1
00:00:45,600 --> 00:00:50,180
you

2
00:00:56,280 --> 00:00:53,430
plum Brook a field station of the Lewis

3
00:00:58,799 --> 00:00:56,290
research center is located about 50

4
00:01:01,890 --> 00:00:58,809
miles west of Lewis on sixty four

5
00:01:04,619 --> 00:01:01,900
hundred acres of land this vast acreage

6
00:01:07,020 --> 00:01:04,629
provides the required clear zones needed

7
00:01:11,070 --> 00:01:07,030
for safely conducting potentially

8
00:01:13,380 --> 00:01:11,080
dangerous aerospace tests several large

9
00:01:15,840 --> 00:01:13,390
unique aerospace test facilities are

10
00:01:18,120 --> 00:01:15,850
located at plum Brook these facilities

11
00:01:21,749 --> 00:01:18,130
are available to support major national

12
00:01:24,330 --> 00:01:21,759
aerospace test programs one of these

13
00:01:26,969 --> 00:01:24,340

facilities the space power facility is

14
00:01:30,180 --> 00:01:26,979
the world's largest space environment

15
00:01:35,670 --> 00:01:30,190
simulation chamber 100 feet in diameter

16
00:01:38,249 --> 00:01:35,680
x 122 feet high in this chamber large

17
00:01:41,190 --> 00:01:38,259
space bound hardware can be ground

18
00:01:43,950 --> 00:01:41,200
tested in a severe environment similar

19
00:01:46,050 --> 00:01:43,960
to that encountered in space the chamber

20
00:01:48,540 --> 00:01:46,060
air can be removed to simulate the

21
00:01:51,980 --> 00:01:48,550
vacuum conditions of space up to an

22
00:01:55,050 --> 00:01:51,990
altitude of about 145 statute miles

23
00:01:57,990 --> 00:01:55,060
charged argon gas can be added to the

24
00:02:00,540 --> 00:01:58,000
chamber while it's at vacuum to simulate

25
00:02:04,199 --> 00:02:00,550
the actual space plasma environment of

26
00:02:06,330 --> 00:02:04,209
low-earth orbit the very cold

27
00:02:09,389 --> 00:02:06,340
temperatures of space can be duplicated

28
00:02:11,460 --> 00:02:09,399
by means of a cryogenic cold wall the

29
00:02:14,699 --> 00:02:11,470
very hot temperatures by means of a

30
00:02:17,280 --> 00:02:14,709
quartz lamp heater even the actual

31
00:02:20,370 --> 00:02:17,290
sunlight experienced in space can be

32
00:02:25,290 --> 00:02:20,380
simulated with an existing 400 kilowatt

33
00:02:26,760 --> 00:02:25,300
arc lamp in 1989 under a cooperative

34
00:02:30,240 --> 00:02:26,770
agreement between the General Dynamics

35
00:02:32,430 --> 00:02:30,250
Corporation and NASA this chamber

36
00:02:35,580 --> 00:02:32,440
supported payload fairing separation

37
00:02:38,460 --> 00:02:35,590
tests for a new generation of atlas 1

38
00:02:40,680 --> 00:02:38,470

launch vehicles a few months after

39
00:02:42,870 --> 00:02:40,690
testing at plum Brook the newly designed

40
00:02:45,390 --> 00:02:42,880
fairing successfully protected the

41
00:02:47,550 --> 00:02:45,400
combined release and radiation effects

42
00:02:50,430 --> 00:02:47,560
satellite as it was launched into

43
00:02:54,720 --> 00:02:50,440
low-earth orbit on board the atlas sent

44
00:02:56,910 --> 00:02:54,730
our vehicle in 1990 the space power

45
00:03:00,420 --> 00:02:56,920
facility qualified expensive flight

46
00:03:02,309 --> 00:03:00,430
hardware for the SDI program here you

47
00:03:05,339 --> 00:03:02,319
see a 100 kilowatt power

48
00:03:08,099 --> 00:03:05,349
why being processed in a class 10,000

49
00:03:11,220 --> 00:03:08,109
clean room located inside the huge

50
00:03:13,649 --> 00:03:11,230
