

▶▶ *Building a PLM Skyscraper*

▶▶ *Who are Schrader Electronics?*



- The **world's number one** supplier of Tire Pressure Monitoring Systems (TPMS)
- Over 50% market share
- Provide sensors and systems for automotive and industrial markets
- Broadest product offering with the largest customer base
- Annual Revenue exceeds **\$300 million**
- Annual R&D expenditure exceeds 8% of sales
- 50 million sensors in 2013
- On course to ship **61 million** sensors in 2014





Our Global Presence



-  Engineering / Manufacturing
-  Sales-Marketing-Engineering-Support

Company History

1896

August Schrader invents the original Schrader valve



1994

Won our first OE contract for RTPM on the 1997 C5 Corvette



2000

TREAD Act announced, TPMS to become mandatory in all US cars



2009

UNECE 64 legislation passed, mandating TPMS for Europe



1985

1990

1995

2000

2005

2010

1988

Formed as supplier of innovative handheld digital tire pressure gauge



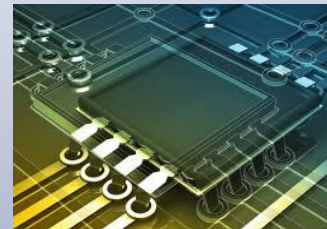
2001

Started high volume automated production, reaching 8m capacity



2007

Acquired SSSL to protect supply chain and exploit ASIC technology



2012

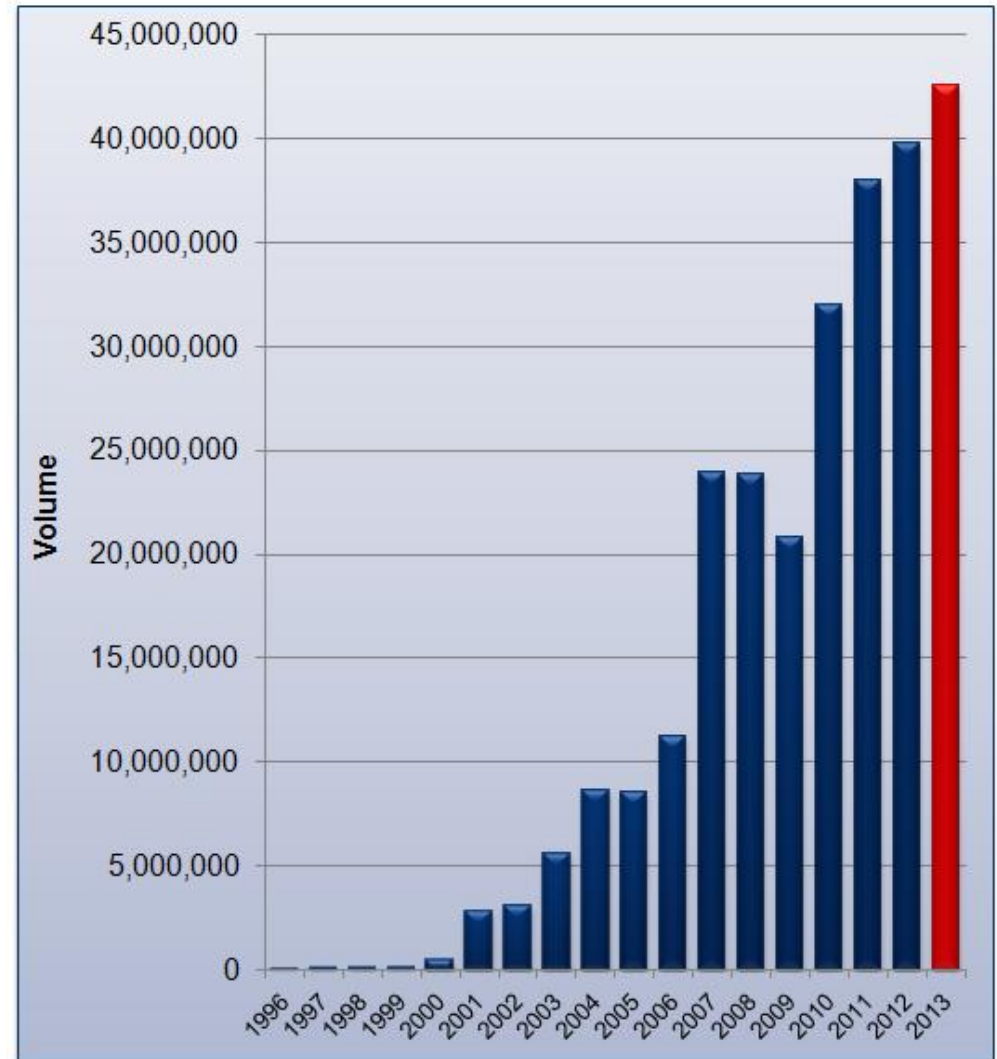
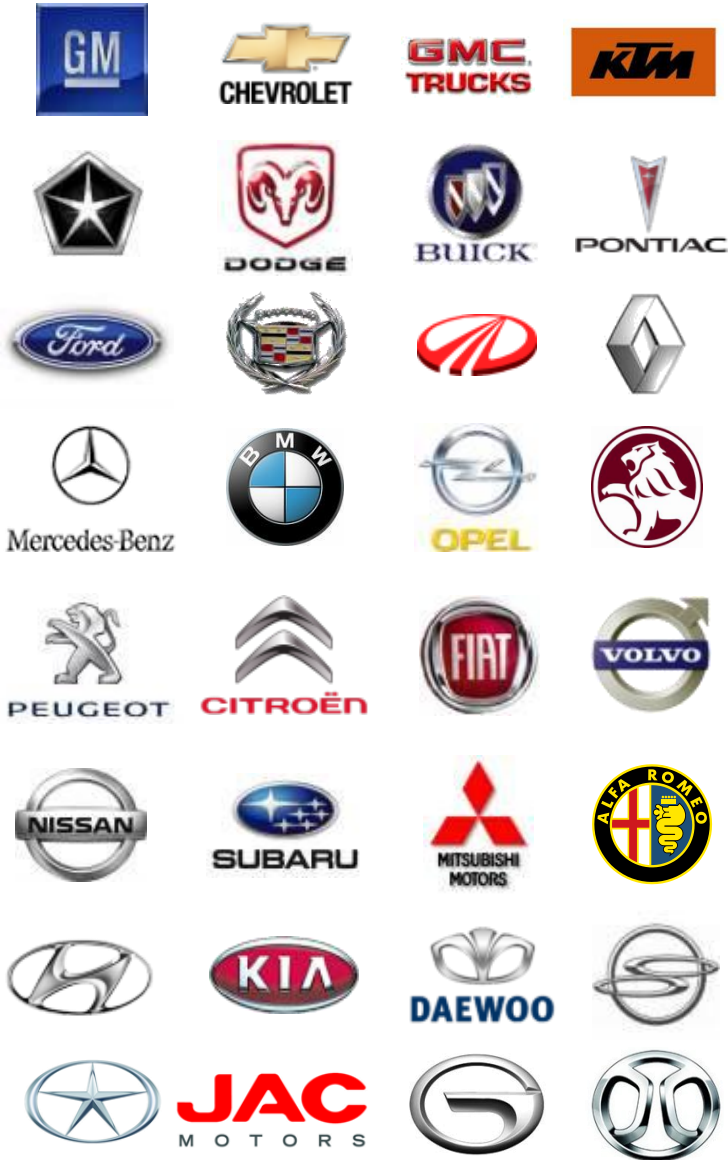
Schrader shipped 200 millionth sensor
In July 2012





