



1
00:05:02,980 --> 00:05:23,529

[Music]

2
00:05:23,539 --> 00:05:29,390

thank you

3
00:05:29,400 --> 00:05:38,150

foreign

4
00:05:42,710 --> 00:05:40,610

we are getting closer to a SpaceX launch

5
00:05:45,350 --> 00:05:42,720

of a Falcon 9 rocket from Cape Canaveral

6
00:05:47,029 --> 00:05:45,360

space force station on that rocket Tempo

7
00:05:49,129 --> 00:05:47,039

which stands for the tropospheric

8
00:05:51,230 --> 00:05:49,139

emissions monitoring of pollution

9
00:05:52,310 --> 00:05:51,240

I'm NASA's Anjali caring and NASA

10
00:05:54,469 --> 00:05:52,320

partnered with the center for

11
00:05:56,450 --> 00:05:54,479

astrophysics Harvard and Smithsonian for

12
00:05:58,010 --> 00:05:56,460

the tempo Mission the tempo instrument

13
00:05:59,870 --> 00:05:58,020

will improve life on Earth by

14

00:06:03,290 --> 00:05:59,880

revolutionizing the way that scientists

15

00:06:06,830 --> 00:06:05,270

when the air around us gets full of

16

00:06:09,650 --> 00:06:06,840

harmful chemicals it can make breathing

17

00:06:10,969 --> 00:06:09,660

and living a lot harder to do one of the

18

00:06:13,249 --> 00:06:10,979

ways that we can keep our air clean is

19

00:06:15,469 --> 00:06:13,259

by keeping an eye on what's in it Tempo

20

00:06:17,450 --> 00:06:15,479

or the tropospheric emissions monitoring

21

00:06:18,830 --> 00:06:17,460

of pollution is a NASA satellite

22

00:06:21,230 --> 00:06:18,840

instrument that's going to help us do

23

00:06:23,270 --> 00:06:21,240

just that from the top of the Intel sap

24

00:06:25,070 --> 00:06:23,280

40e satellite the tempo instrument will

25

00:06:26,990 --> 00:06:25,080

be taking hourly data during all

26

00:06:28,790 --> 00:06:27,000

daylight hours from a fixed orbit that

27

00:06:30,409 --> 00:06:28,800

allow us to see North America all the

28

00:06:31,790 --> 00:06:30,419

time that's really important because

29

00:06:33,529 --> 00:06:31,800

this will be the first satellite

30

00:06:35,570 --> 00:06:33,539

instrument to be taking these kinds of

31

00:06:36,890 --> 00:06:35,580

measurements and all of that rich new

32

00:06:38,930 --> 00:06:36,900

data is going to help us to understand

33

00:06:40,909 --> 00:06:38,940

how different chemicals like waste from

34

00:06:42,830 --> 00:06:40,919

landfills or from car emissions or even

35

00:06:44,689 --> 00:06:42,840

the burning of coal affect the air

36

00:06:46,790 --> 00:06:44,699

quality that we breathe here in North

37

00:06:48,770 --> 00:06:46,800

America and Tempo won't be working long

38

00:06:50,749 --> 00:06:48,780

and will actually be working alongside

39

00:06:53,090 --> 00:06:50,759

your potentials for satellite instrument

40

00:06:55,610 --> 00:06:53,100

as well as South Korea's gem satellite

41

00:06:57,469 --> 00:06:55,620

instrument in addition to a number of

42

00:06:59,689 --> 00:06:57,479

Airborne science missions and ground

43

00:07:01,790 --> 00:06:59,699

monitors all coming together to give

44

00:07:04,249 --> 00:07:01,800

scientists a more complete picture of

45

00:07:07,249 --> 00:07:04,259

the impacts and sources of Your solution

46

00:07:09,469 --> 00:07:07,259

here on Earth

47

00:07:11,029 --> 00:07:09,479

I'm joined Now by division director of

48

00:07:13,969 --> 00:07:11,039

the earth science division for NASA

49

00:07:15,050 --> 00:07:13,979

Karen St Germain Karen it's so great to

50

00:07:17,210 --> 00:07:15,060

have you here and I know that you and

51
00:07:19,670 --> 00:07:17,220
your team must be so excited for launch

52
00:07:22,010 --> 00:07:19,680
well thanks Angelique you know we've

53
00:07:23,930 --> 00:07:22,020
been working on tempo for years now and

54
00:07:25,010 --> 00:07:23,940
it is an absolute thrill to be here for

55
00:07:26,689 --> 00:07:25,020
the launch

56
00:07:28,370 --> 00:07:26,699
it's great to have you here and could

57
00:07:30,170 --> 00:07:28,380
you tell me a little bit about what kind

58
00:07:32,150 --> 00:07:30,180
of information we're actually hoping to

59
00:07:33,589 --> 00:07:32,160
learn from this wide scale look at air

60
00:07:36,529 --> 00:07:33,599
quality the temple will be giving us

61
00:07:40,189 --> 00:07:36,539
sure well air pollution comes from many

62
00:07:43,370 --> 00:07:40,199
sources from Automobiles and and trucks

63
00:07:45,050 --> 00:07:43,380

and cargo ships to power plants and

64

00:07:47,689 --> 00:07:45,060

factories to natural events like

65

00:07:50,689 --> 00:07:47,699

wildfires and volcanoes and when those

66

00:07:53,809 --> 00:07:50,699

pollutants chemicals and and particles

67

00:07:55,730 --> 00:07:53,819

get into the air they they change over

68

00:07:59,870 --> 00:07:55,740

time they move and their composition

69

00:08:02,749 --> 00:07:59,880

changes so with the ability to see these

70

00:08:06,529 --> 00:08:02,759

uh the atmospheric composition every

71

00:08:08,809 --> 00:08:06,539

hour we can understand how those changes

72

00:08:10,430 --> 00:08:08,819

happen over time and that's just going

73

00:08:12,770 --> 00:08:10,440

to give us a much better understanding

74

00:08:14,689 --> 00:08:12,780

of the life cycle of these pollutants

75

00:08:16,370 --> 00:08:14,699

That's so exciting that we'll be able to

76

00:08:18,230 --> 00:08:16,380

understand a little bit better how can

77

00:08:20,270 --> 00:08:18,240

that understanding in in all this new

78

00:08:22,969 --> 00:08:20,280

data help us to make better predictions

79

00:08:25,610 --> 00:08:22,979

about future air quality well it'll help

80

00:08:27,589 --> 00:08:25,620

in two ways first it will give give us

81

00:08:30,469 --> 00:08:27,599

much better situational awareness when

82

00:08:32,630 --> 00:08:30,479

an event is happening but also that

83

00:08:34,850 --> 00:08:32,640

understanding that we get from those

84

00:08:37,730 --> 00:08:34,860

repeated looks will be able to capture

85

00:08:39,589 --> 00:08:37,740

that understanding in models that allow

86

00:08:42,170 --> 00:08:39,599

us to predict

87

00:08:44,269 --> 00:08:42,180

future conditions and that's really

88

00:08:46,370 --> 00:08:44,279

where we bring the power of NASA

89

00:08:50,329 --> 00:08:46,380

missions to bear on our operational

90

00:08:52,370 --> 00:08:50,339

agencies like EPA and NOAA in FEMA we

91

00:08:55,730 --> 00:08:52,380

can feed them that understanding those

92

00:08:58,910 --> 00:08:55,740

models and they then can turn that into

93

00:09:01,790 --> 00:08:58,920

more effective operations how exciting

94

00:09:03,650 --> 00:09:01,800

now speaking of different satellites I

95

00:09:04,850 --> 00:09:03,660

know at the tail end of last year NASA

96

00:09:06,949 --> 00:09:04,860

actually launched a satellite that is

97

00:09:09,290 --> 00:09:06,959

able to measure all of Earth's water now

98

00:09:11,389 --> 00:09:09,300

that we will soon be able to measure air

99

00:09:12,470 --> 00:09:11,399

quality all over North America do you

100

00:09:14,590 --> 00:09:12,480

think that there will be opportunities

101
00:09:17,329 --> 00:09:14,600
to use those data sources

102
00:09:19,430 --> 00:09:17,339
absolutely you know Angelique the earth

103
00:09:21,050 --> 00:09:19,440
works as a system what happens in the

104
00:09:23,750 --> 00:09:21,060
water is connected to what happens in

105
