete push towards safety

451

00:31:35,606 --> 00:31:41,716

and mission success, because each flight was so very expensive that while safety was critical,

452

00:31:41,716 --> 00:31:44,506

mission success was very important.

453

00:31:45,036 --> 00:31:51,696

And everything from the procurement of Tripoli parts all the way

454

00:31:51,696 --> 00:31:57,716

up to the integrated performance testing of a system and how you're going to put it together

455

00:31:57,716 --> 00:32:02,596

and how its going to react to anomalies,
all of that was sort of that you spent many,

456

00:32:02,596 --> 00:32:08,606

many years in your mind perfecting and then
to go sit with another company and say,

457

00:32:08,606 --> 00:32:18,526

"This is your requirement", and then have
that group of very, very clever engineers many

458

00:32:18,526 --> 00:32:21,946

of whom don't know that much
about space, many of them who did,

459

00:32:22,276 --> 00:32:27,056

but all of them very young
have them say, "Well, why?"

460

00:32:27,336 --> 00:32:33,096

And instead of the NASA engineer being
able to say, "Well, this is how we did it",

461

00:32:33,096 --> 00:32:34,866

the question was why do you do it that way?

462

00:32:35,506 --> 00:32:41,696

And so, when that exchange took place it was
a quite enlightening experience for us both,

463

00:32:41,696 --> 00:32:44,496

because once it was clear
to the SpaceX engineer,

464

00:32:44,836 --> 00:32:49,316

what it is that the NASA engineer was
perfecting, trying to protect against,

465

00:32:49,406 --> 00:32:52,606

then the light bulbs would come on again

and you go, oh okay, well in order to solve

466

00:32:52,606 --> 00:32:54,786

that issue this is how I deal with my design.

467

00:32:55,216 --> 00:32:59,496

And then the NASA guys would learn from that and so the biggest piece of it I think

468

00:32:59,496 --> 00:33:03,426

from my perspective, and it's not a bad thing, is just, it's just an adjustment.

469

00:33:03,426 --> 00:33:08,016

And I think actually it's been good for both sides is that we've learned or we kind

470

00:33:08,016 --> 00:33:12,206

of had our eyes opened up to different ways of tackling similar problems.

471

00:33:12,206 --> 00:33:14,336

And in that respect it's been very beneficial.

472

00:33:14,846 --> 00:33:21,526

But I would tell you that it's an adjustment not to have the very detailed design data

473

00:33:21,526 --> 00:33:24,786

that we're used to when you actually design the hardware.

474

00:33:24,786 --> 00:33:27,906

We're more looking at it from a performance standpoint.

475

00:33:28,656 --> 00:33:29,976

>> Bill Gertsenmaier: And I would add one thing too,

476

00:33:30,056 --> 00:33:33,346

a little bit is that the space station team got to see a piece of this

477

00:33:33,346 --> 00:33:35,446

as we put modules on board space station.

478

00:33:35,446 --> 00:33:38,696

Again, the international partners built to a set of our requirements,

479

00:33:38,736 --> 00:33:42,766

but they accommodated those requirements in a potentially different way than we did.

480

00:33:42,766 --> 00:33:47,506

So, in a non-maneuvering vehicle kind of standpoint the station team got a chance

481

00:33:47,506 --> 00:33:51,136

to see how to work with a set of--

482

00:33:51,136 --> 00:33:55,186

with a partner that essentially answers the how to our requirements.

483

00:33:55,276 --> 00:33:59,276

And Mike's discussion was very good about how both teams have really learned from each other.

484

00:33:59,276 --> 00:34:02,586

I get a chance to kind of sit back and watch both teams learn from each other

485

00:34:02,586 --> 00:34:05,486

and it's been a tremendous learning experience for both of us.

486

00:34:05,486 --> 00:34:07,606

So, I think we've learned
new things on the NASA side,

487

00:34:08,096 --> 00:34:12,996

some things we've always done a certain way and
then when we get asked, now why do you really do

488

00:34:12,996 --> 00:34:15,746

that requirement, it's really forced
our folks to go think about it

489

00:34:15,746 --> 00:34:18,526

and we're starting to kind of internalize it.

490

00:34:18,766 --> 00:34:21,096

Hey, there may be another way of
doing some things that are better.

491

00:34:21,096 --> 00:34:23,216

We've definitely learned some things from SpaceX

492

00:34:23,326 --> 00:34:25,886

and hopefully I think they've learned
some things from us as we go through.

493

00:34:25,886 --> 00:34:28,986

So, as a good partnership you
learn from each other and you end

494

00:34:28,986 --> 00:34:31,246

up with a much better product
coming out the other side.