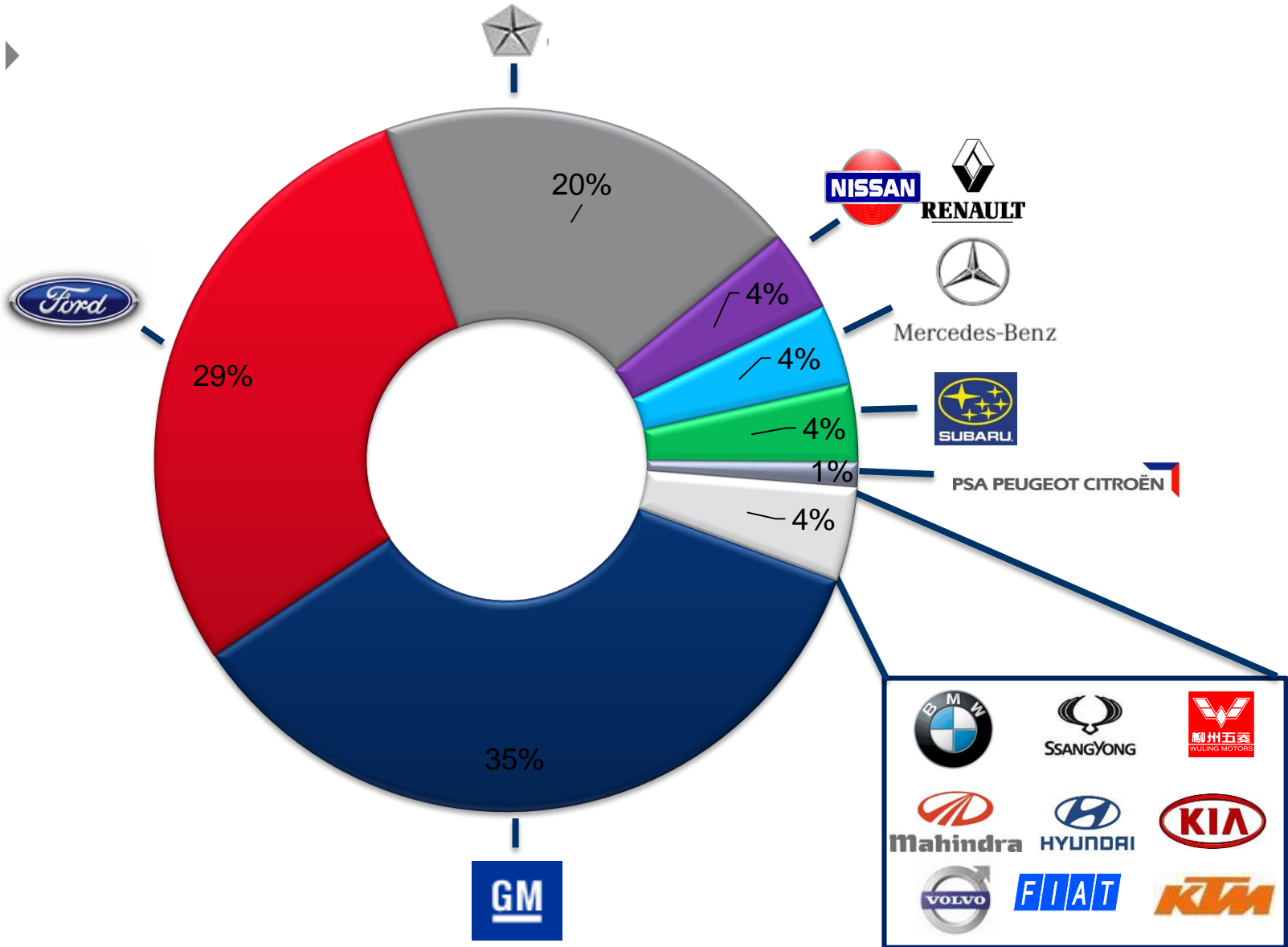
Our Customers

TPMS Customers & Volume



Broad customer base and growing volume

Schrader Customer Base



▶▶ Where do you begin?



- Form a project team
- Understand the starting point
- Define requirements
- Buy a “Dummies Guide to Skyscraper Construction”
- Shortlist Construction Companies
- Ask companies to propose solutions and submit tenders
- Select a company and start building!



