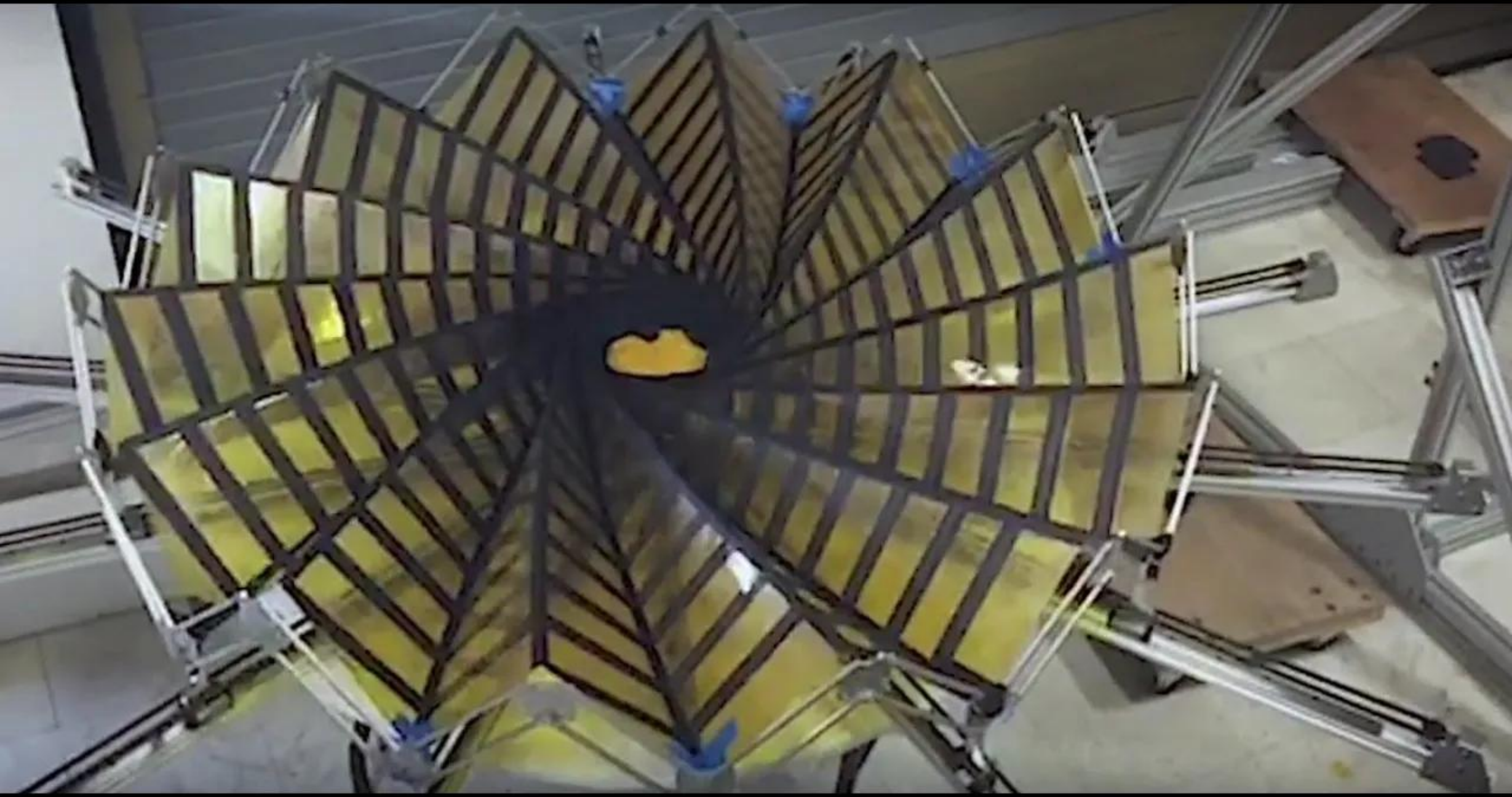

1
00:00:05,059 --> 00:00:03,200
astronomers now know that virtually

2
00:00:07,309 --> 00:00:05,069
every star in the night sky has at least

3
00:00:08,750 --> 00:00:07,319
one planet orbiting around it and they

4
00:00:11,209 --> 00:00:08,760
believe that many of these planet could

5
00:00:12,860 --> 00:00:11,219
Harbor life here's the problem the

6
00:00:14,419 --> 00:00:12,870
planets are orbiting extremely bright

7
00:00:16,099 --> 00:00:14,429
star sometimes billions of times

8
00:00:18,950 --> 00:00:16,109
brighter than the reflection off the

9
00:00:21,050 --> 00:00:18,960
planet but if you can block just the

10
00:00:22,519 --> 00:00:21,060
light from the star all of a sudden you

11
00:00:24,019 --> 00:00:22,529
can study the planet in more detail

12
00:00:26,029 --> 00:00:24,029
let's go figure out how to block a

13
00:00:35,569 --> 00:00:26,039

star's light on this episode of crazy

14
00:00:39,960 --> 00:00:37,770
all right we're here with Nik Sigler in

15
00:00:41,549 --> 00:00:39,970
this very fun looking lab Nik you tell

16
00:00:44,069 --> 00:00:41,559
us a little bit about where we are Mike

17
00:00:46,350 --> 00:00:44,079
we're in JPL's starshade lab what

18
00:00:47,970 --> 00:00:46,360
exactly is a starshade used for Mike

19
00:00:50,430 --> 00:00:47,980
there are two techniques that NASA is

20
00:00:52,799 --> 00:00:50,440
advancing to look for life on exoplanets

21
00:00:55,020 --> 00:00:52,809
the star shade basically is a large

22
00:00:57,119 --> 00:00:55,030
shade that is flown outside of a

23
00:00:59,280 --> 00:00:57,129
telescope with the intention of blocking

24
00:01:01,710 --> 00:00:59,290
the light of the star so then we can see

25
00:01:03,720 --> 00:01:01,720
the planets like skirt the shade and

26
00:01:05,130 --> 00:01:03,730
captured by the telescope okay so this

27
00:01:07,440 --> 00:01:05,140
is much like I'm looking up at the Sun

28
00:01:09,300 --> 00:01:07,450
and I want to see a bird or an airplane

29
00:01:10,680 --> 00:01:09,310
I put my hand up to block the sun's

30
00:01:12,540 --> 00:01:10,690
light but we have to do it on a much

31
00:01:14,850 --> 00:01:12,550
larger scale for a star the star shade

32
00:01:17,900 --> 00:01:14,860
itself is tens of meters in diameter

33
00:01:20,040 --> 00:01:17,910
that's the size of a baseball diamond

34
00:01:22,139 --> 00:01:20,050
just about how far away from the

35
00:01:24,330 --> 00:01:22,149
telescope would it happen why it's tens

36
00:01:26,490 --> 00:01:24,340
of thousands of miles you can fit like

37
00:01:28,560 --> 00:01:26,500
four earths between the telescope and

38
