1
00:00:00,000 --> 00:00:10,077
Music full then under narration.

2
00:00:14,875 --> 00:00:15,662
Guidance, navigation

3
00:00:15,782 --> 00:00:18,127
and control GN&C is a

4
00:00:18,536 --> 00:00:19,887
fundamental, cross-cutting

5
00:00:19,915 --> 00:00:21,023
enabling discipline

6
00:00:21,066 --> 00:00:22,429
of spaceflight. Every

7
00:00:22,760 --> 00:00:23,598
flying vehicle needs

8
00:00:24,026 --> 00:00:25,022
it. Any organization

9
00:00:25,530 --> 00:00:27,742
developing space vehicles needs it. So

10
00:00:28,327 --> 00:00:29,150
guidance Navigation and

11
00:00:29,291 --> 00:00:31,022
control is just vital to

12
00:00:31,147 --> 00:00:32,382
getting a spacecraft

13
00:00:32,417 --> 00:00:34,174

from launchpad to where

14
00:00:34,700 --> 00:00:35,599
it needs to go in orbit

15
00:00:35,836 --> 00:00:36,639
and keep it pointing

16
00:00:36,651 --> 00:00:37,327
correctly once it is

17
00:00:37,446 --> 00:00:38,703
on orbit. G N and C is

18
00:00:38,892 --> 00:00:40,286
important from launch

19
00:00:40,321 --> 00:00:42,766
to landing. Recognized as

20
00:00:43,015 --> 00:00:43,725
an Agency leading

21
00:00:44,075 --> 00:00:44,606
developer of

22
00:00:45,495 --> 00:00:45,710
of earth to orbit and

23
00:00:51,403 --> 00:00:51,535
transportation, spacecraft

24
00:00:52,117 --> 00:00:53,343
control, & automated

25
00:00:53,429 --> 00:00:54,847
rendezvous and capture

26
00:00:54,882 --> 00:00:56,511
technology and testing.

27
00:00:56,546 --> 00:00:58,079
We provide critical

28
00:00:58,114 --> 00:00:59,758
GN&C components for the

29
00:00:59,829 --> 00:01:01,693
SLS – the Redundant

30
00:01:01,766 --> 00:01:03,614
Inertial Navigation Unit,

31
00:01:03,702 --> 00:01:05,374
Rate Gyro Assemblies,

32
00:01:05,494 --> 00:01:07,086
and thrust vector control

33
00:01:07,302 --> 00:01:08,702
electronics. Automated

34
00:01:08,757 --> 00:01:10,110
Rendezvous and docking

35
00:01:10,145 --> 00:01:11,455
or capture is the

36
00:01:11,490 --> 00:01:12,655
integration of multiple

37
00:01:12,690 --> 00:01:13,935
space craft or parts

38
00:01:13,970 --> 00:01:15,438

of a space craft in or

39
00:01:15,473 --> 00:01:17,421
beyond Earth orbit; it

40
00:01:17,430 --> 00:01:18,766
consists of algorithms,

41
00:01:18,822 --> 00:01:21,102
software, and sensors for rendezvous and

42
00:01:21,302 --> 00:01:23,070
proximity operations,

43
00:01:23,319 --> 00:01:24,574
mechanisms for docking

44
00:01:24,742 --> 00:01:25,982
or capture, and fault

45
00:01:26,007 --> 00:01:27,375
detection and recovery

46
00:01:27,410 --> 00:01:29,215
systems. Marshall

47
00:01:29,250 --> 00:01:30,366
provided Advanced Video

48
00:01:30,453 --> 00:01:32,126
Guidance Sensors software

49
00:01:32,630 --> 00:01:33,566
and testing and sensor

50
00:01:33,601 --> 00:01:35,006
suite testing for Dart

51
00:01:35,041 --> 00:01:36,798
and Orbital Express.

52
00:01:36,833 --> 00:01:38,606
In the future, automated rendezvous and

53
00:01:38,641 --> 00:01:40,013
docking or capture will

54
00:01:40,048 --> 00:01:41,326
be critical to the NASA

55
00:01:41,606 --> 00:01:43,630
docking system for ISS,

56
00:01:43,665 --> 00:01:45,375
orbital debris mitigation,

57
00:01:45,410 --> 00:01:46,799
and servicing satellites

58
00:01:47,062 --> 00:01:48,239
and space craft.

59
00:01:48,274 --> 00:01:49,294
Automated Rendezvous and

60
00:01:49,574 --> 00:01:51,245
docking or Capture enables

61
00:01:51,280 --> 00:01:52,638
them to work together

62
00:01:52,673 --> 00:01:53,886
to complete bigger, more

63
00:01:53,921 --> 00:01:54,814

complex missions in a

64
00:01:54,902 --> 00:01:57,150
fiscally-conscious environment.