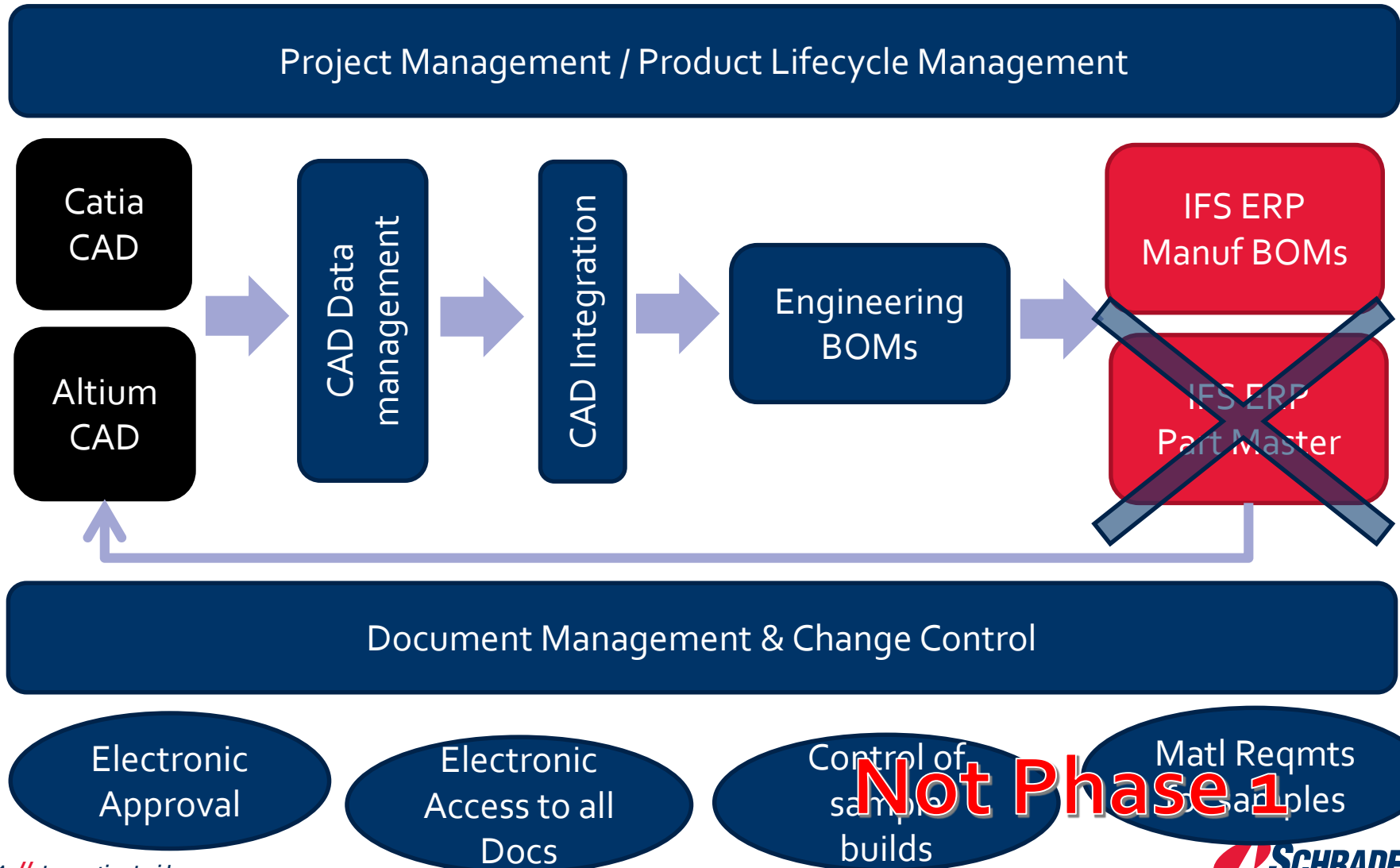
▶▶ ***PLM System Selection Team***

- **Formed in May 2012**
- **Key Managers (all part time) from:**
 - Mechanical and Electronic Design
 - Project Management
 - Document Control
 - IT
- **Weekly Meeting**
- **Executive Support**

▶▶ *Schrader PLM Starting Point*



►► Initial Requirements





▶▶ ***Increasing our PLM knowledge (June-Sept 2012)***

- ▶ **Introductory Workshop**
- ▶ **General Research**
- ▶ **Employees with PLM experience**
- ▶ **3 Systems and 3 Partners Shortlisted**
- ▶ **Learning throughout the selection process**
 - ▶ Detailed requirements gathering – led by Partners
 - ▶ Product demonstrations and workshops

Atos

▶▶ *Final System and Partner Selection (Nov 2012)*

- **System**

- Flexibility
- Companywide usage
- CAD Integration



- **Partner**

- PLM Experience
- Best Practice
- Broader Perspective



►► Construction – Phase 1



Project Management
Change Management
Visualisation
CAD Data Mgmt
Product Doc Mgmt

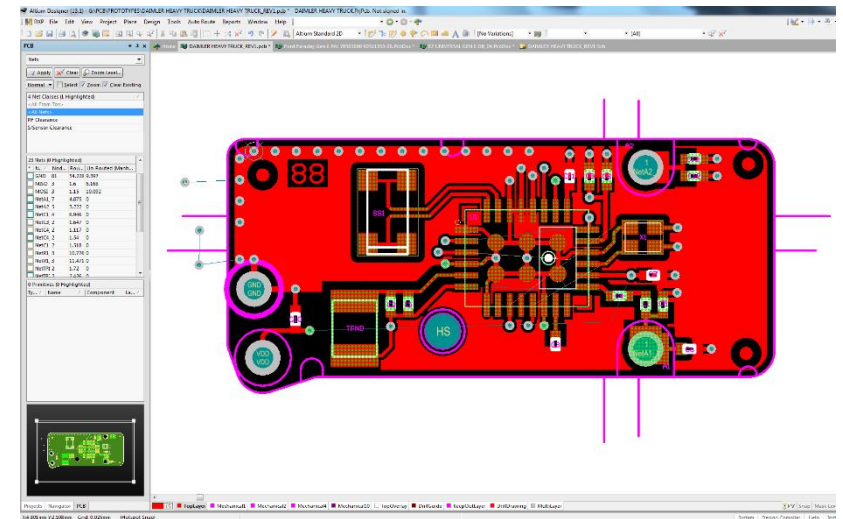
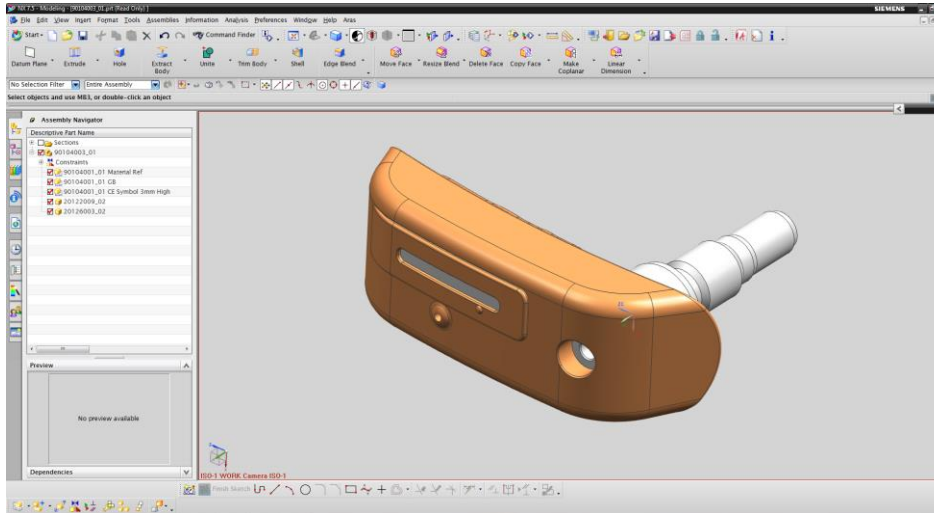
Phase 1 'Floors'