495

00:34:31,776 --> 00:34:31,876

>> Josh Byerly: Okay.

496

00:34:32,976 --> 00:34:35,916

How about Michael with Popular Mechanics?

497

00:34:38,176 --> 00:34:38,536

>> Michael: Hi.

498

00:34:38,706 --> 00:34:43,086

I wonder if someone could break down more specifically what cargo is going to be

499

00:34:43,086 --> 00:34:46,326

on the flight, what sorts of hardware and also are there going

500

00:34:46,326 --> 00:34:48,376

to be any crew provisions on there too?

501

00:34:49,916 --> 00:34:53,066

>> Mike Suffredini: Well, in fact, primarily it is crew provisions.

502

00:34:53,176 --> 00:34:57,136

We're flying quite a bit of food, crew provisions,

503

00:34:57,226 --> 00:35:02,816

some replacement consumable type components.

504

00:35:02,816 --> 00:35:13,946

We have one nanorex payload that's got some, has a number of student experiments on it.

505

00:35:14,006 --> 00:35:15,446

That's a line share of it.

506

00:35:15,446 --> 00:35:19,756

A lot of it is food, but the majority of it is actually food and crew provisions.

507

00:35:21,106 --> 00:35:24,276

>> Michael: What's the total weight going up and the coming down again?

508

00:35:24,546 --> 00:35:27,916

>> Mike Suffredini: Five hundred
twenty one kilograms of cargo up

509

00:35:27,916 --> 00:35:33,086

and six hundred sixty kilograms down and the
down manifest is not completely finalized.

510

00:35:33,086 --> 00:35:38,626

One of things that happens once you get to
orbit is you sort of agree on the mass down

511

00:35:38,626 --> 00:35:41,266

and the biggest drivers of that mass knowing

512

00:35:41,266 --> 00:35:43,236

that once you get there you
might change that a bit.

513

00:35:43,676 --> 00:35:50,726

But, as I mentioned earlier, we do have
some while we kept away from putting one

514

00:35:50,726 --> 00:36:01,806

of a kind orbit replacement units or you
know major components on the ascent side,

515

00:36:01,806 --> 00:36:06,326

we actually did put some OR
use on the return side in hopes

516

00:36:06,326 --> 00:36:08,156

of getting them home so we could refurbish them.

517

00:36:08,156 --> 00:36:13,746

They're not required, but in a couple of cases
if we can get them home and refurbish them,

518

00:36:13,746 --> 00:36:17,086

it'll save us money because otherwise we would have to procure that spare.

519

00:36:17,766 --> 00:36:22,386

That's certainly in our plan and our budget is to procure the spare, but this was a chance

520

00:36:22,386 --> 00:36:23,936

to try to get some home and save some money.

521

00:36:23,936 --> 00:36:30,976

So, we actually do have some OR use coming home on the down manifest.

522

00:36:30,976 --> 00:36:32,086

>> Michael: What are OR use?

523

00:36:32,356 --> 00:36:35,036

>> Mike Suffredini: Those are the replacement spare components

524

00:36:35,096 --> 00:36:36,846

that replace components on board.

525

00:36:36,846 --> 00:36:42,366

We have a pump, a couple of multifiltration beds that were in the water processor

526

00:36:42,366 --> 00:36:49,426

and our JAXA colleagues have a, a power supply box for their communication system

527

00:36:49,426 --> 00:36:50,666

on orbit that's also coming home.

528

00:36:52,076 --> 00:36:52,856

>> Michael: Okay, thanks a lot.

529

00:36:53,376 --> 00:36:55,336

>> Josh Byerly: Okay, Lisa
Grossman with New Scientist.

530
00:36:55,896 --> 00:37:00,326
Lisa. Okay.

531
00:37:00,866 --> 00:37:05,376
Jason Davis with Planetary Society.

532
00:37:05,376 --> 00:37:05,726
>> Jason Davis: Hi guys.

533
00:37:05,726 --> 00:37:11,596
You had talked about some of the gates

534
00:37:11,596 --> 00:37:15,746
and specific checkpoints the Dragon would
be required to go through during each stage

535
00:37:15,746 --> 00:37:20,216
of the approach and I just wanted to
know who holds the final authority

536
00:37:20,216 --> 00:37:22,866
to make decisions during contingency?

537
00:37:23,016 --> 00:37:29,176
Are they planned out in advance or are there
situations where a single party either NASA

538
00:37:29,176 --> 00:37:33,486
or SpaceX would have to make
a decision on how to proceed?

539
00:37:34,076 --> 00:37:36,216
>> Holly Ridings: I'll take that one.

