

CAL Timesharing System Collection  
Paul McJones, October 2022

Contents

Introduction	1
Documents	1
Listings	4

## Introduction

The collection consists of documents (memos, manuals, notes) and source code (listings, with a small number of machine-readable source files). A set of digital files are also included: PDF files containing scans of the documents and listings, plus copies of the machine-readable source files. A top-level web page (<https://mcjones.org/CalTSS/index.html>, also included with the digital files) lists every item and includes an identifier for each document, of the form:

yy[mm[dd]]-short-title-initials

e.g., 711019-maintaining-dir-sys-prm . This identifier is part of the filename of the scanned document: archive/711019-maintaining-dir-sys-prm.pdf for the digital donation, or <https://mcjones.org/CalTSS/archive/711019-maintaining-dir-sys-prm.pdf> for the online version (to be moved to CHM hosting).

## Documents

Most of the physical documents are in a folder corresponding to the author; these folders are sorted alphabetically. Here is a list of the folders and corresponding initials for the document identifiers (see also [index.html#sec1\\_People](#)):

**William A. Bridge (1948–)**      **-whb**  
1969-1971

**Jay Earley and Paul Caizergues** **-je -pc**  
1971

**Control Data Corporation**      **-cdc**  
CDC 6000 manuals

**Laura E. Gould (1932–)** -leg  
1971

**James “Jim” N. Gray (1944–lost at sea in 2007)** -jng  
1969-1970

**Butler W. Lampson (1943–)** -bwl  
1968

**Bruce G. Lindsay (1945-)** -bgl  
1968-1970

**Bruce G. Lindsay (1945-)** -bgl  
1970-1971

**Bruce G. Lindsay (1945-)** -bgl  
Thesis (1977)

**Karl Malbrain (1950–)** -km  
1969-1970

**Gene A. McDaniel (1948–)** -gam  
19679-1971

**Paul R. McJones (1949–)** -prm  
1969-1971 + 2022

**Miscellaneous** (none)  
(non-TSS or unknown authors)

**James H. Morris, Jr. (1941–)** -jhm  
1969-1970

### **Overview of the CAL Time Sharing System**

Marianne Bentley, Jim Gray, Bruce Lindsay, David D. Redell, Howard E. Sturgis  
Undated, circa Jul-Oct 1968

## Photos

1970-71 2515 Channing Way and 2nd Floor Evans Hall

1974 Farewell party for Lindsay

1980 Reunion

1991 Reunion

**David D. Redell (1946–)**      -ddr  
1969-1970

**David D. Redell (1946–)**      -ddr  
1971

**David D. Redell (1946–)**      -ddr  
Thesis (1974)

**Keith P. Standiford (1949–)**      -kps  
1969-1971

**Howard E. Sturgis (1936–1990) -hes**  
5 May 1967-1 Nov 1968

**Howard E. Sturgis (1936–1990) -hes**  
1 May 1969-4/30/1970

**Howard E. Sturgis (1936–1990) -hes**  
1 June 1970-7 Dec 1970

**Howard E. Sturgis (1936–1990) -hes**  
6 Jan 1971-6 Dec 1971

**Howard E. Sturgis (1936–1990) -hes**  
Thesis (1973)

**Vance Vaughan (1939–)**      -vv  
1970

**Vance Vaughan (1939–)**      -vv

1971

**Vance Vaughan (1939–)** -vv

Personal files

**David J. Wheeler (1927–2004)** -djw

Multiplexor manual, circa 1967

**Nov 1969 ECS system documentation**

Marianne Bentley, Bruce G. Lindsay, David D. Redell

CAL Time-Sharing System Users Guide

CAL-TSS Internals Manual

## Listings

The listings are in binders organized by logical component of the system, similar to the order presented in <source/index.html> (or <https://mcjones.org/CalTSS/source/index.html>). Here is a list of the binders and their contents, generally in the same sequence as the contents of the binders, whereas <source/index.html> has been rearranged slightly for a more logical presentation):

## **BINDER: ECS system – PPU and CPU interrupt level code**

### **PPU programs**

- catalog of executable files [PDF](#)
- listing dates [PDF](#)
- DSD - deadstart panel program [PDF](#)
- DMP - dump PPU's and CPU to tape (for use with [DUMPSCAN](#) - see [document](#)) [PDF](#)
- PRE - TSS deadstart preloader [PDF](#)
- INI - initial load of PPU's and CPU [PDF](#)
- MPP - master PPU [PDF](#)
- DSD - display driver and operator interface [PDF](#)
- MUX - multiplexor driver [PDF](#)
- MSM - MUX simulator (using display) [PDF](#)
- SDV - simple-device (tape) driver [PDF](#)
- PDV - printer, card reader, and card punch driver [PDF](#)
- DSK - disk driver [PDF](#)

