MACWORKS PLUS
TECHNICAL OVERVIEW

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CONTENTS

INTRODUCTION

MacWorks Plus is the implementation of the Macintosh Plus 128K ROM for the Apple Macintosh-XL and Lisa-2 computers. MacWorks Plus was developed by a programming team at Sun Remarketing lead by Charles Lukaszewski. The project's design goal is one-hundred percent compatibility with software that operates on the Macintosh Plus.

MacWorks Plus is based on reverse-engineered 128K Macintosh ROM code, reverse-engineered device drivers from the original MacWorks program, and modified versions of current System Software resources. The chief difference between MacWorks Plus and its predecessor is a brand-new hardware interface whose low-level interface to the 128K ROM operating system is identical to that in the Macintosh Plus. All in all, there are about 50 source files which contain some 23,000 lines of source code. The project is managed with the aid of the Macintosh Programmers Workshop (MPW) version 2.0.2.

The code can be easily extended to accommodate future enhancements, should they be desiredt, including SCSI support, extended sound compatibility, and addition of 256K ROM (Macintosh SE and Macintosh II) routines.

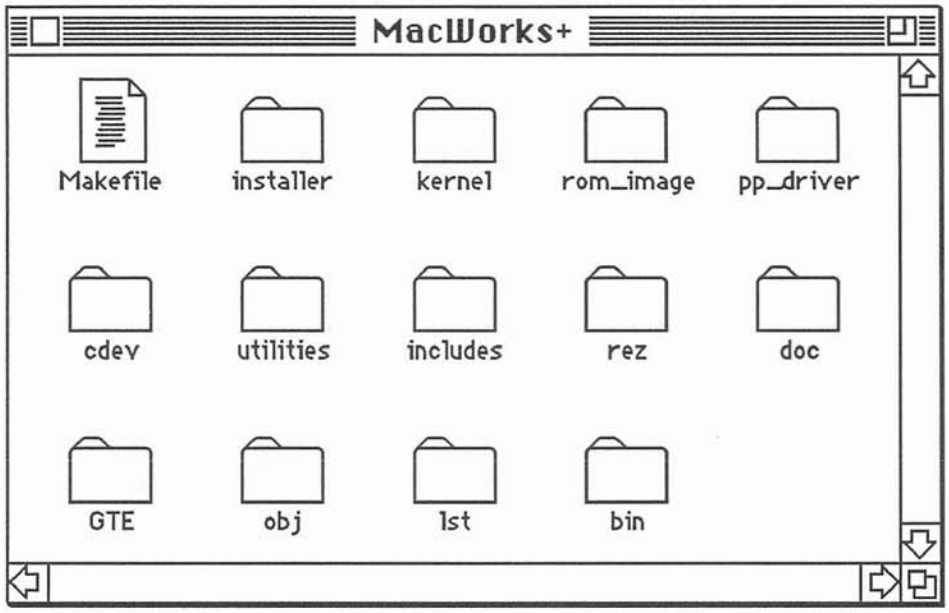
This document is intended to provide an introduction to the MacWorks Plus code for both the programmer and the layman. The programmer should consult this document prior to making any modifications to the source code.

ORGANIZATION OF MACWORKS PLUS SOURCE CODE

MacWorks Plus is generated from 50 source files which can be broadly classified into five categories: ROM image files, hardware kernel files, installer files, user tools and generation utilities. The process of creating executable MacWorks Plus programs has been completely automated through the use of the Macintosh Programmers Workshop 'make' utility.

Location of Source Files

In order to compile the project with MPW, all of the source files must be located in a folder called 'MacWorks+' that resides in the MPW folder (defined by the MPW shell variable {MPW}). The 'MacWorks+' folder contains the following items:



The 'Makefile' is the master control file for MPW. Performing a 'make all' at this directory level will build all segments of MacWorks Plus. The folders contain source code or compiler output:

Folder	Description
installer	source code for the hard-disk and floppy-disk installation program and all boot code
kernel	source code for the hardware interface and device drivers
rom_image	source code for the 128K ROM image
pp_driver	source code for the parallel printer chooser device
cdev	source code for the MacWorks Plus control panel device
utilities	source code for compilation utilities
includes	common definitions and macros for use in other source files
rez	resource files for executable programs
doc	project documentation, including this Overview

GTE	bug reports from GTE
obj	MPW object file repository
lst	MPW compiler listing repository
bin	all executable programs

The 'installer' Folder

There are five source files in this folder: mw_install.a, widgetboot1.a, proboot1.a, sonyboot1.a and mw_boot.a

mw_install.a is the source code for the Installer program. Depending on the setting of the SONY flag at compile time, MPW will generate either the Hard Disk Installer or the Floppy Disk Installer program. Though much of both programs is identical, enough key instructions are missing from the Hard Disk Installer that it would be difficult for someone to create a Floppy Disk Installer.

widgetboot1.a, proboot1.a and sonyboot1.a are the block zero (stage one) boot codes for the widget hard disk, profile hard disk, and floppy disk, respectively. mw_-boot.a is the stage two boot code. It works equally well on any storage device.

The 'kernel' Folder

This folder contains the source code for the hardware interface, and is without question the most important component of the project. The file mw_kernel1.a contains source code which is overlaid on the first $A00 bytes of the ROM image. This is mostly system initialization and verification code. mw_kernel2.a contains the interrupt routines, special trap dispatch handlers and other code to adapt the 128K ROM to another computer.

The files mw_sony.a, mw_harddisk.a, mw_sound.a and mw_serial.a contain the system device drivers.

The 'rom_image' Folder

Every subroutine from the 128K ROM has been sorted by manager and located in the following files, corresponding to chapters in Inside Macintosh:

control.a	desk.a	device.a	dialog.a
file.a	font.a	memory.a	menu.a
os_event.a	os_util.a	package.a	quickdraw.a
resource.a	retrace.a	scrap.a	segment.a
tb_event.a	tb_util.a	textedit.a	time.a
window.a			

The 'pp_driver' and 'cdev' Folders

Apple stresses the importance of a good user interface, and two new tools were introduced with the 1.1 release of MacWorks Plus which provide this for the Lisa user.

These tools are the ParallelPrinter chooser device and the MacWorks! control panel device.

The folder pp_driver contains the source code to the ParallelPrinter program and the folder cdev contains source for the control panel device.

