Episode 10: Gateway to the Moon

May 2019

@NASAKennedy
#NASARocketRanch

New episodes every month!

1
00:00:00,399 --> 00:00:06,850
NASA has been given its loftiest charge since
the 1960s and KSC has a critical role…

2
00:00:06,850 --> 00:00:10,769
We know we're standing on the shoulders
of giants and it's pretty nostalgic and

3
00:00:10,769 --> 00:00:11,849
pretty emotional.

4
00:00:11,849 --> 00:00:13,540
Next, on the Rocket Ranch.

5
00:00:16,900 --> 00:00:21,080
EGS Program Chief Engineer, verify no constraints
to launch.

6
00:00:21,080 --> 00:00:23,560
EGS Chief Engineer team has no constraints.

7
00:00:23,560 --> 00:00:24,880
I copy that.

8
00:00:24,880 --> 00:00:26,780
You are clear to launch.

9
00:00:26,780 --> 00:00:34,020
Five, four, three, two, one, and lift-off.

10
00:00:34,020 --> 00:00:35,940
All clear.

11
00:00:35,980 --> 00:00:39,060
Now passing through max q, maximum dynamic
pressure.

12
00:00:39,060 --> 00:00:40,440

Welcome to space.

13
00:00:42,780 --> 00:00:47,300
NASA’s accelerating a human return to the
Moon and will put the first woman, and the

14
00:00:47,300 --> 00:00:51,020
next man, on the lunar South Pole by 2024.

15
00:00:51,020 --> 00:00:56,040
The agency is going back to the Moon in two
phases – the first is focused on speed.

16
00:00:56,040 --> 00:01:00,690
Second, NASA will establish sustainable missions
by 2028.

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00:01:00,690 --> 00:01:05,400
The Gateway will be the center of that exploration
– serving as a home base in lunar orbit

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00:01:05,400 --> 00:01:08,980
for missions to the surface of the Moon and
beyond.

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00:01:08,980 --> 00:01:15,440
The Gateway will be a collaboration with NASA,
international partners and commercial companies.

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00:01:15,440 --> 00:01:19,940
Kennedy has been handed a piece of the puzzle
and Mark Weise will leverage the expertise

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00:01:19,940 --> 00:01:23,690
already at the space center to lead the logistics
team for Gateway.

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00:01:23,690 --> 00:01:28,690
I was able to catch up with Mark, but first,
a disclaimer: while we’re definitely headed

23
00:01:28,690 --> 00:01:32,170
back to the Moon, we are still working out
some of the details.

24
00:01:32,170 --> 00:01:36,560
As you enjoy this podcast, keep in mind that
plans and details are in flux and what was

25
00:01:36,560 --> 00:01:41,710
accurate at time of recording may have changed
since then—which is great because that just

26
00:01:41,710 --> 00:01:43,720
gives us a reason to do a follow-up episode!

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00:01:43,720 --> 00:01:44,940
Now, Mark.

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00:01:44,940 --> 00:01:46,380
We love rockets down here.

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00:01:46,380 --> 00:01:51,120
And this is the "Rocket Ranch" podcast,
so – should have anticipated that coming.

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00:01:51,120 --> 00:01:52,799
And his side-kick, Johnny Nguyen.

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00:01:52,799 --> 00:01:56,060
It feels like it's, like, project management
101.

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00:01:56,060 --> 00:01:58,520
Hoping they could teach me a thing or two
about Gateway.

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00:01:58,520 --> 00:02:03,560
But first, I had some nagging questions about

our history with the moon.

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00:02:03,560 --> 00:02:06,600
Astronaut Gene Cernan: Probably one of the
most significant things we can think about

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00:02:06,600 --> 00:02:16,100
when we think about Apollo, is that it has
opened for us being the world a challenge

36
00:02:16,100 --> 00:02:18,060
of the future.

37
00:02:18,060 --> 00:02:24,220
The door is now cracked, but the promise of
that future lies in the young people, not

38
00:02:24,220 --> 00:02:28,380
just in America, but the young people all
over the world.

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00:02:28,380 --> 00:02:32,780
All right, so, I am here now in the booth
with Mark Wiese and Johnny Nguyen.

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00:02:32,781 --> 00:02:33,870
Gentlemen, thanks for joining me.

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00:02:33,870 --> 00:02:34,870
Thank you.

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00:02:34,870 --> 00:02:35,870
Thanks for having us.

43
00:02:35,870 --> 00:02:41,160
So, I want to actually go way back for a second
and ask the question, why did we stop flying

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00:02:41,160 --> 00:02:42,200

to the moon?

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00:02:42,200 --> 00:02:45,629
Because we're about to celebrate the 50th anniversary of the first man walking on the

46
00:02:45,629 --> 00:02:48,560
moon, and it's been a long time since we've been there.

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00:02:48,560 --> 00:02:53,930
So we're about to return to that kind of phase of exploration, but why stop?

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00:02:53,930 --> 00:02:57,989
I think the place our country was at back then, it just wasn't as urgent anymore.

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00:02:57,989 --> 00:03:03,469
You know, we made that initial flag to show we were beating the Russians in the space

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00:03:03,469 --> 00:03:04,859
race that we had going on at the time.

51
00:03:04,859 --> 00:03:08,629
And I think, in our country, there was a lot more politically going on domestically of

52
00:03:08,629 --> 00:03:13,029
where to spend money, what was a priority, and space just wasn't the priority right then.

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00:03:13,029 --> 00:03:17,329
So, is that to say that we've kind of come full circle now and, like, this is becoming

54
00:03:17,329 --> 00:03:19,010
a greater priority for our nation?

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00:03:19,010 --> 00:03:23,059
I'm not sure if it's full circle or even a
greater priority, but that's where we're at

56
00:03:23,059 --> 00:03:24,059
right now.

57
00:03:24,059 --> 00:03:28,370
Mike Pence: Just as the United States was
the first nation to reach the moon in the

58
00:03:28,370 --> 00:03:33,200
twentieth century, so too will we be the first
nation to return astronauts to the moon in

59
00:03:33,200 --> 00:03:34,640
the twenty first century.

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00:03:34,640 --> 00:03:36,779
So I think that's an exciting place to be.

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00:03:36,779 --> 00:03:41,640
We're getting to the moon, going to Mars with
this mandate from the White House.

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00:03:41,640 --> 00:03:45,349
What's really the significance of returning
to the moon, for NASA and for America?

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00:03:45,349 --> 00:03:49,519
I think it's a great time to be here at the
Space Center.