vacuum chamber ground testing of this

51
00:03:17,660 --> 00:03:13,659
power supply simulated performance in a

52
00:03:20,490 --> 00:03:17,670
high altitude space plasma environment

53
00:03:22,979 --> 00:03:20,500
more recently this chamber supported

54
00:03:25,979 --> 00:03:22,989
jettison testing of the eighty six foot

55
00:03:27,929 --> 00:03:25,989
tall 16-foot diameter titan for payload

56
00:03:30,629 --> 00:03:27,939
fairing under a cooperative agreement

57
00:03:34,619 --> 00:03:30,639
between the US air force the martin

58
00:03:36,420 --> 00:03:34,629
marietta company and nasa this fairing

59
00:03:38,970 --> 00:03:36,430
the largest ever tested in a vacuum

60
00:03:40,890 --> 00:03:38,980
chamber had internal payload space

61
00:03:44,339 --> 00:03:40,900
dimensions approximating the Space

62
00:03:46,770 --> 00:03:44,349
Shuttle Orbiter Bay here you see the ten

63
00:03:49,379 --> 00:03:46,780

thousand pound titan four fairing being

64
00:03:53,819 --> 00:03:49,389
jettisoned under vacuum conditions in

65
00:03:56,459 --> 00:03:53,829
the test chamber at plum brook scheduled

66
00:03:59,429 --> 00:03:56,469
for nineteen ninety-three is the Erion

67
00:04:03,000 --> 00:03:59,439
five payload fairing separation test for

68
00:04:05,459 --> 00:04:03,010
the european space agency and for 1994

69
00:04:07,890 --> 00:04:05,469
and ninety-five the Space Station

70
00:04:10,740 --> 00:04:07,900
freedom electric power generation system

71
00:04:13,379 --> 00:04:10,750
test for the NASA Lewis research center

72
00:04:15,929 --> 00:04:13,389
and the Space Station freedom laboratory

73
00:04:19,860 --> 00:04:15,939
module radiator test for the Johnson

74
00:04:22,080 --> 00:04:19,870
Space Center not only is the space power

75
00:04:24,719 --> 00:04:22,090
facility the world's largest space

76
00:04:27,210 --> 00:04:24,729
environment testing chamber it is also

77
00:04:29,189 --> 00:04:27,220
the world's only large vacuum chamber

78
00:04:31,680 --> 00:04:29,199
capable of handling the highly

79
00:04:34,170 --> 00:04:31,690
radioactive tests that would be needed

80
00:04:37,740 --> 00:04:34,180
to develop space nuclear electric power

81
00:04:39,870 --> 00:04:37,750
generation systems this is possible

82
00:04:42,689 --> 00:04:39,880
because the chamber walls are made of

83
00:04:45,810 --> 00:04:42,699
aluminum which has a low Neutron capture

84
00:04:47,459 --> 00:04:45,820
cross section this keeps the chamber

85
00:04:50,879 --> 00:04:47,469
walls from becoming highly radioactive

86
00:04:54,629 --> 00:04:50,889
if a space nuclear power reactor is

87
00:04:56,999 --> 00:04:54,639
operated inside the aluminum chamber is

88
00:04:59,629 --> 00:04:57,009

contained within a second vacuum chamber

89
00:05:03,230 --> 00:04:59,639
that has eight foot thick concrete walls

90
00:05:05,370 --> 00:05:03,240
which serve as a radiation shield

91
00:05:08,129 --> 00:05:05,380
adjacent to the chamber is a large

92
00:05:11,370 --> 00:05:08,139
disassembly area which also has eight

93
00:05:13,140 --> 00:05:11,380
foot thick concrete walls this building

94
00:05:15,480 --> 00:05:13,150
can be used for remote control

95
00:05:15,990 --> 00:05:15,490
disassembly of large radioactive

96
00:05:19,980 --> 00:05:16,000
hardware

97
00:05:21,870 --> 00:05:19,990
after tests are complete although the

98
00:05:24,930 --> 00:05:21,880
space power facility has not yet been

99
00:05:27,420 --> 00:05:24,940