The 'utilities' Folder

The 'utilities' folder contains the sources to three important programs:

dump128.a	-	dump Macintosh Plus ROM image into resource file (type MROM, ID=8)
dump_128_rez.a	-	dump Macintosh Plus ROM resources into resource file (types and numbers match those in ROM)
mw_merge.a	-	merge hardware interface, ROM resources, and ROM image and place the result in the data fork of a Hard Disk or Floppy Disk Installer program

The 'includes' and 'rez' Folders

The includes folder contains common definitions and macros used by other source files. The file mw_includes.a is used in all source files; mw_hd_includes.a contains additional information used in the hard disk driver; and, finally, mw_traps.a and mw_data.a is used in compiling the ROM image.

Within the rez folder are resource files for a variety of components of the MacWorks Plus project. The approach taken to resources for the Project is as follows: resource files containing types BNDL, FREF, ICN#, ALRT, DITL, DLOG and owner resources are fairly static. Rather than recompiling each time with the MPW Rez utility, the program ResEdit was used to create and update them. During the compilation process, needed resource files are copied into the 'bin' folder, thus preserving the integrity of theoriginals. Compiled source code is then *linked into the copies.*

The rez folder contains the following files:

mw_image	-	compiled ROM image (identical to Mac Plus ROM from $00400A00 - $004176F7)
mw_image_rez	-	ROM image resources (replacing ROM resource on a Macintosh Plus)
128_image_rez	-	ROM resources dumped from a Macintosh Plus
mw_install_rez -	-	Resource fork from the MacWorks Installer program
mw_pp_rez	-	resource fork from the ParallelPrinter chooser device
mw_cdev_rez	-	resource fork from the MacWorks! control panel device

MACWORKS PLUS SOFTWARE IMPLEMENTATION

In order to understand how MacWorks Plus operates, it is easiest to divide the discussion into three areas: memory model, hardware interface and bootstrap protocol. These are the hardware-dependent aspects of the Macintosh operating system. The fastest way to transport the Macintosh operating system is to emulate them completely. If this can be achieved, then the much larger hardware-independent code can be copied with no modification. This is what has been done with MacWorks Plus.

The MacWorks Plus Memory Model

MacWorks Plus occupies the last $36000 bytes of random-access memory in the Lisa. This includes space for all device buffers, including the screen buffer. The space below the MacWorks Plus operating system is allocated identically to the memory space in a Macintosh Plus. The memory allocation is visualized on the next page.

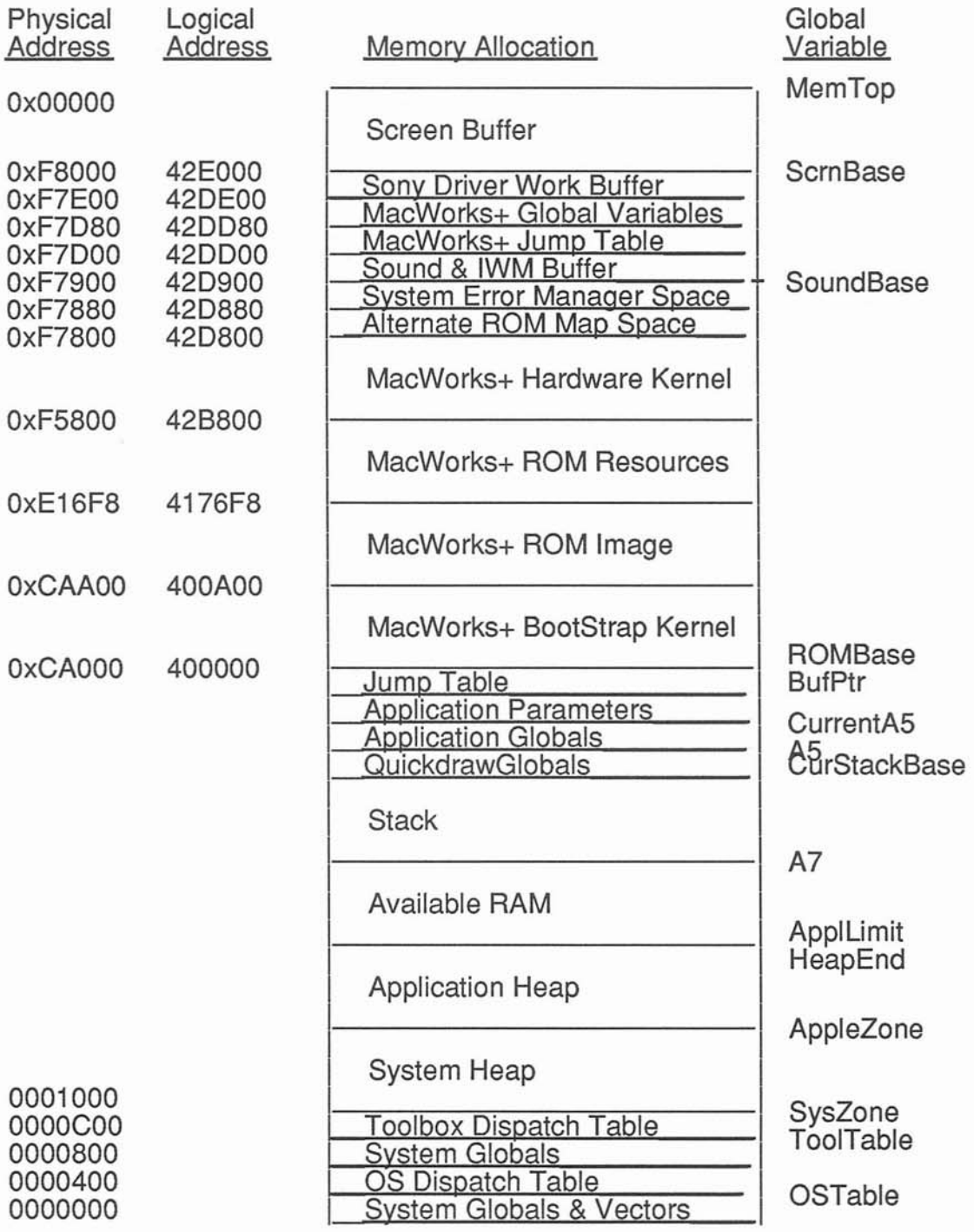
One of the reasons that the original MacWorks program had so many incompatability problems is that its memory layout did not match that of a Macintosh, particularly in low-memory. For example, the trap tables were stored in high memory. However, in MacWorks Plus the memory model exactly duplicates that of other Macintoshes. Even the allocation of $28000 bytes for MacWorks Plus below the screen is done in accordance with accepted Macintosh programming principles.

