
MARSHALL

1
00:00:01,501 --> 00:00:03,236
>> Behind me is the latest

2
00:00:03,236 --> 00:00:05,338
in a series of tests of

3
00:00:05,338 --> 00:00:07,040
a new type of propulsion system

4
00:00:07,040 --> 00:00:08,808
called a solar sail.

5
00:00:08,808 --> 00:00:10,410
Uh, this particular sail

6
00:00:10,410 --> 00:00:11,478
is very large.

7
00:00:11,478 --> 00:00:12,779
Uh, it's about

8
00:00:12,779 --> 00:00:14,547
4,000 square feet,

9
00:00:14,547 --> 00:00:15,181
and this is only

10
00:00:15,181 --> 00:00:16,349
one fourth of it.

11
00:00:16,349 --> 00:00:17,350
In its full size,

12
00:00:17,350 --> 00:00:18,518
when it's deployed in space,

13
00:00:18,518 --> 00:00:20,687

it'll be almost 17,000

14
00:00:20,687 --> 00:00:22,122
square feet in area,

15
00:00:22,122 --> 00:00:22,922
and the thickness

16
00:00:22,922 --> 00:00:24,491
of a human hair.

17
00:00:24,491 --> 00:00:25,892
Now a solar sail

18
00:00:25,892 --> 00:00:27,660
is a propulsion system.

19
00:00:27,660 --> 00:00:29,095
It's not a propulsion system

20
00:00:29,095 --> 00:00:29,829
that'll get a spacecraft

21
00:00:29,829 --> 00:00:31,564
or a rocket off the ground,

22
00:00:31,564 --> 00:00:33,032
but once you get into space,

23
00:00:33,032 --> 00:00:33,767
and you're away from

24
00:00:33,767 --> 00:00:35,001
Earth's gravity,

25
00:00:35,001 --> 00:00:35,902
having all that thrust

26
00:00:35,902 --> 00:00:36,803
of a rocket engine

27
00:00:36,803 --> 00:00:38,872
isn't what's as important.

28
00:00:38,872 --> 00:00:41,207
What's important is efficiency,

29
00:00:41,207 --> 00:00:42,175
and being able to get

30
00:00:42,175 --> 00:00:43,843
a lot of thrust to travel

31
00:00:43,843 --> 00:00:46,546
from one position to another.

32
00:00:46,546 --> 00:00:47,714
And a solar sail

33
00:00:47,714 --> 00:00:49,783
achieves that by reflecting

34
00:00:49,783 --> 00:00:51,584
sunlight, just like a sailboat

35
00:00:51,584 --> 00:00:53,887
on the lake reflects the wind.

36
00:00:53,887 --> 00:00:55,588
So this solar sail

37
00:00:55,588 --> 00:00:57,323
with its large, lightweight

38
00:00:57,323 --> 00:00:59,592

shiny aluminum coating

39
00:00:59,592 --> 00:01:00,894
behaves just like

40
00:01:00,894 --> 00:01:02,862
that sailboat.

41
00:01:02,862 --> 00:01:04,364
We've had several test flights

42
00:01:04,364 --> 00:01:06,166
of solar sails.

43
00:01:06,166 --> 00:01:08,134
The first was in 2010,

44
00:01:08,134 --> 00:01:09,302
and it was a small sail

45
00:01:09,302 --> 00:01:11,304
called Nano Sail D.

46
00:01:11,304 --> 00:01:13,206
It was about 10 square meters.

47
00:01:13,206 --> 00:01:14,541
Um, I am the principal

48
00:01:14,541 --> 00:01:16,576
investigator for NASA's

49
00:01:16,576 --> 00:01:17,977
first interplanetary

50
00:01:17,977 --> 00:01:19,546
solar sail mission,

51
00:01:19,546 --> 00:01:20,113
which is called

52
00:01:20,113 --> 00:01:22,482
Near Earth Asteroid Scout,

53
00:01:22,482 --> 00:01:23,349
which is set to launch

54
00:01:23,349 --> 00:01:25,385
on the Artemis 1 rocket

55
00:01:25,385 --> 00:01:27,353
in the next several weeks.

56
00:01:27,353 --> 00:01:28,388
That mission will deploy

57
00:01:28,388 --> 00:01:31,357
a 925 square foot sail,

58
00:01:31,357 --> 00:01:32,358
again, the thickness

59
00:01:32,358 --> 00:01:33,793
of a human hair,

60
00:01:33,793 --> 00:01:34,928
and use that reflected

61
00:01:34,928 --> 00:01:36,763
sunlight pressure to take

62
00:01:36,763 --> 00:01:38,565
this spacecraft and its science

63
00:01:38,565 --> 00:01:41,401

camera, provided by NASA JPL,

64
00:01:41,401 --> 00:01:42,602
to study an asteroid

65
00:01:42,602 --> 00:01:45,772
after two years of flight.

