

The Play Station Portable™:

Background and Forensic Analysis of the File System and Standard Files on the Play Station Portable

Scott Pancoast, A+, Net+, CFCE, CPA ret.
February 25, 2008

I want to thank the following individuals for this help on this paper and there understanding.

Nicholas Newman, Robert Fried, and Mel Joiner for their input and review of the information in this paper and finally, my wife and my son for your patience.

Without your help, I would not have been able to complete this paper.

Sincerely,

Scott Pancoast

Abstract

Many people regard the Sony Play Station Portable as merely a cute game console for children and young adults. This is far from the truth. Yes, the PSP can play games, play movies, music, and display images, but a user can also browse the internet, or sniff for wireless access points. A user can attach a PSP to any computer via a USB cable to act as a USB storage device or as a platform to run software via another computer. The PSP Homebrew community has ported Linux, FTP servers and other software to the PSP. In the hands of a knowledgeable user the PSP can be used as the base for various nefarious activities.

This paper provides the examiner with a baseline examination of the Sony Play Station Portable (“PSP”). The paper reviews the hardware of the PSP from a device recognition and capabilities viewpoint. The default file systems employed by the PSP’s Operating System and some of the standard file formats are examined. Further, it reviews the evidence that is stored in the PSP’s RAM and on the PSP’s removable memory. Finally, the paper discusses processing considerations.

Contents

Introduction	4
Reference Hardware	5
Device Recognition	6
Select System Specification	6
The Function Buttons	7
The Sony Operating System	7
The Operating System Options	8
Data Storage	11
The Homebrew World of PSP	12
The Format Memory Stick Function	14
Effect of the “Format Memory Stick” option on a 32MB Memory Stick	14
Effect of the “Format Memory Stick” option on a 4GB Memory Stick	15
Examination of the Standard Content of The Directories	16
Processing Considerations	19
Misc addendum	20
References	21

Appendix

- A – Glossary of terms used in conjunction with the PSP
- B – PSP Internet Sites
- C – More System Specifications
- D - Analysis of data left / inserted on to a Sony Memory Stick Duo
 - D1 - Forensic Analysis of a Sony Memory Stick Duo – 32MB
 - D2 - Forensic Analysis of a Sony Memory Stick Duo – 4GB
 - D3 – Examination of the contents of selected directories.

Introduction

Sony introduced the Play Station Portable (“PSP”) in the fourth quarter of 2004. In the first year, Sony sold over 360,000¹ units to the public. The game system with its large selection of games and movies is fun to play and provides hours of entertainment. When the PSP was first released, it included, among its other hardware, an 802.11 Wireless NIC designed to provide some minor networking capabilities. The original intent was to allow users of the PSP to form ad-hoc LANs to share the “gaming experience” and to allow software vendors to upload patches and game improvements to their software. Shortly after the game system was released, a hack to the wireless LAN software was introduced that allowed users to access the internet.

Sony identified the fact that the users of the PSP wanted to access the internet. In response to the users desires Sony added more robust network connectivity software and an internet browser to the device. The current release of the operating system (“OS”) allows users easy access the internet.

In September 2007, Sony released an updated version of the Play Station Portable, system. The new device is slimmer and grey or silver verses black acrylic. PSPs have been sold in other colors, linked to product or movie advertisements. The newest version of the PSP has some upgrades to the hardware and adds a little to the standard OS that is available with the older versions of the PSP. The most notable upgrade to the new PSP is an upgrade that allows the user to play videos on a regular television.

Regardless, of the model of the PSP, the PSP is a lightweight portable personal computer, capable of displaying a variety of data files, from simple pictures to state-of-the-art multi-media. It can connect to the internet allowing communication over the internet from just about anywhere. A law enforcement officer who encounters a PSP needs to be able to identify the device, understand its capabilities and the devices evidentiary potential. This paper will cover how to identify the models of the PSP and its’ current capabilities.

An examiner who receives a PSP needs to know the default file system structure found on a PSP, its’ organization, and the default files created and used by the OS. Additionally, the PSP contains some volatile data in RAM that could be of evidential value. An overview of the OS and how to navigate the PSPs’ interface is covered to help the examiner locate and extract data and view data from RAM.

The PSP user community has a strong grass roots development infrastructure. A brief discussion of the evolution of the PSP from firmware version 1.50 through to the present version of firmware version 3.72 will provide a background for a discussion of the PSP Homebrew community. The Homebrew community has developed methods for expanding on the baseline capabilities of the PSP. While the Homebrew community has been busy trying to hack the PSP, Sony has been busy creating security measures to prevent the Homebrew community from hacking the OS of the PSP. This has led to different versions of the PSPs’ OS and motherboard. The different versions of the PSP motherboards have varying levels of vulnerability to being converted to a Homebrew system. Identification of these main models is discussed so the examiner can identify the methods used to hack the various PSP motherboards, if needed.

¹ SRC: http://www.gamepro.com/news.cfm?article_id=42189

The paper will also cover some processing considerations of the PSP. There is a hidden limitation of the OS / file system management software used with the PSP that may be of some evidential value.

Reference Hardware

Hardware Details

Sony PSP Ver. 1001.
Op Sys Ver. 3.50

OS Setting:

Nickname: slippery
System Language: English
Character set: US (437) for file names
Latin 1 (1252) for file text

UMD Autostart: off
WMA Playback Enabled
Flash Player Enabled
Date Format: MM/DD/YYYY
Time Format: 24 hour
Time Zone: GMT -5:00
Daylight Savings: Standard
Backlight Auto-Off Off
Auto Sleep Off
Wlan Power Save On
AVLS Off
Dynamic Normalizer On
Key Tone Off
Parental Control lvl OFF
RSS Channel Settings All Items

Video

Menu Language English
Audio Language Original Language
Subtitle Language English
UMD Video Vol +2
L/R Button Do Not Use

Model Identification

Currently, Sony has two main models of the PSP available for purchase: the original black version, and the just-released PSP Sliver, aka PSP Slim, aka PSP Ice.

The original version of the PSP was black acrylic, shown below².
Front view and bottom



Back View



Top view



The Sony PSP has been released in a number of colors making identification of the unit slightly more difficult. Additionally, there are modifications, or “mods” that have been done to the PSP. These “mods”

² <http://www.gaminggroove.com/article.php?id=30&pg=1> 11/25/2007.

³ <http://www.gaminggroove.com/article.php?id=30&pg=1> 11/25/2007

range from simple decals to extensive remanufacturing of the PSPs' black acrylic case such as replacing the logo with clear plastic or replacing the face plate.

PSP Silver, aka PSP Slim, aka PSP Ice was released to the public Sept 5, 2007.



There are a number of sub models that can be identified by looking under the battery. The models are the PSP-1000 series and the PSP-2000 series. Additionally, there are different motherboards and chipsets for the device. The presence of these other factors complicates the process of identifying the exact version of the PSP.⁵

Sony places a serial number for each device on the bottom of the device. The model number / version can be located there as well. Additionally, Sony has placed these numbers inside the battery compartment, under the battery.

Select Specifications for the original Play Station Portable

Graphics Subsystem: Geometry T&L Processor

(33M Triangles/sec) + Rendering/Texturing (664 Megapixels/sec)

Audio Subsystem: 166Mhz programmable DSPs

Memory: 32MB (main), 4Mb (embedded)

Dimensions: 6.7" x 2.9" x 0.9" Weight: 0.62 pounds

Display Type: 4.3" TFT, 16x9 aspect ratio

Resolution: 480x272 Color: 16.7 million

Max Brightness: 200cd/m2 (on AC), 180cd/m2 (on battery)

Sound: Stereo speakers

Optical Drive: UMD, 1.8Gb (dual layer)

Permanent Storage: Sony Memory Stick(TM) Duo

Wireless I/O: IrDA/SIRCS (infrared), Wi-Fi (802.11b)

⁴ <http://www.sonymstyle.com>

⁵ The different versions of motherboards had varying degrees of ease in converting the device to a homebrew PSP. (see Homebrew)

IO Ports: USB 2.0

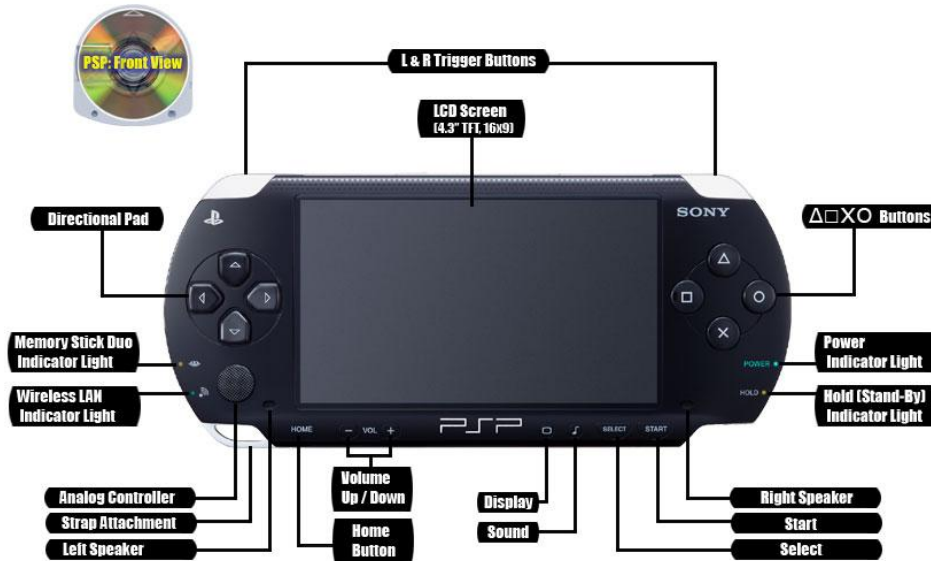
Game Controls: D-Pad, Analog stick, 4-buttons, Left/Right trigger buttons CPUs:

Twin 32-bit MIPS R4000 @333Mhz

Other controls: Volume +/-, Home, Select, Start, brightness, audio, Wi-Fi on/off Switch, Power/Sleep Switch⁶

The Functions of the Buttons.

