DOT/FAA/AM-95/15

Office of Aviation Medicine
Washington, D.C. 20591

Development of a Coding Form for Approach Control/ Pilot Voice Communications

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May 1995

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19950613 098

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/AM-95/15		

4. Title and Subtitle	5. Report Date
Development of a coding form for approach control/pilot voice communications	May 1995
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
O.V. Prinzo, T.W. Britton, and A.M. Hendrix	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
FAA Civil Aeromedical Institute P.O. Box 25082 Oklahoma City, OK 73125	11. Contract or Grant No. DTFA-02-91-C-91089
12. Sponsoring Agency name and Address	13. Type of Report and Period Covered
Office of Aviation Medicine Federal Aviation Administration 800 Independence Ave., S.W. Washington, D.C. 20591	14. Sponsoring Agency Code

15. Supplemental Notes

This work was performed under Task AM-D-94-HRR-117

16. Abstract

The Aviation Topics Speech Acts Taxonomy (ATSAT) is a tool for categorizing pilot/controller communications according to their purpose and for classifying communication errors. Air traffic controller communications that deviate from FAA Air Traffic Control Order 7110.65, and pilot communications that depart from the suggested communication in the Airman's Information Manual can be identified and labeled using the error codes provided in the ATSAT. By using the same procedures and tool to analyze communications, direct comparisons can be made between controller phraseology usage in the field and during simulation. Results of a preliminary study to measure inter-coder agreement revealed that novice coders were more dependent on the surface characteristics of the verbatim transcripts and experts relied more on domain specific background knowledge and experience with ATC phraseology to code ATC communications. If a researcher elects to use the ATSAT, we recommend that all coders receive the same orientation and instruction sessions prior to using the it.

DTIC QUALITY INSPECTED 3

17. Key Words	18. Distribution Statement
ATC-Pilot Communications Communication Taxonomy Phraseology	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
		34	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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DEVELOPMENT OF A CODING FORM FOR APPROACH CONTROL/PILOT VOICE COMMUNICATIONS

1.0 INTRODUCTION

1.1 Background

Voice-radio communication is central to air traffic control (ATC). Air traffic controllers are taught a standard phraseology[1] as part of their formal training, and once they are assigned to an air traffic control tower, terminal, or en route facility, their communication skills are reviewed periodically. Many government agencies, aviation industries, and researchers interested in controller/pilot communication often rely on the Aviation Safety Reporting System (ASRS) and the Office of Safety Information and Promotion (ASP) for aviation-related information. Verbal communication often is represented as a major category (with possibly several general types of communication topics) in addition to other controller performance measures on standardized FAA forms[2]. Voice-radio communication is included as part of investigations involving operational errors, system or pilot deviations, or other events that may have the potential to impact safety.

In aircraft-related accident investigations, a written verbatim transcript of the actual voice-radio communication is included as part of the official records to aid in the identification of the factors surrounding the incident. Written verbatim transcripts also are included in operational error/system deviation investigations. Some researchers (e.g., Cardosi, 1993; Morrow & Roldvold, 1994) have examined audio taped recordings of controller/pilot voice-radio communications provided by ATC. Transcribing and identifying potentially critical verbal communications can be an arduous and expensive task. A cost - effective approach is needed that would allow controller/pilot voice-radio communications to be coded and stored in a database for use by researchers and investigators to answer communication-based safety questions. In so doing, real progress could be achieved in understanding the dynamics of communication between controllers and pilots during routine operations and again when problems arise. A problem with existing databases is the lack of a uniform coding scheme which makes it difficult for users to gain a clear perspective of the magnitude of actual safety-related problems.

As part of a survey of the ATC/pilot voice communications literature, Prinzo and Britton (1993) included samples of air traffic control verbal communications taxonomies. Kanki and Foushee (1989) described typical flight crew performance and decision making (e.g., command, suggestion, inquiry, acknowledgment) using the speech act as the underlying unit of communication measure; whereas, Morrow, Lee, and Rodvold (in press) described TRACON[3] controller/pilot communication using the speech act and aviation topic (e.g., heading) in their analyses. A speech act is a single utterance used to convey a single action or intention for action (see glossary). In another approach Human Technologies, Inc. (1991) examined team co-ordination among en route controllers and pilots using the speech act to analyze communication patterns. Cardosi (1993) examined the complexity of en route communications by counting the number of elements (i.e., new pieces of information within a communication that increased memory load) in a transmission. Unfortunately, the results of these various efforts cannot be integrated and an overall conclusion reached since different measures were used.

From the Prinzo and Britton survey, it became apparent that different researchers used the same words to describe some communications; however,

[1] FAA Order 7110.65G Air Traffic Control
[2] FAA Form 7210-3, Final Operational Error/Deviation Report
[3] Terminal Radar Approach Control

the assigned meanings to those words were not always uniformly applied. For example, Golaszewski (1989) defined readback error as a loss in separation minima resulting from a controller's failure to detect (or correct) an incorrect readback by the pilot. Alternatively, Morrow, Lee, and Rodvold (1990) defined readback error as a failure to read back correctly the information contained in the original transmission; loss of separation was not considered. In some instances, words referencing concepts were provided without benefit of definition (e.g., frequency congestion) (Morrison & Wright, 1989) and left to the reader to interpret. It is uncertain whether experts and novices in the field of aviation consistently apply the same definitions to those words. Without benefit of uniform definitions, the risk of misunderstanding or misinterpretation increases.

1.2 Purpose

The purpose of the present research effort was to develop a voice communication taxonomy and method of data collection that could be used to analyze ATC/pilot voice-radio communication in a systematic and consistent fashion. That product is the Aviation Topics/Speech Acts Taxonomy (ATSAT). This taxonomy was developed as a tool for building a common ground of understanding of ATC communications through the use and application of a standard or common analytic procedure. The appropriateness of the ATSAT to other applications depends on the user's ultimate goal. Thus, the user will need to define the problem and determine the appropriate level of analysis. Within the ATSAT, the aviation topic presents a micro level of analysis and the speech act a macro level. In this taxonomy, the **speech act** defines the purpose of the utterance; that is, its intent.

