



1
00:00:37,069 --> 00:00:35,450
since april nineteen ninety the Hubble

2
00:00:38,450 --> 00:00:37,079
Space Telescope has expanded our

3
00:00:41,840 --> 00:00:38,460
universe with its never-before-seen

4
00:00:43,430 --> 00:00:41,850
views Hubble's awe inspiring images have

5
00:00:45,919 --> 00:00:43,440
not only helped us to better understand

6
00:00:49,130 --> 00:00:45,929
our universe a redefine the way in which

7
00:00:50,799 --> 00:00:49,140
we see it however shortly after the

8
00:00:53,029 --> 00:00:50,809
telescope's deployment into space

9
00:00:55,250 --> 00:00:53,039
scientists discovered that the by stem

10
00:00:57,500 --> 00:00:55,260
booms supporting Hubble's solar arrays

11
00:00:58,939 --> 00:00:57,510
would periodically shake as a result of

12
00:01:01,459 --> 00:00:58,949
the extreme temperature changes that

13
00:01:03,259 --> 00:01:01,469

occurred in the space environment this

14

00:01:04,759 --> 00:01:03,269

movement would then jar the telescope

15

00:01:07,370 --> 00:01:04,769

resulting in misalignment with the

16

00:01:09,499 --> 00:01:07,380

telescope's target Goddard Space Flight

17

00:01:11,539 --> 00:01:09,509

Center the NASA Center managing the

18

00:01:13,280 --> 00:01:11,549

Hubble project contacted Glenn Research

19

00:01:14,870 --> 00:01:13,290

Center to help solve this problem

20

00:01:16,399 --> 00:01:14,880

because of Glenn's expertise and

21

00:01:20,840 --> 00:01:16,409

materials and environmental space

22

00:01:23,179 --> 00:01:20,850

durability Glenn was invited to

23

00:01:27,530 --> 00:01:23,189

participate in some of the Hubble

24

00:01:32,660 --> 00:01:27,540

problem solving issues because we had

25

00:01:34,730 --> 00:01:32,670

expertise in atomic oxygen and they

26

00:01:36,620 --> 00:01:34,740

needed some testing done and there

27

00:01:39,380 --> 00:01:36,630

wasn't anyplace else that they could go

28

00:01:42,139 --> 00:01:39,390

and we had a pretty strong track record

29

00:01:45,109 --> 00:01:42,149

of publications and activity in atomic

30

00:01:47,240 --> 00:01:45,119

oxygen testing and ultimately we did UV

31

00:01:49,730 --> 00:01:47,250

radiation testing as well

32

00:01:52,220 --> 00:01:49,740

the issue that the team Clinton Research

33

00:01:54,500 --> 00:01:52,230

Center addressed was the survivability

34

00:01:56,719 --> 00:01:54,510

of the thermal control material being

35

00:02:00,130 --> 00:01:56,729

used on the x stem of the solar array

36

00:02:02,750 --> 00:02:00,140

specifically the survivability to

37

00:02:04,670 --> 00:02:02,760

electron bombardment atomic oxygen

38

00:02:08,449 --> 00:02:04,680

exposure and vacuum ultraviolet

39

00:02:12,110 --> 00:02:08,459

radiation all environmental factors that

40

00:02:13,930 --> 00:02:12,120

can degrade material being based on our

41

00:02:16,910 --> 00:02:13,940

testing and our results that we found

42

00:02:20,870 --> 00:02:16,920

just using the base material own alumina

43

00:02:23,780 --> 00:02:20,880

mised Teflon was sufficient to perform

44

00:02:27,229 --> 00:02:23,790

the function unit the work that I did

45

00:02:29,780 --> 00:02:27,239

was to characterize the thermal shields

46

00:02:31,220 --> 00:02:29,790

that were durability tested and NASA

47

00:02:34,010 --> 00:02:31,230

Glenn and Goddard Space Flight Center

48

00:02:36,650 --> 00:02:34,020

and exposed to atomic oxygen UV

49

00:02:38,690 --> 00:02:36,660

radiation and thermal cycling I found

50

00:02:42,170 --> 00:02:38,700

that the coating that we were planning

51
00:02:44,300 --> 00:02:42,180
to use as the primary design was falling

52
00:02:46,130 --> 00:02:44,310
off or coming off in little pieces and

53
00:02:48,020 --> 00:02:46,140
this would have been a real problem for

54
00:02:51,140 --> 00:02:48,030
the telescope if that material had been

55
00:02:53,210 --> 00:02:51,150
used NASA Glenn had unique capabilities

56
00:02:55,970 --> 00:02:53,220
in that we had the ultraviolet the

57
00:02:59,150 --> 00:02:55,980
vacuum ultraviolet facility where we

58
00:03:01,130 --> 00:02:59,160
could expose the by stem materials for

59
00:03:02,479 --> 00:03:01,140
the servicing mission they wanted to

60
00:03:04,610 --> 00:03:02,489
take a look at the different coatings

