1
00:00:51,590 --> 00:01:08,570
you

2
00:01:30,950 --> 00:01:16,110
at one false step for man one giant leap

3
00:01:38,539 --> 00:01:34,490
a sleek jet aircraft soars through a

4
00:01:40,760 --> 00:01:38,549
clear blue sky a hard-working piece of

5
00:01:45,380 --> 00:01:40,770
agricultural machine replies an ocean of

6
00:01:48,620 --> 00:01:45,390
fertile farmland an airplane a farm

7
00:01:51,440 --> 00:01:48,630
implement as different as each of them

8
00:01:54,710 --> 00:01:51,450
is from the other they share a most

9
00:01:56,690 --> 00:01:54,720
important feature in common each is made

10
00:02:00,770 --> 00:01:56,700
by a company that is committed to the

11
00:02:03,710 --> 00:02:00,780
commercial use of space but along with

12
00:02:07,029 --> 00:02:03,720
that similarity there is a contrast as

13
00:02:09,949 --> 00:02:07,039

well the airplane maker is conducting

14
00:02:13,910 --> 00:02:09,959
microgravity research in an area that is

15
00:02:15,830 --> 00:02:13,920
totally new to it pharmaceuticals on the

16
00:02:17,930 --> 00:02:15,840
other hand the agricultural equipment

17
00:02:20,990 --> 00:02:17,940
company will be using what it learns

18
00:02:23,030 --> 00:02:21,000
from microgravity research to improve a

19
00:02:26,199 --> 00:02:23,040
basic bread and butter manufacturing

20
00:02:29,059 --> 00:02:26,209
process it is used for years producing

21
00:02:32,210 --> 00:02:29,069
cast-iron components for its farm

22
00:02:34,509 --> 00:02:32,220
machinery there's something else worth

23
00:02:36,770 --> 00:02:34,519
noting about these two companies

24
00:02:42,110 --> 00:02:36,780
agricultural products are America's

25
00:02:44,240 --> 00:02:42,120
leading export airplanes are second the

26
00:02:47,270 --> 00:02:44,250
airplane maker and the farm equipment

27
00:02:49,180 --> 00:02:47,280
manufacturer are just two examples of a

28
00:02:52,430 --> 00:02:49,190
small band of forward-looking

29
00:02:54,590 --> 00:02:52,440
forward-thinking and forward doing

30
00:02:56,720 --> 00:02:54,600
companies that are committed to

31
00:02:59,569 --> 00:02:56,730
improving their competitive positions

32
00:03:02,900 --> 00:02:59,579
and their profit pictures through the

33
00:03:04,449 --> 00:03:02,910
commercial use of space they are

34
00:03:07,699 --> 00:03:04,459
companies working in everything from

35
00:03:10,789 --> 00:03:07,709
electronic crystals to internal

36
00:03:12,830 --> 00:03:10,799
combustion engines they are companies

37
00:03:15,890 --> 00:03:12,840
that already have taken the first steps

38
00:03:20,630 --> 00:03:15,900

toward profiting from the commercial use

39
00:03:22,729 --> 00:03:20,640
of space but most companies are not yet

40
00:03:25,910 --> 00:03:22,739
involved in commercial activities in

41
00:03:30,680 --> 00:03:25,920
space many are uncertain as to just what

42
00:03:32,930 --> 00:03:30,690
space commercialization means to assist

43
00:03:36,259 --> 00:03:32,940
individual managers in private companies

44
00:03:38,110 --> 00:03:36,269
to remove that uncertainty as well as to

45
00:03:41,360 --> 00:03:38,120
support america's national space

46
00:03:43,939 --> 00:03:41,370
commercialization goals lewis research

47
00:03:45,520 --> 00:03:43,949
center has formed an office of space

48
00:03:48,440 --> 00:03:45,530
commercial

49
00:03:51,619 --> 00:03:48,450
the purpose of that office is to help a

50
00:03:54,559 --> 00:03:51,629
company uncover and assess the relevance

51
00:03:58,300 --> 00:03:54,569
of commercial space activities to its

52
00:04:03,080 --> 00:03:58,310
