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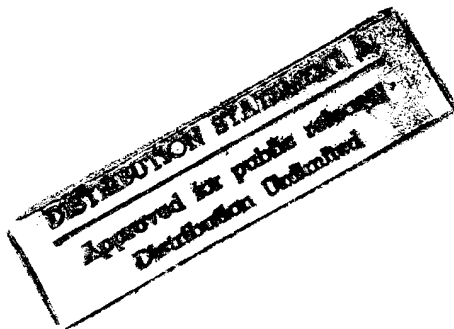
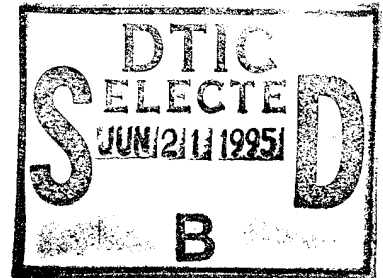
Alternative Methods for Flotation Seat Cushion Use

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16. Abstract Alternative methods of using flotation seat cushions for water crash survivors were identified at the Civil Aeromedical Institute (CAMI). These methods, tested in the CAMI survival tank and a theme park wave pool, were: 1) two people facing each other, holding two cushions between them; 2) two people facing each other, holding two cushions between them, with a third person held between the two cushions; 3) two people facing each other, holding their cushions on the other person's back; 4) two people facing each other, holding their cushions on the other person's back, with a third person held between the two people; and 5) each person holding a cushion while interlocking arms with adjacent survivors to form a large cluster. RESULTS: The first two methods, using cushions held between two people, are beneficial when linking-up is difficult because of rough seas and when heat loss is not a problem. When seas are calm and the water is cold, the third and fourth methods should retard loss of body heat. The fifth method, where the survivors are clustered together, brings together and connects the survivors who are using the other methods. The cluster allows for more support and help for injured and unconscious survivors. Because individuals tend to separate in the water, the cluster also presents a large visual target for rescuers. Preliminary testing, using a small flotation dummy, suggests that the second method could be used to rescue children by placing them between the cushions held by adults.					
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ALTERNATIVE METHODS FOR FLOTATION SEAT CUSHION USE

Introduction

Federal Aviation Regulations (1) require all large aircraft operated over water to be equipped with life preservers or approved flotation means for each occupant. Except for *extended* overwater operations, the typical approved flotation means used by airlines is the flotation seat cushion. Technical Standard Order C-72c (2) sets the minimum design and performance standards for flotation

seat cushions; however, relatively little information has been developed regarding techniques for flotation seat cushion usage by passengers. The typical procedure recommended by airlines for using seat cushions for personal flotation (as depicted on passenger information cards), shows an individual adult holding a single cushion to his/her chest (Figure 1).



Figure 1
Passenger Information Card

This technique provides adequate flotation for the individual, and probably resulted, in part, from a study by McFadden & Simpson (3), in which they conducted a cursory evaluation of flotation attitudes provided by typical flotation seat cushions. However, it is unlikely that every passenger in need of personal flotation will be a conscious, viable adult, capable of attending singularly to his or her flotation needs (4). In recognition of this likelihood, questions have arisen about appro-

priate procedures for using flotation seat cushions to assist injured or unconscious passengers, to protect survivors in the water from hypothermia, to provide life-saving buoyancy for infants and small children, and to prevent dispersion of the survivors while waiting for rescue. To address these concerns, alternative techniques were examined to define methods by which flotation seat cushions could be used by passengers to greater advantage.

