KNOWLEDGE & INFORMATION MANAGEMENT THROUGH LIFE

From Knowledge Management to Digital Curation

a UK report and perspective

Chris McMahon

University of Bath

EPSRC

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Bath, England

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Atlantic LTKR Workshop

- 12-13 February, University of Bath
- Format – keynotes, panels, breakout sessions
- Topics:
  - Challenges and issues in manufacturing informatics
  - Digital archiving models, representation languages and standards
- Programme at:
  http://www.ukoln.ac.uk/events/ltkr-2007/
- Preliminary notes at
  http://www.ukoln.ac.uk/projects/grand-challenge/awltkr/

ALTKR Communities

- Product data and engineering knowledge management community:
  - Airbus, AWE, BAE Systems, EuroStep, Jotne EPM, LMR Systems, NIST, Shapespace, TranscenData, UKCeB, UK MOD
  - Universities: Bath, Drexel, Heriot-Watt, Leeds
- Libraries and archive community
  - MIT Libraries, Library of Congress, UKOLN, DCC
- Two large UK projects:
  - KIM – Knowledge and Information Management *Through Life*
  - DCC – The Digital Curation Centre

KIM Context - Product-Service Systems

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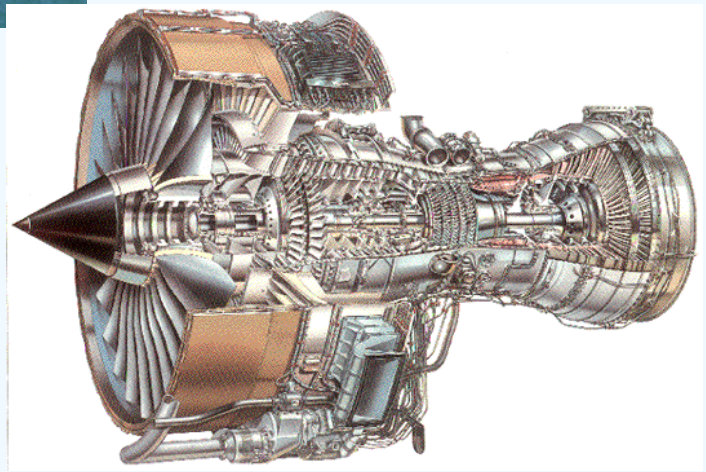

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Context

- Complex, long-lived products – aerospace, construction, marine, military . . .
- The move to product-support – PFI, total care, power-by-the-hour . . .
- Dynamic, distributed organisations and systems
- The need for improved knowledge and information management
- “Personalisation and codification”

KIM Grand Challenge Project

- Centred on the EPSRC (≡NSF) Innovative Manufacturing programme and Innovative Manufacturing Research Centres (IMRCs)
- Project on knowledge and information management through life is one of four "Grand Challenge" projects funded from October 2005
- £5.5 million (c$11 million) over 3.5 years, 11 University partners, >25 industrial partners.

