

# **Design Reviews**

Why, Who, When and How?

John Martin 18 May 2016

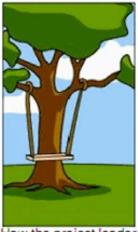
## Reviews are Everywhere

- Oil and Gas
  - BP's Macondo Well
- Medical
  - Review of treatment protocols
- Legal
  - Law makers review/debate legislation
- Management
  - Daily, Weekly, Monthly

# We All Understand the Swing?



How the customer explained it



How the project leader understood it



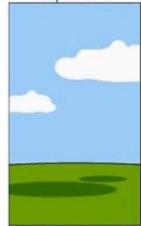
How the engineer designed it



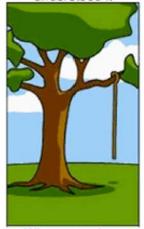
How the programmer wrote it



How the sales executive described it



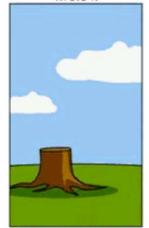
How the project was documented



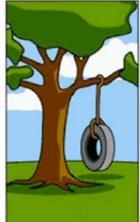
What operations installed



How the customer was billed

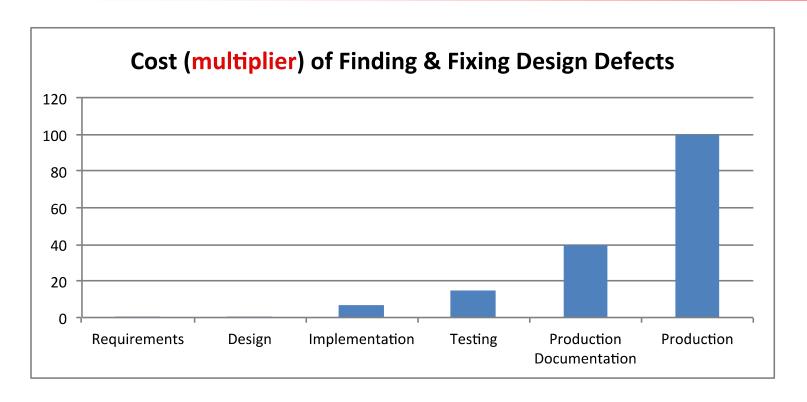


How the helpdesk supported it



What the customer really needed

#### **Cost versus Time**



Early discovery of the real customer needs and consistent communication to the team assures a lower cost and better quality design project.

#### **Reasons for Reviews**

#### Business Reasons

- Quality emphasis
- Ethical responsibility
- Professionalism
- Liability
- Think like owning the business

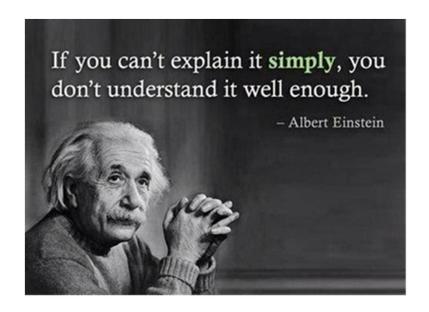
#### Human Resource Reasons

- Basic management practices
- Identify development needs
- Mutual accountability

#### Engineering Reasons

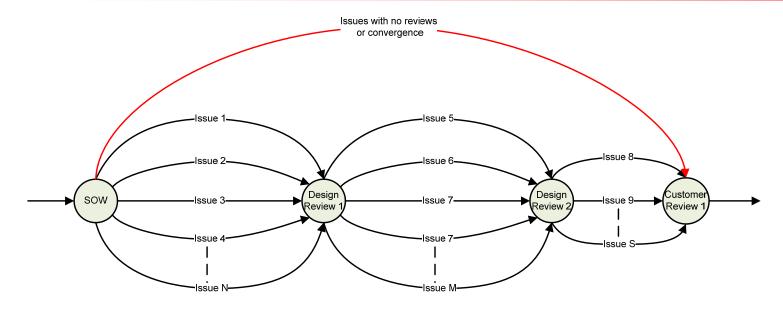
- Sharing of best practices
- Improved project management

# **Reviews Improve Quality**



Design reviews prepare us to present a similar review to the customer. Internal and customer reviews greatly improve the quality of design projects.

