

EXECUTIVE SUMMARY

My assessment of computer aided design (CAD) applications focused on six key areas namely,

- Ease of use
- Legacy data
- Stability
- File size
- Data management
- Future business requirements

My findings have led me to recommend that 'CoCreate' from 'Parametric Technology Corporation (PTC)' should be the Group Product Management and Development Departments preferred computer aided design (CAD) solution and provider.

CoCreate and PTC best accommodate the client's plans for innovation and change, and fulfil best the assessment criteria for this report.

Between Solidworks and CoCreate, CoCreate,

- is the easier package to learn and to use
- is more compatible with the majority of existing data
- is more stable and creates less corrupt models
- models are smaller in file size, and therefore easier to send / more flexible
- is made by the same people who design and support our data management system
- is the leader in 'explicit' modelling, which is better suited to innovative design practices.

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INTRODUCTION

For 13 years, the client has used 3D CAD systems to help design its products and systems. CoCreate and SolidWorks are the main applications in use today, with a few operating companies using ProEngineer, Inventor and SolidEdge.

Operating multiple CAD packages has both advantages & disadvantages, but based on an assumption, that in the future we will be asked to rationalise our packages to one, I was asked for my opinion as to which package would best suit our needs.

History

3D CAD was purchased (in the UK) in 1997, to advance the design and development of products within the company. Solid Designer (the old name for CoCreate), was chosen as it was a natural progression from ME10, (the main 2D CAD software used by the client then and now), and support could be sourced from the same company, (CSI). Eight years ago, SolidWorks was brought in to resolve a complex modelling task. Support for that had to be sourced from a separate vendor (CADtek). This resolved the modelling issue but divided overheads, support and users into two disparate groups.

Emails from 2004 between Senior Management demonstrate a desire to push the client back towards using one CAD system. Even though there was complete agreement as for the need to standardise, no action was taken beyond the creation of a list of plans. Instead of standardising the CAD systems, methods to cope with the multi CAD systems were implemented.

In 2008 an investigative report into CAD systems in UK Supply was put together. Parts of that report are referenced in this assessment.

Current situation

Globally, there are more than just CoCreate and SolidWorks in use; as shown in the table below,

CAD System	No. of Sites	Sites
CoCreate (3D/2D & 2D)	5	UK, Australia, Czech Republic, Watson Marlow, France (Chat - 2D)
SolidWorks (3D/2D)	5	UK, France (Chat), USA, Argentina, Brazil
SolidEdge (3D/2D)	1	Germany
Inventor (3D/2D)	5	Canada, New Zealand, Poland (AutoCad 3D), South Africa, Korea
AutoCad (2D)	14	Argentina, Australia, Belgium, Brazil, Canada, Czech Republic, Denmark, Finland, Japan, New Zealand, Poland, Spain, Thailand, USA
Pro Engineer	1	Italy
No CAD System	1	Switzerland

The table below shows the number of CoCreate or Solidworks licenses in each country,

	<u>CoCREATE</u>		<u>SOLIDWORKS</u>		
	2-D	3-D	Standard	Professional	Premium
US.	4	1	15		1
Australia		1			
Czech Rep.		1			
France	1	1	6	1	2
Italy	2				
Mexico			1	1	
Brazil			7		3
Argentina			3	0	0
UK	19	22	10	1	3

The client are facing a time of unity, sites being consolidated and new initiatives for the way forward. So in this time of forward thinking, the CAD system too, needs to be assessed to see if the current working practice is suitable for the purpose of carrying design and innovation forward.

It is the intention of this report to look at various factors and comparisons for both Solidworks and CoCreate and assess them against criteria,

Which software is best suited to the future needs and purposes of the client ?

PARENT COMPANY OVERVIEW

In 2007 the American Company PTC bought CoCreate.

PTC

The parent company of CoCreate. It was founded in 1985 and they released their first product (Pro/Engineer) and gain 'John Deere' as their first customer. They continue to grow and gain their biggest client in 1992 ('Caterpillar'). That same year, Industry week names Pro/Engineer 'Technology of the Year'. In 2003, Industry Week award the same accolade again to Pro/Engineer.

From 2002 onwards PTC acquires many companies, servicing many sectors, including CoCreate who were acquired in 2007. These acquisitions means that PTC can now offer the industry's most comprehensive suite of modeling solutions. Today, in 2010 PTC are the leading provider of product development solutions.

The capabilities that PTC has:-

2D CAD	3D CAD	CAE
CAID	CAM	Customization
Engineering Calculations	Document Authoring and Design	Distributed Collaboration
Dynamic Publishing	ECAD DataManagement	Data Exchange
Enterprise Content and Process Management	Enterprise Interoperability	MCAD Data Management
Product Analytics	Technical Illustrations	Provisioning of A&D
Reliability management	S1000D Technical Publications	Software Data Management
Product Information Delivery for A&D	Training and eLearning for A&D	Vizualization and Mockup

Spirax-Sarco Ltd has already purchased Mathcad and PLM workflow and Model Manager and PDM Anydocs which are PTC products for making calculations, workflow management and document filing/management. Workflow is a CSI

product, which they have developed to be used within ModelManager. It allows users to manage data and control their business processes.

Industries that PTC supply :-

Aerospace and Defence	Airlines	Automotive
Consumer Products	Electronics & High Tech	Footwear & Apparel
Industrial Equipment	Medical Devices	Retail
Global Education Program	Small & Medium Businesses	

Companies list on the C.F. Design website of companies using CoCreate:-

Canon Inc.	Hewlett-Packard	Elster GmbH
Waterous Company	Molex Incorporated	Agilent Technologies
Emer SpA	Nippon Avionics Co.	Fagor Automation
Keyence Corp.	ERCO Leuchten GmbH	Emerson Process Mangt.
Oce Technologies	Middleby Marshall	

CF Design are our supplier for our Computational Fluid Dynamics Analysis software.



D'assault Systemes

The parent company for Solidworks, since they started in 1981 they have grown and now supply software in 28 countries. Since their inception, they have grown to be the world leaders in 'Product Life Management'

They currently have six brands:-

Solidworks – Mechanical Design in 3D

Catia – Integrated Product Design

Simulia – Realistic Simulations

Delmia – Digital manufacturing and Production

Enovia – Global Collaborative Innovation

3dvia – 3D lifelike experiences

Solidworks is the market leader in Parametric modelling.

