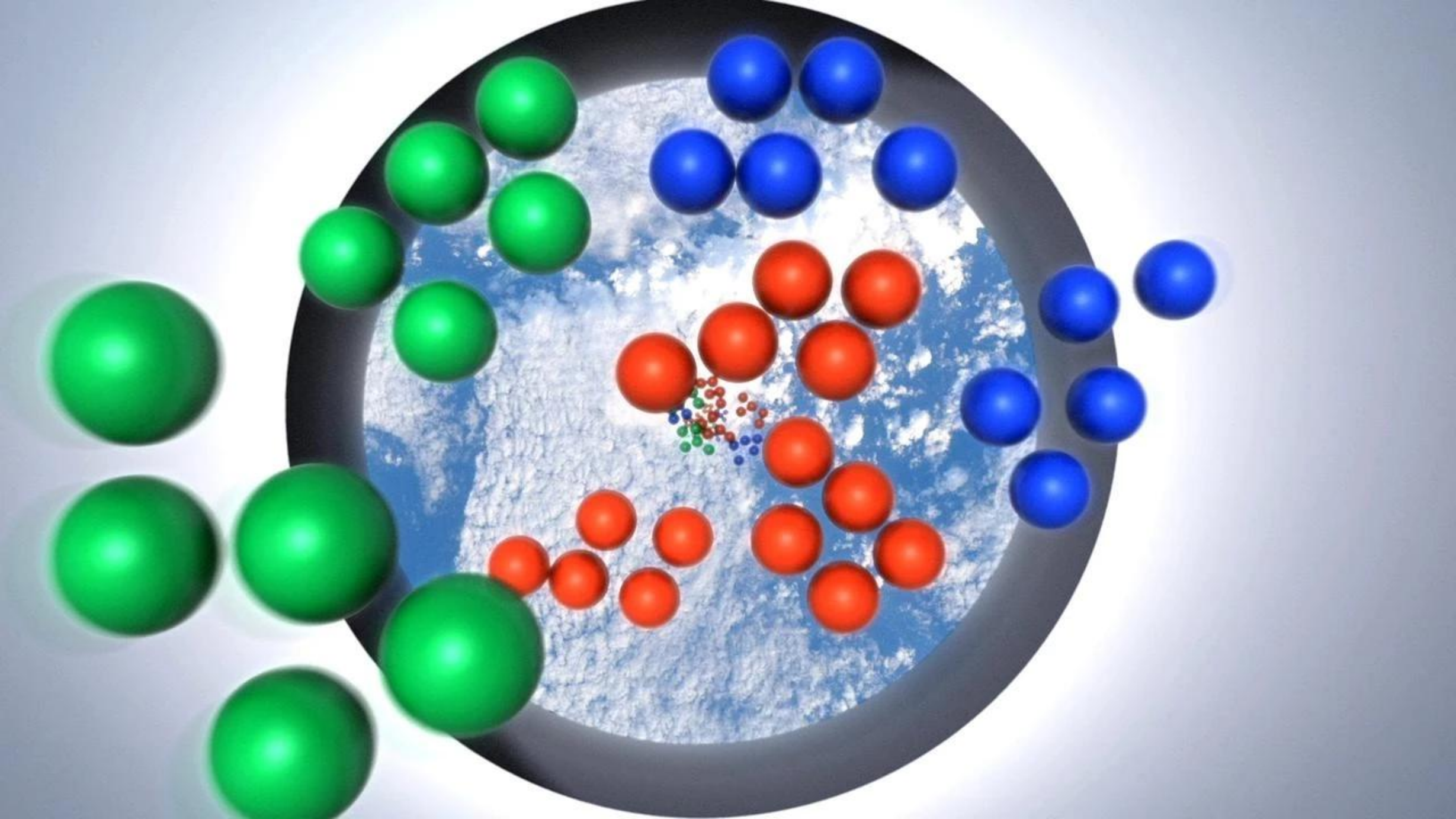

1
00:00:05,910 --> 00:00:04,390
we wanted to take this opportunity to

2
00:00:07,590 --> 00:00:05,920
talk about one of the investigations

3
00:00:09,830 --> 00:00:07,600
that's headed to the international space

4
00:00:11,509 --> 00:00:09,840
station the next cargo craft that's

5
00:00:13,430 --> 00:00:11,519
headed to the orbital complex is planned

6
00:00:15,030 --> 00:00:13,440
to launch next week and one of the

7
00:00:17,510 --> 00:00:15,040
experiments that will be

8
00:00:19,510 --> 00:00:17,520
on board is part of the experiment

9
00:00:21,830 --> 00:00:19,520
called cats or the cloud aerosol

10
00:00:24,150 --> 00:00:21,840
transport system this is going to use a

11
00:00:26,390 --> 00:00:24,160
lidar system pointed back down at the

12
00:00:29,109 --> 00:00:26,400
earth to help create better models of

13
00:00:30,390 --> 00:00:29,119

the planet's climate feedback processes

14
00:00:32,790 --> 00:00:30,400
so we have two gentlemen here this

15
00:00:35,430 --> 00:00:32,800
morning to join us to talk about this dr

16
00:00:37,510 --> 00:00:35,440
matthew mcgill and co-investigator dr

17
00:00:39,110 --> 00:00:37,520
john yorks joining us from nasa's

18
00:00:40,869 --> 00:00:39,120
goddard space flight center in greenbelt

19
00:00:42,869 --> 00:00:40,879
maryland good morning good morning good

20
00:00:44,470 --> 00:00:42,879
morning thanks so much for joining us

21
00:00:47,910 --> 00:00:44,480
matt can you tell me where the idea for

22
00:00:51,990 --> 00:00:49,590
sure nicole thanks

23
00:00:54,950 --> 00:00:52,000
the the cloud aerosol transport system

24
00:00:56,389 --> 00:00:54,960
or cats it's a it's an instrument a new

25
00:00:57,350 --> 00:00:56,399
earth science instrument for the space

26
00:00:59,430 --> 00:00:57,360
station

27
00:01:01,430 --> 00:00:59,440
designed to characterize the global

28
00:01:03,830 --> 00:01:01,440
distribution of clouds and tiny aerosol

29
00:01:05,830 --> 00:01:03,840
particles in the earth's atmosphere

30
00:01:07,830 --> 00:01:05,840
the instrument heritage for cats is

31
00:01:09,590 --> 00:01:07,840
derived from our long-standing heritage

32
00:01:11,350 --> 00:01:09,600
in developing

33
00:01:14,390 --> 00:01:11,360
high fidelity instruments for nasa's

34
00:01:16,550 --> 00:01:14,400
high altitude aircraft such as the er-2

35
00:01:17,670 --> 00:01:16,560
the science behind cats derives from our

36
00:01:19,350 --> 00:01:17,680
need to

37
00:01:21,590 --> 00:01:19,360
demonstrate advanced measurement

38
00:01:23,749 --> 00:01:21,600

concepts that can be used on future free

39
00:01:25,270 --> 00:01:23,759
flyer satellite missions

