

Moving from Theory to Practice: Integrating Human Factors into an Organization

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Acknowledgments

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The Current Environment and the Current Challenge

There is widespread agreement throughout the operational, regulatory, and fiscal communities that integrating human factors and resource management principles into operations is a wise course of action. There is also increasing recognition by airline managers that human error is an inevitable consequence of a human-operated system and that the conditions that lead to error can be managed (Maurino, Reason, Johnston, & Lee, 1995). Senior managers are increasingly using human factors professionals and human factors departments to assist the organization with the identification and management of risk and conditions associated with human error. Increased interest in human factors integration has been fueled by operational successes in the Advanced Qualification Program (AQP), the publishing of the Human Factors National Plan, and the proposed FAA regulations requiring resource management training. For the airline manager it has become more a question of *how* to integrate rather than *if* an organization should integrate human factors and resource management.

The Human Factors National Plan (1995) provides a useful framework for guiding human factors integration. In fact, the application of human performance principles into operations is one of two primary agenda items contained in the National Plan. The Plan calls for “improving the application of research results to planned and ongoing programs.” This report will focus primarily on how to integrate human factors and resource management structures and processes into an organization. Using the guidance from the Human Factors National Plan and the ICAO Human Factors Digest No. 10, we highlight how human factors and resource management can be integrated. This report will focus on several aspects of integration to include the nature of the integration challenge, a systems approach, human factors department attributes, human factors department functionality and conclude with suggestions for moving from principle to action.

Resource management is only one discipline within the larger discipline of human factors. Several derivatives of Crew Resource Management (CRM) have emerged in recent years. Maintenance Resource Management (MRM), Dispatch Resource Management (DRM), Team Resource Management (TRM) and Corporate Resource Management (CRM) are a few acronyms used to describe tailored variations of basic resource management programs. Since this report is directed to the corporate level, all variations of Resource Management will simply be grouped together and labeled “Resource Management.”

The Nature of the Integration Challenge

The challenge for human factors managers can be summed up in one simple sentence: To translate good human performance science into action. This integration must be done with a “whole systems” approach to achieve sustained change.

“Contemporary safety views argue for a broadened perspective which focuses on safety deficiencies in the system rather than in individual performance. Evidence provided by analysis from this perspective has allowed the identification of managerial deficiencies at the design and operating stages of the aviation system as important contributing factors to accidents and incidents.” (ICAO, 1993, p. 1)

The translation of human factors science should happen on at least three levels; the organization, the workplace, and the task. Early human factors and resource management efforts focused primarily on the assessment of attitudes and the development of training programs. The training programs largely stood in isolation as appended

programs. Recent human factors efforts have been plagued by a predisposition to consider human factors and resource management as simply training interventions. It is important to note that one of the primary integration challenges a human factors manager will face will be to educate management and personnel that human factors is more than just training. The theories, models, and work of Professor James Reason and his colleagues have helped lead the industry toward an understanding of human factors in terms of a larger effort to manage human error on the organizational, workplace, and task levels.

Operational solutions to human performance challenges must acknowledge the influence and interdependence of workplace and organizational variables in shaping attitudes, behaviors and culture. Individual as well as organizational issues must be addressed to correct error producing conditions and human performance challenges. Attitudes, behaviors, and culture are shaped on an individual as well as organizational level. One of the most powerful shaping influences on corporate culture is individual and small group accountability. The ultimate measure of successfully internalized norms is observed when someone violates the norms. The following excerpt from the ICAO Human Factors Digest No. 10 (1993) highlights the importance of individual and small group attitude, behavior and culture.

“Culture defines the values and predisposed attitudes, exerting a final influence on the behaviour of a particular group. Norms are enforced by expressing disapproval of wrongdoers; how strongly a culture sanctions those who violate norms is an indication of the importance attached to those norms.” (p. 11)

This internalization on an individual, small group, and organizational level is critical to ensure that sound human factors practices become reflexive and expected. Human Factors Department form and function must be designed to affect individual, small group, and organizational performance. To affect individual and small group attitudes, behavior, and culture, there must be a corporate commitment to systemic integration of human factors. If the human factors principles are not internalized both individually and organizationally, the likelihood of their sustained practice is significantly reduced. Each individual must internalize and subsequently attach importance to human-factors oriented organizational norms. The human factors department must have the breadth and depth of reach to affect the attitudes, behaviors, and culture. This reach simply cannot be realized without a commitment to systemic integration.

