



1
00:00:24,920 --> 00:00:22,400
in january nineteen ninety two

2
00:00:27,200 --> 00:00:24,930
astronauts from the United States Canada

3
00:00:28,730 --> 00:00:27,210
and Europe joined forces on board the

4
00:00:34,610 --> 00:00:28,740
first international microgravity

5
00:00:37,100 --> 00:00:34,620
laboratory this flight of the space

6
00:00:39,410 --> 00:00:37,110
shuttle Discovery offers a preview of

7
00:00:44,200 --> 00:00:39,420
the worldwide cooperation and research

8
00:00:49,459 --> 00:00:46,190
experiments are conducted in a wide

9
00:00:51,170 --> 00:00:49,469
range of disciplines for life sciences

10
00:00:52,790 --> 00:00:51,180
astronauts study a type of motion

11
00:00:55,670 --> 00:00:52,800
sickness known as space adaptation

12
00:00:58,400 --> 00:00:55,680
syndrome tests explore the relationship

13
00:01:02,599 --> 00:00:58,410

between body position sensors located in

14

00:01:04,340 --> 00:01:02,609

the eye and inner ear even in the

15

00:01:07,250 --> 00:01:04,350

weightlessness of space where there is

16

00:01:09,260 --> 00:01:07,260

no clear sense of up and down astronauts

17

00:01:13,850 --> 00:01:09,270

feel they're lying on their side in the

18

00:01:15,830 --> 00:01:13,860

pitch or sideways position for material

19

00:01:18,050 --> 00:01:15,840

science crystals growing in zero gravity

20

00:01:20,719 --> 00:01:18,060

offer new advances in high technology

21

00:01:23,120 --> 00:01:20,729

manufacturing this crystal is being

22

00:01:26,179 --> 00:01:23,130

grown as a detector for x-rays and gamma

23

00:01:27,920 --> 00:01:26,189

rays understanding how this crystal

24

00:01:30,260 --> 00:01:27,930

converts light energy to electric

25

00:01:33,219 --> 00:01:30,270

voltages requires the availability of

26

00:01:35,810 --> 00:01:33,229

large high-quality crystals for research

27

00:01:37,789 --> 00:01:35,820

astronauts also test an eyewash device

28

00:01:42,649 --> 00:01:37,799

being designed for use in Space Station

29

00:01:44,060 --> 00:01:42,659

freedom valuable feedback is gained on

30

00:01:47,389 --> 00:01:44,070

the design of the European Space

31

00:01:49,850 --> 00:01:47,399

Agency's bio rap the unit contains a

32

00:01:51,770 --> 00:01:49,860

cooler a warming incubator and the glove

33

00:01:54,670 --> 00:01:51,780

box that contains objects and debris

34

00:01:56,959 --> 00:01:54,680

that otherwise might float away

35

00:01:59,120 --> 00:01:56,969

experiments are conducted on bacterial

36

00:02:00,800 --> 00:01:59,130

fruit flies bone and tissue cells

37

00:02:03,350 --> 00:02:00,810

examining the effects of cosmic

38

00:02:05,450 --> 00:02:03,360

radiation these studies of the

39

00:02:07,130 --> 00:02:05,460

microgravity environment are critical to

40

00:02:08,290 --> 00:02:07,140

understanding its effect on living

41

00:02:10,850 --> 00:02:08,300

organisms

42

00:02:13,550 --> 00:02:10,860

the first international microgravity

43

00:02:15,650 --> 00:02:13,560

laboratory rates of space-based research

44

00:02:37,850 --> 00:02:15,660

is a powerful tool for scientific

45

00:02:42,150 --> 00:02:40,410

with the Johnson Space Center prime

46

00:02:43,530 --> 00:02:42,160

contractor McDonnell Douglas is

47

00:02:47,790 --> 00:02:43,540

assembling frame members of the

48

00:02:49,740 --> 00:02:47,800

propulsion module development unit each

49

00:02:51,720 --> 00:02:49,750

contact point on the center frame must

50

00:02:54,960 --> 00:02:51,730

be carefully prepared to ensure good

51
00:02:56,580 --> 00:02:54,970
electrical bonding this unit is part of

52
00:02:58,590 --> 00:02:56,590
freedoms propulsion system which

53
00:03:01,110 --> 00:02:58,600
provides thrust for attitude control in

54
00:03:03,600 --> 00:03:01,120