The 5 speech act categories that make up the framework for the ATSAT and its corresponding coding form (See Appendix A) are: 1) Address, 2) Courtesy, 3) Instruction/-Clearance/Readback, 4) Advisory/Remark/Readback, and 5) Request/Readback. A sixth category, Non-Codable, is included as a general category. (See Appendix B.) Non-codable would include unintelligible transmissions due to equipment-related problems, delivery technique, and communications that could not be placed into any of the other major groupings.

The **aviation topic** is the basic unit of meaning (subject) and it is found within the speech act. Aviation topics place constraints on their associated speech acts by limiting the type of action that can occur. For example, headings, altitude restrictions, air speeds, and routes are aviation topics which are frequently included in transmissions containing instructions or requests. A complete list of aviation topics included in the ATSAT, along with their definitions, is included in this report. (See Appendix C.)

2.0 APPROACH

2.1 Development of the Aviation Topic Speech Act Taxonomy

A literature search was performed to acquire copies of the existing research conducted on controller/pilot voice radio communications. The speech act (Kanki & Foushee, 1989; Morrow, Clark, Lee, & Rodvold, 1990) was selected as the major type of communication element in a transmission under which the aviation topics were grouped. A list of the aviation topics was developed from the literature review for possible inclusion in the Aviation Topic Speech Act Taxonomy. These aviation topics were placed into the speech act category into which they were most likely to be found in a transmission.

Similarly, a list of the various types of communication problems was constructed from the Prinzo and Britton literature review and databases (e.g., ASRS). The communication problems were restricted to include only voice-radio messages between the controller and the pilot. Equipment related problems, such as faulty equipment, improperly worn headsets and microphones, intra-facility communication, inter-facility communication, and inter-flight-deck verbal communication were not included. Only controller/pilot voice radio communications within the terminal environment were addressed by this research.

Once the basic structure of the ATSAT was constructed, a sample of TRACON/pilot communications was obtained, transcribed, and coded using the taxonomy. Based on the VHF/UHF audio tapes provided, some of the speech acts were combined into a single category and several aviation topics were discarded or replaced. A retired controller served as the

subject matter expert (SME) during the refinement of the ATSAT. FAA Order 7110.65G Air Traffic Control (1992), Airman's Information Manual (1992), and the FAA Order 7340.1M Co*ntractions* (1992) also were used as resources.

2.2 Identification of Problematic Verbal Communications

The Prinzo and Britton literature review aided in identifying message content errors and delivery technique errors as two major groups of communications-based problems. Although other types of communication problems have been identified (Morrison & Wright, 1989), many are equipment related problems (e.g., equipment outages, obsolete equipment). The ATSAT addresses only controller/pilot-centered verbal communication problems. Verbal communications, which deviated from standard phraseology specified in FAA Order 7110.65G or suggested pilot phraseology in the Airman's Information Manual, were grouped into those stemming from message content and delivery technique.

2.2.1 Message Content Errors

There are 7 different types of message content errors that are included on the ATSAT. These types of errors are listed in Table 1. Although grouped and seqential refer directly to numerical information, omission, substitution, and transposition, errors could also occur for other types of information, such as failing to include an aircraft callsign in a transmission where the callsign would be required. Substitution errors would include replacing the numbers in an assigned airspeed with the numbers assigned for a heading, or an altitude in a transmission that contained at least 2 aviation topics in a speech act instruction. Excessive verbiage errors include any words or phrases in addition to standard phraseology. Partial readbacks are similar to omission errors; however, partial readbacks occur when a pilot fails to include a piece of information in a readback. The two different codes are used because pilots and controllers are judged by the same phraseology standards for the ATSAT. According to FAA Order 7110.65G or the Airman's Information Manual, however, ATC phraseology is more rigidly prescribed for a controller than it is for a pilot.

2.2.2 Delivery Technique Errors

The analysis of the recorded voice-radio transmissions made by the master of the oil tanker Exxon Valdez served as a basis for defining delivery technique errors (Brenner & Cash, 1991). As displayed in Table 1, misarticulations (e.g., slurring of speech) and dysfluencies (e.g., hesitations) are the 2 major types of delivery technique errors included in the ATSAT. Misarticulations and dysfluencies have the potential for decreasing effective information transfer due to excessive pauses or the need to repeat a transmission.

3.0 PROCEDURE

3.1 Instructions

Table 2 lists the steps for transcribing, encoding, and entering the message content of audio transmissions onto the ATSAT Coding Form. Appendices A through D are provided to assist in the encoding process. Appendix A contains a copy of the coding form, a sample page of ATC/pilot transcribed communications, the same transcript page divided into aviation topics and coded with identified phraseology errors, and a completed copy of the coding form. Appendix B lists and defines each of the identified speech act categories according to their placement on the ATSAT Coding Form. Appendix C lists the aviation topics, along with their corresponding definition for each of the speech act categories, in the order of their occurrence on the ATSAT Coding Form. Appendices B and C should assist in the placement of message segments into their appropriate aviation topics and speech act categories on the ATSAT Coding Form. The definitions should not be confused with the more formal definitions of message content terms found in the glossary (Appendix E). Although there should be a close correspondence between how a message segment is defined and the category types presented on the ATSAT, the user occasionally may have to rely on personal experience when a message is slightly ambiguous. Appendix D lists some typical phraseology and delivery technique error types found in each aviation topic, along with their letter code; however, this is not an exhaustive list. It should also be noted that an aviation topic may contain more than one type of error.

Table 1

Communication Phraseology Errors in ATC/Pilot Transcripts.

