

IMPROVING NUCLEAR, BIOLOGICAL, AND CHEMICAL INDIVIDUAL PROTECTION EQUIPMENT (NBC IPE) DESIGN



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PROJECT RESEARCH DESIGN

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I INTRODUCTION

The goal of this project is to improve Nuclear, Biological, and Chemical Individual Protection Equipment (NBC IPE) Design. I have chosen to pursue this subject due to my experience having worn, casual research into, and perceived opportunity for tremendous improvements to be made in NBC IPE. However, much more in-depth and systematic research will be required to locate and define areas in IPE for improvement.

This document details plans for attaining the necessary information required to prescribe improvements in NBC IPE. The goals of the research will be to:

- Gain a strong understanding of Nuclear, Biological, and Chemical agents and their effects on humans
- Gain a strong understanding of past, current, and future characteristics and nomenclature of NBC IPE
- Evaluate and determine advantages and disadvantages of current NBC IPE to include:
 - Donning of IPE
 - Operating in IPE
 - Decontamination of IPE
 - Storage and longevity of IPE
- Evaluate prototype(s)
- Provide documentation on suggested means of improving NBC IPE

II GOAL OF THE PROJECT (HYPOTHESIS)

Question: Can the sensory degradation (i.e. limited vision, hearing, smell, touch, taste, comfort, etc.) which takes place while wearing NBC IPE be drastically reduced so as to allow the user to more capably function for extended periods in a threat of, or actual NBC environment? Or has current NBC IPE nearly reached it's maximum potential for human protection and usage?

Hypothesis: Continued improvements in NBC IPE are necessary to reduce sensory degradation so that the user can function closer to their normal capabilities.

Currently, specific areas of research for NBC IPE improvements will be aimed at:

- How to increase vision
 - Decrease lenses fogging up
 - Increase peripheral vision
 - Increase user's ability to utilize with sights on weapons
 - Ensure ability to use with NVGs (Night Vision Goggles) and future vision related technologies
- Hearing
 - How to increase ability to hear with gear on
 - How to offer the user the ability to reduce high decibel noises (i.e. jet engines, artillery fire, etc.)
- How to decrease the threat of overheating/dehydration
- How to decrease time required to get IPE on and off

- Properly don, seat, and clear the FPM (Field Protective Mask)
- Change between MOPP (Mission Oriented Protective Posture) levels
- How to increase IPE compactness and ease of stowage
- How to increase the user's ability to wear glasses
- How to increase ease and speed of user decontamination
- How to design for varied size and shape of users
- How to Increase the Shelf Life of the NBC IPE
- How to Effectively Evaluate Prototype Design

III PLANNED RESEARCH METHODS

The type of research that will be conducted will be *empirical* in nature. This will include measurement of observable events such as participants' responses to questionnaires and evaluation of prototypes. Initially information will be attained in a *literature review*. This has already begun but will continue throughout the project in order to learn from what others have already studied, learned, designed, and manufactured for NBC IPE. This information will be provided in the bibliography of the research document. This information is broken up into primary sources of original research reports and secondary sources such as: military textbooks, magazine, and internet articles.

The initial attainment of information will be gained through a *questionnaire* directed to military personnel due to their experience with NBC IPE. The goal of the questionnaire is to seek the participants opinion on what are the advantages and disadvantages of current NBC IPE and how the IPE could be improved. The format will contain very few closed questions and many more open-ended questions so as to get the participant to elaborate on the IPE. The key will be to maintain *balance* in the questions so as not to influence the participants' answers. The number of questionnaires need not be more than twenty-thirty due to the fact that the research is aimed at being more *qualitative* than quantitative. It is my goal to sit down with each individual and really define the problems related to wearing IPE. My target audience will be those currently serving in the military as well as individuals without experience wearing IPE. The most important goal is to utilize a *stratified sample* to ensure inclusion of either 5% females to 95% males or 2.5% females to 97.5% males. Since the information gained will be qualitative, I need only review the questionnaires and summarize the information gained.

The second attainment of information will be gained through *simulation* and *participant observation* in which I would be included in, in order to better appreciate requirements of IPE design. The experiment will be designed as a simulation of actual NBC training where personnel would be performing typical military activities. An additional goal of the experimentation would be to test the prototypes in an actual gas chamber using current military training techniques (the military currently trains its personnel in confined chambers with O-chlorobenzylidene malonontrite, aka CS gas or tear gas). The level of realism with which the experiment can be run will depend on several factors. The most crucial would be to decide if this type of evaluation is even necessary. It may be that there might be some other solution such as just having people wear the prototypes or for the second part simply using sort of non-harmful smoke instead. Georgia Tech IRB would have to approve, as well as a military command to allow its personnel to be utilized in such an experiment. Finally each individual would have to consent to participating.

This simulation testing of the prototype(s) could be undertaken several times as necessary to produce a quality prototype(s). The goal would be to test the prototype(s) once, evaluate the results, redesign the prototype(s), and repeat as necessary. As always, time will be the determining factor behind whether these experiments will take place more than once.

IV RESEARCH TIMELINE

The projects timeline will be centered around my goal of graduating in December, 2003. This is four months earlier than compared to other timelines in the Industrial Design Program at Georgia Tech. Therefore, I will be required to take summer courses at Georgia Tech or at other transferable, accredited, universities. The basic timeline is broken down into the three project phases of "Planning and Research," "Conceptualization and Prototyping," and "Evaluation and Presentation"

Approximate dates for these project phases and research events are:

- **Planning and Research:** August 27, 2002 – May 31, 2003
 - Gain a strong understanding of Nuclear, Biological, and Chemical agents and their effects on humans
 - Gain a strong understanding of past, current, and future characteristics and nomenclature of NBC IPE
 - Evaluate and determine advantages and disadvantages of current NBC IPE
 - Complete questionnaire February 22, 2003
 - Seek IRB approval February 22, 2003
 - Conduct pilot study April, 2003
 - Make necessary adjustments April, 2003
 - Conduct research May, 2003
- **Conceptualization and Prototyping:** May 01, 2003 – September 06, 2003
 - N/A
- **Evaluation and Presentation:** August 01, 2003 - November 20, 2003
 - Evaluate prototype(s)
 - Complete prototype evaluation plan September, 2003
 - Seek IRB approval September, 2003
 - Conduct pilot study October, 2003
 - Make necessary adjustments October, 2003
 - Conduct research October, 2003
 - Provide documentation on suggested means of improving NBC IPE November 20, 2003

*Current plans allow for only one testing of period of NBC IPE prototype(s). If time allows, prototypes will be improved upon and reevaluated.

*A detailed listed of items and dates will be contained in the Project Proposal Gantt Chart.

V CONCLUSION

The information above is above a guideline for research to be executed for this project. Items may have been left out or finite dates not set due to lack of experience with research relating to NBC IPE and graduate research work. This does not mean that these items will not be pursued and completed. Examples are: development of a consent form for secondary or tertiary questioning and or experimentation and IRB deadline dates for submission.