



#### iRobot Summary

- iRobot's corporate headquarters are located in Bedford, Mass. The company also has offices in California, the United Kingdom, China and Hong Kong.
- ~30 ECAD users across all sites
- ~ 60 MCAD users across all sites
- ~530 Employees Total

#### PTC Windchill environment

PLM:

- PTC Windchill PDMLink 10.1 M030
- Partslink classification of our electrical components
- Supplier Management controls our AML/AVL lists
- SQL server Intermediary between PTC Windchill and Altium component libraries

CAD:

- PTC Creo
- Solidworks
- Altium

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#### From our Experience

#### ECAD and MCAD are different



Implementing it will be different

Training will be different

#### ECAD to MCAD

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iRobot ECAD Data

Number	Name	Primary Content	Attachment		
▲ 3 4440453	PCBA, MOTOR DRIVER, V1				
4440455_ECAD	ECAD, MOTOR DRIVER	4440440_ECAD.zip	4440455-A.emp 4440455-A.emn		
🐼 4440453_PCBA	PCBA, MOTOR DRIVER, V1		4440453-A EASM, MOTOR DRIVER, V1		
			4440453-A SCH, MOTOR DRIVER, V1		
▲ 2 4440455	PCB, MOTOR DRIVER				
4440455_ECAD	ECAD, MOTOR DRIVER	4440440_ECAD.zip	4440455-A.emp 4440455-A.emn		
6 4440455_PCB	PCB, MOTOR DRIVER	4440441.zip			
🏹 4440455_FAB	PCB, MOTOR DRIVER		4440455-A FAB, MOTOR DRIVER		

#### Before the ECAD WGM

#### Original ECAD Workflow

Filled with many manual steps

• 39 page procedure





Package Files for Release in Windchill



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Naming ar	nd Association Incon	sistencies	<b>PTC<sup>®</sup> Live</b> Global
4328300	PCB, BUMPER, PHOENIX	Not all parts named	or
4328300_ECAD	📔 Smart Bumper Project	Not all parts hamed	
4328300_FAB	📔 Smart Bumper GBR	associated per our g	Juideline
4334734	PCBA, BUMPER, PHOENIX		
4334734_EASM	SmartBumper_EASM		
4334734_SCH	Smart Bumper SCH		
4357152	PCB, MAIN, PHOENIX	Four Different Circui	it Board
4357152_ECAD	Phoenix-Main-Board-Project (9-19-2012 1-32-:	Assemblies	
4357152_FAB	Phoenix-Main-Board-GBR		
4368776	PCBA, MAIN, PHOENIX		
4368776_EASM	Phoenix-Main-Board-EASM		
4368776_SCH	Phoenix Main Board SCH	Nomed Four Differe	at 10/2012
4351269	PCBA, CONNECTOR, EDGE CARD, PHOENIX	<ul> <li>Named Four Differe</li> </ul>	nt ways
4351269_EASM	Connector Carrier PCB ASM		
4351269_SCH	Connector Carrier PCB SCH		
4351270	PCB, CONNECTOR, EDGE CARD, PHOENIX		
4351270_ECAD	Connector Carrier PCB Project		
4351270_FAB	Connector Carrier PCB GBR		
4406097	PCB, BLIND MATE, PHOENIX		
4406097_ECAD	Blind-Mate-PCB (2-12-2013 6-19-01 PM)		
4406097_FAB	Blind-Mate-PCB		
4407738	PCBA, BLIND MATE, PHOENIX		
4407738_EASM	🔉 Wheel Motor EASM		
4407738_SCH	🔉 Wheel Motor SCH		

#### OLD ECAD Data Model

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#### All Manual Steps



431166	PCB         Same XXXXXXX for the PCB Part, Zip and PCB           3         - PCB         Part manually created by engineer. Part Number auto generated by Windchill	nd 2 CAD Parts
	4311663_FAB - Fab Zip Archive	
ECAD	4311663_ECAD - ECAD Zip Archive	]
Assoc +	4311663_PROFILE - PCB MCAD Model of raw PCB before layout - Not used in HRD, possibly dropped by G&I	]
Assoc	4311663 - PCB · · · MCAD Model of PCB after layout	]

- · Manual import from spreadsheet
- Required 24 page procedure to export a BOM from Altium and import to PTC Windchill



 Features that influenced our decision
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 Similar experience to the MCAD users

 FTC Cree parametric
 Solid WORKS

 Experiment of the MCAD users

- · Automatic upload of data and associations between objects
- Automatic BOM generation
- WGM integration with Altium

#### Implementation - Preparation

Define your team of Windchill members and Electrical members



Learn and discover together

Give them time to be successful

#### Implementation - Training

Know your users

Coordinate with project managers

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Create and evaluate guides Plan hands on training