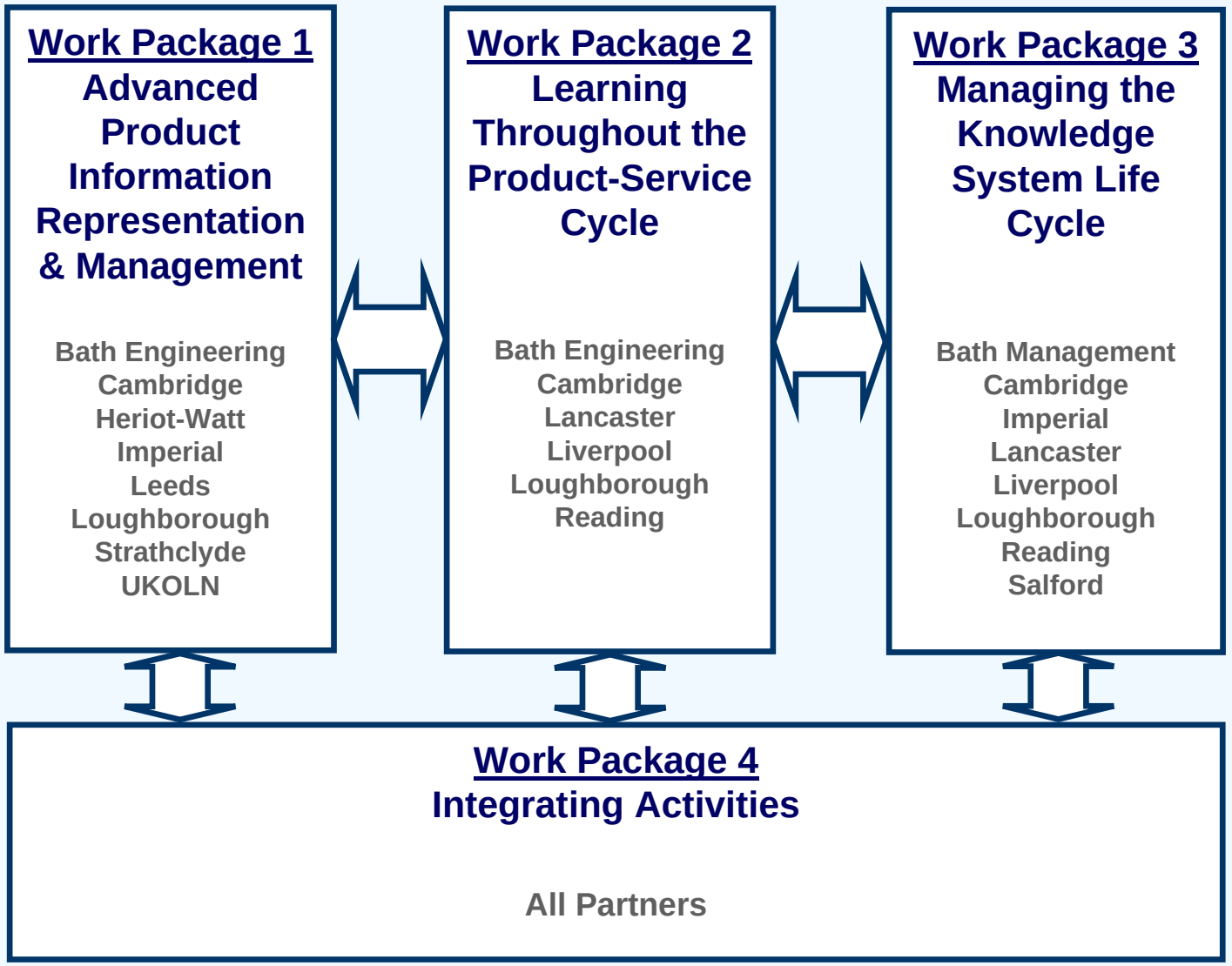
KIM Project Research Aims

- To dev[illegible] for the sustain[illegible]duct, process and rationale.
- To develop approaches to learning about the product in service – the performance of the artefact and its impact on users
- To inv[illegible]nowledge use th[illegible]omplex product-service systems, and to make recommendations for improved effectiveness
- To develop an intellectual framework for the above

Codification

Personalisation

Work Packages



WP1 Tasks

1. To [illegible] of [illegible] ding [illegible] negotiation, evidence of decision making and details of successful and unsuccessful designs)
2. To [illegible] ion [illegible] dels [illegible] service
3. To [illegible] apture of [illegible] ad in [illegible]

How should we represent designs so that we can revisit our decision processes?

