

**XEROX**  
**BUSINESS SYSTEMS**  
*System Development Division*

To: Distribution

Date: May 25, 1978

From: W. C. Lynch

Location: Palo Alto

Subject: Pilot Implementation Work Plan

Organization: SDD/SD/SSW/Pilot

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Filed on: [Iris]<Lynch>pilotImplWp.Memo

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## Introduction

This workplan presents the plan for the creation and delivery of Pilot, in detail, through release 3.0 on March 30, 1978. This workplan does not cover the period beyond the release of Pilot 3.0 in nearly as much detail. Pilot 2.0 will provide almost all of the functions called for in the *Pilot Functional Specifications* but will not necessarily have either the performance or the main memory consumption required for product release.

Common Software (anything not covered in the Pilot Functional Specs) is not covered by this workplan.

Very little in the way of post release support for Pilot 1.0 (Pilot on the Alto) is contemplated and the mechanisms for post release support of system software products in general have not yet been worked out. When they are, additional tasks will undoubtedly be identified.

OIS Mesa, as represented by the *OIS Mesa Functional Specification*, will disappear as an identifiable project, as will that document. The functions represented are being divided between the Pilot project and the Mesa project and the portion subsumed by Pilot is covered by this workplan. The remainder of the functions are to be covered by the Mesa workplans (see [Maxc]<Wick>Pilot-Mesa.Bravo ).

## Background data

### productivity assumptions - document preparation

This section will list the productivity assumptions upon which this workplan is based. The background material that was used to arrive at these assumptions is contained in <Lynch>Productivity.memo. It is the intention in this project to track the actual productivity rates achieved, both to enlarge our data base of productivity information and to

give early warning of potential schedule deviations.

The construction of written documentation is a very significant component of this project. We therefore need an estimate of the productivity of producing this documentation. I estimate a production rate of 4 pages/day if the material is already thought out and no background documents are required (RawPage). Otherwise the rate is .5 pages/day (FinishedPage). The thinking through of the material seems to require 3 SupportPages per FinishedPage. Each SupportPage is treated as a RawPage

Each RawPage requires .67 hours of Alto usage (AltoHour). We therefore estimate 4.5 AltoHours/FinishedPage. Alto usage for document construction will be based on this figure.

#### document size distribution

In order to estimate the effort required to produce the necessary documents, we need to estimate the size of the documents. To this end I estimate that

The design spec is three times the size of the functional spec  
[Is this born out by experience?]

The test spec is 12 pages

The technical documentation is twice the size of the functional spec

#### productivity of coding and unit test

Again from <Lynch>Productivity.memo we estimate that our programmers will code and unit test 800 lines of Mesa source code (*loc*) per man month (*mm.*). at the well established conversion figure of 2.5 [This should be 3.5] bytes of object code per *loc* we obtain a productivity of 2000 bytes/mm. These figures are also consistent with the estimate given in the *SDD Software Development Procedures and Standards (P+S)* which claims that coding and unit test represent 15% of the total effort and that each person will produce about 1500 *loc* per man year overall.

From the data presented in Productivity.memo I estimate that 0.16 AltoHours per *loc* are required and this plan is based on that figure.

Alto usage is not likely to be more than 50% effective. I will therefore assume that one Alto will yeild 100 hrs. of usage per month.

#### program size distribution

In order to estimate the programming effort we need to estimate the size of the individual programs. Information of this sort is contained in <Lynch>PilotSizes.Memo. That document estimated the number of *locs* per procedure and turns that into a number of bytes generated. By doing a regression on the number of procedures per chapter of the *Pilot Functional Specification* we obtain a figure of one thousand bytes of code for every three pages of *Pilot Functional Specification*, deleting first the introductory chapter and appendices and the first introductory 1.5 pages of each chapter.

#### phase distribution

We are already part way through the Pilot project, being just finished with the design phase and beginning the code and unit test phase. Of the remaining effort, the P+S indicates that we will have

33% in the code and unit test phase

67% in the system test phase

The system test phase will commence with the release of Pilot 2.0. All other phases will be completed before the release of Pilot 2.0.

## Alto/Pilot - Pilot 1.0 (Internal release only)

### definition

Alto/Pilot 1.0 is an internal pre-release of Pilot intended to be used for the unit testing of small to medium sized applications modules. It runs on a standard Alto and consists of a thin layer of additional software over the Mesa System 3.0 package. It implements a subset of the procedures described in the Pilot Functional Specifications. It includes essentially all of the file system and memory management procedures in addition to the process structure features described in Appendix B of the Pilot Functional Specifications. The implementation heavily uses the existing Mesa procedures.

Alto/Pilot 1.0 was released on December 15, 1977. No further releases are planned.

