ATLS - STOWAGE AND DEPLOYMENT TESTING OF MEDICAL SUPPLIES AND PHARMACEUTICALS

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OBJECTIVE:

Evaluate stowage and deployment methods for the HMF during microgravity.

TEST DESCRIPTION:

The specific objectives of this experiment are: **1)** to evaluate the stowage and deployment mechanisms for the medical supplies; and **2)** to evaluate the procedures for performing medical scenarios. To accomplish these objectives, the HMF test mini-racks will contain medical equipment mounted in the racks; and self-contained drawers with various mechanisms for stowing and deploying items. The medical supplies and pharmaceuticals will be destowed, handled, and restowed.

IN-FLIGHT TEST PROCEDURES:

Each of the stowage mechanisms will be evaluated by performing the following procedures: **1)** destowage; **2)** deployment; **3)** unpacking from card or container; **4)** dispensing, assembling, or handling; **5)** repacking onto the card or container, and then **6)** restowage.

EQUIPMENT AND MATERIALS

Stowage Mechanisms

The card method (see diagram) used several foam core cards with different supplies and medications attached to them. The attachment methods were small bungee cords, cut-outs in the card, and glueing the overwrap material to the card itself. The container method used an empty plastic tray (4 x 8 x 2), with a sealed cover that could be partly opened to access the contents. These trays were restrained within the drawer with foam (see diagram).

Deployment methods

The cards could be restrained with velcro onto a MRS-mounted metal tray and other surfaces of the drawers. Some cards had notches to "snap" into the handles of the drawers. The plastic trays had velcro on the bottom to be deployed onto the velcro-covered metal tray.

Layout (see diagram)

- Space utilized: Full width of KC-135, and 10 feet of length
- Two metal racks (19"x30"x48")
- Four rack-mounted drawers
  Three - 5" x 17.5" x 30" drawers
  One - 10 x 17.5" x 30" drawer

