1
00:00:20,170 --> 00:00:27,040
As this report period ended on September 30,
the first Saturn space vehicle, SA-1, had

2
00:00:27,040 --> 00:00:30,130
been erected on its launching pad at Cape
Canaveral, Florida.

3
00:00:30,130 --> 00:00:34,860
It was undergoing final preparation for its
history-making launch.

4
00:00:34,860 --> 00:00:39,690
The three eventful months of work and planning
leading up to that climactic moment will be

5
00:00:39,690 --> 00:00:48,300
covered in this film report.

6
00:00:48,300 --> 00:00:53,530
Final checkout of the SA-1 booster together
with its dummy second stage and payload had

7
00:00:53,530 --> 00:01:03,280
been underway in the Quality Division at Marshall
Space Flight Center since June 12.

8
00:01:03,280 --> 00:01:09,600
Among the items checked was the vehicle’s
stabilized platform, known as ST-90, which

9
00:01:09,600 --> 00:01:14,940
was mechanically tilted on this platform to
simulate vehicle attitude changes.

10
00:01:14,940 --> 00:01:23,420
In this manner, attitude errors could be introduced
and correction by the control system observed.

11

00:01:23,420 --> 00:01:28,280
Also verified was the telemeter ground station,
the instrumentation system used to monitor

12
00:01:28,280 --> 00:01:32,340
information on the operation of all systems
during flight.

13
00:01:32,340 --> 00:01:39,439
The station is equipped to receive 900 channels
of information.

14
00:01:39,439 --> 00:01:44,890
Culminating the various systems tests was
the simulated flight test in which all functions

15
00:01:44,890 --> 00:01:48,600
were performed in launch and flight sequence.

16
00:01:48,600 --> 00:01:54,060
With a successful accomplishment of this test,
the SA-1 booster was accepted as flight ready

17
00:01:54,060 --> 00:02:00,859
and released for shipment to the launch site.

18
00:02:00,859 --> 00:02:08,000
On August 1, the SA-1 booster, dummy S-IV
stage, and dummy payload were touched up for

19
00:02:08,000 --> 00:02:09,229
shipping.

20
00:02:09,229 --> 00:02:14,920
The S-V dummy stage had already been shipped
last April on the trail run of the Saturn

21
00:02:14,920 --> 00:02:20,650
barge, Palaemon.

22
00:02:20,650 --> 00:02:26,660
On August 5, the SA-1 booster and payload
were transported to the Saturn barge dock

23
00:02:26,660 --> 00:02:28,340
on the Tennessee River.

24
00:02:28,340 --> 00:02:33,930
The S-IV had been moved the previous day.

25
00:02:33,930 --> 00:02:38,880
Here the units were loaded aboard the Palaemon
to begin the first leg of their thousand 200

26
00:02:38,880 --> 00:02:43,780
mile trip to the Cape.

27
00:02:43,780 --> 00:02:48,549
Several hours later, the Palaemon's cargo
was unloaded just above the damaged Wheeler

28
00:02:48,549 --> 00:02:56,890
Dam, where a collapse of a lock last June
had temporarily interrupted river traffic.

29
00:02:56,890 --> 00:03:01,810
The units were then hauled about one mile
over land around the dam on a road which had

30
00:03:01,810 --> 00:03:08,980
been specially built by the Tennessee Valley
Authority

31
00:03:08,980 --> 00:03:16,959
and loaded onto a second barge, the modified
surplus Navy vessel named Compromise.

32
00:03:16,959 --> 00:03:22,599
The day prior to movement of the flight booster

and inert payload, the water ballasted Saturn

33
00:03:22,599 --> 00:03:28,340
booster simulator plus the flight S-IV dummy
stage had been taken over the Huntsville-Wheeler

34
00:03:28,340 --> 00:03:36,720
leg of the trip to verify loading and unloading
procedures.

35
00:03:36,720 --> 00:03:41,939
The entire transfer operation of all units
from Marshall around the dam to the Compromise

36
00:03:41,939 --> 00:03:45,210
went smoothly.

37
00:03:45,210 --> 00:03:50,950
The Compromise has secured its voyage, took
it through waters of the Ohio and Mississippi

38
00:03:50,950 --> 00:03:56,329
Rivers, the Gulf of Mexico, and the Atlantic
seaboard.