### references

Memo of May 19, 1977 from D. DeSantis to Bill Lynch - subject: Desired Alto-based Pilot Functions

Memo of June 2, 1977 from J. Szelong to W. Lynch - subject: Alto/Pilot

### documents

Alto/Pilot Functional Specification version 1.0 October 1977

Standard Release Description

Alto/Pilot 1.0 Test Specification

## Pilot 2.0

Pilot 2.0 is the first release of Pilot on the D0. This release will implement essentially all of the procedures in the Pilot Functional Specification. The implementation will operate on a "bare" D0, in the sense that the implementation will not be on top of or rely on the Alto Mesa (at that time 4.0) runtime. Any Mesa System functions required for Pilot (eg. the frame allocator) will be integrated with Pilot. Any additional Mesa System procedures required for an application will have to be converted to use Pilot and will not be supplied with Pilot.

At the time of the delivery of Pilot 2.0, the Mesa byte code interface of the D0 will be a superset of the Mesa byte code interface of the Alto.

Consideration is being given to concurrent delivery of an Alto/Pilot 2.0. Such a system would operate on the Alto, would not support virtual memory (Virtual=Real) and would support code swapping.

Pilot 2.0 will not lay particular emphasis on achieving the required levels of processor efficiency or real memory usage. Much of the work in this area will take place after the release of Pilot 2.0 and be reflected in Pilot 3.0.

Pilot 2.0 will require two disk drives to operate. It seems advisable to operate it on a 192k D0 as the space optimization will not be complete until Pilot 3.0.

## D0 Conversion

An important dependency in this workplan is the reliance on the existence of a reasonable programming environment on the D0. The attainment of this situation has come to be known as the D0 conversion problem. The current plan is to achieve the D0 programming environment in a stepwise fashion. The crucial point is to create a set of microcode which will cause the D0 to emulate the Alto. The Mesa debugger will be constructed in such a fashion that the debugger itself will execute in the well debugged Alto world while debugging code operating in the D0 princeps world. The microcode will be swapped upon entering and leaving the Mesa debugger.

With these facilities, D0 programs can be debugged with the full power of the Mesa System available and without regard to how much or how little of the D0 system is working. This dual world system with the two sets of microcode will be released with Pilot 2.0 so that Applications can also enjoy the benefits of a reliable Mesa debugger in their initial D0 efforts.

### references

Memo dated June 6, 1977 from Wendell Shultz to distribution. subject: Conversion plan to D(0)

<Johnsson>Conversion27Jun.bravo

see <Lynch>D0Conversion.Memo

[Iris]<Johnsson>Debugger-Pilot-24Apr.bravo

### Documents

name	prsn <sup>1</sup>	date	size	effort	Alto time
D15 - Project document List	L	7/30/77	* 2 pages	.2 mm.	9 hrs.
D12 - Preliminary Work Plan	L	8/15/77	* 8 pages	1 mm.	36 hrs.
D2 - Pilot Functional Specifications	U	8/30/77	* 75 pages	4 mm.	340 hrs.
D13 - Design Work Plan	L	9/15/77	* 10 pages	1 mm.	40 hrs.
D18 - Alto/Pilot Test Spec	L	9/15/77	* 4 pages	1 mw.	9 hrs.
D16 - Alto/Pilot Functional Spec	H	10/1/77	* 8 pages	1 mw.	9 hrs.
D3 - Pilot Design Specifications	R(GM)	11/1/77	* 75 pages	7 mm.	300 hrs.
D14 - Implementation Work Plan	L	11/15/77	* 10 pages	1 mm.	40 hrs.
D11 - Pilot test Plan	L	12/1/77	* 8 pages	.5 mm.	36 hrs.

D19 - Alto/Pilot Standard Release Description	U	12/15/77	*	2 pages	1 mw.	9 hrs.
D21 - Pilot Functional Specifications - ver 2.0	U	5/1/78	*	90 pages	2 mm.	170 hrs.
D6 - Pilot Test Specs	L	6/1/78		8 pages	1 mm.	36 hrs.
D7 - Std Release Descriptions (2.0)	L	8/30/78		2 pages	1 mw.	9 hrs.
D1 - Pilot Concepts and Facilities	M	10/30/78		40 pages	1 mm.	60 hrs.
D8 - Std Release Descriptions (2.1)	L	11/31/78		2 pages	1 mw.	9 hrs.
D20 - Pilot Design Specifications - ver 2.0	RM	12/1/78		75 pages	3 mm.	100 hrs.
D9 - Std Release Descriptions (3.0)	L	3/1/79		2 pages	1 mw.	9 hrs.
D4 - Pilot Tech Manual	U	11/1/79		225 pages	8 mm.	600 hrs.

