EDICIONES
COMPLUTENSE

Studying crashes to avoid clashes: A translational approach to develop terminological competence for aeronautic communication

Bo Zhu 朱波[1], Hong Gao 高虹[2], Hexiong Wu 巫和雄[3], Wei Wang 王伟[4]

Abstract. Miscommunication in the cockpit or between pilots and air traffic controllers (ATCs) could be fatal when they use English, the de facto language for international civil aviation. To ensure air safety, the International Civil Aviation Organization (ICAO) has set up English proficiency requirements in Document 9835, calling for adherence to standardized terminology in aeronautic communication. For this reason, terminological competence proves a crucial challenge to non-native speakers of English and merits study from a variety of perspectives. Drawing from relevant work, the current study reports on a translational approach to developing terminological competence for student pilots attending a terminology course tailored to ICAO standards. By extracting subtitles from Mayday, a documentary series on air crashes, near-crashes, and crises, we built a specialized bilingual parallel corpus on aviation and analyzed terminological data against the inventory of events, domains, and sub-domains specified in Document 9835. Through the identification, elaboration, translation, and management of specialized terms, we explore the terminological competence development, and through follow-up interviews we identify the features of this course in shaping student pilots into domain experts qualified for aeronautic communication.

[zh] 聚焦事故 避免歧义——面向航空交流的术语能力与翻译路径

摘要：英语是国际民航的通用语言。机舱内或陆空通话中的交流失误会带来灾难性后果。为保障航空安全，国际民航组织在 9835 号文件中设定了专业英语水平要求，倡导在工作交流中优先使用标准化术语。培养母语为非英语者的民航术语能力成为当务之急。参考相关研究，面向飞行学员，设计基于国际民航标准的术语课程，提出促进术语能力的翻译路径。从《空中浩劫》系列记录片中提取字幕，通过翻译，建立专门领域英汉双语平行语料库，参照 9835 号文件所列事件、领域及子域，选择术语数据加以分析。从概念识别、意义细述、跨语对应和数据管理等方面，探讨航空术语能力的培养与发展；利用访谈，展现出课程把语言学习者培养成为领域专家的独特之处。

_____

[1] Nanjing University of Aeronautics and Astronautics 南京航空航天大学 (China). Email: zhu.b@nuaa.edu.cn

[2] Nanjing University 南京大学 (China) Email: hgao@nju.edu.cn

[3] Nanjing University of Aeronautics and Astronautics 南京航空航天大学 (China). Email: wuhx@nuaa.edu.cn

[4] Nanjing University of Aeronautics and Astronautics 南京航空航天大学 (China). Email: davidwang0815@aliyun.com

Contents. 1. Introduction. 2. Terminological Competence in Translation and Its Link with LSP. 2.1. Terminology in Specialized Translation. 2.2. Teaching Terminology for LSP. 2.3. A Translational Approach. 3. The Course and the Inquiry. 4. Acquisition and Assimilation of ICAO Terminologies. 4.1. Identification of Specialized Concepts. 4.2. Elaboration of Information. 4.3. Inter-linguistic Correspondence. 4.4. Management for Future Use. 5. Students' Perceptions 6. Conclusion. References.

1. Introduction

One of the worst aviation accidents in history claimed 583 lives on March 27, 1977 at Los Rodeos Airport on the Spanish island of Tenerife, Canary Islands. The tragedy proved that miscommunication between pilots and air traffic controllers (ATCs) can have serious, even fatal consequences when they switch from their native tongue to English, 'the de facto language for international civil aviation' (Alderson, 2011:387). Other high-profile accidents, including the Avianca crash in Jamaica Bay near JFK and the American Airlines crash in Columbia in 1995, were also the results of communication problems. The effects of communication on safety in aviation and air traffic management have been firmly established ever since (Krifka et al., 2003; Krivonos, 2007).

With mechanical failures featuring less prominently in recent accidents and incidents, more attention has been focused on the human factors that contribute to them. Data obtained from the ICAO Accident/Incident Data Reporting System (ADREP) database, the Aviation Safety Reporting System (ASRS) in the United States, the United Kingdom Mandatory Occurrence Reporting System (MORS), and the Confidential Human Factors Incident Reporting Program (CHIRP) indicate that the role of language in accidents and incidents is significant (ICAO, 2004, 2010). Starting from 1976, miscommunication en-route has caused more than one accident each year (Jones, 2003; Huang & Wu, 2005), prompting efforts to improve the language proficiency of both pilots and ATCs crossing national and linguistic borders.

Based on the work of aviation English and communication experts (Cushing, 1994, 1995; Tajima, 2004; Farris et al., 2008, Alderson, 2009), ICAO issued the *Manual on the Implementation of Language Proficiency Requirements*, more widely known as Document 9835. One of its objectives was to standardize the use of terminologies in radiotelephony (RT). While perfect communication may never be achieved, communication can be greatly improved by agreeing to use, wherever possible, the set phraseologies. For voice communications to provide the level required for safe operations, the use of standardized terminologies must be emphasized. This means 'a re-orientation for controllers or pilots'(ICAO, 2004:29) who may have become accustomed to either non-ICAO terminologies or, perhaps, who have developed some laxity regarding the use of ICAO terminologies.

Flying in China was once only for the privileged few. Now, however, it is becoming one of the most important markets for air travel. A 2018 government report states that a total of 46 airports will be developed within the following five years. New intercontinental routes opened by Chinese carriers in 2006 numbered only six, but from 2014–17 the number was more than 50 (Nunlist, 2017). The Civil Aviation Administration of China (CAAC) forecasts that an annual increase of 2000 to 2,500 pilots will be needed to meet the increasing demand for international flights. Compared with such rapid market development, however, the existing body of studies on aviation English is scanty and scarce. Among them, Wu and Huang (2006) analyzed the influence of ICAO English standards on Chinese ATCs and proposed some measures. Huang (2007) looked into uncertainties in aviation English tests. Wang (2007) examined the development of aviation English curriculum in the Chinese context. Chen (2012) studied the wash-back effects of the Pilots' English Proficiency Examination of China (PEPEC), a test of licensure in line with ICAO standards. Zhao et al. (2017) explored cargo airline pilots' test preparation and learning engagement, and expressed concerns over the effectiveness of a uniform training course for all pilots, given the marked differences in the needs of learners. So far, studies have been to a great extent test-oriented, with only a few on terminological competence and its role in preparing student pilots for meeting ICAO requirements — hence the importance of the current research.