64
00:03:49,519 --> 00:03:55,120
So, it's finally at the point where we can
go really expand and get out of low Earth

65
00:03:55,120 --> 00:03:56,120
orbit, right.

66
00:03:56,120 --> 00:03:58,900
We've been trying to commercialize low Earth
orbit for a while, and now we're at the point

67
00:03:58,900 --> 00:04:03,129
where we can go find a way to leverage the
technologies, try to learn from a deep-space

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00:04:03,129 --> 00:04:05,760
environment, and the moon is our closest neighbor
to go from.

69
00:04:05,760 --> 00:04:07,569
And other countries are going now.

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00:04:07,569 --> 00:04:11,909
I mean, you see, competition is something
that's in our veins as Americans.

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00:04:11,909 --> 00:04:14,909
So, China just put a rover on the moon.

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00:04:14,909 --> 00:04:18,949
So we want to be a part of that again, right,
so that's what charges our political machine

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00:04:18,949 --> 00:04:21,239
to try to find a way to help us get there.

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00:04:21,239 --> 00:04:26,550
So, between almost 50 years ago, when we left
the moon, and our return, hopefully within

75
00:04:26,550 --> 00:04:29,370
the next five years, we've done a lot.

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00:04:29,370 --> 00:04:30,380
We've learned a lot.

77
00:04:30,380 --> 00:04:37,150
And, so, what has been evolution for us of,
"Hey, we're smarter now.

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00:04:37,150 --> 00:04:40,030
It might be taking us a little bit of time
to get back there, but we're way smarter than

79
00:04:40,030 --> 00:04:42,300
we were 45 years ago."

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00:04:42,300 --> 00:04:44,729
I think a lot of it is fiscally.

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00:04:44,729 --> 00:04:48,319
Like, it's cost us tons of money to do what
we've done.

82
00:04:48,319 --> 00:04:52,550
And shuttle was announced, and supposed to
launch weekly, right, and we couldn't pull

83
00:04:52,550 --> 00:04:53,650
that off.

84
00:04:53,650 --> 00:04:58,520
And now -- you know, there's ways for commercial
companies to make money with data from on-orbit,

85
00:04:58,520 --> 00:04:59,520
right.

86
00:04:59,520 --> 00:05:02,389
I mean, our cellphone companies want to find
a way to get out of the cell-tower business

87
00:05:02,389 --> 00:05:03,870
and into orbit.

88
00:05:03,870 --> 00:05:09,670
So there's more of an industry participation,
which is helping us, I think, make these steps

89
00:05:09,670 --> 00:05:10,670
quicker.

90
00:05:10,670 --> 00:05:14,340
Then you take the miniaturization of electronics,
the added manufacturing capabilities -- it's

91
00:05:14,340 --> 00:05:16,389
just a little more doable.

92
00:05:16,389 --> 00:05:18,389
Yeah, I think you’re right.

93
00:05:18,389 --> 00:05:23,020
Like, back then, it was just NASA, but nowadays
we've got so many different commercial companies,

94
00:05:23,020 --> 00:05:28,169
commercial partners, and all of us working
together, using the right capabilities with

95
00:05:28,169 --> 00:05:33,780
each other, I think that's what's really spurring
the innovation, and the ability to get back

96
00:05:33,780 --> 00:05:35,430
so much faster this time around.

97
00:05:35,430 --> 00:05:39,680
I mean, ISS was sold -- it was the first program
I worked when I first came out of college.

98
00:05:39,680 --> 00:05:41,380
And ISS was all about science.

99
00:05:41,380 --> 00:05:44,849
And I remember, in the beginning, it was this
constant battle of, "Well, things are going

100
00:05:44,849 --> 00:05:45,849
wrong.

101
00:05:45,849 --> 00:05:46,849
Things are breaking.

102
00:05:46,849 --> 00:05:47,849
We have to spend crew time on fixing things."

103
00:05:47,849 --> 00:05:49,189
And you just couldn't get science up there.

104
00:05:49,189 --> 00:05:50,409
And they're finally at that point.

105
00:05:50,409 --> 00:05:55,500
Six-person crew, and you have talks of a commercial
space station, and lots of healthcare companies

106
00:05:55,500 --> 00:05:58,810
and research-and-development companies trying
to find ways to take advantage of microgravity

107
00:05:58,810 --> 00:06:00,680
to benefit all of us.

108
00:06:00,680 --> 00:06:06,630
So, you mentioned, obviously, both of you,
the commercial aspect of where we are today.

109
00:06:06,630 --> 00:06:11,630
So I'm assuming that it's safe to say that,
as we look towards Gateway -- which, obviously,

110
00:06:11,630 --> 00:06:15,469
we're gonna get to here in a second -- we're
going arm in arm with commercial companies

111
00:06:15,469 --> 00:06:17,760
to make this a successful mission, yeah?

112
00:06:17,760 --> 00:06:18,760
Yes, arm in arm.

113
00:06:18,760 --> 00:06:21,539
And, you know, it's both -- We need them.

114
00:06:21,539 --> 00:06:24,220
Again, this commercial business case that's
starting to be out there.

115
00:06:24,220 --> 00:06:26,539
The first piece of Gateway is a power-propulsion
element.

116
00:06:26,539 --> 00:06:31,379
So there's commercial satellites that will
benefit from solar propulsion, solar-electric

117
00:06:31,379 --> 00:06:37,469
propulsion, and finding ways to leverage that
for us, as well.

118
00:06:37,469 --> 00:06:41,860
The power and propulsion element will provide
power, propulsion and communications to the

119
00:06:41,860 --> 00:06:43,710
entire Gateway.

120
00:06:43,710 --> 00:06:47,900
NASA is getting ready to make an award to
an American company or companies to develop,

121
00:06:47,900 --> 00:06:49,900
launch and test this element.

122
00:06:49,900 --> 00:06:53,770
It’s targeted to launch on a commercial
rocket by 2022.

123
00:06:53,770 --> 00:06:54,780
Yeah.

124
00:06:54,780 --> 00:06:57,590
I mean, arm in arm.

125
00:06:57,590 --> 00:06:58,600
Sometimes they're pulling us.

126
00:06:58,600 --> 00:07:00,090
Sometimes we're pulling them.

127
00:07:00,090 --> 00:07:01,810
But one way or another, we’re all in this
together.

128
00:07:01,810 --> 00:07:05,820
And, of course, you can't forget the government
side of the house, too, with SLS and Orion.

129
00:07:05,820 --> 00:07:08,889
That's a crucial, crucial piece for us, as
well.