Industries that D'assault supply :-

Automotive and Transport	Aerospace and Defense	Shipbuilding
Industrial Equipment	High-Tech/Electronics	Consumer Goods
Consumer Packaged Goods	Medical	Energy and Process
Architecture	Engineering & Construction	Business Services

Companies list on the C.F. Design website of companies using Solidworks:-

Cisco Systems	St. Jude Medical	Northrop Grumman
L-3 Security	Philips Color Kinetics	Siemens Water
Panasonic	Trek Bicycles	Garmin
InFocus	Wolf Appliance	SureFire
Peerless Pump	GE Lighting	Bosch
Sub Zero	WellDynamics	Air-X-Changers

CF Design are our supplier for our Computational Fluid Dynamics Analysis software.

Financial figures for both parent companies

	D'Assault	PTC
Last price	43.56EUR	18.00USD
Today's change	-0.42 -0.95%	+0.01 +0.06%
Shares traded	- -	155.88k
52 Week range	27.60-44.38	8.42-18.55
52 Week change	+15.70 +56.88%	+9.28 +106.79%

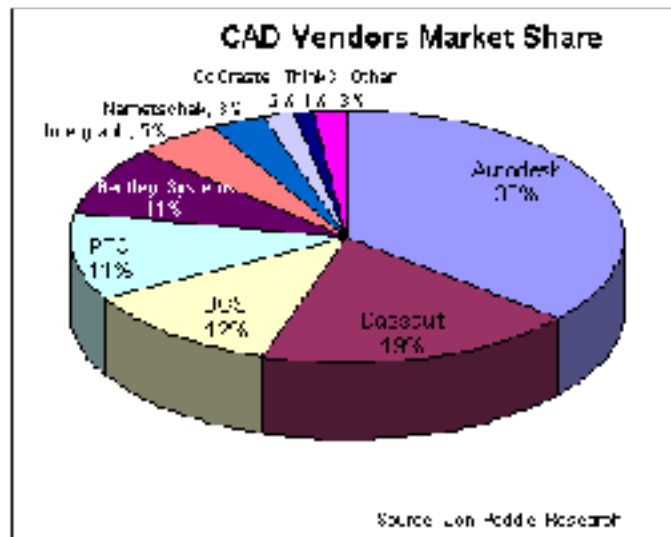
The above figures were taken on 17.03.10

On 30.03.10 figures were:-

	D'Assault	PTC
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Share price	59.08	18.11USD
Mkt. Cap.	6,964.60M	2,121.86M

The chart below shows the market share



The above chart was created before the 2007 PTC buy of CoCreate. Although these figures are slightly out of date it still shows the proportion relationship D'assault and PTC & CoCreate.

TECHNOLOGY OVERVIEW

An explanation of the 3-D modelling methods used by Solidworks and CoCreate.

Explanation of Parametric modelling, taken from Wikipedia:-

Parametric modeling uses parameters to define a model (dimensions, for example). The parameter may be modified later, and the model will update to reflect the modification. Typically, there is a relationship between parts, assemblies, and drawings. A part consists of multiple features, and an assembly consists of multiple parts. Drawings can be made from either parts or assemblies.

Example: A shaft is created by extruding a circle 100 mm. A hub is assembled to the end of the shaft. Later, the shaft is modified to be 200 mm long (click on the shaft, select the length dimension, modify to 200). When the model is updated the shaft will be 200 mm long, the hub will relocate to the end of the shaft to which it was assembled, and the engineering drawings and mass properties will reflect all changes

Parameters refer to constraints whose values determine the shape or geometry of the model or assembly. Parameters can be either numeric parameters, such as line lengths or circle diameters, or geometric parameters, such as tangent, parallel, concentric, horizontal or vertical, etc. Numeric parameters can be associated with each other through the use of relations, which allows them to capture design intent.

Design intent is how the creator of the part wants it to respond to changes and updates. For example, you would want the hole at the top of a beverage can to stay at the top surface, regardless of the height or size of the can. Parametrics allow you to specify that the hole is a feature on the top surface, and will then honor your design intent no matter what the height you later gave to the can.

A history tree tracks all relationships and parameters and stores the order in which designers create features. The tree effectively serves as a part recipe. Changing a step and replaying the recipe forces associations in the history tree to ripple through the model and regenerate the new part. Once a part is built, users need only type in variables to change a pre-programmed model.

Parametric based systems are ideal if you are producing lots of products that are similar in shape but just scaled up or down in size.

Dynamic (Explicit) Modelling is a proprietary term intended to stress the dynamic — that is, fast and flexible. The users directly push and pull models to make changes any time during the design process.

Because of the way Dynamic (Explicit) Modelling works, repurposing of models, (this means to take an existing 3D design and radically transform it by cutting/copying/pasting geometry to derive a new model that has no relationship to the original model) is a very easy process for creating new parts or components.

With an explicit approach, companies can demonstrate accelerated product development by repurposing existing designs into new and completely different products. This is a unique characteristic of explicit approach and can shave weeks or even months from project schedules.

An explicit approach is always open to change, so companies can keep the window for new product information and major product changes open longer. Explicit modelling can offer true flexibility because it doesn't require any upfront planning or the embedding of design information within models.

With Explicit modelling, you are working directly with geometry and don't have the constraints of a program creating parametrics. The closest analogy that can be used is that explicit modelling is like working with clay – you are able to add to the model or take away from the model without effecting or corrupting the rest of the model.

Explicit Modelling or Dynamic Modelling is best suited for projects where there is a regular changing design or lots of 'bespoke' models.

There is a 'grey area' between Dynamic Modelling and Parametric modelling:- Because history-based systems are increasingly adding local direct-editing operations. These tools act like Dynamic modelling tools, but this method still relies on the History tree of Parametric modelling.

On a similar vein as this – There is also a Module for CoCreate that will allow you to edit the geometry using parametrics. The model is still Explicit/Dynamic and there is no history tree as the parametric information is held in an external Excel file.

The two systems of working are very different, but will both produce models that are fit for purpose. With the solidworks models in some circumstances the model will have constraints that will restrict it. (This is due to the file size generated by having a design tree). One restriction is that you are reliant on how the model was put together, as to how you can edit it.

Below is a list of what kind of work is best suited for each method of modelling:-

Parametric Modelling	Explicit/Dynamic Modelling
Design cycles are long and technologies exist for years with few twists in their parameters to adapt to new requirements.	The explicit modelling approach helps designers react to fast changing demands from the market and customers. New design projects are usually built from scratch in the shortest time possible.
Engines - The parametric design approach best captures all the engineering constraints and relationships critical to the engines' success. It drives development with optimized design processes.	A one-of-a-kind design, will be new to market, and must reach consumers in weeks or months to compete in its cut-throat sector.
Complex, highly engineered products Parameters and features capture intended behaviour and precisely define the product's specifications.	Use it to quickly create 3D designs and respond easily to inevitable changes in market and consumer desires using features like on-the-fly interactions with geometry.
Work where you have to set out with design intent and plan how your model is going to be built and what is going to happen.	Explicit modelling is perfect if you design from scratch, work fast, and create one-off designs.
	Explicit modelling is perfect if you create highly customized, one-off designs and your success depends on radically adapting to new and shifting design requirements. You save time because explicit modelling intentionally limits the amount of information captured and embedded as part of the model definition- important for long-lived platforms, but not so much for one-off design.

