

ARTSIV-F01
WVHTC
FOUNDATION
www.wvhtf.org



1
00:00:03,100 --> 00:00:04,550
In March of 2010

2
00:00:04,570 --> 00:00:06,280
NASA Dryden Flight Research Center

3
00:00:06,300 --> 00:00:08,700
began flying its latest flight research platform,

4
00:00:09,170 --> 00:00:12,200
the F-18 Full-scale Advanced Systems Testbed vehicle

5
00:00:12,790 --> 00:00:14,270
or F-18 FAST.

6
00:00:15,340 --> 00:00:18,110
The concept was initially developed with the F-18

7
00:00:18,130 --> 00:00:21,210
High-Angle of Attack Research Vehicle or HARV.

8
00:00:22,070 --> 00:00:24,680
For the HARV project, a new research flight control

9
00:00:24,700 --> 00:00:28,290
system computer was added to a standard F-18 system.

10
00:00:29,340 --> 00:00:32,070
This research system allowed for quick development of

11
00:00:32,090 --> 00:00:33,610
experimental control laws,

12
00:00:33,630 --> 00:00:35,840
while maintaining the production system

13
00:00:35,860 --> 00:00:39,700

as a safe fallback. By limiting the robust F-18

14
00:00:39,720 --> 00:00:42,480
fighter to a restricted slow-speed flight envelope

15
00:00:42,930 --> 00:00:44,840
special safety could be maintained.

16
00:00:45,810 --> 00:00:48,460
The original HARV research system was limited in compute

17
00:00:48,480 --> 00:00:51,810
power and memory. The Advanced Aeroelastic Wing,

18
00:00:51,830 --> 00:00:56,780
AAW project, upgraded the research processor. The AAW

19
00:00:56,800 --> 00:00:59,500
project investigated the use of "wing warping"

20
00:00:59,520 --> 00:01:01,120
to achieve roaring performance

21
00:01:01,140 --> 00:01:03,210
with a lighter-weight wing structure.

22
00:01:04,040 --> 00:01:07,930
The AAW program added a significant amount of loads and

23
00:01:07,950 --> 00:01:10,680
wing deflection instrumentation to the vehicle.

24
00:01:12,450 --> 00:01:15,870
The same AAW aircraft was once again upgraded for the

25
00:01:15,890 --> 00:01:19,300
FAST project. A second research computer dubbed the

26

00:01:19,320 --> 00:01:22,920

Airborne Research Test System IV, or ARTS IV was added.

27

00:01:23,400 --> 00:01:25,880

The ARTS system allowed for direct autocoding

28

00:01:25,900 --> 00:01:28,750

of control law algorithms from an analysis

29

00:01:28,770 --> 00:01:30,370

friendly computer environment.

30

00:01:31,270 --> 00:01:34,370

This makes it much easier to analyze and modify

31

00:01:34,390 --> 00:01:37,660

experimental control laws. In addition to

32

00:01:37,680 --> 00:01:39,980

advanced controls research, the FAST system

33

00:01:40,000 --> 00:01:42,440

allows for simulating system failures.

34

00:01:43,130 --> 00:01:45,350

These simulated failures present challenging

35

00:01:45,370 --> 00:01:47,650

problems for the advanced systems which are

36

00:01:47,670 --> 00:01:50,390

required to restore normal flying characteristics

37

00:01:50,410 --> 00:01:52,190

and allow for a safe landing.

38

00:01:52,210 --> 00:01:53,360

One's moving, the other one's not

39

00:01:53,380 --> 00:01:54,760

One example might be

40

00:01:54,780 --> 00:01:57,580

a frozen control surface. In this case the

41

00:01:57,600 --> 00:02:01,160

right stabilator was disabled, which results in an

42

00:02:01,180 --> 00:02:03,250

unpredictable cross-coupled behavior.

43

00:02:04,420 --> 00:02:06,640

Because pitch-control authority is significantly

44

00:02:06,660 --> 00:02:09,570

reduced by the failure, you can see the altitude

45

00:02:09,590 --> 00:02:12,490

loss that occurs during a roll maneuver.

46

00:02:13,930 --> 00:02:16,800

In the extreme case, all primary aerodynamic

47

00:02:16,820 --> 00:02:19,530

surfaces can be disabled and "propulsion only"

48

00:02:19,550 --> 00:02:23,270

control can be investigated...Up...In this case,

49

00:02:23,290 --> 00:02:26,070

the speed brake was deployed for additional control.

50

00:02:26,660 --> 00:02:29,620

Without the other aerodynamic surfaces an oscillation

51
00:02:29,640 --> 00:02:32,460
and disengagement occurred, but with an advanced

52
00:02:32,480 --> 00:02:34,330
controller good flying characteristics

53
00:02:34,350 --> 00:02:37,020
can be achieved using only engine propulsion.

54
00:02:37,040 --> 00:02:37,980
That was a good one.

55
00:02:38,990 --> 00:02:41,790
The FAST vehicle paves the way for many important flight

56
00:02:41,810 --> 00:02:44,740
research experiments. This system will be used to

57
00:02:44,760 --> 00:02:47,080
investigate integrated active control with

58
00:02:47,100 --> 00:02:49,110
structural feedback and constraints.

59
00:02:49,650 --> 00:02:52,180
The work will help to enable a class of futuristic

60
00:02:52,200 --> 00:02:55,050
lightweight vehicles that are not possible today.

61
00:02:56,890 --> 00:03:00,190
Using the F-18 FAST vehicle, NASA Dryden

62
00:03:00,210 --> 00:03:02,540
Flight Research Center is continuing to push

63
00:03:02,560 --> 00:03:04,910

scientific advancement through flight