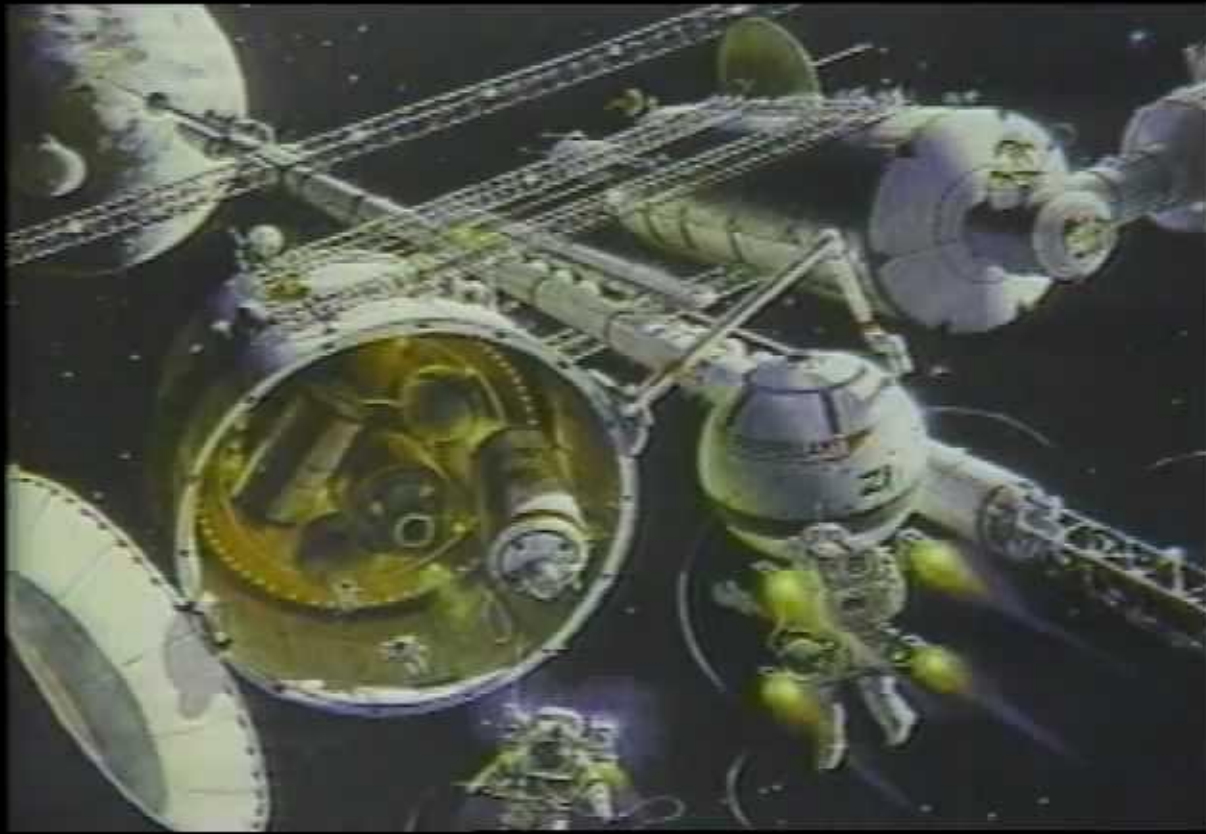

1
00:00:05,510 --> 00:00:02,790
servicing and repairing unmanned

2
00:00:08,150 --> 00:00:05,520
satellites at space station

3
00:00:10,549 --> 00:00:08,160
robots constructing colonies for men and

4
00:00:13,669 --> 00:00:10,559
women to live and work together on the

5
00:00:16,550 --> 00:00:13,679
moon and the planet mars

6
00:00:19,670 --> 00:00:16,560
these are bold complex space missions

7
00:00:23,189 --> 00:00:19,680
being considered by nasa for the 1990s

8
00:00:25,109 --> 00:00:23,199
and well into the 21st century

9
00:00:26,390 --> 00:00:25,119
to support these spellbinding space

10
00:00:29,189 --> 00:00:26,400
adventures

11
00:00:30,470 --> 00:00:29,199
nasa is directing an aggressive program

12
00:00:44,630 --> 00:00:30,480
in automation

13
00:00:48,869 --> 00:00:46,950

one of the key nasa centers developing

14
00:00:51,510 --> 00:00:48,879
state-of-the-art robotics for space

15
00:00:53,670 --> 00:00:51,520
station freedom is nasa's goddard space

16
00:00:55,110 --> 00:00:53,680
flight center just outside of washington

17
00:00:56,869 --> 00:00:55,120
dc

18
00:00:59,590 --> 00:00:56,879
goddard will develop the flight tele

19
00:01:01,830 --> 00:00:59,600
robotics servicer called fts for short

20
00:01:04,229 --> 00:01:01,840
for space station freedom

21
00:01:06,870 --> 00:01:04,239
this includes the development of the fts

22
00:01:09,670 --> 00:01:06,880
operational flight system a series of

23
00:01:11,270 --> 00:01:09,680
test flights aboard space shuttle and

24
00:01:13,429 --> 00:01:11,280
the development of a ground-based

25
00:01:15,350 --> 00:01:13,439
research facility

26
00:01:17,429 --> 00:01:15,360
goddard is responsible also for

27
00:01:19,910 --> 00:01:17,439
transferring this high technology to

28
00:01:22,310 --> 00:01:19,920
american industry and the public

29
00:01:24,830 --> 00:01:22,320
enhancing the united states industrial

30
00:01:28,870 --> 00:01:24,840
competitive posture

31
00:01:31,429 --> 00:01:28,880
worldwide a tele-robotic servicer fts is

32
00:01:33,830 --> 00:01:31,439
a robotic device that combines tele

33
00:01:35,429 --> 00:01:33,840
operation using a human operator to

34
00:01:37,510 --> 00:01:35,439
direct the machine

35
00:01:40,469 --> 00:01:37,520
with autonomous capabilities for

36
00:01:43,429 --> 00:01:40,479
performing tasks mostly by itself but

37
00:01:45,749 --> 00:01:43,439
supervised by man

38
00:01:47,910 --> 00:01:45,759

plans call for the fts to assist the

39
00:01:49,910 --> 00:01:47,920
astronauts in the assembly of space

40
00:01:52,550 --> 00:01:49,920
station freedom

41
00:01:54,789 --> 00:01:52,560
while fts will be limited initially to

42
00:01:55,830 --> 00:01:54,799
spacecraft servicing and maintenance

43
00:01:58,310 --> 00:01:55,840
tasks

44
00:02:01,270 --> 00:01:58,320
ultimately it will be able to reach

45
00:02:03,590 --> 00:02:01,280
retrieve and service unmanned satellites

46
00:02:06,230 --> 00:02:03,600
in an unprecedented manner saving

47
00:02:08,710 --> 00:02:06,240
millions of dollars

48
00:02:11,430 --> 00:02:08,720
servicing a spacecraft crippled in orbit

49
00:02:13,910 --> 00:02:11,440
became a reality in 1984

50
00:02:15,910 --> 00:02:13,920
when astronauts aboard the space shuttle

51
00:02:18,229 --> 00:02:15,920
repaired the solar maximum mission

52
00:02:20,830 --> 00:02:18,239
spacecraft so it once again could