\* means task completed

### Programming Projects

project name	prsn <sup>1</sup>	date req	size <sup>2</sup>	effort	Alto time
P3 - Pilot 1.0 Memory mgmt.	G	9/77	*	1440	2 mm. 230 hrs
P4 - Pilot 1.0 file system	M	10/77	*	2640	3 mm. 420 hrs
P21 - D0 Test program	H	12/1	*	500	1 mm. 115 hrs
P22 - Command Test prog	M	12/1	*	1000	1 mm. 115 hrs
P7 - Pilot 2.0 process structure	R	2/78	*	2160	2 mm. 230 hrs
P5 - Pilot 2.0 Memory mgmt.	M	6/78		1440	1 mm. 115 hrs
P11 - Pilot 2.0 Mesa mods - trap handlers	P	6/78		1000	4 mm. 560 hrs
P6 - Pilot 2.0 file system	RP	6/78		2640	2 mm. 230 hrs
P12 - Pilot 2.0 Swapper - FPT	RM	6/78		2000	3 mm. 420 hrs
P26 - Timers	H	6/78		300	.5mm. 60 hrs.
P9 - Integrate 2.0 communications <sup>3</sup>	U	7/78		n.a.	1 mm. 115 hrs
P10 - Integrate 2.0 I/O devices <sup>3</sup>	U	7/78		n.a.	1 mm. 115 hrs
P13 - Pilot 2.0 Release construction	H	8/78		n.a.	1 mm. 300 hrs.
P16 - Integrate 3.0 I/O devices <sup>3</sup>	U	8/78		n.a.	1 mm. 115 hrs.

P25 - Performance measurement	J	9/78	800	3 mm.	300 hrs.
P14 - Pilot 2.1 Release construction	H	11/78	n.a.	1 mm.	300 hrs.
P19 - Integrate 3.0 communications system <sup>3</sup>	U	11/78	n.a.	1 mm.	115 hrs.
P23 - Utilities Test	P	11/78	n.a.	2 mm.	600 hrs.
P24 - Regression Test	H	11/78	n.a.	2 mm.	600 hrs.
P8 - Pilot 3.0 configuration Install	H	12/78	2000	2 mm.	230 hrs
P20 - Pilot 3.0 Release construction	H	2/79	n.a.	1 mm.	300 hrs.
P15 - Pilot 4.0 swapping over Xerox Wire	M	8/79	1000	1 mm.	140 hrs.
P17 - Pilot 4.0 multiple MDS support	R	8/79	300	.5mm.	60 hrs.
P18 - Pilot 4.0 Star support		8/79			

\* means task completed

notes

1 G - Dave Gifford  
 H - Tom Horsley  
 J - Paul Jalics  
 L - Bill Lynch  
 M - Paul McJones  
 P - Steve Purcell  
 R - Dave Redell  
 U - Hugh Lauer

2 - All numbers are in lines of Mesa code (loc) except the microcode tasks which are in lines of microcode.

3 - Assumes the assistance of the supplying organization.

### Systems Integration and Support

project name	prsn <sup>1</sup>	date req	size <sup>2</sup>	effort	Alto time
S6 - 2.0 System Integration	MPR	8/78		4 mm.	400 hrs.
S5 - 2.0 Alpha test	MPRLHU	9/78		6 mm.	600 hrs.
S2 - Performance tuning	M	8/79		12 mm.	1342 hrs.
S3 - Residency reduction	P	8/79		12 mm.	1342 hrs.
S4 - Customer Aid	GHLMPRU	6/79		6 mm.	600 hrs.
<b>totals</b>			<b>pages</b>	<b>40 mm.</b>	<b>4284 hrs.</b>

**Overhead activities**

project name	prsn <sup>1</sup>	date req	size <sup>2</sup>	effort	Alto time
V - 1978 Vacations	HLP	MRU 12/78		3.5 mm.	0 hrs.
O1 - 1978 Group management	L	12/78	150	6 mm.	100 hrs.
O2 - 1978 Productivity tracking	L	12/78	50	2 mm.	30 hrs.
O3 - 1978 Xerox University Affairs	L	12/78		.5 mm.	5 hrs.
C - 1978 Conferences	HLP	MRU 12/78		3 mm.	0 hrs.
V - 1979 Vacations	HLP	MRU 12/79		3.5 mm.	0 hrs.
O1 - 1979 Group management	L	12/79	150	6 mm.	100 hrs.
O2 - 1979 Productivity tracking	L	12/79	50	2 mm.	30 hrs.
O3 - 1979 Xerox University Affairs	L	12/79		.5 mm.	5 hrs.
C - 1979 Conferences	HLP	MRU 12/79		3 mm.	0 hrs.
<b>totals</b>			400 pages	30 mm.	270 hrs.

