
UCB • OA • NRL • UTD • SDL • CSL • NASA
IONOSPHERIC CONNECTION EXPLORER
ICON
COUNTDOWN
TO
T-ZERO
Pegasus

1
00:00:16,470 --> 00:00:15,589
exploring the universe is a daunting

2
00:00:18,790 --> 00:00:16,480
task

3
00:00:21,830 --> 00:00:18,800
there are often immense challenges that

4
00:00:23,189 --> 00:00:21,840
must be overcome before even setting out

5
00:00:25,910 --> 00:00:23,199
on a mission

6
00:00:28,950 --> 00:00:25,920
the ionospheric connection explorer or

7
00:00:30,790 --> 00:00:28,960
icon has faced multiple barriers that

8
00:00:32,389 --> 00:00:30,800
have delayed its journey to study the

9
00:00:35,110 --> 00:00:32,399
frontier of space

10
00:00:37,510 --> 00:00:35,120
the dynamic zone high in our atmosphere

11
00:00:38,549 --> 00:00:37,520
where earth's weather meets space

12
00:00:40,549 --> 00:00:38,559
weather

13
00:00:43,750 --> 00:00:40,559

but before we can reap the benefits of

14
00:00:45,350 --> 00:00:43,760
its scientific research icon must launch

15
00:00:48,310 --> 00:00:45,360
successfully

16
00:00:50,630 --> 00:00:48,320
the icon team's can do spirit will be

17
00:00:53,029 --> 00:00:50,640
repeatedly pushed to its limits while

18
00:00:56,680 --> 00:00:53,039
striving for a long-awaited and

19
00:00:59,349 --> 00:00:56,690
hard-earned t-zero

20
00:01:01,110 --> 00:00:59,359
[Music]

21
00:01:03,110 --> 00:01:01,120
a successful space launch requires

22
00:01:05,750 --> 00:01:03,120
flawless execution of a highly complex

23
00:01:07,510 --> 00:01:05,760
machine and pegasus icon is no different

24
00:01:09,350 --> 00:01:07,520
during previous attempts we observed

25
00:01:11,190 --> 00:01:09,360
some anomalous readings we worked

26
00:01:13,109 --> 00:01:11,200
through that with nasa and implemented

27
00:01:15,749 --> 00:01:13,119
corrective actions this will ensure a

28
00:01:17,990 --> 00:01:15,759
highly successful mission

29
00:01:21,109 --> 00:01:18,000
perseverance is doing something despite

30
00:01:23,429 --> 00:01:21,119
difficulty or delay in achieving success

31
00:01:25,749 --> 00:01:23,439
it's a required virtue when the subject

32
00:01:28,230 --> 00:01:25,759
is space flight and the focus is a

33
00:01:29,510 --> 00:01:28,240
successful mission just like any rocket

34
00:01:30,870 --> 00:01:29,520
you have your share of problems that you

35
00:01:31,990 --> 00:01:30,880
run into because this is rocket science

36
00:01:34,310 --> 00:01:32,000
after all

37
00:01:37,590 --> 00:01:34,320
issues arose but dedication never

38
00:01:40,630 --> 00:01:37,600

wavered the entire icon team knew this

39
00:01:43,030 --> 00:01:40,640
was about more than just rocket science

40
00:01:45,670 --> 00:01:43,040
it was about the payload science that

41
00:01:49,109 --> 00:01:45,680
would benefit all of humanity

42
00:01:51,910 --> 00:01:49,119
as with every nasa program giving up is

43
00:01:53,910 --> 00:01:51,920
never an option it has taken us months

44
00:01:55,190 --> 00:01:53,920
hours days to really

45
00:01:56,550 --> 00:01:55,200
resolve all these issues with this

46
00:01:58,069 --> 00:01:56,560
integrated team

47
00:01:59,510 --> 00:01:58,079
and thankfully we were able to get

48
00:02:04,840 --> 00:01:59,520
through him and here we are getting

49
00:02:04,850 --> 00:02:11,270
[Music]

