

Research Report 1300

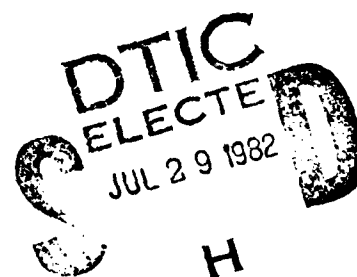


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**DEVELOPMENT OF A LEXICON FOR INTRA-COCKPIT
COMMUNICATIONS WHILE NAVIGATING AT
NAP-OF-THE-EARTH (NOE) ALTITUDE:
FINAL REPORT**

Richard F. Bloom and John W. Hamilton
Dunlap and Associates, Inc.

ARI FIELD UNIT AT FORT RUCKER, ALABAMA



U. S. Army

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October 1980

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COMMUNICATIONS WHILE NAVIGATING AT
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FINAL REPORT

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Office, Deputy Chief of Staff for Personnel
Department of the Army

October 1980

Army Project Number
2Q163743A772

Aircrew Performance in
Tactical Environment

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FOREWORD

The completion of this project required assistance from many officials, experts and colleagues, whose valued cooperation is sincerely appreciated and acknowledged. Chief among those individuals are two at the ARI Field Unit, Ft. Rucker: Mr. Charles Gainer, the COTR for this project; and Dr. Martin Allnutt, the Technical Team Manager. They each provided continuing, excellent technical and administrative support, without which this effort could not have succeeded. Similar appreciation for valuable technical and administrative support goes to Mr. Edward W. Bishop, the Responsible Officer for this project, and Vice President of Dunlap and Associates, Inc.

We are also indebted to those Army Aviators from the following units, who participated as NOE experts in the data collection and lexicon validation tasks: Directorate of Training (Aeroscout and Combat Skills Branches) Fort Rucker, Alabama; 4th Aviation Battalion, Fort Carson, Colorado; 6th Cavalry Brigade (AC), Fort Hood, Texas; 7th Aviation Battalion, Fort Ord, California; 14th Aviation Battalion, Fort Sill, Oklahoma; 82nd Aviation Battalion, Fort Bragg, North Carolina.

Finally, we are indebted to the numerous other staff members with various specialties at the ARI Field Unit, Ft. Rucker, and at Dunlap and Associates, Inc., with whom we gladly share the satisfaction and recognition of our joint accomplishment.


JOSEPH ZEIDNER
Technical Director

DEVELOPMENT OF A LEXICON FOR INTRA-COCKPIT COMMUNICATIONS WHILE NAVIGATING AT NAP-OF-THE-EARTH (NOE) ALTITUDE: FINAL REPORT

BRIEF

Requirement:

More efficient intra-cockpit communication while flying NOE altitudes was needed. The initial requirement was to develop a word list, or lexicon; the lexicon was to consist of a standardized group of terrain descriptors, terrain locators and navigational commands to facilitate communications.

Methods:

Detailed contacts were made with a total of about 100 subject matter experts (SMEs) who were experienced NOE aviators. Some contacts were carried out by observing actual NOE helicopter flights while others involved simulated flights by aircrews on the ground. Tape recorders were made of all actual and simulated intra-cockpit communications. These taped recordings were analyzed, terms were compiled and a final selection of terms was made on the basis of several factors (including frequency of use, degree of standardization or general meaning, familiarity, absence of ambiguity in meaning, and absence of potential confusion with similar sounding terms).

Findings:

A draft version of the lexicon was prepared and a preliminary validation exercise was conducted with experienced Army NOE aviators. Revisions were then made based on these findings and a full color-illustrated lexicon was produced.

Utilization of Findings:

The final version of the lexicon from this project should next be assessed on the basis of comprehensive in-flight NOE demonstration trials in the context of a controlled comparative experiment with Army aviators. Following such a final validation experiment, it would be appropriate to consider releasing the lexicon for Army aviator training and field operations.

DEVELOPMENT OF A LEXICON FOR INTRA-COCKPIT COMMUNICATIONS WHILE NAVIGATING AT NAP-OF-THE-EARTH (NOE) ALTITUDE: FINAL REPORT

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I. INTRODUCTION

This Final Technical Report is submitted in compliance with the requirements of Contract No. MDA903-79-C-0586, entitled "Development of a Lexicon for Intra-Cockpit Communications While Navigating at Nap-of-the-Earth (NOE) Altitude." This report summarizes the technical progress achieved on each task during the course of this project, from 29 August 1979 to 31 October 1980.

As a convenience to the reader, and to provide a self-contained framework for the information described herein, the project goals and tasks are summarized briefly below.

The main goal of this effort was to provide Army aviators with a validated, standard lexicon and procedure for intra-cockpit communications of navigation and terrain information during nap-of-the-earth (NOE) flight. In order to achieve that goal, the following three specific technical objectives were established:

- Devise and develop a lexicon of terrain descriptors and navigational commands so as to facilitate efficient and unambiguous communication between pilot and navigator while flying NOE.
- Demonstrate the advantages of this lexicon in terms of more effective communication between pilot and navigator.
- Present this lexicon in a manner such as to maximize its acceptability to the United States Army Aviation Center (USAAVNC) and to Army aviators.

The Statement of Work (including Modification P00001, dated 2 July 1980) defined six tasks to satisfy the objectives of devising, developing, and validating the lexicon. Each of the six technical task requirements is briefly summarized below, along with some of the implementation guidelines planned:

- Task 1: Study Plan—Required the preparation and submittal of a detailed Study Plan which described the technical and administrative guidelines to be followed in completing the remaining research tasks in order to achieve the overall study effort goals and objectives.
- Task 2: Discussions with Subject Matter Experts—Necessitated that discussions be held with subject matter experts (SMEs) to determine the navigational commands and terrain feature descriptors that a pilot/navigator uses (and presumably needs) to perform NOE. The discussions with military personnel (i.e., Instructor Pilots (IPs) and Experienced Senior NOE Aviators) were to be with SMEs at four (4) military installations which are considered representative of a variety of physical (terrain) environments and a variety of operational settings. The installations selected were Forts Rucker, Carson, Bragg and Ord. Discussions were also to be held with cartographers to gain an understanding of the guidelines they follow in showing man-made and natural features on military maps.

