1
00:00:01,434 --> 00:00:02,668
>> Amiko Kauderer: Hi.

2
00:00:02,668 --> 00:00:03,969
Welcome to the space
vehicle mock up facility here

3
00:00:03,969 --> 00:00:05,638
at the NASA Johnson
Space Center.

4
00:00:05,638 --> 00:00:10,076
Today I am hanging out the
Orion crew module capsule mockup

5
00:00:10,076 --> 00:00:12,211
with NASA Astronaut Lee Morin.

6
00:00:12,211 --> 00:00:13,212
Lee, welcome.

7
00:00:13,212 --> 00:00:14,246
And thank you for
coming out today.

8
00:00:14,246 --> 00:00:14,914
>> Lee Morin: Thank you.

9
00:00:14,914 --> 00:00:15,848
Pleasure to be here.

10
00:00:15,848 --> 00:00:16,649
>> Amiko Kauderer:
So real quick.

11
00:00:16,649 --> 00:00:18,017
Can you tell me about Orion?

12

00:00:18,017 --> 00:00:20,019
>> Lee Morin: Orion is
a man-capable spacecraft

13
00:00:20,019 --> 00:00:25,124
that is able to go far beyond
the low earth orbit to allow us

14
00:00:25,124 --> 00:00:29,662
to explore deep space including
the moon, Mars, or asteroids.

15
00:00:29,662 --> 00:00:30,696
>> Amiko Kauderer:
So real quick also.

16
00:00:30,696 --> 00:00:34,300
Just tell me briefly
what your title is

17
00:00:34,300 --> 00:00:35,734
in relation to you this.

18
00:00:35,734 --> 00:00:37,136
We know you're an astronaut,

19
00:00:37,136 --> 00:00:39,205
but what is your
business here with Orion?

20
00:00:39,205 --> 00:00:41,407
>> Lee Morin: Currently I
lead the crew interface Rapid

21
00:00:41,407 --> 00:00:44,777
Prototyping Lab or RPL where
we're building the prototypes

22
00:00:44,777 --> 00:00:47,146
for the displays and

controls for Orion.

23
00:00:47,146 --> 00:00:48,681
We build the prototype hardware.

24
00:00:48,681 --> 00:00:50,783
And we also are building
the software

25
00:00:50,783 --> 00:00:53,819
for the cockpit displays
and controls.

26
00:00:53,819 --> 00:00:58,057
And that software next year will
be taken by Lockheed Martin,

27
00:00:58,057 --> 00:00:59,925
and turned into the
flight software

28
00:00:59,925 --> 00:01:03,429
that the astronaut will
use to fly to Mars.

29
00:01:03,429 --> 00:01:03,996
>> Amiko Kauderer: Wow.

30
00:01:03,996 --> 00:01:05,064
That's exciting.

31
00:01:05,064 --> 00:01:07,166
And so what milestones
are we looking at.

32
00:01:07,166 --> 00:01:09,835
I understand there's going to
be an exploration flight test.

33

00:01:09,835 --> 00:01:10,336
>> Lee Morin: There is.

34
00:01:10,336 --> 00:01:11,737
The EFT-1.

35
00:01:11,737 --> 00:01:13,272
Exploration Flight Test 1.

36
00:01:13,272 --> 00:01:14,607
It will be about
a year from now.

37
00:01:14,607 --> 00:01:18,544
And that will take the Orion
capsule over 3,000 miles

38
00:01:18,544 --> 00:01:21,714
above the earth so it
can return very fast

39
00:01:21,714 --> 00:01:23,048
and test the heat shield.

40
00:01:23,048 --> 00:01:23,749
>> Amiko Kauderer: Okay.

41
00:01:23,749 --> 00:01:24,950
So 3,000 miles above.

42
00:01:24,950 --> 00:01:27,052
That's further than we've
ever been since what?

43
00:01:27,052 --> 00:01:27,853
The Apollo?

44
00:01:27,853 --> 00:01:28,721
>> Lee Morin: That's further

45
00:01:28,721 --> 00:01:30,089
than a manned spacecraft
has been

46
00:01:30,089 --> 00:01:32,791
since the Apollo Era
until the early '70s.

47
00:01:32,791 --> 00:01:33,792
>> Amiko Kauderer: Okay.