50
00:02:15,830 --> 00:02:13,589
the ionosphere is not only the area

51
00:02:17,910 --> 00:02:15,840
through which radio communications and

52
00:02:20,070 --> 00:02:17,920
gps signals travel

53
00:02:22,550 --> 00:02:20,080
it's also the space where many critical

54
00:02:24,869 --> 00:02:22,560
satellites and spacecraft orbit

55
00:02:28,450 --> 00:02:24,879
including the space station that houses

56
00:02:28,460 --> 00:02:31,830
[Music]

57
00:02:35,830 --> 00:02:33,430
but despite the importance of this

58
00:02:38,070 --> 00:02:35,840
region it is not well known

59
00:02:41,350 --> 00:02:38,080
that's why nasa and the university of

60
00:02:43,830 --> 00:02:41,360
california berkeley built icon

61
00:02:46,630 --> 00:02:43,840
the ionosphere itself where icon will be

62
00:02:48,070 --> 00:02:46,640
doing most of its work is where the gps

63
00:02:50,390 --> 00:02:48,080

signals travel through it's where

64
00:02:52,710 --> 00:02:50,400
astronauts travel and so it's very very

65
00:02:55,110 --> 00:02:52,720
key for us to understand this region

66
00:02:57,190 --> 00:02:55,120
because it has profound effects on us

67
00:02:59,670 --> 00:02:57,200
here on earth because of what space

68
00:03:01,830 --> 00:02:59,680
weather is doing to us but it also gets

69
00:03:04,550 --> 00:03:01,840
profound effects of what our earth

70
00:03:07,270 --> 00:03:04,560
weather is doing to the ionosphere

71
00:03:09,430 --> 00:03:07,280
by studying how the ionosphere reacts to

72
00:03:12,390 --> 00:03:09,440
earth's atmosphere it will help

73
00:03:14,790 --> 00:03:12,400
scientists and meteorologists forecast

74
00:03:17,110 --> 00:03:14,800
the conditions in our space environment

75
00:03:18,790 --> 00:03:17,120
reducing its negative effects on our

76
00:03:22,550 --> 00:03:18,800
technology

77
00:03:24,229 --> 00:03:22,560
from 360 miles above earth at a 27

78
00:03:27,430 --> 00:03:24,239
degree inclination

79
00:03:29,750 --> 00:03:27,440
icon will sample ionospheric variations

80
00:03:33,190 --> 00:03:29,760
in the lower boundaries of space over

81
00:03:34,789 --> 00:03:33,200
the course of hours days seasons and

82
00:03:36,710 --> 00:03:34,799
decades

83
00:03:39,430 --> 00:03:36,720
traveling at more than four miles per

84
00:03:42,070 --> 00:03:39,440
second or about 30 times faster than a

85
00:03:44,869 --> 00:03:42,080
commercial airliner this satellite will

86
00:03:47,350 --> 00:03:44,879
examine how the ionosphere reacts to our

87
00:03:49,750 --> 00:03:47,360
planet's weather

88
00:03:51,830 --> 00:03:49,760

the ionosphere is highly variable more

89
00:03:54,070 --> 00:03:51,840
variable than we ever expected now we

90
00:03:55,910 --> 00:03:54,080
think that the answer to understanding

91
00:03:57,990 --> 00:03:55,920
the conditions in the ionosphere and

92
00:04:00,070 --> 00:03:58,000
being able to predict those conditions

93
00:04:02,149 --> 00:04:00,080
relies on our ability to understand how

94
00:04:04,869 --> 00:04:02,159
weather below is forcing space weather

95
00:04:06,789 --> 00:04:04,879
above so icons built to capture all the

96
00:04:08,630 --> 00:04:06,799
information that we think we need to

97
00:04:10,710 --> 00:04:08,640
understand the mechanisms and the

98
00:04:12,869 --> 00:04:10,720