2. Terminological Competence in Translation and Its Link with LSP

2.1. Terminology in Specialized Translation

A word is a single unit of language that forms part of the general vocabulary (Granda & Warburton, 2001). Unlike a word, which belongs to general language, a term conveys a concept that is specific to a certain field. It can be made up of one word or multiple words, and forms part of the terminology of a specialized language. Together, the concept and term form a terminological unit that, with other such units, makes up the 'nomenclature of a specific field' (ibid: 2). The study of Terminology (We follow the conventional use of upper case for the theory of Terminology and lower case for terminology as the inventory of terms.) focuses on a system of terms used to name things in a particular discipline. Its function is to identify the precise association between the term and concept. Little has been written about how to design and teach a terminology course for different user profiles. Notable exceptions are Parc (1997) and Soffritti et al. (1997), and more specifically in the case of translation studies, Monterde Rey (2002) and Fedor de Diego (2003). The theoretical principles and methods in Terminology were still taking shape. In Spain, Terminology was not taken seriously as an academic subject until 1991 when it began to be taught in universities as part of a degree program in translation and interpreting.

According to Cabré (2000), Translation Studies and Terminology are relatively recent academic disciplines despite the fact that they have existed for centuries as applied language activities. Both are interdisciplinary, and also happen to be convergence points for linguistic, cognitive, and communication

sciences. However, they are different because terminology, as the inventory of terms within as specialized domain, is not in itself a type of speech act, but rather 'an instrument used in specialized communication' (Montero Martínez & Faber, 2009:91).Translation focuses on the communication process and strives for effect and efficiency through terminology. Terminology is interesting to the translator in the sense that it is part of the message conveyed by a specialized text. As a result, the relationship between Terminology and Translation is asymmetric since terminology has no intrinsic need to recur to translation. In contrast, translation must use terminology as a means to achieve 'the inter-linguistic transfer of specialized knowledge units' (Velasquez, 2002:47).

In her study on specialized translation, Faber (2003) found that the actual representation of expert knowledge in specialized translation would necessarily include processes such as the rapid acquisition and assimilation of specialized knowledge into previous cognitive structures by extending them to more specific levels. It would also involve the ability to accurately relate this knowledge to specialized linguistic representations in one or various languages. In this sense, terminological competence can be viewed as a module of translation competence as specified below:

> It would comprise the storage of specialized knowledge in memory, automatisms pertaining to terminological access, creativity related to term formation, as well as the translator's ability to solve problems of knowledge acquisition during the translation process, all of which directly affect the creation and establishment of links between conceptual and linguistic representations. (Faber, 2003:97)

In a later work, Montero Martínez and Faber reiterate that terminological competence in translation does not refer to the acquisition of a list of terms, but rather to 'the ability of the translator to acquire the knowledge represented by these terms'(2009:92).

2.2. Teaching Terminology for LSP

Language for specific purposes (LSP) is an approach to language training that focuses its program content on subjects, topics, and issues of direct interest to learners. LSP training is driven by what learners need to do in the language, and focuses principally on those features of the language that are required to undertake a particular task. In the early days of LSP studies terminology was often prioritized as a defining characteristic of this variety of language, which had been a means of communication for centuries (von Hahn, 1983: 12–47; Fluck, 1985: 27–32). The terms of a domain are indeed a very salient part of any LSP text, as they help to mark the text as belonging to a particular domain and play a major part in the mapping and presentation of the knowledge space and perspective presented in the text. Take *clearance*, for example. The word generally means an act of clearing or distance between objects. When used in aerodromes, however, it becomes a term denoting permission, usually from a control tower, to take off, land, etc.

As LSP studies progressed and developed through the 1990s and into the new millennium, their scope broadened from the linguistic features studied by Hoffmann (1985) and others to the philosophy of science, cultural aspects of LSP, LSP and technology (particularly in relation to terminology), text and pragmatics(Rogers, 2012). The early theme of LSP translation was extended with studies focusing on particular language pairs, particular genres and particular textual features. Further developments in knowledge representation, cognition, sociolinguistics, discourse analysis and the visual aspects of LSP texts were closely linked to terminology studies and can be traced in the proceedings of the European Symposia on LSP (Ahmad & Rogers, 2007: 9–10).

To meet the market demand for translation and localization, the Masters in Translation and Interpreting (MTI) program has developed rapidly in China with policy adjustments to professional degrees since 2007. Because of the common goal of training talents for task-based communication in special domains, MTI educators have drawn extensively from English for Specific Purposes (ESP), ranging from curriculum design to teaching principles (Mu, 2007; Feng, 2015), with mounting awareness of terminological competence for translation in Miao and Gao (2008) and Miao and Wang (2010). Based on the analysis of terminology courses offered by 18 foreign universities for their translation /interpretation graduate programs, Leng, Wang & Liang (2012, 2013) discussed the necessity and principles for the design of terminology course targeting MTI candidates. Drawing from Montero Martínez and Faber, Wang (2011) carried out a component analysis of translation-oriented terminological competence and constructed a scheme of seven sub-competences with application at its core. In addition, he proposed an industry-teaching-research integration mode for terminology education (Wang, 2013).

2.3. A Translational Approach

Airspeak is the English used for international civil aviation. It is English in grammar, vocabulary, and pronunciation, but some of the vocabulary is highly technical and specialized. The ICAO ruled in 1962 that ATCs must provide services in English, and soon afterwards they also recommended that pilots and ATCs communicate with each other using RT phraseology, which includes features such as attention markers, markers of urgency, fronting, imperatives, and ellipsis (Cutting, 2012), all for clarity and transparency in communication. Language proficiency is an intricate interplay of knowledge, skills, and competence, requiring much more than memorization of vocabulary items. The ICAO requires the use of standard phraseology for clear, concise, unambiguous communication. However, it also states that 'memorization of ICAO phraseologies alone does not constitute language proficiency and is an unsafe practice' (2010: 89). Aviation language training for flight crews and air traffic controllers, then, necessarily includes a broader focus on different aspects.