operations manager Harvey Schwartz

53
00:04:05,089 --> 00:04:03,090
explains the general field of commercial

54
00:04:08,300 --> 00:04:05,099
space activities can be broken down in

55
00:04:09,620 --> 00:04:08,310
four major areas first space is a

56
00:04:12,259 --> 00:04:09,630
vantage point from which we can

57
00:04:15,140 --> 00:04:12,269
communicate forecast the weather and

58
00:04:18,289 --> 00:04:15,150
from which we can also observe and map

59
00:04:20,840 --> 00:04:18,299
the earth's resources secondly space is

60
00:04:22,750 --> 00:04:20,850
a location to which the private sector

61
00:04:25,640 --> 00:04:22,760
can provide transportation services

62
00:04:27,710 --> 00:04:25,650
third space is also a location where we

63
00:04:30,080 --> 00:04:27,720

require other kinds of services such as

64
00:04:32,659 --> 00:04:30,090
satellite repair which are not done by

65
00:04:34,670 --> 00:04:32,669
the federal government and fourth space

66
00:04:36,650 --> 00:04:34,680
is a unique environment in which we can

67
00:04:39,530 --> 00:04:36,660
conduct microgravity research on new

68
00:04:41,300 --> 00:04:39,540
processes and products the office of

69
00:04:43,460 --> 00:04:41,310
space commercialization here at the NASA

70
00:04:45,320 --> 00:04:43,470
Lewis Research Center Act can act in a

71
00:04:47,600 --> 00:04:45,330
sense as a broker between the needs of

72
00:04:49,490 --> 00:04:47,610
the private sector and the engineering

73
00:04:52,760 --> 00:04:49,500
and research capabilities we have here

74
00:04:55,870 --> 00:04:52,770
in great depth Louis can offer

75
00:04:59,200 --> 00:04:55,880
researchers hands-on help in a host of

76
00:05:02,930 --> 00:04:59,210
scientific and engineering disciplines

77
00:05:07,430 --> 00:05:02,940
communications space power launch

78
00:05:11,659 --> 00:05:07,440
vehicles microgravity Sciences metals

79
00:05:16,070 --> 00:05:11,669
and alloys composites ceramics and

80
00:05:21,740 --> 00:05:16,080
glasses electronic materials fluid

81
00:05:23,659 --> 00:05:21,750
physics and combustion the assistance

82
00:05:26,600 --> 00:05:23,669
that Lois can give might range from

83
00:05:28,940 --> 00:05:26,610
simply answering general questions to

84
00:05:31,940 --> 00:05:28,950
offering expert and experienced counsel

85
00:05:35,270 --> 00:05:31,950
to help answer the one all-important

86
00:05:38,480 --> 00:05:35,280
specific question can I improve my

87
00:05:40,670 --> 00:05:38,490
company's operations by examining the

88
00:05:45,469 --> 00:05:40,680

physical principles on which they are

89
00:05:47,300 --> 00:05:45,479
based in a microgravity environment for

90
00:05:49,940 --> 00:05:47,310
a company to pursue a commercial venture

91
00:05:53,899 --> 00:05:49,950
in space the project must be broken down

92
00:05:57,320 --> 00:05:53,909
from conception through execution into a

93
00:05:58,550 --> 00:05:57,330
series of steps each of which must fit

94
00:06:00,470 --> 00:05:58,560
the duration and

95
00:06:03,650 --> 00:06:00,480
resource requirements of that company's

96
00:06:06,220 --> 00:06:03,660
planning horizons that makes it possible

97
00:06:08,750 --> 00:06:06,230
to review progress periodically and

98
00:06:11,510 --> 00:06:08,760
reassess the commercial potential of a

99
00:06:15,560 --> 00:06:11,520
project before committing more time and

100
00:06:18,470 --> 00:06:15,570
money to it it's a sensible step-by-step

101
00:06:20,570 --> 00:06:18,480
approach that lewis can support with

102
00:06:23,450 --> 00:06:20,580
unique tailor-made facilities

103
00:06:26,060 --> 00:06:23,460
