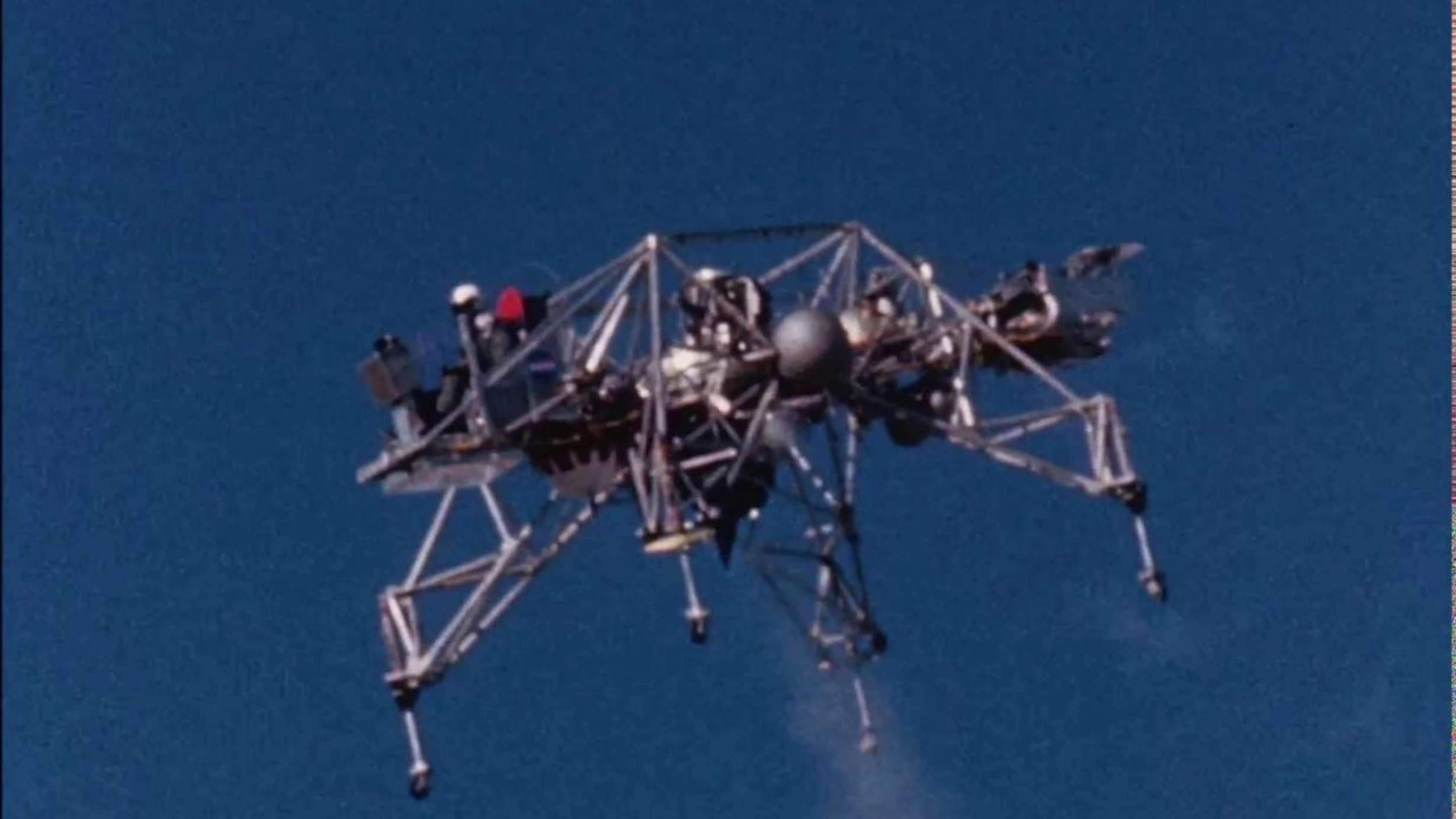

1
00:00:03,596 --> 00:00:06,636
>> Beginning with man's
first attempt to fly faster

2
00:00:06,636 --> 00:00:09,396
than the speed of sound,
the National Aeronautics

3
00:00:09,396 --> 00:00:12,196
and Space Administration's
Flight Research Center has

4
00:00:12,196 --> 00:00:13,486
played an important role

5
00:00:13,486 --> 00:00:17,166
in establishing this country's
leadership in world aeronautics.

6
00:00:17,936 --> 00:00:21,326
The Flight Research Center
was established in 1947,

7
00:00:21,806 --> 00:00:24,856
when a small group of engineers
and technicians were assigned

8
00:00:24,856 --> 00:00:27,016
to the X-1 Flight
Research Program.

