The Experimental Process: As Implemented in DARPA's Command Post of the Future (CPOF) Program

Diana G. Buck

Evidence Based Research, Inc.
1595 Spring Hill Road, Suite 250
Vienna, VA 22182-2216
(703) 287-0381
FAX (703) 821-7742
dbuck@ebrinc.com

ABSTRACT

DARPA's Command Post of the Future program has used experimentation as a vehicle for understanding the impact of new technologies on the command and control process. To ensure that experimental goals, of something as large or complex as a research program or as simple as a single experiment, are met several things are required to ensure success. This paper will highlight the technical, rather than program aspects needed. Specifically, it will cover experimental issues, such as experimental design, hypothesis testing, and data collection and analysis. The section on Experimental Design will cover definitions of experimentation and other important terms, steps in planning a sound experiment such as hypothesis development, common experimental designs, the advantages of pilot studies, and ethical considerations when involving human participants in research projects. Hypothesis Testing will cover how hypotheses were tested, in the context of CPOF. And Data Collection and Analysis will cover different data collection techniques, such as observation, questionnaire, and interview; with data analysis covering data management, quantitative analysis techniques (parametric and non-parametric), qualitative analysis techniques, as well as what types of information to include in reports and methods of presenting results.

The following information can be found in several social science resources. However, my goal is to consolidate the information and provide practical "real" world examples from CPOF of how these procedures have been implemented.

Experimental Design

Introduction

To ensure that experimental goals are met, a sound experimental design is necessary. This section will cover the definition of experimentation and other important terms, steps in planning a sound experiment, common experimental designs, the advantages of pilot studies, and ethical considerations when involving human participants in research projects.

Definitions

An experiment can be defined as "the process undertaken to discover something new or to demonstrate that events that have already occurred will occur again under a specified set of conditions; a principal tool of the scientific method." (Myers & Hansen, 1993, p. 493). "Experimentation, properly understood, is a method of building knowledge. As the Typology of Information and Science…., the scientific process moves from observation to classification, explanation, prediction, and ultimately to prescription." (Evidence Based Research, Inc. (EBR) proposal for DARPA CPOF, BAA 98-27). "Individual empirical experiments are situations in which one or more factors of interest (at the data level, dependent variables) can be observed (measured) under conditions that vary factors thought to cause changes in the factors of interest (independent variables), while other factors (control variables) are held constant (either empirically or through statistical manipulation)." (EBR, BAA 98-27) It is a credible means for attaining information and an attempt to gain answers to complex problems.

All experiments include variables that are of interest to the research program. Variables related to the role they play in the experiment include Independent (IV), Dependent (DV), and Control. IV's are manipulated by the experimenter and sometimes referred to as input, treatment, or stimuli. Because they are "independent" of the outcome itself, they are presumed to cause, affect or influence the outcome. DV's are sometimes referred to as output, outcome, or response variables. Because they are dependent on the independent variables, the outcome presumably depends on how these input variables are managed or manipulated.

Control variables typically involve background, classificatory information and are so delineated because they need to be controlled, held constant, or randomized so that their effects are neutralized, canceled out, or equated for all conditions (Pedhazur & Pedhazur, 1995). Typically included are such factors as age, sex, IQ, SES (socio-economic status), educational level, level of experience, and motivational level. It is often possible to redefine these particular examples as either independent or dependent variables, according to the intent of the research.

As stated above, there are numerous types of variables. They are classified by the type of data of which they consist and what role they will play in the experiment: IV, DV or

Control. IV, DV, and Control variables can contain data that is continuous, discrete, and categorical. Continuous variable are entities, factors, or characteristics "that can assume several values along a continuum or can represent two or more classifications or categories, often qualitatively different" (Isaac & Michael, 1995, pg. 2). These variables are ones "that typically comprises numbers that have been assigned to objects along a scale from low to high with many gradations of intensity and amount"(Isaac et. al, 1995, pg. 2). Discrete variables consist of two or more categories (Isaac et. al, 1995, pg. 2).

