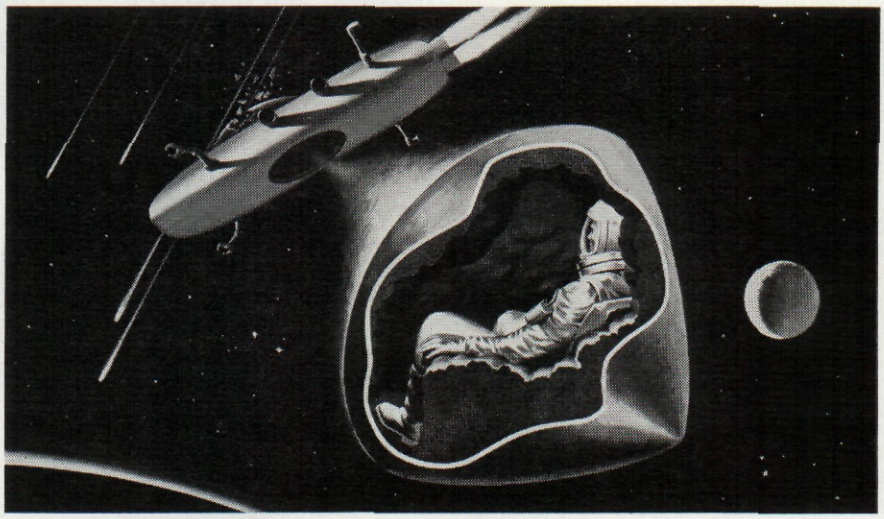
air-embolism in the patient. The filtration is actually done with a 60-mesh stainless steel screen, held together by the Kel-F disks containing a specially treated "window" of Kel-F.

Major advantages of this type of construction are its resistance to thermal shock and its ability to withstand high-temperature steam autoclaving in conventional hospital sterilizing equipment. Fracturing, softening, and warping of the 3-M product are nonexistent even after hundreds of sterilizations. Dr. Alvin A. Bakst of New York, who dreamed up the idea for this filter, has performed many successful open-heart operations calling for the tedious outside heart-lung equipment.

Space Cocoons for Orbiting Astronauts

Proposed satellite life jacket—formed of foamed resin during free fall—could permit re-entry to atmosphere



Space man "spins" plastic foam cocoon for fast, safe return from ailing space ship. Vehicle protects him from heat of re-entry

One of many types of emergencies which space pioneers may face in the next few years is a fast return to earth from a disabled manned satellite. A plastic-foam "cocoon," visualized by research engineers at General Electric's Missile and Space Vehicle Dept., in Philadelphia, could be an answer to the problem of getting back to *terra firma* in a hurry.

Foamed of polyurethanes (or improved modifications) during free fall, the cocoon would protect the spaceman from heat of atmospheric friction during re-entry and then cushion him against the moderate shock of a parachute landing. After this, the human meteorite would peel out of his covering and await rescuers guided to him by automatic radio beacon.

The simplest type of cocoon system is a satellite life jacket known as the MOOSE (Man Out of Space Easiest). Here, the astronaut—in a space suit with attendant oxygen supply, recovery aids, and survival gear—dons (or is already wearing) a very loose plastic bag. Straps or cords assure his proper position inside his placental pouch. To this he attaches tanks containing foaming plastic and mixer.

To deorbit, he takes a retrorocket package, visually orients himself to earth, and measures the altitude and

(*Continued on page 38 A*)

flight direction with an optical sight on the retrorocket. This tells him the proper direction to aim and fire the hand-rocket to achieve re-entry. He then inflates the plastic bag and turns on the foam generator. The quick-setting material fills the space between the immediate clothing and the outer bag.

A dense (50 lb. per cu. foot) foam cover about an inch thick forms an ablation shield on the nose portion of the designed conisphere shape. The outer afterbody foam coating is much less dense (about 3 lb. per cu. foot). And a very low density foam (1 lb. per cu. foot) fills in the rest of the space between man and shell, much like the white of an egg surrounds the yolk. This protects the cosmic high jumper from heat of atmospheric friction and from shock of deceleration and landing.

Weight Requirements for "Moose" *Satellite Life Jacket*

Component	Weight, Lb.
Space suit	15
Back pack (O_2 supply, ventilation)	10
Survival kit	12
Beacon and battery	5
Antenna for beacon	2
Recovery aids—radar chaff, sofar bombs, flares (high and low altitude), timer and ejector, dye marker	10
Parachute	13
Foamed vehicle	198
Total	265
Foam tanks and mixer (discarded before re-entry)	20
Propulsion pack	188

General Electric's John H. Quillinan and Harold L. Bloom have considered an orbiting altitude of 100 to 400 nautical miles for their preliminary calculations. They assume re-entry to the earth's atmosphere begins at an altitude of 50 nautical miles. During free fall prior to re-entry, the astronaut will fire a high-intensity flare to indicate emergency re-entry from orbit, and will turn on the beacon.

The stable conisphere shape orients itself early in re-entry, and the dense foam on the nose ablates. After re-entry heating has passed its peak, the occupant helps rescuers track his fall by expelling radar

chaff and firing another flare. At an altitude of about 30,000 feet, a parachute (metallized to give large radar cross section) automatically opens and pulls cutting cords which tear the light foam from around the man's hands and arms. Thus freed, he can yank these cords after landing (the parachute limits impact velocity to 30 feet per second at sea level) and can cut the foamy insulation away from the rest of his body. Finally, he digs out survival equipment embedded in the foam.

In case he lands in water, the former astronaut releases sofar bombs to pinpoint his location, and the MOOSE system serves as a life raft. The radio beacon continues to operate, providing a directional fix, and a dye marker aids visual sighting.

Other deorbiting systems receiving preliminary consideration at General Electric include a satellite life raft and a satellite lifeboat. These rigid vehicles may have a thin glass fiber liner protected by a nylon-reinforced phenolic ablation shield. They would have an afterbody of glass fiber cored with aluminum honeycomb.

New chemical materials—now solving present industrial, military, and consumer problems—will be the answer to increasingly complex future needs, too. Catastrophic accidents are almost sure to occur during early space exploration. But, certainly in the cases of orbiting satellites, they need not always be fatal. D.G.W.

Look Down, Look Down

AN OLD MOUNTAINEER said to the flatland tourist who asked where the road in front of his cabin went: "Since the state built it 40 years ago, it ain't gone nowhere." Scientists at Socony Mobil Oil's Paulsboro, N. J., research department can make this statement nowadays without any attempt at being facetious—they have built a four-lane highway that permit autos to "travel" up to 100

(*Continued on page 40 A*)