

TENIX DEFENCE



Working towards biologically based theories of organization and knowledge to understand how organizations work best

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(NZ KM Net/GOVIS Presentation, September 2003)



Thanks to my sponsor!

- ◆ Trip funded by the **Technical Communicators Association of NZ** (<http://www.tcanz.org.nz>).
- ◆ I have just come from giving a keynote address to the 4-5 Sept. Conference in Auckland - Focus on Users.
- ◆ **Technical writers assemble and assimilate data, information and and people's tacit knowledge into explicit knowledge.**



Scope

- ◆ **Themes**
 - **Towards a biologically based theory of organizational knowledge**
 - **Roles of information technology in changing the nature and processing of organizational knowledge**
- ◆ **Presentation is in two parts:**
 - 1. Theory of knowledge and knowledge management for individuals and organizations**
 - Growth of persistent knowledge and organizational adaptation through criticism and selection
 - Technological revolutions extend cognition
 - Impacts of revolutionary technology on:
 - production and management of knowledge by individuals and firms
 - nature of the organization
 - 2. How new concepts are being applied in Tenix Defence**
 - capturing, managing, delivering fleet support knowledge
 - capturing knowledge into precedents based authoring

A lot of ideas - can drill down in discussion later



Part 1. Theory of knowledge for individuals and organizations

- ◆ **KM is more than IM but IM a major component**
- ◆ **The theory of knowledge used by many KM practitioners is too limited for effective IT use**
 - De-emphasizes explicit, persistent forms of knowledge
 - Leads to inadequate requirements specifications for IT
 - IM without KM is also problematic in the same way
- ◆ **A "biological" theory of knowledge gives KM a stronger foundation for using IT**
- ◆ **5 core ideas presented here**
 - **Kuhn's revolutions, paradigms and incommensurability**
 - Karl Popper defines knowledge and shows how it grows
 - Maturana and Varela's autopoiesis defines "life"
 - John Boyd's OODA Loop wins conflicts
 - Ian Coombe's WIKID turns data into strategic power

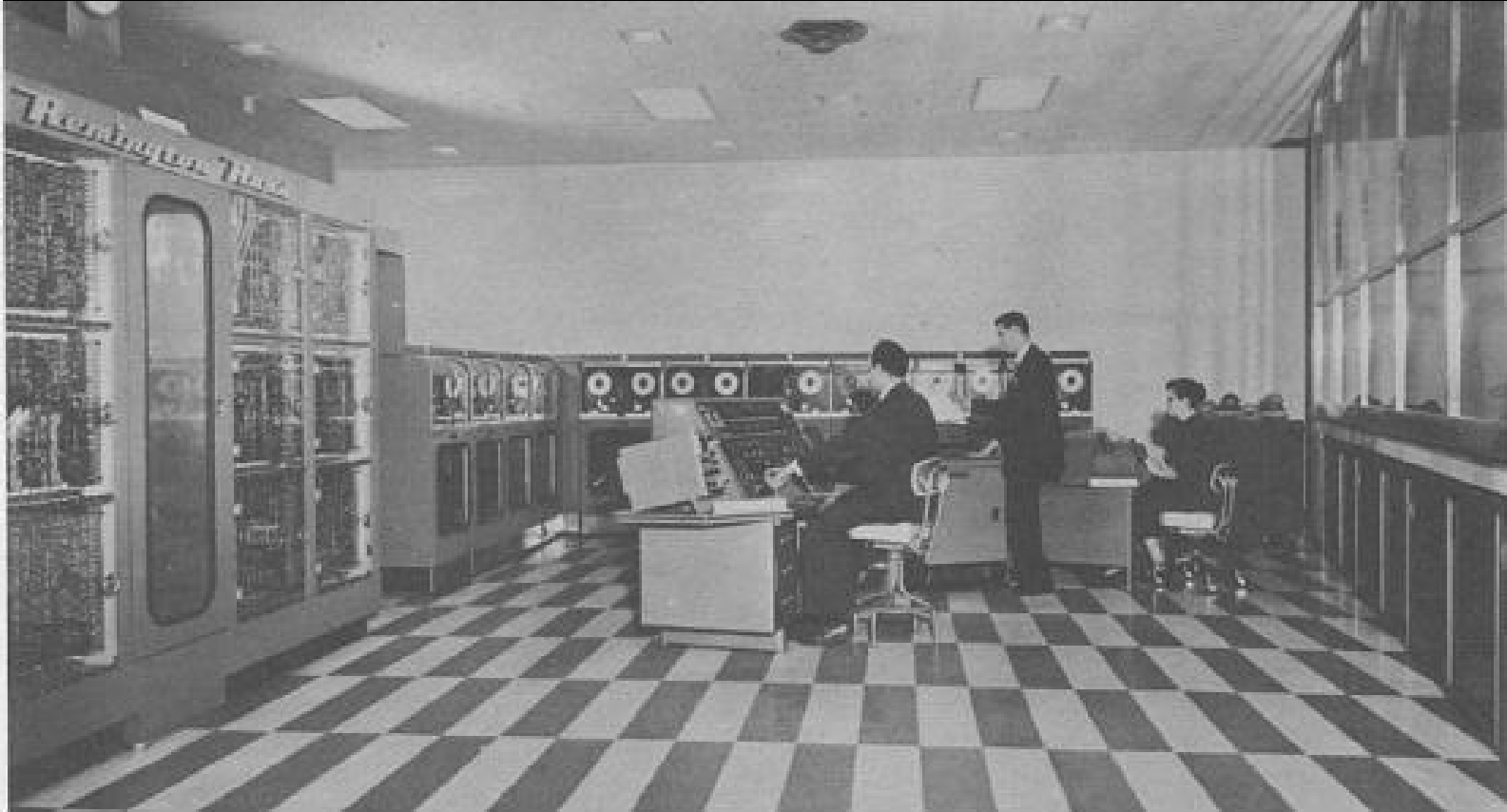


Paradigms and Revolutions: Five cognitive revolutions each fundamentally changed the nature of the human species

- ◆ **Revolutions reinvent the biological nature of humanity**
 - **Technology extends human physical capabilities**
 - Reach and metabolism extended (fire, sticks, stones as tools ~2.5 M years) → *Homo sapiens*
 - Nature harnessed (ropes, hoes >10 K years) → husbandry, farming
 - Metabolism extended (heat engines ~300 yrs) → industrial revolution
 - **Cognition extended and externalised (50 yrs) → microelectronics**
 - **The first four cognitive revolutions extend human brains**
 - **Genetic revolutions (hereditary changes)**
 - *Memory and learning (> 200 M years)*
 - *Speech and the transfer of learning (1-2 M years)*
 - **Cultural revolutions (heredity and selection externalised - the invention of objective knowledge)**
 - *Invention of counting, writing and reading (10,000 years)*
 - *Invention of books and printing presses → universal literacy (~ 550 years)*
 - **The fifth ICT revolution (in my own lifetime)**
 - *Automating cognition and the assembly of knowledge (50 years)*
 - **Impact on our profession**



What do I mean by revolution?



- ◆ 1952: UNIVAC - RAM 12 KB, Clock 2.2 MHz, Storage 10 x 1.4 MB tapes: cost \$ 1 M x 10 for inflation
- ◆ 2002: Dell - RAM 128 MB, Clock 3.5 GHz, Storage 28 GB hard disk: cost \$ 1 K
- ◆ raw power per dollar ((speed * memory)/cost) on my desktop is $\sim 3.8 \times 10^{13}$ times that of the UNIVAC I



Epistemology and cognitive revolutions

- ◆ **My guides to knowledge and communication**
 - **Thomas Kuhn (scientific revolutions & **paradigms**)**
 - how does scientific understanding evolve through time
 - concept of "normal" science vs revolutions
 - concepts of paradigms and paradigmatic **incommensurability**
 - **Karl Popper (outstanding philosopher of 20th century)**
 - what is knowledge?
 - what makes it scientific?
 - how do we grow knowledge through time?



Thomas Kuhn's concept of a paradigm

- ◆ ***Symbolic generalisations*** — deployed by authors without question or introspection, and immediately understandable by the group,
- ◆ ***Models*** — including those with heuristic and metaphysical presumptions that provide the group with preferred analogies or even with an ontology, and
- ◆ ***Exemplars*** — which are unquestioned and accepted concrete examples of how to solve particular kinds of problems or of what constitutes "good" science — i.e., paradigms in the common English usage of the term.
- ◆ ***Values*** — in the sense providing a predictive or epistemic value: "values to be used in judging whole theories: they must, first and foremost, permit puzzle-formulation and solution; where possible they should be simple, self-consistent, and plausible, compatible, that is, with other theories currently deployed"



Thomas Kuhn's concept of incommensurability

- ◆ Derives from the maths concept of incommensurability
- ◆ Revolutions occur when only a new theory is able to accommodate observations. Requires:
 - new exemplars, models and/or symbolic generalizations
 - This often requires new vocabulary and alters meanings and connotations of existing vocabulary.
 - Even where different paradigms use the same words, their meanings no longer correspond logically.
 - **The world view (created by symbolic generalisations, models, exemplars and their associated theory-laden vocabulary) held by practitioners of one paradigm is logically incommensurable with that held by practitioners of the alternative paradigm. Even though holders of different paradigms look at the same data, they see different worlds.**
- ◆ Rational discourse is impossible without first surfacing and understanding the paradigmatic differences and mapping the impacts of these differences on the vocabulary of discourse. Failures in rational discourse lead to holy wars.