The technique that Apple recommends for INIT resources which need memory at system startup time (RAM disks, for example) is to force the global variable BufPtr down. This is what MacWorks does. Each time the system is rebooted through software or hardware, MacWorks Plus sets BufPtr just below the screen. It then moves BufPtr down to the base of the ROM image. This protects MacWorks Plus from being overwritten while at the same time being completely compatable with the Macintosh.

There are two important differences: Macintosh error handlers use a $80 byte area in very high memory. Under MacWorks Plus, this has been mapped into the the operating system variable area at $42D880. This has been done because the screen uses all of high memory unlike on the Macintosh. The second difference is that on the Macintosh an alternate boot ROM may be installed at location $F80000. Since several programs check this address even though they should not, it has been mapped at address $42D800.

The entire logical memory space below four megabytes wraps around on itself. That is, for a one megabyte machine, addresses $000000, $100000, $200000 and $300000 all map into the same physical memory. On a two megabyte machine, addresses $000000 and $200000 would map into the same physical memory.

All the logical memory above the end of the ROM image has also been mapped into physical memory to avoid problems with Bus Errors. When a program references a memory location that has not been mapped, it causes a Bus Error which crashes the system. Microsoft Excel is a good example of a program which does this. (Note - this is highly illegal programming practice, but we can counter it to avoid incompatibility). Since the Lisa maps memory in 128K blocks, each 128K increment above $440000 is mapped to physical address $20000.



MacWorks Plus sets up low memory exactly as in the Mac Plus. This means that many low-memory variables set up by the Mac XL or Lisa boot ROM are not preserved. They do not need to be.

The MacWorks Plus Hardware Interface

Under MacWorks Plus, devices are handled very differently than they were under MacWorks. There are six drivers in MacWorks Plus: Hard Disk, Floppy Disk, Serial Port, Sound Generator, Parallel Printer and AppleTalk. They have been created from scratch. Though each can trace some of its code back to the respective drivers under MacWorks and the Macintosh Plus, the MacWorks Plus versions are unique. The drivers interact with the Macintosh operating system just as they do on the Macintosh Plus. This provides an added level of compatibility.

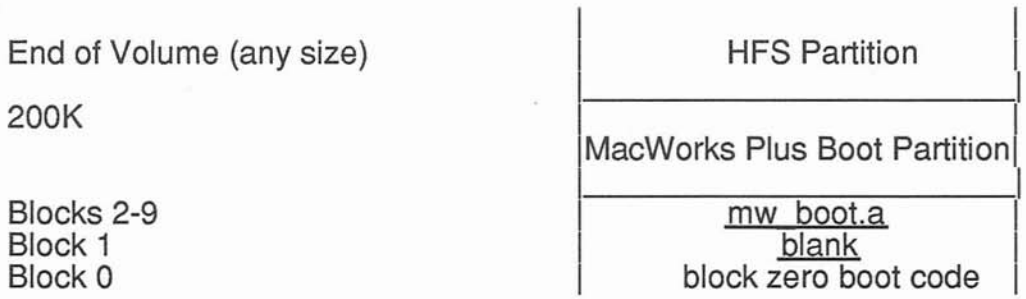
The keyboard, clock and parameter memory are handled as part of the interrupt system, which has also been developed from the ground up. Parameter memory is handled just as on the Macintosh Plus, and the newer system calls which deal with extended parameter memory are also supported. This particular emulation is important for compatability with System Software version 6.0 and higher.

The MacWorks Plus Bootstrap Protocol

The MacWorks Plus boot code is contained in four files: three of which contain the block zero boot code for the Sony, Widget and Profile devices, and one which contains a multi-device loader for getting the MacWorks Plus ROM image into memory and executing it.

The block zero boot codes each of these disk drives is identical to that used under MacWorks. The block zero boot code loads an eight-block code segment that is responsible for starting an operating system on the Lisa. This code segment was developed specially for MacWorks Plus. It is a universal loader that works for all types of disk drives, and is responsible for setting up logical memory space as well as initializing important environment variables and the MacWorks Plus jump table.

All MacWorks Plus disk are partitioned in the following manner:



MacWorks Plus claims only 200K of the volume it is installed on, which is superior to MacWorks (500K) and HFS-AL (~900K). This also leaves approximately 60K for additional enhancements in the future.

THE MACWORKS PLUS INSTALLATION PROGRAM

As mentioned in the introduction, HD Install, Two-Port Install and MultiPort install have been phased out with MacWorks Plus. Instead there is a program called MacWorks Plus Install which is capable of installing MacWorks Plus onto any device attached to a Mac XL or Lisa.

The program is set up very much like HD Install. It differs primarily on the introductory display page, which has a larger dialog and has space for buttons for all of the devices that could be attached to the unit. These buttons are activated as appropriate. The user selects the device and then a check is made to see if a MacWorks or MacWorks Plus volume exists, in which case the user may update MacWorks Plus or just erase the disk and start over.

Hard disk support uses the standard hard disk driver, and control calls 30 (init device) and 31 (erase disk) are of primary importance. In addition, call 9 (set offset) is used to control writes to the operating system partition of the disk.

There is no support for shared 7/7 or Lisa partitions. The performance degradation from such support makes it an unrealistic goal.

The program may be easily extended in the future to handle SCSI drives.

KNOWN INCOMPATABILITIES

The following programs do not operate properly as of MacWorks Plus version 1.0.3:

Program	Reason
MacGolf	Direct access of Macintosh Hardware
MacRacquetBall	Direct access of Macintosh Hardware
Switcher	?
FastBack	Direct access of Macintosh Hardware
Shanghai	Installs its own interrupt handlers as part of a copy protection scheme; no way to circumvent
XL Screen	Parameter storage under MacWorks XL conflicts with pa rameter storage under MacWorks Plus
Dark Castle	?
HD Install	Requires MacWorks XL
PP Install	Requires MacWorks XL
MacServe	Works properly only under System Software 5.3/3.2

ISSUES IN TRANSPORTING THE MACINTOSH ROM

The process of developing MacWorks Plus has provided a variety of insights into the practical difficulties of transporting the Macintosh operating system to another computer. Most of the work has already been done by Apple because the Macintosh ROM is highly dependent on the contents of low-memory global variables in order to create its environment. However, one cannot simply put the correct values into the correct place on another computer and expect it to work. Here are some things to consider:

Bootstrap Considerations

The bootstrap process is where all of the system environment variables need to be determined and stored. This is a one-time process, and is best suited to this part of system startup. In MacWorks Plus, there is an area of high memory reserved for MacWorks Plus globals, as well as an area of memory just inside the beginning of the ROM image. These include screen size, offsets to particularly important patches and parameter RAM settings.