Error	Code	Definition
Message Content Errors		
Grouped	G	Grouping of numerical information contrary to paragraph 2-85, FAA Order 7110.65G, March 1992
Sequential (Non-grouped)	N	Failure to group numbers in accordance with paragraphs 2-87, 2-88, 2-90, and non-use of the phonetic alphabet in accordance with paragraph 2-84, FAA Order 7110.65G, March 1992
Omission	O	Leaving out number(s), letter(s), word(s), prescribed in phraseology requirements in FAA Order 7110.65G, March 1992
Substitution	S	Use of word(s) or phrases(s) in lieu of phraseology outlined in FAA Order 7110.65G, March 1992 (e.g., "verify altitude" vs. "say altitude")
Transposition	T	Number(s) or word(s) used in the improper order (e.g., "TWA six forty-five" instead of "TWA five forty-six")
Excessive Verbiage	E	Adding word(s) or phrase(s) to phraseology outlined in FAA Order 7110.65G, March 1992, and the phraseology suggested in the Airman's Information Manual. (e.g., "TWA the number one airline six forty-five")
Partial Readback*	P	Pilot report or readback that does not include specific reference to a topic subject (i.e., altitude topic "out of six for four" would be recorded as a P. *Note: A verbatim readback of a controller's instruction or advisory would not be recorded as a P, nor would a readback containing a general acknowledgment and the aircraft identifier.
Delivery Technique Errors		
Dysfluency	D	Pause(s), stammer(s), utterance(s), that add no meaning to the message (e.g., "uh," "ah," or "ok" when not used as a general acknowledgment
Misarticulation	M	Improperly spoken words (i.e., slurs, stutters, mumbling, etc.)

For example, on line 11 of the "Sample Transcript Sheet" (cf. Appendix A, p. 6), air traffic control is transmitting the following message to Plato* 290:

"***Plato two-ninety roger clear visual three one left other traffic landing three one right.***"

The transcriptionist would spell out the numbers in the aircraft callsign and for each of the runways. Once transcribed, the message is segmented in each of the speech act categories by placing a diagonal slash between them (See Table 2, Part 2, Step 2): "*/ Plato two-ninety / roger / clear visual three one left / other traffic landing three one right /.*"

Next, each aviation topic in the transmission is numbered in the order in which it was spoken by the controller (See Table 2, Part 2, Step 3): "/ 1 *Plato two-ninety* / 2 *roger* / 3 *clear visual three one left* / 4 *other traffic landing three one right* /"

The final step in the encoding process is identifying those aviation topics containing errors (See Table 2, Part 2, Step 4). In the present example, an omission occurred in the third aviation topic, which should have read: "clear visual **approach runway** three one left," according to FAA Order 7110.65G. The error did not occur in the fourth aviation topic because that specific phraseology is not stated in the manual for issuing traffic advisories.

"/1 *Plato two-ninety* /2 *roger* /3 O *clear visual three one left* /4 *O; E other traffic landing three one right* /" should have been read as: "cleared visual approach runway three one left; traffic at (clock code, position, and aircraft type) landing runway three one right".

Once complete, the encoded message is transferred to the ATSAT Coding Form using the steps listed in Part 3 of Table 2. This is a fairly straight-forward process.

4.0 PRELIMINARY STUDY ON THE RELIABILITY OF THE ATSAT

4.1 Introduction

The ATSAT was developed by the authors to analyze phraseology usage by controllers and pilots at a micro level of analysis. It uses the terms and definitions found in FAA Order 7110.65 as its basic structure. The ATSAT may be helpful to other researchers in its current form or serve as a foundation or point of departure for developing their own voice communications coding schemes. To determine how reliable experts and novices were in coding ATC transmissions according to the ATSAT Coding Form's instructions and procedures, a preliminary study was performed.

4.2 Subjects

Four novices and 4 ATC instructors volunteered to code the same 25 transmissions from a transcript of ATC/pilot communications. Novices were FAA technical support staff who lacked domain specific prior knowledge of ATC terminology and phraseology usage. Experts were former ATCS employed as FAA Academy ATC instructors. Each volunteer was given a copy of the instructions from Tables 1 and 2 along with Appendices A through D to help with the coding.

4.3 Procedure

A 30 - minute orientation session on how to code the transmissions was given by one of the developers of the taxonomy who, as Facilitator, explained the coding process step by step with each group of novice and instructor coders. The novices were provided with 2 hours of additional instruction pertaining to ATC terminology and phraseology to ensure that they had the minimum requisite aviation knowledge necessary to complete the taxonomy. Since the Experts were responsible for observing and instructing their students on correct phraseology, they were not provided the additional instruction session.

4.4 Results and Discussion

The Facilitator also coded the same 25 transmissions to compare with the novices' and experts' data, and the percentage of items agreeing with the facilitator was computed. The coded transmissions of each group were compared to the coded transmissions of the facilitator for: (1) segmenting the entire message into speech acts and aviation topics, (2) correctly placing the segments onto the coding form, both in

* Plato was chosen for illustrative purposes only; It is a fictitious air carrier.

Table 2

Steps for Translating Audio-Taped Voice Communications to the ATSAT Coding Form.

1. Transcribe audio tapes to written verbatim copy.

Step 1. Identify and record the speaker identification.
Step 2. Copy message spelling out numbers.
Step 3. Enter time in minutes and seconds at the beginning of each transmission. (optional)
Step 4. Sequentially number transcript lines. (Each transmission should be numbered as a line. See example Appendix A.)

2. Encode transcript.

Step 1. Using Appendix C, divide each line of the transcript into aviation topics by placing a diagonal line at the beginning and end of each topic.
Step 2. Sequentially number the aviation topics, placing the number immediately after the beginning diagonal line.
Step 3. Using the "Communication Errors in ATC/pilot Transcripts Table" (Table 1), identify each error and place its letter code after its aviation topic number (Examples are provided in Appendix A.)