- Task 3: Aircrew Survey and Flight Observations—Required lexicon discussions with representative, experienced aircrews and observations of representative actual or filmed NOE flights. This task was to be performed concurrently with Task 2 at the same military installations. The purpose of Task 3 was to develop candidate lexicon terms/phrases based on current intra-cockpit communications practices during NOE flights.
- Task 4: Lexicon Development—Required that the candidate lexicon terms, collected in Tasks 2 and 3, be carefully evaluated and organized in order to select the most suitable term or phrase to describe each terrain feature and navigational command. The output of this task was to be a draft version of the lexicon.
- Task 5: Lexicon Validation and Approval—Required validation of the draft lexicon, and was planned to be conducted in a two-part activity as follows: 1) SME review and critique of the candidate lexicon terms and 2) SME exercise with NOE flight paths shown on films, photographs, and/or maps to assess the appropriate uses of associated lexicon terms. SME responses were to be evaluated to determine any required lexicon changes. It was planned that the validation would take place at two locations (Forts Sill and Hood), using a minimum of six (6) Army aviators per site.
- Task 6: Lexicon Presentation—Was devoted to the objective of maximizing the likelihood of the NOE lexicon's acceptance by USAAVNC and Army aviators. This was to be accomplished by producing a lexicon whose final format and packaging considered the user operational and training needs.

II. TECHNICAL APPROACH

A. General

At the beginning of this project, a Study Plan was prepared which described all project activities, procedures, forms and schedules. Figure 1 summarizes the activities and schedules of the project, including all modifications that were made after publication of that Study Plan in November 1979.

Early visits by project staff members to Fort Rucker provided an opportunity to make some initial NOE flights, to develop and assemble the apparatus necessary for recording of all helicopter intra-cockpit communications and ground interviews, to develop preliminary flight plans for Task 3 in-flight data collection, to obtain review copies of Map Interpretation and Terrain Analysis Course materials and to acquire other valuable documents. We also visited the Defense Mapping Agency in Brookmont, Maryland where information was obtained on standardized terms and map symbols used by cartographers.

The data collection forms and protocols submitted with the Study Plan were pre-tested with the ARI staff at Fort Rucker. A total of four in-flight observations, one aircrew interview and one subject matter expert (SME) interview were completed at that time. Only minor modifications to the data collection procedures were necessary as a result of those pre-tests.

From December 1979 to March 1980, various site visits were made for data collection Tasks 2 and 3. Data analysis began in February 1980, and involved the verbatim transcription of all audio cassette recordings, sorting all phrases into appropriate categories, compiling the results and determining the appropriate terms for inclusion in the final work list (lexicon). A preliminary list of selected terms, and a document format were then developed for validation in Task 5. The validation consisted of another set of site visits and SME interviews. The final document, referred to as "terms and procedures" rather than "lexicon" was based on the results of that validation effort.

Details of the data collection, data analysis, lexicon development and validation efforts are described next.

B. Data Collection

The basic data for lexicon development were collected during the conduct of Tasks 2 and 3. Table 1 notes how many aviators were interviewed at each location. In Task 2, every SME essentially was instructed to talk his/her way through an NOE flight using a pre-marked flight map or MITAC 16mm films. This information was recorded on audio cassettes for later analysis. In Task 3, Aircrew Survey interviews involved the simulated "flying" of an NOE route in which the "pilot" was given an unmarked version of the map used by the "navigator." The "pilot" received terrain information and navigation instructions from the "navigator," and traced out the route he/she was "flying." This allowed the "pilot" to state, periodically, what was "seen" as the "flight" progressed. Occasional comparisons of map grid coordinates were also made to assure accurate tracking between the two crew members who could not see each other's maps.