The first $A00 bytes of the Mac Plus ROM image need to be replaced with code to restart the system. This code must do a memory clear, a ROM Image self-verify, and then fall into the standard low-memory initialization that the Mac Plus bootstrap does. The subroutines which govern boot device polling need to be modified depending on the presence of SCSI interfaces. The first $A00 bytes of code can simply be overwritten. This is what MacWorks Plus does. You do need to preserve two jump vectors, however: The Sad Mac vector at $400136 and the DoSound vector at $40028A.

Memory Management Considerations

Be cautioned that many programs reference memory above the four megabyte mark as a quick way of doing environment checking. If you are transporting the ROM image to a system with a memory management unit, this will result in a BUSERR. You will also need to make special provisions for certain programs like Dark Castle which expect the characteristics of the Mac Plus memory manager to be duplicated. For example, comparing any value against invalid memory sets the Z bit in the condition codes.

Device Driver Considerations

Device drivers need only conform to the interface guidelines in Inside Macintosh; all the code below the operating system interface can be done in any fashion you choose. If you do not support SCSI, then there are eight additional driver slots available in the unit table. However, one should read through the Software Problem Reports with Corrective Action later in this report to note the undiscovered operating system fussing with internal queues. For example, some part of the operating system sequences the drive number of the floppy disk VCB, and special action needed to be taken in the Sony driver to counteract it.

System Software Considerations

As a rule, transported Macintosh operating systems cannot afford to let the PTCH resources in the System Software be executed. While mostly harmless, they do contain replacement interrupt handlers and special device manager additions (i.e. SCSI code). The simplest solution is to create your own ROM resource file and build the PTCH resource into it. Keep in mind that you will need to also set the RomMapInsert flag in order to read the resource in at the proper time.

System Software 6.0 presents a variety of unique headaches. In an effort to strip it down, the Appletalk drivers as well as other code was removed. The rule of thumb here is not to count on what is in the system software. With MacWorks Plus v1.1, many resources from the System Software were built into the ROM resources, expanding the memory size significantly but circumventing compatibility problems that would otherwise have occurred.

SOFTWARE PROBLEM REPORT SUMMARY

This section summarizes the bugs encountered at various phases of development. Problems listed here in the context of specific applications are not considered to be program incompatibilities, but rather general operating system errors.

1.0alpha Problem Reports

SPR001	An error occurs when multiple disk devices are on-line and one tries to execute an application from a disk other than the default. If there is a copy of the application on the default volume, it will execute from there. If not, a system error 26 will result.
SPR002	Disk-switching messages do not appear on the screen. Inserting a disk anyway causes a system crash to the debugger
SPR003	System error messages are not centered on the screen
SPR004	No version of MacsBug will work
SPR005	The clock contains an invalid date/time whenever the system is restarted
SPR006	Choosing 'Shutdown' from the Finder 'Special' menu causes a reboot
SPR007	Pressing the power-off button does nothing
SPR008	Apple-power-off and option-power-off do not respond consistently
SPR009	The Sun-20 hard disk will not boot MacWorks Plus, but will boot a Macintosh System once MacWorks Plus has been loaded from a floppy-disk
SPR010	'Erase Disk' on the Finder 'Special' menu does nothing for floppies
SPR011	The startup screen aspect ratio is incorrect
SPR012	Keypad input is ignored
SPR013	Many applications cause a 'Bus Error' just after launch
SPR014	Excel crashes with a 'Bus Error'
SPR015	Mouse tracking not affected by control panel
SPR016	Pressing 'd' key always causes instantaneous autorepeat
SPR017	Message 'Application Busy or Damaged' or 'File Locked or Busy' appears occasionally after program launch
SPR018	Cursor freezes at random intervals; machine must be restarted
SPR019	HD Backup refuses to load disks from a Macintosh
SPR020	Every fifth disk dragged to the trash fails to eject even though the icon disappears from the desktop
SPR021	Volume control on control panel has no effect
SPR022	Sony drive not ejected on autoboot from a hard disk
SPR023	Mousedowns during MacsBug cause a '#' to appear on screen
SPR024	Hard Disk Installer fails to format a Widget
SPR025	Data under cursor not cleared upon a 'Restart' from menu
SPR026	Left option-key fails to consistently cause boot from the floppy drive instead of hard disk when starting MacWorks Plus
SPR027	'Macsbug Loaded' message not centered
SPR028	Profiles called 'Appletalk Device' in initialization confirmation dialog

SPR029 400K diskettes do not copy properly to hard disk

1.0beta Problem Reports

SPR030 Sound manager calls cause a system crash
SPR031 Sun-20 hard disk never comes back on-line after a 'Restart' from Finder
SPR032 The state of the write-protect switch on floppy-disks is ignored
SPR033 Pre-6.0/4.2 System Software crashes with an ID=12 error on bootup
SPR034 If a profile is disconnected after startup, it is not put off-line
SPR035 Button hits during SysError call are only detected above and to the left of the button's location on the screen
SPR036 Lisa-formatted disks do not work properly on other Macintoshes
SPR037 Macintosh II disks do not read on a Lisa or Mac XL
SPR038 When booting straight into multifinder, a disk-insert event is always posted which puts up the 'eject/single/double' dialog
SPR039 The Lisa will occasionally autorepeat or autoshift without causing it on the keyboard
SPR040 No default font in parameter RAM
SPR041 Command-Option-3 (Screen Dump to File) causes address error
SPR042 Command-Option-4 (Screen Dump to Printer) prints partial garbage
SPR043 Serial driver will not communicate above 9,600 baud
SPR044 The program MazeWars+ causes a Bus Error ($EFE1FE)
SPR045 The program MacPlaymate causes a Bus Error ($EFE1FE)
SPR046 The program CricketDraw causes a Bus Error ($800568)