3. Transfer data to the ATSAT Coding Form. See Appendix A.

Step 1. Enter the facility name and the coder's name or initials in the appropriate spaces at the top of the ATSAT form.
Step 2. Record the line number from the transcript into the "Line No." column.
Step 3. Identify the speaker by entering the aircraft callsign for aircraft or "ATC" for the controller in the "Speaker" column of the ATSAT form.
Step 4. Sequentially number the communication attempts to a specific receiver and place that transmission number in the far right of the space in which the speaker is identified.
Step 5. Identify the receiver by entering the aircraft callsign for aircraft or "ATC" for controller in the "Receiver" column of the ATSAT form.
Step 6. Record each identified topic by entering the placement number of the topic transcript into the applicable topic column within the appropriate speech act category (Use the "Speech Act Categories" (Appendix B) and "Aviation Topics" (Appendix C) to determine the correct topics and categories.)
Step 7. Indicate any errors within the topics in the same space in which the topic is recorded, using the codes from the "Communication Errors in ATC/Pilot Transcripts" list (Appendix D).
Step 8. Place any additional information or explanation in the "Comment" column using the position number for reference.
Step 9. Repeat steps 8 & 9 until the entire line has been completed.
Step 10. Repeat steps 4 through 10 until each line from the transcript has been coded.

Table 3

Percentage Agreement by Novices and Experts with ATSAT Facilitator in Message Encoding and Classification.

		Message Encoding and Classification		
Coder	N	Segmentation	Placement into ATSAT Categories	Error Code
Experts	4	78%	30%	58%
Novices	4	89%	70%	73%

Table 4

Inter-rater Percentage Agreement in Placement of Message Segments into Speech Act and Aviation Topic Categories by Novices and Experts.

		ATSAT Category	
Coder	N	Speech Act	Aviation Topic
Experts	4	59%	56%
Novices	4	82%	78%

the proper speech act category and in the proper aviation topic, and (3) recognizing that a speech error occurred within an aviation topic. The coded transmissions of the novices then were compared to each other and percentage agreement was computed on properly placing the transmission segments into speech act categories and into aviation topics. The same comparison was performed for the experts.

As shown in Table 3, the novices and experts had higher percentage agreement on segmenting messages than they did on placing those segments into their respective categories on the ATSAT Coding Form or recognizing the presence of a speech error. Correct placement into ATSAT categories required that each segment be correctly labeled on the basis of speech act category and aviation topic and the correct placement of the coded information onto the coding form. It is not surprising that overall percent agreement decreased since a much more granular level of analysis is demanded here than on either segmentation or error recognition. Correct recognition of a speech error required the coders to simply compare the content of an aviation topic to the error type definitions and determine if a match occurred. On correctly recognizing a speech error within an aviation topic, the average agreement with the facilitator was higher for novices than for experts.

As shown in Table 4, novices had a higher percent agreement among themselves than the experts in placing transmission segments into the proper speech act and aviation topic categories. The differences between novices and instructors could have resulted

from differences in ATSAT coding instructions. Instructors were not provided with the 2 hours of additional instruction pertaining to ATC terminology as were the novices. Novices could have approached the task from a similar perspective and purpose. The lack of formal instruction may have increased the variability among the instructors since they were forced to rely on their more subjective and individualized schemes for data classification. Also, they may have relied more on their prior knowledge and experience than on the materials provided to them; the former requiring less effort than the later.

5.0 DISCUSSION

The Aviation Topics-Speech Acts Taxonomy and coding form were developed for studying ATC/pilot voice communications. The ATSAT may be of use by other researchers in its present form or it may be modified to suit particular needs. If a researcher elects to use the ATSAT, several words of caution are in order that are not unique to the ATSAT. First, all coders should receive the same orientation and instruction sessions prior to using the ATSAT, regardless of their domain specific background knowledge or experience with ATC voice communications. Providing only the novices with the instructional session resulted in their being more in agreement with the Facilitator than were the instructors in labeling and placing the coded segments onto the coding form and identifying errors. Providing uniform orientation and instruction sessions to all coders should increase inter-coder agreement, since they would tend to approach the task from the same perspective and purpose.

Second, whereas the novices in the study were more dependent on the surface characteristics of the verbatim transcripts, the instructors may have relied more on experiential and domain specific knowledge to assist them in placing segments into their proper aviation topics and speech acts categories on the ATSAT coding form. Providing experts with instructions on the importance and use of objective measures over their subjective judgments when coding transmissions should improve inter-coder agreement.

Lastly, provisions for practice trials with direct feedback during training should increase inter-coder percentage agreement. The Facilitator was available while novices completed the ATSAT and provided further instruction upon request. Thus, immediacy of instruction, a common understanding of the concepts and procedures, and monitoring of performance may improve inter-coder percentage agreement.

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7.0 APPENDICES

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Aviation Topics within the Speech Act Categories ---------- C-1
Some Typical Errors within Aviation Topics ---------- D-1
Glossary of Terms Used for the TRACON ATSAT Coding Scheme ---------- E-1

Facility:_____ Coder:_____

			Address/Addressee		Courtesy			Instruction/Clearance - Readback/Acknowledgment				
			Speaker	Receiver					Heading		Altitude	
Line No.	Speaker	Receiver	ID	ID	Thanks	Greetings	Apology	Heading	Mod.	Altitude	Restrict	Speed

ATSAT Coding Form

Facility:_____ Coder:_____

Instruction/Clearance - Readback/Acknowledgment (con't)						Advisory/Remarks - Readback/Acknowledgment						
Appr/ Departure	Freq.	Holding	Route	Transpond Code	General Acknowl	Heading	Heading Mod.	Altitude	Altitude Restrict	Speed	Appr/ Departure	Route Position

ATSAT Coding Form

Facility:_____ Coder:_____

Advisory/Remarks - Readback/Acknowledgment (con't)						Request - Readback/Acknowledgment						
			General	Traffic	General				Appr/	Route		
NOTAMS	ATIS	Weather	Sighting	Info	Acknowl	Heading	Altitude	Speed	Departure	Position	Type	NOTAM

ATSAT Coding Form

Facility:_____ Coder:_____

Request - Readback (con't)			Non - codable			
		General				
Traffic	Weather	Acknowl	Equipment	Delivery	Other	Comments