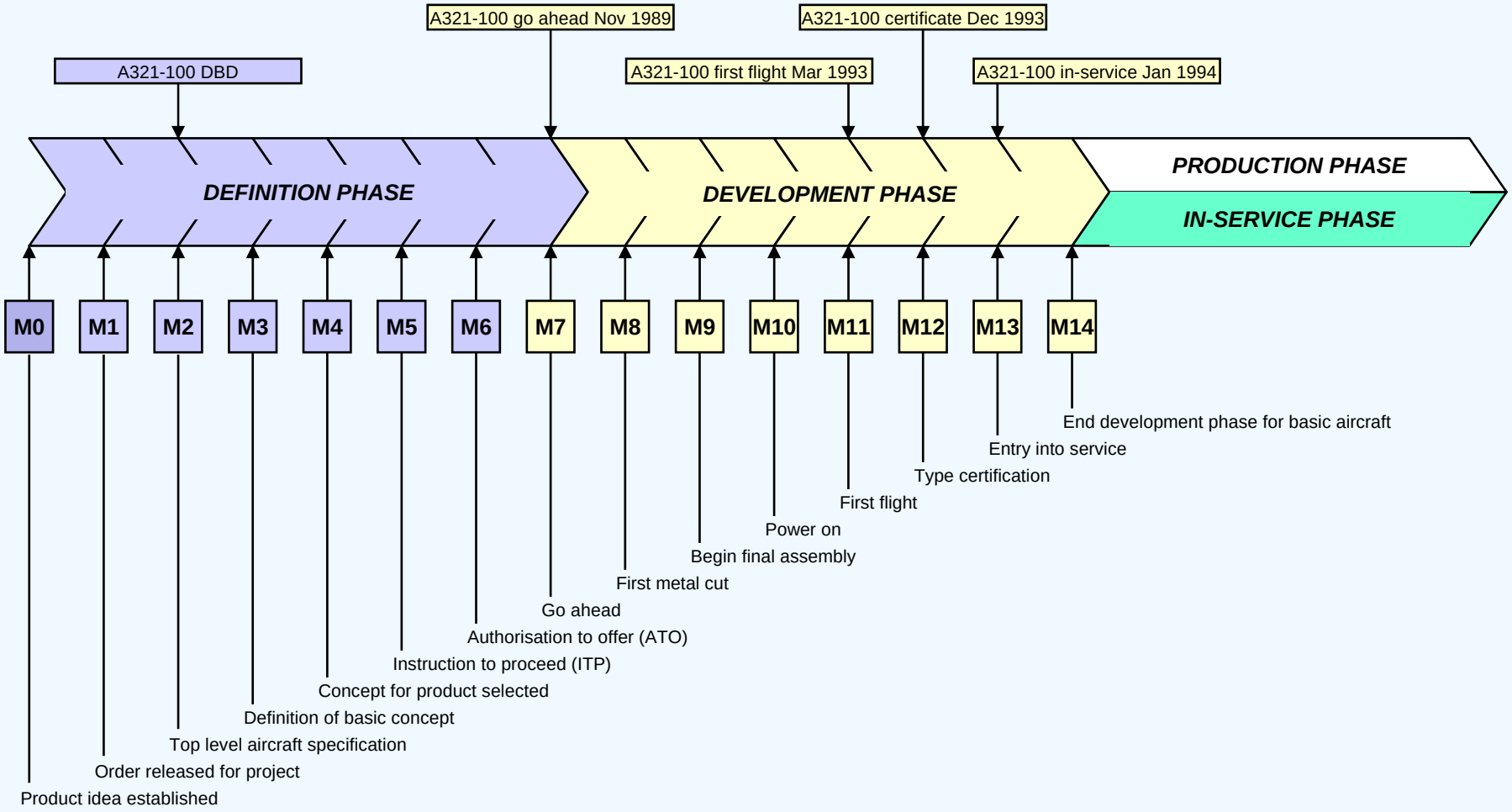
How should we organise the information set?

How can we minimise the preparation effort required?

The “Research Space”

- How can we think about design activities in order to judge how well we are covering the “space”?
  - Stages of the design process?
  - Types of design activity?
  - Granularity of design process description?
  - Computing technologies?
  - Degree of structure?
  - Or some other measure?

Stage-gate Model



Type of Design Activity

- Synchronous acti[illegible]son to person e.g. meetings, co[illegible]he calls . . .
- Asynchronous activities – person to person communication but also "person to tool" activities

Critical situations

		Same time	Different but predictable time	Different and unpredictable time
		Synchronous	***Asynchronous***	
Same place		Face-to-face meetings and discussion aids	Team meeting rooms and discussion areas	Physical bulletin and notice boards
Different but predictable place	*Distributed*	Tele / video conferencing, virtual meeting rooms	Multi-user editors and collaborative writing tools	Messaging systems - e.g. email
Different and unpredictable place	*Distributed*	Interactive multicast seminars	Workflow systems	Virtual bulletin and notice boards

After Johansen

Design Process Granularity

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Process Elements	Modelled by	Participants	Deliverables	Timescales
Stages	Stage Gate Models	Inter-company T	Large-scale formation packages	Months – Years
Work Packages e.g. Durability Evaluation	Gantt cha DSM,			Months – Years
Tasks e.g. structural analysis	Gantt charts, DSM, P3		ation packages	Weeks – Months
Activities e.g. FE Analysis	IDEF0, UML Activity diagrams	Small teams	Information objects e.g. CAD models	Hours – Weeks
Operations e.g. modelling a Constraint	State transitions Petri ne		tures and ts jects	Minutes – Hours
Actions/Events e.g. selecting a face on a CAD Model	Event logs		t GUI y level.	Seconds - Minutes

How to arrange and organise to be most useful?

