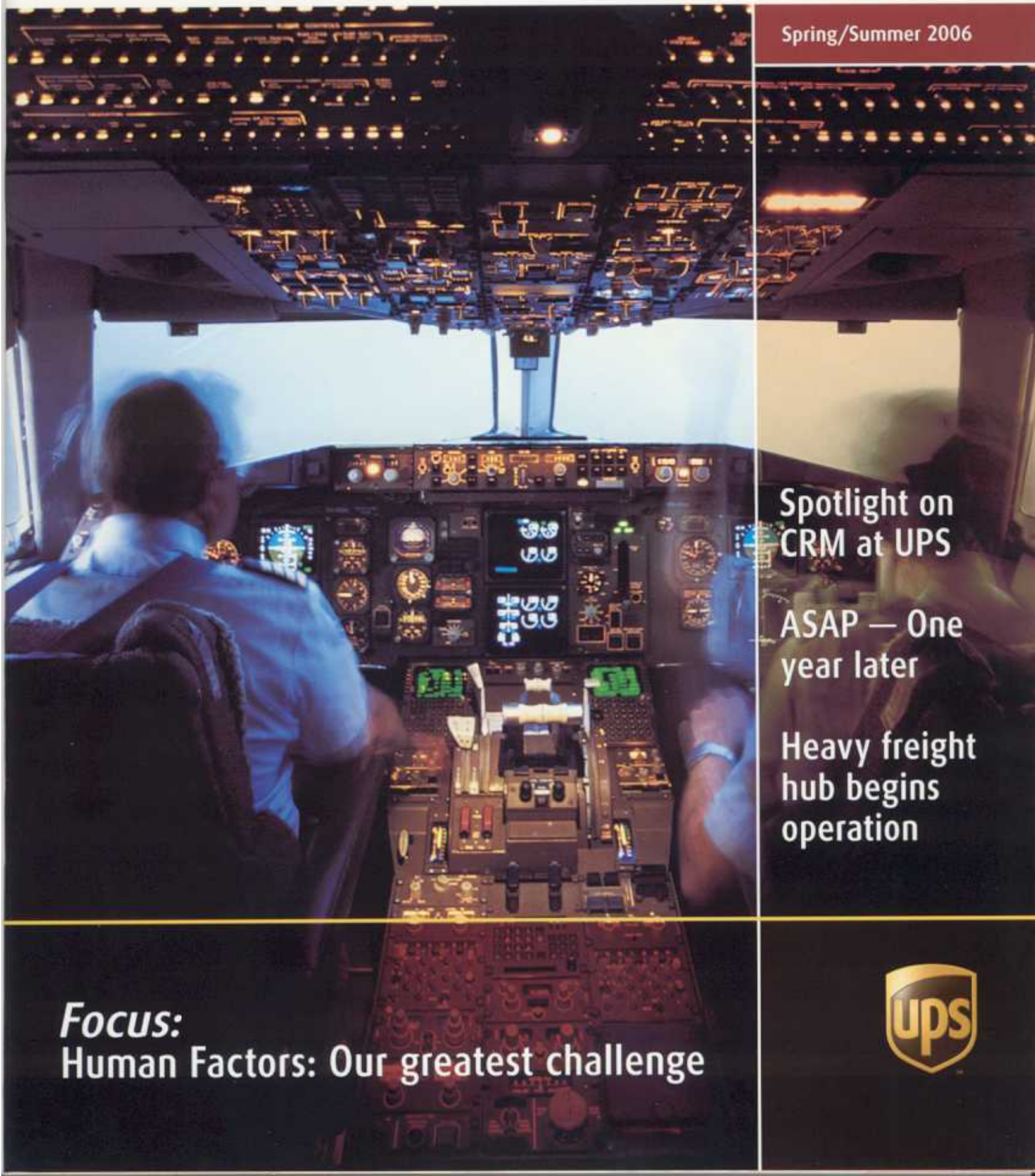
LeadingEdge

A UPS Flight Operations & Safety Magazine

Spring/Summer 2006



Spotlight on CRM at UPS

ASAP — One year later

Heavy freight hub begins operation

Focus:
Human Factors: Our greatest challenge

Two views of human factors challenges

By Dr. Bill Johnson, FAA, and Frank Skubis, UPS Airlines Director of Safety

The idea of writing about diverse human factors challenges from the flight operations and maintenance environment came about during casual conversation between the two authors. Each author created a list of the five most important challenges, one in the maintenance environment and one in the flight environment, and then combined their lists for this article.