9
00:00:28,296 --> 00:00:30,396
Since then, the specially
designed

10
00:00:30,396 --> 00:00:33,626
and highly instrumented
research aircraft has become one

11

00:00:33,626 --> 00:00:37,146
of the most valuable tools of
advanced aeronautical research.

12
00:00:39,516 --> 00:00:42,976
The X-1 was the first
research aircraft to fly faster

13
00:00:42,976 --> 00:00:44,026
than the speed of sound.

14
00:00:44,606 --> 00:00:46,686
Its mission was to
probe the sound barrier.

15
00:00:47,396 --> 00:00:51,216
Powered by an XLR-11 rocket
engine rated at 6,000 pounds

16
00:00:51,216 --> 00:00:53,076
of thrust, it used propellants

17
00:00:53,076 --> 00:00:55,046
of ethyl alcohol
and liquid oxygen.

18
00:00:55,826 --> 00:00:59,736
The X-1 air launched from a
B-29 mothership made its first

19
00:00:59,736 --> 00:01:01,726
powered flight in 1946.

20
00:01:02,396 --> 00:01:04,236
In 1947, Capt.

21
00:01:04,236 --> 00:01:07,876
Charles Yeager piloted the
X-1 in level flight faster

22
00:01:07,876 --> 00:01:09,016
than the speed of sound.

23
00:01:09,576 --> 00:01:14,306
The D-558 Skyrocket was the
second rocket-powered research

24
00:01:14,306 --> 00:01:15,306
aircraft to fly.

25
00:01:16,326 --> 00:01:19,366
It was designed to investigate
jet aircraft characteristics

26
00:01:19,366 --> 00:01:22,756
at transonic speeds,
including stability and control

27
00:01:22,756 --> 00:01:24,306
and buffet investigations.

28
00:01:25,396 --> 00:01:29,916
The D-558 was the first American
aircraft to use swept back wings

29
00:01:30,026 --> 00:01:32,806
and stall fences,
features that are common

30
00:01:32,806 --> 00:01:35,186
to our present-day
commercial jet transports.

31
00:01:36,426 --> 00:01:39,836
The D-558 was the first
aircraft to fly faster

32
00:01:39,836 --> 00:01:41,576
than twice the speed of sound.

33
00:01:45,836 --> 00:01:48,366
The largest of the early
research aircraft was the

34
00:01:48,366 --> 00:01:49,526
X-3 Stiletto.

35
00:01:50,516 --> 00:01:53,746
It was 69 feet long with
a wingspan of 22 feet.

36
00:01:54,806 --> 00:01:58,146
The primary mission of the
X-3 was thin wing research.

37
00:01:58,696 --> 00:02:02,566
Powered by two jet engines, the
X-3 had a top speed of slightly

38
00:02:02,566 --> 00:02:05,336
in excess of Mach 1,
the speed of sound.

39
00:02:05,856 --> 00:02:09,026
The X-4 was easily recognizable

40
00:02:09,026 --> 00:02:11,126
by its lack of a
horizontal tail.

41
00:02:12,326 --> 00:02:15,426
The X-5 was the first paragraph
that could sweep its wings

42
00:02:15,426 --> 00:02:17,936
from 20 degrees to
60 degrees in flight.

43

00:02:18,336 --> 00:02:20,596
This variable sweep
concept is being used

44
00:02:20,596 --> 00:02:22,606
in current fighter
and bomber designs.

45
00:02:22,866 --> 00:02:26,036
The X-5 made its
first flight in 1951.

46
00:02:29,196 --> 00:02:34,146
First flown in 1955, the X-1E
was used for thin wing research,

47
00:02:34,176 --> 00:02:36,506
aerodynamic heating
studies, and stability

48
00:02:36,506 --> 00:02:38,116
and control investigations.

49
00:02:41,516 --> 00:02:45,136
The most successful of the
research aircraft was the X-15,

50
00:02:45,386 --> 00:02:49,416
which made its first powered
flight on September 17, 1959.

51
00:02:50,406 --> 00:02:55,116
The three X-15 aircraft flew
199 flights to obtain data

52
00:02:55,116 --> 00:02:57,226
on the aerodynamics
of hypersonic flight.

53
00:02:58,606 --> 00:03:02,126

The X-15 is the only manned
aircraft that has flown

54
00:03:02,126 --> 00:03:07,926
to altitudes of 354,200
feet and speeds of Mach 6.7.

55
00:03:08,496 --> 00:03:11,486
The flight program
made significant

56
00:03:11,486 --> 00:03:14,516
and unique contributions
to future aircraft designs

57
00:03:15,156 --> 00:03:18,886
and proved that winged Earth
exit and reentry are well

58
00:03:18,886 --> 00:03:20,926
within the controlled
capabilities of man.

59
00:03:21,476 --> 00:03:27,126
The XB-70, the world's
largest experimental aircraft,

60
00:03:27,206 --> 00:03:31,646
was 185 feet long, had
a wingspan of 105 feet,

61
00:03:31,956 --> 00:03:33,936
and was 30 feet high
at the tail.

