
NASA

1
00:00:14,580 --> 00:00:11,960
[Music]

2
00:00:16,620 --> 00:00:14,590
from NASA's Kennedy Space Center in

3
00:00:19,410 --> 00:00:16,630
Florida you're watching a live coverage

4
00:00:22,319 --> 00:00:19,420
of the 15th SpaceX car resupply mission

5
00:00:24,029 --> 00:00:22,329
to the International Space Station hi

6
00:00:26,130 --> 00:00:24,039
I'm Stephanie Martin and thanks for

7
00:00:28,649 --> 00:00:26,140
joining us today's launch to the station

8
00:00:31,140 --> 00:00:28,659
is scheduled for 542 Eastern this

9
00:00:33,720 --> 00:00:31,150
morning from Space Launch Complex 40 on

10
00:00:36,180 --> 00:00:33,730
Cape Canaveral Air Force Station today

11
00:00:37,850 --> 00:00:36,190
we have team coverage from Dan Huot at

12
00:00:40,320 --> 00:00:37,860
station Mission Control in Houston

13
00:00:43,800 --> 00:00:40,330

Torrey McClendon and Mike Curie and

14
00:00:45,990 --> 00:00:43,810
NASA's control center SpaceX's Mike

15
00:00:47,820 --> 00:00:46,000
Hammersley directly from there Mission

16
00:00:49,980 --> 00:00:47,830
Control in Hawthorne California and

17
00:00:52,020 --> 00:00:49,990
Amanda Griffin is standing by with

18
00:00:54,900 --> 00:00:52,030
several experts who have hardware and

19
00:00:57,300 --> 00:00:54,910
experiments onboard the dragon today's

20
00:00:58,950 --> 00:00:57,310
launch will be SpaceX is 15th cargo

21
00:01:01,380 --> 00:00:58,960
resupply mission to the International

22
00:01:04,200 --> 00:01:01,390
Space Station and the second SpaceX

23
00:01:06,149 --> 00:01:04,210
resupply mission of the year the Dragon

24
00:01:08,550 --> 00:01:06,159
spacecraft in Falcon 9 rocket will

25
00:01:11,160 --> 00:01:08,560
deliver about 59 hundred pounds of

26
00:01:13,980 --> 00:01:11,170
research crew supplies and hardware to

27
00:01:16,500 --> 00:01:13,990
the orbiting laboratory today's launch

28
00:01:18,780 --> 00:01:16,510
window is instantaneous meaning SpaceX

29
00:01:20,760 --> 00:01:18,790
has only a single second to launch off

30
00:01:23,190 --> 00:01:20,770
Space Launch Complex 40 at Cape

31
00:01:26,520 --> 00:01:23,200
Canaveral Air Force Station adjacent to

32
00:01:29,070 --> 00:01:26,530
NASA's Kennedy Space Center we are now

33
00:01:30,960 --> 00:01:29,080
26 minutes away from launch let's check

34
00:01:34,289 --> 00:01:30,970
in with NASA's Torrey McClendon and Mike

35
00:01:36,149 --> 00:01:34,299
Curie thanks Stephanie I'm Tory

36
00:01:39,090 --> 00:01:36,159
McClendon and with me is Mike Curie

37
00:01:41,670 --> 00:01:39,100
good morning Tory we are looking forward

38
00:01:44,460 --> 00:01:41,680

to today's launch we're one day removed

39
00:01:46,830 --> 00:01:44,470
from an official full moon and the time

40
00:01:49,859 --> 00:01:46,840
of launch is 44 minutes away from

41
00:01:52,289 --> 00:01:49,869
sunrise here on Florida's Space Coast so

42
00:01:54,480 --> 00:01:52,299
I'm looking forward to a really probably

43
00:01:56,609 --> 00:01:54,490
spectacular view of the Falcon 9 and

44
00:01:58,350 --> 00:01:56,619
Dragon as they lift off the launch pad

45
00:02:00,210 --> 00:01:58,360
this morning sounds great we're

46
00:02:02,070 --> 00:02:00,220
definitely looking forward to it and we

47
00:02:04,230 --> 00:02:02,080
are actually here live at hangar AE on

48
00:02:05,730 --> 00:02:04,240
Cape Canaveral Air Force Station which

49
00:02:08,070 --> 00:02:05,740
is not far from the launch site of

50
00:02:10,259 --> 00:02:08,080
today's Falcon 9 rocket that will lift

51
00:02:11,910 --> 00:02:10,269
off from Space Launch Complex 40 that's

52
00:02:13,589 --> 00:02:11,920
right and you're looking at a live shot

53
00:02:17,700 --> 00:02:13,599
of the launch site with the Falcon 9

54
00:02:19,230 --> 00:02:17,710
rocket with gaseous oxygen venting

55
00:02:22,920 --> 00:02:19,240
as the rocket is being prepared for

56
00:02:24,810 --> 00:02:22,930
launch at 5:42 and 42 seconds a.m.