Challenges in the Maintenance Environment

The task of identifying the five key challenges in the maintenance environment is straight forward since an FAA-industry panel did that in 2005. The result of their work was the creation of the Operator's Manual for Human Factors in Aviation Maintenance (www.hf.faa.gov/opsmanual). A team of industry, government, and academic human factors practitioners combined wisdom and experience to briefly explain why each topic is critical, how to address the topic, how to measure success and key sources for additional information. By design, the book is concise. It is written in straight forward language and appears to be more of a "how to" check list than a treatment of the human factors topic. Industry is quite receptive to this new breed of web-based FAA guidance material. It is already published in English, Spanish and Chinese. The FAA Administrator recently recognized the document with a coveted award for the use of plain language in government documents.

The Chapters of the Operator's Manual cover Event Investigation, Documentation, Training, Shift Turnover, and Fatigue/Alertness. Those chapters are the five main maintenance human factors challenges and are each briefly discussed here.

Event Investigation

To reduce maintenance human error events, organizations must recognize the contributing factors. This challenge is listed first because it is the most important step in addressing issues that, most often, are with the organization rather than the individual. The flight community discovered this long ago and has capitalized on the safety opportunities associated with event reporting.

Regulators, maintenance organizations and individuals are undergoing the cultural shift to report the factors that contribute to maintenance error. Maintenance is stepping up to the Aviation Safety Reporting System (ASRS) as well as the Aviation Safety Action Program (ASAP) that is working well for flight crews. Boeing's Maintenance Error Decision Aid (MEDA) is the universal tool for investigating events and guiding organizational actions toward optimal corrective actions.

The event reporting challenge lies in the corporate culture that encourages responsible reporting and provides fair systems to treat all reports. All maintenance organizations must move in that direction.

Documentation and Procedures

FAA research in 2001 showed that documentation errors were the most common cause for aircraft to have events after heavy maintenance checks. Quite simply, someone did not follow a procedure. Post accident analyses, where maintenance is a contributing factor, often

show that procedures were not followed. This is a very significant challenge for maintenance organizations.

Procedures are not followed for many reasons. While it is often as simple as "the mechanic failed to follow procedure," additional underlying causes often exist. For example, the local accepted practice or norm may be to skip certain procedures when rushed. In many cases, poorly written procedures are not corrected, thus they are not followed. Whatever the reason, all maintenance organizations must continue to focus on the quality of and adherence to procedures.

Human Factors Training

Until 2005, the FAA did not require human factors training in maintenance. The rules in Canadian and in European rules require such training. In 2005, rules for guidance materials for all maintenance repair stations (14 CFR FAR Part 145) strongly encouraged the inclusion of human factors in all approved maintenance training programs. Similar rules for Part 121 are being formed.

Training is only one part of a Human Factors program. It cannot be the only part of a program. The training can merely serve as a means to introduce the topic to the maintenance workforce and to inform them of other human factors interventions. The best training focuses on company-specific examples of human error events. Recurrent training will help ensure that the workforce maintains attention to the topic.

Shift/Task Turnover

Industry event data show that many errors are made because of the quality of communication as an incomplete task is handed from one person to another. While these handovers are most commonly at shift change they can happen anytime during the work day. The likely remedy is heightened attention to use of procedures, diligence in written documentation, and following the "3 Cs" for effective spoken and written communication — clear, correct and complete.