process by which our lower atmosphere

99
00:04:15,589 --> 00:04:12,879
affects our upper atmosphere icon will

100
00:04:19,430 --> 00:04:15,599
be sent into orbit by a northrop grumman

101
00:04:21,830 --> 00:04:19,440
pegasus xl air launched rocket

102
00:04:23,350 --> 00:04:21,840
the rocket has three solid propellant

103
00:04:25,670 --> 00:04:23,360
stages

104
00:04:30,790 --> 00:04:25,680
and can deploy satellites weighing up to

105
00:04:32,550 --> 00:04:30,800
1 000 pounds into low earth orbit

106
00:04:34,070 --> 00:04:32,560
we selected the pegasus xcel launch

107
00:04:36,070 --> 00:04:34,080
vehicle it provided an excellent

108
00:04:38,790 --> 00:04:36,080
combination of mission performance and

109
00:04:40,870 --> 00:04:38,800
flexibility for the mission design for a

110
00:04:43,110 --> 00:04:40,880
spacecraft of the mass of icon the

111
00:04:45,590 --> 00:04:43,120
launch of icon will be anything but

112
00:04:48,790 --> 00:04:45,600
ordinary it will be carried on the

113
00:04:52,070 --> 00:04:48,800

underbelly of northrup grumman's l-1011

114
00:04:54,150 --> 00:04:52,080
stargazer aircraft a launch pad far

115
00:04:55,749 --> 00:04:54,160
above the clouds in the sky the one

116
00:04:57,990 --> 00:04:55,759
unique thing about pegasus is that it's

117
00:05:00,230 --> 00:04:58,000
air launched so the l-1011 which is the

118
00:05:01,909 --> 00:05:00,240
last flying plane of its kind it is

119
00:05:03,350 --> 00:05:01,919
essentially our launch pad and air it's

120
00:05:04,710 --> 00:05:03,360
a mobile launch pad that flies up to

121
00:05:06,469 --> 00:05:04,720
about 40 thousand feet and that's where

122
00:05:08,469 --> 00:05:06,479
we launch the pegasus from with the

123
00:05:11,430 --> 00:05:08,479
tireless effort by the team to reach

124
00:05:13,590 --> 00:05:11,440
mission success it is time for icon to

125
00:05:15,430 --> 00:05:13,600
prepare for another launch attempt there

126
00:05:18,710 --> 00:05:15,440
are no constraints on these for all

127
00:05:20,550 --> 00:05:18,720
involved this is familiar territory yet

128
00:05:22,950 --> 00:05:20,560
something feels different this time

129
00:05:24,950 --> 00:05:22,960
taking a little extra time and extra

130
00:05:28,070 --> 00:05:24,960
care with the launch vehicle but we're

131
00:05:29,749 --> 00:05:28,080
about there why i'm excited right now is

132
00:05:32,469 --> 00:05:29,759
that we're getting so close to launch

133
00:05:36,790 --> 00:05:32,479
and it has taken a huge effort to get

134
00:05:42,469 --> 00:05:39,430
vandenberg air force base in california

135
00:05:45,110 --> 00:05:42,479
is bustling with activity the excitement

136
00:05:46,390 --> 00:05:45,120
is palpable as icon literally comes

137
00:05:49,350 --> 00:05:46,400
together

138
00:05:50,629 --> 00:05:49,360

pegasus stages one two and three are

139
00:05:53,670 --> 00:05:50,639
assembled

140
00:05:55,350 --> 00:05:53,680
the aft skirt and fin installation are

141
00:05:59,029 --> 00:05:55,360
now complete

142
00:06:02,070 --> 00:05:59,039
icon solar array illumination is tested

143
00:06:04,960 --> 00:06:02,080
and finally the spacecraft is mated to

144
00:06:10,309 --> 00:06:04,970
pegasus

145
00:06:12,230 --> 00:06:10,319
[Music]