66
00:01:45,772 --> 00:01:47,240
The sail deployment test

67
00:01:47,240 --> 00:01:48,241
that we just completed here

68
00:01:48,241 --> 00:01:50,109
at NASA Marshall was really

69
00:01:50,109 --> 00:01:51,578
a test of functionality

70
00:01:51,578 --> 00:01:52,378
of the sail.

71
00:01:52,378 --> 00:01:53,746
Could you get these two

72
00:01:53,746 --> 00:01:55,482
hundred-foot long booms

73
00:01:55,482 --> 00:01:57,317
coiled up, put in a deployer,

74
00:01:57,317 --> 00:01:59,552
attached to a sail that has

75
00:01:59,552 --> 00:02:00,220
the area of over

76
00:02:00,220 --> 00:02:01,521
4,000 square feet when

77
00:02:01,521 --> 00:02:03,356
it's all folded and rolled,

78
00:02:03,356 --> 00:02:04,924
put it in a small box,

79
00:02:04,924 --> 00:02:06,893
and get it to deploy un-aided.

80
00:02:06,893 --> 00:02:08,628
And the answer is, yes.

81
00:02:08,628 --> 00:02:10,830
We had a very successful test,

82
00:02:10,830 --> 00:02:12,465
and the results are evident

83
00:02:12,465 --> 00:02:13,233
in the pictures that

84
00:02:13,233 --> 00:02:13,867
have been taken

85
00:02:13,867 --> 00:02:14,868
and the data we collected

86
00:02:14,868 --> 00:02:16,736
during the test.

87
00:02:16,736 --> 00:02:18,338
And the key to enabling

88
00:02:18,338 --> 00:02:19,372

some of these missions

89
00:02:19,372 --> 00:02:20,473
is having larger

90
00:02:20,473 --> 00:02:21,407
and larger sails

91
00:02:21,407 --> 00:02:22,976
that are very lightweight.

92
00:02:22,976 --> 00:02:23,476
And that's why we're

93
00:02:23,476 --> 00:02:24,644
moving from sails

94
00:02:24,644 --> 00:02:26,145
the size of NEA Scout,

95
00:02:26,145 --> 00:02:28,114
925 square feet,

96
00:02:28,114 --> 00:02:30,750
to 17,800 square feet

97
00:02:30,750 --> 00:02:31,918
with Solar Cruiser,

98
00:02:31,918 --> 00:02:32,685
and in the future,

99
00:02:32,685 --> 00:02:33,753
we'll make sails that

100
00:02:33,753 --> 00:02:35,688
are even larger still.

101
00:02:35,688 --> 00:02:36,990
And the larger the sail,

102
00:02:36,990 --> 00:02:38,124
generally speaking,

103
00:02:38,124 --> 00:02:39,425
the better it has

104
00:02:39,425 --> 00:02:41,194
a capability to do propulsion

105
00:02:41,194 --> 00:02:42,795
and higher thrust.

106
00:02:42,795 --> 00:02:43,730
Some of the missions

107
00:02:43,730 --> 00:02:44,464
that are of interest

108
00:02:44,464 --> 00:02:46,533
for solar sailing are

109
00:02:46,533 --> 00:02:48,935
things like space weather.

110
00:02:48,935 --> 00:02:49,869
Most people on the ground

111
00:02:49,869 --> 00:02:51,104
don't really think about it,

112
00:02:51,104 --> 00:02:52,839
but spacecraft in space

113
00:02:52,839 --> 00:02:54,240

are affected by activities

114
00:02:54,240 --> 00:02:55,408
on the sun.

115
00:02:55,408 --> 00:02:56,876
And there are solar storms

116
00:02:56,876 --> 00:02:57,677
that spread out into

117
00:02:57,677 --> 00:02:58,978
the solar system

118
00:02:58,978 --> 00:03:00,747
that require advance warning

119
00:03:00,747 --> 00:03:01,915
so that our spacecraft

120
00:03:01,915 --> 00:03:03,216
can essentially batten down

121
00:03:03,216 --> 00:03:04,083
the hatches and be ready

122
00:03:04,083 --> 00:03:05,885
to weather the storm.

123
00:03:05,885 --> 00:03:07,453
A solar sail craft

124
00:03:07,453 --> 00:03:09,455
can continually thrust

125
00:03:09,455 --> 00:03:10,990
along the sun/Earth line

126
00:03:10,990 --> 00:03:12,025
between the Earth and the sun,

127
00:03:12,025 --> 00:03:13,126
closer to the sun

128
00:03:13,126 --> 00:03:13,560
than the current

129
00:03:13,560 --> 00:03:14,994
warning satellites,

130
00:03:14,994 --> 00:03:16,329
and increase that warning time

131
00:03:16,329 --> 00:03:18,398
by up to 50%.