Paradigms in writing and conversing

- ◆ **Our day-to-day vocabularies and world views are conditioned by theories we don't think about**
 - Theories and examples of where they apply are learned implicitly as an integral part of learning a discipline
 - We often don't think about theories behind words or how they condition the way we see the world, so we cannot converse rationally with those seeing the world from within different paradigms.
 - *We must surface paradigmatic differences and communicate those first.*
- ◆ **Absent understanding paradigmatic differences, knowledge advances via holy war and revolution rather than smooth evolutionary processes. Individual change requires "religious conversion".**



KM uses several poorly understood paradigms

- ◆ **Epistemology**
 - **personal knowledge (Michael Polanyi)**
 - **objective knowledge (Karl Popper)**
- ◆ **Organization theory**
 - **resource view**
 - **environment view**
 - **autopoietic view**
- ◆ **How to analyse knowledge in the organization**
 - **individual view**
 - **social view**
 - **critical view**
 - **alternative views**
- ◆ **How organizations create knowledge**
 - **cognitivist view**
 - **connectionist view**
 - **autopoietic view**



Conflicting paradigms of knowledge in KM

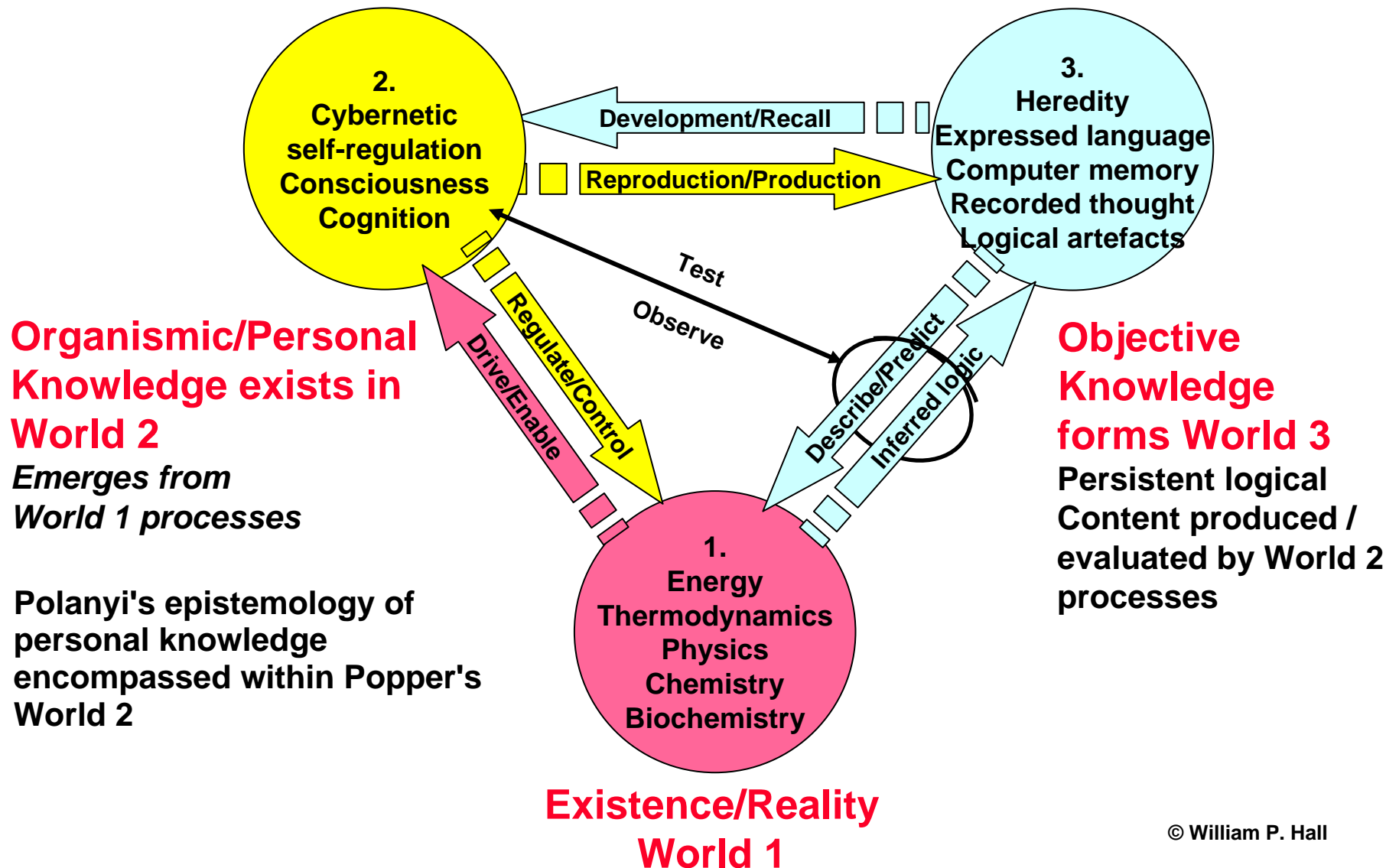
- ◆ Polanyi (1958, 1966): personal/tacit knowledge
 - Focus
 - *knowing subjects*
 - knowledge of doing, personal skills
 - belief, faith and intuition final arbiters of "truth"
 - tends to denigrate explicit knowledge to mere "information"
 - Popularised in organization theory and KM by Nelson & Winter, Sveiby, Nonaka, von Krogh & Roos
- ◆ Popper (1972): epistemology *without a knowing subject*
 - Value of knowledge increased through conjecture & refutation, i.e., criticism against reality
 - Different kinds of knowledge:
 - personal - as a property of cognition and living memory
 - persistent - objectively transcending individual cognition
 - Joe Firestone of Macroinnovation Associates one of few KM practitioners using Popperian epistemology



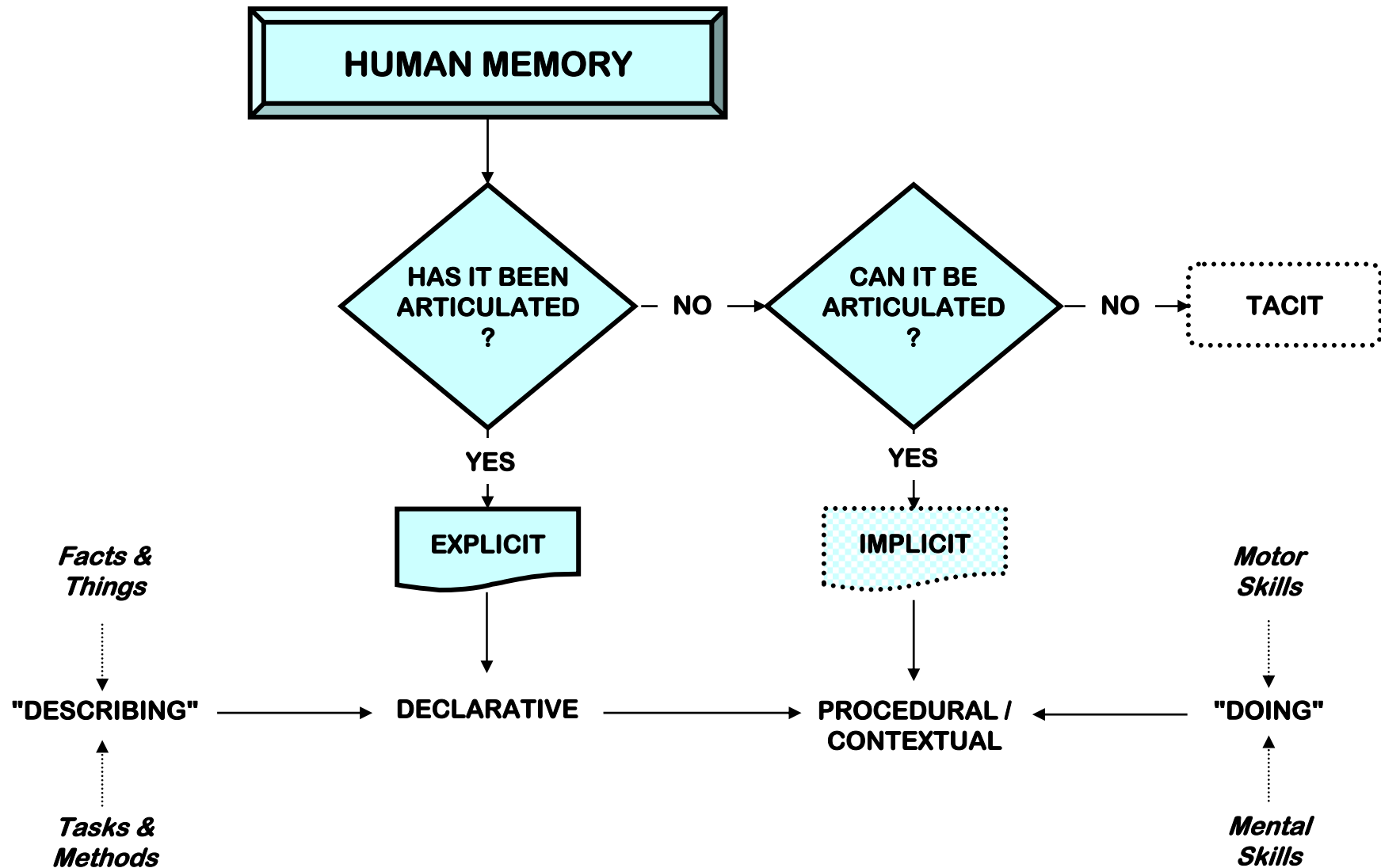
Incommensurability of the paradigms

- ◆ **Michael Polanyi "Personal Knowledge"**
 - Google hits = 1,760 (1,450) 18% growth from 11 Feb 02 - 8 Aug 02
- ◆ **Karl Popper "Objective Knowledge"**
 - Google hits = 1,850 (1,570) 15% growth
- ◆ **Both together**
 - Google hits = 64 (55) 14% growth
- ◆ **Only 1.8% of authors citing either book cited both!**
- ◆ **Conclusion**
 - Writers concerned with one author's thinking were not interested in or could not cope with discussing the other author's thinking in the same context - even to the extent of listing them in a single bibliography.

Karl Popper defines knowledge and shows how it grows: Popper's three worlds



Nickols' (2000) Explicit - Tacit Dimension



From Nickols 2000



Corporate knowledge in World 3

- ◆ **Persistent objects of corporate knowledge**
 - Articles of incorporation & employment agreements
 - Contracts
 - E-mails & correspondence
 - Plans, records, process & procedure documents
 - Enacted workflow systems
 - Written history
 - Links & captured contexts
 - Databases
 - AV recordings
- ◆ **World 3 comprises the bulk of organizational memory or heredity**



Maturana and Varela's autopoiesis defines "life": Paradigm of the autopoietic organization (1)

- ◆ **Maturana and Varela 1980: Autopoiesis & Cognition – properties of living things**
 - Early 1970s quest to define the property of life
 - Autonomous entities defined by self regulation and self production
- ◆ **Nelson & Winter 1982: Evolutionary Theory of Economic Change**
 - Postulated that organizational knowledge transcending the knowledge of individual members persisted as organizational heredity to maintain the existence and behaviour of the organization (i.e., self-production).
 - Assumed this transcendent knowledge was tacit (Polanyi)
 - routines
 - contexts
 - connections



Definition of autopoiesis

Autopoiesis (= self + production) is the condition achieved by a bounded and self-regulating autocatalytic set of processes able to maintain its existence as an autonomous entity in the face of environmental perturbations; i.e., that which gives a living entity the property of life.