540
00:37:36,216 --> 00:37:39,326
So, it certainly depends on

where you are in the mission.

541

00:37:39,326 --> 00:37:43,646

If it's very early in the flight and the launch in that far field phasing

542

00:37:43,906 --> 00:37:51,266

where the Dragon is not near the space station then it's the responsibility of the Dragon team

543

00:37:51,266 --> 00:37:57,516

and SpaceX, but once the Dragon arrives near the space station

544

00:37:57,516 --> 00:38:01,096

and near is kind of defined by my graphic.

545

00:38:01,096 --> 00:38:07,066

It's coming up about 10 kilometers below the space station then there are,

546

00:38:07,066 --> 00:38:11,086

and actually during the fly around there are go/no go points.

547

00:38:11,086 --> 00:38:15,676

Again I defined that earlier as we take a poll and make sure we've got all the capabilities.

548

00:38:15,896 --> 00:38:18,396

And all of those go/no go points the team here

549

00:38:18,396 --> 00:38:22,926

in Houston per all our documentation holds the final authority.

550

00:38:23,496 --> 00:38:30,146

There's also a couple of other cases if we do have an abort, something that is unexpected

551

00:38:30,526 --> 00:38:33,906

that the Dragon needs to leave
the proximity of the space station

552

00:38:34,186 --> 00:38:40,606

and then the Dragon team can figure out that
issue and put the Dragon back on a trajectory

553

00:38:40,796 --> 00:38:43,756

to potentially make another
attempt of that process.

554

00:38:43,996 --> 00:38:46,096

Houston has authority over that process.

555

00:38:46,486 --> 00:38:52,186

And then if anything were to go
unexpectedly wrong at the space station even

556

00:38:52,186 --> 00:38:56,776

if the Dragon is fairly far away from us
we would exert some authority in a sense

557

00:38:56,776 --> 00:39:00,286

of telling them we're absolutely not
going to be ready for you anytime soon.

558

00:39:00,876 --> 00:39:02,956

So, we don't want you to
come up too close to us.

559

00:39:03,156 --> 00:39:08,356

So, there's kind of the very
specific predefined items.

560

00:39:08,356 --> 00:39:13,056

Again, there's go/no goes that are in our
flight rule that are those height adjust.

561

00:39:13,176 --> 00:39:15,836

We'll give them burns, the maneuvers the Dragon performs

562

00:39:15,836 --> 00:39:18,286

as it comes increasingly closer to the space station.

563

00:39:18,646 --> 00:39:22,296

There are those points predefined as it flies around the space station

564

00:39:22,606 --> 00:39:27,416

and those points predefined as it comes up to the final rendezvous in the birthing

565

00:39:27,416 --> 00:39:31,726

and the proximity operations and then there's those generic catchalls

566

00:39:31,726 --> 00:39:36,996

for if something goes unexpected and all of that has been discussed with the team

567

00:39:37,666 --> 00:39:39,506

in Hawthorne and our team here in Houston.

568

00:39:39,596 --> 00:39:47,186

It's all written down in our documentation that we fly with, in our flight rules.

569

00:39:47,376 --> 00:39:51,106

>> Josh Byerly: Okay, John Louis Santini from Au Jaune France.

570

00:39:55,076 --> 00:39:56,316

How about Kelly Sheraton?

571

00:39:58,786 --> 00:40:02,806

Okay, Eric with Nature Magazine.

572

00:40:03,396 --> 00:40:07,766

I'll keep going.

573

00:40:08,476 --> 00:40:15,196

Steven Clark of Space Flight Now,
maybe they got tired of the music.

574

00:40:15,536 --> 00:40:17,386

Ann Walters with the German Press Agency.

575

00:40:19,506 --> 00:40:23,516

How about Iren Klotz.

576

00:40:24,826 --> 00:40:25,466

>> Iren Klotz: Thanks Josh.

577

00:40:25,466 --> 00:40:26,156

I am here.

578

00:40:26,156 --> 00:40:28,606

I have a couple questions for you.

579

00:40:28,796 --> 00:40:35,746

The first is including that 381 million from
NASA, how much more money has SpaceX spent

580

00:40:35,746 --> 00:40:42,146

to get to this point in the development
and overall what do you think the odds are

581

00:40:42,236 --> 00:40:46,826

that this mission will be completely
successful in terms of docking at station

582

00:40:46,976 --> 00:40:50,016

and of successful retrieval after splashdown?