57
00:02:27,060 --> 00:02:24,820
Eastern Time as Stephanie was mentioning

58
00:02:30,090 --> 00:02:27,070
it's an instantaneous launch window so

59
00:02:32,550 --> 00:02:30,100
42 seconds after 542 a.m. will be the

60
00:02:34,260 --> 00:02:32,560
time of launch this morning at that time

61
00:02:36,750 --> 00:02:34,270
the International Space Station will be

62
00:02:39,900 --> 00:02:36,760
over the South Pacific southeast of New

63
00:02:41,730 --> 00:02:39,910

Zealand at an altitude of 258 statute

64
00:02:43,560 --> 00:02:41,740
miles that's right and the launch today

65
00:02:45,930 --> 00:02:43,570
would have the Dragon spacecraft that is

66
00:02:48,150 --> 00:02:45,940
filled with fifty nine hundred pounds of

67
00:02:49,980 --> 00:02:48,160
research crew supplies and vehicle

68
00:02:51,810 --> 00:02:49,990
hardware being captured by the

69
00:02:55,290 --> 00:02:51,820
International Space Station on Monday

70
00:02:56,790 --> 00:02:55,300
July 2nd at 7:00 a.m. Eastern the dragon

71
00:02:59,340 --> 00:02:56,800
would then connect to the station's

72
00:03:01,680 --> 00:02:59,350
harmony module launch team has received

73
00:03:04,920 --> 00:03:01,690
a weather briefing from US Air Force

74
00:03:06,480 --> 00:03:04,930
45th space weather squadron Officer Mike

75
00:03:09,720 --> 00:03:06,490
michaleen and he's our launch weather

76
00:03:12,090 --> 00:03:09,730
officer he says that we can expect good

77
00:03:14,610 --> 00:03:12,100
weather today probability of violation

78
00:03:18,030 --> 00:03:14,620
is only 10 percent that means we're 90

79
00:03:20,180 --> 00:03:18,040
percent favorable light winds 8 to 10

80
00:03:22,110 --> 00:03:20,190
miles per hour from the southwest

81
00:03:24,420 --> 00:03:22,120
temperature at the time of liftoff

82
00:03:26,310 --> 00:03:24,430
expected to be 76 degrees the only

83
00:03:29,070 --> 00:03:26,320
concerns the cumulus and anvil cloud

84
00:03:31,560 --> 00:03:29,080
rules but again at this time Mike

85
00:03:34,860 --> 00:03:31,570
MacLean is saying that we have thin and

86
00:03:36,990 --> 00:03:34,870
high cirrus clouds there's really not

87
00:03:38,520 --> 00:03:37,000
much of a probability of anything

88
00:03:40,350 --> 00:03:38,530

happening between now and the time of

89
00:03:41,670 --> 00:03:40,360
launch so it looks like the weather is

90
00:03:44,280 --> 00:03:41,680
not going to be a concern for us today

91
00:03:46,170 --> 00:03:44,290
Tory sounds great teams are also working

92
00:03:48,420 --> 00:03:46,180
through the necessary procedures to

93
00:03:50,160 --> 00:03:48,430
prepare the Falcon 9 rocket and the

94
00:03:52,620 --> 00:03:50,170
Dragon spacecraft for launch and that

95
00:03:54,480 --> 00:03:52,630
includes loading fuel into both stages

96
00:03:57,360 --> 00:03:54,490
of the rocket and making sure that all

97
00:03:59,070 --> 00:03:57,370
systems are properly checking out so far

98
00:04:02,160 --> 00:03:59,080
the countdown has progressed toward the

99
00:04:05,670 --> 00:04:02,170
timeline loading of rp1 fuel began at

100
00:04:08,790 --> 00:04:05,680
t-minus one hour and 10 minutes at 4:32

101
00:04:12,600 --> 00:04:08,800
a.m. loading of liquid oxygen began at

102
00:04:15,420 --> 00:04:12,610
t-minus 35 minutes at 5:07 a.m. so at

103
00:04:18,729 --> 00:04:15,430
t-minus 23 minutes 25 seconds and

104
00:04:22,150 --> 00:04:18,739
Counting status from Falcon

105
00:04:24,129 --> 00:04:22,160
back to you thanks Tori and Mike NASA is

106
00:04:26,409 --> 00:04:24,139
working with two American companies to

107
00:04:28,900 --> 00:04:26,419
deliver cargo to the International Space

108
00:04:31,089 --> 00:04:28,910
Station joining us now from Hawthorne

109
00:04:33,129 --> 00:04:31,099
California is SpaceX engineer Michael

110
00:04:36,279 --> 00:04:33,139
Hammersley Michael can you tell us a bit

111
00:04:38,260 --> 00:04:36,289
more about SpaceX yeah absolutely

112
00:04:40,089 --> 00:04:38,270
thanks Stephanie we're really excited

113
00:04:42,969 --> 00:04:40,099

for today's launch this will be SpaceX

114
00:04:45,460 --> 00:04:42,979
is 12th launch of 2018 and the third

115
00:04:47,110 --> 00:04:45,470
nasa commercial resupply mission to use

116
00:04:50,650 --> 00:04:47,120
both a flight proven rocket and

117
00:04:52,749 --> 00:04:50,660
spacecraft CRS 15 will also mark SpaceX

118
00:04:55,719 --> 00:04:52,759
is ninth flight proven booster to fly

119
00:04:57,520 --> 00:04:55,729
this year and the 14th to date that

120
00:04:59,230 --> 00:04:57,530
means SpaceX has actually flown more

121
00:05:01,089 --> 00:04:59,240
flight proven rockets this year than new

122
00:05:03,909 --> 00:05:01,099
vehicles and we expect that trend to

123
00:05:05,920 --> 00:05:03,919
continue into the future Falcon 9's

124
00:05:07,930 --> 00:05:05,930
first stage for this mission previously

125
00:05:09,520 --> 00:05:07,940
supported the test mission in April of

126
00:05:11,170 --> 00:05:09,530
this year which makes it the quickest

127
00:05:13,180 --> 00:05:11,180
turnaround time for a flight proven

128
00:05:15,850 --> 00:05:13,190
booster so far it at two and a bit

129
00:05:18,010 --> 00:05:15,860
months CRS 15s Dragon spacecraft

130
00:05:20,439 --> 00:05:18,020
previously supported the CRS nine

131
00:05:23,230 --> 00:05:20,449
mission in July of 2016

132
00:05:25,149 --> 00:05:23,240
both Falcon 9 and Dragon were designed

133
00:05:26,589 --> 00:05:25,159
with reef light in mind so the vehicle

134
00:05:28,540 --> 00:05:26,599
hardware is built to support multiple

135
00:05:30,640 --> 00:05:28,550
missions with minimal refurbishment in

136
00:05:32,560 --> 00:05:30,650
between for this mission we've

137
00:05:34,480 --> 00:05:32,570
refurbished dragon's heat shield and

138
00:05:37,089 --> 00:05:34,490

thermal protection system on dragons

139
00:05:39,370 --> 00:05:37,099
exterior we also replaced the passive

140
00:05:41,469 --> 00:05:39,380
common berthing mechanism which is the

141
00:05:42,939 --> 00:05:41,479
ring on top of dragon that connects to

142
00:05:45,070 --> 00:05:42,949
the International Space Station

143
00:05:47,020 --> 00:05:45,080
our dragon spacecraft has been flying

144
00:05:48,430 --> 00:05:47,030
for six years now and today it's the

145
00:05:51,040 --> 00:05:48,440
only vehicle flying that can deliver

146
00:05:53,469 --> 00:05:51,050
significant cargo both to and from the

147
00:05:55,390 --> 00:05:53,479
International Space Station in 2010

148
00:05:57,249 --> 00:05:55,400
SpaceX became the first private company

149
00:06:00,310 --> 00:05:57,259
to send a spacecraft to orbit and return

150
00:06:01,600 --> 00:06:00,320
to Earth two years later in 2012 dragon

151
00:06:03,430 --> 00:06:01,610
became the first privately developed

152
00:06:05,620 --> 00:06:03,440
spacecraft to visit the international

153
00:06:08,560 --> 00:06:05,630
space station since then we've made a

154
00:06:10,360 --> 00:06:08,570
total of 13 trips to the ISS and were

155
00:06:13,540 --> 00:06:10,370
under contract with NASA for a total of

156
00:06:15,279 --> 00:06:13,550
26 cargo resupply missions now we're

157
00:06:17,409 --> 00:06:15,289
currently flying only cargo missions but

158
00:06:20,170 --> 00:06:17,419
will soon fly humans to space as part of

159
00:06:21,850 --> 00:06:20,180
NASA's Commercial Crew program SpaceX is

160
00:06:23,560 --> 00:06:21,860
upgrading its Dragon spacecraft to

161
00:06:24,610 --> 00:06:23,570
support human spaceflight with its first

162
00:06:27,070 --> 00:06:24,620
demonstration mission

163
00:06:29,460 --> 00:06:27,080

targeted for later this year and back to

164
00:06:32,530 --> 00:06:29,470
you Stephanie

165
00:06:34,300 --> 00:06:32,540
thanks Michael research conducted aboard

166
00:06:36,310 --> 00:06:34,310
the space station is helping to advance

167
00:06:39,490 --> 00:06:36,320
scientific knowledge across multiple

168
00:06:42,430 --> 00:06:39,500
disciplines such as earth space physical

169
00:06:44,320 --> 00:06:42,440
and biological sciences and all of these

170
00:06:46,930 --> 00:06:44,330
studies are designed to benefit us here

171
00:06:48,970 --> 00:06:46,940
on earth in fact a new cancer treatment

172
00:06:51,510 --> 00:06:48,980
study is among the many research

173
00:06:53,890 --> 00:06:51,520
investigations launching today

174
00:06:56,950 --> 00:06:53,900
approximately 200 million people

175
00:07:00,280 --> 00:06:56,960
globally and 16 million in the u.s. are

176
00:07:02,530 --> 00:07:00,290
currently living with cancer the ng acts

177
00:07:05,440 --> 00:07:02,540
cancer therapy study aims to improve the

178
00:07:08,110 --> 00:07:05,450
understanding of endothelial cells that

179
00:07:10,090 --> 00:07:08,120
line the walls of blood vessels growing