130
00:07:08,889 --> 00:07:13,340
And how it all plays together, again, I think
that's what makes it interesting, and hopefully

131
00:07:13,340 --> 00:07:15,540
a positive perception by everybody, too.

132
00:07:15,540 --> 00:07:16,540
It's a way to make us stronger.

133
00:07:16,540 --> 00:07:20,389
You know, the beginning of NASA, that 10 healthy centers, and you spread out the political

134
00:07:20,389 --> 00:07:21,699
leverage across the country.

135
00:07:21,699 --> 00:07:24,939
Now we have this spread-out political leverage over government systems, commercial systems,

136
00:07:24,939 --> 00:07:26,219
all working and leveraging each other.

137
00:07:26,219 --> 00:07:27,490
It's a really good time.

138
00:07:27,490 --> 00:07:31,310
So, Mark, tell me what exactly is Gateway?

139
00:07:31,310 --> 00:07:36,249
So, Gateway is a lunar outpost in the moon's orbit.

140
00:07:36,249 --> 00:07:37,629
It's a camping trip.

141
00:07:37,629 --> 00:07:40,449
I mean, we're going a quarter of a million miles away from home.

142
00:07:40,449 --> 00:07:42,050
We need just the minimal stuff.

143
00:07:42,050 --> 00:07:44,099

It's an RV in lunar orbit.

144
00:07:44,099 --> 00:07:45,099
It's small.

145
00:07:45,099 --> 00:07:46,099
Okay.

146
00:07:46,099 --> 00:07:47,099
It's not Space Station.

147
00:07:47,099 --> 00:07:48,099
It's a spacecraft.

148
00:07:48,099 --> 00:07:51,759
It's a lunar outpost, a way point for us to
aggregate pieces and, really, to get down

149
00:07:51,759 --> 00:07:52,879
to the surface of the moon.

150
00:07:52,879 --> 00:07:57,029
And, so, is this a "deliver it all at one
time"?

151
00:07:57,029 --> 00:08:01,469
Is this "fly things one piece at a time" like
we did with Space Station, and connect them

152
00:08:01,469 --> 00:08:02,570
once we're in orbit?

153
00:08:02,570 --> 00:08:06,879
What's the process for getting from Earth's
surface to orbit around the moon?

154
00:08:06,879 --> 00:08:11,810
So, it's that "one piece at a time," like
we did Space Station, and definitely figure

155
00:08:11,810 --> 00:08:15,569
out what's that minimal capability you need
now that we have this huge charge to land

156
00:08:15,569 --> 00:08:17,419
humans on the moon within five years.

157
00:08:17,419 --> 00:08:20,479
So, get up that power-propulsion element,
commercially launched.

158
00:08:20,479 --> 00:08:25,370
Delivery on orbit, actually, where a commercial
provider will get it on orbit, check it out

159
00:08:25,370 --> 00:08:28,310
for a year on their own, and then turn it
over to the government.

160
00:08:28,310 --> 00:08:31,010
So we will kind of be even more hands-off
there.

161
00:08:31,010 --> 00:08:34,501
Then JSC's building a utilization module,
kind of like a node on Space Station -- a

162
00:08:34,501 --> 00:08:37,820
bunch of docking ports, connector space, some
habitable volume on the inside.

163
00:08:37,820 --> 00:08:41,790
Get that up there, get logistics up there
so that you've got some supplies, and then

164
00:08:41,790 --> 00:08:46,030
start to put pieces of the lander up there
so we can get boots on the moon in 2024.

165
00:08:46,030 --> 00:08:48,890
And then, after that, you grow Gateway a little bit more, and you start to put some habitable

166
00:08:48,890 --> 00:08:51,890
volume on there and you get a little bigger.

167
00:08:51,890 --> 00:08:57,250
And it feels like we couldn't do what we do today with our strategy without the foundational

168
00:08:57,250 --> 00:09:02,940
steps of what LSP has done, Commercial Crew has done, commercial cargo resupply, all these

169
00:09:02,940 --> 00:09:03,940
other folks.

170
00:09:03,940 --> 00:09:08,140
I can't imagine doing a program like this in the way we're doing it, lean and agile,

171
00:09:08,140 --> 00:09:09,230
10, 15 years ago.

172
00:09:09,230 --> 00:09:11,710
I mean, the timing is perfect with Commercial Crew.

173
00:09:11,710 --> 00:09:16,480
I mean, all the work they've had to do to put human systems on commercial rockets and

174
00:09:16,480 --> 00:09:22,030
figure out how to get requirements lined up to give a lot to the commercial providers

175
00:09:22,030 --> 00:09:26,180
and find a way to assess that on our side,

we're gonna learn and leverage from that,

176
00:09:26,180 --> 00:09:29,750
and Gateway's gonna be a human-tended system
when Orion docks.

177
00:09:29,750 --> 00:09:33,401
So we're trying to find that sweet spot of,
we're not human-rated all the time, but when

178
00:09:33,401 --> 00:09:36,140
Orion's there, we've got to find the right
requirements to levy.

179
00:09:36,140 --> 00:09:38,320
So, I mean, we're leveraging all over the
place.

180
00:09:38,320 --> 00:09:41,200
And then partnering with EGS, like I said,
SLS/Orion is key.

181
00:09:41,200 --> 00:09:42,890
That's how we get the crew up there.

182
00:09:42,890 --> 00:09:46,780
And, ideally, the agency wants that huge,
heavy lift capability to put up as big of

183
00:09:46,780 --> 00:09:47,870
pieces as we can.

184
00:09:47,870 --> 00:09:49,720
That's where you get efficiencies of scale.

185
00:09:49,720 --> 00:09:50,720
All right.

186
00:09:50,720 --> 00:09:52,880

So, coming back to where we are now.

187
00:09:52,880 --> 00:09:56,780
So, Mark, you have been -- and I'm gonna get
this wrong, so correct me.

188
00:09:56,780 --> 00:10:02,940
You've been set up as the director at the
Kennedy Space Center for the logistics module

189
00:10:02,940 --> 00:10:03,940
of Gateway.

190
00:10:03,940 --> 00:10:04,940
What is your title?

191
00:10:04,940 --> 00:10:09,080
Yeah, so, I'll come off of that pedestal that
Josh put me on.

192
00:10:09,080 --> 00:10:13,790
I am the manager of the logistics element,
which is really just a project office.

193
00:10:13,790 --> 00:10:17,870
So, Johnson Space Center is the program office
for Gateway, for all the different pieces

194
00:10:17,870 --> 00:10:19,260
of gateway.

