SMALLTALK DESKTOP COMPUTER

PROPOSAL

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Introduction

- This is a proposal for a Tektronix desktop computer which exploits the Smalltalk programming system.

- The proposed development strategy emphasizes minimal investment and fast time-to-market. This will be accomplished by using software developed within Applied Research and components from Unicorn terminal products.

- This product provides the basis for a unique family of technically-oriented desktop computers.

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What is Smalltalk?

- Smalltalk is a programming system designed at Xerox PARC to support highly interactive graphic applications in a workstation environment.

- Smalltalk is based on a simple and integrated set of design principles that extend from the fundamental structure of the language all the way to the user interface.

- The Smalltalk language is comparable in expressive power to Lisp and other languages used for artificial intelligence applications.

- Smalltalk has an inherently graphic user interface which combines text and pictures in multiple display windows. Both Apple Lisa and Xerox Star are modeled on Smalltalk.

- Smalltalk-80 is the current version of Smalltalk. It includes both the language and an integrated programming environment.

- Smalltalk is currently only available on the Xerox 1100, a $50,000 workstation.

Smalltalk and Tektronix

- Tektronix has been working with Smalltalk since July 1980 as part of an evaluation effort cooperative with Xerox. H-P, DEC and Apple also participated in this effort.

- Tektronix, H-P, DEC and Apple have licenses to sell Smalltalk in products without paying royalties to Xerox. Licenses are not currently available to other companies.

- Tektronix has developed implementation techniques for Smalltalk which enable it to run significantly faster on a 68000 processor than on the Xerox 1100. H-P, DEC and Apple have not achieved comparable results.

- Xerox and Tektronix are clearly the technological leaders with Smalltalk implementations.

Product Overview

The entry product is a Smalltalk desktop computer priced at less than $10,000.

Key features include:

- A complete implementation of the Smalltalk-80 programming system.

- High-performance processor with one million bytes of memory.

- Monochrome bit-mapped graphics display.

- Full keyboard and a mouse pointing device.

- Local mass storage on floppy and hard disks.

- Communications to host computers and peripheral devices.

- CP/M compatibility for access to external software sources.

- Selected technically-oriented applications.

Product Strategy

The strategy for the proposed product emphasizes:

- Fast time-to-market.

- Low development costs.

- Product differentiation through innovative software.

Fast time-to-market and low development costs will be achieved by minimizing new developments and by utilizing key individuals in the effort. Many components will by shared with IDD products and new hardware will be based on simple, but powerful hardware architectures.

Product differentiation will be obtained by exploiting software developed within Applied Research. Smalltalk and highly interactive, graphical applications for the engineering and scientific community could result in attention comparable to that afforded the Apple Lisa.

Product Description

The entry product includes:

- Unicorn 4105 enclosures, power supply, keyboard and miscellaneous mechanical parts (cables, connectors, etc.).

- Processor board with MC68000 processor, 1 Mbyte of memory and display interface for medium resolution monochrome bitmap display.

- Communications board with keyboard, host, hardcopy and peripheral interfaces.

- A 15″ black/white monitor (made by Panasonic, the vendor for Unicorn monitors).

- A mouse pointing device (made by Xerox, Summagraphics, and other vendors).

- IDD 4926 mass storage product with 10 Mbyte Winchester and floppy disk.

- A complete implementation of Smalltalk-80 containing over half a million bytes of object code.

- CP/M-68K operating system and utilities.

- Selected applications including terminal emulation, word processing, and presentation graphics.

Applications Software

An initial set of applications packages should be available at introduction. These applications will provide basic support for technical users and the framework for future software products. The initial application set should include:

- Terminal Emulation - This package will allow the Smalltalk Desktop to be used as a terminal with a remote host computer and with applications designed to run on ANSI terminals.

- Word Processing - This package will provide a basic, technically-oriented document preparation facility. The package should allow for the inclusion of pictorical and graphic information within documents.

- Presentation Graphics - This package will allow the preparation of various graphs and charts from tabular data.

Follow-on development should result in a full range of applications packages oriented to technical users. These should include applications such as Statistical Analysis, Design and Drafting, Project Management, and Electronic Mail.

Third-party applications developed to run under CP/M-68K should be supported. This should be provided within the Smalltalk environment.