Maintenance task turnover must be as clear as flight deck communication as the aircraft transfers from ground–tower–departure–center. Effective communication is a shared responsibility between the transmitter and the receiver. One opportunity for improvement at UPS, and in most airlines, is between flight crews and maintenance. A lot of maintenance troubleshooting can be reduced if the written and verbal communication of flight crewmembers follows the three Cs. Communication is also critical between UPS maintenance personnel and the contract providers of maintenance services.

Fatigue/Alertness

In 2000, the FAA conducted research on alertness issues in maintenance. The results of extensive data collection showed that maintenance personnel were not sleeping enough. The FAA did not recommend an immediate rule change but instead suggested more training on the subject of alertness. Properly educated workers will view fatigue as the "fitness for duty" issue that it is. Schedulers and managers, properly trained, will recognize unreasonable schedules that may compromise work performance. Transport Canada is moving forward on a requirement for fatigue management programs in maintenance. It is only a matter of time, or events, before the FAA institutes such guidance. Until then, enlightened companies will address alertness issues for sound economic and safety motivation.

Sustaining a Human Factors Program in Maintenance

A final challenge for the maintenance environment is the lack of strict regulations regarding human factors. As a result the lean financial times leads to the reduction or elimination of programs not required by law. Maintenance Human Factors, because it is not yet required, have faced reduction. The FAA's Operator's Manual for Human Factors in Aviation Maintenance offers a straight forward method to conduct cost justification on human factors interventions. Human factors programs do not have to be law to make good economic sense. Proper analyses in any organization will demonstrate that you should not wait for the regulator to improve human performance in the company.

Challenges on the Flight Deck

The flight deck, not unlike an around-the-clock maintenance operation, is a very dynamic environment and presents many human factors challenges. In fact, many of the same challenges are encountered by maintenance technicians and flight crews, alike. For instance, Human Factors training, communications, adherence to procedures, and fatigue/alertness issues are problematic and affect both the pilot on the flight deck and the mechanic on the flight line.

To identify the most significant challenges, effective safety management systems (SMS),

such as UPS System Safety, must rely on non-punitive data collection programs. Currently, UPS employs several mature voluntary safety programs such as ASAP, Flight Operations Quality Assurance (FOQA), and the Event Reporting System to identify specific challenges at our airline. According to UPS System Safety Manager Jim Kent, "The purpose of any effective safety management system is to identify the hazard, measure the risk and mitigate that threat." In the near future, another complimentary safety program, Line Operations Safety Audits or LOSA, will join the mix. Past LOSA observations from other air carriers can provide meaningful insight into identifying current and future human factors challenges on our flight decks.

LOSA began in the early 1990s when the University of Texas – Austin received FAA funding to begin a Human Factors Research Project (UTHF). Initially, trained observers were placed on aircraft jump seats to help airlines gauge the effectiveness of their CRM programs. According to Dr. Robert Helmreich, a professor of psychology and leader of the UTHF project, these observations were the precursors of LOSA. In the late 1990s, the UTHF project and Continental Airlines expanded the concept and methodology to include recording of threats and errors and how flight crews deal with them. "This change greatly enhanced the usefulness of LOSA for airlines," says Helmreich, "expanding it from a Crew Resource Management (CRM) audit to one that places CRM skills into perspective as operational threat-and-error countermeasures."

According to Capt. Daniel E. Maurino, coordinator of the International Civil Aviation Organization (ICAO) Flight Safety and Human Factors Program, "LOSA has raised the level of safety analysis and provides airlines with earlier warnings of potential problems. With FOQA, for example, we know that we have a problem with unstabilized approaches, but we need to experience unstabilized approaches to trigger the data capture. It's the same thing with ASAP."

ICAO calls the concept and methodology of LOSA the "fifth generation of CRM," which in the context of LOSA is based on the premise that "human error is ubiquitous, inevitable and a valuable source of information." Threats and errors are a part of daily flight operations and must be managed. Observing the management of these threats and errors is a barometer of flight crew performance.

A Threat and Error Management Approach (TEM)

Threats may include factors such as adverse weather, hazardous terrain, unfamiliar airports, aircraft system abnormalities and malfunctions, or subtle time pressures that may not be apparent to the crew. Threats may also be introduced by others such as Air Traffic Control, additional crew members, dispatchers and maintenance technicians.

