FUSE Demonstrator Document

Application Experiment – 2212

Title Microelectronics in Cooker Hoods

Business Description W S Westin designs, manufactures and markets metal fabrications and appliances for the luxury domestic fireplace and kitchen sectors. Customers are architects, interior designers, and distributors of semi-professional cookers.

Electronic Technology **New:** Microcontroller **Previous:** None

Abstract

Microcontroller technology is used to give increased technical performance relating to user convenience, amenity, safety, energy saving and ease of installation.

Temperature is monitored to determine when the fan should be activated. Fan speed profiles are implemented to give a high initial extraction rate of steam, fumes and hot air. The speed is then reduced to achieve optimum hub temperature. At the end of hob usage the fan is kept running to extract fumes and odours for a preset time.

The new unit offers an increased range of user controls and audio visual alarm indicators which can be used to indicate when basic servicing of grease filters is needed and operating limits exceeded.

Westin employ 25 staff, none are electronic engineers.

The approved budget was 50KECUs, the duration 7 months and the payback period is 1 year. The return on investment is estimated to be seven-fold. The project started in December 1996 and finished in January 1998.

Benefits

- Company staff can now analyse the feasibility of future applications, evaluate and specify hardware, write application programs using ANSI C language, test systems using in-circuit-emulation, assemble microcontroller modules, and service/fault-find microcontroller systems.
- A comprehensive technical product database has been obtained.
- Management, design and technician staff are now trained in modern methods of control.

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1 COMPANY INFORMATION

1.1 Name and Address

W S Westin Ltd
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United Kingdom
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Contact John Reed

1.2 Company Size

Number of direct employees is 25
Number of Electronic Engineers is 0

1.3 Industry Sector

Mechanical Engineering and Fabricated Metal Products
ME, FM, EQ, EQ1, EQ3, EQ4

1.4 Business Description

W. S. Westin Ltd is a company with 25 employees which was established in 1921. The company undertakes the custom design and manufactures internally the cooker hoods for specialist applications with architects, interior designers and distributors of semi-professional cookers for non-standard and luxury market domestic kitchens.

W. S. Westin Ltd intends to continue operating in this niche market rather than in competition with high volume manufacturers.

1.5 Markets - kitchen products

The Kitchen Products Department supplies kitchen retailers, interior designers, architects and distributors of semi-professional cookers in the UK. There are plans to expand into the US market. The UK market for semi-professional cooker hoods is expected to grow by 30-50% p.a.

1.6 Projected improvement in competitive position

Westin is the market leader in the semi-professional domestic hood market with no serious competition for the following reasons:

- specialist craftsmen are trained and employed specifically in decorative metalwork.
- the workers, experienced in bespoke and small batch production, operate to high standards
- a purpose-built factory with high intensity optimised lighting is used for the manufacture of high quality decorative/domestic products.

Westin's established reputation is based on traditional methods of working and hand craftsmanship. The introduction of microelectronics will add a technological dimension to the Company's image, and will offer a product with more attractive features which appeal to the target buyer/specifier/user keeping Westin ahead of any emerging competition.

The following table summarises past, present and forecast sales of semi-professional cooker hoods in the UK. The predicted effect of the new microcontroller launch is shown for the period 1998 to 2001. The figures do not include the additional sales as a result of marketing efforts in USA.

Note: *Not all the products are the same price. The actual and projected sales are made up of a mixture of different product models and the mix may change from year to year.*

Justification for the increased sales are:

1. **More technically appealing to the user:** The product will have a more impressive technological appeal than the existing product e.g. LCD display console, automatic operation, etc.

2. **Enhanced technical and environmental performance:** The product is easier to use and has automatic energy-saving features.

Current Product	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/ 2000**	**2000/ 2001**
Turnover current product (kECU)	89	156	325	398	482	557
Variable cost (kECU)	53	94	195	239	289	335
Fixed cost (kECU)	35	62	129	141	153	171
Profit current product only (kECU)	1	1	1	18	40	51
Number of current products sold	150	223	465	570	690	798
Market share current product	80%	80%	80%	80%	80%	80%
Improved Product with Microcontroller						
Turnover including improved product (kECU)	N/a	N/a	N/a	450	648	777
Variable cost (kECU)	N/a	N/a	N/a	270	389	466
Fixed cost (kECU)	N/a	N/a	N/a	142	156	171
Profit current & improved product (kECU)	N/a	N/a	N/a	38	103	140
Number of products sold	N/a	N/a	N/a	630	880	1048
Market share improved product	N/a	N/a	N/a	85%	90%	90%
Increased profit of improved product (kECU)	N/a	N/a	N/a	20	63	89

1.7 Experience and Expertise

W S Westin Ltd was established in 1921 as mechanical and electrical engineers serving local industry in West Yorkshire - mainly textiles and light engineering.