Product Cost and Price

- Manufacturing cost estimates have been made by consulting with product managers in the Unicorn and mass storage groups.

- The manufacturing cost for the entry product is estimated at $3380 for 3Q FY400. By 1Q FY500, lower component costs (particularly memory) will reduce manufacturing cost to approximately $3215.

- A large portion of the entry product cost is for purchased components. The monitor, keyboard, mouse and disks total approximately $1300. Memory component costs total $660 (assuming 144 64K RAMs at $4.60 each).

- The price goal for this product is $10,000. In 3Q FY400, this results in a price/cost ratio of about 3.0. By 1Q FY500 the price/cost ratio should improve to 3.1.

Manufacturing Cost Analysis

	3Q FY400	1Q FY500
Enclosure	$ 90	$ 90
Monitor	200	180
Processor Board	950	860
I/O Board	240	210
Power Supply	117	117
Keyboard	105	100
Mouse	100	80
Miscellaneous	33	33
CP/M-68K License	10	10
Documentation	20	20
Final Assembly	20	20
Subtotal	$ 1885	$ 1720
4926, Option X	1495	1495
Total	$ 3380	$ 3215

- The processor board has one million bytes of parity-checked memory. The board will cost approximately $950 if 64K RAMs at the current price of $4.60 a piece are used. If 64Kx4 SIP RAMs at $30 a piece must be used to save board space then the cost will be about $1350. The estimate for 1Q FY500 projects availability of 64K RAMs at $4 a piece or of 256K RAMs at $16 a piece.

- The manufacturing cost of the 4926, option X is estimated by adding $1200 (the cost of the 4926 with only a Winchester disk), $170 for a 5 1/4" half-height floppy disk, and $125 for a floppy disk controller. A similar configuration is planned as the 4926, option 25 which will include two floppy disks; however, only a single floppy is needed for this application.

- The miscellaneous parts include connectors, connector plate, cables, and mechanical fasteners.

Product Family

It is vital in planning any product to ensure that paths exist for future growth in performance and applications. The family of Smalltalk desktop computers can be extended in three ways:

- Options - Hardware options may provide memory expansion, mass storage, Ethernet, MDP HSI interface, and GPIB instrument control. Software options will address a wide range of engineering and scientific applications.

- New products - The family can be extended both in capability and value. The second product may be a color version of the entry product (using the monitor from the Unicorn 4107 terminal) with a price goal of under $12,000. A reduced-cost version of the first product may also be done using packaging proposed for a Unicorn terminal with integrated programability.

- New markets - A variety of application markets may be addressed with different product configurations. For example, the products may be configured as bit-mapped graphics terminals (similar to the BBN BitGraph terminal), and as workstations which run MDP software development tools.

FAMILY WITH ROOM FOR PERFORMANCE AND VALUE GROWTH

PRODUCT	DESCRIPTION	RELATIONSHIP WITH IDD PRODUCTS
1	MR MONOCHROME, SEPARATE DISKS	UNICORN 4105 COMPONENTS, 4926
2	MR COLOR, SEPARATE DISKS	UNICORN 4107 COMPONENTS, 4926
3	HR MONOCHROME, SEPARATE DISKS	UNICORN 4109 COMPONENTS, 4926
4	MR MONOCHROME, INTEGRATED DISKS	UNICORN/INTEGRATED PROGRAMABILITY
5	MR COLOR, INTEGRATED DISKS	UNICORN/INTEGRATED PROGRAMABILITY
6	HR MONOCHROME, INTEGRATED DISKS	UNICORN/INTEGRATED PROGRAMABILITY
7	LCCS COLOR	LCCS UNICORN
8	HIGH PERFORMANCE SMALLTALK	
9	PORTABLE BASED ON EL PANELS	PORTABLE UNICORN?

