



1  
00:00:38,280 --> 00:00:32,280  
the human body a complex and sometimes

2  
00:00:44,639 --> 00:00:38,290  
fragile machine as new plans are set

3  
00:00:54,890 --> 00:00:47,529  
new medical challenges will have to be

4  
00:00:59,610 --> 00:00:57,480  
previous space flights have demonstrated

5  
00:01:01,830 --> 00:00:59,620  
the physiological changes that may be

6  
00:01:13,560 --> 00:01:01,840  
expected after living in a microgravity

7  
00:01:22,730 --> 00:01:16,770  
areas of particular concern include

8  
00:01:36,780 --> 00:01:31,289  
loss of muscle and bone mass and changes

9  
00:01:39,779 --> 00:01:36,790  
in blood chemistry in addition to the

10  
00:01:42,090 --> 00:01:39,789  
physiological changes astronauts and

11  
00:01:44,430 --> 00:01:42,100  
scientists on space station will need to

12  
00:01:47,039 --> 00:01:44,440  
cope with common ailments such as two

13  
00:01:53,910 --> 00:01:47,049

things as well as more serious medical

14

00:01:56,040 --> 00:01:53,920

conditions such as kidney stones crew

15

00:01:58,350 --> 00:01:56,050

members must also be prepared to face

16

00:02:03,350 --> 00:01:58,360

many of the hazards which are found in

17

00:02:14,789 --> 00:02:10,640

with longer missions larger crews and

18

00:02:16,800 --> 00:02:14,799

the complexities of a medical rescue the

19

00:02:23,460 --> 00:02:16,810

health of the crew will be an important

20

00:02:25,080 --> 00:02:23,470

factor to the success of the mission the

21

00:02:29,340 --> 00:02:25,090

space station health maintenance

22

00:02:32,250 --> 00:02:29,350

facility or h MF will provide necessary

23

00:02:35,280 --> 00:02:32,260

in-flight medical care including

24

00:02:37,770 --> 00:02:35,290

prevention diagnosis treatment and care

25

00:02:45,000 --> 00:02:37,780

during transport if the patient must be

26

00:02:47,340 --> 00:02:45,010

evacuated the hmf is currently under

27

00:02:55,020 --> 00:02:47,350

development by NASA at the Johnson Space

28

00:02:57,720 --> 00:02:55,030

Center in Houston Texas because of its

29

00:03:00,030 --> 00:02:57,730

specialized function the hmf is being

30

00:03:02,849 --> 00:03:00,040

designed primarily by a team of NASA

31

00:03:09,300 --> 00:03:02,859

physicians biomedical engineers and

32

00:03:12,090 --> 00:03:09,310

other allied health professionals in

33

00:03:14,099 --> 00:03:12,100

building the hmf current off-the-shelf

34

00:03:17,160 --> 00:03:14,109

equipment will be used as much as

35

00:03:19,860 --> 00:03:17,170

possible however existing technology

36

00:03:22,410 --> 00:03:19,870

must be adapted in order to operate in

37

00:03:29,300 --> 00:03:22,420

microgravity and conform to space

38

00:03:34,210 --> 00:03:32,449

the kc-135 provides a testing

39

00:03:42,320 --> 00:03:34,220

environment for equipment and procedures

40

00:03:45,710 --> 00:03:42,330

to be used in space using a parabolic

41

00:03:48,290 --> 00:03:45,720

flight path the kc-135 can simulate

42

00:03:58,160 --> 00:03:48,300

weightlessness for a few valuable

43

00:04:02,750 --> 00:03:58,170

seconds here a prototype of the patient

44

00:04:05,000 --> 00:04:02,760

restraint system is analyzed this piece

45

00:04:08,690 --> 00:04:05,010

of equipment must be both flexible and

46

00:04:11,809 --> 00:04:08,700

portable on space station it will be

47

00:04:19,520 --> 00:04:11,819

used as a stretcher a treatment area a

48

00:04:21,199 --> 00:04:19,530

dental chair and an x-ray table the

49

00:04:23,810 --> 00:04:21,209

health maintenance facility has been

50

00:04:30,440 --> 00:04:23,820

divided into flight subsystems as well

51  
00:04:32,719 --> 00:04:30,450  
as ground support these subsystems are

52  
00:04:38,990 --> 00:04:32,729  
