How to Conduct and Quantify PPE Field Tests

Testing different PPE brands leads to data for better purchasing decisions

FireRescue1.com

FIRE CHIEF
EVERY DEPARTMENT, EVERY LEADER

GLOBE
ATHLETIC GEAR FOR FIREFIGHTERS™

How to Conduct and Quantify PPE Field Tests

By Jeffrey O. Stull and Grace G. Stull

CONTENTS

Brought to you by FireRescue1, Fire Chief and Globe Turnout Gear

FireRescue1.com

FIRE CHIEF
EVERY DEPARTMENT, EVERY LEADER

GLOBE
ATHLETIC GEAR FOR FIREFIGHTERS™

INTRODUCTION

Applying Field Tests for Proper Selection of PPE

The ability to choose the right PPE for you and your department, including garments, helmets, gloves, footwear, and hoods is complicated by the fact that there are so many different choices in the marketplace.

Different manufacturers offer different features in terms of overall designs, ergonomic features, reinforcements, types of trim and patterns, pockets, and several other aspects which can make it extremely difficult for departments to make a choice that feels fully tailored to them.

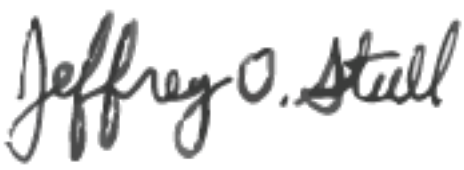
Making a definitive choice on PPE should not be done based on manufacturer literature alone. Instead, departments should consider field tests or a manual assessment of the overall product as it is designed and constructed. There are many variances in these products that cannot be understood on paper or by simply looking at one set of gear.

Conducting a field test is one of the better methods that can be used to decide which gear is suitable for the department. This also is the only practical way to determine whether there are issues relative to a particular type of gear being used by the department for the first time. A change in supplier, new design, product features or completely different materials are common concerns when trying out new gear.

So what exactly is a field test? While it may seem obvious, field tests can actually take several different forms. Not all departments are in a position to conduct a full evaluation of gear, especially when it involves multiple suppliers. Field tests are a practical assessment of a product either in actual use or performed in a way that simulates use. This is usually tested over a period of time and involves departmental operations.

The most common field test is to procure different sets of a new type of gear and to try it out in the field to see how it compares with what is currently being used. This approach is the most practical and easiest to implement. However, getting meaningful information out of this type of evaluation can be difficult and does not lend itself to a truly objective assessment. Field tests need to be structured whether they involve a short evaluation, such as training in a burn building, or months of evaluation from actual use in the field.

Well-designed field tests determine if the new products will function and provide protection as expected and serve to justify a specific decision. Remembering that gear has to interface with a number of other items of PPE and meet operational requirements makes it even more important to take these details into account.



Jeffrey O. Stull

Grace G. Stull

How to Set Up a PPE Field Test

Conducting a well-structured field test of different PPE brands will aid in making the right purchase choice

The PPE selection process becomes important as departments are nearing the end of a budget year and the beginning of a new budget cycle. Some departments may be looking to expend grant monies; others will have to contend with local resources.

For all departments, PPE selection should entail an element of long-term planning, the centerpiece of which should be a field test. If your department is in the market for new gear, a properly conducted field test is a critical step to ensure that you find the PPE that best fits your needs.

The first step in designing an effective field test is to assess a department's needs. This is typically done by conducting a hazard and risk assessment, which can follow the guidelines provided in the appendix of NFPA 1851*, Standard on Selection, Care and Maintenance of Structural and Proximity Fire Fighting Protective Ensembles*, 2014 edition.

In addition, it is important to outline the department's bunker gear requirements, which should include the desired protective properties, features and configurations. Determining the department's needs as part of the hazard and risk assessment is usually conducted by the department's safety officer with input and recommendations from a PPE committee. The assessment should consider:

- Type of duties performed: The firefighting and rescue tactics that a department performs and the day-to-day duties of the firefighters wearing the gear are critical factors.
- Frequency of use: The average number of runs and the frequency of use in both training and non-training activities are important. Departments with a high volume of activity may choose an outer shell with high-abrasion or other durability characteristics that can extend the life of the bunker gear.
- Organization experiences: This can run the gambit from first-hand experience of gear previously worn to feedback on service and repair issues experienced by neighboring or mutual-aid departments.
- Incident operations: Consider the types of calls a department runs and if it will be used for extrication and EMS calls, or if those will require separate gear.
- Location and climate: Gear designed for departments in North Dakota will have different requirements than gear designed for departments in Southern California. The gear's weight, thermal protection and breathability must be considered.

PPE manufacturers can provide information to help develop specifications and to educate firefighters on new features, designs and composites. Most PPE manufacturers are well-versed in the NFPA 1971, which is another requirement that a department must consider.

That standard sets the minimum requirements for structural PPE. Fire departments should always look for products that meet and often exceed the requirements for the utmost protection.

Ensure that the requirements represent a complete and detailed description of what the department is looking for prior to commencing the field test. This will allow you to clearly define and communicate the departmental needs and help you determine which PPE manufacturer is doing the best job in meeting those needs.