Part Master
Basic ERP Integration

Foundations (LIVE Sept 2013)

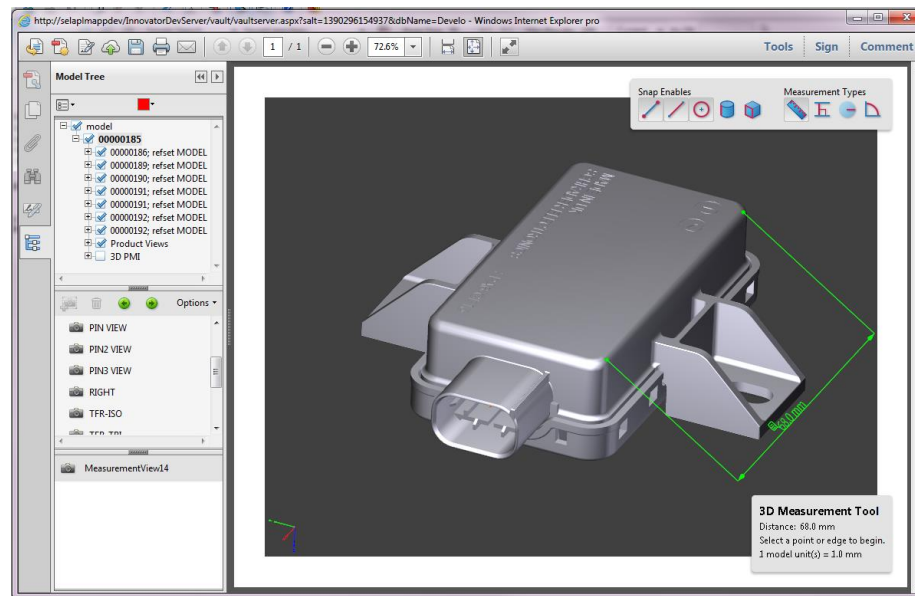
▶▶ Mechanical and Electrical CAD Data Management

- ▶ Designs are created in specialist packages (CATIA, UG and Altium)
- ▶ Stored and controlled in Aras integration menus
- ▶ Eliminates uncontrolled data
- ▶ Fully traceable design and release process



▶▶ *Company – Wide Access to 3D Designs*

- ▶ Viewable files in 3D PDF format generated from CAD
- ▶ Linked to the part record and accessible by anyone with PDF Reader
- ▶ Can be manipulated, sectioned and measured
- ▶ Encourages data re-use



▶▶ Systematically Generated BOMs

- ▶ Integrations combine the electronic and mechanical BOMs into a complete digital BOM in Aras
- ▶ Design changes automatically reflected in the digital BOM
- ▶ Eliminates sources of error when the BOM is no longer manually created and updated

The screenshot displays the Schradar software interface for a part. The top right corner features the Schradar logo. The main area is divided into several sections:

- Part Information:** Includes fields for SEL Part Number (00518716), Revision (03), Status (Released), and Changes Pending. The Name is "FORD Gen6 PAL Faraday HG SI Tx 433 (XLT) BOM" and the Type is "Manufactured Assemb".
- Unit and Customer Part Number:** Unit is "Places" and Customer Part Number is "FZGT-1A180-CB".
- Part Number Allocation:** Shows a tree view with "3 - Internal Drawings and Documents", "15 - Item Car", and "18 - BOM's".
- Doc - Control Only:** Includes checkboxes for "Manually Enter Part Number", "Approved For Production", "Yes No", "If S Eng Rev", and "If S Rev AN".
- BOM Structure Table:** A table showing the BOM structure with columns for Part Number, Rev., Status, Sequence, Quantity, Lock, Name, and Reference Desig. The table lists various components like PCBs, plates, labels, and crystals.

Part Number	Rev.	Status	Sequence	Quantity	Lock	Name	Reference Desig.
70503931	03	Released	1	1		FORD Gen6 PAL Faraday HG SI Tx 433	
505011023	03	Released	1	1		FORD Gen6 PAL Faraday HG SI Tx 433 PCB S/A PRO 2	
505011022	02	Released	1	1		FORD Gen6 PAL Faraday HG SI Tx 433 PCB S/A PRO 1	
30543012	01	Released	2	1.8E 05		975CLF18AGS88 5V L/F Plate 650G	
20546581	02	Released	3	1		2D Digit High Temp PCB Printed Barcode Label	
40545008	01	Released	5	1		0402 50V COG 8 2pf +/-0.5pf AVX	
30531100363R01	01	Released	6	1		Ed G6F 55SM67C PAL XFAB (FORD) 433MHz	
30534094R01	01	Released	7	1		24MHz NX2016SA Crystal	
60501508	02	Released	2	1		FORD Gen6 PAL Faraday HG SI Tx 433 MECH S/A	
10542001	01	Released	3	1		Sensor Seal	
30571159R03	01	Released	4	1		Hawai CR2032HR with Tags based n T34	
30543016	01	Released	5	0.08		Solder Wire 309 975C 0.7mm Green Pb Free	
10508219R05	06	Released	6	1		Faraday Id. laser welded Id. Edison (Prod Tool)	
40508622	02	Released	2	1		FORD Gen6 PAL Faraday HG SI Tx 433 (XLT) PACK S/A	

▶▶ Change Tracking and Digital Signatures

- ▶ Paper-based change system replaced by digital signatures on an online workflow
- ▶ Progress towards release is fully visible
- ▶ Signatories and any comments are recorded against the change

The screenshot shows the 'Part' management interface in a web browser. The top navigation bar includes 'Leave Feedback', 'Help Videos', and the Schrader logo. The main content area displays the following information:

- Part Details:** SEL Part Number: 90518670, Revision: 07, Status: Released, Changes Pending:
- Name:** Hyundai Hybrid Snap in PAL Tx 433, **Type:** Manufactured Assembly
- Unit:** Pieces, **Customer Part Number:** S2933-C1100
- Part Number Allocation:** Product Category: (dropdown), Product Allocation: (dropdown), General Group: (dropdown)
- Doc - Control Only:** Manually Enter Part Number: Approved For Production: IFS Eng Rev: (radio buttons), IFS Rev All: (checkbox)
- Metadata:** Created By: Innovator Admin, Created On: 26/09/2013, Modified By: Innovator Admin, Modified On: 16/01/2014, Major Rev: 07, Release Date: 15/01/2014, Effective Date: 15/01/2014, Generation: 7, State: Released

At the bottom, there is a 'BOM' section with a table showing the structure of the part.