195
00:10:19,260 --> 00:10:23,431
And my title now -- I guess I'm, like, Johnny,
two weeks, maybe a month it's official, I

196
00:10:23,431 --> 00:10:24,431
think.

197
00:10:24,431 --> 00:10:27,650

So, it's Manager of Logistics Element for
the Gateway Program.

198
00:10:27,650 --> 00:10:31,820
In my defense, Mark described his job about
3 different ways to me over the course of

199
00:10:31,820 --> 00:10:33,510
our time together that day.

200
00:10:33,510 --> 00:10:38,560
The punchline is that these guys are way more
focused on getting the job done than job titles.

201
00:10:38,560 --> 00:10:40,750
I just make up a new title for you every week.

202
00:10:40,750 --> 00:10:41,750
[Laughter]

203
00:10:41,750 --> 00:10:43,450
Just every time somebody asks you, just make
it up a little bit different?

204
00:10:43,450 --> 00:10:44,450
"Oh, Mark?

205
00:10:44,450 --> 00:10:45,450
Yeah, yeah.

206
00:10:45,450 --> 00:10:46,450
Czar of Logistics.

207
00:10:46,450 --> 00:10:47,450
Yes, yes, yes."

208
00:10:47,450 --> 00:10:50,420
What exactly is the logistics module, and
what's kind of included in that?

209
00:10:50,420 --> 00:10:53,860
So, we're officially given the logistics element.

210
00:10:53,860 --> 00:10:56,460
The "element" term means project office.

211
00:10:56,460 --> 00:11:01,570
So we are all things delivery services to
Gateway.

212
00:11:01,570 --> 00:11:04,620
That includes a launch and a spacecraft.

213
00:11:04,620 --> 00:11:09,780
The spacecraft will include a logistics module
-- so, a volume that can carry cargo, whether

214
00:11:09,780 --> 00:11:13,690
it's inside, pressurized, and will hook up
to a docking port and astronauts can go enter

215
00:11:13,690 --> 00:11:18,190
that habitable volume and do science or take
out food or load it with trash, and it's also

216
00:11:18,190 --> 00:11:23,370
the external ability to lock payloads onto
the outside, or other pieces of Gateway that

217
00:11:23,370 --> 00:11:25,150
we might want to bring up, like a robotic
arm.

218
00:11:25,150 --> 00:11:28,770
And, so, Johnny, where do you fit in this
picture with Gateway?

219
00:11:28,770 --> 00:11:33,400

I am supporting Mark and helping to set up
what I'll call the project-control type stuff.

220
00:11:33,400 --> 00:11:37,860
Listen to the inflection in his voice, because
he's not sure what his title is, yet, either.

221
00:11:37,860 --> 00:11:38,860
[Laughter]

222
00:11:38,860 --> 00:11:39,860
So, project control.

223
00:11:39,860 --> 00:11:40,860
What does that mean?

224
00:11:40,860 --> 00:11:41,860
Unpack that for me.

225
00:11:41,860 --> 00:11:43,620
So, it's like all the background, backbone
type stuff.

226
00:11:43,620 --> 00:11:50,670
Risk management, config management, budget
resource, workforce, standing up the organization,

227
00:11:50,670 --> 00:11:56,020
data management, how do we all collaborate
and work together cohesively as a team?

228
00:11:56,020 --> 00:12:00,440
So, hopefully, it's all behind-the-scenes
type stuff that just makes things work easier.

229
00:12:00,440 --> 00:12:01,440
He's selling himself short.

230
00:12:01,440 --> 00:12:04,400

So, I mean, the amount of whiteboard sessions
we've done in the past -- I don't know if

231
00:12:04,400 --> 00:12:07,020
there's a title for, like, strategist.

232
00:12:07,020 --> 00:12:11,060
The two of us spent a lot of time in the beginning
trying to brainstorm, "How do we pull in and

233
00:12:11,060 --> 00:12:13,370
leverage the rest of the Center?

234
00:12:13,370 --> 00:12:14,370
How do we do this?”

235
00:12:14,370 --> 00:12:18,180
And he's got a great creative brain, so it's
been a huge help.

236
00:12:18,180 --> 00:12:19,750
So, what's got you really excited?

237
00:12:19,750 --> 00:12:22,740
What are you really focused on going into
this project?

238
00:12:22,740 --> 00:12:25,120
I love doing what I'm doing right now.

239
00:12:25,120 --> 00:12:29,550
So, today has been this really cool day where
we did these two town halls at the Center,

240
00:12:29,550 --> 00:12:33,700
and I get to sit in this, like, padded room
that's not because I'm banging my head against

241
00:12:33,700 --> 00:12:34,700

the walls.

242
00:12:34,700 --> 00:12:35,780
I was gonna say -- [Laughs]

243
00:12:35,780 --> 00:12:38,330
Trying to make sure I can get the message
out.

244
00:12:38,330 --> 00:12:44,360
I enjoy trying to inspire others and connect
them with this awesome mission that we get.

245
00:12:44,360 --> 00:12:47,510
We do a lot of hard things in this agency,
and it's so easy to get wrapped up in the

246
00:12:47,510 --> 00:12:51,910
art of what's impossible, and I get to try
to help inspire people to the art of the possible.

247
00:12:51,910 --> 00:12:53,580
And that's what gets me out of bed.

248
00:12:53,580 --> 00:12:57,110
So, explain to me a little bit about kind
of the path forward for Gateway.

249
00:12:57,110 --> 00:13:04,030
So, it seems like you guys are really in kind
of a brainstorming and planning period.

250
00:13:04,030 --> 00:13:11,080
So how much do the other operations of Gateway
impact you guys, and how much of it is you

251
00:13:11,080 --> 00:13:17,380
guys just really trying to figure out, like,
"We need to be masters of our piece here.

252
00:13:17,380 --> 00:13:19,250
We need to make sure we can connect to the
other guy.

253
00:13:19,250 --> 00:13:20,320
But we're just here doing our thing."

254
00:13:20,320 --> 00:13:22,830
There's so much of that going on right now.

255
00:13:22,830 --> 00:13:27,140
You know, the traditional NASA way of doing
things is, line up all these requirements,

256
00:13:27,140 --> 00:13:32,300
decompose requirements for a long time, get
them all perfect, and then let's go move forward.

257
00:13:32,300 --> 00:13:34,010
And we don't have that time.