The mechanical engineering side of the business has developed into a high quality decorative metalwork serving the domestic fireplace and kitchen sectors. The electrical engineering business is concerned with repairs/breakdown services to local industry.

Fireplace Products Department: This includes fire frames, canopies, frets and curbs/fenders. Most customers are fireplace retail outlets with business directed to the building industry.

Kitchen Products Department: This business developed in the 70's and 80's to provide bespoke cooker hoods. This later developed into the manufacture of standard 600 and 900 mm wide cooker hoods for the fitted kitchen market. Mass production of hoods at the end of the 80's, mainly in Italy, swamped the market with cheap, low margin products and Westin decided to concentrate its marketing strategy on the up-market, bespoke service based on its reputation for craftsmanship and personal service. This has proved successful and continues to be the favoured direction. The bespoke service has also diversified into other kitchen products such as stainless steel work surfaces, back splashes, cupboard doors and racking.

Electrical Engineering Department: This consists of an electrical repair/breakdown service to local industry. The range of services is being expanded to cover electrical, control and instrumentation engineering design and control panel assembly in which W. S. Westin are specialists.

This project relates to the development of a product for the Kitchen Products Department. The company had no previous experience in the design or application of microelectronics. The current Managing Director (Mr John C Reed) has experience in the design of control and instrumentation systems and project management in the industrial process control sector.

W.S. Westin will continue to subcontract microelectronic design work but support the manufacturing, testing and servicing as required by the expansion of business.

2 THE PRODUCT

2.1 Product Code

2971

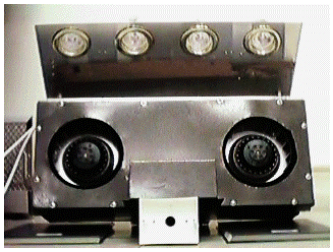
2.2 Existing Design

Westin cooker hoods are either custom-built or made in small batches of 5-10 units. A typical hood will comprise:

- hood shell which can be painted or clad in stainless steel
- fan box housing single or multiple fans
- stainless steel base plate on which is mounted the halogen spotlights, electrical controls and removable grease filter

The electrical control system is limited to manual open loop control of the fan speed using a triac. There is no dimming facility for the spot lights. Monitoring of the performance of the unit is limited to power on indication and a graduated rotary control setting for fan speed.

A picture of the fan hood is shown opposite.



2.3 Product Improvements

The objective of the experiment is to produce a cooker hood with increased technical performance relating to user convenience, amenity, safety, energy saving and ease of installation.

The component realised during the experiment is a control module for cooker extraction hoods which will monitor and automatically control the air environment in the vicinity of the cooker.

The main improvements over the current system are:

- ♦ reduced electrical power consumption due to better control
- ♦ a controlled environment in the kitchen
- ♦ minimal exhaust of warm air thereby providing savings in space heating costs
- ♦ reduced component count means greater reliability
- ♦ modular design will reduce assembly costs
- ♦ field programmable parameters will enable optimising of final performance on-site

2.4 The Improved Product

The new design is intended to be more economical in its operation. In its automatic mode the temperature is to be monitored to determine when the fan should be activated. Fan speed profiles are implemented to initially have a high extraction rate to clear the build-up of steam, fumes and hot air. The speed will then be reduced to achieve optimum temperature over the hob. At the end of hob usage the temperature will fall below a set threshold and the fan will be kept running to extract residual fumes and odours for a preset time before stopping.

The new unit offers an increased range of user controls (fan speed and lighting levels) and audio visual alarm indicators. These can be used to indicate when basic servicing of grease filters is required and when safe operating limits are exceeded, such as hood over-temperature conditions.