1.0 Problem Reports

SPR047 The chooser does not properly switch serial devices
SPR048 Hypercard hangs when dialing a number
SPR049 The program FileMaker detects that it is running on a Lisa and halts
SPR050 AppleTalk will always take port B on startup whether it is configured for a printer or not
SPR051 Serial communication does not work at all
SPR052 Menu clocks and CalendarMaker do not have the correct date unless Control Panel is used first
SPR053 Saved files do not have correct date and time unless Control Panel is used immediately before saving
SPR054 Hard-disk backup programs and floppy-disk initializing programs always create 400K disks, even when told to format double-sided
SPR055 The program Insight v2.01 causes Bus Errors ($016701A4)
SPR056 Programs which require master disks are unable to detect the information they need to continue
SPR057 No sound is ever generated, even by the control panel
SPR058 MacWrite and MacTerminal lose keystrokes

1.0.1 Problem Reports

SPR059 Printers wont work out the 'A' serial port
SPR060 HFS 400K diskettes won't read properly on a Lisa->Macintosh->Lisa cycle
SPR061 Word Perfect causes a system crash while starting up

SPR062 The 3.2/5.3 System Software crash when trying to boot
SPR063 The program StarChart causes an address error
SPR064 The program MGM-CAD geometry module causes a system error 23
SPR065 The program Speed Reader crashes with a Sad Mac $000B
SPR066 The program Hypercard v1.2.1 crashes
SPR067 The program Microsoft Basic v2.1 crashes with a Sad Mac $0002 when trying to save a file

1.0.2 Problem Reports

SPR068 Contrast is set too high when booting from a hard disk
SPR069 Icon mask for floppy disks is missing bits on the top left corner
SPR070 Only 32 megabytes of a larger-than-32M hard disk is available
SPR071 Keypresses during boot are ignored (i.e. the 'I' key to disable Microsoft Mail)
SPR072 _ReadXPram and _WriteXPram causes system crashes
SPR073 System Software 6.0 crashes when booting
SPR074 Desk accessories do not work under MultiFinder
SPR075 Desktop icons do not refresh under MultiFinder
SPR076 The program Disk First Aid indicates that hard disks are not HFS
SPR077 MockTerminal dial always fails the first time but then works
SPR078 The program MacZap Tools FastCopy does not recognize internal floppy disk
SPR079 The program WayStation hangs when performing a ShutDown
SPR080 Copying a floppy to a floppy does not work
SPR081 Copying a file from a floppy in small-icon mode to a hard disk in large-icon mode causes the copied file to become invisible
SPR082 System crashes when opening files from other folders under MultiFinder

SOFTWARE PROBLEM REPORTS WITH CORRECTIVE ACTION

This section details the solution for each Software Problem Report. This information is of general value because many of these errors would be encountered in any attempt to transport the Macintosh Operating System to another computer. In the source code the patches for each bug are denoted in the comment field with the SPR number in the first position.

1.0alpha Problem Reports

SPR001 An error occurs when multiple disk devices are on-line and one tries to execute an application from a disk other than the default. If there is a copy of the application on the default volume, it will execute from there. If not, a system error 26 will result.

Here's a funny bug: The _SetVol trap has the same number as the _SCSIDispatch trap. With the advent of discreet toolbox and operating system trap tables, it is nec essary to specify ,NEWTOOL or ,NEWOS when setting traps. When MacWorks Plus was installing its SCSI intercept routine, it overwrite _SetVol instead.
[mw_kernel2.a]

SPR002 Disk-switching messages do not appear on the screen. Inserting a disk anyway causes a system crash to the debugger

An error in the Sony driver failed to notice new disk inserts. It was necessary to in stall a hook to our own procedure in DskSwitchHook to handle the positioning of the alert rectangle (modified DSAlert- Rect).
[mw_kernel2.a]

SPR003 System error messages are not centered on the screen

The DSAlertRect low-memory global needed to be modified to the screen size of the current machine. Note that this involves a ROM test to see if the A3 or H8 ROMs are in place. Also one should be aware that this rectangle is modified by the Disk Switch procedure and then replaced when it is done.
[mw_kernel2.a]

SPR004 No version of MacsBug will work

Macsbug 5.5 was chosen as the debugger necessary for development. It was nec essary to replace the keyboard input routine with one of our own. This patch is done at system startup time so that an off-the-shelf version of Macsbug may be used. The subroutine is called GetMBKey.
[mw_kernel2.a]

SPR005 The clock contains an invalid date/time whenever the system is restarted

A debugging routine in the _InitUtil trap forced the global variable Time to zero dur ing every call. Removing it solved the problem.
[mw_kernel2.a]

SPR006 Choosing 'Shutdown' from the Finder 'Special' menu causes a reboot

The ShutDown Manager normally performs a reboot on a Macintosh Plus when 'Shutdown' is selected. The subroutine LastPatch was added to the hardware in terface kernel which makes use of the intercept capability built into the ShutDown Manager. Immediately before the restart would normally happen, the ShutDown Manager calls the MacWorks Plus kernel and a power-off with dim is forced to occur. Control is never returned to the ShutDown Manager.
[mw_kernel2.a]

SPR007 Pressing the power-off button does nothing

Support for power-off had not been added immediately and some people who re ported this problem had an earlier version of the code.

SPR008 Apple-power-off and option-power-off don't respond consistently

The original coding of the Level-2 interrupt handler didn't properly handle multiple Level-2 interrupts and some got lost. This also accounted for loss of keystrokes and forced autorepeats.
[mw_kernel2.a]

SPR009 The Sun-20 hard disk will not boot MacWorks Plus, but will boot a Macintosh System once MacWorks Plus has been loaded from a floppy-disk (75 error)

Block Zero of the device was compiled with two instructions that differed from the block zero code in MacWorks XL. Since the Lisa boot ROM does a checksum on the bootcode, this was generating an invalid boot file error. The proper instructions were hardcoded into the bootcode.
[proboot1.a]

SPR010 'Erase Disk' on the Finder 'Special' menu does nothing for floppies

The Sony driver made a handshake call instead of a format call due to a numeric typo in the code.
[mw_sony.a]

SPR011 The startup screen aspect ratio is incorrect

It was incorrectly assumed during the initial coding of the bootstrap kernel that the source rect for startup screens should be the same as the screen size. Since star tup screens are saved in Mac Plus size (512x342) and copybits automatically scales the image, restoring the original rect fixed the problem.
[mw_kernel1.a]