Another aspect to all experiments is the development of a hypothesis or hypotheses. A hypothesis "…may be viewed as a declarative statement of a relationship between two variables, often recast from a corresponding research question" (Isaac & Michael, 1995, pg. 3). "Formal scientific experiments always include precise specification of the concepts being tested in the form of a hypothesis; if-then statements that indicate the relationships posited by the experimenter. For example, the statement that 'better' battlespace visualization is better, then the military planning will be better" (EBR, BAA 98-27). However, traditionally hypotheses are stated in the null hypothesis format. The null hypothesis of the above would read "if battlespace visualization is improved, then no change will be observed in the quality of military planning" (EBR, BAA 98-27). Hypotheses guide the research project. They define the focus of observations, variables of interest, and the expected interaction of these variables. While they provide this focus, it is important not to allow them to create blind spots—that is, provide such strict guidance that other important and previously unknown issues are lost (Pedhazur, et. al, 1992). The development of hypotheses is elaborated upon in Section 4.0 of this paper.

Steps to Planning Good Research

Appropriate steps should be followed in order to conduct research that is thorough, without a waste of effort, time, or money. These steps include: careful identification of the problem area; surveying relevant literature; preparing a clear definition of the actual problem to be investigated (problem formation), including the development of testable hypotheses (hypothesis formation); and acknowledging possible underlying assumptions about the problem which may effect the interpretation of the results. When the problem space has been well researched, and hypotheses have been developed, careful construction of a research design can begin (design and procedures). Ideally, the research design will maximize internal and external validity. Internal validity is the extent to which the research design and instruments address the problem under investigation and external validity relates to how well the research can be applied to what occurs in "real world" situations. Some issues to be covered when developing a research design include: subjects/participants (sampling and ethical issues), setting, variables, how outcomes will be evaluated/evaluation criteria, and what instruments will be required to collect the data needed. Additionally, data collection and analysis procedures should be determined. Once these items are in place, the research plan can be executed and the subsequent data analysis performed.

Problem & Hypothesis Formation

There are a number of issues to consider when defining the problem under study. They can be as simple as “does the problem really need a solution?” and collecting information and facts related to the problem and deciphering their relevance to the issue. Determining relevance could be achieved through the use of Subject Matter Experts (SME’s) and through a deeper analysis of the problem. In CPOF, Block Party events were used to generate and clarify hypotheses, and determine relevance. When relevant facts are identified, then relationships between them can be explored, which may reveal the keys to the problem under investigation. This can then lead to the development of possible explanations and hypotheses. Ideally, observations of situations related to the problem or research focus can be used to validate the relationships hypothesized. If observations are not possible, SME’s can be very helpful in determining the validity of hypotheses developed. This step is key in that it provides a clear direction for the experiment.

Several problems that may occur in this phase of planning an experiment include “collecting data without a well-defined plan or purpose, hoping to make some sense of it afterward” (Isaac et. al, 1995, p. 36). If this path is taken, the researcher can only perform a post-hoc analysis, and must make a statement to this effect in any reports generated from the analysis. A similar mistake would be “taking a ‘batch of data’ that already exists and attempting to fit meaningful research questions to it” (Isaac et. al, 1995, p. 36). Using general or ambiguous terms to define research objectives, and not taking the time to review the professional literature on the problem being investigated are other errors to be avoided. These could lead to redundant efforts, and a waste of time and money. A researcher should also avoid ‘tunnel vision.’ Possible symptoms of tunnel vision [could] include a failure to base the research on a sound theoretical foundation, recognize limitations in the proposed research approach, and anticipate alternative hypotheses (Isaac et. al, 1995, p 36).” Avoidance of errors such as these will help keep the research project focused and well-grounded.

Design & Procedures /Methods

There are numerous types of designs from which to choose. These include historical, descriptive, developmental, case or field, correlational, and causal-comparative. Each design has its own purpose and requirement. Historical designs are typically used to “reconstruct the past objectively and accurately, often in relation to the tenability of an hypothesis” (Isaac et. al, 1995, p. 46). Descriptive designs are used to “describe systematically a situation or area of interest factually and accurately (Isaac et. al, 1995, p. 36),” and developmental designs focus on patterns and sequences as they occur over time. Case and/or field designs focus on a particular group or individual, covering both the background and current status of such person or group. Correlational designs strive to investigate relationships between factors, and causal-comparative designs investigate cause and effect relationships.