146
00:06:14,070 --> 00:06:12,240
once it's mated to the rocket there

147
00:06:15,110 --> 00:06:14,080
there'll be a compatibility test between

148
00:06:19,029 --> 00:06:15,120
the rocket

149
00:06:22,070 --> 00:06:19,039
have will be the interface to

150
00:06:24,870 --> 00:06:22,080
communicate to icon so we can command it

151
00:06:27,430 --> 00:06:24,880
once uh once we certify that we will

152
00:06:29,909 --> 00:06:27,440
encapsulate it we'll put it on a

153
00:06:32,070 --> 00:06:29,919
transport platform roll it out to the

154
00:06:34,270 --> 00:06:32,080
hotpad and then integrate it to the

155
00:06:43,590 --> 00:06:34,280
l-1011

156
00:06:48,230 --> 00:06:45,430
now that processing and mating are

157
00:06:50,230 --> 00:06:48,240
complete the icon mission takes off from

158
00:06:53,189 --> 00:06:50,240
vandenberg

159
00:06:56,629 --> 00:06:53,199
hours later it arrives at cape canaveral

160
00:06:59,110 --> 00:06:56,639
air force station skid strip in florida

161
00:07:02,790 --> 00:06:59,120
important logistics must be coordinated

162
00:07:04,790 --> 00:07:02,800
with the 45th space wing prior to launch

163
00:07:07,270 --> 00:07:04,800

once in florida there is a week of

164
00:07:08,390 --> 00:07:07,280
processing and testing prior to launch

165
00:07:10,870 --> 00:07:08,400
day

166
00:07:13,510 --> 00:07:10,880
lieutenant samantha parr is in charge of

167
00:07:15,830 --> 00:07:13,520
making sure icon launches into a safe

168
00:07:17,670 --> 00:07:15,840
environment i keep track of the weather

169
00:07:19,749 --> 00:07:17,680
i keep track of our instrumentation and

170
00:07:21,749 --> 00:07:19,759
i keep track of our surveillance and i

171
00:07:24,150 --> 00:07:21,759
provide a recommendation to our launch

172
00:07:25,830 --> 00:07:24,160
decision authority and he or she can

173
00:07:28,970 --> 00:07:25,840
make a determination on whether or not

174
00:07:33,029 --> 00:07:28,980
we're clear the launch

175
00:07:38,550 --> 00:07:35,990
we are now at launch day the team has

176
00:07:40,230 --> 00:07:38,560
been here before and optimism is guarded

177
00:07:42,469 --> 00:07:40,240
it's been a lot of work to get here at

178
00:07:44,230 --> 00:07:42,479
this point we kind of see the end and

179
00:07:45,909 --> 00:07:44,240
we're looking forward to mission and

180
00:07:47,189 --> 00:07:45,919
putting the satellite

181
00:07:48,390 --> 00:07:47,199
into orbit and

182
00:07:51,350 --> 00:07:48,400
seeing what that science does in the

183
00:07:52,309 --> 00:07:51,360
future anticipation builds to a fever

184
00:08:00,300 --> 00:07:52,319
pitch

185
00:08:00,310 --> 00:08:04,150
[Music]