similar to the medical services found in

53  
00:04:44,210 --> 00:04:42,080  
for example the hmf will be designed to

54  
00:04:51,980 --> 00:04:44,220  
provide emergency medical care for

55  
00:04:59,140 --> 00:04:51,990  
injuries medical life-support with

56  
00:05:12,460 --> 00:05:05,250  
respiratory support intravenous or IV

57  
00:05:19,660 --> 00:05:12,470  
fluid and nutritional support a variety

58  
00:05:26,790 --> 00:05:19,670  
of physicians instruments imaging for

59  
00:05:36,000 --> 00:05:29,770  
clinical laboratory to provide tests and

60  
00:05:41,140 --> 00:05:38,200  
pharmacy containing necessary

61  
00:05:52,420 --> 00:05:41,150  
medications and a computerized inventory

62  
00:05:54,610 --> 00:05:52,430  
control system central supply and a

63  
00:06:02,380 --> 00:05:54,620

hyperbaric facility for treatment of

64

00:06:04,360 --> 00:06:02,390

decompression sickness although each of

65

00:06:06,760 --> 00:06:04,370

these capabilities will be needed on the

66

00:06:09,340 --> 00:06:06,770

space station it isn't feasible to

67

00:06:14,350 --> 00:06:09,350

launch a large hospital facility into

68

00:06:17,100 --> 00:06:14,360

orbit as a result the entire health

69

00:06:19,690 --> 00:06:17,110

maintenance facility with its preventive

70

00:06:22,150 --> 00:06:19,700

diagnostic and therapeutic capabilities

71

00:06:27,940 --> 00:06:22,160

must be designed to fit into a very

72

00:06:32,770 --> 00:06:30,700

in a hospital a large staff of highly

73

00:06:36,490 --> 00:06:32,780

trained professionals provides health

74

00:06:45,610 --> 00:06:36,500

care services the space station will not

75

00:06:49,210 --> 00:06:45,620

have those resources because of limited

76  
00:06:55,620 --> 00:06:49,220  
medical personnel the hmf equipment will

77  
00:07:04,900 --> 00:06:58,870  
in order to provide maximum flexibility

78  
00:07:06,070 --> 00:07:04,910  
the hmf will have a modular design each

79  
00:07:08,560 --> 00:07:06,080  
piece of equipment will be

80  
00:07:15,120 --> 00:07:08,570  
self-contained and will be held in

81  
00:07:19,900 --> 00:07:17,710  
this modular design will allow the

82  
00:07:22,540 --> 00:07:19,910  
components to be switched out easily for

83  
00:07:30,880 --> 00:07:22,550  
repairs or to be upgraded as new

84  
00:07:32,800 --> 00:07:30,890  
technology becomes available the patient

85  
00:07:35,380 --> 00:07:32,810  
restraint system which provides the

86  
00:07:38,020 --> 00:07:35,390  
treatment area will be located in front

87  
00:07:44,860 --> 00:07:38,030  
of the racks and will be stowed when not

88  
00:07:51,160 --> 00:07:44,870

in use preventive health care is another

89

00:07:53,410 --> 00:07:51,170

major objective of the hmf exercise

90

00:07:58,390 --> 00:07:53,420

protocols will be designed to meet the

91

00:08:00,520 --> 00:07:58,400

individual needs of each crew member in

92

00:08:03,520 --> 00:08:00,530

addition to providing a cardiovascular

93

00:08:05,710 --> 00:08:03,530

workout these protocols will be used to

94

00:08:09,570 --> 00:08:05,720

help prevent the detrimental effects of

95

00:08:12,120 --> 00:08:09,580

weightlessness on bone and muscle

96

00:08:15,010 --> 00:08:12,130

exercise sessions will also generate

97

00:08:21,070 --> 00:08:15,020

physiological data for later analysis by

98

00:08:23,410 --> 00:08:21,080

NASA scientists here a computerized

99

00:08:27,160 --> 00:08:23,420

video system is being developed for use

100

00:08:29,290 --> 00:08:27,170

with the exercise equipment this system

101  
00:08:37,709 --> 00:08:29,300  
is designed to motivate the crew member

102  
00:08:50,769 --> 00:08:40,060  
another piece of equipment currently

103  
00:08:56,949 --> 00:08:54,699  