Below is a diagram of the various buttons on a PSP.



7

The Sony Operating System

The Operating System that Sony released with the PSP has had major and minor revisions. The first PSPs in the US were shipped with OS Version 1.50. The current release is version 3.72 (as of 11/25/07). The OS is also referred to as the firmware. The OS is stored on a reprogrammable chip inside the device.

The user interface is called the “Cross-Tab browser” or the “Cross –T” interface.

⁶ <http://www.gaminggroove.com/article.php?id=30&pg=1;>

⁷ <http://pspmedia.ign.com/psp/image/article/523/523021/psp-close-up-look-20040614001233819.jpg>



The interface is accessed from the main screen. Main functions are selected by traversing right or left, using the arrow keys on the left hand side of the unit, to highlight a functions Icon. Once one of the main functions has been selected, sub-options are selected by using the up and down arrow keys to show the available options under the main topic. A specific option is then selected by pressing the “X” button on the right hand side of the unit. The circle button can be used to “BACK out” of an option or selection.

Once particular object/function has been selected (e.g. photo, video or music) pressing the triangle button “Δ “ (see “the Functions of Buttons”, above), provides additional function options. These options show up in a different colored area to the right of the screen. The additional options can be “Play”, “Delete”, “Information”, “Start”, “Slideshow”, “Receive”, “Send”, and “Display”.

The Operating System Options

The options available with OS version 3.50 are:

Network update (updates the firmware for the psp)

Start firmware update process.

USB Connection (used to connect to a PSP to a computer system)

Connects the device to a USB port as a USB Device

Video Settings (set options for the built-in dvd/UMB player)

Menu Language

Audio Language

Subtitle Language

UMD Video Volume

L/R Button (Use / Do Not Use)

Photo Settings (setting the photo slide show)

Slide Show Speed

⁸ img src: Author

System Settings

- Nick Name
- System Language
- Character Set
- UMD Auto start
- Battery Information
- Format Memory Stick
- Enable WMA Playback
- Enable Flash Player
- Restore Default Settings
- System Information
- S/W Version #
- MAC address
- About PSP – Credits

Theme Setting (changes the theme and color of the main interface)

- Theme Color (select a color)
- Wallpaper (Use / Do Not Use)

Date & Time Settings

- Date and Time
 - Set manually
 - Set via the internet
- Date Format
 - YYYY/MM/DD - DD/MM/YYYY - MM/DD/YYYY

Time Format

- 12 hour Clock
- 24 hour clock
- Time Zone (lots)
- Daylight Savings

Power Save Settings

- Back Light Auto-Off
- Auto Sleep
- WLAN Power Save

Sound Settings (settings for the MP3 Player)

- AVLA
- Dynamic Normalizer
- Key Tone

Security Settings (sets access right for the device)

- Change Passwords (passwords for parental controls and the internet browser)
- Parental Control Level
- Internet Browser Start Control

RSS Channel Settings

Item Save Options

Network Settings (network connection settings)

Ad-hoc

Infrastructure Mode

New / Connection Selection

Scan (for access Points)

Enter Manually

Automatic >

AOSS – AirStation One-Touch Secure system

Use Wireless hotspot

T-Mobile USA

Photo (displays individual images on screen or via a slideshow)

Camera

Memory Stick

Music (play music)

Memory Stick

Video (play videos)

Memory Stick

UMD disk

Game (Plays stored games and starts new ones)

Games Sharing (compete against / with other psp players)

Saved Data Utility Browse for Saved game data

UMD Play a game

Memory Stick

Network (access internet locations and services)

Online Instruction manual

Location Free Player

This works in conjunction with Sony's "Location Free" Player.⁹

Remote Play

Connect via internet,

Connect via Private network

RSS Channel

Options

Save Multiple (channels)

Set Timer

Save

Play

⁹ Sony's "Location Free" player allows the user to control and watch a video being played on the user home video system, anywhere in the world via the internet. Sony's "Location Free" player is similar the the "Slingbox"TM.

Open Website
Delete
Information

Internet Browser

Opens Web browser

Sony has released a number of upgrades to the PSPs' original operating system. Sony releases the OS updates through it's website <http://www.us.playstation.com> . The site can be reached via any pc or through the PSP itself. In addition, OS updates can be found on many mirror sites.

The process for updating the PSP operating system or firmware is fairly simple. The user first downloads the latest upgrade package (the "updater" package) from the Sony website, or via the Network Update feature or by downloading the update software from any one of the mirror sites available on the internet. This file is called **EBOOT.PBP**. Regardless of where the user gets the updater file, this file is saved onto the Memory Stick Duo and stored in the directory **"PSP/Games/."**

The size of the update file has been growing over time. Originally, the file was about 14MB. The recent versions are approximately 25MB in size.

After the user has saved the file to a device, the user selects the game option, and navigates to the memory stick. The PSP reads the contents of the sub-directory and provides the user with the option to run the **"PSP™ Update ver. X.XX"**. The user selects the updater file and starts the update process (The user presses the "X" button.)

Once the updater program starts it, examines the charge in the battery. If the charge in the battery is not sufficient, the update program will not proceed with the update. The updater program requires that the battery be fully charged prior to the commencement of the update.

Data Storage

Memory Stick Duo¹⁰

The PSP has 32MB of RAM installed in the device. There are no provisions for upgrading the memory installed in the PSP.

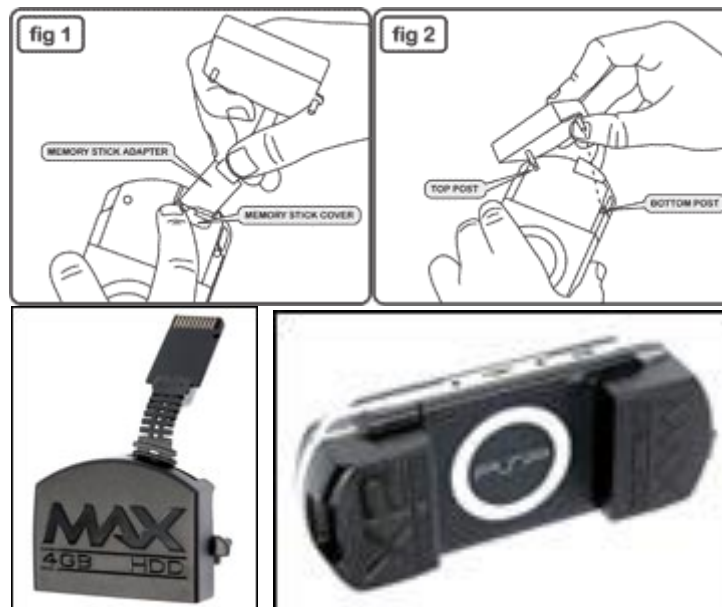
The PSP has a slot that allows for additional removable storage. The storage device is Sony's proprietary Format Memory Stick Duo ("MSD"). The Memory Stick Duo is available in a number of different sizes. The MSD is available in sizes up to 8GB as of this writing. Not all of the MSD will function in a PSP, although the manufacturers claim they will. A Lexar MSD failed to work in a PSP, the exact cause was not identified.

¹⁰ See the details of the examination of Memory Stick Duos in Appendix D



PSP Hard Drive

A hard drive attachment is available for purchase. The hard drive is connected through the Memory Stick Duo slot to the PSP and attached to the rear of the device. This hard drive made the PSP lopsided so the manufacturers of this device sold the device with an additional battery pack design to even out the size and weight of the PSP with the hard disk attached.



The hard drive unit and the additional battery back seen from underneath the unit. ¹²

A number of other accessories are available for the SONY PSP, for example, various cases and connections methods. There is also 1.3 mega pixel camera that can be attached to the PSP. The newest model has the ability to play movies on a regular TV.

The Homebrew World of PSP

The original PSP was limited in its options and capabilities, but it had potential to be a very useful device. Shortly after the PSP was first released in North America in the 4th quarter of 2004, enthusiasts

¹¹ src :<http://www.dpreview.com/news/0701/07010801sonymsduo8gb.asp>

¹² image src: uk.codejunkies.com/news_reviews.asp?c=GB&cr=GBP&cs=&r=1&l=1&s=7&p=18

hacked one of the games sold for the PSP. The game allowed users to access the software developer's website and download updates to the game using an open wireless access point and the PSPs' wireless NIC. (see Appendix A - glossary for term definitions)

Hackers exploited the ability to access the internet through the wireless NIC to enable PSP users visits sites other than the software developer's intended website. In mid 2005, other hackers figured out how to replace the firmware in the PSP with hacked software. This hacked firmware and software is collectively known as "Homebrew." There are a variety of OS hacks and emulators available. The enhanced capabilities of the PSP can vary dramatically and depend on how the device has been hacked.