particularly in the area of microgravity

104
00:06:28,970 --> 00:06:26,070
research the first of these facilities

105
00:06:32,629 --> 00:06:28,980
is the microgravity material science

106
00:06:35,540 --> 00:06:32,639
laboratory the purpose of the mm SL is

107
00:06:37,820 --> 00:06:35,550
to give American companies a competitive

108
00:06:39,800 --> 00:06:37,830
edge in their markets by helping them

109
00:06:42,469 --> 00:06:39,810
take the first step toward developing

110
00:06:45,770 --> 00:06:42,479
better products and processes through

111
00:06:49,760 --> 00:06:45,780
microgravity research specifically the

112
00:06:52,460 --> 00:06:49,770
mm SL offers a low-cost low-risk way for

113
00:06:55,060 --> 00:06:52,470

researchers to test new ideas for

114
00:06:57,950 --> 00:06:55,070
material science and process research

115
00:07:01,719 --> 00:06:57,960
before starting formal efforts in their

116
00:07:05,990 --> 00:07:01,729
own laboratories Thomas K Glasgow

117
00:07:08,719 --> 00:07:06,000
manager of the mm SL at lewis elaborates

118
00:07:11,090 --> 00:07:08,729
a company should consider the use of the

119
00:07:12,770 --> 00:07:11,100
microgravity environment if it is

120
00:07:15,860 --> 00:07:12,780
interested in growing more perfect

121
00:07:19,670 --> 00:07:15,870
semiconductors or opto-electronic

122
00:07:23,240 --> 00:07:19,680
crystals the microgravity environment is

123
00:07:24,760 --> 00:07:23,250
also a good laboratory for studying what

124
00:07:29,930 --> 00:07:24,770
are usually convection dominated

125
00:07:32,300 --> 00:07:29,940
processes such as combustion another

126
00:07:34,909 --> 00:07:32,310
reason we're looking at the microgravity

127
00:07:38,060 --> 00:07:34,919
or space flight environment is for

128
00:07:41,180 --> 00:07:38,070
preparation of corrosive glasses such as

129
00:07:44,719 --> 00:07:41,190
those which might interact highly with a

130
00:07:47,000 --> 00:07:44,729
container on earth for these processes

131
00:07:48,920 --> 00:07:47,010
or any other process which would be

132
00:07:51,080 --> 00:07:48,930
dominated by convection or gravity

133
00:07:53,450 --> 00:07:51,090
effects on earth the microgravity

134
00:07:56,829 --> 00:07:53,460
environment of space offers an

135
00:08:02,389 --> 00:08:00,260
the mm SL has equipment with functional

136
00:08:06,019 --> 00:08:02,399
capabilities similar to space shuttle

137
00:08:09,079 --> 00:08:06,029
flight hardware major items in the mm SL

138
00:08:10,879 --> 00:08:09,089

are a general-purpose furnace which

139
00:08:13,899 --> 00:08:10,889
simulates one of the three furnace

140
00:08:16,579 --> 00:08:13,909
cavities flown aboard the shuttle an

141
00:08:19,399 --> 00:08:16,589
electromagnetic levitating furnace with

142
00:08:22,669 --> 00:08:19,409
a one-second instrumented drop tube for

143
00:08:27,070 --> 00:08:22,679
container less solidification up to 10

144
00:08:31,820 --> 00:08:30,320
isothermal dendrite growth apparatus to

145
00:08:33,949 --> 00:08:31,830
observe the growth and shape of

146
00:08:37,389 --> 00:08:33,959
individual free dendrites in a

147
00:08:40,309 --> 00:08:37,399
transparent supercooled melt a

148
00:08:43,309 --> 00:08:40,319
general-purpose resistance heated high

149
00:08:47,710 --> 00:08:43,319
vacuum furnace to heat treat samples in

150
00:08:51,350 --> 00:08:47,720
a vacuum or an inert gas atmosphere a

151
00:08:53,240 --> 00:08:51,360
single axis acoustic levitator to study

152
00:08:59,990 --> 00:08:53,250
the container less solidification of

153
00:09:01,910 --> 00:09:00,000