Quasi-experimental designs attempt to meet the conditions of a true experiment, without the control of relevant variables. In a true experimental design, the typical goal is to investigate cause and effect relationships “by exposing one or more experimental groups to one or more treatment conditions and comparing the results to one or more control groups not receiving the treatment” (Isaac et. al, 1995, p. 46).

Common Experimental Designs

The simplest design is a Treatment-Posttest design (see Figure 1 below). In this design, a participant is exposed to a treatment for a specified amount of time and then the participant receives the post test. This design has numerous disadvantages, such as the lack of control and internal validity, and it only allows implicit comparisons. The researcher is urged to read Isaac & Michael (1995) and Neuman (2000) for more in-depth coverage of these and other designs.

Treatment-Posttest Design

Treatment	Posttest
X	O_1

Figure 1

A step up in complexity is to the One-Group Pretest-Posttest design (see Figure 2 below). This design is very similar to the Posttest design, except that it adds a pretest step. By

One-Group Pretest-Posttest Design

Pretest	Treatment	Posttest
O_1	X	O_2

Figure 2

adding a pretest, internal validity is gained by providing control over selection and mortality variables, if the same subjects take both the pretest and posttest. Though gains in internal validity are made, limitations and problems with this design still remain. These limitations can include the effects of history, maturation, testing effects, changing effects of instrumentation, statistical regression towards the mean, and selection biases if all subjects did not take the pre and posttest.

A Randomized Control-Group Pretest-Posttest design offers more control and gains in internal validity (see Figure 3 below). This design requires the random selection of subjects and random assignment of subjects to groups, both treatment and non-treatment or control. All groups receive a pretest of the dependent variable of interest and then receive their respective treatments (or no treatment), then all groups take a posttest of the same dependent variable. Mean scores are derived for each group and then appropriate statistical analyses can be performed to determine if a significant difference in group scores exists. This design if good for increasing internal validity, but can leave external validity wanting.

Randomized Control-Group Pretest-Posttest Design

Group	Pretest	Treatment	Posttest
Experimental (Randomized)	O_1	X	O_2
Control (Randomized)	O_1		O_2

Figure 3

When dealing with the problem of having a limited number of subjects available for an experiment, a Repeated Measures Counterbalanced design can be used (see Figure 4 below). This type of design was used for CPOF's LOE1, and for a technology developer experiment. This design allows for a number of treatment variations to be tested, since subjects will not be seeing the same treatments in the same order. The basic procedure for this design allows for each subject to be exposed to each treatment variation at different times/runs during the experiment. This allows for control over effects such as order of presentation and learning. However, if this design is chosen, subjects can experience fatigue when going through repeated trials. Do not make the mistake of creating a large data set at the expense of your subjects. Subject fatigue can provide skewed results. (Isaac et. al, 1995).

Repeated Measures Counterbalanced Design

	Treatment Variations			
Replication	X_a	X_b	X_c	X_d
1	A	B	C	D
2	B	D	A	C
3	C	A	D	B
4	D	C	B	A

Figure 4

Advantages of Pilot Studies

Pilot studies are essential for debugging experimental designs and data collection and analysis procedures. A pilot study involves a "dry-run" of the experiment being planned. All procedures are followed to insure they make sense, work, and will truly provide the required data to be captured. It allows the preliminary testing of hypotheses and reduction of treatment errors, and can save the researcher both time and money that would be expended on a project that may not yield the knowledge or information of interest. Additionally, a pilot study provides an opportunity to receive feedback from subjects and other interested parties that could lead to improvements to the design, procedure, and analysis of the experiment (Isaac et. al, 1995; Neuman, 2000; Schaffer, Hall, & Bilt, 1997).

Ethical Issues with Using Human Participants

When planning a research project that will involve the use of human subjects/participants, consult the client to determine the appropriate procedures to be followed. In general, the "Institutional Review Board Guidebook" is a good source to consult for overall IRB requirements. DODD 3216.2 Protection of Human Subjects in DoD-Supported Research provides clear information requirements.