583

00:40:51,976 --> 00:40:56,936
>> Elon Musk: I don't have the exact number that SpaceX has spent,

584
00:40:56,936 --> 00:41:03,156
but we have raised several hundred million dollars in bench capital,

585
00:41:03,296 --> 00:41:09,766
the initial part which came from me and then there's been ongoing payments

586
00:41:09,836 --> 00:41:13,406
for further milestones that have been achieved for NASA and for other customers.

587
00:41:13,406 --> 00:41:17,886
I think probably the total amount spent cumulatively would somewhere

588
00:41:17,886 --> 00:41:19,856
around a billion dollars.

589
00:41:21,086 --> 00:41:24,316
So, that's cumulative over the life of SpaceX.

590
00:41:24,896 --> 00:41:32,716
And then in terms of probability of success there's some hesitation

591
00:41:32,716 --> 00:41:34,646
about giving exact numbers since there's--

592
00:41:35,016 --> 00:41:40,296
they're pretty big, there's a pretty big range I think.

593
00:41:40,296 --> 00:41:49,546
But, yeah I personally hesitate to give an exact number but I think that the likelihood

594

00:41:49,546 --> 00:41:53,446

that the rocket works is pretty good since its worked twice before.

595

00:41:54,016 --> 00:41:58,326

The likelihood of the non-birthing or portions of the space craft

596

00:41:58,326 --> 00:42:00,386

that have been flown before working is also quite good.

597

00:42:00,976 --> 00:42:06,606

But then there's much more question mark around the proximity operations and birthing system

598

00:42:06,696 --> 00:42:12,856

and solar rays, which are being tested for the first time.

599

00:42:13,056 --> 00:42:17,656

>> Irene Klotz: For either Bill or Alan could you just refresh my memory

600

00:42:17,656 --> 00:42:23,696

and tell me what it would cost approximately based on I think GAO did a report,

601

00:42:23,696 --> 00:42:27,326

if not NASA had developed a similar capability

602

00:42:27,326 --> 00:42:30,036

under a traditional cost plus award fee contract.

603

00:42:31,806 --> 00:42:35,946

>> Alan Lindenmoyer: Well, there were studies done that said

604

00:42:35,946 --> 00:42:39,256

if you use our traditional modeling
and our traditional approaches

605

00:42:39,256 --> 00:42:45,496

and assumptions it could have been
anywhere from four to ten times higher

606

00:42:45,686 --> 00:42:48,026

under a traditional NASA development.

607

00:42:48,496 --> 00:42:50,396

>> Irene Klotz: Thanks very much.

608

00:42:50,736 --> 00:42:51,726

Good luck.

609

00:42:52,736 --> 00:42:53,366

>> Josh Byerly: Okay, thanks Irene.

610

00:42:53,366 --> 00:42:56,896

Is there anybody else on the phone
line that did not get a chance

611

00:42:56,896 --> 00:42:58,726

and would like to ask a follow up?

612

00:42:59,556 --> 00:43:00,356

>> Bill Harwood: Hey Josh.

613

00:43:00,356 --> 00:43:01,586

Bill Harwood with CBS.

614

00:43:01,586 --> 00:43:01,876

>> Josh Byerly: Hey Bill.

615

00:43:01,876 --> 00:43:02,056

Go ahead.

616

00:43:02,056 --> 00:43:03,566

>> Bill Harwood: Oh thanks a lot.

617

00:43:03,566 --> 00:43:08,986

Two quick ones for Holly; if the Atlas stays on the range where it is and if Soyuz stays

618

00:43:08,986 --> 00:43:13,736

where it is, which they will and if SpaceX doesn't get off on those first two attempts,

619

00:43:13,736 --> 00:43:18,536

what, how, when would this guy slip, how far would it slip I'm assuming

620

00:43:18,536 --> 00:43:24,706

after Soyuz it wouldn't be a way to get it in between Atlas and Soyuz, is that right?

621

00:43:24,706 --> 00:43:26,946

>> Holly Ridings: I mentioned earlier that there is quite a few variables.

622

00:43:27,306 --> 00:43:31,246

In general yea, there's a window kind of this late April early May,

623

00:43:31,246 --> 00:43:36,416

which is when we've been talking about with the 30th and the 3rd and potentially some options.

624

00:43:36,416 --> 00:43:41,146

I know Atlas is in there and then there's an after Soyuz window kind

625

00:43:41,146 --> 00:43:43,926

of in the you know mid to late May time frame.

626

00:43:43,926 --> 00:43:48,576

And you know mentioned earlier, a lot of the variables in all of those need to line up,

627

00:43:48,576 --> 00:43:53,346

but those are the two windows that are the high probability ones

628

00:43:53,446 --> 00:43:55,326

that we've been looking at right now.