258
00:13:34,010 --> 00:13:38,480
So, you know, once you talk about, Johnny's
in the throes right now of a bottoms-up, you

259
00:13:38,480 --> 00:13:39,480
know?

260
00:13:39,480 --> 00:13:42,650
We have to go figure out what this is gonna
cost for the next 10 years.

261
00:13:42,650 --> 00:13:43,650
And you're starting at zero.

262
00:13:43,650 --> 00:13:44,650
10 years, man.

263

00:13:44,650 --> 00:13:45,650
That's a long time.

264
00:13:45,650 --> 00:13:47,590
Trying to figure out how much it costs us.

265
00:13:47,590 --> 00:13:48,590
Have we been here 10 years?

266
00:13:48,590 --> 00:13:51,570
I don't think I've been at -- No, I guess
we've been here 10 years.

267
00:13:51,570 --> 00:13:52,570
Time goes fast.

268
00:13:52,570 --> 00:13:53,570
But, I mean, it's hard.

269
00:13:53,570 --> 00:13:55,930
Think about the early years of your career,
and saying, "All right, what am I gonna do

270
00:13:55,930 --> 00:13:57,490
for the next 10 years?”

271
00:13:57,490 --> 00:13:58,540
It's hard.

272
00:13:58,540 --> 00:14:02,250
But it does feel like -- all right, you tell
me if I am wrong here, Mark, but it feels

273
00:14:02,250 --> 00:14:05,860
like it's project management 101 to the degree
where, "All right.

274
00:14:05,860 --> 00:14:08,050
Let's start this massive new project.

275
00:14:08,050 --> 00:14:09,050
What will it take?

276
00:14:09,050 --> 00:14:10,050
'A,' I got to assemble the team.

277
00:14:10,050 --> 00:14:12,200
I got to figure out roles and responsibilities.

278
00:14:12,200 --> 00:14:16,210
What are the crucial first steps I need to
outline out there?”

279
00:14:16,210 --> 00:14:19,720
Let that get some traction, let that grow
a little bit.

280
00:14:19,720 --> 00:14:24,170
And then, as the team grows, and as the responsibility
grows, we'll just keep on expanding a little

281
00:14:24,170 --> 00:14:25,170
more.

282
00:14:25,170 --> 00:14:29,350
But the core building blocks have to be there
in terms of, like, requirements, operations,

283
00:14:29,350 --> 00:14:32,000
schedules, stuff like that.

284
00:14:32,000 --> 00:14:33,000
Yeah.

285
00:14:33,000 --> 00:14:38,860
You know, and it brings more emphasis to light
of how you have to trust people and leverage

286
00:14:38,860 --> 00:14:39,860
expertise, right.

287
00:14:39,860 --> 00:14:41,310
Delegate things down to the lowest level.

288
00:14:41,310 --> 00:14:43,320
Ask people what they think is right.

289
00:14:43,320 --> 00:14:46,810
And make sure you have open communication,
transparent communication as you roll that

290
00:14:46,810 --> 00:14:50,740
stuff up, and everybody understands the trades
you're bouncing around in your head.

291
00:14:50,740 --> 00:14:51,740
Because you're spitballing it.

292
00:14:51,740 --> 00:14:53,730
You're trying to take that early wag.

293
00:14:53,730 --> 00:14:56,690
And then, in the requirements straight space,
I mean, that's eating our lunch right now,

294
00:14:56,690 --> 00:14:59,710
trying to -- Level 2 would like to -- and
I say Level 2.

295
00:14:59,710 --> 00:15:01,172
The program office at JSC, right.

296
00:15:01,172 --> 00:15:03,700
They're working hard to try to nail down exactly
what this is.

297

00:15:03,700 --> 00:15:07,340
But it's a commercial partnership, so there's
only so much they know, and we don't have

298
00:15:07,340 --> 00:15:08,770
the time to wait for everything.

299
00:15:08,770 --> 00:15:11,640
So we're trying to run in parallel with them
and communicate along the way.

300
00:15:11,640 --> 00:15:12,640
"All right.

301
00:15:12,640 --> 00:15:13,640
We're writing this down.

302
00:15:13,640 --> 00:15:14,680
Does that look like it lines up with you?”

303
00:15:14,680 --> 00:15:19,630
And as long as we set up our contracts appropriately
and have the flexibility, you can always change

304
00:15:19,630 --> 00:15:20,630
things.

305
00:15:20,630 --> 00:15:23,530
It might cost you money to change things,
but if you set it up the right way, and you

306
00:15:23,530 --> 00:15:28,670
push down authority to the contracts, as well,
you should have the flexibility to enable

307
00:15:28,670 --> 00:15:31,000
this in the long run.

308
00:15:31,000 --> 00:15:36,240

Sustainability is a big component of our return
to the Moon, but what's that mean?

309
00:15:36,240 --> 00:15:37,720
We got to be sustainable.

310
00:15:37,720 --> 00:15:39,460
We have to find a way to be reusable, right?

311
00:15:39,460 --> 00:15:41,120
I mean, we're spending the taxpayers' dollars.

312
00:15:41,120 --> 00:15:43,250
Let's not just throw it all away in one shot.

313
00:15:43,250 --> 00:15:47,680
We want to go there to stay, and ultimately
we want to find ways to push towards deep-space

314
00:15:47,680 --> 00:15:51,760
transportation capabilities so that we can
go out further in our solar system.

315
00:15:51,760 --> 00:15:58,570
So this is the learning, the early building
blocks for us to get there.

316
00:15:58,570 --> 00:16:03,690
And, on a technical level, what do you see
as being the greatest engineering challenges?

317
00:16:03,690 --> 00:16:09,240
Are we talking about, we're just repackaging
lots of great technology, or are we, like,

318
00:16:09,240 --> 00:16:10,240
cutting-edge stuff here?

319
00:16:10,240 --> 00:16:13,340

So, the environment out there in the lunar vicinity is much harsher.

320
00:16:13,340 --> 00:16:15,940
So, a lot stronger radiation environment.

321
00:16:15,940 --> 00:16:19,870
The extremes of hot and cold are definitely tougher.

322
00:16:19,870 --> 00:16:24,110
The biggest challenge -- and I remember an early control board talking through this -- we're

323
00:16:24,110 --> 00:16:28,630
not gonna have a crew there 24/7, so how do we make sure we're not just throwing things

324
00:16:28,630 --> 00:16:32,260
up to our garage and it sits there forever, like happens at my house?

325
00:16:32,260 --> 00:16:36,300
So there's a lot of talk about, how do we make sure we have intra-vehicle robotics,

326
00:16:36,300 --> 00:16:41,510
and how do we design things now for capabilities we're not sure of how we'll use them yet?

