

Human Factors Assessment and Redesign of the International Space Station Respiratory Support Pack Cue Card

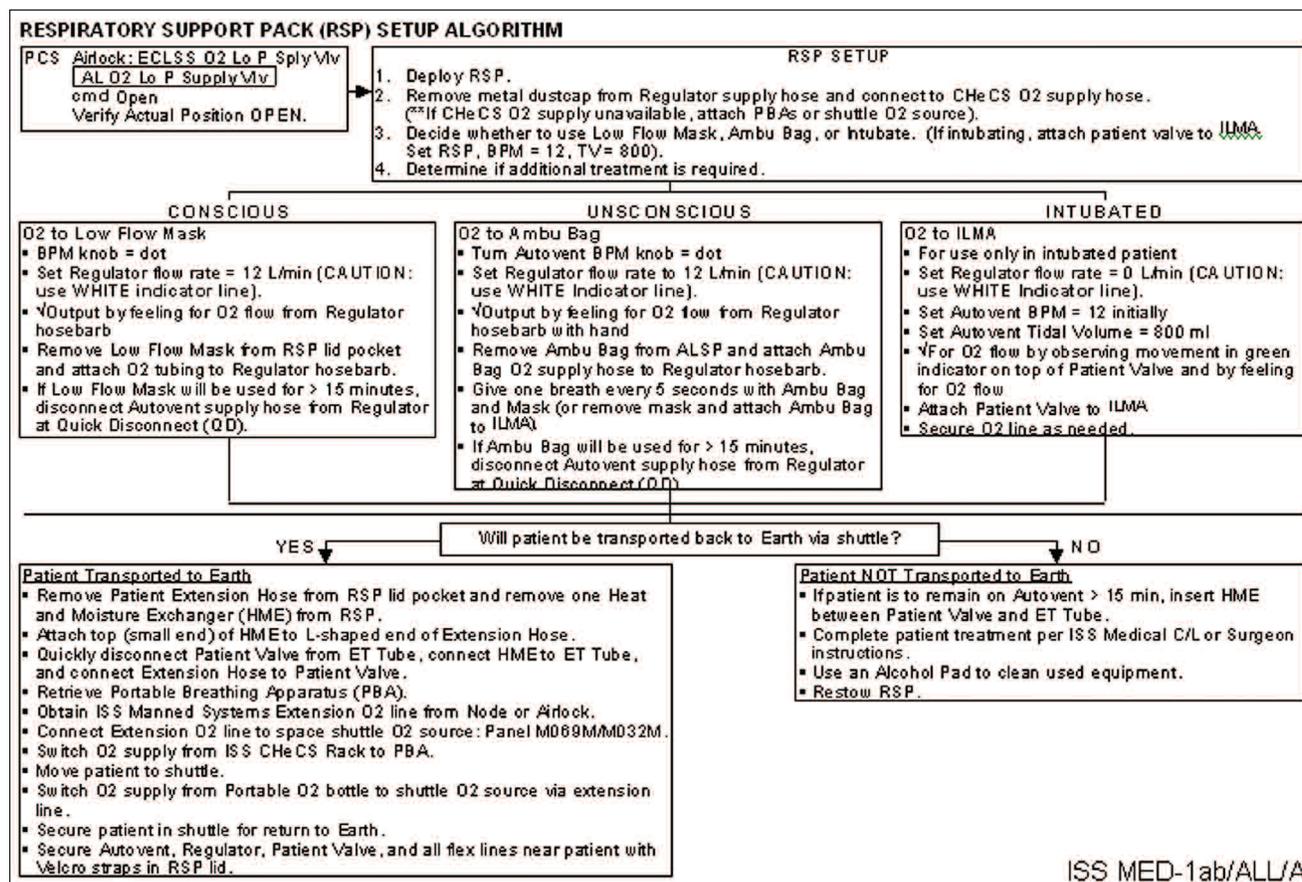
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The Respiratory Support Pack (RSP) is a medical pack onboard the International Space Station (ISS) that contains much of the necessary equipment for providing aid to a conscious or unconscious crew member in respiratory distress. Inside the RSP lid pocket is a 5.5-in. by 11-in. paper procedural cue card used by a Crew Medical Officer (CMO) to set up the equipment and deliver oxygen to a crew member. In training, crew members expressed concerns about the readability and usability of the cue card; consequently, the cue card update was completed. The Usability Testing and Analysis Facility at Johnson Space Center (JSC) evaluated the original layout of the cue card and proposed several new cue card designs based on human factors principles.

