Case study from HP/Agilent

How to change direction in new product development in 30 days without a budget!

by Mark A. Hart, President, OpLaunch (mark_hart@oplaunch.com)

It's always a challenge to change direction at the last minute. But to change direction when launching a product modification—within budget—can require a herculean effort. Mark Hart describes how this was achieved at HP/Agilent[1] a few years ago, when he worked there as a functional specialist in marketing. The company was upgrading its very popular mass spectrometer, an instrument widely used to measure chemicals.

Mark A. Hart
OpLaunch

Last-minute change is a challenge. And it is a challenge virtually every new product professional comes across at some point in his or her career: This challenge can be particularly frustrating when there are no additional resources available—and only one month in which to make the change.

How can you influence product development decisions in this situation? Particularly if the new product being upgraded or improved is one of the world's best selling products of its kind. That is the challenge we faced about a year before the product launch of the Hewlett Packard/Agilent 5973 Network Mass Selective Detector (MSD) product platform—an instrument used in chemical analysis.

The HP 5973 MSD had become the globally dominant instrument in its category in the late 1990s. HP/Agilent was developing an upgrade. At a late date it became clear that some additional adjustments to the upgrade needed to be made. The question was: How to overcome the inertia of the existing design and make changes with limited time, no budget, and a lack of staffing resources. This article summarizes how new product development professionals at HP/Agilent, including myself, did it.

Background

A mass spectrometer (MSD) is a measurement device used for identification and quantification of different chemicals. A mass spectrometer is used for many analysis tasks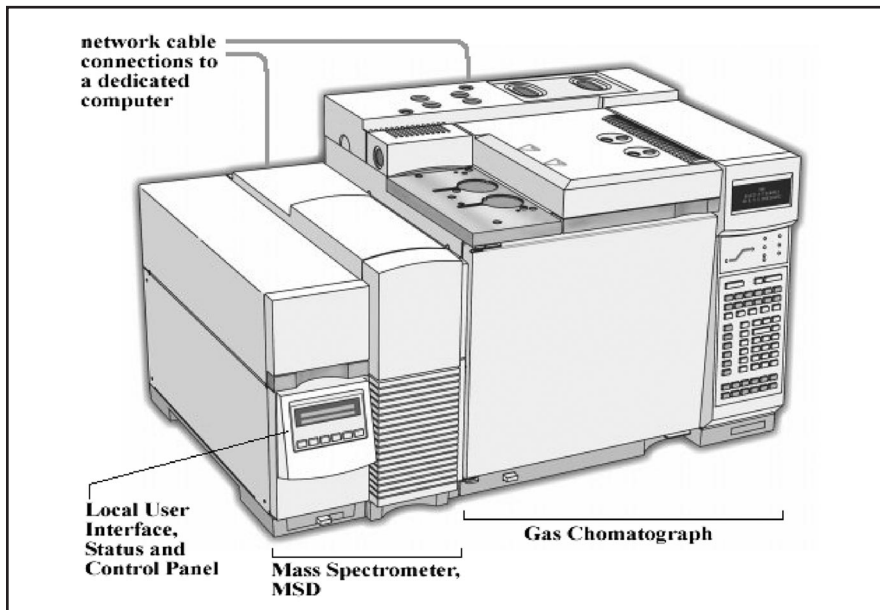 including the characterization of environmental samples, foods, and medicines by chemists and other scientists. Such systems are frequently coupled with a separation device such as a gas or liquid chromatograph and a computer, as shown in Exhibit 1 on this page. The cost of such systems is in the $70,000 - $100,000 range.

HP/Agilent's legacy MSD product had an on/off switch and a few status lights. Operators used a dedicated personal computer that was connected by a cable a few meters away for both complex tasks such as data acquisition and analysis and simple operations such as setting a temperature. The portfolio management team authorized a small project to revise the product. Two major project goals were:

- First, to replace the HP-IB interface, an interface standard proposed by HP in the late 1970s that is typically restricted to a few meters between devices, with a standard network interface for future expandability. This would allow the new MSD to be controlled by one or more PCs that could be located anywhere.
- Second, to add a local user interface to the MSD that would increase the amount of status information, allow a few parameters to be set locally, and initiate a few tasks.

