



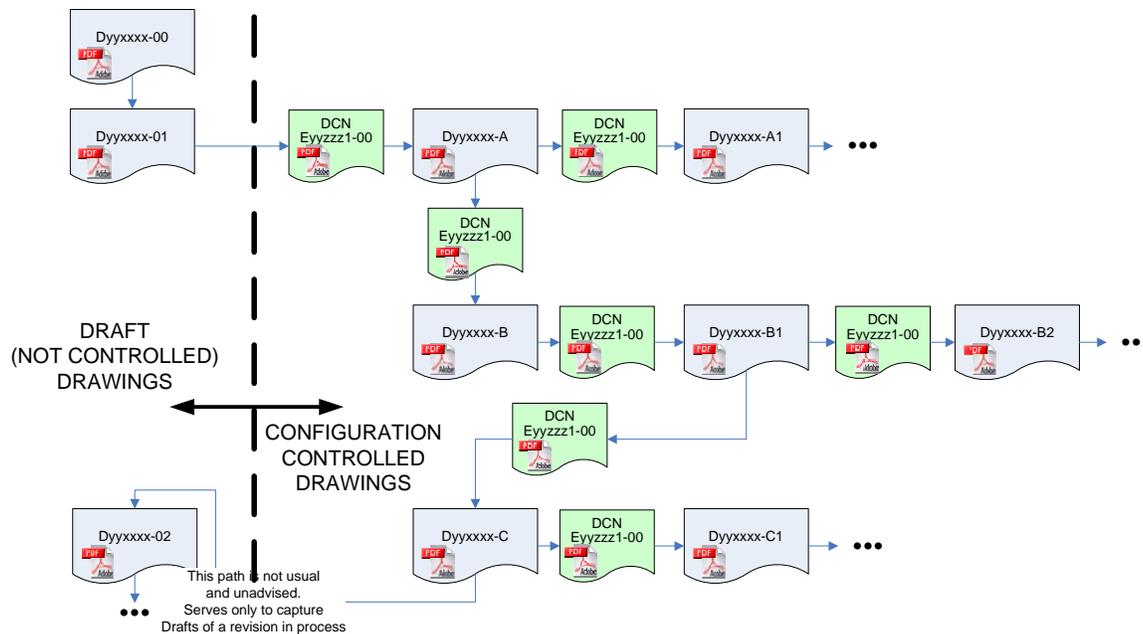
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Date:	24 Aug 2006
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Subject:	Possible Alternatives to the Current LIGO Drawing Revision Control/Sequence Scheme
To:	Rich Abbott, Todd Etzel, Calum Torrie, Janeen Romie, Linda Turner
From:	Dennis Coyne
cc:	Phil Lindquist, Larry Wallace

The revision control of drawings is described in "Drawing Requirements", [LIGO-E030350-A](#). In particular the capability to branch the revision sequence is described in section 4.8.7 and depicted in Figure 1. This capability is particularly useful for electronics board design/fabrication wherein the root of the revision branch represents a printed circuit board (PCB) layout realization in hardware and subsequent part value changes or cuts & jumper changes are revisions on the basic layout. This is the basis for the LIGO alphanumeric revision code sequence.

Figure 1: Branched Revision Control (versioning) currently used in LIGO



Once a document is placed into configuration control, signified by a lettered revision, all changes must be described and approved. This is accomplished currently in LIGO by the Document Change Notice (DCN). Only documentation used to build hardware, such as drawings and specifications (but not necessarily technical memos and letters, etc.) need to

go into configuration control. Note that all transitions between revisions that are configuration controlled are accomplished by a DCN in Figure 1.

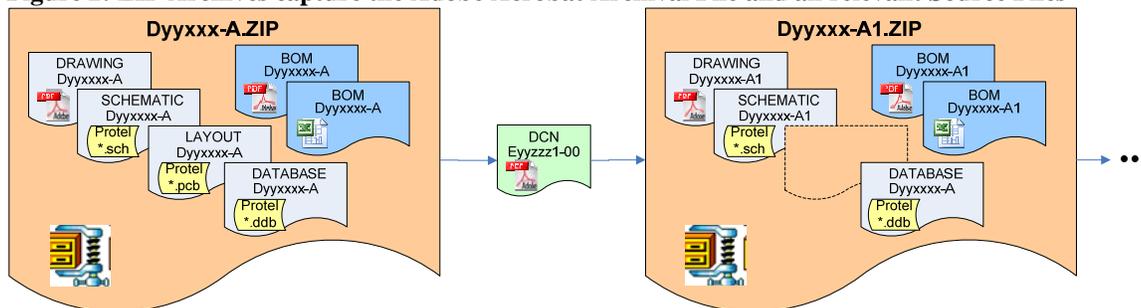
Another way to indicate the meaning behind the LIGO alphanumeric revision code is given in Table 1. To date we have generally only filed the schematic drawing of a circuit as a pdf file with a single drawing (D) number. However, in reality there is other information unrecorded, such as the details of the physical layout (the PCB artwork) and the Bill Of Materials (BOM, aka parts list). When the letter in a revision changes, it signifies a change to the basic physical layout of the PCB.