reactive and unusual glasses a high

154
00:09:10,429 --> 00:09:01,920
temperature batch melt furnace for

155
00:09:14,569 --> 00:09:10,439
glasses and a hot stage microscope to

156
00:09:17,720 --> 00:09:14,579
observe phase separation in glasses in

157
00:09:20,389 --> 00:09:17,730
addition a visiting researcher will be

158
00:09:23,059 --> 00:09:20,399
supported by Lewis's computer capability

159
00:09:25,189 --> 00:09:23,069
and by the center's micro structural

160
00:09:27,579 --> 00:09:25,199
characterization chemical

161
00:09:31,759 --> 00:09:27,589
characterization and spectrometric

162
00:09:34,370 --> 00:09:31,769
analysis facilities the microgravity

163
00:09:37,460 --> 00:09:34,380

material science laboratory however is

164
00:09:41,449 --> 00:09:37,470
only the first step that can be taken by

165
00:09:44,900 --> 00:09:41,459
a researcher at Lewis a typical project

166
00:09:48,470 --> 00:09:44,910
might begin by establishing 1g baseline

167
00:09:51,290 --> 00:09:48,480
data in the mm SL and then proceeding if

168
00:09:54,110 --> 00:09:51,300
indicated to a drop tower or to a

169
00:09:58,569 --> 00:09:54,120
research aircraft to qualify the project

170
00:10:01,550 --> 00:09:58,579
for spaceflight Lewis has to drop towers

171
00:10:03,829 --> 00:10:01,560
the larger of the two is designed to

172
00:10:05,290 --> 00:10:03,839
provide reduced gravity exposure for

173
00:10:08,530 --> 00:10:05,300
either 5 or

174
00:10:11,650 --> 00:10:08,540
10 second periods experiment packages

175
00:10:14,530 --> 00:10:11,660
fall through a distance of 430 feet

176
00:10:17,139 --> 00:10:14,540
during a five-second drop for a

177
00:10:19,509 --> 00:10:17,149
10-second simulation the experiment

178
00:10:22,000 --> 00:10:19,519
package is propelled by means of a

179
00:10:24,490 --> 00:10:22,010
pneumatic accelerator from the bottom of

180
00:10:28,329 --> 00:10:24,500
the tower to within inches of the top

181
00:10:30,610 --> 00:10:28,339
before falling back reducing the air

182
00:10:32,800 --> 00:10:30,620
pressure inside the shaft makes possible

183
00:10:34,990 --> 00:10:32,810
an experimental drop in which

184
00:10:39,750 --> 00:10:35,000
gravitational force has been reduced to

185
00:10:42,670 --> 00:10:39,760
one 100,000 of its normal earth value

186
00:10:44,920 --> 00:10:42,680
high speed motion picture cameras inside

187
00:10:46,870 --> 00:10:44,930
the experiment vehicle record the

188
00:10:52,840 --> 00:10:46,880

experiment during the period of reduced

189
00:10:55,540 --> 00:10:52,850
gravity statistical data such as

190
00:10:58,389 --> 00:10:55,550
pressure temperature and acceleration

191
00:11:02,040 --> 00:10:58,399
are recorded by onboard instrumentation

192
00:11:04,449 --> 00:11:02,050
and transmitted to the control room a

193
00:11:06,400 --> 00:11:04,459
clean room is available for the

194
00:11:08,850 --> 00:11:06,410
preparation of experiments that are

195
00:11:11,710 --> 00:11:08,860
particularly sensitive to contamination

196
00:11:14,860 --> 00:11:11,720
even from normal atmospheric conditions

197
00:11:19,389 --> 00:11:14,870
an example would be certain fluid

198
00:11:21,730 --> 00:11:19,399
physics studies during testing all

199
00:11:24,160 --> 00:11:21,740
activity in the experiment chamber is

200
00:11:28,329 --> 00:11:24,170
monitored on closed-circuit television

201
00:11:30,940 --> 00:11:28,339
in the control room a cross-sectional

202
00:11:33,220 --> 00:11:30,950
scale model of the test chamber provides

203
00:11:37,630 --> 00:11:33,230
a simple visual explanation of the

204