Paradigm of the autopoietic organization (2)

- ◆ **Morowitz (1968) – Energy Flow in Biology:**
 - Systems forced to evolve increasingly complex cycles to transport energy/matter from sources to sinks
- ◆ **Kauffman (1993) – Origins of Order:**
 - "autocatalytic sets"
 - "organization for free"
- ◆ **von Krogh and Roos (1995) Organizational Epistemology – criteria for autopoiesis**
 - Identifiably bounded (membranes, tags)
 - Identifiable components within the boundary (complex)
 - Mechanistic (i.e., metabolism/cybernetic processes)
 - System boundaries internally determined (self reference)
 - System intrinsically produces own components
 - Self-produced components are necessary and sufficient to produce the system (autonomy)

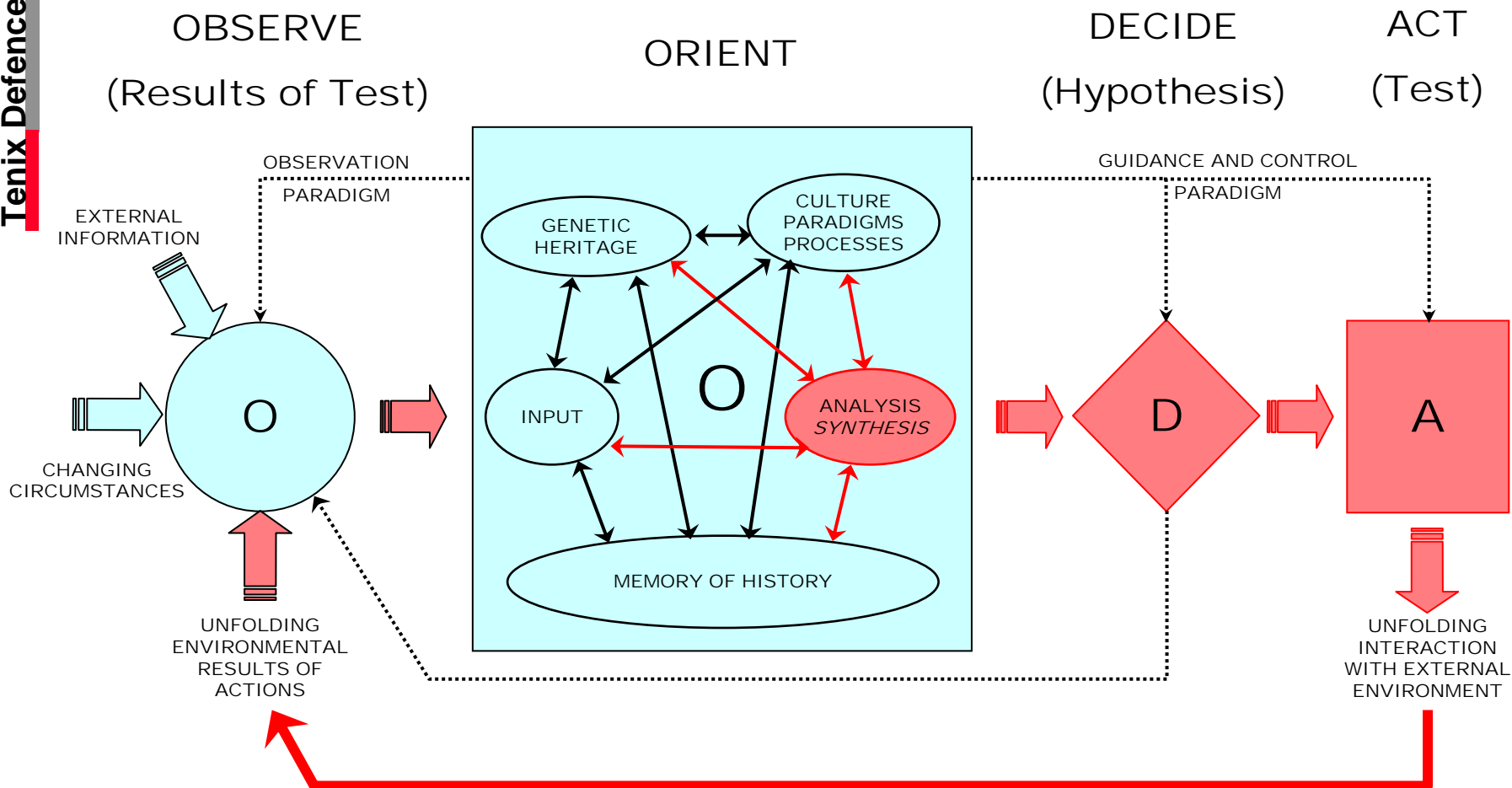


Existing users of Autopoiesis neglect World 3

- ◆ **Current paradigm of organizational autopoiesis**
 - **Blind spot: Maturana & Varela legitimately did not include reproduction in their minimal definition of autopoiesis**
 - **As stated the concept does not consider persistent heredity transcending the life of a single entity**
- ◆ **Nelson & Winter**
 - **Represents late 1970s early 1980s thinking**
 - **World 3 organizational content largely consisted of data, information & transaction records, not knowledge**
 - **Focus on tacit personal & organizational knowledge**
- ◆ **Roles of persistent knowledge (heredity) to guide growth & maintenance of the living organization**



John Boyd's OODA Loop wins conflicts



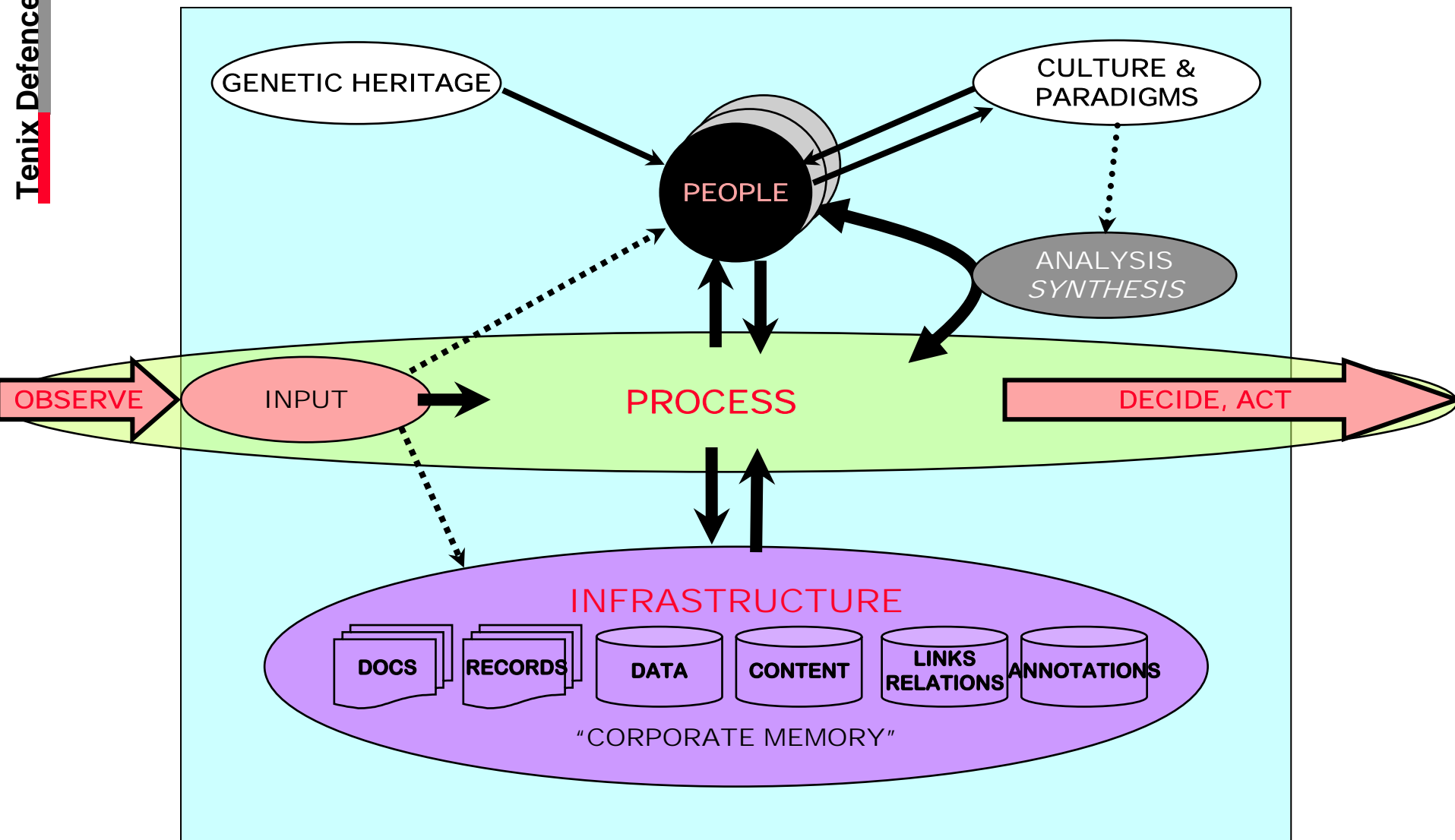
- ◆ An organisation's success in a competitive environment depends critically its ability to do a better job of assimilating information, increasing its epistemic quality to generate strategic power, and reducing decision cycle times. See <http://www.belisarius.com>.



Some OODA definitions

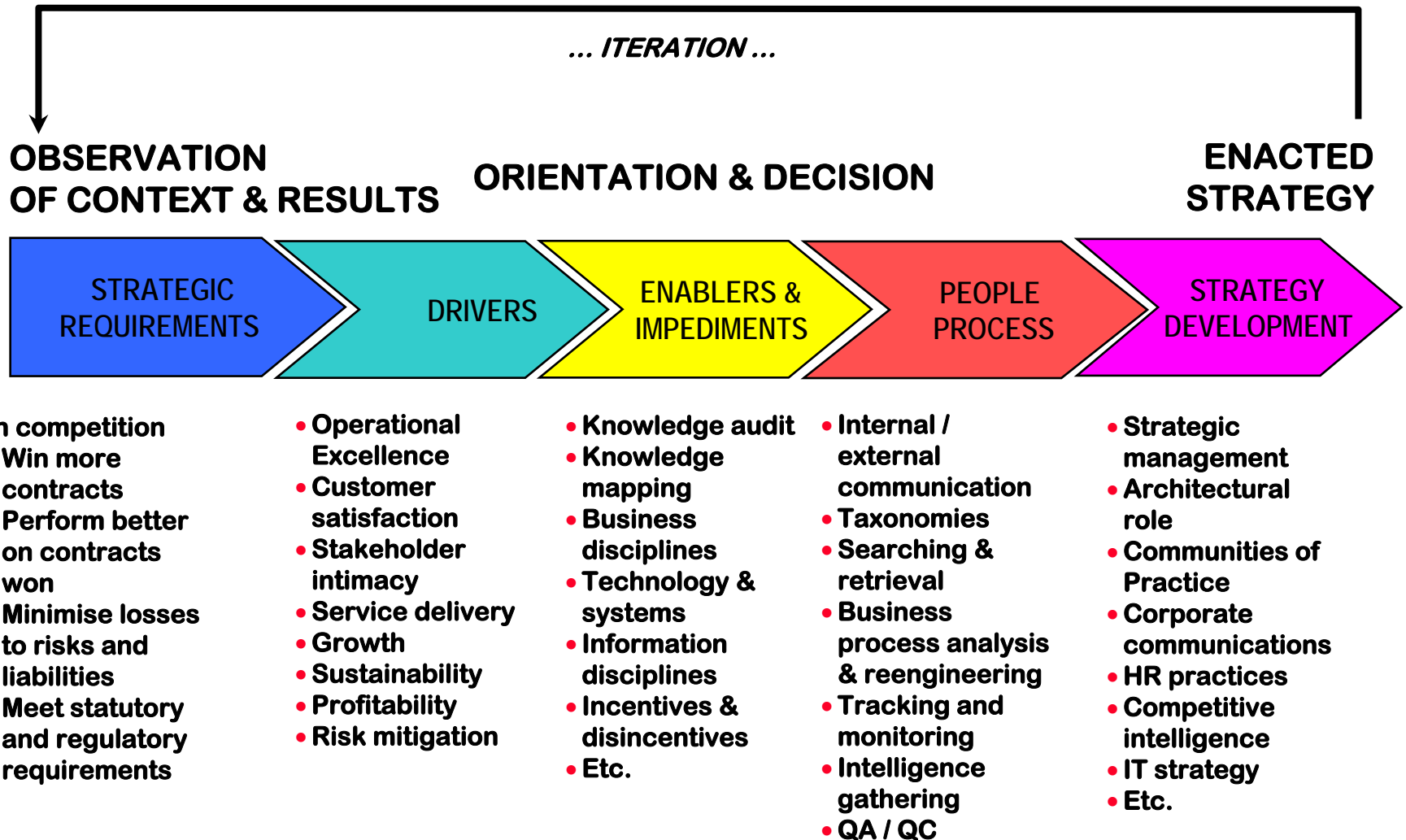
- ◆ **Observation** assembles information about the world in which the adaptive entity exists (including the entity's own effects and those of its competitors on that world). Data is given a context relating to the entity's interactions with the world.
- ◆ **Orientation** processes that information into knowledge knowledge in the form of a world view comprised of new information, memories of prior experience (which may be explicit, implicit or even tacit, genetic heritage (i.e., "natural talent"), cultural traditions (i.e., paradigms), and analysis (destruction) of the existing world view, and synthesis (creation) of a revised world view including possibilities for action. This generates intelligence (in a military sense).
- ◆ **Decision** selects amongst possible actions generated by the orientation, one action to try. Choice is governed and informed by wisdom based on prior experience gained from previous OODA cycles, informed by synthesis (creation) of new possibilities to try.
- ◆ **Action** involves putting the decision to test by applying it to the world. The loop begins to repeat as the entity observes the results of its action.