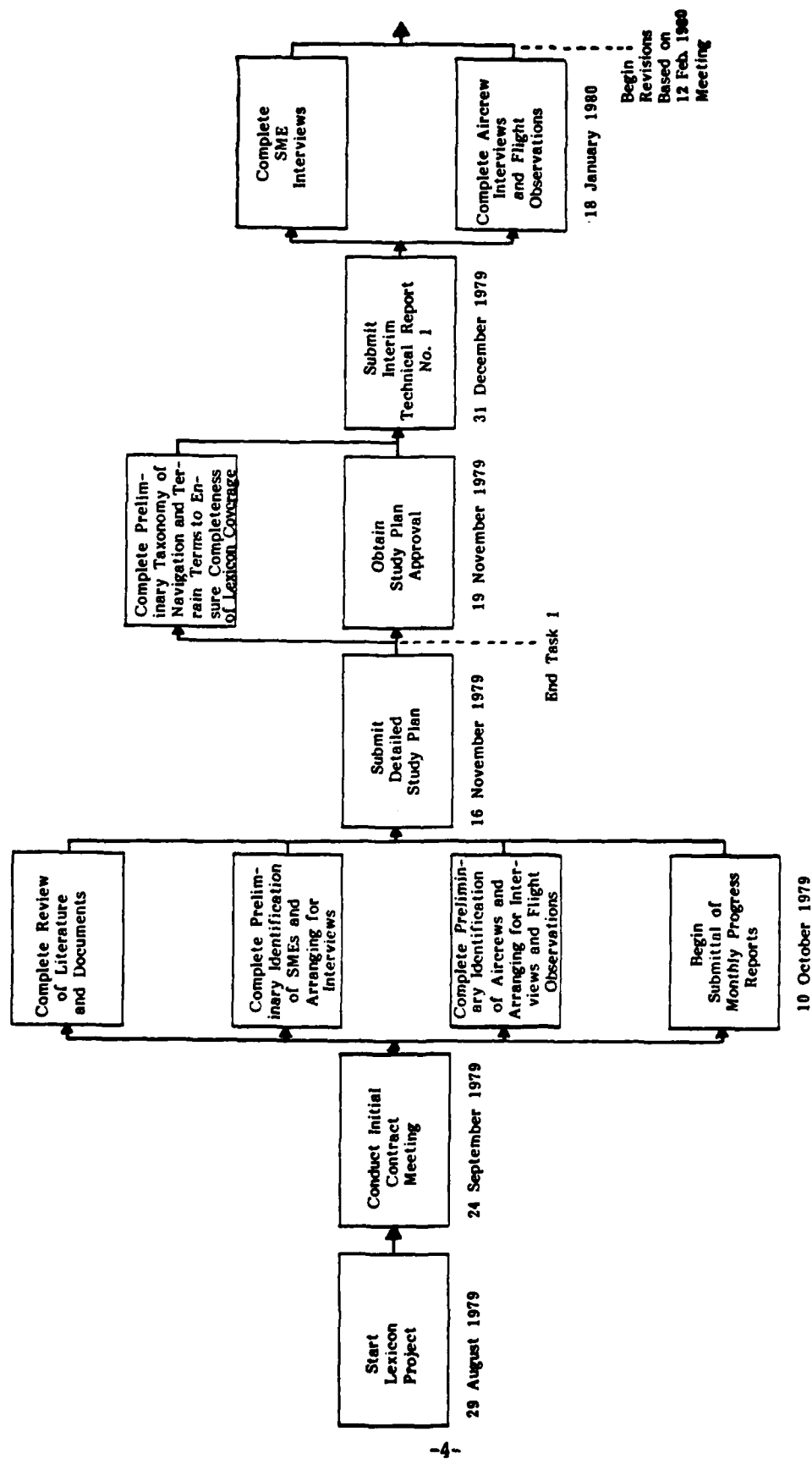


Figure 1. Revised Flow Chart of Critical Events

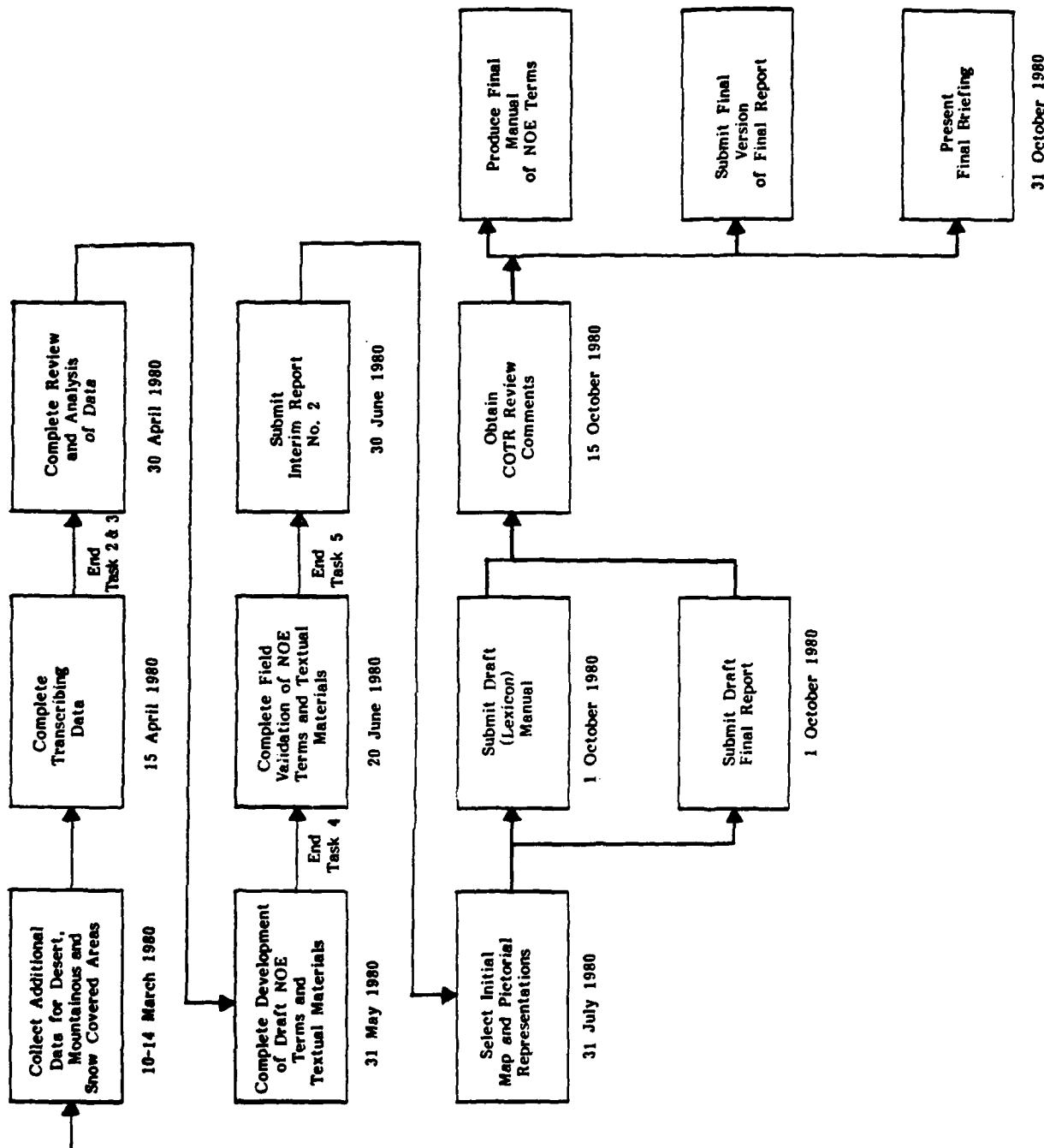


Figure 1. Continued

Table 1. Site Visits Completed for Tasks 2 and 3 (Initial Data Collection)

