CATALOG OF CD-I TECHNICAL NOTES
MARCH 22, 1994

TECHNICAL NOTE #022
Using RGB555 Images
Anderson, Eric - AIM
A technical note to call attention to special handling requirements for RGB555 images. Use of the UCM function dm_write() is discussed along with IFF storage format considerations, and the use of RGB images in real-time files.
No revisions.

TECHNICAL NOTE #034
DYUV Panning Algorithms
Townsend, Dave - Capitol Disc
Algorithms for panning a large DYUV draw map.
No revisions.

TECHNICAL NOTE #039
NTSC Coloring Problems
Wood, Rodney E. - AIM
Most CD-I applications designers make some assumptions about the video output from the consumer CD-I player. Some assume that the player is connected to an RGB monitor and others assume that the connections is to a television. Small pixel patterns are displayed quite differently on an RGB monitor and on an NTSC television. This document describes some caveats regarding the use of the bit patterns in CD-I.
No revisions.

TECHNICAL NOTE #041
CD-I Application Library/Trap Handler Usage
Anderson, Eric - AIM
This technical note describes the use of trap handlers found in CD-RTOS ROM. Using trap handlers allows you to save application memory. Additional memory can be saved by removing stack checking code.
No revisions.

TECHNICAL NOTE #042
Reduction of Flicker in Interlaced Pictures
Richards, Norman - PRL

Contrary to general belief, the base case CD-I system, the JNMS player, is capable of displaying interlaced pictures in a trivial manner and in a way entirely consistent with the Green Book standard.
No revisions.

TECHNICAL NOTE #044
Using Functions With Variable-Length Argument Lists in OS-9
Rader, Kirk - AIM
OS-9 does not contain standard mechanisms for writing C code using functions that take variable-length argument lists. With special care, however, it is possible to use conventional techniques when writing C code under OS-9.
No revisions.

TECHNICAL NOTE #046
Restrictions on the Use of Load CLUT Color Instructions
Anderson, Eric - AIM
This technical note describes a hardware restriction with the new VSR chip found in all CD-RTOS v1.0 players and CD-I development platforms. This restriction is not described in the current Green Book Specification (14 November 1988), but in all likelihood will be included in the next edition.
No revisions.

TECHNICAL NOTE #048
Preparing CD-I Titles for the International Marketplace
van Luijt, Alty - PIMA
Different levels of preparation may be adopted by CD-I developers to assure that CD-I titles can be used on various television systems in the international marketplace. This note makes some recommendations to assist CD-I developers in preparing their titles for international distribution.
No revisions.

TECHNICAL NOTE #047
Real-Time Code Loading
Golvin, Charles - PIMA
This technical note describes a method for loading an executable program from a real time record and executing that program. This technique may be used by titles with memory considerations provided the title engineer is able to divide the title into separately compiled programs. This technique does not provide the ability to load, execute, and return from a code fragment, such as a function or subroutine.

No revisions.

TECHNICAL NOTE #049
Performance Considerations in CD-RTOS
van Luijt, Alty - PIMA
Although recent changes in the 1.0 Philips JNMS player and in CD-RTOS have resulted in better responsiveness, title designers and software engineers can take additional steps to assure satisfactory performance from a CD-I disc.
No revisions.

TECHNICAL NOTE #051
EASI: Editing and Animation Sound Interface
Mills, Rusty - PIMA
EASI is a movieola-style CD-I system that allows you to edit sound to exact frames. By dispensing with the need to use real-time files, EASI dramatically reduces the time required to edit.
No revisions.
052
Notes on QHYB: Base Case QHY
Richards, Norman - PRL
No revisions.

TECHNICAL NOTE #054
Error Strategy for CD-I Final Product Deliverable
van Luijt, Alty - PIMA
An earlier AIM technical note, #43.1, on recommended error tolerance strategy has been widely ignored by titles in production. The current note describes the preferred and minimum requirements for error tolerance for alpha tape deliverables to AIM. Non-compliance with at least the minimum strategy is reason for rejection of the alpha tape. Supersedes and replaces AIM TN#43.1 by Robert Patton.

TECHNICAL NOTE #056
CARLIE: Compressed AIM Run-Length Image Encoding
Pferdner, Richard - Adaptive Design
CARLIE is a technique for compressing run-length encoded images. The number of bytes required for a run-length encoded image is reduced by compressing the image in the vertical direction. CARLIE works best with cartoon-like images whose original size is under 20K.
No revisions.