SPR012 Keypad input is ignored

An error in the Lisa to Macintosh keyboard translation algorithm was corrected.
[mw_kernel2.a]

SPR013 Many applications cause a 'Bus Error' just after launch

The system error space was not mapped originally ($3FFC80) into physical space. This was corrected so that the system could store its error information in an out-of-the-way location in MacWorks Plus image space.
[mw_boot.a]

SPR014 Excel crashes with a 'Bus Error'

As part of its initialization and environment check code, Excel v1.5 manipulates RAM at location $500000. This is highly illegal programming practice that is dupli cated in other Microsoft products. The solution was to map all of the memory above the ROM Image ($440000 and higher) into physical space at boot time.
[mw_boot.a]

SPR015 Mouse tracking not affected by control panel

The first few drafts of the bootstrap kernel forced the CrsrTask routine to be that from the ROM Image. In the Mac Plus ROM, however, a check is made to see if CrsrTask low-memory global contains a value (set by the Control Panel/System Software). MacWorks Plus was updated to do this properly.
[mw_kernel2.a]

SPR016 Pressing any key always causes instantaneous autorepeat

The KeyRepThresh field in parameter memory was being cleared to zero by the bootstrap kernel code; eliminating the clear repaired the bug.
[mw_kernel1.a]

SPR017 Message 'Application Busy or Damaged' or 'File Locked or Busy' appears occasionally after program launch

This error was also caused by the mistake in replacing the _SetVol trap with the _SCSIDispatch intercepts (see SPR001)
[mw_kernel2.a]

SPR018 Cursor freezes at random intervals; machine must be restarted

The VBL queue header was being zeroed by the VBL task from the Sony driver; the Sony driver was modified so that it didn't need a VBL task.
[mw_kernel2.a, mw_sony.a]

SPR019 HD Backup refuses to load disks from a Macintosh

This problem cleared itself up at some point during a reworking of the Sony driver.
[mw_sony.a]

SPR020 Every fifth disk dragged to the trash fails to eject even though the icon disappears from the desktop

Some part of the code (where has never been determined) was setting the eject/noneject flag in the drive queue to non-ejectable. The fix was an addition to

the prime routine in the Sony driver that resets the flag for every prime call.
[mw_sony.a]

SPR021 Volume control on control panel has no effect

When the Sound Manager is present (as with trap intercepts for System Software 6.0 compatibility) the Sound Driver is overridden. Removing the Sound Manager after the 1.0.2 version restored full square-wave sound.
[mw_kernel2.a]

SPR022 Sony drive not ejected on autoboot from a hard disk

Two additions needed to be made to the bootstrap kernel: first, a check of the disk-in-place field was necessary to determine whether to even attempt an eject. If a disk is detected, it must first be clamped before it can be unclamped. The original approach only had an unclamp.
[mw_kernel1.a]

SPR023 Mousedowns during MacsBug cause a '#' to appear on screen

The keyboard input routine for MacsBug support did not screen out mouse-downs from the keyboard COPS.
[mw_kernel2.a]

SPR024 Hard Disk Installer fails to format a Widget (returns immediately without any action)

Format subroutine in the Hard Disk driver did not pay attention to the DriveType field established when hard disks are added to the drive queue. It attempted to send Profile formatting commands which were ignored.
[mw_harddisk.a]

SPR025 Data under cursor not cleared upon a 'Restart' from menu

Memory was not being cleared between reboots. A subroutine was added which cleared memory from $000000 to the base of the MacWorks image.
[mw_kernel1.a]

SPR026 Left option-key fails to consistently cause boot from the floppy drive instead of hard disk when starting MacWorks Plus

The keycheck subroutine was originally located in the loop which polls for connect ed boot disks. At this point, interrupts are enables so the standard key processor intercepts it. The keycheck was moved earlier in the system startup code.
[mw_kernel1.a]

SPR027 'Macsbug Loaded' message not centered

The DSAT resource containing the string position needed to be directly modified. Changing the coordinate system of the window affected everything else. So a patch was made in the startup code to scan the DSAT resource for the necessary header and change the positions before it is displayed.
[mw_kernel2.a]

SPR028 Profiles called 'Appletalk Device' in initialization confirmation dialog

The hard disk driver 'Get Icon' control call was not completely implemented. In ad dition to the icon and mask, the device manager also expects a string placed into user dialogs via _ParamText calls. Adding the string solved the probem.
[mw_harddisk.a]

SPR029 400K diskettes do not copy properly to hard disk

Some part of the code (this has not been determined) was sequencing the drive number of the floppy disk in the VCB entry. The solution was to reset the drive number in the TSS_Calc subroutine in the Sony driver.
[mw_sony.a]

1.0beta Problem Reports

SPR030 Sound manager calls cause a system crash

The PTCH 117 resource for System Software 6.0 contains a call to load 'ptch' re source 3, containing the Sound Manager. This directly referenced the hardware. An interim solution was to NOP out the 'ptch' load and replace those traps with in tercepts in the hardware interface kernel.
[mw_kernel2.a]

SPR031 Sun-20 hard disk never comes back on-line after a 'Restart' from Finder

The ShutDown Manager performs a restart on a Macintosh Plus with the RESET instruction in assembly language. On a Lisa, this causes the parallel bus to hang. The Restart was intercepted through a ShutDown Manager feature and the ROM version was changed to $FFFF, which causes a JMP to $40000A instead.
[mw_kernel2.a]

SPR032 The state of the write-protect switch on floppy-disks is ignored

The original code of the Sony driver 'forgot' to check the write protect switch. The fix included a test for it (direct call to the 6504 to test the WP sense bit) that is im plemented with a header patch to the _MountVol call.
[mw_sony.a]

SPR033 Pre-6.0/4.2 System Software crashes with an ID=12 error on bootup

When the code to process power-offs was added, it was assumed that the ShutDown Manager was always present. This was not the wisest assumption in the world, especially since System Software before 6.0/4.2 didn't contain the ShutDown Manager. A patch to the LastPatch routine was made to check for the presence of the _ShutDown trap.
[mw_kernel2.a]

SPR034 If a profile is disconnected after startup, it is not put off-line

Code was added to the one-second interrupt andler to scan for disconnections once per second and to force the drive off-line in that event.
[mw_kernel2.a]