After WGM





#### Common Template for all Users

	Data Inte	grity Checks	are now ava	lable	News   Learning Po	ortal   Request Acc	ess Search		P 💌 🗠
D	Libraries > ECAD Template,	Robet > Fel	ders						Recently Ac
2	Actions - ECAL	Templa	ite						
igato	E Folders (7 objects)		Folder Co	ntent	All	*			(13 o
Nav	Search in selected folder	Nev	C) v Document N	ew Par	T New Change Notice	New Change Requ	est, New Folder, Copy, Add	t to We	Actions -
	BOL ECAD Template				Number	Name 1			Version
	- archive	0	5	-	SCH_CAD	TECAD, TE	MPLATE	<b>(i)</b>	A.15
	Baselines	0	6	1.00	SCH_PART	ECAD, TE	MPLATE - FITTED BOM	0	A.4 (Design)
	ECAD Definitions	0	1	1.00	BOARD_CAD	PCB, TEN	1PLATE	۲	A.10
	ECAD Template	13	\$	1	BOARD_FAB	PCB, TEN	IPLATE	0	A.3
	Promotion Requests	1	6	1	BOARD_PART	PCB, TEN	IPLATE	۲	A.6 (Design)
	Scripts	6	8	1	VARIANTI_CAD	PCBA, TE	MPLATE, VI	0	A.18
		8	6	3	VARIANTI_PART	PCBA, TE	MPLATE, V1	1	A.6 (Design)
		E	8	1 1	VARIANT2_CAD	DCBA, TE	MPLATE, V2	0	A.18
		0	10	3	VARIANT2_PART	PCBA, TE	MPLATE, V2	0	A.6 (Design)
		Ð	8	4	VARIANT3_CAD	PCBA, TE	MPLATE, V3	(1)	A.18
		0	10	3 100	VARIANT3_PART	PCBA, TE	MPLATE, V3	(1)	A.6 (Design)
		13	8	1	VARIANT4_CAD	DCBA, TE	MPLATE, V4	(1)	A.18
		13	6	3	VARIANTS_PART	PCBA, TE	MPLATE, V4	0	A.6 (Design)

Ensures all design start
 the same way

 Allows for easy maintenance and updates

 Improves capability to onboard new engineers

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#### Naming and associations are the same



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Automation Forces Common Naming and Numbering

		4434866		PCB, LOGGER, SD, ELPASO
	[1000] 1.1.1.1	4434866		PCB, LOGGER, SD, ELPASO
Þ.	24	4434866_ECAD	Ŷ	ECAD, LOGGER, SD, ELPASO
\$	[1000] 	4434866_FAB	٩	PCB, LOGGER, SD, ELPASO
â6y	diser	4434866_PCB	٩	PCB, LOGGER, SD, ELPASO
	[1000]	4434867		PCBA, LOGGER, SD, ELPASO
		4434867		PCBA, LOGGER, SD, ELPASO
<b>\$</b> }}	1.1.1.1	4434867_PCBA	Ŷ	PCBA, LOGGER, SD, ELPASO, V1

4420455         PCB, DEBUG, ELPASO           4420455         PCB, DEBUG, ELPASO           4420455         PCB, DEBUG, ELPASO           4420455, ECAD         PCB, DEBUG, ELPASO           4420455, PCB         PCB, DEBUG, ELPASO           4420455, PCB         PCB, DEBUG, ELPASO           4420455, PCB         PCB, DEBUG, ELPASO           4420456         PCBA, DEBUG, ELPASO		
↓ 4420455         ➡ PCB, DEBUG, ELPASO           ↓ 4420455_ECAD         ↓ ECAD, DEBUG, ELPASO           ↓ 4420455_FAB         ↓ PCB, DEBUG, ELPASO           ↓ 4420455_PCB         ↓ PCB, DEBUG, ELPASO           ↓ 4420455_PCB         ↓ PCB, DEBUG, ELPASO           ↓ 4420455_PCB         ↓ PCB, DEBUG, ELPASO           ↓ 4420456         ➡ PCBA, DEBUG, ELPASO	4420455	PCB, DEBUG, ELPASO
Image: Second	4420455	PCB, DEBUG, ELPASO
***         ***         PCB, DEBUG, ELPASO           ***         ***         PCBA, DEBUG, ELPASO           ***         ***         PCBA, DEBUG, ELPASO           ***         ***         PCBA, DEBUG, ELPASO           ***         ***         ***           ***         ***         ***	4420455_ECAD	🕸 ECAD, DEBUG, ELPASO
Image: A420455_PCB         PCB, DEBUG, ELPASO           Image: A420456         PCBA, DEBUG, ELPASO           Image: A420456         Image: A420456           Image: A420456 <th>🍇 🚃 4420455_FAB</th> <th>🕸 PCB, DEBUG, ELPASO</th>	🍇 🚃 4420455_FAB	🕸 PCB, DEBUG, ELPASO
4420456         PCBA, DEBUG, ELPASO           4420456         PCBA, DEBUG, ELPASO           4420456         PCBA, DEBUG, ELPASO           4420456         PCBA, DEBUG, ELPASO	4420455_PCB	🕸 PCB, DEBUG, ELPASO
Image: Second state	4420456	PCBA, DEBUG, ELPASO
🖗 🔜 4420456_PCBA 🔹 🔹 PCBA, DEBUG, ELPASO	4420456	PCBA, DEBUG, ELPASO
	4420456_PCBA	PCBA, DEBUG, ELPASO