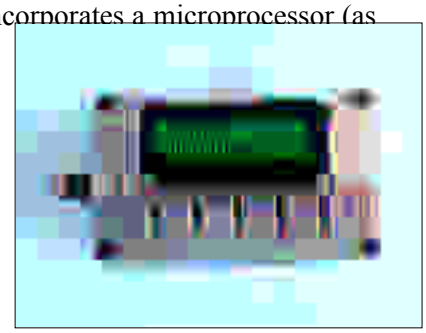
The block diagram and photographs shown below indicate the new system consisting of the functional modules:

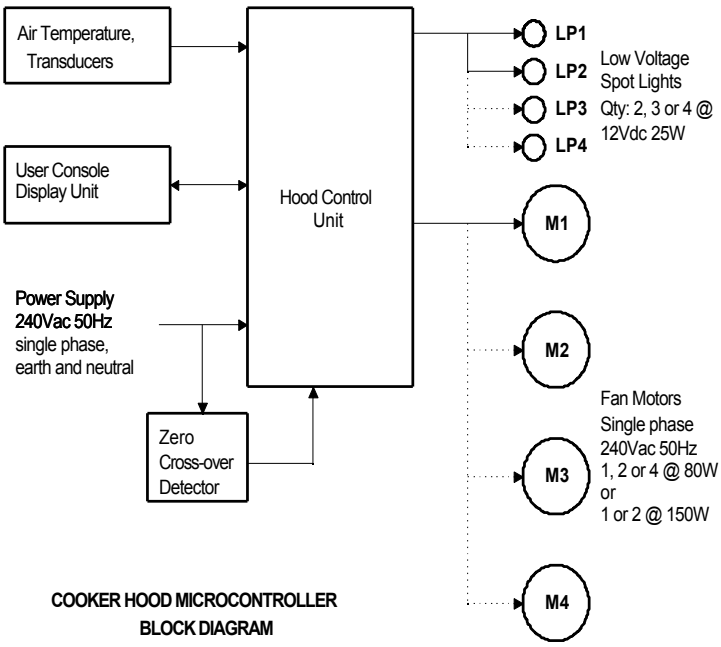
User Console Display Unit

This is the interface with the microcontroller driven cooker system. It allows the user to select the mode of operation, input manual commands and monitor the performance of the appliance using push buttons and an LCD display. The console will also allow the operator to enter installation set-up data. The console will be designed to fit into a wall-mounted enclosure adjacent to the cooking area. This module will incorporate a microprocessor which will handle the push-button inputs, display messages and communicate with the Hood Control Unit. Two microprocessor are used in the overall system they are the Texas Instruments TMS370C742AFNT operating from a supply of 5V at 20MHz with 8K bytes EPROM, 256bytes EEPROM, 256 bytes RAM and two timers on board.

Hood Control Unit

This unit will receive signals from the transducers and the User Console Display Unit, perform computations and control algorithms, provide status outputs to the console (via the serial link) and supply power output voltages to the lights and motors. This module incorporates a microprocessor (as above) and power electronic devices (triacs).





COOKER HOOD MICROCONTROLLER BLOCK DIAGRAM

3 CHOICES

3.1 Design Methodology and Technology

A microcontroller with one-time-programmable (OTP) memory was chosen for the following reasons:

- The anticipated production quantities will be about 1,000 units per year.
- there is a mix of microelectronics (for control) and power drive (for fan motors and lights)
- increasing the reliability of the hardware by reducing the component count.
- control software should be easily and cheaply developed and refined throughout the life cycle of the product
- A portion of the memory should be user programmable, using non volatile memory (EEPROM), in order to customise the appliance during site commissioning e.g. maximum/minimum extraction rates, correlation of fan speed to extraction rate to take account of pressure drop in the exhaust ducting, temperature set points, etc.

Memory has been implemented using Field Programmable devices. The control programme was written using 'C' and tested using In Circuit Emulation (ICE) during the development phase.

3.2 Choice of Evaluation Route

Test Rig

The test rig was built and installed at Westin's factory for preliminary research to quantify the performance needs and to evaluate the system performance against the Functional Specification.

Design, Development & Testing

The use of In Circuit Emulation (ICE) enabled the two types of microcontroller modules, User Console Display Unit and Hood Control Unit, to be bench tested and evaluated against the Functional Specification prior to testing the assembled system.

System Evaluation

After completion of the bench testing, the prototype modules will be installed in the test rig. The fully integrated system of microcontroller, power supplies, fan motors and lamps will then be rigorously tested in four representative hood configurations.

Choice of Fabrication Technology

The number of units to be produced annually did not merit consideration of ASIC technology for fabrication. The units will use microcontrollers using through-mount PCBs.

The PCB contains discrete and standard integrated circuits and was designed using EDWIN CAD.

It is planned to sub-contract the module assembly.

3.3 Tools

The hardware utilised in the project was the Texas Instruments 370 Series Microcontroller (TMS370C742) device.