formation objects

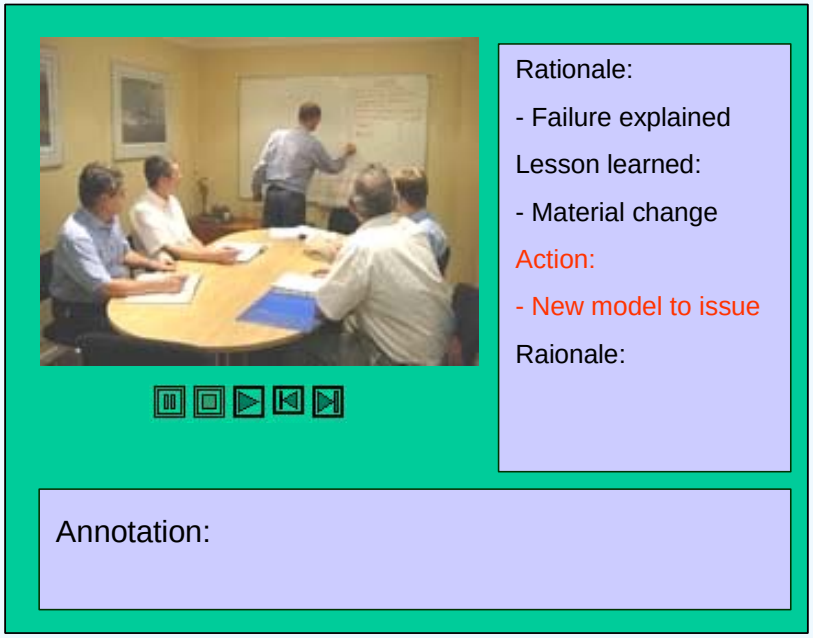
What detail to record and how?

Current thinking

- Different activity types documented in substantially different ways
- Typed, human readable, modular, composite documents
  - Exploit styles, schema
- “Datuments”
- Annotation for semantics and relationships
- Automatic documentation through monitoring of activities
- OAIS repository for representation information

Records of synchronous activities

- Two approaches – multimedia minutes and IBIS-based Design Rationale editor



Records of asynchronous activities

- Categorise into “learning activities” and “transaction activities”
- Learning activities - sub-divide according to target of learning
  - Specific to artefact
  - Specific to class of artefact
  - Generic
  - Document e.g. using Wiki technologies
- Transaction activities – map information dependencies through linking and annotation

“Datuments”

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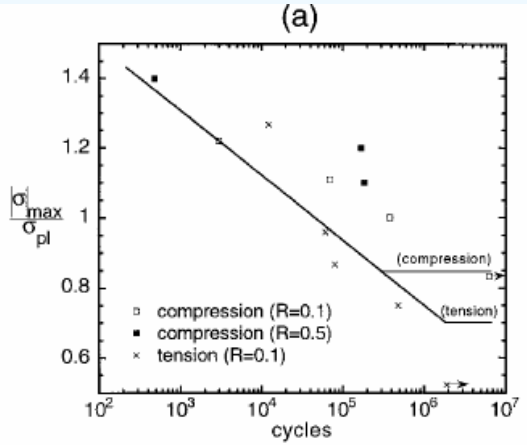

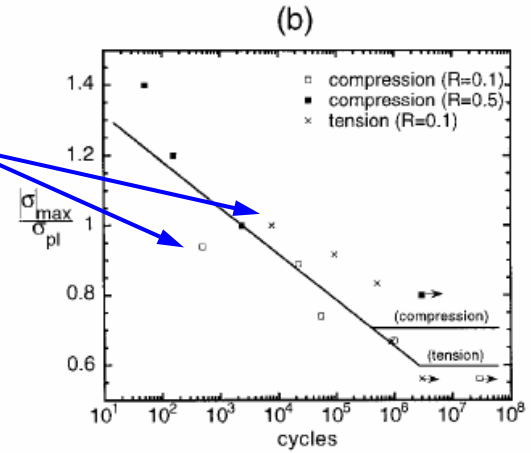

Fig. 5. *S–N* curves for compression–compression fatigue

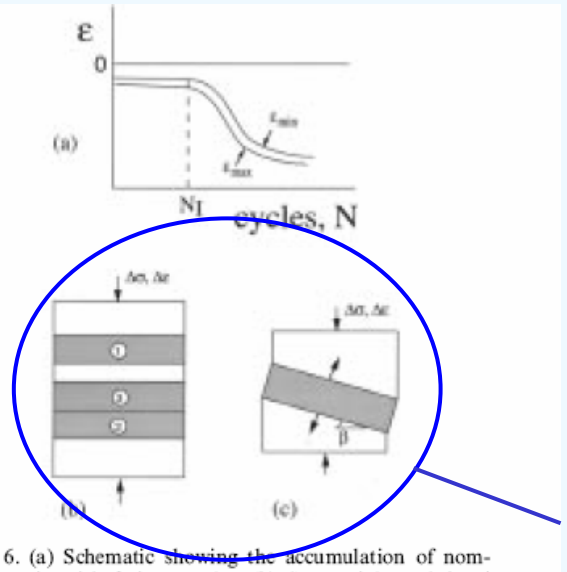

Fig. 6. (a) Schematic showing the accumulation of nominal strain with fatigue cycles. (b) Sequential crush-band formation, as observed by Sugimura *et al.* [7] for compression–compression fatigue of Alporas. (c) Crush-band broadening of Alporas in compression–compression fatigue, as observed in the current study.