## 4432632\_FAB PCB, WALL DOCK, BARCELONA 1 4432632\_PCB PCB, WALL DOCK, BARCELONA 1 4432630 PCBA, WALL DOCK, BARCELONA 1 4432630\_PCBA PCBA, WALL DOCK, BARCELONA

PCB, WALL DOCK, BARCELONA

PCB, WALL DOCK, BARCELONA
 ECAD, WALL DOCK, BARCELONA

- Easier for users to follow the same process
- · Data is consistent

4432632

4432632

4432632\_ECAD

 Lessons Learned - Implementation
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 Before discovery, agree to an ECAD data model
 Image: Complex

 Think like an end user
 Image: Complex

#### Lessons Learned - Training





- · Can't train in a vacuum
- Have projects ready to go
- · You care about how it works
- They care about what it does for them

#### Lessons Learned – Day to Day

- Issues and frustration are reduced when users have an accurate mental model of how PTC Windchill works
- MCAD WGM mirrors the cad tool, the ECAD WGM does not
- Difficulty in managing variants



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#### **Current Issues**

#### Captured User Issues

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Primary Active	Workspace: USB Hub - Pic	k an Action - 💌			
Object List	t As a list	<ul> <li>ECAD</li> </ul>	*		
File • Edit • 🛅	- aloc				
Remove Upk	Import to Workspace Export from Workspace	heck Out Update Aut	Associate Revise A	🕈 👷 dd New Part N	ew CAD Document Refresh
8	Synchronize	Name   ECAD, USB HUB	A (	actions	Version State A.7 In Work
4	P Refresh				

- Not clear to users the difference between refresh, synchronize, and update.
- The associations of the different objects are not well understood. Users don't understand what model items are.

Number	Association Type	Name †	Revision
4448157_ECAD		ECAD, MOTOR DRIVER	Α
□ (0)4448156		ECAD, MOTOR DRIVER - FITTED BOM	Α
SCH_PART	Owner 💌	ECAD, TEMPLATE	Α
□ (0)4448157		PCB, MOTOR DRIVER	Α
SCH_PART	Contributing Content	ECAD, TEMPLATE	Α
\$4448157_FAB	Content	PCB, MOTOR DRIVER	Α
4448157_PCB	Content	PCB, MOTOR DRIVER	Α
□ (0)4448153		PCBA, MOTOR DRIVER, V1	Α
\$4448153_PCBA	Content	PCBA, MOTOR DRIVER, V1	Α
VARIANT1_PART	Owner 💌	PCBA, TEMPLATE, V1	Α

### • The revise collection adds all WT parts in a BOM and is a confusing window.

R	levise						
	Current Settings: None Dependents	; Latest : Working		•		( 79 c	of 79 objects )
	🎨 🛅 🛍 🖬 🎽 🗅 🏓 🗄	1 🖞 😘 🐂 👕	🔲 🔪 🔄 🗹 😏	Dep	endents -	Search in table	۰ 🗄 ۹
	t Number	Version	Organization ID		Name		New Revisio
	• @ •	A.2 (Design)	-iRobot		Do Not Install		-B
	• 🔅 4327017	1.8 (Design)	iRobot		SNAPTRON_SW_ONE_SIDED - D	ome Switch 8mm Tri	-A
	• 🎲 4335512	1.13 (Design)	iRobot		Capacitor Ceramic 18pF 0402 C0	G-50V	-A =
		1.13 (Design)	iRobot		Capacitor Ceramic 3.3nF 0603 X	7R 10% 50V	-A
		1.14 (Design)	i iRobot		Capacitor Ceramic 100pF 0402 C	0G 50V	A
		1 13 (Design)	- iRobot		Canacitor Ceramic 1uE 0603 X78	2 10% 16V	Δ

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#### **Final Words**

Electrical designs are different than mechanical designs.

Understanding these differences will ensure a successful implementation of the ECAD WGM



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# ???