Because of its linkage with LSP and specialized translation, terminology is vital to aviation language training that focuses program content on the subjects, topics, and issues of direct interest to learners. It is driven by what they need to do in the language and focuses primarily on those features of the language that are required to undertake a particular task. For Chinese student pilots to fly

international routes, the translation needs are twofold: one in the inter-lingual sense of transferring from Chinese into English, and the other in the intra-lingual sense of switching from plain words to standard phraseologies. They need to establish terminological competence to function in the special domains of aviation. Drawing from the above studies on terminological competence and its crucial role in LSP, specialized translation and translator training, we initiate a translational approach to develop such competence for aeronautic communication with data interpretation to explain the following research questions:

> How did the students develop terminological competence for airspeak in this course?
>
> How did they perceive the design of this course and adapt to new professional profiles during it?

3. The Course and the Inquiry

This paper presents the design of a terminology course tailored to the needs of student pilots in China. It features *Mayday,* a Canadian documentary television series produced by Cineflix that recounts air crashes, near-crashes, fires, hijackings, bombings, and other mainly flight-related disasters and crises. The program is known as *Air Crash Investigation(s)* outside the United States and Canada, and also known as *Air Emergency* or *Air Disasters* in the United States. By extracting subtitles from 14 episodes of *Mayday* we built up a bilingual parallel corpus on air crash investigations and explored the development of terminological competence by translating English for civil aviation into simplified Chinese.

First, a class of first-year student pilots was divided evenly into 14 groups. Each group was assigned one episode of *Mayday* and asked to transcribe the subtitles in English. Second, the subtitles were translated by the students into Chinese and cross-checked within the group. Third, a bilingual parallel corpus was constructed using the translations, which were modified and revised by the instructor. Fourth, each group was guided to extract 5 items of terminological data in terms of frequency and relevance to topic, forming a terminology bank against the backdrop of events, domains, and sub-domains detailed in Document 9835. Finally, these data were collected and analyzed in the corpus to cultivate terminological competence for aeronautic communication. A list of the episodes from *Mayday* and the data extracted from these episodes are given in Table 1.

Following this data analysis, a further mixed method inquiry was conducted to explore the development of terminological competence for airspeak. A questionnaire was developed through preliminary interviews with student pilots about their learning of terminology and preparation for the ICAO tests. The questionnaire consisted of three parts concerning general background information, the identification and translation of terms, and term management for future use. The questionnaire underwent two rounds of trial and modification before being administered. It covered all the students attending the course (n=42), and follow-up interviews were conducted with four of them to collect details about the learning of terminology through translation and exploration of specialized concepts. The authors went through and compared their field notes in

detail, focusing on how the students developed terminological competence for airspeak in this course, and their perception of its design. We hope the findings will shed some light on the training of terminological competence for professional communication, and trigger more studies of the teaching of aviation English and the didactic aspects of LSP and Terminology.

G.	Serial No.	Title	ENG	CHN	Terms
1	E05S10	*Hudson River Runway*	6199	8687	bird strike, APU, FCC, airspeed, QRH
2	E10S12	*Polish Air Force 101*	6380	8765	visibility, FDR, go around, explosives, altimeter
3	E13S12	*Air France Flight 447: Vanished*	5361	9338	pitot tube, stall, pitch, CVR, sensor
4	E05S13	*Queen's Catastrophe*	5585	9085	turbulence, rudder, V1, terrain, vertical stabilizer
5	E06S13	*Into the Eye of the Storm*	6448	9849	hurricane, cross wind, shutdown, penetration, dy-icing
6	E08S13	*Deadly Test*	5379	8841	airspace, auto-trim, acceptance flight, stall protection, dive
7	E10S13	*Qantas 32: Titanic in the sky*	5623	10093	ECAM, hydraulics, ROP, slats, landing gear
8	E01S14	*Choosing Sides*	5656	8376	vibration, throttle, metal fatigue, brace for impact, terrain
9	E07S14	*Air France 4590 What happened?*	4914	7392	delta wing, grounding, wear strip, rupture, cowling
10	E11S14	*Malaysia 370 What happened?*	5466	8443	ACARS, hostage, transponder, mask, hypoxia
11	E02S16	*American Airlines 77*	5692	9059	black box, terrorism, autopilot, CAPPS, tarmac
12	E08S16	*River Runway*	4749	8624	WXR, thrust, ground proximity, hydraulics, thunder storm
13	E04S17	*Explosive Proof (TWA Flight 800)*	5979	9062	CWT, wreckage, CVR, beam, flammability
14	E09S17	*Deadly Discussion (LAPA 3142)*	5068	8301	EPR, budget airline, checklist, blade, thrust reverser

Table 1. Details of the bilingual parallel corpus and the terms extracted

4. Acquisition and Assimilation of ICAO Terminologies

To assist program, curriculum, and material developers, Document 9835 offers several resources to guide training. Among them is an inventory of events and related domains which characterize the routine and non-routine day-to-day work of ATCs and pilots. These 'events' represent control situations, routine or non-routine, which all controllers and pilots must be able to handle. Each event may require familiarity with many lexical domains, with which are associated related words and terms. The inventory consists of three parts: (1) events, domains, and sub-domains in aerodrome control, e.g. air-misses, approach delay; (2) events and domains linked to en-route air traffic control, e.g. aircraft breakdown, special flights, weather, and MET problems; and (3) other domains such as ground services and airfield facilities.

A total of 1,300 terms were categorized into 50 different domains and sub-domains. When they appear in *Mayday*, the students are able to acquire and assimilate them by a translational approach that consists of the following strategies drawn from the inquiry.

4.1. Identification of Specialized Concepts

E13S12 traces the disappearance of FA447 on June 1, 2009. A scheduled flight from Rio de Janeiro, Brazil to Paris, France, the Airbus A330 entered a *stall*, killing all 228 people aboard. The initial investigation was hampered because the flight data recorders (FDRs) were not recovered from the ocean until two years later. The final report concluded that the aircraft crashed after temporary inconsistencies between the airspeed measurements, likely due to the aircraft's *pitot tubes* being obstructed by ice crystals, caused the autopilot to disconnect, after which the crew reacted incorrectly and ultimately caused the aircraft to *stall* and crash. Below is an extract from this episode, translated by the students from Group 3. From the specification of prototypical actions of pulling, they developed a better understanding of the special concept of *stall* and 'its cause and consequence evident in an action-environment interface' (Zhu & Wang, 2013:96).