# Convergence of Issues at Reviews



Reviews provide milestones for the development process that improve project management. Issues include Technical & Schedule & Budget.

#### Two Heads are better than One

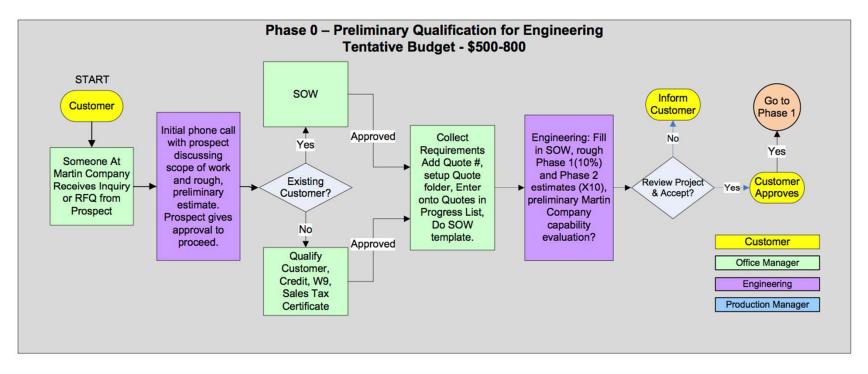


Linus's Law states that "given enough eyeballs, all bugs are shallow"; or more formally: "Given a large enough beta-tester and co-developer base, almost every problem will be characterized quickly and the fix will be obvious to someone." Created by Linus Torvalds - Linux Kernel Chief Architect

# **Martin Company**

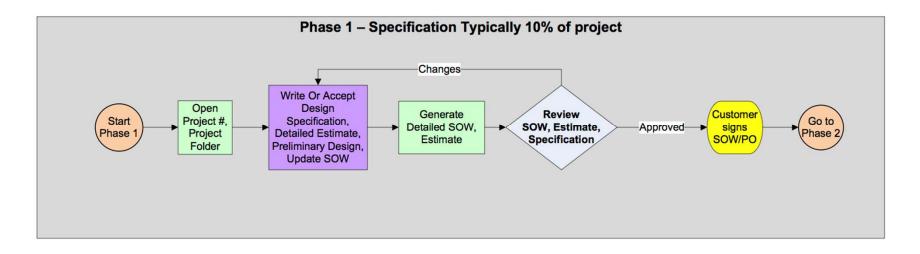
Our goal is that we **review 100%** of the work that we do. All design, eCAD and engineering projects will plan for, estimate, sell and explain to the customer the need for and document design reviews. We review the Design Review folders on all projects on a regular basis to verify the existence of proper reviews. Our personnel reviews, the ISO-9001 quality management system and the management of Martin Company **require** documented reviews to do their jobs properly.

# New Project Review



- BY: Office manager or accountant, project manager, president
- FOCUS: Credit information, Preliminary SOW and Estimate, Resource loading