Avoiding the “Quick Fix” Trap

Corrections to errors or human performance deficiencies too often focus on individual or crew remediation (punishment or additional training). Administering discipline or training the individual or crew is usually the quickest, easiest, and most familiar response to a deficiency. While there are times when discipline and/or training may be the correct response to a human performance deficiency, an accident, or incident, too often these “quick fixes” are used as bandages that do not correct the systemic or root causes of the problem. It does very little good to spend a lot of effort building “training vaccinations” or sending memos to change individual performance without considering the departmental and organizational components that contribute to individual performance. A quick fix (a memo, a briefing, etc.) may change behavior for a short time but the underlying habit patterns of the individual, the department, and the organization will generally drive behaviors back to the original state unless the underlying system is also fixed.

To look beyond individual performance, it is important to identify and assess the systemic and organizational factors that shape individual performance. A simple “fix-the-operator” approach to human performance neglects the reality and influence of other systemic contributors. To have a sustained effect on individual performance, the human factors programs must also address the organizational structures and processes that affect attitude, behavior, and culture.

Human Factors Department Attributes

This section highlights some of the attributes that should be integral attributes of a human factors department form and function.

Sufficient Resources to Sustain Change

One of the important attributes of a human factors department will be sufficient resources (staff, budget,

equipment, commitment) to sustain integration of the department and the programs. Integrating human factors into an organization's culture is like planting a tree in an arid climate; it must be nurtured and supported until it has deep enough roots to reach ground water after which time it will continue to survive on its own. This concept applies equally to the entire human factors department as it does for individual human factors projects. The end result of a "quick fix" approach is that the organization ends up where it started without the benefit of the money and time spent on the quick fix.

A Single Corporate Focal Point for Consistency

Many organizations have elements of human factors-oriented programs, policies, procedures, documents, and training scattered throughout the organization. The challenge of the human factors manager is to bring some consistency to the human performance programs that exist and to fill in the gaps where they do not exist. As the Human Factors Manager begins to scan existing programs, he or she will invariably identify gaps and duplications. The dissociated nature of departmental programs is the genesis of many gaps and duplications in human factors programs. A manager must ask "Is it possible that our organization has outstanding technical merit and performance as individual departments, yet on an organizational level we are inefficient?"

While it is important that human factors programs be tailored in language and function to each area of the company, it is equally important that there is a corporate-level focal point for core human factors related development. This focal point insures consistency while identifying and reducing duplication of effort. Systemic changes to philosophies, policies, procedures and practices, etc. must be consistent across organizational boundaries to become part of the corporate culture and style.

Placement at the Corporate Level

An early challenge for the senior manager who oversees the human factors department will be to create an organizational structure (form) that will allow for sufficient human factors breadth and depth to be able to shape attitudes, behaviors, and culture across organizational and operational boundaries. To accomplish this, the human factors manager must have the authority to reach across the whole operation.

Cross-Organizational and Cross-Departmental Reach

Many systemic difficulties that lead to human performance deficiencies are born from insufficient communications across departmental or operational boundaries. It is not reasonable to assume that all the individuals who affect the organizational structures and processes will have a comprehensive awareness of human factors science to be able to identify and incorporate these tenets. Without some common corporate focal point, it is even more unlikely that different departments (or operators in the case of contracts) will integrate these principles consistently. There must be an entity that assists with the integration of sound human factors principles consistently across departmental and operational lines.

Defining Human Factors Department Functionality

Human factors functionality must support existing core corporate programs while incorporating all the basic tenets of a sound safety orientation. ICAO Human Factors Digest No. 10: Human Factors Management and Organization (1993), offers several attributes inherent in a safety-oriented organization (See Figure 1). Philosophies, goals, definitions and models are all useful tools for building a program foundation and an enduring focus. A human factors manager must identify and use these boundaries to shape the human factors department and human factors programs. The human factors philosophies, definitions, and models a company selects are less important than the fact that they have selected some upon which to build a human factors program.

In general terms, safe organizations:

- Pursue safety as one of the objectives of the organization and regard safety as a major contributor in achieving production goals;
- Have developed appropriate risk management structures, which allow for an appropriate balance between production management and risk management;
- Enjoy an open, good and healthy safety corporate culture;
- Possess a structure which has been designed with a suitable degree of complexity, standardized procedures and centralized decision-making which is consistent with the objectives of the organization and the characteristics of the surrounding environment;
- Rely on internal responsibility rather than regulatory compliance to achieve safety objectives; and
- Respond to observed safety deficiencies with long-term measures in response to latent failures as well as short-term, localized actions in response to active failures.

Defining a Philosophy to Focus and Prioritize Human Factors Efforts

A philosophy is a useful tool for determining program and department direction as well as prioritization. From this philosophy, a coherent and consistent set of policies, procedures, and practices can be derived. As one moves from philosophy to practice, the verbiage becomes less abstract and more action oriented. Wiener and Degani (1991) state: “.. by establishing a philosophy of operations, management states how it wants the organization to function. Such philosophy can only be established by the highest corporate level. From philosophy, policies can be developed. Policies are broad specifications of the manner in which management expects tasks to be accomplished...”