- DS2 - code to receive 2nd copy of disk driver [PDF](#)
- See also [CPU](#) programs LOWCM, SYSPAR, GENLINT, MUXINT, SDVCINT, DSKINT, and DSPINT

## CPU programs

- SYSPAR - system parameters (memory field lengths, ECS reference address, etc.)
  - 1970/07/02 [PDF](#)
- GENLINT - general data for interrupts [PDF](#)
- MUXINT - multiplexor interrupt [PDF](#)
- SDVCINT - simple-device interrupt (tapes, and also printer, card reader, and card punch?) [PDF](#)
- DSKINT - disk interrupt [PDF](#)
- DSPINT - display interrupt [PDF](#)
- INTINIT - initialize interrupt objects (buffer files and event channels, with their pseudo-processes)
  - 1970/07/19 [PDF](#)

## BINDER: ECS system

### CPU programs

- load map, 1971/11/03 [PDF](#)
- ERRORS XTEXT - error classes and error codes [PDF](#)
- TSSTYPS - program to generate ECS system type codes [PDF](#)
- LOWCM - pointers to interrupt storage; first initialization code [PDF](#)
- SYSPAR - system parameters (memory field lengths, ECS reference address, etc.)
  - 1971/10/11 [PDF](#)
- SYSERR - error recovery for ECS error [PDF](#)
- SYSENTR - system entry / exit (interface between system and user) [PDF](#)
- ERRCODE - entry points for transfers generated by ERROR macro [PDF](#)
- OPERATE - operations [PDF](#)
- EVENT - event channels [PDF](#)
- MAPS - subprocess memory<->file maps [PDF](#)
- CAPABLE - capability lists [PDF](#)
- MISC - subprocess class codes and miscellaneous [PDF](#)
- FILES - ECS files [PDF](#)
- SCHED - process scheduler [PDF](#)
- PROCESS - processes [PDF](#)
- SUBPROC - subprocesses [PDF](#)
- ALOCBLK - allocation blocks [PDF](#)
- SWAP - swap process between central memory and ECS [PDF](#)
- INITL - initialize ECS and create initial objects [PDF](#)

- ECSINIT - zero ECS, move in ECS-resident actions, create free list and master object table, etc. [PDF](#)
- INTINIT - initialize interrupt objects (buffer files and event channels, with their pseudo-processes)
  - 1971/10/20 [PDF](#)
- IPROC - system initial loader (first process; repeatedly reads from tape, creating and running specified subprocesses) [PDF](#)
  - See also [TSS system initialization](#)

## **BINDER: Tests for ECS system**

- ECSTIMES\_results - output from ??? [PDF](#)
- TESTIO - blah, blah [PDF](#)
- ISUBP - interface twixt Bead and ECS system tests [PDF](#)
- LAST - storage allocation for ECS system tests [PDF](#)
- Allocation blocks
  - TALOCX - allocation block test (force compaction) [PDF](#) [loadmap](#)
  - TALOCX loadmap [PDF](#)
  - TALOC1 - allocation block creation, destruction, display [PDF](#)
  - TALOC2 - move reserved space, steal ECS space, move CPU time [PDF](#)
  - TALOC3 - move MOT slots, increment charge rate, increment charge meter [PDF](#)
  - TALOC4 - return capability for Nth object, display object, display allocator [PDF](#)
  - TALOC1/2/3/4 load map [PDF](#)
- Capability lists
  - TCLST1 - creation, indirect fetching of capabilities [PDF](#)
  - TCLST2 - creation, display capability from full capability list [PDF](#)
  - load map [PDF](#)
- Event channels
  - TEVCH1 - creation, send event, get event [PDF](#)
  - TEVCH2 - send to another process, "you lose" event, get event or FRETURN. [PDF](#)
  - TEVCH3 - more testing with slave process [PDF](#)
  - TEVCH4 - multiple event channel operations [PDF](#)
  - TEVCH5 - test various error cases [PDF](#)
  - load map [PDF](#)
- Files
  - TFILE1 - creation of 1-level and multi-level files, creation of blocks, moving blocks, testing dirty bit, testing errors [PDF](#)
  - load map [PDF](#)
- Miscellaneous
  - TMISC1 - create class code, etc. [PDF](#)
  - load map [PDF](#)
- Subprocesses
  - TSUBP1 - ??? [PDF](#)