Orientation in the organization





Building and maintaining an adaptive KM architecture





Ian Coombe's WIKID turns data into strategic power: Transformations add epistemic quality

- ◆ **Data** is the raw state of information, i.e., binary or character strings without context or syntax
 - Context and syntax (i.e. relationships) →
- ◆ **Information** is data that has been given a context by relating it syntactically to other items of data
 - Assimilation (into a human memory) and semantics (meanings) →
- ◆ **Knowledge** is information that is made useful because it is semantically assimilated into a body of information grounded in experience. **Explicit knowledge is assimilated information able to be transmitted to others**
 - Assessment and selection →
- ◆ **Intelligence** (military sense) is knowledge that is assessed and evaluated for its logical consistency and relationships to what is already known
 - Hypothesis and action (testing against reality) →
- ◆ **Wisdom** is tested intelligence with a proven value based on experience
 - Application and control →
- ◆ **Power** (in a strategic sense) is the result of applying wisdom to gain or maintain control over external circumstances.

(derived originally from Ian Coombe's [WIKID Power](#))



**Tenix Defence's
Technologies for
Corporate
Knowledge Workers**



Managing support knowledge for the ANZAC Ship fleet



- ◆ **10 frigates (8 RAN, 2 RNZN)**
 - Total package including logistic support & training
 - 16 year design/build cycle
 - 27 year designed lifespan for each ship
 - Computerised maintenance management
- ◆ **\$A 5 BN fixed price contract in 1989!**
- ◆ **80% ANZIP content (i.e., 20% of that spent in New Zealand)**



M113 Upgrade Project



- ◆ ~ 350 Vehicles ~ \$500 M
 - 22 identified variants
 - Long life-span
- ◆ Progressive upgrade
 - New systems
 - New documentation



Role of the technical writer

- ◆ **The role of technical writing is to capture data, information and knowledge from a variety of sources; and to transform what is captured into objective products of knowledge that can be readily assimilated and used by other people.**
- ◆ **Good technical writers distil and transform data, information and implicit knowledge about complex things and processes into explicit and transferable artifacts of knowledge that contribute to a corporate memory.**
- ◆ **By these definitions, technical writers are knowledge mangers.**



More paradigms: knowledge on paper vs virtual containers for knowledge

- ◆ **Paper documents**
 - Production, storage, indexing, retrieval, distribution & change management require ponderous physical processes
 - Content is often out of date
 - Writing and reading are linear processes requiring manipulation of physical pages
 - **Electronic MS Word & PDF formats don't change the paradigm**
- ◆ **Electronic containers for knowledge**
 - Structural controls & validation
 - Virtual assembly & reuse of existing content
 - Contextual linking builds webs of knowledge
 - Automation of production, storage & distribution
 - Automation of cognitive processes in indexing and retrieval, etc.
- ◆ **Paradigmatic incommensurability still a major issue with senior management who think that the only real documents are paper**



Major issues for a fleet operator

- ◆ **Capability when it is needed**
 - **Reliably** does what it is supposed to
 - **Available** for service when needed
 - **Maintainable** - problems can be fixed when they arise
 - **Supportable** - critical needs available in supply chain
 - **Operable** within limits of human knowledge & capacity
- ◆ **Health, safety and operational knowledge issues**
 - **Heavy/complex engineering systems can kill!**
- ◆ **Life-cycle cost**
 - Minimise acquisition cost
 - Minimise documentation, support & maintenance costs
 - **Implement "lean maintenance" philosophy**

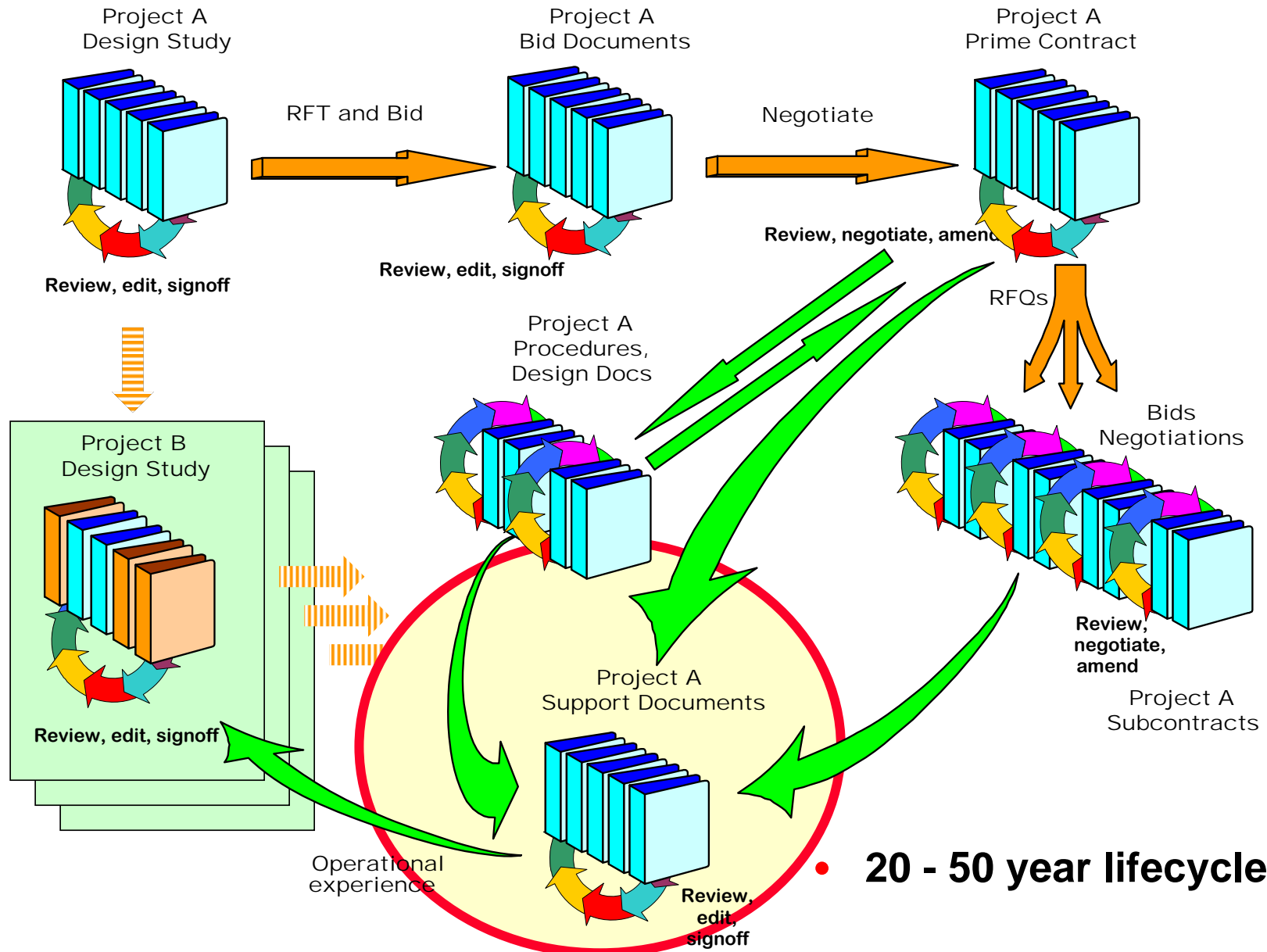
Adequate performance on all issues depends on the quality of authoring, management and transfer of technical knowledge from supplier to operators