00:09:25,130 --> 00:09:23,760
the atmosphere and on land so all of

106
00:09:27,110 --> 00:09:25,140
these missions working together

107
00:09:29,570 --> 00:09:27,120
observing different parts of the system

108
00:09:32,269 --> 00:09:29,580
give us that understanding about how the

109
00:09:34,070 --> 00:09:32,279
whole system is evolving over time and

110
00:09:35,630 --> 00:09:34,080
so yeah we really look forward to

111
00:09:37,970 --> 00:09:35,640
Bringing together the data from these

112
00:09:39,710 --> 00:09:37,980
multiple systems how exciting thank you

113
00:09:41,990 --> 00:09:39,720

so much Karen for taking some time to

114

00:09:43,490 --> 00:09:42,000

talk with us it's great to be here thank

115

00:09:45,230 --> 00:09:43,500

you

116

00:09:46,910 --> 00:09:45,240

now Temple will let scientists see

117

00:09:49,370 --> 00:09:46,920

emissions as they occur throughout the

118

00:09:51,829 --> 00:09:49,380

day hour by hour instead of a single

119

00:09:53,389 --> 00:09:51,839

sampling researchers say that this is a

120

00:09:55,310 --> 00:09:53,399

major step forward in monitoring air

121

00:10:00,110 --> 00:09:55,320

quality

122

00:10:02,570 --> 00:10:00,120

really talking about the health of the

123

00:10:04,730 --> 00:10:02,580

population as it has to breathe the air

124

00:10:06,230 --> 00:10:04,740

that that we need to live one of the

125

00:10:08,150 --> 00:10:06,240

real difficulties in helping people

126

00:10:10,790 --> 00:10:08,160

understand that air quality is a problem

127

00:10:12,410 --> 00:10:10,800

is that on a beautiful day you may not

128

00:10:14,389 --> 00:10:12,420

see evidence of poor air quality but

129

00:10:15,949 --> 00:10:14,399

it's there you might be surprised to

130

00:10:18,590 --> 00:10:15,959

hear that the number of deaths in the

131

00:10:21,610 --> 00:10:18,600

United States per year attributed to air

132

00:10:24,350 --> 00:10:21,620

quality is estimated to be about 60 000.

133

00:10:25,910 --> 00:10:24,360

I'm Jim Crawford I'm a senior scientist

134

00:10:27,949 --> 00:10:25,920

here at nasalonia Research Center for

135

00:10:29,870 --> 00:10:27,959

atmospheric chemistry and my job as an

136

00:10:31,670 --> 00:10:29,880

atmospheric chemist I work with a team

137

00:10:33,110 --> 00:10:31,680

of scientists trying to study air

138

00:10:35,150 --> 00:10:33,120

quality in the atmosphere we do that

139

00:10:37,370 --> 00:10:35,160

with research aircraft for a couple

140

00:10:39,590 --> 00:10:37,380

decades now we've really benefited from

141

00:10:41,870 --> 00:10:39,600

space in terms of satellite observations

142

00:10:43,370 --> 00:10:41,880

very far but those observations have

143

00:10:45,410 --> 00:10:43,380

been from the low earth orbit where you

144

00:10:47,630 --> 00:10:45,420

get one look per day and you can imagine

145

00:10:49,430 --> 00:10:47,640

that in terms of understanding a day in

146

00:10:50,750 --> 00:10:49,440

the life of a city in terms of the early

147

00:10:52,610 --> 00:10:50,760

emissions in the morning from rush hour

148

00:10:54,889 --> 00:10:52,620

and all the chemistry that takes place

149

00:10:56,329 --> 00:10:54,899

throughout the day a lot can happen that

150

00:10:59,269 --> 00:10:56,339

we need to understand what we're getting

151
00:11:01,250 --> 00:10:59,279
from Tempo is both that continuity and

152
00:11:02,630 --> 00:11:01,260
the high resolution it's important to

153
00:11:04,610 --> 00:11:02,640
recognize that Tempo doesn't work alone

154
00:11:06,530 --> 00:11:04,620
it has to be integrated into what we

155
00:11:08,269 --> 00:11:06,540
call the observing system you have

156
00:11:10,310 --> 00:11:08,279
ground monitors which you're measuring

157
00:11:12,290 --> 00:11:10,320
at the highest Precision what air

158
00:11:13,610 --> 00:11:12,300
quality conditions are you have Airborne

159
00:11:15,889 --> 00:11:13,620
measurements which can't be done

160
00:11:18,350 --> 00:11:15,899
continuously but can bring into the

161
00:11:20,210 --> 00:11:18,360
picture great information about the

162
00:11:22,250 --> 00:11:20,220
complexity of the air quality conditions

163
00:11:23,870 --> 00:11:22,260

and what's happening over above our head

164

00:11:25,910 --> 00:11:23,880

which plays a role in what we breathe

165

00:11:28,250 --> 00:11:25,920

down here when we talk about air quality

166

00:11:30,230 --> 00:11:28,260

it's not a problem that you simply solve

167

00:11:33,050 --> 00:11:30,240

at One Moment In Time human activity

168

00:11:36,050 --> 00:11:33,060

changes over time populations shift

169

00:11:39,170 --> 00:11:36,060

Industries rise and fall we really need

170

00:11:41,449 --> 00:11:39,180

to be able to monitor how those things

171

00:11:43,850 --> 00:11:41,459

are changing because the air quality

172

00:11:44,990 --> 00:11:43,860

outcomes change in concert with the

173

00:11:47,569 --> 00:11:45,000

changes in what we put into the

174

00:11:49,550 --> 00:11:47,579

atmosphere and so we don't need one look

175

00:11:52,490 --> 00:11:49,560

we need to continuous looks to be able

176
00:11:55,190 --> 00:11:52,500
to see and respond to what's happening

177
00:11:59,269 --> 00:11:55,200
in terms of atmosphere and its response

178
00:12:03,889 --> 00:12:01,610
this launch is happening during a busy

179
00:12:05,810 --> 00:12:03,899
week for NASA on Monday NASA revealed

180
00:12:15,130 --> 00:12:05,820
the moon crew four astronauts were

181
00:12:20,569 --> 00:12:18,350
your mission specialist Christina

182
00:12:25,670 --> 00:12:20,579
hammock

183
00:12:30,530 --> 00:12:25,680
your mission specialist Jeremy Hansen

184
00:12:34,790 --> 00:12:30,540
you're Artemis 2 pilot Victor Glover

185
00:12:38,509 --> 00:12:34,800
your Artemis 2 Commander Reed Wiseman

186
00:12:41,090 --> 00:12:38,519
we're gonna hear the words go for launch

187
00:12:43,250 --> 00:12:41,100
on top of the most powerful rocket

188
00:12:46,250 --> 00:12:43,260

NASA's ever made the space launch system

189

00:12:47,990 --> 00:12:46,260

these four astronauts will travel 600

190

00:12:49,970 --> 00:12:48,000

000 miles around the Moon and back in

191

00:12:52,490 --> 00:12:49,980

the Orion capsule and we are going to

192

00:12:54,290 --> 00:12:52,500

the Moon together let's go

193

00:12:56,150 --> 00:12:54,300

the Artemis 2 mission will Mark the

194

00:12:59,329 --> 00:12:56,160

first time humans are that close to the

195

00:13:01,310 --> 00:12:59,339

Moon in more than 50 years this is a

196

00:13:02,870 --> 00:13:01,320

global effort Artemis 2 and it's only

197

00:13:06,170 --> 00:13:02,880

going to get larger with Artemis 3 and

198

00:13:08,870 --> 00:13:06,180

Beyond so to the NASA Workforce we say a

199

00:13:11,269 --> 00:13:08,880

huge thank you it is the next step on

200

00:13:14,750 --> 00:13:11,279

the journey that gets Humanity to Mars

201
00:13:17,509 --> 00:13:14,760
the Artemis 2 crew represents thousands

202
00:13:21,829 --> 00:13:17,519
of people working tirelessly to bring us

203
00:13:26,389 --> 00:13:21,839
to the Stars this is their crew this is

204
00:13:27,889 --> 00:13:26,399
our crew this is Humanity's crew the

205
00:13:28,750 --> 00:13:27,899
first group Artemis mission is set for

206
00:13:31,129 --> 00:13:28,760
2024.

207
00:13:35,889 --> 00:13:31,139
[Music]

