



© Chris Sorensen Photography

Word lists and writing rules take the confusion out of aviation maintenance documents.

Simplifying the

English is the international language of aviation — and therefore the language most frequently used in technical and maintenance documents — but often it is not the native language of the maintenance personnel who use these documents.

As a result, complex technical instructions can be misunderstood, especially by those without strong English language skills — and occasionally by native-English speakers — and the misunderstandings can lead to accidents.

The International Civil Aviation Organization (ICAO) said in a 1996 article in the *ICAO Journal* that language errors had become more prevalent, partly because air carrier airplanes were being manufactured in many different countries, where many different languages are spoken.

“Sometimes, the technical language of the manufacturer does not translate easily into the technical language of the customer, and the result can be maintenance documentation that is difficult to understand,” ICAO said.¹

“Anecdotal evidence suggests a case where a certain maintenance procedure was ‘proscribed’ (i.e., prohibited) in a service bulletin. The technician reading this concluded that the procedure was ‘prescribed’ (i.e., defined, laid down) and proceeded to perform the forbidden action.”

The International Federation of Airworthiness (IFA) cited another example involving a Japanese operator’s airplane, in service for five days without batteries for the emergency exit door operation auxiliary system.²

“During maintenance, the battery cases were replaced,” the IFA report said. “Seven of the eight [replacement] cases did not contain batteries. Another mechanic who should have checked the existence of the batteries had reportedly misread the English manual.”

These and other examples illustrate how difficult a language English can be, said the Aerospace and Defence Industries Association of Europe (ASD), which has developed rules for the use of English in aviation maintenance documents.

“Many readers [of technical maintenance documents] have a knowledge of English that is limited, and are easily confused by complex sentence structures and by the number of meanings and synonyms which English words can have,” the ASD said.

Pattern of Errors

A study conducted for the U.S. Federal Aviation Administration (FAA) on language errors within the worldwide maintenance repair and overhaul (MRO) market found that the most common errors involve both written English and spoken English.³ The study identified the most frequent language-related errors as involving one of the following three scenarios, in which a maintenance employee:³

- Was unable to communicate verbally at the level required for adequate performance;
- Did not realize that a person he or she was speaking with had limited English ability; or,
- Did not fully understand written documentation in English, such as a maintenance manual or a work card.

“Language errors of many types are possible, although only a few are frequent, with a language-error-prone activity having consistent characteristics: complex task instructions; poorly designed document, in English; users

Technicalities

BY LINDA WERFELMAN

with low ability in English and low familiarity with the task to be performed; and time pressure to complete the task,” said one of several reports on the study, which included surveys of 941 maintenance personnel in Asia, Europe, Latin America and the United States, along with task-card comprehension tests and group discussions of scenarios involving language errors.

“When listed in this way, language errors appear to have all of the usual human factors ingredients for error, not just language error. ... The implication is that if the ‘usual’ error-shaping factors are present, then the ‘usual’ interventions should be effective (e.g., training, documentation design [and] organization design.)”

© Chris Sorensen Photography



The study identified a similar pattern in the most frequently cited factors that could prevent language errors:

- “The mechanic or inspector is familiar with this particular job;
- “The document follows good design practice;
- “The document is translated into the native language of the mechanic or inspector;
- “The document uses terminology consistent with other documents; [and,]
- “The mechanic or inspector uses the aircraft as a communication device, for example, to show the area to be inspected.”

Although the study found language errors to be a “potential problem,” it also identified two frequent factors in the discovery of an error: the mechanic or inspector either “asked for assistance or clarification” or “appeared perplexed.” Both factors rely on “feedback from the message recipient to the message sender,” the report said, and both typically occur early in the maintenance process.

“Detection of language errors is typically reported well before any maintenance/inspection errors have been committed, or [before] the aircraft is released for service,” the report said.

The study found that younger maintenance personnel and those with better reading skills experienced fewer language errors.

“Increasing mastery of English will have a significant impact on comprehension and is a vindication of the English language training programs invested in by many of the MROs we visited,” the report said.

‘Strong Case’ for Simplification

ICAO said in its 1996 article that the preponderance of maintenance information published in English made a strong case for the use of simplified technical English, a “controlled language” — that is, a language specifically adapted to eliminate ambiguity and complexity by using only selected words and applying grammar rules in very specific ways.

Others in the aviation industry have shared that belief. Efforts to address maintenance problems associated with misunderstandings of written English began on a large scale in the late 1970s, when the Association of European Airlines asked the European Association of Aerospace Industries (AECMA) — as the ASD was then known — to develop its first version of simplified technical English suitable for use in aviation maintenance documentation. AECMA's first product, *AECMA Simplified English*, has been revised several times; the current document is *ASD Simplified Technical English, Specification ASD-STE100*, which combines writing rules and a dictionary of “controlled vocabulary” (see “Writing to Rule”).⁴

“Clear and unambiguous maintenance instructions are the scope of the specification,” said Orlando Chiarello, chairman of the ASD STE Maintenance Group and product support manager for Secondo Mona, an Italian manufacturer of aircraft fuel systems and other components. “Although sometimes difficult for the writer, the unique scope of ASD-STE100 is to give to whoever does maintenance in whichever part of the world a text which must be technically correct and simple to understand. The user does not have to learn ASD-STE100; she/he has simply to read an English text that is clear and easy.”

