

Machine Tool and Die

Business Scenario

Southern Machine Tooling (SMT) is an electrical discharge machine shop specializing in advanced aerospace, medical prototype parts and custom tooling. SMT is staffed by four employees: three in engineering and production and an office manager. Since SMT's inception in 2006, the firm has matured with research and development (R&D) underlining the core of the company's business activities.

SMT constantly conducted R&D over the years to create new and improved products and processes to perform to the best of their ability. Some of SMT's daily operations include cutting aerospace alloys and hardened steel, aluminum and steel molds, prototype parts, plastic, high tolerance work $\pm .0001$ ", and aluminum extrusion dies and tungsten carbide machining.

In 2012, SMT was approached by a client to modify a pre-formed door panel for an aircraft. The specification called for dozens of holes and several rectangular windows cut from the panel. However, SMT discovered that the panel itself was not within the specification, and all the features that SMT was required to machine needed to be cut perpendicular to the curved surfaces on which they were located. SMT had to design a fixture to hold the part in its proper shape, design a fixture to hold a long electrode so SMT could rotate it to the proper angle, and create a program that would not only rotate the electrode to the correct angle but position it in the proper hole location relative to a datum established on the fixture.

In order to qualify for the Research and Development Tax Credit, SMT needed to determine the eligibility of its proposed R&D activities. The "qualified research" must meet four main criteria, known and developed by Congress as the Four-Part Test. SMT's qualified R&D activities included the following.

SMT's Eligible R&D Activities:

Design and development of a series of prototypes to achieve the technical objectives (design of door panel).

SMT develops many tooling and prototypes from ideas, sample parts, or rough sketches. When SMT creates components for the aerospace and medical parts, the design is generally provided. SMT's engineering focuses on developing a precision method of manufacturing so parts meet the highly technical and extremely precise design requirements submitted by the clients.

SMT's hypothesis for this activity questioned whether a door panel could be designed to meet the specifications and requirements of the space.

The experiments SMT conducted in the design phase predominantly entailed computer modelling, conceptual engineering drawings and mathematical calculations. These

experiments could only be proven effective or ineffective in the prototype development and testing phase.

Following the experiments in that phase, during which the process was tested in various applications, the design was modified and re-tested until the desired outcome was achieved.

Trials and analysis of data to achieve results that can be reproduced to a satisfactory standard (development and testing of door panel).

The main objective for this activity stated that with improved knowledge of the intrinsic factors related to the process required to modify the door panel, it was possible to manufacture the door panel to the necessary specifications.

Details of this experiment included development of the fixture to hold the panel in its proper shape, development of a fixture to hold a long electrode and development of a program that would rotate the electrode to the correct angle.

Background research to evaluate current knowledge gaps and determine feasibility (background research of the development of SMT's process).

Besides the lack of comparable solutions available, the outcomes of activities in this research could not have been known or determined in advance due to a number of specific technical challenges.

SMT's eligible R&D activities during this phase of experimentation included:

- Literature search and review, including maintaining up-to-date knowledge on relevant certification and standards.
- Consultation with industry professionals and potential customers to determine the level of interest and commercial feasibility of the product.
- Preliminary equipment and resources review with respect to capacity, performance and suitability for the project.
- Consultation with key component/part/assembly suppliers to determine the factors they considered important in the design and to gain an understanding of how the design needed to be structured accordingly.

The background research conducted by SMT was directly related to the main objective of designing an improved metal vaporization process, therefore qualifying as R&D.

Ongoing analysis of customer or user feedback to improve the prototype design (feedback R&D of the interpretation software).

SMT's eligible R&D activity for this phase of its project included:

- Ongoing analysis and testing to improve the efficiency and safety of the project.
- Ongoing development and modification to interpret the experimental results and draw conclusions that served as starting points for the development of new hypotheses.
- Commercial analysis and functionality review.

These activities were necessary to evaluate the performance capabilities of the new design in the field and to improve any flaws in the design, therefore qualifying as R&D.

Commentary Qualified Research Defined

Qualified research consists of research for the intent of developing new or improved business components. A business component is defined as any product, process, technique, invention, formula, or computer software that the taxpayer intends to hold for sale, lease, license, or actual use in the taxpayer's trade or business.

The Four-Part Test

Activities that are eligible for the R&D Credit are described in the "Four-Part Test" which must be met for the activity to qualify as R&D.

1. Permitted Purpose: The purpose of the activity or project must be to create new (or improve existing) functionality, performance, reliability, or quality of a business component.
2. Elimination of Uncertainty: The taxpayer must intend to discover information that would eliminate uncertainty concerning the development or improvement of the business component. Uncertainty exists if the information available to the taxpayer does not establish the capability of development or improvement, method of development or improvement, or the appropriateness of the business component's design.
3. Process of Experimentation: The taxpayer must undergo a systematic process designed to evaluate one or more alternatives to achieve a result where the capability or the method of achieving that result, or the appropriate design of that result, is uncertain at the beginning of the taxpayer's research activities.
4. Technological in Nature: The process of experimentation used to discover information must fundamentally rely on principles of hard science such as physical or biological sciences, chemistry, engineering or computer science.

What records and specific documentation did SMT keep?

Similar to any tax credit or deduction, SMT had to save business records that outlined what it did in its R&D activities, including experimental activities and documents to prove that the work took place in a systematic manner. SMT saved the following documentation:

- Project records/ lab notes
- Innovation Log
- Conceptual sketches
- Design drawings
- Literature review
- Background research
- Records of changes
- Testing protocols
- Results of records of analysis from testing/trial runs
- Records of resource allocation/usage logs
- Staff time sheets
- Tax invoices
- Receipts

By having these records on file, SMT confirmed that it was "compliance ready" — meaning if it was audited by the IRS, it could present documentation to show the progression of its R&D work, ultimately proving its R&D eligibility.