The CDT 370 development kit was used for the development and design, the cost for purchase was about 1200ECUs and provided:

- **A 'C' Compiler for programme design, and**
- **An InCircuit Emulator (ICE) for verification,**

We assess these tools as some of the best available which were very good, easy to use, efficient and cost effective. After the initial learning curve our experience has been that the use of this ICE considerably reduces the development time over other lower cost ICE products. The software was found to be robust and never crashed.

- **A PCB design suite.**

Edwin design was used at a cost of 1500ECUs for the upgrade version with a 700ECUs annual maintenance cost. The agreement reached was that up to 12 PCBs p.a. could be designed within this agreed educational price. This had a long learning curve and libraries were developed over the period of use. It is extremely useful to know that is that the product is supported on the Internet.

3.4 Barriers

The choices made during the course of the Application Experiment were influenced by the barriers initially perceived:

Knowledge Barriers

The present owners acquired the company in 1993 at a time when markets were shrinking and the incumbent management were nearing retirement. The new management introduced a new ethos into the Company. This, together with the previously untapped enthusiasm of the work force led to a rapid expansion of markets for existing products, particularly in the domestic kitchen sector.

- The Microelectronic knowledge base of the Company was minimal.
- Potential new products and technologies were investigated.

While attending a local seminar, contact was made with Bolton Institute, this led to Westin's successful application for funding under the FUSE programme.

Technical Risks

The technical risk is that the company would choose and to adopt a new technology without adequate training and support. This could result in the launch of a badly engineered product or service or worse still no product.

With no support or advice Westin could have adopted an incorrect or inappropriate technology.

FUSE provided the ability to apply an appropriate new technology in a virtually risk free manner, with highly skilled support, both from the TTN and potential suppliers of components and services.

The skilled support and training overcame the technical risks, the message being – "do not try it on your own without some advice and support".

Commercial Risks

The commercial risk is primarily the damage that could be done to the reputation of the business as a direct consequence of the technical risks.

Commercially the company had no choice other than to forgo the income earning potential of staff whilst they are undergoing training. FUSE funding covered the costs of the staff during training.

An important commercial risk for an SME is that while staff are being trained they do not contribute to the income of the company.

The economic benefits, in business and new orders already obtained, the value of investing in new skills has been clearly demonstrated. Without the support of the FUSE programme Westin would, in time, have undertaken a training programme, but it would have taken far longer to complete.

Lack of Resources

Westin is a small company that has to use its staff productively. No "slack" is available to undertake investment-type projects such as developing new products. The FUSE programme allowed Westin to have a virtually risk-free "trial run" which greatly increases the probability of success in future projects.

- Sources of expertise are identified to supplement the direct labour force during projects.
- Management confidence is increased through accurate planning of future projects.
- Valuable partnerships are established for future use, e.g. TTN, suppliers and service providers.

Steps to Overcome Barriers

The knowledge barriers were overcome using the help of a local business support organisation who introduced the company to the TTN staff. The initial contact was at a seminar which was followed be an intensive period of joint working between TTN staff and company staff in order to produce a feasibility study. The potential new product and technologies were investigated and the feasibility study was successfully submitted to the FUSE programme for funding as an Application Experiment.

The technical risks were overcome by establishing a close working partnership with our subcontractor.

FUSE provided the ability to apply an appropriate new technology in a virtually risk free manner, with highly skilled support, both from the TTN and potential suppliers of components and services.

The skilled support and training overcame the technical risks, the message being do not try it on your own without some advice and support.

4 WORK PROGRAMME

4.1 Rationale

The overall workplan management was the responsibility of W.S.Westin Ltd who also provided the detailed functional specification and closely followed the technical and test specification through the stages of design, development and prototype testing.

The microelectronic design and development was subcontracted but continuously monitored by the first user who received training in elements of microelectronic management procedures and relevant programming principles. The subcontractor worked closely with the first user throughout the project and contributed to the iterative development of the product as necessary.