ATSAT Coding Form

Sample Transcript Sheet

1	00:00	PLATO 754	ZERO TWO ZERO PLATO SEVEN FIVE FOUR
2	00:03	ATC	PLATO THIRTY-FIVE HEAVY CONTACT (NAME) TOWER ONE TWO THREE POINT FOUR GOOD DAY
3	00:09	PLATO 35	PLATO THIRTY-FIVE GOOD DAY AND THANK YOU A LOT
4	00:24	ATC	PLATO SEVEN FIFTY-FOUR SAY YOUR SPEED
5	00:32	PLATO 754	AH WE'RE DOING ONE NINETY SEVEN FIFTY-FOUR
6	00:38	ATC	SEVEN FIFTY-FOUR ROGER INCREASE SPEED TO TWO ONE ZERO
7	00:41	PLATO 754	PICK IT UP TO TWO TEN SEVEN FIFTY-FOUR
8	00:47	PLATO 290	APPROACH PLATO TWO-NINETY AT A FOUR POINT SIX FOR TWO
9	00:48	ATC	PLATO TWO-NINETY (NAME) APPROACH TURN LEFT HEADING ZERO TWO ZERO
10	00:52	PLATO 290	ZERO TWO ZERO WE HAVE THE AIRPORT IN SIGHT ALSO
11	00:56	ATC	PLATO TWO-NINETY ROGER CLEAR VISUAL THREE ONE LEFT OTHER TRAFFIC LANDING THREE ONE RIGHT
12	00:59	PLATO 290	CLEAR TO VISUAL THREE ONE LEFT AND WE'LL WATCH THE TRAFFIC ON THE RIGHT ONE PLATO TWO-NINETY
13	01:04	ATC	ATTENTION ALL AIRCRAFT LANDING (NAME) INFORMATION PAPA NOW CURRENT THE WEATHER IS STILL BETTER THAN FIVE THOUSAND FIVE
14	01:24	PLATO 880	<u>(TRANSMISSION PARTIALLY BLOCKED) SIX THOUSAND</u> SEVEN HUNDRED FOR THREE THOUSAND HEADING ZERO FOUR ZERO

Sample Transcript Sheet

1	00:00	PLATO 754	/ **{1P}** ZERO TWO ZERO / **{2N}** PLATO SEVEN FIVE FOUR /
2	00:03	ATC	/**{1}** PLATO THIRTY-FIVE HEAVY / **{2}**CONTACT (NAME) TOWER ONE TWO THREE POINT FOUR / **{3}** GOOD DAY /
3	00:09	PLATO 35	/ **{1}** PLATO THIRTY-FIVE / **{2}** GOOD DAY / **{3E}** AND THANK YOU A LOT /
4	00:24	ATC	/ **{1}** PLATO SEVEN FIFTY-FOUR / **{2E}** SAY YOUR SPEED /
5	00:32	PLATO 754	/ **{1DC}** AH WE'RE DOING ONE NINETY / **{2P}** SEVEN FIFTY-FOUR /
6	00:38	ATC	/ **{1O}** SEVEN FIFTY-FOUR / **{2}** ROGER / **{3O}** INCREASE SPEED TO TWO ONE ZERO /
7	00:41	PLATO 754	/ **{1SCP}** PICK IT UP TO TWO TEN / **{2P}** SEVEN FIFTY-FOUR /
8	00:47	PLATO 290	/ **{1P}** APPROACH /**{2}** PLATO TWO-NINETY / **{3EP}** AT A FOUR POINT SIX FOR TWO /
9	00:48	ATC	/ **{1}** PLATO TWO-NINETY / **{2}** (NAME) APPROACH / **{3}** TURN LEFT HEADING ZERO TWO ZERO /
10	00:52	PLATO 290	/ **{1P}** ZERO TWO ZERO / **{2E}** WE HAVE THE AIRPORT IN SIGHT ALSO /
11	00:56	ATC	/ **{1}** PLATO TWO-NINETY / **{2}** ROGER / **{3O}** CLEAR VISUAL THREE ONE LEFT / **{4OE}** OTHER TRAFFIC LANDING THREE ONE RIGHT /
12	00:59	PLATO 290	/ **{1}** CLEAR TO VISUAL THREE ONE LEFT / **{2S}** AND WE'LL WATCH THE TRAFFIC ON THE RIGHT ONE / **{3}** PLATO TWO-NINETY /
13	01:04	ATC	/ **{1}** ATTENTION ALL AIRCRAFT LANDING (NAME) / **{2}** INFORMATION PAPA NOW CURRENT / **{3OE}** THE WEATHER IS STILL BETTER THAN FIVE THOUSAND FIVE /
14	01:24	PLATO 880	<u>/ **{1}** (TRANSMISSION PARTIALLY BLOCKED)</u> / **{2}** SIX THOUSAND SEVEN HUNDRED FOR THREE THOUSAND / **{3}** HEADING ZERO FOUR ZERO /

Facility:_____ Coder:_____

			Address/Addressee		Courtesy			Instruction/Clearance - Readback/Acknowledgment				
			Speaker	Receiver					Heading		Altitude	
Line No.	Speaker	Receiver	ID	ID	Thanks	Greetings	Apology	Heading	Mod.	Altitude	Restrict	Speed
1	PLATO 754	ATC	2N					1P				
2	ATC	PLATO 754		1		3						
3	PLATO 35	ATC	1		3E	2						
4	ATC	PLATO 754		1								
5	PLATO 754	ATC	2P									
6	ATC	PLATO 754		1O								3O
7	PLATO 754	ATC	2P									1SCP
8	PLATO 290	ATC	2	1P								
9	ATC	PLATO 290	2	1				3				
10	PLATO 290	ATC	1P									
11	ATC	PLATO 290		1								
12	PLATO 290	ATC	3									
13	ATC	ALL		1								
14	PLATO 880	ATC										

ATSAT Coding Form

Facility:_____ Coder:_____

Instruction/Clearance - Readback/Acknowledgment (con't)						Advisory/Remarks - Readback/Acknowledgment						
Appr/ Departure	Freq.	Holding	Route	Transpond Code	General Acknowl	Heading	Heading Mod.	Altitude	Altitude Restrict	Speed	Appr/ Departure	Route Position
	2											
								3EP				
3O												
1												
						3		2				