53
00:02:22,710 --> 00:02:20,840
continue its investigation of the solar

54
00:02:25,670 --> 00:02:22,720
cycle

55
00:02:27,589 --> 00:02:25,680
study contracts to develop fts concepts

56
00:02:29,830 --> 00:02:27,599
have recently been completed for goddard

57
00:02:32,229 --> 00:02:29,840
by grumman space systems and martin

58
00:02:33,670 --> 00:02:32,239
marietta astronautics group

59
00:02:36,070 --> 00:02:33,680
one of the two companies will be

60
00:02:39,589 --> 00:02:36,080
selected for a final design contract in

61
00:02:42,309 --> 00:02:39,599
the spring of 1989

62
00:02:45,830 --> 00:02:42,319
when operational fts will improve

63
00:02:48,710 --> 00:02:45,840

reliability productivity and safety and

64
00:02:50,790 --> 00:02:48,720
will act as an aid to astronauts

65
00:02:53,270 --> 00:02:50,800
also it will perform tedious and

66
00:02:55,750 --> 00:02:53,280
hazardous tasks

67
00:02:57,350 --> 00:02:55,760
to meet this technological challenge the

68
00:02:59,350 --> 00:02:57,360
goddard space flight center is

69
00:03:00,630 --> 00:02:59,360
developing a unique space robotics

70
00:03:06,070 --> 00:03:00,640
facility

71
00:03:08,229 --> 00:03:06,080
robots computers display systems plus

72
00:03:10,470 --> 00:03:08,239
the full-scale mock-up of space station

73
00:03:13,270 --> 00:03:10,480
hardware will be used by the goddard

74
00:03:15,670 --> 00:03:13,280
robotics team to create test and

75
00:03:18,149 --> 00:03:15,680
evaluate new robotic technologies

76
00:03:21,430 --> 00:03:18,159
required to support the evolution of the

77
00:03:23,270 --> 00:03:21,440
flight tele-robotic servicer

78
00:03:24,949 --> 00:03:23,280
during the past year several

79
00:03:26,789 --> 00:03:24,959
demonstrations were successfully

80
00:03:29,110 --> 00:03:26,799
conducted at goddard

81
00:03:31,190 --> 00:03:29,120
some highlights include the removal of

82
00:03:34,149 --> 00:03:31,200
an orbital replacement unit by

83
00:03:35,990 --> 00:03:34,159
industrial robots vision control docking

84
00:03:38,309 --> 00:03:36,000
which permits the robot to find an

85
00:03:40,550 --> 00:03:38,319
object and dock on it for removal

86
00:03:42,630 --> 00:03:40,560
and voice control of cameras which

87
00:03:44,630 --> 00:03:42,640
freeze the operator's hands for tele

88
00:03:46,630 --> 00:03:44,640

operation

89
00:03:49,190 --> 00:03:46,640
one of the key demonstrations was the

90
00:03:51,910 --> 00:03:49,200
use of a forced reflecting master slave

91
00:03:54,229 --> 00:03:51,920
tele-robot which successfully repaired a

92
00:03:56,470 --> 00:03:54,239
full-scale mock-up of the solar maximum

93
00:04:01,190 --> 00:03:56,480
mission spacecraft using the same

94
00:04:03,750 --> 00:04:01,200
procedures performed in space in 1984

95
00:04:05,350 --> 00:04:03,760
looking toward the future a gantry robot

96
00:04:08,710 --> 00:04:05,360
will be installed in the robotics

97
00:04:12,869 --> 00:04:08,720
facility by january of 1989 to

98
00:04:15,750 --> 00:04:12,879
demonstrate fts operational tasks

99
00:04:18,390 --> 00:04:15,760
the final goal of the fts program is to

100
00:04:20,789 --> 00:04:18,400
move innovative concepts from research

101
00:04:22,870 --> 00:04:20,799
into flight systems thus providing

102
00:04:25,350 --> 00:04:22,880
spin-off benefits for the science and

103
00:04:27,350 --> 00:04:25,360
industrial communities

104