Early in the project R&D developers selected a six-button, two-line panel for the control and status panel. It was incorporated into the industrial design of the product. Based on the characteristics of the control and status panel, R&D devised a schema of button labels, terminology, and navigation. The panel would

> **"This challenge [of last-minute change] can be particularly frustrating when there are no additional project resources available —and only one month of time."**

Exhibit 1: MSD System Sketch

network cable connections to a dedicated computer

Local User Interface, Status and Control Panel

Mass Spectrometer, MSD

Gas Chomatograph

Shown to comparative usability test participants

form the basis of a local user interface. This is termed Design A in this article.

The challenge

Characteristics of Design A, such as the consistency of terminology with other HP products, a common local interface button for both *Start* and *Stop* operations and a right-to-left flow of button operation, caused some people to express a concern about the potential usability of the design. But negatively commenting on Design A without proposing alternative solutions would not have resulted in changes. This user interface was described in a document nearly 100 pages in length but it was difficult to extrapolate the user experience from the text.

Given these challenges, there were several possible courses of action. One was simply to "fix the problem through documentation." In this choice, customers would have to be trained to adapt to possible usability problems with the new control and status panel.

Additional resources were not officially available to change the panel due to commitments to other projects. In addition, the R&D team believed that the interface was adequate. A delay in the schedule could not be tolerated. Because of the limited time available, working through a series of small modifications to the schema would not have been effective. Unless an alternate schema was shown to be significantly better, the user interface would not be changed.

Development professionals believed that unless customers and field representatives were delighted with the user interface (which was large portion of the new features for the upgrade), the potential success of the product launch would be reduced.

I was not a member of the core development team, but I became an invited, special guest for 30 days, to help find a practical solution to this problem. I worked on this project an hour or two a day for the next four weeks.

The first week

We took a fresh look at the control panels in one of HP's most successful printers: The HP LaserJet 4 series. This product allowed users to be observed *dynamically* interacting with common status messages such as "Ready" or "Out of Paper" and locating infrequently used submenus. We decided that this line of printers would serve as a model for the new MSD interface.

A virtual prototype was created that was based on the existing R&D documentation

Exhibit 2: Sample Control Panel Screens Created in Virtual Prototypes

Prototype A
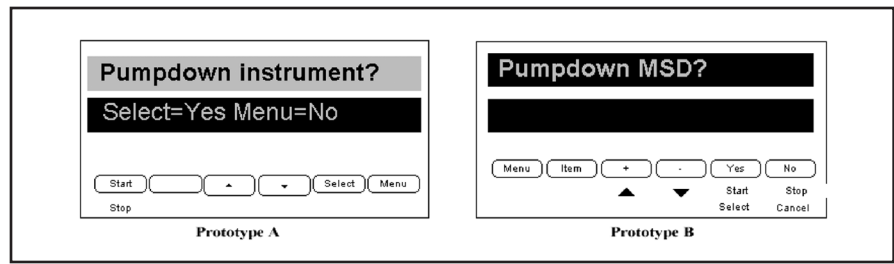
Prototype B

using Macromedia Director. Design A was transformed into a virtual instrument—Prototype A. This prototype would help us gain an appreciation of the dynamic interactions that a user might have with the control and status panel. It had limited functionality but it would save us usability testing time.

The user interface development deadline was confirmed at the core team meeting.

> This prototype … had limited functionality but it would save us usability testing time.

The second week

At the same time, we designed another version of the user interface—Prototype B. Its terminology which included button labels and status messages was reviewed and refined by marketing and field representatives. Several common MSD tasks were identified and supporting code was added to both prototypes.

We undertook preliminary operational testing using Prototypes A and B with approximately 10 participants. Each test took approximately 15 minutes. The results from these tests were used to prepare for the more formal testing. An unexpected result of the pre-tests was that we saw we needed to change some of the nomenclature required in the test documents.

Personas

At the same time, several "personas" were developed and reviewed by field representatives. A *persona* is a composite representation of the behaviors and workflow undertaken by the person who will use the device. Alan Cooper (www.cooper.com) popularized and refined the persona concept for new products. The persona can be used to guide the development team. Several relevant personal characteristics are assigned and the persona is given a name. Unlike demographic or ethnographic data, the persona can take on the attributes of a familiar acquaintance. The box on page10 shows what makes a good persona.