180
00:07:12,550 --> 00:07:10,100
these cells in microgravity aboard the

181
00:07:15,340 --> 00:07:12,560
station could create an important model

182
00:07:18,250 --> 00:07:15,350
for evaluate evaluating vascular

183
00:07:20,800 --> 00:07:18,260
targeted drugs like ng x which could

184
00:07:24,490 --> 00:07:20,810
target both tumor cells and tumor blood

185
00:07:26,650 --> 00:07:24,500
vessels with lower toxicity levels the

186
00:07:28,420 --> 00:07:26,660
space station also serves as the world's

187
00:07:30,910 --> 00:07:28,430
leading laboratory where cutting-edge

188
00:07:32,320 --> 00:07:30,920

research and technology continues to

189
00:07:33,280 --> 00:07:32,330
bring us closer to deep-space

190
00:07:35,530 --> 00:07:33,290
exploration

191
00:07:39,250 --> 00:07:35,540
meaning sending astronauts back to the

192
00:07:41,320 --> 00:07:39,260
moon and even to Mars from robotic arms

193
00:07:42,910 --> 00:07:41,330
that grapple approaching spacecraft to

194
00:07:45,490 --> 00:07:42,920
artificial intelligence working

195
00:07:48,010 --> 00:07:45,500
alongside our crew members robotics are

196
00:07:49,630 --> 00:07:48,020
an important aspect Alif about living

197
00:07:51,790 --> 00:07:49,640
aboard the International Space Station

198
00:07:54,430 --> 00:07:51,800
our Amanda Griffin is joining us now

199
00:07:55,840 --> 00:07:54,440
with more thanks Stephanie and I can

200
00:07:57,610 --> 00:07:55,850
definitely say it's brighter in your

201
00:07:59,230 --> 00:07:57,620
studio than it is out here this morning

202
00:08:01,270 --> 00:07:59,240
but that darkness should make for a

203
00:08:03,190 --> 00:08:01,280
beautiful launch what's great about

204
00:08:05,860 --> 00:08:03,200
today is that we are seeing science

205
00:08:07,510 --> 00:08:05,870
fiction turn into reality many of our

206
00:08:09,640 --> 00:08:07,520
viewers may have heard of Robonaut our

207
00:08:10,300 --> 00:08:09,650
Robosapien who recently spent time on

208
00:08:12,070 --> 00:08:10,310
the space station

209
00:08:16,530 --> 00:08:12,080
but today we're sending a new crew

210
00:08:21,220 --> 00:08:19,030
built for the German Aerospace Center

211
00:08:22,750 --> 00:08:21,230
Simon stands for crew interactive mobile

212
00:08:24,280 --> 00:08:22,760
companion and he will be the first

213
00:08:26,950 --> 00:08:24,290

flying autonomous astronaut assistant

214
00:08:28,960 --> 00:08:26,960
featuring artificial intelligence the

215
00:08:31,420 --> 00:08:28,970
size of a medicine ball Simon is able to

216
00:08:34,719 --> 00:08:31,430
see here understand and even interpret

217
00:08:36,850 --> 00:08:34,729
moods and feelings of the human crew and

218
00:08:39,880 --> 00:08:36,860
another robotic element going up to

219
00:08:41,740 --> 00:08:39,890
station today is for the the crew for

220
00:08:42,790 --> 00:08:41,750
the robotic arm for the Canada arm with

221
00:08:44,440 --> 00:08:42,800
me today

222
00:08:46,540 --> 00:08:44,450
is Ken podlaski from Canadian Space

223
00:08:47,980 --> 00:08:46,550
Agency so Ken thanks for joining us can

224
00:08:49,240 --> 00:08:47,990
you tell us a little bit about this

225
00:08:50,860 --> 00:08:49,250
piece that's going up and what it does

226
00:08:52,690 --> 00:08:50,870
so what we're going to be flying on

227
00:08:54,850 --> 00:08:52,700
SpaceX 15 is the latching end effector

228
00:08:57,160 --> 00:08:54,860
so the latching end effector the league

229
00:08:59,920 --> 00:08:57,170
are basically the hands of the canadarm2

230
00:09:01,930 --> 00:08:59,930
so when SpaceX 15 arrives to space

231
00:09:03,370 --> 00:09:01,940
station on Monday it's going to match

232
00:09:04,990 --> 00:09:03,380
speed with the International Space

233
00:09:06,069 --> 00:09:05,000
Station and then what we're gonna do is

234
00:09:08,019 --> 00:09:06,079
the crew is going to reach out with the

235
00:09:09,340 --> 00:09:08,029
canadarm2 using the latching end

236
00:09:10,690 --> 00:09:09,350
effector at its tip and we're actually

237
00:09:12,190 --> 00:09:10,700
going to grapple that vehicle and then

238
00:09:14,139 --> 00:09:12,200

attach it to the space station and can

239
00:09:15,490 --> 00:09:14,149
you guys grapple any vehicle we can

240
00:09:17,710 --> 00:09:15,500
grapple all the vehicles that were

241
00:09:19,360 --> 00:09:17,720
designed to do that we were designed to

242
00:09:21,430 --> 00:09:19,370
do it with four so today we do that for

243
00:09:22,660 --> 00:09:21,440
SpaceX we also do that for the orbital

244
00:09:24,400 --> 00:09:22,670
vehicle and we also do that for the

245
00:09:27,550 --> 00:09:24,410
Japanese h2 Transfer Vehicle as well

246
00:09:28,569 --> 00:09:27,560
okay and in the future what other are

247
00:09:30,579 --> 00:09:28,579
there vehicles in the future that you

248
00:09:32,139 --> 00:09:30,589
guys are gonna be prepared for well NASA

249
00:09:34,300 --> 00:09:32,149
is gonna go ahead with its next

250
00:09:35,980 --> 00:09:34,310
commercial contracts which are going to

251
00:09:36,910 --> 00:09:35,990
include Sierra Nevada so Sierra Nevada

252
00:09:37,930 --> 00:09:36,920
is going to be producing a new vehicle

253
00:09:39,430 --> 00:09:37,940
as well that's me flying the

254
00:09:40,930 --> 00:09:39,440
International Space Station so we're

255
00:09:42,310 --> 00:09:40,940
anticipating having to do free flyer

256
00:09:43,750 --> 00:09:42,320
captures of that vehicle as well with

257
00:09:44,889 --> 00:09:43,760
Canada arm too right and we've been

258
00:09:47,590 --> 00:09:44,899
sending these vehicles for quite some

259
00:09:50,319 --> 00:09:47,600
time so why are we replacing it now well

260
00:09:52,030 --> 00:09:50,329
we've gotten about 17 years of good

261
00:09:54,069 --> 00:09:52,040
operations out of Canada arm - and it's

262
00:09:55,840 --> 00:09:54,079
been going very very well last year back

263
00:09:57,699 --> 00:09:55,850

in October and then earlier this year in

264
00:09:59,699 --> 00:09:57,709
February we actually took the steps to

265
00:10:02,620 --> 00:09:59,709
change out the hands on the Canada arm -

266
00:10:04,060 --> 00:10:02,630
we had we were watching performance

267
00:10:05,590 --> 00:10:04,070
things we're getting things were getting

268
00:10:07,090 --> 00:10:05,600
a little bit arthritic in terms of those

269
00:10:08,560 --> 00:10:07,100
hands and they were starting to act up a

270
00:10:10,510 --> 00:10:08,570
little bit so we made a decision to

271
00:10:12,040 --> 00:10:10,520
change them out we've got two fully

272
00:10:13,480 --> 00:10:12,050
functional latching end effectors on the

273
00:10:15,040 --> 00:10:13,490
Canada arm - now so the arm is

274
00:10:16,120 --> 00:10:15,050
completely the arm and its hands are

275
00:10:18,639 --> 00:10:16,130
completely a functional and operational

276
00:10:20,470 --> 00:10:18,649
now the the latching end effector that

277
00:10:22,480 --> 00:10:20,480
we're launching today is actually going

278
00:10:24,280 --> 00:10:22,490
to go up to be the new spare available

279
00:10:25,449 --> 00:10:24,290
in the space station and I understand

280
00:10:26,380 --> 00:10:25,459
there's another one coming back down

281
00:10:27,970 --> 00:10:26,390
that's right

282
00:10:29,380 --> 00:10:27,980
so the the one one of the ones that we

283
00:10:31,180 --> 00:10:29,390
changed out actually had a failed

284
00:10:32,620 --> 00:10:31,190
component in it and we're actually going

285
00:10:33,850 --> 00:10:32,630
to be loading that inside the Dragon

286
00:10:35,079 --> 00:10:33,860
capsule dragon capsules going to come

287
00:10:36,340 --> 00:10:35,089
back down to earth and then we're gonna

288
00:10:39,280 --> 00:10:36,350

ship that hardware back to our prime

289
00:10:40,449 --> 00:10:39,290
contractor MDA in Ontario Canada they're

290
00:10:41,740 --> 00:10:40,459
gonna refurbish that and that'll be

291
00:10:43,210 --> 00:10:41,750
another subsequent spare that will be

292
00:10:44,710 --> 00:10:43,220
available to keep the space robotics

293
00:10:46,090 --> 00:10:44,720
running on space station perfect as

294
00:10:47,590 --> 00:10:46,100
everyone knows in space you have ten

295
00:10:49,430 --> 00:10:47,600
redundancies in place so we appreciate

296
00:10:51,199 --> 00:10:49,440
you guys tuning that up for us

297
00:10:54,980 --> 00:10:51,209
very welcome to do it things back to you

298
00:10:56,660 --> 00:10:54,990
Stephanie thanks Amanda

299
00:10:58,760 --> 00:10:56,670
among the teams supporting today's

300
00:11:01,190 --> 00:10:58,770
launch as NASA's Johnson Space Center in

301
00:11:02,680 --> 00:11:01,200
Houston which is home to Mission Control

302
00:11:07,150 --> 00:11:02,690
for the International Space Station