629

00:43:56,346 --> 00:43:59,716

>> Bill Harwood: Alright and one more quick one for you and this will do it for me Josh.

630

00:44:00,286 --> 00:44:03,966

Can you give us a little bit better sense of what sort of issues you guys have been working

631

00:44:03,966 --> 00:44:05,776

on the last couple of months with SpaceX?

632

00:44:05,776 --> 00:44:09,026

I mean obviously they wanted to launch in February and it slipped a bit

633

00:44:09,126 --> 00:44:13,496

and I've never heard any good details about what sort of things everybody was trying

634

00:44:13,496 --> 00:44:15,816

to get resolved that took the extra time.

635

00:44:15,816 --> 00:44:18,236

If you could give me some sense of that, I'd appreciate it.

636

00:44:21,456 --> 00:44:21,616

Thanks.

637

00:44:22,126 --> 00:44:26,506

>> Holly Ridings: Okay, well I can certainly tell you from an operational perspective a lot

638

00:44:26,786 --> 00:44:30,796

of the capabilities that the SpaceX team wanted to work

639

00:44:30,796 --> 00:44:34,056

on were their mission success capabilities,

640

00:44:34,306 --> 00:44:38,296

things that Elon can probably tell you were very important to them.

641

00:44:39,046 --> 00:44:42,096

So, when they came with those capabilities

642

00:44:42,096 --> 00:44:46,486

that obviously requires a joint sort of review and determination.

643

00:44:46,986 --> 00:44:53,756

One of the ones we talked a lot about was recovering from abort type scenarios.

644

00:44:53,886 --> 00:44:59,256

Those capabilities are complicated and difficult and we'd done some preliminary work

645

00:44:59,256 --> 00:45:04,536

but we really took this extra time to make sure that we've got a real solid plan

646

00:45:05,296 --> 00:45:09,426

so that we've got a higher probability of being able to work together

647

00:45:09,426 --> 00:45:14,356

to accomplish their primary objective, which of course, is the success of the mission.

648

00:45:14,356 --> 00:45:19,966

And so we made our teams here, the operations team as well as other teams available

649

00:45:19,966 --> 00:45:22,776

to really talk through some of those items.

650

00:45:22,776 --> 00:45:27,036

That's my example and I don't
Elon if you have others.

651

00:45:27,036 --> 00:45:32,076

That's really the one we've spent the most time on in the operations world talking

652

00:45:32,076 --> 00:45:33,216

about because it's very important.

653

00:45:33,216 --> 00:45:37,986

We want to be able to do that as a team in the event that we need that capability.

654

00:45:39,246 --> 00:45:44,606

>> Elon Musk: Yea, I think its like I said earlier, you now it's really just

655

00:45:44,606 --> 00:45:48,826

about the hardware loop testing and validation of the software.

656

00:45:49,016 --> 00:45:51,756

That's the biggest driver.

657

00:45:51,756 --> 00:45:56,596

I mean there are other things that were done in that time, but just testing a vast amount

658

00:45:56,976 --> 00:46:01,436

of intelligence that's occurring in
the software and making sure even

659

00:46:01,436 --> 00:46:09,936

in highly unusual situations that the mission
is successful at least in the simulation

660

00:46:10,316 --> 00:46:13,846

that that's what's taking
the most amount of time.

661

00:46:13,846 --> 00:46:16,616

And it's just a very, very complex system.

662

00:46:17,636 --> 00:46:19,536

>> Josh Byerly: Okay, thanks Bill.

663

00:46:19,716 --> 00:46:21,686

Is there anybody else on the phone lines?

664

00:46:24,046 --> 00:46:26,856

Alright let's come back here to Houston
and let's start back over here with Mark.

665

00:46:28,256 --> 00:46:28,776

>> Mark Carreau: Thank you.

666

00:46:28,776 --> 00:46:31,366

Mark Carreau for Aviation Week.

667

00:46:32,266 --> 00:46:39,486

I guess I'm a little hazy on whether
there's an MMT authority during the flight

668

00:46:39,566 --> 00:46:46,156

or if that is the space station IMMT that
sort of is the big picture supervision.

669

00:46:46,436 --> 00:46:47,696

>> Mike Suffredini: It's the space station IMMT.

670

00:46:47,696 --> 00:46:48,206

>> Mark Carreau: Thank you.

671

00:46:49,996 --> 00:46:53,006

>> Eric Berger: Eric Berger
again with the Chronicle.

