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AVIATION ENGLISH: HISTORY AND PEDAGOGY

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Abstract. *Pilots who fly internationally must demonstrate a basic level of English language profi-ciency set forth by the International Civil Aviation Authority (ICAO) in a set of descriptors outlining varying ability levels. This insures clear communication between aircraft and air traffic control (ATC), a key element of air safety. Course design addressing ab initio students/trainees and licensed pilots in need of recurrency training must take into account learners' specific needs for operational proficiency and licensure within the greater institutional framework. English communication standards exist to foster a safe and efficient operating environment. This paper will illustrate the connection between accident prevention, the implementation of language testing in aviation training, and the techniques and materials used in the aviation classroom.*

Key words*: English for specific purposes, aviation English, aviation safety, English as a lingua franca*

1. INTRODUCTION

The learner, the teaching institution and ultimately society at large, all maintain discernibly different, discreet needs forming a juncture to achieve the common goal of air safety (Basturkmen 2009). To meet this goal, all air traffic controllers and pilots in ICAO signatory nations must pass an operational level of English and are required to speak English frequently (ICAO, 2011). This provides a uniform standard of communication to ensure that all parties understand one another. In addition to a General English proficiency rubric for pilots and controllers, a standardized language, known as *phraseology*, simplifies communications by paring down language to its essential form. All extraneous words are omitted (Eurocontrol). Normally, this system is quite effective, although difficulties still arise periodically due to linguistic difficulties causing a communication breakdown. Language is a decisive, one could argue causal, factor in many air accidents. Clear communication could have prevented them. This paper will illustrate the connection between these accidents, the implementation of language testing in aviation training, and the techniques and materials used in the aviation classroom.

Aviation English teachers and the classroom are the frontline defenses against linguistic failures. They balance these needs by teaching the required content within any practical resource-related constraints, i.e., time, placed on the course, drawing upon a wealth of knowledge provided by a base of relevant literature. Aviation is an ideal area of discourse for a narrow angled, highly contextualized, and thus efficient English for Specific Purpose (ESP) approach taught through content (Basturkmen 2009). Course design catering to ab initio students and licensed pilots in need of recurrency training must take into account the learner's specific needs for operational proficiency and a subsequent licensure endorsement within the greater institutional framework. This fosters a safe and efficient operating environment.

2. BACKGROUND

The deadline for compliance with the ICAO descriptors was 05 March 2008, although airlines were able to extend compliance if filing a plan of action with ICAO identifying how they planned to remedy their non-compliant state. This was due to the vast array of tasks challenging the placement of testing and enforcement structures: the airlines, ATC administrators and local civil aviation authorities simply did not have adequate time. (Read 2009).

While radio phraseology in itself is quite simple at first glance, aviation English as a whole contains complex elements. These pose important functional linguistic questions and present challenging concepts to teachers of second language aviation students. Modals, prepositions, questions of first language (L1) interference and accent versus intelligibility present challenges to the aviation English discourse community. Modals have differing meanings. The meaning depends upon whether one is addressing probability (extrinsic) or desirability (intrinsic) qualities (Thornbury, 1997). This does not present difficulty in routine exchanges using standard phraseology; but, emergency or non scripted situations offer opportunity for confusion. Research confirms the author's anecdotal finding that native speaker ATC members, often drift away from phraseology and operate in plain English. This can present difficulties to non-native speakers.

Language used by native speaker (NS) instructors in training situations presents its own unique difficulties. The author observed second language (L2) student pilots exhibit delayed response to non-standard commands. In one instance, there was an eight second lag requiring instructor intervention when the student pilot was commanded to increase throttle during a touch n' go landing at Melbourne, Florida. This lag followed a directive from the instructor to "put in the throttle". This action can be said in several ways including *push in the throttle, add throttle, increase throttle, add thrust, give it some gas, give it throttle, add power, increase thrust, increase power,* etc. As one can see, there are many possible ways to state a simple concept. This can give great pause to a pilot operating in an L2.