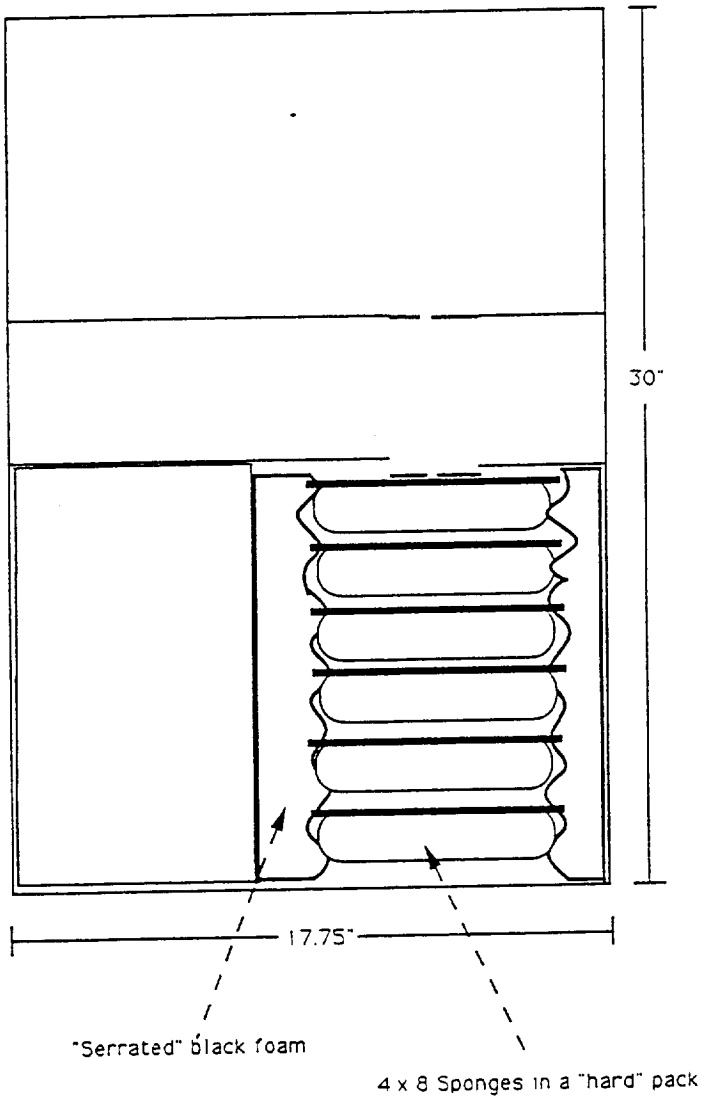
Inner drawer restraint devices

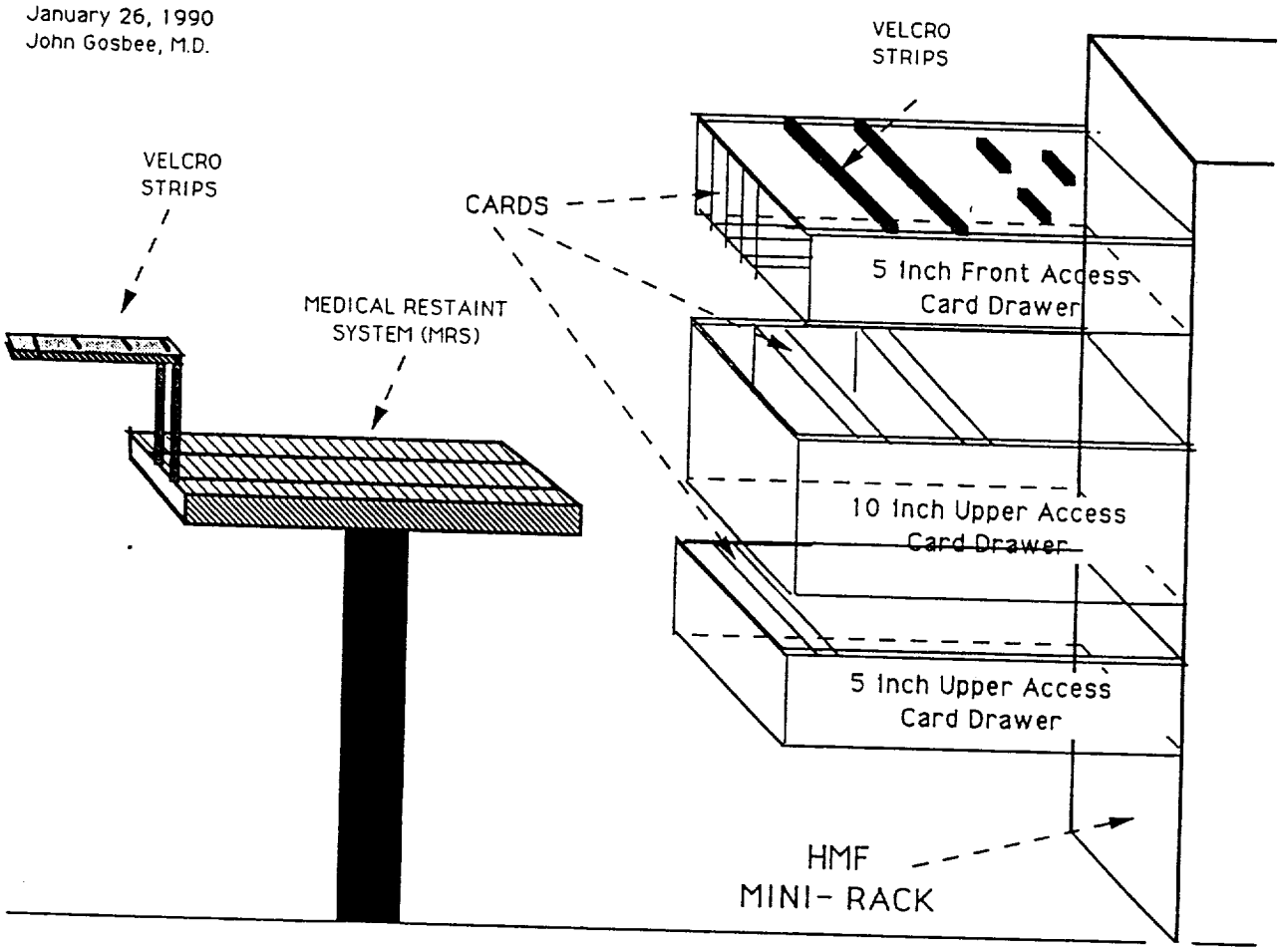
- Upper access cards with stowed items: 5 and 10 inch drawers
- Front access cards with stowed items: 5 inch drawer
- 4 x 8 inch trays within foam insets: 5 inch drawer

HMF prototype Medical Restraint System (MRS)

- Waist harness/straps for each "CMO"
- Rope around perimeter of MRS table
- One point tether straps attached to floor or base of racks

Plastic Tray Drawer Layout




January 26, 1990
John Gosbee, M.D.
VELCRO STRIPS
VELCRO STRIPS
CARDS
MEDICAL RESTAINT SYSTEM (MRS)
5 Inch Front Access Card Drawer
10 Inch Upper Access Card Drawer
5 Inch Upper Access Card Drawer
HMF MINI- RACK