One point of view says there is a case for having both systems in the NPI process:-

- Explicit/Dynamic modelling for the early concepts in the design stage
- You aren't constrained by the mathematics and a history tree meaning that you can easily create/alter 3-D geometry frequently, without causing possible corruption.
- Parametric modelling for the more established designs
- You could then use the Mathematics of Parametrics to easily create different ranges of that design.

However, after your concept design stage, you don't have to move onto using Parametrics you can continue using the explicit method of work to carry the design through to completion.

If you do require the parametrics later in the design process, CoCreate is able to work in both Parametric and Explicit, where as Solidworks isn't able to work explicitly.

ASSESSMENT CRITERIA

Speed and performance

Solidworks and CoCreate are both very similar when it comes to the day-to-day running and working - performance of tasks and speed etc. Because of the nature of Parametric modelling, the file size is bigger and takes slightly longer for the computer to work with.

Ease of use

Because of the explicit style of modelling, CoCreate is easier to learn from scratch. On Tuesday February 23rd 2010 we started evaluating the new version of CoCreate, (V.17). There are tools and systems of working that greatly speed up the time it takes to do tasks. Users no longer need to know where various command buttons are because there is a new command sensitive sub menu which appears next to your cursor. CoCreate intuitively guesses what you are going to do next.

The Explicit way of working gives the users the ability to work on any model at any time, with out the need to know how that model was created. Explicit modelling works with Geometry where Parametric modelling work with a programme and calculations. Explicit modelling allows users to concentrate on the job without having to consider any potential changes that may be required.

Ease of use (Case study 1)

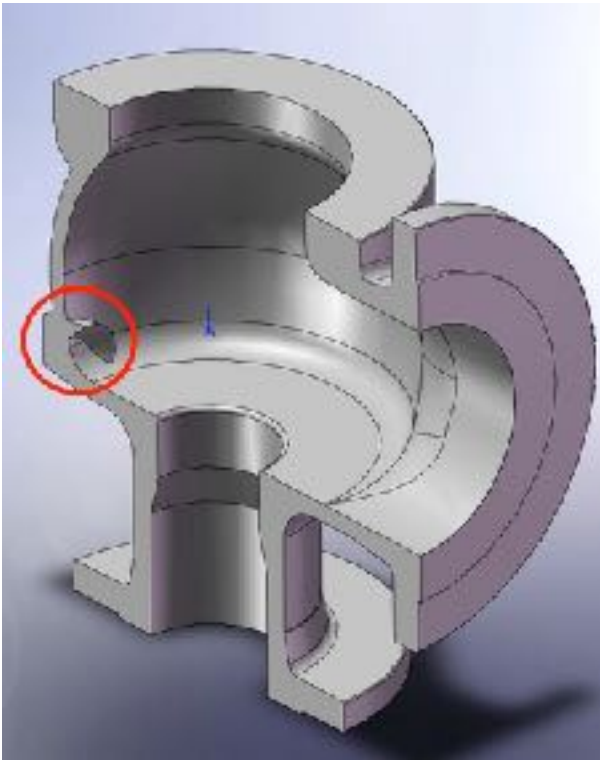
PRODUCT DETAILS:-	2389001 – SV607 DN100 Body Casting SG
PROBLEM:-	The 3-D CAD model had been created in Solidworks, and a boss had been put on the side of the body as part of the design. (Which can be seen in the Image below.) When the boss was put on the body, it protruded through the shell into the inside of the model.

Because of the Parametrics of the model, it took almost a day to find out:-

- what part in the history was causing the problem
- what other parts in the history tree it was connected to, and therefore what it would effect

In CoCreate because of the way explicit modelling works, the protruding part could have been removed very quickly by using the 'Cut Face' tool. This operation took 55 seconds in CoCreate using the 'Cut Face' tool.

Image for case study one showing the protruding feature.



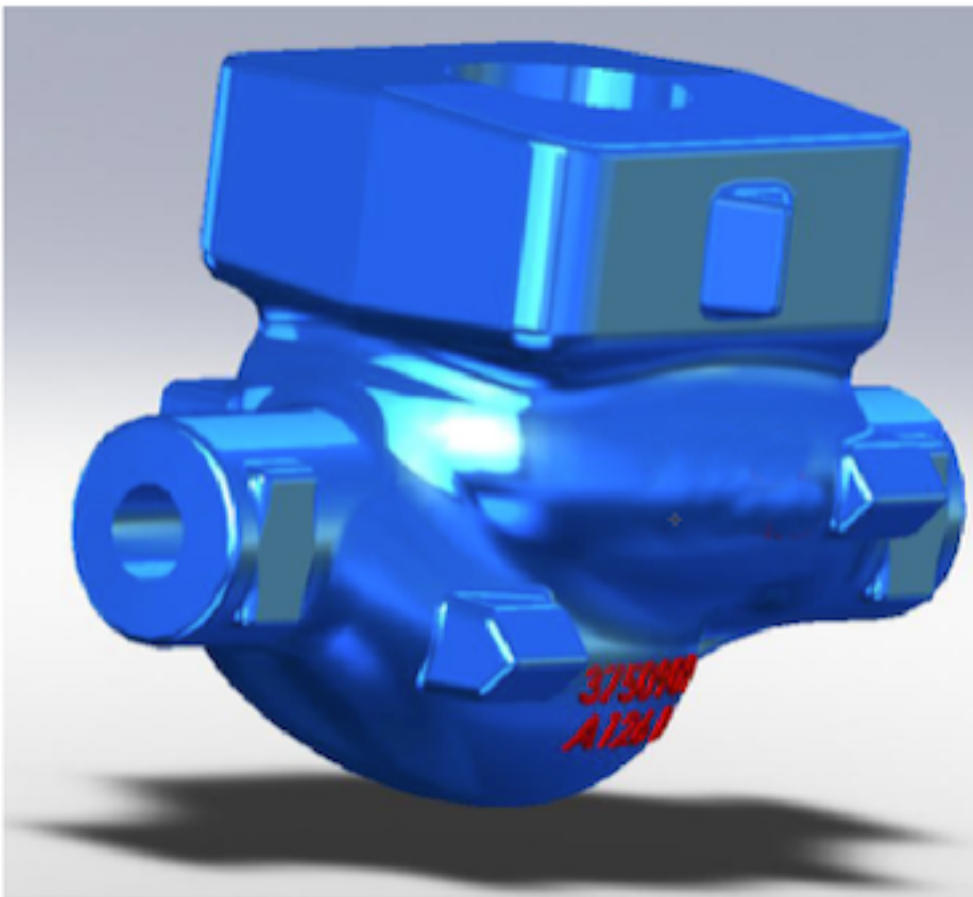
Reliability/Stability

- Since December 2009, we have had several Solidworks models corrupt, which has resulted in time being spent to resolve the issues.
- During the Solidworks demonstration mentioned in the 2008 report, the software crashed for unknown reasons.
- Again, according to Noel's report, many users of Solidworks noted that it regularly crashes. Although no details were given.