Table 1: Correspondence of LIGO Alphanumeric Revision (version) code and PCB artwork changes

D# Schematic	Rev Schematic	D# BOM Rev A	D# BOM Rev B	D# BOM Rev C
D# artwork Rev A	D# artwork Rev B	D# artwork Rev C		
Dyyxxxx	00			
Dyyxxxx	01			
Dyyxxxx	02			
Dyyxxxx	...			
Dyyxxxx	A	✓		
Dyyxxxx	A1	✓		
Dyyxxxx	...	✓		
Dyyxxxx	B		✓	
Dyyxxxx	B1		✓	
Dyyxxxx	B2		✓	
Dyyxxxx	...		✓	
Dyyxxxx	C			✓
Dyyxxxx	C1			✓
Dyyxxxx	...			✓

Realizing that we are missing a complete definition, we have recently been striving to capture all of the source files associated with the archival Adobe Acrobat (*.pdf) file that represents “the document”. As indicated in Figure 2, we wish to capture the schematic in pdf file format, but also in its source format, as well as the PCB layout file, the parts list, etc. The method for accomplishing this in the current DCC is to create a zipped (*.zip) archive of all of the files.

Figure 2: ZIP Archives capture the Adobe Acrobat Archival File and all relevant Source Files



The FileHold '06 software currently being configured for LIGO application has an inherent, built-in version control (and check-in/check-out) system which does not explicitly allow for branching in the versioning per se. It also can only label version numerically in an uninterrupted, increasing sequence starting at 001 (i.e. 001, 002, 003, 004, 005, ...). Unlike the current implementation for the LIGO Document Control Center (DCC), the FileHold

system has significant document linking (parent/child relationships) which are visible to the user. The DCN defines a relationship between one version and another. (Actually a DCN as currently defined can release multiple documents at various revision levels.) The relationships for the hypothetical branched revision history indicated in Figure 1 are depicted in Table 2.

Table 2: Drawing Revisions, DCNs and linking file association

Original DCC				FileHold			
Schematic Drawing Number	Schematic Revision, Temporal Sequence	Linked DCN Document Number	Linked Derivative Schematic Number	Schematic Drawing Number	Version #	Linked DCN Document Number	Linked Derivative Schematic Number
Dyyxxxx	00	--	--	D-yyyy-xxxx	001	--	--
	01	--	--		002	--	(D-yyyy-xxxx-001)
	A	Ezzwww1-00	--		003	E-zzzz-www1-001	(D-yyyy-xxxx-002)
	B	Ezzwww2-00	Dyyxxxx-A		004	E-zzzz-www2-001	D-yyyy-xxxx-003
	A1	Ezzwww3-00	Dyyxxxx-A		005	E-zzzz-www3-001	D-yyyy-xxxx-003
	B1	Ezzwww4-00	Dyyxxxx-B		006	E-zzzz-www4-001	D-yyyy-xxxx-004
	B2	Ezzwww5-00	Dyyxxxx-B1		007	E-zzzz-www5-001	D-yyyy-xxxx-006
	C	Ezzwww6-00	Dyyxxxx-B1		008	E-zzzz-www6-001	D-yyyy-xxxx-006
	C1	Ezzwww7-00	Dyyxxxx-C		009	E-zzzz-www7-001	D-yyyy-xxxx-008
	02	--	--		010	--	(D-yyyy-xxxx-008)

Let's consider a real example and try to implement it into the FileHold '06 system. Consider the LOS Coil Driver drawing (D000325) filed into the current DCC:

Figure 3: Current Drawings associated with the LOS Coil Driver (D000325)

(Note: revision B is missing)



LIGO Document Control Center

Document Search

Search result of 6 starting with #1 [Display Help](#)

#	Document	pdf	Doc Date	Title
1	D000325-C-C	pdf	01/31/2003	LOS Coil Driver
2	D000325-C1-C	pdf	01/13/2005	LOS Coil Driver
3	D000325-B3-C	pdf	10/17/2002	LOS Coil Driver
4	D000325-B2-C	pdf	02/20/2002	LOS Coil Driver
5	D000325-B1-C	pdf	10/29/2001	LOS Coil Driver
6	D000325-A-C	pdf	10/16/2000	LOS Coil Driver

Your search terms are:
 Document No = D000325

One can also search the current DCC for the DCN documents that released each of these drawings. This is difficult to do. The Adobe Acrobat drawing files do not have the authorizing

DCN number embedded in the drawing (this would be good practice at any rate so that the governing DCN is visible on the printed document). However embedding the DCN number in the Adobe file is not the best way to enable or facilitate finding the related documents. A powerful text-based search engine can be used (and FileHold reports that it has a very capable search engine). FileHold also has document linking capability that the users can employ to define the relationships defined in the DCNs, as depicted in Table 3.

