2009 BFRL Project Description

Project Title: Economic Impacts of Improved Service Life Prediction

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BFRL Program: Service Life Prediction of Nanostructured Polymeric Materials

Objective: Identify industries affected by BFRL's Measurement Science for Sustainable Infrastructure Materials research, estimate economic impacts resulting from BFRL's SLP-related research, and estimate the return on BFRL's SLP-related research investment dollars.

Problem:

What is the problem? The measurement of economic impacts of research is a major objective of NIST. Improved methods for measuring economic impacts are essential to BFRL to help select the "best" among competing research programs, to evaluate the cost-effectiveness of existing research programs, and to justify programs on the basis of their economic impact. This need for measurement methods exists across programs in both BFRL and NIST. Another objective of NIST and BFRL is to promote innovation by U.S. industries. To improve their competitiveness, key construction industry stakeholders need to know how improved SLP can help them make economically efficient choices among construction materials and products. This project addresses those needs. To make cost-effective choices for investments in products with improved durability, decision makers must have data on benefits and costs associated with more reliable, accurate, scientifically-based, and timely service life predictions of these products, as well as tools for measuring those benefits and costs. The problem is how to create economic tools that will help facility owners and other stakeholders identify and measure the benefits and costs of choosing between new products with increased durability and traditional products, and that will accelerate the introduction and acceptance of new products in the U.S. and abroad.

Why is it hard to solve? Measuring economic impacts is hard because any given area of research, like SLP, has unique stakeholders with unique interests in the benefits of research. The problem is how to get an in-depth understanding of the type of research benefits and a metric for measuring the magnitude of those research benefits. It is hard to develop such tools because economists and materials scientists must work together to deliver the data and metrics required. Today, decisions are generally made on the basis of traditional material testing techniques, with minimal attention to life-cycle cost considerations.

How is it solved today, and by whom? It has not been solved, although progress has been made. BFRL is a recognized authority in the measurement of economic impacts of research programs. BFRL developed a structured approach, demonstrated feasibility with the CONSIAT

economic impact assessments, and documented it in NISTIRs 6501 and 6763. This approach uses standardized methods to measure and evaluate economic impacts and a standardized format for concisely summarizing economic impacts.

Why NIST? Advancements in measurement science that provide key stakeholders with the means to make cost-effective choices for investments in products with improved durability is closely aligned with BFRL's *Performance, durability and service life prediction* core *competency, BFRL's Measurement Science for Sustainable Infrastructure Materials* strategic goal, and BFRL's mission.

Approach:

What is the new technical idea? The new ideas behind this research are combining the materials data with economic methods, models, and tools for an improved set of impact metrics demonstrating how to measure the impacts of SLP research. The suite of methods/models/ tools/data outputs benefits BFRL/NIST managers in allocating research budgets, thereby increasing research impacts per budget dollar spent. In addition, the suite will help construction industry stakeholders make more cost-effective choices among construction materials and products, thereby reducing the life-cycle cost of construction to the ultimate consumers of building services. This research differs from other impact studies, both current (e.g., HYPERCON) and past (e.g., CONSIAT), due to its focus on a comprehensive analysis of the benefits and costs associated with more reliable, accurate, and scientifically-based service life predictions for polymeric materials.

Why can we succeed now? Success now is likely because the science of SLP, the economics of impact measurement, and a history of experience with SLP are all at a stage of development that permits a fruitful collaboration. BFRL is the best place to do this work because it has these three essential parts of the collaboration.

What is the research plan? BFRL will complete the impact assessment begun in FY 2007 and publish the results of the assessment. In carrying out the impact assessment, BFRL will employ a two-pronged strategy to target organizations—associations, societies, and advocacy groups—which can leverage contacts with stakeholders. BFRL's strategy for reaching stakeholders is driven by the fact that BFRL's SLP-related research impacts different sets of stakeholders. Consequently, BFRL's strategy is designed *both* to seek information and data for estimating and/or documenting SLP-related benefits (savings) and costs *and* to promote awareness and define expectations of the stakeholders, as well as to leverage the dissemination of findings. The report will describe the data and document the key assumptions upon which estimates of benefits (savings) and costs are based, describe the process through which these estimates were developed, show how to calculate the baseline values of key outcomes (e.g., the rate of return on BFRL's SLP-related research), and assess, through sensitivity analysis, the implications of changing assumptions on key outcomes (i.e., how variations in one or more key assumptions affect the baseline values of key outcomes). An EPDM roofing case study will be included in the report as an illustration of the methodology.

Recent Results: BFRL has published a suite of economic impact studies. The most recent covered BFRL's CONSIAT product and was published as NISTIR 6763. In FY 2007, BFRL planned and initiated the impact assessment of BFRL's SLP-related research and documented the

methodology in a white paper. In FY 2008, BFRL developed a methodology for a retrospective case study of EPDM roofing.

Output: Chapman, R., Butry, D., and Thomas, D., Strategy for Identifying, Collecting, and Measuring SLP-Related Benefits and Costs, June 2007 (Unpublished White Paper).
Outcome: Developed a methodology for a retrospective case study of EPDM roofing.

Standards and Codes: This project will make extensive use of economic standards published by the ASTM Subcommittee E06.81 on Building Economics, namely E 917 (Life-Cycle Cost Method), E 964 (Savings-to-Investment Ratio), E 1074 (Net Savings), E 1369 (Treatment of Uncertainty and Risk), and E 2204 (Summary Format for Economic Impacts).