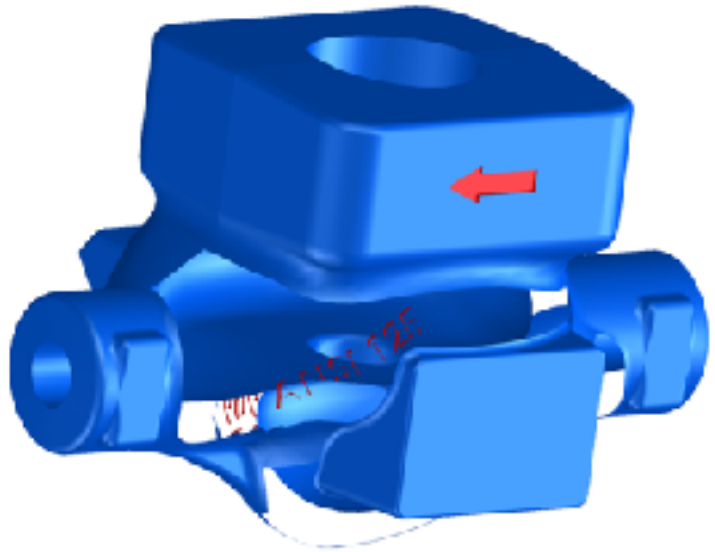
Reliability/Stability (Case study 2)

PRODUCT DETAILS:-	3770909 – Body casting NPT LEA31, L_A series Control valve ½”
WHEN:-	March 2010
PROBLEM:-	The 3-D CAD model had been created in Solidworks, and then exported into a Sat. file. When opened in CoCreate or a 3 rd party 3-D viewer, the sat. file was corrupt (see image below).
ACTION TAKEN:-	Two hours taken to amend the corrupt part of the model

An image showing the Solidworks model.



An image showing the corrupt .sat file.



As you can see from the above image, the corrupt part has no body mass to the side of it.

The Solidworks model was sent to CADtek, who run the clients support with Solidworks, to see if it was user error (an error in the way the model was created).

In a call to CADtek I asked if the history tree showed if the user had created the model badly or was user making errors. I was informed:-
'I can't see anything wrong with the way the model has been created.'

I was also informed that the corruption was due to the file size of the Sat file (25Meg). The complex parametrics of the complex geometry is what makes the file size so big. The Solidworks is 9Meg.

This is the text of the e-mail that I received from support@cadtek.com:-

'Unfortunately there is nothing that can be done to reduce the file size, as it is driven by the .SAT file format. If you open up a .SAT file in a text editor you will see that it consists of a huge number of 3D coordinates, this defines the geometry. Less complex geometry would result in a smaller file, but obviously this would no longer convey the same design intent.'

Financials

The main factor to look at for any planned investment is the financial implications, whether it's directly (capital outlay – buying licenses and paying for training) or indirectly (time taken to create models using the software).

Another factor to consider is the hardware aspect. Because of the way parametric modelling works, the file size increases due to the history tree. This potentially means that higher spec. machines are needed to work on the models.

Users + Future Training

In a company Report it was stated that the Users of Solidworks and CoCreate are loyal to the software they are using.

CAD User Attitude:-

The users of 3D CAD throughout are split between Solid Works and Solid Designer. If/when a move is made towards one of these systems, the implications on the moral of the users is an important aspect to consider.

From talking to all users while investigating the uses of CAD within the company, a trend of negative view was seen to be held against the CAD software that wasn't used by that user. The strength of these views varied from relatively mild to very strong.

This above quote is in this report purely for comment, and not meant to have a bearing on the decision of management:-

It is ideal for the end users to adapt to the change easily, but in reality whatever CAD platform is chosen, some of the end users are going to be unhappy because they are comfortable with the software they work on. However, they have to use whatever tools they are given to complete their job.

I have had working knowledge and complete 5 day training courses on both pieces of software, and before October 2009, I hadn't used either. In my limited experience of Solidworks and CoCreate I have found that CoCreate was the easier software to learn and to use. Mainly because you are working directly on the geometry and not editing data that alters the 3-D geometry. It is also my belief that new users will learn CoCreate quicker than they will learn Solidworks.

Looking at the numbers of users, there are more users of CoCreate than Solidworks so if Management decided to change to Solely using CoCreate then less users would be un-happy.

Where training is concerned, I think that all users will pick up the chosen CAD platform quite quickly due to them already having an understanding of how to

work in 3-D, however there will be an initial period of uncertainty of how to do certain tasks in the new software.

Future business requirements

The 'push' for the company direction is for more innovation & technical leadership. This is backed up by the increased financial backing for the R&D section. Therefore The CAD platform to be used is one which best supports creativity & flexibility. This would indicate a move towards the explicit modelling way of working. This is free of the limitations of parametrics.

File Sizes

File size is not an issue in terms of data storage. Memory is cheap, and the company network and servers are more than capable of coping with the larger files. However, it does have an effect on the following issues:-

- In terms of communicating the data with customers and associates.
- Solid works files can be of 30MB. ISD prefer attachments to emails to be kept to 25MB so as to keep the system running smoothly.
- Customers want smaller files that can be placed into assemblies. Larger files will slow their software down.
- Bigger file sizes means that computer spec.'s need to be bigger.
- Bigger file size also means that file back ups and recovery would take longer.
- As stated in Case Study 1, the file size of a Solidworks file exported to .sat format can cause corruptions.

(See the tables below to see what the files sizes are for the software's when working with various file formats).