303
00:11:09,530 --> 00:11:07,160
joining us now is NASA's Dan Huot Dan

304
00:11:11,780 --> 00:11:09,540
hey Stephanie and good morning everybody

305
00:11:13,519 --> 00:11:11,790
and welcome to Mission Control Houston

306
00:11:16,610 --> 00:11:13,529
we're in the International Space Station

307
00:11:18,889 --> 00:11:16,620
flight control room where the orbit one

308
00:11:20,480 --> 00:11:18,899
team is currently on console they're led

309
00:11:21,980 --> 00:11:20,490
today by Mary Lawrence they're

310
00:11:23,389 --> 00:11:21,990
supporting the crew onboard the

311
00:11:24,829 --> 00:11:23,399
International Space Station and they're

312
00:11:27,110 --> 00:11:24,839
also going to be watching along with

313
00:11:29,269 --> 00:11:27,120

today's launch they're supporting the

314
00:11:30,320 --> 00:11:29,279
day-to-day operations here in this room

315
00:11:32,900 --> 00:11:30,330
but they're also going to be working

316
00:11:36,110 --> 00:11:32,910
with flight controllers from SpaceX out

317
00:11:37,639 --> 00:11:36,120
at Hawthorne once Dragon is in orbit and

318
00:11:40,370 --> 00:11:37,649
approaching the International Space

319
00:11:42,590 --> 00:11:40,380
Station the crew on orbit right now is

320
00:11:44,690 --> 00:11:42,600
the crew of expedition 56 it's a

321
00:11:47,060 --> 00:11:44,700
six-person contingent from countries all

322
00:11:49,130 --> 00:11:47,070
around the globe they're led right now

323
00:11:50,720 --> 00:11:49,140
by astronaut drew Foyle you can see him

324
00:11:53,180 --> 00:11:50,730
live right here on the International

325
00:11:56,180 --> 00:11:53,190
Space Station he's joined on board by

326
00:11:57,860 --> 00:11:56,190
NASA astronauts Serena aunon Chancellor

327
00:12:00,860 --> 00:11:57,870
and Ricky Arnold two russian cosmonauts

328
00:12:04,240 --> 00:12:00,870
oleg artemiev and sergei prokofiev and

329
00:12:07,190 --> 00:12:04,250
then german astronaut alexander gerst

330
00:12:08,690 --> 00:12:07,200
once dragon actually arrives at the

331
00:12:10,760 --> 00:12:08,700
International Space Station there will

332
00:12:12,740 --> 00:12:10,770
be the crew that reaches out with the

333
00:12:14,930 --> 00:12:12,750
station's robotic arm and captures the

334
00:12:17,060 --> 00:12:14,940
vehicle as it hovers just about 30 feet

335
00:12:18,920 --> 00:12:17,070
away from the station ricky arnold is

336
00:12:20,990 --> 00:12:18,930
going to be the prime so he's going to

337
00:12:22,670 --> 00:12:21,000
be the one operating the robotic arm and

338
00:12:25,069 --> 00:12:22,680

then drew faisal is going to be backing

339
00:12:27,290 --> 00:12:25,079
him up providing any support and talking

340
00:12:30,500 --> 00:12:27,300
with the teams back down here on the

341
00:12:32,630 --> 00:12:30,510
ground the crews been training for this

342
00:12:34,519 --> 00:12:32,640
capture operation for the last couple of

343
00:12:36,470 --> 00:12:34,529
weeks also getting all the systems

344
00:12:38,389 --> 00:12:36,480
onboard the station ready to receive

345
00:12:40,699 --> 00:12:38,399
dragon because once it gets there

346
00:12:43,460 --> 00:12:40,709
becomes very very busy for these crew

347
00:12:45,440 --> 00:12:43,470
members onboard not only capturing the

348
00:12:47,480 --> 00:12:45,450
vehicle but once it gets attached and

349
00:12:49,550 --> 00:12:47,490
they get the hatch open they go straight

350
00:12:51,829 --> 00:12:49,560
into executing a lot of that science

351
00:12:53,990 --> 00:12:51,839
that's on board and also unloading the

352
00:12:56,329 --> 00:12:54,000
thousands of pounds of stuff that dragon

353
00:12:59,060 --> 00:12:56,339
is delivering to them it'll be a very

354
00:13:01,010 --> 00:12:59,070
busy four weeks of science operations in

355
00:13:02,750 --> 00:13:01,020
cargo as they offload everything

356
00:13:04,850 --> 00:13:02,760
executes the science and then put it

357
00:13:07,070 --> 00:13:04,860
back on for Dragon to come home just a

358
00:13:09,620 --> 00:13:07,080
little under a month later it'll

359
00:13:11,570 --> 00:13:09,630
actually also be the second US

360
00:13:14,210 --> 00:13:11,580
commercial cargo vehicle docked to the

361
00:13:16,550 --> 00:13:14,220
station as right now there is a north of

362
00:13:18,650 --> 00:13:16,560
Grumman Cygnus vehicle still docked to

363
00:13:21,170 --> 00:13:18,660

the earth-facing side of the unity

364
00:13:22,520 --> 00:13:21,180
module but for now everybody here in

365
00:13:24,440 --> 00:13:22,530
Mission Control Houston gonna follow

366
00:13:26,420 --> 00:13:24,450
along with the launch very excited to

367
00:13:28,250 --> 00:13:26,430
see a liftoff today and to see a dragon

368
00:13:30,680 --> 00:13:28,260
arrive at the station in just a couple

369
00:13:32,780 --> 00:13:30,690
of days for that we'll head it over back

370
00:13:38,180 --> 00:13:32,790
to you at Kennedy Stephanie everybody's

371
00:13:40,790 --> 00:13:38,190
real excited and go dragon thanks Dan at

372
00:13:42,380 --> 00:13:40,800
t-minus 13 minutes and Counting let's go

373
00:13:43,940 --> 00:13:42,390
back to Torian Mike in the control

374
00:13:47,570 --> 00:13:43,950
center for an update on how things are

375
00:13:49,790 --> 00:13:47,580
progressing thanks Stephanie as you just

376
00:13:51,340 --> 00:13:49,800
heard we are at t minus 13 minutes and

377
00:13:54,950 --> 00:13:51,350
Counting and we're continuing to monitor

378
00:13:57,230 --> 00:13:54,960
today's launch countdown this the SpaceX

379
00:14:00,260 --> 00:13:57,240
Falcon 9 rocket stands poised to take

380
00:14:01,610 --> 00:14:00,270
off with the Dragon spacecraft filled

381
00:14:04,160 --> 00:14:01,620
with science and supplies to the

382
00:14:05,840 --> 00:14:04,170
International Space Station and as Dan

383
00:14:07,910 --> 00:14:05,850
Huot just said the crew aboard the

384
00:14:10,070 --> 00:14:07,920
International Space Station awaits the

385
00:14:11,780 --> 00:14:10,080
arrival of Dragon and meanwhile teams

386
00:14:12,800 --> 00:14:11,790
here on earth are working hard today to

387
00:14:14,960 --> 00:14:12,810
make that happen

388
00:14:17,690 --> 00:14:14,970

adjacent to NASA's Kennedy Space Center

389
00:14:19,580 --> 00:14:17,700
at Cape Canaveral Air Force Station the

390
00:14:21,740 --> 00:14:19,590
SpaceX launch control center team is

391
00:14:23,620 --> 00:14:21,750
working with its partners at SpaceX

392
00:14:26,240 --> 00:14:23,630
Mission Control in Hawthorne California

393
00:14:28,240 --> 00:14:26,250
and with the International Space Station

394
00:14:31,160 --> 00:14:28,250
Mission Control Center in Houston Texas

395
00:14:33,110 --> 00:14:31,170
to oversee today's launch of the Falcon

396
00:14:35,270 --> 00:14:33,120
9 rocket it truly is a team effort

397
00:14:38,090 --> 00:14:35,280
spanning the u.s. from the east to the

398
00:14:40,100 --> 00:14:38,100
west coast it certainly is and the US

399
00:14:43,040 --> 00:14:40,110
Air Force also monitors the eastern

400
00:14:44,390 --> 00:14:43,050
range or simply called the range to make

401
00:14:46,940 --> 00:14:44,400
sure that commercial and personal

402
00:14:49,340 --> 00:14:46,950
aircraft are clear of the any restricted

403
00:14:50,810 --> 00:14:49,350
areas and that the waters within the

404
00:14:53,360 --> 00:14:50,820
launch safety zone are clear of any

405
00:14:55,700 --> 00:14:53,370
boats each mission the range reports

406
00:14:58,760 --> 00:14:55,710
Andy colas which stands for collision

407
00:14:59,870 --> 00:14:58,770
avoidance with objects in space so far

408
00:15:01,370 --> 00:14:59,880
missions

409
00:15:03,440 --> 00:15:01,380
excuse me milestones that have already

410
00:15:05,060 --> 00:15:03,450
been performed include collision

411
00:15:07,400 --> 00:15:05,070
avoidance coordination with the eastern

412
00:15:10,310 --> 00:15:07,410
range a checkout of the autonomous

413
00:15:12,350 --> 00:15:10,320

flight termination system and the

414
00:15:13,400 --> 00:15:12,360
eastern range confirms that it is go for

415
00:15:15,560 --> 00:15:13,410
launch of the Falcon 9

416
00:15:16,580 --> 00:15:15,570
that's right Torrey and the 45th Space

417
00:15:18,650 --> 00:15:16,590
Wing also keeps

418
00:15:20,420 --> 00:15:18,660
on the weather conditions and launch

419
00:15:23,300 --> 00:15:20,430
weather officer Mike Mackel Ihnen

420
00:15:26,450 --> 00:15:23,310
continues to hold a 90% chance of

421
00:15:31,190 --> 00:15:26,460
favorable weather for liftoff today at 5

422
00:15:33,950 --> 00:15:31,200
42 42 am the only possibility is some

423
00:15:35,750 --> 00:15:33,960
clouds leftover from thunderstorms last

424
00:15:36,920 --> 00:15:35,760
night but at this point that's not

425
00:15:38,960 --> 00:15:36,930
