1
00:00:00,460 --> 00:00:01,600
[Music]

2
00:00:01,720 --> 00:00:08,360
>>Over 41,000 airports are scattered across
our planet, housing more than 23,000 airplanes.

3
00:00:08,520 --> 00:00:14,480
Everyday, everywhere, air traffic controllers
keep pilots and passengers safe from not only

4
00:00:14,480 --> 00:00:17,460
collisions, but also wake encounters, which
can be just as dangerous.

5
00:00:17,560 --> 00:00:20,280
[Airplane flying]

6
00:00:21,120 --> 00:00:26,240
>>Behind an aircraft, you have these counter-rotating vortices.

7
00:00:26,400 --> 00:00:33,200
There is this invisible wake with this upwash
portion on the outboard part of that counter-rotating,

8
00:00:33,200 --> 00:00:34,680
and then a downward on the inside.

9
00:00:34,680 --> 00:00:37,200
Just think of them as horizontal tornadoes.

10
00:00:37,360 --> 00:00:38,480
[Music]

11
00:00:38,480 --> 00:00:42,560
>>Engineers at NASA's Armstrong Flight Research
Center are testing new technologies and methods

12

00:00:42,560 --> 00:00:47,360
to help aircraft identify where wakes are,
and avoid them- or even ride them.

13
00:00:47,360 --> 00:00:50,300
[Music/cockpit ambience]

14
00:00:52,000 --> 00:00:54,000
>>It's really biologically inspired.

15
00:00:54,000 --> 00:00:59,000
If you've ever seen a flock of geese, the
reason they fly in a 'v' is that the trailing

16
00:00:59,040 --> 00:01:05,720
birds are really gaining efficiency from the
lead bird by flying in the upwash caused by

17
00:01:05,720 --> 00:01:08,360
vortices generated by the wing in flight.

18
00:01:08,720 --> 00:01:14,000
>>So if you fly in the area where the air is rising, it's like gliders that soar in thermal updrafts.

19
00:01:14,000 --> 00:01:15,600
You can extract energy from that.

20
00:01:15,600 --> 00:01:20,120
The ultimate objective of flying in the upwash portion of the wake is to reduce the

21
00:01:20,120 --> 00:01:22,960
fuel burn and the emissions of the trailing
airplane.

22
00:01:22,960 --> 00:01:26,920
[Music/jet engine revving up]

23
00:01:36,440 --> 00:01:38,440
>>Ok, it's pilot's airplane.

24
00:01:39,840 --> 00:01:45,920
>>Copy that, and let's go ahead and start moving
on to Card 9, and give 808 the lead.

25
00:01:46,440 --> 00:01:50,600
>>We would begin first by positioning ourselves about 4000 feet back

26
00:01:50,720 --> 00:01:54,840
and to the side of and above of where we estimated where the wake would be.

27
00:01:55,060 --> 00:01:56,360
>>PPA is engaged...

28
00:01:56,700 --> 00:01:57,280
>>TCS released...

29
00:02:00,080 --> 00:02:00,900
>>saw the engage...

30
00:02:01,100 --> 00:02:02,220
roll command
is climbing...

31
00:02:03,080 --> 00:02:06,160
we're getting some long-term oscillations, so I think we're close...

32
00:02:07,200 --> 00:02:10,060
>>we're
gonna do a 5 foot step-in, to a cross-track

33
00:02:10,060 --> 00:02:10,560
of minus 75...

34
00:02:11,060 --> 00:02:11,560
>>ok...

35
00:02:11,760 --> 00:02:13,880

>>activating new command, 3, 2, 1-
activate...

36
00:02:15,480 --> 00:02:19,820
>>we're getting a little bit of buffeting, very slight, can you guys feel that in back?

37
00:02:20,940 --> 00:02:22,940
>>Just a little bit, but yeah.

38
00:02:23,680 --> 00:02:29,860
>>What we're noticing about this flight, I think,
is that the power required to maintain a constant

39
00:02:29,860 --> 00:02:36,700
position when our wing tip is in the wake
is less, than is required when we're not in

40
00:02:36,720 --> 00:02:40,640
the wake, which means we're gonna save fuel,
that's the idea.

41
00:02:43,040 --> 00:02:44,840
[Airplane landing]

42
00:02:46,500 --> 00:02:47,920
[Music]

43
00:02:53,480 --> 00:02:58,880
>>I was even surprised by some of the flight
dynamics, and things that we saw in flight.

44
00:02:59,220 --> 00:03:02,580
There really is no substitute for taking an
experiment to flight.

45
00:03:03,100 --> 00:03:10,460
You learn things that sometimes you don't
want to learn, but you also see the beauty