However, a few basic ethical considerations regarding the use of human subjects should be observed. These include respect for persons and their autonomy, maximizing the possible benefits and minimizing the possible harms of research, justice, trust, and fidelity and scientific integrity (Smith, 2000). Simply put, subjects should be given a choice to participate or not participate, the assurance of confidentiality (that their names will not be linked to their data), a clear explanation of the purpose for the research, an opportunity to ask questions, and be provided experimental findings, if appropriate (Tangey, 2000).

The following is a description, with examples taken from CPOF, of hypothesis testing venues.

<u>Hypothesis Testing</u>

Hypothesis testing, in the context of CPOF, occurs in Limited Objective Experiments and Comprehensive Experiments.

Limited Objective Experiments (LOE)

These experiments are designed to place technologies in a rich military context. They evolve from the Technology Developer Experiments and other hypothesis generating activities. LOE's require a pre-specified hypothesis or hypotheses to be tested, "including independent, dependent, and control variables; the measures of merit and associated metrics; a complete experimental design (how many iterations, with what types of training for subjects, and what types of control for experience, learning or other exogenous factors) and test conditions; infrastructure requirements; data collection plan, including needs for subjects, instrumentation, observation, data collection instruments, and so forth; the plan by which the raw data will be organized and scored for analysis; the data analysis plan (including statistical methods) to cover both hypothesis testing and recognition of unanticipated insights or opportunities; the plan for archiving the data; and the plan for feedback both to the experimentation process and the Technology Developers. LOE's are both an extension of the Hypotheses Generating Exercises in furthering knowledge, and also in complexity and level of effort required to complete.

The following is a practical description using CPOF's LOE1 as an example.

> CPOF LOE - 1
>
> The experimental objective was to determine the effects of visualization technologies on the ability of the subjects to comprehend a situation, recognize the inherent patterns and remember the important elements.
>
> Experiment plan
> LOE - 1 was conducted from 15-19 November 1999 at the Battle Command Battle Laboratory, Fort Leavenworth, KS. Subjects consisted of 38 Army field grade officers and 2 civilian employees drawn from the Battle Lab and C&GSC staffs. The objective of this experiment was to determine the ability of three selected visualization techniques to enhance situation awareness as perceived by an experienced military officer.

Hypotheses

The basic hypothesis was that the selected visualizations would enhance the ability of an experienced military officer to comprehend a situation. The null hypotheses were:

- The selected visualizations would not improve the quality of the overall comprehension of the situation.
- The selected visualizations would not improve the quality of the understanding of the key elements and patterns that dominated the situation.

Conduct of Experiment

The techniques investigated were presented in the form of static displays. The experiment was similar in character to a "flash card" experiment. That is, the subjects were exposed to different displays, in different scenarios for three distinct time intervals.

After viewing the display, the subjects were asked to respond to a set of questions to determine how well they were able to comprehend the situation, discern patterns, and retain factual and spatial information about major entities on the battlefield. Subjects' answers were compared to those provided in advance by retired senior military officers and other experts selected by the Military advocates and DARPA.

Tasks

Each subject was given the task of watching a visualization of a military situation and then answering a set of questions designed to determine the subject's comprehension of the situation and retention of major events and elements on the battlefield The questions were the same for all runs – the observers could, however, ask questions to elicit a more detailed response when warranted. These questions were general in nature and not leading. Each subject underwent four trials.

Subjects' environment

The subjects were placed in an office environment consisting of a desk, chair, a desktop computer, map board, video camera on a tripod, small audio tape recorder, and a timer. The only other person in the room was the observer who operated the computer, camera and audio recorder, and conducted the debrief.

Analysis plan

The subjects were randomly assigned to situations and were exposed to three experimental visualizations and one baseline. The baseline consisted of the standard Army map display that would be used for the particular scenario. Displays were visual only (no concurrent briefing was provided) and interaction between the subjects and the displays, training and scenario brief was not permitted.