61
00:03:06,979 --> 00:03:04,620
and see if they would if they would work

62
00:03:08,870 --> 00:03:06,989
or if the ultraviolet radiation would

63
00:03:10,820 --> 00:03:08,880

degrade those so we looked at those

64

00:03:12,890 --> 00:03:10,830

candidate materials in our ultraviolet

65

00:03:14,479 --> 00:03:12,900

facilities the work I did with the

66

00:03:17,319 --> 00:03:14,489

Hubble Space Telescope mission was to

67

00:03:20,000 --> 00:03:17,329

take ideas from the research team for

68

00:03:22,729 --> 00:03:20,010

developing materials to extend the

69

00:03:25,370 --> 00:03:22,739

lifetime of the hubble space craft and

70

00:03:27,860 --> 00:03:25,380

test these materials in a simulated

71

00:03:29,900 --> 00:03:27,870

environment that would accelerate the

72

00:03:32,150 --> 00:03:29,910

life testing of these materials and

73

00:03:34,420 --> 00:03:32,160

automate the facilities so that facility

74

00:03:36,880 --> 00:03:34,430

could actually run 24-7 on

75

00:03:39,039 --> 00:03:36,890

the most challenging aspect of working

76
00:03:41,880 --> 00:03:39,049
on Hubble was meeting the aggressive

77
00:03:45,220 --> 00:03:41,890
schedule for example to prepare for

78
00:03:47,649 --> 00:03:45,230
servicing mission one we had less than a

79
00:03:49,479 --> 00:03:47,659
year significantly less than a year we

80
00:03:51,849 --> 00:03:49,489
had to do a major upgrade of our

81
00:03:53,410 --> 00:03:51,859
ultraviolet test facility by including

82
00:03:57,250 --> 00:03:53,420
heating lamps and we had never done that

83
00:03:59,289 --> 00:03:57,260
before and we needed to get the test rig

84
00:04:02,050 --> 00:03:59,299
to work we needed to take research data

85
00:04:04,690 --> 00:04:02,060
we need to analyze samples and return

86
00:04:06,909 --> 00:04:04,700
results back to Goddard to prepare for

87
00:04:09,309 --> 00:04:06,919
that mission after the second servicing

88
00:04:11,530 --> 00:04:09,319

mission they found large cracks in the

89

00:04:14,199 --> 00:04:11,540

outer layer of insulation on the Hubble

90

00:04:16,509 --> 00:04:14,209

Space Telescope and so God are put

91

00:04:18,909 --> 00:04:16,519

together a failure review board with

92

00:04:21,039 --> 00:04:18,919

some experts from across the country and

93

00:04:23,800 --> 00:04:21,049

they invited three members from NASA

94

00:04:27,700 --> 00:04:23,810

Glenn myself Bruce banks and Joyce dever

95

00:04:30,339 --> 00:04:27,710

so we were part of this Hubble failure

96

00:04:33,430 --> 00:04:30,349

review board and we did two different

97

00:04:35,890 --> 00:04:33,440

tasks primarily 12 was determined how

98

00:04:38,770 --> 00:04:35,900

damaged the material is on the telescope

99

00:04:40,600 --> 00:04:38,780

and to come up with a replacement

100

00:04:42,879 --> 00:04:40,610

material that they could take up during

101
00:04:44,680 --> 00:04:42,889
the next servicing mission I was brought

102
00:04:47,020 --> 00:04:44,690
in as part of the team to try to figure

103
00:04:49,930 --> 00:04:47,030
out why this had happened and how we

104
00:04:53,469 --> 00:04:49,940
could fix it my role was to look at some

105
00:04:56,050 --> 00:04:53,479
of the high-energy radiation to see what

106
00:04:59,170 --> 00:04:56,060
was going on so for instance that was

107
00:05:03,510 --> 00:04:59,180
that x-rays was a gamma rays was it

108
00:05:07,420 --> 00:05:03,520
ultraviolet I looked at all of those in

109
00:05:09,219 --> 00:05:07,430
simulating the the environment to try to

110
00:05:11,439 --> 00:05:09,229
figure out what we could do on earth

111
00:05:13,060 --> 00:05:11,449
that would give us the same kind of

112
00:05:15,219 --> 00:05:13,070
degradation that we were seeing the

113
00:05:17,499 --> 00:05:15,229

space what we found was that was

114

00:05:20,529 --> 00:05:17,509

actually a combination of things it was

115

00:05:22,930 --> 00:05:20,539

both a radiation and the thermal cycling

116

00:05:25,600 --> 00:05:22,940

heating up and cooling down but if you

117

00:05:27,490 --> 00:05:25,610

had either one by itself didn't have a

118

00:05:30,100 --> 00:05:27,500

lot of damage if you had the two

119

00:05:32,219 --> 00:05:30,110

together that's when the Teflon

120

00:05:34,390 --> 00:05:32,229