Field test design and parameters

There are several different ways to structure a field test. Some departments prefer to put field test gear on a busy company and let them test the gear in their normal day-to-day activities.

Other departments conduct field tests at training facilities where each participant is run through a series of training simulations to determine the gear's performance and the participants' preferences. Still other departments use a combination of both the methods.

Regardless of the method, there are four key considerations to include when structuring the field test.

- **Invite the manufacturer**
  Before the field test is conducted, invite manufacturers to make presentations on the benefits of their prospective products. These meetings are an opportunity to lay ground rules with the manufacturers for how they should interact with the department to keep the selection process above board and transparent.

- **Test all gear**
  To get the most objective and fair evaluations of gear being tested, it is crucial that all field test participants wear and test each different product being evaluated. It is also recommended that departments cycle through each model a minimum of three times.

  This allows a better chance for each participant to experience the gear in a wide variety of conditions and to validate their initial findings or opinions of each product being tested.

- **Quantify data**
  At the end of the field test, a lot of data must be compiled and analyzed. Having a quantifiable scoring system in place throughout the testing process will make that job a lot easier. Potential rating categories are provided in the sidebar.

  It is also possible to actually make some physical measurements with the appropriate tools and expertise. For example, tape, rulers and photography can be used to measure and document rise and reach of members using various sets of gear to see how the gear impacts movement.

  Furthermore, use of a numeric rating scale is recommended for each facet of the gear as opposed to a subjective narrative. When developing field-test evaluation forms, define the activities being scored and what is being measured for each activity.

  Be as specific as possible in what the participants are asked to measure, and provide a scoring scale so they can best match their experience with the criteria. At the end of each section, or component being tested, provide an opportunity for additional comments to gain more detail on exactly what each participant experienced.

  Some manufacturers will provide field test evaluation forms with their samples. These forms can be used either as a ready-to-use tool or a starting point for developing your own form.

- **Set timeframes**
  For a field test to run smoothly it will need defined timeframes and a schedule that includes all of the activities and key milestones.

  Determine in advance how long the test will last, when the participants will cycle through each product, when they will fill out evaluation forms, when the gear will be collected and when the safety officer or PPE committee will analyze the results and present recommendations.

All of this information should then be communicated to everyone included in the test. It is important that the field test be transparent within the department so it is clear that an objective process has been used.

The primary reason for conducting a field test is to generate a recommendation for a product that best fits a department's needs. This recommendation will be delivered in the form of a final report, which should be used to develop purchase specifications.

When putting together field-test parameters, determine in advance who will be responsible for developing the final report, any interim reports associated with the testing and what will be included in the reporting at each stage. Also, determine who will have access to these reports along the way and to the final report.

A well-documented field test that results in a recommendation based on quantifiable results can be a powerful tool in providing justification for the purchase of the gear that will be the best solution for your department.

Factors for rating bunker gear during field testing

Specific rating areas for overall clothing

- Degree of fit
- Feeling of bulkiness and weight
- Ease of movement – walking
- Ease of movement – duck walking or crawling
- Exposure of body areas to fireground environment
- Ease of interface with other equipment – helmet, gloves, footwear, hood, SCBA
- Ease of donning and doffing
- General thermal comfort (breathability)

Specific rating areas for parts of clothing

- Effectiveness of coat sleeve – glove interface
- Effectiveness of pant – footwear interface
- Ability to reach with arms
- Ability to bend at legs and waist
- Ease of coat front closure operation
- Pocket placement and utility
- Comfort of extended collar with helmet, hood, and SCBA facepiece
- Comfort of knee reinforcements

General questions

- What features or characteristics of the bunker gear did you like?
- What features or characteristics of the bunker gear did you not like?

How to Conduct a PPE Field Test

A properly conducted field test will help a fire department choose the right gear and have the data to support that choice

Last year, guidance was provided on conducting a needs assessment and designing the field test as a means for selecting PPE. The additional parts of the field test program are recommended for applying a systematic approach in making a defensible choice of your department's PPE.

According to NFPA 1851, *Standard on Selection, Care and Maintenance of Structural and Proximity Fire Fighting Protective Ensembles*, 2014 edition, "Test participants should be selected based on a cross section of personnel, willingness to participate, objectivity and level of operational activity."

This means you should select participants for your field test that include experienced members who know what to look for in properly functioning bunker gear. These participants should also have an open mind about all of the products being tested — you don't want a participant in an objective field test who has already decided that one product is the only clear choice before beginning the evaluation.

Make sure that the participants are involved in all areas of the department's operational activity and that they are willing and able to commit time to the process of testing the gear and completing the field test evaluation forms in a timely manner.

Kicking it off

The initial step in implementing the field test should be a kick-off meeting. In this meeting, the safety officer will provide the participants with all of the field test details to ensure they know what the objective is and how the test will be conducted. The risk assessment, field test schedule, participant requirements and an explanation of products being tested should be covered in this meeting.

Prior to this meeting, have the manufacturers of the products that will be evaluated measure the participants and then come in to fit the gear and instruct participants on how to properly wear the gear. This is the time to let the manufacturers know what will be expected of them and to provide rules that prevent undue influence in their effects on the field test (the products should speak for themselves).