- TSUBP2 - create an operation to call a subprocess [PDF](#)
- load map [PDF](#)
- Timing
  - TTEST - test the TOPER test macro [PDF](#)
  - load map [PDF](#)
- Timing
  - tTIME1 - measure time spent in a loop ??? [PDF](#)
  - load map [PDF](#)

## **BINDER: Bead (interim user-level system)**

- BEAD1 -- initializes Bead directory (run once to initialize new disk ???) [PDF](#) [load map](#)
- BEAD2 -- TTY scanner and panic handler (daemon process ???) [PDF](#)
- ERROR -- print Bead error messages [PDF](#)
- TTYLINE -- TTY line collector [PDF](#)
- BEAD -- file handler / user executive [PDF](#)
- DISK -- disk file manager (includes disk initialization, load, recover, dump) [PDF](#)

## **BINDER: System initialization (IPROC/BUILDER)**

Name files - these guide [BUILDER](#)

- OPNAMES\_XTEXT - indexes of ECS operations in the operations capability list ??? [PDF](#)
- OPERCL - operations capability list [PDF](#)
- FULL -- list of names of all files following the ECS system itself on a system deadstart tape [PDF](#) [loadmap](#)
- USER -- names of TSS subprocesses to appear in user processes [PDF](#) [loadmap](#)
- TERMIN -- names of TSS subprocesses to appear in disk system TERMINATOR processes [PDF](#) [loadmap](#)
- HELPER -- names of TSS subprocesses to appear in disk system HELPER processes [PDF](#) [loadmap](#)
- ACCTP -- names of TSS subprocesses to appear in disk system ACCOUNTANT processes [PDF](#) [loadmap](#)
- TTYWTCH -- names of TSS subprocesses to appear in disk system TELETYPE WATCHER processes [PDF](#) [loadmap](#)
- JPROC -- names of TSS subprocesses to appear in JPROC [PDF](#) [loadmap](#)
- Name file generation dayfile [PDF](#)

**IPROC subprocesses (each is linked with [OPERCL](#))**

- NULLSUB - null subprocess [PDF](#) [load map](#)
- OPER1 - create operations capability list [PDF](#)

- DISK1 - create global disk system operations [PDF](#)
- DISK2 - initialize disk data (except allocation) [PDF](#)
- DISK3 - initialize disk allocation tables [PDF](#)
- DISK4A and DISK4B - create disk system class codes and call operations; create initialization call operations [PDF](#)
- DIR1 - initialize directory system (also linked with DRCTCL) [PDF](#) [load map](#)
- CMMD1 - initialize operations for command processor level [PDF](#) [load map](#)
- CMMD2 - TTY scanner and panic handler [PDF](#)
- DISK5 - create global disk system processes (TERMINATOR, HELPER, ACCOUNTANT) [PDF](#)
- OPER2 - create user operations capability list [PDF](#)
- TTYW1 - create TELETYPE WATCHER process [PDF](#)
- JANITOR - runs last in IPROC to clean up [PDF](#)

### Simulation for debugging

- XIPROC - simulated IPROC [PDF](#) [load map](#)
- XROOT - simulation of root of user process (calls BUILDER) [PDF](#) [load map](#)

### BUILDER - create and run subprocesses and processes at system initialization time and user process creation time

- BUILDER [PDF](#)

## BINDER: Disk file system Vol. 1

### Code

- HASH - user disk subprocess hash control [PDF](#)
- USERA - user process subprocess header [PDF](#)
- FRWA - F-RETURN subprocess header [PDF](#)
- TERMA - I/O request terminator process subprocess header [PDF](#)
- HELPERA - helper process subprocess header [PDF](#)
- ACCTP - accountant process [PDF](#)
- LOWCORE - bottom of address space (parameters, etc.) [PDF](#)
- COMCORE - common core cells used by everyone [PDF](#)
- LOCSYMB - local subprocess symbols [PDF](#)
- FRWLOC - F-RETURN subprocess local storage [PDF](#)
- HELPLOC - HELPER subprocess local storage [PDF](#)
- HEADERS buffers for file header block and file header record [PDF](#)
- DABUF - "DAR/DAB buffer" - disk accounting record and disk allocation block ??? [PDF](#)
- DBUGLOC - data for DEBUG [PDF](#)
- DEBUG - debugging routine [PDF](#)