> Here, their speed dropped more than 90 knots in less than a minute.
> This triggered a **stall** warning here.
> Raising the nose of a plane at high altitude put the plane into a **stall** very quickly.
> In an air dynamic **stall**, the wings lose lift, and the plane drops from the sky.
> It was the pilots' actions that led to the **stall**.
> They fell more than 12,000 feet per minute.
> Inexplicably, the pilot continues to pull back, when he should have been pitching the plane's nose down to gain speed and lift.
> 此时，飞机速度在不到一分钟内下降 90 节。
> 这触发了**失速**警告。
> 在这一高度把机头拉起，很快就会让飞机**失速**。
> 气动**失速**状态下，机翼失去升力，飞机就会从天上坠落。
> 飞行员操作造成了**失速**。
> 他们以每分钟超过 12000 英尺的速度落下。
> 难以理解的是，飞行员继续拉杆，此时他应推杆，把机头向下，通过加速获得升力。

Most students (39/42) were familiar with the concept of 失速(shisu, *stall*) as a malfunction in the flight of an aircraft, in which there is a sudden loss of lift that results in a downward plunge. However, only 5 of them (12%) knew the word *stall* for this concept in English before watching this episode. When the word appeared in the above context, its usual meaning in general English (a stand, booth, or compartment for the sale of goods in a market) gave way to the professional representation. From this context, students also learned that sufficient airspeed must be maintained in flight to produce enough lift to support the airplane without requiring too large *an angle of attack*. At a specific angle of attack, called the critical angle of attack, the air going over a wing will separate from the wing, or 'burble' (see Figure 1), causing the wing to lose its lift (*stall*).

The airspeed at which the wing will not support the airplane without exceeding this critical angle of attack is called the *stalling speed*. This speed will vary with changes in wing configuration (flap position). Excessive load factors caused by sudden maneuvers, like those in E13S12, can cause the aircraft to exceed the critical angle of attack and thus *stall* at any airspeed and any attitude. Speeds permitting a smooth flow of air over the airfoil and control surfaces must be maintained to control the airplane. The term *stall* is therefore embedded in a system of concepts and reinforced through visual images.
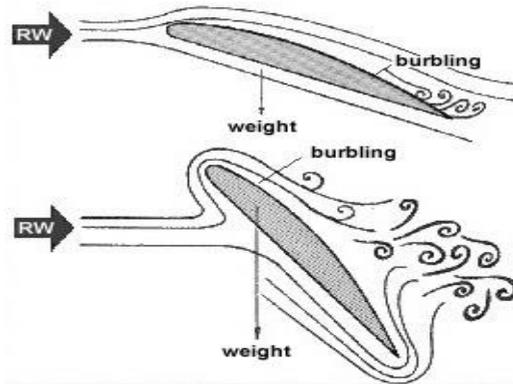

Figure 1:Airfoil approaching and entering a stall

4.2. Elaboration of Information

E05S13 examines the crash of American Airlines 587 on November 12, 2001. It occurred two months and one day after the 911 attack. Shortly after takeoff the plane crashed into the Queens borough of New York City, killing 260 people aboard and five bystanders on the ground, making it the second deadliest aviation accident on US soil. Terrorism was officially ruled out as the cause by the National Transportation Safety Board (NTSB), which instead attributed the disaster to the first officer's overuse of rudder controls in response to *wake turbulence*, or jet wash, from a Japan Airlines Boeing 747-400 that had taken off minutes before it. According to the final report, this aggressive use of the rudder controls by the co-pilot caused the vertical stabilizer to snap off the plane. The plane's two engines also separated from the aircraft before it hit the ground.

Turbulence is a frequent occurrence in the air and is a term often heard in flight announcements. Passengers on a commercial airplane are most likely to be injured by turbulence if their seatbelts aren't fastened. As shown in one of the data extracts from E05S13, *turbulence* has two equivalents in simple Chinese: one is 湍流 (tuanliu, meaning the unstable flow of air, eddies and vertical currents), and the other is 颠簸 (dianbo, meaning the bump or jolt resulting from such flow). From http://shuyu.cnki.net/and the *Dictionary of Aeronautical Terms*, Group 4 found the origin of this term from fluid dynamics, meaning any pattern of fluid motion characterized by chaotic changes in pressure and flow velocity. They got further information from *Britannica* on clear air turbulence (CAT),

erratic air currents that occur in cloudless air between altitudes of 6,000 and 15,000 metres (20,000 and 49,000 feet) and which constitute a hazard to aircraft. Also called '气穴' (qi xue, *air pockets*), CAT can be caused by small-scale wind velocity gradients around the jet stream, where rapidly moving air is close to much slower air. It is most severe over mountainous areas and also occurs in the vicinity of thunderstorms. As a type of *CAT*, *wake turbulence* appears when the rotating vortex created by aircraft wings remains for some time after its taking off or passing by (see Figure 2). When this occurs, the lingering turbulence can deflect or even flip other aircraft on the ground or in the air. While severe *turbulence* can produce considerable changes in attitude, altitude, heading, and airspeed, extreme *turbulence* can cause damage to aircraft structure and even loss of aircraft control. Through all these the concept of *turbulence* was elaborated and situated in a more complex network of relations with other concepts, which turned translation into a process of acquiring terminologies for professional communication.

Figure 2: Wake turbulence by aircraft wings

4.3. Inter-linguistic Correspondence

E05S10 recalls the emergency water landing by US Airways 1549 on January 15, 2009. After takeoff from LaGuardia Airport in New York, the flight struck a flock of Canada geese and lost all engine power. The pilots glided the plane to a ditching in the Hudson River off Midtown Manhattan. All 155 people aboard were rescued. A NTSB report (It can be found in the database of https://aviation-safety.net/) attributed the survivability of the incident to:(1) the decision-making of the pilots and the crew resource management; (2) the availability and use of the forward slide/rafts, though the aircraft was not required to be so equipped; (3) the performance of the cabin crewmembers while expediting the evacuation of the airplane; and (4) the proximity of the emergency responders to the accident site and their immediate and appropriate response to the accident.

A *bird strike*, sometimes called bird ingestion (for an engine), bird hit, or bird aircraft strike hazard (BASH), is a collision between an airborne animal (usually

a bird) and a manmade vehicle, especially an aircraft. The term is also used for bird deaths resulting from collisions with structures such as power lines, towers, and wind turbines. *Bird strikes* are a significant threat to flight safety. More than 262 people have been killed and over 247aircrafts destroyed by bird and other wildlife strikes since 1988 (Dolbeer et al., 2016: xii).