Forts Visited	Task 2	Task 3	
	No. of SMEs	No. of Aircrew Surveys	No. of Flights Observed
Rucker	11	5	4
Carson	6	3	1
Bragg	2	3	4
Ord	4	4	7
Total Trials and Number of Aviators Involved	23 Individual Aviators	15 Pairs of Aviators	16 Pairs of Aviators

The procedures for Task 3 Flight Observations involved the project observer making a cassette recording and taking in-flight notes of the terms and phrases used by the crew. After completing the NOE route, and in transition back to the landing field, specific questions were prepared on the basis of the notes. The group debriefing then consisted of asking the crew those specific questions; no cassettes were played back during that debriefing.

The information presented to aviators during the data collection tasks is found in the protocol statements included in Appendix A of this report. That appendix also contains the forms used to record each respondent's background, the flight observation data, and preferences for ultimate lexicon format and packaging.

C. Data Analysis

To develop the standardized terrain descriptors and navigational directions, each NOE intra-cockpit communication sentence (as stated during the film and map exercises and during actual NOE flights) was analyzed to develop the initial terms and phrases in three categories:

1. Terrain Descriptors - Words and phrases utilized to describe natural and man-made features.
2. Terrain Locators - Words and phrases utilized to describe where the feature is relative to the aircraft (distance forward or laterally (left/right) or relative to a ground reference point.
3. Navigational Directions - Words and phrases utilized to convey heading, airspeed and altitude information.

Table 2 is a sample transcription of actual intra-cockpit communications during an NOE flight. The notations identify the analyst's designation of each phrase as either a terrain descriptor (TD), a terrain locator (TL), or a navigational direction (N). Upon completion of those designations, each term was added to the existing file of terms, and a compilation of terms and their frequency of use was obtained. That compilation formed the basis of lexicon development described in the next section.

In addition to analyzing the communications terms used by aviators during NOE flight, other analyses were made to help describe the backgrounds of those aviators who participated in this project. The background data demonstrate the representativeness of the aviators NOE experience considering geographical areas flown, types of terrain flown and types of missions previously flown. For the respondents in Tasks 2 and 3, Table 3 shows the types of terrain they flew over, and Table 5 shows the types of missions they flew. Figure 2 identifies the geographical boundaries of U.S. regions listed in Table 3.

D. Lexicon Development and Preliminary Validation

A draft version of the lexicon was completed by reviewing the compiled data from recordings and data collection forms. Overall trends in the use of terms and phrases were examined. The combined lists of terms from Tasks 2 and 3 were analyzed as one group. A frequency count was made of all the descriptors and finally a preferred terms list was selected from the set. As expected, not every

**Table 2. Transcription of Actual Intra-Cockpit Communications
During NOE Flight**

1. (Make a left pedal turn. Orient yourself down) (the valley.) (Right straight down) (the gulley.)
2. (Go ahead and move out.)
3. (Fly right down) (this draw,) Randy, and (when you get down the bottom of) (the draw), (make a right turn, keeping) (the high ground) (off to your right.)
4. You should see (a pond) just (as we get to the very bottom of it,) (a very, very small pond.)
5. (You're looking good,) (there's) (the pond.)
6. (You see) you have (a dirt road) (out here running from left to right out there.)
- 6a. Just (keep this) (high ground) (off to your right.) (Continue to swing around to the right.)
7. (Keep that off to your left.)
8. (Keep) (the high ground) (to your right.)
9. We have (some wires) (coming up here shortly.)
10. (Now about 500m up) we have (a draw) that's (going to be breaking out from our right) so (what I would like you to do) because it's a crazy course
- 10a. (Keep) (the high ground) (to our right when I hit) (the draw.) (Stay on the right hand side of) (the draw,) (heading up) (the hill.)

**Table 2. Transcription of Actual Intra-Cockpit Communications
During NOE Flight (continued)**

11. (Which should be ^{TL} coming up very shortly.)
12. ^{TL} (Looks like) (a ^{TD} predominant draw) (on the ^{TL} right here.) [pilot]
13. (Move up on the ^N right hand side of) (the ^{TD} draw,) (all the ^N way towards) (the ^{TL} top
of it) where (the ^{TD} creek ends.)
14. (Then you'll be making a ^N U-Turn heading down) (the ^{TL} other side of) (the ^{TD} draw.)