40
00:01:29,109 --> 00:01:25,280
great and can you describe the hardware

41
00:01:32,469 --> 00:01:30,870
sure

42
00:01:34,870 --> 00:01:32,479
cats as you mentioned it's a laser

43
00:01:37,270 --> 00:01:34,880
remote sensing instrument or lidar

44
00:01:40,789 --> 00:01:37,280
and lidar works a lot like radar except

45
00:01:42,789 --> 00:01:40,799
we use low energy pulses of laser light

46
00:01:44,069 --> 00:01:42,799
the cat's instrument has

47
00:01:46,310 --> 00:01:44,079
two lasers each with different

48
00:01:48,710 --> 00:01:46,320
characteristics a receiving telescope

49
00:01:50,550 --> 00:01:48,720
and special photon counting detectors

50
00:01:52,310 --> 00:01:50,560
it's about the size of a household

51
00:01:53,749 --> 00:01:52,320
refrigerator you see in the animation

52
00:01:57,749 --> 00:01:53,759
there

53
00:01:59,109 --> 00:01:57,759
and capability packed into the to the

54
00:02:01,109 --> 00:01:59,119
box

55
00:02:03,030 --> 00:02:01,119
once on iss cats will mount to the

56
00:02:05,270 --> 00:02:03,040
japanese experiment module exposed

57
00:02:06,870 --> 00:02:05,280
facility and it can operate there for up

58
00:02:08,550 --> 00:02:06,880
to three years

59
00:02:10,070 --> 00:02:08,560
john would you explain how this lidar

60
00:02:12,949 --> 00:02:10,080
system measures particulates in the

61
00:02:18,869 --> 00:02:16,070
cats uses a laser that generates three

62
00:02:21,350 --> 00:02:18,879
wavelengths or colors of light

63
00:02:23,190 --> 00:02:21,360

internal to the laser special optical

64
00:02:26,150 --> 00:02:23,200
crystals are used to generate these

65
00:02:27,670 --> 00:02:26,160
wavelengths by taking the energy of two

66
00:02:30,630 --> 00:02:27,680
photons and adding them together to

67
00:02:33,589 --> 00:02:30,640
create a single new photon the final

68
00:02:35,589 --> 00:02:33,599
output beam is made up of all three of

69
00:02:38,949 --> 00:02:35,599
these wavelengths and these photons are

70
00:02:42,070 --> 00:02:38,959
then transmitted to the atmosphere

71
00:02:44,470 --> 00:02:42,080
in groups at the speed of light as the

72
00:02:47,030 --> 00:02:44,480
photons encounter clouds and particles

73
00:02:48,949 --> 00:02:47,040
scattering of the laser beam occurs

74
00:02:50,790 --> 00:02:48,959
very few of these photons are actually

75
00:02:53,350 --> 00:02:50,800
scattered back to the instruments

76
00:02:54,630 --> 00:02:53,360
optical telescope but the ones that are

77
00:02:56,630 --> 00:02:54,640
are

78
00:02:57,830 --> 00:02:56,640
collected and counted by

79
00:02:59,910 --> 00:02:57,840
sensitive

80
00:03:01,509 --> 00:02:59,920
detectors and

81