Major quality issues in delivering support knowledge

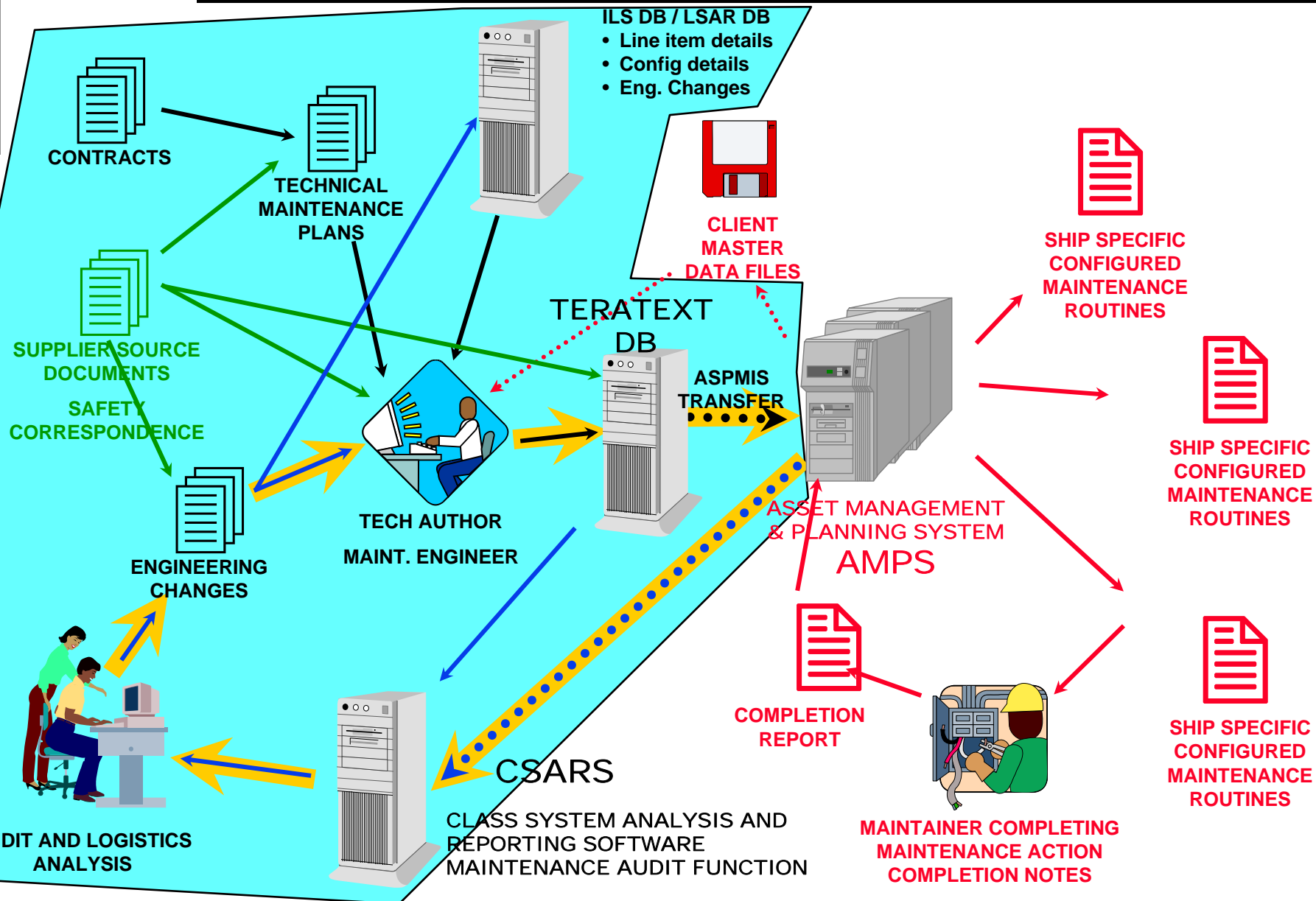
- ◆ **Client's operational knowledge delivery goals**
 - **Correct**
 - Correct information
 - Consistent across the fleet
 - **Applicable/Effective**
 - Applicable to the configuration of the individual ship/vehicle
 - Effective for the point in time re engineering changes, etc.
 - **Available**
 - To who needs it, when and where it is needed
 - **Useable**
 - Readily understandable by humans
 - Readily managed & processed in computer systems
- ◆ **Supplier's knowledge production and usage goals**
 - **Fast**
 - **High quality**
 - **Low cost**

Knowledge development lifecycle for a large project





The full fleet knowledge management environment





Structured Authoring

Adobe FrameMaker+SGML

File Edit Element Format View Special Graphics Table Window Help

01-I-A-1---A0002762-(-).fm

3	4	5	6	7	8	9	10	11	12	13
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4240-661421674) VISOR, CLEAR, TO SUIT BROW GUARD

7240-660193635) BUCKET, UTILITY, PLASTIC, 10 LITRE

4240-661420089) PROTECTOR, HEARING

PROCEDURE

Warning:) All maintenance personnel must comply at all times precautions in Ships and Departmental Standing Ord equipment manuals.

Warning:) Exercise caution when performing maintenance on li pressurised gas or fluids.

Warning:) Thcorrect isolation valve orientation may allow full sys to the test hose. This could cause injury to persone equipment. The isolation valve for the gauge under te: Incorrectly fitted isolation valves must be reported to t supervisor.

Note:) All abnormalities found while performing planned mainten reported, at first opportunity, to the responsible maintenanc

Note:) TWhen performing this procedure, the gauge under test is to stiction or erratic movement of the indicator whenever the as

Structure View

- Miscitem
 - Lineitem +
 - Nsn
 - Suppliercode 4240
 - Niin 661420089
 - Itemdesc PROTECTOR,
 - Itemidn 29516
 - Uom EA
 - Qty 1

- Mreprocedure +
- Title + PROCEDURE
- Warning +
 - Para + Warning: All maintenance persone...
- Warning +
 - Para + Warning: Exercise caution when pe...
- Warning +
 - Para + Warning: Incorrect isolation valv...
- Note +
 - Para + Note: All abnormalities found whi...

Elements

- Annotation
- Warning
- Caution
- Conditions
- Note
- Preliminary
- Tasks
- Applic
- Applicabil
- Callout
- Change
- Cmc
- Cmcdesc
- Completion
- Condpara
- Configrunits
- Def
- Emphasis

Insert

Wrap

Change

Options...

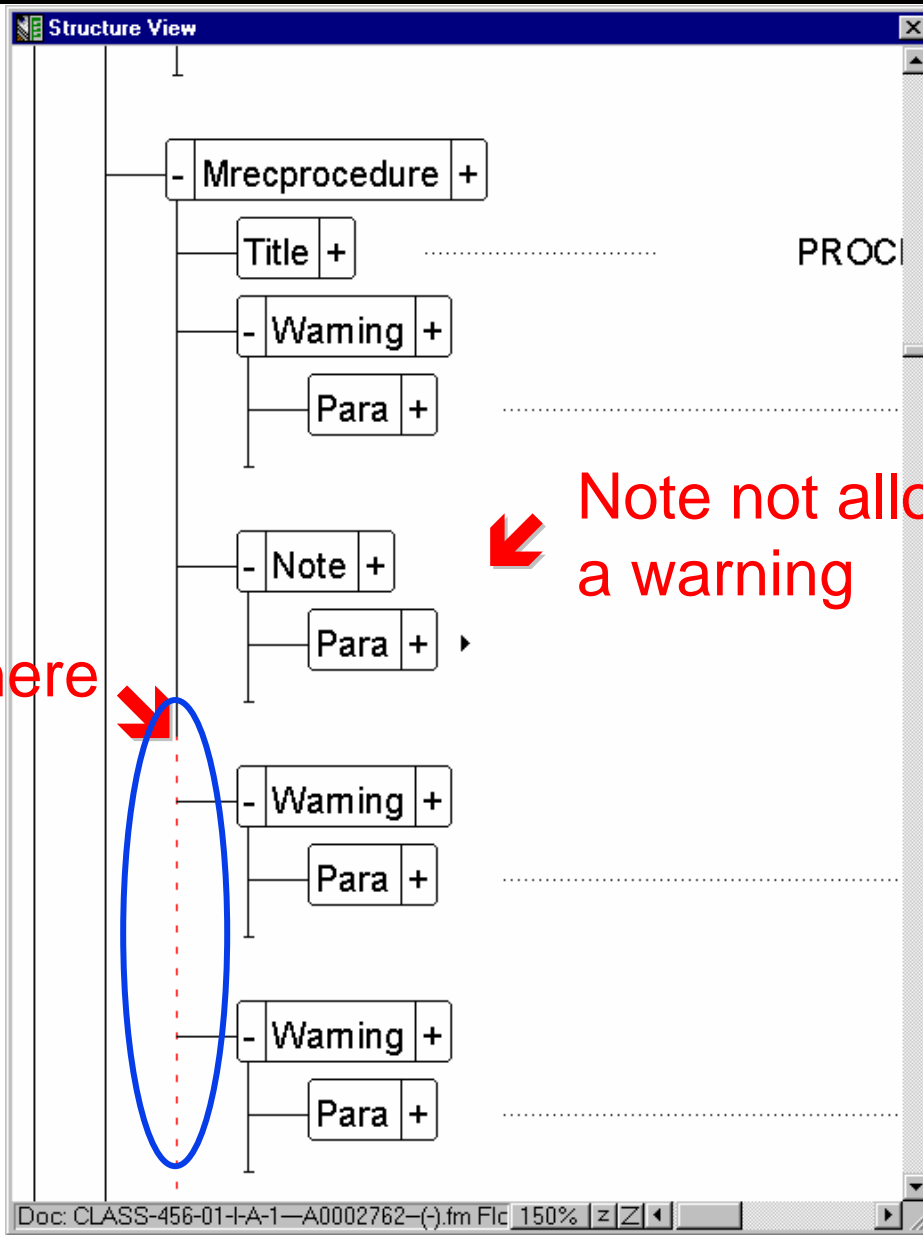
Doc: CLASS-456-01-I-A-1---A0002762-(-).fm Flow: 80%



Structure view with an error

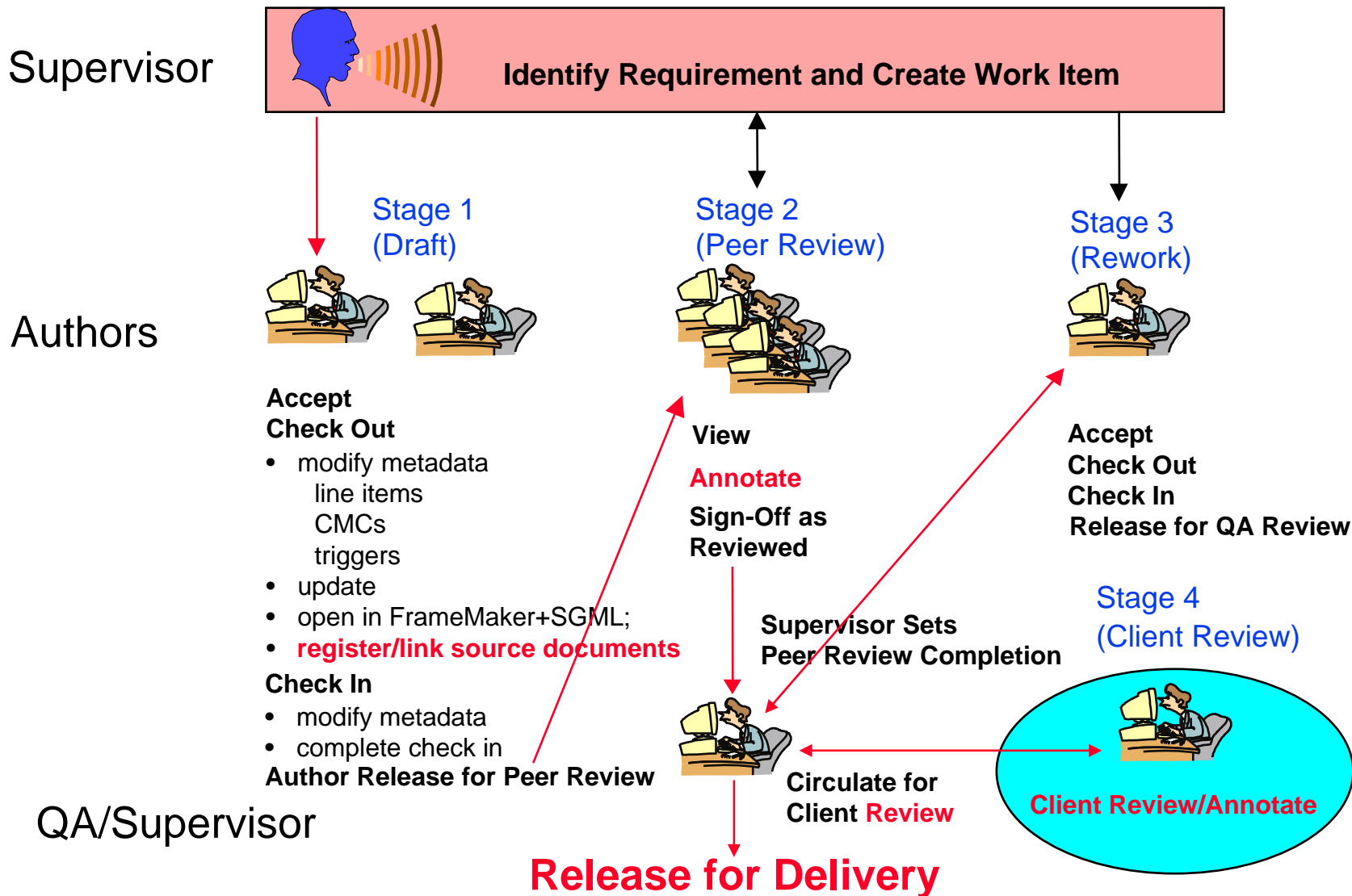
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Note not allowed in front of a warning