There is a running competition between the members of the Homebrew community and Sony. Sony has been implementing security measures to prevent software and intellectual property piracy. These measures have been in the form of changes in the software and hardware used in and by the PSP. The members of the homebrew community work hard to break the latest security measures. In some cases the measures have been by-passed in a few days, others have taken several months.

As the Sony PSP's security measures have evolved there have been changes in the actual hardware used in the devices. On the List-servs, or chat rooms, these differences are categorized by the motherboards that are installed in the devices. The PSP has had a number of different motherboards. The type of motherboard present in the device does not affect the PSP's capabilities when the device is using the OS developed by Sony. The type of motherboard in the device does affect the implementation of a "Home brew" operating system.

The motherboards are identified by a "TA" number such as "TA-82", and "TA-86" or the "regular" motherboard.

"To identify the motherboard open the PSP UMD panel and look near the top right corner. If you can see the letters "IC1003" the mother board is either a TA-82 or TA-86. If you do not see any printing the mother board is the "regular" mother board."¹⁰

Type 1 – TA- 81/ 82 /86 Model TA-082 have been seen in recent Asian PSPs and North American Core Packs.¹³

¹³ <http://psp.about.com/od/homebrew/ig/TA-082-Motherboard-Tutorial/>



If your PSP has that "IC1003" at the [UMD](#) door then it's TA-082/86, if not then it's a regular PSP.¹⁵ If the code "IC6001" appears on the left, and there is NOTHING on the right, you have a TA-081 mother board.¹⁰

The “Format Memory Stick” Function

MSDs must be formatted before the Sony PSP can use any MSD. The “Format Memory Stick” Function performs two processes on the MSDs (see Appendix D1 & D2 for analysis details). The first is to format the MSD, the 2nd is to install a standard directory structure in the MSD. Two MSDs were examined to determine what the “Format Memory Stick” function actually did to the MSDs. The two MSDs were, a Sony 32MB MSD, (“MSD-32”) that was included with the “Core” system and a SanDisk 4GB Memory Stick Pro Duo (“MSD-4”) the was purchased separately. The “Format Memory Stick” function installed a FAT-12 File system on the MSD-32 and a FAT-32 on the MSD-4.

If the “Format Memory Stick” function is used, the Memory Stick Duo is formatted with a FAT file system¹⁶. There were two versions of the FAT file systems installed on the MSDs test, a FAT12 and a FAT32. (Details of the contents and analysis of the MSDs are in the appendix.)

Effect of the “Format Memory Stick” option on a 32MB Memory Stick Duo.

For the MSD-32: formatting resulted in changes to sector 0, through 19.
Sector 0 contained a Master Partition Table but no boot code.
Sectors 2-18 were not altered
Sectors 19-31 were wiped and filled with Hex values 0x00;
FAT Table 1 starts at sector 20; FAT Table 2 starts at sector 26
The cluster size is set to 64 sectors per cluster

¹⁴ src: [mahfood1990 http://www.psp-hacks.com/forums/about111139.html](http://www.psp-hacks.com/forums/about111139.html)

¹⁵ src: [mahfood1990 http://www.psp-hacks.com/forums/about111139.html](http://www.psp-hacks.com/forums/about111139.html)

¹⁶ See Appendix D1 and D2 for the details of the analysis of two Memory Stick Duo cards

Sectors 32 through sector 415 are wiped and filled with 0x00s. These are the sectors that contain the directories created during the format. The wiping of these sectors is a typical step in the preparation for a cluster to receive a Directory. Sectors 416 through the end MSD were not affected by the format.

The directory entries are typical directory entries of a FAT file system. The directories accept Long File names. The root directory is located in physical sector 32.

The standard layout created by the “Format Memory Stick” command on the MSD-32:

Filename	Path	Dir	Size	Creation Date	Cr Time	Last Write Date	LW Time	Last Access Date	1st Cluster
MEMSTICKIND	\		0	0	0	0	0	0	0
MSTK_PROIND	\		0	0	0	0	0	0	0
(Root directory)		D	32768						2
PSP	\	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	3
GAME	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	4
SAVEDATA	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	5
COMMON	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	6
SYSTEM	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	7
MP_ROOT	\	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	8
100MNV01	\MP_ROOT	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	9
101ANV01	\MP_ROOT	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	10
MUSIC	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	11
PICTURE	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	12
VIDEO	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	13

Effect of the “Format Memory Stick” option on a 4GB Memory Stick Duo.

When the MSD-4 was formatting with the “Format Memory Stick” function, sectors 0-190 are overwritten with hex 0x00. The MSD is formatted as a FAT 32 device.

Sector 0 contains a Master Partition Table, starting at offset 446. There is no boot code.

The “Format Memory Stick” function wipes Sectors 2 through 189. (physical sector)

Sector 190, 191 contains a Boot Record for the device, Sector 196 and 197

FAT 1 begins at Sector 222 and FAT 2 begins at Sector 1199

The cluster size is set to 64 sectors per cluster.

Listed below are the typical directory entries of a PSPs FAT file system. The directories accept long file names. There are 190 sectors that are not used between the end of FAT2 and the ROOT Directory.

Root Directory Created¹⁷/ begins in Logical Sector 1986

Filename	Path	Dir	Size	Creation Date	Cr Time	Last Write Date	LW Time	Last Access Date	1st Cluster
MEMSTICKIND	\		0	0	0	0	0	0	0
MSTK_PROIND	\		0	0	0	0	0	0	0
(Root directory)		D	32768						2
PSP	\	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	3
GAME	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	4
SAVEDATA	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	5
COMMON	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	6
SYSTEM	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	7

¹⁷ This is a compilation of a number of reports from Winhex that has been reformatted for this paper.

MP_ROOT	\	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	8
100MNV01	\MP_ROOT	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	9
101ANV01	\MP_ROOT	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	10
MUSIC	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	11
PICTURE	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	12
VIDEO	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	13

Clusters 2 through 13 are the clusters that contain the directories created during the format. Just like in a typical DOS / Windows OS, clusters are wiped in preparation for a cluster to receive a directory. Physical sectors 2,944 through the end of the MSD-4 are not affected by the format and retain their original data.

The dates and times shown in the directory structure are from the local device. The device itself has no method for changing the file dates and times. But, the system date and time can be altered using the “Setting > Date & Time Settings” functions.

Examination of the Standard Contents of the Directories.

Regardless of the file system placed on the MSDs, the same initial directory structure is used. The directory structure used by the PSP is setup to mimic the functions of the device. The directories under the directory **PSP** hold the default storage locations for each different type of activity.

\PSP

\PSP\GAME – this is the directory where games are expected to store game data. Each game creates its own subdirectory to store the data it generates. Such data could be player history, location in the game, status of the player, or different player opponent statistics. An empirical examination of the directories created by several games suggests the standard naming convention for the games is “ULUS” followed by a varying number of digits.

The OS system saves the OS “updater” file in this directory after the file is downloaded from Sony.

\PSP\SAVEDATA - this is the directory where Sony instructs game developers to store Game Specific Data. The sub-directories are named like “ULUS10120” or “ULUS100950000”. The Game Icons that are displayed on screen under the “Game function” are stored in each game’s subdirectory. The icons are .PNG files.

The files in two typical games subdirectories are:

\PSP\SAVEDATA\ULUS10120 (Crossword Puzzle Games)

- DATA.BIN - There are binary data files. And can be large (> 1.0MB)
- ICON0.PNG - Small picture file (game file)
- ICON1.PMF - Small picture file (game file)
- PARAM.SFO - Game data file / information
- PIC1.PNG - Small picture file (game file)

and

\PSP\SAVEDATA\ULUS100950000 (a version of Sudoku)

- ICON0.PNG - Small picture file (game file)
- PARAM.SF0 - Game data file in formation

- PIC1.PNG - Small picture file (game file)
- SIJDOKU.BIN - These are binary data files, and can be large (> 1.0MB)

\PSP\COMMON - The author has not been able to generate a file in this directory.

\PSP\SYSTEM - This directory contains information about internet usage.

This is the location where the files for the browser are located.

There are two subdirectories created when the browser is used “\browser” and “\rssch”

- \PSP\SYSTEM\browser
 - BOOKMARKS.HTML - Bookmark file for the browser
 - HISTORYF.DAT - the data is not readable
 - HISTORYI.DAT - URLs the user has keyed into the system.
 - HISTORYV.DAT - The names and URLS of sites the user has visited

When a web site is visited, all three history files are updated. The files are not present until the first use of the browser. If the site, is not accessed by the system because of a connection error then only the HISTORYI.DAT file is updated.

HISTORYV.DAT:

This file contains a history of sites that have been visited by the user. The browser creates this file automatically. The information is in name/ value pairs, (e.g. the name of the site and then the URL for the site.) The Name and URL information is preceded by the length of the name and the URL respectively, and terminated by **0x12 36 00 00**

So the data packet has the following format: **Name length; Name; URL length, URL, 0x12 36 00 00**

Between each NAME URL pair are 28bytes of data. The next record starts with **0x01 00 00 00**

The signature for this file is:

56 65 72 2E 30 31 00 00 00 00 4E 45 50 40 44 44 41 54 <- Hex
V e r . 0 1 N F P K D D A T <- ACSII

The most recent files are shown at the beginning of the file. There is no apparent date or time associated with these entries.