In the aftermath of the Hudson ditching, the goal of education about *bird strikes* has been achieved. While processing the data, Group 1 reported three different designations for this term, namely, 鸟击(niaoji), 鸟撞(niaozhuang), and 鸟撞击(niaozhuangji), all of which appeared in papers in the China National Knowledge Infrastructure (CNKI) Database. Table 2 shows that niaozhuang (bird impact) is favored by local scholars over niaoji (bird strike) even though the latter is recommended by the ICAO and CAAC. For the sake of 'accuracy, readability, and transparency in term translation' (Jiang, 2005), niaoji is adopted in our corpus as the equivalent to *bird strike*.

Term in EN	Translation variants in	Frequency	Percentag	Back translation
bird strike	鸟击 (niaoji)	75	21%	bird strike/bird hit
	鸟撞 (niaozhuang)	221	61%	bird impact
	鸟撞击 (niaozhuangji)	64	18%	bird strike/collision

Table 2. Details of bird strike as keyword and its translation

For AA1549, the damage was not directly to the engines. Evidence of strikes was also found on the *wings*, the *flaps*, and the *fuselage*. While translating, students in this group translated *wing* as 机翼(jiyi) and *fuselage* as 机身(jishen), but they struggled with others that were difficult to detect. The first was *flap* (jinyi, 襟翼), an auxiliary control built into the wings of an airplane. Such a device can be extended, or lowered, to change the airfoil shape of the wing to increase both its lift and drag. The second was *skin*. As it denotes the outside covering of an aircraft airframe, the correspondence in Chinese is 蒙皮(meng pi) instead of 皮肤 (pi fu). The third was *Mayday*, derived from the French word 'm'aidez' (help me) and pronounced 'mayday' in English. This is the international call for help, used in voice radio transmission as SOS is used in code transmission. Nothing gets the attention of Search and Rescue (SAR) apparatus faster than a radioed *mayday* call followed by a loss of radar contact. For urgent situations that are not immediately life-threatening but which require assistance from the ground, a *Pan-Pan* call should be used. Since there are no corresponding expressions in Chinese, the students were guided to render them directly into the target language as 'zero-translation' (Qiu, 2001:24), the intact transference of symbols from source language. The process of translating not only created links between conceptual and linguistic representations, but turned students into mediators across linguistic and cultural differences.

4.4. Management for Future Use

E19S13 recounts the forced landing of Qantas 32 because of engine shutdown, the first such incident involving an A380, the world's largest passenger aircraft. During a long-haul journey from Heathrow to Sydney the plane experienced an

avalanche of warnings following an explosion just four minutes after taking off from Singapore-Changi International Airport (SIN) for the second leg of the journey. On inspection it was found that a turbine disc in the No.2 Rolls-Royce Trent 900 engine had fallen apart, causing damage to the nacelle, wing, fuel system, landing gear, and flight control system, and a fire in the left wing fuel tank. Mounting failures soon made the big bird unsafe to fly. After a two-hour ordeal, the crew struggled to a stop on the same runway they had taken off from, with only 150 metres to spare. The accident led to the grounding of the Qantas A380 fleet and inspections/engine replacements on some Rolls-Royce powered A380s.

To fly or land the A380, a pilot needs courage, patience, and skill to master a small control stick. In this episode, the 575-ton aircraft was weighted down with fuel as it has burned little of the 105 tons it took on at Changi. The heavier an aircraft, the more runway and the higher the speeds will be needed for its approach. Maintaining the right speed on landing is critical; too slow and the plane will lose lift and plummet to the ground, but too fast and it could run off the end of the runway and crash. If the crew misses the runway there is no way that the crippled plane can go around for another try.
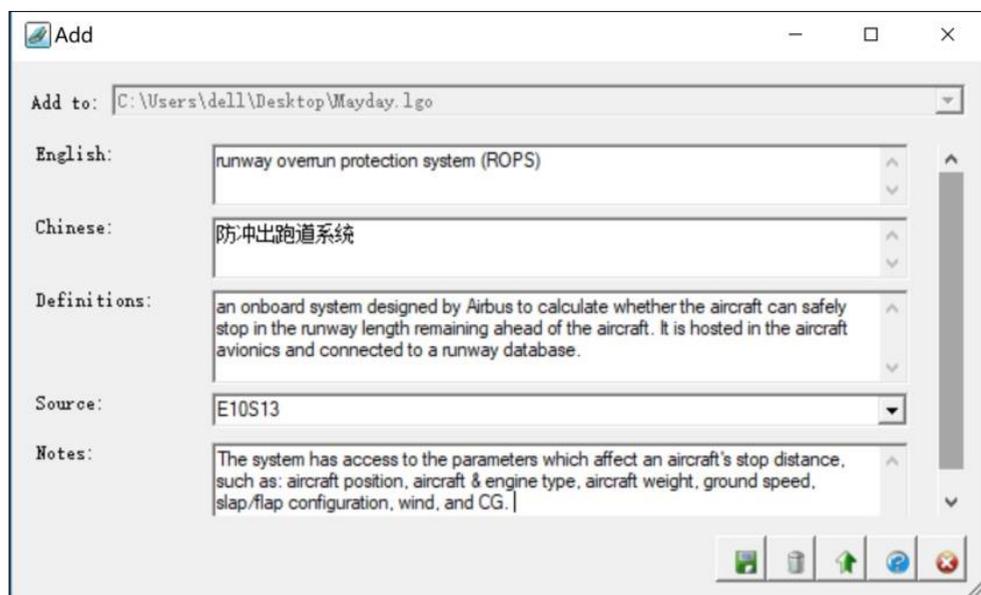
Figure 3: Datum added and managed in Lingo

From this incident students realized the vital role of *runway overrun protections* (ROP), an onboard technology that increases situational awareness during landing, reduces exposure to runway excursion risk, and if necessary, provides active protection. Impacted by the A380 cockpit and its *fly-by-wire* (FBW) technology, Group 7 reported that they used Lingo, a standalone system that allows the creation and management of subject specific glossaries (see

Figure 3), to probe into A380's internal mechanisms and plan language practice through a self-developed database for future use.