N_T [Fig. 6(c)]. The Alporas foam used in the present study appears to have a more homogeneous microstructure than that employed by Sugimura *et al.* [7]; this is consistent with the observation that the monotonic plateau stress σ_{pl} equals 1.4 MPa in Sugimura *et al.* [7] compared with the value $\sigma_{pl} =$ 1.9 MPa in the present study for the same relative density of 11%.

Progressive shortening also occurs in the Duocel foam, with the same qualitative shape of strain-cycle response as shown in Fig. 6(a); however,

This data is not accessible computationally

This is not computer interpretable

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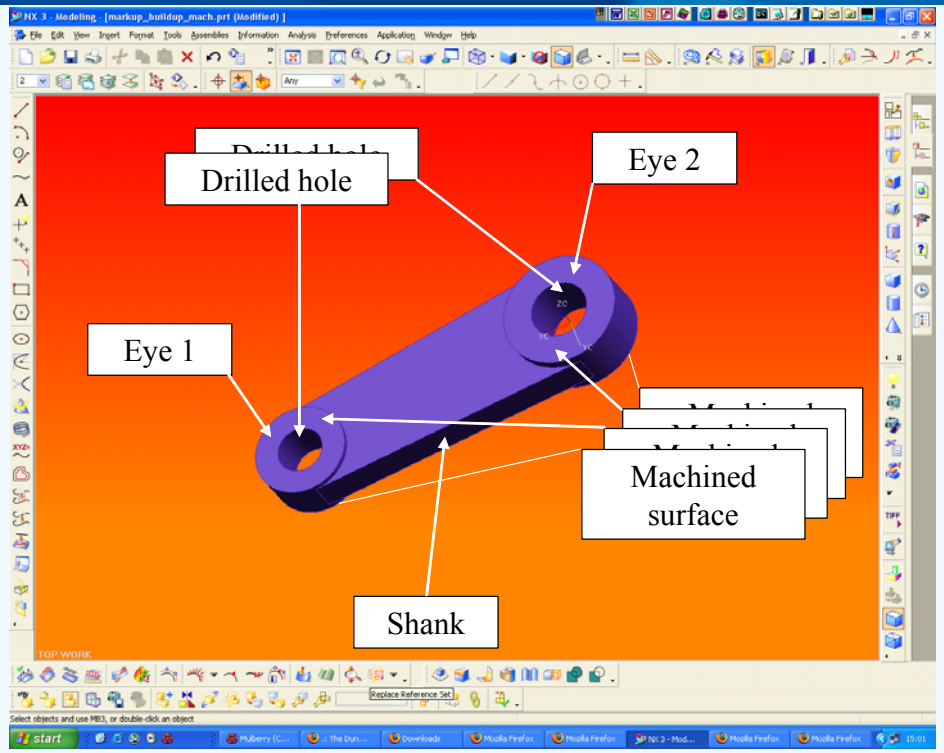
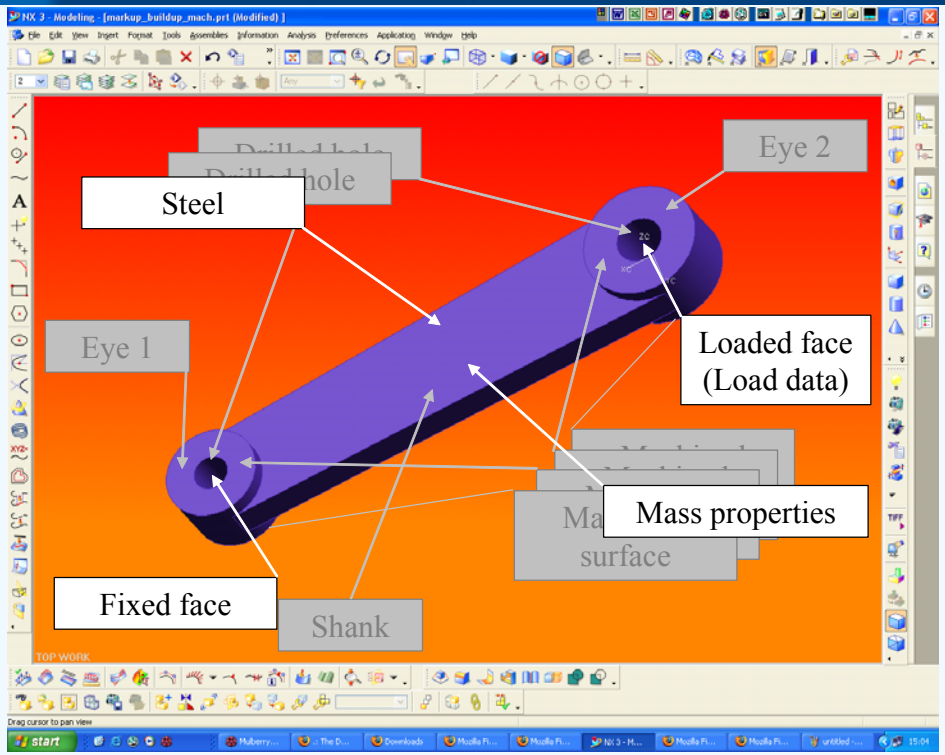
Granularity





