
Justin Jackson
Materials Engineer
NASA's Marshall Space Flight Center

1
00:00:05,895 --> 00:00:21,693
Music

2
00:00:21,728 --> 00:00:22,908
Our NASA missions operate in

3
00:00:22,943 --> 00:00:24,900
extreme environments that

4
00:00:24,935 --> 00:00:26,372
require stronger, higher

5
00:00:26,407 --> 00:00:27,997
performing materials, such as

6
00:00:28,032 --> 00:00:30,428
composites. Composites are the

7
00:00:30,463 --> 00:00:31,820
materials of the future for

8
00:00:31,855 --> 00:00:33,029
aerospace. We have a fantastic

9
00:00:33,064 --> 00:00:35,062
new addition to our Composites

10
00:00:35,097 --> 00:00:36,733
Technology Center at the

11
00:00:36,768 --> 00:00:38,037
Marshall Space Flight Center.

12
00:00:38,072 --> 00:00:39,796
This new robotics composites

13
00:00:39,831 --> 00:00:41,924

capability will allow us to

14
00:00:41,959 --> 00:00:45,236
build components for our

15
00:00:45,271 --> 00:00:47,365
programs such as our

16
00:00:47,400 --> 00:00:48,676
technology demonstrations

17
00:00:48,711 --> 00:00:50,829
missions program and the

18
00:00:50,864 --> 00:00:52,221
next-generation of spacecraft

19
00:00:52,256 --> 00:00:53,973
for our exploration programs.

20
00:00:54,008 --> 00:00:56,476
Composite materials offer

21
00:00:56,511 --> 00:00:58,196
significant advantages over

22
00:00:58,231 --> 00:00:59,476
traditional materials, like

23
00:00:59,511 --> 00:01:01,420
metals. They can offer weight

24
00:01:01,455 --> 00:01:02,940
savings in the range of 30

25
00:01:02,975 --> 00:01:04,789
percent and also cost savings

26
00:01:04,824 --> 00:01:06,453
up to about 20 percent.

27
00:01:06,488 --> 00:01:08,229
Advanced manufacturing and

28
00:01:08,264 --> 00:01:09,837
composites technology are

29
00:01:09,872 --> 00:01:11,173
exciting the next generation of

30
00:01:11,208 --> 00:01:13,804
engineers. This new capability

31
00:01:13,839 --> 00:01:16,389
will provide a platform for that

32
00:01:16,424 --> 00:01:18,213
next generation to build some of

33
00:01:18,248 --> 00:01:19,828
the largest composite structures

34
00:01:19,863 --> 00:01:22,541
ever conceived. It is

35
00:01:22,576 --> 00:01:24,877
essentially a very sophisticated

36
00:01:24,912 --> 00:01:26,349
tape dispenser. It takes the

37
00:01:26,384 --> 00:01:28,788
composite material, which is

38
00:01:28,823 --> 00:01:30,740

slit down on spools and then

39
00:01:30,775 --> 00:01:32,525
dispenses those through the head

40
00:01:32,560 --> 00:01:34,237
of the machine in a very

41
00:01:34,272 --> 00:01:36,077
precision laid out pattern, and

42
00:01:36,112 --> 00:01:37,965
then places and removes those

43
00:01:38,000 --> 00:01:39,917
tows of composite material

44
00:01:39,952 --> 00:01:42,364
precisely where we want them to.

45
00:01:42,399 --> 00:01:43,948
So that offers us a lot of

46
00:01:43,983 --> 00:01:45,140
flexibility in being able to

47
00:01:45,175 --> 00:01:47,781
fabricate large scale composite

48
00:01:47,816 --> 00:01:51,172
components whether it be fairings

49
00:01:51,207 --> 00:01:53,717
or skirts, any time of a number

50
00:01:53,752 --> 00:01:55,373
of things for buildups. The

51
00:01:55,408 --> 00:01:58,268
robotic platform allows you to

52
00:01:58,303 --> 00:02:00,060
optimize and tailor where you

53
00:02:00,095 --> 00:02:02,781
want those fibers to be. So,

54
00:02:02,816 --> 00:02:04,053
what the machines use is

55
00:02:04,088 --> 00:02:07,085
industry standard slit tape.

56
00:02:07,120 --> 00:02:08,485
So what we're feeding through

57
00:02:08,520 --> 00:02:09,477
the machine for this particular

58
00:02:09,512 --> 00:02:11,973
configuration is half-inch tow.