HISTORYF.DAT:

This file does not appear to be readable by the user.

HISTORYI.DAT:

This file contains the information that has been entered into the Browser address bar.

BOOKMARKS.HTML:

This file contains the bookmarks set by the user. The “BOOKMARKS.HTML” file is an html document (without the ending tags for the body or html tags). Text inside the “BOOKMARKS.HTML” file state that the file is a “generated file” (by the system, *sic*) and the file will be read and over written. The date and time information for this file confirms that statement. Additionally, the author attempted to edit the

contents of the “BOOKMARKS.HTML” file and caused the PSP to not show any of the “BOOKMARKS.HTML” details. The *Create Date* and *Time* for this file coincides with the date and time of the last entry in the “BOOKMARK.HTML” file itself. The dates and times included with the “BOOKMARKS.HTML” file are the system time, adjusted to GMT, (based on the time zone set in the system). When a bookmark is clicked or linked to or followed, the “LAST VISIT:” and “LAST__MODIFIED:” date / times are updated, the “ADD_DATE:” remains unchanged.

The author has not been able to determine the recycle and retainage period of time for the data in the four files found in this directory. Empirical analysis, based on previous usage by the author, indicates that some of the data can be two or three months old.

\PSP\SYSTEM\RSSCH

\TEMP

\ITEM — this is a System / **RSS** temporary folder

\CHANNELS

CHLIST — contains a list of the RSS channels the user has added to his system. When data is downloaded and saved from an RSS site the data is stored in the \PICTURES sub-directory in a directory beginning with “[RSS]”.

\MP_ROOT

\MP_ROOT\100MNV01 - This is the directory where the PSP expects to find movies the user wishes to view. The movies can be viewed are in the MPEG-4 Format¹⁸

- Memory Stick Linear Format / MP4
 - MPEG-4 Simple Profile (AAC)
 - H.264 / MPEG-4 AVC Main Profile (CABAC)(AAC) and Baseline Profile AAC
 - AVI
 - Motion JPEG (Linear PCM)
 - Motion JPEG; (μ -Law)

The file naming pattern is “M4V”, 5 numbers, and the extension MP4. (e.g. “MV20022.MP4”). A thumbnail file can be associated with the MP4 video file. Video files that are not named according to this naming convention are not displayed on the screen and therefore can’t be directly accessed through the device

The MP4 video files must be encoded correctly or the PSP will not play them. There are several encoding software packages. Sony sells its “PSP Media Manager” software, another is “PSP Movie Creator” sold by PQDVD, and AcalaDVD’s “PSP Ripper 4.0.”

The header for the MP4 video files is:

00 00 00 ftypMSNV 00 00 02 00 MSNV 00 00 00 “ uuidPROF

There appears to be about 128 bytes of header. (See appendix D3 for the complete 128bytes.) Using “ftypMSNV”, in ACSII, with a 3 byte offset should get you the start of these files.

¹⁸ See Sony Online documentation. The list is effective 11/23/2007. Src: Sony Online manual:
[Http://manuals.playstation.net/document/en/psp/current/index.html](http://manuals.playstation.net/document/en/psp/current/index.html)

There is a footer on the file as well “1969/12/31 19:00:00” in Unicode. Preceding the footer, at the end of the movie file, is the encoding used and the name of the file. (See appendix D3 for more details.)

Associated with each movie file is a file with the same name, but ending in “.THM” this file is not required to play the video file. The file is a thumbnail picture of the contents of the video file.

\MP_ROOT\101ANV001 – This is also a movie directory. The files that are stored in this directory have a different naming convention, e.g. “MAQ122Q5.MP4”. The difference is the “MP4” is replaced by “MAQ”.

Video files that are not named according to these naming conventions are not displayed on the screen and therefore can't be directly accessed through the device

\Music

\Music is the directory where the user places music files to be played by the PSP. These files can be organized into subdirectories. The Cross - Tab interface has a limitation, the interface is programmed to read only certain directories, it will recognize one sub-directory level below these programmed directories, but will not recognize any directories that are in the next level down the directory tree. In other words, if the user places a music subdirectory called “\Country Music” under the “\Music” directory and under “\Country Music” another directory one called “\Alannah Myles”. The directory “\Alannah Myles” will not be viewable by the Cross-Tab interface.

According to Sony the following types of media can be played on the PSP™ system.¹⁹

Memory Stick™ Audio Format

- ATRAC3™
 - ATRAC3p1us™
 - MP3
 - MP3 (MPEG-IP Audio Layer3)
- MP4 (MPEG-4 AAC)
- WAVE (Linear PCM)
- WMA

Picture

\Picture is the sub-directory where the user can place photos he wants to display on screen. The user can organize his pictures into subdirectories. The sub-directories can only be one layer deep. The picture browser will show pictures from anywhere in the device, provided it is one layer down in a directory the device recognizes.

According to the manual for the latest version of the PSP, the PSP will display the following file formats²⁰

- JPEG (DCF 2.0 / Exif 2.21 compliant)
- TIFF
- GIF
- PNG
- BMP

¹⁹ See Sony Online documentation. The list is effective 11/23/2007. Src: Sony Online manual:
[Http://manuals.playstation.net/document/en/psp/current/index.html](http://manuals.playstation.net/document/en/psp/current/index.html)

²⁰ See Sony Online documentation. The list is effective 11/23/2007. Src: Sony Online manual:
[Http://manuals.playstation.net/document/en/psp/current/index.html](http://manuals.playstation.net/document/en/psp/current/index.html)

Video – this is another directory added so that a user can view video files.

Processing Considerations

Large amounts of the data can be stored on the “Memory Stick Duos” used by the **PSP**. These MSDs should be imaged and reviewed as if they were hard drives. The MSDs are reasonable stable and not affected by outside conditions, so they can be stored a long time independent of any power supply. MSDs do not have a write blocker switch, so a software or hardware write blocker should be used to ensure the integrity of the data on the device. During the research for this paper no write blockers were employed, no changes to the data on the MSDs were observed (other, than the intended changes) during my processing. I have examined the MSDs through a USB connection, (via a MSD card reader), and via the PSP itself plugged into computer via a USB connection.

The PSP does have a function that will reformat a MSD. This function merely replaces the system areas. Additionally, any time the “Format Memory Stick” feature is run on the PSP the exact same default directories are created, in their original locations. The remaining data is not altered. So formatting the MSD, while it is destructive to the system area data, will not eliminate the evidence on the MSD.

After seizure, the PSP should be plugged into a power outlet as soon as possible using a charger designed for the device. If the device goes into hibernation mode, similar to a screensaver option, versus being shut off, the life of the battery is considerably shorter (days versus weeks or months.)

Many of the settings and much of the historical information is stored in RAM, only. I have not been able to identify any means for extracting the information stored in RAM other than a manual method, (e.g. selecting the option and recording the settings). I recommend that the information be captured either manually (writing it down) or via a recording device of some type (camera, video camera) (see other notable in information).

Miscellaneous Addendum

Settings:

The system does not save the system settings anywhere but in RAM. The battery keeps the information in RAM. There is a back up power supply that maintains the data in RAM for a short period of time. This back up power supply is intended to maintain the data in RAM while the user swaps out the battery.

Access Point Connection:

The Operating System maintains a list of wireless access points to which the system has connected. The system can store the access point information for up to eleven (11) access points. After the system has recorded the information for the 11 wireless access points, the information for one of the stored access points must be manually released before a new one can be added. The data can be displayed by going to the **System** -> **Network** option and reviewing each connection’s information separately. There is no method for dumping the contents of the access point list to any device.

The information that can be recovered is;

Connection name, SSID, Security settings, IP Address Subnet mask, Default Router Address, Primary and Secondary DNS, if a Proxy server needs to be used and if the Internet Browser should be launched automatically.

Password and Logon Information:

The system can maintain passwords and logon information. If the option to store the password and logon information is accepted when a web page offers to store a password, the password and logon information is retained in RAM. The author went to two sites where an offer to store a passwords was presented. The author accepted the offers. Later, the author returned to the sites with full access. At this time, with no way to dump the RAM out of the device the only method for recovering the data is to manually visit the sites the user has visited.

Cookies, Cache, Proxy Settings:

The browser maintains Cookies, Proxy settings, and a cache, but it has no way to display the information. There is however a method for deleting the cookies, and the cache.

The Cross Tab browser will only allow the data files to be a single level below the standard default directories created during the "Format Memory Stick" function. In some cases the browser can be directed to lower levels using the URL "files:///" addressing format through the internet browser.