Table 3: Comparison of Original DCC and FileHold Implementation of an example Import of D000325
 (Note: Legacy drawings like D000325 actually keep their current numbers. This is a fictitious example. Note that the DCNs for revisions B3 and C are missing as is D000325-B.)

Original DCC				Example Import to FileHold			
Schematic Drawing Number	Schematic Revision, Temporal Sequence	Linked DCN Document Number	Linked Derivative Schematic Number	Schematic Drawing Number	Version #	Linked DCN Document Number	Linked Derivative Schematic Number
D000325	A	(missing DCN)	--	D-2006-0001	001	E-2006-0001-001	--
	(missing B)						
	B1	E010212-00	D000325-B		002	E-2006-0002-001	D-2006-0001-001
	B2	E020285-00	D000325-B1		003	E-2006-0003-001	D-2006-0001-002
	B3	(missing DCN)	D000325-B2?		004	E-2006-0004-001	D-2006-0001-003
	C	(missing DCN)	D000325-B3?		005	E-2006-0005-001	D-2006-0001-004
	C1	E050035-00	D000325-C		006	E-2006-0006-001	D-2006-0001-005

These 6 drawing files (Adobe Acrobat *.pdf files) were uploaded into the demo FileHold06 application customized for LIGO. The associated DCN files (*.pdf) were also uploaded. (Some of the DCN files were repeated to make up for the missing files from the DCC.) The FileHold link capability was then used to define the relationships indicated in Table 3.

If one uses views the file list in a folder, one sees just the latest version called out. If one selects the "History of Changes" option on a particular file, then one see a list of all versions. If one then selects one of these versions and uses the "View Linked Documents" option, one sees a secondary list of all linked documents for the version highlighted. This list shows both parent and child relationships. In the screen snapshot of Figure 4, one sees the three files linked to drawing version 5. These files are the DCN that released version 5 (E-2006-0005-01), the drawing from which version 5 was derived (D-2006-0001-04) and the drawing that was subsequently created from version 5 (D-2006-0001-06).

I think the linking capability gives us all of the information and capability that we had in the original LIGO versioning scheme. As for the physical boards that are changed (e.g. from C to C1), we currently write the numeric part of the version next to the lettered version (i.e. we add "1" next to "A"). It would seem to be just as easy to "cross-out" the original version and mark the new version (remove "005" and write "006").

Figure 4: Listing Files Linked to a particular version of a Document

The screenshot displays the LIGO FileHold web interface. At the top, the LIGO logo is on the left, and navigation links for 'System Admin', 'Library Admin', 'User: test', and 'Log Out' are on the right. Below the header is a 'Document Tray' with a navigation menu on the left and a toolbar with options like 'Get a Copy', 'Check Out', 'Edit Metadata', 'Link', 'Move/Copy', 'Email', 'Delete', 'Add to Tray', and 'Add To Virtual Folder'.

The main content area is titled 'History of Document Versions for D-2006-0001-06'. It contains a table with the following data:

<input type="checkbox"/>	☆	📄	🗑️	Document Name	Type	Linked	Ver	Status	Last Modified	Owner	Edit
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-06	Drawing	2	6	Checked In	8/23/2006 10:21:09 PM	test	Edit
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-05	Drawing	3	5	Checked In	8/23/2006 10:18:56 PM	test	Edit
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-04	Drawing	2	4	Checked In	8/23/2006 10:17:30 PM	test	Edit
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-03	Drawing	1	3	Checked In	8/23/2006 10:16:14 PM	test	Edit
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-02	Drawing	1	2	Checked In	8/23/2006 10:11:21 PM	test	Edit

Below this table is a section titled 'Files Linked to: D-2006-0001-05' with a 'Remove Link' button. It contains a table with the following data:

<input type="checkbox"/>	☆	📄	🗑️	Document Name	Parent / Child Location	Type	Linked	Ver	Status	Last Modified
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-04	Drawings / Electronics / electronics_WG / LOS Coil...	Drawing	2	4	Checked In	8/23/2006 10:17:30 PM
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-06	Drawings / Electronics / electronics_WG / LOS Coil...	Drawing	2	6	Checked In	8/23/2006 10:21:09 PM
<input type="checkbox"/>	☆	📄	🗑️	E-2006-0005-01	Engineering / DCN's / LOS Coil Driver	Engineering	1	1	Checked In	8/23/2006 10:43:07 PM

At the bottom, there is another 'Document Tray' section with a 'Clear' button, containing a table with one entry:

<input type="checkbox"/>	☆	📄	🗑️	Document Name	Location	Type	Linked	Ver	Status	Last Modified
<input type="checkbox"/>	☆	📄	🗑️	D-2006-0001-06	Drawings / Electronics / electronics_WG / LOS Coil...	Drawing	2	6	Checked In	8/23/2006 10:21:09 PM

The footer of the interface includes the copyright notice '© FileHold Systems Inc. 2006' and the FileHold logo.