Comprehensive Experiments

These experiments are designed to investigate the impact of technology in an actual command post setting. The design of the experiments will be based on inputs from the results of LOE's and technology developer experiments. They will use a Command Post Exercise (CPX) format, and may be actual command post exercises conducted by operational units or simulations at a battle laboratory using integrated technologies with operational teams in a realistic command post environment.

However, prior to implementing hypothesis testing, a data collection and analysis plan is needed.

<u>Data Collection and Analysis</u>

To keep the development of a research project on-line, Data Collection and Analysis plans should be done prior to beginning any experiment.

Data Collection

Data collection can be accomplished using many different techniques. The CPOF program has employed the following data collection techniques: observation, questionnaire, structured interviews, and unstructured interviews.

Observation

Observation is useful when the experimental environment will not allow direct interactions between participants and data collectors. Though this technique "appears" to lack rigor, if applied with a careful design, as covered in the experimental design section of this COBP, it can provide high value of insight and knowledge. Some factors to consider when planning to collect data through observation include: will the researcher participate in the group being studied or will the researcher be the proverbial "fly on the wall," attempting to be as non-obtrusive as possible; will the observer be overt or covert; and will the observations occur in a laboratory or natural setting (Sedlack & Stanley, 1992).

In CPOF, this technique was employed at Block Parties through the use of human non-obtrusive, overt observers in a laboratory-type setting. In addition to human observers, the analysis team had access to audio and videotapes of the Block Party exercises.

Questionnaire

Questionnaires are self-administered instruments and are most appropriate when the researcher has very clear research objectives (Sedlack & Stanley, 1992). They can be used with numerous designs, such as pre-post test , and also to gain personal information about the subjects. In CPOF's LOE1, questionnaires were used to gather data about the subjects' past military experience. An example of one of the experience questionnaires can be found in Appendix A.

Interview

Interviews are also effective for data collection, varying in structure, depending upon the clarity of research focus, the amount of input required or preferred from the subjects, and when the analyst would like to ask open-ended questions. In CPOF, interviews were used in "debriefing" the subjects for LOE1. This took the form of a semi-structured interview, where data collectors had a distinct set of questions (LOE1 debrief) to ask the subjects, but all input from the subjects was taken. An example of the LOE 1 debrief can be found in Appendix B.

Data Analysis

Data Considerations (types of data – ordinal, nominal, continuous, qualitative)

To determine appropriate data analysis techniques, the levels of measurement for the variables used in the experiment (nominal, ordinal, or continuous).

Nominal variables involve naming or categorizing data or attributes of interest. Examples of nominal variables include: gender, religion, service type, branch, etc. Ordinal variables involves a quantifiable ranking or sequencing of a variables category, such as the variable Rank, Whereas a continuous variable involve values not limited to whole numbers. Typically continuous variables represent scores, where you may have a test of 10 items with a total of 100 points. If partial credit can be given for test items or amount of experience, such as 2.75, 99.5, 72.25, etc (Sirkin, 1999). The military experience questionnaire used in CPOF included such variables, as well as ordinal and continuous. The impact of data types will be covered in more depth in the quantitative analysis section below.

Data Base Management/Data Entry Procedures & Error Avoidance

In analyzing LOE 1 data collection, the following data entry procedures should reduce the amount of error in the data base:

1. Consider the use of SPSS Data Entry Building module to do data entry.
2. Also include a process of double data entry, where all data would be entered twice by two different people and then the SPSS Data Entry Building module can compare the two versions and create a report of the differences.
3. Then look up the errors to determine which is correct by comparing suspected errors with the actual data.
4. After all this, before any analyses are run, run frequencies to check the ranges and missing values of the variables being used.

Data Cleaning

With this SPSS Data Entry Building module, skip patterns and validation rules can be built in i.e. if a variable should only be a 1 or 2, it can be set up so that if any other value is entered, it beeps and prompts for the reentry of the value.