208
00:13:40,730 --> 00:13:38,870
congratulations to our moon crew we

209
00:13:42,650 --> 00:13:40,740
can't wait to see you fly

210
00:13:44,210 --> 00:13:42,660
NASA scientists have been collecting air

211
00:13:46,550 --> 00:13:44,220
pollution measurements for more than two

212
00:13:48,290 --> 00:13:46,560
decades from low earth orbit Tempo will

213
00:13:53,150 --> 00:13:48,300

take a look at three main pollutants

214

00:13:54,829 --> 00:13:53,160

nitrogen dioxide formaldehyde and ozone

215

00:13:57,230 --> 00:13:54,839

now we've been doing Satellites with

216

00:13:59,329 --> 00:13:57,240

colleagues for a number of years but

217

00:14:01,670 --> 00:13:59,339

this is the first one that has these

218

00:14:03,530 --> 00:14:01,680

special qualities no other Earth

219

00:14:06,050 --> 00:14:03,540

absorbing satellite has ever been

220

00:14:08,210 --> 00:14:06,060

designed to specifically measure ozone

221

00:14:09,710 --> 00:14:08,220

in the lowest atmosphere Tempo is

222

00:14:11,569 --> 00:14:09,720

something we've been working on for a

223

00:14:13,970 --> 00:14:11,579

number of years so we're very very

224

00:14:16,550 --> 00:14:13,980

excited and we can't hardly wait until

225

00:14:18,769 --> 00:14:16,560

we get up and see what we can learn my

226

00:14:21,650 --> 00:14:18,779

name is Kelly chance I'm the principal

227

00:14:24,050 --> 00:14:21,660

investigator for Tempo open today NASA

228

00:14:26,329 --> 00:14:24,060

and Smithsonian space instrument is

229

00:14:28,550 --> 00:14:26,339

going to launch this April and we will

230

00:14:31,009 --> 00:14:28,560

be measuring atmospheric pollution for

231

00:14:33,590 --> 00:14:31,019

greater North America every hour my

232

00:14:35,389 --> 00:14:33,600

first job is investigators to make these

233

00:14:38,210 --> 00:14:35,399

instruments work so the data are

234

00:14:40,550 --> 00:14:38,220

available to everyone again my research

235

00:14:42,889 --> 00:14:40,560

group and I will be doing all kinds of

236

00:14:44,990 --> 00:14:42,899

scientific experiments learning in

237

00:14:46,970 --> 00:14:45,000

detail about where the pollution is and

238

00:14:49,310 --> 00:14:46,980

how it affects us and how hopefully

239

00:14:51,829 --> 00:14:49,320

we've been predicted better and make it

240

00:14:57,050 --> 00:14:53,290

foreign

241

00:14:58,430 --> 00:14:57,060

is a grading UV visible spectrometer it

242

00:15:01,189 --> 00:14:58,440

sits on a commercial communication

243

00:15:04,430 --> 00:15:01,199

satellite called intelsat 40e that

244

00:15:07,009 --> 00:15:04,440

weighs 13 600 pounds that's the same as

245

00:15:08,689 --> 00:15:07,019

about 10 elephants the satellite has two

246

00:15:10,970 --> 00:15:08,699

Deployable solar arrays which combine

247

00:15:13,250 --> 00:15:10,980

measure 81 feet and that's almost the

248

00:15:15,110 --> 00:15:13,260

length of a basketball court Tempo is

249

00:15:17,090 --> 00:15:15,120

designed to monitor the same place all

250

00:15:19,490 --> 00:15:17,100

the time which is why it'll be in

251
00:15:22,129 --> 00:15:19,500
geostationary orbit about 22 000 miles

252
00:15:23,689 --> 00:15:22,139
above earth's equator traveling 7000

253
00:15:26,810 --> 00:15:23,699
miles per hour

254
00:15:28,370 --> 00:15:26,820
now geostationary refers to where and

255
00:15:30,470 --> 00:15:28,380
how the satellite will orbit the earth

256
00:15:32,269 --> 00:15:30,480
it will be placed above earth's equator

257
00:15:34,430 --> 00:15:32,279
with an orbital time matching Earth's

258
00:15:36,650 --> 00:15:34,440
rotation this way Tempo will be able to

259
00:15:41,509 --> 00:15:36,660
sweep the entire continent once every

260
00:15:45,470 --> 00:15:43,430
as we near launch let's learn more about

261
00:15:47,389 --> 00:15:45,480
how Tempo data will be used with Erica

262
00:15:49,790 --> 00:15:47,399
Wright our education specialist at

263
00:15:51,829 --> 00:15:49,800

Smithsonian astrophysical Observatory hi

264

00:15:53,329 --> 00:15:51,839

Erica hi Angelique it's so exciting to

265

00:15:55,009 --> 00:15:53,339

be here with you today for launch it's

266

00:15:56,449 --> 00:15:55,019

so exciting to have you here Erica could

267

00:15:58,610 --> 00:15:56,459

you can you tell us a little bit more

268

00:16:00,470 --> 00:15:58,620

about the different sources of pollution

269

00:16:03,110 --> 00:16:00,480

the tempo will be measuring absolutely

270

00:16:05,210 --> 00:16:03,120

so Tempo is going to measure a number of

271

00:16:08,110 --> 00:16:05,220

key air quality constituents that tell

272

00:16:10,670 --> 00:16:08,120

us things about impacts on human health

273

00:16:12,949 --> 00:16:10,680

Agriculture and in our environment it's

274

00:16:15,290 --> 00:16:12,959

going to be things like nitrogen dioxide

275

00:16:17,110 --> 00:16:15,300

things that our cars and other

276

00:16:19,850 --> 00:16:17,120

combustion engines put out

277

00:16:21,769 --> 00:16:19,860

formaldehyde these are categories of

278

00:16:23,269 --> 00:16:21,779

pollutants called volatile organic

279

00:16:25,430 --> 00:16:23,279

compounds things that you might smell

280

00:16:28,490 --> 00:16:25,440

markers and paints and things like that

281

00:16:29,930 --> 00:16:28,500

as well as ozone which might be one that

282

00:16:31,069 --> 00:16:29,940

you know our listeners are thinking

283

00:16:32,930 --> 00:16:31,079

about

284

00:16:34,490 --> 00:16:32,940

um the ozone hole right A lot of people

285

00:16:35,870 --> 00:16:34,500

think about the ozone hole and that's a

286

00:16:37,490 --> 00:16:35,880

good thing you want to close that in you

287

00:16:39,889 --> 00:16:37,500

want more ozone but down here on Earth

288

00:16:41,389 --> 00:16:39,899

it's actually a pollutant that when

289

00:16:44,030 --> 00:16:41,399

humans breathe in it can cause injury

290

00:16:45,590 --> 00:16:44,040

damage to both us and our environment so