TeraText's role based workflow for ANZAC Ship maintenance procedures





TeraText document & content management

- ◆ **State of the art content management system**
 - Native XML database optimized for scalability
 - Repositories for structured/unstructured docs
 - Concurrent indexing and retrieval
 - Application development tools (Ace or Java)
 - work flow
 - validation
 - extract
 - automatic rendering (e.g., SGML to ASPMIS CDF / HTML / etc.)
 - delivery (Web and other formats)
- ◆ **100% Australian IP**
 - Tenix specifications - Aspect implementation/integration
- ◆ **100% Australian support**
- ◆ **Export: SAIC provides sales & support in USA and Europe**



Developed by RMIT Multimedia Database Systems: <http://www.mds.rmit.edu.au>;
 InQuirion Pty Ltd: <http://www.teratext.com.au>; Opposite City Baths, Melbourne



Metadata error trapping

PMEdit.aspx - Microsoft Internet Explorer

Address [1:6062/tools/usertools/A60337362936Ddma%3A%2F%2F%2Fcms%2F1ec68a40-5323-11d5-9c8b-00508b04af6e%2Fguid%3D228d0000-7978-11d5-8e5d-0050da06bfb4T2/refresh](#)

File Edit View Favorites Tools Help

Links [Best of the Web](#) [Channel Guide](#) [Customize Links](#) [Free HotMail](#) [Internet Start](#) [Microsoft](#)

Check-Out

[Update Metadata](#)
[Open in External Editor](#)
[Return to Worklists](#)
[Annotation Report](#)
[Add New Document Annotations](#)

[standard activity](#)
[cmc](#)
[equipment](#)
[miscellaneous](#)
[procedure](#)
[tagout](#)
[cnc](#)
[shutdown](#)
[cnc](#)
[tools](#)
[parts](#)
[materials](#)
[fluids](#)
[test](#)

Standard Activity

Std Activity No.
Revision
IssueStatus
Mandatory Designation
Country
SA Cancel

Standard Activity No A0005901 is not in list of valid values.

CMC Code

Configuration Item

CMC

☐

Triggers

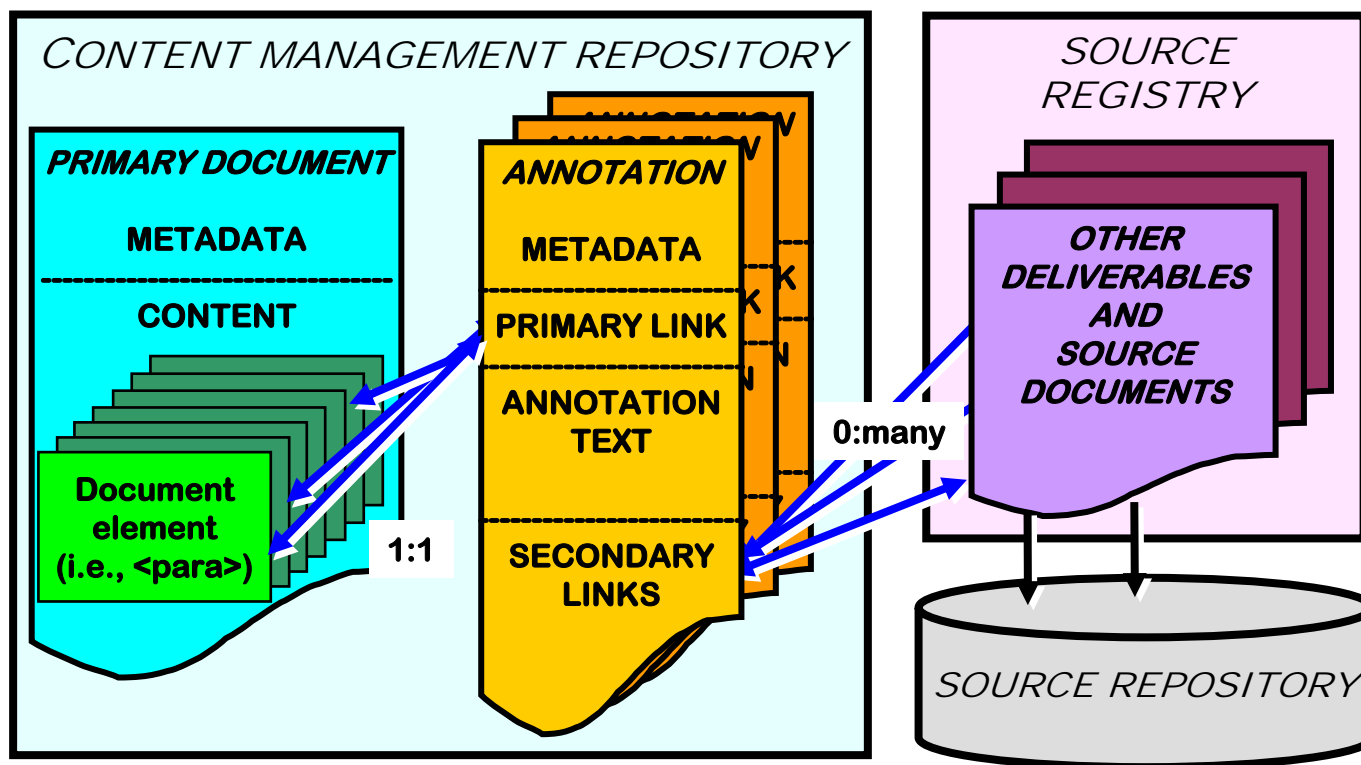
MRECSTDACTIVITYNO4A3276C : fatal : Standard Activity No A0005901 is not in list of valid values.

Local intranet



Capture contextual knowledge with links and annotations

- ◆ Explicit and implicit links encode contextual knowledge
- ◆ Links are 2-way connections
- ◆ **Annotations are the key to converting authors' implicit contextual knowledge to codified explicit knowledge**





Annotation markers

PMDView.aspx - Microsoft Internet Explorer

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit

Address [992941:6062/tools/usertools/A71316710264Ddma%3A%2F%2F%2Fcms%2F1ec68a40-5323-11d5-9c8b-00508b04af6e%2Fguid%3Dcef8e000-7a65-11d5-b8ab-0050da06bfb4T1](#)

File Edit View Favorites Tools Help

Links [Best of the Web](#) [Channel Guide](#) [Customize Links](#) [Free HotMail](#) [Internet Start](#) [Microsoft](#)

- t. Set up the calibrator for testing positive pressure IAW the instructions in the user manual.
- g. Connect the calibrator to the free end of the test hose.
- h. Check that the indication on the gauge under test is at zero.
- i. Gradually apply pressure using the calibrator pressure pump until the gauge under test reads full scale.
- j. Record the reading shown on both the calibrator display and the gauge under test.
- k. Slowly open the calibrator pressure vent valve to relieve pressure from the gauge under test and check that the gauge indicator has returned to the zero position.
- l. Record the reading shown on both the calibrator display and the gauge under test.
- m. Gradually apply pressure using the calibrator pressure pump and check the accuracy of the gauge under test at 0%, 25%, 50%, 75% and 100% scale points.
- n. Record the reading shown on both the calibrator display and the gauge under test (at each scale point).
- o. Confirm that the gauge under test is within the required tolerance of $\pm 1.0\%$ across all tested scale points.
- p. Slowly open the calibrator pressure vent valve to relieve pressure from the gauge under test until the gauge reads zero.

CAUTION: Do not switch the calibrator directly from a pressurised state to a vacuum.

NOTE: If gauge under test indicates positive pressures only, proceed to step x. If the gauge under test indicates negative pressure (vacuum), perform the following steps.

- q. Set up the calibrator for testing vacuum IAW the instructions in the user manual.
- r. Gradually apply vacuum with the calibrator pump until the gauge under test reads full scale.
- s. Record the reading shown on both the calibrator display and the gauge under test.
- t. Reduce vacuum applied to the gauge under test by slowly opening the calibrator pressure vent valve until the 50% point of the vacuum scale is reached.
- u. Record the reading shown on both the calibrator display and the gauge under test.

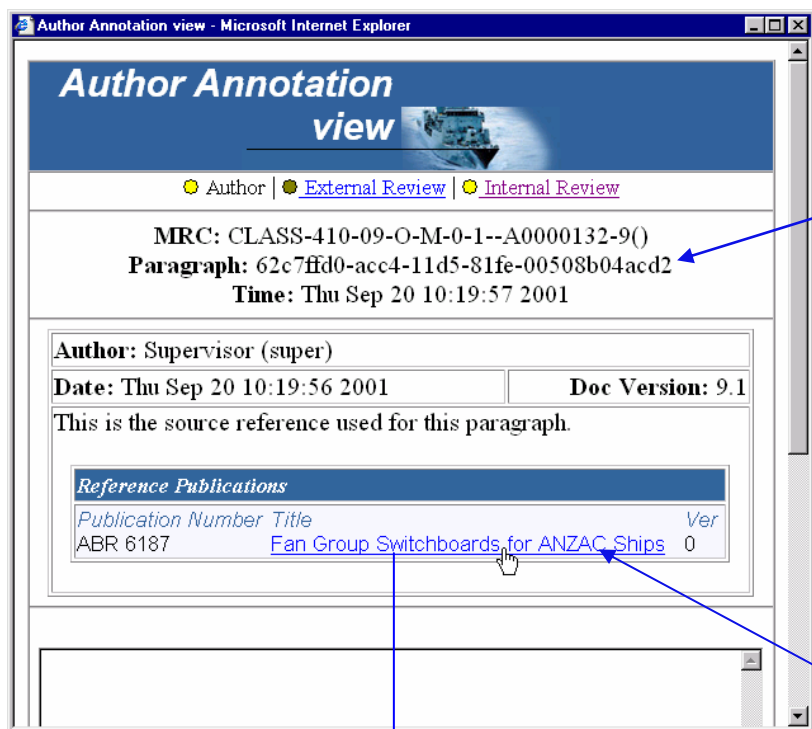
WARNING: The pressure calibrator and the gauge under test must be indicating zero pressure before disconnection.