48
00:01:33,792 --> 00:01:34,326
And this is not going
to be manned?

49
00:01:34,326 --> 00:01:35,461
This test.

50
00:01:35,461 --> 00:01:36,162
>> Lee Morin: The EFT-1
will not be a manned.

51
00:01:36,162 --> 00:01:37,096
It's an initial test.

52
00:01:37,096 --> 00:01:38,197
So that's not manned.

53
00:01:38,197 --> 00:01:41,100
But it's a man-capable vehicle.

54
00:01:41,100 --> 00:01:44,470
And we will be going on to
the EM-1 and EM-2 missions.

55
00:01:44,470 --> 00:01:47,273
The EM-2 mission will be
the first man mission.

56
00:01:47,273 --> 00:01:48,407
>> Amiko Kauderer: Okay.

57
00:01:48,407 --> 00:01:50,910
And I understand we have
actually had some ascent

58
00:01:50,910 --> 00:01:55,080
simulations with this cockpit
control that you've been working

59
00:01:55,080 --> 00:01:56,182
on now with astronauts.

60
00:01:56,182 --> 00:01:57,383
Can you tell me a
little bit about that?

61
00:01:57,383 --> 00:01:58,617
>> Lee Morin: We have.

62
00:01:58,617 --> 00:02:00,152
This year we've done our
first integrated simulation

63
00:02:00,152 --> 00:02:03,722
where we'll have teams of
astronauts of commander

64
00:02:03,722 --> 00:02:06,225
and flight engineers working
the controls and going

65
00:02:06,225 --> 00:02:07,826
through the ascent procedures.

66
00:02:07,826 --> 00:02:12,031
Also testing the

emergency abort procedures.

67
00:02:12,031 --> 00:02:14,233
And so that was done for
the first time this year.

68
00:02:14,233 --> 00:02:17,169
And the first time we've used
this medium fidelity mockup.

69
00:02:17,169 --> 00:02:18,671
And that's a big
milestone for us.

70
00:02:18,671 --> 00:02:19,605
>> Amiko Kauderer:
Wow, exciting.

71
00:02:19,605 --> 00:02:20,739
So we're ready.

72
00:02:20,739 --> 00:02:22,408
I'm ready to get inside
there is take a look--

73
00:02:22,408 --> 00:02:23,776
>> Lee Morin: Let's go in.

74
00:02:23,776 --> 00:02:24,643
>> Amiko Kauderer: -- at what
you've guys have been doing.

75
00:02:24,643 --> 00:02:26,278
Let's take a look.

76
00:02:26,278 --> 00:02:27,379
Okay, Lee.

77
00:02:27,379 --> 00:02:29,415

So now we're inside
the crew module mockup.

78
00:02:29,415 --> 00:02:31,750
And right now tell me what
are we looking at here?

79
00:02:31,750 --> 00:02:33,352
This is the cockpit.

80
00:02:33,352 --> 00:02:34,453
>> Lee Morin: Right.

81
00:02:34,453 --> 00:02:36,589
This is the console
of the Orion cockpit.

82
00:02:36,589 --> 00:02:38,490
And basically, the view
you have now is the view

83
00:02:38,490 --> 00:02:39,959
that the astronauts
who are going

84
00:02:39,959 --> 00:02:44,463
to be leaving the near earth
orbit and going out to Mars

85
00:02:44,463 --> 00:02:46,565
or the moon or an
asteroid, this is view

86
00:02:46,565 --> 00:02:48,500
of how their mission starts.

87
00:02:48,500 --> 00:02:50,669
And what we have
is three consoles.

88
00:02:50,669 --> 00:02:54,006
And these are the
screens that have all

89
00:02:54,006 --> 00:02:56,575
of the electronic
procedures, which you see here.

90
00:02:56,575 --> 00:02:58,577
And they also have all
of the flight instruments

91
00:02:58,577 --> 00:03:01,080
and system instruments
that you can see here.

92
00:03:01,080 --> 00:03:03,582
And this is how they'll
control the vehicle.

93
00:03:03,582 --> 00:03:06,885
As you go up hill, you
can follow your trajectory

94
00:03:06,885 --> 00:03:09,388
on these flight instruments.