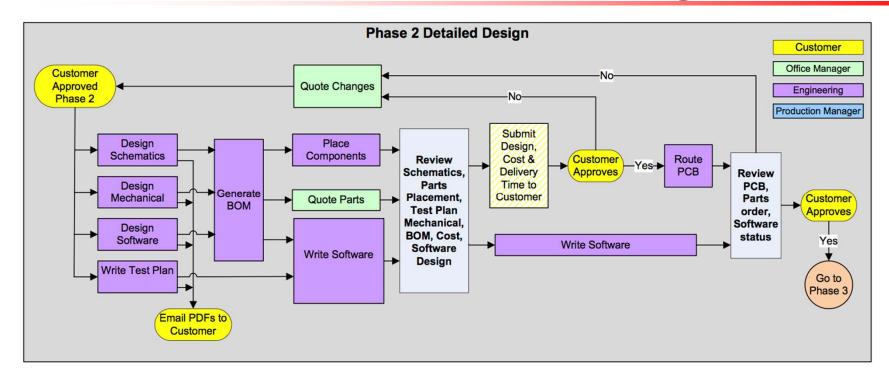
# **Project Specification Review**



3	Testing	136	9				145	\$9,968		14 Nov '14	13 Jan '15	
3.1	Creating test procedure	16	2				18	\$1,248		14 Nov '14	21 Nov '14	
3.2	Simulation testing	80	4				84	\$5,760		14 Nov '14	19 Dec '14	
3.3	Hardware testing	40	3				43	\$2,960		14 Nov '14	2 Dec '14	
4	Design Review	4	2	2			8	\$682		14 Nov '14	17 Nov '14	
5	Project Managment			2	2	2	6	<b>\$</b> 434		14 Nov '14	14 Nov '14	

- BY: Project Members, invite Customer
- FOCUS: SOW, Estimate, Specifications

## **Detailed Design Review**



- BY: Project Members, invite Customer
- FOCUS: SOW, Project Status, Specification, Change List, Schematics, Parts Placement on PCB, Mechanical Design, Software Design, Test Plan

# **Customer Design Update Email**



#### David.

Here are the updated PCB check-plots. Please review them and let us know if there are any issues.

The PCB is on the ASF template and all the DRC issues have been resolved. If it looks OK, we'll do our final design review (you're welcome to attend), and then we can generate the CAM files.

We're also attaching (again) the schematics, but they still need to transferred to the current ASF template (and be renamed AS800005).

One final issue – I'm attaching a change list that Charles had in the project directory – it mentions something about adding a mounting hole? That would be a fairly large effort (you can see there really isn't room for one – given the top/bottom components, and the test points that cannot be moved). The only space I can see on the board might be at the top-right were the board number is in top-copper, however a mounting hole at corner of the board doesn't seem stable. Is this a requirement?

Thank you

John Keker

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MARTIN COMPANY

Electronics Engineering and Manufacturing

ISO 9001:2008 Certified

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# **Template Reviews Phase 2**

#### **Engineering Revision Control.doc**

General Description				
Customer Name:	Northern Woods Electronics	Project Number	2112	
Project Name:	ASF board	1300		

**Project Documentation Name List** 

Document Type	Original Document Name/Revision:	Date	Appr by:
Design	ASF Initial Specification.pdf (David)	29Oct08	JM
Specification			
Protel	AS800005 (ASF Master LV Rev NR).ddb	18 Mar 13	CP
Mechanical			
Drawings			
Assembly	AS800005 (ASF Master LV Rev A) - Assembly	06 Jun 13	JK
Drawings			
Firmware			
Test Plan			

Note that this is a new board (with new name & NWE #) but is basically a revision of the original ASF Master Board (AS800005 - Rev G) board.

Revision History (from AS800005 - Rev G)

#	Revision Date:	Description of Revision and Reason for Revision:	Rev. by:	Appr. by:
Sch	ematic Revisio	on NR		
1.	18 Mar 13	Change Q2 FET to a T0-252 version (metal can type failed the pressure test).	JK	CP
2.	18 Mar 13	Change resistors around Q2 FET (to match turn/off of original part).	JK	CP
3.	18 Mar 13	Change Current Sense and Balancing resistors to molded plastic types (ceramic types can crack over temperature & pressure).	JK	CP
4.	18 Mar 13	Add test connector (P1) (per David's request)	JK	CP
5.		Add redundant RS485 connections to J5 (per David's request)	JK	CP
PCF	Layout Revi	sion NR		
6.	18 Mar 13	Change Q2 FET to a T0-252 version.	JK	CP
7.	18 Mar 13	Add redundant RS485 connections to J5.	JK	CP
8.	18 Mar 13	Add redundant RS485 connections to J6.	JK	CP
Sch	ematic Revision	on 01		
9.	06 Jun 13	Change R22 and R23 to 24.9K	CP	JK
Sch	ematic Revision	on 02		
10.	29 Aug 13	Add Female connector part @ P1 (per Jim Blake's request)	JK	CP
11.	29 Aug 13	Remove ANEG from GND and connect AGND to GND (allows correct sensing of current during low power.)	JK	CP
12.	29 Aug 13	Add 10uF caps to the inputs of U8 & U11 (prevent accidental resets & enables).	JK	CP
	3 Layout Revi			
	06 Jun 13	Revision changed from NR to A	CP	JK
PCI	Layout Revi	sion B		