Native Solid Works file format

The file sizes for basic models are bigger than that of CoCreate files. This can increase to a much higher value where the model is complex due to all the history held in it. Saving as a para-solid can reduce the file size.No matter how the model is created the file size would be the same. File size is also dependent on how the model is created. An experienced SW user would create a smaller file size than a new user, just because of the history, even though the resulting model would be identical.

Native CoCreate format

Due to the way that Explicit modelling systems work, the file size is low compared to a Parametric system.

3-D model library - Other file formats

The models (web profiles) in the 3-D library are Sat or Stp files. These are small file sizes

The possibility of using 3-D PDF as a file format is currently being explored. The benefits of this format are smaller file size as apposed to .Step or .Sat and it is a more widely used/available file format.

CoCreate already has the capability to create 3-D PDF's. Currently Solidworks doesn't have this capability, and no information is available as to whether or not they are going to make this a feature of later versions of Solidworks.

File size – K series (Case Study 3)



This is an image of the model that was created in Solidworks, that corrupted when it was exported as a Sat file. This then had to be re-modelled in CoCreate.

From CoCreate it was then exported into the relevant file formats.

For this exercise, the model was exported from solidworks into '.sat', '.step' and '.igs' file formats. The CoCreate version was then also exported into '.sat', '.step' and '.igs' file formats.

Below you can see the table of results. 'Increase rate' is that multiplication that occurred when the file was exported. 'Native' refers to the File in it's 'Native' file format – Solidworks or CoCreate.

K Series (Solidworks)

	Native	Sat	Step	Iges
File size	2.1 Meg	22.8Meg	41.3Meg	48.5meg
Increase rate		x10	x19.5	x22.9

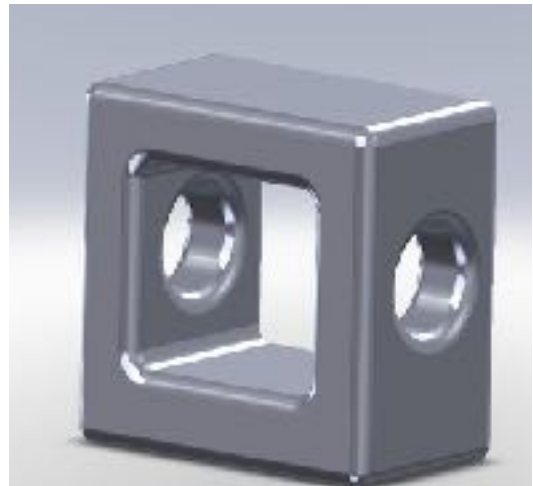
K Series (CoCreate)

File size	1.1Meg	5.7 Meg	3.7 Meg	5.9
Increase rate		x5.18	x3.3	X5.36

File size – Single component (Case Study 4)

This is an image of a component that was simultaneously modelled in CoCreate and Solidworks using the same dimensions.

Below you can see the table of results. 'Increase rate' is that multiplication that occurred when the file was exported. 'Native' refers to the File in it's 'Native' file format – Solidworks or CoCreate.



Single component (Solidworks)

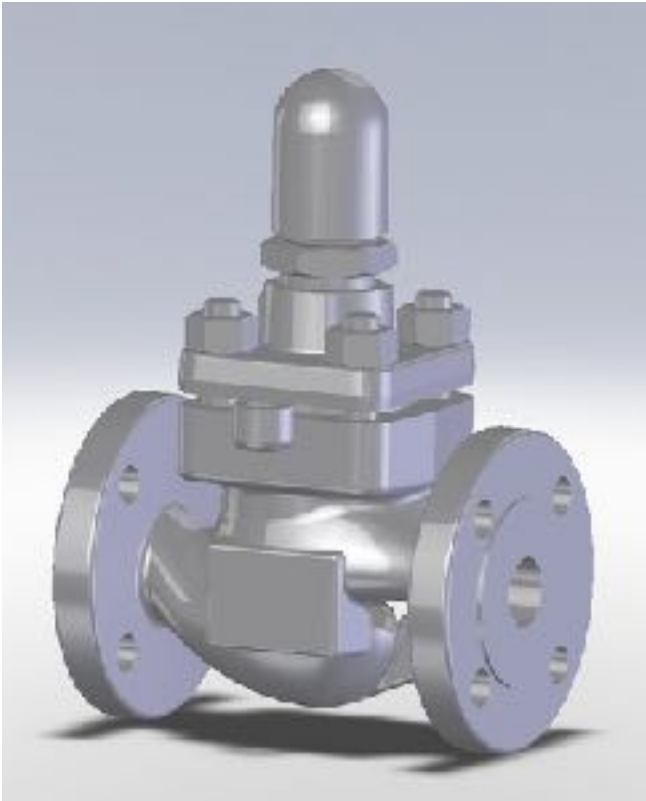
	Native	Sat	Step	Iges
File size	302kb	111kb	166kb	429kb
Increase rate		x.37	x.55	X1.42

Single component (CoCreate)

File size	34kb	91kb	68kb	307kb
Increase rate		X2.67	x2	x9.02

The Solidworks component was also saved as a Para-solid. The file size was 47kb. This was a 'Dumb model', meaning that it couldn't be edited. Ie- the radius could not be edited like you can with the file formats. With the dumb model you would have to mill a bigger hole, or if you wanted a smaller hole, then you would have to fill the hole, then mill/punch a hole back into the side.

File size – Assemblies (Case Study 5)



This is an image of a model that was created in Solidworks and then exported as .Sat file, .Step and .Igs.

Below you can see the table of results. 'Increase rate' is that multiplication that occurred when the file was exported. 'Native' refers to the File in it's 'Native' file format – Solidworks.

Assembly (Solidworks)

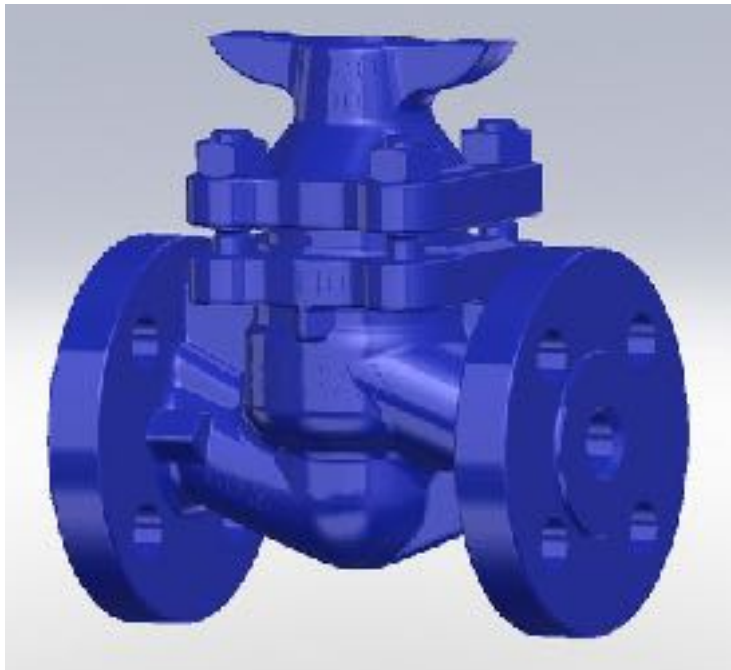
	Native	Sat	Step	Iges
File size	3 Meg	34.5 Meg	41.57 Meg	55.94 Meg
Increase rate		x11.5	x13.85	X18.6

File size – Assemblies (Case Study 6)

This is an image of a model that was created in CoCreate and then exported as .Sat file, .Step and .Igs.

