



simulators

1

00:00:00,003 --> 00:00:03,440

>>Flashing across California desert skies, the airplanes you see

2

00:00:03,440 --> 00:00:07,544

here are writing new chapters in the story
of man made flight....there she goes!

3

00:00:07,544 --> 00:00:12,082

>>This is my first opportunity
to greet you as deputy administrator

4

00:00:12,082 --> 00:00:15,752

of the National Aeronautics
and Space Administration.

5

00:00:16,086 --> 00:00:18,722

>>Together, you and I must make our new agency

6

00:00:18,722 --> 00:00:20,056

>>A most unusual place

7

00:00:20,090 --> 00:00:22,926

>>An organization that can challenge
conventional wisdom.

8

00:00:22,926 --> 00:00:26,530

>>We can engineer anything we can write the requirements for.

9

00:00:26,530 --> 00:00:27,931

>>We're going to make your idea work.

10

00:00:27,931 --> 00:00:30,500

This particular idea is quite disruptive.

11

00:00:31,168 --> 00:00:35,439

>>A typical flight, of course, starts
under the wing of the B-52 mothership.

12

00:00:35,605 --> 00:00:41,044
>>This sleek, high speed machine
would have made Rube Goldberg proud.

13
00:00:41,178 --> 00:00:44,047
>>The manner in which we fly
reentry from space,

14
00:00:44,047 --> 00:00:48,051
on the space shuttle was
pioneered on the X-15.

15
00:00:48,051 --> 00:00:53,657
>>The X-31 pretty much wrote the book on thrust vectoring, along with its sister program, the F-18 HARV.

16
00:00:53,657 --> 00:00:55,826
>>An observation of an occultation is

17
00:00:55,826 --> 00:00:58,795
one of the more challenging
missions that SOFIA can do.

18
00:00:59,596 --> 00:01:18,782
[Music/Background sound]

19
00:01:19,616 --> 00:01:23,987
>>Right now, we are looking
at the dawn of a new era of aviation.

20
00:01:27,023 --> 00:01:31,361
[Music/Background sound]

21
00:01:39,165 --> 00:01:40,333
[Music]

22
00:01:40,333 --> 00:01:43,169
>>The secret to our
business is to be as prepared as possible,

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00:01:43,336 --> 00:01:46,072
and we find simulators a very useful tool.

24
00:01:47,440 --> 00:01:50,944
>>Flight simulators have been used at Dryden
since the X series.

25
00:01:51,344 --> 00:01:54,747
They allow researchers to investigate
hundreds of variations

26
00:01:54,747 --> 00:01:57,383
before committing an airplane
to flight.

27
00:01:57,383 --> 00:02:01,588
...program actual missions and simulate
every conceivable in-flight problem

28
00:02:01,588 --> 00:02:04,724
the pilot might expect to face.

29
00:02:05,425 --> 00:02:09,129
>>The largest and most complex
analog simulation

30
00:02:09,129 --> 00:02:13,633
ever constructed at the time; it was used
in the design of the research programs,

31
00:02:13,633 --> 00:02:16,102
flight planning, system development,

32
00:02:16,369 --> 00:02:18,371
and of course, as a pilot training aide.

33
00:02:19,572 --> 00:02:22,609
>>I think almost every flight had
something happened to it

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00:02:22,976 --> 00:02:26,579

that maybe was not according
to the flight plan, but had been practiced

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00:02:26,713 --> 00:02:30,717

because the pilot spent anywhere
from 10 to 50 hours in the simulator for a flight.

36

00:02:30,717 --> 00:02:33,620

>>...3 or 4 hours
in the simulator a week.

37

00:02:33,620 --> 00:02:38,391

>>...200 to 250 hours of simulator time
flying this exact mission.

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00:02:38,858 --> 00:02:40,693

So I was extremely well prepared.

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00:02:40,693 --> 00:02:42,629

>>...by the time of first flight,

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00:02:42,629 --> 00:02:45,565

many potential problems
have been identified and solutions

41

00:02:45,565 --> 00:02:46,666

developed.

42

00:02:46,666 --> 00:02:48,935

>>In the case of the space
shuttle, the flight simulator

43

00:02:48,935 --> 00:02:53,439

is more important than ever before
because the shuttle is such a complex

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00:02:53,439 --> 00:02:57,177

machine- flies in such a wide range

of atmospheric conditions

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00:02:57,343 --> 00:03:02,115

and at Mach 25 travels much faster than any plane has done before.

46

00:03:03,049 --> 00:03:07,120

>>Simulation is essential to developing the X-29 flight control system.

47

00:03:07,687 --> 00:03:10,957

This fixed base simulator is wired directly to the aircraft's

48

00:03:10,957 --> 00:03:13,059

three flight control computers.

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00:03:13,059 --> 00:03:15,795

These in turn are wired to attitude sensors

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00:03:16,029 --> 00:03:18,865

and to a simulated X-29 hydraulic system.

51

00:03:19,866 --> 00:03:21,601

>>This is the X-59 simulator...

52

00:03:21,601 --> 00:03:24,003

...we did a lot of design trade studies on features

53

00:03:24,003 --> 00:03:27,006

that we think we'd want in the airplane or not want in the airplane...