SPR035 Button hits during SysError call are only detected above and to the left of the button's location on the screen

Two fixes were necessary here: the error handler was polling the VIA directly. There were two checks, and they are replaced during system startup with polls of the button down bit in the VIA. The second fix was to the coordinate rectangles.
[mw_kernel1.a]

SPR038 When booting straight into multifinder, a disk-insert event is always posted which puts up the 'eject/single/double' dialog

Multifinder issues a phantom eject for drive two. Inserting a drive one check into the Sony driver prevented this error.
[mw_sony.a]

SPR039 The Lisa will occasionally autorepeat or autoshift without causing it on the keyboard

This was caused by a reworking of the level-2 interrupt handlers and was solved by reworking them yet again.
[mw_kernel2.a]

SPR040 No default font in parameter RAM

There was a typo in the default value list that is used when parameter memory is invalid. The default font was set to zero, rather than two.
[mw_kernel2.a]

SPR043 Serial driver will not communicate above 9,600 baud

The original draft of the serial driver did not include code to compensate for the 2% speed difference between the Mac Plus and the Lisa.
[mw_serial.a]

SPR044 The program MazeWars+ causes a Bus Error ($EFE1FE)

Mapping the entire logical memory space above $440000 into physical RAM solved this problem. In addition, the global variable VIA had to be filled with a value that is not the real VIA location, because VIA + Register A on the Macintosh maps into the Screen Page register on the Lisa.
[mw_boot.a,mw_kernel1.a]

SPR045 The program MacPlaymate causes a Bus Error ($EFE1FE)

Mapping the entire logical memory space above $440000 into physical RAM solved this problem. See SPR044 for comments about VIA addressing.
[mw_boot.a,mw_kernel1.a]

SPR046 The program CricketDraw causes a Bus Error ($800568)

See SPR045 for the solution to this bug.
[mw_boot.a]

1.0 Problem Reports

SPR047 The chooser does not properly switch serial devices

Because of the lack of error checking in the .MPP driver (see SPR050) the Choos er would permit illegal switches when serial ports were already in use. Adding our own MPP driver solved the problem.
[mw_mpp.a]

SPR049 The program FileMaker detects that it is running on a Lisa and halts

The low-memory global HwCfgFlags did not have the extended parameter memory bit set, so calls to _SysEnvirons returned a Mac 512Ke rather than a Mac Plus. FileMaker required a Mac Plus. The bootstrap kernel has been patched to put the correct value in the global.
[mw_kernel1.a]

SPR050 AppleTalk will always take port B on startup whether it is configured for a printer or not

MacWorks Plus originally used the .MPP AppleTalk driver from the system soft ware because it contained code for running on the Lisa. Unfortunately, because it was not ROM-based it assumed that a .MPP driver had already been installed and it did no error checking on PortBConfig. The solution was to generate an MPP driver for the MacWorks Plus ROM resource file.
[mw_mpp.a]

SPR051 Serial communication does not work at all

A last-minute fix for the 1.0 release prevented the serial drivers from opening cor rectly. This was repaired for version 1.0.1

SPR052 Menu clocks and CalendarMaker do not have the correct date unless Control Panel is used first.

The _InitUtil routine forced the global variable Time to zero. The clear was re moved to fix the problem.
[mw_kernel2.a]

SPR053 Saved files do not have correct date and time unless Control Panel is used immediately before saving

The _InitUtil routine forced the global variable Time to zero. The clear was re moved to fix the problem.
[mw_kernel2.a]

SPR055 The program Insight v2.01 causes Bus Errors ($016701A4)

Mapping the entire logical space after $440000 into physical RAM corrected this problem. The Insight program did exactly the same thing on both the Mac Plus and Lisa when tested, but the Mac Plus's memory management is dumb enough not to error out.
[mw_boot.a]

SPR057 No sound is ever generated, even by the control panel

This is the Sound Manager incompatability documented in SPR021.

1.0.1 Problem Reports

SPR059 Printers wont work out the 'A' serial port

The 'A' port configuration string was missing two characters that were in the 'B' port configuration string.
[mw_serial.a]

SPR062 The 3.2/5.3 System Software crash when trying to boot

This was corrected in repairing SPR033.
[mw_kernel2.a]

1.0.2 Problem Reports

SPR068 Contrast is set too high when booting from a hard disk

A change to the universal loader inadvertently bypassed the contrast reset routine which has always been present. The bypass was removed.
[mw_boot.a]

SPR069 Icon mask for floppy disks is missing bits on the top left corner

The icon masks were validated with ResEdit and reinserted back into the Sony and Hard Disk drivers.
[mw_sony.a, mw_harddisk.a]

SPR070 Only 32 megabytes of a larger-than-32M hard disk is available

Two bugs needed fixing: The hard disk driver was written to ignore the high word of the drive size returned by a status inquiry; and the drive queue element had to be configured to use a longword instead of a word. These changes were made in the Control Call 30 handler in the Hard Disk driver.
[mw_harddisk.a]

SPR072 _ReadXPram and _WriteXPram trap calls cause system crashes

The extended parameter memory information was obtained from Apple Computer and the _ReadXPram and _WriteXPram calls were implemented.
[mw_kernel2.a]

SPR073 System Software 6.0 crashes when booting

The System Software 6.0 compatability package was added for version 1.1a. This includes building modified PTCH 117, ptch 0, ptch 1, ptch 2, NBP and MPP drivers into the ROM resource file. These extensive modifications should prove adequate to support System Software 7.0 as well.
[mw_mpp.a,mw_kernel2.a,mw_image_rez]

PENDING SOFTWARE PROBLEM REPORTS

Some problems have yet to be resolved. They are listed here.