95
00:03:09,388 --> 00:03:12,224
And so that would be
the prime job commander,

96
00:03:12,224 --> 00:03:15,194
which is the person
sitting in my seat.

97
00:03:15,194 --> 00:03:16,595
And then the flight
engineer sitting

98

00:03:16,595 --> 00:03:19,665
in your seat would be primarily
looking at the various systems

99
00:03:19,665 --> 00:03:22,935
to make sure that the vehicle
is performing properly.

100
00:03:22,935 --> 00:03:24,670
And that there are
no malfunctions.

101
00:03:24,670 --> 00:03:25,871
>> Amiko Kauderer: Okay.

102
00:03:25,871 --> 00:03:28,774
So I've seen the cockpit
inside the space shuttle.

103
00:03:28,774 --> 00:03:31,377
And this is quite a
bit more condensed.

104
00:03:31,377 --> 00:03:33,212
Tell me, what are some
of the improvements

105
00:03:33,212 --> 00:03:36,982
that you guys have worked
on for this particular?

106
00:03:36,982 --> 00:03:38,350
>> Lee Morin: Right.

107
00:03:38,350 --> 00:03:41,754
The crew on the shuttle had
over 2,000 switches around them.

108
00:03:41,754 --> 00:03:44,823
Here we have just about 60.

109
00:03:44,823 --> 00:03:48,160
And all those other switches
have been moved on to the glass.

110
00:03:48,160 --> 00:03:51,030
So this is a glass cockpit,

111
00:03:51,030 --> 00:03:54,066
which means that you use a
lot more computer screens.

112
00:03:54,066 --> 00:03:57,369
In addition, the shuttle had
several hundred pounds of books

113
00:03:57,369 --> 00:04:01,840
that the crew used to tell them
what their procedures were.

114
00:04:01,840 --> 00:04:04,610
Now, all of these books are
here on the glass in the form

115
00:04:04,610 --> 00:04:07,179
of electronic procedures
or EProcs.

116
00:04:07,179 --> 00:04:09,982
And these EProcs will
actually walk the crew

117
00:04:09,982 --> 00:04:13,252
through the things they need
to do to operate the vehicle

118
00:04:13,252 --> 00:04:16,422
or to respond to an
emergency or a malfunction.

119
00:04:16,422 --> 00:04:17,556
>> Amiko Kauderer: Okay.

120
00:04:17,556 --> 00:04:18,657
So we've been able to
eliminate all of that.

121
00:04:18,657 --> 00:04:20,492
How many pounds of
paperwork [laughs]?

122
00:04:20,492 --> 00:04:24,997
>> Lee Morin: It was about
250 pound of office supplies

123
00:04:24,997 --> 00:04:26,932
and paper and materials.

124
00:04:26,932 --> 00:04:28,734
And now almost all of
that is on the glass.

125
00:04:28,734 --> 00:04:31,403
You still need one small
book to tell you how

126
00:04:31,403 --> 00:04:33,172
to reboot the computers
if you need to.

127
00:04:33,172 --> 00:04:34,406
>> Amiko Kauderer: Okay.

128
00:04:34,406 --> 00:04:35,374
>> Lee Morin: But other than
that, everything will be

129
00:04:35,374 --> 00:04:37,509
on the glass as you

see right here.

130
00:04:37,509 --> 00:04:38,811
>> Amiko Kauderer: And
you mention on the glass.

131
00:04:38,811 --> 00:04:39,878
This is not touch.

132
00:04:39,878 --> 00:04:40,813
>> Lee Morin: Right.

133
00:04:40,813 --> 00:04:41,947
Right. These are
not touch screens.

134
00:04:41,947 --> 00:04:43,882
What we use and we
have edge buttons.

135
00:04:43,882 --> 00:04:47,119
And so those edge buttons
allow you to navigate

136
00:04:47,119 --> 00:04:49,755
between different displays.

137
00:04:49,755 --> 00:04:53,792
Buttons on this bottom allow you
to bring up different screens.

138
00:04:53,792 --> 00:04:56,595
The buttons along the
sides allow you to interact

139
00:04:56,595 --> 00:04:58,397
with that specific display.

140
00:04:58,397 --> 00:05:02,501

So, for example, over there
you can see those edge keys.

