

# Crew Management Processes Revitalize Patient Care

## Originating Technology/NASA Contribution

In January 2009, birds struck the engines of US Airways Flight 1549 and forced an emergency landing into the Hudson River. Everyone on board survived, and the crew was lauded for remaining calm under pressure and keeping passengers safe. The pilot, Captain Chesley Sullenberger, is a former U.S. Air Force pilot, trained in Crew (or cockpit) Resource Management (CRM) which originated at NASA in 1979. Even before



Astronauts and pilots receive line oriented flight training (LOFT) in simulators, such as the one shown here. LOFT prepares crews for both routine and hazardous situations through highly realistic simulations.

they knew they had an emergency, the crew was using specific training for safe and effective operations: all parts of key NASA CRM methods required by US Airways since 1995.

In June 1979, John Lauber in the Aviation Safety Research office at Ames Research Center chaired a workshop that presented formal studies and discussions on human error in aviation. The workshop, *Resource Management on the Flight Deck*, presented research from over a dozen commercial and military pilots, university researchers, as well as Ames employee Hugh Patrick “H.P.” Ruffell Smith, whose data showed human error was the primary cause of aviation accidents.

Lauber and Ruffell Smith suggested that these human errors were caused by failures on a variety of levels: interpersonal communications, inadequate leadership, failure to prioritize and delegate, preoccupations with minor mechanical problems, and lack of situational awareness, which is the ability to recognize warning signs and anticipate potential danger. Another problem the researchers discovered was a failure to use available resources, including maps, navigation equipment, or others’ expertise.

Initially referred to as simply Resource Management, the proposed solutions evolved into CRM, a series of management techniques geared at reducing human error and improving safety through effective coordination of all resources. These skills, which can be improved through mock situations and simulations, include effective teamwork, meaningful communication, task coordination through checklists, and situational awareness.

In order to keep workflows predictable and as error-free as possible, CRM advocates using simple checklists to coordinate both tasks and communications among crewmembers. Without clear, predictable steps, disasters have occurred when captains assumed co-pilots had handled a seemingly minor problem, such as a malfunctioning light on an instrument panel. With CRM, crewmembers are taught to make no assumptions, but to follow printed

checklists, communicate clearly, and maintain constant awareness.

In CRM, everyone learns to articulate a discrepancy between what is happening and what should be happening—a moment in which one’s training in situational awareness becomes critical. Untrained operators may not notice this discrepancy, or may ignore it, which can lead to a serious situation, mistake, or fatality. CRM techniques include clearly expressing concerns and problems, after which everyone commits to a solution. While this may sound like common sense, the 1979 research showed that subordinates regularly hesitated to correct their supervisors out of a traditional—but sometimes dangerous—respect for authority.

Ruffell Smith also suggested a CRM-related program now known as Line Oriented Flight Training (LOFT), in which crews fly complete, realistic missions in simulators. In debriefings after the simulations, crew and instructors discuss, in detail, what areas need more training.

The Federal Aviation Administration (FAA), the military, several commercial airlines, and of course NASA, use NASA’s CRM and LOFT to prepare flight crews—like that of US Airways Flight 1549—for both routine and hazardous situations.

## Partnership

Cardiologist Drew Gaffney flew as a payload specialist in 1991 on STS-40, the first Spacelab mission dedicated to biomedical studies. On the mission, he worked with fellow physician and astronaut Rhea Seddon. Seddon became an astronaut in August 1979 and ultimately spent 722 hours in space, acting as a mission specialist on STS-51D (1985) and STS-40, and then as payload commander on STS-58 (1993). NASA prepared Seddon and Gaffney for both routine and emergency situations in their missions through extensive CRM skill training and LOFT simulations. In 2005, Seddon and Gaffney collaborated with two former FedEx Corporation CRM trainers and U.S. Navy top gun pilots, Steve Harden and

Alan Mullen, to found LifeWings Partners LLC, based in Memphis. The LifeWings founders had realized the medical industry was a natural fit for NASA's CRM and could benefit from techniques that helped crews function in stressful, fast-paced environments.

## Product Outcome

Situational awareness, peer monitoring, simulation training, and procedural checklists have long been a part of NASA's astronaut training, and the LifeWings partners discovered the need for these same tools in medicine. In medicine like with space missions, Gaffney explains, "There was a lot of routine, but a lot of stress. Decisions were high-consequence." As a result, LifeWings designed an approach to help hospitals use the same cockpit training and tools that had been so useful in making commercial aviation safe and reliable. LifeWings provides customized, in-depth CRM training to health care teams, which begins with onsite evaluations and focus groups, progresses with customized realistic simulations and extensive training in CRM techniques, and concludes with team assessments and interviews.

One skill that LifeWings stresses in its training is situational awareness. Doctors, nurses, and other hospital staff learn to notice subtle changes in their surroundings and to check in regularly with teammates. Gaffney explains that the LifeWings CRM training helps "create a culture that is psychologically and administratively safe," so that any employee can spot and report potential hazards without fear. Everyone shares responsibility for patient safety, and having team accountability works far more effectively than individual accountability alone.

This ongoing peer monitoring helps eliminate costly (and sometimes dangerous) medical mistakes, such as duplicating the administration of a drug, because everyone is aware of what a teammate is (or is not) doing. Gaffney says, "Because of their CRM training, if there is any confusion, everyone is expected to speak up and raise a concern," intervening with clearly stated questions



Rhea Seddon became an astronaut in August 1979 and ultimately spent 722 hours in space, acting as a mission specialist on STS-51D (1985) and STS-40 (1991), and then as payload commander on STS-58 (1993). In this image, Seddon performs cardiovascular experiments as part of the biomedical studies on STS-40's Spacelab mission.

or observations. Using good CRM, another teammate or the team leader acknowledges the question and responds; the added information and teamwork protect the patient from avoidable errors. Eventually, this cycle becomes routine and part of the culture, resulting in significant reduction in medical errors.

LifeWings uses simulations to evaluate new clients and see how their health care teams respond to different stressful situations, such as staff or room shortages, procedural bottlenecks, and various patient emergencies. These simulations help LifeWings identify focus areas for training or re-training, enabling the company to improve efficiency in both emergencies and routine procedures, such as getting a patient's results from a hospital laboratory or reducing waiting times. Health care teams, like astronaut

crews, benefit from rehearsing responses to realistic situations, and after being trained in CRM, the crews are better able to follow proper procedures, regardless of the situation.

Research published in January 2009 in *The New England Journal of Medicine* describes how doctors using a simple checklist before surgery were able to reduce post-surgical deaths by more than 36 percent. According to LifeWings president Steve Harden, when hospitals follow the LifeWings CRM training, they have seen major improvements, such as in risk-adjusted patient mortality. Harden explains, "We've seen decreases from 1.2 to 0.68," in observed to expected deaths, indicating an almost 50-percent improvement.

Focus group interviews performed by LifeWings indicated medical staff felt, after CRM training, they had better teamwork, less waste, greater efficiency, and better overall patient outcomes. The LifeWings data showed 51-percent improvement in operating room turnaround, 40-percent decrease in post-operative infections, and vast improvements in team members' willingness to speak out about possible problems and advocate for patient safety. Hospital administrators also note that the LifeWings CRM training seems to improve employee satisfaction, reduce patient stays and time in routine procedures, and reduce employee turnover.

In its first operating year of 2005, LifeWings had sales of close to \$500,000. Since 2007, sales have remained close to \$3 million, despite a struggling U.S. economy. Since 2005, LifeWings has brought its CRM training to over 90 health care organizations. ❖

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