Delta’s Human Factors Department Operating Philosophy:

Identify and manage the conditions that contribute to human error while remaining the facilitators of human performance excellence

The absence of accidents is not a reliable indicator of system safety. Safety and human factors programs must be more than goal line defense efforts that react to errors or focus on minimum acceptable compliance standards. Programs should identify and manage conditions that lead to error while facilitating a movement toward human performance excellence. Excellence, however, cannot be mandated; it must be internalized at the individual, small group, and organizational level. While minimum compliance standards should be respected as inviolate, they should not become the benchmark for optimum system or individual performance. Increased safety margins through improve human performance are best realized by identifying and managing the conditions that lead to human error and focusing on excellence. Management commitment to both managing error and building human performance excellence should be visible and unwavering. Human performance will be as good as senior management desires or as bad as they will allow. There is a huge spectrum of possible performance that is largely determined by senior management orientation, proactivity, and support.

Delta’s Human Factors Department Goals

To improve the safety and efficiency of Delta operations by: 1. Assist in creating and supporting programs for managing and mitigating risk associated with human error; 2. Facilitating excellence in human performance programs.

Delta’s Human Factors Department Mission

To manage the risk of human error by analyzing human performance with respect to all four resource quadrants (people, policies/procedures, machines, operational support structure) on three levels (organization, work conditions, & tasks) using multiple disciplines (psychological, physiological, psychosocial, biomechanical, systems science, management science, etc.) to arrive at adjustments and improvements in the four areas a manager controls to shape job performance and minimize the risk of human error (selection, training, resources, and motivation).

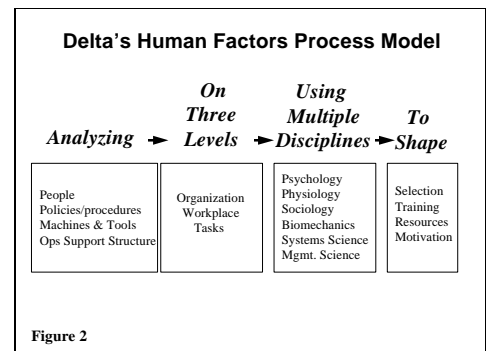


Figure 2

The Human Factors Department Role:

The role of the Delta Human Factors Department is to be a service entity providing guidance and insight to operational managers (internal customers) across departmental boundaries for identifying and managing the risks and conditions associated with human error and integrating human factors principles in a systemic manner. The goal is to provide operational managers the awareness and tools to manage the risks associated with human error and strengthen human performance themselves.

The following are some of the services offered to internal customers by Delta Air Lines’ Human Factors department:

- Conducting risk assessments and human performance audits to identify opportunities for performance enhancement
- Assisting in the development of human factors and resource management training programs

- Conducting human factors analysis component of accident and incident investigations
- Matching human performance challenges with experts inside and outside the company
- Assisting in the development of performance-oriented recruitment, selection, and personnel development programs
- Assisting in the development of human performance and risk management feedback and information systems

Building Form and Function with the Basics

Many of the basic principles of human factors, resource management, and training are timeless and provide a useful foundation for building human factors form and function regardless of the national or organizational culture. This section highlights some of the basic principles and models used to shape Delta’s Human Factors form and function.

To build realistic boundaries for your Human Factors department and programs it will be useful to establish definitions for both Human Factors and Resource Management. While this may seem basic, without a common definition and common boundaries, a common vision of program form and function will be elusive. Without foundational definitions and models, the human factors manager will likely find himself or herself creating a program without limits while chasing amorphous and ill-defined expectations.

Human Factors Definition:

Human factors can be defined as the multi-disciplinary science focusing on systematic and comprehensive assessment and improvement of human performance.

The Primary Disciplines of Human Factors

There are many disciplines associated with human performance. To be a credible human performance resource, the human factors department should have the capability to address the primary disciplines (Psychology, Physiology, Sociology, Biomechanics, Systems Science, & Management Science) integral to human factors.

Delta’s Core Human Factors Model

At Delta, we use an adaptation of the Edward’s SHELL model as a core framework for human factors. The human function is analyzed in four different contexts: hardware, software, liveware, and environment.

Four Contributing Factors to Job Performance a Manager Controls

To shape human performance, it is important to assess the factors that are within the control of an operational manager. The Jones (1993) model highlighted in Figure 4 highlights the four components of job performance a manager controls.