Type	Number	Title	State
ECO	ECO-100178	ECN4934 Hyundai Hybrid Snap in PAL Tx 433 70...	Released
ECO	ECO-100229	ECN4968 Hyundai Hybrid Snap in PAL Tx 433 70...	Released
ECO	ECO-100085	ECN4772 Hyundai Hybrid Snap in PAL Tx 433 70...	Released
ECO	ECO-100128	ECN4877 Hyundai Hybrid PAL Snap in PAL Tx 433 70...	Released
ECO	ECO-100237	ECN4992 Hyundai Hybrid Snap in PAL Tx 433 70...	Released
ECO	ECO-100154	ECN4904 Hyundai Hybrid Snap in PAL, Volvo HS...	Released

The screenshot shows the 'Document' management interface. The top navigation bar includes 'Leave Feedback', 'Help Videos', and the Schrader logo. The main content area displays the following information:

- Document Details:** Document Number: 90518670, Revision: 06, Status: Released
- Document Type:** Calibration Specification
- Metadata:** Created By: Innovator Admin, Created On: 02/08/2014, Modified By: EUGENE BRENNAN, Modified On: 20/01/2014, Major Rev: 06, Release Date: (blank), Effective Date: (blank), Generation: 3, State: Preliminary
- Associated Part Numbers:** 90503697, 90503697
- Document Sign-offs:** Initial Reviewer: PADMM SUNDARALINGAM, Project Leader: PADMM SUNDARALINGAM, System Developer: PHILIP KEARNEY, Sensor Design: PHILIP KEARNEY, Sensor Development: PHILIP KEARNEY, Asics Development: GARY SMITH

Below the document details is a 'Workflow History Report' table showing the progress of the document through various stages.

Activity	State	Assigned To	Completed By	How Voted	When	Comments
Initial Review	Closed	PADMM SUNDARALINGAM	PADMM SUNDARALINGAM	Approve	20/01/2014 08:22:41	
Review	Active	Paul McKee				
Review	Active	SARREN BLANE				
Review	Active	PHILIP KEARNEY				
Review	Active	Gary Smith				
Review	Active	EUGENE BRENNAN	EUGENE BRENNAN	Approve	20/01/2014 09:49:06	

▶▶ Accessing Released Documentation

- ▶ Control maintained in Aras rather than sending copies
- ▶ Doc. search Application for easy access
- ▶ All sites and sister companies instantly pick up changes

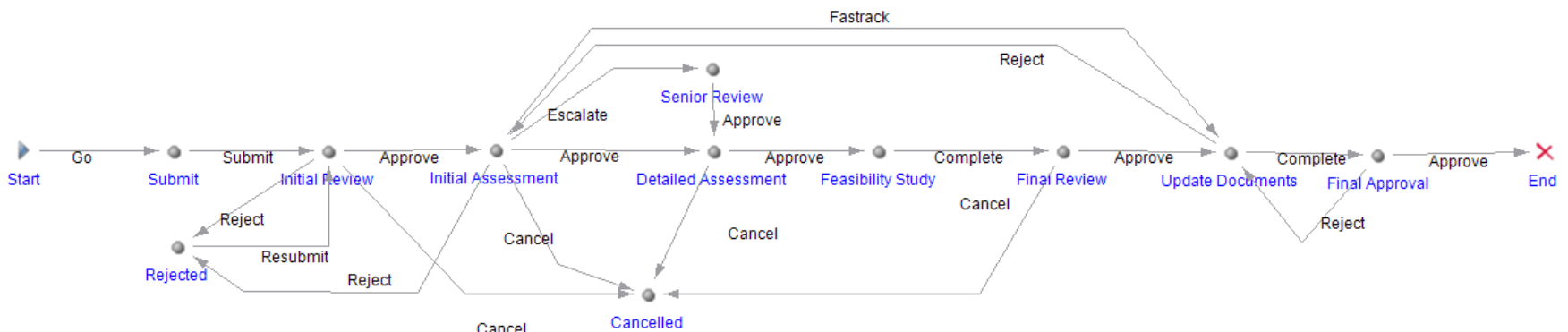
The screenshot shows the Aras Document page for a document titled "Calibration Specification - Number 9053801012". The document is in a "Preliminary" status. The page includes a "Document" section with fields for Document Number, Revision (05), Status (Preliminary), Document Type (Calibration Specification), Name (TMS 2050 Series Truck 433 70803008), and Description. It also features a "Workflow History Report" table with columns for Activity, State, Assigned To, Completed By, How Voted, When, and Comments. The report shows a series of reviews and approvals by various users, including Ian Elliott, Connor Barry, Philip Kearney, and Bob Sittlington, all completed by James Davies.

Activity	State	Assigned To	Completed By	How Voted	When	Comments
Initial Review	Closed	IAN ELLIOTT	IAN ELLIOTT	Approve	17/01/2014 12:43:52	
Review	Closed	CONNOR BARRY	CONNOR BARRY	Approve	17/01/2014 13:21:05	
Review	Closed	PHILIP KEARNEY	PHILIP KEARNEY	Approve	20/01/2014 07:38:04	
Review	Closed	BOB SITTLINGTON	BOB SITTLINGTON	Approve	20/01/2014 08:14:54	
Review	Closed	James Davies	James Davies	Approve	20/01/2014 14:39:07	
Review	Closed	James Davies	James Davies	Approve	20/01/2014 18:50:44	
Document Control	Active	SEL_DocumentControl				

The screenshot shows the "Aras Document Search" application interface. It features a search bar, a "Search for a Document" button, and a "Clear Search" button. Below the search bar is a list of document categories, including "Product Documents/BOM", "Product Documents/CAD", "Product Documents/Calibration Specification", "Product Documents/Control Plan", "Product Documents/COP Performance Limit", "Product Documents/Customer Offer Drawing", "Product Documents/DFMEA", "Product Documents/Drawings", "Product Documents/ECN", "Product Documents/Engineering Training References", "Product Documents/FTA", "Product Documents/Guidelines", "Product Documents/Internal Equipment", "Product Documents/Manufacturing Process Drawings", "Product Documents/Matrices", "Product Documents/Miscellaneous", "Product Documents/Mounting Instructions", "Product Documents/Packaging Specification", "Product Documents/PCB (Panel Drawing)", "Product Documents/PCB Atwork", "Product Documents/PCB Panel Details", "Product Documents/PCB Raw Pick and Place Data", "Product Documents/PCB Schematic", "Product Documents/DFMEA", "Product Documents/DFMCD", "Product Documents/Process Flow", "Product Documents/Product Characterisation Specific", "Product Documents/Production Test Specification", "Product Documents/Simulation Data Files", and "Product Documents/Software". The interface also includes a "Documents Found" section and a "Files Stored on Selected Document" section.

