

the system in all follow-on Apollo Applications missions. The technical objectives of a land landing system encompass the capabilities of the descent system to provide a greater glide range with maneuvering controls necessary to provide the crew with the ability to make a controlled touchdown (fig. 84, MC67-5763). The system will provide decreased impact velocities and the capability to return heavier payloads. In addition, the system retains the original water landing capability.

Since many of the Apollo Applications program missions are of long duration and open-ended, the capability to effect a land landing as well as a water landing, increases mission abort flexibility and capability with greater assurance of crew safety. The lower impact velocities will lessen the chances of crew injury during touchdown in abnormal landing conditions.

For several years, the NASA supporting development programs have investigated various configurations of descent systems for manned spacecraft (fig. 85, MC 67-5516). To meet the technical objectives of the Apollo Applications landing system, several gliding parachutes have been identified and tests performed on small scale models. They are the cloverleaf, the parawing, and the sailwing. Sufficient development effort on the cloverleaf configuration has verified its capability when used in conjunction with retro rockets for impact attenuation. Modifications to the Command Module are minimum and consist of structural configurations for storage and deployment of the parachutes and the mounting of the retro rockets.

The parawing and the sailwing have greater glide ranges and maneuverability control and if selected for the Apollo Applications program, could obviate the necessity for the retro rockets. It is planned to continue development and test of larger scale models of the sailwing and parawing to a point where a firm de-

APOLLO APPLICATIONS LAND LANDING

- **DESIGN OBJECTIVES**
 - **COMMAND MODULE REUSABILITY**
 - **INCREASED CREW COMPLEMENT**
 - **REDUCED WATER RECOVERY FORCES**
 - **INCREASED LANDING FLEXIBILITY**
- **DEVELOPMENT REQUIREMENTS**
 - **GLIDING CHUTES**
 - **MANEUVERABILITY CONTROLS AND DISPLAYS**

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FIGURE 84