Local intranet

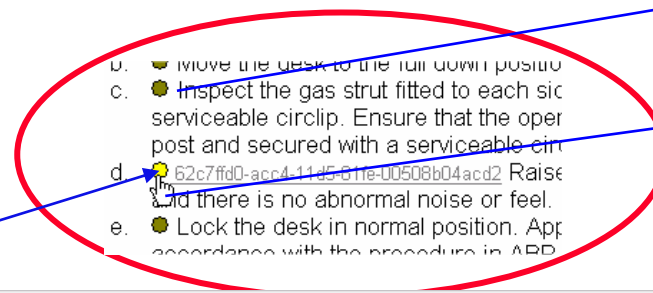


Annotations

◆ Annotations provide the key to capturing context

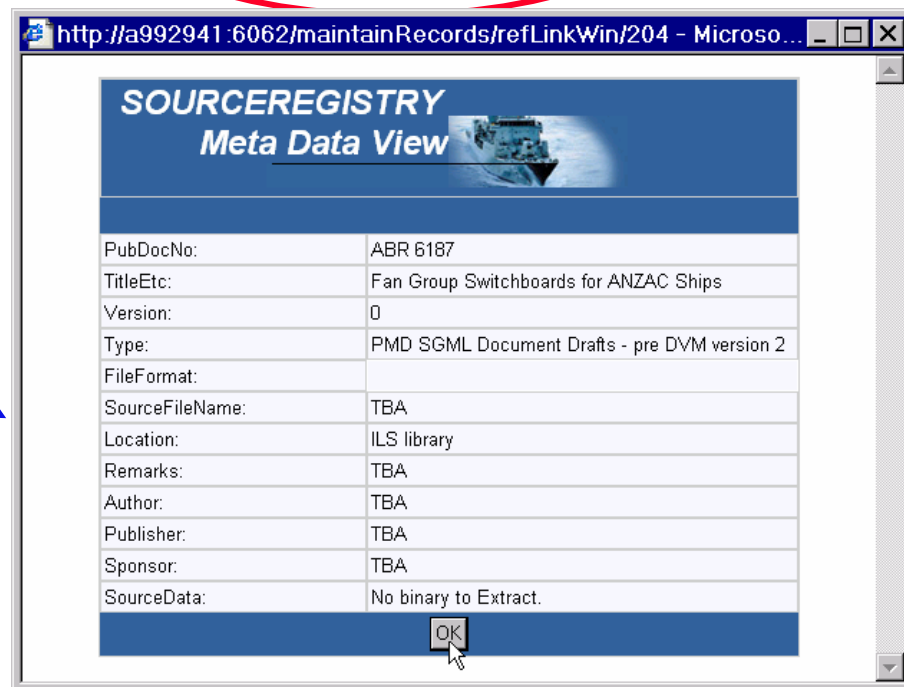


Source registry reference



Annotation may be added here

Yellow marker indicates annotation exists here. Click on marker to see it





Tenix's ANZAC measured improvements from structured authoring and content management

- ◆ **Tenix's Ship 05 delivery challenge**
 - Client difficulties feeding flat files into AMPS
 - Documentation configuration management issues
 - Client threat to not accept 05 if still dissatisfied
- ◆ **TeraText resolved the issue**
 - **Condensed 8,000 procedures for 4 ships to 2,000 class-set of 'SGML records' for 10 ships**
 - 5 people completely reworked 2,000 routines in around 3,000 person/hours - major quality gain
 - **Routines delivered for Ship 5 CUT 80%**
 - **Subsequent content deliveries CUT 95%**
 - **Keyboard time for one change CUT more than 50%**
 - **Change cycle time CUT from 1 year to days**
- ◆ **Client is now a good reference**



Tenix/Navy architecture developed in Melbourne for managing ANZAC Ship support knowledge

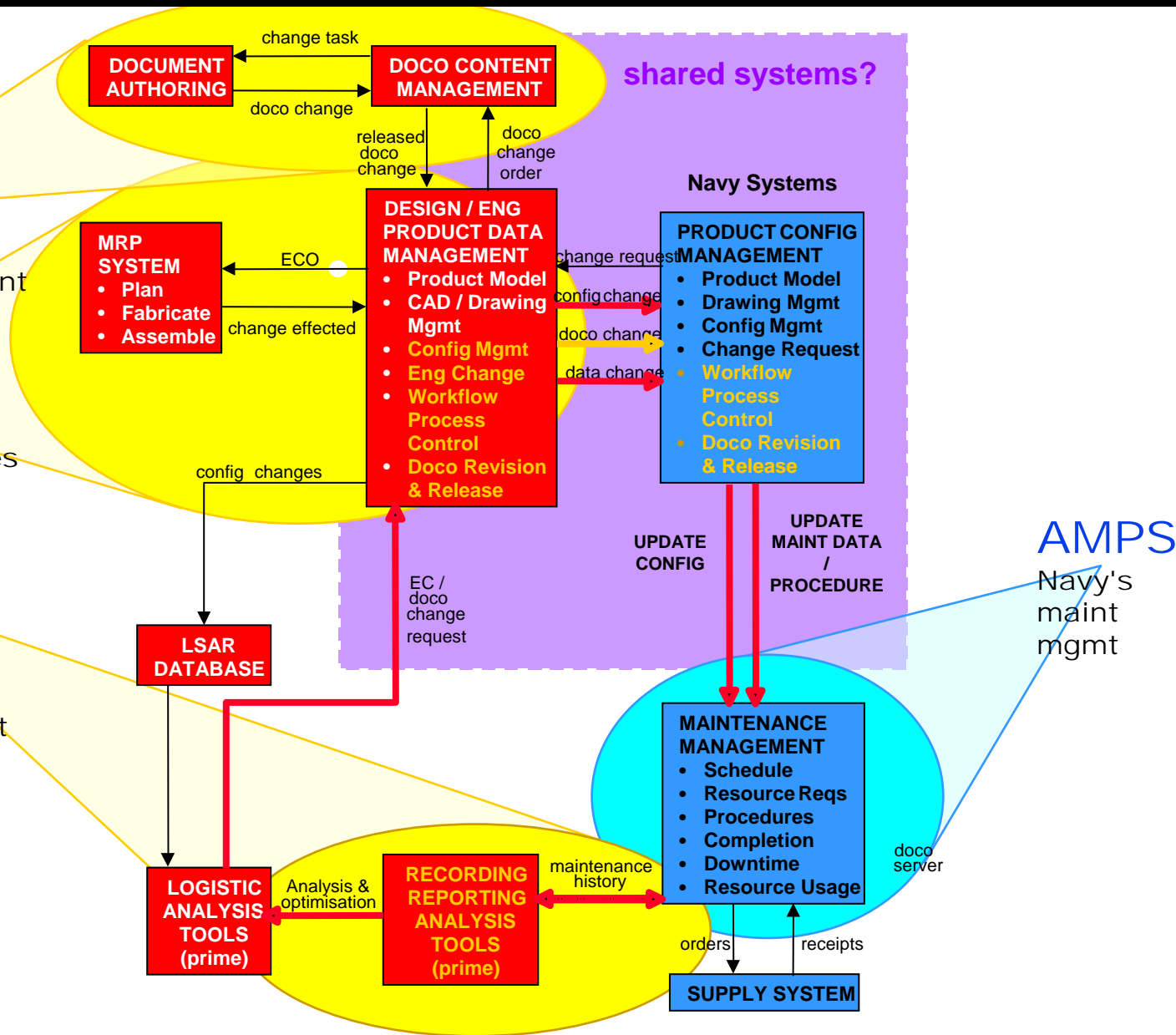
TeraText
Content management

Crossbow

Validates and integrates data across 15 legacy systems

CSARS

Provides corrective feedback from AMPS into supplier's knowledge development activities





The business issue resolved by Crossbow

- ◆ **Engineering data and documentation metadata in 15 legacy databases**
- ◆ **Impossible to reconcile key information across all databases in synchrony**
- ◆ **Could not deliver data suitable for immediate loading into Client's relational databases for maintenance management**
- ◆ **Client was threatening to refuse acceptance of ships if problem not resolved**
- ◆ **Manual resolution involved a physical audit of complete ships just prior to delivery**