COST

PERFORMANCE
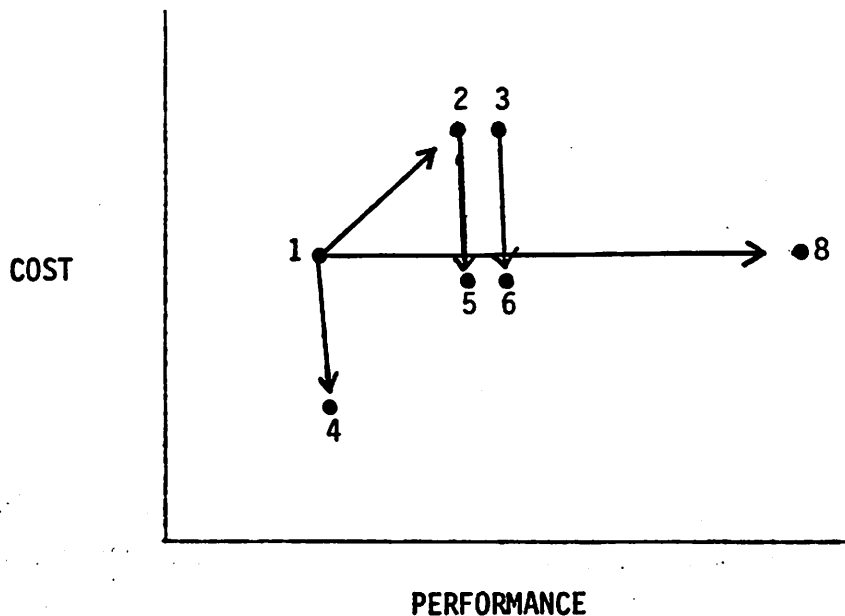
FAMILY OF APPLICATION DOMAINS

	MC68000 PROCESSOR	1 MBYTE MEMORY	RS-232, HARD COPY, ETC.	BITMAP DISPLAY	WINCHESTER DISK	FLOPPY DISK	SMALLTALK	CP/M – 68K	STANDALONE WINDOW MGMT.	4050 BASIC	GPIB	4041 BASIC	ETHERNET + PROTOCOLS	CRL PROGRAMMING ENVIRONMENT	MDP HSI	MDP TOOLS	UNIX OPERATING SYSTEM
SMALLTALK DESKTOP COMPUTER	●	●	●	●	●	●	●	●									
LOW COST ENGINEERING DESKTOP COMPUTER	●	1/4	●	●		●		●	●								
WINDOW-ORIENTED TERMINAL	●	1/4	●	●					●								
4050 LOW-END FOLLOW-ON	●	1/4	●	●		●		●	●	●							
4050 HIGH-END FOLLOW-ON	●	●	●	●	●	●	●	●		●							
INSTRUMENT CONTROLLER	●	1/4	●	●		●		●	●		●	●					
MDP PROGRAMMING ENVIRONMENT TERMINAL	●	●	●	●					●				●	●			
NETWORK WINDOW-ORIENTED TERMINAL	●	1/2	●	●					●				●				
NETWORK SMALLTALK DESKTOP COMPUTER	●	●	●	●			●	●					●				
MDP LOW-END WORKSTATION	●	1/4	●	●		●		●	●						●	●	
MDP HIGH-END WORKSTATION	●	●	●	●	●	●	●	●						●	●	●	
UNIX-BASED WORKSTATION	●	●	●	●	●	●			●								●

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Market Description

The market for Smalltalk desktop computers includes:

- System developers who desire to explore the new concepts in the Smalltalk language and user environment.

- Applications developers who need the power of the Smalltalk programming system to build the next generation of sophisticated application environments.

- Technically-oriented end-users who want to use the Smalltalk integrated program development environment to meet their personal programming needs.

- End-users who want a personal computer to run applications with the highly interactive, graphical user interfaces made possible by Smalltalk. This is essentially the market for professional personal computers.

Market Dynamics

The market for personal computers is growing rapidly:

- The worldwide value of personal computer shipments is projected to grow from \$4.8B in 1982 to \$21.6B in 1987. (Future Computing, Inc.)

- The number of units is projected to grow from 1M in 1982 to 4M in 1986. (International Data Corp.)

- The business/professional submarket is the largest subsegment of the market. In 1986, it is expected to account for 50-60% of units (2-2.4M) and 70-80% of dollar value (\$12-14B) in the total market.

- In 1986, the scientific application subsegment of the market is expected to account for 5-15% of units (.2-.6M) and 10-25% of dollar value (\$1.8-4.5B) in the total market.