ATSAT Coding Form

Facility:_____ Coder:_____

Advisory/Remarks - Readback/Acknowledgment (con't)						Request - Readback/Acknowledgment						
ATIS	NOTAMS	Weather	General Sighting	Traffic Info	General Acknowl	Heading	Altitude	Speed	Appr/ Departure	Route Position	Type	NOTAM
								2E				
								1DC				
			2E									
				4OE	2							
				2								
2		3OE										

ATSAT Coding Form

Facility:_____ Coder:_____

Request - Readback (con't)			Non - codable			
		General				
Traffic	Weather	Acknowl	Equipment	Delivery	Other	Comments
		2				
			1			Transmission partially blocked

ATSAT Coding Form

APPENDIX B:
DEFINITION OF SPEECH ACT CATEGORIES IDENTIFIED IN 10 HOURS OF ATC/PILOT TRANSCRIPTS

1. **Address/Addressee.**

   The facility/position or aircraft identified as speaker or receiver (e.g., (Facility Name) TRACON, (Facility Name) departure, sector twenty-one, Plato two forty-one, November one two three alpha, Baron one two three alpha).

2. **Courtesy.**

   Word(s) or phrase(s) spoken as an act of courtesy.

3. **Instruction/Clearance—Readback/Acknowledgment.**

   Instruction/Clearance: Phraseology used by a controller to issue instructions to an aircraft (e.g., climb and maintain three thousand, turn left heading two two zero, cleared ILS runway three five right approach).

   Readback/Acknowledgment: Words or phrases spoken by a pilot or controller ***in response to*** an instruction/clearance.

4. **Advisory/Remark—Readback/Acknowledgment.**

   Advisory/Remark: Required communication based on the controller's responsibility for issuing advisories (e.g., altimeter, traffic, expected approach or altitude, a request for information, etc.) and the pilot's responsibility for making certain reports (e.g., ATIS, position, altitude, speed, etc.).

   Readback/Acknowledgment: Words or phrases spoken by a pilot or controller ***in response to*** an advisory/remark.

5. **Request—Readback/Acknowledgment.**

   Request: Speech act initiated by the pilot or controller for the purpose of acquiring information and/or a service.

   Readback/Acknowledgment: Words or phrases spoken by a pilot or controller ***in response to*** a request.

6. **Non-Codable Remarks.**

   Remarks/comments that are not codable into a speech act of **Address/Addressee, Courtesy, Instruction/Clearance Readback/Acknowledgment, Advisory/Remark—Readback/ Acknowledgment, Request—Readback/Acknowledgment**. A speech act that is unintelligible due to equipment problems or speaker delivery.

7. **Comments.**

   Information entered by encoder to clarify a coding entry.

APPENDIX C:
AVIATION TOPICS WITHIN THE SPEECH ACT CATEGORIES

1. Address/Addressee.

a. Speaker: Identification of the speaker.

b. Receiver: Identification of the receiver.

2. Courtesy.

a. Thanks: "Thanks," "thank you," or words of appreciation.

b. Greetings: "Good day," "so long," "hello".

c. Apology: Any apology, example: "I'm sorry," "I owe you," etc.

3. Instruction/Clearance—Readback/Acknowledgment.

a. Heading: An assigned vector or readback by a pilot.

b. Heading Modifier: A word or phrase indicating an increased/decreased rate of turn.

c. Altitude: Altitude assigned by a controller or readback by a pilot.

d. Altitude Restriction: Any restriction to altitude assignment by a controller or readback by a pilot. *Note*: Includes "no delay in descent".

e. Speed: Speed assigned by a controller or readback by a pilot. *Note*: "Present speed," "reduce now," are speed assignments.

f. Approach/Departure: A clearance given by a controller to make an approach to an airport, or runway assignment (either IFR or VFR) or readback by a pilot.

g. Frequency: A radio frequency used for communications or navigation aid assignment by a controller or readback by a pilot. *Note*: May or may not include megahertz frequency.

h. Holding: Holding instruction issued by a controller or readback by a pilot.

i. Route: Any instruction issued by a controller that pertains to the course an aircraft is assigned or readback by a pilot. *Note*: Includes headings, vectors, airways, J routes, ILS, approaches, departure and arrival routes (SID, STAR, PDR).

j. Transponder: A beacon code and/or ident instructions issued by a controller or readback by a pilot.

k. General Acknowledgment: Word(s) used by a pilot as general acknowledgment of a clearance/instruction. *Note*: "Roger," "ok," "alright," may be used in addition to aircraft identification and/or readback of all or portions of a clearance/instruction.

4. Advisory/Remark—Readback/Acknowledgment.

a. Heading: An expected vector/heading given by a controller or his/her readback of a pilot report. A pilot report of a vector/heading.

b. Heading Modifier: Word(s) or phrase(s) used by either a controller or pilot indicating an increased/decreased rate of turn.

c. Altitude: An expected altitude assignment issued by a controller or his/her acknowledgment of an altitude reported by a pilot. An altitude reported by a pilot.

d. Altitude Restriction: An expected altitude restriction issued by a controller or his/her readback of a report by a pilot. A pilot report of an altitude restriction.

e. Speed: An expected speed assignment issued by a controller or his/her readback of a pilot speed report. A speed reported by a pilot.

f. Approach/Departure: An expected approach/departure instruction issued by a controller or his/her readback of a pilot report. A pilot report of assigned approach/departure.

g. Route/Position: A route or position issued by a controller or his/her readback of a route or position reported by a pilot. A pilot report of a route or position.

h. NOTAM/Advisory: A Notice to Airmen (NOTAM) or aviation advisories issued by a controller or his/her readback of a pilot report. A pilot report of aviation advisories or his/her readback of a NOTAM/advisory (e.g., runway construction, status of navigation equipment, bird traffic.).

i. **ATIS:** Relay of Automatic Terminal Information Service (ATIS) by a controller. A pilot report of having ATIS or his/her readback of a controller relay.

j. **Weather:** The relay/readback of weather information including, but not limited to, altimeter, wind, cloud cover, sigmets or other atmospheric conditions, by either a controller or pilot.

k. **General Sighting:** Information issued by a controller on the location of an airport in relation to an aircraft's position or his/her acknowledgment of a pilot report of an airport sighting. A pilot report of sighting of airport, runway, etc.

l. **Traffic:** Traffic information issued by a controller in accordance with Order FAA Order 7110.65G, March 1992, or his/her acknowledgment of a pilot report of traffic. A pilot report of traffic or acknowledgment of a traffic advisory.

m. **General Acknowledgment:** Word(s) used by a pilot as general acknowledgment of an advisory/remark. *Note*: "Roger," "ok," "alright," may be used in addition to aircraft identification and/or readback of all or portions of an advisory/remark. The words "roger" or "ok" used by a controller to acknowledge an entire transmission.