Jenkins (2001) posits that L1 English speakers are at a disadvantage during English as lingua franca exchanges. Indeed, L2 pilots report Frankfort, Germany and Schipol, Netherlands ATC, are much easier to understand than those at London Heathrow. Further, pilots report Frankfort ATC speaking at a standard 100 word per minute rate, enunciating clearly and strictly conforming to standard phraseology, while Heathrow ATC tends to speak very quickly, using a native variety of pronunciation and often using plain or idiomatic English. Beyond the basic linguistic factors is the question of performing time-pressured communications while multi-tasking in potentially stressful environments as real time events are unfolding.

The author's anecdotal observation of L2 student pilots having difficulty processing directives and information issued by their certified flight instructor (CFI) while maintaining appropriate situational awareness and aircraft control is confirmed by Ganushchak and Schiller's 2009 study in which they discovered that:

… under time pressure participants had more interference from their native language, which in turn led to a greater response con-flict and thus enhancement of the amplitude of the ERN (Error-Related Negativity). This result demonstrates once more that the ERN is sensitive to psycholinguistic manipulations and suggests that the functioning of the verbal self-monitoring system during speaking is comparable to other performance monitoring, such as action monitoring...

This suggests a need for a level of declarative knowledge required to pass the test exists in tandem with a need for procedural knowledge to be able to communicate in a wide variety of situations, including time sensitive, pressured response circumstances.

Circumstances leading to mandatory English proficiency:

Between 1976 and 2001 seven accidents which can be attributed, at least in part, to linguistic factors, killed a total of 1,460 people (Cookson). Aircraft accidents are rarely, if ever, caused by a single catastrophic factor, but rather by a chain of events surrounding the primary cause. If any one of the discrete events within the sequence is removed, or even if the timing changed, the resulting incident or accident will be avoided. Cookson quotes Dismukes et al. (2007) in stating that "airline accidents are invariably caused by a complex interplay of multiple factors". This fundamental principle is true for all aircraft crashes, particularly air carrier crashes in which multiple safeguards and levels of redundancy in all aspects of the equipment, procedure and flight operation are implemented.

Three accidents clearly identifying the relationship between multiple causes and their effects forming a chain of events culminating in tragedy are: the Zagreb mid-air collision, the Tenerife runway collision and the New Delhi mid-air collision. While each of these accidents may have a pivotal, active failure identified as the 'cause', they are indeed complex chains; one link is removed and the accident is avoided despite the presence of other crucial events. Linguistic factors play a significant factor in each chain of events leading to these accidents, quite possibly acting as a necessary condition for them to have occurred.

The 'Swiss cheese model' illustrates the complexity of an air crash. It defines points at which a chain of events can be stopped. While most accidents have a primary or active 'cause', there are many contributing factors.

Linguistic factors display a very high probability as a necessary condition for the afore-mentioned accidents to have occurred; however, it is impossible to determine with *absolute certainty* whether or not an accident would have been avoided if the sequence had been disrupted.

In addition to the directly contributing factors, such as language, many undiscovered latent factors may exist (Waenaar, et al., 1990). A latent factor is an underlying unsafe condition which may not be readily apparent. These can include procedures, managerial policies and equipment design. By itself, a latent factor does not cause an accident. Under the correct conditions, it reveals itself and contributes to the accident.

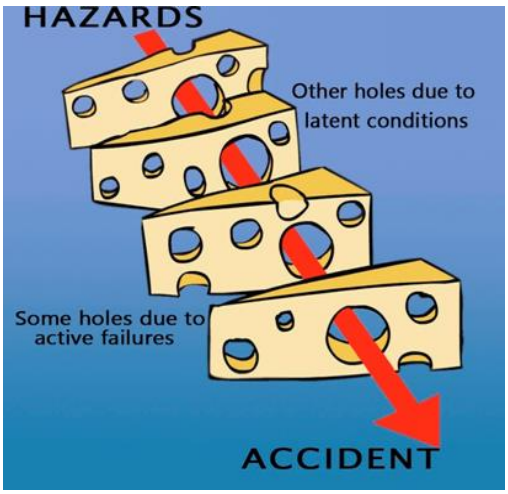

Fig. 1 Swiss Cheese Model

Independently, these latent factors do not cause accidents. Once the appropriate chain of events is set in motion and combines with an active failure, the latent factors contri-bute to an aviation accident. In addition to diagramming the causes of aviation acci-dents, the Swiss Cheese Model is used in industry and medicine. The fields may differ; however, the basic model of interconnectivity at differing