References

Sony PSP Rview by Evil Cartman Mar 30, 2005 available at
<http://www.gaminggroove.com/article.php?id=30&pg=1> 11/25/2007.

http://uk.codejunkies.com/news_reviews.asp?c=GB&cr=GBP&cs=&r=1&l=1&s=7&p=18

How to tell if your motherboard is aModel TA-082 by Niko Silvester, 2007 found at
<http://psp.about.com/od/homebrew/ig/TA-082-Motherboard-Tutorial/>

how to upgrade to Original firmware from Custom firmware (TA-XX) by mahfood, hodiedah, Yeman
<http://www.psp-hacks.com/forums/about111139.html>

<http://www.sonystyle.com>

Sony Online Manual for the PSP
<http://manuals.playstation.net/document/en/psp/current/index.html>

This Glossary (reformatted and updated) by the ICEMAN. Iceman's entire post can be found at <http://www.psp-hacks.com/forums/about70493.html>

Sony PSP Playstation Portable Homebrew forum: FW Downgraders List + link +CFW + Pandora by Nimo
Posted 2/12/2007

http://en.wikipedia.org/wiki/PlayStation_Portable -
A major update to this site includes much of the information

Appendix A

Glossary of Terms ²¹

Bootsound-

The sound that plays when a PSP is coldbooted.

BOOSTER-

The developer responsible for DevHook.

Brick-

A system critical file has been corrupted on the Flash Memory, rendering the PSP unable to start. Depending on how critical the corrupted file, it may be possible to recover the PSP using any Custom Firmwares' recovery mode. Also, ANY brick (Full, or Partial) can be recovered using Pandora.

Bricker-

A slang term used to refer to any homebrew game/app that either accidentally, or purposefully, permanently damages the critical parts of the PSP's Flash, rendering it a brick.

BSoD-

This comes up when something on the Flash 1 has been corrupted. Pressing O will reset it with no permanent damage. This also commonly shows up after a downgrade. A.K.A- Blue Screen Of Death

Coldboot-

A "hard start" of the PSP

Cross-Tab Browser

This is the main menu interface on the PSP.

Custom Firmware-

Special firmware version created by PSP hackers to allow for additional features

Custom firmware is also a new development. The Custom Firmware requires that Sony's firmware 1.5 be installed on the device prior to the installation of the Custom Firmware. Installing the Custom Firmware involves writing to the PSP's flash memory, and 1.5 is the safest firmware to do so from. Not to be confused with official Sony firmwares, custom firmwares allow us to have some of the best features that Sony would never allow. Custom Firmware allows you to have recovery mode, so the PSP can be brought back in the event that it is ever bricked.

There are several notable PSP custom firmwares out right now.

HarleyG's Custom Firmware- This is a basic custom firmware, based on the proof of concept. It features a recovery mode, and the ability to dual boot between Devhook, and 1.5, among other features.

²¹ This Glossary was reformatted and updated from a post on a list-serv by the ICEMAN. Iceman's entire post can be found at <http://www.psp-hacks.com/forums/about70493.html>.

Dark_aleX's 2.71 SE- An earlier form of the OE firmwares, this custom firmware was based off of the 2.71 firmware. It is not widely used any more, instead being favored for the OE series of firmwares.

Dark_aleX's OE series - This is the most popular custom firmware, not to be confused with regular 3.xx firmwares. Unlike the official Sony version, this allows all homebrew to be played as if it were a 1.5 PSP, allows ISO files to be played without a loader, and also has recovery mode, among other features.

Eiffel65's 1.53- This is a custom firmware very similar in functions to HarleyG's custom firmware, but has a number of improvements. It has all of the features of HarleyG's Custom Firmware, as well as a few new features, such as the ability to load a custom XMB. It is still in its early releases, and will most likely be improved.

M33 Firmwares- Developed by Team M33, this firmware improves upon the OE series of firmwares that were left behind when Dark_AleX left the PSP hacking scene.

Information on putting any of these onto your PSP can be found in the tutorial section of this website. Just like a downgrader, these write to flash memory, so there is always a slight risk.

Crack-

Meaning we've found a potential weakness in the PSP's firmware, which may lead to homebrew.

CSO-

"Compressed ISO", a way to make an ISO file smaller on your memory stick

Customization-

'Modifying' your PSP by flashing new fonts, icons, backgrounds, or sounds to the PSP's flash memory, usually through the use of XFlash

Dark_aleX-

Possibly one of the most well known PSP hackers, known for his work on many downgraders, and the SE/OE series of Custom Firmware.

DAX-

A shortened form of the famed PSP hacker, Dark_aleX. It is also a form of PSP ISO Compression

Decrypt-

The encryption keeping us from looking at Sony's code has been broken. This allows us to analyze the PSP's code, and look for a weakness.

Dedaleus-

The most actively developed Nintendo 64 emulator for PSP.

Devhook-

A homebrew application that allows the PSP to emulate, or imitate, another firmware version without actually upgrading, Created by BOOSTER. This is the most common loader in use. A.K.A- Device Hook

Disc0-

This is how the UMD drive is identified to the PSP

Downgrade-

The act of rewriting the PSP's flash memory with a lower firmware version to allow for Homebrew. Requires a Kernel Mode exploit

Downgrader-

Rewrites the PSP's flash memory to a lower version. Can potentially brick your PSP.

Downgraders are homebrew applications that rewrite the PSP's flash memory to change it to a lower version. The PSP's Flash Memory holds all of the PSP's vital information, such as how it is supposed to run. Without this information, the PSP cannot run. The only way to change this is through downgraders. Downgrading is slightly dangerous, if something goes wrong, you will have a very expensive brick. It is also extremely difficult to make a downgrader. First a User Mode exploit needs to be found, which allows us to run homebrew on that firmware version, and then a kernel mode exploit must be found, which allows us to access the PSP's flash memory to change it. Just because you hear of a firmware being 'decrypted' does not mean that it can be downgraded. Whenever possible, it is highly recommended to downgrade your PSP to version 1.5, where you can then go to Custom firmware

Downgrading is very safe. The warnings you see about bricking your PSP is there just to allow the developers to cover their bases, so that if something does go wrong, they aren't responsible. Every time you change anything on the PSP's flash memory, from a font, to a full downgrade, you have a very small chance to brick. 99% of all downgrades are successful. The other 1% is usually because the person doing the downgrade cannot follow instructions. So always read the readme file before running the downgrader, and you'll be fine. Downgrading is ALWAYS recommended over HEN or the like.

Dump-

Usually includes Flash0, and occasionally Flash1. These files are copied from the PSP's flash memory, usually for use with DevHook.

Eboot-

A file that the PSP can run.

Eloader-

A.K.A Eboot Loader, A application that allows homebrew to be run on PSP firmwares 2.0 and higher

Emulator-²²

This fools the PSP into thinking it's something it's not, such as a SNES.

1. What are Emulators?

Emulators are programs written by some programmers which makes a virtual clone of a specific gaming console to make it playable on the PC or any other console, though not all consoles has emulators and not all of them can play all emulators. Emulators need ROMS to play with, and some need BIOS for emulators to work. e.g. PSX emulator on PC, Genesis emulator on PSP, MasterSystem emulator on PSX, etc.....

i) ²² (*src:* <http://www.psp-hacks.com/forums/about81043.html>)

2. What are ROMS?

Roms are a clone of games for specific consoles. ROMS are used with emulators to play certain games. Each console has specific file extension but sometimes one file extension can be for several ROM types. e.g. NES ROMS has the extension (.nes), Genesis ROMS has the extension (.smd), PSX ROMS as well as PS2 ROMS has ISO or BIN extension, etc...

3. What is BIOS?

BIOS(In Emulators) is a clone of the interface of console which contain the booting screen and other things like "Memory card manager"(In PS1 and "PS2).

4. Are emulators, ROMS and BIOS Legal?

Emulators are completely legal but ROMS and BIOS most of them are illegal to upload and give links in forums, though it is legal to have your own ROMS and BIOS, if you own the game .

Exploit-

A weakness has been found in the Firmware, which allows us to play unsigned code, A.K.A Homebrew

Fastloader-

An older form of a PSP ISO loader. Devhook is more common now.

Firmware-

The 'operating system' of the PSP

The firmware is the files that the PSP uses to run, which is located on the PSP's internal flash memory. This is everything the PSP does, from how it plays a game, to the sound it makes when it starts. It controls every aspect of the PSP, including whether or not we can play homebrew. Firmware versions 1.0 and 1.5 are fully capable of running homebrew applications. 2.0 and up, however, require the eloader, and HEN (Homebrew Enabler) to run homebrew. Often times, these firmwares can be downgraded to a lower version, such as 1.5, which can play all homebrew at full speed, without the need for any extra loaders.

1.0-1.5 -> Full homebrew capability. No restrictions. Used to install custom firmware

2.0-3.50 -> Limited homebrew capability. Can all be downgraded to 1.5

1.5 POC, 1.5 CFW, 1.53, 2.71 SE, 3.03 OE, 3.10 OE, 3.30 OE, 3.40 OE, 3.50 OE, M33 -> Custom Firmwares.

Full homebrew capabilities with no restrictions.

1.0-3.50 (Special Note) -> Using Pandora's Battery, ALL firmwares can be downgraded. However, to run it requires you have a PSP already capable of running homebrew games.

Firmware 1.5-

The most hacked firmware, next to custom firmware, that allows us to do anything

Flashing-

The act of copying a file to the Flash Memory to change the operation of your PSP.

Flash-

The internal memory of the PSP, which contains all information on how the PSP is supposed to run. Cannot be easily altered.

Flash 0-

This contains the PSP's system information

Flash 1-

This contains the PSP's information on the user, such as wifi setup, and usernames

Flash 2/3-

Rumored areas of the PSP's flash memory. Not much is known about their use.