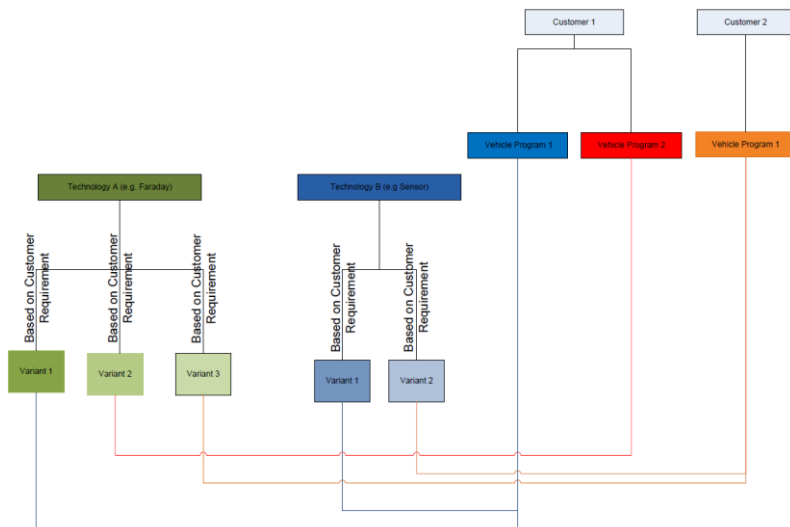
▶▶ Proposed ECR and ECO Processes

- ▶ Schrader only operates an ECN process
- ▶ Communication and consultation prior to change not always complete
- ▶ Proposed ECR system, followed by ECO



►► Project Management In PLM

- Timelines will be live and available to project team
- Documents and other deliverables uploaded directly into projects
- Improved collaboration between departments with visibility of data



N	Project Tree	Descri...	Predecessors	Status	Leader [...]	Lead Role	Plan Start	Plan Finish	Duration
	C344 C-Max Project Plan 09Jul2013 Simplified_1						21/11/2013	04/02/2014	
	Phase 0 Run at Rate						22/11/2013	09/01/2014	
1	Order PCBs KCE			0			22/11/2013	19/12/2013	20
2	Enclosure Delivery		1	0			20/12/2013	31/12/2013	8
3	DV/VP SMT Input		2	0			01/01/2014	07/01/2014	5
4	Mechanical Assembly		3	0			08/01/2014	09/01/2014	2
5	Run at rate complete		4	0			09/01/2014	09/01/2014	0
	PP Sample Build						21/11/2013	04/02/2014	
6	Material Deliver		5	0			09/01/2014	09/01/2014	0
7	Sample Build Docs		5	0			10/01/2014	23/01/2014	10
8	SMT input		7	0			24/01/2014	31/01/2014	6
9	Mechanical Final Test		8	0			03/02/2014	04/02/2014	2
10	PP Build Delivery		9	0			04/02/2014	04/02/2014	0
11	Review Meeting			0			21/11/2013	21/11/2013	0

▶▶ Construction – Future Phases



Project Management
Change Management
Visualisation
CAD Data Mgmt
Product Doc Mgmt

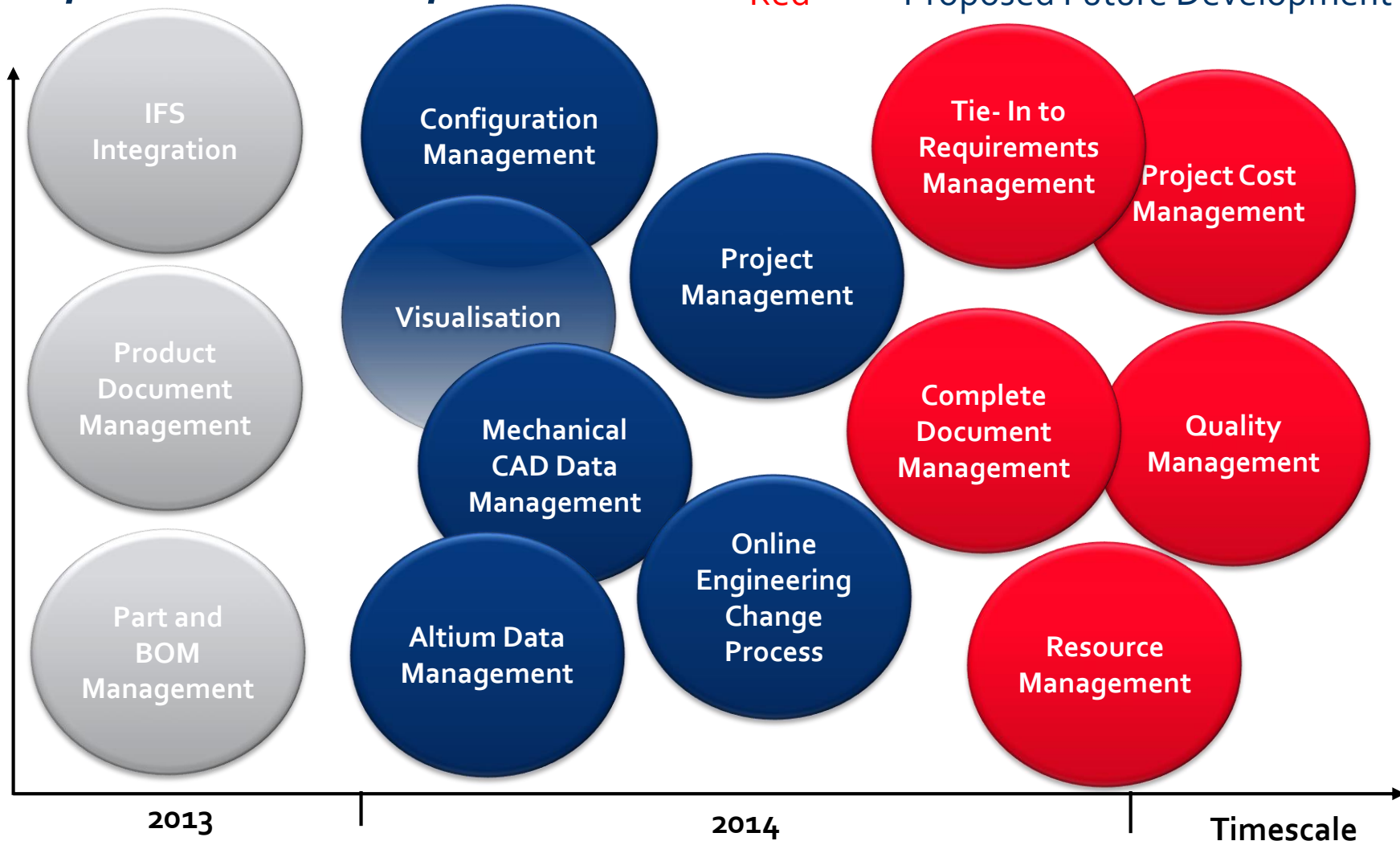
Part Master
Basic ERP Integration

- ▶ Resource Management
- ▶ Collaboration – ‘Secure Social’
- ▶ Secure File Distribution
- ▶ Quality Management
- ▶ Project Cost Management
- ▶ Replacing MS docs with system functionality
- ▶ Change Implementation
- ▶ Ideas capture and filtering