327
00:16:41,510 --> 00:16:46,530
So we got to, like, really leverage flexible designs so that we can do as many things autonomously

328
00:16:46,530 --> 00:16:48,670
as possible.

329
00:16:48,670 --> 00:16:53,180
I've been told that the orbit is not what you would typically think about for, like,

330
00:16:53,180 --> 00:16:54,280
orbiting a body.

331
00:16:54,280 --> 00:16:59,780
Like, Space Station stays fairly similar range
to the Earth as it orbits.

332
00:16:59,780 --> 00:17:02,210
It's something like 250 miles.

333
00:17:02,210 --> 00:17:05,270
But I've heard that the orbit around the moon
for Gateway is much different.

334
00:17:05,270 --> 00:17:06,819
Is that accurate?

335
00:17:06,819 --> 00:17:08,630
It's a highly elliptical orbit.

336
00:17:08,630 --> 00:17:10,130
So it gets really close.

337
00:17:10,130 --> 00:17:14,370
Now they're looking at, again, this halo orbit.

338
00:17:14,370 --> 00:17:17,390
It's an elliptical orbit.

339
00:17:17,390 --> 00:17:18,390
I don't know.

340
00:17:18,390 --> 00:17:19,390
We're starting to get out of my wheelhouse.

341
00:17:19,390 --> 00:17:21,439
This is where we're leveraging LSP, because

the PR only goes so far.

342
00:17:21,439 --> 00:17:25,240
You know, the orbital mechanics takes a lot
of smart people that know exactly what they're

343
00:17:25,240 --> 00:17:27,310
doing.

344
00:17:27,310 --> 00:17:28,890
It's in that highly elliptical orbit.

345
00:17:28,890 --> 00:17:31,070
We're orbiting the Earth just like the moon.

346
00:17:31,070 --> 00:17:35,370
So, we just showed some views in a town hall
where, if you step back, Gateway orbits the

347
00:17:35,370 --> 00:17:38,680
Earth, goes around the Earth in the same period
as the moon.

348
00:17:38,680 --> 00:17:41,161
And then, if you look at it from a different
perspective, it's this highly elliptical orbit

349
00:17:41,161 --> 00:17:45,020
around the moon, and kind of leveraging some
of the equilibrium points in gravity, Lagrange

350
00:17:45,020 --> 00:17:49,150
points out there so that it's pretty stable,
it's easy to get in and out of, and it's a

351
00:17:49,150 --> 00:17:51,870
great place to leverage science opportunities.

352
00:17:51,870 --> 00:17:53,710

So, spitball me some numbers.

353
00:17:53,710 --> 00:17:57,640
How close do we get at our closest, and how
far away do we get at our furthest?

354
00:17:57,640 --> 00:17:58,640
I don't know.

355
00:17:58,640 --> 00:18:00,080
I'd be making it up.

356
00:18:00,080 --> 00:18:01,080
[Laughter]

357
00:18:01,080 --> 00:18:03,450
Well, hey, you said that's what you're doing
right now, right?

358
00:18:03,450 --> 00:18:04,450
You said you're just making it up as you go.

359
00:18:04,450 --> 00:18:07,480
I want to say you're in, like, the -- I don't
even know.

360
00:18:07,480 --> 00:18:09,650
Hundreds of kilometers at the closest.

361
00:18:09,650 --> 00:18:12,680
And then it's probably tens of thousands a
the furthest.

362
00:18:12,680 --> 00:18:13,680
Okay.

363
00:18:13,680 --> 00:18:16,471
I'm gonna go back and look at that, and then
everybody can laugh at me and say, "Yep, keep

364
00:18:16,471 --> 00:18:19,320
him doing podcasts and now actually running
pen to paper."

365
00:18:19,320 --> 00:18:21,960
[Laughs]

366
00:18:21,960 --> 00:18:24,050
It's not as close as Space Station.

367
00:18:24,050 --> 00:18:28,511
When it gets in that low orbit around the
moon -- I wish I still had Joe Dant.

368
00:18:28,511 --> 00:18:30,530
He was just in here with us with the town
hall.

369
00:18:30,530 --> 00:18:34,390
We got some really sharp people across this
center that know this stuff better.

370
00:18:34,390 --> 00:18:37,570
But I don't think it gets as close as Space
Station is to us today.

371
00:18:37,570 --> 00:18:40,480
So the lunar landers have to bring the capabilities
to actually descend.

372
00:18:40,480 --> 00:18:42,570
But, again, the gravity well is a lot different.

373
00:18:42,570 --> 00:18:46,540
It's not as strong, so it's easier to get
down, and they got to have the ascent capability

374
00:18:46,540 --> 00:18:47,540

to get back.

375
00:18:47,540 --> 00:18:51,440
So Gateway's kind of that safe haven for them
to get back to and be able to stage the crew,

376
00:18:51,440 --> 00:18:53,840
get back on Orion, and get back home.

377
00:18:53,840 --> 00:18:55,780
Mark was actually pretty close.

378
00:18:55,780 --> 00:19:00,150
We got a hold of Joe Dant, who is the ranking
member of the Gateway team representing safety

379
00:19:00,150 --> 00:19:04,800
and mission assurance, and he was able to
confirm that Gateway’s apolune, or furthest

380
00:19:04,800 --> 00:19:11,340
point from the moon, is 75,000 km and its
perilune, or closest point to the moon, is

381
00:19:11,340 --> 00:19:12,470
3,200 km.

382
00:19:12,470 --> 00:19:18,190
At its closest, that’s about the diameter
of the moon and at its farthest it is equivalent

383
00:19:18,190 --> 00:19:22,160
to about 20 percent of the distance between
the earth and the moon.

384
00:19:22,160 --> 00:19:28,040
And, so, why is this kind of an orbit better
than just kind of staying close to the moon

385

00:19:28,040 --> 00:19:30,630
and kind of keeping that tight orbit around
the moon?

386
00:19:30,630 --> 00:19:33,070
Because then it's easier for Orion to get
to.

387
00:19:33,070 --> 00:19:39,100
So, we don't have to have the tight tolerances
of getting Orion really close to the moon.

388
00:19:39,100 --> 00:19:43,720
You can go rendezvous with Gateway when it's
further away and it's not as hard to get into.

389
00:19:43,720 --> 00:19:47,180
Gives you a little bit less Delta-v to get
there, and then you ride this orbit -- you

390
00:19:47,180 --> 00:19:51,940
know, when you kind of switch planes a little
bit and ride this orbit in closer to the surface.

