
S
NASA

1
00:00:01,526 --> 00:00:05,196
>> This the largest test article
ever built with a curved path.

2
00:00:08,046 --> 00:00:11,346
The name of this project
is the Passive Aeroelastic

3
00:00:11,576 --> 00:00:12,576
Tailored Wing.

4
00:00:12,826 --> 00:00:14,686
We call it the PAT Wing
because it's easier to say.

5
00:00:16,516 --> 00:00:23,976
[Music]

6
00:00:24,476 --> 00:00:27,906
>> Minus 30 on 4, reengage.

7
00:00:30,296 --> 00:00:32,846
>> There are several
differences between this wing

8
00:00:32,846 --> 00:00:34,226
and a traditional wing.

9
00:00:34,226 --> 00:00:35,906
First of all, it's
built out of composites.

10
00:00:36,326 --> 00:00:39,006
Some of the newer aircraft
that we see being built

11
00:00:39,006 --> 00:00:41,456
in commercial transports
are built out of composite,

12
00:00:41,796 --> 00:00:44,666
but it's different from
those not only in the shape,

13
00:00:44,946 --> 00:00:47,336
the geometry, the length,
and the width and thickness,

14
00:00:47,916 --> 00:00:50,986
but also the biggest
difference is in the skins.

15
00:00:51,496 --> 00:00:54,216
We're actually steering
the composite fibers.

16
00:00:54,546 --> 00:00:58,016
With this particular design,
we're trying to tailor

17
00:00:58,106 --> 00:01:00,076
that stiffness, and so instead

18
00:01:00,076 --> 00:01:03,066
of going straight along the
wing, we're actually curving

19
00:01:03,066 --> 00:01:05,016
that fiber in the
plane of the wing

20
00:01:05,146 --> 00:01:07,966
so that we can change the
stiffness along the full length.

21
00:01:08,516 --> 00:01:16,776
[Music]

22

00:01:17,276 --> 00:01:19,586
>> This was one of the most
heavily instrumented wings we've

23
00:01:19,586 --> 00:01:20,186
ever tested.

24
00:01:20,186 --> 00:01:22,146
There was about 10,000
sensors on our wing,

25
00:01:22,146 --> 00:01:24,626
which included fiberoptic
strain sensing,

26
00:01:24,686 --> 00:01:27,616
conditional strain sensing,
displacement sensors,

27
00:01:27,716 --> 00:01:30,846
load sensing, and
also inclinometers.

28
00:01:31,446 --> 00:01:35,946
>> Surface prep, bonding,
wiring, check-out,

29
00:01:35,946 --> 00:01:37,976
so there's quite a bit
that does go into it.

30
00:01:38,516 --> 00:01:42,546
[Music]

31
00:01:43,046 --> 00:01:46,386
>> For the last four years or
so, the wing was fabricated

32
00:01:46,546 --> 00:01:50,256
by Aurora in Mississippi, and

the wing was brought here.

33
00:01:50,256 --> 00:01:52,526
Over the last 6 months,
we integrated it

34
00:01:52,526 --> 00:01:53,706
into our test fixture.

35
00:01:53,826 --> 00:01:57,476
We use the hydraulic load
control system to apply load

36
00:01:57,476 --> 00:01:59,496
at 7 stations along the wing.

37
00:02:00,471 --> 00:02:02,471
[Music]

38
00:02:02,926 --> 00:02:03,696
>> Pressure's up
for [inaudible].

39
00:02:04,516 --> 00:02:29,756
[Music]

40
00:02:30,256 --> 00:02:31,516
>> Just figuring out
where we need to be,

41
00:02:31,516 --> 00:02:34,356
to be at the right angles so
that we can see the targets.

42
00:02:35,056 --> 00:02:38,016
>> Each camera bar has two
cameras on it in stereo,

43
00:02:38,496 --> 00:02:40,246

so it's giving us a
three-dimensional position

44
00:02:40,246 --> 00:02:41,586
of each of those targets.

45
00:02:42,516 --> 00:02:48,096
[Background Conversation]

46
00:02:48,596 --> 00:02:51,816
>> In future transports, we see
the wings are getting larger,

47
00:02:52,156 --> 00:02:55,596
longer, and thinner for
aerodynamic benefits,

48
00:02:55,746 --> 00:02:58,816
mostly for drag reduction,
and so the challenge is

49
00:02:58,896 --> 00:03:00,936
when wings get longer
and thinner,

50
00:03:00,966 --> 00:03:05,306
they become more flexible,
and so the intention

51
00:03:05,306 --> 00:03:08,996
of this particular test was to
try to control that flexibility

52
00:03:09,556 --> 00:03:12,586
to allow us to still
build a lightweight wing

53
00:03:12,976 --> 00:03:14,316
with the structural benefits

54
00:03:14,346 --> 00:03:16,846
and enable the aerodynamic
benefits simultaneously.

55
00:03:17,246 --> 00:03:20,116
>> Because this wing was going
to see large displacements

56
00:03:20,116 --> 00:03:23,146
under load, we designed
a special loading system

57
00:03:23,146 --> 00:03:26,416
that included both under-wing
loading and over-wing loading.

58
00:03:26,946 --> 00:03:31,006
>> The length of the wing is 39
feet and the tip is projected

59
00:03:31,086 --> 00:03:32,806
to deflect on the
order of 8 feet.

60
00:03:33,076 --> 00:03:34,476
>> Go ahead and start
the load profile.

61
00:03:35,256 --> 00:03:37,126
>> The testing lasted
for a couple of weeks.

62
00:03:37,436 --> 00:03:40,766
Typical positive upload tests
took approximately an hour,

63
00:03:41,246 --> 00:03:44,876
and that data the sensors
collected at 100 hertz

64
00:03:45,186 --> 00:03:47,186
or 20 hertz, depending
on the type of sensor,

65
00:03:47,826 --> 00:03:51,036
will be collected and we
will take that and analyze

66
00:03:51,036 --> 00:03:52,356
that over the next 6 months.

67
00:03:55,056 --> 00:03:58,086
>> We hope that this will find
its way into commercial market,

68
00:03:58,086 --> 00:04:00,956
and this is really the
first step to demonstrate

69
00:04:00,986 --> 00:04:03,336
that it's not only
feasible, but then, you know,

70
00:04:03,336 --> 00:04:05,686
it'll give us a path
towards being able

71
00:04:05,746 --> 00:04:08,196
to certify the technology
so that it can be used