This model is of a BSA3T , with the top part of the assembly removed so that it was a similar physical size to the assembly model used for the Solidworks test.

Below you can see the table of results. 'Increase rate' is that multiplication that occurred when the file was exported. 'Native' refers to the File in it's 'Native' file format – Solidworks.



Assembly (CoCreate)

	Native	Sat	Step	Iges
File size	3.16Meg	8.18 Meg	8.35 Meg	18.93Meg
Increase rate		x2.58	x2.64	x5.99

The CoCreate assembly was saved as a 3-D PDF. The file size was 1.37 Meg (x.43) of the native file size.

Legacy data considerations

The information for this table was gathered off the current data management system, which contains about 95% of all CAD data in Group Product Management & Development and UK Supply.

Number of documents held within Work Manager

Type of data	Solid Works (2007)	Solid Works (2010)	CoCreate (2007)	CoCreate (2010)
2d	3,744	5894	64,806	94,820
3d	3,943	7292	18,982	167,479
Total data	7,687	13,186	83,788	260,299

Comparing the 2007 and 2010 figures shows the following percentages:-

	Solidworks	CoCreate
2007 total data figures (2-D and 3-D)	8.4%	91.6%
2010 total data figures (2-D and 3-D)	4.8%	95.2%

A quote from a previous report from 2008:-

If only solid works was used:

Solid works can open up Solid Designer files, however they become known as a dumb solid. No features are recognised, so changes have to be done manually. For example a hole diameter could not be changed from 10mm to 11mm as Solidworks would not see it as a hole. There is a feature recognition module which is part of the larger package, but it is limited in its use and would take time to use.

If only solid designer was used:

Solid works files can be imported and then worked on straight away. No time would need to be spent preparing the model for changes to be made. All data would be accessible and usable from the day of implementation.

Both Solidworks and CoCreate are able to import 2-D data from AutoCAD, however Solidworks will not open files created in ME10. There would have to

be a batch convert of all the ME10 files. This would have time and financial implications.

CoCreate can import all neutral file types (SAT, IGES, STEP). Once they have been imported they are native CoCreate format and all the functionality of the CoCreate software can be used. Solidworks can import neutral files but they become 'dumb lumps' and the functionality of Solidworks tools is limited. Native file types from other systems require translation software. It should be mentioned that importing data from another source always has the chance of corruption taking place.

Analysis

Both Solidworks and CoCreate export data for use in the CFD analysis and both CAD platforms are able to conduct FEA analysis to a suitable standard.

Until recently the FEA ability of CoCreate has been quite basic compared to the abilities of Solidworks. However, the latest version of CoCreate (V.17) utilises the 'Advanced Mechanica' module which is already available with Pro E.

PTC are releasing V.17 in May 2010.

Free viewer

Both CoCreate and Solidworks come with free viewing software:-

SW only has eDrawings. Users can only view the content of the eDrawing file. No additional models can be added. The content of the file cannot be modified. Data can only be exported as an STL file.

CC can produce eDrawings but also has the 3D Access software. This can connect to Model Manager, allows models to be added and removed from the session and also provides some very basic modelling tools. These tools provide the user the ability to modify models in order to propose changes/ideas. The software can also export data in neutral file formats (SAT, IGES, STEP) and has rendering capabilities. This software does not require a license to run, so there is no limit on the number of seats. (Note. There is a license that can be purchased from PTC, but this is not enforced unless 3D Access greatly outnumbers the number of full Modelling seats.)

Alternative Software Possibilities

Whilst undertaking the writing of this report, I looked into other 3-D CAD systems mainly – Solidthinking and Autodesk Inventor.

On the surface, Inventor looked like it was ideal for the purposes of the client.

It is a Parametrics based systems and boasted that it was able to work in both Parametric modelling and Explicit modelling, On further investigation, the explicit modelling system was history based, which is essentially still parametric modelling.

It's interesting to note that a lot of the Parametric software is suddenly boasting Explicit modelling capability. Could it be that they see the benefits of Explicit Modelling because Sales figures are boosting for CoCreate and other Explicit modelling systems (ie SpaceClaim) and they are trying to take back some of the ground that Explicit modelling is taking.

As stated earlier in this report:-

A lot of the major Parametric software platforms are saying that they have explicit/Dynamic editing capability. On further investigation, they appear to be tools for dynamically editing the 3-D geometry. However all of this editing is still stored in a history tree. So therefore you still have the limitation of the history tree – large file size, prone to corruption

Solidthinking used a system called NURBS (Non-Uniform Rational Basis Spline) to create and edit 3-D geometry. On further investigation this was seen to still be working on a History tree/parametric foundation, with what is essentially another system for editing the geometry. This software would still leave us with the large file sizes and related problems associated with parametric based systems.

From the research that I have undertaken during this report, the general consensus amongst professionals and users in the industry is that the two CAD technologies will never be able to combine.

So you will always be left with the choice between the freedom and speed of the explicit modelling system or the feature rich mathematical approach of the Parametric system.

The possibility of moving away from both CoCreate and Solidworks isn't really financially viable. License price isn't really the issue:-

- Inventor is about £4,000 per license, about the same as CoCreate and Solidworks
- Solidthinking is about £2,000 per license

The extra financial outlay, comes in the fact that so many people would have to be trained in the software due to no one being an existing user.

CONCLUSION

Results

Below are the results of the findings of this report, in both 'quick-point' form and 'score sheet' form

For this table, 2 points were awarded to the software that appeared to be a clear winner on a criteria, and 1 point was added if both pieces of software did equally as well on a criteria.