►► Implementation Scope

Grey
Blue
Red

Complete
In Development
Proposed Future Development





▶▶ *Lessons Learned ... so far!*

- ▶ **Aras was the right choice**
- ▶ Flexible system and agile approach is critical
- ▶ **BUT** should have set a step by step roll out plan sooner
- ▶ It's difficult to build several floors at once!
- ▶ Having internal Aras 'development' resource is essential
- ▶ We can always work harder at communicating with the business
- ▶ It is a challenge to keep focused on delivering priorities but have a way to capture ideas for the future
- ▶ 'Feedback' button was a good idea

▶▶ *Developing Aras – Outside Aras*

Why Work Outside The Client?

▶▶ Two main reasons:

1. To give users direct access to information which is stored/controlled in the PLM.
 - ▶ Reduces the need for training
 - ▶ Speeds up common tasks
 - ▶ Easier to get buy-In
2. Automating Aras Processes
 - ▶ A user friendly way of carrying out a process in Aras
 - ▶ E.g. creating a 'Change' item and adding affected items

▶▶ Controlling Documents

▶ Before Aras

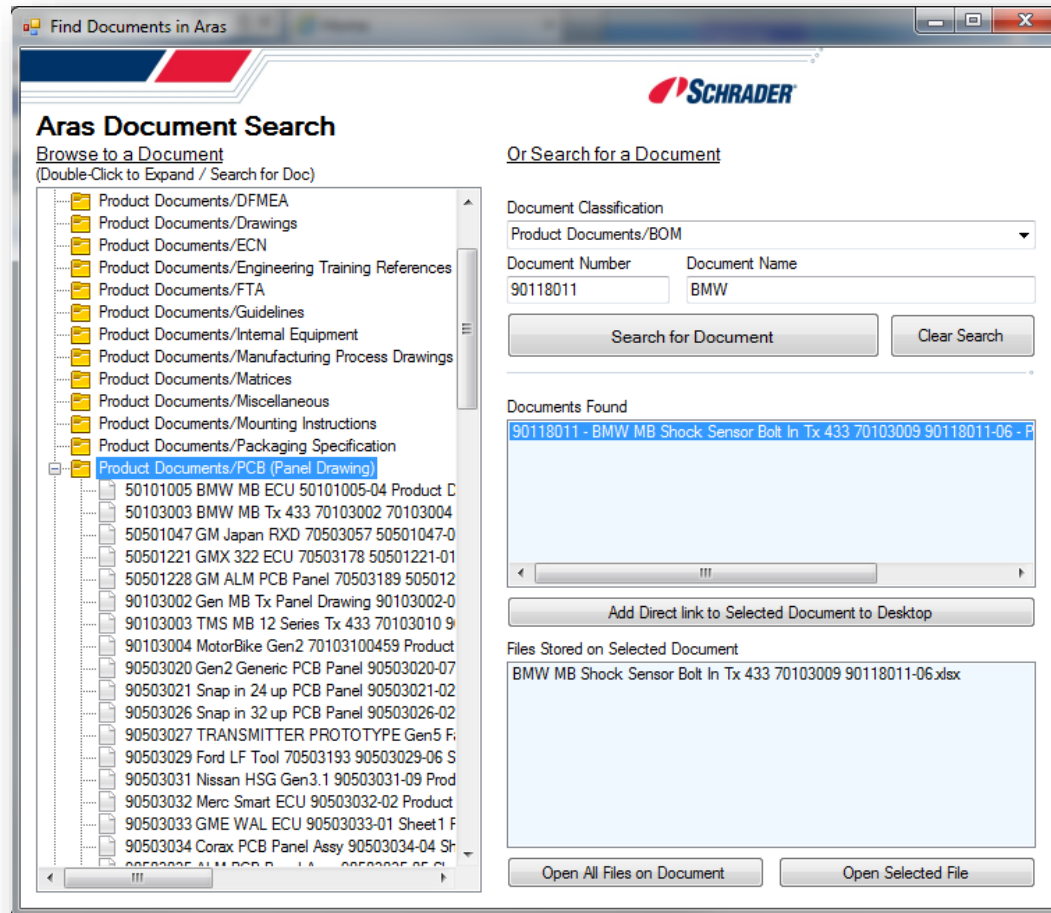
- Document Control Team manually controlling shared folders of latest Released Documents
- Several applications pulling files straight from folders
- Manual control, prone to errors

▶ Many teams need access to Released documents, but aren't involved in authoring or review

- Big overhead to train
- Users don't care about Meta-Info, just want outputs

Solving Problems

▶▶ Aras Document Search App



- ▶ Allows user to browse folder structure, or search for Docs Directly

▶▶ Related Solutions

- ▶ Implemented several small applications:
 - Pulling files and metadata into other company systems
 - Replacing pre-Aras solutions
- ▶ Storing and sending 'read only' links to Documents in Aras

▶▶▶ **Electronic CAD Change**

▶ **Before Aras:**

- ▶ Design files **not** controlled
- ▶ Documents managed manually by Doc Control
- ▶ Parts recorded manually on BOM Spreadsheets

▶ **Aras – Altium Integration:**

- ▶ PCB Designs created in Altium
- ▶ “Integrate” connector saves Design into Aras producing:
 1. Parts
 2. Documents
 3. CAD Item
- ▶ Change difficult for a new User

Solving Problems

▶▶ Electronic CAD Change App

- ▶ User launches from CAD design Item in Aras

The screenshot displays the 'ECAD Revisions App' window. At the top, the Schrader logo is visible. The main heading is 'Choose the Items below that you want to Revise'. Below this, there are three sections for selecting revisions: 'Current CAD Revisions', 'Current Part Revisions', and 'Current Document Revisions'. Each section contains a list of items with checkboxes. The 'Current CAD Revisions' section has one item: 'CAD: 00000228 Rev 02 - Electronic - Test Project 1'. The 'Current Part Revisions' section has two items: 'Part: 50501100319 Rev 02 - Manufactured Assembly - Test Project 1 Variant1' and 'Part: 50501100318R01 Rev 02 - Purchased Component or Assembly - Test Project 1'. The 'Current Document Revisions' section has four items: 'Document: D100435 Rev 02 - Product Documents/PCB Raw Pick and Place Data - Test Project 1 Variant 1 DOC', 'Document: D100432 Rev 02 - Product Documents/PCB Schematic - Test Project 1', 'Document: D100433 Rev 02 - Product Documents/PCB Atwork - Test Project 1', and 'Document: D100434 Rev 02 - Product Documents/PCB Panel Datafile - Test Project 1'. Below these sections are three empty boxes for 'New CAD Revisions', 'New Part Revisions', and 'New Document Revisions'. On the right side, there are two green buttons: 'Choose ECO Options' and 'Create Revisions and add to ECO', with a green arrow pointing from the first to the second. Below the buttons are input fields for 'ECO Number', 'Title', 'Change Description', and 'Change Reason'. At the bottom right, there is a button labeled 'Update Change Title / Description / Reason in Aras'.