Flight crew errors are defined as actions or inactions that lead to deviations from the intentions or expectations of the flight crew or airline. Errors tend to reduce the margin of safety and can lead to accidents or incidents if not managed. According to ICAO, here are some common flight crew errors:

Intentional noncompliance errors are willful deviations from

standard operations procedures (SOPs) or regulations. These may include violating sterile cockpit procedures, using non-standard radio terminology, conducting checklist items from memory, or failing to respond to Traffic Collision Avoidance System or Enhanced Ground Proximity Warning System warnings.

Procedural errors are deviations in the execution of SOPs or regulations in which the intention is correct, but the execution is flawed. Forgetting to do something would fall into this category. Other procedural errors may include failing to conduct a checklist, incorrectly setting the altimeter or failing to cross-check instruments.

Communication errors include miscommunication, misinterpretation or failure to communicate pertinent information among flight crew or between the flight crew and another individual such as a maintenance technician, air traffic controller or dispatcher.

Proficiency-based errors involve lack of knowledge or "stick and rudder" (psychomotor) skills. Examples include inadequate knowledge of avionics systems which may cause automation errors or a hard landing caused by a limited amount of recent experience in the seat.

Operational decision errors are decision-making errors that are not standardized by SOPs or regulations that compromise the safety of flight. ICAO suggests that an operational decision error includes at least one of the following conditions: the flight crew ignores a more conservative operation; the crewmember who made the decision does not brief other crewmembers about the decision; or the crew does not use available time to evaluate options. One example of an operational decision error is the pilot monitoring accepting ATC instructions for a visual approach without the concurrence of the other crewmembers. There are many examples of operational decision errors based on convenience or complacency.

Typically, three outcomes result when an error occurs. The flight crew will either trap or properly manage the error, exacerbate the error with action or inaction that results in an additional error, or fail to respond to or ignore the error. Fortunately, most errors are properly managed and have inconsequential outcomes. Operators must continue to place emphasis on CRM training and recurrent training with emphasis placed on threat and error management skills.

Is There Really a Difference between Human Factors in Flight Vs. Maintenance Environments?

The authors fundamentally described the same human factors challenges albeit with a few wording changes. Both authors relied on industry information that has identified the most common challenges and corrective measures. Both the maintenance and the flight communities use the Aviation Safety Action Program as a way to encourage voluntary reporting and involvement of individuals, unions, management and the regulator. FOQA and LOSA are excellent tools to monitor and improve flight deck performance. It is not quite as easy to monitor individual performance of maintenance personnel. While maintenance organizations use MEDA, it is more reactive than proactive. TEM practices will evolve to the maintenance environment. Safety Management System philosophy and practice has the potential to blur the line between attention to human factors, whether it is flight deck or maintenance.

No matter what the title, uniform, rank, responsibility or work environment, we are all humans. We can all do a better job on written and verbal communication. We can all enhance our adherence to procedures and to documentation. We all suffer moments of fatigue, frailty, forgetfulness and attention deficit. Fortunately, we work with excellent team members and with equipment and systems that are quite forgiving. We must continue to appreciate the great "human factors" that make us joke, laugh and sometimes cry. We must appreciate that individually, and especially collectively, we can make difficult decisions and improvise like no machine ever will. As humans we must embrace our many cognitive and physical capabilities while being ever aware of the human factors that may lead to error.

Dr. Bill Johnson, FAA, Chief Scientific and Technical Advisor for Human Factors in Aircraft Maintenance Systems, was a contributing writer for this article. He has more than 30 years applied research and development experience with a focus on human performance in maintenance and repair of complex systems. For twelve years, he served as the contractor manager for the FAA's Research on Human Factors in Aircraft Maintenance and Inspection. In that capacity, he was the initial manager of the team that conceptualized and delivered the Online Aviation Safety Information System (OASIS). He is a Private Pilot and an Airframe and Powerplant Mechanic.