levels offering opportunities to avert mishap follows the same principals and has broad application. In fact, "Reason's Swiss cheese model has become the dominant paradigm for analyzing medical errors and patient safety incidents" (Perringer, 2005).

Latent factors include the following items in these three accidents:

Tenerife:

- The KLM work hour limit, which applied time pressure to the crew who was facing a duty limit. This would have prevented crew's return to the Amsterdam base during that workday if breached.
- Inoperative runway lighting at the Tenerife-Sur Airport.
- Traffic levels exceeding airport capacity.
- First officer with limited experience (419 hours flying time) being paired with a senior captain having 11,700 flight hours (Captain van Zanten had even been featured in KLM promotional materials, posing for advertising stills as the public face of experience and sound aeronautical decision making).
- Linguistic analysis bore out the first officer's deference to the captain as 'devices of mitigation' were used to reword statements as questions when questioning the captain's actions.
- Tenerife ATC controllers exhibiting a rudimentary English proficiency level. The Spanish authorities, in practice, placed a very minimal operational standard upon the tower controllers. Upon interview, the controllers thought the first officer said "We are at takeoff position," when he actually said either "We are now —eh—taking off" or "We are now at takeoff". Proper phraseology and read back procedure would have presented another layer to close the holes in the Swiss Cheese and an opportunity to break the chain of events (McCreary et al. 1998).

New Delhi:

- Approach and departure procedures which utilize reciprocal headings - inbound and outbound traffic were routed on opposite directions. This unusual arrangement was utilized in order to reserve other air space for military use, squeezing the civilian traffic into a narrow corridor.
- The use of metric instrumentation in the Soviet built IL-76. This adds an additional element of cognitive load upon the Kazakh crew who must convert altitudes to feet from meters.
- Management policy allowing for a non-English speaking captain to conduct an international flight into airspace where communication in his L1 (Russian) would not be possible.

Zagreb:

- Tolerance of code mixing (multiple language use) in an international ATC facility. Code mixing creates operational hazards at two levels:
    I. Traffic not sharing a common language will not comprehend each other's communication with ATC, effectively removing a potential arresting point in the chain of events as the sequence progresses: the holes in the cheese are not blocked. For example, pilots overhearing communication with other aircraft have a higher level of situational awareness in regard to other traffic's position and intentions.
    II. Cognitive load and response times are increased proportionately as code switches and mental translations are taking place.

Wagenaar et al. contend that:

Accidents are always caused by unsafe acts. This does not mean that accidents are caused deliberately, or that the actors involved were conscious of imminent danger. On the contrary, we will see that in most accidents the actors could not know that their actions would contribute to a disaster. The occurrence of unsafe acts means only that accidents could have been prevented by the elimination of some proceeding actions.

An additional incident illustrates the role English proficiency can play in the breakdown of aviation safety. A LOT Polish Airways Boeing 737 became lost over London as the crew was unable to respond to simple ATC directions. The navigation information was deleted from the computer, necessitating ATC directions (vectors). While being vectored the crew consistently confused left and right. It was not necessarily that they did not know the difference between left and right. Language can become very difficult to process in a high stress, time pressured situation. This likely exacerbated any confusion following the computer error, leading to the loss of situational awareness.

The aforementioned accidents and incident *may* have been averted in absence of linguistic factors. Using the Swiss cheese model, we can see how the varying layers of safeguards each contained "holes" in the process allowing the unsafe condition to advance to the following level and continuing to propagate itself until culminating in an accident.

