



1
00:00:01,200 --> 00:00:09,200
Aircraft Sound/Music

2
00:00:10,530 --> 00:00:14,339
Troy Asher: Why RC models are important to us in the test pilot business is the first

3
00:00:14,339 --> 00:00:17,910
time you climb aboard one of those airplanes to go do something that may have never been

4
00:00:17,910 --> 00:00:23,810
done before, it's actually been simulated and been flown a lot and scaled down and tried on many

5
00:00:23,810 --> 00:00:25,450
different platforms.

6
00:00:25,450 --> 00:00:27,080
Jim Less: Rarely do test pilots just go out and

7
00:00:27,080 --> 00:00:29,800
hop in an airplane and give it a whirl and see what happens.

8
00:00:29,800 --> 00:00:35,650
David Larson: Sometimes it's just too unsafe to go fly that aircraft in that flight regime. When

9
00:00:35,650 --> 00:00:39,489
we first start out, maybe we test a concept on a smaller scale.

10
00:00:39,489 --> 00:00:44,510
>>If you want to try a new shape of a wing or you wanted to try a new whole airplane

11
00:00:44,510 --> 00:00:49,229
concept, it's much cheaper and easier, you

can do it for orders of magnitude less.

12

00:00:49,229 --> 00:00:53,469

>>Model testing is a stepping stone towards a full-sized aircraft.

13

00:00:53,469 --> 00:00:58,869

Music

14

00:01:09,600 --> 00:01:11,600

>>Hi, I'm Red Jensen, chief pilot for sub-scale

15

00:01:11,600 --> 00:01:17,409

research aircraft here at Armstrong Flight Research Center, welcome to my lab.

16

00:01:17,409 --> 00:01:21,249

Here at Armstrong, we use a variety of subscale aircraft to test out new and emerging technologies

17

00:01:21,260 --> 00:01:25,400

that may or may not make it to the full-scale world. And we've been doing this for a very

18

00:01:25,400 --> 00:01:27,360

long time.

19

00:01:27,360 --> 00:01:30,720

Music/Model Airplane sounds

20

00:02:00,960 --> 00:02:04,960

>>As you can see, these are not your normal model airplanes. This is our DROID aircraft,

21

00:02:04,970 --> 00:02:08,860

and this is really a flying testbed and the backbone of the model lab. We can use this to test

22

00:02:08,860 --> 00:02:13,439

out many different technologies. For instance,

we currently have ADS-B onboard, and we also

23

00:02:13,439 --> 00:02:19,420

use this as a tow plane for our towed glider project. This is our twin-glider air launch

24

00:02:19,420 --> 00:02:23,790

concept. The idea here is to tow a rocket up underneath, with a payload on it, and launch

25

00:02:23,790 --> 00:02:28,810

it from about 40,000 feet. This will reduce our launch cost to orbit. This is Photo-1,

26

00:02:28,810 --> 00:02:32,520

which is an octo-copter, and we use this for a variety of filming applications around the

27

00:02:32,520 --> 00:02:33,680

center.

28

00:02:36,200 --> 00:02:39,790

This is HUGH, which is basically an RC airplane, except that we're testing an

29

00:02:39,790 --> 00:02:43,459

experimental flight computer, which allows researchers and students alike the ability

30

00:02:43,459 --> 00:02:45,499

to customize flight control systems.

31

00:02:48,120 --> 00:02:50,510

This is PRANDTL, and this is research into lowering

32

00:02:50,510 --> 00:02:53,790

induced drag, or a new way of thinking about wing design.

33

00:02:53,800 --> 00:02:57,000

Wind

34

00:02:57,480 --> 00:02:58,310

>>Here in the model lab, one of

35

00:02:58,310 --> 00:03:02,220

the cool things about us is we're a one-stop shop. Here is where we configure and maintain

36

00:03:02,220 --> 00:03:07,489

our autopilot and data acquisition systems. Over here, we have a 3D printer. Almost everything

37

00:03:07,489 --> 00:03:12,040

we build here is a one-off, so this allows us to build parts instantly, right here in

38

00:03:12,040 --> 00:03:13,000

the lab.

39

00:03:13,680 --> 00:03:15,480

And when it's time to fly,

40

00:03:16,840 --> 00:03:18,720

we have a completely self-contained mobile ground

41

00:03:18,739 --> 00:03:23,179

control station that allows us to operate in any austere environment.

42

00:03:23,179 --> 00:03:30,160

Music/Background Noise

43

00:03:32,400 --> 00:03:33,600

>>We're gonna do the control check-

44

00:03:33,620 --> 00:03:35,569

>>Left roll?
>>Right roll?

45
00:03:35,569 --> 00:03:37,030
>>Right rudder?
>>Yep.

46
00:03:37,040 --> 00:03:38,320
Mechanical Sounds

47
00:03:38,320 --> 00:03:40,320
>>We're ready to hook up the fibers.

48
00:03:40,320 --> 00:03:43,800
Background Noise

49
00:03:44,640 --> 00:03:46,200
>>Let's go back to the control algorithm one

50
00:03:46,200 --> 00:03:47,640
more time, I want to get it to its neutral
position.

51
00:03:47,640 --> 00:03:52,160
>>Yaw left? Yaw right?
>>Roll right?