391
00:19:51,940 --> 00:19:55,550
And I know you mentioned 10 years for budget,
planning.

392
00:19:55,550 --> 00:19:56,760
That's a long time.

393
00:19:56,760 --> 00:20:02,100
[Chuckles] So, what's the projected timeline
for things coming together?

394
00:20:02,100 --> 00:20:06,760
And when you think about a 10-year plan, what
are you guys putting in that 10-year plan?

395
00:20:06,760 --> 00:20:10,520

So, kind of like you mentioned, the first element --

396
00:20:10,520 --> 00:20:14,320
For the record, I just got a couple of guys staring at each other, really, like...

397
00:20:14,320 --> 00:20:18,660
It's, like, changing every day, so we had to look at each other like, "Did anything

398
00:20:18,660 --> 00:20:19,660
happen this morning?

399
00:20:19,660 --> 00:20:20,660
Did it change again?”

400
00:20:20,660 --> 00:20:22,600
I mean, like, there's a manifest out there.

401
00:20:22,600 --> 00:20:25,690
So there's a high-level guidance as far as, like, "Here's Gateway.

402
00:20:25,690 --> 00:20:29,840
Here's the essential building blocks for that, and here's when we want to launch it and put

403
00:20:29,840 --> 00:20:30,840
it all together.”

404
00:20:30,840 --> 00:20:37,880
So, we have a rough master plan, per se, to build against, and that's what we're executing

405
00:20:37,880 --> 00:20:38,880
against.

406
00:20:38,880 --> 00:20:42,540

So as we're laying the details for each of
those components, we kind of fine tune it

407
00:20:42,540 --> 00:20:44,900
and say, "Oh, okay, I think this is much more
realistic.

408
00:20:44,900 --> 00:20:49,740
Oh, hey, I think this is not so realistic,"
or, "We'll need some more money to make this

409
00:20:49,740 --> 00:20:50,970
happen or not."

410
00:20:50,970 --> 00:20:55,940
So I think that's where this cycle all comes
together.

411
00:20:55,940 --> 00:21:00,090
We have the rough blueprints, but as we come
together with this project-management review,

412
00:21:00,090 --> 00:21:03,230
I think we'll see exactly, "Okay, this is
highly achievable.

413
00:21:03,230 --> 00:21:07,330
Okay, this, we need to carry a risk against,"
and we can work on that over the next couple

414
00:21:07,330 --> 00:21:08,330
years.

415
00:21:08,330 --> 00:21:13,070
I mean, Space Station took 10, 12 years for
assembly complete.

416
00:21:13,070 --> 00:21:16,770
You know, that first FGB in the node I think
went up in '98.

417
00:21:16,770 --> 00:21:20,750
Mr. Cabana, I hear him scratching his head,
wondering why I don't know the exact date.

418
00:21:20,750 --> 00:21:21,750
That was his mission.

419
00:21:21,750 --> 00:21:23,870
So, that was the first two pieces going together.

420
00:21:23,870 --> 00:21:27,830
The first crew went on orbit -- that was when
I first started working -- was in October

421
00:21:27,830 --> 00:21:29,280
2000.

422
00:21:29,280 --> 00:21:31,830
And it went through the end of the shuttle
program, was getting all the major pieces

423
00:21:31,830 --> 00:21:32,950
up there and assembling it.

424
00:21:32,950 --> 00:21:34,550
So, we're not a space station.

425
00:21:34,550 --> 00:21:35,550
I mentioned that before.

426
00:21:35,550 --> 00:21:36,550
It's something smaller.

427
00:21:36,550 --> 00:21:41,510
So it's like six launches, you know, to get
all the main pieces we need put together.

428

00:21:41,510 --> 00:21:45,210
So everything that we're looking at in this
10-year period is in the short term.

429
00:21:45,210 --> 00:21:48,460
It's accelerated a little bit to get boots
on the moon even sooner.

430
00:21:48,460 --> 00:21:49,460
[sound effect]

431
00:21:49,460 --> 00:21:53,400
And is the focus really on the moon at that
point, or is there opportunity to use Gateway

432
00:21:53,400 --> 00:21:54,590
for further exploration?

433
00:21:54,590 --> 00:21:57,680
So, the focus is definitely on the moon.

434
00:21:57,680 --> 00:22:03,320
But what Gateway is showing, it's that test
objective for us to start to understand what

435
00:22:03,320 --> 00:22:04,660
would it take to go to Mars.

436
00:22:04,660 --> 00:22:09,700
So the agency's looked at, for years, a deep-space
transport capability, which would have to

437
00:22:09,700 --> 00:22:13,600
be something small, to have habitable volume
for a crew, and have to have some kind of

438
00:22:13,600 --> 00:22:16,450
propulsion that could get them out there,
and you'd probably dock Orion to it.

439
00:22:16,450 --> 00:22:20,870
So Gateway is kind of a first analogue for
what that might become, and help us learn

440
00:22:20,870 --> 00:22:21,870
from that.

441
00:22:21,870 --> 00:22:24,830
Just like we learned in low Earth orbit Space
Station, now we're gonna go learn a quarter

442
00:22:24,830 --> 00:22:28,030
of a million miles away from home, something
a lot smaller, that camping trip, and start

443
00:22:28,030 --> 00:22:31,640
to understand how we can explore deep space.

444
00:22:31,640 --> 00:22:35,280
Will there be a regular human presence on
board like we see with Space Station today?

445
00:22:35,280 --> 00:22:36,280
So, no.

446
00:22:36,280 --> 00:22:39,830
So, Space Station, right, it's got 24/7 human
operations.

447
00:22:39,830 --> 00:22:41,260
Gateway is that camping trip.

448
00:22:41,260 --> 00:22:45,680
So we're setting it up to go out there for
a 30-day mission at first, and as we start

449
00:22:45,680 --> 00:22:51,680
to expand the habitable capabilities of the
modules, we can hopefully get to 60, 90 days,

450
00:22:51,680 --> 00:22:52,710
maybe got a little bit beyond.

451
00:22:52,710 --> 00:22:54,630
But we're trying to size it for that small.

452
00:22:54,630 --> 00:22:57,780
Go once a year, and go for 30, 60, 90 days.

453
00:22:57,780 --> 00:23:03,860
And, kind of, as the leader of the team here
at KSC, do you guys feel a significant weight

454
00:23:03,860 --> 00:23:07,040
this year with the 50th anniversary of our
first walk on the moon?