00:03:03,350 --> 00:03:01,519
electronics

82
00:03:06,710 --> 00:03:03,360
by timing the difference between the

83
00:03:08,309 --> 00:03:06,720
emission and detection of the

84
00:03:10,149 --> 00:03:08,319
photons emitted

85
00:03:12,470 --> 00:03:10,159
we can determine the

86
00:03:15,030 --> 00:03:12,480
altitude of the particles in the earth's

87
00:03:17,990 --> 00:03:15,040
atmosphere thus cats will measure the

88
00:03:19,670 --> 00:03:18,000

vertical distribution of the particles

89
00:03:21,270 --> 00:03:19,680
in the earth's atmosphere

90
00:03:25,110 --> 00:03:21,280
okay and how does the presence of those

91
00:03:28,869 --> 00:03:25,120
particles impact the climate processes

92
00:03:30,830 --> 00:03:28,879
well small particles from desert dust

93
00:03:33,830 --> 00:03:30,840
such as

94
00:03:35,509 --> 00:03:33,840
uh dustin and also

95
00:03:39,990 --> 00:03:35,519
um

96
00:03:42,869 --> 00:03:40,000
known as aerosols

97
00:03:46,309 --> 00:03:42,879
aerosols besides their harmful impact on

98
00:03:48,470 --> 00:03:46,319
human health can also impact climate by

99
00:03:50,390 --> 00:03:48,480
directly

100
00:03:53,670 --> 00:03:50,400
scattering and

101
00:03:54,869 --> 00:03:53,680
absorbing solar radiation they can also

102
00:03:57,110 --> 00:03:54,879
indirectly

103
00:03:58,390 --> 00:03:57,120
influence climate by interacting with

104
00:04:02,949 --> 00:03:58,400
clouds

105
00:04:05,030 --> 00:04:02,959
uncertainties in climate prediction

106
00:04:07,190 --> 00:04:05,040
because they are a key regulator of the

107
00:04:09,030 --> 00:04:07,200
planet's average temperature

108
00:04:10,710 --> 00:04:09,040
water clouds near the surface tend to

109
00:04:12,789 --> 00:04:10,720
reflect sunlight

110
00:04:14,630 --> 00:04:12,799
back to space cooling the earth's

111
00:04:17,430 --> 00:04:14,640
surface while

112
00:04:21,749 --> 00:04:17,440
high ice clouds tend to trap the earth's

113
00:04:24,710 --> 00:04:21,759

radiation and warm the atmosphere

114
00:04:26,550 --> 00:04:24,720
changes in the abundance or location of

115
00:04:29,670 --> 00:04:26,560
these clouds and aerosols can have a big

116
00:04:31,830 --> 00:04:29,680
impact on climate even more so than the

117
00:04:34,469 --> 00:04:31,840
effect of greenhouse gases

118
00:04:35,590 --> 00:04:34,479
computer models that forecast climate

119
00:04:38,070 --> 00:04:35,600
change

120
00:04:39,270 --> 00:04:38,080
will use cats data to improve their

121
00:04:40,550 --> 00:04:39,280
forecasts

122
00:04:43,830 --> 00:04:40,560
and

123
00:04:45,990 --> 00:04:43,840
prediction

124
00:04:47,670 --> 00:04:46,000
okay does the orbital path of the space