39
00:03:56,329 --> 00:04:02,230
On August 15, after a ten day journey, averaging
about nine miles an hour, the Saturn-carrying

40
00:04:02,230 --> 00:04:09,060
craft arrived safely at its destination, Cape
Canaveral.

41
00:04:09,060 --> 00:04:18,090
The dummy payload was the first unit to be
unloaded from the Compromise.

42
00:04:18,090 --> 00:04:22,710
Then the huge Saturn booster was taken off
and towed directly to the launching pad about

43
00:04:22,710 --> 00:04:30,140
two miles away.

44
00:04:30,140 --> 00:04:32,870
The dummy S-IV stage followed.

45
00:04:32,870 --> 00:04:37,230
Both the S-IV and the payload were hauled
to Launch Operations Directorate's Hanger

46
00:04:37,230 --> 00:04:46,090
D for temporary storage.

47
00:04:46,090 --> 00:04:52,660
After checkout and adjustment of the launching
pedestal support and hold down arms, LOD personnel

48
00:04:52,660 --> 00:04:57,070
prepared for the painstaking task of erecting
the gigantic booster.

49
00:04:57,070 --> 00:05:03,170
Following the steps outlined in the erection
procedure manual, the Saturn booster, some

50
00:05:03,170 --> 00:05:08,230
eighty feet in length and twenty-one and a
half feet in diameter was raised for positioning

51
00:05:08,230 --> 00:05:17,310
in the 310 foot tall movable service structure.

52
00:05:17,310 --> 00:05:22,950
Then the booster was slowly lowered onto the
pedestal from which it would be fired.

53
00:05:22,950 --> 00:05:28,920
And the horizontally retracting work platforms

of the service structure were adjusted to

54
00:05:28,920 --> 00:05:33,280
embrace the vehicle.

55
00:05:33,280 --> 00:05:36,200
Installation of the long cable mast was next
accomplished.

56
00:05:36,200 --> 00:05:41,110
The mast provides electrical, pneumatic, and
cooling connections for booster checkout,

57
00:05:41,110 --> 00:05:46,690
monitoring, countdown, and rapid disconnect
for the booster prior to liftoff.

58
00:05:46,690 --> 00:05:55,340
The long cable mast will be used for SA-1
through SA-4 in lieu of the umbilical tower.

59
00:05:55,340 --> 00:06:00,630
After the booster was in place, the inert
S-IV, or second stage, measuring forty feet

60
00:06:00,630 --> 00:06:09,990
long and eighteen feet in diameter, was raised
into position and mated to the first stage.

61
00:06:09,990 --> 00:06:16,210
Then the inert S-V, or third stage, twenty
feet long and ten feet in diameter, was hoisted

62
00:06:16,210 --> 00:06:21,710
aloft and mated to the second stage.

63
00:06:21,710 --> 00:06:31,370
Finally, the inert payload for the first Saturn
flight, a Jupiter nosecone and aft section,

64
00:06:31,370 --> 00:06:38,250
was lifter and mated to the third stage.

65
00:06:38,250 --> 00:06:44,120
The fully assembled Saturn, 162 feet high,
stood enclosed by the work platforms of the

66
00:06:44,120 --> 00:06:49,740
service structure, ready to undergo vertical
checkout and flight preparations.

67
00:06:49,740 --> 00:06:55,000
Later, the service structure was rolled away

68
00:06:55,000 --> 00:06:59,800
and the Saturn stood alone on the launching
pad for the first time while various radio

69
00:06:59,800 --> 00:07:05,340
frequency tests were conducted.

70
00:07:05,340 --> 00:07:09,340
Long before the Saturn was erected, though,
back at the Marshall Center’s Computation

71
00:07:09,340 --> 00:07:14,900
Division, the vehicle was being mathematically
flown thousands of times inside this powerful

72
00:07:14,900 --> 00:07:18,380
IBM 7090 digital computer.

73
00:07:18,380 --> 00:07:28,300
Such simulated flights saved NASA months of
man effort and many thousands of dollars.

74
00:07:28,300 --> 00:07:33,190
Using analog computer, Computation Division
had also solved numerous Saturn problems,

75
00:07:33,190 --> 00:07:38,210
for example, equations which describe the
draining of the liquid oxygen tanks when the

76
00:07:38,210 --> 00:07:46,830
booster is fired.