672

00:46:53,006 --> 00:46:59,086

A quick question for Bill or Mike; could one of
you address the feeling inside the space program

673

00:46:59,216 --> 00:47:03,746

with this launch coming up
because this is an American company

674

00:47:03,746 --> 00:47:08,276

and obviously there's been a lot of heat on
NASA in the last couple of years relying on,

675

00:47:08,276 --> 00:47:12,376

last year relying on Russian rockets for
humans and this is a potential way out of that.

676

00:47:12,956 --> 00:47:16,966

So, is it something that a lot
of people are looking forward to

677

00:47:16,966 --> 00:47:23,916

or how would you characterize the
mood sort of leading up to the launch?

678

00:47:23,916 --> 00:47:26,696

>> Bill Gertsenmaier: Do you
want to do mood or do I do mood?

679

00:47:26,806 --> 00:47:28,126

>> You can do mood.

680

00:47:30,306 --> 00:47:30,806

>> Mike Suffredini: Thanks.

681

00:47:32,906 --> 00:47:38,406

[Laughter] Well, you know from our perspective what you're referring

682

00:47:38,406 --> 00:47:44,366

to is probably a combination of perceived emotions way back when when we started

683

00:47:44,366 --> 00:47:49,306

down this road because it had to do with getting out of the space shuttle business and getting

684

00:47:49,306 --> 00:47:54,586

into a commercial venture and that probably played a little bit of a role of a misconception

685

00:47:54,586 --> 00:48:00,356

and perhaps not everybody being completely behind this effort.

686

00:48:00,926 --> 00:48:06,196

But, I can tell you from a program perspective, and those are the people that I see and talk

687

00:48:06,196 --> 00:48:11,346

to every day, we couldn't be more pleased with what we're off to go do.

688

00:48:11,346 --> 00:48:17,186

And the reason is A it provides indigenous capability within the U.S. to supply the ISS,

689

00:48:17,186 --> 00:48:19,056

which we think is very important.

690

00:48:19,056 --> 00:48:25,146

It does have implications to human transport again to ISS.

691

00:48:25,146 --> 00:48:29,306

It's commercializing if you will, helping commercialized low earth orbit

692

00:48:29,306 --> 00:48:38,036

which we think is a very important need and something that NASA is responsible for and some

693

00:48:38,036 --> 00:48:43,686

of us, and particularly myself believe this is a very important step to take in order for us

694

00:48:43,686 --> 00:48:51,326

to do exploration in the future NASA needs to develop and or encourage the capability

695

00:48:51,326 --> 00:48:57,396

and help the development of a commercial capability to support low earth orbit both

696

00:48:57,396 --> 00:48:59,846

in terms of cargo and humans and other capabilities,

697

00:48:59,846 --> 00:49:01,656

robotic servicing and things like that.

698

00:49:02,156 --> 00:49:07,726

And NASA needs to start focusing on human exploration beyond low earth orbit.

699

00:49:07,726 --> 00:49:15,326

And so those of us who are looking forward to the next step for NASA, really are very excited

700

00:49:15,326 --> 00:49:18,506
about this next step for the space station.

701
00:49:18,506 --> 00:49:23,566
And we believe this is-- in order for space station to be successful these systems have

702
00:49:23,646 --> 00:49:29,316
to be there for us and so we look on it very favorably

703
00:49:29,316 --> 00:49:31,886
and they're very excited about this pending launch.

704
00:49:32,856 --> 00:49:34,026
>> Bill Gertsenmaier: And I can add just a little bit,

705
00:49:34,186 --> 00:49:36,696
you know this is absolutely critical to space station.

706
00:49:37,226 --> 00:49:41,676
We really need this cargo capability to be able to get to station and the return capability

707
00:49:41,676 --> 00:49:44,796
that Dragon provides is truly unique of any one

708
00:49:44,796 --> 00:49:47,696
of the cargo providers including the Russians and Soyuz.

709
00:49:48,236 --> 00:49:52,146
The amount of cargo we can get back with Dragon is just phenomenal from a return standpoint.

710
00:49:52,146 --> 00:49:54,876
So, we absolutely need this capability for ISS

711

00:49:54,876 --> 00:49:57,636

and then we're really rooting
for the teams to come through.

712

00:49:57,636 --> 00:50:02,626

I think it's also been encouraging
to see SpaceX, to work hard issues

713

00:50:02,626 --> 00:50:07,466

and they had some EMI, electrode magnetic
interference issues that they worked

714

00:50:07,466 --> 00:50:12,626

and they spent some really good engineering time
to resolve those issues and get them resolved.

715

00:50:13,156 --> 00:50:17,536

They had some engine lamination concerns
and again they were very rigorous.

716

00:50:17,536 --> 00:50:21,106

They tested some things that they didn't
absolutely have to go test but they wanted

717

00:50:21,106 --> 00:50:22,686

to go test them to make sure
that they were right.

