

Investigators failed to 'connect the dots' in their analysis of language factors in the 2006 collision over the Amazon.

# Speaking Outside the Box

Second of Two Parts



BY ELIZABETH MATHEWS

**A**lthough the final accident investigation report on the 2006 collision of a Boeing 737-800 and an Embraer Legacy 600 over the Amazon identifies findings involving communication and language, the report does not draw a connection between inadequate English language proficiency and the communication failures cited as causal factors (ASW, 12/11–1/12, p. 22).

In particular, there is evidence that air traffic controllers had inadequate English

language proficiency and may have experienced a resulting degree of “communication apprehension,” a factor that could explain the otherwise nearly inexplicable failure of at least two controllers to communicate routine, key and required information.

The Legacy pilots, in turn, demonstrated a lack of awareness of their responsibility to adhere to International Civil Aviation Organization (ICAO) language requirements and of the threats inherent in cross-cultural and

cross-linguistic communication. In addition, they demonstrated inadequate communication strategies, perhaps partly as a result of a degree of inhibition in response to several instances of difficult or failed communication with controllers.

Taken together, these factors helped establish the latent conditions upon which the active operational failures depended to generate the unlikely but calamitous result — the Sept. 29, 2006, collision of the two aircraft, which killed all 154 people in the 737.

### The Stage Is Set

The report by the Brazilian Aeronautical Accident Investigation and Prevention Center (CENIPA) detailed various distractions on the flight deck of the Legacy, including the pilots' focus on a laptop computer, which interfered with their situational awareness, their monitoring of instruments and their communication with air traffic control (ATC).

In addition to the evidence that the pilots allowed themselves to be distracted on the flight deck and did not maintain an adequate level of vigilance, it is noteworthy that by the time the Legacy had crossed the Brasília VHF omnidirectional radio (VOR), they had experienced several communication failures with ATC.

### Communication Strategies

One minor problem occurred when a Legacy pilot failed to use ICAO phraseology to tell ATC how many people were in the airplane. He spoke about “souls on board,” instead of the ICAO-required “persons on board.”

A second communication breakdown centered on the delivery of clearance information. The episode — described in the CENIPA report — provides insight into the effect that communication difficulties can have. The report noted that, on two occasions, “the Legacy crew tried to learn the altitude to be maintained at the OREN SID [standard instrument departure], but the pilot did not get a correct answer from the ATC unit.”

A review of the transcript of this exchange reveals a number of subtle linguistic phenomena.

Because the clearance had omitted the initial altitude to be maintained, the Legacy pilot queried the controller, “And what initial altitude for clearance?” The controller asked the pilot to “Say again, please.” The pilot’s reply was difficult to hear because of radio interference, and only “... altitude for takeoff?” is intelligible.

At this point, according to the CENIPA report, “Either due to having misunderstood or because he did not feel comfortable to ask the pilot to repeat, [the controller] replied that the aircraft was authorized to taxi up to the holding point of Runway ... 15 of São José airport.” That is, the controller responded to the pilot but did not answer his question.

CENIPA identified the discomfort that instances of failed communication cause. When confronted with communication difficulties, participants have two choices: They can use strategies that will help them achieve their communication goals (achievement strategies) despite the difficulties, or they can employ “reduction strategies” and reduce their communication goals in response to the difficulties.<sup>1</sup>

Topic avoidance is one example of a reduction strategy. Responding without answering the pilot’s question could be a face-saving technique; feeling too uncomfortable to once more ask the pilot to “say again,” the controller provided other information, unrelated to the pilot’s question, avoiding the topic.

When the pilot sought clarification a third time, he implemented a number of achievement strategies within his request of, “Yes sir, after takeoff, what altitude you’d like (unintelligible).” In the face of his own probable discomfort over having to repeat his question, the pilot sought to maintain rapport by employing politeness strategies: He prefaced his query with “Yes sir” and used a polite question form, “you’d like” (for “you *would* like.”) He also rephrased his request, placing key information

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— “After takeoff” — at the beginning of his question. He attempted to simplify the request and clarify his question, from his original “initial altitude for clearance” to “after takeoff, what altitude.”

Again, the controller replied — “After takeoff, report Oren Departure, Oscar Romeo Echo November, Transition Poços de Caldas” — but did not answer the pilot’s question. After these three tries, the pilot gave up and continued to taxi, another example of a communication reduction strategy: The pilot abandoned the communication.

Although this was a minor exchange with no seemingly direct bearing on the critical communication breakdown over the Brasília VOR, it is worthwhile, nonetheless, to consider how this early communication breakdown may have influenced pilot expectations for the tenor of future communication with ATC.

Both the literature on crew resource management and linguistic research confirm the chilling effects of inadequate early communication on subsequent communication.<sup>2,3,4</sup>

Robert Young and William Faux found, in a 2010 study, that when confronted with difficult communication with non-native English speakers, native English speakers “quit, withdrew or made no attempt to continue with difficult conversations” more frequently when they perceived that the non-native English speaker’s limited proficiency caused a failure in the execution of his or her job responsibilities. That is, native speakers were less tolerant of communication difficulties when it was perceived that the language problems interfered with the ability of the non-native speaker to do his or her job.<sup>5</sup> Communication breakdowns introduce stress into the interaction and can cause a subsequent reluctance to engage in further communication.

