of the emphasis we have already placed on the subjects of stress corrosion and material incompatibility. As the Apollo program progresses these technical discoveries push the technology frontier a little further out.

An Apollo program directive has been issued which requires thorough test revalidation of the compatibility of all use fluids with their tank materials.

Environmental Control Unit

The Environmental Control Unit experienced technical difficulties during the past year that resulted in delays to the test program requiring redesign and requalification of the system.

As a result of this occurrence, early in November we placed a modified Environmental Control System in the Command and Service Module of the AS–204 space vehicle undergoing prelaunch testing at KSC. Spacecraft for all flights will now use the requalified Environmental Control System.

Lunar Module development

We foresee no major engineering problems remaining to be resolved in the development of the Lunar Module. We have experienced the type of difficulties you might expect in such a development effort. However, additional ground and flight testing is required to demonstrate that the configuration is acceptable for the lunar mission.

Landing radar

The need for additional testing is particularly true of the landing radar, where performance under flight conditions has yet to be demonstrated. An intensive ground test program is being conducted including flight tests with radar installed on helicopters and fixed wing aircraft. Tests are also planned on the Lunar Module development flight missions to measure radar performance in the vibration, temperature, and engine plume environment of the spacecraft. We were much encouraged by the performance of the Surveyor I radar, which is similar to the one used on the Lunar Module.

Engines

In the descent and ascent engine area, we encountered obstacles which delayed the start of the qualification program (fig. 44, MA66–9185; fig. 45, MA66–9186).

The descent engine was experiencing erosion of the ablative engine throat and low performance which were corrected by minor changes to the injector design.

The ascent engine had difficulties with chamber erosion and instability, both of which were related to injector construction methods.

The results of the LM–1 flight tests are expected to verify performance of the propulsion systems.

Weight of Lunar Module

Last year we were faced with a potentially serious weight growth trend on the Lunar Module and a weight improvement program was started. This effort has reflected in a continuing weight decrease during 1966. The vehicle is below the control weight at this time. The weight margin can be used to advantage in loading additional propellant on board.

CHECKOUT, TEST, AND LAUNCH OPERATION FACILITIES

Launch vehicle checkout facilities

Activation of the stage checkout facilities to support the Saturn V program continued as planned during the past year. Static test stands and factory post-static test facilities became operational for the checkout of the 1st, 2nd and 3rd stages, and the Instrument Unit.

Michoud Assembly Facility

The second factory checkout position for the Saturn V 1st stage was activated at the Michoud Assembly Facility near New Orleans, Louisiana in August and handled the factory checkout of the S–IC–4. Analysis of our experiences shows that the two checkout positions can handle the maximum planned flow rate of six stages per year in both factory and post-static checkout.