While SPSS Data Entry Builder is a helpful tool, budgetary limitations may create problems with its' use. Realizing the use of that this may be a possibility, another suggestion for a data entry procedure would include for every 1 of 5 records, manually check each variable for correctness and keep track of the number of errors detected and compute an error rate. If the error rate is greater than 1%, consider manually checking additional records, maybe even all, if the error rate was very high.
errors found/# variables=error rate

Quantitative Analysis

This section is not intended to provide a complete survey of quantitative analysis. For further in-depth coverage, please see Sirkin (1999), Tabachnick & Fidell (1996), and Pedhazur (1982). It is helpful and wise to begin by looking at descriptive statistics, such as frequencies, ranges, means, modes, etc. and graphs of your data. Descriptive statistics can highlight possible errors in the database and also provide insight into where the most interesting area in your data lies.

Parametric Assumptions

In general, parametric statistics assume the use of random sampling, and therefore the presence of a normal distribution (Sirkin, 1999). The following figure illustrates the appropriate use of particular parametric and equivalent non-parametric tests (for use when assumptions cannot be met)(Isaac & Michael, 1995).

(insert parnon-par tests cobp.ppt file)

Qualitative Analysis

Define Qualitative Analysis (including purpose and components of)

Qualitative analysis can be defined as a "…nonmathematical process of interpretation, carried out for the purpose of discovering concepts and relationships in raw data and then organizing these into a theoretical explanatory scheme" (Strauss & Corbin, 1998). However, analysts can take what would be termed as qualitative data and quantify it, thereby providing the means to perform quantitative data analysis. The CPOF project incorporated both of these methods. Debriefing interviews were transcribed, coded, scored/quantified, and then analyzed using appropriate statistical techniques. Once the quantitative analysis of the qualitative data was completed, these results were used to point the direction towards interesting aspects worthy of further/deeper examination using qualitative techniques (see Section 4 “Experimental Campaign”). The major components to qualitative research, just as in quantitative research, include the data, procedures, and report preparation. Descriptions of some useful qualitative techniques follow.

Microscopic Analysis

When beginning the analysis of qualitative data, such as from interview or observations/transcriptions of dialogue, it is helpful to start with a microanalysis of the data. This involves “the detailed line-by-line analysis … to generate initial categories (with their properties and dimensions) and to suggest relationships among categories” (Straus & Corbin, 1998). In the analysis of Block Party data, the analysis typically began by transcribing tapes and analyzing how the data could be categorized, using both HEAT and adding other categories as observed, such as categories for collaboration.

Coding

Before beginning the coding process, it is helpful to first, be aware of the central ideas in the data represented as concepts (phenomena), which are the building blocks of a theory. This will assist in the development of coding categories, essential to the coding process.

Open Coding

Open coding is the “analytic process through which concepts are identified and their properties and dimensions are discovered in data” (Straus & Corbin, 1998). In order to code, categories and subcategories must be identified.

Developing Categories & Subcategories

Categories represent what is going on of interest in the data. Once they have been identified, they need to be refined to reflect properties and dimensions of what the categories mean and how to identify them in the data. Properties are “general to specific characteristics or attributes of a category”, and “dimensions represent the location of a property along a continuum or range” (Straus & Corbin, 1998).

The relationship between categories and subcategories is evident by example, such as a category of decision and a subcategory of decision type. Subcategories can reflect the when, why, where and how the phenomenon identified as a category occurs, therefore generating a more complete “picture” of what is occurring in the data.

Other coding techniques include axial, selective, and process. Axial coding is the process of linking categories to subcategories at the property and dimension level. Selective coding involves the integrating and refining categories to integrate and refine theory. Process coding analyzes action and interactions over time to note how and if these actions or interactions change.

The Conditional/Consequential Matrix (used for theory building)

Developing the conditional/consequential matrix of the data can further develop theory and by revealing and illustrating the interplay or process between conditions and the evolving situation under study. This matrix can help the analyst scope the research project and develop explanatory hypotheses.

The qualitative analysis process just described, reflect the process used in analyzing CPOF Block Parties. It involved transcribing tapes and notes of what occurred during the exercise, to generate categories (microanalysis), further refining and defining subcategories (open coding), through which further refining of categories and subcategories in relation to context, i.e. situation, tools used, etc., Process was also coded for to see the type and frequency of interactions between subjects, and it is hoped that through further analysis across Block Parties, to look for changes over time.