The inadequate communication to ATC by the Legacy pilots — cited in the CENIPA report as a factor in the accident — may be attributed, in some part, to their reaction to a series of difficult or inadequate

communication from ATC, beginning with their earliest communication. That is, they responded in a way that research suggests is

## Opinion: It’s Not Someone Else’s Problem

This topic cannot be concluded without a final note regarding the criminal trial of at least one of the controllers involved and the chilling effect that such legal action has on aviation safety.

Criminalizing aviation errors, even those with tragic results, misplaces the energy for action that inevitably is invoked by tragedy. Only an uninhibited probe of all aspects of an accident or incident can provide the information the industry requires to improve safety. If operational personnel fear the threat of prosecution, they are not able to be forthcoming with vital information.

More urgently, at a personal level for the controller in this case, if, as the evidence suggests and as his attorney claims, language proficiency was an underlying factor in his failure to communicate the required information, then culpability for his air traffic control communication failures would most certainly not be his, but would instead belong to the system that placed a controller without adequate English language proficiency into a position for which he was not adequately trained.

English language proficiency is not optional for air traffic control; it is fundamental. Controllers and pilots have the right to effective training to ensure their English proficiency is adequate to safely manage all requirements of their jobs.

Passengers have the right to expect that the pilots and controllers on whom their safety depends are able to communicate effectively and safely in all instances.

Extending that argument to a legitimate conclusion, the case is made that the “system” in this case is *not* simply the Brazilian air navigation service provider. International Civil Aviation Organization language proficiency requirements are of such importance to global aviation safety, and the training required to achieve proficiency is so extensive, that adequate communication should not be considered the responsibility of any single individual or any one organization — or nation — but rather a burden that should be shared by the industry.

To consider English standards in the industry as “someone else’s problem” — solvable with one or another short commercial course selected by administrators who cannot easily identify high quality language training in an unregulated market and who must rely on commercial aviation language training providers who may misunderstand the elements required for successful language learning programs — is to underestimate the challenge of implementing effective language training for aviation professionals.

The aviation industry is a global industry; this is a safety issue that requires better global leadership from those organizations able to make a difference.

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a normal human reaction to communication difficulties — with avoidance strategies — including avoiding subsequent communication. Supporting this hypothesis, the pilots “reported difficulty with the ATC use of the English language” to accident investigators, an opinion further bolstered by one pilot’s expression of frustration (“I’ve no idea what the hell he said”) after a routine but difficult communication with an en route controller.

These early communication failures are important to the accident investigation in two regards. First, they provide evidence of a lack of awareness of the requirements imposed on pilots by the ICAO language standards — to use ICAO phraseology, to use appropriate communication strategies to exchange messages and to recognize and resolve misunderstandings. More importantly, they may provide insight into why the pilots failed to

proactively initiate and maintain communication with ATC.

### Confounding Failures

Just as subtle linguistic clues help us better understand the pilots’ lack of proactive communication with ATC around Brasília — cited as a factor in CENIPA’s report — they also help make better sense of the otherwise confounding communication failures from ATC to the Legacy during the same timeframe. In its comments on the report, the U.S. National Transportation Safety Board (NTSB) cited a “lack of timely ATC action after the loss of the Legacy’s transponder and two-way radio communication,” as a deficiency in the ATC system that is not “sufficiently supported with analysis or reflected in the conclusions or cause of the accident.”

The CENIPA report cited a number of ATC communication failures by the controllers in Sector 5 — the early handoff and the failure to issue level change instructions — and Sector 7 — the failure to issue level change instructions and the failure to notify pilots of the loss of their transponder signal. However, with a vagueness that was inconsistent with the rest of the report, the communication failures were attributed to a procedural breakdown, although the report acknowledged a lack of any discernible “plausible reason” for not just one, but a series of procedural and communication failures by multiple controllers.

So the question remains: Why did two consecutive controllers not follow prescribed communication procedures in the crucial minutes preceding the collision, and what motivated the Sector 5 controller to make such an early handoff, cited by the NTSB as a latent failure in the accident?

The CENIPA report discussed, at some length, a number of hypotheses to explain these communication failures by controllers in Sectors 5 and 7, including their aptitude and knowledge, the possibility of low situational awareness due to other distractions, complacency, poor judgment, lack of communication

## Recommendations

The linguistic analysis of the accident investigation report suggests a number of safety recommendations for the industry, including:

- Investigators should be thoroughly familiar with the International Civil Aviation Organization (ICAO) language proficiency requirements: the standards and recommended practices in Annexes 1, 5, 10 and 11, and guidance in Document 9835.
- Investigators should be more aware of the role of language as a human factor in aviation.
- Protocols should be developed for the investigation of language as a potential factor in aviation accidents and incidents.
- When language proficiency or language use is suspected as a factor, specialists in applied linguistics should assist with that aspect of the investigation.
- Transcriptions of cockpit voice recordings should be linguistically precise, that is, prepared without corrections or modifications, and made available to applied linguists for review or research.
- Pilots and controllers should be trained to adhere to ICAO English phraseology in international operations.
- Pilots and controllers should receive cross-cultural and language awareness training for international aviation operations.

