



1
00:00:00,507 --> 00:00:03,090
(gentle music)

2
00:00:05,707 --> 00:00:09,510
- Hey, I'm Thomas Zurbuchen,
also known as Dr. Z.

3
00:00:09,510 --> 00:00:13,040
- And I'm Ellen Stofan
also known as Dr. E.

4
00:00:13,040 --> 00:00:16,210
And this is the next
episode of E.Z. Science.

5
00:00:16,210 --> 00:00:18,800
- We're here at the Steven
F. Udvar-Hazy Center

6
00:00:18,800 --> 00:00:21,020
our other Air and Space Museum.

7
00:00:21,020 --> 00:00:22,670
Today we're gonna be
talking about something

8
00:00:22,670 --> 00:00:24,180
a little different that some people

9
00:00:24,180 --> 00:00:26,260
might not associate with NASA.

10
00:00:26,260 --> 00:00:28,530
- That's right, we're
talking about balloons.

11
00:00:28,530 --> 00:00:32,450
Balloons that float very, very
high up in the atmosphere.

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00:00:32,450 --> 00:00:34,780

- Now this was actually
a really special balloon

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00:00:34,780 --> 00:00:36,700

called the Breitling Orbiter 3.

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00:00:36,700 --> 00:00:39,330

It took Bertrand Piccard and Brian Jones

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00:00:39,330 --> 00:00:44,330

around the world nonstop
for the first time in 1999.

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00:00:44,550 --> 00:00:47,140

So a record breaking flight
that we celebrate here

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00:00:47,140 --> 00:00:49,100

at the Hazy Center but
you have a little bit

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00:00:49,100 --> 00:00:51,030

of a connection because obviously Thomas

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00:00:51,030 --> 00:00:54,040

you're from Switzerland and
this launched from Switzerland.

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00:00:54,040 --> 00:00:56,780

- Exactly right, I remember
of course watching this.

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00:00:56,780 --> 00:00:59,250

There was tremendous coverage
in all of Switzerland

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00:00:59,250 --> 00:01:01,000

also all over the world.

23

00:01:01,000 --> 00:01:04,040

- Well to me what we
celebrated here at Hazy

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00:01:04,040 --> 00:01:05,510

and at the Air and Space Museum

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00:01:05,510 --> 00:01:08,010

is this idea that innovators and explorers

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00:01:08,010 --> 00:01:09,390

help to change the world.

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00:01:09,390 --> 00:01:12,489

And balloon science
really helps us understand

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00:01:12,489 --> 00:01:16,610

not just our world better but
actually the whole universe.

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00:01:16,610 --> 00:01:17,770

- That's exactly right.

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00:01:17,770 --> 00:01:20,080

That essential idea of the balloon

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00:01:20,080 --> 00:01:24,240

is to move and experiment
over the atmosphere.

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00:01:24,240 --> 00:01:26,050

Per square inch, there's something like

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00:01:26,050 --> 00:01:29,960

15 pounds of atmospheric
weights on top of us.

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00:01:29,960 --> 00:01:31,929

- Sometimes we have to make our spacecraft really small

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00:01:31,929 --> 00:01:34,630

if we're trying to get them all the way up into orbit.

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00:01:34,630 --> 00:01:35,900

But going up in a balloon

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00:01:35,900 --> 00:01:37,730

we can actually take a fair amount of weight.

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00:01:37,730 --> 00:01:39,680

That's important because the more mass you have

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00:01:39,680 --> 00:01:42,620

that means the more instruments and more science you can do.

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00:01:42,620 --> 00:01:45,670

- [Thomas] Exactly right, so we can bring up to 8000 pounds.

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00:01:45,670 --> 00:01:47,220

- [Ellen] How big are these balloons and how long

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00:01:47,220 --> 00:01:48,760

do they actually stay up?

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00:01:48,760 --> 00:01:50,330

- We have a variety of balloons.

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00:01:50,330 --> 00:01:52,470

The biggest ones are so big they'll fill

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00:01:52,470 --> 00:01:54,590

a whole football stadium.

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00:01:54,590 --> 00:01:57,350

Some of them last for hours and days

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00:01:57,350 --> 00:01:59,830

and the longest ones, the
super pressure balloons,

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00:01:59,830 --> 00:02:01,937

last for up to 100 days.

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00:02:01,937 --> 00:02:03,770

- And one of the things
I think it's important

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00:02:03,770 --> 00:02:06,280

for people to understand
is they actually rely

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00:02:06,280 --> 00:02:08,120

on balloons every day in a way

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00:02:08,120 --> 00:02:09,690

that they might not know about.

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00:02:09,690 --> 00:02:11,510

Weather balloons launched every day

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00:02:11,510 --> 00:02:14,843

help us to understand and
predict tomorrow's weather.

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00:02:14,843 --> 00:02:17,900

- NASA launches about 15 balloons a year

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00:02:17,900 --> 00:02:20,444

from a variety of locations all the way

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00:02:20,444 --> 00:02:22,670

from New Zealand to Texas.

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00:02:22,670 --> 00:02:25,040

- We actually have three
different NASA instruments

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00:02:25,040 --> 00:02:27,930

that flew on balloons
in our downtown museum.

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00:02:27,930 --> 00:02:30,100

All of them we're looking at radiation

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00:02:30,100 --> 00:02:31,640

left over from the Big Bang

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00:02:31,640 --> 00:02:33,842

to help us understand the Big Bang better.

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00:02:33,842 --> 00:02:35,430

- These measurements have really

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00:02:35,430 --> 00:02:37,430

transformed our understanding.