186
00:08:04,160 --> 00:08:12,070
so

187
00:08:17,189 --> 00:08:14,710
the actual time parameters for a launch

188
00:08:19,589 --> 00:08:17,199

of a pegasus mission is much different

189
00:08:21,990 --> 00:08:19,599
than your standard uh ground-based

190
00:08:24,710 --> 00:08:22,000
missile launch that's tied to the fact

191
00:08:27,430 --> 00:08:24,720
that the pegasus literally has a first

192
00:08:29,510 --> 00:08:27,440
stage by being on an airplane

193
00:08:32,070 --> 00:08:29,520
the airplane's at 40 000 feet it's

194
00:08:34,630 --> 00:08:32,080
moving close to 500 miles an hour it's

195
00:08:37,750 --> 00:08:34,640
moving you can't stop it you can't slow

196
00:08:39,909 --> 00:08:37,760
it down it is going and it's dynamic

197
00:08:42,070 --> 00:08:39,919
the stargazer jet takes off from the

198
00:08:44,230 --> 00:08:42,080
skid strip at the cape canaveral air

199
00:08:46,949 --> 00:08:44,240
force station hilton 11 is airborne at

200
00:08:49,910 --> 00:08:46,959
this time the l-1011 has now reached a

201
00:08:52,470 --> 00:08:49,920
cruising altitude of 40 000 feet and has

202
00:08:54,630 --> 00:08:52,480
begun flying in a racetrack pattern we

203
00:08:56,550 --> 00:08:54,640
fly a pattern called the racetrack

204
00:08:58,870 --> 00:08:56,560
it's an oval in the sky and so the

205
00:09:01,590 --> 00:08:58,880
airplane takes off flies through the

206
00:09:03,350 --> 00:09:01,600
launch point at a lower altitude as it's

207
00:09:05,269 --> 00:09:03,360
climbing to the point we're going to

208
00:09:08,870 --> 00:09:05,279
launch it which is roughly 40 thousand

209
00:09:11,269 --> 00:09:08,880
feet we verify that all of our gps are

210
00:09:13,829 --> 00:09:11,279
synchronized and ensure that we are

211
00:09:15,269 --> 00:09:13,839
going to put the launch vehicle in the

212
00:09:17,750 --> 00:09:15,279
correct heading so that we get the

213
00:09:20,150 --> 00:09:17,760

spacecraft into the correct orbit

214
00:09:22,310 --> 00:09:20,160
lc peg go for fin pin retract

215
00:09:23,190 --> 00:09:22,320
lpo go for fin pen retract and fence

216
00:09:25,910 --> 00:09:23,200
week

217
00:09:26,870 --> 00:09:25,920
lc senior memco countdown l1011 is in

218
00:09:29,750 --> 00:09:26,880
the box

219
00:09:32,310 --> 00:09:29,760
about 50 miles offshore of daytona beach

220
00:09:35,269 --> 00:09:32,320
the pegasus xl is released from the

221
00:09:39,590 --> 00:09:35,279
l-1011 with the countdown we hear

222
00:09:41,430 --> 00:09:39,600
drop on my mark three two one drop and

223
00:09:43,829 --> 00:09:41,440
we push a button in the cockpit the

224
00:09:46,150 --> 00:09:43,839
hydraulic releases actually release the

225
00:09:47,910 --> 00:09:46,160
rocket pegasus away the rocket drops for

226
00:09:50,070 --> 00:09:47,920
five seconds the airplane climbs for

227
00:09:52,790 --> 00:09:50,080
five seconds and at the end we have a

228
00:09:55,750 --> 00:09:52,800
fairly good safety margin five seconds

229
00:09:58,470 --> 00:09:55,760
later the pegasus rocket ignites

230
00:10:01,110 --> 00:09:58,480
stage one ignition has been confirmed

231
00:10:04,230 --> 00:10:01,120
that's the minute that i consider t zero

232
00:10:06,870 --> 00:10:04,240
for me soon after pegasus ignites first

233
00:10:10,550 --> 00:10:06,880
stage booster burnout and separation

234
00:10:12,310 --> 00:10:10,560
occurs stage one separation confirmed

235
00:10:14,069 --> 00:10:12,320
stage two ignition has been confirmed

236
00:10:16,790 --> 00:10:14,079
and attitude is nominal

237
00:10:18,790 --> 00:10:16,800
followed by fairing separation and

238
00:10:21,030 --> 00:10:18,800

second stage separation steering

239
00:10:23,670 --> 00:10:21,040
deployment has been confirmed after

240
00:10:26,150 --> 00:10:23,680
third stage separation the icon

241
00:10:28,550 --> 00:10:26,160
satellite is deployed into its lower

242
00:10:30,790 --> 00:10:28,560
earth orbit spacecraft separation can

243
00:10:32,790 --> 00:10:30,800
take a quick launch vehicle to thank you

244
00:10:35,430 --> 00:10:32,800
old friend for doing that and uh good

245
00:10:38,870 --> 00:10:35,440
luck icon it is a monumental moment for

246
00:10:42,069 --> 00:10:38,880
the entire icon team who banded together

247
00:10:44,389 --> 00:10:42,079
to overcome hurdle after hurdle

248
00:10:47,110 --> 00:10:44,399
powered by teamwork and unwavering

249
00:10:50,069 --> 00:10:47,120
dedication to its mission icon has

250
00:10:52,949 --> 00:10:50,079
overcome all obstacles in its path on

251
00:10:54,230 --> 00:10:52,959
the way to a successful t-zero well it's

252
00:10:56,310 --> 00:10:54,240
been quite a ride it's been an

253
00:10:57,990 --> 00:10:56,320
incredible journey to get to this point

254
00:10:59,190 --> 00:10:58,000
and require the sacrifice of a very

255
00:11:01,190 --> 00:10:59,200
large team

256
00:11:03,110 --> 00:11:01,200
we couldn't be more excited and honored

257
00:11:04,230 --> 00:11:03,120
to have launched the icon spacecraft in