multi-layer insulation failed

121

00:05:36,310 --> 00:05:34,400

additionally as a result of the failure

122

00:05:38,140 --> 00:05:36,320

review board the team made

123

00:05:40,420 --> 00:05:38,150

recommendations for replacement material

124

00:05:41,290 --> 00:05:40,430

to be installed during servicing mission

125

00:05:47,170 --> 00:05:41,300

3a

126
00:05:49,540 --> 00:05:47,180
had the chance to analyze materials that

127
00:05:51,939 --> 00:05:49,550
were retrieved during that mission work

128
00:05:54,850 --> 00:05:51,949
we did was important because we were

129
00:05:57,070 --> 00:05:54,860
able to tell godart how damaged that mli

130
00:05:59,290 --> 00:05:57,080
insulation should be when the astronauts

131
00:06:02,020 --> 00:05:59,300
were going to go up and do an e VA and

132
00:06:06,189 --> 00:06:02,030
they use that information to develop the

133
00:06:08,830 --> 00:06:06,199
rules that govern what the astronauts

134
00:06:10,899 --> 00:06:08,840
dorant do during the EV a the issue

135
00:06:14,589 --> 00:06:10,909
address for servicing mission for was

136
00:06:17,619 --> 00:06:14,599
the brittleness of a quilted blanket it

137
00:06:19,899 --> 00:06:17,629
was on novel space telescope earlier it

138
00:06:21,850 --> 00:06:19,909

had gotten exposed the environment so

139

00:06:24,610 --> 00:06:21,860

there was appeared that when the

140

00:06:27,850 --> 00:06:24,620

astronauts were working on servicing

141

00:06:29,529 --> 00:06:27,860

mission for that the parts of the

142

00:06:31,420 --> 00:06:29,539

blanket would break apart and drift in

143

00:06:34,300 --> 00:06:31,430

front of the camera or get into the

144

00:06:37,059 --> 00:06:34,310

electronics so I was looked at the

145

00:06:39,129 --> 00:06:37,069

material on the ground and used some

146

00:06:41,860 --> 00:06:39,139

space environment projections to

147

00:06:44,170 --> 00:06:41,870

determine that the blanket would not be

148

00:06:46,120 --> 00:06:44,180

brutal for the source servicing mission

149

00:06:48,219 --> 00:06:46,130

people went away feeling pretty

150

00:06:51,159 --> 00:06:48,229

comfortable with the recommendation and

151
00:06:53,439 --> 00:06:51,169
it was very defendable to senior

152
00:06:56,589 --> 00:06:53,449
management because you considered every

153
00:06:59,769 --> 00:06:56,599
issue every person and all materials so

154
00:07:02,140 --> 00:06:59,779
there was there was a not much doubt in

155
00:07:04,510 --> 00:07:02,150
anyone's mind that we gave the best

156
00:07:05,769 --> 00:07:04,520
recommendation we could basically if you

157
00:07:07,559 --> 00:07:05,779
have the opportunity to work with

158
00:07:10,059 --> 00:07:07,569
anything for the Hubble Space Telescope

159
00:07:12,700 --> 00:07:10,069
you know you feel like you played a just

160
00:07:14,980 --> 00:07:12,710
a small part but it's it's just you know

161
00:07:16,930 --> 00:07:14,990
it's such an accomplishment for NASA it

162
00:07:19,899 --> 00:07:16,940
was a great experience for me I've taken

163
00:07:22,570 --> 00:07:19,909

a lot of way from that in my life sense

164

00:07:24,219 --> 00:07:22,580

away from NASA and but I have a lot of

165

00:07:27,219 --> 00:07:24,229

great memories and a lot of appreciation

166

00:07:29,499 --> 00:07:27,229

for all the people on the team and we

167

00:07:31,600 --> 00:07:29,509

remain close to this day I feel very

168

00:07:33,969 --> 00:07:31,610

fortunate to have worked on a mission

169

00:07:35,920 --> 00:07:33,979

that has had such a sweeping impact on

170

00:07:38,860 --> 00:07:35,930

our understanding of our solar system

171

00:07:41,529 --> 00:07:38,870

and the universe well working on Hubble

172

00:07:45,700 --> 00:07:41,539

is mean was just it's like what we do

173

00:07:48,159 --> 00:07:45,710

every day and so as we were doing it

174

00:07:51,100 --> 00:07:48,169

it's just kind of the same old you know

175

00:07:52,540 --> 00:07:51,110

what we do but every once in a while

176

00:07:53,519 --> 00:07:52,550

when you see the images from Hubble

177

00:07:56,339 --> 00:07:53,529

you're real

178

00:07:57,689 --> 00:07:56,349

is that you know gee I had a small part

179

00:08:00,119 --> 00:07:57,699

in the fact that Hubble was still