455
00:23:07,040 --> 00:23:11,260
So, I am blessed to have some amazing people
at the Space Center helping me, and I couldn't

456
00:23:11,260 --> 00:23:16,160
get there without all the expertise and all
the passion that's coming from this team.

457
00:23:16,160 --> 00:23:21,130
And it's definitely -- you know, we all look
around, a lot of us don't have memories of

458
00:23:21,130 --> 00:23:22,250
50 years ago, right?

459
00:23:22,250 --> 00:23:27,480
So we know we're standing on the shoulders
of giants, and it's pretty nostalgic and pretty

460
00:23:27,480 --> 00:23:30,270
emotional to think about the opportunity that's

before us.

461
00:23:30,270 --> 00:23:32,280
So we're all really excited about that.

462
00:23:32,280 --> 00:23:37,290
That definitely makes it much more impactful
and exciting.

463
00:23:37,290 --> 00:23:40,940
I've had the opportunity over the course of
my career to work a couple times where you

464
00:23:40,940 --> 00:23:44,170
get to put together something that people
don't think you're able to do.

465
00:23:44,170 --> 00:23:46,130
That's what our agency's founded on, right?

466
00:23:46,130 --> 00:23:48,890
I mean, this whole "Failure is not an option,"
right?

467
00:23:48,890 --> 00:23:50,600
That's what we're doing in Gateway.

468
00:23:50,600 --> 00:23:56,280
So, I mean, we are totally focused on trying
to mold the clay into something that's gonna

469
00:23:56,280 --> 00:24:00,600
be sustained excitement for the Space Coast,
for Florida, for our agency, and something

470
00:24:00,600 --> 00:24:02,700
that we're proud of going forward.

471
00:24:02,700 --> 00:24:06,360

And we're getting a little bit ahead of ourselves with this question, but thinking about the

472
00:24:06,360 --> 00:24:10,080
future, obviously thinking about -- whenever you start a new project, you're thinking about

473
00:24:10,080 --> 00:24:11,380
your end goal.

474
00:24:11,380 --> 00:24:12,380
What do you think it's gonna be like?

475
00:24:12,380 --> 00:24:16,150
How are you gonna be feeling when we start seeing pieces of Gateway fly, and when we

476
00:24:16,150 --> 00:24:17,780
turn on the lights?

477
00:24:17,780 --> 00:24:21,580
So, I've thought about this question a couple times as I go through it.

478
00:24:21,580 --> 00:24:24,740
You know, there's so many times where you lose sleep, where your head is just spinning

479
00:24:24,740 --> 00:24:28,800
trying to understand what information is being throw at you, and how you're gonna put it

480
00:24:28,800 --> 00:24:29,800
all together.

481
00:24:29,800 --> 00:24:34,630
And you get a little bit of reprieve when you step back and think about how awesome

482

00:24:34,630 --> 00:24:36,230
of a challenge this is we're doing.

483
00:24:36,230 --> 00:24:40,140
I have a feeling that when the day comes that
we first turn on the lights, I'm gonna be

484
00:24:40,140 --> 00:24:43,730
so buried in trying to figure out how we get
past the next problem that I'm not gonna be

485
00:24:43,730 --> 00:24:45,679
able to step back and enjoy it.

486
00:24:45,679 --> 00:24:49,280
But I hope someone pinches me and we do, because
we're going back to the moon.

487
00:24:49,280 --> 00:24:52,620
I mean, this is -- it's hard to even fathom
this.

488
00:24:52,620 --> 00:24:53,620
It's really amazing.

489
00:24:53,620 --> 00:24:56,570
I mean, this is the stuff that inspires the
next generation.

490
00:24:56,570 --> 00:24:57,980
And I was inspired by movies.

491
00:24:57,980 --> 00:25:02,730
And so many people find little things in science
fiction and turn it into science fact, and

492
00:25:02,730 --> 00:25:08,559
we're paving in that ground for our kindergartners
and our sixth graders and the child that's

493
00:25:08,559 --> 00:25:10,650
not born yet, which is really neat.

494
00:25:10,650 --> 00:25:13,350
All right, guys.

495
00:25:13,350 --> 00:25:16,550
Thank you so much, Johnny and Mark.

496
00:25:16,550 --> 00:25:18,200
Best of luck to you guys.

497
00:25:18,200 --> 00:25:20,250
Obviously the nation is watching.

498
00:25:20,250 --> 00:25:23,290
We're excited to see you guys succeed over
the next five years.

499
00:25:23,290 --> 00:25:24,290
Thank you for having us, Josh.

500
00:25:24,290 --> 00:25:25,290
This was awesome.

501
00:25:25,290 --> 00:25:28,490
We're very excited to be the voice of Kennedy
to try to bring this to bear, and it's gonna

502
00:25:28,490 --> 00:25:29,590
take the whole workforce.

503
00:25:29,590 --> 00:25:30,590
Yeah, me too.

504
00:25:30,590 --> 00:25:31,590
And thank you.

505
00:25:31,590 --> 00:25:35,940
It's a great time to be out here, to be part
of something so important, to have a little

506
00:25:35,940 --> 00:25:36,940
bit of a legacy.

507
00:25:36,940 --> 00:25:39,960
We got a design review to get to.

508
00:25:39,960 --> 00:25:43,550
I'm Joshua Santora, and that's our show.

509
00:25:43,550 --> 00:25:45,000
Thanks for stoppin' by the rocket ranch.

510
00:25:45,000 --> 00:25:49,000
And special thanks to our guests Mark Wiese
and Johnny Nguyen.

511
00:25:49,000 --> 00:25:55,610
To learn more about mankind's future exploration
of the Moon, visit nasa.gov/moontomars.

512
00:25:55,610 --> 00:25:59,500
And to learn more about everything going on
at the Kennedy Space Center, go to nasa.gov/kennedy.

513
00:25:59,500 --> 00:26:05,050
Check out NASA's other podcasts to learn
more about what's happening at all of our

514
00:26:05,050 --> 00:26:09,440
centers at nasa.gov/podcasts.

515
00:26:09,440 --> 00:26:14,180
A special shout-out to my colleague, Amanda
Griffin, our producer, John Sackman, our soundman

516
00:26:14,180 --> 00:26:17,040
Lorne Mathre, and editor Michelle Stone.

517
00:26:17,040 --> 00:26:21,470
And remember: on the rocket ranch… even
the sky isn't the limit.

518
00:26:21,470 --> 00:26:24,620
Did he say that with a smirk on his face?