TECHNICAL NOTE #058

Notes from Charlie Golvin: SCCS Usage, Portation to SPARC, etc.
Golvin, Charles - PIMA
This technical note is an informal compendium of issues and techniques of interest to CD-I developers. In includes discussion of non real-time sectors in real-time files, the use of error detection code in Form 2 sectors, the use of AIM "include" files, the portation of code to the SUN SPARC environment, the use of SCCS, error detection in PCLs, and two useful programs.
No revisions.

TECHNICAL NOTE #060
Recommended Disc Building Pathways
Golvin, Charles - PIMA
In this technical note, disc building pathways that do not employ buildcd are recommended to AIM title engineers. These pathways will shorten the turnaround time required for disc building.
No revisions.

TECHNICAL NOTE #061
Software Sprites in CD-I
van Luijt, Alty - PIMA
Architecturally, CD-i is not very similar to a "game machine." Characteristics, such as sprites and collision detection, are not supported by the hardware. Yet CD-i's powerful graphics capabilities, relatively powerful CPU, two-plane video display architecture, built-in run-length logic, and superior audio circuitry--all under the control of a real-time operation system--can provide substantial functionality in the domain of action games, albeit at a different level of sophistication.
No revisions.

TECHNICAL NOTE #062
Living with Reality: Remaining Bugs in CD-RTOS 1.1
van Luijt, Alty - PIMA
In the state currently reached by CD-i players, many of the older problems have been resolved and a very workable situation has been achieved. However, a number of issues remain: the actual available implementation may deviate from Green Book definitions or the Green Book definitions are ambiguous. The time has come for title productions to face these items and plan strategies to work around them, rather than to rely on fixes in a future version of the player or its software. This note describes some of the points that have to be taken into account and suggests workarounds whenever possible. The notion of a workaround is such that the solution that is suggested is

always upward compatible; that is, discs that utilize these workarounds will work well on future players, even after the player bugs have been fixed.
No revisions. Formerly PIMA TN#62.

TECHNICAL NOTE #063
Display Synchronization in CD-I
van Luijt, Alty - PIMA
CD-i has a fairly elaborate display architecture and correspondingly complex system software support. The different functions are explained in this technical note, with the emphasis on setting up the display system in such a way that glitches can be avoided. This is probably not an issue for "simple titles," where the functionality as provided by UCM is already adequate. However, titles that rely on more complex imagery composited from both video planes need to pay attention to the problems raised in this note. Two solutions are described, one that relies on careful planning of transitions, while the other describes a more fundamental solution by properly synchronizing the transition with the display timing.
No revisions.

TECHNICAL NOTE #064
Using the GNU Cross Compiler
Golvin, Charles - PIMA
Capitol Disc recently merged two implementations of GNU to produce a cross compiler that runs under the SunOS and produces OS-9 assembly code. The GUN cross compiler employs the Microware assembler (o68) and linker l68) to produce code executable on the CD-i player.
No revisions.

TECHNICAL NOTE #065
High Resolution Graphics Tools
Vitz, Frank
The CD-i community needs techniques for capturing, converting, and displaying still images of the highest possible quality for inclusion in a variety of CD-i applications. The tools discussed here were developed to provide a production pathway to QHYB images; however, they may also be used wherever producers need to produce high resolution images.
No revisions.

TECHNICAL NOTE #066
Accessing Audio Files on a CD-I Disc

van Luijt, Alty - PIMA
CD-i has inherited some addressing conventions from CD audio which are discussed in this note. A two-second offset exists between the "Absolute Time" base and the "Logical Block Numbers" used in accessing files.
No revisions.

TECHNICAL NOTE #067.2
Tape Submission of Disc Images (revised)
Golvin, Charles - PIMA
This document is intended to completely describe the format of a tape containing a CD-i disc image, whether the disc image is submitted for mastering by a disc replication facility or submitted to PIMA to produce a limited number of one-off (WORM) discs. IN addition, the process of making such a tape on the Macintosh using the standard PIMA-recommended tape writing utilities and on the Sun using a public domain tape-writing utility is described.
Revised 8/25/92. Supersedes PIMA TN#67.1 (PIMA internal distribution only) and PIMA TN#67.