5. Students' Perceptions

While there is a role for general language training and learning, aviation-focused language training and learning at all skill levels are essential because of safety and learner motivation. As increased safety is the motivating factor beneath any initiative, including the establishment of provisions for language proficiency in civil aviation, it is important that language training programs address appropriate needs within the domain of operational communications. As an extension of the translational approach, 4 students were interviewed to find out how they perceived the design of the course and its effectiveness in preparing them to develop a professional profile and meet ICAO requirements. The findings are summarized below.

Adherence

In daily life, miscommunication frequently occurs but rarely results in anything other than minor inconvenience, embarrassment, or lost time. In aeronautical radiotelephony communications, however, communication errors have the potential to cause far more serious consequences. Because of the high-stakes nature of language practice within the aviation industry, it is critical that course designers and developers maintain quality by conscientious adherence to standardized phraseology which is embodied as an ICAO Standard. Terms are univocal and universal to avoid ambiguity. Only when standardized phraseology cannot serve an intended transmission, plain language shall be used. By a translational approach, this course targeted the work in or around the wreckage of a crash site and led students to communicate in specific and job-related domains with accuracy, making them accountable for mediation at critical moments. When a stall occurs, the sudden loss of lift is frightening to a beginner student pilot and some pilots with few hours in the air. For a quick recovery, the pilot has to relax the backpressure on the stick and push it slightly forward. The nose of the airplane will drop below the horizon line. This remedy action, coupled with clarity and precision in language use, helps the airplane to generate lift again. The crash of flight AF447 deepened students' understanding of *stall* and *level flight*, and the adherence to standard terminology for cockpit communication, as noted by Charlie in the interview:

> I learned a lot from this terminology course. It is more than just finding out the cause of a crash. Stalls need not be feared. They are just a set of maneuvers we have to practice to understand the flight characteristics of the airplane we are flying. It is not only what you say, but how you say it that counts. A demonstrable and well-articulated adherence to terms ensures the best possible communication under stress-induced situations. (Interview notes)

Affordance

An affordance is a quality of an object, or an environment, which allows an individual to perform an action (Gibson, 1975). Affordances interact with various individually-perceived action environments, such as teaching, studying, learning, and communication environments. It is the task of the teacher to help students start seeing and perceiving and then benefiting from the course. Different from previous programs where linguistic data are collected and disseminated by the instructor, this course affords the students an opportunity to experience and explore, encouraging them to create a corpus of their own and compile their own data bank.

Like long security lines and bad coffee, air turbulence is one of the headaches travelers face when they decide to board an airplane. After watching the crash of UA587 in E05S13, students in Group 4 became interested in air turbulence. They went further into this subject, looking at aspects such as causes, grade, and forecasting, based on the corpus they developed. From this initiative we saw learners can take ownership, literally and figuratively, of their development in terminological competence, managing and processing their data by having a closer bond with them, and increasing the potential for discovery by collaborating with fellow students and teachers.

Airworthiness

Airworthiness is a special term for a condition in which the aircraft or component meets its type design and is suitable for operation. To become an accredited pilot for international routes, the student pilots have to go through a series of screening and selection stages. The use of terminology is an operational skill that is taught by qualified specialists, and trainees are expected to reach a certain level of proficiency. Document 9835 stipulates that they should demonstrate Level 4 (Operational) proficiency in the use of terminology. Those below Level 6 (Expert) will be re-evaluated at intervals. ICAO recommends the interval should be 6 years for those at Level 5 (Extended) and 3 years for those at Level 4. This can be seen as a measure to ensure airworthiness among aviation English learners and their instructors.

Less than a minute after takeoff, Captain Sullenberger of UA 1549 reported a 'double bird strike' and asked to return to the ground. An eerie calm characterized subsequent communications in the cockpit as their options dwindled and the flight crew decided to ditch into the Hudson. The first announcement to the cabin, when the die had been cast, was: 'This is the captain. Brace for impact.' Three and a half minutes, the time elapsed between the strike and the landing, seems long enough for effective decision making. The outcome was the result of good teamwork and the belief that a pilot's judgment must go hand-in-hand with technology and terminology.

As a combination of skill and high standards, airworthiness also means the ability to say more with less in the face of crises and dangers. By focusing on the terms from the events, domains, and sub-domains in aerodrome control, en-route air traffic control, and other domains, this course brought the trainees up to ICAO standards and made them airworthy through 'agentic choices and actions' (Tao & Gao, 2017:347). To alert classmates to the significance of

professional communication through terminology, Kevin from Group 2 reported an agentic action of consulting Document 9835 for the use of 'go around' to avoid misunderstanding and ensure airworthiness.

> … When a captain elects to initiate a go-around while still in the clouds, it is a regulatory requirement that the ATCs be notified as soon as practical. We found in 3.3 of Document 9835 some variations or non-standard phrases such as "missed approach", "balked approach", "abandon approach", or "we're on the go". If non-standard phrases or local jargon are used, the actions within the cockpit may be clear and the crew may perform it as a team, their intentions may not be clearly understood by those on the radio frequency, including other aeroplanes in the vicinity as well as the controller responsible for providing separation. (Interview notes)

Authenticity

According to Qin (2003:82), authenticity is one of the core elements for ESP teaching. The use of authentic material for input has become increasingly common in ESP programs. For student pilots in particular, exposure to the language and terminology used by professionals in this field may accelerate their graduation into the target domain with improved skills for communication. A key issue for ESP teachers is to base the course on true materials and enable the students to use what they have learned naturally in their future work (Li, 2016). In line with the students' needs, this course is based on real-world communications, and improves both the efficiency of meeting strict terminology requirements, as well as the overall effectiveness of their use in communication. In his interview, Louis from Group 7 said that he had learned the terms underlined below, and recognized their impact when they appeared in *Mayday* accompanied by the explosion of a Rolls-Royce engine.

> There was a loud explosion. Everybody just said ,'What was that?'
> My reaction immediately was, 'Oh my goodness, maybe this is it?'
> The first thought when it goes bang is an engine failure. Possibly severe damage.
> We lost No. 2.
> Holding 7,400 feet.
> DeCrespigny wastes no time, taking over control from the autopilot. 35 years of flying tells him what to do next.
> I pressed the altitude hold button, which would cause the nose to lower and aircraft level.
> Matt, ECAM actions.