291

00:16:47,210 --> 00:16:45,600

those are some of the things just some

292

00:16:48,710 --> 00:16:47,220

of the numbers of many pollutants that

293

00:16:49,730 --> 00:16:48,720

Tempo will be measuring there's

294

00:16:50,870 --> 00:16:49,740

definitely a lot of pollutants and

295

00:16:53,210 --> 00:16:50,880

definitely a lot of information we're

296

00:16:55,189 --> 00:16:53,220

going to be getting can you tell me how

297

00:16:57,290 --> 00:16:55,199

the public will be able to access and

298

00:16:59,389 --> 00:16:57,300

learn from that information absolutely

299

00:17:02,930 --> 00:16:59,399

so Tempo data is going to be publicly

300

00:17:04,309 --> 00:17:02,940

available online for Via various NASA

301
00:17:06,590 --> 00:17:04,319
interfaces as well as Smithsonian

302
00:17:09,409 --> 00:17:06,600
interfaces so anybody can access it

303
00:17:10,490 --> 00:17:09,419
themselves which is really exciting that

304
00:17:12,710 --> 00:17:10,500
data is going to tell them things about

305
00:17:14,809 --> 00:17:12,720
their local backyard so they can look up

306
00:17:16,309 --> 00:17:14,819
what's happening outside today and maybe

307
00:17:18,110 --> 00:17:16,319
even make decisions do I want to go for

308
00:17:19,370 --> 00:17:18,120
a run today right is their quality a

309
00:17:21,710 --> 00:17:19,380
little bad today maybe I'll stay inside

310
00:17:23,510 --> 00:17:21,720
or work out inside so there's a lot of

311
00:17:26,270 --> 00:17:23,520
great local information that you can get

312
00:17:28,669 --> 00:17:26,280
from the tempo data and Erica who are

313
00:17:30,110 --> 00:17:28,679

some of the early adopters of tempo and

314

00:17:32,630 --> 00:17:30,120

how can they use this day-to-day

315

00:17:34,850 --> 00:17:32,640

information to actually decrease

316

00:17:36,650 --> 00:17:34,860

pollution in the future yeah so there's

317

00:17:39,470 --> 00:17:36,660

actually a whole community of tempo

318

00:17:41,450 --> 00:17:39,480

early adopters over 300 individuals and

319

00:17:43,310 --> 00:17:41,460

organizations have signed on to be part

320

00:17:44,930 --> 00:17:43,320

uh the tempo what's that early adopters

321

00:17:46,730 --> 00:17:44,940

program and learn about how to use that

322

00:17:49,549 --> 00:17:46,740

data right away and so those are state

323

00:17:52,789 --> 00:17:49,559

and local air quality Regulators those

324

00:17:54,230 --> 00:17:52,799

are Health researchers they're Community

325

00:17:55,970 --> 00:17:54,240

organizations

326

00:17:58,370 --> 00:17:55,980

um and non-profits that want to use the

327

00:18:00,830 --> 00:17:58,380

data uh to improve their local air

328

00:18:02,870 --> 00:18:00,840

quality and study impacts on our human

329

00:18:04,610 --> 00:18:02,880

health and the environment that's so

330

00:18:05,990 --> 00:18:04,620

incredibly exciting can't wait to see

331

00:18:07,610 --> 00:18:06,000

what's happening with all of that data

332

00:18:08,810 --> 00:18:07,620

thank you so much Erica for taking some

333

00:18:11,510 --> 00:18:08,820

time to talk with us about it thanks so

334

00:18:15,169 --> 00:18:13,490

in just a few moments launch coverage

335

00:18:17,210 --> 00:18:15,179

will continue with our friends at SpaceX

336

00:18:19,669 --> 00:18:17,220

in Hawthorne California as they walk us

337

00:19:03,590 --> 00:18:19,679

through terminal count live we'll see

338

00:19:08,330 --> 00:19:06,230

time launch from space launch complex 40

339

00:19:09,409 --> 00:19:08,340

at Cape Canaveral space force station

340

00:19:12,169 --> 00:19:09,419

Florida

341

00:19:15,409 --> 00:19:12,179

Welcome to our live launch coverage of

342

00:19:16,970 --> 00:19:15,419

the is-40e and Tempo mission for our

343

00:19:19,789 --> 00:19:16,980

customer Intel set

344

00:19:22,430 --> 00:19:19,799

today's launch marks our 220 second

345

00:19:24,650 --> 00:19:22,440

overall SpaceX mission to date and our

346

00:19:26,750 --> 00:19:24,660

23rd launch this year

347

00:19:28,789 --> 00:19:26,760

my name is Kate Tice quality systems

348

00:19:30,169 --> 00:19:28,799

engineering manager here at SpaceX and

349

00:19:32,870 --> 00:19:30,179

I'm joining you today from SpaceX

350

00:19:34,310 --> 00:19:32,880

headquarters in Hawthorne California we

351
00:19:37,669 --> 00:19:34,320
have a pretty unique payload on board

352
00:19:39,890 --> 00:19:37,679
the second stage tonight is 40e is a

353
00:19:41,750 --> 00:19:39,900
geosynchronous communication satellite

354
00:19:43,909 --> 00:19:41,760
that will provide coverage over North

355
00:19:46,310 --> 00:19:43,919
America for Intel sets commercial

356
00:19:49,909 --> 00:19:46,320
Aviation mobility and network service

357
00:19:51,890 --> 00:19:49,919
customers attached to is-40e is NASA's

358
00:19:54,890 --> 00:19:51,900
tropospheric emissions monitoring

359
00:19:57,350 --> 00:19:54,900
pollution or Tempo instrument operated

360
00:19:59,330 --> 00:19:57,360
by intelsat Tempo is a partnership

361
00:20:01,789 --> 00:19:59,340
between NASA and the Smithsonian

362
00:20:04,190 --> 00:20:01,799
institutions Smithsonian astrophysical

363
00:20:05,870 --> 00:20:04,200

Observatory and will improve life on

364

00:20:08,450 --> 00:20:05,880

Earth by revolutionizing the way

365

00:20:10,669 --> 00:20:08,460

scientists observe air quality it will

366

00:20:12,650 --> 00:20:10,679

also be the first space-based instrument

367

00:20:15,110 --> 00:20:12,660

to Monitor and track Air Pollution

368

00:20:17,930 --> 00:20:15,120

across North America on an hourly basis

369

00:20:20,029 --> 00:20:17,940

and Report observations during the day

370

00:20:22,370 --> 00:20:20,039

the satellite is scheduled to enter into

371

00:20:24,590 --> 00:20:22,380

service next month and Tempo will start

372

00:20:32,240 --> 00:20:24,600

operations this summer here's a little

373

00:20:36,529 --> 00:20:33,730

[Music]