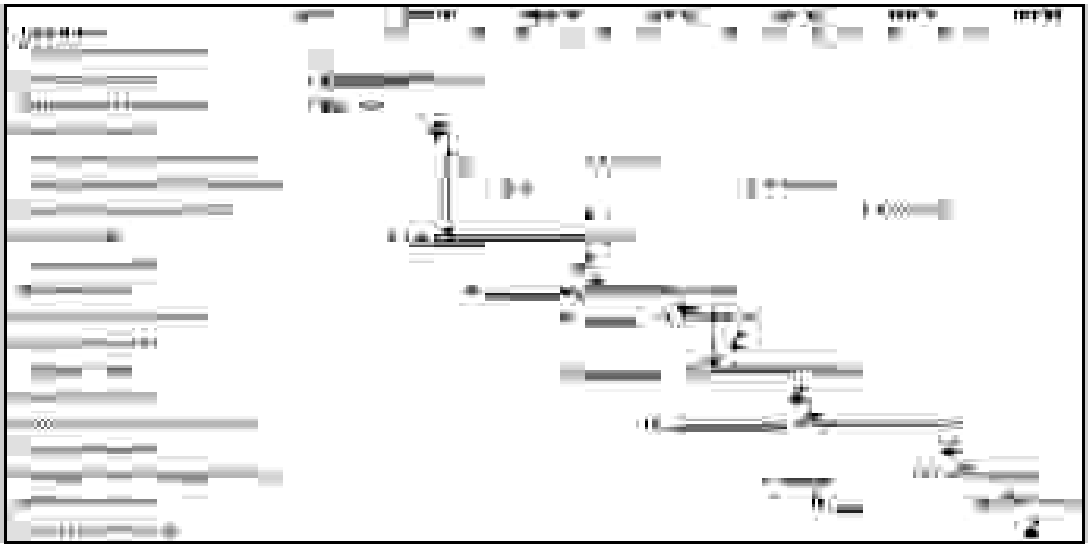
Evaluation and field testing was the responsibility of the first user.

4.2 Workplan

The following workplan indicates the schedule planned in the original Technical Annex and approved by the Commission before the start of the Application Experiment.

		Planned Man Days			**Actual Man days**		
		Westin	Subcont		Westin	Subcont	
4.1.1 Management	Plan, Manage	7 days	0	1	5.5		
	Report,	7 days	0		3.5	0	
	Dissemination,	20 days	0		16	3	
	Total	**34 days**		0	**25**		**4**
4.1.2 Specification	Functional	6 days		2	8		2
	System	5 days	2		7	2	
	Technical	4 days	3		8	2	
	Total	**15 days**		**7**	**23**		**6**
4.1.3 Training	Management	1 days	1		1	1	
	Design	18 days	9		12	6	
	Evaluation	5 days	5		6	3	
	Total	**24 days**		**15**	**19**		**10**
4.1.4 Design	System	4 days		13	13		24
	Subsystem	6 days	22		23	36	
	Total	**10 days**		**35**	**36**		**60**
4.1.5 Evaluation	Prototype Production	5 days	5		5	5	
	Test Rig	5 days	0		4	0	
	Functional Test	3 days	4		4	3	
	Prototype Test	4 days	4		3	4	
	Field Test	10 days	0		8	0	
	Total	**27 days**		**13**	**24**		**12**
	First User Effort	**110 days**					**127 days**

Subcontractor Effort(Man days) **70 days** **92 days**



4.3 Project Costs

The Application Experiment had an approved budget of 50 kECUs which included an initial up-front payment of 12.0 kECUs (25%). The initial payment was made on 15 January 1997.

The predicted costs for the duration of the experiment were planned and scheduled as shown in the information given in section 4 under workplan and includes all aspects of the work.

Cost statements and progress reports were submitted each month.

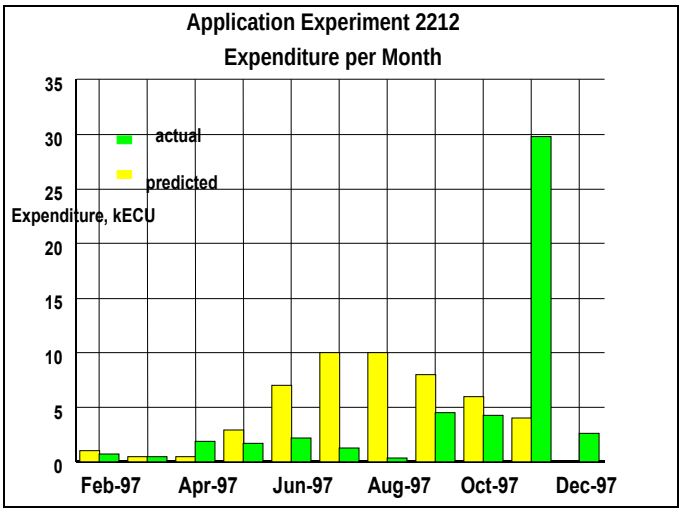
The attached chart indicates:

