1
00:00:00,410 --> 00:00:00,800
\h

2
00:00:01,020 --> 00:00:03,509
Mario Livio, Astrophysicist/Space Telescope Science Institute: Ask anybody the name of a

3
00:00:03,510 --> 00:00:03,640
telescope, Hubble is the name that always comes up.

4
00:00:06,780 --> 00:00:09,559
Todd Halvorson, Space Reporter/Florida Today: The public, the general public seems to have a

5
00:00:09,560 --> 00:00:11,160
love affair with Hubble.

6
00:00:11,200 --> 00:00:12,829
Mario Livio, Astrophysicist/Space Telescope Science Institute: I mean, this is the telescope

7
00:00:12,830 --> 00:00:18,630
that everybody recognizes, recognizes the images from this telescope and recognizes its

8
00:00:19,530 --> 00:00:25,596
importance, you know, to literally, you know, everybody's life in the sense of inspiration.

9
00:00:27,090 --> 00:00:29,033
President Barack Obama: And I should point out, by the way, that in my private office just off the

10
00:00:31,680 --> 00:00:35,413
Oval, I've got the picture of Jupiter from the Hubble.

11
00:00:36,700 --> 00:00:37,700
(Music)

12
00:00:47,720 --> 00:00:49,029
Lisa Malone, Public Affairs Director/Kennedy Space Center: Twenty years after launching

13
00:00:49,030 --> 00:00:50,366

on a space shuttle and opening its instruments to the farthest reaches of space, NASA's Hubble

14
00:00:53,960 --> 00:00:54,363
Space Telescope has become synonymous with exploration, discovery and even a bit of luck.

15
00:00:59,490 --> 00:01:01,079
Mario Livio, Astrophysicist/Space Telescope Science Institute: One of the things that Hubble

16
00:01:01,080 --> 00:01:07,746
has done is it really taught us something about our place in the universe and our role within it. We

17
00:01:08,670 --> 00:01:08,910
want to know, how did the universe start? How did our galaxy start? How did the Earth start? How

18
00:01:14,830 --> 00:01:20,430
did life on Earth start? And we also want to know, how will all of these things end?

19
00:01:26,090 --> 00:01:28,749
George Diller/NASA Public Affairs Officer: When the telescope arrived, there was a lot of

20
00:01:28,750 --> 00:01:35,350
anticipation because there was so much extraordinary effort required at KSC in order to assure that

21
00:01:38,360 --> 00:01:39,223
the telescope was going to be able to maintain in the kind of environment that it had to be. And that

22
00:01:44,230 --> 00:01:50,496
meant a cleanliness standard that was extremely pristine, far beyond anything that we had ever

23
00:01:51,250 --> 00:01:52,316
launched before.

24
00:01:54,060 --> 00:01:55,419
Lisa Malone, Public Affairs Director/Kennedy Space Center With years of design and

25
00:01:55,420 --> 00:01:57,260
construction behind it, along with months more of processing, the Hubble was sealed inside

26
00:01:59,580 --> 00:02:00,870
Discovery for liftoff. The Hubble Space Telescope flew into the national consciousness on April 24,

27
00:02:04,890 --> 00:02:08,623
1990, inside the payload bay of space shuttle Discovery.

28
00:02:10,490 --> 00:02:12,673
Todd Halvorson, Space Reporter/Florida Today: The launching of the telescope itself was a

29
00:02:14,240 --> 00:02:20,040
huge deal because the Hubble Space Telescope was long-awaited and it was supposed to be

30
00:02:20,780 --> 00:02:24,713
launched in the year that the Challenger accident happened.

31
00:02:26,470 --> 00:02:28,289
Lisa Malone, Public Affairs Director/Kennedy Space Center: Hubble was different from

32
00:02:28,290 --> 00:02:30,510
land-based observatories because it would operate from a point hundreds of miles above the

33
00:02:32,070 --> 00:02:38,670
distorting effects of Earth's atmosphere. Though its 94-and-a-half-inch mirror is small compared to

34
00:02:38,680 --> 00:02:39,546
those built on the ground, the telescope is huge by spacecraft standards. At more than 43 feet long,

35
00:02:44,480 --> 00:02:51,080
the telescope took up most of the shuttle's payload bay. But as large as Hubble was, it was sent up

36
00:02:52,000 --> 00:02:52,276
with a tiny flaw in its main mirror. It was an imperfection less than the width of a human hair, but it

37
00:02:58,590 --> 00:02:58,806
was enough to blur Hubble's images and leave the observatory's potential in doubt.

38
00:03:03,840 --> 00:03:10,040

Todd Halvorson, Space Reporter/Florida Today: To find out two months after launch that it was

39
00:03:10,340 --> 00:03:13,940
launched with a misshapen mirror was crushing to NASA.

40
00:03:16,230 --> 00:03:18,160
George Diller/NASA Public Affairs Officer: When the telescope had its spherical aberration

41
00:03:20,300 --> 00:03:26,700
needed glasses, we had already built expectations to the point where that they were expecting to

42
00:03:27,540 --> 00:03:28,886
see these kind of things right away. When in fact, even if the telescope had worked, it was going to

43
00:03:32,860 --> 00:03:39,326
take astronomers a considerable amount of time to get some of that data and then to see what else

44
00:03:40,510 --> 00:03:40,870
Hubble was going to find that we didn't know about.

45
00:03:43,550 --> 00:03:46,159
Lisa Malone, Public Affairs Director/Kennedy Space Center: The telescope was quite

46
00:03:46,160 --> 00:03:48,226
powerful even with the flaw, but NASA knew it would have to fix it. So engineers set out to build

47
00:03:50,560 --> 00:03:52,626
Hubble a set of contact lenses.