Flash Memory-

This is the internal memory of the PSP, which contains all of its system information. A.K.A – Flash

Full Brick-

This happens when a critical part of the Flash Memory is damaged. A signal of a full brick is the inability to access recovery mode on Custom Firmware. These can be recovered using Pandora's Battery.

Gameboot-

This is the movie that is played when any game, or UMD is run

GTA

One of Sony's legitimate games that is used to hack a downgrade / upgrade to a homebrew firmware.

Hack-

Anything to make the PSP do something it isn't meant to

HEN-

Homebrew Enabler. This tricks the PSP into thinking it really is allowed to run homebrew code on higher firmware versions.

Homebrew-

"Unsigned Code" used to play games that Sony doesn't normally allow. Usually this software is developed by individuals in the PSP user community.

Homebrew is, in a technical sense, 'unsigned code'. What this means is that all Sony provided games, from downloaded demos to UMD games, are digitally signed. When the PSP tries to run any game, it looks for this digital signature, and if it can't find it, or it's wrong, the PSP won't run it. Homebrew is run by exploiting 'holes' in the firmware that bypasses this signature check, and allows the game to be run. Sony has encrypted, or hidden, this signature from all of us. Every time we try to mess with their file, this signature gets smudged, so it can't be read anymore. This prevents us from just taking an official Sony file and replacing it with our own code, or just looking for the Sony signature

Homebrew itself is anything that is created by a user. This ranges from a SNES emulator to any of the truly original games, such as Callisto, out there. Much of it is actually very fun, and can really add to your PSP

experience. Various methods have been designed to play homebrew games. This ranges from the 'kxloit' trick in firmware 1.5, to the eloader in versions 2.0 and up.

ID Storage Keys-

A set of information stored on the PSP that defines the general rules for how it works, from how to handle the charger, to what firmware versions are allowed to run. (In the case of the TA-082/86 PSP's) This is above a firmware in the way that PSP uses it.

ISO-

PSP game 'image' that is usually illegally downloaded

Kernel Mode-

A way to run homebrew, and allows access to Flash memory. This allows for downgraders, or for homebrew to be run at max speed.

LCS-

Refers to Grand Theft Auto : Liberty City Stories. Commonly used to downgrade or run homebrew.

Loader-

Assists in the playing of PSP ISO's

Lumines-

A UMD Game containing a flaw allowing for PSP Downgrades in some recent (3.30 +) firmwares.

"Magic" (Or Pandora) battery-

This refers to any battery pack that has been modified using the Pandora program to allow it to un-brick a PSP. While in this state, the battery CAN NOT be used normally, but it can be restored to its original state using a backup of the battery's flash. Read the tutorial section for more information.

"Magic" (Or Pandora) Memory Stick-

This refers to any Memory Stick that contains the files used by the Pandora program to un-brick a PSP.

Modchip-

A second Flash Memory that can be soldered to a PSP's motherboard, making the PSP 'unbrickable'. However, this requires advanced skills to install. A.K.A- Undiluted Platinum

MP4-

The only movie format that the PSP can play. In order to play, it must be specially converted for the PSP using computer software.

MS Root-

The Root of your memory stick, or the first folder you see when you open it on your PC.

Noobz team-

A team of PSP hackers that have contributed the eLoader, xLoader, and help with many PSP downgrades

OE-

"Open Edition". The common term for Dark_aleX's most recent Custom Firmware. Currently at 3.10 OE-A

Official Firmware-

Not to be confused with custom firmware, this is the firmware released by Sony to block homebrew games

Pandora-

A application that will turn your PSP's components, including its memory stick and battery, into special "Magic" items. This is the same process Sony uses to un-brick PSP's you send them.

This is an application, released by a team of VERY skilled PSP hackers, that allows us to un-brick any PSP without sending it to Sony. It uses the same process that Sony uses at its repair centers, allowing it to un-brick any PSP sent to them. The catch is, here, a minimal version of 1.5 is installed, as opposed to the latest firmwares that Sony would install. This application can also be used to downgrade ANY past, present, or future official Sony firmware. More information on where to find this application, and how to use it, can be found in the Tutorial section of this site.

A few notes, however-

1. The "Pandora Battery" required to un-brick a PSP CAN NOT be used normally in that state. When transforming the battery into a Pandora Battery, you have the option to create a backup of the battery's flash data. This is ESSENTIAL if you intend to use it again as a normal battery. See the tutorial section for more info.
2. There is a similar process used on the memory card. A simple Re-Format using the PSP's "Format Memory Stick" will return it to it's normal state.
3. The version of 1.5 running from the Pandora's Battery MINIMAL. Many things will NOT work. Pandora's Battery does come with a flasher that allows you to re-flash 1.5 to your PSP.

Special Note-> Pandora's Battery can unbrick or downgrade ANY PSP. The exception to this rule is any PSP that was bricked (Bricked. It can still downgrade TA-082/86 PSP's) by corrupted ID Storage Keys. PSP's bricked in this manner CAN NOT be unbricked, as Pandora's Battery has no way to fix them. (I.E- Attempting to downgrade a TA-082/86 PSP without the special downgrader)

Pandora Battery



23

The Hack necessary to create a Pandora Battery

²³ http://www.psp-hacks.com/images/psp_pandora.jpg

Pandora Memory Stick

Patched (Grand Theft Auto)-

Commonly used to refer to a version of the Liberty City Stories UMD game that has had the flaw to run homebrew removed. Impossible to tell on the box, but contains a 2.50 or 2.60 update on the UMD. Most common version of Liberty City Stories on store shelves.

PSP2.50 > 1.50 > 3.03oe-a > 3.10oe-a > 3.40oe-a > 3.40* > 3.52 M33 > 3.52 M33-2 3.52 OMY 07

This string of characters described the upgrade path that a user can follow in install a home brew firmware. Downgrade from firmware version ("f/w") 2.50 to f/w version 1.50 to 3.03oe-a (a homebrew f/w), Then the upgrades to follow. (see **firmware**)

Recovery Mode-

This allows you to bring your PSP back to life, if you happen to partially brick it.

RSoD-

More severe than a BSoD, this may mean something serious is corrupted. Usually, resetting the PSP will cure this, however. May also show up after a downgrade, in which case a reset will get rid of it. A.K.A- Red Screen Of Death

RSS-

RSS is a family of Web feed formats used to publish frequently updated content such as blog entries, news headlines or podcasts. An RSS document, which is called a "feed," "web feed," or "channel," contains either a summary of content from an associated web site or the full text. RSS makes it possible for people to keep up with their favorite web sites in an automated manner that's easier than checking them manually.

SE-

"Special Edition", used as in 2.71 SE, which is a custom firmware created by Dark_aleX

Semi Brick-

This is a brick that was not caused by corrupting critical files. The PSP can be recovered using Custom Firmwares' Recovery Mode, or Pandora's Battery. If recovery mode can be accessed, it is a semi-brick, not a full brick. A.K.A- Half Brick

Signature-

The way that Sony tries to restrict homebrew. The PSP will look for this every time any code is run. Hacks allow us to bypass this.

SNES 9x-

The most common SNES emulator for the PSP

Sony-

The company that designed and developed the PSP

Sony Official Firmware-

Any firmware released by Sony. These are most commonly released to combat the hacks that the PSP hacking scene has discovered. Upgrading to any Sony Official Firmware will make your PSP unable to play any homebrew games.

TA 079-

One of the "good" motherboards, which can be downgraded without any extra steps

TA 081-

Another "Good" motherboards, can also be downgraded without any extra steps.

TA 082-

"Bad" PSP motherboard. Requires a different downgrader to downgrade. Can be identified by "IC1003" marking on the upper right of the PSP UMD tray.

TA 086-

Another "Bad" PSP motherboard. Requires the same downgrader as a TA-082 board. Can be identified in the same manner as TA 082.

UMD-

Universal Media Disk. This is what the PSP plays its legitimate games from.

Unpatched (Grand Theft Auto)-

Refers to the version of Liberty City Stories that contains a flaw allowing us to run homebrew and downgraders. Impossible to tell by the box, but has a 2.00 update on the UMD. Not easy to find anymore.

Unsigned Code-

A.K.A Homebrew. Code that is run on a PSP without the officially Sony signature.

Upgrade-

Usually referred to upgrading the PSP's firmware using an official Sony update, which is highly discouraged. May also refer to installing custom firmware.

User Mode-

This is a way that homebrew can be run, but cannot access anything on the flash memory, so it runs slower than kernel Mode

XFlash-

Allows for customization of the PSP by flashing new items to the flash memory, such as fonts, or pictures. Has a very small risk of bricking.

xLoader-

An experimental version of the eLoader, created for firmware 2.80

XMB-

Cross-Media-Bar, The PSP's 'main menu'. This is where you can choose a UMD game, view pictures, listen to music, or watch movies.

Appendix B

PSP Internet Sites:

<http://www.us.playstation.com/psp/landing.aspx#/start/> - Sony PSP home

<http://www.mrmodchips.co.uk/catalog/> - Replacement parts for PSP's.

