Systemic Functional Linguistics in Aviation English

Course Book Construction

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Abstract

Systemic functional linguistics contributes greatly in language teaching, and it also influences course book design and construction. Following the theory of textual function, this paper explores cohesion, coherence, theme, contexts, functions and notions, language skills and interactive communications in aviation English course book compilation. In Aviation English, cohesion is largely dependent on the contents and contexts. Materials selected for the text should be authentic and directly related to aviation themes. Coherence is realized through keeping contextual consistency, consistency in shared knowledge, expectational consistency, and particularly cognitive consistency by following the flight training procedures. The structure of the course book can be divided into two parts. The first part, Section A, is for language input and the second part, Section B, is for language skills and interactive communications. Functions and notions are cued in the first part, and are also stressed in language skill practicing. In interactive communications, pair work, group work, role-play and interactive activities are arranged to complete language tasks for air traffic controllers and pilots.

1. Introduction

In order to improve flight safety, the International Civil Aviation Organization (ICAO) has published the new document *Manual on the Implementation of ICAO Language Proficiency Requirements* in which English language level and proficiency for air pilots and air traffic controllers are strictly set out. The document, *Doc9835* for short, approved by the ICAO Assembly, signed by the Secretary General and published under his authority, is based on the proposal by the accident investigators who find that insufficient English language proficiency of the flight crew or a controller has played a contributing role in the chain of events leading to accident.

The ICAO language proficiency requires: strengthen the requirement for English to be provided by air navigation service providers; establish minimum skill level requirements for language proficiency for flight crews and air traffic controllers; introduce an ICAO language proficiency rating scale; clarify the requirement for the use of both plain language and...
phraseologies; standardize the use of ICAO phraseologies and recommend a testing schedule to demonstrate language proficiency.

Aviation English is defined as a comprehensive but specialized subset of English related broadly to aviation (Doc9835: 4-8). Not restricted to controller and pilot communications, it can also include the use of English relating to any other aspect of aviation, such as the language used by pilots for briefings, announcements, and flight deck communication; or the language used by maintenance technicians, flight attendants, dispatchers, or managers and officials within the aviation industry. As concerns the English course book compiled for pilots and air traffic controllers, the following problems should be solved: How to organize the language functions, events, domains and tasks in a cohesive and coherent way? How to structure the text so that language functions and notions can be focused? While the texts are largely in written form, how to provide language skill practice and interactive communications? This paper explores cohesion, coherence, theme, contexts, functions and notions, language skills and interactive communications in Aviation English course book compilation.

2. Cohesion, Contents, Contexts and Themes

2.1 Cohesion and Contents

Cohesion is a key term in discourse linguistics. Halliday and Hasan (1976) consider cohesion a semantic concept which is concerned with the sense relation between words and between sentences. There are four ways (Halliday 1994) by which cohesion is created in English: reference, ellipsis, conjunction, and lexical organization. Hu Zhuanglin (1994) divides cohesion into the following four categories: reference, structure, logical cohesion and lexical cohesion.

As lexical cohesion makes up about 40% of all cohesive ties, Hoey (1991) thinks that lexical cohesion is the most prominent as well as the most important form of cohesion. There are two kinds of lexical cohesion: reiteration and collocation. The former basically includes repetition and some other forms while the latter includes all the lexical items that are semantically related in a discourse.

Liu Chendan (1999) points out that the relation between lexis of reiteration and
collocation is largely restricted by discourse and context. And the dependence of lexical relation on discourse and context makes it even harder to determine the domain of lexical items. Judging the possible relation of lexical collocation depends upon the background knowledge, i.e. the degree of familiarity of the contents in the discourse. So, the reader’s background knowledge in recognition of lexical relations plays a more important role than his recognition of other cohesive ties. This is particularly true in Aviation English discourse. Furthermore, the meaning of the words is cued or restricted by contents and contexts. This is illustrated by the following sentences and discourses, which are excerpted from aircraft manuals:

1) The airplane is **powered** by two CFM56-3 **engines**.
2) If an engine **generator** is no longer supplying **power**, the APU **generator** may be used to **power** one generator bus.
3) He landed **power-off**.
4) A: Beijing Ground, CA981, radio check 129.0.
   B: CA981, Beijing Ground, **read** you 5.

The word “power” has the meanings of energy and electricity and is used frequently. In sentence 1) there is a co-occurrence of “power” and “engine”, we can judge here that “power” means energy. In sentence 2) “power” is collocated with “generator”, so it means electricity. In sentence 3) when there is no lexical collocation, what does the word “power” mean? Electricity or energy? The verb “land” here provides the context: the pilot is making an approach to land the aircraft. A power-off landing is the landing without power being delivered from the engine. When used in discourse, comprehension is largely dependent on the participant’s background knowledge.