TECHNICAL NOTE #068
The CD-I Player and NVRUI
Lediaev, Lucy - PIMA
This document is a summary of the purpose and functions of the user interface to the CD-i player's non-volatile RAM. The information in this note was drawn from the AIM design document, "User Interface Design Criteria and Recommendations for NV-RAM," by Blake, Kaufman, van Luijt, and van Allen, and from a talk given to the AIM Product Test organization by Tyler Blake. The goal of this summary is to provide information on NVRUI to CD-i producers, designers, product testers, and other non-engineering personnel.
No revisions.

TECHNICAL NOTE #069
Technical Status of the Philips 910 CD-I Player
van Luijt, Alty - PIMA
In the current state of CD-i players, many of the older problems have been resolved, and a very workable situation has been achieved. However, a number of issues remain in which the actual available implementations deviate from Green Book definitions, where Green Book definitions are somewhat ambiguous, or where timing aspects play a role. This note describes some of the issues that need to be taken into account and suggests workarounds whenever possible. The

notion of a workaround implies that the suggested solution is always compatible. That is, discs that utilize these workarounds will work well on future players, even after the player bugs have been fixed or timing constraints have been relaxed.
No revisions.

TECHNICAL NOTE #070.1
Inhibiting the Replication of Global Data
Golvin, Charles - PIMA
This technical note describes a method of inhibiting the double memory cost that applications pay for initialized data, initialized data references, and initialized code references.
Revised 8/20/92. Supersedes PIMA TN#70.

TECHNICAL NOTE #057.1
Initializing a Player's Configurable Parameters (revised)
van Allen, Philip; revised by Charles Golvin - PIMA
The "CD-I Full Functional Specification" does not guarantee that the CD-i player will "boot" with a specific configuration. Therefore, the application must initialize the player's configurable parameters or risk unexpected behavior.
Revised and supersedes TN# 57.

TECHNICAL NOTE #071.1
Resource Compiler/Manager for CD-I Applications (revised)
Ellinwood, Ken - PIMA
This technical note describes a method for loading and accessing pre-initialized data at run-time. This method is intended to aid in the development of data-driven CD-i applications. This technical note supersedes the note for the original version (1.0) Dated December 2, 1991, and pertains to version 1.1 of the software.
Supersedes PIMA TN#71.

TECHNICAL NOTE #072
Passing Open Paths Between Processes (revised)
Golvin, Charles - PIMA
CD-i applications may employ more than one process. It may be required that these processes share a path to an open device. This note describes the technique for passing open paths between processes, and for determining the type of CD-i device associated with a path number.
No revisions.

TECHNICAL NOTE #073.2

Reading the Player Control Keys
Golvin, Charles - PIMA
A proposed addendum to the Green Book describes the implementation of the Player Control Keys (PCKs). This note gives concrete examples of how to actually implement these keys on both the Philips 910 player and, for debugging purposes, on the Philips 18x player. This note has been revised to describe the role of the ss_enable function in the use of the PCKs.
Supersedes PIMA TN#73.1 and 73.

TECHNICAL NOTE #074
Abekas A60 Tape Utility
Berson, Lisa - PIMA
This utility allows you to extract frames from an Abekas A60 back-up tape in CD-I IFF RGB888 file format. It also allows you to create an Abekas A60 back-up tape from CD-I IFF RGB888 files. This utility runs on a Sun3 or Sun4 machine.
No revisions.

TECHNICAL NOTE #075
Recommended Disc Labeling Conventions for PIMA Titles
Topel, Drew - PIMA
This note provides disc labeling conventions that take into account the features offered by various CD-i player manufacturers. For instance, some manufacturers will make volume and album identifiers accessible to the user. Thus, the information placed in these fields needs to be accurate and consistent with usage on other titles.
No revisions.

TECHNICAL NOTE #076
Differences between the Philips 18x and 605 Development Platforms
Golvin, Charles - PIMA
This note summarizes the major differences between the Philips 18x and 605 development platforms. This note is based on revision 1.1 of the 605 ROM.
No revisions.

TECHNICAL NOTE #077
Implementing a Compass Cursor in CD-I
Hunt, Kevin and Yoon, Douglas - PIMA
This note lays out a method for implementing a compass cursor (frequently used in traditional arcade games) in CD-i. The method described here relies heavily on the Balboa System Cursor/Hotspot

Manager. Thus, familiarity with the Balboa System is required for successful implementation of the compass cursor described here.
No revisions.