5. Request—Readback/Acknowledgment.

a. **Heading:** Heading information requested by a controller or his/her readback of heading information given by a pilot. Heading requested by a pilot.

b. **Altitude:** Altitude information requested by a controller or his/her readback of altitude information given by a pilot. Altitude requested by a pilot. *Note*: An assignment of an altitude by a controller is not a readback and would be entered as a topic in the Instruction/Clearance speech category.

c. **Speed:** Speed information requested by a controller or his/her readback of speed information given by a pilot. Speed requested by a pilot.

d. **Approach/Departure:** Runway approach/departure requested by a pilot or a controller readback of a pilot request.

e. **Route/Position:** A route/position requested by either a controller or pilot, or read back by either.

f. **Type:** A controller request for make, model, or designator of an aircraft or report/readback by either a controller or pilot.

g. **NOTAM/Advisory:** Notice to Airmen (NOTAM) and aviation advisories requested by a pilot.

h. **Traffic:** A request by a controller or pilot for information/sighting of other aircraft.

i. **Weather:** A report or request by a controller or pilot for weather information.

j. **General Acknowledgment:** Word(s) used by a pilot as general acknowledgment of a request. *Note*: "Roger," "ok," "alright," may be used in addition to aircraft identification and/or readback of all or portions of a request. The words roger" or "ok" used by a controller to acknowledge an entire transmission. Acknowledgments that are identified within other speech act categories are entered in the appropriate categories.

6. Non-Codable.

a. **Equipment:** Not codable due to equipment malfunction.

b. **Delivery:** Not codable due to simultaneous reception of UHF/VHF or multiple frequencies.

c. **Other:** Communication that does not fall into defined topics.

APPENDIX D:
SOME TYPICAL ERRORS WITHIN SPEECH ACT TOPICS

A. **Speaker:** Reference par 2-76, 77, 86, 87 of FAA Order 7110.65G and par 4-33 of AIM
Example - Initial contact:
Pilot: "Regional Approach **Plato ten twenty-two...**"
Controller: "Plato ten twenty-two **Regional Approach...**"

Example - After initial contact:
Pilot: "**Plato ten twenty-two...**"
Controller: "Plato ten twenty-two..."

		CODE
1.	Omission of facility name or function	O
2.	Omission of company name, general aviation designator, military service, etc.	O
3.	Omission of any number in the identification or use of less than three numbers/letters in general aviation or military identification	O
4.	Failure to group air carrier callsigns or to use the phonetic alphabet in aircraft identifications	N
5.	Grouping military or general aviation callsigns	G
6.	Additions to callsigns	E
7.	Substitution of company name, military service, or complete numbers/letters, etc.	S
8.	Transposed numbers/letters	T

B. **Receiver:** Reference par 2-76, 77, 86, 87 of 7110,65G and 4-33 of AIM
Example - Initial contact:
Pilot: "**Regional Approach** Plato ten twenty-two..."
Controller: "**Plato ten twenty-two** Regional Approach..."

Example - After initial contact:
Controller: "**Plato ten twenty-two...**"
Pilot: Ground station (control facility) may be omitted

		CODE
1.	Omission of facility name or function	O
2.	Omission of company name, general aviation designator, military service, etc.	O
3.	Omission of any number in identification or use of less than three numbers/letters in general aviation or military identification	O
4.	Failure to group air carrier callsigns or to use the phonetic alphabet in aircraft identifications	N
5.	Grouping military or general aviation callsigns	G
6.	Additions to callsign	E
7.	Substitution of company name, military service, or complete numbers/letters, etc.	S
8.	Transposed numbers/letters	T

Note: A pilot readback of controller's exact instructions is not recorded as an error.

C. **Heading:** Reference par 2-85h, 91 of FAA Order 7110.65G and 4-33, 40, 86 of AIM.

Note: No example of pilot phraseology, just the suggestion to readback the vectors. A readback of the vector (heading) without the word "heading" or "degrees" is considered incomplete.

Example:

Controller: "Plato one twenty-five **turn left heading two two zero**"
Pilot: "Plato one twenty-five **left heading two two zero**"
Controller: "November three five papa **fly heading two two zero**"
Pilot: "November three five papa **heading two two zero**"
Controller: Navy five five five **turn twenty degrees left**"
Pilot: "Navy five five five **twenty degrees left**"

	CODE
1. Failure to include the word "heading" or "degrees"	
by the controller	O
by the pilot	P
2. Failure of the controller to include the phrase "turn left" or "turn right" when a turn is issued	O
3. Grouping of heading numbers	G
4. Additional and unnecessary words	E

D. **Heading modifier:** A word or phrase indicating an increased/decreased rate of turn. There is no standard phraseology listed. Since the rate of turn is included in the Federal Aviation Regulations (FARs), the usage of this phrase is confusing. There are no no-gyro vectors in these transcripts.

