

A Systems-Based Analysis of Teamwork Under Pressure in Aviation

Aviation has long been shaped by a strong safety culture built on the idea that accidents are rarely caused by a single mistake. Instead, they result from interacting system weaknesses, human limitations, and environmental pressures. Modern aviation safety culture emphasizes reporting errors without fear of punishment, standardizing procedures, and continuously improving training. Two foundational concepts within this culture are human factors and Crew Resource Management (CRM). Human factors refers to the study of how people interact with technology, procedures, and each other in complex environments. It recognizes limits in attention, perception, fatigue, and decision-making. CRM, developed after several high-profile accidents in the 1970s, focuses on communication, leadership, teamwork, situational awareness, and effective use of all available resources. Together, these principles aim to reduce error and improve outcomes, particularly in high-pressure situations.

One powerful example is United Airlines Flight 1175. Shortly after departure from San Francisco en route to Honolulu, the aircraft experienced a catastrophic right engine failure when the engine cowling detached mid-flight. Approximately 200 miles from Honolulu, the explosion caused severe vibration, disconnection of the autopilot and autothrottle, and significant cockpit workload. Captain Christopher Benham and First Officer Paul Ayres had difficulty communicating due to the noise and shaking. They struggled to read instruments, some of which were malfunctioning. As the aircraft descended through thick clouds, visual reference to the airport was lost. A third pilot, First Officer Ida Guren, who was seated in the jump seat, assisted with checklists and calculations while the captain manually controlled the aircraft for roughly forty minutes. The crew ultimately landed safely in Honolulu with no injuries.

From a human factors perspective, this incident involved high workload, sensory overload, degraded automation, and potential communication breakdown. The sudden loss of autopilot increased task saturation. Shouting over noise likely reduced clarity of communication and increased the risk of misunderstanding. However, effective CRM was evident. Leadership was adaptive rather than authoritarian. The captain focused on aircraft control, while responsibilities were redistributed. The authority gradient appeared balanced; the jump-seat pilot was integrated into the team and actively contributed. Situational awareness was maintained despite instrument challenges, and workload was managed through task delegation. Proper CRM was not merely theoretical in this case, it actively shaped the outcome. Clear role assignment, mutual support, and calm communication under stress prevented task overload from escalating into loss of control.

A different type of human factors breakdown is seen in British Airways Flight 5390. Shortly after takeoff from Birmingham in 1990, the windscreen of the BAC-111 aircraft detached due to incorrect maintenance bolts installed the previous day. The sudden decompression partially ejected Captain Tim Lancaster from the cockpit. His legs became entangled in the control column, causing the aircraft to pitch downward. First Officer Alastair Atchison assumed

control while flight attendants physically restrained the captain to prevent further structural damage. Despite severe wind and chaos, Atchison stabilized the aircraft and landed safely at Southampton. The captain survived.

This event highlights the importance of systemic human factors beyond the cockpit. The root cause was a maintenance error involving incorrect bolt sizing. This reflects breakdowns in procedural compliance, verification processes, and possibly normalization of deviance. Within the cockpit, CRM principles were critical. The first officer immediately assumed command authority when the captain became incapacitated. The authority gradient flattened out of necessity. Cabin crew became essential operational resources rather than passive participants. Communication under extreme stress remained task-focused: aviate, navigate, communicate. Decision-making was rapid and prioritized aircraft control. Proper CRM training likely prepared the crew to redistribute leadership dynamically and integrate non-pilot crew members into the problem-solving process. Without structured teamwork and assertive role adaptation, the outcome could have been fatal.

Air Canada Flight 797 in 1983 illustrates a different human factors challenge involving ambiguity and fire progression. A minor electrical issue in the rear lavatory escalated into an in-flight fire aboard a DC-9. Early signs included circuit breakers popping and a faint odor. Smoke later intensified, but the fire remained concealed behind panels. As electrical systems failed, navigation instruments degraded, and smoke entered the cockpit, the crew declared an emergency and diverted to Cincinnati. The captain landed successfully. However, during evacuation, a flashover occurred approximately ninety seconds after landing, resulting in twenty-three fatalities.

In this case, human factors centered on incomplete information, time pressure, and evolving risk assessment. Fire behind interior panels limited situational awareness. Without smoke detectors or clear visual confirmation, the severity was difficult to gauge. Decision-making involved balancing rapid descent with aircraft control and passenger management. Some controversy followed regarding whether evacuation timing or coordination contributed to fatalities. From a CRM perspective, this event occurred during an earlier era of CRM development. Modern CRM emphasizes assertive communication between cockpit and cabin, standardized emergency briefings, and early recognition of smoke as a high-threat condition. Today, structured communication and clearer evacuation authority protocols might further streamline decision-making. Importantly, this accident led to systemic improvements, including mandatory lavatory smoke detectors, improved firefighting equipment, and better cabin crew training. The lesson reinforces that CRM is not only about cockpit interaction but also about coordinated cockpit-cabin teamwork.

Across these three incidents, several common themes emerge. First, communication clarity under stress is central. Whether shouting over engine vibration, coordinating during explosive decompression, or assessing hidden fire, degraded communication increases risk. Second, leadership must be flexible. Effective captains redistribute workload and invite input

rather than relying solely on rank. Third, authority gradient matters. In both United 1175 and British Airways 5390, team members outside traditional command roles contributed significantly. Flattened hierarchy enabled better outcomes. Fourth, situational awareness is fragile when information is incomplete or instruments fail. Structured CRM techniques, such as cross-checking and verbalizing intentions, help maintain shared mental models. Finally, systemic human factors, especially maintenance errors and design limitations, demonstrate that safety culture extends beyond flight crews.

These themes resonate strongly with high-pressure healthcare teamwork. In an emergency department, like in aviation, outcomes depend on structured communication, clear role allocation, and the ability to speak up regardless of hierarchy. Safety culture in healthcare increasingly mirrors aviation by encouraging reporting of near misses and using standardized communication tools such as SBAR. Just as a first officer must assertively challenge a captain if needed, a nurse or technician must feel empowered to question a medication order or raise concerns about patient deterioration. Fatigue, workload, and authority gradients affect both environments.

What stands out in these incidents is not only technical skill but disciplined teamwork. CRM transforms high-stress situations into structured, manageable tasks. It reduces the likelihood that human limitations become catastrophic failures. In both aviation and healthcare, the goal is the same: protect lives through preparation, communication, and shared responsibility. These cases reinforce that safety is not accidental. It is built deliberately through systems that recognize human vulnerability and design teamwork to compensate for it.