- ▶ User selects what Parts of Design to revise
- ▶ User can choose to create new ECO or add to existing
- ▶ Populates ECO information

Solving Problems

▶▶ Electronic CAD Change App

Choose the Items below that you want to Revise

Current CAD Revisions

CAD: 0000228 Rev 02 - Electronic - Test Project 1

Current Part Revisions

Part: 50501100319 Rev 02 - Manufactured Assembly - Test Project 1 Variant1

Part: 50501100318R01 Rev 02 - Purchased Component or Assembly - Test Project 1

Current Document Revisions

Document: D100435 Rev 02 - Product Documents/PCB Raw Pick and Place Data - Test Project 1 Variant1 DOC

Document: D100432 Rev 02 - Product Documents/PCB Schematic - Test Project 1

Document: D100433 Rev 02 - Product Documents/PCB Atwork - Test Project 1

Document: D100434 Rev 02 - Product Documents/PCB Panel Datafile - Test Project 1

New CAD Revisions

CAD: 0000228 Rev 03 - Electronic - Test Project 1

New Part Revisions

Part: 50501100319 Rev 03 - Manufactured Assembly - Test Project 1 Variant1

Part: 50501100318R01 Rev 03 - Purchased Component or Assembly - Test Project 1

New Document Revisions

Document: D100435 Rev 03 - Product Documents/PCB Raw Pick and Place Data - Test Project 1 Variant1 DOC

Document: D100432 Rev 03 - Product Documents/PCB Schematic - Test Project 1

Document: D100433 Rev 03 - Product Documents/PCB Network - Test Project 1

Document: D100434 Rev 03 - Product Documents/PCB Panel Datafile - Test Project 1

Choose ECO Options

Create Revisions and add to ECO

ECO Number: ECO-100254

Title: Test Change

Change Description: Testing the change App

Change Reason: To Test

Update Change Title / Description / Reason in Area

- Affected Items created
- New Revisions linked appropriately

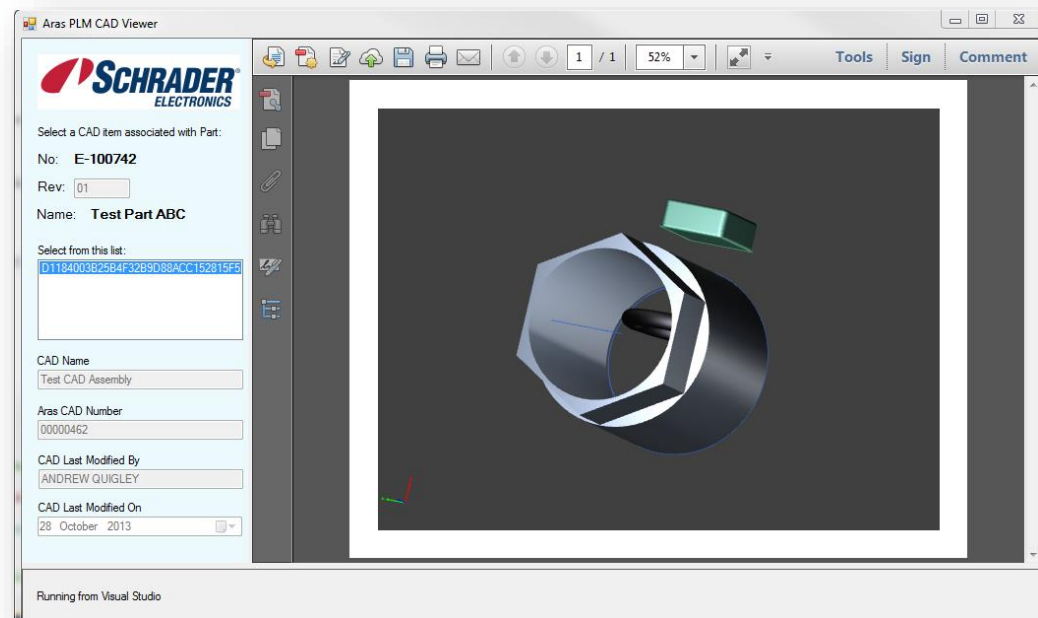
Type	Action	Old Number [...]	Old Revision	Checked	Approved	Create Revs?	New Number [...]	New Revision	Checked	Approved
Change		50501100319 Test Project 1 Variant1	02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	50501100319 Test Project 1 Variant1	03	<input type="checkbox"/>	<input type="checkbox"/>
Change		50501100318R01 Test Project 1	02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	50501100318R01 Test Project 1	03	<input type="checkbox"/>	<input type="checkbox"/>
Change		0000228 Test Project 1 Electronic	02	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0000228 Test Project 1 Electronic	03	<input type="checkbox"/>	<input type="checkbox"/>
Change		D100435 Test Project 1 Variant1 DO...	02	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D100435 Test Project 1 Variant1 DOC Produc...	03	<input type="checkbox"/>	<input type="checkbox"/>
Change		D100432 Test Project 1 Product Doc...	02	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D100432 Test Project 1 Product Documents/...	03	<input type="checkbox"/>	<input type="checkbox"/>
Change		D100433 Test Project 1 Product Doc...	02	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D100433 Test Project 1 Product Documents/...	03	<input type="checkbox"/>	<input type="checkbox"/>
Change		D100434 Test Project 1 Product Doc...	02	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D100434 Test Project 1 Product Documents/...	03	<input type="checkbox"/>	<input type="checkbox"/>

Possible Future Integrations

- ▶▶ **Amount of information captured in Aras increasing**
 - ▶ Aras not everyone's primary system, many users tied to ERP system
 - ▶ Long term plan to give quick access to Aras information from every system

Example

- ERP user finds Part in IFS
- Right click action allows them to directly view drawings pulled from Aras



▶▶ *Questions?*