Market Strategy

- The development of the proposed products is technology-driven. The software technologies in the Smalltalk programming system and the applications to be built with it are the key to differentiating the products from other personal computers. Since these technologies are not yet commonly available most of the potential customers are unfamiliar with them. Successful marketing of this product will require the development of customer appreciation for these technologies.

- The initial marketing strategy should emphasize sales to the innovative system and application designers and technically-oriented end-users in industry, government and university R&D groups. Many of these people will already have some awareness of Smalltalk and its potential advantages to them. They are the trend setters and can be expected to produce application packages which will broaden the appeal of Smalltalk products.

- After a market is established among innovators then the strategy should be expanded to address specific subsegments of the personal computer market.

Market Potential

- Product requirements and marketing efforts for the Smalltalk desktop computer probably would be focussed on the scientific application subsegment of the personal computer market. Some additional sales may occur in the educational and business/professional submarkets.

- The Tektronix 4050 series graphics desktop computers also addressed the scientific submarket. Through 1981, Tektronix had approximately 6-8% of the units and 9-10% of the dollar value in it.

- The successful marketing of the Smalltalk desktop computer could achieve a similar market share. Assuming 6% of unit volume, 9% of dollar value, and using minimum estimates of the scientific submarket size, this could result in FY700 sales of 12,000 units with a dollar value of over $160M.

Development Tasks

- Hardware development needed for the entry product includes design of two circuit boards, qualification of a monochrome monitor, and qualification of a mouse pointing device.

- Software development includes the integration of the CRL Smalltalk implementation and CP/M-68K with the hardware, enhancement of the Xerox Smalltalk-80 system, design of selected applications, and development of diagnostic programs.

- User's manuals, service manuals and other standard Tek documentation must be prepared. Smalltalk documentation will be available in part from Addison-Wesley; tutorials and implementation-specific documentation must still be written. Manuals for CP/M-68K are available from Digital Research.

- Other tasks include preparation of marketing strategies, coordination with Unicorn and mass storage engineering groups, and development of manufacturing, service and sales plans.

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Development Resources

- A staff of around fourteen will be required to develop the entry product. This includes product management, marketing, hardware and software engineering, and documentation.

- Resources shared with existing product groups include mechanical engineering (Unicorn group), peripherals engineering (IDD mass storage group), ECB design and prototyping, reliability engineering, and manufacturing engineering.

- Other required resources include computer support (four Magnolias, access to a VAX), instrumentation, hardware prototype expenses, and facilities for the staff.

Development Schedule

● The schedule objective is customer availability of the entry product early in 3Q FY400.

● Approximate intermediate goals for meeting this objective include approval of the proposal in period 312, completion of the hardware design in 403, release of the hardware design to manufacturing in 406, and completion of the software in 408.

● This is an agressive schedule but it is made possible by use of major elements of the Unicorn design enabling manufacturing commonality, use of planned IDD mass storage peripherals, exploitation of the large software base represented by Smalltalk, and availability of highly motivated engineers experienced with the technologies involved in the design.

Development Cost

The development costs for the entry product include:

- Staff expenses - 14 people for nine months at a rate of $50,000 per person-year, approximately $500,000.

- Operations/support - ECB design, mechanical design, computer support, reliability engineering expenses of about $150,000.

- Manufacturing start-up - about $50,000.

- Product marketing and sales support - approximately $200,000.

The development cost is estimated to total $900,000.

Capital costs (including facilities, computers, instrumentation, etc.) are expected to be less than $100,000.

Development Team

The development team will include approximately fourteen people. Positions and responsibilities include:

Product Manager	Administration and external coordination.
Marketing	Develop of marketing and sales strategies.
Engineering Manager	Coordinate design and development of product.
(6) Software Engineers	Develop Smalltalk, CP/M-68K, and applications.
(2) Hardware Engineers	Design processor and I/O circuit boards.
Diagnostics Engineer	Confidence, manufacturing, and service diagnostics.
Engineering Assistant	Support prototype implementation.
Technical Writer	Prepare manuals.

Conclusions

- Tektronix can develop an innovative desktop computer with very low investment and bring it to market in less than a year.

- Smalltalk and other advanced software technologies developed within Applied Research will differentiate this product in the market.

- This product can be the cornerstone for a broad family offering excellent performance, value and market growth paths.