TECHNICAL NOTE #078
A Technique for Menu Highlighting
Senftner, Blake - PIMA
This note reviews a simple method for menu highlighting that is also very flexible. It involves use of a DYUV background image with a series of run-length 7 (RL7) images. It can be used to highlight standard menu hotspots and can be adapted for use with slide bars and other graphical controls.
No revisions.

TECHNICAL NOTE #079
Monitoring Audio Play from Memory
Golvin, Charles - PIMA
This technical note summarizes the methods available for monitoring audio play from memory. In particular, this note describes differences between the Green Book description and current implementation for some of these methods.
No revisions.

TECHNICAL NOTE #080
Using Sub-Routine Modules
Golvin, Charles - PIMA
This technical note describes the use of OS-9 subroutine modules in order to dynamically load executable code on demand.
No revisions.

TECHNICAL NOTE #081
Using SrcDbg to Debug CD-I Software
Ellinwood, Ken - PIMA
Microware's source level debugger, SrcDbg, is a very useful tool for debugging CD-I software. This document offers many hints and tricks that make the debugger easier to use. This document is not intended as a tutorial on SrcDbg commands or how to use debuggers.
No revisions.

TECHNICAL NOTE #082
A Graphical Method for Hotspot Generation
Trott, Graham - BEPL

This note describes a graphical method for defining hotspots and an MPW script for generating resource compiler source or any other source that acts as input to the CD-I build. This method uses the depict tool, part of Palomar Software's PICT Detective.™
No revisions.

TECHNICAL NOTE #083
A Compression Algorithm for Monochrome Images
Trott, Graham - BEPL
A compression algorithm was developed during solution of the problem of putting up a graphical error screen which needed to be kept in memory at all times. The compression method discussed herein results in a considerable reduction of the image storage requirements for these error screens.
No revisions.

TECHNICAL NOTE #084
ArtSpace Animation Conversion Pathway
Senftner, Blake - PIMA
This note describes the use of the program anim_converter. This is a UNIX-based program that takes a series of TGA or RGB888 images and converts them to a set of RL7 images suitable for compiling as an animation to be used as part of a CD-I title.
No revisions.

TECHNICAL NOTE #085.1
Ensuring Title Compatibility Across Players
Golvin, Charles - PIMA
This technical note describes potential issues to which a title developer must attend in order to assure compatibility with all CD-I players. In particular, some issues exposed by the introduction of the Philips 220 player are discussed.
Supersedes TN#85.

TECHNICAL NOTE #086
Improved DYUV Encoding Methods
Burley, Brent - PIMA
This note describes a DYUV encoding method which examines an entire scan line as opposed to the pixel-by-pixel method. This method can reduce error in the converted image and can meet the additional constraints required for DYUV "blitting." Two new tools, rgbdyuv and dyuvfit, have been developed to take advantage of this method.
No revisions.

TECHNICAL NOTE #087
Memory Allocation in CD-RTOS
Golvin, Charles - PIMA
This technical note describes how memory is allocated in CD-RTOS. It also provides guidelines for how to best control memory allocations and, therefore, prevent fragmentation.
No revisions.

TECHNICAL NOTE #088
Status of the Digital Video System
Charles Golvin - PIMA
This technical note describes reported problems with the initial CD-i Digital Video system. These reports consist of both confirmed and potential problems.
No revisions.

TECHNICAL NOTE #089
A New Method for Video Scan Synchronization in CD-i
Jon Piesing - PRL
This technical note describes three methods of video scan synchronization in CD-i, two that are described in the Green Book and one recently discovered by the author. This is of particular significance to highly interactive action games, since the two Green Book methods fall far short of what is available on other platforms.
No revisions.

TECHNICAL NOTE #090
Improved Seek Times with I$Seek
Luijks, Cor - IMS; and Golvin, Charles - PIMA
This technical note describes the use of the function I$Seek to improve seek times.
No revisions.

TECHNICAL NOTE #091
A Beginner's Guide to Balboa Edition 1
Rolff, Jan - IMS; Maxfield, Andy - IMS; and Piesing, Jon - PRL
This document provides a simple overview of Balboa and includes a simple slide-show application.
No revisions. Formerly IMS TSA#-001R to be re-released under this number.

