1
00:00:00,000 --> 00:00:42,299
I

2
00:00:47,170 --> 00:00:44,619
imagine taking off from an airport

3
00:00:50,169 --> 00:00:47,180
runway flying at three to five times the

4
00:00:53,049 --> 00:00:50,179
speed of sound at altitudes of 20 miles

5
00:00:55,180 --> 00:00:53,059
or even higher a few short hours after

6
00:00:58,389 --> 00:00:55,190
departure you come to a stop halfway

7
00:01:00,310 --> 00:00:58,399
around the world or maybe you took off

8
00:01:02,709 --> 00:01:00,320
from a runway and flew directly into

9
00:01:04,539 --> 00:01:02,719
orbit to work in space and then you

10
00:01:08,350 --> 00:01:04,549
returned landing on a conventional

11
00:01:11,170 --> 00:01:08,360
Airport runway the National aerospace

12
00:01:14,380 --> 00:01:11,180
plane will try to make both scenarios a

13
00:01:16,899 --> 00:01:14,390

reality NASA and the Department of

14
00:01:20,410 --> 00:01:16,909
Defense have done research on hyper

15
00:01:23,169 --> 00:01:20,420
sonic technology for many years the NASA

16
00:01:26,169 --> 00:01:23,179
technology demonstrator will be a highly

17
00:01:28,660 --> 00:01:26,179
advanced explain a new member of the

18
00:01:32,620 --> 00:01:28,670
elite special research aircraft that

19
00:01:34,389 --> 00:01:32,630
includes the x1 which in 1947 was the

20
00:01:37,930 --> 00:01:34,399
first aircraft to break the speed of

21
00:01:40,930 --> 00:01:37,940
sound and fly supersonic in the early

22
00:01:44,289 --> 00:01:40,940
1960s the x-15 became one of the first

23
00:01:48,010 --> 00:01:44,299
manned hypersonic aircraft and reached

24
00:01:51,210 --> 00:01:48,020
speeds of Mach 7 or about 4,500 miles

25
00:01:55,389 --> 00:01:51,220
per hour one of the key technological

26
00:01:58,559 --> 00:01:55,399
developments of the x30 or NASA are in

27
00:02:01,059 --> 00:01:58,569
the propulsion area an air-breathing

28
00:02:05,740 --> 00:02:01,069
hydrogen-fueled supersonic combustion

29
00:02:07,900 --> 00:02:05,750
ramjet engine or scramjet engine is now

30
00:02:12,729 --> 00:02:07,910
being developed for speeds from about

31
00:02:15,369 --> 00:02:12,739
Mach 7 to Mach 25 the engine uses the

32
00:02:19,150 --> 00:02:15,379
velocity of the vehicle to compress air

33
00:02:21,190 --> 00:02:19,160
as it is rammed into the intake this

34
00:02:24,309 --> 00:02:21,200
compressed air is then mixed with

35
00:02:27,490 --> 00:02:24,319
gaseous hydrogen at this stage to

36
00:02:30,640 --> 00:02:27,500
generate high thrust a development on

37
00:02:33,460 --> 00:02:30,650
which we will focus is materials here to

38
00:02:37,869 --> 00:02:33,470

speak on that is Matt MELAS with the

39
00:02:39,850 --> 00:02:37,879
advent of the aerospace plane there's

40
00:02:41,290 --> 00:02:39,860
become a need for a lot of new material

41
00:02:44,140 --> 00:02:41,300
development beyond a shadow of a doubt

42
00:02:46,630 --> 00:02:44,150
we need new materials alright and these

43
00:02:48,550 --> 00:02:46,640
new materials will most probably be

44
00:02:49,650 --> 00:02:48,560
composite materials but instead of using

45
00:02:52,230 --> 00:02:49,660
on

46
00:02:55,740 --> 00:02:52,240
metal matrix based composite will be

47
00:02:57,960 --> 00:02:55,750
using our epoxy based will be using a

48
00:03:01,380 --> 00:02:57,970
metal matrix based composite all right

49
00:03:04,170 --> 00:03:01,390
metal matrix being copper for instance

50
00:03:05,700 --> 00:03:04,180
one of the big problems NASA is facing

51
00:03:08,340 --> 00:03:05,710
with the advent of the National

52
00:03:11,160 --> 00:03:08,350
aerospace plane deals with not only

53
00:03:13,290 --> 00:03:11,170
finding the right materials to use but

54
00:03:16,110 --> 00:03:13,300
in cooling them as well we have to

55
00:03:17,760 --> 00:03:16,120
figure out some way of making a very

56
00:03:20,000 --> 00:03:17,770