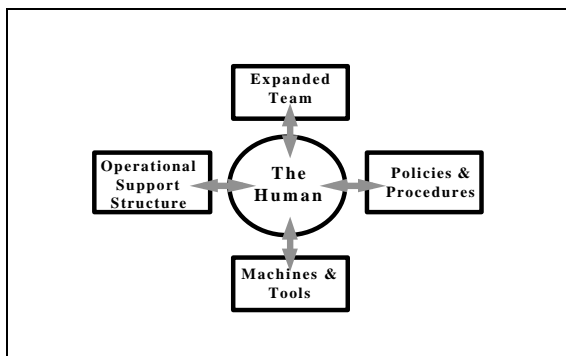


Figure 3: Delta’s Basic Human Factors Model (An adaptation of Edward’s SHELL Model)

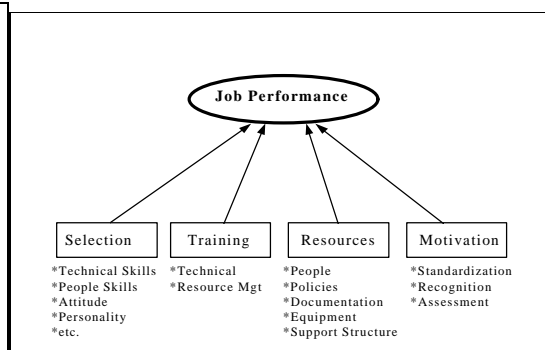


Figure 4. The Four Contributing Factors to Job Performance a Manager Controls (An adaptation of the Jones Model)

Resource Management Definition

Within the discipline of Human Factors, Resource Management training programs will be one of the most useful tools available to managers throughout the organization for shaping performance. A clear definition of Resource Management will help define the scope and focus of departmental and program efforts. Recent definitions of

Resource Management have begun to encompass a much broader scope and have been coined as Corporate Resource Management. It will be important for the manager to determine the scope of resource management efforts to establish a focus and boundaries for program development. We found it useful to break down (C)RM into individual components, define each separately, then offer a collective definition. The following is Delta's definition of (C)RM:

* *Crew / Team / Maintenance / Dispatch / Corporate*: The scope of extended group that collectively contributes to the operation. * *Resource*: The people, policies, machines and operational structure that the group can call upon during the operation. * *Management*: The knowledge, skills, and roles the individual uses to manage resources. **The Collective Definition of Resource Management:** The knowledge, skills and roles used to direct, control, and coordinate all available resources toward safe and effective operations.

Delta's Six Resource Management Categories

To systematically integrate the resource management skill set into documents, standards, policies, procedures, training and evaluations, it will be important to further identify, define, and categorize resource management. The categories collectively represent the skill set an individual uses to manage resources. Many organizations slice the Resource Management pie in different ways. How an airline categorizes resource management is less important than the fact that they have established a categorization scheme. Delta's six resource management categories are: Communication, Crew Coordination, Planning, Workload Management, Decision Making, and Situational Awareness Management. It is important to note that the categories should be stated in terms of skills and not abstractions or concepts.

Moving from Theory to Practice

The principles of good human performance are relatively simple. Translating these simple concepts into practice (e.g. selection criteria, policies, procedures, documents, training) is the challenge. Most airlines would not be in business if they did not have a cursory understanding of how to adapt to environmental demands and harness human performance. As the industry increasingly puts voice to the tenets of human performance, the airline manager can structure sound adaptations by objectively and overtly weaving human factors principles into philosophies, policies, procedures, and practices. To create excellence in human performance the managers, and the line personnel will have to extend the understanding and integration of human factors beyond an unstructured adaptation or a cursory awareness. The first challenge is to put these sound human factors and resource management principles into an organizational language that can be understood by everyone. The next challenge is to weave these concepts into policies, procedures, documents, company structures, training, etc. in a coherent and unified manner from top to bottom. Figure 5 highlights a list of integration tips to help the human factors manager. Due to space restrictions, the tips cannot be further developed within the context of this paper. Suffice it to say, however, that entire papers or book chapters could be dedicated to each of the tips.

- Identify, assess, and report human performance problems and error producing conditions to management
- Bring the sciences to bear on the problems and challenges
- Generate operational solutions and prototypes
- Help managers develop and use risk management and human performance feedback systems
- Proactively develop a departmental structure rather than letting one emerge
- Two options for identified risks and human performance deficiencies: Fix the system or adapt to the limitations
- Accommodate the reality of limited company resources by prioritizing risks and interventions
- Identify and leverage existing company people, programs, and resources
- Continually educate managers and personnel how to use human factors principles to improve their capability

Figure 5: Tips for moving from theory to action for the human factors manager

Conclusion

There have been some notable successes in applied human factors within airline organizations. Human error, however, will always be a variable that must be managed and there are many human performance challenges and opportunities that remain undeveloped. Through an orientation toward translating theory into practice, a foundation in human factors and resource management basics, a clear understanding of human factors department

attributes and functionality, all tied together in a systems approach, human performance improvements can become an integral part of an airline's form and function.

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