718

00:50:22,986 --> 00:50:27,286

That's really encouraging so I can really
you know get behind somebody that is doing

719

00:50:27,286 --> 00:50:30,106

that extra work to get ready to go fly.

720

00:50:30,626 --> 00:50:35,286

But, as Elon said this is really a tough flight
and I mean what we're asking them to go do

721

00:50:35,286 --> 00:50:38,166

on this demonstration flight is amazing.

722

00:50:38,166 --> 00:50:42,656

When you look at all those things that Holly talked about on her charts and the many hours

723

00:50:42,686 --> 00:50:48,046

and this hard graft of work and all the software has to interact and the six computers

724

00:50:48,046 --> 00:50:52,636

and the eighteen thrusters and all this has to work as a nice combined set to get

725

00:50:52,636 --> 00:50:56,816

into this precise box to be picked up by the SSR, that is no easy task.

726

00:50:57,216 --> 00:51:01,056

So this will be a very demanding mission and we need to look at it

727

00:51:01,056 --> 00:51:03,096

as a test flight, what it should be.

728

00:51:03,516 --> 00:51:06,356

We'll see how well the test works out that there was,

729

00:51:06,506 --> 00:51:08,876

they've really done a good job in getting ready for this test.

730

00:51:08,876 --> 00:51:10,046

So, it was an asset team.

731

00:51:10,046 --> 00:51:14,686

We're ready to watch, participate and help

and we truly need this capability for ISS.

732

00:51:15,976 --> 00:51:16,286

>> Josh Byerly: David.

733

00:51:17,056 --> 00:51:20,156

>> David Hirsh: And just to get a more detailed sense of where we are technically today

734

00:51:20,156 --> 00:51:24,546

as of this meeting, the hardware in loop issue that you were describing a little bit earlier,

735

00:51:24,546 --> 00:51:29,136

does that relate specifically to something on the timeline that Ms. Ridings was taking us

736

00:51:29,136 --> 00:51:30,576

through earlier, a specific element there?

737

00:51:30,576 --> 00:51:33,176

Was that as you were saying maybe something that's more generalized over,

738

00:51:33,386 --> 00:51:35,486

over the entire mission?

739

00:51:35,486 --> 00:51:41,196

>> Elon Musk: Yea, well so hardware in loop means you're a little more,

740

00:51:41,946 --> 00:51:48,566

essentially we have a complete replication of the, of the Dragon's avionic system on a,

741

00:51:48,566 --> 00:51:53,436

on a bench and then it flies a simulated mission.

742

00:51:53,436 --> 00:51:58,706

And it actually its like, it's sort of like a, like a brain in a tub thing.

743

00:51:58,706 --> 00:52:04,426

It actually thinks it flew to the space station and it does-- we watch to see what it does.

744

00:52:04,426 --> 00:52:08,066

Does it do all the right things on the way to get there?

745

00:52:08,556 --> 00:52:10,766

And if it doesn't then where did it go wrong?

746

00:52:11,306 --> 00:52:16,226

And what happens if we unplug certain devices essentially simulating failure

747

00:52:16,226 --> 00:52:17,536

at the worst possible moment?

748

00:52:17,676 --> 00:52:23,366

Does it, does it then take the proper steps and what happens

749

00:52:23,366 --> 00:52:25,326

if you fail several simultaneous things?

750

00:52:25,646 --> 00:52:28,196

And what if you fail something and then restore it?

751

00:52:28,196 --> 00:52:35,966

There are many, you know the cross product of all those things is a huge number of tasks.

752

00:52:35,966 --> 00:52:37,666

>> David Hirsh: You're introducing failure.

753

00:52:37,966 --> 00:52:38,856

>> Elon Musk: We introduce failures yea.

754

00:52:38,856 --> 00:52:42,406

>> David Hirsh: There's nothing along that timeline just to move it along

755

00:52:42,546 --> 00:52:45,696

because I know its getting late here, in Ms. Ridings timeline

756

00:52:45,696 --> 00:52:50,576

that you're specifically focused as far as a mission element that, that might be problematic.

757

00:52:50,576 --> 00:52:53,196

You would just need to introduce more failures and troubleshoot that

758

00:52:53,196 --> 00:52:54,576

and see how the system is going to react.

759

00:52:54,786 --> 00:52:55,046

>> Elon Musk: Right.

760

00:52:55,176 --> 00:53:02,626

Exactly, in fact the recent, I'd say in the last month or so the top things to have to deal

761

00:53:02,626 --> 00:53:09,066

with have been false reports, where it actually initiates a mission aboard

762

00:53:09,206 --> 00:53:12,076

because it was too sensitive to the parameters.