A common language for air traffic communication is a *prima facia* requirement for a safe air transportation system. These accidents and incident provide readily decodable, empirical data illustrating this requirement and the potential consequences when they are not satisfied. Clear communication in a common language in each of these instances could have provided the defensive layer to close the hole, stopping the event.

The ICAO requirement serves to insure that all parties in the air traffic control system possess the communicative competency to serve as defensive layer to prevent similar occurrences.

A modern flight crew operates as a unit, and today's air crews are radically different from those of years past. Crew resource management (CRM) is employed to check, clarify and confirm all of the critical links in the complex structures which allow an aircraft to become airborne, navigate and operate safely in the airspace system.

CRM originally stood for *cockpit resource management*, then evolved to include cabin crews, engineering and maintenance, dispatch, ground crews/"ramp rats," airline management, aerodrome facility management, ATC, and, in fact, all persons bearing responsibility for the safe execution of the flight (Baron, 2011). One can readily see the public's vested interest in the ability of these diverse parties to be able effectively and accurately in a real time communication.

The parties with the most immediate need for a common language are flight deck personnel and ATC; hence, the ICAO mandate applies to these two parties. However, there is a move within the industry to train all of the aforementioned groups to maintain English proficiency in the interest of safety and efficient operations. There is an increasing awareness for the need to achieve widespread English proficiency. Although not mandated by ICAO, the Federal Aviation Administration (FAA) nor the European Joint Aviation Authority (JAA), English training is now being extended beyond pilots. Many airlines now assess dispatch personnel in addition to flight deck crew members. While English is not a *de jure* mandate for dispatchers, it is a de facto requirement as dispatch must communicate with a wide array of international entities including government agencies, manufacturers and service providers. Additionally, anecdotal evidence points to an English speaking culture evolving within many airlines.

Company-wide English proficiency creates an added level of safety when dispatch can communicate with linguistically mixed pilots or engineers and mechanics who do not share an L1 with the dispatcher. The matrix between these groups, while duly noted as being of paramount importance and a major constituent of CRM, is beyond the scope of this paper as the author focuses on the ICAO requirements and communication between the flight deck and ATC.

3. Testing

ICAO does not directly administer tests, the organisation sets forth a general set of guidelines which are open to interpretation. This led to the development of a variety of tests representing a large cross section of quality and levels of industry acceptance (Alderson 2010). The test quality and methods range from the automated VERSANT test given by the FAA via telephone and computer to elaborate tests, such as the English for Aviation Language Testing System (EALTS) to lesser tests of questionable reliability, relevance and accuracy (Cheng et al 2009). EALTS exemplifies a multipart test. An interlocutor proctors and scores the test which is also scored by a second examiner who is present during testing. The test results are then relayed to the UK for independent verification. Once in the UK, the test results are subject to further scrutiny by remote assessors.

In an effort to increase the quality and ensure consistent testing standards, ICAO began endorsing testing services to "make it easier to achieve that objective by providing countries with impartial recommendations on selecting or developing English language tests that comply with our standards." ICAO breaks language down into six discrete features; these features are pronunciation, structure, vocabulary, fluency, comprehension and interaction. Each discrete feature is rated according to the candidate's proficiency level on a one to six scale, one being the least proficient and six the most (ICAO, 2011).

4. Educational Methods and Pedagogical Considerations

One can view accidents and incidents as a combination of latent conditions and active failures synergistically acting in chains of events ending in an accident. So can we trace these chains starting at the accident through their conclusion in the classroom: language learning implemented to avoid repetition of costly errors.

Kumaravadivelu posits that we are in a post-method pedagogical state. While this is true at one level, this paper maintains that various techniques falling within a narrow angled, English for a special purpose approach best serve the needs of all actors: the learners, teacher, institution, the aviation community and society at large.

Each group has its own unique requirements which ultimately converge to form the goal of clear and effective communication between aircraft and air traffic control. Language teaching has a rich and varied history from which to draw; many methods have been used over the years, each having its own distinct advantages (Diaz-Maggioli, 2012). The narrow-angled pedagogical approach practiced by the author borrows and further develops elements from disparate methods as needed to satisfy the varied stakeholders' requirements.