**Table 3. Geographical Areas Previously Flown at NOE Altitudes
by Respondents in Tasks 2 and 3***

Geographical Areas Flown At NOE Altitudes	Task 2	Task 3	
	No. of SMEs	No. of Aircrew Survey Members	No. of Flight- crew Members
Northeast U.S.	3	0	0
Southeast U.S.	11	7	5
North Central U.S.	4	5	0
South Central U.S.	16	29	12
Northwest U.S.	3	7	4
Southwest U.S.	11	16	10
North Europe	6	2	3
Carribean	0	0	0
South America	0	0	0
Africa	0	0	0
Southeast Asia	9	5	3

*Respondents generally had additional experience flying in other categories (as listed) at altitudes higher than NOE. (Tables 3, 4 and 5)

**Table 4. Terrain Types Previously Flown Over at NOE Altitudes
by Respondents in Tasks 2 and 3**

Terrain Types Flown Over at NOE Altitudes	Task 2	Task 3	
	No. of SMEs	No. of Aircrew Survey Members	No. of Flightcrew Members
Mountainous	14	17	9
Hills	16	26	11
Rolling	20	34	19
Plains	10	17	9
Swamps	11	24	13
Coastal	6	13	8
Jungle	5	5	2
Arctic	1	1	0
Desert	7	16	7
Snow	2	2	1
Urban	1	0	0

**Table 5. Types of Missions Previously Flown at NOE Altitudes
by Respondents in Tasks 2 and 3**

Types of Missions Flown at NOE Altitudes	Task 2	Task 3	
	No. of SMEs	No. of Aircrew Survey Members	No. of Flighterew Members
Reconnaissance	16	27	16
Security	15	17	11
Surveillance	11	17	9
Destroy	14	19	11
Rescue	4	8	5
Recovery	4	6	6
Psyops	1	0	1
Adjust Artillery	14	15	8
Airlift	16	20	9
Communications	7	7	4
FAC	8	4	1
Teaching NOE	15	16	5
Demonstrations VIP	9	16	8
Special Exercise	4	5	1
Medical Evacuation	0	0	0
Training	0	0	3

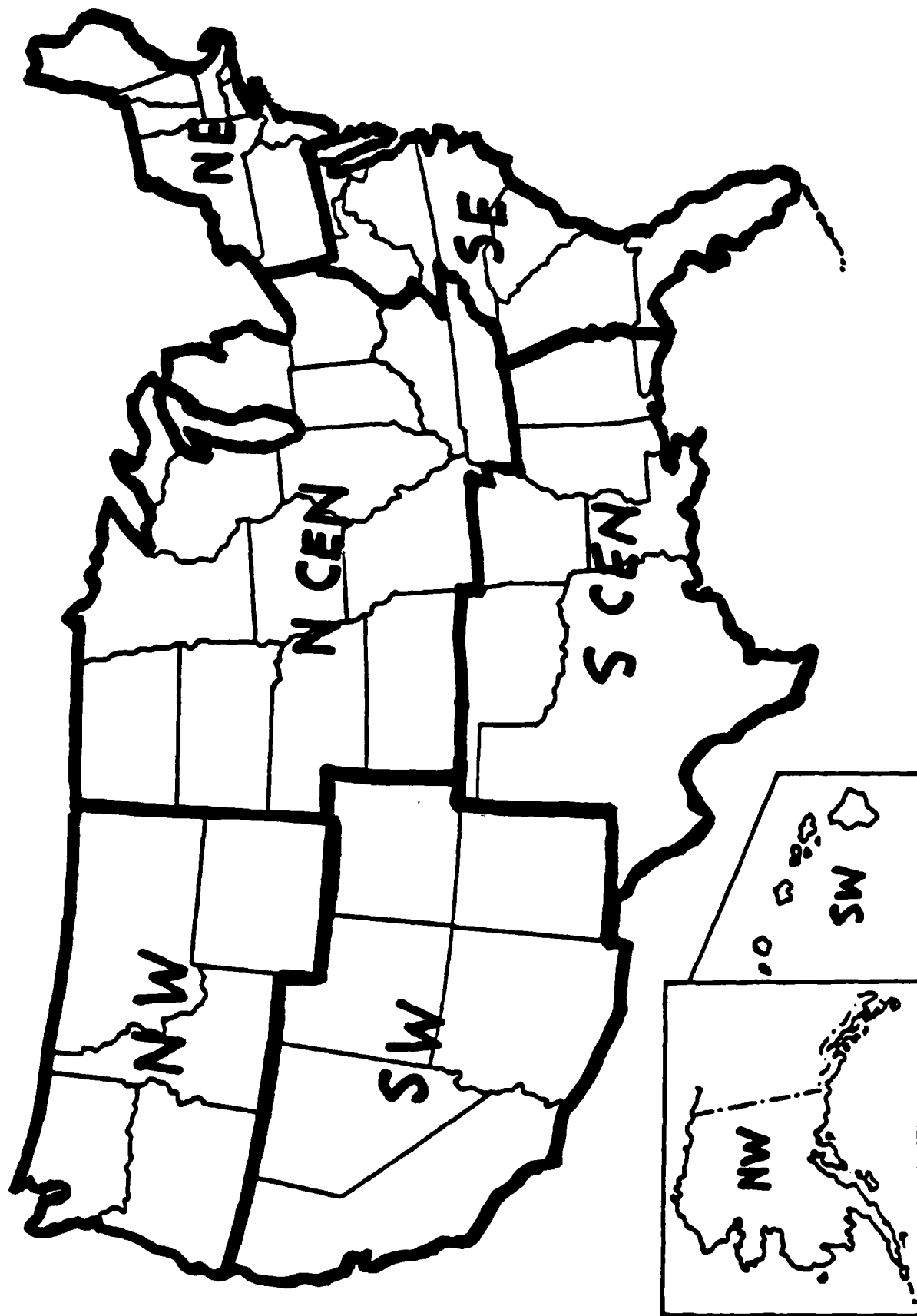


Figure 2. Geographical Boundaries of U.S. Regions

aviator communicated by using the same set of terms. For example, to describe a hard-surfaced road, such terms as "hard top, hard stand, hard ball, black-topped, medium duty road, secondard road, improved road, intermediate road," etc., were used. In this case, "hard-surfaced road" was selected as the preferred term on the basis of various factors including frequency of use, degree of standardization of general meaning, familiarity, absence of ambiguity in meaning and absence of potential confusion with similar sounding terms. Similar decisions were made regarding other terms. In addition to text, the lexicon contained color photographs and map excerpts to illustrate the terrain descriptors.