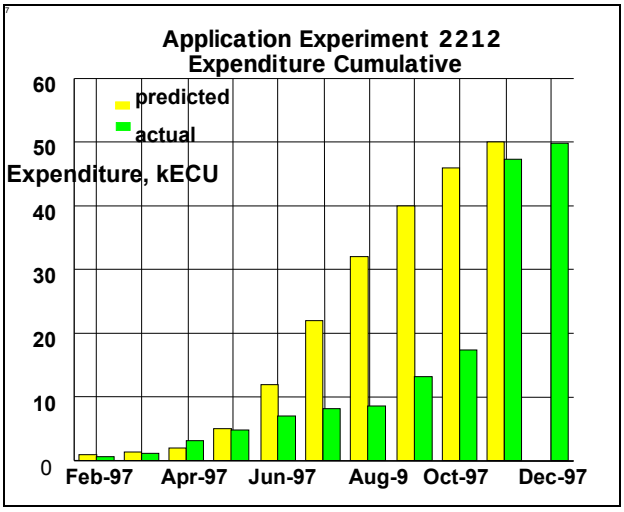
1. The predicted and actual monthly expenditure
2. The predicted and actual cumulative expenditure

It can be seen that actual expenditure is shifted more towards the end of the project than was predicted. This was due to the following:

· the slippage in the programme (see Section 5) caused the high value design and testing activities concentrated in the last third of the project

· the actual expenditure figures are based on invoiced values and therefore do not accurately reflect when the expense was incurred.





4.4 Product Costs

The predicted and actual product costs were:

Predicted costs in submission:	**117 ECU**
Actual costs:	**120 ECU**

Although the market is not very price sensitive, the accuracy of the out-turn costs has had significant benefits:

- existing customers, impressed by the technical performance but had reservations about its commercial viability, are now enthusiastic about its market potential.

- the result confirmed to Westin management that using microelectronics is commercially feasible even for relatively small volumes (less than 1,000 units p.a.)

4.5 Subcontractor Information

Bolton Institute Technology Development Unit is part of the Institute of Higher Education and has been set up to develop Microelectronic Applications support for industrial research, development and technology transfer specialising in new materials, manufacturing processes and product development. The unit was formed in 1992 and is currently (1997) managing in excess of 3 million ECUs of research and development contracts mostly in UK.

They provide independent and impartial advice and solutions to companies on a cost effective basis by providing access to a highly qualified multi-disciplined technological-commercial team of expertise. The unit also provides access to public (i.e. DTI and EC) finance and specialise in training. They can manage projects from feasibility through to the design and prototype stage.

4.5.1 Role in the Application Experiment

Bolton Institute TDU provided both management and technical expertise for the project. Specifically they assisted Westin Ltd in the evaluation of a range CAD tools available.

After the selection they provided training in use of 'C', with particular emphasis on 'Good Design Practice'. They also provided the technical input for the component design. Particular emphasis was placed on how to mix different technologies.

4.5.2 Subcontractor contribution

The Bolton Institute TDU, Microelectronics Design Centre, was responsible for the design of the microelectronic components of this Application Experiment.

The TDU provided and produced:

- Checking/commenting on the initial Westin functional specification.
- Detailed System and Technical Specifications.
- Design and procurement of the microelectronic hardware.
- Microelectronic System and Circuit Design and implementation to prototype.
- PCB circuit details using EDWIN CAD system.
- Printed Circuit Board (PCB) layouts for manufacture by Lyncolec Ltd.
- Software design and implementation for the microelectronics.
- Prototype assembly.
- System documentation, for presentation to Westin including:
    - Functional, system and technical specifications.
    - Circuit diagrams.

- Sample boards fully populated and working to the agreed specifications.
- Design notes.
- Software listings and disk containing source and compiled code.

The TDU Microelectronics provided the training course in addition to working with the staff of Westin during the specification and design phases of the Application Experiment. The following courses were delivered to three Westin staff (Mr John C Reed and two electrical technicians, Mr D Broadbent and Mr Robert Crawshaw):

Introduction to microcontrollers, managing and specifying microcontroller projects.

ANSI 'C' course.

ANSI 'C' on microcontrollers.