<http://www.pspworld.com/sony-psp/software/>

<http://www.pspnerd.com>

<http://pspupdates.qj.net/Personal-Media-Manager-v2-87/pg/49/aid/79074>

<http://www.psphomebrew.net>

<http://psp-news.dcemu.co.uk/>

<http://www.psphome.com/>

<http://www.xtremepsp.com/>

<http://www.psp-vault.com>

<http://www.psphacks.net/forums/>

<http://psphacks.blogspot.com/2005/04/psp-home-control-10.html>

<http://forums.ps2dev.org>

<http://pspnetwork.net/forum/>

<http://www.pspforums.com/forums/>

<http://www.psp-hacks.com>

<http://www.psp-vault.com/>

<http://www.pspgarden.com/>

<http://www.psphacker.com/>

Appendix C

The released details of the psp, taken from gamesradar.com:

CPU Core:

MIPS R4000 32-bit core
128-bit bus
333MHz, 1.2V
8 MB eDRAM main memory
2.6GB/sec bus [bandwidth](#)
I-Cache, D-Cache

Graphics Core 1:

2 MB VRAM
5.3Gbps bus bandwidth

Graphics Core 2:

Rendering Engine + Surface Engine
166MHz, 1.2V
664M pixels/sec fill rate

Sound Core:

VME (Virtual Mobile Engine)
166MHz, 1.2V
3D sound, 7.1 channel
Support for ATRAC3 Plus, AAC, MP3
Reconfigurable DSP engine

Media:

UMD—Universal Media Disc, 60 mm diameter
660 nm laser diode
1.8 GB dual layer
11Mbps transfer rate
Unique disc ID

Display:

4.5" TFT LCD with 16:9 widescreen display
480×272 pixels, 24-bit full color

Communication:

Wireless LAN (802.11) [Hotspots, Home Server]
IrDA infrared wireless communication [PSP, Mobile Phone]
USB 2.0 [PSP, PS2, PC]
Memory Stick

Controller:

Directional pad, analogue stick

Circle, Cross, Triangle, Square, L1, R1, Start, Select buttons

Misc:

MPEG4 AVC Decoder

Rechargeable lithium-ion battery

Appendix D1

Forensic Analysis of a Sony Memory Stick Duo 32 mb ("MSD-32")

The MSD-32 was wiped and filled the with the hex pattern 0x00:

The resulting MD5 hash for the entire stick is EFB81CC27AFE3491FA2660084AD3A089 - 63424 sectors (note this is the MD5 for the Wiped MSD-32)

The MSD-32 was formatted using the "Format Memory Stick" function.

Format time: 10/23/2007 22:30 (my display doesn't show any more accurately)

Initial hash: 7368FD8AECD4473D596C862F96BD275B (MD5 128) per Winhex

Created Image: Sony PSP 32MB MemDuo.dd

Image Hash file: Sony PSP 32MB MemDuo.txt

Image Hash: 7368FD8AECD4473D596C862F96BD275B per ILook

Sector 0 - Partition Table no boot code present!

partition marked as active;	80
start head	1
Start Sector	4
Start cylinder	0
partition type	01
end head	3
end sector	16
end cylinder	989
sectors preced'g partn	19
sectors in partition	63341

Sector 1- 18: all "00"s

Sector 19: Boot record

no boot code

boot record identifies the device as a FAT12 file type

bytes per sector	512
sectors per cluster	32
reserve sectors	1
number of FATs	2
root entires:	512
sectors under 32MB:	63341
media descriptor:	F8
sectors per FAT:	6
Sectors per track:	16
Heads:	4

Hidden sectors: 19
sectors over 32MB 0
BIOS Drive (hex, HD-8x) 00
unused 0
Ext Boot Signature 29h
Volume Serial Number 00 00 00 00
Volume Label blank
File System FAT 12
Signature 55 AA

WinHex 12.9 SR-3
10/24/2007, 00:18:15

Removable medium 1
Model: Sony PSP
Firmware Rev.: 1.00
Bus: USB
Total capacity: 32,473,088 bytes = 31.0 MB
Number of cylinders: 3
Number of heads: 255
Sectors per track: 63
Bytes per sector: 512
Sector count: 63,424
Sector count: ? [according to ATA]
Surplus sectors at end: 15,229
Partition 1
Sectors 19 - 63,359
Partition table: Sector 0
File system: FAT12
Total capacity: 32,430,592 bytes = 30.9 MB
Sector count: 63,341
Usable sectors: 63,296
First data sector: 45
Bytes per sector: 512
Bytes per cluster: 16,384
Free clusters: 1,967 = 99% free
Total clusters: 1,978

Unused inter-partition space:
Sectors 1 - 12 (6.0 KB)
Sectors 14 - 18 (2.5 KB)
Sectors 63,360 - 63,423 (32.0 KB) = 40.5 KB

FAT 1 / FAT 2 - Initial Entries

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 <- offset
F8 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

ILOOK Media Structure Report: Initial Structure of a 32MB Mem Stick Duo

+-\PSP Mem Stick Duo (4), Size 30.969 MB, Unused 41.500 KB

+-\0-FAT12, Size 30.928 MB, Free 30.929 MB

```

| +- \MP_ROOT
|   | +- \100MNV01
|   | +- \101ANV01
|   +- \MUSIC
|   +- \PICTURE
|   +- \PSP
|     | +- \COMMON
|     | +- \GAME
|     | +- \SAVEDATA
|     | +- \SYSTEM
| +- \VIDEO
    
```

Win Hex directory report²⁴

Path Root	Name	Size	Type	Attrib	Created	Last Modified	Last Accessed	St Cluster (sector)
\	MEMSTICK.IND	0	IND	--HR		27/01/2005 20:37:46		
\	PSP	4	Folder		10/23/2007 22:30:30	10/23/2007 22:30:30	10/23/2007	2 (64)
\PSP\	GAME	0	Folder		10/23/2007 22:30:30	10/23/2007 22:30:30	10/23/2007	3 (96)
\PSP\	SAVEDATA	0	Folder		10/23/2007 22:30:30	10/23/2007 22:30:30	10/23/2007	4 (128)
\PSP\	COMMON	0	Folder		10/23/2007 22:30:30	10/23/2007 22:30:30	10/23/2007	5 (160)
\PSP\	SYSTEM	0	Folder		10/23/2007 22:30:30	10/23/2007 22:30:30	10/23/2007	6 (192)
\	MP_ROOT	2	Folder		10/23/2007 22:30:30	10/23/2007 22:30:30	10/23/2007	7 (224)
\MP_ROOT\	100MNV01	0	Folder		10/23/2007 22:30:32	10/23/2007 22:30:32	10/23/2007	8 (256)
\MP_ROOT\	101ANV01	0	Folder		10/23/2007 22:30:32	10/23/2007 22:30:32	10/23/2007	9 (288)
\	MUSIC	0	Folder		10/23/2007 22:30:32	10/23/2007 22:30:32	10/23/2007	10 (320)
\	PICTURE	0	Folder		10/23/2007 22:30:32	10/23/2007 22:30:32	10/23/2007	11 (352)
\	VIDEO	0	Folder		10/23/2007 22:30:32	10/23/2007 22:30:32	10/23/2007	12 (384)

Hex View screen print of sector 32²⁵:

Root Directory At sector 32

16384	4D 45 4D 53 54 49 43 4B	49 4E 44 03 00 00 00 00	00 00 00 00 00 00 B7 A4	3B 32 00 00 00 00 00 00	MEMSTICKIND	␣;2
16416	50 53 50 20 20 20 20 20	20 20 20 10 00 00 CF B3	57 37 57 37 00 00 CF B3	57 37 02 00 00 00 00 00	PSP	İ³W7W7 İ³W7
16448	4D 50 5F 52 4F 4F 54 20	20 20 20 10 00 00 CF B3	57 37 57 37 00 00 CF B3	57 37 07 00 00 00 00 00	MP_ROOT	İ³W7W7 İ³W7
16480	4D 55 53 49 43 20 20 20	20 20 20 10 00 00 D0 B3	57 37 57 37 00 00 D0 B3	57 37 0A 00 00 00 00 00	MUSIC	Đ³W7W7 Đ³W7
16512	50 49 43 54 55 52 45 20	20 20 20 10 00 00 D0 B3	57 37 57 37 00 00 D0 B3	57 37 0B 00 00 00 00 00	PICTURE	Đ³W7W7 Đ³W7
16544	56 49 44 45 4F 20 20 20	20 20 20 10 00 00 D0 B3	57 37 57 37 00 00 D0 B3	57 37 0C 00 00 00 00 00	VIDEO	Đ³W7W7 Đ³W7
16576	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16608	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16640	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16672	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16704	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16736	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16768	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16800	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16832	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		
16864	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00		

²⁴ This is a compilation of a number of reports from Winhex that has been reformatted for this paper.

²⁵ This is a Winhex screenshot that has been reformatted for this paper.

I filled the entire MSD with hex values “ABCDEF”, as a repeating pattern.

I formatted the MSD-32 using the “Format Memory Stick” function.

Format date and Time 10/24/07 12:26am

Sectors 2 -18 not wiped or altered.

19-31 wiped filled with hex values 0x00.

Sectors 32 through end of 415 are wiped, these are the sectors that contain the directories created during the format. Sectors 416 through the end are not affected by the “Format Memory Stick” function.

Drive returned to initial state filled with hex pattern 0x00.

I formatted the MSD-32 using the “Format Memory Stick” function.