which converts to a rower this machine

104  
00:08:59,170 --> 00:08:56,959  
will provide a cardiovascular workout

105  
00:09:04,960 --> 00:08:59,180  
with the added feature of offering a

106  
00:09:07,600 --> 00:09:04,970  
choice of exercise activities unlike a

107  
00:09:10,749 --> 00:09:07,610  
hospital with its mounds of forms and

108  
00:09:13,269 --> 00:09:10,759  
stacks of paper the hmf will use the

109  
00:09:15,400 --> 00:09:13,279  
space station's computer resources to

110  
00:09:21,460 --> 00:09:15,410  
integrate all the information from each

111  
00:09:23,860 --> 00:09:21,470  
subsystem dr. James Logan manager of the

112  
00:09:26,470 --> 00:09:23,870  
Medical Sciences Space Station office at

113  
00:09:28,689 --> 00:09:26,480

the Johnson Space Center explains this

114

00:09:30,549 --> 00:09:28,699

innovative approach one of the things

115

00:09:32,980 --> 00:09:30,559

that we're developing at Johnson Space

116

00:09:36,819 --> 00:09:32,990

Center is a concept known as the medical

117

00:09:39,009 --> 00:09:36,829

information bus or MIB the MIB would

118

00:09:41,139 --> 00:09:39,019

enable all the medical devices on the

119

00:09:43,059 --> 00:09:41,149

health maintenance facility to not only

120

00:09:45,569 --> 00:09:43,069

interact with each other but also

121

00:09:47,619 --> 00:09:45,579

interact with the hmf computer

122

00:09:48,939 --> 00:09:47,629

additional things that would be housed

123

00:09:51,460 --> 00:09:48,949

in the health maintenance facility

124

00:09:53,679 --> 00:09:51,470

computer would be things like diagnostic

125

00:09:57,400 --> 00:09:53,689

and treatment protocols or inventory

126  
00:09:59,160 --> 00:09:57,410  
management for the hmf another aspect

127  
00:10:01,540 --> 00:09:59,170  
would be the crew performance data

128  
00:10:04,689 --> 00:10:01,550  
especially as it related to the exercise

129  
00:10:06,970 --> 00:10:04,699  
devices if there was an illness on board

130  
00:10:09,100 --> 00:10:06,980  
the space station after the crew medical

131  
00:10:10,869 --> 00:10:09,110  
officer did a diagnostic physical exam

132  
00:10:13,749 --> 00:10:10,879  
he would enter the results of that

133  
00:10:15,490 --> 00:10:13,759  
physical exam on a keyboard which would

134  
00:10:17,980 --> 00:10:15,500  
put those results in an electronic

135  
00:10:20,230 --> 00:10:17,990  
medical record however all the

136  
00:10:23,199 --> 00:10:20,240  
laboratory data and the radiographic

137  
00:10:25,480 --> 00:10:23,209  
data and the electrophysiologic data

138  
00:10:27,460 --> 00:10:25,490

such as an electrocardiogram would

139

00:10:30,670 --> 00:10:27,470

automatically be entered into an

140

00:10:32,530 --> 00:10:30,680

electronic medical record this is the

141

00:10:34,629 --> 00:10:32,540

Mission Control Center in Houston Texas

142

00:10:36,759 --> 00:10:34,639

this is the nerve center for the entire

143

00:10:38,980 --> 00:10:36,769

mission the flight director and all the

144

00:10:40,090 --> 00:10:38,990

flight controllers stay in this room

145

00:10:42,669 --> 00:10:40,100

throughout the duration of the mission

146

00:10:45,759 --> 00:10:42,679

this is also where the mission surgeon

147

00:10:47,410 --> 00:10:45,769

sits after the crew medical officer on

148

00:10:50,980 --> 00:10:47,420

the space station gathers all the

149

00:10:52,960 --> 00:10:50,990

medical data and the data is collated by

150

00:10:55,059 --> 00:10:52,970

the medical information bus that

151  
00:10:57,489 --> 00:10:55,069  
information is downlink to the earth and

152  
00:10:59,829 --> 00:10:57,499  
reconstructed at this console here in

153  
00:11:02,019 --> 00:10:59,839  
Mission Control when the information is