In simplified draft form, the lexicon (including all terms) was brought to two locations (Forts Sill and Hood) for preliminary validation by SMEs. A total of 17 individual aviators were used for this task (8 at Fort Sill; 9 at Fort Hood). Appendix A contains the protocol used to brief those aviators and an example of the form they used to indicate their reactions to the terms. Each SME also completed the previously described background information form. SMEs were asked to review and critique: 1) an abbreviated version of the entire lexicon document, and 2) the entire preliminary list of recommended words. Each SME was asked to consider the following characteristics for the words:

- Is the term one that in his judgment should be accepted as a standardized term or is there a "better" or more acceptable term? (better terms were recorded)
- Is the definition of the term "correct?" Does he agree with the definition or is there a "better" definition? (better definitions were recorded)
- How frequently has he used the term or its equivalent during NOE flights? (three rating categories were provided: regularly, seldom, never)

Upon completing evaluation of the preferred terms, each participant was asked to evaluate the proposed format and design of the lexicon. The major sections of the prototype lexicon as shown to the respondents addressed the following topics:

- Introduction
 - Purpose of the word list
 - How to use the word list
 - How this list was developed
- Guide to Intra-Cockpit Communication
 - Piloting and navigating
 - Formulating statements
 - Ambiguity of frequently used terms
- Preferred Terms
 - Navigational directions
 - Terrain descriptors and modifiers
 - Terrain locators

- Special Terms for Special Situations
- References and Related Documents
- Alphabetical List of Preferred Terms

The prototype lexicon was abbreviated in terms of the number of terrain descriptors shown with map and actual color photograph representations. Participants were asked for their subjective comments on such items as:

- Adequacy of documentation
- Clearness and understanding of the textual material
- The organization and format of the overall document
- The organization of each section, especially the format of illustrative material relative to terrain descriptors
- Suggestions for changes

The validation responses were compiled and analyzed by the project team to indicate the degree of agreement among the SMEs as to the validity (i.e., correctness and currency) of each term. Changes were made where the need was indicated.

The final version of the lexicon, as developed through the end of this project, contained a discussion of preferred navigational directions, an illustrated (with maps and photos) list of 93 terrain descriptors, a discussion of modifiers for the terrain descriptors, and a discussion of preferred terrain locators.

E. Final Validation

Although originally intended to be a part of this development, a final validation through in-flight NOE demonstration trials was deleted early in the project in favor of a larger data collection and analysis effort. Two alternative validation designs were being considered. In the first, two matched groups of aircrews would have been used for the demonstration trials (i.e., an experimental or lexicon trained group and a control group). In the second, a repeated measures design was being considered, in which each crew would have served as its own control (i.e., pre- and post-training NOE flights). In either design, the groups would have been required to fly NOE flight paths under controlled conditions. Navigational errors and significant events would have been noted by observers. All intra-cockpit NOE communications would have been recorded. The data analysis would have determined any significant differences. A final validation, such as indicated here, is still considered an essential step in the development of a lexicon that can be released for general use in Army aviator training and field operations.

III. CONCLUSIONS AND RECOMMENDATIONS

The lexicon, or word list, resulting from this project is viewed as a potentially useful basic document, once it is validated by in-flight demonstration trials of sufficient number and duration. As it now exists, the lexicon reflects the communications behavior, thinking, and preferences of about 100 experienced NOE Army aviators who participated as respondents in Tasks 2, 3 and 5. Good concordance was found in the responses by those aviators. Task 5 respondents, as well as staff members associated with this project, have expressed a high degree of confidence in the lexicon as it now exists. Application of the present lexicon can provide the Army with useful training and experience, as well as research information. However, general release should be contingent upon satisfactory completion of a final validation procedure.

APPENDIX A

Sample Briefing Protocols and Data Collection Forms for Tasks 2, 3 and 5

Tasks 2 and 3 Forms

Initial Data Collection

(used with SMEs, Aircrews and Actual Flight Crews)

PROTOCOL

Background Briefing for Aircrew Flights

The Army Research Institute Field Unit at Ft. Rucker, Alabama has contracted with Dunlap and Associates, Inc. of Conn. to study intra-cockpit communications at nap-of-the-earth (NOE) altitudes. A recent survey of NOE flights indicates that about 30% of the crew's time is spent communicating information to each other. However, NOE navigational communication skills are not specifically taught as part of the Initial Entry Rotary Wing training program. Further, instructor pilots (IPs) have stated during interviews that ambiguous descriptions of terrain were almost universally considered to be a prime cause for poor intra-cockpit communications during NOE flights. One of the goals of the present effort is to develop a set of terrain descriptors and navigational commands that will result in more effective communication between pilot and co-pilot while flying at NOE altitudes. Our initial set of communication terms will be developed as a result of discussions with operational aircrews, like you, and other individuals with NOE experience. In order to gain a better understanding of pilot-co-pilot communications while flying NOE, I will go along as an observer on-board your aircraft. I will not interfere with your duties and tasks during the flight. However, once the mission is complete and we have returned to base, we will have an informal debriefing. The debriefing will review the intra-cockpit communications procedures that were utilized during the NOE segment(s) of your flight.

We have no pre-conceived idea of which NOE terms and phrases should be in this standardized list. It will be developed from terms and phrases provided by individuals such as yourself. Therefore, it is essential that you talk to each other just as you normally would if I were not present. In order to help us later in reviewing the things you said to each other, I will tape record the NOE portions of our flight by plugging in an audio jack in the intercom line. Your name will not be associated with any materials we give to the Army, and the information you provide will be used without identifying you as the source. Your comments will be pooled with all the others, and each of you will remain anonymous to the Army. Finally, although we are interested in your current operating NOE communication practices, we are equally interested in those navigational and terrain terms that you would prefer to use during NOE flights.