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between supervisors and controllers, and poor team resource management.

Although CENIPA did not have direct access to the controllers involved for questioning and reported inadequately organized or updated training records, accident investigators were able to determine that the Sector 5 controller's "priority in relation to that aircraft would be a quick hand-over to the next sector." The report noted that at the time of the transfer, the number of aircraft in his sector was not excessive. Investigators surmised that the failures of one air traffic control officer (ATCO) in Sector 7 might have been due to his either not knowing the procedures or preferring not to adopt them; in either case, the CENIPA report said, he demonstrated an attitude of passivity and complacency.

Although CENIPA was not able to uncover information concerning the English proficiency of the Sector 5 controller, the brief exchange with the Legacy pilots cited earlier suggested inadequacy.

CENIPA said that the Sector 7 ATCO "showed difficulty mastering the English language, with an effect on his use of the related phraseology" and that his result on the English language evaluation was "non-satisfactory." It was this controller who was sentenced in 2010 in connection with the collision, and whose lawyer claimed, in his defense, "He does not speak English and was obliged to coordinate a flight involving foreign pilots," and that his lack of proficiency in English "hindered his ability to alert the pilots"<sup>6</sup> (see "Opinion: It's Not Someone Else's Problem," p. 43).

A second Sector 7 ATCO, who also noticed but failed to adequately manage the transponder failure, was reported to have attended "beginning and intermediate" English courses; his test results were reported as "inadequate."

In general, there is no evidence provided in the report to indicate that any of these three controllers had adequate English language proficiency; there is, however, evidence of *inadequate* English language proficiency. Nonetheless, this factor does not appear to

have been considered as a possible explanation for the serious communication failures that occurred in the hour or so preceding the collision. In contrast with an otherwise thorough investigation of possible explanations for the communication failures over the Brasília VOR, the consideration of language proficiency as a possible factor is not explicitly addressed.

A valid investigative question that remains unanswered is whether inadequate English language proficiency inhibited these controllers from engaging in what necessarily would have been non-routine communication.

### Communication Apprehension

Although the language required to communicate about a transponder failure could be fairly simple — such as, "N600XL, check your transponder" — it would have called for the use of English "outside the box" of the standardized ICAO phraseologies typically used by en route controllers. In addition, initiating an exchange about a non-routine event — "Check your transponder," or "I am not receiving your transponder signal" — would inevitably open up a nonstandard dialogue calling for the use of English beyond standard ICAO phraseology. It would be impossible to predict, even in the tightly constrained linguistic environment of ATC communication, how the pilot would respond to the controller's notification of loss of signal. A particularly stressful feature of initiating communication with a native speaker is that it is impossible to predict possible responses. For a controller with limited English proficiency, initiating such an unpredictable and open-ended dialogue would have been daunting.

Communication apprehension is a documented linguistic phenomenon, defined as "an individual's level of fear or anxiety associated with either real or anticipated communication with another person or persons."<sup>7</sup> Furthermore, research shows that individuals with high communication apprehension tend to use communication reduction strategies more frequently,

Why did two consecutive controllers not follow prescribed communication procedures in the crucial minutes preceding the collision?

including topic avoidance, or to simply avoid communicating at all.<sup>8,9</sup>

The possibility that weak English proficiency — and a resulting degree of communication apprehension — is the underlying cause of the controllers' operational failures deserves to be investigated with as much rigor as other possible causal factors.

### Investigating Language

While it does not change the fundamental conclusions of the report, a careful linguistic analysis illuminates an area affecting flight safety that too often remains obscure in accident and incident investigations. The failings of the CENIPA and NTSB reports to more systematically investigate the possible role of controller language proficiency or pilot language awareness as contributory factors is not a failing unique to this accident or to these accident investigation teams. Rather, in general, aviation accident investigators and human factors specialists, even those who specialize in communication — an academic area of study that is distinct from linguistics — generally have neither the linguistic training and expertise to consider the subtle role that language use may have in aviation communication nor access to standardized tools that would enable them to more easily uncover language proficiency problems (see “Recommendations,” p. 44).

### The Fundamental Lesson

The aviation industry naturally tends to place a high priority on issues that capture people's attention. Only by accurately perceiving the full extent of underlying causes of the communication failures can we adequately implement safety improvements. At the most fundamental level, if the link between language proficiency and safety is not made explicit, if only the most glaring language issues are detected and the more subtle, yet still powerful, influence of less obvious language and language awareness deficiencies goes unnoticed, then the industry will continue to

misunderstand the critical need for language training to become a priority and a long-term, industrywide commitment. ➤

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### Notes

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