

# The Good, the Bad and the Tradeoff

**Compromise between productivity and accuracy cannot be avoided.**

## BOOKS

### Push and Pull

#### The ETTO Principle: Efficiency–Thoroughness Trade-Off

Hollnagel, Erik. Farnham, Surrey, England and Burlington, Vermont, U.S.: Ashgate, 2009. 162 pp. Figures, tables, references, index.

The ETTO (efficiency–thoroughness tradeoff) principle can be stated most simply, Hollnagel says, as follows: “In their daily activities, at work or at leisure, people routinely make a choice between being [efficient] and being thorough, since it rarely is possible to be both at the same time. If demands for productivity or performance are high, thoroughness is reduced until the productivity goals are met. If demands for safety are high, efficiency is reduced until the safety goals are met.”

A bird in the wild looking for dinner can illustrate the ETTO principle, Hollnagel says. It must go “head-down” to find food, but “head-up” to detect predators. Neither requirement can be eliminated. “The partly unpredictable environment of wild birds therefore requires them to find a balance or a strategy that increases their chances of survival on both counts,” he says.

When people assume that there is little or no risk, efficiency takes over and thoroughness is a distant second. “As long as the assumption is right and there is no risk, it is safe,” says Hollnagel. “But as soon as there is a risk, it is not.

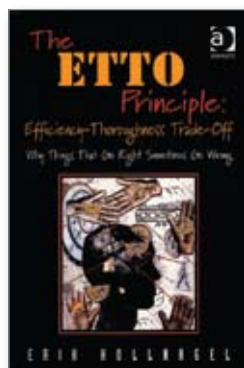
And human — and organizational — memory is unfortunately rather short.”

Another way to look at the principle is to distinguish between information “pull” and information “push.” In the former, “the user or operator decides when to get information, and will therefore also usually have the time and resources (and readiness) to make use of it,” Hollnagel says. “In information push, the information is forced upon the operator who may not be ready to deal with it.”

One form of information push happens when ongoing activities are interrupted by a new event. “If this happens often, the typical response is to be efficient rather than to be thorough, since this reduces the likelihood of losing control,” he says.

There are dozens of unofficial work rules based on efficiency. Among those Hollnagel cites are these:

- “It is good enough for now, or for ‘government work’” — meaning that it passes someone’s minimal requirements;
- “It will be checked later by someone else’ — so we can skip this test now and save some time; [and,]
- “We must get this done before someone else beats us to it or before time runs out’ — therefore, we cannot afford to follow the procedures, rules and regulations in every detail.”



The ETTO principle often takes the form of a relationship between how fast something can be done and how precisely it can be done. This applies to individuals and organizations.

“When asked to perform a task as well as possible, people will apply various strategies that may optimize speed, optimize accuracy or combine the two,” Hollnagel says. “For a concrete example, think of a radar operator trying to identify an approaching object, which could be friend or foe. An incorrect identification might be fatal, but so might waiting too long in order to be sure.”

At the organizational level, “It is not unusual that the pressure to plan and implement a change — often with the primary purpose to cut costs — forces decisions to be made on an insufficient basis,” he adds.

Although safety professionals are inclined to focus on the value of thoroughness, that cannot be an end in itself. For example, Hollnagel says, “Thoroughness requires that all, or as much as possible, of the available information is used, processed or taken into account. This demand is reasonable, as long as the amount of information is limited. But in our day and age, that is not the case. We are all constantly inundated with data, and frequently find ourselves in a situation that best can be characterized as information input overload. ... There is more information available than can be made use of in the time available.”

In practice, says Hollnagel, using the ETTO, individuals respond with tactics such as omission, or temporary non-processing of information; reduced precision, or trading accuracy for time, which leads to a “more shallow” use of the input; queuing, or delaying response during high workload, hoping for a lull later on; and filtering, or neglecting to process certain information categories, prioritizing data types.

The book describes many kinds of tradeoffs, some leading to bad outcomes, but most capable of being viewed as sensible. “Making such tradeoffs is not only normal for

humans and organizations, it is actually necessary,” Hollnagel says. “The best illustration of that is when people stop making them, as when they work strictly according to the written procedures and follow safety or other regulations to the letter. ‘Work-to-rule’ invariably leads to a slowdown and a loss of efficiency and is therefore often used as a minimal form of a labor strike.”

— Rick Darby

## ELECTRONIC MEDIA

### Portable Instruction

#### Safety Behaviours: Human Factors for Pilots

Australian Government, Civil Aviation Safety Authority (CASA). CASA Aviation Safety Promotion. First edition. 2009. To request information about obtaining kits, e-mail <humanfactors@casa.gov.au> or visit <www.casa.gov.au>.

“Safety Behaviours: Human Factors [HF] for Pilots,” a training package for “fixed-wing pilots from low-capacity air transport and charter operations, flying training schools and private operators” was developed by CASA. The target audience is general aviation and low-capacity public transport sectors, CASA says, because they tend to lack the resources to implement safety management systems, HF training, flight operational quality assurance and other currently recommended safety programs.

The kit is designed to enhance awareness of single-pilot HF issues and threat and error management (TEM). According to CASA, “On March 1, 2008, the Day Visual Flight Rules Syllabuses (Aeroplanes) Issue 4 and (Helicopters) Issue 3 became effective. These documents contained new flight standards for single-pilot HF and TEM. From July 1, 2009, HF and TEM are being assessed on flight test exams for the General Flying Progress Test and private and commercial pilot licenses. Additionally, TEM will be examined in all HF aeronautical knowledge examinations for these licenses from July 1, 2009. Consequently, instructors will be required to teach HF and TEM skills, and approved testing officers and flight operations inspectors



will need to assess the standards on license and rating flight tests.”