77
00:07:46,830 --> 00:07:52,060
Parameters of the system, such as orifice
sizes and tank diameters may be varied by

78
00:07:52,060 --> 00:07:54,720
adjustment of potentiometer dials.

79
00:07:54,720 --> 00:07:59,220
Variables of the system, such as liquid levels
or draining rates, are automatically graphed

80
00:07:59,220 --> 00:08:06,720
on the XY plotter in order to provide engineers
with necessary design information.

81
00:08:06,720 --> 00:08:11,870
Continuing Saturn wind tunnel tests, such
as this one using the Schlieren optical technique,

82
00:08:11,870 --> 00:08:15,460
were run this quarter by Marshall’s Aeroballistics
Division.

83
00:08:15,460 --> 00:08:20,650
The test produces a picture of the airflow
present around the Saturn model, thereby revealing

84
00:08:20,650 --> 00:08:26,420
any undesirable aerodynamic effects caused
by body shapes or test conditions.

85

00:08:26,420 --> 00:08:27,980
[Sound of Testing]

86
00:08:27,980 --> 00:08:31,890
A one-twentieth scale Saturn booster model
was also tested in a sixteen foot diameter

87
00:08:31,890 --> 00:08:37,500
wind tunnel at Tullahoma, Tennessee to measure
the heat around the booster's base while

88
00:08:37,500 --> 00:08:41,860
undergoing various flight conditions.

89
00:08:41,860 --> 00:08:47,899
Using these small tanks, a series of demolition
test photographed at high speed were run by

90
00:08:47,899 --> 00:08:53,379
Structures and Mechanics Division to determine
the most effective means of range safety destruction

91
00:08:53,379 --> 00:08:58,470
of a Saturn vehicle in the event it should
veer dangerously off course.

92
00:08:58,470 --> 00:09:04,959
Employing one hundred grain Primacord and
flexible shape charges as the explosive devices,

93
00:09:04,959 --> 00:09:10,509
tests indicated that the latter will initiate
an explosion of less violent intensity, resulting

94
00:09:10,509 --> 00:09:15,779
in a minimum amount of blast destruction,
thus realizing a higher degree of safety for

95
00:09:15,779 --> 00:09:23,709
both personnel and equipment without sacrifice

of reliability.

96
00:09:23,709 --> 00:09:29,620
Dynamic vibration testing of the test booster,
called SA-D, in the new dynamic test stand

97
00:09:29,620 --> 00:09:36,770
was delayed from June 23 to July 3 in order
to allow time for installation of wind screens

98
00:09:36,770 --> 00:09:37,770
around the stand.

99
00:09:37,770 --> 00:09:49,350
The screens enable testing to be carried out
in winds up to fifteen miles per hour.

100
00:09:49,350 --> 00:09:55,790
The SA-D vehicle, a simulation of the SA-1
configuration, was suspended on steel cables

101
00:09:55,790 --> 00:10:01,810
and excited through a frequency range sufficient
to determine the significant bending, torsional,

102
00:10:01,810 --> 00:10:07,370
and longitudinal mode shapes and frequencies,
including the damping coefficients associated

103
00:10:07,370 --> 00:10:09,370
with each mode.

104
00:10:09,370 --> 00:10:16,029
Flight time conditions tested included liftoff,
thirty-five seconds, sixty-three seconds at

105
00:10:16,029 --> 00:10:22,970
which maximum aerodynamic pressure is reached,
and 119 seconds for cutoff.

106
00:10:22,970 --> 00:10:28,930
Tests were conducted by S&M Division together
with Guidance and Control Division.

107
00:10:28,930 --> 00:10:34,430
The huge SA-D booster is suspended in the
dynamic test stand in a manner similar to

108
00:10:34,430 --> 00:10:41,399
this tiny functional model, which is used
by G&C Division to conduct preliminary investigations.

109
00:10:41,399 --> 00:10:47,029
Such information as effect of suspension on
bending modes, spring resonance effects, and

110
00:10:47,029 --> 00:10:57,290
pendulum motions can be studied here since
the model can be pre-calculated.

111
00:10:57,290 --> 00:11:02,221
Research on a new method of measuring torques
and air bearing used in Saturn’s guidance

112
00:11:02,221 --> 00:11:06,540
and control system was also conducted by G&C.

113
00:11:06,540 --> 00:11:12,089
The flow of air within an air bearing gyroscope
exerts a small, undesirable force, which tends

114
00:11:12,089 --> 00:11:15,050
to rotate the floating member of the bearing.