141
00:05:02,501 --> 00:05:03,902
It says NAV source.

142
00:05:03,902 --> 00:05:06,905
So if you push that, it would
change the navigational source.

143
00:05:06,905 --> 00:05:08,440
>> Amiko Kauderer:
And so explain

144
00:05:08,440 --> 00:05:12,144
to me why guys decided not
to go with the touch screen.

145
00:05:12,144 --> 00:05:13,479
>> Lee Morin: Right.

146
00:05:13,479 --> 00:05:15,347
Well, the decision was made
not to go with touch screen.

147
00:05:15,347 --> 00:05:17,182
We were concerned
about two things.

148
00:05:17,182 --> 00:05:20,486
One is something hitting a
touch screen floating in space

149
00:05:20,486 --> 00:05:23,522
and making an inadvertent
action that you wouldn't want.

150
00:05:23,522 --> 00:05:26,658
And the other is that touch
screens really require your

151
00:05:26,658 --> 00:05:28,327
fingers to touch the screen.

152
00:05:28,327 --> 00:05:32,398
And in spacesuit gloves
that becomes a problem.

153
00:05:32,398 --> 00:05:34,233
>> Amiko Kauderer:
So tell me what goes

154
00:05:34,233 --> 00:05:36,835
into you designing
this type of interface?

155
00:05:36,835 --> 00:05:40,572
Just kind of go through
the process.

156
00:05:40,572 --> 00:05:41,840
>> Lee Morin: What happens is

157
00:05:41,840 --> 00:05:44,209
that you'd have the system
engineers would say well,

158
00:05:44,209 --> 00:05:45,511
this is what we're
going to have.

159
00:05:45,511 --> 00:05:48,247
This is how many tanks and
valves and switches we need

160
00:05:48,247 --> 00:05:49,314
for a particular system.

161
00:05:49,314 --> 00:05:51,283

Maybe the propulsion system.

162
00:05:51,283 --> 00:05:55,154
And this is how this
system works.

163
00:05:55,154 --> 00:05:58,257
So we would sit down with crew
and mission operations people,

164
00:05:58,257 --> 00:06:00,125
the flight controllers.

165
00:06:00,125 --> 00:06:03,629
And we would say, well this is
what we need the crew to see.

166
00:06:03,629 --> 00:06:06,899
And we would draw a
thing on a blackboard.

167
00:06:06,899 --> 00:06:08,300
And then we would
take that and turn it

168
00:06:08,300 --> 00:06:09,968
into a prototype program.

169
00:06:09,968 --> 00:06:11,703
First in PowerPoint.

170
00:06:11,703 --> 00:06:13,439
And then actual with
the program.

171
00:06:13,439 --> 00:06:15,374
And then we would put
that in front of a crew.

172

00:06:15,374 --> 00:06:18,210
And they would tell you what
they didn't like about it.

173
00:06:18,210 --> 00:06:19,545
And we would watch
the crew work it.

174
00:06:19,545 --> 00:06:21,547
And we can see the
mistakes they made.

175
00:06:21,547 --> 00:06:23,482
And then we would improve that.

176
00:06:23,482 --> 00:06:25,284
And what you see
here is the result

177
00:06:25,284 --> 00:06:27,886
of seven years of
that improvement.

178
00:06:27,886 --> 00:06:30,122
>> Amiko Kauderer:
And so these sims

179
00:06:30,122 --> 00:06:34,526
that we've been doing is
designed to help us kind of find

180
00:06:34,526 --> 00:06:37,329
out what things work and
what things don't work.

181
00:06:37,329 --> 00:06:38,464
>> Lee Morin: That's right.

182
00:06:38,464 --> 00:06:40,566
And using more and more

of the cockpit together.

183
00:06:40,566 --> 00:06:43,202
So the big milestone that we've
had this year is we've finally

184
00:06:43,202 --> 00:06:47,239
gotten so that we are working
with the cockpit as a whole.

185
00:06:47,239 --> 00:06:50,209
And so you have two
people working together

186
00:06:50,209 --> 00:06:52,344
and doing a complete
phase of a mission.

187
00:06:52,344 --> 00:06:54,213
In other words, an ascent
all the way to orbit.