looking like they're gonna present a

426
00:15:40,370 --> 00:15:38,970
problem for us we are keeping our

427
00:15:42,560 --> 00:15:40,380
fingers crossed and we'll continue to

428
00:15:45,350 --> 00:15:42,570
monitor the launch countdown activities

429
00:15:46,880 --> 00:15:45,360
for SpaceX CRS 15 the flight to the

430
00:15:49,220 --> 00:15:46,890
International Space Station which is the

431
00:15:51,530 --> 00:15:49,230
third SpaceX resupply mission for NASA

432
00:15:54,440 --> 00:15:51,540
to use both a previously flown

433
00:15:57,770 --> 00:15:54,450
spacecraft and a booster and with that

434
00:15:59,630 --> 00:15:57,780
we will go back to you Stephanie thanks

435
00:16:01,670 --> 00:15:59,640
to Orion Mike we would like to welcome

436
00:16:03,950 --> 00:16:01,680
those of you just joining us on NASA's

437
00:16:06,590 --> 00:16:03,960
social media platforms I'm Stephanie

438
00:16:08,570 --> 00:16:06,600

Martin the SpaceX Falcon 9 rocket and

439
00:16:12,160 --> 00:16:08,580
Dragon spacecraft are poised to lift off

440
00:16:14,810 --> 00:16:12,170
at 542 a.m. this morning

441
00:16:17,000 --> 00:16:14,820
today's launch will be an instantaneous

442
00:16:19,550 --> 00:16:17,010
launch window meeting SpaceX has only a

443
00:16:21,920 --> 00:16:19,560
single second to launch this will be

444
00:16:24,470 --> 00:16:21,930
SpaceX's second cargo resupply mission

445
00:16:27,260 --> 00:16:24,480
of the year the Dragon spacecraft and

446
00:16:29,960 --> 00:16:27,270
Falcon 9 will deliver 59 hundred pounds

447
00:16:34,250 --> 00:16:29,970
of crew research supplies and other

448
00:16:35,840 --> 00:16:34,260
hardware to the orbiting laboratory the

449
00:16:38,270 --> 00:16:35,850
Dragon spacecraft launching on today's

450
00:16:41,480 --> 00:16:38,280
mission was previously flown on SpaceX

451
00:16:44,150 --> 00:16:41,490
is ninth cargo resupply mission and the

452
00:16:46,310 --> 00:16:44,160
Falcon 9 launch NASA's exoplanet hunter

453
00:16:52,150 --> 00:16:46,320
spacecraft known as Tess earlier this

454
00:16:57,160 --> 00:16:54,740
so for now let's go back to Amanda

455
00:17:00,020 --> 00:16:57,170
Griffin she's standing out in the field

456
00:17:02,240 --> 00:17:00,030
thanks Stephanie so people are starting

457
00:17:05,240 --> 00:17:02,250
to gather out here we can't wait for

458
00:17:07,370 --> 00:17:05,250
this Falcon 9 to light up this early

459
00:17:09,620 --> 00:17:07,380
morning sky out here and there are quite

460
00:17:11,990 --> 00:17:09,630
a few plan experiments going to Space

461
00:17:16,340 --> 00:17:12,000
Station today and among them is space

462
00:17:18,260 --> 00:17:16,350
algae growing algae in space may help to

463
00:17:20,390 --> 00:17:18,270

recycle carbon dioxide while providing

464
00:17:22,490 --> 00:17:20,400
food for long-duration missions many

465
00:17:23,870 --> 00:17:22,500
species of algae are rich in proteins

466
00:17:26,210 --> 00:17:23,880
and oil it's important for human

467
00:17:27,949 --> 00:17:26,220
nutrition antioxidants from algae may

468
00:17:29,750 --> 00:17:27,959
also help mitigate harmful effects of

469
00:17:32,090 --> 00:17:29,760
microgravity and cosmic radiation during

470
00:17:33,950 --> 00:17:32,100
spaceflight while we want to understand

471
00:17:35,720 --> 00:17:33,960
how plants grow in space we also know

472
00:17:37,730 --> 00:17:35,730
how plants here on earth are responding

473
00:17:39,290 --> 00:17:37,740
to ever warming conditions as Earth's

474
00:17:40,430 --> 00:17:39,300
climate changes some regions are

475
00:17:41,840 --> 00:17:40,440
undergoing longer and more frequent

476
00:17:45,650 --> 00:17:41,850
droughts with more extreme conditions

477
00:17:47,330 --> 00:17:45,660
expected by using the space station eco

478
00:17:49,970 --> 00:17:47,340
stress will give scientists early

479
00:17:52,070 --> 00:17:49,980
warnings about plant stress current

480
00:17:53,810 --> 00:17:52,080
satellite data on plant color shows

481
00:17:56,090 --> 00:17:53,820
regions where plants are so stressed

482
00:17:57,860 --> 00:17:56,100
that they've turned brown by that time

483
00:18:00,410 --> 00:17:57,870
plants are already dead and others are

484
00:18:01,820 --> 00:18:00,420
too stressed to save eco stresses

485
00:18:03,710 --> 00:18:01,830
temperature measurements will show where

486
00:18:05,150 --> 00:18:03,720
plants are still green and healthy but

487
00:18:07,460 --> 00:18:05,160
struggling to stay cool and conserve

488
00:18:09,350 --> 00:18:07,470

water the data could give agricultural

489
00:18:11,150 --> 00:18:09,360
water managers time to intervene with

490
00:18:13,760 --> 00:18:11,160
the right amount of water when it's most

491
00:18:17,150 --> 00:18:13,770
needed just another way we are working

492
00:18:19,580 --> 00:18:17,160
off the earth for the earth and speaking

493
00:18:22,070 --> 00:18:19,590
of an importance of watering plants so

494
00:18:24,170 --> 00:18:22,080
Eco stress is dealing with water here on

495
00:18:25,940 --> 00:18:24,180
earth and I know I have with me Trent

496
00:18:27,740 --> 00:18:25,950
Smith he's a veggie project manager and

497
00:18:29,840 --> 00:18:27,750
I know watering plants in space and in

498
00:18:31,160 --> 00:18:29,850
microgravity is an issue we're not gonna

499
00:18:32,840 --> 00:18:31,170
get into that this morning but I

500
00:18:34,700 --> 00:18:32,850
understand you have some special seeds

501
00:18:37,100 --> 00:18:34,710
on board and can you tell me about those

502
00:18:39,200 --> 00:18:37,110
and maybe who helped you sure thing and

503
00:18:41,300 --> 00:18:39,210
first of all we have a wasabi mustard

504
00:18:43,040 --> 00:18:41,310
that we're gonna send up and I think -

505
00:18:45,080 --> 00:18:43,050
knots were like that spiciness we have

506
00:18:46,730 --> 00:18:45,090
red Russian kale and down in South

507
00:18:48,440 --> 00:18:46,740
Florida we have a we've partnered with

508
00:18:50,270 --> 00:18:48,450
the Fairchild tropical Botanic Garden

509
00:18:52,430 --> 00:18:50,280
and we have more than 100 schools down

510
00:18:54,800 --> 00:18:52,440
there growing plants for science for our

511
00:18:57,080 --> 00:18:54,810
NASA scientists and they identified and

512
00:18:59,660 --> 00:18:57,090
tested Dragoon lettuce and extra door of

513
00:19:02,270 --> 00:18:59,670

POC joy those did well in this the

514
00:19:03,980 --> 00:19:02,280
school classroom we tested them here now

515
00:19:04,380 --> 00:19:03,990
they're on board dragon so I guess the

516
00:19:05,490 --> 00:19:04,390
Mai

517
00:19:07,470 --> 00:19:05,500
said as if they could grow in a

518
00:19:08,940 --> 00:19:07,480
classroom they could grow in space yeah

519
00:19:10,620 --> 00:19:08,950
yeah you know the classroom can be a

520
00:19:12,660 --> 00:19:10,630
tough place especially across all the

521
00:19:14,760 --> 00:19:12,670
different schools and I think of it as a

522
00:19:16,740 --> 00:19:14,770
robustness index I love it citizen

523
00:19:18,570 --> 00:19:16,750
science so apart from you know making

524
00:19:20,250 --> 00:19:18,580
sure that these plants can thrive what

525
00:19:21,840 --> 00:19:20,260
other what other aspects are you looking

526
00:19:24,000 --> 00:19:21,850
for from plants yeah yeah so space

527
00:19:26,100 --> 00:19:24,010
plants really need to germinate well

528
00:19:27,750 --> 00:19:26,110
grow quickly they need to be compact

529
00:19:30,420 --> 00:19:27,760
because we have limited volume and

530
00:19:32,430 --> 00:19:30,430
veggie and a pH so they need to grow

531
00:19:34,050 --> 00:19:32,440
fast and taste good so speaking of

532
00:19:35,670 --> 00:19:34,060
tasting good I understand that

533
00:19:37,500 --> 00:19:35,680
astronauts like spicy things like that

534
00:19:38,580 --> 00:19:37,510
sabe mustard you're sending back why is

535
00:19:40,410 --> 00:19:38,590
that so

536
00:19:42,600 --> 00:19:40,420
in Gratton and gravity our hearts are

537
00:19:44,400 --> 00:19:42,610
pumping the blood against gravity and in

538
00:19:46,320 --> 00:19:44,410

microgravity well it doesn't happen and

539
00:19:47,820 --> 00:19:46,330
so the fluid shifts to the head and so

540
00:19:48,870 --> 00:19:47,830
if you've ever had a hot head cold you

541
00:19:50,610 --> 00:19:48,880
know things might taste a little

542
00:19:52,140 --> 00:19:50,620
different and so we think that

543
00:19:53,790 --> 00:19:52,150
astronauts will really like to spicy

544
00:19:56,070 --> 00:19:53,800
wasabi mustard because it does give you

545
00:19:57,990 --> 00:19:56,080
that horseradish wasabi flavor right I

546
00:19:59,610 --> 00:19:58,000
bet so what are the future plans for

547
00:20:01,710 --> 00:19:59,620