154  
00:11:03,310 --> 00:11:02,029  
reconstructed the mission surgeon has to

155  
00:11:05,590 --> 00:11:03,320  
make several key decision

156  
00:11:09,070 --> 00:11:05,600  
the first decision he or she would have

157  
00:11:10,960 --> 00:11:09,080  
to make is whether or not to activate a

158  
00:11:12,550 --> 00:11:10,970  
group of consultants which would be

159  
00:11:15,130 --> 00:11:12,560  
other physicians and surgeons located

160  
00:11:17,410 --> 00:11:15,140  
all across the country to have them

161  
00:11:20,350 --> 00:11:17,420  
actually look at the data with him or

162  
00:11:22,120 --> 00:11:20,360  
her the next decision that the doctor

163  
00:11:24,000 --> 00:11:22,130

would have to make is whether or not the

164

00:11:26,920 --> 00:11:24,010

medical condition can be treated

165

00:11:29,980 --> 00:11:26,930

definitively at the hmf onboard the

166

00:11:33,040 --> 00:11:29,990

space station or whether a rescue needs

167

00:11:35,020 --> 00:11:33,050

to be even considered it becomes obvious

168

00:11:37,540 --> 00:11:35,030

then when you consider the mission and

169

00:11:39,580 --> 00:11:37,550

the cost of medical rescue that one of

170

00:11:41,350 --> 00:11:39,590

the prime goals of having a health

171

00:11:44,350 --> 00:11:41,360

maintenance facility on board the space

172

00:11:47,230 --> 00:11:44,360

station is to be able to treat as many

173

00:11:52,660 --> 00:11:47,240

medical conditions as possible in flight

174

00:11:54,640 --> 00:11:52,670

without having a rescue here on earth

175

00:11:57,490 --> 00:11:54,650

the development of a health maintenance

176

00:12:04,390 --> 00:11:57,500

facility may alter some current concepts

177

00:12:06,850 --> 00:12:04,400

for medical care the key to the hmf

178

00:12:09,490 --> 00:12:06,860

concept is the ability to combine

179

00:12:14,320 --> 00:12:09,500

existing equipment with computer

180

00:12:16,510 --> 00:12:14,330

technology this integrated package of

181

00:12:18,400 --> 00:12:16,520

health care resources can be used to

182

00:12:20,770 --> 00:12:18,410

assist in the diagnosis and management

183

00:12:23,800 --> 00:12:20,780

of medical problems which occur in

184

00:12:30,820 --> 00:12:23,810

remote environments such as isolated

185

00:12:33,010 --> 00:12:30,830

rural communities also the medical

186

00:12:35,800 --> 00:12:33,020

information bus can improve the quality

187

00:12:40,420 --> 00:12:35,810

of care in areas such as a hospital

188

00:12:42,550 --> 00:12:40,430

intensive care unit by integrating the

189

00:12:44,800 --> 00:12:42,560

information gathered from all the

190

00:12:46,660 --> 00:12:44,810

monitoring equipment the medical

191

00:12:49,320 --> 00:12:46,670

information bus will simplify the

192

00:12:53,190 --> 00:12:49,330

various equipment connections and

193

00:12:56,410 --> 00:12:53,200

eliminate most of the paperwork burden

194

00:13:02,180 --> 00:12:56,420

this will allow the care providers more

195

00:13:08,460 --> 00:13:05,220

on previous space flights there was

196

00:13:10,110 --> 00:13:08,470

nothing comparable to the hmf during

197

00:13:12,930 --> 00:13:10,120

those missions the need for in-flight

198

00:13:18,110 --> 00:13:12,940

health care was not as great as it will

199

00:13:23,300 --> 00:13:20,930

in order to successfully live and work

200

00:13:25,760 --> 00:13:23,310

on the space station crew members will

201

00:13:32,199 --> 00:13:25,770

have to maintain their health without

202

00:13:39,259 --> 00:13:34,730

the space station health maintenance

203

00:13:41,629 --> 00:13:39,269

facility the hmf will be an important

204

00:13:43,910 --> 00:13:41,639

step in understanding the intricacy of