Before we go on the training flight, do you have any questions?

PROTOCOL

Background Briefing for Crews and Subject Matter Experts

The Army Research Institute Field Unit at Ft. Rucker, Alabama has contracted with Dunlap and Associates, Inc., of Connecticut to develop a standardized set of navigational commands and terrain descriptors. These standardized terms are intended for use by rotary-wing pilots and co-pilots to communicate effective navigational information at nap-of-the-earth (NOE) altitudes. A recent survey of NOE flights indicates that about 30% of the crew's time is spent communicating information to each other. However, NOE navigational communication skills are not specifically taught as part of the Initial Entry Rotary Wing training program. Further, instructor pilots (IPs) have stated during interviews that ambiguous descriptions of terrain were almost universally considered to be a prime cause for poor intra-cockpit communications during NOE flights. One of the goals of the present effort is to develop a set of terrain descriptors and navigational commands that will result in more efficient, unambiguous communication between the pilot and co-pilot while flying at NOE altitudes. The initial NOE-specific listing of navigational and terrain descriptor terms and phrases will be developed as a result of discussions with mapmakers (cartographers), IPs, operational aircrews and other subject matter experts (SMEs) and by our observations of NOE flights. We are asking you to participate in this development by providing as many of the terrain descriptors and navigational terms as you use, or think should be used, relevant to pilot-co-pilot communications during NOE flights.

We have no pre-conceived idea of which NOE terms and phrases should be in this standardized list. It will be developed from terms and phrases provided by individuals such as yourself. Your name will not appear in any materials we give to the Army, and the information you provided will be used without identifying you as the source. Your comments will be pooled with all others and each of you will remain anonymous to the Army. Finally, although we are interested in your current operating NOE communication practices, we are more interested in those navigational and terrain terms that you would prefer to use during NOE flights. Before we go on to the interview, do you have any questions?

NOE Research Project

Respondent Background Form

(Initial Informal Screening Question: Have You Flown NOE?) Yes _____ No _____

If YES:

1. Name: _____ 2. Control No.: _____
3. Rank: _____ 4. MOS/Specialty: _____
5. Branch: _____

Duty Assignments:

- 6a. Present duty assignment/job: _____
Present location: _____
Unit Mission: _____
6b. Last (previous) duty assignment: _____
Last location: _____
Unit mission: _____
6c. Location of first duty assignment where you have flown NOE? _____

7. States/countries in which you spent the major portion of your life, say up to age 16: _____

8. Highest educational level completed (check one):

High School Some College College Graduate Advanced Degree
☐ ☐ ☐ ☐

9. Present age: _____

Flight Experience:

- 10a. Considering all types of aircraft flown, estimate the total number of flight hours you have flown (to the nearest 100 hours): _____
10b. Considering military rotary wing aircraft flown, estimate your total flight hours (to the nearest 50 hours): _____
10c. Are you a Ft. Rucker Trained IP? Yes _____ No _____
Are you a trained Specialty IP? Yes _____ No _____
If YES, date of IP rating: _____ month _____ year

12. Considering all aircraft flown: a) over what types of terrain or areas have you flown; and b) over what types of terrain or areas have you flown NOE? (check all applicable)

a) All Flights

b) NOE Flights

☐	Mountainous) (>2000 ft. above surround)	☐
☐	Hills (<2000 ft. above surround)	☐
☐	Rolling Countryside	☐
☐	Plains	☐
☐	Swamps	☐
☐	Coastal Areas	☐
☐	Jungle	☐
☐	Arctic	☐
☐	Desert	☐
☐	Other: _____	☐
☐	_____	☐
☐	_____	☐
☐	_____	☐
☐	_____	☐
☐	_____	☐

13. Types of rotary wing missions you have flown? (check all applicable) (If hard to recall, list those most flown or those most influential on terms used.)

Missions

**Missions which included
NOE flying**

☐	Reconnaissance	☐
☐	Security	☐
☐	Surveillance	☐
☐	Destroy/Disrupt	☐
☐	Rescue	☐
☐	Recovery	☐
☐	Psyops	☐
☐	Adjust Artillery Fires	☐
☐	Airlift Troops, Weapons, Equipment and/or Supplies	☐
☐	Communication, Command and Control	☐
☐	Forward Air Controller (FAC)	☐
☐	Teaching NOE	☐
☐	Demonstrations (VIP)	☐
☐	Other: _____	☐
☐	_____	☐
☐	_____	☐

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

NOE Research Project

Flight Observation Data

1. Name: _____ 2. Control No.: _____

3. Location: _____ 4. Date: _____

5. Type of Rotary Wing Aircraft:

UH-1

UH-60

AH-1

Other _____

☐
☐
☐

6. Mission Profile:

a. Map No. _____ Route: _____ Type Map: _____

b. Time: Take Off: _____ Land: _____

c. Type of Mission: _____

d. Duration of NOE Segments:

1) Start: _____ 2) Start: _____ 3) Start: _____ 4) Start: _____

End: _____ End: _____ End: _____ End: _____

Min.: _____ Min.: _____ Min.: _____ Min.: _____

e. Terrain Characteristics During NOE:

Segment 1. _____
2. _____
3. _____
4. _____

f. Weather:

1) Clouds Clear Scattered Broken Overcast

☐
☐
☐
☐

2) Precipitation Rain ☐ Snow ☐ Sleet ☐ (check if applicable)

None Very Light Light Moderate Heavy

☐
☐
☐
☐
☐

3) Ceiling: _____ feet Visibility: _____ miles

g. Average Altitude Above Terrain During NOE (in feet):