125
00:04:49,430 --> 00:04:47,680
station matter in terms of the data

126
00:04:52,230 --> 00:04:49,440
you're going to gather

127
00:04:55,670 --> 00:04:52,240
the iss orbit is a great match with the

128
00:04:57,749 --> 00:04:55,680
goals of the cats instrument the 51

129
00:04:59,749 --> 00:04:57,759
degree inclination orbit provides

130
00:05:01,510 --> 00:04:59,759
comprehensive coverage of the tropics

131
00:05:04,629 --> 00:05:01,520
and mid-latitudes

132
00:05:07,270 --> 00:05:04,639
and it also encompasses the majority of

133
00:05:09,990 --> 00:05:07,280
the earth's population and land masses

134
00:05:12,710 --> 00:05:10,000
in addition the iss

135
00:05:14,150 --> 00:05:12,720
passes over a different location at a

136
00:05:17,029 --> 00:05:14,160
different

137
00:05:19,990 --> 00:05:17,039
local time every time and this permits

138
00:05:21,749 --> 00:05:20,000

studies of data night changes in

139
00:05:23,990 --> 00:05:21,759
clouds and aerosols

140
00:05:26,310 --> 00:05:24,000
which cannot be obtained from polar

141
00:05:28,790 --> 00:05:26,320
orbiting earth science satellites okay

142
00:05:30,870 --> 00:05:28,800
very interesting matt will cats run

143
00:05:33,350 --> 00:05:30,880
continuously and how is it commanded and

144
00:05:34,710 --> 00:05:33,360
controlled

145
00:05:36,710 --> 00:05:34,720
sure

146
00:05:39,350 --> 00:05:36,720
cats is controlled from a very simple

147
00:05:41,350 --> 00:05:39,360
ground station here at goddard using iss

148
00:05:43,270 --> 00:05:41,360
provided software they have a software

149
00:05:44,390 --> 00:05:43,280
package called trek they provide that to

150
00:05:46,629 --> 00:05:44,400
the users

151
00:05:48,230 --> 00:05:46,639
cats is designed to operate autonomously

152
00:05:49,670 --> 00:05:48,240
so once it's on

153
00:05:52,230 --> 00:05:49,680
and we're safe for operation we can

154
00:05:54,390 --> 00:05:52,240
operate for extended periods of time now

155
00:05:56,070 --> 00:05:54,400
because it's a laser when astronauts are

156
00:05:58,390 --> 00:05:56,080
out and about we do turn off the laser

157
00:06:00,070 --> 00:05:58,400
for safety concerns and when there are

158
00:06:02,469 --> 00:06:00,080
docking vehicles

159
00:06:04,070 --> 00:06:02,479
will turn off because the exhaust plumes

160
00:06:06,390 --> 00:06:04,080
from the vehicles can contaminate or

161
00:06:08,230 --> 00:06:06,400
damage our sensitive optics

162
00:06:09,749 --> 00:06:08,240
aside from that we're intended to

163
00:06:11,270 --> 00:06:09,759

operate continuously or near

164
00:06:13,270 --> 00:06:11,280
continuously

165
00:06:14,550 --> 00:06:13,280