	Solidworks	CoCreate
Purpose	1	1
File Size		2
Users + Future Training		
Ease of use		2
Reliability		2
Financials	1	1
Legacy Data		2
Analysis	1	1
Future	1	1
Future business requirements		2
	4	14

Purpose	Both Solidworks and CoCreate fulfil the day-day needs of a 3-D CAD platform for the client.
File size	The Explicit Modelling style of CoCreate means that the File Size is smaller. Means that CoCreate files are more manageable
Ease of Use	The explicit style of CoCreate, means that it is easier to create and modify models with out having to know how the model was put together. Tools in the new version of CoCreate make it easier still than previous versions.

Reliability	During the test period in 2007 and 2009/2010, Solidworks was a lot more prone to crashing. In November 2009, many models that were create with Solidworks were corrupted.
Legacy Data	CoCreate is able to open file formats from all CAD software that Spirax-Sarco Ltd use, unlike Solidworks.
Future Business requirements	The flexible method of working with CoCreate, is very much suited to Spirax-Sarco Ltd's vision of workin the future.

After writing this report and looking at the results, I believe that if Management were to decide on a single 3-D CAD platform then they should go with CoCreate. My reasons being:-

As the two CAD platforms are very similar in many respects - license price, training costs, support from the supplier and capability to produce 3-D models in the required file formats, the choice comes down to:-

- reliability and performance of the software.
- the software platform that best accommodates the company's plans for innovation and change.
- the amount of data that is already on the Data Management system that was created by each piece of software. Most of the models on the Data Management system are created by CoCreate. This is the first thing to take into consideration. CoCreate would import the legacy data of the Solidworks files (the minority), a lot easier than the solidworks would import the legacy data of the CoCreate files (the majority).

Since October 2009, there have been several cases where models created in Solidworks have corrupted either in the native file or when exported to a .sat file

Ease of Use

As a CAD user with 14 years experience, I have used many different pieces of CAD software; I have never used a CAD platform that is so easy and intuitive to learn as CoCreate. With in a week of using the software (with limited previous 3-D CAD experience), I was able to create models and edit models.

CoCreate is more stable (even though it crashes, like all software, it crashes less frequently than Solidworks.)

This exert was taken from the 2008 report:-

Since using both packages from the start of the investigation, there has been a clear difference in the stability of each. Solid Works:- It crashed during the 2008 upgrade demonstration for unknown reasons- It freezes up on occasions while modelling- Everyone who has used it, experiences these same problems Solid Designer:- Has not crashed yet during the project investigation- Common users of Solid Designer has seen it crashing, but it only occurred rarely.

In conclusion, Solid Designer is a much more stable and reliable system. It takes up less memory, and can run smoothly alongside other programs on the pc without causing problems. The instability of Solid Works does not prevent it from being used, but can cause great inconvenience if data is lost. Reasons behind it crashing would need to be explored if it became the chosen CAD package within Spirax.

It is obvious that Solidworks is a very good product and is capable of things that CoCreate isn't able to do, for example –

the configurator, where you can switch features on and of. E.g. you may have a model of a tank with various connections. Using the configurator you can set up different instances of the tank with the appropriate connections being shown. You have one model with all the connections and use the configurator to switch them on/off for a given instance.

However the things that Solidworks are able to do, that CoCreate can't do, aren't relevant to the needs of the client. Therefore it isn't a case of 'Which piece of software is best?', but a case of 'Which piece of software is best for client purpose' due to the speed of work, the flexibilities required of models produced and the need for reliability.

As mentioned in the introduction, Solidworks was brought in to fulfil more complex tasks that CoCreate couldn't cope with (at that particular time). With the evolution of CoCreate, the software has become more robust and capable, to the point that it is now capable of doing everything that the client require from a 3-D CAD system

Data management

The client has chosen Model manager by PTC for the Data management. This was done with significant financial outlay (£40,000), and was chosen because CoCreate is the most widely used CAD platform. If the change was to move to solely using Solidworks, then that would make the purpose for that financial outlay redundant. PTC have written a 'ModelManager Integrator module' for Model Manager so that it will work with Solidworks. This is fine as Solidworks files are in the Minority, but if they were the majority, then there would be two options:-

- change the data management system to one that was native to Solidworks
- continue using Model Manager, with files that aren't meant to be used with it using a 'ModelManager Integrator module'

Future (Solidworks and CoCreate)

It is impossible to get away from the popularity of Solidworks. It is obviously the market leader in the 3-D CAD stadium. They have a good product, and have blanketed the market with publicity. As a result they have a majority of the market, including some leading Multi-National companies. It is also obvious that they will be top of the market for years to come.

Each CAD platform comes with a CAD Viewer:-

3-D Access is the CAD viewer for CoCreate and allows the user a lot of interaction with the CAD data. It allows you to import other CAD data and it will also interact with Model manager.

E-Drawings is the CAD viewer for Solidworks. It is more limited than 3-D Access as it can only work with the data that is already in the E-drawings file.

(For more information, please see the links in Appendix 3)

CoCreate, is the leader in the Explicit modelling market, and now that they have the financial backing of 'PTC' they are publicising well and putting a lot of money into development of CoCreate. With the backing of PTC, CoCreate has already started to take some of Solidworks' market (mainly on the continent).

It was the intention of this report to show the number of license sold of CoCreate and solidworks in 2007 compared with in 2010. Unfortunately all of this data was not available.

One of the things that the CoCreate suite wasn't able to do, that Solidworks could do, was pipe work layouts. The Klietsch Module has been purchased and a large amount of time has been invested in configuring the system to work with the companies systems. This is something that would have to be done again if the company decided to go with Solidworks as apposed to CoCreate.

A module has been brought for CoCreate so that geometry can be worked on using Parametric tools and can also create animations and relationships between parts. The animations and relationships can't be done as easily as it can be done in Solidworks, but these aren't features that are used a lot.

Investment by PTC

From looking at the upcoming release of CoCreate (Version 17, to be released in May2010), it is obvious that PTC are investing in the technology of the CoCreate brand, and expanding on it's label as the world's most popular explicit modelling software. PTC have further backed this statement up, by introducing new technology for handling the 'Topology' (maths data). They have introduced the Kernel from Pro/Engineer. (The Kernel is the core Algorithm for processing the maths data). The introduction of this means that CoCreate will be able to work with more complicated geometry. It also means that CoCreate will be able to open and import native Pro/Engineer files.