Drive hash: 7368FD8AECD4473D596C862F96BD275B (MD5 128) per Winhex (note: matches initial hash)

Changed video setting: No change to memory stick

Shutting down device.

Added a number of files to the MSD-32. This was to test the type of directory entry created by the PSP. The PSP created a standard FAT directory entry. Long filenames are created according to the normal FAT32 long file name system.

Attempt Internet access without a Wireless Access point connection, there is a change to historyI.dat.

Partition table: Sector 0
 File system: FAT32
 Total capacity: 4,095,640,576 bytes = 3.8 GB
 Sector count: 7,999,298
 Usable sectors: 7,997,312
 First data sector: 1,986
 Bytes per sector: 512
 Bytes per cluster: 32,768
 Free clusters: 124,946 !FSInfo mismatch! = 100% free
 Total clusters: 124,958

Unused inter-partition space:

Sectors 1 - 189 (94.5 KB)

Sectors 7,999,488 - 8,005,631 (3.0 MB) = 3.1 MB 7999488

Review of formatted MSD 4.0gb

Boot Record at 190

The space between sectors 1 through 189 has been zero'd out.

Sectors 190 and 191 contains boot record code, a copy of the boot code is found in sectors 196 and 197

Boot record::

```

97280 EB 58 90 20 20 20 20 20 20 20 20 00 02 40 20 00 02 00 00 00 00 F8 00 00 3F 00 FF 00 BE 00 00 00
97312 42 0F 7A 00 D1 03 00 00 00 00 00 00 02 00 00 00 01 00 06 00 00 00 00 00 00 00 00 00 00 00
97344 80 00 29 00 00 00 00 00 4E 4F 20 4E 41 4D 45 20 20 20 20 46 41 54 33 32 20 20 20 00 00 00 00
97376 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97408 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97440 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97472 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97504 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97536 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97568 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97600 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97632 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97664 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97696 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97728 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97760 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 55 AA

97792 52 52 61 41 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97824 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97856 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97888 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97920 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97952 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
97984 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98016 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98048 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98112 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98144 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98176 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98208 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
98272 00 00 00 00 72 72 41 61 1D E8 01 00 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 55 AA
  
```

Sectors 198 through 221 have been zero'd out.

FAT 1 started at sector 222;

FAT 2 started at sector 1199; Sectors per FAT (1199-222=977)

End of FAT2 (1199+977 = 2,176)

FAT entries beginning at offset (These entries are duplicated in the 2nd FAT) (613888 = physical bytes offset)

Sector 1199

```

613888  F8 FF FF FF  FF FF FF 0F  initial entries
        FF FF FF 0F  CLUSTER 2
        FF FF FF 0F  CLUSTER 3
        FF FF FF 0F  CLUSTER 4
        FF FF FF 0F  CLUSTER 5
        FF FF FF 0F  CLUSTER 6
        FF FF FF 0F  CLUSTER 7
613920  FF FF FF 0F  CLUSTER 8
        FF FF FF 0F  CLUSTER 09
        FF FF FF 0F  CLUSTER 10
        FF FF FF 0F  CLUSTER 11
        FF FF FF 0F  CLUSTER 12
        FF FF FF 0F  CLUSTER 13
        00 00 00 00
        00 00 00 00
  
```

Root Directory begins in logical Sector 1986 (physical Sector 2,176)²⁶

Filename	Path	Dir	Size	Creation Date	Cr Time	Last Write Date	LW Time	Last Access Date	1st Cluster
MEMSTICKIND	\		0	0	0	0	0	0	0
MSTK_PROIND	\		0	0	0	0	0	0	0
(Root directory)		D	32768						2
PSP	\	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	3
GAME	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	4
SAVEDATA	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	5
COMMON	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	6
SYSTEM	\PSP	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	7
MP_ROOT	\	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	8
100MNV01	\MP_ROOT	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	9
101ANV01	\MP_ROOT	D	32768	10/24/2007	22:43:24	10/24/2007	22:43:24	10/24/2007	10
MUSIC	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	11
PICTURE	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	12
VIDEO	\	D	32768	10/24/2007	22:43:26	10/24/2007	22:43:26	10/24/2007	13

²⁶ This is a compilation of a number of reports from Winhex that has been re-formatted for this paper.

Clusters 2 through 13 have been zero'd out by the format. These sectors contain the directories created by the format function. The remaining space on the MSD is unchanged.

Several files were added to the directories. The directories are normal FAT 32 directory entries. The PSP accepts Long file names. The remaining unallocated sectors have not been altered.

Appendix D3

File formats used

Please note this is not an exhaustive list of the file formats read by the PSP. These are the test files known to work with the PSP. There may be other formats.

MP4 Header accepted by PSP

The header in Hex

```
00 00 00 14 66 74 79 70  4D 53 4E 56 00 00 02 00  4D 53 4E 56 00 00 00 94  75 75 69 64 50 52 4F 46
21 D2 4F CE BB 88 69 5C  FA C9 C7 40 00 00 00 00  00 00 00 03 00 00 00 14  46 50 52 46 00 00 00 00
00 00 00 00 00 00 00 00  00 00 00 2C 41 50 52 46  00 00 00 00 00 00 00 02  6D 70 34 61 00 00 02 0F
00 00 00 00 00 00 00 80  00 00 00 80 00 00 5D C0  00 00 00 02 00 00 00 34  56 50 52 46 00 00 00 00
00 00 00 01 6D 70 34 76  00 00 01 03 00 00 00 00  00 00 00 00 00 00 00 00  00 1D F8 51 00 1D F8 51
```

The Header appears to be:

```
00 00 00 ftypMSNV 00 00 02 00 MSNV 00 00 00 "uuidPROF
```

I would recommend "ftypMSNV" in ACSII, with a 3 byte offset.

The Footer appears to be:

```
1969/12/31 19:00:00 in Unicode.
```

Note:

Preceding the footer "1969/12/31/19:00:00" is an entry that appears to be the name of the movie, and preceding the name of the movie, is the encoding method or possibly the codec used to encode the file.

The name of the movie begins 4 bytes after the hex code "2A 0E". So the last hundred to two hundred bytes of the MP4 video file could look like this:

```
"55 C4" fifteen bytes, then the encoding method
```

```
    "FFmpeg0.4.9-pre1-based-MobileHackerz030b4743"
```

```
"2A 0E" 4 bytes then the File / Movie name
```

```
    "1265-movie04"
```

```
"55 C4" 3 bytes then the footer
```

```
    "1969/12/31 19:00:00"
```

Music directory

Inserted a music file in a .wav format and played the file. Inserted several sub directories, populated those directories with music files, and played those files. I created a sub sub directory to of Jimmy Buffet songs. I could not locate the sub-sub directory with the browser.

Pictures

I inserted several .jpg pictures into the Picture sub directory. Then I created sub sub directories. These directories could not be seen though the system browser.


```

<DT><A HREF="http://www.barrettrifles.com/training_armorer.aspx" ADD_DATE="1195960096" LAST_VISIT="1195960096"
LAST_MODIFIED="1195960096" LAST_CHARSET="UTF-8">Barrett Rifles</A>
<DT><A HREF="http://www.google.com/" ADD_DATE="1195961281" LAST_VISIT="1196003488"
LAST_MODIFIED="1196003488" LAST_CHARSET="UTF-8">Google</A>
<DT><A HREF="http://electronicsworld.tripod.com/" ADD_DATE="1195963567" LAST_VISIT="1196001031"
LAST_MODIFIED="1196001031" LAST_CHARSET="UTF-8">circuit diagrams, electronic circuits, tutorials, hobbyists,
schematics</A>
<DT><A
HREF="http://mobile.usablenet.com/mt/www.vehix.com/DefaultUbiquityVersion.aspx?cid=42&brand=mobile&AspxAutoDetectCoo
kieSupport=1" ADD_DATE="1195963721" LAST_VISIT="1195963721" LAST_MODIFIED="1195963721"
LAST_CHARSET="UTF-8">Vehix.com - Home</A>
<DT><A HREF="http://www.google.com/search?hl=en&ie=ISO-8859-1&q=burn+notice&btnG=Google+Search"
ADD_DATE="1195964793" LAST_VISIT="1195964793" LAST_MODIFIED="1195964793" LAST_CHARSET="UTF-8">burn
notice - Google Search</A>
</DL><p>

```

**Analysis of the date and time from within “BOOKMARKS.HTML” data:
Is this a unix time stamp? Yes**

This file was created on November 24, 2007 @about 11:26pm. (per my cell phone)
(notice the last entry in the file, created at about 4:26am in the morning)
Time zone is set for eastern time Zone (-5:00)

So the time stored for the last entry should be November 25, 2007 4:26pm

Assume the number is the number of seconds since 1/1/1970 00:00:00

Base date to 11/24/07 23:59:59	1,195,948,800		
Site	ADD_DATE	Diff	
http://www.barrettrifles.com/training_armorer.aspx	1195960096	11296	11/25/2007 3:08:16
http://www.google.com	1195961281	12481	11/25/2007 3:28:01
http://electronicsworld.tripod.com	1195963567	14767	11/25/2007 4:06:07
http://mobile.usablenet.com	1195963721	14921	11/25/2007 4:08:41
http://www.google.com/search?h.... burn+notice	1195964793	15993	11/25/2007 4:26:36