Data acquisition

- In-flight written questionnaires
- Post-test debriefing
- Still and video photography

RESULTS

5-inch front access drawer

- Drawer front opened easily
- Tongue that was used to hold door open perpendicular worked great
- Cards slid out without trouble, but occasionally got jammed when putting them back in, or one of the items got cought up on the drawer opening.
- Pill bottles under loops were easy to remove, ONLY if the user held the unrestrained end of the card fixed.
- Pills went all over when trying to dispense into a baggy, or hand
- Bottles were hard to replace on the card under the loops
- Main deployment area used was the mountable card and the top of the drawer that had velcro.
- Cards and deployment surfaces didn't match up well, and therefore the cards were merely fixed loosely on one end, but not truly "restrained" so that items could be removed without holding onto the free edge of the card.
- This was true for the other 5 inch and 10 inch cards as well
- The shuttle-type, push up pill bottle failed. The only way to extract a pill was to "peel" back the plastic triangles and "flip" out one or more pills.
- The top of this drawer was used for deployment, but was unsatisfactory because it wasn't flush with the edges of the drawer.

10-inch upper access drawer

- The poor one-ended deployment was accentuated since these cards had more and larger items attached.
- Unpacking from the loops was good
- Unpacking from loops and an "edge" was no better, and a bit worse than loops alone for the 4x4's
- Again, with objects on both sides of the cards, they would never lay flat on any surface.
- In addition, you couldn't see what was on the other side of the card
- The "briefcase" type card that folded open onto the metal tray deployed very nicely, and stayed fixed upon the tray during the accessing of items under loops on the card.

5-inch upper access drawer:

- The cards slid out easily
- Poor deployment schemes, as above
- Some syringes and plungers were stowed separately in a standard box.
- There was no "clean" way to deploy these when assembling the syringes.

5-inch drawer with plastic trays:

- 4x8 plastic trays (packs) destowed easily with one hand
- Packs could be deployed onto the metal tray (with velcro) so easily, that they could be thrown onto the surface and stick down from a distance of 2-4 feet.
- Removal of one or more items from the packs was easy (Some packs were hard to tear open with the ad hoc use of staples)

- Sometimes the operator(s) would open the packs to much (90% of the way), which allowed all of the items out at once
- Restowage into the packs was easy, except for flexible items like sponges or cloth masks, which bunched up and had to be "stuffed" in.
- The packs restowed easily into the foam drawer with one hand.

SUMMARY OBSERVATIONS

1. All of the cards were easily destowed from the different drawer types. In restowing these cards, it was easy to misalign cards. This was partially due to the fact that the cards were constructed of foamcore, which is more difficult to maneuver. Also, this may be eliminated by making each card location specific.

2. There were problems in deploying the cards once they were removed from a drawer. It was somewhat of a hindrance to have velcro on the blind side of the card. It wasn't always obvious where the velcro would be, and as a result the card was often turned over to find out how to attach it. Lack of commonality continually caused a delay in deploying cards. When velcro was placed on the "blind side" of the card, or the side not facing the CMO when the card was destowed, the deployment attachment site was especially hard to spot. It was determined that restraint mechanisms for cards (velcro was used for this flight) must be uniform in location and method.

   The metal tray used on this flight had a raised surface around it's edge. This made it less appealing as a deployment surface. Firm attachment was impossible because the card couldn't lie flat. A level tray would be much more appropriate. Further thought would be required to determine the orientation for the velcro attachment points.

   Cards deployed to the front of the drawer had parallel attachment points, and were unstable. It was suggested that stability could be increased by attaching cards with parallel and perpendicular restraints.

   Use of the top of the front access drawer as a deployment surface was much the same as using the metal tray. Since this was not a flat surface area, cards didn't attach very well.

The card tray attached to the drawer front stuck fairly well, but lacked stability during unpacking. Once again, added perpendicular restraints could be used to increase the strength of this deployable surface.

The card tray "notched" to the drawer handle was completely unstable. This was partially due to the fact that it was constructed from foamcore, and wasn't as rigid as necessary. Even if the card was attached well, a torquing effect may still occur, making unpacking impossible.

3. Different containment methods were viewed as more advantageous than others.

   Items glued on cards worked well.

   Restraining items with loops received mixed reviews. This was an efficient method, but a CMO with larger hands would have some difficulty. A loop attached permanently on both sides tended to be easier to slip items out of, although it was harder to restow items into this restraint. A loop attached permanently on one side allowed free clearance to lift the item off of the card. These were cumbersome to detach, however, and also presented problems for restowage, especially when items required a certain orientation. Where multiple items were restrained under one bungee it was difficult to remove one item at a time.