374

00:20:38,690 --> 00:20:36,539

Intel sat is Bridging the digital divide

375

00:20:40,549 --> 00:20:38,700

by operating one of the world's largest

376

00:20:42,950 --> 00:20:40,559

satellite Fleet and connectivity

377

00:20:45,350 --> 00:20:42,960

infrastructures enabling people and

378

00:20:47,510 --> 00:20:45,360

their tools to speak over oceans see

379

00:20:49,730 --> 00:20:47,520

across continents and listen through the

380

00:20:52,370 --> 00:20:49,740

skies to communicate cooperate and

381

00:20:54,830 --> 00:20:52,380

coexist with a history of Firsts in

382

00:20:56,570 --> 00:20:54,840

telecommunications intelsat team members

383

00:20:58,850 --> 00:20:56,580

are addressing a new generation of

384

00:21:01,730 --> 00:20:58,860

challenges

385

00:21:04,130 --> 00:21:01,740

is the latest addition for a field of 56

386

00:21:07,070 --> 00:21:04,140

geostationary satellites they will be

387

00:21:10,549 --> 00:21:07,080

operated at 91 West so over North

388

00:21:13,450 --> 00:21:10,559

America its primary mission is managed

389

00:21:16,669 --> 00:21:13,460

Mobility Services over North America

390

00:21:19,010 --> 00:21:16,679

Intel set is 40e satellite will provide

391

00:21:22,010 --> 00:21:19,020

focused coverage for many of intelsat's

392

00:21:23,570 --> 00:21:22,020

business units the ee stands for epic a

393

00:21:26,450 --> 00:21:23,580

high throughput satellite connecting

394

00:21:30,049 --> 00:21:26,460

customers in the air on the ground and

395

00:21:31,510 --> 00:21:30,059

at Sea it means inside connectivity for

396

00:21:34,210 --> 00:21:31,520

commercial airline passengers

397

00:21:37,190 --> 00:21:34,220

connectivity for people on business Jets

398

00:21:39,049 --> 00:21:37,200

connectivity for maritime users like

399

00:21:42,649 --> 00:21:39,059

people on cruise ship as well as

400

00:21:44,830 --> 00:21:42,659

Mobility for Disaster Recovery in

401
00:21:47,810 --> 00:21:44,840
addition to serving Intel sat customers

402
00:21:50,510 --> 00:21:47,820
is40e will host a NASA and Smithsonian

403
00:21:52,310 --> 00:21:50,520
payload called Tempo Intel sat will

404
00:21:54,289 --> 00:21:52,320
operate the instrument while it monitors

405
00:21:56,990 --> 00:21:54,299
and tracks air pollution across North

406
00:21:58,490 --> 00:21:57,000
America on an hourly basis with the

407
00:22:00,830 --> 00:21:58,500
ability to stay over a region of

408
00:22:04,010 --> 00:22:00,840
Interest during a natural disaster like

409
00:22:05,930 --> 00:22:04,020
a major fire or volcanic eruption this

410
00:22:08,210 --> 00:22:05,940
is going to be the first time that we

411
00:22:10,190 --> 00:22:08,220
have an instrument providing air quality

412
00:22:13,010 --> 00:22:10,200
measurement from the geostationary orbit

413
00:22:15,649 --> 00:22:13,020

it will allow to better understand the

414

00:22:19,130 --> 00:22:15,659

Dynamics of air quality over the large

415

00:22:23,450 --> 00:22:19,140

cities Intel's role is basically to

416

00:22:26,270 --> 00:22:23,460

provide the ground systems which enables

417

00:22:30,710 --> 00:22:26,280

the Smithsonian to send commands to the

418

00:22:33,169 --> 00:22:30,720

satellite and obtain measured data this

419

00:22:34,909 --> 00:22:33,179

measured data then is stored in our

420

00:22:38,330 --> 00:22:34,919

Riverside systems

421

00:22:48,110 --> 00:22:38,340

that will be accessed by the Smithsonian

422

00:22:52,490 --> 00:22:50,630

hi everyone I'm Ronnie foreman and I'm a

423

00:22:54,890 --> 00:22:52,500

commercial sales manager here at SpaceX

424

00:22:57,830 --> 00:22:54,900

I'm excited to join you and Kate to

425

00:22:59,570 --> 00:22:57,840

cover the is-40e mission tonight with

426
00:23:01,669 --> 00:22:59,580
liftoff just about seven minutes from

427
00:23:03,169 --> 00:23:01,679
now I want to talk to you first a little

428
00:23:05,090 --> 00:23:03,179
bit more about the Rockets supporting

429
00:23:07,549 --> 00:23:05,100
tonight's launch

430
00:23:10,070 --> 00:23:07,559
our Falcon 9 vehicle that you see on the

431
00:23:12,049 --> 00:23:10,080
pad is the two-stage rocket designed and

432
00:23:15,950 --> 00:23:12,059
manufactured by SpaceX

433
00:23:17,990 --> 00:23:15,960
standing 229 feet tall the Falcon 9 is

434
00:23:20,630 --> 00:23:18,000
about 40 feet taller than the Leaning

435
00:23:23,450 --> 00:23:20,640
Tower of Pisa in Italy and for all you

436
00:23:25,490 --> 00:23:23,460
Star Wars fans out there Falcon 9 was

437
00:23:27,350 --> 00:23:25,500
named after the Millennium Falcon from

438
00:23:29,390 --> 00:23:27,360

Star Wars

439

00:23:31,730 --> 00:23:29,400

the number nine indicates the number of

440

00:23:33,649 --> 00:23:31,740

Merlin 1D engines on the first stage

441

00:23:36,049 --> 00:23:33,659

which make up the bottom two-thirds of

442

00:23:38,149 --> 00:23:36,059

the vehicle

443

00:23:39,830 --> 00:23:38,159

speaking of the first stage its

444

00:23:41,690 --> 00:23:39,840

objective is to accelerate the vehicle

445

00:23:43,669 --> 00:23:41,700

through the Earth's atmosphere to space

446

00:23:46,549 --> 00:23:43,679

and then separate from the rest of the

447

00:23:48,890 --> 00:23:46,559

rocket this first stage also referred to

448

00:23:51,409 --> 00:23:48,900

as the booster is flying for the fourth

449

00:23:53,930 --> 00:23:51,419

time there you hear the call out that

450

00:23:56,029 --> 00:23:53,940

we've completed rp1 loading into the

451

00:23:58,190 --> 00:23:56,039

booster which again is for flying for

452

00:24:01,970 --> 00:23:58,200

the fourth time today it previously

453

00:24:04,850 --> 00:24:01,980

supported crs-26 one web launch 16 and a

454

00:24:08,990 --> 00:24:07,010

we will attempt to recover this booster

455

00:24:10,789 --> 00:24:09,000

again on our drone ship a shortfall of

456

00:24:12,470 --> 00:24:10,799

Gravitas which is currently positioned

457

00:24:14,090 --> 00:24:12,480

in the Atlantic Ocean and you can see it

458

00:24:17,750 --> 00:24:14,100

on your screen now

459

00:24:19,669 --> 00:24:17,760

it's successful that will Mark our 184th

460

00:24:22,430 --> 00:24:19,679

Landing of an orbital class rocket

461

00:24:24,770 --> 00:24:22,440

including both Falcon 9 and Falcon heavy

462

00:24:27,350 --> 00:24:24,780

side boosters

463

00:24:29,090 --> 00:24:27,360

moving on up above the first stage is

464

00:24:31,789 --> 00:24:29,100

the second stage which has a single

465

00:24:34,070 --> 00:24:31,799

Merlin vacuum or mvac engine that

466

00:24:36,289 --> 00:24:34,080

ignites after stage separation

467

00:24:39,230 --> 00:24:36,299

the second stage is what will carry the

468

00:24:42,350 --> 00:24:39,240

Intel sat 40e and NASA Smithsonian Tempo

469

00:24:46,549 --> 00:24:44,450

speaking of the payload it's currently

470

00:24:48,230 --> 00:24:46,559

safely tucked inside the 17-foot

471

00:24:50,210 --> 00:24:48,240

diameter payload fairing that you see on

472

00:24:52,310 --> 00:24:50,220

your screen now it's a large barrel

473

00:24:54,770 --> 00:24:52,320

structure with a pointed nose at the

474

00:24:56,870 --> 00:24:54,780

very top of the rocket made of carbon

475

00:24:58,669 --> 00:24:56,880

composite material the fairing protects

476
00:25:00,890 --> 00:24:58,679
the payload from Aero thermal heating

477
00:25:03,289 --> 00:25:00,900
and contamination on its trip to space

478
00:25:05,390 --> 00:25:03,299
before being jettisoned approximately

479
00:25:07,490 --> 00:25:05,400
three minutes into flight

480
00:25:08,990 --> 00:25:07,500
much like the first stage the fairing

481
00:25:11,270 --> 00:25:09,000
halves on today's flight are flight

482
00:25:15,230 --> 00:25:11,280
proven one half is flying for the second

483
00:25:18,049 --> 00:25:16,610
there you hear the call out that we're

484
00:25:20,390 --> 00:25:18,059
getting ready for strong back retract

485
00:25:22,370 --> 00:25:20,400
after separation those fairing halves

486
00:25:25,490 --> 00:25:22,380
will return to Earth to be recovered by

487
00:25:27,529 --> 00:25:25,500
our recovery vessel Doug

488
00:25:29,269 --> 00:25:27,539

and the large trust structure that you

489

00:25:31,130 --> 00:25:29,279

see next to Falcon 9 is what we were

490

00:25:33,590 --> 00:25:31,140

just talking about on the Nets that's

491

00:25:36,289 --> 00:25:33,600

the transporter erector or te for short

492

00:25:38,330 --> 00:25:36,299

we use it to roll the rocket out to the

493

00:25:41,810 --> 00:25:38,340

pad and raise it to its vertical launch

494

00:25:43,490 --> 00:25:41,820

position ahead of takeoff started

495

00:25:46,190 --> 00:25:43,500

the call out there says we're beginning

496

00:25:48,350 --> 00:25:46,200

to pull the te away from the vehicle the

497

00:25:50,510 --> 00:25:48,360

CE also routes the vehicle's fluids

498

00:25:52,310 --> 00:25:50,520

power and Telemetry umbilicals from the

499

00:25:54,769 --> 00:25:52,320