space booster energy to maintain proper

55
00:03:07,650 --> 00:03:03,610
orbit and maneuverability needed for

56
00:03:09,390 --> 00:03:07,660
collision avoidance the assembly proves

57
00:03:12,740 --> 00:03:09,400
the efficiency of modern cad/cam

58
00:03:15,030 --> 00:03:12,750
techniques used to create these parts

59
00:03:17,040 --> 00:03:15,040
computer-aided design and computer-aided

60
00:03:18,660 --> 00:03:17,050
manufacturing are an important

61
00:03:20,490 --> 00:03:18,670
ingredient in maintaining a robust

62
00:03:32,940 --> 00:03:20,500
manufacturing sector in the United

63
00:03:34,770 --> 00:03:32,950

States living and laboratory modules for

64

00:03:35,880 --> 00:03:34,780

Space Station freedom similar to those

65

00:03:38,130 --> 00:03:35,890

used on the first international

66

00:03:39,720 --> 00:03:38,140

microgravity laboratory are the

67

00:03:42,080 --> 00:03:39,730

responsibility of the Marshall Space

68

00:03:44,670 --> 00:03:42,090

Flight Center in Huntsville Alabama

69

00:03:47,970 --> 00:03:44,680

Boeing Company prime contractor is

70

00:03:49,560 --> 00:03:47,980

assembling these units large ring sealed

71

00:03:51,810 --> 00:03:49,570

the connection points of the living and

72

00:03:53,789 --> 00:03:51,820

laboratory modules debris is removed

73

00:03:56,940 --> 00:03:53,799

from the structure in preparation for

74

00:03:58,979 --> 00:03:56,950

mounting the berthing ring once in

75

00:04:00,509 --> 00:03:58,989

proper position the ring is tack welded

76
00:04:03,240 --> 00:04:00,519
to the development unit in preparation

77
00:04:05,940 --> 00:04:03,250
for testing

78
00:04:07,680 --> 00:04:05,950
in the hot drape former area technicians

79
00:04:09,990 --> 00:04:07,690
are fabricating structural members of

80
00:04:12,000 --> 00:04:10,000
the modules this technique shapes

81
00:04:14,310 --> 00:04:12,010
multiple apply layers simultaneously

82
00:04:17,039 --> 00:04:14,320
reducing the labor needed to fabricate

83
00:04:19,199 --> 00:04:17,049
complex designs the graphite epoxy

84
00:04:22,550 --> 00:04:19,209
materials must be heated to an internal

85
00:04:25,080 --> 00:04:22,560
temperature of 140 degrees Fahrenheit

86
00:04:28,650 --> 00:04:25,090
after cooling the surface release film

87
00:04:30,540 --> 00:04:28,660
is removed the finished product will be

88
00:04:34,800 --> 00:04:30,550

incorporated in one of the modules being

89

00:04:36,659 --> 00:04:34,810

developed for Space Station freedom by

90

00:04:38,820 --> 00:04:36,669

implementing Universal standards for the

91

00:04:43,860 --> 00:04:38,830

payload racks significant savings have

92

00:04:45,240 --> 00:04:43,870

been achieved scientists from around the

93

00:04:47,460 --> 00:04:45,250

world are planning a diversity of

94

00:04:56,970 --> 00:04:47,470

experiments all utilizing one

95

00:04:58,650 --> 00:04:56,980

cost-effective modular structure the

96

00:05:00,990 --> 00:04:58,660

Lewis Research Center in Cleveland Ohio

97

00:05:03,240 --> 00:05:01,000

is responsible for all systems that

98

00:05:06,240 --> 00:05:03,250

generate store and distribute electrical

99

00:05:07,980 --> 00:05:06,250

power prime contractor the Rocketdyne

100

00:05:10,020 --> 00:05:07,990

division of Rockwell International has

101
00:05:13,230 --> 00:05:10,030
began the transition from design to

102
00:05:14,820 --> 00:05:13,240
fabrication Construction is now underway

103
00:05:16,880 --> 00:05:14,830
on components of the electric power

104
00:05:19,290 --> 00:05:16,890
system these electromagnetic

105
00:05:21,990 --> 00:05:19,300
interference units help shield equipment

106
00:05:23,130 --> 00:05:22,000
from disturbances in space since the

107
00:05:25,140 --> 00:05:23,140
power system is one of the earliest