- Separate process representation from artefact model; link through annotation
- Documentation is separated product model + description of manipulation

Automatic Information Capture

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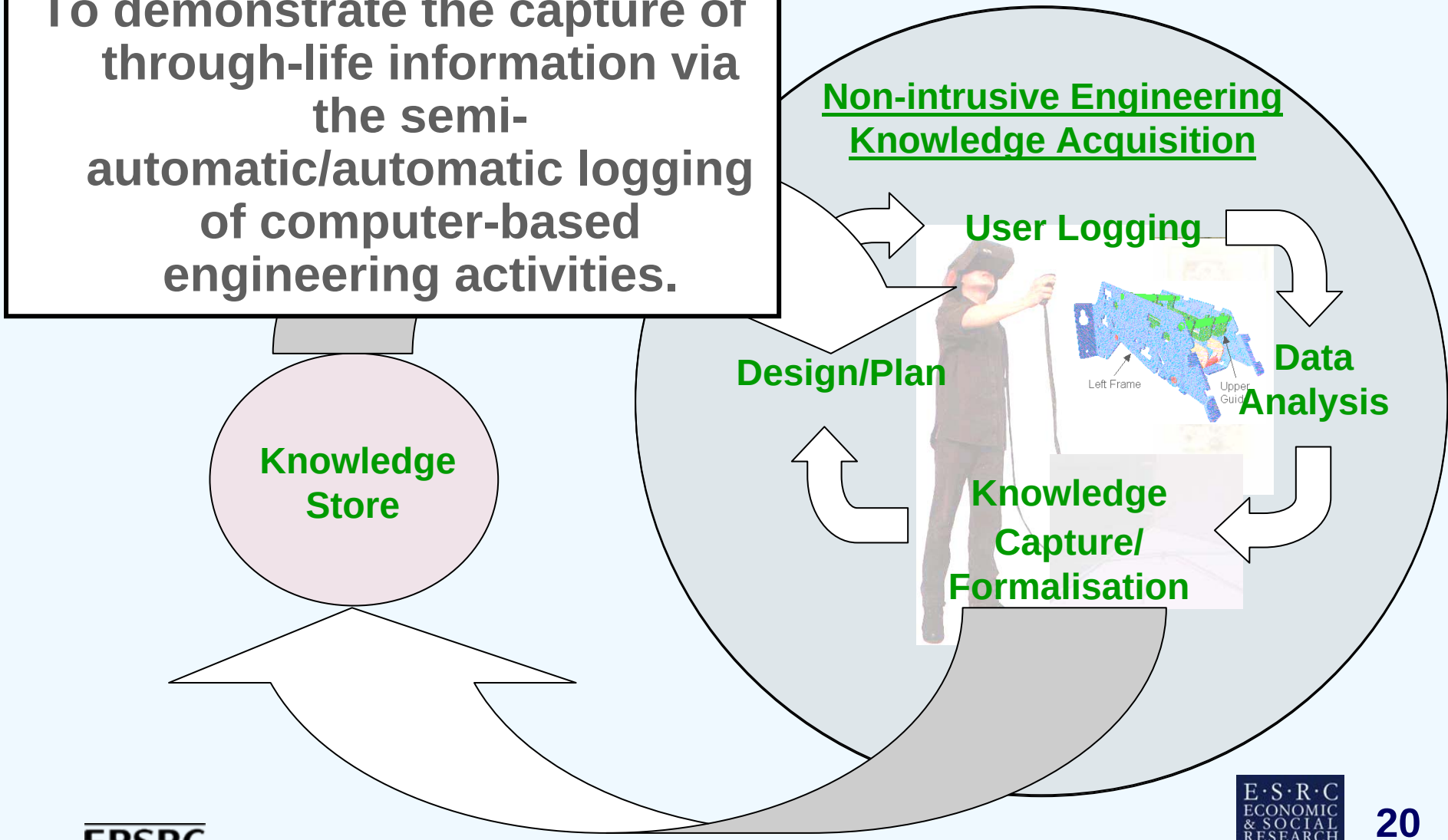