00:04:29,590 --> 00:04:27,360
goddard's long-range plan for the

105
00:04:32,070 --> 00:04:29,600
robotics facility is to make it a

106
00:04:34,469 --> 00:04:32,080
national resource for use by private

107
00:04:37,189 --> 00:04:34,479
industry other government agencies and

108
00:04:40,469 --> 00:04:37,199
universities to test and evaluate their

109
00:04:42,230 --> 00:04:40,479
own concepts and hardware

110
00:04:44,469 --> 00:04:42,240
working closely with the national

111
00:04:45,830 --> 00:04:44,479
institute of standards and technology

112
00:04:48,230 --> 00:04:45,840
nist

113
00:04:50,550 --> 00:04:48,240

goddard's far-reaching goal for robotics

114
00:04:52,469 --> 00:04:50,560
in space is the definition and

115
00:04:54,070 --> 00:04:52,479
maintenance of a functional systems

116
00:04:56,870 --> 00:04:54,080
architecture

117
00:04:58,629 --> 00:04:56,880
the nasa nist standard reference model

118
00:05:01,749 --> 00:04:58,639
for telerobot control system

119
00:05:04,550 --> 00:05:01,759
architecture or nasrim has been selected

120
00:05:07,110 --> 00:05:04,560
and developed by the fds program to fill

121
00:05:09,029 --> 00:05:07,120
this national need

122
00:05:11,990 --> 00:05:09,039
one of the unique technologies being

123
00:05:14,629 --> 00:05:12,000
developed by goddard for the fts program

124
00:05:16,950 --> 00:05:14,639
is a robot simulation system

125
00:05:19,270 --> 00:05:16,960
this animated graphic system is being

126
00:05:21,189 --> 00:05:19,280
used to emulate the control system for

127
00:05:23,270 --> 00:05:21,199
robot configurations

128
00:05:25,590 --> 00:05:23,280
and provide critical information

129
00:05:27,749 --> 00:05:25,600
regarding the robot's reach capability

130
00:05:31,270 --> 00:05:27,759
potential path planning collision

131
00:05:36,230 --> 00:05:33,510
the flight tele robotics servicer aboard

132
00:05:38,550 --> 00:05:36,240
space station freedom will revolutionize

133
00:05:40,870 --> 00:05:38,560
america's space program

134
00:05:43,670 --> 00:05:40,880
it will allow us to service and repair

135
00:05:46,310 --> 00:05:43,680
both the space station and spacecraft

136
00:05:48,310 --> 00:05:46,320
such as the hubble space telescope and

137
00:05:50,950 --> 00:05:48,320
gamma ray observatory

138
00:05:53,830 --> 00:05:50,960

conduct routine maintenance services and

139
00:05:56,710 --> 00:05:53,840
replenish hazardous fuels

140
00:05:58,390 --> 00:05:56,720
fts will also assemble spacecraft and

141
00:06:00,230 --> 00:05:58,400
instruments which have been flown on

142
00:06:01,590 --> 00:06:00,240
separate flights to the station by the

143
00:06:03,670 --> 00:06:01,600
shuttle

144
00:06:05,909 --> 00:06:03,680
the assembly of large instruments at

145
00:06:07,909 --> 00:06:05,919
space station could have a major impact

146
00:06:11,110 --> 00:06:07,919
in scientific investigations of the

147
00:06:13,670 --> 00:06:11,120
cosmos and planet earth for generations

148
00:06:18,950 --> 00:06:16,070
nasa's development of robotics will

149
00:06:21,270 --> 00:06:18,960
allow the united states to explore and

150
00:06:22,950 --> 00:06:21,280
extend the endless boundaries of the

151
00:06:26,309 --> 00:06:22,960
space frontiers

152
00:06:27,510 --> 00:06:26,319
advancing science technology and private

153
00:06:29,670 --> 00:06:27,520
enterprise

154
00:06:31,270 --> 00:06:29,680
to support human settlements from the