54

00:03:27,006 --> 00:03:30,877

>>This is going to be exactly like the inside of the actual aircraft.

55

00:03:30,977 --> 00:03:33,546

Instead of having to read all the labels,
or read all the switches,

56

00:03:33,546 --> 00:03:35,682

they will have their muscle memory
trained.

57

00:03:35,682 --> 00:03:38,651

>>We're using it to do some development
and analyze

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00:03:38,651 --> 00:03:41,788

some of the new flight control software
that's come down...

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00:03:41,788 --> 00:03:44,557

Eventually we'll also use it for training.

60

00:03:44,557 --> 00:03:46,426

>>We provide projects,

61

00:03:46,426 --> 00:03:50,897

the ability to make informed decisions
and the ability to manage risk.

62

00:03:50,997 --> 00:03:54,100

>>Those who own the simulation
own the program.

63

00:03:54,100 --> 00:03:58,805

>>In '54, there were a number of engineers out here
who took advantage of the first

64

00:03:58,805 --> 00:04:01,174

electronic ground simulator...

65

00:04:03,610 --> 00:04:04,711

...to mimic

66

00:04:04,711 --> 00:04:08,081
a reaction control system and mimic
an airplane,

67
00:04:08,348 --> 00:04:10,450
leaving the Earth's atmosphere.

68
00:04:10,450 --> 00:04:12,085
>>Practice landings using predetermined

69
00:04:12,085 --> 00:04:15,955
settings that can simulate the low
lift/drag ratio of the X-15...

70
00:04:16,956 --> 00:04:19,359
...nothing is left to chance.

71
00:04:19,359 --> 00:04:22,195
>>The Lunar Landing Research
Vehicle was the only free-flying

72
00:04:22,228 --> 00:04:25,265
airborne simulator for the final seconds
of the lunar descent.

73
00:04:25,465 --> 00:04:26,733
This simulator provided

74
00:04:26,733 --> 00:04:30,703
the early Apollo astronauts
with a calibration of time and distance.

75
00:04:30,970 --> 00:04:34,641
>>In fact, Neil Armstrong came back a year
or so after he landed on the moon and said

76
00:04:34,641 --> 00:04:39,545
because of the training that he received
on the LLTVs and the LLRV

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00:04:39,545 --> 00:04:42,949

he was able to make his maneuver
the last 20 or 30 feet.

78

00:04:42,982 --> 00:04:46,953

>>We also had the shuttle training aircraft.
Thrust reversers were used to hold

79

00:04:46,953 --> 00:04:48,554

the airplane back so we could dive

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00:04:48,554 --> 00:04:52,091

at the steep angles that we were planning
to fly the orbiter at.

81

00:04:52,091 --> 00:04:55,895

>>The Calspan TIFS in flight simulator...

82

00:04:55,895 --> 00:04:59,499

>>...a modified Convair aircraft
configured with two different cockpits,

83

00:04:59,499 --> 00:05:03,469

and it's kind of a dial-a-plane aircraft,
a variable stability

84

00:05:03,469 --> 00:05:07,607

aircraft that can be made to simulate
the characteristics of any other airplane.

85

00:05:07,607 --> 00:05:11,778

We also utilized our F-8 Fly-By-Wire aircraft to simulate

86

00:05:11,778 --> 00:05:14,914

some of the characteristics
of the shuttle flight control system.

87

00:05:15,815 --> 00:05:19,052

>>GPAS, General Purpose Airborne Simulator...

88
00:05:19,052 --> 00:05:21,120
>>...which was a JetStar that was modified

89
00:05:21,788 --> 00:05:23,890
to do variable stability.

90
00:05:23,890 --> 00:05:25,892
[Music]

91
00:05:26,492 --> 00:05:27,593
>>In addition

92
00:05:27,593 --> 00:05:30,697
to simulating the aircraft
flying here in our airspace,

93
00:05:30,730 --> 00:05:34,667
we also have the ability to take
our sim lab and connect it

94
00:05:34,667 --> 00:05:38,438
as a component of a larger
live, virtual, constructive environment

95
00:05:38,438 --> 00:05:40,573
like we do with flying unmanned vehicles.

96
00:05:40,573 --> 00:05:42,308
UAS in the NAS type projects.

97
00:05:42,308 --> 00:05:46,312
>>...both simulated aircraft and then a live intruder aircraft...

98
00:05:46,312 --> 00:05:48,715
...virtual or simulated encounters...

99
00:05:48,948 --> 00:05:51,584

>>Fused Reality is a new technology

100

00:05:51,584 --> 00:05:53,419
for simulation.

101

00:05:53,419 --> 00:05:56,189

>>Things that simulators
aren't good at modeling is real air.

102

00:05:56,189 --> 00:05:59,625

What you gain here
is taking a simulator into the air

103

00:05:59,759 --> 00:06:02,695

and you're actually exposed
to the flying environment;

104

00:06:02,695 --> 00:06:05,531

taking that simulator
and visually kind of superimposing

105

00:06:05,531 --> 00:06:06,366

that on top of...

106

00:06:06,366 --> 00:06:08,601

>>...being able
to put other aircraft that aren't

107

00:06:08,634 --> 00:06:11,704

actually there in your field of view
and make you feel like you're actually