48
00:03:54,290 --> 00:03:56,899
George Diller/NASA Public Affairs Officer: So, I think that was our, probably our biggest

49
00:03:56,900 --> 00:04:03,366
challenge was to try to make people realize that these things were still going to happen. We just

50
00:04:04,170 --> 00:04:06,903
needed a little time to fix this problem.

51
00:04:07,160 --> 00:04:08,740
Todd Halvorson, Space Reporter/Florida Today: Being able to restore the Hubble Space

52
00:04:11,180 --> 00:04:17,646
Telescope's observational capabilities was incredibly to the agency and they put together a great

53
00:04:19,210 --> 00:04:20,210
plan to do it.

54
00:04:21,980 --> 00:04:23,269
Lisa Malone, Public Affairs Director/Kennedy Space Center: Astronauts made five back-

55
00:04:23,270 --> 00:04:23,633
to-back spacewalks during the repair mission, a first. They spent more than 35 hours working on

56
00:04:29,240 --> 00:04:29,623
the telescope in the payload bay. The Hubble repair had effects reaching beyond the telescope's

57
00:04:35,190 --> 00:04:36,256
health, as well.

58
00:04:37,220 --> 00:04:39,759
Todd Halvorson, Space Reporter/Florida Today: This mission wasn't just about restoring the

59
00:04:39,760 --> 00:04:45,893
Hubble Space Telescope, it was about whether NASA had the capability to go off and build the

60
00:04:45,940 --> 00:04:47,806
International Space Station.

61
00:04:48,970 --> 00:04:52,013
George Diller/NASA Public Affairs Officer: The problem was fixed to the extent that it never

62
00:04:52,060 --> 00:04:59,126
occurs to anybody to even think about it anymore because the results are just so dramatic from the Hubble.

63
00:04:59,770 --> 00:05:05,370

Lisa Malone, Public Affairs Director/Kennedy Space Center: The first images from the

64
00:05:05,680 --> 00:05:06,743
telescope proved the servicing achieved its goal. The space telescope was free to look into the

65
00:05:10,950 --> 00:05:17,483
farthest distances ever seen, nearly as far back as the beginning of the universe. Astronauts made

66
00:05:18,960 --> 00:05:20,430
four more servicing flights to the Hubble Space Telescope to upgrade its instruments and replace

67
00:05:23,890 --> 00:05:25,223
critical components.

68
00:05:26,010 --> 00:05:28,963
George Diller/NASA Public Affairs Officer: We did it in a way that we knew it was the last time

69
00:05:29,390 --> 00:05:30,626
we were ever going to visit the telescope, and we had to do everything to it that we wanted to do if

70
00:05:34,820 --> 00:05:41,353
we wanted it to last a lot longer. So that made it more complex and when the mission was over, the

71
00:05:42,300 --> 00:05:44,033
feeling was, we'd done it.

72
00:05:44,390 --> 00:05:44,990
Todd Halvorson, Space Reporter/Florida Today: They have seen different worlds for the very

73
00:05:49,790 --> 00:05:55,990
first time through the eyes of the Hubble Space Telescope and its really expanded the general

74
00:05:56,490 --> 00:05:56,730
public's view of the universe, how the universe began, what the ultimate fate of the universe is

75
00:06:02,650 --> 00:06:09,250
going to be. It has ignited, it just has ignited the imagination of the collective American public.

76
00:06:16,720 --> 00:06:18,379
Lisa Malone, Public Affairs Director/Kennedy Space Center: The space telescope repaid

77
00:06:18,380 --> 00:06:24,380
each mission with more incredible views of space that all could see and appreciate. Hubble

78
00:06:24,760 --> 00:06:24,920
observations astounded researchers by showing the universe was not only expanding, it was speeding up.

79
00:06:31,400 --> 00:06:33,339
Mario Livio, Astrophysicist/Space Telescope Science Institute: Imagine your amazement if

80
00:06:33,340 --> 00:06:39,673
when I throw these keys up, you would suddenly see these keys accelerate in toward the ceiling.

81
00:06:39,980 --> 00:06:46,446
This is what we discovered. This was extraordinarily surprising and it led to this notion of dark

82
00:06:47,000 --> 00:06:50,533
energy that is pushing on the universe to accelerate.

83
00:06:51,070 --> 00:06:53,263
George Diller/NASA Public Affairs Officer: Once we began to get things back from Hubble, the

84
00:06:55,010 --> 00:06:56,256
scientists were beginning to see physical processes going on that they didn't really understand, and

85
00:07:00,430 --> 00:07:02,496
hadn't been able to see before.

86
00:07:03,050 --> 00:07:04,399
Lisa Malone, Public Affairs Director/Kennedy Space Center: Twenty years after opening

87
00:07:04,400 --> 00:07:10,866
a new eye on the universe, Hubble continues to dazzle by reaching farther back in time and space.

88
00:07:11,200 --> 00:07:14,090

George Diller/NASA Public Affairs Officer: The light that we're just now receiving from some of

89
00:07:14,710 --> 00:07:15,000
these galaxies and different objects show younger and younger galaxies and stars, the light from

90
00:07:20,820 --> 00:07:27,220
which, when they left that galaxy, the Earth hadn't even been formed yet. That's how far back in

91
00:07:29,520 --> 00:07:30,986
time Hubble is seeing.

92
00:07:31,710 --> 00:07:33,113
Mario Livio, Astrophysicist/Space Telescope Science Institute: We're talking about questions

93
00:07:36,440 --> 00:07:40,173
that a few tens of years ago we didn't even know to ask.

94
00:07:41,680 --> 00:07:43,310
George Diller/NASA Public Affairs Officer: The whole thing, it's a very storied program from the

95
00:07:46,450 --> 00:07:49,850
very first launch until the last servicing mission.