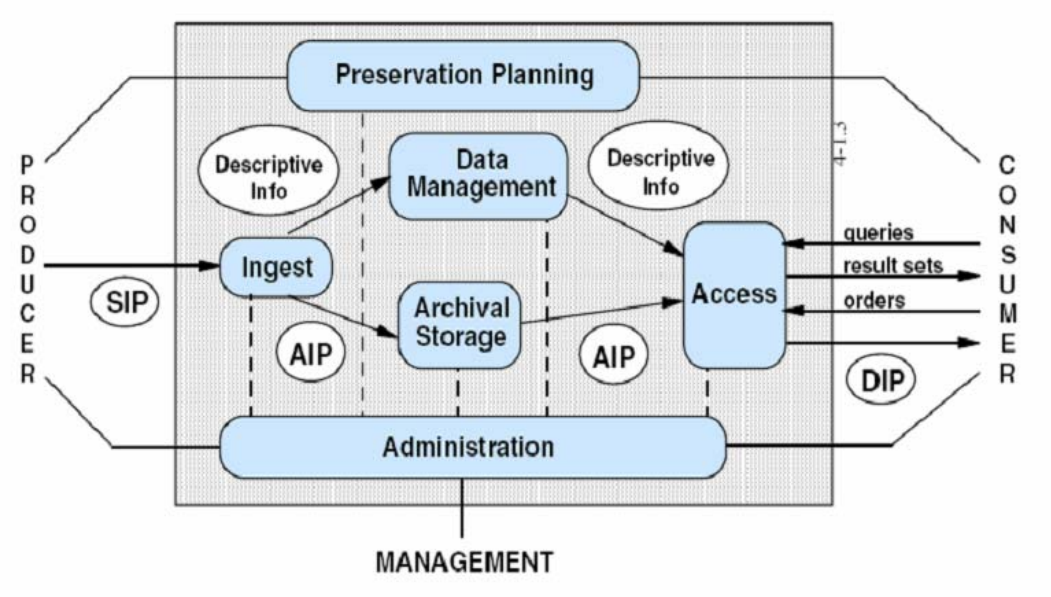
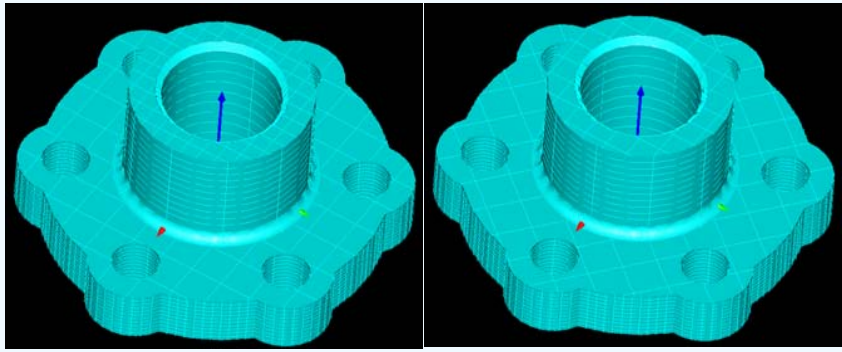
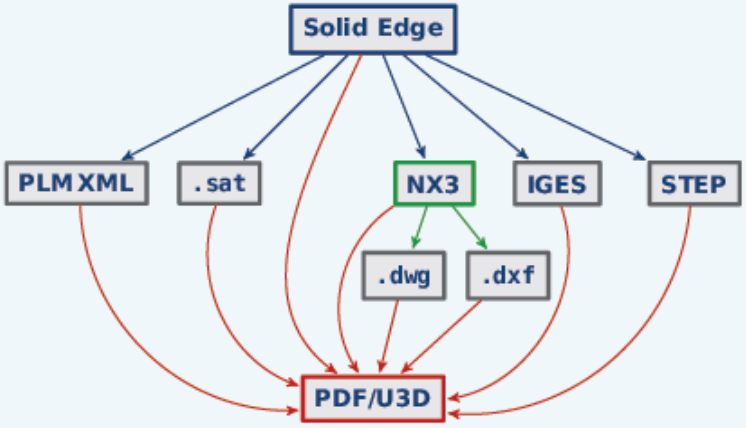
To demonstrate the capture of through-life information via the semi-automatic/automatic logging of computer-based engineering activities.