SPR036	Lisa-formatted disks do not work properly on other Macintoshes
SPR037	Macintosh II disks do not read on a Lisa or Mac XL
SPR041	Command-Option-3 (Screen Dump to File) causes address error
SPR042	Command-Option-4 (Screen Dump to Printer) prints partial garbage
SPR048	Hypercard hangs when dialing a number
SPR054	Hard-disk backup programs and floppy-disk initializing programs always create 400K disks, even when told to format double-sided
SPR056	Programs which require master disks are unable to detect the information they need to continue
SPR058	MacWrite and MacTerminal lose keystrokes
SPR060	HFS 400K diskettes won't read properly on a Lisa->Macintosh->Lisa cycle
SPR061	Word Perfect causes a system crash while starting up
SPR063	The program StarChart causes an address error
SPR064	The program MGM-CAD geometry module causes a system error 23
SPR065	The program Speed Reader crashes with a Sad Mac $000B
SPR066	The program Hypercard v1.2.1 crashes
SPR067	The program Microsoft Basic v2.1 crashes with a Sad Mac $0002 when trying to save a file
SPR071	Keypresses during boot are ignored (i.e. the 'I' key to disable Microsoft Mail)
SPR074	Desk accessories do not work under MultiFinder
SPR075	Desktop icons do not refresh under MultiFinder
SPR076	The program Disk First Aid indicates that hard disks are not HFS
SPR077	MockTerminal dial always fails the first time but then works
SPR078	The program MacZap Tools FastCopy does not recognize internal floppy disk
SPR079	The program WayStation hangs when performing a ShutDown
SPR080	Copying a floppy to a floppy does not work
SPR081	Copying a file from a floppy in small-icon mode to a hard disk in large-icon mode causes the copied file to become invisible
SPR082	System crashes when opening files from other folders under MultiFinder

MACWORKS PLUS

CHANGES SINCE VERSION 1.0.18

1.0.19 (ROM)	Traditionally, the code that is responsible for starting the system (clearing memory, displaying the blinking question mark and the happy-faced Mac on boot, and the initial startup code) has been located at the start of the Macintosh ROM ($00400000). In the ROM, this space is needed by power-up diagnostics and hardware configuration instructions. Further, since there has never been enough space in the startup code, portions of it were stored in the main "kernel" or guts of the Macworks Plus program elsewhere in memory. This necessitated a "jump table" that was used to get between places. The jump table idea is nothing new - Macworks 3.0 used the same approach. However, the jump table will not work if Macworks Plus is in ROM. Therefore, in 1.0.19 and all future versions, this code was relocated to main kernel. This entailed extensive modifications to the files 'mw_kernel1.a', 'mw_kernel2.a', as well as the bootstrap code 'mw_boot.a'.
1.0.19 (Upkeep)	Eliminated all hardcoded references to the address of parameter RAM - replaced them with equates stored in the file 'mw_includes.a'
1.0.19 (Fix)	Make the screen go totally to black before shutting down to cover-up the bomb box that appeared on Lisas (no way to eliminate the bomb box - so it had to be hidden)
1.0.19 (Fix)	Patch one of the Appletalk Name Binding Protocol modules to solve the problem where Quickmail 2.0 and InterPoll would crash when you tried to run them. Both programs now run fine.
1.0.19 (Fix)	Eliminated disk-based Extended Parameter Memory Use - replace with a brief kludge to simulate it without actually doing anything. This was a precursor to actually fixing the problem while I moved onto other bugs.
1.0.19 (Fix)	Patch the sound installation code to look for both versions of the Sound card and to respond appropriately.
1.0.19 (ROM)	Version 1 of our own Lisa Startup code for the ROM (ROM version only)
1.1a (Fix)	Implemented Extended Parameter Memory completely in RAM. This introduced a couple of problems because the Lisa has one quarter of the parameter memory in the Mac Plus, but more parameter memory than in the Mac 512 and Mac 128. So I had to pick and chooser which things I kept. I used the Extended Paramter Memory specification from Apple which David Ramsey provided as a favor (this information is *NOT* available in any public channel). Unfortunately, there were errors in the specification. Items marked as specifically used only on the Mac II were, in reality, used on the Plus - like the delay between when you select a hierarchical menu and when it actually appears.
1.1a (Fix)	Installed James MacPhail's solution for spontaneous shutdowns (he isolated an error I had described to Roger but been unable to locate with my tools)
1.1a (ROM)	Version 2 of our own Lisa Startup code for the ROM (ROM version only) - fixed errors in memory mapping which prevented access to entire Macworks Plus ROM image

1.1b (Fix)	Track down and repair all errors in Apple's Extended Parameter Memory specification and implement them in Macworks Plus.
1.1b (Fix)	Made the new Sound Manager always present in a patched form to eliminate Hypercard and other programs from hanging when they called it. Also had to break-down, analyze, and hand-modify all of the custom sound resources in the System Software for each version of the System Software and include these in our ROM Resource file.
1.1b (Fix)	Modify the dimming software to eliminate a potential conflict between dimming and hard disk usage (supplied by James MacPhail)
1.1b (Fix)	Temporarily replaced our Serial Driver with a patched version from the original MacWorks in order to get a fix for the Imagewriter spacing problem out the door.
1.1c (Fix)	Repaired bug in the startup code which ignored any attached and bootable SCSI disks if there was not a bootable internal Sun-20, Widget or Profile.
1.1c (Fix)	Installed fix for Imagewriter spacing problem (supplied by James MacPhail) and replaced our original Serial Driver.
1.1c (Fix)	Hand-patch a couple of Sound Manager patches that slipped through the first time.
1.1c (ROM)	Version 3 of our own Lisa Startup code for the ROM (ROM version only) - fixed problem with memory sizing and SCSI card conflict
1.1d (Fix)	Adjusted the startup code which controls the patches we make in order to run multiple versions of the Macintosh System Software. An error made it so that System 6.0/Finder 6.0 would no longer boot up, but rather put up a bomb box with the message 'A needed resource could not be loaded.' NOTE: Systems 3.2/5.4, 4.0/5.5, 5.0/5.6, 6.0.1/6.1, 6.0.2 and 6.0.3 all worked fine.
1.1b-d (ROM)	In addition to a jump table, Macworks Plus also used another concept from Macworks 3.0 - storing information it needs about the system (memory size, type of machine, attached hard disks, etc) within itself. Of course, if Macworks Plus is in ROM, this will not work. So in these versions, this vital information is stored in a special part of memory inaccessable to Macintosh programs, but not in ROM. This entailed extensive modifications to the files 'mw_kernel1.a', 'mw_kernel2.a', as well as the bootstrap code 'mw_boot.a'. The Sony and Harddisk drivers were also affected
1.1e (Fix)	This version reimplements from scratch each of the post-1.0.18 changes in an attempt to carefully eliminate errors. Obviously, some are still with us. **THERE IS NO REDUCED FUNCTIONALITY BETWEEN 1.1d and 1.1e, and NO NEW BUGS**
1.1e(Fix)	Hand-patch a couple more Sound Manager patches that slipped through the first time.