The Electronic Centralized Aircraft Monitor (ECAM) is an electronic instrument system that monitors the functions of the aircraft and displays the information on two color displays in the cockpit. In *Qantas 32*, Captain Richard De Crespigny, once a fighter pilot, was quick to respond when the explosion occurred. He took control of the plane and held *altitude*, and assigned his first officer to locate the malfunction using *ECAM* data. By introducing students to the sites of accident and incident, this course works like a simulator and enhances their terminological awareness and competence with 'the visual

information in images for a better understanding of complex and dynamic concept systems' (Faber et al., 2007:39), supporting student pilots' attempts to learn aviation terminologies and sharpening their skills for communication.

6. Conclusion

Terminology is not only a matter of terms and term entries that try to represent pieces of objective reality. The representation of a specialized field should be more than a list or a configuration of objects linguistically translated into either simple or compound nominal forms. It is necessary to situate concepts in a setting and within the context of dynamic processes that 'define and describe the principal event in the specialized field in question' (Faber et al., 2005:127). Addressing the relationship between aviation English and terminology and general English, the ICAO proposes that aviation English, RT English, and ICAO terminologies as increasingly smaller subsets within the larger category of the English language (2010:32). A sub-category of aviation English, RT English is the language used in RT communications. It includes but must not be limited to ICAO terminology, and can require the use of general English at times. ICAO terminologies are standardized words/phrases approved for RT communications. They have been developed over years and represent a very narrow, specialized, and rigid subset of language. The instructors in such a course should be familiar with a variety of language teaching methods and techniques, with principles of curriculum development, and with the notions of learner style and motivation. They are expected to link the approach used to an underlying theory of language and language learning, creating a program with domain-specific materials to teach ICAO terminologies.

As Stevick (2000: 43) points out, central to the quests of both alchemists and language teachers was 'some quick and simple piece of equipment – the so-called philosopher's stone' that would make the transformation possible. This paper has made a brief introduction to teaching ICAO terminologies to student pilots in China, and takes the perspective of a translational approach to develop terminological competence for airspeak. The approach derives from previous studies on Terminology, LSP and specialized translation at home and abroad. The content was based on a need determined by the first author's dual professional experience as an ESP and MTI instructor designing and delivering a terminology course, a component of the aviation English program for student pilots and MTI candidates, in the Nanjing University of Aeronautics and Astronautics (NUAA) of China. By teaching aviation terminologies and thereby continuing to develop aviation English courses, we should be able to steadily improve systematic and comprehensive curricula for teaching aviation English, in collaboration with the joint efforts of fellow language practitioners. It is our hope that this paper has provided some insight into the challenges facing the LSP/ESP instructor acting as an aviation English curriculum developer, and the complexity of shaping language learners into domain experts qualified for professional communication.

Acknowledgments

References

Ahmad, K., & Rogers, M., (2007). *Evidence-based LSP*: *Translation, Text and Terminology*. Bern: Peter Lang.

Alderson, J. C., (2009). Air safety, language assessment policy, and policy implementation: The case of Aviation English. *Annual Review of Applied Linguistics*. *29* (1), 168–187.

Alderson, J. C., (2011). The politics of aviation English testing. *Language Assessment Quarterly*. *8* (4), 386–403.

Cabré, M. T., (2000). La enseñanza de la Terminologíaen España: Problemas y propuestas. *Hermèneus*.*2*, 41–94.

Chen, H.N., 陈华妮 (2012). PEPEC考试对飞行学生英语学习策略的反拨效应 [Washback Effects of PEPEC on English Learning Strategies of Pilot Students]. *中国民航飞行学院学报* [*Journal of Civil Aviation University of China*].*23*(1), 67–70.

Cushing, S., (1994). *Fatal words*: *Communication clashes and aircraft crashes*. Chicago, IL: University of Chicago Press.

Cushing, S., (1995). Pilot-air traffic control communication: It's not only what you say, it's how you say it. *Flight Safety Digest*. *14*(7), 1–10.

Cutting, J., (2012). English for airport ground staff. *English for Specific Purposes*.*31*, 3–13.

Dolbeer, R. A., et al., (2016). *Wildlife Strikes to Civil Aircraft in the United States 1990–2015*. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report 22, Washington, DC.

Faber, P. (2003). Terminological competence and enhanced knowledge acquisition. *Research in Language*.*1*, 95–117.

Faber, P., Márquez, C., & Vega, M., (2005). Framing terminology: a process-oriented approach. *Meta: Translators' Journal*.*50* (4), 121–146.

Faber, P., et al., (2007). Linking images and words: the description of specialized concepts. *International Journal of Lexicography*. *20*(1), 39–65.

Farris, C., et al., (2008). Air traffic communication in a second language: implications of cognitive factors for training and assessment. *TESOL Quarterly*. *42* (3), 397–410.

Fedor de Diego, A., (2003). Sobre las propiedades metacognitivas y constructivistas de la terminología y susconsecuencias didácticas. In R. Muñoz Martín (ed.), *I AIETI. Actas del I Congreso Internacional de la Asociación Ibérica de Estudios de Traduccióne Interpretación*. Granada, 12–14 February 2003. 19-31. Granada, Spain.

Feng, J.Z. 冯建中 (2015). 基于ESP的MTI教育模式研究 [Research on MTI education model based on ESP]. *外语研究* [*Foreign Languages Research*]. 2,51–55.

Fluck, H-R., (1985). *Fachsprachen*. 3rd ed. Tübingen: Francke.

Gibson, J. J., (1975). Affordances and behavior. In E. S. Reed & R. Jones (eds.), *Reasons for Realism: Selected Essays of James J. Gibson* (pp. 410–411). Hillsdale: Lawrence Erlbaum.

Granda, R., & Warburton, K., (2001). Terminology management as data management. Paper presented at the 2001 conference of the Centre for Advanced Studies on Collaborative research.

Hoffmann, L., (1985). *Kommunikationsmittel Fachsprache*. 2nd ed. Tübingen: Gunter Narr.

Huang, D.Y., 黄大勇 (2007). 民航英语测试的不确定性 [Uncertainties of aviation English test]. *中国民用航空* [*China Civil Aviation*].*10*, 41–42.

Huang, D.Y., 黄大勇 & Wu, T.X., 吴土星 (2005). 民航英语通讯失误引发事故分析 [Analysis of miscommunication in aviation English]. *中国民航大学学报* [*Journal of Civil Aviation University of China*].*23*(1), 45–48.