used for nuclear testing it stands ready

100
00:05:31,470 --> 00:05:27,430
to support such space power supply

101
00:05:33,990 --> 00:05:31,480
development programs another of plum

102
00:05:36,920 --> 00:05:34,000
brooks world-class facilities is the

103
00:05:40,320 --> 00:05:36,930
spacecraft propulsion research facility

104
00:05:43,200 --> 00:05:40,330
here large upper stage rocket vehicles

105
00:05:48,720 --> 00:05:43,210
can be hot fired in a simulated space

106
00:05:51,510 --> 00:05:48,730
environment a 38-foot diameter by 55

107
00:05:54,750 --> 00:05:51,520
foot high stainless steel vacuum chamber

108
00:05:58,640 --> 00:05:54,760
is capable of simulating pressures of 1

109
00:06:03,600 --> 00:05:58,650
times 10 to the minus 6 tour or about

110
00:06:06,720 --> 00:06:03,610
115 statute miles altitude a full-sized

111
00:06:09,150 --> 00:06:06,730
launch vehicle up to 100,000 pound

112
00:06:10,860 --> 00:06:09,160
thrust capability can be loaded in the

113
00:06:14,790 --> 00:06:10,870

chamber through the top hatch and

114
00:06:16,650 --> 00:06:14,800
secured to the bed plate a cryogenic

115
00:06:19,500 --> 00:06:16,660
cold wall simulates the cold

116
00:06:21,900 --> 00:06:19,510
temperatures of space a quartz lamp

117
00:06:25,650 --> 00:06:21,910
heater array simulates the heat from the

118
00:06:28,469 --> 00:06:25,660
Sun the facility was designed and built

119
00:06:31,710 --> 00:06:28,479
to safely handle the large quantities of

120
00:06:36,030 --> 00:06:31,720
liquid hydrogen and oxygen carried on a

121
00:06:38,850 --> 00:06:36,040
fully fueled centaur vehicle in test

122
00:06:41,340 --> 00:06:38,860
firings of fueled vehicles conducted by

123
00:06:44,250 --> 00:06:41,350
remote control from a blockhouse a half

124
00:06:46,820 --> 00:06:44,260
mile away vehicles experience an

125
00:06:50,100 --> 00:06:46,830
environment similar to that in space at

126
00:06:53,580 --> 00:06:50,110
the moment of firing an 11 foot diameter

127
00:06:55,469 --> 00:06:53,590
high vacuum valve springs open at the

128
00:06:58,350 --> 00:06:55,479
bottom of this diffuser tube and

129
00:07:01,890 --> 00:06:58,360
releases the rocket exhaust products to

130
00:07:04,110 --> 00:07:01,900
the spray chamber below the 150 foot

131
00:07:07,020 --> 00:07:04,120
deep spray chamber is filled with a

132
00:07:10,409 --> 00:07:07,030
chilled water spray that is used to cool

133
00:07:14,010 --> 00:07:10,419
down the exhaust from the rocket at the

134
00:07:16,080 --> 00:07:14,020
same time huge steam ejectors pump out

135
00:07:18,630 --> 00:07:16,090
the exhaust products from the firing and

136
00:07:23,909 --> 00:07:18,640
maintain a high altitude condition

137
00:07:25,320 --> 00:07:23,919
throughout the tests in 1987 the vacuum

138
00:07:28,320 --> 00:07:25,330

chamber portion of this facility

139
00:07:30,260 --> 00:07:28,330
supported testing of flight hardware for

140
00:07:32,820 --> 00:07:30,270
the SDI program

141
00:07:35,610 --> 00:07:32,830
ground testing of high-voltage power

142
00:07:37,499 --> 00:07:35,620
supplies in a simulated space plasma

143
00:07:41,820 --> 00:07:37,509
environment determined flight

144
00:07:44,700 --> 00:07:41,830
performance in advance this facility may

145
00:07:46,739 --> 00:07:44,710
be fully reactivated to support advanced

146
00:07:48,839 --> 00:07:46,749
upper stage launch vehicle development

147
00:07:54,029 --> 00:07:48,849