more citizen science like this yeah so

548
00:20:03,210 --> 00:20:01,720
we have actually students in Ohio Puerto

549
00:20:04,530 --> 00:20:03,220
Rico and South Florida that are helping

550
00:20:06,540 --> 00:20:04,540
us and we're gonna meet with the

551
00:20:07,920 --> 00:20:06,550
Fairchild scientists and and identify

552
00:20:09,510 --> 00:20:07,930
different questions that we have and

553
00:20:11,340 --> 00:20:09,520
develop experimental methods for the

554
00:20:13,110 --> 00:20:11,350
students to perform this next semester I

555
00:20:15,240 --> 00:20:13,120
love it the students get to be part of

556
00:20:17,100 --> 00:20:15,250
real NASA missions and do the astronauts

557
00:20:19,620 --> 00:20:17,110
get to actually eat the crops they chose

558
00:20:21,480 --> 00:20:19,630
so these new crops we have undergone the

559
00:20:22,740 --> 00:20:21,490
food safety testing the results look

560
00:20:24,270 --> 00:20:22,750
good we still got to go talk to the

561
00:20:26,280 --> 00:20:24,280
flight Doc's and the Safety Board but

562
00:20:28,020 --> 00:20:26,290
I'm very hopeful I'm so excited for

563
00:20:30,060 --> 00:20:28,030

these kids I got to choose that thanks

564
00:20:31,140 --> 00:20:30,070
so much for engaging them and and for

565
00:20:35,040 --> 00:20:31,150
veggie not pleasure

566
00:20:37,650 --> 00:20:35,050
thanks back to you Stephanie thanks

567
00:20:39,300 --> 00:20:37,660
Amanda at t-minus six minutes we're

568
00:20:41,370 --> 00:20:39,310
closing in on the final activities

569
00:20:42,990 --> 00:20:41,380
leading up to today's launch let's go

570
00:20:44,480 --> 00:20:43,000
back to the control room with Tori and

571
00:20:47,220 --> 00:20:44,490
Mike to follow the final countdown

572
00:20:49,410 --> 00:20:47,230
thanks Stephanie and yes we are at

573
00:20:50,640 --> 00:20:49,420
t-minus six minutes and Counting welcome

574
00:20:53,040 --> 00:20:50,650
to those of you just joining us on

575
00:20:54,750 --> 00:20:53,050
social media we are here at hangar AE

576
00:20:57,450 --> 00:20:54,760
and Cape Canaveral Air Force Station

577
00:20:59,280 --> 00:20:57,460
supporting the SpaceX Sierra's 15 launch

578
00:21:01,320 --> 00:20:59,290
of the Falcon 9 and the Dragon

579
00:21:02,670 --> 00:21:01,330
spacecraft that will deliver science and

580
00:21:04,680 --> 00:21:02,680
supplies to the International Space

581
00:21:06,570 --> 00:21:04,690
Station for now let's get you caught up

582
00:21:08,610 --> 00:21:06,580
to speed on today's launch countdown and

583
00:21:11,790 --> 00:21:08,620
what you can expect from here on out

584
00:21:13,920 --> 00:21:11,800
Mike yes Corey the Air Force launch

585
00:21:16,650 --> 00:21:13,930
weather officer Mike McAlinden continues

586
00:21:18,150 --> 00:21:16,660
to give us a go forecast and current

587
00:21:20,880 --> 00:21:18,160
conditions so weather is

588
00:21:22,980 --> 00:21:20,890

not a concern the airforce eastern range

589
00:21:24,780 --> 00:21:22,990
or the range which is responsible for

590
00:21:27,000 --> 00:21:24,790
public safety during launches from here

591
00:21:29,310 --> 00:21:27,010
on the East Coast has been coordinating

592
00:21:30,960 --> 00:21:29,320
with SpaceX and the NASA teams ensuring

593
00:21:32,880 --> 00:21:30,970
that the launch area and the flight path

594
00:21:34,830 --> 00:21:32,890
are clear for the launch of the Falcon 9

595
00:21:37,320 --> 00:21:34,840
rocket everything is looking good in

596
00:21:39,000 --> 00:21:37,330
that regard as well the range starts at

597
00:21:40,890 --> 00:21:39,010
the launch pads at Cape Canaveral Air

598
00:21:42,390 --> 00:21:40,900
Force Station and Kennedy Space Center

599
00:21:45,780 --> 00:21:42,400
and extends eastward out over the

600
00:21:48,060 --> 00:21:45,790
Atlantic Ocean into the Indian Ocean the

601
00:21:51,780 --> 00:21:48,070
range coordinator has verified that the

602
00:21:53,520 --> 00:21:51,790
range is go for launch at t-minus five

603
00:21:55,470 --> 00:21:53,530
minutes the range will complete

604
00:21:57,090 --> 00:21:55,480
communications checks and then at

605
00:21:58,830 --> 00:21:57,100
t-minus two minutes the range control

606
00:22:02,520 --> 00:21:58,840
officer will verify that the eastward

607
00:22:05,070 --> 00:22:02,530
range is officially go for launch and

608
00:22:07,890 --> 00:22:05,080
the Falcon 9 to flying today is a

609
00:22:10,680 --> 00:22:07,900
two-stage rocket the first stage has

610
00:22:12,390 --> 00:22:10,690
nine engines named Merlin the second

611
00:22:14,120 --> 00:22:12,400
stage has a single Merlin engine which

612
00:22:17,340 --> 00:22:14,130
can operate in the vacuum of space

613
00:22:19,590 --> 00:22:17,350

the engines are fueled by our p1 which

614
00:22:22,590 --> 00:22:19,600
has a rocket grade kerosene and liquid

615
00:22:25,530 --> 00:22:22,600
oxygen rp1 feeling of both the Falcon

616
00:22:28,290 --> 00:22:25,540
nine stages began on time at t-minus one

617
00:22:29,970 --> 00:22:28,300
hour and 10 minutes liquid oxygen began

618
00:22:33,720 --> 00:22:29,980
flowing into both rocket stages as

619
00:22:35,940 --> 00:22:33,730
planned at t-minus 35 minutes and teams

620
00:22:39,270 --> 00:22:35,950
will begin setting up for final fuel at

621
00:22:41,160 --> 00:22:39,280
t-minus seven minutes we are now at

622
00:22:44,280 --> 00:22:41,170
t-minus five minutes and Counting and

623
00:22:46,650 --> 00:22:44,290
about t-minus 10 well the launch

624
00:22:48,780 --> 00:22:46,660
director verified about t-minus 10

625
00:22:50,340 --> 00:22:48,790
minutes with the mission manager that

626
00:22:52,800 --> 00:22:50,350
the Dragon spacecraft was moved to

627
00:22:54,570 --> 00:22:52,810
internal power that's right and the

628
00:22:57,150 --> 00:22:54,580
Falcon 9 first stage engines were

629
00:22:59,460 --> 00:22:57,160
chilled down prior to launch that

630
00:23:01,740 --> 00:22:59,470
occurred at t-minus seven minutes this

631
00:23:03,270 --> 00:23:01,750
allows the engines to be cold enough to

632
00:23:05,310 --> 00:23:03,280
safely move the propellants or fuel

633
00:23:07,410 --> 00:23:05,320
through them shortly after that the

634
00:23:09,270 --> 00:23:07,420
Falcon 9 began to move to internal power

635
00:23:12,170 --> 00:23:09,280
and the system responsible for igniting

636
00:23:15,650 --> 00:23:12,180
the engines T tab just before liftoff

637
00:23:18,480 --> 00:23:15,660
was pressurized at t-minus six minutes

638
00:23:20,340 --> 00:23:18,490

the strong back which is the structure

639
00:23:22,410 --> 00:23:20,350
next to the Falcon nine will begin to

640
00:23:25,350 --> 00:23:22,420
retract to its launch position at

641
00:23:27,270 --> 00:23:25,360
t-minus four minutes and 50 seconds the

642
00:23:29,040 --> 00:23:27,280
thrust vector control actuators we moved

643
00:23:30,840 --> 00:23:29,050
or gimballed and this is the system

644
00:23:32,159 --> 00:23:30,850
which allows for the control of vehicle

645
00:23:35,460 --> 00:23:32,169
while in flight that will look

646
00:23:37,499 --> 00:23:35,470
at t minus 2 minutes and 55 seconds we

647
00:23:40,470 --> 00:23:37,509
currently are at t-minus four minutes

648
00:23:42,570 --> 00:23:40,480
and Counting at t-minus one minute the

649
00:23:44,609 --> 00:23:42,580
SpaceX Falcon 9 computer will begin its

650
00:23:46,979 --> 00:23:44,619
final pre-launch checks and then at

651
00:23:49,499 --> 00:23:46,989
t-minus 45 seconds SpaceX launch

652
00:23:52,259 --> 00:23:49,509
director Mike Taylor will verify go for

653
00:23:54,599 --> 00:23:52,269
launch and liftoff the Falcon 9 will

654
00:23:57,810 --> 00:23:54,609
produce 1.7 million pounds of thrust

655
00:24:00,810 --> 00:23:57,820
which is greater than five 747s at full

656
00:24:02,759 --> 00:24:00,820
power after liftoff the Falcon 9 will

657
00:24:05,669 --> 00:24:02,769
begin a maneuver called a pitch kick at

658
00:24:07,409 --> 00:24:05,679
10 seconds into flight this move gets

659
00:24:09,419 --> 00:24:07,419
the rocket flying on its correct path

660
00:24:12,330 --> 00:24:09,429
you can see that the strong back has

661
00:24:15,149 --> 00:24:12,340
retracted to its pre launch position of

662
00:24:17,249 --> 00:24:15,159
eighty eight point three degrees at one

663
00:24:19,139 --> 00:24:17,259

minute five seconds after liftoff the

664
00:24:20,849 --> 00:24:19,149
Falcon nine will reach transonic speed

665
00:24:23,489 --> 00:24:20,859
and will pass through the area of

666
00:24:26,609 --> 00:24:23,499
maximum aerodynamic pressure or max Q at

667
00:24:29,460 --> 00:24:26,619
t minus or at one minute 18 seconds

668
00:24:31,109 --> 00:24:29,470
after liftoff and at the time of launch

669
00:24:33,450 --> 00:24:31,119