108
00:05:27,000 --> 00:05:25,150
components needed to operate Space

109
00:05:29,730 --> 00:05:27,010
Station freedom it is among the first

110
00:05:31,500 --> 00:05:29,740
being produced this new circuit tester

111
00:05:33,719 --> 00:05:31,510
useful in a wide variety of other

112
00:05:35,370 --> 00:05:33,729
commercial applications is being used to

113
00:05:39,780 --> 00:05:35,380

automatically test the integrity of

114

00:05:41,610 --> 00:05:39,790

every circuit board one component

115

00:05:43,110 --> 00:05:41,620

approaching final assembly is the

116

00:05:45,530 --> 00:05:43,120

battery box which houses the

117

00:05:48,030 --> 00:05:45,540

rechargeable nickel hydrogen batteries

118

00:05:51,180 --> 00:05:48,040

in preparation for the critical design

119

00:05:53,219 --> 00:05:51,190

review slated in December 1992 the box

120

00:05:54,960 --> 00:05:53,229

is readied for neutral buoyancy testing

121

00:05:58,290 --> 00:05:54,970

in the Johnson Space Center's weightless

122

00:06:00,150 --> 00:05:58,300

environment training facility here in

123

00:06:02,040 --> 00:06:00,160

large underwater tanks astronauts

124

00:06:04,409 --> 00:06:02,050

practice tasks in an environment that

125

00:06:06,939 --> 00:06:04,419

simulates weightlessness

126
00:06:09,159 --> 00:06:06,949
Patrick boxes tested for maneuverability

127
00:06:12,219 --> 00:06:09,169
and accessibility with both power and

128
00:06:15,429 --> 00:06:12,229
hand tools is it directional like a

129
00:06:18,219 --> 00:06:15,439
socket the results are analyzed and

130
00:06:20,459 --> 00:06:18,229
designs revives the best position is

131
00:06:23,409 --> 00:06:20,469
determined for handholds on equipment

132
00:06:26,079 --> 00:06:23,419
also to prevent tools from floating away

133
00:06:29,649 --> 00:06:26,089
in space ideal locations for tie-downs

134
00:06:31,959 --> 00:06:29,659
are identified a remote manipulator

135
00:06:34,259 --> 00:06:31,969
system provided by the Canadian Space

136
00:06:37,149 --> 00:06:34,269
Agency is tested for manual deployment

137
00:06:43,889 --> 00:06:37,159
the participation of Canada Europe and

138
00:06:49,149 --> 00:06:46,989

the Japanese experiment module consists

139

00:06:51,249 --> 00:06:49,159

of a pressurized shirtsleeve compartment

140

00:06:53,529 --> 00:06:51,259

for living and working a remote

141

00:06:56,439 --> 00:06:53,539

manipulator arm for outside experiments

142

00:06:59,079 --> 00:06:56,449

an exposed facility for astronomical and

143

00:07:02,849 --> 00:06:59,089

her fob servation and to logistics

144

00:07:05,439 --> 00:07:02,859

modules to store and warehouse materials

145

00:07:07,119 --> 00:07:05,449

tester now underway to evaluate the ease

146

00:07:11,229 --> 00:07:07,129

with which the crew can operate inside

147

00:07:13,299 --> 00:07:11,239

the module here a technician occupies a

148

00:07:15,789 --> 00:07:13,309

sophisticated seat that simulates body

149

00:07:18,429 --> 00:07:15,799

posture in orbit and I mark recorder is

150

00:07:20,319 --> 00:07:18,439

mounted on his head the moving mark on

151
00:07:22,569 --> 00:07:20,329
the screen traces I movements across the

152
00:07:25,229 --> 00:07:22,579
workstations panel as the technician is

153
00:07:27,429 --> 00:07:25,239
instructed to perform a variety of tasks

154
00:07:29,379 --> 00:07:27,439
data from these tests will enable

155
00:07:32,799 --> 00:07:29,389
designers to improve the workstations

156
00:07:34,139 --> 00:07:32,809
physical layout tests are also being run

157
00:07:36,519 --> 00:07:34,149
on the remote manipulator system

158
00:07:39,669 --> 00:07:36,529
operated inside the spacecraft to

159
00:07:41,529 --> 00:07:39,679
perform tasks outside this model allows

