The page was blank when the men of the Landing and Recovery Division (LRD) were tasked with developing the processes, procedures and hardware, required for a recovery of flight crew personnel and hardware of the NASA's manned spaceflight program(s).

To paraphrase an early LRD person, Mr. Pete Armitage, after being hired, Pete asked the management, what hardware do you want me to develop? The management answered, that is for you to tell me.

That defined the task for the men of the LRD. So without any documentation of prior manned recovery operations, these recent graduate engineers designed the processes, procedures and hardware, used for the recovery of the flight crew(s), and hardware (command modules) of the Mercury, Gemini, and Apollo programs.

Overview of Launch Site Recovery Operations

By

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The recovery operations, were divided, not intentionally, into two areas, one was recovery on a global basis, and one for the near launch area. The overview of the launch site operations is provided by the LRD (Landing and Recovery Division) coordinator to the launch site.

To define the probable landing area in the event of a launch abort three major factors were considered: (1. the launch vehicle (booster) trajectory. (2. The trajectories of the escape system(s). (3. The historical wind velocities and directions.

The launch vehicle trajectories were defined by the Mission Planning and Analysis Division of the Johnson Space Center, and limits for a flight deviation were defined by Range Control of the Eastern Test Range, this defined a cone of reference, for the booster's flight. The escape systems trajectories, ejection seats for the Gemini program and an escape rocket for the Apollo command module, were superimposed on the cone of reference and analyzed for landing dispersions. The analysis addressed both the altitude and down range position of the booster at time of abort. This assumed a space fixed position of the personnel or hardware to be recovered. The historical wind data was then superimposed on the recoverable item(s), knowing or assuming the rate of descent, a high probable landing area or footprint was defined.

Throughout the maturity of the operations, a computer program was developed addressing, the trajectories and the current launch day wind profile. The wind profile was measured by the current state of the art of radar balloon tracking. This data provided a high probability landing corridor. This data allowed the launch site recovery commander, a member of the DOD, to position the recovery forces in the highest probable landing areas.

The types of recovery vehicles, and owners were: (1. Three M113 personnel carriers, Cape Kennedy, for near pad recovery. (2. Four Helicopters USAF Air Rescue, for overall land and downrange recovery, (3. Four LARCs. Vehicles, Cape Kenney, for rough terrain and near ocean operations. (4. Two LVTR, United States Marine Corp vehicles, for shallow surf recovery. (5. Two Cape Kennedy range surveillance boats. And (5. Two US Coast Guard ships for down range clearance and recovery assistance as needed.

A compliment of flight surgeons and support medical personnel were deployed on the helicopters and the medical facilities at Cape Kennedy.

The overall operation was under the command of an Air Force Colonel with a NASA coordinator to provide technical input as required. A total of 17 vehicles and 165 personnel were deployed for the support of each mission.

The LRD was a member of the Cape Kennedy Pad Egress committee, which addressed the Launch Pad and General Launch Area land operations. One highlight of this committee was the evaluation of the use of a new fire retardant material, NOMEX, for suits for personnel operating in the pad and other high temperature areas. The material was adopted for near pad use, and later adopted by race car drivers.

The overall recovery operations were the responsibility of the DOD, with technical support provided by NASA/LRD. Prior to each mission DOD recovery commanders from all world wide theaters of operations would convene at a convenient geographical location for a mission support conference. All plans and problems were discussed.

Some of the following system or procedures evaluations were conducted in the process of developing a launch area recovery force. The locations are identified:

(1. The Sikorsky sky crane for the recovery of the Apollo CM. Cape Kennedy
(2. K-501 Firebird fire extinguisher demo. The K-501 small dual rotor helicopter with a twin bottle fire extinguisher. Cape Kennedy
(3. UH-1B with a high intensity light system for night operations. Greenville Texas
(4. Apollo egress procedures. Downey CA.
(5. Night time operation procedures. Key West Fl.
(6. Operating procedures in a Hypergolic environment. Cape Kennedy Fl.
(7. Air Force MOL launch area recovery conference. Western test range
(8. Apollo RTG (Radation Thermal Gemerator) recovery procedures development, Post Apollo 11 at Cape Kennedy, for the Alsep Lunar experiments.

The recovery procedures for the retrieval of the command module for the Mercury, Gemini and Apollo programs were basically the same. Which was: locate, and retrieve, using the inventory of identified vehicles.

The Gemini presented an additional problem, with the addition of ejection seats as the escape method from a failing booster from altitudes of on the pad to 1800 meters (approximately 45000 feet). For ejections from on the pad to 9000 feet, the personnel parachutes would open immediately. For ejections above 9000 feet and to 18000 meters, the flight crew would free fall stabilized by a ballute to 9000 feet where the personal parachutes would open.

This required the development of hardware, i.e. a mannequin which could be fitted with a parachute and deployed from altitude simulating a high altitude abort.

This was accomplished by building a stick man (frame) (two each) of an individual, using 1¼ inch Stainless steel tubing with flexible joints at the shoulders, elbows hips and knees and lead shot in the stainless steel tubing as ballast for the weight of a typical flight crew person. Old flight crew suits were procured, for the stick men, and a parachute for each. A barostat was set to initiate parachute deployment at 9000 feet.

This system was deployed at an altitude in excess of 9000 feet to simulate an abort, and to train the rescue personnel. In a training exercise at Lake Okeechobee, one stick man was lost, sank in the lake. Years later, even after the Apollo Program a fisherman retrieved the stick man in his fishing net.