strong material that's going to survive

57
00:03:22,200 --> 00:03:20,010
in a high temperature environment and

58
00:03:25,410 --> 00:03:22,210
what we're going to have to do is

59
00:03:28,050 --> 00:03:25,420
actively cool this material alright by

60
00:03:29,880 --> 00:03:28,060
putting some kind of a cryogenic fluid

61
00:03:32,580 --> 00:03:29,890
behind a gaseous hydrogen or liquid

62
00:03:34,770 --> 00:03:32,590
hydrogen which is very cold and acts as

63
00:03:36,780 --> 00:03:34,780

a good heat transfer medium to take heat

64
00:03:39,840 --> 00:03:36,790
away from the leading edge so on on one

65
00:03:41,250 --> 00:03:39,850
side of the of the material on the

66
00:03:43,440 --> 00:03:41,260
inside of the wing for instance there'll

67
00:03:45,390 --> 00:03:43,450
be a lot of coolant rushing through to

68
00:03:47,670 --> 00:03:45,400
cool the inside down and on the outside

69
00:03:49,320 --> 00:03:47,680
you'll have a very hot surface and that

70
00:03:51,000 --> 00:03:49,330
is why we need to high heat conductivity

71
00:03:53,220 --> 00:03:51,010
for instance you look at fighter jets

72
00:03:54,830 --> 00:03:53,230
that's travel mock water Mach 2 or even

73
00:03:57,980 --> 00:03:54,840
the Concorde which goes oh come on to

74
00:04:00,950 --> 00:03:57,990
you see the three wins are very narrow

75
00:04:02,420 --> 00:04:00,960
okay and there's a problem with that

76
00:04:06,080 --> 00:04:02,430
because the smaller the leading edge

77
00:04:07,610 --> 00:04:06,090
gets the more difficult it is to cool

78
00:04:10,130 --> 00:04:07,620
and the hotter it gets because it's such

79
00:04:13,540 --> 00:04:10,140
a small it's just such a small point

80
00:04:17,240 --> 00:04:13,550
lying out there in the free stream that

81
00:04:20,030 --> 00:04:17,250
it gets very warm very quickly the

82
00:04:22,520 --> 00:04:20,040
national aerospace plane is one of the

83
00:04:25,790 --> 00:04:22,530
projects being developed by NASA for

84
00:04:28,730 --> 00:04:25,800
future space use but we cannot expect it

85
00:04:30,260 --> 00:04:28,740
to do all of our work in space the

86
00:04:34,690 --> 00:04:30,270
national aerospace plane being something

87
00:04:37,790 --> 00:04:34,700
that will possibly be able to supplement

88
00:04:40,940 --> 00:04:37,800

the shuttle fleet or maybe even replace

89
00:04:42,590 --> 00:04:40,950
it but obviously if you have an airplane

90
00:04:45,440 --> 00:04:42,600
that can take off from a runway and go

91
00:04:46,970 --> 00:04:45,450
to orbit with some people in it and go

92
00:04:50,240 --> 00:04:46,980
to the space station for instance or

93
00:04:56,150 --> 00:04:50,250
something like that obviously it would

94
00:04:58,250 --> 00:04:56,160
be capable of shuttle type operations as

95
00:05:00,260 --> 00:04:58,260
far as payload goes I think moving big

96
00:05:02,020 --> 00:05:00,270
things like space station components or

97
00:05:04,700 --> 00:05:02,030
say for instance they want to go to Mars

98
00:05:06,380 --> 00:05:04,710
and they have to get some big boosters

99
00:05:08,660 --> 00:05:06,390
up there or something like that I don't

100
00:05:10,370 --> 00:05:08,670
see the National aerospace plane taking

101
00:05:13,250 --> 00:05:10,380
that kind of payload up there the

102
00:05:15,320 --> 00:05:13,260
National aerospace plane is expected to

103
00:05:18,590 --> 00:05:15,330
yield a high payoff for the United

104
00:05:22,040 --> 00:05:18,600
States in the early 21st century with

105
00:05:24,440 --> 00:05:22,050
reduced space launch costs vastly

106
00:05:27,320 --> 00:05:24,450
reduced transit time on long-haul air

107
00:05:29,420 --> 00:05:27,330
routes major investments by private

108
00:05:32,690 --> 00:05:29,430
enterprise in commercial space ventures

109
00:05:35,570 --> 00:05:32,700
and sustained us preeminence in