
NASA

1
00:00:03,240 --> 00:00:04,600
In March of 2010

2
00:00:04,600 --> 00:00:06,220
NASA Dryden Flight Research Center

3
00:00:06,220 --> 00:00:07,500
began flying its latest

4
00:00:07,500 --> 00:00:08,800
flight research platform.

5
00:00:09,200 --> 00:00:11,620
The F-18 Full-scale Advanced Systems Testbed

6
00:00:11,620 --> 00:00:14,200
vehicle or F-18 FAST.

7
00:00:15,440 --> 00:00:17,320
The concept was initially developed with

8
00:00:17,320 --> 00:00:20,000
the F-18 High Angle of Attack Research Vehicle

9
00:00:20,000 --> 00:00:20,880
or HARV.

10
00:00:21,840 --> 00:00:23,280
For the HARV project

11
00:00:23,280 --> 00:00:25,600
a new research flight control system computer

12
00:00:25,600 --> 00:00:28,300
was added to a standard F-18 system.

13
00:00:29,580 --> 00:00:31,020

This research system allows for

14
00:00:31,020 --> 00:00:32,739
quick development of experimental

15
00:00:32,740 --> 00:00:34,760
control laws while maintaining the

16
00:00:34,760 --> 00:00:37,400
production system as a safe fallback.

17
00:00:37,760 --> 00:00:40,180
By limiting the robust F-18 fighter

18
00:00:40,180 --> 00:00:42,520
to a restricted slow speed flight envelope

19
00:00:42,660 --> 00:00:44,840
special safety could be maintained.

20
00:00:45,760 --> 00:00:47,559
The original HARV research system was

21
00:00:47,560 --> 00:00:49,320
limited in compute power and memory

22
00:00:50,180 --> 00:00:53,100
The Advanced Aeroelastic Wing (AAW) project

23
00:00:53,100 --> 00:00:55,560
upgraded the research processor.

24
00:00:56,020 --> 00:00:58,860
The AAW project investigated the use wing

25
00:00:58,870 --> 00:01:01,040
warping to achieve rolling performance

26
00:01:01,040 --> 00:01:03,080
as a lighter-weight wing structure.

27
00:01:04,020 --> 00:01:06,780
The AAW program added a significant amount

28
00:01:06,780 --> 00:01:09,680
of load and wing deflection instrumentation

29
00:01:09,840 --> 00:01:10,860
to the vehicle.

30
00:01:12,360 --> 00:01:15,760
The same AAW aircraft was once again upgraded for

31
00:01:15,760 --> 00:01:17,000
the FAST project.

32
00:01:17,500 --> 00:01:19,160
A second research computer dubbed

33
00:01:19,160 --> 00:01:21,560
the Airborne Research Test System Four

34
00:01:21,760 --> 00:01:22,980
where yard score was added.

35
00:01:23,540 --> 00:01:25,320
The yard system allows for direct auto

36
00:01:25,330 --> 00:01:27,740
coating of control mount algorithms

37
00:01:27,740 --> 00:01:30,440
from an analysis friendly computer environment.

38
00:01:31,180 --> 00:01:33,360

This makes it much easier to analyze

39
00:01:33,360 --> 00:01:35,680
and modify experimental control laws.

40
00:01:36,760 --> 00:01:39,080
In addition to advanced controls research,

41
00:01:39,080 --> 00:01:40,620
the FAST system allows for

42
00:01:40,630 --> 00:01:43,120
stimulating system failures.

43
00:01:43,120 --> 00:01:45,280
These simulated failures prevent challenging

44
00:01:45,280 --> 00:01:47,200
problems for the advanced systems

45
00:01:47,200 --> 00:01:49,390
which are required to restore normal flying

46
00:01:49,390 --> 00:01:52,660
characteristics and allow for a safe landing.

47
00:01:53,720 --> 00:01:56,620
One example might be a frozen control surface.

48
00:01:56,820 --> 00:01:59,380
In this case the right stabilator was disabled,

49
00:02:00,040 --> 00:02:03,460
which results in an predictable cross couple behavior.

50
00:02:04,400 --> 00:02:05,940
Because pitch control authority is

51
00:02:05,940 --> 00:02:07,880
significantly reduced by the failure

52
00:02:08,300 --> 00:02:10,659
you can see the altitude loss that occurs

53
00:02:10,660 --> 00:02:12,420
during a roll maneuver.

54
00:02:14,140 --> 00:02:17,360
in the extreme case, all primary aerodynamic surfaces

55
00:02:17,380 --> 00:02:20,300
can be disabled and propulsion only control can be

56
00:02:20,300 --> 00:02:21,340
investigated.

57
00:02:22,480 --> 00:02:23,960
In this case the speed brake

58
00:02:23,960 --> 00:02:25,380
was deployed for additional control.

59
00:02:26,680 --> 00:02:28,880
Without the other aerodynamic
services

60
00:02:28,880 --> 00:02:31,080
and oscillation and disengagement occurred.

61
00:02:31,420 --> 00:02:32,900
but with an advanced controller

62
00:02:33,020 --> 00:02:35,020
good flying characteristics can be achieved

63

00:02:35,020 --> 00:02:37,220
using only engine propulsion.

64
00:02:37,220 --> 00:02:38,480
That was a good one.

65
00:02:38,900 --> 00:02:40,760
The FAST vehicle paves the way for

66
00:02:40,760 --> 00:02:43,000
many important flight research experiments.

67
00:02:43,500 --> 00:02:45,920
This system will be used to investigate integrated

68
00:02:45,920 --> 00:02:47,840
active control with structural feedback

69
00:02:47,840 --> 00:02:49,180
and constraints.

70
00:02:49,720 --> 00:02:51,380
The work will help to enable a class

71
00:02:51,380 --> 00:02:53,320
of futuristic lightweight vehicles

72
00:02:53,700 --> 00:02:55,180
that are not possible today.

73
00:02:57,020 --> 00:02:59,940
Using the F-18 FAST vehicle NASA Dryden

74
00:02:59,940 --> 00:03:02,260
Flight Research Center is continuing to