Number 4) is a discourse between the pilot and an air traffic controller. The content of communication is a radio check. The word “read” which has a meaning shift would puzzle anyone who does not have the knowledge of radio telephony: “I read you 5” means I hear your voice loud and clear.

These examples show that contents and background knowledge contribute greatly to meaning comprehension in Aviation English.
2.2 Contexts and Themes

Context can be divided into three types: linguistic context, situational context and cultural context (Hu Zhuanglin 1994: 182-188). Linguistic context refers to the environment within the discourse. Situational context refers to outside factors around the discourse such as time, place, mode, relation of the participants, and so forth. Cultural context refers to the specific history, culture, customs and values of the language users’ community. In the compilation of aviation English textbooks, besides linguistic context, more attention should be paid to situational context, and cultural context should be considered as well.

In flight pilot ground training courses, such contents should be placed under different themes for student pilots: 1) aircraft system, 2) airspace system, 3) principles of flight, 4) aviation weather, 5) aircraft performance and limitations, 6) basic navigation, 7) radio communication procedures, 8) flight procedure and techniques, 9) system and equipment malfunctions, 10) aviation physiology.

As for airline pilots the aircraft systems based on large aircraft manufactured by Airbus Industry and Boeing Aircraft Company can be selected as themes, including: APU, pneumatic, anti-icing system and rain protection, electric power systems, flight control systems, fuel systems, Hydraulic systems, oxygen systems, warning and fire protection systems, communications, instruments and navigational systems, aircraft performance, flight procedures and human factors.

3. Coherence, Flight Procedure and Text Structure

3.1 Coherence

In Systemic Functional Linguistics and text linguistics, coherence is another important discourse feature. However, the linguists do not have consensus on the definition of the term. Though Halliday discusses coherence in many of his works, he does not give the term a clear definition (Cheng Xiaotang 2003: 267). He uses it as an ordinary word rather than a specific term, and seems to believe that the readers themselves can sense the discourse continuity. In addition, it seems that he thinks cohesion is the prerequisite and coherence is the result. This arouses much criticism.
Some linguists argue that cohesion and coherence parallel discourse features in equal positions, which work together and make sentences and paragraphs connected to the discourse through semantic relations. Other scholars try to distinguish cohesion and coherence semantically. They claim that cohesion and coherence share the quality of connectedness in discourse. However they propose that cohesion refers to the connectedness of forms, while coherence offers the connectedness in contents (Lyons 1995).

Cheng Xiaotang (2003) defines cohesion as the connective relations or connectiveness between elements in discourse and coherence as the consistency of the elements with respect to theme, style and so on. He argues that the connectiveness and consistency can be in different aspects and on different levels. The different aspects can be relations between discourses, discourse and contexts, discourse and readers/listeners. On different levels there can be relations of discourse elements in speech sounds, lexicon/syntax and meaning. He sets up a framework to explain coherence in terms of different kinds of consistency which include: 1) contextual consistency, 2) consistency in shared knowledge, 3) expectational consistency and 4) cognitive consistency.

Cheng (2003: 270-278) explains that a coherent discourse must have the feature of consistency with the situational context. The coherence depends to some degree on the interaction between the discourse and the readers or listeners. When the contents of a discourse do not agree with the expectation of the reader or listener, the discourse lacks coherence. And a coherent discourse should be cognitively consistent for the readers or listeners. As human cognitive procedure is always a transition from known to unknown, from given information to new information, the organization of information in a discourse should also follow the rule. Otherwise, readers or listeners cannot sense the coherence in the discourse.

3.2 Flight Training Procedure

Here I apply Cheng’s framework of coherence as the criteria to evaluate the coherence in aviation textbook compilations. As the materials adopted are authentic texts on aviation themes, and the learners are student pilots or airline pilots, it seems easy to keep contextual
consistency, consistency in shared knowledge and expectational consistency. However, when checking the aircraft operation manuals or pilot training manuals published by aircraft companies, we find that most of the items or themes are arranged in alphabetic order from A to Z. If we follow this sequence, the textbook will not be cognitive consistent for the readers and learners.

In studying the pilot ground school courses and the pilot flight training procedures, I find that they gear with learners’ cognitive psychology in a better way. Therefore, I argue that in textbook compilation for student pilots, the ground school courses could be selected on the basis of priorities as the following: 1) Airplane Systems, 2) Aerodynamic Principles, 3) The Flight Environment, 4) Communication and Flight Information, 5) Meteorology for Pilots, 6) Interpreting Weather Data, 7) Airplane Performance, 8) Navigation, 9) Flying Cross-country, 10) Applying Human Factors Principles.