The approach taken for the assessment was an iterative process. First, to completely understand the issues with the RSP cue card, crew member post-training comments regarding the RSP cue card were taken into consideration. Over the course of the iterative process, the procedural information was reorganized into a linear flow after the removal of irrelevant (nonemergency) content. Pictures, color coding, and borders were added to highlight key components in the RSP to aid in quickly identifying those components. There were minimal changes to the actual text content.

Three studies were conducted using non-medically trained JSC personnel (total of 34 participants) to evaluate the cue



Original Pack.

Human Factors Assessment and Redesign of the International Space Station Respiratory Support Pack Cue Card *continued*

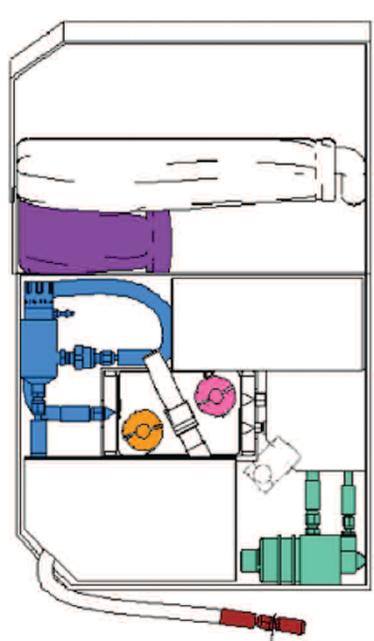
cards. Since CMOs may come from nonmedical fields, evaluation by similar subjects was necessary for confirmation of the cue card's effectiveness. Non-medically trained personnel participated to approximate a scenario of limited CMO exposure to the RSP equipment and training (which can occur 6 months prior to the mission). In each study, participants were asked to perform two respiratory distress scenarios using one of the cue card designs to simulate resuscitation (using a mannequin along with the hardware).

Procedure completion time, errors, and subjective ratings were recorded. The last iteration of the cue card featured a schematic of the RSP, colors, borders, and simplification of the flow of information. The time to complete the RSP procedure was reduced by approximately 3 minutes with the new design. In an emergency situation, 3 minutes significantly increases the probability of saving a life. In addition, participants showed the highest preference for this design.

The results of the studies and the new design were presented to a focus group of astronauts, flight surgeons, medical trainers, and procedures personnel. The final cue card was presented to a medical control board and approved for flight. The revised RSP cue card is currently onboard the ISS.

As a result of this project, these cue card design guidelines were developed:

- Provide a definite “start” and “stop” point
- Create a linear flow of information
- Add numbers to steps
- Add schematic(s) or picture(s) to cue card, but avoid too many pictures/too much detail
- Use color where feasible for identification, but do not overuse color (e.g., for decoration)
- Highlight important words with the use of bold, underlined, or bordered text



UNCONSCIOUS PATIENT				
1. Deploy RSP, ALSP and Defibrillator	4. Regulator WHITE indicator line → 12	6. Place Ambu Bag on Patient and give 1 breath every 5 sec while preparing ILMA (in IK/A)	8. Regulator WHITE indicator line → 0	11. Verify movement of green indicator on top and feel for Oxygen flow from Patient Valve
2. Pull red metal cap off Regulator Supply Hose and connect to Oxygen port (**if ChECs unavailable, use PBA port**)	5. From ALSP, retrieve blue Ambu Bag and attach Ambu Bag Tubing to RSP Regulator hosebarb	7. From IK/A, insert ILMA using ILMA cue card	9. Autovent BPM knob → 12	12. Patient Valve → ← ILMA
3. Autovent BPM knob → white dot (●)			10. Autovent Tidal Volume → 800	13. Contact Flight Surgeon
				14. Monitor patient
CONSCIOUS PATIENT				
1. Deploy RSP, ALSP and Defibrillator	4. Regulator WHITE indicator line → 12	7. Contact Flight Surgeon		
2. Pull red metal cap off Regulator Supply Hose and connect to Oxygen port (**if ChECs unavailable, use PBA port**)	5. Remove Low Flow Non-Rebreather Mask from RSP lid pocket and attach Mask Inlet Tubing to Regulator hosebarb.	8. Monitor patient		
3. Autovent BPM knob → white dot (●)	6. Put mask on patient			

Modified pack.