188
00:06:54,213 --> 00:06:58,517
All the way up to the
[inaudible] that you do in orbit

189
00:06:58,517 --> 00:07:01,553
to adjust your orbit or
adjust your trajectory.

190
00:07:01,553 --> 00:07:03,188
And doing all those tasks

191
00:07:03,188 --> 00:07:05,257
which involves using
many different systems.

192
00:07:05,257 --> 00:07:08,060
And we brought all those
systems together with all

193
00:07:08,060 --> 00:07:11,763
of the procedures to do
that as an integrated

194
00:07:11,763 --> 00:07:13,098
cockpit evaluation.

195
00:07:13,098 --> 00:07:14,433
And so that's a great milestone.

196
00:07:14,433 --> 00:07:15,667
We did that for the first time

197
00:07:15,667 --> 00:07:19,571
in this medium fidelity
mockup this September.

198
00:07:19,571 --> 00:07:23,475
And that involved doing also
our first look at ascents.

199
00:07:23,475 --> 00:07:26,812
And also ascent aborts where you
have emergencies where you have

200
00:07:26,812 --> 00:07:30,315
to stop going into space
and return to earth.

201
00:07:30,315 --> 00:07:31,917
>> Amiko Kauderer:
Tell me what is next?

202
00:07:31,917 --> 00:07:34,353
What are the next steps
in designing this?

203
00:07:34,353 --> 00:07:37,789

And when do we know when
we have the control system?

204
00:07:37,789 --> 00:07:39,057
>> Lee Morin: Right.

205
00:07:39,057 --> 00:07:42,060
The next steps for this,
we're doing another evaluation

206
00:07:42,060 --> 00:07:43,662
in a couple of months
in February,

207
00:07:43,662 --> 00:07:47,799
which will put it all together
with a lot of malfunction.

208
00:07:47,799 --> 00:07:49,635
So we're really going
to stress the crews

209
00:07:49,635 --> 00:07:51,403
and give them a lot
of breaking things.

210
00:07:51,403 --> 00:07:55,107
We want to make sure that they
can work multiple malfunctions

211
00:07:55,107 --> 00:07:58,243
at the same tame working
parallel And that this set

212
00:07:58,243 --> 00:08:00,312
of this arrangement of
the electronic procedures

213
00:08:00,312 --> 00:08:03,382
and the glass cockpit

is up to that task.

214
00:08:03,382 --> 00:08:06,718
And then next year, we will be
working with Lockheed Martin

215
00:08:06,718 --> 00:08:08,921
to actually take these
designs and turn them

216
00:08:08,921 --> 00:08:12,524
into the flight software
that will actually be used

217
00:08:12,524 --> 00:08:16,161
by the crews going to Mars
or the moon or an asteroid.

218
00:08:16,161 --> 00:08:17,229
>> Amiko Kauderer:
This is so exciting.

219
00:08:17,229 --> 00:08:20,299
And so earlier we
talked about the EFT-1,

220
00:08:20,299 --> 00:08:22,501
the Exploration Flight
Test Vehicle.

221
00:08:22,501 --> 00:08:25,304
It's not going to
be a manned vehicle.

222
00:08:25,304 --> 00:08:28,707
However, will there be any
data from that test at all

223
00:08:28,707 --> 00:08:32,144
that will help further

development?

224
00:08:32,144 --> 00:08:32,978
>> Lee Morin: Absolutely.

225
00:08:32,978 --> 00:08:34,379
There will be data from EFT-1.

226
00:08:34,379 --> 00:08:39,318
And, in fact, we are setting up
a - we will take the EFT-1 data

227
00:08:39,318 --> 00:08:41,853
as it happens and feed
it into these displays

228
00:08:41,853 --> 00:08:44,890
so we can watch how the
displays would look if you were

229
00:08:44,890 --> 00:08:47,125
on the EFT-1 spacecraft.

230
00:08:47,125 --> 00:08:48,193
>> Amiko Kauderer:
Well, thank you so much

231
00:08:48,193 --> 00:08:50,429
for taking the time
to show this to us.

232
00:08:50,429 --> 00:08:51,496
It's all very exciting.

233
00:08:51,496 --> 00:08:53,432
You guys are doing
obviously a great job.

234
00:08:53,432 --> 00:08:55,834

And we look forward
to seeing what's next.