65
00:01:57,157 --> 00:01:58,430
A great example is the

66
00:01:58,470 --> 00:02:00,366
Mighty Eagle Lander, capable

67
00:02:00,401 --> 00:02:01,678
of landing at multiple

68
00:02:01,713 --> 00:02:03,278
locations, which allows

69
00:02:03,313 --> 00:02:04,655
it to complete such varied

70
00:02:04,662 --> 00:02:06,078
tasks as safe landing,

71
00:02:06,213 --> 00:02:07,678
rockets for refueling, and

72
00:02:07,686 --> 00:02:09,293
lifting off the moon with

73
00:02:09,328 --> 00:02:12,478
return samples Flight

74
00:02:12,502 --> 00:02:13,934
software integrates all the

75
00:02:14,117 --> 00:02:15,566
flight hardware systems;

76
00:02:15,766 --> 00:02:16,238
Essentially it is the glue

77
00:02:16,566 --> 00:02:18,078
or brain of the vehicle

78
00:02:18,113 --> 00:02:19,534
it controls everything from

79
00:02:19,569 --> 00:02:20,863
on pad operations where

80
00:02:20,898 --> 00:02:22,079
you tank the vehicle to

81
00:02:22,114 --> 00:02:23,757
launch and ascent. We're

82
00:02:24,038 --> 00:02:24,974
using it, developing it here

83
00:02:25,078 --> 00:02:25,951
at Marshall for the Space

84
00:02:25,986 --> 00:02:27,006
Launch System, our heavy

85
00:02:27,046 --> 00:02:28,014
launch vehicle, down to

86
00:02:28,038 --> 00:02:30,830
Microsatelletes. FASTSAT

87
00:02:31,126 --> 00:02:32,366
successfully operated 6 science

88
00:02:32,710 --> 00:02:33,630

and technology experiments

89
00:02:34,118 --> 00:02:35,950
at low-cost. In order to

90
00:02:38,197 --> 00:02:38,863
quickly and effectively

91
00:02:39,382 --> 00:02:40,111
meet the needs of any

92
00:02:40,389 --> 00:02:41,742
project, Marshall has built

93
00:02:42,005 --> 00:02:42,925
up a stable of

94
00:02:43,062 --> 00:02:43,983
state-of-the-art

95
00:02:44,134 --> 00:02:44,685
tools, facilities

96
00:02:45,270 --> 00:02:46,942
and test environments.

97
00:02:46,949 --> 00:02:48,542
Agile methodology has been

98
00:02:48,577 --> 00:02:49,870
adapted to provide more

99
00:02:49,905 --> 00:02:51,550
flexibility during development

100
00:02:51,585 --> 00:02:53,230
and allowing regular

101
00:02:53,265 --> 00:02:55,102
visibility of software progress

102
00:02:55,137 --> 00:02:56,671
and changes. The Unified

103
00:02:56,822 --> 00:02:58,558
Modeling Language or

104
00:02:58,593 --> 00:02:59,887
UML is used throughout

105
00:02:59,922 --> 00:03:01,454
the software life cycle for

106
00:03:01,489 --> 00:03:03,294
modeling software systems.

107
00:03:03,329 --> 00:03:04,478
Marshall was the first

108
00:03:04,502 --> 00:03:05,774
NASA Center to receive

109
00:03:05,809 --> 00:03:07,326
Capability Maturity Model

110
00:03:07,510 --> 00:03:09,934
Integration CMMI level 3

111
00:03:10,261 --> 00:03:11,823
rating. The Marshall developed

112
00:03:11,941 --> 00:03:13,215
software, ARTEMIS and

113
00:03:13,222 --> 00:03:14,655

MAESTRO, provides real-time

114
00:03:14,710 --> 00:03:16,781
simulation-hardware-in-the-loop

115
00:03:16,816 --> 00:03:18,062
(HWIL) capabilities.

116
00:03:18,097 --> 00:03:19,054
We have the Integrated

117
00:03:19,094 --> 00:03:20,702
Avionics Test Facility

118
00:03:20,737 --> 00:03:22,910
- IATF for testing SLS

119
00:03:22,945 --> 00:03:25,038
avionics. Modular in design

120
00:03:25,073 --> 00:03:26,862
to accomodate a variety of

121
00:03:26,897 --> 00:03:29,582
configurations and simulations.

122
00:03:29,617 --> 00:03:31,055
For both launch vehicles and spacecraft.

123
00:03:31,090 --> 00:03:34,079
and a Small Projects Rapid Integration and

124
00:03:34,114 --> 00:03:35,918
Test Environment – SPRITE facility to