Engineering Revision Control.doc Version 1.0 by JM on 16 October 2007

14.	29 Aug 13	Adjust footprint of P1 (to accept Harwin # B52-5000123 connector).	JK	CP
15.	29 Aug 13	Remove ANEG from GND and connect AGND to GND.	JK	CP
16.	29 Aug 13	Fix footprint on NI1026 dual FET's (using mfg's recommended footprint).	JK	CP
17.	29 Aug 13	Add 3 test points (67, 68 & 69) for FET measurement on automated tester.	JK	СР
Asse	embly Revisio	n B		
18.	21 Oct 13	Changed schematic revision block to, "Rev B"	CP	JK
19.	21 Oct 13	Changed assembly file revision block to, "Rev B"	CP	JK
20.	21 Oct 13	Changed BOM to reference Rev B pick-and-place	CP	JK
21.	21 Oct 13	Changed BOM to reference Rev B schematic	CP	JK
22.	21 Oct 13	Changed BOM to reference Rev B assembly	CP	JK
PCI	and Assemb	ly Revision C		
23.	07 Mar 14	Removed erroneous paste mask from bottom layer POGO pins	CP	JK
24.	07 Mar 14	Added test points 70 and 71 for POGO pin connection to NFET drain and source	CP	JK
25.	07 Mar 14	Slightly moved R7, R103, and F1 so that the new test point would fit	CP	JK
26.	07 Mar 14	Modified new BOM assemblies so that they call out the correct part revisions	CP	JK

Initial (Rev N/R) Design Review

Design Review Attendees	Documents, Revision # Reviewed:	Document Date	Date	Appr by:
JM, CP, GP, JK	AS800005 (ASF Master LV Rev NR) - Schematic.pdf	25 Mar 13	25 Mar 13	CP
JM, CP, GP, JK	AS800005 (ASF Master LV Rev NR) - PCB Checkplots.pdf	25 Mar 13	25 Mar 13	CP
JM, CP, GP, JK	AS800005 (ASF Master LV Rev NR) - Gerber Plots.pdf	25 Mar 13	25 Mar 13	CP
JM, CP, GP, JK	AS800005 (ASF Master LV Rev NR) - Pastemask.zip	25 Mar 13	25 Mar 13	СР
JM, CP, GP, JK	AS800005 (ASF Master LV Rev NR) - CAM Files.zip	25 Mar 13	25 Mar 13	СР

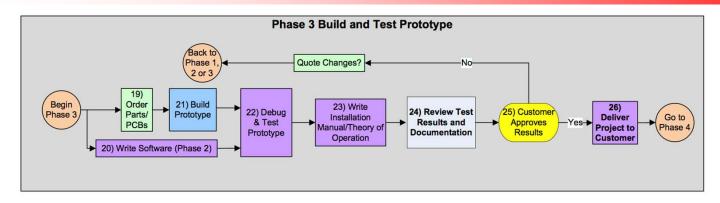
Rev 01 Design Review

Design Review Attendees	Documents, Revision # Reviewed:	Document Date	Date	Appr by:
CP, JK	AS800005 (ASF Master LV Rev 01).ddb	05 Jun 13	06 Jun 13	JK
CP, JK	AS800005 (ASF Master LV Rev 01) - Schematic.pdf	05 Jun 13	06 Jun 13	JK
CP, JK	AS800005 (ASF Master LV Rev NR) - Pick- and-Place.zip	05 Jun 13	06 Jun 13	JK
CP, JK	AS800005 (5 SERIES Master LV Rev NR) - BOM.xls	05 Jun 13	06 Jun 13	JK

Engineering Revision Control.doc Version 1.0 by  $\ensuremath{\mathsf{TM}}$  on 16 October 2007



