



1
00:00:00,506 --> 00:00:14,500
[Music]

2
00:00:20,536 --> 00:00:22,796
>> My earliest interest
in science really stemmed

3
00:00:22,796 --> 00:00:24,736
from my love of nature and
the outdoors and wanting

4
00:00:24,736 --> 00:00:27,626
to understand why the world
worked the way it worked

5
00:00:27,626 --> 00:00:29,796
and why animals did the
things that they did.

6
00:00:30,456 --> 00:00:32,746
My parents recognized
pretty early

7
00:00:32,746 --> 00:00:35,206
on that I was a very curious
kid, and did their best

8
00:00:35,286 --> 00:00:37,946
to encourage that, and I was
lucky enough to have teachers

9
00:00:37,986 --> 00:00:41,416
who also instilled and
fostered that curiosity in me.

10
00:00:41,636 --> 00:00:44,646
My name is Erin Waggoner,
and I'm an aerospace engineer

11

00:00:44,646 --> 00:00:45,446
in the aerodynamics

12
00:00:45,446 --> 00:00:46,926
and propulsion branch,
and I work for NASA.

13
00:00:46,986 --> 00:00:50,366
So, I got into engineering,
and then I ultimately went

14
00:00:50,366 --> 00:00:51,806
and majored in aerospace
engineering

15
00:00:51,806 --> 00:00:55,106
at Wichita State University
and minored in math.

16
00:00:55,306 --> 00:00:57,866
Because I knew I ultimately
wanted to end up at NASA someday

17
00:00:57,866 --> 00:00:59,996
for my career, I
applied to be a co-op

18
00:00:59,996 --> 00:01:01,406
through the school's
co-op office.

19
00:01:01,536 --> 00:01:04,106
The boom was very faint
across the entire carpet.

20
00:01:04,376 --> 00:01:07,666
So, I ended up getting picked
up by NASA Armstrong and I came

21
00:01:07,666 --> 00:01:08,806

out here sight-unseen.

22

00:01:09,226 --> 00:01:11,606

I absolutely loved
the work I was doing.

23

00:01:11,606 --> 00:01:15,156

I started out on SOFIA, and the
I had the luck to go over to CEV

24

00:01:15,156 --> 00:01:18,026

and then X-48, so I got to see a
lot of the very unique projects

25

00:01:18,026 --> 00:01:22,156

that were coming through
here in the early 2010s era.

26

00:01:22,476 --> 00:01:25,536

And, I got a call, just before
I was graduating from college,

27

00:01:25,626 --> 00:01:27,356

with a formal job
offer from here,

28

00:01:27,396 --> 00:01:32,216

and it was my dream come true.

29

00:01:32,256 --> 00:01:35,266

Essentially, my job
entails everything

30

00:01:35,266 --> 00:01:37,396

from planning a flight
test all the way

31

00:01:37,396 --> 00:01:39,256

through executing a
fight test and looking

32

00:01:39,256 --> 00:01:40,196
at the data afterwards.

33

00:01:41,036 --> 00:01:43,486
My current project is the
acoustic research measurement,

34

00:01:43,686 --> 00:01:44,876
or ARM-3 flights.

35

00:01:46,786 --> 00:01:49,226
ARM-3 uses a large
microphone array that's set

36

00:01:49,226 --> 00:01:51,926
up in a spiral pattern called
a beam-forming microphone array

37

00:01:52,326 --> 00:01:55,026
to measure aircraft noise off
of a G-III, and essentially,

38

00:01:55,026 --> 00:01:57,696
what we're doing is trying to
measure aircraft noise and look

39

00:01:57,696 --> 00:01:59,666
at aircraft noise
mitigation measures.

40

00:01:59,716 --> 00:02:02,736
So, we have various fairings
and flaps and cavity treatments

41

00:02:02,736 --> 00:02:04,196
that we've put on the
airplane, and we're trying

42

00:02:04,196 --> 00:02:06,306
to see what the effect
of those treatments is

43

00:02:06,306 --> 00:02:07,500
on the overall noise
signature of the airplane.

44

00:02:07,846 --> 00:02:11,000
>> Three, two, one, mark.

45

00:02:16,246 --> 00:02:19,106
>> The beam-forming array is
also called an acoustic camera.

46

00:02:19,656 --> 00:02:22,296
It gives you a picture of
an airplane that looks a lot

47

00:02:22,296 --> 00:02:24,066
like a heat map, if you've
ever seen a heat map,

48

00:02:24,286 --> 00:02:26,566
but in the picture of the
airplane that we end up getting,

49

00:02:26,566 --> 00:02:29,896
red is noisy, or
loud, instead of hot.

50

00:02:30,236 --> 00:02:32,376
So, we can use this to tell
where the noisiest parts

51

00:02:32,376 --> 00:02:35,476
of the airplane are, and we can
use this to figure out if any

52

00:02:35,476 --> 00:02:37,106

of our mitigations
have been successful,

53

00:02:37,106 --> 00:02:38,816

and to what extent they
have been successful.

54

00:02:39,726 --> 00:02:40,396

>> [inaudible] copy.

55

00:02:40,396 --> 00:02:43,526

Let's go ahead and
move to 165, gear up.

56

00:02:43,626 --> 00:02:44,516

>> Two zero.