CASA summarizes the importance of HF to safe aviation operations as follows:

- “Human performance issues continue to dominate aviation accident statistics;
- “The effective management of error remains one of the greatest challenges to the further reduction of accidents and improving aviation safety;
- “Effective technical [factors] and HF are required for safe and efficient flight operations; [and,]
- “The continuing threat of low-capacity air transport accidents, the need for improved efficiency and the importance of having fit-for-duty flight crew highlight the crucial role of effective HF”

The safety behaviors kit is designed for group-facilitated or self-paced, individualized training. Kit contents include a pilot’s workbook, resource guide, facilitator’s guide, DVD, CD-ROM and guidance material. CASA recommends that individuals work with a mentor or tutor, perhaps a senior pilot, rather than training alone, thus enabling discussion of case studies and exercises. Classes with a facilitator provide even greater value, says CASA. The elements of the learning program encourage a systematic pattern of studying a chapter in the resource guide, then watching the corresponding dramatization on the DVD and following up with related exercises in the pilot’s workbook.

The “Resource Guide for Pilots” study topics are fatigue, stress, alcohol and other drugs, communication, teamwork, leadership, situational awareness, decision making, TEM and airmanship. Each chapter of the resource guide is a self-contained module focusing on one of the topics and contains explanatory text, figures, tables, photographs, references, a list of related resources and a summary of key points.

The DVD includes a 30-minute dramatic re-enactment based on the lives of two young pilots working for a low-capacity regional airline. One pilot, single with an active social life, and the other, with a family, face challenges of work-life balance, fatigue and sleep deprivation, alcohol and medication abuse, stress and other life issues. Re-enactments demonstrate personal and workplace events to illustrate preparation and communication, personal responsibility and self-discipline, crew resource management, mentoring from senior staff and HF skills. Upon completing the first part of the DVD, pilots are encouraged to complete corresponding exercises in the accompanying workbook. In the second part of the DVD, HF and industry experts analyze problems exposed in the drama and discuss solutions.

The “Workbook for Pilots” contains case studies to teach and reinforce a practical understanding of various HF issues. Chapter topics match those in the resource guide and correlate with the DVD. Each chapter contains suggested discussion, practical activities and written exercises.

The kit includes a facilitator’s guide with recommended group-facilitated and self-paced learning strategies and a reprint of CASA-issued Civil Aviation Advisory Publication (CAAP) 5.59-1(0), “Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management.” The CAAP is a guidance document for instructors and is also available free at <[www.auf.asn.au/safety/CAAP\\_5\\_59\\_1.pdf](http://www.auf.asn.au/safety/CAAP_5_59_1.pdf)>.

The final item in the kit is a CD containing full-text versions of all books in the kit. These electronic duplicates may be read online, downloaded or printed as needed.

“While we cannot eliminate human error, a thorough understanding of human factors principles can lead to the development of appropriate policies, strategies and practical tools to mitigate its adverse impact on aviation safety,” CASA says.

— Patricia Setze

**‘Human performance issues continue to dominate aviation accident statistics.’**

**WEB SITES**

**Focusing on Commercial Aviation Safety**

**United Kingdom Flight Safety Committee,**  
 <[www.ukfsc.co.uk](http://www.ukfsc.co.uk)>

“The United Kingdom Flight Safety Committee [UKFSC] is an unincorporated association of professionals dedicated to the improvement of commercial aviation safety,” the Web site says. “Members meet regularly to exchange safety information and to examine ways to improve safety and to avoid incidents and accidents.”

The committee makes some of its publications and resources available to nonmembers — safety alerts, notices and briefings; risk assessment and management, and safety management system materials from the U.K. Civil Aviation Authority and other organizations; and examples of fatigue and safety attitude surveys. These documents, articles, presentations, workshop handouts and other materials are free and may be read online or printed. Likewise, past issues (2000–2007) of UKFSC’s official magazine, *FOCUS on Commercial Aviation Safety*, are free online.

Videos, CDs and books are available to members only, but publishers and authors are identified, making it easy for nonmembers to locate their own sources. The Web site includes information about UKFSC events, courses, committee activities and history.

The UKFSC has transitioned to a new Web site, but the old site may still be accessed through a connecting link from the new site or directly at <[www.ukfsc.co.uk/oldsite](http://www.ukfsc.co.uk/oldsite)>.

— Patricia Setze



**Looking Through the Portal**

**Aircraft System Safety,** <[www.aircraftsystemsafety.com/Home/tabid/36/Default.aspx](http://www.aircraftsystemsafety.com/Home/tabid/36/Default.aspx)>

The opening page says, “The aim of this website is to provide a ‘first stop’ portal for anyone interested in safety assessments and safety cases.” As a portal, the site identifies and links to information and resources that focus on the development and operation of large aircraft systems.

The site contains a glossary of aviation terms; a bibliography of aviation system safety books, papers and magazines; links to safety-related Web sites; industry news articles; and information on safety services offered by the Web site authors. Readers are invited to contribute to the bibliography.

There is a lengthy list of “safety assessment tools and techniques” that are used by various industries, including aviation and transportation. Software, diagrams, graphics, analyses, methodologies, and other tools and techniques are briefly described. The site says, “Each of these tools has its own advantages and disadvantages and the extent to which these can be used during various phases of the product life cycle, and the degree to which they can be applied to safety assessments, vary.”

— Patricia Setze