132
00:03:18,398 --> 00:03:19,632
Solar sailing captivates

133
00:03:19,632 --> 00:03:20,567
the imagination.

134
00:03:20,567 --> 00:03:21,100
It's the ultimate

135
00:03:21,100 --> 00:03:22,635
green propulsion system.

136
00:03:22,635 --> 00:03:23,436
What we're doing is

137
00:03:23,436 --> 00:03:24,671
we're maneuvering in space

138
00:03:24,671 --> 00:03:25,638

without any fuel,

139
00:03:25,638 --> 00:03:26,773
just using the natural

140
00:03:26,773 --> 00:03:27,774
environment to get from

141
00:03:27,774 --> 00:03:29,208
point A to point B.

142
00:03:29,208 --> 00:03:30,944
As long as the sun is shining,

143
00:03:30,944 --> 00:03:32,545
we can get propulsion.

144
00:03:32,545 --> 00:03:33,446
And the significance

145
00:03:33,446 --> 00:03:34,147
of that is there are

146
00:03:34,147 --> 00:03:35,448
a lot of science missions

147
00:03:35,448 --> 00:03:36,382
that need to be accomplished

148
00:03:36,382 --> 00:03:37,517
that cannot be done

149
00:03:37,517 --> 00:03:39,085
any other way.

150
00:03:39,085 --> 00:03:40,286
It will allow scientists

151
00:03:40,286 --> 00:03:41,721
to gain views of the sun's

152
00:03:41,721 --> 00:03:43,790
north and south poles

153
00:03:43,790 --> 00:03:45,224
on future missions,

154
00:03:45,224 --> 00:03:47,393
which we can't study right now.

155
00:03:47,393 --> 00:03:48,027
The reason why that's

156
00:03:48,027 --> 00:03:49,495
so exciting is I can't

157
00:03:49,495 --> 00:03:51,197
imagine trying to understand

158
00:03:51,197 --> 00:03:52,498
the Earth's weather systems

159
00:03:52,498 --> 00:03:53,333
if we don't know what's

160
00:03:53,333 --> 00:03:54,100
happening at the North

161
00:03:54,100 --> 00:03:55,535
and South Pole.

162
00:03:55,535 --> 00:03:56,803
Scientists are similarly

163
00:03:56,803 --> 00:03:57,737

handicapped when

164
00:03:57,737 --> 00:03:59,505
they try to study the sun,

165
00:03:59,505 --> 00:04:00,340
because they don't have

166
00:04:00,340 --> 00:04:01,741
near continuous observations

167
00:04:01,741 --> 00:04:03,309
of the Poles.

168
00:04:03,309 --> 00:04:04,844
Now solar sails are obviously

169
00:04:04,844 --> 00:04:06,079
not for everything.

170
00:04:06,079 --> 00:04:06,913
Sails are limited to

171
00:04:06,913 --> 00:04:08,081
small spacecraft

172
00:04:08,081 --> 00:04:09,015
and small payloads.

173
00:04:09,015 --> 00:04:10,216
We won't be flying humans

174
00:04:10,216 --> 00:04:11,851
with them anytime soon.

175
00:04:11,851 --> 00:04:12,719
But that doesn't mean

176
00:04:12,719 --> 00:04:13,653
they can't be used

177
00:04:13,653 --> 00:04:15,622
to support human missions.

178
00:04:15,622 --> 00:04:16,689
In near-Earth space,

179
00:04:16,689 --> 00:04:17,957
going to the moon,

180
00:04:17,957 --> 00:04:18,725
they can be put into

181
00:04:18,725 --> 00:04:19,826
novel orbits to give

182
00:04:19,826 --> 00:04:21,594
near-continuous communications

183
00:04:21,594 --> 00:04:22,962
coverage to the moon.

184
00:04:22,962 --> 00:04:23,463
They can give us

185
00:04:23,463 --> 00:04:24,564
observations of what's

186
00:04:24,564 --> 00:04:25,565
happening on the lunar

187
00:04:25,565 --> 00:04:27,900
far side, continuously.

188
00:04:27,900 --> 00:04:29,102

They give us the capability

189
00:04:29,102 --> 00:04:30,136
to maneuver in

190
00:04:30,136 --> 00:04:31,337
near-Earth space,

191
00:04:31,337 --> 00:04:32,205
and take spacecraft from

192
00:04:32,205 --> 00:04:34,874
point A to point B, repeatedly,

193
00:04:34,874 --> 00:04:36,676
over years, because they don't

194
00:04:36,676 --> 00:04:39,078
run out of gas, and eventually

195
00:04:39,078 --> 00:04:41,014
the descendents of this sail,

196
00:04:41,014 --> 00:04:42,048
that are much larger

197
00:04:42,048 --> 00:04:43,483
and much more durable

198
00:04:43,483 --> 00:04:45,451
will fly very close to the sun