today the International Space Station

670
00:24:36,090 --> 00:24:33,460
will be over the South Pacific southeast

671
00:24:39,690 --> 00:24:36,100
of New Zealand at an altitude of 258

672
00:24:41,519 --> 00:24:39,700
statute miles t-minus three minutes and

673
00:24:43,289 --> 00:24:41,529
Counting and from now until left off

674
00:24:45,450 --> 00:24:43,299
we'll be monitoring the countdown net

675
00:24:50,180 --> 00:24:45,460
the primary circuit used by the SpaceX

676
00:24:57,269 --> 00:24:55,259
weather remains go the strong back has

677
00:25:08,759 --> 00:24:57,279
reached its launch position of eighty

678
00:25:13,359 --> 00:25:11,470
liquid oxygen venting from both first

679
00:25:16,239 --> 00:25:13,369
and second stages of the Falcon 9 rocket

680
00:25:18,249 --> 00:25:16,249
as it sits on the launch pad at space

681
00:25:28,180 --> 00:25:18,259
complex 40 on Cape Canaveral Air Force

682
00:25:35,050 --> 00:25:30,550
t-minus 2 minutes 10 seconds and

683
00:25:38,560 --> 00:25:35,060
counting states along to close every

684
00:25:42,190 --> 00:25:38,570
flight stage 2 liquid oxygen closed out

685
00:25:58,690 --> 00:25:42,200
for flight signifying a good liquid

686
00:26:00,970 --> 00:25:58,700
oxygen load next major milestone at

687
00:26:03,850 --> 00:26:00,980
t-minus one minute five seconds the

688
00:26:08,380 --> 00:26:03,860

autonomous flight termination system

689
00:26:28,030 --> 00:26:08,390
will be checked and termed ready for a

690
00:26:28,040 --> 00:26:37,950
- - one minute ten seconds and counting

691
00:26:49,630 --> 00:26:43,060
vehicles and startup Falcon 9 is in

692
00:26:52,750 --> 00:26:49,640
start-up mode flight computer is making

693
00:26:55,780 --> 00:26:52,760
its final pre-launch checks propellant

694
00:26:58,030 --> 00:26:55,790
tanks or Cobra lunch flight pressure and

695
00:27:01,540 --> 00:26:58,040
as you hear launch director mike taylor

696
00:27:08,230 --> 00:27:01,550
gives go for launch of today's spacex

697
00:27:15,500 --> 00:27:11,080
do you - 30 seconds gas closeouts

698
00:27:20,390 --> 00:27:17,930
the pad deluge water system will be

699
00:27:24,550 --> 00:27:20,400
activated at t-minus 18 seconds on tanks

700
00:27:30,650 --> 00:27:24,560
pressure plate you know 13 seconds

701
00:27:40,070 --> 00:27:30,660
everything is go 9 t-minus eight seconds

702
00:27:43,010 --> 00:27:40,080
seven six five four three two one we

703
00:27:45,080 --> 00:27:43,020
have ignition and liftoff the Falcon 9

704
00:27:47,410 --> 00:27:45,090
rocket powers the Dragon spacecraft

705
00:27:49,730 --> 00:27:47,420
toward the International Space Station

706
00:27:56,550 --> 00:27:49,740
laden with new research for the

707
00:27:56,560 --> 00:28:00,110
don't promise nominal

708
00:28:00,120 --> 00:28:09,100
because missing downrange

709
00:28:13,970 --> 00:28:11,299
I'm one minute five seconds

710
00:28:15,710 --> 00:28:13,980
Falcon 9 reaches transonic speed the

711
00:28:17,539 --> 00:28:15,720
vehicle passed through the area of

712
00:28:19,289 --> 00:28:17,549
maximum aerodynamic pressure or perhaps

713
00:28:21,690 --> 00:28:19,299

cute

714
00:28:24,060 --> 00:28:21,700
eighteen seconds after liftoff this is

715
00:28:25,619 --> 00:28:24,070
the point limiter nominal mechanical

716
00:28:27,479 --> 00:28:25,629
stress on the rocket reaches his peak

717
00:28:28,889 --> 00:28:27,489
because of the Rockets velocity and

718
00:28:38,600 --> 00:28:28,899
resistance created by the Earth's

719
00:28:38,610 --> 00:28:51,530
one minute into flight

720
00:28:57,890 --> 00:28:53,840
confirmation and the Falcon Highness

721
00:29:03,190 --> 00:29:00,700
see the contrail

722
00:29:08,710 --> 00:29:03,200
as the rocket passes through maximum

723
00:29:08,720 --> 00:29:19,520
Nicholas reaching back dynamic pressure

724
00:29:24,860 --> 00:29:22,070
just over 1 minute left in the flight of

725
00:29:26,750 --> 00:29:24,870
the first stage of the Falcon 9 at

726
00:29:29,420 --> 00:29:26,760
around 2 minutes 35 seconds into the

727
00:29:31,130 --> 00:29:29,430
flight all 9 engines will sequentially

728
00:29:38,380 --> 00:29:31,140
shut down and you'll hear the call miko

729
00:29:38,390 --> 00:29:44,690
I'm back engine to

730
00:29:52,050 --> 00:29:49,280
the EM vac is the second stage merlin

731
00:29:54,990 --> 00:29:52,060
vacuum engine it's being chilled for its

732
00:30:19,020 --> 00:29:55,000
operation which will get underway in a

733
00:30:19,030 --> 00:30:26,740
standing by for main engine cutoff

734
00:30:33,250 --> 00:30:31,270
Rico page separation confirmed we go and

735
00:30:35,350 --> 00:30:33,260
stage separation confirmed the first

736
00:30:37,960 --> 00:30:35,360
stage of the Falcon 9 rocket having done

737
00:30:40,690 --> 00:30:37,970
its job falls away from the second stage

738
00:30:43,000 --> 00:30:40,700

and recognition am back ignition the

739
00:30:49,840 --> 00:30:43,010
merlin vacuum engine has ignited they

740
00:30:51,850 --> 00:30:49,850
join a FD FF it the M back engine and

741
00:30:52,690 --> 00:30:51,860
the second stage will burn for about six

742
00:30:56,260 --> 00:30:52,700
and a half minutes

743
00:30:58,810 --> 00:30:56,270
bringing dragon into low-earth orbit the

744
00:31:16,810 --> 00:30:58,820
engine produces 210 thousand pounds of

745
00:31:16,820 --> 00:31:35,270
prerequisite

746
00:31:43,920 --> 00:31:37,440
coming up on four minutes into the

747
00:31:46,560 --> 00:31:43,930
flight of Falcon & dragon first stage

748
00:31:48,810 --> 00:31:46,570
falling away in the upper left portion

749
00:31:50,550 --> 00:31:48,820
of your picture second stage continues

750
00:31:54,620 --> 00:31:50,560
to burn with dragon on its way to the

751
00:32:22,290 --> 00:31:57,150
four minutes fifteen seconds remaining

752
00:32:22,300 --> 00:32:34,140
position in New Hampshire

753
00:32:47,590 --> 00:32:36,430
coming up on five minutes after launch

754
00:32:49,450 --> 00:32:47,600
everything continues to go well the

755
00:32:51,940 --> 00:32:49,460
first stage and the lower left portion

756
00:32:58,930 --> 00:32:51,950
of your picture not returning to the

757
00:33:03,660 --> 00:32:58,940
launch site today safely being disposed

758
00:33:06,690 --> 00:33:03,670
of meanwhile stage two continues to burn

759
00:33:38,110 --> 00:33:06,700
three minutes five seconds remaining

760
00:33:42,650 --> 00:33:40,910
six minutes after launch propulsion

761
00:33:48,340 --> 00:33:42,660
officer says everything continues to

762
00:34:08,940 --> 00:33:50,900
two minutes 20 seconds remaining in this

763
00:34:17,710 --> 00:34:14,589

two minutes remaining before Seco the

764
00:34:19,899 --> 00:34:17,720
second stage engine doing its job taking

765
00:34:40,530 --> 00:34:19,909
the Dragon spacecraft to its assigned

766
00:34:44,770 --> 00:34:42,760
seven minutes two seconds after launch

767
00:34:48,780 --> 00:34:44,780
just under a minute and a half remaining

768
00:34:51,360 --> 00:34:48,790
of the burn falcon second stage

769
00:35:09,680 --> 00:34:51,370
remaining on the proper trajectory

770
00:35:39,540 --> 00:35:12,510
one minute remaining in the burn of the

771
00:35:41,610 --> 00:35:39,550
Falcon nine second stage eight minutes

772
00:35:43,010 --> 00:35:41,620
after launch everything continues to go

773
00:35:45,590 --> 00:35:43,020
well they do it in terminal guidance

774
00:35:51,390 --> 00:35:45,600
Stage two is in terminal guidance

775
00:35:55,050 --> 00:35:51,400
Stage two afdf have saved autonomous

776
00:35:58,800 --> 00:35:55,060
flight termination system is safe about

777
00:36:16,910 --> 00:35:58,810
fifteen seconds away from a second stage

778
00:36:33,539 --> 00:36:30,029
engine shutdown nominal orbit insertion

779
00:36:36,839 --> 00:36:33,549
and as you hear a normal orbit insertion

780
00:36:39,990 --> 00:36:36,849
acquisition of digne neukölln next major

781
00:36:53,069 --> 00:36:40,000
milestone will be the deploy of the

782
00:36:55,200 --> 00:36:53,079
Dragon spacecraft looking at the SpaceX

783
00:36:57,390 --> 00:36:55,210
mission control center at Hawthorne

784
00:37:12,580 --> 00:36:57,400
California standing by for Dragon deploy

785
00:37:22,160 --> 00:37:20,270
and we have dragons separation dragon

786
00:37:24,800 --> 00:37:22,170
flying on its own down very firm

787
00:37:26,570 --> 00:37:24,810
separation confirmed separation as

788
00:37:39,020 --> 00:37:26,580

dragon begins its journey toward the

789
00:37:41,180 --> 00:37:39,030
International Space Station one minute

790
00:37:44,480 --> 00:37:41,190
away from the beginning of solar array

791
00:37:46,220 --> 00:37:44,490
deploy this will ensure that the Dragon

792
00:37:57,470 --> 00:37:46,230
spacecraft is powered for its trip to

793
00:37:59,359 --> 00:37:57,480