TECHNICAL NOTE #092

Audio Considerations in CD-I
van Luijt, Alty - IMS
In CD-i there are two mechanisms for audio playback, direct and through sound maps. Each of them, and especially the combination, have some caveats. This note describes what tradeoffs play a role in this area.
No revisions. Formerly IMS TSA#002 to be re-released under this number.

TECHNICAL NOTE #093
Image Formats for Compatibility
van Luijt, Alty - IMS
This application note describes the various CD-I screen considerations in 525, 625 line, and wide screen (16:9) television formats. It emphasizes what a producer can do when 625 line production equipment is used. Refer to TECHNICAL NOTE 009 by the same author for a USA perspective.
No revisions. Formerly IMS TSA#003 to be re-released under this number.

TECHNICAL NOTE #094
Various Time Bases in CD-I
van Luijt, Alty - IMS
The CD-i player has three different time bases; the disc rate, the video filed rate, and the timer or system tick. This note describes the properties of these time bases and the pitfalls that an application has to avoid to achieve proper operations across a variety of players.
No revisions. Formerly IMS TSA#004 to be re-released under this number.

TECHNICAL NOTE #095
Media Mogul Script-to-Disc
van der Meer, Sander - IMS
The Media Mogul authoring software requires the Script-to-Disc software to create CD-i images to be tested out on an emulator. This note describes two options for Script-to-Disc: running it in-house or at Philips IMS in Eindhoven.
No revisions. Formerly IMS TSA#005 to be re-released under this number.

TECHNICAL NOTE #096
Emulator and Emulation
van Vroonhoven, Joost - IMS

Creating a CD-i application involves collecting and encoding of assets and the writing of application software to implement the interactivity. After premastering, the CD-i disc image can be tested on a CD-i player connected to an emulator. This note describes the various aspects of emulation on different hosts.
No revisions. Formerly IMS TSA#006 to be re-released under this number.

TECHNICAL NOTE #097
The Full Motion System for CD-I
van der Meer, Jan - MS
The full motion system is defined to extend CD-i with the capability to play moving natural pictures on full screen with associated audio of compact disc quality. To play full motion sequences from CD-i disc requires compression of the audiovisual information to the CD-I bit rate. The full motion system applies a compression method based on the MPEG standard. This note describes the features of the CD-i full motion system, application of the MPEG standard for full motion and the architecture of a full motion CD-i player. Major parts of this application note have been published in the paper, "The Full Motion System for CD-i" in the November, 1992, issue of IEEE Transactions on Consumer Electronics."
No revisions. Formerly IMS TSA#007 to be re-released under this number.

TECHNICAL NOTE #098
Introduction to Programming the FMV System
Ellinwood, Ken - PIMA
This paper reveals the basic knowledge required to successfully implement simple FMV features, such as play, pause, slow motion, and scan. The build-time tools, run-time algorithms and data structures required to support these features are covered. Code examples are used to illustrate the techniques described.
No revisions. Formerly IMS TSA#008 to be re-released under this number.

TECHNICAL NOTE #099
Balboa Video Manager Insights 1
Piesing, Jon - PRL; and Rolff, Jan - IMS
This document contains an introduction to the Balboa video manager. It concludes with an example of a DYUV movie.
No revisions. Formerly IMS TSA#009 to be re-released under this number.

TECHNICAL NOTE #100
Balboa Video Manager Insights 2
Piesing, Jon - PRL; and Rolff, Jan - IMS
This document contains an introduction to the Balboa video manager. It concludes with an example of a scrolling CLUT screen.
No revisions. Formerly IMS TSA#010 to be re-released under this number.

TECHNICAL NOTE #101
Extension Memory in CD-i
Golvin, Charles - Philips Interactive Media
This technical note describes how extension memory is provided in CD-i. It also provides guidelines for the specific instance of the one additional megabyte of system memory provided in the Philips Digital Video cartridge.
No revisions.

TECHNICAL NOTE #102
EOS Problem in Current DV Cartridge
Maris, Stefan
Parallel processing of video material on several computers to create MPEG data streams may results in the creation of extraneous end of sequence (EOS) codes. Occasionally, the DV cartridge loses count of its frames after encountering an EOS code, which may result in read errors or system crashes. This note recommends removal of unnecessary EOS codes from the MPEG stream and provides source code for the program "patcheos," which performs this removal operation.