- USRDEBUG - running DEBUG for user process [PDF](#)
- RUNDEBUG - running DEBUG [PDF](#) [dayfile](#)
- GFILE - global file template [PDF](#)
- MAINCL - main capability list template [PDF](#)
- TERMIN - terminator process [TERMIN](#)
- HELPER - helper process: close, destroy, etc. [PDF](#)
- ENTRY - entry/exit [PDF](#)
- CREATE - create/destroy disk file [PDF](#)
- CREBLK - create/delete file blocks [PDF](#)
- OPNCLO - open/close disk file [PDF](#)
- ATTACH - attach/detach file blocks; map actions [PDF](#)
- CLAIM - shared/exclusive file claims (locks) [PDF](#)
- ASORT - assorted actions: probe for missing blocks, get and reset clocks, get file status, etc. [PDF](#)
- FRWENT - F-RETURN read/write entry/exit [PDF](#)
- FRETRW - F-RETURN read/write action [PDF](#)
- SERVICE - service routines [PDF](#)
- ALLOC - disk allocator [PDF](#)
- ACCNT - accounting block manipulation routines [PDF](#)
- DARSPA - internal disk system accounting [PDF](#)
- TRAVERS - file tree traversal driver [PDF](#)
- COMMIO - I/O routines common to all subprocesses [PDF](#)
- USERIO - I/O routines appearing in user disk service subprocess [PDF](#)
- FRETIO - I/O routines appearing in F-RETURN handler subprocess [PDF](#)
- HELPIO - I/O routines appearing in HELPER subprocess [PDF](#)
- CONSTR - construct local file table header, destroy a pointer block in DDS [PDF](#)
- CONSTR1 - construct pointer block in DDS [PDF](#)
- USERC - user disk service subprocess tail [PDF](#)
- FRWC - F-RETURN handler subprocess tail [PDF](#)
- TERMC - terminator subprocess tail [PDF](#)
- HELPERC - helper subprocess tail [PDF](#)

## **BINDER: Disk file system Vol. 2**

### **Load maps**

- USRDSK [PDF](#)
- FRETRW [PDF](#)
- HELPER [PDF](#)
- TERMIN [PDF](#)
- ACCTP\_loadmap [PDF](#)

### **Development tools**

- EXTRACT [PDF](#)
- EDITBIN [PDF](#)

### **XTEXT files**

- PARAMS\_XTEXT [PDF](#)
- SYSCALL\_XTEXT [PDF](#)
- ERRNUMS\_XTEXT [PDF](#)
- TYPES\_XTEXT [PDF](#)
- OBBITS\_XTEXT [PDF](#)
- SYSSUBP\_XTEXT [PDF](#)
- USRSUBP\_XTEXT [PDF](#)
- DSKOPS\_XTEXT [PDF](#)
- DSKOPR\_XTEXT [PDF](#)
- SYMBOLS\_XTEXT [PDF](#)
- BEADTST\_XTEXT [PDF](#)

## **BINDER: Directory system**

- MISCMAC\_XTEXT [PDF](#)
- SYSMAC\_XTEXT [PDF](#)
- DIOPS\_XTEXT [PDF](#)
- DESCR - subprocess descriptor and data area [PDF](#)
- DEBUG [PDF](#)
- CONSTS - read-only parameter list specification and other constants [PDF](#)
- DRCTCL - template for the global directory system capability list [PDF](#)
- IO - routines to do file opening and closing [PDF](#)
- SUBRS - miscellaneous subroutines [PDF](#)
- ACTIONS - directory actions [PDF](#)
- LAST - error generation, window (buffer) [PDF](#)
- load map
  - 1971/09/07 [PDF](#)
  - 1971/09/15 [PDF](#)

## **BINDER: Command processor**

### **CMMD - command processor subprocess**

- loadmap
  - 1971/03/07 [PDF](#)
  - 1971/11/16 [PDF](#)

- CMMDA - login, built in commands, and more [PDF](#)
- CMMDB - parse and evaluate parameters (expressions) [PDF](#)
- CMMDC - character code conversion and input/output [PDF](#)
- CMMDD - parser tables for parameters [PDF](#)
  - SYNTAXA\_SNOBOL - first pass of generation of CMMDD from file GRAMMAR (missing) [PDF](#)
  - SYNTAXB\_SNOBOL - second pass of generation of CMMDD [PDF](#)
- CMMDE - parser tables for commands(?) [PDF](#)
  - SYNTAX1\_SNOBOL - first pass of generation of CMMDE from file GRAMMAR (missing) [PDF](#)
  - SYNTAX2\_SNOBOL - second pass of generation of CMMDE [PDF](#)
- CMMDF - translation of error codes to text messages [PDF](#)
- OPERCL - see [tss/init/OPERCL](#)
- DIRECTCL - see ???