62
00:03:34,536 --> 00:03:37,666
It was capable of flight at
speeds of three times the speed

63
00:03:37,666 --> 00:03:42,636

of sound, 2,000 mph, at
altitudes of 70,000 feet.

64
00:03:43,386 --> 00:03:44,416
The major objectives

65
00:03:44,416 --> 00:03:47,346
of the XB-70 Flight
Research Program were

66
00:03:47,346 --> 00:03:48,976
to study the airplane's
stability

67
00:03:48,976 --> 00:03:52,106
and handling characteristics,
evaluate its response

68
00:03:52,106 --> 00:03:53,456
to atmospheric turbulence,

69
00:03:53,926 --> 00:03:56,106
and assess propulsion
system performance.

70
00:03:56,706 --> 00:03:59,486
The wingtips could be lowered
in flight to allow the aircraft

71
00:03:59,486 --> 00:04:01,686
to cruise at higher
speeds more efficiently.

72
00:04:02,406 --> 00:04:05,406
At these higher speeds,
water vapor condensed

73
00:04:05,406 --> 00:04:07,106
at the forward control surfaces.

74
00:04:07,696 --> 00:04:10,706
The vapor can be seen
streaming from the aircraft.

75
00:04:12,126 --> 00:04:14,266
A program to develop
the piloting techniques

76
00:04:14,296 --> 00:04:15,916
that were used during
the final phase

77
00:04:15,916 --> 00:04:17,806
of the manned lunar
landing was started

78
00:04:17,806 --> 00:04:20,156
at the Flight Research
Center in 1964.

79
00:04:21,386 --> 00:04:24,606
This program used a free-flying
simulator called the Lunar

80
00:04:24,606 --> 00:04:27,146
Landing Research
Vehicle, or LLRV.

81
00:04:27,146 --> 00:04:31,026
To compensate for
the gravitational

82
00:04:31,026 --> 00:04:34,326
and atmospheric differences
between the Earth and the Moon,

83
00:04:34,326 --> 00:04:37,046
the LLRV was equipped
with a gimbaled jet engine

84
00:04:37,466 --> 00:04:40,596
that produced enough
thrust to counterbalance 5/6

85
00:04:40,596 --> 00:04:43,786
of its weight, thereby
simulating 1/6 gravity

86
00:04:43,786 --> 00:04:44,246
of the Moon.

87
00:04:45,876 --> 00:04:49,236
Small rocket motors were used by
the pilot to control horizontal

88
00:04:49,236 --> 00:04:51,706
and vertical movement
in a simulated approach

89
00:04:51,836 --> 00:04:52,976
to the surface of the Moon.

90
00:04:58,066 --> 00:05:00,006
One of the research
craft recently tested

91
00:05:00,006 --> 00:05:02,776
at the Flight Research Center
was the M2 Lifting Body.

92
00:05:04,076 --> 00:05:08,046
The M2 was towed to
altitude by a C-47 aircraft.

93
00:05:09,026 --> 00:05:11,076
Lifting bodies are
wingless vehicles

94
00:05:11,196 --> 00:05:13,396

that obtain aerodynamic
lift for flight

95
00:05:13,606 --> 00:05:15,076
from the shape of their bodies.

96
00:05:16,426 --> 00:05:18,156
Vehicles like these
are being tested

97
00:05:18,156 --> 00:05:21,406
to obtain basic flight test
data to aid in the development

98
00:05:21,406 --> 00:05:24,886
of future space shuttle craft
that will be used to supply men

99
00:05:24,886 --> 00:05:27,306
and materials to
orbiting space stations.

100
00:05:29,056 --> 00:05:30,486
Three minutes after launch,

101
00:05:30,486 --> 00:05:32,896
the M2 began its final
landing approach.

102
00:05:34,346 --> 00:05:37,166
Total flight time for a
normal glide flight was almost

103
00:05:37,166 --> 00:05:37,876
four minutes.

104
00:05:44,486 --> 00:05:47,446
The HL-10 was the second
manned research craft

105
00:05:47,446 --> 00:05:49,056
of the wingless lifting
body class

106
00:05:49,056 --> 00:05:51,126
of reentry vehicles
studied by NASA.

107
00:05:51,696 --> 00:05:55,566
It was flight tested to provide
technology for the design

108
00:05:55,566 --> 00:05:58,076
of future spacecraft that
are maneuvered in flight

109
00:05:58,076 --> 00:06:01,146
to normal landings at
selected landing sites.

110
00:06:02,806 --> 00:06:05,856
During the final approach,
the HL-10 pilot pushed

111
00:06:05,856 --> 00:06:09,026
over to increase the horizontal
speed before performing the

112
00:06:09,026 --> 00:06:10,856
flare maneuver to
cushion the landing.