Solidworks users

At the start of 2009, there was talk of a change in the CAD platforms, moving towards using one platform. This list of questions was put forward Arguing the case for keeping Solidworks (the text in *Italics* is written in answer to the comments):-

Question	Reply
History based models have a positive advantage which allow you to copy, modify & suppress features. OSD looses all workplanes sketches when model is closed unless saved as a package.	<i>You do not need to retain workplanes, they have no link with the model. This is one of the Fundamental differences between Solidworks and CoCreate.</i>
It is possible to draw up one set of components & assy at say DN25 & to copy & stretch them to DN100 versions meaning you are only modifying components not drawing from scratch.	<i>You can 'stretch' a model. Our products tend to change severely between sizes so a simple stretch is not usually possible.</i>
A component in an assy can be morphed into something completely different (eg a turning into a pressing) in situ retaining mating features.	<i>CoCreate parts do not have mating relationships, again this is a fundamental difference between CoCreate and Solidworks. A part in an assembly can be modified in situ. Using the Parametrics module, you can add relations between objects.</i>

Most of our components are simple shapes say less than 4 sketches which means that they are quite easy to understand if modified.	<i>This statement negates that purpose for Solidworks being introduced, as it was brought in to perform tasks involving more complex shapes, that at the time CoCreate couldn't manage.</i>
I have copied say DN25 body to DN40 where every dimension has changed. With OSD this requires a start from scratch.	<i>If it was just a case of shrinking or elongating then the model geometry can be modified without remodelling.</i>
You can load many models & drgs at the same time so that you can modify component drg & assy drg or completely different assy models so that you can jump between projects without re accessing from workmanager.	<i>You can load multiple models into CoCreate. True you can only load 1 drawing but you can only work on one drawing. If you need to reference other drawings the user can use the 'view pdf' feature in Model Manager. The improved speed of Model Manager makes accessing Model Manager a non issue.</i>
Assemblies are updated in real time so that you can see the implications of change on say DN25 & DN15 of a shared component.	<i>True of CoCreate also.</i>
The 3D capability of solidworks of lofted forms are more flexible & controlable than OSD allowing for increasing complex shapes required by future Triz trends.	<i>Triz does not drive towards more complex shapes. Complex shapes can be done in CoCreate</i>
When modifying parts on OSD (CoCreate) the process could be:- a) carefully remove a feature without disturbing other features of the model b) regenerate the alternative feature (workplanes & sketches) c) Patch up the blends. this is akin to toolmaker adding & fabricating features.	<i>A matter of technique. Using the section tool to isolate the part of the model to be modified. Use the project tools to put geometry on a workplane. The reference to being like a machining op shows how easy it is to understand the method of modelling.</i>

Components can be generated from mathematical formula so that you could have a bellows which various amounts of compression & stored at different configurations then these components can be copied & modified DN25 to DN100 where every dimension has been changed & edited to suit.	<i>Parametrics are available in CoCreate. We have not gone down that route since it causes problems with versioning and the need to check every permutation of the model driven by the parametrics. How many models are there currently that are driven in this manner?</i>
FEA is built in to the package so it is easy to change and re-mesh without changing packages & file formats saving time.	<i>FEA is also in CoCreate.</i>
There are numerous advanced packages built in for future requirements (animation, dynamic load, piping, pressings) which have an engineering feel.	<i>This is also true with CoCreate</i>
The amount of personnel who are already familiar with SolidWorks & large majority would use as a preference if allowed to.	<i>License numbers would indicate that this is marginally true – Solidwork – 54 Licenses CoCreate – 52 Licenses But the amount of models created by CoCreate in 2007 was 91.6% of total models and in 2010 that figure has risen to 95%</i>
It is clearly a more popular system World wide - they can't all be wrong. The trend that is clear now in the Global CAD market is that people are making a move toward the explicit modelling system due to the ease of use and the	<i>No they are not but some are...lots of instances of companies who have SolidWorks and get bogged down in modifying data because of the history...clients office in USA for instance</i>

RECOMMENDATIONS

Training for all users. Surfacing training for relevant Solidworks users.

Phasing in CoCreate:-

- When Licenses for other software that is being used, expire, then they should not be renewed. CoCreate should be installed on the CAD machines before hand, so that the User can have some time to get to know that software.

Change Management

There needs to be a process/plan put in place to manage the transition and the effect it will have on the users. This is something that can be researched at length. A process similar to 'John P. Kotter's – Eight steps to successful change', a brief outline of which is:-

- | | |
|-------------------------------------|--|
| 1 - Increase urgency - | Inspire people to move, make objectives real and relevant. |
| 2 - Build the guiding team - | Get the right people in place with the right emotional commitment, and the right mix of skills and levels. |
| 3 - Get the vision right - | Get the team to establish a simple vision and strategy, focus on emotional and creative aspects necessary to drive service and efficiency. |
| 4 - Communicate for buy-in - | Involve as many people as possible, communicate the essentials, simply, and to appeal and respond to people's needs. De-clutter communications - make technology work for you rather than against. |
| 5 - Empower action - | Remove obstacles, enable constructive feedback and lots of support from leaders - reward and recognise progress and achievements. |

- 6 - Create short-term wins -** Set aims that are easy to achieve - in bite-size chunks. Manageable numbers of initiatives. Finish current stages before starting new ones.
- 7 - Don't let up -** Foster and encourage determination and persistence - ongoing change - encourage ongoing progress reporting - highlight achieved and future milestones.
- 8 - Make change stick -** Reinforce the value of successful change via recruitment, promotion, new change leaders. Weave change into culture.

This above list is the general, synopsis of the theory. Some part would have to be changed and tailor-made to suit the staff and the situation.

This method of Change Management doesn't have to be adopted. There are a whole resource online of methods and theories. This was just put into the highlight the kind of steps

A program of 'CoCreate Champions' should be rolled out so that the local new users would have someone locally based that they can go to with problems, questions or queries.

A series of forums, open plan discussions could be set up, with questions and Queries being addressed by a Champion, in front of a group of new users.

APPENDIX 1 - LINKS

www.solidworks.com	The website for the software Solidworks
www.cocreate.com	The website for PTC's CoCreate software
www.3ds.com	The website for Dassault Corporation who own and develop Solidworks
www.ptc.com	The website for the company who own and develop CoCreate
www.cadtek.com	The website for the agents who Spirax-Sarco Ltd bought Solidworks from, and continue to supply support.
www.csi-europe.com	The website for the agents who Spirax-Sarco Ltd bought CoCreate from, and continue to supply support.
www.ptc.com/products/cocreate/model-manager	The Website for Modelmanager, the Data management system that Spirax-Sarco Ltd use.
www.ptc.com/products/proengineer/advanced-mechanica	The website for the Pro E. software from which the FEA module for CoCreate V17 is based.
www.edrawingsviewer.com	The website for E-drawings, the Solidworks, free viewer.
www.ptc.com/products/cocreate/3d-access	The website for 3-D Access, the CoCreate free viewer.