The participants should only wear and retain one set of the test gear at a time to minimize confusion and the chance that all gear is not equally tested. Distribute the gear for the initial round of evaluations at the kick-off meeting.

Evaluation forms

In accordance with the field test schedule, at preset intervals, the safety officer should provide participants with evaluation forms and have them completed. These forms must be filed for future analysis. This can be done in person or electronically.

The next gear in the rotation should not be provided until the evaluation forms are completed for the current gear being tested. Evaluation forms should be filled out throughout the test — NFPA 1851 recommends that each participant complete three evaluation forms per ensemble or product.

It is important that the safety officer establish a process to report events that fall outside the normal

reporting procedures. This may include the need to repair or replace field test gear, delete or reorient specified options, any service-related issues associated with the gear or any critical information that comes to light as a result of the field test that may not be included on the evaluation forms. Once documented, it is added to the data used to compile the final report.

It is best to have the same participants throughout the test. If for some reason one participant needs to drop out of the test, it is better not to replace that participant. Also, discard any evaluation forms submitted by that participant unless you have a complete cycle of evaluations from that participant for all gear being tested.

Be sure that any substitute participants are of the same size, weight and height as the original participant to ensure proper fit of the test gear.

After the test

The safety officer should collect and retain all field test gear once the test is completed so that the selection committee can examine all samples prior to developing a formal recommendation.

Once the official testing in completed, it's time to compile the results and develop a formal recommendation. Prior to writing a formal recommendation, be sure to look at all of the information and results the field test has generated.

If the evaluation forms provide quantifiable scoring data, then it will be easier to calculate the results for each category tested. But do not limit the report to just the information generated by the evaluation forms.

The safety officer and PPE committee should also perform a thorough inspection of all sample gear used in the field test. Any findings associated with wear, component failure or workmanship should be included as part of the final review and resulting recommendations.

In addition, the safety officer should include in the final recommendation any information pertaining to the field test that relates to service, delivery, repair or accuracy to specification.

Making the recommendation

The most effective recommendations begin with an overview of the requirements that were developed based on the initial risk assessment. This sets the stage by letting readers know exactly what the gear committee was looking for and why.

This section is then followed by results of the field test by category tested. In most cases, departments tabulate all scores and then provide an average product score for each question on the evaluation form. Any participant comments are listed by manufacturer at the end of each section of the report. The overall organization of the report will be based on how the field test was conducted and how the evaluation forms were designed.

The final section should be a formal recommendation of a specific product that includes the rationale of why that product was selected. This recommendation should form the basis for the development of a formal bid for the product tested. If your bid specification does not align with the results of your field test, then you are probably not going to get the product that best meets your department's needs.

Field testing offers the best way for your department to assess the different brands available and to determine how well that gear will live up to the intended and expected performance. A properly designed field test that is quantitative, balanced and transparent allows your department to provide documentation for obtaining the gear that best meets the department's needs.

ABOUT THE AUTHORS

Jeffrey O. Stull and Grace G. Stull are president and vice president, respectively, of International Personnel Protection, which provides expertise on the design, evaluation, selection and use of personal protective clothing, equipment and related products to end users and manufacturers. International Personnel Protection is considered one of the leading sources of expertise in the field of personal protective equipment.

Mr. and Mrs. Stull are members of several National Fire Protection Association committees on personal protective equipment as well as the ASTM International committee on protective clothing. Mr. Stull was formerly the convener for international work groups on Heat/Thermal Protection and Hazardous Materials PPE as well as the lead U.S. delegate for International Standards Organization (ISO) Technical Committee 94/Subcommittees on Protective Clothing and Firefighter PPE.

Mr. and Mrs. Stull participate in the government's Interagency Board for Equipment Standardization and Interoperability. They have written more than 100 articles, chapters, and guides in the area of protective clothing and equipment. They have authored the book, *PPE Made Easy*, now in print by Government Institutes. The Stulls are long-standing subject-matter experts and columnists on PPE for FireRescue1.

Send questions or feedback to Jeffrey or Grace at Jeffrey.O.Stull@FireRescue1.com.

RELATED RESOURCES

NFPA Standards & Requirements
Globe Manufacturing Company, LLC
Learn about the NFPA standards and requirements for maintaining turnout gear.

Finding the Right Test for PPE
FireRescue1.com
The testing of bunker gear and all the elements that make up the protective ensemble that firefighters wear is a critical business.

Care and Cleaning Guidelines
Globe Manufacturing Company, LLC
Learn about requirements for the inspection, care and cleaning of protective ensemble elements covered by NFPA 1851.

Survey: Firefighter PPE Care Is Improving
FireRescue1.com
New survey results show that the fire service is doing a better job of cleaning and repairing its turnout gear than it did 10 years ago.

Free Online Training
PPE101.com
The latest research, information and online training for personal protective equipment, which goes through NFPA 1851 chapter by chapter.

FireRescue1.com

FIRE CHIEF®
EVERY DEPARTMENT, EVERY LEADER

GLOBE®
ATHLETIC GEAR FOR FIREFIGHTERS™