### Miscellaneous

- Obsolete version of SYNTAX table generator ??? [PDF](#)
- Fragment of code from PROFILE ??? [PDF](#)

## **BINDER: Command processor, continued (“HES Miscellaneous”)**

### **TLINE - TTY line collector subprocess**

- TLINE - line collector subprocess (compare with [Bead/TTYLINE](#)) [PDF](#)

### **BEADS - Bead and command processor services subprocess**

- loadmap [PDF](#)
- BEADS - Bead and command processor services [PDF](#)
- HESMISC\_profile\_fragment.pdf ???
- PROFILE - profiles and accounting [PDF](#)
- OPERCL - see [tss/init/OPERCL](#)

### **CLNPRF - clean profile ???**

- HEAD - system interface BCPL code [PDF](#)
- CLNPRF\_BCPL [PDF](#)
- TAIL - defines first global data location (no listing available)
- OPERCL - see [tss/init/OPERCL](#)
- loadmap [PDF](#)

## BEADG - Bead ghost subprocess

- BEADG - Bead ghost: root subprocess for user process [PDF](#)
- loadmap [PDF](#)

## FAKEG - Fake Bead ghost subprocess, used for disk system

- FAKEG [PDF](#)

## BINDER: TEST - subprocess for testing CMMD debugging features ???

- TEST [PDF](#)
- OPERCL - see [tss/init/OPERCL](#)
- loadmap [PDF](#)

## BINDER: Utility programs

- BRDCST - broadcast messages to all teletypes [PDF](#)
- DUMPSCAN - interactive viewer for tape written by [DMP](#) PPU program - see [document](#)
  - DMPSCN - header and scratch area [PDF](#)
  - DMPSCAN - main program [PDF](#)
  - load map [PDF](#)
- DUMPFIL - dump SCOPE files to tape [PDF](#) loadmap [PDF](#)
- DUMPTPE - dump the files in an interim TSS disk directory to a tape? [PDF](#) load map [PDF](#)
- EDITOR - text editor [PDF](#)
- GETCARD - read card deck [PDF](#) load map [PDF](#)
- GETFILE [PDF](#) load map [PDF](#)
- GETTPE [PDF](#) load map [PDF](#)
- PRINTER - print file
  - PRINTER - storage allocation, initialization, etc. [PDF](#)
  - PRINT - main loops [PDF](#)
  - DISKTTY - teletype input and output -- borrowed from Load/Dump/Recover???
  - [PDF](#)
  - ENDPRN - finalization [PDF](#)
  - load map [PDF](#)
- SCOPE - SCOPE simulator [PDF](#)

## **BINDER: BASIC**

- UPDATEY log #1 [PDF](#)
- UPDATEY log #2 [PDF](#)
- BASIC [PDF](#)
- Dayfile [PDF](#)
- CALIDOSCOPE system messages from January 1971 [PDF](#)

## **BINDER: BASIC**

- BCPL - [PDF](#) (see [documentation](#) and <http://www.cl.cam.ac.uk/~mr10/BCPL.html>)

## **BINDER: COOLAID**

- TEST\_COOLAID - examples of each instruction format [PDF](#)
- DESCR - Bead-style subprocess descriptor and data area [PDF](#)
- FIRST - temporary initialization [PDF](#)
- TOKPROC - tokenizer [PDF](#)
- ASSMBLR - COOLAID tokens into object file [PDF](#)
- SPITTER - instruction outputting routines [PDF](#)
- SSST - system standard symbol table routines [PDF](#)
- LAST - defines end of code segment [PDF](#) [PDF](#)
- loadmap [PDF](#) [PDF](#) [PDF \(partial\)](#)
- COPYL loadmap - ??? [PDF](#)

## **BINDER: Development tools**

- NEWSYS - create a new system tape [PDF](#)
- SIMTSS - simulate CDC 6x00 system: CPU, PPU, and devices
  - CLKSYNC - clock synchronizer [PDF](#)
  - CENTRAL - configure central memory size [PDF](#)
  - PRINTL - print line, etc. [PDF](#)
  - ECS - configure extended core storage size [PDF](#)
  - PPUSIM - simulate peripheral processing units [PDF](#)
  - DSPAN - simulate ??? [PDF](#)
  - DISPLAY - simulate display ??? [PDF](#)
  - TAPEDR - simulate tape drive [PDF](#)
  - CPUSIM - simulate central processing unit [PDF](#)
  - Listing [prelude](#) [postlude](#)
  -

## **BINDER: Operations**

- Dayfile
  - 1971/10/25 - 1971/10/31 [PDF](#)
  - 1971/11/1 - 1971/11/30 [PDF](#)
  - 1971/12/1 - 1972/01/21 [PDF](#)
  - 1972/01/25 - 1972/05/24 "THE VERY LAST DAYFILE DUMP" [PDF](#)
- Crash dumps
  - ECS system, 1971/10/14 [PDF](#)