59
00:02:12,008 --> 00:02:14,332
It is an intermediate modulus

60
00:02:14,367 --> 00:02:16,084
fiber with a toughened epoxy

61
00:02:16,119 --> 00:02:17,333
resin system.

62
00:02:17,368 --> 00:02:19,588
The machine lays down individual

63
00:02:19,623 --> 00:02:21,165

tows of carbon fiber to a

64
00:02:21,200 --> 00:02:23,036
predetermined path which is

65
00:02:23,071 --> 00:02:24,437
dictated by our design and

66
00:02:24,472 --> 00:02:25,685
analysis for any type of

67
00:02:25,720 --> 00:02:26,901
specific strength or loading

68
00:02:26,936 --> 00:02:28,956
conditions. In this particular

69
00:02:28,991 --> 00:02:31,356
facility, we can fabricate

70
00:02:31,391 --> 00:02:33,077
anything up to about a 4-meter

71
00:02:33,112 --> 00:02:36,572
cube. Size is really limited by

72
00:02:36,607 --> 00:02:38,526
your infrastructure. So, these

73
00:02:38,561 --> 00:02:40,141
machines, in the proper setting,

74
00:02:40,176 --> 00:02:42,149
can be made to build extremely

75
00:02:42,184 --> 00:02:44,532
large parts such as monolithic

76
00:02:44,567 --> 00:02:46,396
structures for an SLS class

77
00:02:46,431 --> 00:02:48,420
vehicle. Marshall has a long

78
00:02:48,455 --> 00:02:50,157
history with automated fiber

79
00:02:50,192 --> 00:02:52,180
placement. We've had one of the

80
00:02:52,215 --> 00:02:54,109
first production fiber placement

81
00:02:54,144 --> 00:02:56,006
machines. We built a series of

82
00:02:56,041 --> 00:02:58,541
different parts and pieces for

83
00:02:58,576 --> 00:03:00,620
programs. We made the external

84
00:03:00,655 --> 00:03:02,220
tank nose cap, which was actual

85
00:03:02,255 --> 00:03:03,652
flight hardware, as well as

86
00:03:03,687 --> 00:03:05,109
last summer, we fabricated the

87
00:03:05,144 --> 00:03:06,492
largest out of autoclave

88
00:03:06,527 --> 00:03:09,245

composite tank ever built. This

89
00:03:09,280 --> 00:03:10,685
machine will allow us to build

90
00:03:10,720 --> 00:03:13,189
large structures for SLS and

91
00:03:13,224 --> 00:03:15,836
beyond. It is not just the

92
00:03:15,871 --> 00:03:18,396
robotic technology, it is all

93
00:03:18,431 --> 00:03:20,421
of the other associated

94
00:03:20,456 --> 00:03:22,389
infrastructures. Like clean

95
00:03:22,424 --> 00:03:24,493
rooms. Like large autoclave

96
00:03:24,528 --> 00:03:27,029
capability. Heavy equipment

97
00:03:27,064 --> 00:03:29,589
transportation. The freezers.

98
00:03:29,624 --> 00:03:31,301
The composite cutting

99
00:03:31,336 --> 00:03:33,244
capabilities. Robotic technology

100
00:03:33,279 --> 00:03:36,941
really brings several capability

101
00:03:36,976 --> 00:03:40,109
to us. One is because we can do

102
00:03:40,144 --> 00:03:43,301
manufacturing faster. It affects

103
00:03:43,336 --> 00:03:47,220
the timeline for the composites

104
00:03:47,255 --> 00:03:49,532
material. And also, we can

105
00:03:49,567 --> 00:03:51,677
control and make parts

106
00:03:51,712 --> 00:03:54,589
consistently. Because when you

107
00:03:54,624 --> 00:03:56,629
go from hand lay up to robotic

108
00:03:56,664 --> 00:04:01,349
application, you can do work a

109
00:04:01,384 --> 00:04:03,300
whole lot more accurately with

110
00:04:03,335 --> 00:04:04,524
a whole lot more consistency.

111
00:04:04,559 --> 00:04:06,988
Our guys are excited because

112
00:04:07,023 --> 00:04:08,732
now we have the technology

113
00:04:08,767 --> 00:04:10,364

which is up to par with this