00:01:29,279 --> 00:01:28,570

the shade it's got its own propulsion

39
00:01:31,590 --> 00:01:29,289
system

40
00:01:32,999 --> 00:01:31,600
it's literally its own spacecraft how do

41
00:01:34,440 --> 00:01:33,009
we get it up into space that's the

42
00:01:36,330 --> 00:01:34,450
engineering challenge is how do we get

43
00:01:38,280 --> 00:01:36,340
something that has to deploy to tens of

44
00:01:40,319 --> 00:01:38,290
meters of diameter that gets it on top

45
00:01:42,450 --> 00:01:40,329
of a rock so now our engineers have come

46
00:01:45,630 --> 00:01:42,460
up with a technique based on the ancient

47
00:01:47,670 --> 00:01:45,640
practices of origami sounds difficult

48
00:01:49,530 --> 00:01:47,680
how do you know that's gonna work well

49
00:01:52,020 --> 00:01:49,540
we do what we always do we start small

50
00:01:53,280 --> 00:01:52,030
and we work our way up so we started in

51
00:01:55,469 --> 00:01:53,290
this case with something just a few

52
00:01:58,020 --> 00:01:55,479
inches in size then we built something

53
00:02:00,810 --> 00:01:58,030
meter in diameter and we mature it up to

54
00:02:03,090 --> 00:02:00,820
2 meters and now we finally got up to 5

55
00:02:05,219 --> 00:02:03,100
meters the one that flies in space is

56
00:02:07,380 --> 00:02:05,229
gonna be tens of meters okay so you're

57
00:02:09,150 --> 00:02:07,390
using origami to make this really large

58
00:02:11,100 --> 00:02:09,160
star shape it's a fun mechanical

59
00:02:12,330 --> 00:02:11,110
engineering project but you mentioned

60
00:02:13,080 --> 00:02:12,340
that NASA is actually investing in two

61
00:02:15,360 --> 00:02:13,090
different technologies

62
00:02:16,620 --> 00:02:15,370
what's the second technology that one is

63
00:02:18,479 --> 00:02:16,630

called a coronagraph

64
00:02:21,060 --> 00:02:18,489
the coronagraph can we take a look at

65
00:02:22,170 --> 00:02:21,070
that one let's go okay Nick this is

66
00:02:23,850 --> 00:02:22,180
obviously a lot different than the last

67
00:02:25,350 --> 00:02:23,860
lab we were in we're in bunny suits now

68
00:02:26,940 --> 00:02:25,360
are trying to be super clean can you

69
00:02:29,430 --> 00:02:26,950
tell us where we are right now Mike we

70
00:02:31,710 --> 00:02:29,440
are in JPL's high contrast imaging

71
00:02:34,199 --> 00:02:31,720
testbed lab this is where we test the

72
00:02:36,630 --> 00:02:34,209
next-generation space coronagraphs

73
00:02:38,699 --> 00:02:36,640
behind us is one of our vacuum chambers

74
00:02:40,560 --> 00:02:38,709
where we simulate the environment of

75
00:02:42,479 --> 00:02:40,570
space what's the big difference than

76
00:02:44,790 --> 00:02:42,489