52
00:03:52,160 --> 00:03:54,620
Background Noise

53
00:03:54,620 --> 00:03:55,440
>>We're good!

54
00:03:55,440 --> 00:03:57,740
>>Ok, from a pre-flight standpoint, are you
guys ready to go?

55
00:03:57,740 --> 00:03:59,720
>>We're ready.

>>We're ready.

56

00:03:59,720 --> 00:04:00,800

>>Good to go!

57

00:04:00,800 --> 00:04:02,320

Airplane motor starting

58

00:04:02,320 --> 00:04:04,800

Airplane Takeoff

59

00:04:04,800 --> 00:04:06,500

>>Take off at 7:20.

60

00:04:06,500 --> 00:04:09,599

>>Thank you.

>>Edwards Tower, NASA UAS is airborne, UAS

61

00:04:09,599 --> 00:04:12,719

work area surface to 3,000 feet.

62

00:04:12,719 --> 00:04:14,999

>>All right, Red, I moved the radius, 500

63

00:04:15,010 --> 00:04:17,830

foot radius, and I moved it closer to you.

>>Perfect.

64

00:04:17,830 --> 00:04:22,900

>>Holding 55 knots, capturing...climbing to 3,000.

65

00:04:22,900 --> 00:04:26,379

>>Handoff to pilot.

>>...and, I got it.

66

00:04:27,460 --> 00:04:31,600

>>In a lot of people's eyes it's not as glamorous, not an F-18 or an F-15 or something like that.

67
00:04:31,600 --> 00:04:35,590
It's a small airplane. But what a lot of people
don't realize is you can get an amazing amount

68
00:04:35,590 --> 00:04:39,800
of data and testing done very quickly with
a model aircraft rather than waiting years

69
00:04:39,800 --> 00:04:42,380
to see if your full-scale article is gonna
fly.

70
00:04:42,380 --> 00:04:45,580
Music

71
00:04:45,580 --> 00:04:46,780
>>Standby for auto...

72
00:04:46,780 --> 00:04:50,769
>>Ready for auto...
>>3...2...1...auto

73
00:04:50,769 --> 00:04:52,769
Background Noise

74
00:04:52,900 --> 00:04:57,400
>>The autopilot is capable of getting the
standard accels, airspeed, altitude, position

75
00:04:57,410 --> 00:05:01,720
through GPS, things like that; some of the
aircraft have an additional data system onboard.

76
00:05:01,720 --> 00:05:06,710
For instance, the APV-3 FOSS aircraft has
a fiber optic strain sensing network in the

77
00:05:06,710 --> 00:05:11,080

wing, where we're measuring bending deflection
to do real-time gust load alleviation. How

78

00:05:11,080 --> 00:05:14,880

much does the wing bend? And how much do we
have to deflect the control surface to neutralize

79

00:05:14,880 --> 00:05:16,960

or minimize that bending moment?

80

00:05:16,960 --> 00:05:19,820

Music

81

00:05:20,320 --> 00:05:24,920

>>HUGH has an open-architecture type autopilot
which means it's not locked to a certain configuration.

82

00:05:24,930 --> 00:05:29,400

The beauty of that is you can make HUGH behave
like another airplane simply by changing the

83

00:05:29,400 --> 00:05:34,810

control laws. If you wanted to make it
fly like a Cessna 310, or a T-38, or something

84

00:05:34,810 --> 00:05:38,979

like that, you can emulate these different types of
aircraft, and the advantage of that is again,

85

00:05:38,979 --> 00:05:42,790

low cost, rapid development, and much quicker
to fruition.

86

00:05:42,790 --> 00:05:45,830

Music/Airplane Sounds

87

00:05:45,830 --> 00:05:47,130

>>I like to say that we do the stuff that's

88

00:05:47,130 --> 00:05:51,139

either too dangerous, too boring, or not enough money for. For instance, the TGALS, it's kind

89

00:05:51,139 --> 00:05:54,540

of a wild concept, you would never build a manned airplane right off the bat, so we build

90

00:05:54,540 --> 00:05:58,150

a subscale model, prove the concept, and then go forward with that technology.

91

00:05:58,150 --> 00:05:59,790

Music

92

00:05:59,790 --> 00:06:01,100

>>Another thing is the auto ground collision

93

00:06:01,100 --> 00:06:05,800

avoidance system, where you're flying an aircraft at a blind canyon and let a computer take

94

00:06:05,800 --> 00:06:10,300

over, and avoid the obstacle. Well that's obviously very risky to do in a manned aircraft,

95

00:06:10,300 --> 00:06:14,419

so it makes perfect sense to do it in a subscale aircraft, where if something happens,

96

00:06:14,419 --> 00:06:16,179

well there's no harm to any person.

97

00:06:16,179 --> 00:06:18,199

Music/Airplane flyby

98

00:06:19,289 --> 00:06:24,660

>>I feel that Armstrong uses sUAS to enhance the Center's capability. Somebody can have

99

00:06:24,669 --> 00:06:29,169

some wild, hare-brained idea, they can come to the model lab, we can either fit the technology

100

00:06:29,169 --> 00:06:33,460

in an existing platform, or we can build an all-new platform to test this thing.