3.3 Structure of the Text

The text of the course books can be divided into two parts: Section A and Section B. Section A provides aviation knowledge and language input. Section B is for language skill practice and interactive communication. This division allows the text to cover more contents on the same theme, and has a clear distinction of the function of each section. Here we take the theme of Power-plant as an example.

The chapter in the Boeing 737 Pilot Training Manual contains a general system description and other branches such as engine fuel system, engine oil system, engine start system, ignition system, thrust reverser and air bleed system, in 20 pages. How can we put
this much content into the text when we know that aviation knowledge is very important? The main part, the General System Description, can be put in Section A, as it provides the most important information and language input for the whole power-plant system. Other sub-systems can be put in Section B for skill practice and interactive activities.

In this way, the text can cover as much content as possible. In each section there is something new for students to learn, and the contents are closely related to the theme of Power-plant, which makes for contextual consistency and cognitive consistency as well.

4. Language Functions, Skills and Interactive Communications

4.1 Functions and Notions

Halliday’s Systemic Functional Linguistics sees language as an instrument used to perform various functions in social interaction. For Halliday, learning language is learning to mean. In order to be able to mean, one has to master a set of language functions which have direct relation to sentence forms. In child language there are seven initial functions. In adult language, these discrete functions are replaced by three Meta-functions: the ideational function, the interpersonal function and the textual function.

Systemic Functional Linguistics leads to the development of the functional approach in the field of language teaching. Since communicative function is the basic function of language in use, the functional approach is also called the communicative approach, according to which language learning and developing communicative competence are the ultimate goals in language teaching.

The concept of ‘competence’ originally comes from Chomsky and has been criticized for being too narrow. D. H. Hymes (1971) proposes a communicative competence which has four components: Possibility – the ability to produce grammatical sentences; Feasibility – the ability to produce sentences which can be decoded by the human brain; Appropriateness – the ability to use correct forms of language in a specific socio-cultural context; and Performance – the fact that the utterance is completed. Hymes’ theory takes us a step further towards communicative syllabuses and communicative approaches in language teaching.

The concept of ‘notion’ refers to the meaning one wants to convey, while that of
‘function’ refers to what one can do with language (Hu Zhuanglin 2001). Notion can be divided into two categories: general notions and specific notions. General notion refers to the notions which are appropriate to all kinds of language situations which are connected to function items. Depending on the themes, specific notion varies, and the theme decides the lexicon inventory.

Function refers to language act, i.e. one uses language to describe and express ideas (Zhang Jianzhong 1983). In *ICAO Doc9835* there is a detailed inventory of the communicative language functions, events, domains and tasks. The items of communicative functions directed towards triggering actions include: orders, requests and offers to act, advice, permission/approved, undertakings – altogether as many as 116 items. As function means to use language to describe events, to express ideas, to pass messages, and notion refers to the use of language to explain the meaning of contents, functions and notions are always co-located and closely related in text and in practical language teaching.

### 4.2 Functions and Notions in Text

In Aviation English textbook compilation language functions and notions should not only be focused in Section A, the text, but also be stressed in Section B, the part for language skills and interactive communication. The following passage is adopted from *Private Pilot Manual* to show how the text in Section A can be structured:

During flight, the four forces acting on the airplane are lift, weight, thrust, and drag. **Lift** is the upward force created by the effect of airflow as it passes over and under the wings. It **supports** the airplane in flight. **Weight** opposes lift. It is caused by the downward pull of gravity. **Thrust** is the forward force which **propels** the airplane through the air. It varies with the amount of engine power being used. Opposing thrust is **drag**, which is a backward, or retarding, force that **limits** the speed of the airplane.

In this passage the notion of the four forces of “lift”, “weight”, “thrust” and “drag” can be defined according to “upward force”, “downward force”, “forward force” and “backward or retarding force” respectively. Their functions can be realized through words such as “support”, “propel”, “oppose”, and “limit”.

In text compilation these functions and notions can be placed either next to the passage or above/below the passage as the clue through such questions as: What is lift?
In a more complex text, other questions can be designed to introduce language functions and notions such as those related to the topic of flight instruments: What is the name of this gauge? Where is it located on the instrument panel? How does it work? What action should the pilot take to control it? How can it be corrected when there is malfunction?