115
00:11:15,050 --> 00:11:19,910
Since the gyro cannot differentiate between
this course and an actual change in vehicle

116
00:11:19,910 --> 00:11:26,139

attitude, it became necessary to devise this
apparatus to accurately measure the force

117
00:11:26,139 --> 00:11:33,839
in units of dyne centimeters of torque for
analysis and elimination of its causes.

118
00:11:33,839 --> 00:11:46,720
[Sound of Engines Firing]

119
00:11:46,720 --> 00:11:52,430
Static testing continued this quarter with
five firings of the SA-T-2 booster, which

120
00:11:52,430 --> 00:11:55,920
simulates the second flight booster, SA-2.

121
00:11:55,920 --> 00:12:03,529
The Final SA-T-2 firing on August 25 was a
successful engine-out capability test in which

122
00:12:03,529 --> 00:12:13,360
one engine was intentionally cut off at ninety-four
seconds while the others ran to 114 seconds

123
00:12:13,360 --> 00:12:15,550
duration.

124
00:12:15,550 --> 00:12:23,430
Assembly of the SA-2 booster, begun on December
27 of last year, was completed on August 1

125
00:12:23,430 --> 00:12:31,389
and checkout of the vehicle by Quality Division
started the same day.

126
00:12:31,389 --> 00:12:37,860
Assembly of the third Saturn flight booster,
SA-3, got underway July 31 and the last tank

127
00:12:37,860 --> 00:12:43,499
was installed near the close of this report
period.

128
00:12:43,499 --> 00:12:49,540
Fabrication was initiated on the fourth flight
booster, SA-4, on July 31.

129
00:12:49,540 --> 00:12:54,480
The relatively new process of micro welding,
in which the operator must use a magnifying

130
00:12:54,480 --> 00:13:00,050
glass or a microscope, illustrates the wide
range of activity, from the mammoth to the

131
00:13:00,050 --> 00:13:04,950
minute, being accomplished in Marshall's
FA&E Division.

132
00:13:04,950 --> 00:13:09,899
Wires or sheaths as small as one thousandth
of an inch in diameter or thickness may be

133
00:13:09,899 --> 00:13:15,660
joined by this process.

134
00:13:15,660 --> 00:13:22,449
While booster and dummy S-IV fabrication continued
at Marshall, manufacture of the flight S-IV

135
00:13:22,449 --> 00:13:28,939
stage was underway by the contractor, Douglas
Aircraft Company in California.

136
00:13:28,939 --> 00:13:34,480
The new technique of explosive forming, shown
being tested in this slow motion sequence,

137

00:13:34,480 --> 00:13:39,999
is expected to accelerate S-IV tank segment fabrication.

138
00:13:39,999 --> 00:13:46,000
Besides vehicle manufacturing, work also moved ahead on ground support equipment with several

139
00:13:46,000 --> 00:13:50,959
GSE test sets and control panels virtually completed.

140
00:13:50,959 --> 00:13:56,420
Construction of Douglas' ninety thousand gallon liquid hydrogen storage tank and liquid

141
00:13:56,420 --> 00:14:01,519
oxygen storage tanks has recently been concluded.

142
00:14:01,519 --> 00:14:06,740
A concentrated buildup of facilities at the Marshall Space Flight Center was also in progress

143
00:14:06,740 --> 00:14:15,740
this quarter, including excavation on the new 10.8 million dollar static test facility.

144
00:14:15,740 --> 00:14:20,100
addition to the Fabrication and Assembly Engineering Division,

145
00:14:20,100 --> 00:14:27,430
a five story addition to Structures and Mechanics Division,

146
00:14:27,430 --> 00:14:31,740
and a large new pressure test cell for Quality Division.

147
00:14:31,740 --> 00:14:37,850

And at Cape Canaveral, site clearing and earth
fill was being done for construction of a

148
00:14:37,850 --> 00:14:45,220
new Saturn complex, Vertical Launch Facility
37, designed to handle launch of Saturn vehicles

149
00:14:45,220 --> 00:14:49,009
through the more advanced stages.

150
00:14:49,009 --> 00:14:56,230
Meanwhile, approximately five thousand feet
to the south of Cape Canaveral, the first

151
00:14:56,230 --> 00:15:02,649
Saturn flight vehicle stood poised on its
launching pad at Complex 34 and preparations