approaches here with the starshade we

77
00:02:45,809 --> 00:02:44,800
saw that the blocker was way outside of

78
00:02:47,429 --> 00:02:45,819
the telescope

79
00:02:50,220 --> 00:02:47,439
now as another approach we're going to

80
00:02:51,750 --> 00:02:50,230
take that huge blocker and shrink it

81
00:02:53,970 --> 00:02:51,760
down to the size of something that could

82
00:02:55,739 --> 00:02:53,980
fit in between your fingers this way you

83
00:02:59,250 --> 00:02:55,749
can fit on the back end of a telescope

84
00:03:02,129 --> 00:02:59,260
this particular mask is the size of a

85
00:03:04,470 --> 00:03:02,139
pinhead all of that star light has to be

86
00:03:06,300 --> 00:03:04,480
focused right on to that little pinhead

87
00:03:08,190 --> 00:03:06,310
we want to make sure that the focused

88
00:03:10,530 --> 00:03:08,200

light from the star hits the sweet spot

89
00:03:13,020 --> 00:03:10,540
of the mask so it's critical that we

90
00:03:15,149 --> 00:03:13,030
have a mechanism to control the focus

91
00:03:16,739 --> 00:03:15,159
light all right we saw the star shade

92
00:03:18,479 --> 00:03:16,749
and now the coronagraph they're both

93
00:03:20,429 --> 00:03:18,489
crazy in their own ways and a lot of

94
00:03:21,479 --> 00:03:20,439
really great engineering so what's the

95
00:03:23,369 --> 00:03:21,489
endgame what do we hope to accomplish

96
00:03:25,679 --> 00:03:23,379
Mike we're trying to develop the

97
00:03:28,110 --> 00:03:25,689
technology to be able to look for life

98
00:03:30,899 --> 00:03:28,120
on other planets the hard part is

99
00:03:32,849 --> 00:03:30,909
blocking the light from the star once we

100
00:03:34,409 --> 00:03:32,859
do that we have other technologies that

101
00:03:36,089 --> 00:03:34,419
are much more mature and we'll be in a

102
00:03:38,789 --> 00:03:36,099
better position to look for evidence of

103
00:03:40,409 --> 00:03:38,799
life Nick thank you so much for showing

104
00:03:42,089 --> 00:03:40,419
us both of these approaches in both your

105
00:03:43,500 --> 00:03:42,099
laboratories we really got a sense of

106
00:03:45,209 --> 00:03:43,510
the contrast between the different

107
00:03:46,679 --> 00:03:45,219
approaches hope you guys out there had a

108
00:03:47,970 --> 00:03:46,689
lot of fun learning about it and check

109
00:03:56,670 --> 00:03:47,980
back soon for some more crazy

110
00:04:00,910 --> 00:03:59,050
if you guys like that you can click over

111
00:04:02,380 --> 00:04:00,920
here to watch more crazy engineering or

112
00:04:04,030 --> 00:04:02,390
click here to subscribe to the JPL

113
00:04:05,830 --> 00:04:04,040

YouTube channel if you want to learn a