**Schedules**

1978

	J	F	M	A	M	J	J	A	S	O	N	D
Horsley						P26	P13	S5	VC	P14	<u>P8</u>	-
Jalics	<u>n.a.</u>		-	-	-	<u>S2</u>	-	-	-	<u>n.a.</u>	-	-
Lauer			<u>D21</u>	-	P9	P10	P16	S5	VC	P19		
Lynch	<u>O1</u>	-	-	<u>O2</u>	D6	D7		S5	VC	D8		
McJones			<u>P12</u>	-	P5	<u>S6</u>	-	S5	VC	D1	D20	<u>S2</u>
Purcell	<u>n.a.</u>	<u>P11</u>	-	P6	<u>P11</u>	-	S6	S5	VC	<u>D20</u>	-	<u>S3</u>
Redell	<u>P7</u>	-	P12		P6		S6	S5	VC	<u>S4</u>	-	

*Alto hours*

1979

J F M A M J J A S O N D

Horsley	S4	P20	<u>S4</u>	-	-	-	VC	<u>P24</u>	-			
Lauer	<u>D4</u>	-	-	-	-	-	VC	<u>D4</u>	-			
Lynch	O1	D9	<u>O1</u>	-	-	<u>O2</u>	-	V	<u>O1</u>	-	-	O3-C
McJones	P15	<u>S2</u>	-	-	-	-	VC					
Purcell	<u>S3</u>	-	-	-	-	-	VC	<u>P23</u>	-			
Redell	P17	<u>S3</u>	-	-	S2		VC					

*Alto hours*

### Special Hardware

One Interim Rigid Disk Controller (IRDC) and two (2) Model 31 disk drives

One extra memory board

### Dependencies

Delivery to the Pilot group of an accepted D0 (model 4C see memo from W. Klein dated April 19, 1978 entitled "STAR Venture Program Update") - *by June 1, 1978*

IRDC - *dua! model 31's*

D0 ethernet

Alto compatible keyboard, mouse, and display for initial debugging

D0 Alto environment

Debugger - *D0 debugger received by July 1, 1978*

Mesa features

Loader (copy global frame) - *June 1, 1978*

Loader (new global frame) - *July 15, 1978*

BootMesa - *June 1, 1978*

Process structure - *May 1, 1978*

D0 compiler - *October 1, 1978*

Global frame size reduction - *October 1, 1978*

D0 Mesa Princeps environment - *October 1, 1978*

Default parameters in D0/Mesa - *October 1, 1978*



Cross Debugger - *October 1, 1978*

#### Tools features

Program librarian - *Installed and operational by May 1, 1978*

Compiler server - *Installed and operational by June 1, 1978*

Consistant Compilation tool - *Installed and operational by Oct. 1, 1978*

Availability of the Mesa group for consultation in the construction of the frame allocation and other traps.

Mesa group - Collection and delivery of those Mesa modules (such as the Signaller) to be integrated into Pilot.

Receipt by June 1, 1978 of the IOCS and device driver implementations.

Reciept by June 1, 1978 of the Ethernet, Xerox Wire, and RS232C device driver modules from the communications group.

Receipt by June 1, 1978 of the microcode for booting.

Implementation for co-delivery with Pilot 2.0 of Scavenger, Movedisk, and Copydisk programs.

#### Disk Driver Integration

To minimize the schedule risks inherent in sequential development, the following approach will be taken to the development of the Pilot file system and the disk driver software. During the initial development of the Pilot file system, a dummy disk driver will be constructed which stores the files in un-occupied real memory. Following this, another disk driver will be constructed which stores the files in the Alto BFS system in a fashion similar to the way files are implemented in Pilot 1.0. Finally, the real disk driver supplied by the I/O group will replace these interim drivers and be integrated with the system. This approach decouples the debugging of the Pilot disk drivers from the development of the rest of Pilot.

#### Unresolved Issues

How much of the Alto/Mesa System shall we convert to run with Pilot? How will this be done?

What will be the mechanism by which customer software is updated after delivery? What impact does this have on the requirements for the Pilot Install feature?

#### Releases

Alto/Pilot - Pilot 1.0 - Dec. 15, 1977

Pilot 2.0 Alpha test - July 30, 1978

Pilot 2.0 - August 30, 1978

Pilot 2.1 - December 1, 1978

Pilot 3.0 - March 1, 1979

This is IT, the Star 1 release Pilot

Pilot 3.1 - June 1, 1979

Pilot 3.2 - Sept. 1, 1979

Pilot 4.0 - Dec. 1, 1979

### Reviews

Pilot Functional Specifications

September 15, 1977

Pilot Design Specifications

June 1, 1978

Pilot Test Specifications

June 1, 1978

Pilot Release Plan

September 15, 1979

### Milestones

All reviews and all releases