4.5.3 Westin Ltd Contribution

Throughout the project the major contribution by Westin Ltd was:

- Management of the project,
- Initial planning of tasks and deliverables, producing monthly reports including budget and cost statements.
- The functional specification was developed by Westin using their experience, customer contacts and market requirements. The test specification was developed by Westin.
- Training was undertaken by Westin in the management of microcontrollers and 'C' for use with microcontrollers in order to provide knowledge, experience and insight into the new technology.
- Evaluation of the product was the responsibility of Westin Ltd. A prototype was evaluated using test schedules written by Westin.

5 RESULTS

5.1 Monitoring

The original submission in December 1995 planned the Application Experiment to start in March 1996 and finish in December 1996. The actual start date was February 1997. This delay pushed the project into a period of rapid expansion at Westin which meant that staff originally allocated to the project were not available. Additional work was diverted to the Project Manager/Engineer (John Reed) and the programme slipped.

The Gantt chart shows the original baseline plan and actual outcome. The rationale behind the original plan was based on the following key activities:

Preliminary Investigation

It was imperative that the performance of the existing cooker hoods was accurately evaluated so that key parameters for the design of the new controller could be established. Evaluation of the sensors used to monitor the environment in the vicinity of the cooker was investigated in detail. This activity overran due to unexpected problems testing the infrared fume sensors.

System Design

The requirement specification was written by the Westin design engineer using data compiled in the preliminary Research phase. Bolton Institute engineers checked and suggested amendments to this specification which delayed the start of the next phase.

Hardware & Software Design

The hardware design was undertaken by the subcontractor and prototype assembly was completed to schedule. Changes were made to the initial design to enhance the product functionality and performance.

Prototype Evaluation & Bench Testing

Using test schedules previously written by Westin, this phase of the programme was finished by Christmas 1997. At this stage the overall programme delay was 10 weeks.

Prototype Evaluation & Testing on Test Rig

This stage was completed within schedule by the end of January 1998.

5.2 Lessons Learned

1. The calibre of staff currently employed by Westin have neither the necessary technical qualifications nor the experience to undertake sophisticated microelectronic design projects. It is unlikely that Westin will be in a position to employ full-time engineering design staff in the foreseeable future. Engineering and design aspects of any future projects will be sub-contracted.

2. The decision to use subcontractors should be taken at an early stage if there is any possibility of directly employed staff being diverted from the project by other business demands.

3. Formal project planning, management and control has been shown to work, and will be applied in future to other similar contracts.

4. Adequate time and resources should be allocated for preliminary testing of technology not used before. This lesson would have applied to the evaluation of the Westin environmental sensors.

5. Time spent compiling accurate specifications and controlling revisions bears dividends later in the smooth execution of the design and assembly stages of the project.

6. External advice and expertise (e.g. a TTN) is essential if an SME wishes to expand into a new technology.

7. Scepticism by Westin management and customers regarding the commercial viability of the product in the 1,000-off per annum volumes envisaged at the start of the project was dispelled by the accuracy of the out-turn costs of the product.

5.3 Knowledge Acquired

1. Westin management, which already had project management skills acquired in the industrial process control sector, has extended these skills to the management of microelectronic development projects.

2. A network of suppliers of expertise in project management, specification, design, testing and assembly of microelectronic products has been established for use in future projects.

3. Westin technician grades have benefited from the technical training given under the FUSE programme, they now understand the technology incorporated in the new product and are capable of performing testing, installation set-up and fault-finding.

4. Westin management have gained confidence in the application of microelectronics, in particular:

   - there is a greater appreciation of the benefits of using microelectronics.
   - a more imaginative perception of the potential for new products due to the power and flexibility of microelectronic devices.
   - the use of microelectronics is now a key component in planning new products.
   - During the initial stages of the project it was necessary to evaluate the extraction performance of the existing hoods to gain data essential for the design of the new controller. This testing and evaluation has resulted in the compilation of a comprehensive database on the technical performance of the Company's products. This benefit was not foreseen at the start of the project. Future product design will be influenced and improved as a result of this knowledge base.

5.4 Resulting Product

The new product has a considerably improved technical performance and flexible for the requirements of the custom market. It has a higher cost than the existing product but has added value and a higher profit margin.

Additionally the following features are available with the new design:

- In automatic mode the temperature is monitored and the fan activated as required.
- An increased range of user controls and audio and visual alarm indicators.
- Fan control combinations and speed profiles are implemented to allow high extraction rates to rapidly clear the environmental build-up of steam, fumes and hot air.
- The new design uses less power due to better control.
- Automatic indication of servicing and operating limits.

The new features allow future flexibility and design security.