Long-term preservation







- Constructing a representation information registry for engineering-specific file formats and software (part of DCC registry)

Digital Curation Centre

- Digital Curation is maintaining and adding value to a trusted body of digital information for current and future use; specifically, the active management and appraisal of data over the life-cycle of scholarly and scientific materials.
- Funded by JISC and the e-Science programme to 2010
- A key objective is creation and maintenance of a DCC Digital Curation Manual.
- http://www.dcc.ac.uk/ is very comprehensive

DCC Web Site

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cni Coalition for Networked Information

DCC

3rd International Digital Curation Conference
"Curating our Digital Scientific Heritage:
a Global Collaborative Challenge"
12–13 December 2007
Renaissance Washington DC Hotel
Washington, USA

Home > Events > DCC Conference 2007

E-mail to a Friend

In conjunction with the US National Science Foundation (NSF) [external] and the Coalition for Networked Information (CNI) [external] we are holding our 3rd International Digital Curation Conference, entitled "Curating our Digital Scientific Heritage: a Global Collaborative Challenge," which will focus on emerging strategy, policy implementation, leading-edge research and practitioner experience, and comprise a mix of peer-reviewed papers, invited presentations and keynote international speakers.

This event will follow on from the Fall 2007 CNI Task Force Meeting on 10–11 December 2007 at the same venue, the Renaissance Washington DC Hotel [external]

Further details and a Call for Papers will be published shortly.

Chris Rushbridge – DCC

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- Funes the Memorious (Jorge Luis Borges)
  - Funes is a boy who develops such clear perception and memory that he has trouble ignoring the differences in things caused by different perspectives and the passage of time, to the extent that he can no longer make abstractions and generalizations. This robs him of vital analytical skills.
- The problem of curating engineering documentation:
  - Characterized by what makes the information fragile, and what would make it robust.
  - What other tools, technologies and training do today's engineers need to do a better job?

Atlantic LTKR Workshop

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- Panel 1: Challenges and Issues in Engineering Informatics
  - Long Term Archiving and Retrieval in the Aerospace Industry (LOTAR)
  - Activities in the Development of Standards and Technology for the LTKR of 3D Product Data
  - The MIMER project - new solutions to archive PLM and 3D data
  - Product Life Cycle Support - from standard to deployment
  - Long Term Sustainment of Digital Information for Engineering Design: Model Driven Approach
  - UKCeB Challenges in Long Term Knowledge Retention

- Panel 2: Digital Archiving Models, Representation Languages and Standards
  - STEP approaches to LTKR
  - Navigation and browsing of large archives of 3D CAD models
  - Definition and integration of product-service data
  - Representing Policies for Long-Term Data Retention
  - Collaborating to compile information about formats: the vision, the current state, and the challenges for format registries
  - Knowledge retention infrastructures and archives, and their validation

Engineering Informatics

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- Information Silos
  - Presentations dominated by geometry and STEP
  - Can we preserve **all** information across life cycle?
  - No clear way forward across **all** of the silos – needs to be consciously managed; identify what can't be done.
  - Is there a broader interest group away from discrete parts manufacture we could involve? Are there lessons from other communities?
  - What are plan A, B and C?

Engineering Informatics

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- Plan A
  - Enumerate the silos and their state w.r.t. standards; manage expectations; we have hundreds or thousands of tools.
  - For those aspects covered keep STEP and use that and other standards. Use PLCS – which is to STEP as C++ is to C
  - But note, in standards “specialists will never terminate”
  - Disincentives: Does liability increase if more information is available? Will designers be penalized or encouraged reusing existing work?

Engineering Informatics

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- Representation Information
  - Are there clear ways we can express the relationship between data and information it represents? What is the representation information needed? What is the background knowledge needed?
  - How to start making some of this a reality? Vendors are beginning to realise that they have an interest in open-ness, but how to influence them. Big shift in MS view. Open standards and IPR issues.
  - What is missing from the debate is a comprehensive set of use cases for the engineering preservation problem.

- What can we do to minimise risk?
  - Do a gap analysis and use risk/cost models
  - Use STEP, de facto standards, PDF, simpler representations.
  - Recognise we have to re-engineer
  - Dessicated/lightweight models
  - Stop using spreadsheets!
  - Identify art of the possible
  - Pay for gap analysis

Thank you

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Any questions?

enscam@bath.ac.uk

http://www.kimproject.org

http://www.dcc.ac.uk