<10 ft 10-20 ft 20-30 ft 30-50 ft >50 ft

Segment 1 ☐ ☐ ☐ ☐ ☐

Segment 2 ☐ ☐ ☐ ☐ ☐

Segment 3 ☐ ☐ ☐ ☐ ☐

Segment 4 ☐ ☐ ☐ ☐ ☐

7. Flight Assessment and Significant Events

a. Conformance with Flight Plan: Yes _____ No _____

If NO, reasons for non-conformance: _____

b. Completion of Mission Objective(s): Yes _____ No _____

If NO, why not: _____

c. Unforeseen Conditions Requiring Decisions/Actions: _____

d. Emergencies: Type: _____

e. Accidents/Injuries: _____

f. Equipment Malfunctions: _____

8. Pilot/Navigator NOE Communication Evaluation:

a. Pilot's Overall Assessment: Typical ☐ Unusual ☐

Comments: _____

b. Navigator's Overall Assessment: Typical ☐ Unusual ☐

Comments: _____

c. Observer's Overall Assessment: Typical ☐ Unusual ☐

Comments: _____

Task 5 Forms
Preliminary Validation
(used with SMEs)

PROTOCOL

Background Briefing for Experienced NOE Aviators Validating NOE Terms

Background

The Army Research Institute Field Unit at Ft. Rucker, Alabama has contracted with Dunlap and Associates, Inc., to study intra-cockpit communications at nap-of-the-earth (NOE) altitudes. Currently, NOE intra-cockpit communications with regard to terrain descriptions and navigational directions are not specifically taught as part of the Initial Entry Rotary Wing (IERW) training program. Instructor Pilots (IPs) have stated that ambiguous descriptions of terrain were universally considered to be a major cause for poor intra-cockpit communications during NOE flights. A goal of this research effort is to develop a set of terrain descriptors and navigational directions that will result in more efficient, unambiguous communications between the pilot and co-pilot while flying at NOE altitudes.

To develop the standardized terrain descriptors and navigational directions data were collected by conducting map exercises with IP's and NOE experienced aircrews and by observing and recording actual NOE flights at four Army installations, i.e., Ft. Ord, California, Ft. Carson, Colorado, Ft. Bragg, North Carolina, and Ft. Rucker, Alabama. Each NOE intra-cockpit communicational sentence as stated during map exercises and actual NOE flights was analyzed to develop the initial terms and phrases in three categories:

1. Terrain Descriptors—Words and phrases utilized to describe natural and man-made features.
2. Terrain Locators—Words and phrases utilized to describe where the feature is relative to the aircraft [distance forward or laterally (left/right)] or relative to a ground reference point.
3. Navigational Directions—Words and phrases utilized to convey heading, airspeed, and altitude information.

As you might expect, not every data source (aviator) communicated the same vocabulary of terms. For example, to describe a hard-surfaced road such terms as "hard top, hard stand, hard ball, black topped road, medium duty road, secondary road, improved road, intermediate road," etc., emerged.

A frequency count was made of all the descriptors and finally a preferred term was selected from the set. In the above example, "hard surfaced road" was selected as the preferred term on the basis of various factors including frequency of use, degree of standardization or general meaning, familiarity, absence of ambiguity in meaning and absence of potential confusion with similar sounding terms.

Your Task

The next task in the lexicon development process is the validation of the terms and their definitions as well as an evaluation of an abbreviated design of the proposed lexicon. As an experienced NOE aviator, you will be given a booklet which contains all of the terrain descriptor, terrain locator and navigational terms. We are asking you to carefully review each of the terms and their definitions and to make a judgment of whether you agree with the term and its definition or you may disagree and can provide a better term and/or a better definition. A response sheet has been developed to aid in the validation procedure. As a result of the validation appropriate corrections, additions or deletions will be made.

Prior to explaining the validation procedure, do you have any questions?

ATTACHMENT II
Example of the Data Collection Form

Man-Made Features		How frequently have you used this term or an equivalent term during NOE flights? (Check appropriate answers)			
NAME	DEFINITION	Regularly	Seldom	Never	Not An NOE Term
• ROAD Better Term: _____ _____ _____	A paved or unpaved way for traveling between places by vehicular traffic. Better Definition: _____ _____ _____				
- HARD SURFACE ROAD Better Term: _____ _____ _____	All weather road requiring minimum maintenance. The road surface may be concrete, asphalt, rock asphalt. Hard surfaced roads will be 2 or more lanes wide. Better Definition: _____ _____ _____				
- HIGHWAY Better Term: _____ _____ _____	A limited access multi-lane hardsurface road. Better Definition: _____ _____ _____				
- IMPROVED ROAD Better Term: _____ _____	All weather road requiring periodic maintenance. The road surface may be oil-surfaced, soil and gravel, gravel, or graded and drained soil or gravel surface. Also included in this category are hard surfaced roads less than 2 lanes. Better Definition: _____ _____				

NOE Research Project

Format and Packaging of Standardized NOE Navigational Commands and Terrain Descriptors

Name: _____ Control No. _____

Location: _____ Date: _____

Background Information: Once the set of standardized NOE navigational commands and terrain descriptors are known and have been validated, it must be produced in a format and packaged in a way which is most acceptable to Army aviators. We would like to know your preference and what would be most acceptable to you.

1. Where might a new pilot keep this standardized set of NOE terms during Initial Rotary Wing training? _____

2. Where might an experienced pilot keep it? _____

3. Under what circumstances or situations might a new pilot use it? _____

4. Under what circumstances or situations might an experienced pilot use it? _____

5. How do you feel it should be packaged to be most useful to pilots? (e.g., card file, book or manual, foldout chart, etc.) _____

6. Other Preferred Features (size, material, color, etc.)? _____