Data Analysis Results

Once the analysis is completed, presenting the results clearly, to generate understanding and help expansion and replication of findings and theory, is critical.

Statistical Presentation

In general, statistical results should include the value of the test, degrees of freedom, probability level, and direction of effect. In addition, descriptive statistics, such as mean, median, and their associated measures of variability, such as standard deviations, should also be included. Another item to include is statistical power, effect size, and how these were determined. In addition, this information can be presented in chart or graphic form, if appropriate.

There are numerous ways to graphically represent data, such as using histograms, frequency distributions, scatter plots, stem and leaf diagrams, box and whisker charts, as well as the standard bar chart. If score dispersion is of interest, then a researcher might choose to use frequency distributions, scatter plots, stem and leaf diagrams or box and whisker charts. However, if you are only interested in displaying the mean, while noting the standard deviation and n, histograms work just as well.

Conclusion

As mentioned in the abstract for this paper, the goal of this paper was to provide an overview of experimental processes, through the use of experimentation examples from DARPA's CPOF program. If you are interested in more in-depth coverage, I refer you to the sources listed below.

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Appendix A

Appendix A: Experience Questionnaire Example

Subject No. _____________ Name: _____________________ Date: __________

Biographical Information

The purpose of this questionnaire is to obtain some information about your military background and experiences. This information will be used to better understand your responses. All information collected will remain confidential and will not be released to third parties. We appreciate your cooperation in completing this form.

1. Rank _________ 2. Service ________________ 3. Years on Active Duty ______

4. Current Position ____

5. Military Schools Attended

6. Have you received training that included training in situation awareness?

Yes _______ No ________

7. Assignments in Command Centers: (answer for each command center assignment)

Assignment________________________ Level of Command Center__________

Length of Service ___________________ Role in Command Center ___________

Combat? Yes No

If yes, campaign_____________________ Duration _________________________

*****

Assignment________________________ Level of Command Center__________

Length of Service ___________________ Role in Command Center ___________

Combat? Yes No

If yes, campaign_____________________ Duration _________________________

*****

Assignment________________________ Level of Command Center__________

Length of Service ___________________ Role in Command Center ___________

Combat? Yes No

If yes, campaign_____________________ Duration _________________________

8. Command Assignments (answer for each command assignment)

Assignment__________________________ Level of Command _____________

Length of Command Tour ______________

Combat Yes_____ No_______

If yes, which campaign _______________________ and duration _____________

Field Exercises Yes_____ No______

If yes, which Field Exercises ____________________ and duration ________________

*****

Assignment__________________________ Level of Command _____________

Length of Command Tour ______________

Combat Yes_____ No______

If yes, which campaign _______________________ and duration _____________

Field Exercises Yes_____ No_____

If yes, which Field Exercises ____________________ and duration ________________

*****

Assignment__________________________ Level of Command _____________

Length of Command Tour ______________

Combat Yes_____ No_____

If yes, which campaign _______________________ and duration _____________

Field Exercises Yes_____ No_____

If yes, which Field Exercises ____________________ and duration ________________

9. Approximately how many CPX’s have you participated in? _________________

(From most recent)

At what levels of command: ____

Your roles in CPX’s : ____

10. On which, if any, systems supporting command, control, communications, computers, and intelligence (C4I) do you considers yourself trained? (list all that apply)

Appendix B

1.You have three minutes to brief your commander on your assessment of the situation, what do you tell him?

1a. In this situation what are the friendly:

Opportunities?

Risks?

1b. What are the adversary's:

Offensive capabilities?

Defensive capabilities?

Vulnerabilities?

Intentions?

1c. What are the vulnerabilities for own forces?

2a. If you are not certain about adversary intentions and capabilities, what are the different possibilities?

2b. If you are not certain, what information would you require to resolve this uncertainty?

3a. What specific elements or element combinations lead you to your situation assessment?

3b. Please make a sketch of the situation, including the specific elements or element combinations cited in your previous answer.

3c. Was any information you would find valuable missing from the presentation of the situation?

4. What was good and or bad about this display? What would you like to see added, removed or changed?

10/29/99 DRAFT