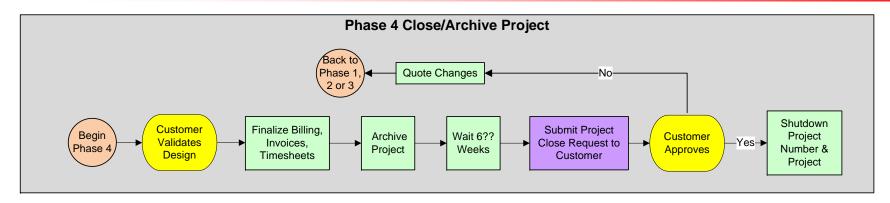
### **Test Results and Release**



#	Revision	Description of Revision and Reason for Revision:	Rev.	Appr.		
	Date:		by:	by:		
Desig	Design Specification Revision XX					
1.						
Test 1	Test Procedure Rev Revision XX					
1.						
Test 1	Test Results Rev Revision XX					
1.						

- BY: Project Members, invite Customer
- FOCUS: SOW, Project Status, Specification, Change List, Schematics, PCB, Mechanical Design, Software Design, Test Results
- ALSO: Gerbers, Manufacturing Files, CM42 or Production BOM

## **Template Review Close Out Phase 4**



#### Final Documentation Review

Design Review	Documents,	Document	Review Date	Appr
Attendees	Revision # Reviewed:	Date		by:

#### **Project Close and Archive**

Customer Contacted	Customer Comments	Date	Review Date	Appr by:
Project Close	Comments	Date	Review Date	Appr by:

Engineering Revision Control.doc Version 1.0 by JM on 16 October 2007

■BY: Project Members

■FOCUS: Final document package, customer feedback, project close

## 09 Design Review Folders

- Black and white SOW.pdf
- Black and white Estimate.pdf
- Black and white Project Status.pdf
- Black and white Change List or Engineering Control Document.pdf
- Color Specification. Pdf
- Color Schematics.pdf
- Color Parts Placement.pdf
- Color PCB Layout.pdf
- Color Software Design Diagrams.pdf
- Color Code Review.pdf
- Black and white BOM from Altium.pdf
- Black and white Mechanical Drawings.pdf
- Black and white Assembly Drawings.pdf
- Color Test Plan and Test Results.pdf
- Black and White Gerbers.pdf
- Black and White Manufacturing Files.pdf
- Black and White CM42 or Production BOM from GeMS.pdf



### Requirements for a Good Review

- Careful Preparation
- Timely Submittal of Documents to Participants
  - Two working days ahead of time
- Good Meeting Practices
  - Agenda, Time Keeping, Minutes, Table Topics, <u>Template</u>
  - Summary and Objective
  - Respectful Culture
- Guided Discussion
  - Focus on critical, controversial, difficult
- Focus: Happy Customers = Repeat Customers