4.3 Language Skills and Interactive Communications

Language is viewed as a system of forms in linguistics, but it is also regarded as a set of skills in the field of language teaching (Hu Zhuanglin 2001). According to communicative approach theory, communicative competence is one’s capability of using language and non-verbal means such as gesture and facial expressions to realize the goal of communication. Actually, this kind of competence shows one’s capability as a whole, which involves many aspects including: language knowledge, cognitive competence, cultural knowledge, knowledge of style, knowledge of paralinguistics, and emotive factors (Shu Dingfang & Zhuang Zhixiang 1996).

Since communicative competence refers to one’s capability of using language and paralinguistic means to achieve specific communicative goals, communicative competence includes both comprehension and expression as two important aspects. When we talk about developing communicative competence, we mean to cultivate the integral capability of listening, speaking, reading and writing.

In the ICAO Language Proficiency Requirements speaking and listening proficiency are seen as the areas needing more critical address. In aviation English textbook compilation Section B, which is for language skills and interactive communications, the skills of speaking and listening are stressed. Language functions and notions are the keystones for maintaining consistency between the text and the skill practice part. Here are some examples to show how functions and notions are focused in listening, speaking, and in interactive communication.
4.3.1 The Passage for Listening

This is the passage for listening:

The altimeter senses pressure changes and displays altitude in feet. It usually has three pointers, or hands, to indicate the altitude. The longest pointer shows hundreds of feet, the middle-sized pointer indicates thousands of feet, and the shortest pointer shows tens of thousands of feet. It also has an adjustable barometric scale for changes in pressure.

The words in boldface can be deleted before listening. After listening to the passage, the following questions should be answered: What is the instrument called that senses pressure changes and displays altitude? (altimeter); How many pointers does it have? (three); What shows hundreds of feet? (the longest pointer); What indicates thousands of feet? (the middle-sized pointer); What shows tens of thousands of feet? (the shortest pointer); What instrument displays the changes in air pressure? (barometric scale).

4.3.2 The Passage for Speaking

The passage for speaking is as follows:

In small airplanes, the power-plant includes both the engine and the propeller. The primary function of the engine is to provide the power to turn the propeller. It also generates electrical power, provides a vacuum source for some flight instruments, and, in most single-engine airplanes, provides a source of heat for the pilot and passengers.

After listening to this passage, the students are required to name the functions of the engine which: 1) provides the power to turn the propeller; 2) generates electrical power, 3) provides a vacuum source for some flight instruments, and 4) provides a source of heat for the pilot and passengers. The words in boldface can be deleted before practicing speaking.

4.3.3 Interactive Communications

As for interactive communications, pair work, group work, role play and interactive activities are designed around language tasks for air traffic control: manage air traffic controllers, control aircraft or vehicle ground movement, flight plan, perform situation monitoring, resolve aircraft conflict situations, assess weather impact, respond to emergencies, conduct emergen-
cy procedures, and manage sector or position resources. The following is a passage for inter-active communication:

The **primary flight controls** are the ailerons, elevators and rudder. These hydraulically powered surfaces **provide flight control in roll, pitch, and yaw.** **Hydraulic power** is provided from hydraulic systems A and B; either system can operate all primary flight controls. The ailerons and elevators may be operated manually if required. The rudder may be operated **by the standby hydraulic system if system A and/or B pressure is not available.**

When having read or listened to this passage, the students will discuss and exchange their ideas about the following questions: What are primary flight controls? (The primary flight controls are the ailerons, elevators and rudder); what functions do they have? (These hydraulically powered surfaces provide flight control in roll, pitch, and yaw); how are they powered? (Hydraulic power is provided from hydraulic systems A and B; either system can operate all primary flight controls); How is the rudder operated if hydraulic systems A and B are failed? (The rudder may be operated by the standby hydraulic system if system A and/or B pressure is not available).

5. **Conclusion**

Halliday’s Systemic Functional linguistics contributes greatly in language teaching, and it also influences course book design. This paper explores cohesion, coherence, theme, contexts, functions and notions, language skills and interactive communications in Aviation English textbook compilation. In Aviation English, cohesion is largely dependent on the contents and contexts. Materials selected for the texts should be authentic and directly related to aviation themes. Coherence is realized through maintaining contextual consistency, consistency in shared knowledge, expectational consistency, and particularly cognitive consistency by following the flight training procedures. The structure of the text can be divided into two parts. The first part, Section A, is for language input and the second part, Section B, for language skills and interactive communications.

Following communicative approach theory, language function and notion are the two keystones in Aviation English textbooks. Functions and notions are cued in the texts, and are
stressed in language skill practicing. In interactive communications, pair work, group work, role-play and interactive activities are arranged to complete language tasks for air traffic controllers and air pilots.

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