5.5 Industrialisation

The new product is now available in prototype quantities and continuous in-house and field testing with customers leading to product confidence and performance refinement. The plan to bring the product to market is indicated below.

The plan to bring the product to market is as follows:

Item	Activity	J	F	M	A	M	J	J	A	S	O	N	D
1	Product in-house testing	X	X	X	X								
2	Marketing Campaign, Brochures					X	X	X	X				
3	Approval by independent laboratory									X			
4	Final design agreed										X		
5	Assemble trial batch											X	
6	Assemble first production batch												X
7	Ship first batch												X

An agreement has been concluded with a major customer for access to the product for the first six months following market launch in return for marketing the product through their network of distributors.

5.6 Internal replication

The company is in discussion with customers relating to two new products that will incorporate microelectronics and directly use the experience and skills gained from this FUSE project.

5.7 Economic Impact

As indicated earlier the product being developed is specifically customised and broad figures of costs can only be approximated. Not all the products are the same price and actual and projected sales are a mixture of different product models which change from year to year.

The table presented on earlier indicates an increase in product price of 2% and a market share of 5% with an increased profit of 20%.

These factors are due entirely to the added value of the product with a more impressive technical appeal including an LCD display console, automatic operation and economical operation.

The anticipated seven-fold return on investment and payback period of 12 months together with the anticipated increase in turnover quoted earlier and bigger market share fully justify the project.

W. S. Westin are already embarking on further enhancing their range of products by incorporating microelectronics in two new products.

6 DISSEMINATION

6.1 Documents Available

The following public relations activities have resulted during and since the completion of the Application Experiment:

- Presentation given at seminar at Sheffield Science & Technology Park 1 October 1997: *"Six Examples of Company Projects funded by FUSE"*.

- A Flyer has been produced which highlights the product and the involvement of Westin in the FUSE programme.

- The company is willing to participate in certain dissemination activities in the period following the AE completion, in order to help achieve the necessary replication effect.

6.2 Target Audience

The target audience for FUSE information are SME's with products that do not use electronic components for the luxury domestic and semi-professional markets.

- Specifically small companies with no electronic expertise who are predominantly mechanical manufacturing establishments who use electrical components as part of their product, e.g. lamps, switches, motors with their associated interconnection wiring.
- Small companies addressing custom markets.
- Companies needing subcontractor expertise to implement microcontroller designs.

The results of this Application Experiment are generic and can be applied to a wide variety of products and types of company.

6.3 Replication

Westin have concluded an agreement with a major customer to give them exclusive access to the product for the first 6 months following market launch. In return the customer will market the product through its network of distributors. This has given Westin a controlled and predictable introduction of the new product into the market place.

The Company is currently in discussion with customers relating to two new products that will incorporate microelectronics.

- An additional version of the product is currently being developed to allow access to a market which requires reduced specification and appropriate lower cost.

7 CONCLUSIONS

7.1 FUSE Programme

The FUSE programme overran by 11 weeks. This was due mainly to:

- longer than anticipated preliminary testing and evaluation
- over commitment by key Westin staff

The experience and knowledge gained during the Application Experiment will mean that both problems would be anticipated and would not be repeated.

7.2 Product – Industrialisation/ Internal replication

The primary new end product produced during the project is a control module for cooker extraction hoods. The module monitors and automatically controls the atmospheric environment in the vicinity of the cooker. The product is being augmented by an additional lower specification, lower cost product for the price sensitive market sector.

7.3 Company Personnel

The Managing Director, John Reed, has supplemented his engineering and management skills gained in the industrial control sector with similar skills pertaining to microelectronics projects.

The technicians, David Broadbent and Richard Crawshaw, understand the technology used in the new product and are now capable of performing testing, installation set-up and fault finding.

Microelectronics is a key component of planning for new products.

Future microelectronic projects would be subcontracted because Westin staff do not have either the required technical qualifications nor experience.

7.4 Profits Forecast

The new product costs are slightly greater than those of the existing product. However, increased profits are forecast due to increased sales. Justification for increased sales are:

- The product is now much more technically appealing to the customer.
- The product is easier to use than the existing one.
- The product has value added. e.g.energy-saving features.

As mentioned earlier an additional product is being developed for the more cost conscious market sector.

8 SUMMARY

- This is an innovative product with clear added values.
- Lessons learned will enhance the experience of the company and are being used to replicate.
- Westin will not, at present, undertake new projects in-house without the help of subcontractors.

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