tumor regression in 26 out of 32 patients with bladder cancer, with complete tumor regression in 4 of the patients. That year still another team described how heat led to cancer regression in 25 out of 38 patients with a variety of advanced cancers.

None of these techniques was designed to spare healthy tissues from heat treatments, however. LeVeen and his team set out to do so. Past research had told them that there is a reduced blood flow to tumors compared to that of healthy tissues. They measured blood flow through surgically excised malignant and healthy tissues to try to confirm these results. They were confirmed. Tumor blood flow, they found, was only 2 to 15 percent that of healthy tissues. The larger the tumor, the greater was the reduction of blood flow to it. Blood flow through body tissue acts like a radiator, with greater cooling occurring when the flow is rapid. So they theorized that if heat were applied to tumors in strategic amounts, the slow blood flow to tumors would make them absorb enough heat to self-destruct, whereas healthy tissues would be spared because of their faster blood flow.

They tested their hypothesis, first in animals, then in patients. When they used radio-frequency radiation to raise the temperature of tumors in mice and rabbits 7° to 9°C above that of surrounding tissue, the tumors were rapidly and completely killed, and surrounding tissue was minimally destroyed. When they used radio-frequency radiation to raise the temperature of tumors in 21 patients, 8° to 10°C above surrounding tissues, all of the patients experienced tumor death or at least cancer regression accompanied by symptomatic improvement. So their hypothesis was found to be correct.

"The demonstration of a sizeable reduction in tumor blood flow offers an explanation for the observed success of radio-frequency therapy," they conclude in the May 17 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. The interplay between the blood supply of the tumor and heat therapy, they say, escaped the attention of past investigators who ascribed the benefits of heat to changes in cell metabolism or to altered sensitivity to drugs.

In an editorial in the same issue of JAMA, Joan M. Bull and Paul B. Chretien, physicians at the National Cancer Institute, call the results "exciting." The Brooklyn researchers' technique, they believe, has a simplicity and selectivity of action that may hold more clinical potential than do heat therapies tried in the past. They caution, however, that the results need to be confirmed by other researchers, especially in controlled clinical trials. The value of using the technique along with X-rays and drugs, they assert, also needs exploration in view of increasing evidence that multimodal therapies are more effective than single ones (SN: 1/11/75, p. 26). □

Beachballs to the space-shuttle rescue

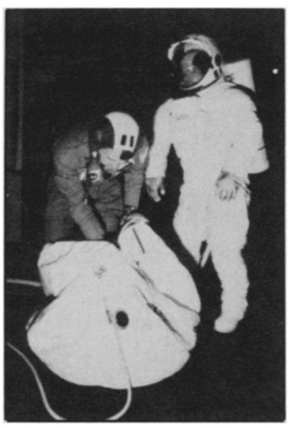
Curling up inside a beachball, zipping it closed over your head and being carried off like a suitcase hardly seems like an exercise in the latest space-age technology, but in fact it is just that: a rescue system for the crews of the space shuttle.

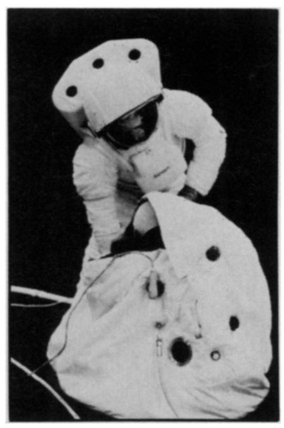
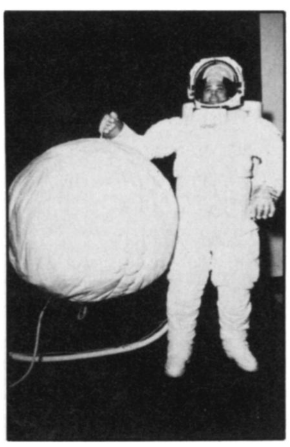
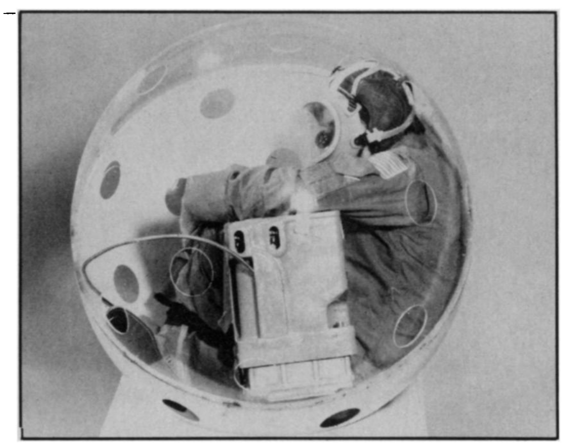
Hard-pressed for elbow room in the shuttle's crew-carrying orbiter section, engineers at the National Aeronautics and Space Administration's Johnson Space Center in Houston have developed the beachball, called the "personal rescue enclosure," as a compact escape system to replace bulky spacesuits in case the orbiter becomes disabled or a crew member is injured. With as many as five shuttle vehicles planned and a mission schedule that NASA hopes will reach 60 flights a year in the 1980s, rescue becomes a matter of sending up a second vehicle, loading most of the crew into the beachballs and letting the two space-suited crew members (the pilot and mission specialist) run the transfer operation.

The beachballs are nothing if not cramped. The user must step through the zippered opening, tuck into a near-fetal position (see cutaway photo, bottom right) and close himself into a sphere only 34 inches in diameter, broken only by a single, tiny, plastic porthole. Someone outside the beach ball plugs the sealed container into the shuttle's oxygen supply while transfer preparations are being completed. When the shuttle supply is disconnected, the beachball occupant has an hour of oxygen left in an oxygen-mask-style respirator that is in the minuscule space with him, presumably plenty of time to be carried across to the waiting rescue craft.

There are three ways of making the trip now being studied by NASA engineers: suitcase, clothesline and claw. As a suitcase, the rescuee is simply carried across by a suited comrade. In the clothesline method, the beachball would be hauled across on a line strung between the two shuttlecraft, like a boatswain's-chair transfer from one seagoing ship to another. The claw is the remote manipulator arm in the cargo bay of each shuttle orbiter; a crewman in the rescue vehicle would use it to reach across the intervening space, pick up the beachball and draw it in to safety. Alternatively, the distressed ship could use its own claw.

The spacesuits, too, will be brand new designs, though only two or three of as many as seven people on board will be wearing them. Instead of the costly, custom-fitted versions worn by previous astronauts, they will come in small, medium and large, suitable for men or women. Elbow, knee and other joints will be made from a fabric called Kevlar instead of the former molded rubber joints with cables. The beachball will be made of a Kevlar-urethane sandwich with an outer layer of thermal insulation. □



NASA