Since 1987, the use of ASD-STE100 has been a requirement of international standards for aircraft maintenance documents.

With its beginnings in Europe and North America — home to most manufacturers of aircraft, aircraft engines and other components — simplified technical English has remained more prevalent on those continents than elsewhere in the world, Chiarello said. Nevertheless, manufacturers in Africa, Asia, Australia and South America also use ASD-STE100, he said. In addition, in Russia, one manufacturer has requested permission to adapt ASD-STE100 to the Russian language with the development of Simplified Russian. Originally developed for civilian aviation, ASD-STE100 has been incorporated into standards for production of military aircraft.

“Theoretically, all manufacturers who write maintenance procedures in accordance with [the

Writing to Rule

Simplified technical English in general — and Specification ASD-STE100, developed by the Aerospace and Defence Industries Association of Europe, in particular — is intended specifically for people who use English language technical documents in the aerospace industry.^{1,2}

The primary components of simplified technical English are a set of writing rules for style and grammar, and a dictionary containing about 1,000 approved words. Also included are a thesaurus and guidelines for adding words to the approved technical vocabulary.

Among the rules:

- Write in the active voice (i.e., “The pilot flew the airplane,” rather than “The airplane was flown by the pilot”);
- Avoid long compound words and long sentences; and,
- Be consistent in your choice of words.

— LW

Notes

1. Aerospace and Defence Industries Association of Europe (ASD). *Simplified Technical English*. <www.simplifiedenglish-aecma.org/Simplified_English.htm>.
2. Boeing. *Simplified English Checker*. <www.boeing.com/phantom/sechecker/se.html>.

international standards] should mandatorily use ASD-STE100,” Chiarello said. “How correctly it is used is difficult to say, and there are many factors that may have influence on the correct usage.”

Although ASD-STE100 results in the use of simplified English for the readers of maintenance documents, it is “not a simplified version of English for the writers,” he said, noting that those who use the specification to prepare aviation maintenance documents in technical English must have a good command of written English and thorough training in the use of ASD-STE100.

The ASD-STE100 dictionary contains about 1,000 “general vocabulary” words, although writers using the specification may add the technical names and technical verbs required to describe various maintenance procedures, said Richard Wojcik, associate technical fellow for Boeing Phantom Works, a research and development unit at Boeing. There are, however, 20 categories that must be applied to determine whether a word qualifies as a technical name and 11 categories of technical verbs, Wojcik said.

When the technical names and technical verbs are included, “you have potentially thousands and thousands of words,” he said, adding that, to some extent, “it’s up to the judgment of the writing establishments within the companies which words they’re going to allow for their companies as technical names.”

The ASD says that the specification emphasizes the principle of “one word — one meaning.” Therefore, in situations in which several English words mean approximately the same thing, the dictionary includes only one and excludes the synonyms.

“For example, ‘start’ was chosen instead of ‘begin,’ ‘commence,’ ‘initiate’ or ‘originate,’” the ASD says. “When there are several possible definitions of a word in English, the specification selects one of these definitions to the exclusion of the others. For example, ‘to fall’ has the definition of ‘to move down by the force of gravity,’ not ‘decrease’ (Table 1).”

Wojcik cited another example: the word “interference,” which according to the rules may not be used “when it means things knocking together” but is permitted in describing electrical interference, which is “not an event but rather an environmental condition.”

“Many of the rules in simplified technical English are designed just to clarify — they’re the same rules that any good technical writer would apply,” Wojcik said. “In general, it’s a clarifying standard. ... It just forces people to take out the double-talk, the unnecessary wording, the circumlocution, all the things that people will put into a document because they want to sound educated or because they just aren’t thinking very carefully about how the reader is going to understand what they’re saying.”

Several companies produce the software typically used to implement

Simplification	
STE:	“Stop the power supply.”
Non-STE:	“Turn off the power.”
Explanation:	“‘Turn’ is approved when you use it to ‘move something around its axis.’ If you do not ‘turn’ something to stop the power supply ... do not use the word ‘turn.’”
STE:	“Continue the test.”
Non-STE:	“The test can be continued by the operator.”
Explanation:	“Use the active voice” — rather than the passive voice in choices of verbs and sentence structure.
STE:	“Set the rotary switch to INPUT.”
Non-STE:	“Rotary switch to INPUT.”
Explanation:	“Do not omit verbs [to make sentences shorter]. The reader will not know what the action is.”
STE:	“When the landing gear retracts: <ol style="list-style-type: none"> (1) The door-operating bar on the leg touches and turns the latch. (2) This causes the roller to move out of the slot. (3) The second roller holds the door-operating bar.”
Non-STE:	“During the final movement of the landing gear retraction, the door operating bar located on the leg contacts and turns the latch, withdrawing the roller from the slot and the second roller entraps the door operating bar.”
Explanation:	“The tabular layout of text ... with standard punctuation can help to show the relationship between two or more complex actions or events. This is clearer than writing long sentences.”
STE:	“Make sure that the oxygen tubes are fully clean. This will help to prevent contamination and explosions.”
Non-STE:	“Extreme cleanliness of oxygen tubes is imperative.”
Explanation:	“Be specific in a warning or caution. You must tell the users exactly what they must do and what can happen, to get their attention immediately.”
STE = standard technical English	
Source: Aerospace and Defence Industries Association of Europe. ASD-STE100, <i>Simplified Technical English</i> . Issue 4. January 2007.	