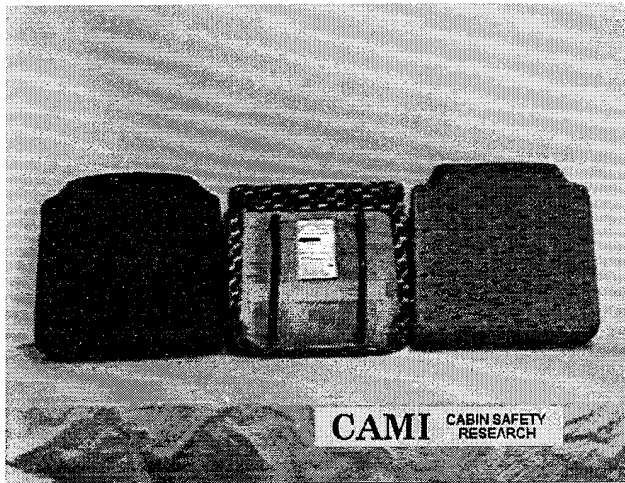


Figure 2
Flotation Seat Cushions

Method

Subjects: The subjects consisted of cabin crew and other aviation industry personnel attending the Civil Aeromedical Institute's (CAMI's) Cabin Safety Workshops, and paid subjects acquired by a local contractor. In all cases, the subjects were male and female adult humans, capable swimmers, and in good physical condition. A "2-year-old" flotation dummy was used to simulate rescue techniques for a child.

Apparatus: Flotation trials were conducted in the CAMI survival tank (water temperature = 89 degrees F.), and in the wave pool at the White Water Bay Theme Park in Oklahoma City, OK (water temperature = 69 degrees F.). New flotation seat cushions that conform to FAA-TSO C-72c were used in all trials. They were manufactured with parallel straps, 9.5 inches apart, sewn to the bottoms of the cushion covers (Figure 2). The activity above and below the surface of the water was recorded by video cameras.



Figure 3
Flotation Technique 1

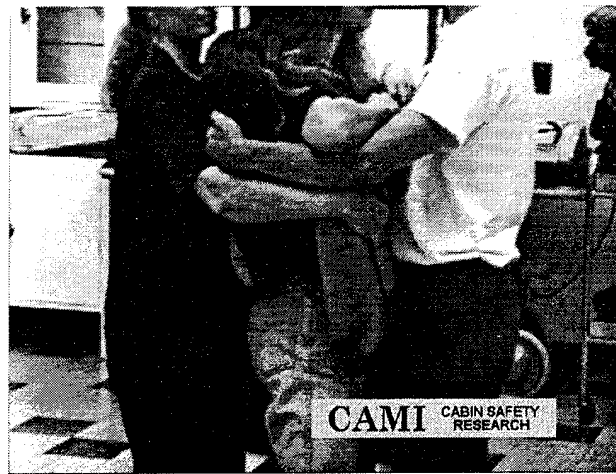


Figure 4
Flotation Technique 2



Figure 5
Flotation Technique 3

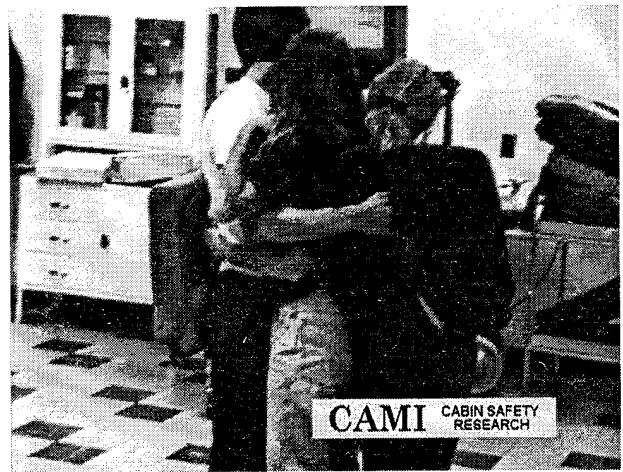


Figure 6
Flotation Technique 4

Procedure: Five techniques (see Figures 3-7) for flotation seat cushion use were selected for study: 1.) two subjects facing each other while holding two cushions between them, grasping the straps on the other subject's cushion; 2.) technique 1 with a third subject held between the two cushions; 3.) two subjects facing each other while each of them holds his or her own cushion on the other subject's back; 4.) technique 3 with a third subject held between the other two subjects; and 5.)

multiple subjects holding cushions and interlocking arms to form a large cluster. All techniques were performed first in a classroom, in order to explain the procedures, then in calm water in the CAMI survival tank. Later, a group of subjects was asked to perform the procedures in a pool with wave generation capabilities to simulate open-water conditions. In all configurations, the subjects were asked to interlock ankles or legs to form a more stable unit and to conserve body heat.