113
00:06:12,176 --> 00:06:16,286
The HL-10 landing
speed was about 230 mph

114
00:06:16,606 --> 00:06:19,606
and rollout was approximately
1 and a half miles.

115
00:06:24,136 --> 00:06:27,626
The X-24A was another of the
three lifting body shapes

116
00:06:27,626 --> 00:06:29,496
which have been flown at
the Flight Research Center.

117
00:06:30,066 --> 00:06:34,636
First flown on April 17, 1969,
the craft made 28 flights.

118
00:06:35,046 --> 00:06:39,026
Top speed reached by
the X-24A was 1,000 mph

119
00:06:39,406 --> 00:06:42,316
and the highest altitude
was 71,000 feet.

120
00:06:43,606 --> 00:06:47,306
A new airfoil shape called the
supercritical wing is being

121
00:06:47,306 --> 00:06:50,086
flight tested aboard an
extensively modified F-8

122
00:06:50,196 --> 00:06:51,016
jet aircraft.

123
00:06:51,636 --> 00:06:54,676
Almost the direct opposite of
conventional airfoil shapes,

124
00:06:55,066 --> 00:06:57,816
the supercritical wing has
a flattened top surface,

125

00:06:57,816 --> 00:06:59,816
which delays shock
wave formation

126
00:07:00,096 --> 00:07:02,396
and increases the
total wing efficiency.

127
00:07:02,956 --> 00:07:06,876
An advanced flight control
system called the digital

128
00:07:06,876 --> 00:07:08,996
fly-by-wire system
has been installed

129
00:07:08,996 --> 00:07:12,266
by the Flight Research Center
in a modified F-8 jet aircraft.

130
00:07:13,466 --> 00:07:16,126
The heart of the control
system is a digital computer

131
00:07:16,446 --> 00:07:19,086
and an inertial measuring
unit that were developed

132
00:07:19,086 --> 00:07:21,816
for the flight control system
of the Apollo Lunar Module.

133
00:07:23,316 --> 00:07:26,366
Use of this kind of control
system could make air travel

134
00:07:26,366 --> 00:07:28,186
of the future smoother and safer

135
00:07:28,476 --> 00:07:32,266

by reducing aircraft vibrations
caused by turbulent air

136
00:07:32,506 --> 00:07:34,816
through automatic
response from the computer

137
00:07:34,946 --> 00:07:36,576
to the aircraft controls.

138
00:07:38,196 --> 00:07:39,596
The National Aeronautics

139
00:07:39,596 --> 00:07:42,436
and Space Administration has
assumed operational control

140
00:07:42,436 --> 00:07:45,206
of two YF-12 aircraft
being flown

141
00:07:45,206 --> 00:07:47,586
in a joint Air Force/NASA
research program.

142
00:07:48,576 --> 00:07:52,186
The basic purpose of the YF-12
flight research program is

143
00:07:52,186 --> 00:07:55,046
to obtain information from
sustained cruise flight

144
00:07:55,046 --> 00:07:58,366
at Mach 3, approximately
2,000 miles per hour,

145
00:07:58,856 --> 00:08:01,166
at altitudes near 75,000 feet.

146
00:08:02,206 --> 00:08:04,726
Data obtained from the
program will be used

147
00:08:04,726 --> 00:08:06,586
to further the development
and operation

148
00:08:06,586 --> 00:08:09,876
of supersonic aircraft, both
commercial and military,

149
00:08:10,236 --> 00:08:11,866
and the proposed space shuttle.

150
00:08:13,086 --> 00:08:15,276
Major areas of interest
in the NASA portion

151
00:08:15,276 --> 00:08:18,586
of the program are structural
and performance research.

152
00:08:19,466 --> 00:08:22,216
Other research regions
include stability and control,

153
00:08:22,586 --> 00:08:26,076
aerodynamics, the physiological
and biomedical aspects

154
00:08:26,076 --> 00:08:29,216
of sustained high-speed
cruise, and the physics

155
00:08:29,216 --> 00:08:30,296
of the upper atmosphere.

156
00:08:31,286 --> 00:08:33,216

Future aircraft design
will depend

157
00:08:33,216 --> 00:08:36,806
on the work we do here today at
the NASA Flight Research Center.

158
00:08:38,176 --> 00:08:42,276
And so, after 25 years of basic
research into all the facets

159
00:08:42,276 --> 00:08:45,936
of manned flight, the NASA
Flight Research Center is ready

160
00:08:46,006 --> 00:08:48,666
for the challenge of
tomorrow, looking forward

161
00:08:48,906 --> 00:08:50,676
to new horizons to conquer.

162
00:08:51,686 --> 00:08:55,086
Programs are under consideration
which will tax present knowledge