ground systems to the rocket and

500

00:25:58,669 --> 00:25:54,779

satellites until Falcon 9 transfers to

501
00:26:02,269 --> 00:26:00,230
there you can see the clamp arms are

502
00:26:09,710 --> 00:26:02,279
opening up beneath the fairing in

503
00:26:13,610 --> 00:26:12,110
and as Ronnie mentioned those clamp arms

504
00:26:15,470 --> 00:26:13,620
are now open

505
00:26:18,169 --> 00:26:15,480
and we should hear the call out

506
00:26:19,970 --> 00:26:18,179
momentarily that the strong back is

507
00:26:24,350 --> 00:26:19,980
reclining actually I think we can see it

508
00:26:28,730 --> 00:26:26,690
at t0 the ground hydraulic systems will

509
00:26:42,409 --> 00:26:28,740
pull the te even further away from the

510
00:26:46,850 --> 00:26:44,269
at this point in the countdown both the

511
00:26:49,549 --> 00:26:46,860
first and second stages are nearly fully

512
00:26:52,370 --> 00:26:49,559
loaded with one million pounds of liquid

513
00:26:54,850 --> 00:26:52,380

oxygen and kerosene fuel we use two

514

00:26:57,830 --> 00:26:54,860

propellants a refined form of kerosene

515

00:26:59,630 --> 00:26:57,840

complete ever heard that column stage

516

00:27:02,570 --> 00:26:59,640

one is now fully loaded with all of its

517

00:27:06,230 --> 00:27:02,580

liquid oxygen and fuel stage two is

518

00:27:08,630 --> 00:27:06,240

undergoing its locks load uh uh full

519

00:27:10,549 --> 00:27:08,640

fuel load is complete on stage two we

520

00:27:12,350 --> 00:27:10,559

expect locks loading to wrap up at T

521

00:27:14,510 --> 00:27:12,360

minus two minutes

522

00:27:16,250 --> 00:27:14,520

the liquid oxygen is chilled well below

523

00:27:18,110 --> 00:27:16,260

its boiling point so that it has a much

524

00:27:20,870 --> 00:27:18,120

greater amount of mass per volume

525

00:27:22,010 --> 00:27:20,880

allowing us to load more of it into the

526
00:27:24,230 --> 00:27:22,020
rocket

527
00:27:27,169 --> 00:27:24,240
in addition to these two propellants we

528
00:27:29,750 --> 00:27:27,179
also use a chemical t-tab or triethyl

529
00:27:31,669 --> 00:27:29,760
aluminum and triethyl boring and we use

530
00:27:34,970 --> 00:27:31,679
that as our ignition source

531
00:27:37,549 --> 00:27:34,980
the combustion of rp1 and locks is what

532
00:27:39,649 --> 00:27:37,559
makes the rocket go and it's the t-tab

533
00:27:43,190 --> 00:27:39,659
that sets the match to that propellant

534
00:27:47,810 --> 00:27:45,649
so once again the first stage has all of

535
00:27:51,169 --> 00:27:47,820
its propellants on board fully loaded

536
00:27:53,570 --> 00:27:51,179
with all of its liquid oxygen and rp1

537
00:27:55,669 --> 00:27:53,580
that rp1 load is complete on the second

538
00:27:58,370 --> 00:27:55,679

stage and we're expecting the locks load

539

00:28:00,470 --> 00:27:58,380

to wrap up here any second now on the

540

00:28:02,570 --> 00:28:00,480

second stage

541

00:28:05,390 --> 00:28:02,580

that's a minus 60 seconds we'll hear the

542

00:28:07,789 --> 00:28:05,400

call out Falcon 9 isn't startup

543

00:28:09,649 --> 00:28:07,799

it's an indication that the onboard uh

544

00:28:11,330 --> 00:28:09,659

internal flight computers have taken

545

00:28:14,269 --> 00:28:11,340

over the launch countdown

546

00:28:18,230 --> 00:28:14,279

and just inside T minus two seconds we

547

00:28:20,750 --> 00:28:18,240

light the Merlin 1D engines for liftoff

548

00:28:23,029 --> 00:28:20,760

stage two oxford complete

549

00:28:25,549 --> 00:28:23,039

and there's that call out so as of now

550

00:28:26,930 --> 00:28:25,559

Falcon 9 is fully loaded with all of its

551
00:28:29,750 --> 00:28:26,940
propellants

552
00:28:32,390 --> 00:28:29,760
the is-40e and Tempo payload continues

553
00:28:35,090 --> 00:28:32,400
to be healthy and the Falcon 9 team is

554
00:28:38,110 --> 00:28:35,100
tracking no major issues on the rocket

555
00:28:40,370 --> 00:28:38,120
currently weather is green

556
00:28:43,070 --> 00:28:40,380
whether it's green and the range is

557
00:28:45,409 --> 00:28:43,080
ready to support the t0 of 12 30 am

558
00:28:53,090 --> 00:28:45,419
eastern time just one minute and 20

559
00:28:58,070 --> 00:28:55,310
we heard that call a little bit ago for

560
00:29:00,049 --> 00:28:58,080
the ground Closeouts we'll now see some

561
00:29:01,310 --> 00:29:00,059
more of that liquid oxygen venting from

562
00:29:04,730 --> 00:29:01,320
the tea

563
00:29:09,289 --> 00:29:04,740

as those lines are now closed out to the

564

00:29:13,070 --> 00:29:11,149

all right there's that call out letting

565

00:29:15,830 --> 00:29:13,080

us know that the onboard flight

566

00:29:20,930 --> 00:29:15,840

computers have taken control of the

567

00:29:25,370 --> 00:29:23,330

LD go for launch

568

00:29:27,230 --> 00:29:25,380

and there's our final go for launch

569

00:29:31,430 --> 00:29:27,240

tonight coming from our launch director

570

00:29:33,470 --> 00:29:31,440

we're now at T minus 35 seconds all

571

00:29:36,289 --> 00:29:33,480

systems are go for launch of Falcon 9

572

00:29:39,169 --> 00:29:36,299

with the Intel sat 40e and NASA 30

573

00:29:42,110 --> 00:29:39,179

seconds and the NASA Smithsonian Tempo

574

00:29:50,289 --> 00:29:42,120

payload less listening to the terminal

575

00:29:50,299 --> 00:29:55,370

15 seconds

576
00:29:55,380 --> 00:30:00,770
damage

577
00:30:00,780 --> 00:30:23,389
[Applause]

578
00:30:23,399 --> 00:30:29,830
I want these Enterprise

579
00:30:41,389 --> 00:30:36,500
[Music]

580
00:30:46,010 --> 00:30:43,730
if you're just joining us those gorgeous

581
00:30:48,529 --> 00:30:46,020
views on your screen mean that Falcon 9

582
00:30:52,149 --> 00:30:48,539
has successfully lifted off from pad 40

583
00:30:54,649 --> 00:30:52,159
at Cape Canaveral space force station

584
00:30:56,149 --> 00:30:54,659
Telemetry they call out there that

585
00:30:56,990 --> 00:30:56,159
nominal power and Telemetry for the

586
00:30:59,149 --> 00:30:57,000
vehicle

587
00:31:01,549 --> 00:30:59,159
during this phase which is called Ascent

588
00:31:03,710 --> 00:31:01,559

we tilt the engines the technical term

589

00:31:05,570 --> 00:31:03,720

for this is called gimbaling and that

590

00:31:07,210 --> 00:31:05,580

turns the rocket horizontally in what we

591

00:31:10,010 --> 00:31:07,220

call a gravity turn

592

00:31:11,870 --> 00:31:10,020

is supersonic there's a call out that

593

00:31:13,549 --> 00:31:11,880

Falcon 9 is now traveling faster than

594

00:31:15,470 --> 00:31:13,559

the speed of sound

595

00:31:17,630 --> 00:31:15,480

during this period we're still going up

596

00:31:19,970 --> 00:31:17,640

but we're also heading horizontally away

597

00:31:22,070 --> 00:31:19,980

from the launch

598

00:31:23,930 --> 00:31:22,080

just moments ago we throttled down in

599

00:31:25,909 --> 00:31:23,940

preparation for Max Q which is the

600

00:31:27,710 --> 00:31:25,919

period of Maximum aerodynamic pressure

601
00:31:30,169 --> 00:31:27,720
that the vehicle will see on Ascent so

602
00:31:32,330 --> 00:31:30,179
that's what's happening right now

603
00:31:36,169 --> 00:31:32,340
the rocket typically needs to go about

604
00:31:37,850 --> 00:31:36,179
17 500 miles per hour horizontally in

605
00:31:39,710 --> 00:31:37,860
order to avoid being pulled back to

606
00:31:41,389 --> 00:31:39,720
Earth and reach orbit

607
00:31:43,490 --> 00:31:41,399
now we're going to have three events

608
00:31:45,769 --> 00:31:43,500
coming up in quick succession

609
00:31:48,889 --> 00:31:45,779
starting with main engine cutoff stage

610
00:31:51,470 --> 00:31:48,899
separation and second engine start one

611
00:31:53,389 --> 00:31:51,480
main engine cutoff or Mikko is the point

612
00:31:55,730 --> 00:31:53,399
during the flight where we shut down the

613
00:31:56,870 --> 00:31:55,740

nine Merlin 1D engines on the first

614

00:32:01,549 --> 00:31:56,880

stage

615

00:32:03,350 --> 00:32:01,559

separate from each other so that the

616

00:32:05,389 --> 00:32:03,360

second stage isn't carrying unnecessary

617

00:32:07,310 --> 00:32:05,399

Mass to orbit and of course the first

618

00:32:08,090 --> 00:32:07,320

stage booster begins its trip back to

619

00:32:10,370 --> 00:32:08,100

Earth

620

00:32:12,350 --> 00:32:10,380

the last callout you heard was about the

621

00:32:14,870 --> 00:32:12,360

mvac engine that's what we're going to

622

00:32:17,090 --> 00:32:14,880

start up during ses1 or second engine

623

00:32:18,529 --> 00:32:17,100

start one that's the period during the

624

00:32:20,510 --> 00:32:18,539

flight where we'll ignite the Merlin

625

00:32:22,970 --> 00:32:20,520

vacuum engine on board the second stage

626
00:32:24,590 --> 00:32:22,980
for the first time

627
00:32:27,049 --> 00:32:24,600
so we'll see all three of those happen

628
00:32:40,130 --> 00:32:27,059
back to back just about 10 seconds from

629
00:32:47,890 --> 00:32:42,529
thank you

630
00:32:53,029 --> 00:32:50,330
[Applause]

