

1  
00:00:08,880 --> 00:00:12,100

As soon as the Hubble Space  
Telescope was launched,

2  
00:00:12,099 --> 00:00:16,929

astronomers were clamoring to see what  
it could do... (loud cheers)

3  
00:00:16,929 --> 00:00:22,170

the problem was there is only so much  
observing time to go around

4  
00:00:22,170 --> 00:00:26,850

Bob Williams: "It was still not clear if you just took  
what we call a blank field some

5  
00:00:26,850 --> 00:00:29,480

indistinguished thing which field of the sky

6  
00:00:29,480 --> 00:00:33,750

and sat Hubble on it and took picture after  
picture electronically added them

7  
00:00:33,750 --> 00:00:37,558

for a period of ten days that you'd come  
up with something that people would say

8  
00:00:37,558 --> 00:00:39,549

'yeah, this was worth it.'

9  
00:00:39,549 --> 00:00:43,599

A job like that meant other projects  
would have to wait their turn.

10  
00:00:43,600 --> 00:00:46,770

Alan Dressler: Telescopes are time machines because  
they look back

11  
00:00:46,770 --> 00:00:50,890

to earlier times. The light has been  
traveling for such a long time to get to

12  
00:00:50,890 --> 00:00:53,179

us that it left a long time ago.

13  
00:00:53,179 --> 00:00:56,829  
Sandra Faber: We had a theory that said that galaxies should look really different back in time.

14  
00:00:57,329 --> 00:01:01,079  
They should be smaller. They should be bluer,

15  
00:01:01,079 --> 00:01:04,299  
and they should be more irregular because they were still

16  
00:01:04,299 --> 00:01:08,039  
accumulating as the mass fell together via gravity.

17  
00:01:08,040 --> 00:01:13,290  
All three of those predictions were confirmed in the very first Hubble pictures.

18  
00:01:13,290 --> 00:01:15,290  
That was my really gotcha moment. It was great.

19  
00:01:16,799 --> 00:01:22,039  
Steve Beckwith: The galaxies were much smaller, much more distorted if you like they weren't really galaxies.

20  
00:01:22,040 --> 00:01:23,270  
They were just pieces of stuff,

21  
00:01:23,269 --> 00:01:25,799  
star clusters coming together to form galaxies.

22  
00:01:26,200 --> 00:01:27,978  
Garth Illingworth: The first images that were taken

23  
00:01:27,978 --> 00:01:31,700  
in the mid 90s were eye-opening

24  
00:01:31,700 --> 00:01:36,609  
but then we put a new camera on it in 2002 and that just was hugely different

25

00:01:36,608 --> 00:01:41,000  
bigger, better, brighter... more distant.

26  
00:01:41,000 --> 00:01:42,530  
While that follow-on deep field image

27  
00:01:42,530 --> 00:01:45,769  
added to our understanding  
of the early universe,

28  
00:01:45,769 --> 00:01:49,789  
it was the last servicing mission in  
2009 that allowed us to see

29  
00:01:49,789 --> 00:01:53,420  
all the way back to when the universe  
was essentially a toddler.

30  
00:01:53,420 --> 00:01:57,109  
Alan Dressler: They put on this new Wide Field Camera  
and that gave it an

31  
00:01:57,108 --> 00:02:02,000  
infrared sensitivity and suddenly we were  
back to within a half a billion years of the Big Bang.

32  
00:02:02,200 --> 00:02:05,740  
Beckwith: If you think of human  
development, the difference in looking at

33  
00:02:05,739 --> 00:02:08,069  
a toddler between one year and two years

34  
00:02:08,069 --> 00:02:12,949  
or six months and two years is enormous  
so even though it's only going back

35  
00:02:13,000 --> 00:02:17,020  
another couple billion years you're actually  
looking at something in a much

36  
00:02:17,020 --> 00:02:20,300  
more nascent state of development.

37  
00:02:20,300 --> 00:02:24,140

As the development of the cosmos continues to be a burning question,

38

00:02:24,139 --> 00:02:27,919  
astronomers are getting another assist from the universe itself.

39

00:02:27,919 --> 00:02:31,549  
Jennifer Lotz: Instead of looking at essentially

40

00:02:31,550 --> 00:02:34,700  
an unspecial piece of sky, they proposed

41

00:02:34,699 --> 00:02:39,179  
looking at a very special place... the fields around strong lensing

42

00:02:39,180 --> 00:02:42,189  
clusters... the most massive objects in the universe.

43

00:02:42,189 --> 00:02:45,270  
and Einstein's Theory of General Relativity

44

00:02:45,270 --> 00:02:49,310  
tells us that space and time is bent around those objects

45

00:02:49,310 --> 00:02:54,039  
and so they can actually act as natural telescopes, bending the light

46

00:02:54,039 --> 00:02:57,000  
and magnifying the light from galaxies that are behind that.

47

00:02:57,000 --> 00:02:59,000  
Basically, we're using Hubble

48

00:02:59,330 --> 00:03:02,490  
in combination with nature's telescopes to see

49

00:03:02,490 --> 00:03:05,730  
farther than we could possibly see with Hubble alone.

50  
00:03:05,729 --> 00:03:09,530  
Faber: The so-called Deep Fields are the longest  
images

51  
00:03:09,530 --> 00:03:13,539  
ever taken of the universe and some of the  
most informative

52  
00:03:13,539 --> 00:03:17,359  
pictures ever taken by human beings.  
They're a real milestone

53  
00:03:17,360 --> 00:03:19,000  
in the course of human science.

54  
00:03:20,000 --> 00:03:22,229  
While Hubble is still showing how the

55  
00:03:22,229 --> 00:03:24,799  
universe has evolved over billions of years,

56  
00:03:24,800 --> 00:03:27,500  
there's still much we don't know.

57  
00:03:27,500 --> 00:03:30,000  
We haven't found the very first generation of galaxies.

58  
00:03:30,729 --> 00:03:34,429  
That would be an amazing time. We call it  
cosmic dawn...

59  
00:03:34,430 --> 00:03:37,430  
when the universe switched on...starlight  
for the first time

60  
00:03:37,430 --> 00:03:42,150  
Now, was this a sudden moment? Did the  
universe suddenly go from darkness

61  
00:03:42,150 --> 00:03:45,360  
to light? Or was it a gradual process?

62  
00:03:46,000 --> 00:03:48,919  
Answers to these questions and many

more

63

00:03:48,919 --> 00:03:52,530

will have to wait until Hubble's  
successor, the James Webb Space Telescope,

64

00:03:52,530 --> 00:03:56,479

takes over the reins at its primed with  
infrared vision

65

00:03:56,479 --> 00:03:57,500

to look even farther back in time.

66

00:04:00,000 --> 00:04:01,500

From the Space Telescope Science Institute

67

00:04:01,500 --> 00:04:04,099

in Baltimore, MD. I'm Mary Estacion.