E. **Altitude:** reference par 2-85b, 4-45, 46, 47, 5-31b, 6-50 of FAA Order 7110.65G and par 4-33, 39, 86, and 5-31b of AIM

Example:

Controller: "Plato four **maintain one one thousand**"
Pilot: "Plato four **maintain one one thousand**"

	CODE
1. Grouping of altitude numbers	G
2. Omission of "thousand" or "hundred"	
by the controller	O
by the pilot	P
3. Word used in lieu of "climb" or "descend"	S
4. Additional and unnecessary words	E

F. **Altitude restriction:** Reference par 2-85b, 4-45, 46, 47, 5-31b, 6-50 of FAA Order 7110.65G and 4-33, 39, 86, and 5-31b of AIM

Example:

Controller: "Air force one **cross (Fix Name) at eight thousand** climb and maintain flight level three five zero"
Pilot: "Air force one **cross (Fix Name) at eight thousand** climb and maintain flight level three five zero"

	CODE
1. Word(s) in lieu of "expedite" or "immediately"	S
2. Failure to identify runway or NAVAID	
by the controller	O
by the pilot	P
3. Errors may include those listed in E. Altitude.	

G. Speed: Reference par 2-851, 5-101 of FAA Order 7110.65G and 4-41, 86, 91 of AIM

Example:

Controller: "**...maintain present speed**"

Pilot: "**...(number of knots) knots**"

	CODE
1. Omission of "knots," except when assigning a speed in conjunction with an altitude	O
2. Omission of "knots" or "speed" by pilot	P
3. Grouping of speed numbers	G
4. Additional and unnecessary words	E

Note: One method of speed control not obvious, but used at least twice, was the assignment of altitude to allow higher speed or force a lower speed.

H. Approach/Departure: Reference par 2-85j, 4-60, 80, Chapter 5 sections 9-10, par 7-2, 10, par 7-2, 10, 31, 32, 33, 111 of FAA Order 7110.65G and par 4-86 of AIM.

Example:

Controller: "**...cleared ILS runway three five left**"

Pilot: "**...ILS runway three five left approach**"

	CODE
1. Grouping of runway numbers	G
2. Incomplete description of approach by controllers	O
3. Incomplete description of approach by pilot	P
4. Use of "join" for "intercept" and vice versa	S

I. Frequency: Reference par 2-85k, 86 of FAA Order 7110.65G and 4-33d of AIM

Example:

Controller: "**...contact (Facility) tower one one eight point five**"

Pilot: "**...(Facility) tower one one eight point five**"

	CODE
1. Addition of "on," "now," "the," etc.	E
2. Grouping of frequency numbers	G
3. Omission of "point"	
by the controller	O
by the pilot	P
4. Omission of the facility name or function by the controller	O

J. **Holding:** Reference par 2-85h, 90, 91, 5-126, 140, 141 of 7110.65G and par 4-38, 86 of AIM

K. **Route:** Reference par 2-90, 4-14, 5-41, 8-40 of 7110.65g and par 5-85 of AIM

Example:

Controller: "**...fly heading two two zero join victor twelve**"
"**...follow the MD Eighty...**"
"**...proceed direct (Name) VORTAC...**"
"**...join ILS localizer runway three five...**"
Pilot must include enough information to identify the route he or she will fly.

	CODE
1. Use of "join" for "intercept" and vice versa	S
2. Use of "when receiving (NAVAID)" or "when able"	E
3. Failure of pilot to identify the route by NAVAID airway, etc	P

L. **Transponder:** Reference par 2-85l, 5-20, 32, 40, 42 of FAA Order 7110.65G and par 4-18h, 38 of AIM

Example:

Controller: "**...squawk three four zero five**"
Pilot: "**...squawk three four zero five**"

	CODE
1. Phrase "reset transponder"	E
2. Omission of "squawk"	
by the controller	O
by the pilot	P
3. Grouping of code numbers	G
4. Pilot readback of three code numbers or less	P

M. **Type:** Reference par 2-88 of FAA Order 7110.65G. Errors may be N, O, S, T, E, or P.

N. **NOTAM/Advisory:** Notice to Airmen (NOTAM) and aviation advisories requested by a pilot.

	CODE
1. Grouping of numbers in reference to runway, altitude, heading, etc.	G
2. Non-grouping of identification, airways, or not using the phonetic alphabet, etc.	G
3. Incomplete readback by the pilot	P

O. **Traffic:** Reference par 2-84, 2-85, 2-86, 2-88 pilot/controller glossary of FAA Order 7110.65G and AIM

Example:

Controller: "**...traffic (number) o'clock, (number) miles, (other pertinent information if known)**"

	CODE
1. Pilot response other than "traffic/airport in sight" or "negative contact"	S
2. Omission of word(s) required by standard phraseology	O

P. Weather: Reference par 2-111, 2-85f, RVR 2-122.

		CODE
1.	Omission of "runway" when giving RVR	O
2.	Grouping numbers contrary to standard phraseology	G
3.	Non-grouping of numbers contrary to standard phraseology	N
4.	Failure to include the station (altimeter or weather)	O

Q. ATIS: The pilot should report his awareness of current airport information (ATIS) by stating the phonetic letter of the ATIS information he has received. Controller communication reference to ATIS should be to confirm pilot awareness. Specific phraseology is not provided in either AIM or FAA Order 7110.65G.

		CODE
1.	Addition to a single phonetic letter	E
2.	Non-phonetic or incorrect phonetic letters	S
3.	Words/phrases other than "confirm ATIS (letter)	S

R. General Acknowledgment: Word(s) used by a pilot as a general acknowledgment of a clearance/instruction.

Note: "Roger," "ok," "alright," may be used in addition to aircraft identification and/or readback of all or portions of a clearance/instruction.

Note: This appendix is added as a guide for coding communication errors onto the ATSAT Coding Form. The lists of errors are not exhaustive, and it is possible to have more than one error per aviation topic. Controller standard phraseology is taken from applicable parts of FAA Order 7110.65G, dated March 5, 1992. Pilot phraseology is taken from applicable parts of AIM, dated March 5, 1992, and where no phraseology is listed, a combination of FAA Order 7110.65G and par 4-86b1 and 4-86b2 of the AIM is used. The examples are illustrations of correct phraseology, and the underlined portions refer to the aviation topics. Aviation topics appear in bold type.

☆U.S. GOVERNMENT PRINTING OFFICE: 1995 - 660-067/00131