763

00:53:12,196 --> 00:53:16,206

So, if things were actually okay but Dragon got too worried

764

00:53:16,666 --> 00:53:19,586

and aborted the mission [Laughter] so--

765

00:53:20,126 --> 00:53:21,046

>> David Hirsh: From LA so--

766

00:53:21,246 --> 00:53:21,406

>> Elon Musk: Right.

767

00:53:21,486 --> 00:53:28,196

So, it's you know, it's-- you don't want to have-- definitely abort if something's wrong.

768

00:53:28,196 --> 00:53:31,196

Sometimes it may think something's wrong but it's actually okay.

769

00:53:32,316 --> 00:53:36,336

And there all sorts, there are all different types of failure

770

00:53:36,336 --> 00:53:39,206

like say you can have something fail and stay off.

771

00:53:39,406 --> 00:53:41,036

You can have something fail erratically.

772

00:53:41,196 --> 00:53:45,366

It goes off and comes back and sort of oscillates.

773

00:53:45,366 --> 00:53:49,606

You can have multiple things go at the same time and the systems be able

774

00:53:49,606 --> 00:53:52,026

to deal with all of those contingencies.

775

00:53:52,536 --> 00:53:55,366

>> Josh Byerly: Okay, is that it here in Houston?

776

00:53:55,976 --> 00:53:59,486

Okay, before we finish up we're going to take a look at our launch and mission coverage

777

00:53:59,486 --> 00:54:01,436

that we have here upcoming on NASA Television.

778

00:54:02,016 --> 00:54:06,606

Coming up at L minus one there will actually be a pre-flight, pre-launch news conference

779

00:54:06,606 --> 00:54:11,246

from the Kennedy Space Center and then on Monday, April 30th at 10:00 a.m. central time

780

00:54:11,246 --> 00:54:14,646

that is when our launch coverage will begin and once again launch is actually scheduled

781

00:54:14,646 --> 00:54:17,596

for 11:22 a.m. central time right now.

782

00:54:17,596 --> 00:54:22,286

And then at 1:00 p.m. central time we'll have a post-launch news conference from KSC as well.

783

00:54:22,836 --> 00:54:26,786

On flight 82, which right now should be on Tuesday, May 1st we will not,

784

00:54:26,786 --> 00:54:29,186

we will not have any live coverage on NASA Television

785

00:54:29,186 --> 00:54:34,046
but we will have an update during our
typical ISS update show here at JSC,

786
00:54:34,046 --> 00:54:37,626
which will air at 10:00 a.m.
central time, 11:00 a.m. eastern.

787
00:54:37,626 --> 00:54:41,746
And then on Wednesday, May
2nd at 1:30 a.m. central time,

788
00:54:42,186 --> 00:54:44,996
very early in the morning we'll have
our fly under coverage from here

789
00:54:45,046 --> 00:54:48,156
at Johnson Space Center inside
Mission Control Houston

790
00:54:48,486 --> 00:54:54,246
and then 9:00 a.m. central time we will have
a mission status briefing here at JSC as well.

791
00:54:54,286 --> 00:54:58,326
And finally, Thursday, May 3rd at 1:00 a.m.
central time that is when our rendezvous

792
00:54:58,326 --> 00:55:01,536
and birthing coverage will begin here
at the Johnson Space Center once again

793
00:55:01,536 --> 00:55:03,666
from Mission Control Houston and then

794
00:55:03,666 --> 00:55:08,766
at noon central time we should have a
mission status briefing again here at JSC.

795
00:55:08,766 --> 00:55:11,236

Of course, all of these times
are subject to change.

796

00:55:11,606 --> 00:55:16,496

To see all of this and to also see any of the
slides that you saw today from our participants,

797

00:55:16,636 --> 00:55:22,506

just log onto www.nasa.gov/spacex;
all lower case.

798

00:55:22,506 --> 00:55:23,566

It's important that you do that.

799

00:55:24,096 --> 00:55:25,766

If you look on the right hand side of the page

800

00:55:25,766 --> 00:55:28,506

down at the bottom there's
a media resources section.

801

00:55:28,826 --> 00:55:32,746

You can find all these slides as well as the
press schedule once we get it finished up

802

00:55:32,746 --> 00:55:35,866

and posted there as well
as the NASA TV schedule.

803

00:55:35,866 --> 00:55:38,086

So, just log onto there to
get all of the latest.

804

00:55:38,226 --> 00:55:42,166

I want to thank all of our participants for
joining us today and we'll see you back here