NASA - Langley

LANGLEY RESEARCH EFFORTS ON RECOVERY SYSTEMS

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The only highly-developed recovery system available at present is a parachute system, such as for project Mercury. This may have to be used again, either as a primary or at least as a back-up system. However, an advanced recovery system capable of maneuverability is urgently needed and such a system should desirably provide near-zero vertical velocity and depending on trade-offs involved, low or near-zero horizontal velocity.

The first slide summarizes Langley's research efforts on recovery systems. Most of the effort to date has been on the parawing, which combines the stowability and light weight of a parachute with flight control and flared landing capability of a conventional wing. The results obtained in the various research areas will be discussed in five papers.

Some effort is now also being made on rotary-wing recovery systems. Performance and other characteristics are available from helicopter research; a current effort which will be discussed in a paper today deals primarily with deployment and dynamic stability.

Work has also been done at Langley on decelerators at both supersonic and subsonic speeds. Results of wind-tunnel investigations on decelerators at supersonic speeds will be summarized in a paper today. Although not discussed today, brief low-speed drop tests have also been made of inflatable devices which were dropped from a helicopter and successfully filled with foam in flight to provide drag in the air or to provide buoyancy after landing in the water.

A paper will also be presented on problems associated with energy dissipation upon ground impact in the recovery of space vehicles.

Some miscellaneous work which is not covered in the talks and which has been given only little effort deals with guided parachutes and with retro rockets in conjunction with a parachute. Use of these devices is depicted on the next slide.

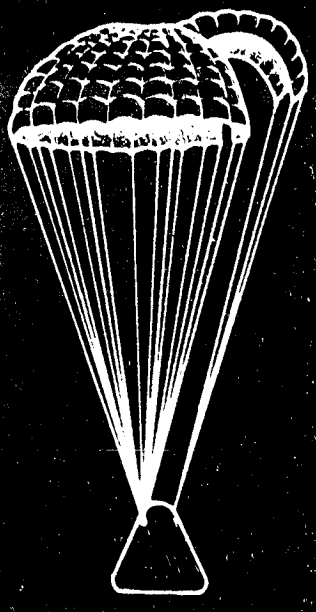
Use of a flapped parachute, or of a cluster of parachutes with inflated rings gave an L/D of approsimately 0.5. The flapped parachute L/D was limited by collapsing of the forward edge of the chute skirt; the L/D of the clustered chutes appeared to be limited by the drag of the rings which were perhaps larger than necessary. Retro rockets in conjunction with a chute, although giving no glide capability, provided near-zero touch-down velocity in vertical descent.

LANGLEY RESEARCH CENTER EFFORTS ON RECOVERY SYSTEMS

Research Areas	Parawing	Rotary Devices	Aerodynamic Decelerators	Energy Dissipation	Guided Chutes	Retro Rockets
Static Aerodynamic Characteristics	✓	✓	✓	✓	✓	✓
Stability	✓		✓		✓	✓
Control	✓					
Deployment	✓	✓				
Flared Landings	✓	✓				
Loads Materials Aeroelasticity	✓			✓		

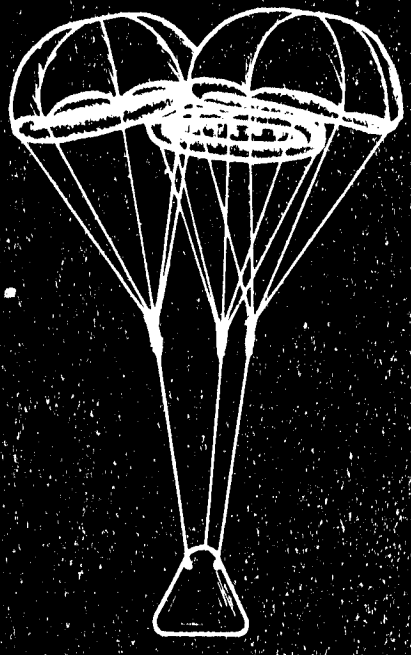
GUIDED PARACHUTES

FLAPPED (GLIDESAIL)



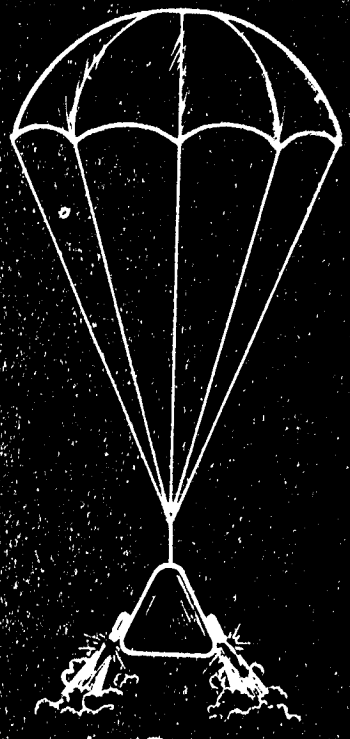
L/D ≈ 0.5

CLUSTER (WITH INFLATABLE RINGS)



L/D ≈ 0.5

PARACHUTE + RETROROCKETS



L/D = 0