#### **Status of Review Practices**

#### Numerical Score:

Hene	Control Filled	Separate Design
atindes	1-Not Done.	3 N/A , 5-Complete
1326.lok	3	5
1650 Cel Bal Fack Fra W Gause-lok	5	5
1710.lnk	5	5
1766 Chaige Fire Praduction Texter.Ink	5	5
1922 Rederion Leab Date ation Instrument Ink	1	1
1821 Undate AMS-40 Decian Ink	5	5
1905 BOTTPL 900 Pack Protect link	5	5
1949 EXP Box 1HRE LRB Charge Box LinkS	5	5
1952 - Integration of Hisrarllotion and Antarer Ink	5	5
1974 Universal Passer Supply Decian.Inh	- 1	1
2012 Engineering Support Joh	1	1
2076.tok	5	5
2156 Hour Generation DCU.Ink	5	5
2100 (Cail to Perforator Interface.Ink	5	5
2221 New Exit Sian Degian and UL Ink	5	5
2242 Interrupter Detenator Inh	5	5
2269 BIM Electronic Decigo Buard Jok	S	5
2271EFIFire Set-lok	5	5
2286 UBL CE Evel Report.lok	- 1	1
2231Ecliere Production Texter.Ink	5	5
2202 Edieze IPDT Terter.Ink	5	1
2242 Engineering Support Inh	5	5
2245 - Dinda OR Circuit Jok	5	5
2386 Viceray Tool Derica, Ink	5	5
2387 10 Serier Hart BMS Board with GAM Bur.lnk		3
2300 Revisions to Sensor Interface Doord.ink	5	š
2291Frantal Biaid Flex.lnk	4	3
2417 SENS001 Buard Derian Inh	- 8	5
2429 SENSOOZ FP GA HDL Derian Jok	ś	S S
2436 Multiplur, lok	5	
2437 Eggle Repeater Suftware.ink	9	á
2457 Eagle Nepeater Sartuare.ink	5	5
2440 - 26V 40A Diade Offine Beard.Ink		1
2452 StinaBay EOAD Support Ink	1 5	5
2454 Pattery Suk Circuit.Ink 2455 Fort Beard Circuit.Ink	2	3
		2
2458 Engineering Support.Ink	1	
2476 Fractal ASFS2 Julia Simulator.ink	3	3
2400 Engineering Support.Ink	3	5
2494 Perf Lenath Praiest Inh	5	5
2495 Pulyarash Saftware Rederian Ink		
2518 PTC-Russed-link		
2520 Lead Bax Decumentation.ink	1	1
2521Engineering Support.Ink	- 1	1
2540 Slim Decarivator Undater.Ink	3	3
2541DSVR Single Pattery Firmware.Inh	5	5
2544 oFire HT Redecian.lnk		
2553 Secure2 Plur Rederion.lnk	5	5
2570 Ultraronic Tort Bonch Undate.ink	5	5
2574GSD Beard.ink	5	5
2576 Camelese Gett's DOM - UDL.ink	1	1
2526 Remote Las Daviolas d'Inh	5	5
2597 PTC to A Resultsk	5	5
2612 IWIS Header SENSELINK	5	1
2613 GFD Buith Gable link	5	5
26210PT cOAD Succept.Ink	21	3
2626 HSD100-D ProLITE.ink	5	S
2627 Automatic HCM Buncter Tester Inh	5	5
2620 APWD Curtam DLL.lnk	5	5
2632 PiaPack USB Saftware.lnk	- 5	5
2643 Falcan MGM Simulator PWA.Ink	5	5
2650 WPS cOAD Succent.Ink	5	5
2662 a OBD Updater to Telemetry, Transceiver, and Load PWAr. Inh	1	1
2557FLCNPW& Bedliner Subsmitting Job	5	5
2669 AAPS with Shock Detect.Ink		5
2672 FLGN005HV FraLite.lnk		5
2674 Pairing and Tortor Sub Buard.ink	5	5
260112 Channel Palvarach.ink	Ś	- 6
2691Venur BAQ Simulater ProLITE.ink	- 6	
2692 FLONOOSLU PraLITE.Ink	5	1 2
ATTACA TO THE TALL AND THE TALL	1	1
2695 Battery Pregram Evaluation. Ink		5
2696 PDF to Altium Conversion Drawing.lnk	5	5
2719 200 C Address able Suitch link	5	5
2726 DTR ROD Electronise Decian.Ink	3	3
2725 Pattery Life Gause Inh	5	5
2727 CU Wire Band PWB.Inli		
2741Battery Controller Dezian.ink 2743 High Pressure SeaSafe Terting.ink	5	5
	1	1

Project Reviews	Engineering Revision Control Filled Out	Separate Design Review Documents
Done		53
Not Done	14	14
Not Started	6	6
Total	74	73

#### **■ Some Conclusions:**

- We have some projects that are successful with no documented reviews and some that were highly reviewed but considered "difficult" projects.
- We have to follow accepted, best practices and protocols in order to maintain consistent quality and manage projects and people.

#### **Final Words**

- **Every Project:** Our goal is to do documented design reviews on all design projects unless there is a signed waiver in place of the design review.
- **Training:** We will provide training so that our engineers can explain to the customer the benefit and cost saving of design reviews.