the space station this is just the

794
00:38:02,000 --> 00:37:59,369
beginning of a carefully choreographed

795
00:38:03,560 --> 00:38:02,010
series of Draco thruster firings to

796
00:38:05,930 --> 00:38:03,570
reach the space station and all that

797
00:38:09,050 --> 00:38:05,940
activity will be managed and monitored

798
00:38:11,180 --> 00:38:09,060
here at the International Space Station

799
00:38:15,740 --> 00:38:11,190
flight control room at Mission Control

800
00:38:18,920 --> 00:38:15,750
Center in Houston Texas you can see the

801
00:38:24,680 --> 00:38:18,930
view in the right of the International

802
00:38:29,359 --> 00:38:24,690
Space Station crew standing by for solar

803
00:38:58,970 --> 00:38:29,369
array deploy on the Dragon spacecraft in

804
00:39:02,480 --> 00:39:01,250
this is Dragon CC on countdown dragons

805
00:39:04,280 --> 00:39:02,490
propulsion system has successfully

806
00:39:26,680 --> 00:39:04,290
primed at all thrusters report ready for

807
00:39:45,680 --> 00:39:28,910
standing by for confirmation of solar

808
00:39:55,340 --> 00:39:45,690
array deployed dragon is deploying a

809
00:39:58,310 --> 00:39:55,350
solar arrays and as you can see the

810
00:40:03,260 --> 00:39:58,320
solar arrays deploying on the Dragon

811
00:40:05,960 --> 00:40:03,270
spacecraft provide power to dragon as it

812
00:40:13,340 --> 00:40:05,970
initiates its journey toward the

813
00:40:15,230 --> 00:40:13,350

International Space Station twelve and a

814
00:40:16,580 --> 00:40:15,240
half minutes after liftoff everything

815
00:40:19,100 --> 00:40:16,590
went very well

816
00:40:27,020 --> 00:40:19,110
dragon is where it belongs in space the

817
00:40:28,910 --> 00:40:27,030
solar arrays locking into place so it's

818
00:40:30,560 --> 00:40:28,920
dragon unfurls its solar arrays the

819
00:40:33,020 --> 00:40:30,570
spacecraft will continue its journey to

820
00:40:34,670 --> 00:40:33,030
the International Space Station dragon

821
00:40:37,580 --> 00:40:34,680
will arrive at the station on Monday

822
00:40:39,800 --> 00:40:37,590
July 2nd NASA television coverage begins

823
00:40:42,350 --> 00:40:39,810
at 5:30 a.m. Eastern with regarded

824
00:40:44,030 --> 00:40:42,360
here's her four dragon rendezvous

825
00:40:45,740 --> 00:40:44,040
grapple and berthing to the station

826
00:40:48,860 --> 00:40:45,750
capture is scheduled for approximately

827
00:40:51,230 --> 00:40:48,870
7:00 a.m. following at 9:00 a.m. Eastern

828
00:40:54,920 --> 00:40:51,240
as coverage of the installation to the

829
00:40:57,290 --> 00:40:54,930
station's harmony module NASA astronaut

830
00:41:00,200 --> 00:40:57,300
ricky arnold backed by fellow ass nasa

831
00:41:02,540 --> 00:41:00,210
astronaut drew foist ole will supervise

832
00:41:04,940 --> 00:41:02,550
the operation of the canada armed two

833
00:41:07,910 --> 00:41:04,950
robotic arm for dragons capture while

834
00:41:11,480 --> 00:41:07,920
nasa astronaut Serena aunon Chancellor

835
00:41:13,730 --> 00:41:11,490
monitors the spacecraft systems after

836
00:41:15,290 --> 00:41:13,740
dragon capture ground commands we sent

837
00:41:17,360 --> 00:41:15,300
from Mission Control in Houston for the

838
00:41:18,650 --> 00:41:17,370

station's arm to rotate it and install

839
00:41:23,660 --> 00:41:18,660
it on the bottom of the station's

840
00:41:26,660 --> 00:41:23,670
harmony module thirteen minutes 45

841
00:41:29,120 --> 00:41:26,670
seconds after launch a successful launch

842
00:41:30,710 --> 00:41:29,130
and the deploy of the dragon and its

843
00:41:33,590 --> 00:41:30,720
journey to the International Space

844
00:41:35,510 --> 00:41:33,600
Station well underway that will wrap

845
00:41:37,430 --> 00:41:35,520
our coverage from here in Falcon launch

846
00:41:38,540 --> 00:41:37,440
control Stephanie and for now we will

847
00:41:41,540 --> 00:41:38,550
send it back to you

848
00:41:43,100 --> 00:41:41,550
thank you both dragons journey now

849
00:41:45,650 --> 00:41:43,110
continues as it approaches the

850
00:41:47,840 --> 00:41:45,660
International Space Station for more on

851
00:41:50,030 --> 00:41:47,850
dragons course let's go back to NASA's

852
00:41:54,380 --> 00:41:50,040
Dan Huot and Mission Control at Johnson

853
00:41:56,420 --> 00:41:54,390
Space Center Dan hey Stephanie and again

854
00:41:58,520 --> 00:41:56,430
welcome back everybody a successful

855
00:42:00,410 --> 00:41:58,530
launch always great to see dragon in

856
00:42:02,630 --> 00:42:00,420
orbit and now on its way to the

857
00:42:04,280 --> 00:42:02,640
International Space Station as you heard

858
00:42:06,080 --> 00:42:04,290
it's gonna start doing some thruster

859
00:42:07,340 --> 00:42:06,090
firings so the engines on dragon are

860
00:42:09,350 --> 00:42:07,350
actually gonna fire over the next

861
00:42:11,360 --> 00:42:09,360
several days and it's gonna raise its

862
00:42:12,950 --> 00:42:11,370
orbit it's only a little ways off the

863
00:42:14,420 --> 00:42:12,960

earth now eventually it's gonna be all

864
00:42:17,000 --> 00:42:14,430
the way up in the same level as the

865
00:42:19,000 --> 00:42:17,010
International Space Station about 250

866
00:42:21,860 --> 00:42:19,010
statute miles over the Earth's surface

867
00:42:23,840 --> 00:42:21,870
after it executes these firings over the

868
00:42:25,880 --> 00:42:23,850
next couple of days it'll get into the

869
00:42:27,680 --> 00:42:25,890
station's neighborhood on Monday and

870
00:42:29,780 --> 00:42:27,690
then the folks here in this room and

871
00:42:31,820 --> 00:42:29,790
Mission Control Houston will be working

872
00:42:34,280 --> 00:42:31,830
very closely with the teams out in

873
00:42:36,680 --> 00:42:34,290
Hawthorne California overseeing dragon

874
00:42:39,230 --> 00:42:36,690
systems as the to work to bring dragon

875
00:42:41,060 --> 00:42:39,240
in on the final stretches it's going to

876
00:42:43,130 --> 00:42:41,070
go through a series of checkpoints on

877
00:42:45,320 --> 00:42:43,140
Monday morning before eventually

878
00:42:47,390 --> 00:42:45,330
arriving at what's known as the capture

879
00:42:49,700 --> 00:42:47,400
point which is about 30 feet away from

880
00:42:52,220 --> 00:42:49,710
the station and as you heard Tory talk

881
00:42:54,740 --> 00:42:52,230
about the prime robotics operator for

882
00:42:57,410 --> 00:42:54,750
that day Ricky Arnold will control the

883
00:42:59,630 --> 00:42:57,420
robotic arm reach out grapple the Dragon

884
00:43:01,760 --> 00:42:59,640
spacecraft and then hand it over to the

885
00:43:04,520 --> 00:43:01,770
teams back down here on the ground to

886
00:43:06,050 --> 00:43:04,530
actually get dragon installed and then

887
00:43:08,240 --> 00:43:06,060
it'll be time to open up the hatch that

888
00:43:10,280 --> 00:43:08,250

usually coming sometimes a couple of

889
00:43:12,650 --> 00:43:10,290
hours later but usually the day after

890
00:43:14,270 --> 00:43:12,660
and then unloading all of that science

891
00:43:17,630 --> 00:43:14,280
and just a reminder we'll be doing that

892
00:43:20,270 --> 00:43:17,640
live coverage on Monday July 2nd we'll

893
00:43:22,130 --> 00:43:20,280
be starting at 5:30 a.m. Eastern Time

894
00:43:24,410 --> 00:43:22,140
caPSURE coming right around 7:00 a.m.

895
00:43:26,270 --> 00:43:24,420
Eastern 6:00 a.m. Central here in

896
00:43:27,800 --> 00:43:26,280
Houston and we'll break for a little bit

897
00:43:30,950 --> 00:43:27,810
coming back on for the installation

898
00:43:33,260 --> 00:43:30,960
coverage but for now dragon in orbit a

899
00:43:34,760 --> 00:43:33,270
successful launch it's on its way to the

900
00:43:36,530 --> 00:43:34,770
space station and we can't wait for it

901
00:43:38,720 --> 00:43:36,540
to get there so with that I'll hand it

902
00:43:42,230 --> 00:43:38,730
over to you Stephanie great morning

903
00:43:44,390 --> 00:43:42,240
great dragon in orbit thanks Dan

904
00:43:46,850 --> 00:43:44,400
this concludes our live coverage of the

905
00:43:47,359 --> 00:43:46,860
flaw of Falcon 9 sending dragon filled

906
00:43:49,400 --> 00:43:47,369
with 50

907
00:43:52,309 --> 00:43:49,410
900 pounds of research and crew supplies

908
00:43:53,870 --> 00:43:52,319
to the International Space Station for

909
00:44:04,249 --> 00:43:53,880
more information about the space station

910
00:44:07,039 --> 00:44:04,259
please visit www.nasa.gov

911
00:44:08,359 --> 00:44:07,049
ford slash spacex and don't forget to

912
00:44:10,519 --> 00:44:08,369
tune into the post-launch news

913
00:44:12,380 --> 00:44:10,529

conference on NASA television at 8:00

914
00:44:14,900 --> 00:44:12,390
a.m. this morning Eastern Time

915
00:44:16,309 --> 00:44:14,910
I'm Stephanie Martin for them tip from