Table 1

ASD-STE100, including Boeing, whose Simplified English Checker tells writers if they have used unapproved words or violated writing rules. The program does not automatically correct what it identifies as errors, however; instead, it provides writers with information and allows them to determine whether what they have written makes sense.⁵

Changing Practices

Philip Shawcross, vice president of the International Civil Aviation English Association, said that standardization of language used by maintenance personnel has become increasingly necessary because of the substantial changes in maintenance practices over the past 20 years, including:

- Expansion of the role of computers in the maintenance environment;
- Fewer translations of documents from English to a native language;
- Increased use of manufacturer-generated standardized training materials — written in English;
- More alliances among airlines, many of which are in countries that have no common language; and,
- An increasingly mobile, multicultural work force.⁶

“All these trends have something ‘invisible’ in common: a much increased reliance upon language and upon a single language — English,” said Shawcross, who also is in charge of training curriculum design for Aviation English Services, which provides training and testing in aviation-specific English.

“The regulations set by civil aviation authorities represent only one of the pressures exerted on operators to ensure that their maintenance staff [attains] a given level of proficiency in English,” Shawcross said. “Operational, technical, safety, financial and commercial pressures are probably more effective in the way they drive for efficient communication. ... Translation is costly and slow. Computer-assisted translation for technical texts is still very far from being reliable. ... Using the single universally recognized aviation language competently also makes good business sense.”

Simplified technical English is not perfect, Shawcross said, noting that critics sometimes complain about its rules and/or choices of words.

However, it “does embody a considerable amount of common sense and good practice and has provided editors worldwide with a single framework within which to write,” he added. “As a

result, maintenance documents from all the main manufacturers are much more uniform and accessible than many were 20 years ago.”

Nevertheless, authors of the FAA language-error study said they were surprised to find that simplified technical English “had no consistent effect” in limiting language errors among non-native speakers of English outside the United States. Earlier findings had shown that simplified technical English was effective for non-native English speakers in the United States.⁷

“Perhaps [simplified technical English] is less useful when applied in a setting where the native language is other than English,” their report said. “Similarly, neither the interventions of a bilingual coach or a glossary produced any significant results, despite their widespread use as interventions at MRO sites.”

The report added that translation of information from English into the native language was “the only consistent significant intervention” in preventing misunderstanding. Partial translation, with technical terms left in English, was as effective as full translation.

As a result of the study’s findings, the report recommended training for maintenance personnel in written and spoken English and use of good design practices in work documents, as well as recognition of “the symptoms of imperfect communication” and the harmful effects of time pressures.

Proficiency Requirements

Although ICAO moved in 2004 to establish a baseline for English language proficiency for pilots and air traffic controllers, with proficiency testing set to begin in 2008, maintenance personnel were not included.

Elizabeth Mathews, a specialist in applied linguistics and leader of the international group that developed ICAO’s English language proficiency standards, said that maintenance personnel require skills in reading, writing and speaking/listening to English. Detailed studies would be required before the appropriate proficiency levels for maintenance personnel could be determined, she said. ●

Notes

1. International Civil Aviation Organization (ICAO) Secretariat. “Awareness Grows of Importance of Human Factors Issues in Aircraft Maintenance and Inspection.” *ICAO Journal*. January–February 1996.
2. International Federation of Airworthiness (IFA). “Human Factors: New Technology Adds a New Dimension to Documents.” *IFA News*, 2006.
3. Drury, C.G.; Ma, J.; Marin, C. “Language Error in Aviation Maintenance: Findings and Recommendations.” Included in *Aviation Maintenance Human Factors Program Review, Fiscal Year 2005*, July 2006. The study was conducted for the U.S. Federal Aviation Administration, which was especially interested in maintenance, repair and overhaul facilities that were engaged in contract maintenance for major airlines.
4. Aerospace and Defence Industries Association of Europe (ASD). *Simplified Technical English*. <www.simplifiedenglish-aecma.org/Simplified_English.htm>.
5. Boeing. *Simplified English Checker*. <www.boeing.com/phantom/sechecker/se.html>.
6. Shawcross, Philip. “Reading and Writing English in Engineering and Maintenance.” Presentation to the 20th conference of the International Airline Language and Communication Organisation. Feb. 3–4, 2005.
7. Drury; Ma; Marin.

Further Reading From FSF Publications

FSF Editorial Staff. “High Stakes in Language Proficiency.” *Flight Safety Digest* Volume 25 (January–February 2006).