for programs such as the space

148
00:07:56,100 --> 00:07:54,039
exploration initiative to Mars the third

149
00:07:58,649 --> 00:07:56,110
space environment chamber at plum Brook

150
00:08:01,320 --> 00:07:58,659
the 25 foot diameter cryogenic

151
00:08:03,600 --> 00:08:01,330
propellant tank facility is being used

152
00:08:05,850 --> 00:08:03,610
to develop the technology for storing

153
00:08:10,290 --> 00:08:05,860
and transferring liquid hydrogen in

154
00:08:12,959 --> 00:08:10,300
space recently an 800-gallon slush

155
00:08:15,390 --> 00:08:12,969
hydrogen batch production plant the

156
00:08:17,939 --> 00:08:15,400
nation's first was constructed at the

157
00:08:21,719 --> 00:08:17,949
site to support development testing for

158
00:08:23,879 --> 00:08:21,729
the national aerospace plane here you

159
00:08:27,029 --> 00:08:23,889
see liquid hydrogen being converted to

160
00:08:30,360 --> 00:08:27,039
slush using the freeze-thaw method in

161
00:08:32,639 --> 00:08:30,370
the generator at plum Brook previously

162
00:08:34,560 --> 00:08:32,649
slush hydrogen had been produced only in

163
00:08:38,040 --> 00:08:34,570

leader sized quantities in the

164
00:08:41,250 --> 00:08:38,050
laboratory in addition to its three

165
00:08:43,920 --> 00:08:41,260
large space environment chambers plum

166
00:08:46,980 --> 00:08:43,930
Brook also has a large hypersonic wind

167
00:08:51,780 --> 00:08:46,990
tunnel capable of performing flow tests

168
00:08:54,810 --> 00:08:51,790
at Mach 5 6 or 7 high-pressure nitrogen

169
00:08:57,720 --> 00:08:54,820
gas stored in a high volume tank

170
00:08:59,819 --> 00:08:57,730
adjacent to the facility is released and

171
00:09:02,130 --> 00:08:59,829
flows through a three megawatt

172
00:09:06,810 --> 00:09:02,140
electrical heater that raises its

173
00:09:09,180 --> 00:09:06,820
temperatures to nearly 2,500 Kelvin then

174
00:09:12,620 --> 00:09:09,190
sufficient oxygen is added to the hot

175
00:09:15,150 --> 00:09:12,630
nitrogen to produce an heir composition

176
00:09:17,400 --> 00:09:15,160
the heated air flows through a

177
00:09:22,079 --> 00:09:17,410
hypersonic flow nozzle and passed the

178
00:09:24,420 --> 00:09:22,089
model a large steam ejector also pulls a

179
00:09:25,920 --> 00:09:24,430
vacuum on the test chamber to help

180
00:09:31,199 --> 00:09:25,930
establish the flow pattern and

181
00:09:33,870 --> 00:09:31,209
assimilate a high altitude condition the

182
00:09:37,889 --> 00:09:33,880
hypersonic tunnel facility was last used

183
00:09:41,309 --> 00:09:37,899
in 1974 to test a hypersonic research

184
00:09:43,079 --> 00:09:41,319
engine at Mach 7 conditions under a

185
00:09:43,769 --> 00:09:43,089
joint program between the garrett

186
00:09:46,679 --> 00:09:43,779
corporation

187
00:09:49,379 --> 00:09:46,689
and NASA currently it's being

188
00:09:52,079 --> 00:09:49,389

reactivated by NASA to support generic

189
00:09:54,360 --> 00:09:52,089
hypersonic research and is expected to

190
00:09:59,189 --> 00:09:54,370
be operational by mid nineteen ninety

191
00:10:01,259 --> 00:09:59,199
three the four major facilities at plum

192
00:10:04,499 --> 00:10:01,269
Brook together with the surrounding

193
00:10:07,259 --> 00:10:04,509
clear zone land the infrastructure and

194
00:10:10,290 --> 00:10:07,269
the train staff provide a significant

195
00:10:13,889 --> 00:10:10,300
national test capability available to