160
00:07:43,479 --> 00:07:41,539
software engineers to check computer

161
00:07:46,269 --> 00:07:43,489
programs which operate and control the

162
00:07:49,350 --> 00:07:46,279
arm in space video cameras mounted on

163
00:07:52,299 --> 00:07:49,360

the arm help in the evaluation process

164

00:07:54,759 --> 00:07:52,309

these computer generated images simulate

165

00:07:57,069 --> 00:07:54,769

operation of the manipulator arm the

166

00:07:58,839 --> 00:07:57,079

pictures include the control panel two

167

00:08:00,579 --> 00:07:58,849

views from TV cameras that will be

168

00:08:03,759 --> 00:08:00,589

mounted outside the spacecraft and the

169

00:08:05,259 --> 00:08:03,769

view out the window the knowledge and

170

00:08:07,269 --> 00:08:05,269

skills gained in developing this

171

00:08:09,759 --> 00:08:07,279

advanced technology have benefits here

172

00:08:11,379 --> 00:08:09,769

on earth when risky tasks must be

173

00:08:13,689 --> 00:08:11,389

performed in hazardous or toxic

174

00:08:15,850 --> 00:08:13,699

environments sophisticated robots like

175

00:08:17,650 --> 00:08:15,860

these are able to spare human workers

176
00:08:19,550 --> 00:08:17,660
from danger

177
00:08:21,500 --> 00:08:19,560
experiments that are difficult or

178
00:08:29,570 --> 00:08:21,510
impossible to conduct on earth can be

179
00:08:31,460 --> 00:08:29,580
carried out in the vacuum of space the

180
00:08:33,440 --> 00:08:31,470
space station processing facility at the

181
00:08:35,000 --> 00:08:33,450
Kennedy Space Center is where elements

182
00:08:37,700 --> 00:08:35,010
of freedom will arrive for final

183
00:08:39,620 --> 00:08:37,710
assembly and testing cleanroom

184
00:08:41,930 --> 00:08:39,630
environments cranes and video

185
00:08:44,029 --> 00:08:41,940
communication systems allow NASA staff

186
00:08:46,850 --> 00:08:44,039
to perform a wide variety of pre-launch

187
00:08:48,800 --> 00:08:46,860
activities specially designed work

188
00:08:50,600 --> 00:08:48,810

stands will support the hardware while

189

00:08:53,060 --> 00:08:50,610

trials and simulations are run on the

190

00:08:56,240 --> 00:08:53,070

fluid electrical control and monitoring

191

00:08:58,220 --> 00:08:56,250

systems the building is designed to

192

00:09:01,010 --> 00:08:58,230

contain hardware operations facilities

193

00:09:03,530 --> 00:09:01,020

offline laboratories control rooms to

194

00:09:06,980 --> 00:09:03,540

support test activities and areas for

195

00:09:08,840 --> 00:09:06,990

logistics and general support after

196

00:09:10,610 --> 00:09:08,850

components for freedom are assembled and

197

00:09:12,440 --> 00:09:10,620

tested they are transported to the

198

00:09:18,200 --> 00:09:12,450

launch pad for installation and delivery

199

00:09:20,950 --> 00:09:18,210

on board the space shuttle on April 60

200

00:09:23,330 --> 00:09:20,960

1991 groundbreaking ceremonies were held

201
00:09:24,910 --> 00:09:23,340
is going to be located on this side

202
00:09:27,680 --> 00:09:24,920
right over here to your left

203
00:09:29,480 --> 00:09:27,690
construction of the 460 6,000

204
00:09:33,670 --> 00:09:29,490
square-foot facility has involved more

205
00:09:36,140 --> 00:09:33,680
than 90 contractors from 22 states

206
00:09:39,620 --> 00:09:36,150
structural steel was erected in October

207
00:09:42,320 --> 00:09:39,630
of 1991 and the building was topped off

208
00:09:43,970 --> 00:09:42,330
in april of nineteen ninety two early

209
00:09:46,100 --> 00:09:43,980
activities include construction of

210
00:09:50,120 --> 00:09:46,110
footers piers tunnels and underground

211
00:09:59,030 --> 00:09:50,130
plumbing the space station processing

212
00:10:07,230 --> 00:10:02,010
International Cooperation scientific