631
00:32:54,830 --> 00:32:53,039
and bad condition

632
00:32:56,750 --> 00:32:54,840
heard and definitely saw those great

633
00:32:58,669 --> 00:32:56,760
views on your screen three events

634
00:33:02,389 --> 00:32:58,679
happening back to back main engine cut

635
00:33:04,430 --> 00:33:02,399
off stage separation and ses1 coming up

636
00:33:07,310 --> 00:33:04,440
next we'll be fairing separation in just

637
00:33:10,970 --> 00:33:08,870
during this portion of the flight will

638
00:33:20,630 --> 00:33:10,980

jettison both fairing halves and then

639

00:33:28,250 --> 00:33:22,850

both vehicles are following nominal

640

00:33:33,470 --> 00:33:31,490

bearing separation confirmed

641

00:33:35,210 --> 00:33:33,480

there we've got confirmation of fairing

642

00:33:37,250 --> 00:33:35,220

separation which means both fairing

643

00:33:40,190 --> 00:33:37,260

halves are on their way back to Earth to

644

00:33:42,350 --> 00:33:40,200

be recovered by our recovery vessel Doug

645

00:33:43,909 --> 00:33:42,360

coming up next there are two Burns for

646

00:33:46,009 --> 00:33:43,919

our first stage as we prepare for

647

00:33:53,810 --> 00:33:46,019

landing on our drone ship a shortfall of

648

00:33:59,810 --> 00:33:56,990

acquisition of signal Bermuda

649

00:34:02,570 --> 00:33:59,820

for now t plus three minutes and 54

650

00:34:04,430 --> 00:34:02,580

seconds into today's Mission and we're

651
00:34:07,009 --> 00:34:04,440
currently as you there see there on your

652
00:34:09,409 --> 00:34:07,019
screen we're in the first of two planned

653
00:34:11,629 --> 00:34:09,419
and back Burns that will occur prior to

654
00:34:15,230 --> 00:34:11,639
satellite deployment

655
00:34:17,210 --> 00:34:15,240
at t plus six minutes and 31 seconds or

656
00:34:20,149 --> 00:34:17,220
around there you should see on your

657
00:34:23,690 --> 00:34:20,159
screen the first stage is entry burn

658
00:34:26,869 --> 00:34:23,700
for that entry burn we relight three m1d

659
00:34:29,030 --> 00:34:26,879
engines which are the uh those nine

660
00:34:32,270 --> 00:34:29,040
engines at the base or the bottom of the

661
00:34:33,950 --> 00:34:32,280
first stage we will relight first the

662
00:34:36,710 --> 00:34:33,960
center engine or

663
00:34:39,109 --> 00:34:36,720

called E9 and then shortly thereafter we

664

00:34:41,450 --> 00:34:39,119

will also relight two radial engines

665

00:34:43,430 --> 00:34:41,460

engines one and five

666

00:34:45,589 --> 00:34:43,440

and all three of those together will

667

00:34:52,250 --> 00:34:45,599

help slow the vehicle down as it passes

668

00:34:58,190 --> 00:34:54,649

We performed that re-entry burn in order

669

00:35:00,109 --> 00:34:58,200

to slow excuse me to slow down the

670

00:35:02,810 --> 00:35:00,119

booster which helps to reduce those

671

00:35:04,910 --> 00:35:02,820

re-entry forces that it sees and in turn

672

00:35:07,550 --> 00:35:04,920

that helps us recover and reuse our

673

00:35:10,490 --> 00:35:07,560

first stages both vehicles continue to

674

00:35:12,349 --> 00:35:10,500

follow nominal trajectories

675

00:35:14,750 --> 00:35:12,359

although we can't see the first stage

676
00:35:16,550 --> 00:35:14,760
right now you can follow along with the

677
00:35:18,589 --> 00:35:16,560
Telemetry there in the bottom left-hand

678
00:35:21,650 --> 00:35:18,599
corner for stage one and then that stage

679
00:35:24,349 --> 00:35:21,660
two Telemetry there in the right hand uh

680
00:35:26,810 --> 00:35:24,359
bottom corner of your screen

681
00:35:29,210 --> 00:35:26,820
we can see that the first stage is now

682
00:35:31,310 --> 00:35:29,220
beginning its descent uh back to Earth

683
00:35:34,910 --> 00:35:31,320
so it has already passed through its

684
00:35:37,790 --> 00:35:34,920
apogee making its way uh back down this

685
00:35:39,109 --> 00:35:37,800
time we're targeting a landing on our

686
00:35:40,790 --> 00:35:39,119
drone ship which is parked a couple

687
00:35:44,089 --> 00:35:40,800
hundred miles off the coast of Florida

688
00:35:47,329 --> 00:35:44,099

in the Atlantic Ocean

689

00:35:49,550 --> 00:35:47,339

during that entry burn Falcon 9 is

690

00:35:51,950 --> 00:35:49,560

decelerating is decelerating by firing

691

00:35:53,630 --> 00:35:51,960

its Merlin engines but it's still moving

692

00:35:55,370 --> 00:35:53,640

very rapidly

693

00:35:57,770 --> 00:35:55,380

this causes the vehicle to fly through

694

00:36:01,849 --> 00:35:57,780

Merlin's exhaust gases also known as the

695

00:36:05,450 --> 00:36:01,859

Rockets plume and by doing so we get a

696

00:36:06,589 --> 00:36:05,460

deposit of soot on the uh on the vehicle

697

00:36:09,050 --> 00:36:06,599

surface

698

00:36:14,750 --> 00:36:09,060

that's it then basically comes from the

699

00:36:20,870 --> 00:36:16,550

we're expecting that entry burn to begin

700

00:36:24,829 --> 00:36:22,730

everything continues to look good there

701
00:36:26,150 --> 00:36:24,839
for that second stage we can see that

702
00:36:29,109 --> 00:36:26,160
mvac engine

703
00:36:33,069 --> 00:36:29,119
uh which is the singular Merlin engine

704
00:36:39,890 --> 00:36:33,079
designed for use in the vacuum of space

705
00:36:44,990 --> 00:36:42,290
stage one entry burn startup

706
00:36:46,430 --> 00:36:45,000
stage one FTS is saved

707
00:36:47,990 --> 00:36:46,440
all right so there on that left hand

708
00:36:50,450 --> 00:36:48,000
side of your screen those stage one

709
00:36:52,069 --> 00:36:50,460
views are back we can see that entry

710
00:36:54,230 --> 00:36:52,079
burn has begun and it's also

711
00:36:56,810 --> 00:36:54,240
illuminating the grid fins which help to

712
00:37:02,329 --> 00:36:56,820
steer the booster for re-entry and also

713
00:37:07,730 --> 00:37:05,630

stage one entry burn shutdown

714

00:37:09,349 --> 00:37:07,740

all right we can see that entry burn has

715

00:37:13,010 --> 00:37:09,359

completed Vehicles continue to follow

716

00:37:17,870 --> 00:37:16,069

as a reminder the first stage that we

717

00:37:21,230 --> 00:37:17,880

saw there on the left hand side of your

718

00:37:23,690 --> 00:37:21,240

screen that performed the entry burn for

719

00:37:27,950 --> 00:37:23,700

the fourth time it previously supported

720

00:37:29,390 --> 00:37:27,960

CRS 26 one web launch 16 and a starlink

721

00:37:31,970 --> 00:37:29,400

mission

722

00:37:34,370 --> 00:37:31,980

Falcon 9 is the world's first orbital

723

00:37:36,109 --> 00:37:34,380

class reusable rocket and this is

724

00:37:38,569 --> 00:37:36,119

important because reusability allows

725

00:37:40,849 --> 00:37:38,579

SpaceX to refly the most expensive parts

726

00:37:48,470 --> 00:37:40,859

of the rocket which in turn drives down

727

00:37:53,750 --> 00:37:50,329

the next major Milestone we have coming

728

00:37:56,870 --> 00:37:53,760

up is Seco or second engine cutoff one

729

00:37:59,210 --> 00:37:56,880

which is coming up in about 20 seconds

730

00:38:00,950 --> 00:37:59,220

that will be followed very quickly which

731

00:38:03,650 --> 00:38:00,960

one transonic

732

00:38:05,870 --> 00:38:03,660

that call out tells us that the first

733

00:38:09,290 --> 00:38:05,880

stage is traveling near the speed of

734

00:38:11,870 --> 00:38:09,300

sound that first stage will begin its

735

00:38:22,010 --> 00:38:11,880

Landing burn just after we have the

736

00:38:26,270 --> 00:38:24,710

and back shut down

737

00:38:28,670 --> 00:38:26,280

all right there's that call out telling

738

00:38:32,810 --> 00:38:28,680

us that we had successful shutdown or

739

00:38:37,730 --> 00:38:35,150

you can see Landing burn has begun there

740

00:38:39,890 --> 00:38:37,740

on that screen thanks to FTS is safe you

741

00:38:43,010 --> 00:38:39,900

can see those grid fins working hard to

742

00:38:46,250 --> 00:38:43,020

steer it back to the Drone ship for its

743

00:38:48,650 --> 00:38:46,260

Landing Elemental orbit insertion

744

00:38:58,150 --> 00:38:48,660

great call out there indicating like

745

00:39:01,730 --> 00:39:00,520

stage one Landing confirmed

746

00:39:03,890 --> 00:39:01,740

[Music]

747

00:39:06,950 --> 00:39:03,900

there you can see on your screen an

748

00:39:10,370 --> 00:39:06,960

amazing view as always that Landing

749

00:39:12,770 --> 00:39:10,380

marks spacex's 184th recovery of an

750

00:39:15,410 --> 00:39:12,780

orbital class rocket including first

751
00:39:18,770 --> 00:39:15,420
stage Landings for Falcon 9 and Falcon

752
00:39:20,690 --> 00:39:18,780
heavy the mission isn't over just yet we

753
00:39:23,569 --> 00:39:20,700
did hear the call out telling us that

754
00:39:25,910 --> 00:39:23,579
the second stage achieved good orbit so

755
00:39:28,310 --> 00:39:25,920
it is now embarking on its First Coast

756
00:39:30,530 --> 00:39:28,320
phase after this Coast phase we will

757
00:39:32,510 --> 00:39:30,540
light that mvac engine for a second time

758
00:39:35,450 --> 00:39:32,520
and that will happen around the t plus

759
00:39:37,849 --> 00:39:35,460
26 minute Mark so hang tight we'll see

760
00:39:40,580 --> 00:39:37,859
you back here in about 15 minutes

761
00:39:54,760 --> 00:39:40,590
foreign

762
00:40:14,710 --> 00:39:54,770
[Music]

763
00:40:52,030 --> 00:40:14,720

foreign

764

00:41:20,700 --> 00:41:08,270

[Music]

765

00:41:57,290 --> 00:41:20,710

foreign

766

00:42:31,270 --> 00:41:57,300

[Music]

767

00:42:31,280 --> 00:42:39,900

[Applause]

768

00:43:14,080 --> 00:42:55,190

[Music]

769

00:43:32,460 --> 00:43:14,090

foreign

770

00:43:33,630 --> 00:43:32,470

[Music]

771

00:43:47,450 --> 00:43:33,640

[Applause]

772

00:44:16,790 --> 00:43:47,460

[Music]

773

00:44:16,800 --> 00:44:21,040

foreign

774

00:44:21,050 --> 00:44:50,690

[Music]

775

00:45:30,890 --> 00:44:50,930

thank you

776
00:45:30,900 --> 00:45:33,710
I don't know

777
00:45:33,720 --> 00:45:40,220
foreign

778
00:46:39,880 --> 00:46:38,630
[Music]

779
00:46:44,610 --> 00:46:39,890
foreign

780
00:47:01,830 --> 00:46:44,620
[Music]

781
00:47:43,010 --> 00:47:01,840
[Applause]

782
00:47:43,020 --> 00:47:47,530
foreign

783
00:47:52,750 --> 00:47:48,020
[Applause]