Here is a brief description of the *persona* created for this study which was named Orin—

Orin *operates several systems. Some are HP systems. This is the only MS system (MSD) in his facility with a Local User Interface (LUI). Most of the time, this MSD is functional and running samples. Orin is not an expert on the MSD hardware and doesn't want to be. Orin's attitude is 'If it is working, leave it alone. If there is a problem, I'll deal with it somehow.' Most people think of him as an instrument operator or chemist. Most often, the MSD is operated using a dedicated PC and proprietary software. On occasion, Orin may perform the following operations using the LUI: check MSD status (ready or not ready), start data acquisition, stop data acquisition, and initiate a vent cycle. Once or twice a year, there may be a need to troubleshoot a mass spectrometer leak. Orin has cleaned a mass spectrometer ion source several times. Other components of the system require maintenance more often than the mass spectrometer.*

Action—Weeks 3 and 4

Meanwhile, a test methodology was being formalized which included development of a usability test. It included provisions such as asking the test participant to sign a non-disclosure form if they were not an employee; the very scientific decision to flip a coin to determine which prototype will be tested first; and the decision to allow each user about 5-10 minutes to become familiar with the basic operation of the prototype.

There were two main tasks the user had to perform. We needed to measure the time required to complete the task and record user comments. Then, we would do the same for the second prototype. The two primary tasks were:

- *Task #1—Change a temperature setting.*
- *Task #2—Prepare the instrument for maintenance.*

Comparative usability tests were conducted with 14 employees from marketing, R&D, manufacturing, executive management, and field service. Each test required 20-30 minutes of the participant's time.

Fourth week

In addition, we conducted comparative usability tests with four customers. The results were presented at the core team meeting. The engineering documentation was revised for the Prototype B changes.

Preference results

Overall, users preferred using Prototype B. They described operations using Proto-

> ## More traditional usability testing …would have been too slow.

type B as more comfortable and intuitive. Users completed tasks faster and with fewer errors.

- The average time required to complete selected, common tasks was three times greater using Prototype A.
- The average number of errors made while performing selected tasks was two times greater using Prototype A.
- Of the 18 participants, 17 participants expressed a strong preference for Prototype B and one participant didn't have a preference.

Decision to switch

The decision to switch to Prototype B was made by the core team. Quantitative performance data from tests done with dynamic, virtual prototypes combined with the quotes from test participants provided an objective basis for the team decision.

The dynamic, virtual prototypes encouraged participation in usability tests by individuals who would normally avoid studying lengthy specification lists. Because the software prototypes could be modified quickly, they supported a Design:Build: Test:Iterate process.

Comparative, virtual usability testing revealed the preferred choice for the interface. More traditional usability testing (which typically includes observing participants, noting problem areas, and writing a report) would have been too slow.

Performance tests were conducted using the virtual prototypes several months before the physical components were available. Because the design was proven using virtual, dynamic prototypes, representatives from R&D, purchasing, and manufacturing had additional confidence when they began to order parts to build the actual prototypes.

The development of a *persona* guided the design of the user interface. Prototype B allowed users to quickly get status information and set parameters with confidence. The interface was based on an already successful design found in HP LaserJet 4 printers.

The drivers for this effort were to increase supportability, increase product desirability, and reduce warranty costs. It required an hour or two of my time each day for one month. Additional expenses were minimal. The disruption to other projects was minimal because participants in the comparative usability testing only committed 30 minutes of their time.

The current Agilent 5973 Network MSD features the interface that was developed and proven within a 30-day project. The project was conducted within the culturally accepted limits of the core team. No deadlines were extended. Disruptions were minimal. Data was objective and obtained from a respected, cross-functional population.

By including executive management representatives in the comparative usability testing, they recognized that this improved the new product development process. ◆

Mark A. Hart, now President of Pennsylvania-based OpLaunch (mark_hart@ oplaunch.com), was working at HP as a functional specialist in marketing when this upgrade was undertaken.

Footnote:

1. Hewlett-Packard Company was founded in 1939. In 1999, the portion of HP that focused on measurement was spun off as Agilent. The product described in this article was introduced as an HP product. It is sold now as an Agilent product.