   An easy method of stowage and unpacking was found with items fixed in slots which were attached to cards. These items were easy to unpack and to restow. This method, however, is only practical for flat items (such as gauze).

   Packaged items that were rolled up and attached to the card worked fairly well. If these items had any memory, however, they would tend to stay in their rolled configuration. Also, this method is only feasible for items which do not require to be kept flat.

   Individual items attached with velcro were easily unpacked and restowed.

   All of the items mentioned previously required two handed destowage. The "kits" with velcro on the bottom were very easy to destow one handed (deployed easily to the tray surface). They worked well even

without internal restraints, because items were densely packed within the kit. This packing tended to create a problem in restowing any unused portions. Also, only items that lent themselves to stacking could be restrained in this manner. Although more thought might be involved to fully develop this mechanism, it is seen as a viable stowage concept.

"Kits" made from cards worked fairly well. They presented a method of placing several items anticipated to be used repetitively in one convenient package. They were heavier than regular cards and therefore more cumbersome to handle. Because of the increased weight of the kit, it is more difficult to attach to the metal tray, and to restow in the drawer. Once again, this is partially explained by the material used in it's construction. Items within the Kit would most appropriately be placed in the order used.

Two sided cards were unsuccessful. Not only did they present a problem in seeing what was on the card, they could not be laid flat for restrain with velcro. Even if they were somehow restrained, they would have to be flipped after a period of time to access items on the other side. This problem could be solved if this card had another mechanism (beside laying parallel to a deployed surface) of restraint.

4. Items requiring assembly, such as syringes, generated a lot of trash. It was recommended that items such as these not be kept in a box (and then restrained to the card) if possible.

ISSUES AND RECOMMENDATIONS

1. Items need to be stowed on one side of card only. If items or kits excede the space available on one side of a card, a 'briefcase' card is a possibility.

2. Restraint mechanism for cards needs to be common in both method and location on the card.

3. The concept of having a work surface (ie either a separate pullout 'work tray' or a work card within a tray) is a good idea. The restraint of cards once deployed needs to be worked with the design of the MRS.

4. A method of restraining pills in bottles or in bags is necessary (e.g., the Freeman 1 device). A bottle alone with separate bags in which to place

the pills after dispensing is unacceptable.

5. 'Clips' should be used whenever possible. The use of rubber bands should be limited, especially in the case of bottles. Rubber bands (or bungees) might be suitable for some central supply items. Further research on the subject is needed.

6. The current Shuttle pill bottle should be redesigned. The Freeman 1 device needs to be explored.

7. Placing syringes in separate boxes is not optimal. This causes undo waste, takes up too much space, and is not easy to work with. Clips may be an adequate stowage and deployment device for pre-filled syringes.

8. Connections between loose items, such as the syringe and its cap, should be evaluated to decrease floating trash.

9. Plastic 'packs' need to be considered as a stowage and deployment device - possibly as a complement to the tray concept. It is possible the packs can be designed to restrain any amount of items.

10. Restowage a consideration that needs to be addressed? We need to see how it works once contents of the pack is low.

11. For visible aids, what about see through cards to allow CMO to see deployed restraint mechanism.

12. Human restraint is also a factor when exploring deployment and other restraint methods. This must be clearly defined to evaluate card restraint methods, areas for restraints, etc.

13. Cards must have a flat surface to restrain them in a stable fashion with velcro, or be bungeed down on either end of the card.

14. Additionally, it is inconvenient and difficult to "see" both sides of the card at once. A card that "folds out" like the Foley card may be better if you plan to use every item on the card in rapid sequence.

15. Cards or deployable tray cards need to have a more stable attachment mechanism than just a few strips of velcro on one end.

16. It was not obvious preflight, but it seemed that there are some inherent

problems involved in trying to restow used (or partially used) items on cards. It is almost always true that the shape of the item before unpacking and use differs from the shape of the replacement item.

17. It was apparent that deployment should be an integral part of the Medical Restraint System (MRS).

18. By placing deployment surfaces on the MRS, CMOs of varying stature could comfortably use these work surfaces.

NASA PHOTO REFERENCE

S90-35999 - 36000
Demonstrating weightlessness

S90-36015
Transfer of pills from bag to container in 0-g

S90-36022 - 26
Deployment of medical supplies from stowage

S90-36035 - 38
Deployment of medical supplies from stowage

S90-36050 - 51
Demonstrating weightlessness

S90-36055
Deployment of medical supplies from stowage

S90-36066 - 73
Deployment of medical supplies from stowage