sending data in near real time down to

166
00:06:16,390 --> 00:06:14,560
the ground where it's going to be

167
00:06:18,230 --> 00:06:16,400
continuously

168
00:06:20,950 --> 00:06:18,240
injected into these aerosol forecast

169
00:06:22,469 --> 00:06:20,960
models that john talked about okay

170
00:06:24,790 --> 00:06:22,479
i also know that katz is part of the

171
00:06:26,469 --> 00:06:24,800
earth right now campaign can you tell us

172
00:06:29,430 --> 00:06:26,479
how the cat's mission fits in with that

173
00:06:33,590 --> 00:06:31,510
sure

174
00:06:35,189 --> 00:06:33,600
cats is really a cost effective way to

175
00:06:37,749 --> 00:06:35,199
demonstrate new earth science

176
00:06:40,710 --> 00:06:37,759
measurements and new technologies uh

177
00:06:42,950 --> 00:06:40,720
using the iss is a low-cost easy access

178
00:06:44,870 --> 00:06:42,960
platform

179
00:06:46,710 --> 00:06:44,880
technologies in the cat's instrument so

180
00:06:48,790 --> 00:06:46,720
for example the lasers or specific

181
00:06:50,309 --> 00:06:48,800
technologies that are in the detector

182
00:06:52,309 --> 00:06:50,319
receiver chain

183
00:06:53,990 --> 00:06:52,319
they're providing on orbit demonstration

184
00:06:56,309 --> 00:06:54,000
and validation that the technologies and

185
00:06:58,629 --> 00:06:56,319
the measurement concept behind cats are

186
00:07:01,749 --> 00:06:58,639
mature enough and ready to use in the

187
00:07:04,550 --> 00:07:01,759
more demanding more expensive

188
00:07:06,710 --> 00:07:04,560

nasa free flyer missions in the future

189
00:07:08,309 --> 00:07:06,720
we used what we call a build to cost

190
00:07:10,150 --> 00:07:08,319
approach to building cats we think

191
00:07:11,589 --> 00:07:10,160
that's a fiscally responsible way to

192
00:07:14,230 --> 00:07:11,599
approach these

193
00:07:16,950 --> 00:07:14,240
tech demo and risk reduction

194
00:07:18,950 --> 00:07:16,960
measurements for earth science and as uh

195
00:07:21,749 --> 00:07:18,960
space station matures now into an

196
00:07:23,749 --> 00:07:21,759
operational science platform

197
00:07:26,070 --> 00:07:23,759
utilizing that capability for earth

198
00:07:28,629 --> 00:07:26,080
science becomes an exciting new era for

199
00:07:30,150 --> 00:07:28,639
the earth science community

200
00:07:31,909 --> 00:07:30,160
great well thank you both gentlemen for

201
00:07:34,230 --> 00:07:31,919
joining us we really appreciate it again

202
00:07:36,150 --> 00:07:34,240
dr matthew mcgill and dr john yorks from

203
00:07:37,830 --> 00:07:36,160
the goddard space flight center you can

204
00:07:40,469 --> 00:07:37,840
find out more about their research at