00:11:40,810 --> 00:11:37,640
system and its capabilities most of the

205
00:11:43,360 --> 00:11:40,820
facility is below ground level inside

206
00:11:47,980 --> 00:11:43,370
the concrete shaft is a 20 foot diameter

207
00:11:50,470 --> 00:11:47,990
steel vacuum chamber in the model a

208
00:11:52,630 --> 00:11:50,480
vehicle containing an experiment is

209
00:11:56,350 --> 00:11:52,640
shown at the top of the chamber ready

210
00:11:58,540 --> 00:11:56,360
for a five-second drop at the end of a

211
00:12:00,970 --> 00:11:58,550
drop the experiment package is brought

212
00:12:04,060 --> 00:12:00,980
to a stop in a container of polystyrene

213
00:12:07,150 --> 00:12:04,070

pellets the experiment stops in

214
00:12:12,699 --> 00:12:07,160
approximately 15 feet and experiences a

215
00:12:14,800 --> 00:12:12,709
force of about 35 GS the package is

216
00:12:16,960 --> 00:12:14,810
designed so that there is no damage to

217
00:12:20,510 --> 00:12:16,970
the experiment or to the recording

218
00:12:26,190 --> 00:12:23,370
another frequently used lewis facility

219
00:12:29,670 --> 00:12:26,200
is a smaller ninety five foot drop tower

220
00:12:32,940 --> 00:12:29,680
which can provide 2.2 seconds of reduced

221
00:12:35,790 --> 00:12:32,950
gravity the small drop tower is open to

222
00:12:38,550 --> 00:12:35,800
the atmosphere reduced gravity

223
00:12:40,880 --> 00:12:38,560
conditions are achieved by enclosing the

224
00:12:45,720 --> 00:12:40,890
experiment packaged in a shield to

225
00:12:47,940 --> 00:12:45,730
isolate it from aerodynamic drag longer

226
00:12:51,270 --> 00:12:47,950
periods of reduced gravity are possible

227
00:12:55,020 --> 00:12:51,280
with research aircraft lewis has a

228
00:12:58,110 --> 00:12:55,030
Learjet model 25 a small passenger jet

229
00:13:01,130 --> 00:12:58,120
with a modified interior that serves as

230
00:13:04,950 --> 00:13:01,140
an airborne reduced gravity laboratory

231
00:13:07,140 --> 00:13:04,960
by flying parabolic trajectories it can

232
00:13:12,440 --> 00:13:07,150
produce variable low gravity conditions

233
00:13:14,790 --> 00:13:12,450
for as long as 20 seconds in

234
00:13:17,820 --> 00:13:14,800
nineteen-sixty-nine when Neil Armstrong

235
00:13:21,770 --> 00:13:17,830
stepped onto the moon mankind took its

236
00:13:24,210 --> 00:13:21,780
first giant leap in space today

237
00:13:27,750 --> 00:13:24,220
commercial potential offers us the

238
00:13:30,210 --> 00:13:27,760

chance to take the second commercial use

239
00:13:33,330 --> 00:13:30,220
of space is a tremendous opportunity for

240
00:13:35,430 --> 00:13:33,340
the researcher with good ideas and for

241
00:13:38,100 --> 00:13:35,440
the manager who wants his company to be

242
00:13:41,430 --> 00:13:38,110
in a unique market position in the years

243
00:13:46,110 --> 00:13:41,440
ahead but it is an opportunity that can

244
00:13:48,780 --> 00:13:46,120
be lost by a wait-and-see attitude the

245
00:13:51,450 --> 00:13:48,790
decision to go forward is being made by

246
00:13:54,120 --> 00:13:51,460
those managers who are focusing on what

247
00:13:55,830 --> 00:13:54,130
is possible and are willing to explore

248
00:13:57,990 --> 00:13:55,840
new approaches to meeting the

249
00:14:01,650 --> 00:13:58,000
competitive and technical challenges

250
00:14:04,590 --> 00:14:01,660
that lie before them to take the first

251
00:14:06,180 --> 00:14:04,600
step requires courage however the

252
00:14:08,310 --> 00:14:06,190
opportunity to discover something

253
00:14:12,120 --> 00:14:08,320
totally new through microgravity