Figure 7
Cushion Technique 5

Results

The findings included observations of the research staff, a review of the video tapes, and comments from the participants. The first technique (Figure 3), with two people facing each other while holding two flotation seat cushions between them, appeared to be easy to initiate and maintain. It was a simple maneuver to separate and rejoin the two cushions around an "injured" person to form the second technique (Figure 4). Using this technique, the outer subjects' chests were covered by the cushions and the "injured" person in the middle was covered both chest and back by the cushions. This coverage should retard heat loss. The third method (Figure 5), accomplished by two people holding the cushions on the others' backs, was somewhat more difficult for the subjects to achieve. It also made it more difficult to hold the cushions down in the water. Similarly, it was more difficult to introduce an "injured" person between the two people, while maintaining control of the cushions (Figure 6). In spite of the difficulties, all subjects were able to accomplish the procedures, even in the wave pool. The chest and back of the "injured" survivor was covered by the chests of the cushion-holders. These were, in turn, covered front and back by either a cushion or by another member of the unit, further serving to retain body heat. The interconnected group (Figure 7) was usually a randomly-formed cluster that used any means to stay together. These means included interlocking arms, holding the straps on another's cushion, and grasping another's clothing. Some groups of participants formed short chains by placing their cushions between their chests and the backs of others (Figure 8). These chains were then connected laterally by interlocking arms or reaching over to grasp the straps of another's cushion. The subjects in the center of the group were covered on all sides with cushions and bodies of the other people. In the CAMI survival tank, where the

water temperature was 89 degrees F., some subjects complained of being uncomfortably warm. In all groups, subjects had a tendency to continue moving their legs around, as if to tread water. With frequent reminding, they would link legs, and cease movement, allowing them to remain buoyant and conserve energy and heat.

Very limited observations, using the small flotation dummy, suggest that the second technique (Figure 4), could be used effectively to assist a child when he/she is placed between the adults' cushions.

Discussion

Flotation seat cushions are likely to be used in the aftermath of an airplane landing in water, when they are the only means of flotation available, or when there is no time to equip passengers with inflatable life vests. Cushions are unique among emergency flotation equipment, in that they cannot be used properly by a passive survivor. Inflatable devices allow the victims to relax at some point, but seat cushions require diligent personal attention from the onset of crisis until rescue is completed. Therefore, less capable survivors, and those who did not retrieve a cushion while exiting the aircraft, will require assistance from other passengers to avoid drowning. Survivors that form and maintain groups should be able to assist others more efficiently by sharing responsibilities and resources. Techniques that place and keep survivors in close proximity to each other should have the added benefit of maintaining a sense of emotional well-being, while decreasing the effects of shock and hypothermia. Because individual floating objects tend to separate in moving water, grouping prevents survivors from drifting away from each other and becoming lost. Groups also make a larger visual target for rescuers to identify.

References

- 1.) *Code of Federal Regulations*, Title 14, Aeronautics and Space. Washington, DC: U.S. Government Printing Office, 1994.
- 2.) *Technical Standard Order C-72c, Individual Flotation Devices*, FAA Office of Airworthiness. Washington, DC, February 19, 1987.
- 3.) McFadden, EB; Simpson, JM; *Flotation Characteristics of Aircraft Passenger Seat Cushions*, FAA Office of Aviation Medicine Report Number DOT/FAA/AM-66-13. Oklahoma City, OK, 1966.
- 4.) *Safety Study - Air Carrier Overwater Emergency Equipment and Procedures*, National Transportation Safety Board Report Number NTSB/SS-85/02. Washington, DC, 1985.