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00:02:37,430 --> 00:02:38,680

- Now it's hard for people to understand

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00:02:38,680 --> 00:02:40,930

how we can be studying the Big Bang

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00:02:40,930 --> 00:02:43,500

from our atmosphere,
something that happened

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00:02:43,500 --> 00:02:46,440

billions and billions and
billions of years ago.

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00:02:46,440 --> 00:02:50,120

But all those particles are
coming from a huge distance.

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00:02:50,120 --> 00:02:52,771

It takes them a long time to travel to us.

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00:02:52,771 --> 00:02:56,720

So it's really almost
an echo of the Big Bang

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00:02:56,720 --> 00:02:58,960

that just took a long
time to reach the earth.

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00:02:58,960 --> 00:03:01,824

And that helps us to actually
understand that event

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00:03:01,824 --> 00:03:04,384

that we don't understand very well yet.

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00:03:04,384 --> 00:03:07,220

- So as we make those measurements

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00:03:07,220 --> 00:03:09,290

and combine them with
measurements from the ground

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00:03:09,290 --> 00:03:10,780

but also from spacecraft,

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00:03:10,780 --> 00:03:13,980

that picture of the earliest

moments of the Big Bang

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00:03:13,980 --> 00:03:17,620

and then also the evolution
of the first galaxies,

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00:03:17,620 --> 00:03:21,205

you know the evolution of matter,
is really coming together.

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00:03:21,205 --> 00:03:22,423

We've made a lot of progress and in part

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00:03:22,423 --> 00:03:24,240

because of these balloons.

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00:03:24,240 --> 00:03:27,210

- Now we also study the earth
from balloon based instruments

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00:03:27,210 --> 00:03:29,080

like I know one of the
experiments that was done

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00:03:29,080 --> 00:03:31,370

not that long ago was actually looking at

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00:03:31,370 --> 00:03:34,630

how much solar radiation
comes back from the earth

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00:03:34,630 --> 00:03:36,530

into space which is important for us

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00:03:36,530 --> 00:03:38,630

trying to understand how does Earth's

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00:03:38,630 --> 00:03:41,120

climate and weather work?

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00:03:41,120 --> 00:03:43,840

And that solar radiation
and how much stays in,

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00:03:43,840 --> 00:03:46,432

how much leaves is really
critical to understanding that.

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00:03:46,432 --> 00:03:47,265

- Yeah, that's right.

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00:03:47,265 --> 00:03:49,213

What's really important
about that experiment too

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00:03:49,213 --> 00:03:51,740

is that we used the balloon
really as a platform

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00:03:51,740 --> 00:03:53,481

to try the technology.

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00:03:53,481 --> 00:03:57,530

We can afford probably 1%
of the cost, go try it out,

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00:03:57,530 --> 00:04:00,260

and make sure we understand
it before we're finally ready

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00:04:00,260 --> 00:04:02,393

and putting it up there in space.

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00:04:02,393 --> 00:04:04,630

You know the other thing that
we don't often talk about

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00:04:04,630 --> 00:04:05,850

and I'm really passionate about

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00:04:05,850 --> 00:04:08,560

is it's with these very
balloons we actually train

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00:04:08,560 --> 00:04:10,420

the next generation of explorers

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00:04:10,420 --> 00:04:13,700

and the next generation
of instrument makers.

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00:04:13,700 --> 00:04:15,700

- We actually run a summer camp

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00:04:15,700 --> 00:04:17,850

here at the National Air and Space Museum

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00:04:17,850 --> 00:04:19,890

for girls on aviation.

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00:04:19,890 --> 00:04:21,990

And one of the things
that we have the girls do

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00:04:21,990 --> 00:04:24,820

is actually launch a
weather ballon basically

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00:04:24,820 --> 00:04:26,900

up to the stratosphere.

110

00:04:26,900 --> 00:04:29,410

Seeing the looks on their
faces when the data comes back

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00:04:29,410 --> 00:04:32,410

and realizing that they're

part of this experiment,

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00:04:32,410 --> 00:04:36,150

you go try, you put something
up there, is really exciting.

113

00:04:36,150 --> 00:04:37,710

- So Ellen I have a question for you.

114

00:04:37,710 --> 00:04:39,660

How long do you think it would take

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00:04:39,660 --> 00:04:42,540

until we have a balloon in
the atmosphere of Venus?

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00:04:42,540 --> 00:04:45,110

- Venus is a perfect planet
to explore with the balloon

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00:04:45,110 --> 00:04:47,390

because while it's very hot on the surface

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00:04:47,390 --> 00:04:50,540

it actually gets cooler as you
go higher in the atmosphere.

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00:04:50,540 --> 00:04:53,130

So you can't really have a rover on Venus.

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00:04:53,130 --> 00:04:54,890

That mobility where we want to visit

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00:04:54,890 --> 00:04:58,040

lots of different sites, it's
just too hot with a rover.

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00:04:58,040 --> 00:05:00,510

So the idea is could we

send a balloon to Venus

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00:05:00,510 --> 00:05:03,220

that could go up into
the atmosphere, cool off,

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00:05:03,220 --> 00:05:06,800

move along, come back and
explore a different site?

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00:05:06,800 --> 00:05:08,830

- Perhaps one of your
innovators will figure out

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00:05:08,830 --> 00:05:10,610

how we get to Venus with a balloon.

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00:05:10,610 --> 00:05:12,170

- Absolutely, that's our role here

128

00:05:12,170 --> 00:05:14,210

at the Air and Space Museum is to inspire

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00:05:14,210 --> 00:05:17,070

that next generation of
innovators and explorers.

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00:05:17,070 --> 00:05:19,853

If you have topics for us or questions

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00:05:19,853 --> 00:05:22,820

please send them in and
we'll talk about them

132

00:05:22,820 --> 00:05:24,747

on a future episode of