ICAO, (2004, 2010). *Manual on the Implementation of ICAO Language Proficiency Requirements*. Montréal: International Civil Aviation Organization.

Jiang, W.Q., 姜望琪 (2005). 论术语翻译的标准[On the criteria of term translation]. *上海翻译* [*Shanghai Journal of Translators*]. *S1*, 80–84.

Jones, R.K., (2003). Miscommunication between pilots and air traffic control. *Language Problems & Language Planning*. 27(3), 233–248.

Krifka, M., Martens, S., & Schwarz, F., (2003). Group interaction in the cockpit: some linguistic factors. In R. Dietrich (ed.), *Communication in High Risk Environments* (pp.75–101). Hamburg: Helmut BuskeVerlag.

Krivonos, P., (2007). Communication in aviation safety: Lessons learned and lessons required. Paper presented at the 2007 regional seminar of the Australia and New Zealand societies of air safety investigators. http://www.asasi.org/papers/2007/Communication_in_Aviation_Safety_Paul_Krivonos.pdf

Leng, B.B., 冷冰冰 (2012).浅谈术语教学走进翻译硕士课程体系[Discussion on the Necessity of Terminology Training for MTI Students]. *中国科技术语*[*China Terminology*].*6*, 15–18, 25.

Leng, B.B., 冷冰冰 Wang, H.S., 王华树 & Liang, A.L.,梁爱林 (2013).高校MTI术语课程构建 [On the construction of Terminology Course for MTI Students]. *中国翻译* [*Chinese Translators' Journal*].*1*, 55–59.

Li, Y.T., (2016). Civil aviation English for pilots: an English air-ground communication course based on simulating videos. *Master's Projects and Capstones*. *346*. https://repository.usfca.edu/capstone/346

Montero Martínez, S., & Faber, P., (2009). Terminological competence in translation. *Terminology, 1*, 88–104.

Miao, J., 苗菊 & Gao, Q.高乾 (2008). 构建翻译专业教学模式——术语学的借鉴意义 [The enlightenment of terminology on constructing a model of instruction for translation as a major]. *外语与外语教学* [*Foreign Languages and their Teaching*], *10*, 57–60.

Miao, J., 苗菊 & Wang, S.S.,王少爽 (2010). 翻译行业的职业趋向对翻译硕士专业 (MTI)教育的启示[MTI education in light of a survey on employment trend in translation industry]. *外语与外语教学* [*Foreign Languages and their Teaching*].*3*, 63–67.

Monterde Rey, A. M., (2002). Creación de bancos de datosterminológicos con MultiTerm:Unaexperienciadocente. In S. Bravo Utrera(ed.), *Estudios de FilologíaModerna y Traducciónenlosinicios del nuevomilenio* (pp. 169–201). Las Palmas de Gran Canaria: Departamento de Filología Moderna de la Universidad de Las Palmas de Gran Canaria.

Mu, L., 穆雷 (2007). 翻译硕士专业学位: 职业化教育的新起点[On MTI as the new starting point of professional education]. *中国翻译* [*Chinese Translators' Journal*].*4*, 12–13.

Nunlist, T., (2017). Flying High: China's aviation industry is becoming a global force.http://knowledge.ckgsb.edu.cn/2017/04/17/airline-industry/china-aviation-industry-becoming-global-force/

Parc, F., (1997). Évolution d'une formation en milieu de travail. *Terminologies Nouvelles: Terminologie et formation*.*17*, 35–36.

Qin, X.B., 秦秀白 (2003). ESP 的性质、范畴和教学原则 [On the nature, category and teaching principles of ESP. *华南理工大学学报* [*Journal of South China University of Technology*].*4*, 79–83.

Qiu, M.R.,邱懋如 (2001). 可译性及零翻译 [Translability and zero translation]. *中国翻译* [*Chinese Translators' Journal*].*1*, 24–27.

Rogers, M., (2012). Translating specialised texts: from terms to communication. *The Journal of Specialized Translation*.*18*, 1–6.

Soffritti, M., Bertaccini, F., & Cortesi, C., (1997). L'icone dans la fiche terminologique: un nouveau point de départ? *Terminologies Nouvelles: Terminologie et formation,* 17, 43–48.

Stevick, E.W., (2000). Affect in learning and memory: from alchemy to chemistry. In J. Arnold (ed.), *Affect in Language Learning* (pp. 43–57). Cambridge: Cambridge University Press.

Tao, J., & Gao, X.S., (2017). Teacher agency and identity commitment in curricular reform. *Teaching and Teacher Education,* 63, 346–355.

Tajima, A., (2004). Fatal miscommunication: English in aviation safety. *World Englishes*. *23*(3), 451–470.

Velasquez, G., (2002). Translation and terminology in mediated bilingual communication. *Meta: Translators' Journal*. *47* (3), 444–459.

von Hahn, W., (1983). *Fachkommunikation*. Berlin/New York: de Gruyter.

Wang, A.G., (2007). Teaching aviation English in the Chinese context: Developing ESP theory in a non-English speaking country. *English for Specific Purposes,* 26, 121–129.

Wang, S. S., 王少爽 (2011). 面向翻译的术语能力：理念 构成与培养 [Translation-oriented terminological competence: concept, components and cultivation]. *外语界* [*Foreign Languages World*].*5*, 68–75.

Wang, S.S., 王少爽 (2013). 翻译专业学生术语能力培养：经验、现状与建议 [Developing translation majors' terminological competence: experience, the status quo and suggestions]. *外语界* [*Foreign Languages World*]. *5*, 26–34.

Wu, T.X., 吴土星 & Huang, D.Y., 黄大勇 (2006). ICAO 英语标准对我国民航空中交通管制人员的影响及对策 [The influence of ICAO English standard on China's air traffic controllers and counter-measures]. *南京航空航天大学学报* [*Journal of Nanjing University of Aeronautics and Astronautics*]. *3*, 87–90.

Zhao, K. 赵珂, Guo, X.H., & Gao, X.S. 高雪松, (2017). Learning English to fly: A study of Chinese cargo airline pilots' learning engagement. *English Today*.*4*, 5–11.

Zhu, B., 朱波 & Wang, W., 王伟 (2013). 论民航专业文本中的术语翻译 [On terminologies in the domain of civil aviation and their translations]. *中国翻译* [*Chinese Translators' Journal*]. 6, 94–98.