Working in a highly specialised area brings its own technical vocabulary and grammatical structures. The author finds an analogue of Palmer, West et al.'s structural-situational method lends itself to the narrow-angled approach. The structural-situational

method utilises a triple-pronged approach of selection, gradation and presentation. Their method focuses on frequency-based lexis, gradation and usefulness in tandem with providing models of grammatical structure and sentence patterns. This method provided the foundation which evolved into the once popular audio-lingual method (Kumaravadivelu, 2006). While audio-lingualism reached its zenith toward the middle of the Twentieth Century before being supplanted by the communicative method, it still maintains utility and value within the ESP- aviation context. The teaching of specific lexis is an obvious requirement for admission to the aviation discourse community and for safe operation within the international airspace system.

Additionally, flight operations, flight instruction and radiotelephony all follow a very specific protocol using the same basic structure for declarative, interrogative and imperative functions. In this context structure may not have a one to one relationship to function. For example, ATC making the statement "Aircraft xyz, maintain heading xxx and altitude xxx" can functionally be an imperative or conversely, it can function as an interrogative because a read-back or confirmation is expected.

So ATC may query an aircraft using a phrase which is declarative in structure as the aircraft will respond with a confirmation.

This basic grammatical construct often finds its way into flight training as well. The CFI can provide directives, ask questions or make statements using a basic declarative structure. This form is also used on the flight deck in communications between crew members to check, clarify and confirm in the course of communication requiring a carefully structured protocol.

While this simplification of the method has its use, adherence to any single method may be counter-productive to meeting the goal of English proficiency. Incorporating elements of total physical response (TPR) into the classroom helps the learner to operationalise pilots declarative knowledge. TPR may be an ideal prophylactic regarding confusion experienced by the LOT 737. The semiotic value of lexis is demonstrated and reinforced through acting out commands issued by the teacher (Diaz-Maggioli, 2011). This drilling technique is especially effective for the acquisition of prepositions, an absolute necessity as each command, confirmation or declaration relates to a physical action performed by the pilots and / or the aircraft. In this sense, TPR techniques mirror real world interaction: language being spoken, then subsequently processed and carried out in physical actions. Under pressure, an L2 pilot is much more likely to make errors due to language. In fact, research confirms that linguistic errors committed by L2 speakers increase during periods of pressured response (Ganushchak and Schiller, 2005).

Task based learning also provides an added dimension of efficacy in the aviation ESP classroom. Various tasks from formulating flight plans to designing an aircraft serve to create situations within the classroom to foster both communication and thought in English. It is the thought which is most important as the ability to operate in English with the application of the least possible additional cognitive load is key. Translating from L1 to L2 while flying the aircraft, possibly in a pressured situation can add a significant response time and additional step during which error can occur. The ideal training situation prepares the L2 aviation professional for these challenges.

5. Conclusions

A narrow angled ESP approach provides maximum economy of resources to meet the needs of all stakeholders in the aviation community and society at large. One can utilise

the Swiss Cheese model to visualise the chain of events forming from a combination of latent and active failures. For an accident to occur, these failures must align perfectly. ICAO prescribes proficiency requirements which add an additional layer to close the holes and prevent the repetition of accidents involving linguistic factors.

Techniques employed by this narrow angled approach can be co-opted from a variety of methods and approaches for an added practical advantage. This gives the ESP teacher many options to meet the desired outcome of achieving operational proficiency. The costs of failure and the benefits derived from success are too great to be weighted down by philosophical considerations relating to pedagogy. Language teaching has indeed entered a post-method state; the pedagogy proscribed in this paper is reflective of the post-method paradigm in its quest to best prepare members of the aviation discourse community. Narrow-angled ESP meets the needs of all stakeholders engaged in aviation discourse.

The pedagogy required for ESP-aviation is a practical, results driven response to the need to prevent accidents by reducing or removing linguistic factors from their chains of events.

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