784
00:47:56,060 --> 00:47:52,760
[Music]

785
00:49:00,010 --> 00:47:56,070
[Applause]

786
00:49:00,020 --> 00:49:06,460
thank you

787
00:49:08,820 --> 00:49:07,010
[Music]

788
00:49:24,110 --> 00:49:08,830

[Applause]

789

00:49:24,400 --> 00:49:24,120

[Music]

790

00:49:36,050 --> 00:49:24,410

[Applause]

791

00:49:36,060 --> 00:49:39,320

foreign

792

00:51:08,710 --> 00:50:43,880

[Music]

793

00:51:08,720 --> 00:51:13,870

thank you foreign

794

00:51:27,540 --> 00:51:18,180

[Music]

795

00:51:35,140 --> 00:51:27,550

[Applause]

796

00:51:35,900 --> 00:51:35,150

[Music]

797

00:51:59,770 --> 00:51:35,910

[Applause]

798

00:52:13,809 --> 00:52:06,390

[Music]

799

00:52:13,819 --> 00:52:18,890

thank you

800

00:52:25,360 --> 00:52:24,640

[Music]

801
00:53:03,290 --> 00:52:25,370
[Applause]

802
00:54:15,770 --> 00:53:03,300
[Music]

803
00:54:15,780 --> 00:54:27,790
foreign

804
00:54:49,740 --> 00:54:47,390
[Music]

805
00:56:06,790 --> 00:54:49,750
foreign

806
00:56:12,109 --> 00:56:09,430
welcome back to the SpaceX webcast

807
00:56:15,349 --> 00:56:12,119
tonight's Falcon 9 mission is carrying

808
00:56:17,690 --> 00:56:15,359
the Intel sat 40e and NASA Smithsonian

809
00:56:19,910 --> 00:56:17,700
Tempo payload for our customer intelsat

810
00:56:23,450 --> 00:56:19,920
we've had a nominal Mission so far

811
00:56:26,210 --> 00:56:23,460
Falcon 9 launched on time at 12 30 a.m

812
00:56:27,890 --> 00:56:26,220
Eastern from space launch complex 40 and

813
00:56:30,109 --> 00:56:27,900

then successfully landed on our drone

814

00:56:32,270 --> 00:56:30,119

ship a shortfall of Gravitas

815

00:56:34,430 --> 00:56:32,280

well the second stage completed its

816

00:56:35,930 --> 00:56:34,440

first burn taking our payload into its

817

00:56:37,970 --> 00:56:35,940

initial parking orbit

818

00:56:39,770 --> 00:56:37,980

we're just about five seconds away from

819

00:56:41,870 --> 00:56:39,780

a second ignition of the Merlin vacuum

820

00:56:43,849 --> 00:56:41,880

engine which will carry the second stage

821

00:56:45,049 --> 00:56:43,859

and today's payload into the orbit

822

00:56:46,130 --> 00:56:45,059

needed to deploy the satellite

823

00:56:48,049 --> 00:56:46,140

recognition

824

00:56:52,069 --> 00:56:48,059

here's the confirmation we've got for

825

00:56:54,230 --> 00:56:52,079

ses2 second engine start 2. this burn of

826
00:56:57,290 --> 00:56:54,240
the mvac engine is planned to last just

827
00:57:02,630 --> 00:56:59,390
right now you can see the mvac skirt

828
00:57:07,190 --> 00:57:02,640
glowing orange as it burns

829
00:57:11,510 --> 00:57:09,710
while the mvac and Merlin engines on

830
00:57:13,670 --> 00:57:11,520
board the first stage are quite similar

831
00:57:15,710 --> 00:57:13,680
the mvac is unique and that has been

832
00:57:18,170 --> 00:57:15,720
optimized to perform in the vacuum of

833
00:57:26,750 --> 00:57:18,180
space which gives its gives it its name

834
00:57:30,650 --> 00:57:28,670
just about 10 seconds to go on this burn

835
00:57:41,930 --> 00:57:30,660
before we'll hear before we expect to

836
00:57:52,250 --> 00:57:44,569
Index right now there's the confirmation

837
00:57:56,569 --> 00:57:54,890
Elemental orbit insertion

838
00:57:59,270 --> 00:57:56,579

now confirms that we're in the correct

839

00:58:01,730 --> 00:57:59,280

orbit so right now the payload is still

840

00:58:03,589 --> 00:58:01,740

attached to Falcon 9's second stage with

841

00:58:06,230 --> 00:58:03,599

deployments scheduled in just about four

842

00:58:07,790 --> 00:58:06,240

minutes while we wait sit back and enjoy

843

00:58:11,260 --> 00:58:07,800

the views

844

00:59:24,620 --> 00:59:04,849

[Music]

845

01:00:00,430 --> 00:59:27,430

[Applause]

846

01:00:13,970 --> 01:00:11,210

thank you

847

01:00:13,980 --> 01:00:22,500

foreign

848

01:00:46,500 --> 01:00:45,349

[Music]

849

01:01:08,500 --> 01:00:46,510

foreign

850

01:01:08,510 --> 01:01:14,089

[Music]

851

01:01:37,849 --> 01:01:15,380

foreign

852

01:01:43,190 --> 01:01:39,950

if you're just joining us welcome to the

853

01:01:45,770 --> 01:01:43,200

webcast for the is-40e and Tempo Mission

854

01:01:48,650 --> 01:01:45,780

we've had a nominal Mission so far with

855

01:01:51,589 --> 01:01:48,660

an on-time liftoff at 12 30 a.m eastern

856

01:01:53,990 --> 01:01:51,599

time followed by successful Ascent stage

857

01:01:56,630 --> 01:01:54,000

separation and two second stage engine

858

01:01:58,849 --> 01:01:56,640

Burns we're now coming up on the final

859

01:02:01,670 --> 01:01:58,859

mission Milestone of the day and that's

860

01:02:03,710 --> 01:02:01,680

payload deployment of course and that

861

01:02:05,870 --> 01:02:03,720

payload payload as you see there on your

862

01:02:08,270 --> 01:02:05,880

screen will be deploying from our second

863

01:02:10,130 --> 01:02:08,280

stage

864

01:02:13,250 --> 01:02:10,140

as a reminder our customer for today's

865

01:02:15,049 --> 01:02:13,260

mission is intelsat and their is-40e

866

01:02:17,210 --> 01:02:15,059

payload is a geosynchronous

867

01:02:19,970 --> 01:02:17,220

communication satellite that also

868

01:02:22,010 --> 01:02:19,980

features a NASA payload Tempo or

869

01:02:24,349 --> 01:02:22,020

tropospheric emissions monitoring

870

01:02:27,049 --> 01:02:24,359

pollution the payload will be operated

871

01:02:29,089 --> 01:02:27,059

by Intel SAT but Tempo is a partnership

872

01:02:31,490 --> 01:02:29,099

between NASA and the Smithsonian

873

01:02:33,470 --> 01:02:31,500

institutions Smithsonian astrophysical

874

01:02:36,710 --> 01:02:33,480

Observatory

875

01:02:39,349 --> 01:02:36,720

code separation confirmed

876

01:02:41,329 --> 01:02:39,359

beautiful view there as you can see and

877

01:02:45,470 --> 01:02:41,339

as we heard called out successful

878

01:02:56,750 --> 01:02:45,480

confirmation of the intelsat 40e and

879

01:03:01,210 --> 01:02:59,089

all of us here at SpaceX want to give a

880

01:03:04,789 --> 01:03:01,220

big thank you to our customers

881

01:03:07,069 --> 01:03:04,799

Intel Sac for entrusting us with today's

882

01:03:08,809 --> 01:03:07,079

Mission we also want to give a shout out

883

01:03:10,370 --> 01:03:08,819

to the range and Federal Aviation

884

01:03:12,710 --> 01:03:10,380

Administration for supporting today's

885

01:03:15,950 --> 01:03:12,720

launch tonight's flight concludes

886

01:03:19,490 --> 01:03:15,960

spacex's 222nd overall mission to date

887

01:03:21,289 --> 01:03:19,500

and our 23rd launch of 2023. thanks to

888

01:03:22,970 --> 01:03:21,299

all our viewers for tuning in hope you

889

01:03:27,190 --> 01:03:22,980

enjoy the rest of your morning and we'll

890

01:03:32,270 --> 01:03:29,870

that's going to wrap up NASA's SpaceX

891

01:03:34,130 --> 01:03:32,280

coverage of the launch of Intel sat 40e

892

01:03:36,170 --> 01:03:34,140

and Tempo you can find more information

893

01:03:38,690 --> 01:03:36,180

about this Mission and other NASA

894

01:03:40,370 --> 01:03:38,700

launches by going to nasa.gov for NASA

895

01:03:43,150 --> 01:03:40,380

community Communications I'm Anjali

896

01:03:55,789 --> 01:03:43,160

paring have a good night

897

01:04:09,010 --> 01:03:56,990

thank you

898

01:05:03,609 --> 01:04:09,020

[Music]