57

00:02:44,956 --> 00:02:47,456

>> During an ARM flight, the
G-III flies, essentially,

58

00:02:47,456 --> 00:02:49,526

an approach over the
microphone array.

59

00:02:49,526 --> 00:02:52,256

>> Three, two, one,
descend, two point three.

60

00:02:52,686 --> 00:02:53,776

>> Well, before they
reach the array,

61

00:02:53,776 --> 00:02:56,256

the pilots have throttled
back the engines so that it's

62

00:02:56,256 --> 00:02:58,286

as quiet as possible, from
an engine perspective,

63

00:02:58,286 --> 00:02:59,176
while they're over the array.

64

00:02:59,776 --> 00:03:02,146
We also have them fly at
various different airspeeds,

65

00:03:02,146 --> 00:03:03,946
and with various
different flap deflections,

66

00:03:03,996 --> 00:03:06,326
because that will affect
the noise signature.

67

00:03:07,576 --> 00:03:08,936
So, on the other side
of the sound barrier,

68

00:03:08,936 --> 00:03:12,276
I do more acoustic research on
the supersonic side of things.

69

00:03:12,826 --> 00:03:15,976
It's not a boom that happens
once, or it's not a boom

70

00:03:15,976 --> 00:03:18,286
that happens once or twice,
in that a lot of people think,

71

00:03:18,286 --> 00:03:19,426
"Okay, so I've sped up.

72

00:03:19,426 --> 00:03:21,456
I've broken through
this sound barrier.

73

00:03:21,736 --> 00:03:22,146
It's gone.

74

00:03:22,146 --> 00:03:25,166
I'm no longer producing a sonic boom, and then when I slow down,

75

00:03:25,166 --> 00:03:27,106
and I brake through it the other way,

76

00:03:27,106 --> 00:03:28,026
now I'm going to make a boom."

77

00:03:28,336 --> 00:03:29,756
It's really not like that.

78

00:03:30,176 --> 00:03:31,796
It's more like a wake on a boat,

79

00:03:32,256 --> 00:03:34,986
so as long as it's moving supersonically,

80

00:03:34,986 --> 00:03:38,106
or over the speed of sound, you're going to continue

81

00:03:38,106 --> 00:03:40,636
to drag, effectively, a wake of a sonic boom with you

82

00:03:40,636 --> 00:03:41,856
through the air that will reach the ground.

83

00:03:41,856 --> 00:03:49,006
I've worked on SonicBAT recently, and that was a test

84

00:03:49,366 --> 00:03:52,156

to look at how sonic
booms propagate

85

00:03:52,236 --> 00:03:53,356

through a turbulent atmosphere.

86

00:03:54,046 --> 00:03:58,056

During that project, I had the
privilege to fly in the TG-14

87

00:03:58,546 --> 00:04:01,756

and record the sonic booms
between where they were produced

88

00:04:01,966 --> 00:04:04,486

on the aircraft and where they
were recorded on the ground.

89

00:04:05,356 --> 00:04:07,876

The rationale behind
using the TG-14 is it's

90

00:04:07,876 --> 00:04:11,186

because it's a motorized glider,
so the engine can be turned off

91

00:04:11,446 --> 00:04:12,886

and on in the middle
of a flight,

92

00:04:13,246 --> 00:04:14,646

and it's a very quiet aircraft.

93

00:04:17,526 --> 00:04:19,546

So, the F-18 would
produce the boom

94

00:04:19,626 --> 00:04:22,556

from a very specific location
and at a very specific airspeed.

95

00:04:22,826 --> 00:04:25,936

The TG-14 would record the
boom as it had propagated

96

00:04:25,936 --> 00:04:28,446

through the atmosphere prior to
it hitting the turbulent layer,

97

00:04:28,956 --> 00:04:30,106

and then the microphone arrays

98

00:04:30,106 --> 00:04:33,296

on the ground would have record
how that sonic boom sounded

99

00:04:33,296 --> 00:04:35,776

on the ground after it had gone
through the layer of turbulence.

100

00:04:36,806 --> 00:04:38,546

The way I describe
engineering now is

101

00:04:38,546 --> 00:04:41,586

that you have this giant
puzzle, and you have

102

00:04:41,616 --> 00:04:44,256

to follow some rules in
order to solve your problem,

103

00:04:44,486 --> 00:04:47,646

but the only rules that you have
to follow are physics and math.

104

00:04:47,646 --> 00:04:49,676

And, if you follow

physics and math

105

00:04:49,676 --> 00:04:51,076

and you can find the
right technology,

106

00:04:51,076 --> 00:04:52,606

you can solve any
problem you want to solve.

107

00:04:52,886 --> 00:04:53,660

>> Go on up.

108

00:04:56,516 --> 00:04:59,026

>> I mean, ultimately,
I just feel very blessed

109

00:04:59,496 --> 00:05:00,366

to be able to work here.

110

00:05:00,806 --> 00:05:02,176

That's what I wanted.

111

00:05:03,706 --> 00:05:06,616

You can't let anybody
define your path for you.

112

00:05:06,616 --> 00:05:08,146

>> Six flight copy, clear
takeoff [inaudible].

113

00:05:08,186 --> 00:05:10,716

>> You have to have the
confidence in yourself to go

114

00:05:10,806 --> 00:05:12,426

after your goals and to
go after your dreams,

115

00:05:13,126 --> 00:05:15,276
and you can't let
those people deter you.