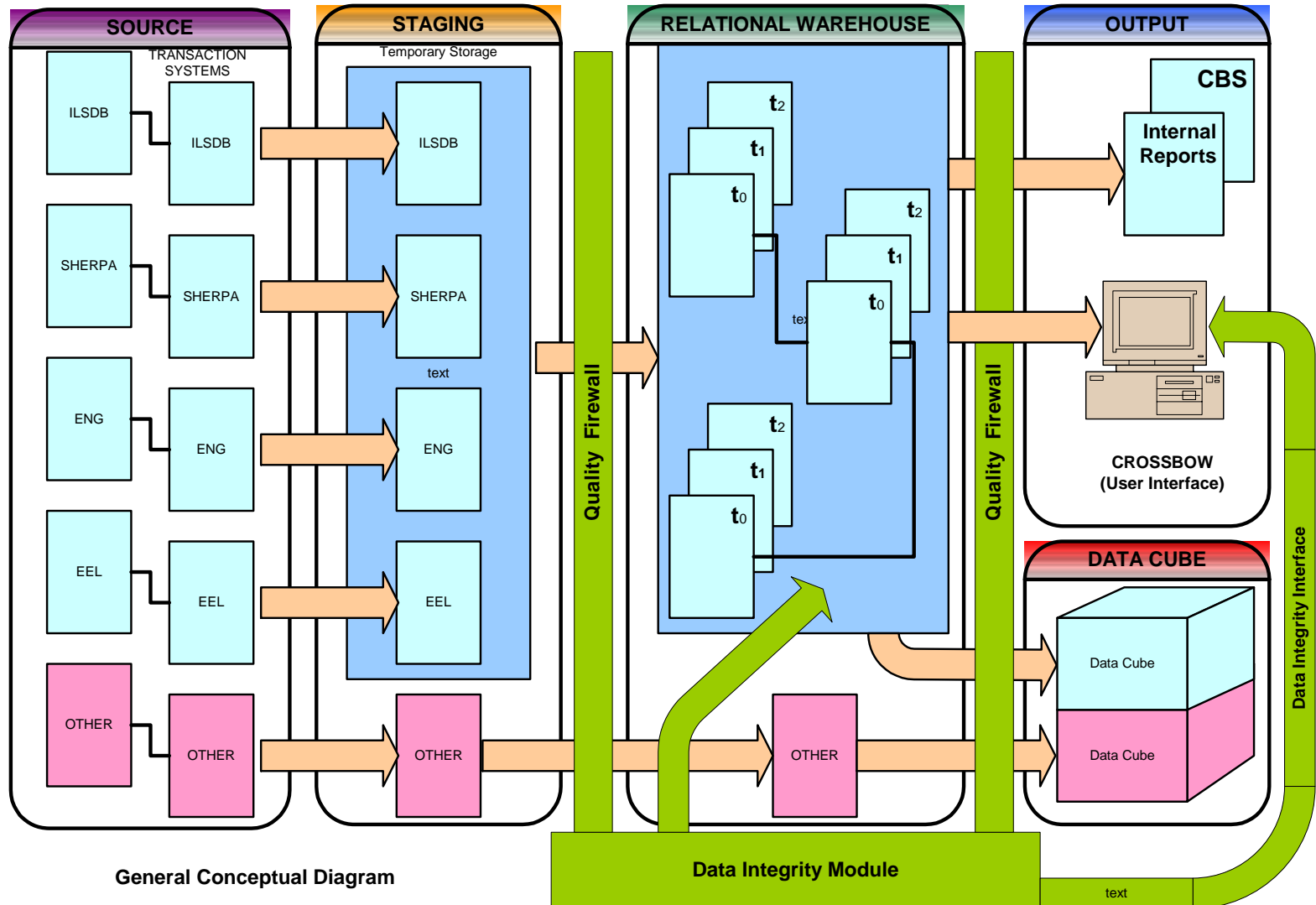
Crossbow business case

- ◆ **Conservative cost to manage problems with existing technology = \$0.65M**
- ◆ **From 2000 through to the end of the project (2007), data management inefficiencies and errors could have cost Tenix a further \$4 M to \$6**
- ◆ **Slightly more than \$1 M was sought for the whole of the Crossbow development project. It was completed on time and under budget for a final cost of approximately \$850,000.**



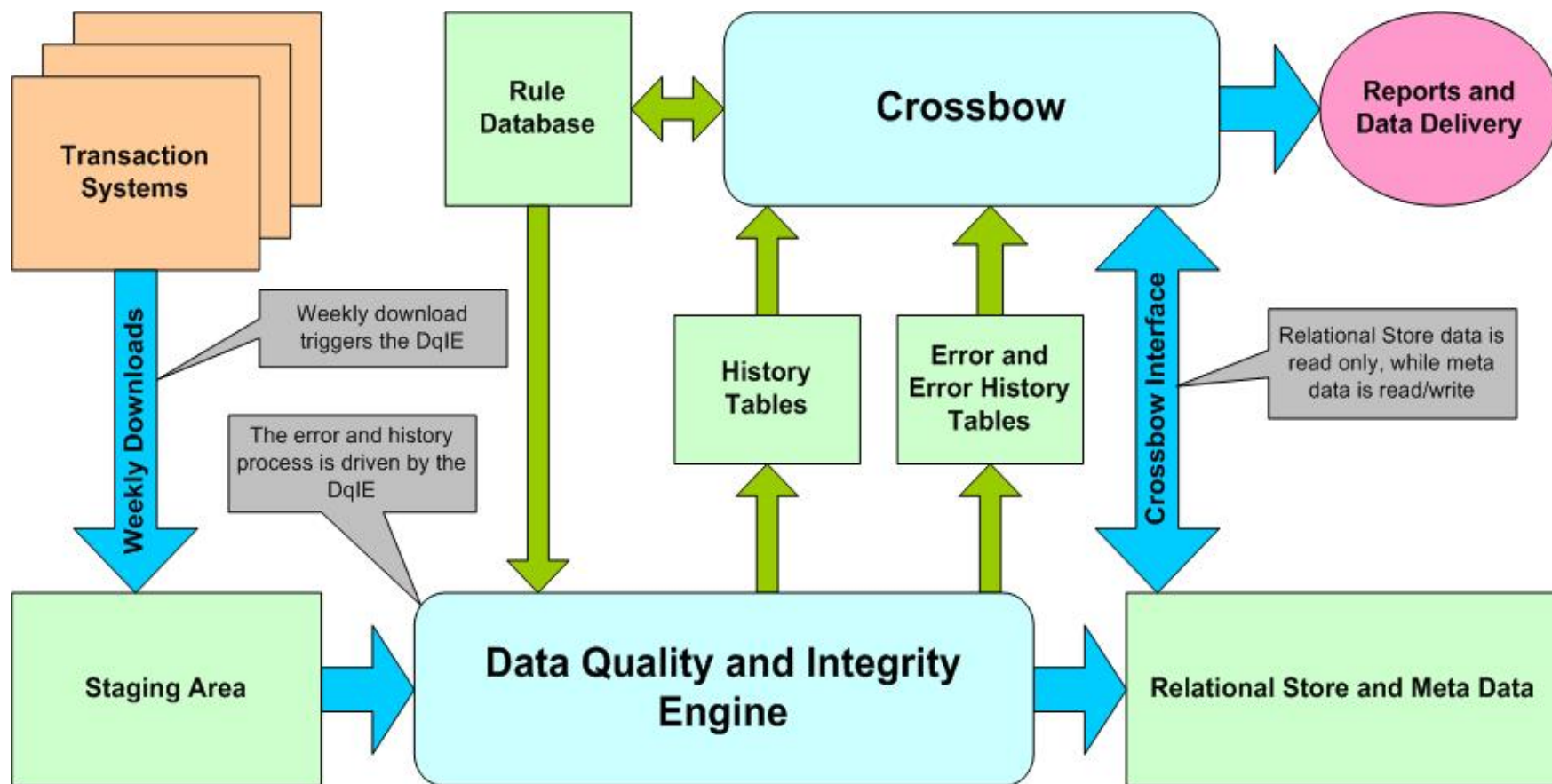
Crossbow™ architecture

DATA WAREHOUSE ARCHITECTURE





Data flow in Crossbow






Crossbow query screen

Time Frame: 18-Nov-2002 02:03

(All Locations)

Menu Search


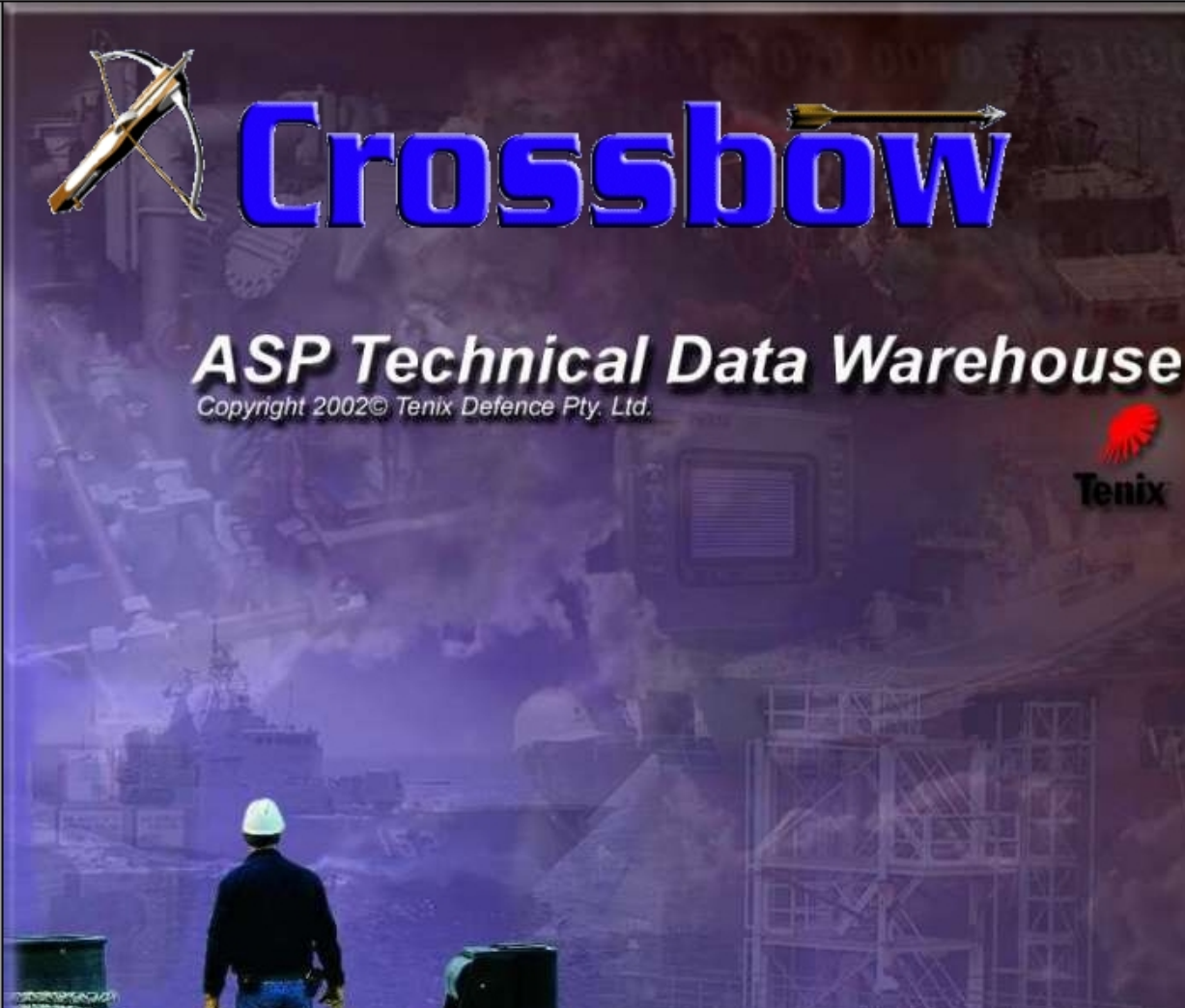
- Parts
 - As-built Configuration Part
 - Specific Certified Item
 - BHA Catalogue Number
- ILS
 - ILS Configuration (CON) Part
 - AID Header
 - AID (APL) Piece Part
 - On-board Allowance
 - Common Management (CMC)
- Engineering
 - Engineering Equipment List
 - ENG Drawing Parts List
 - Cable Detail
- Documents
 - Configuration Document
- Planned Maintenance
 - Standard Activity Item
 - SA Resource
 - Reference Publication
- Engineering (or WSC) Change
- Trial Card



Crossbow

ASP Technical Data Warehouse

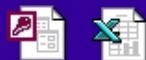
Copyright 2002© Tenix Defence Pty. Ltd.



Crossbow results screen

Time Frame: Sunday, November 17, 2002 10:49 PM



Count=500 of 1358

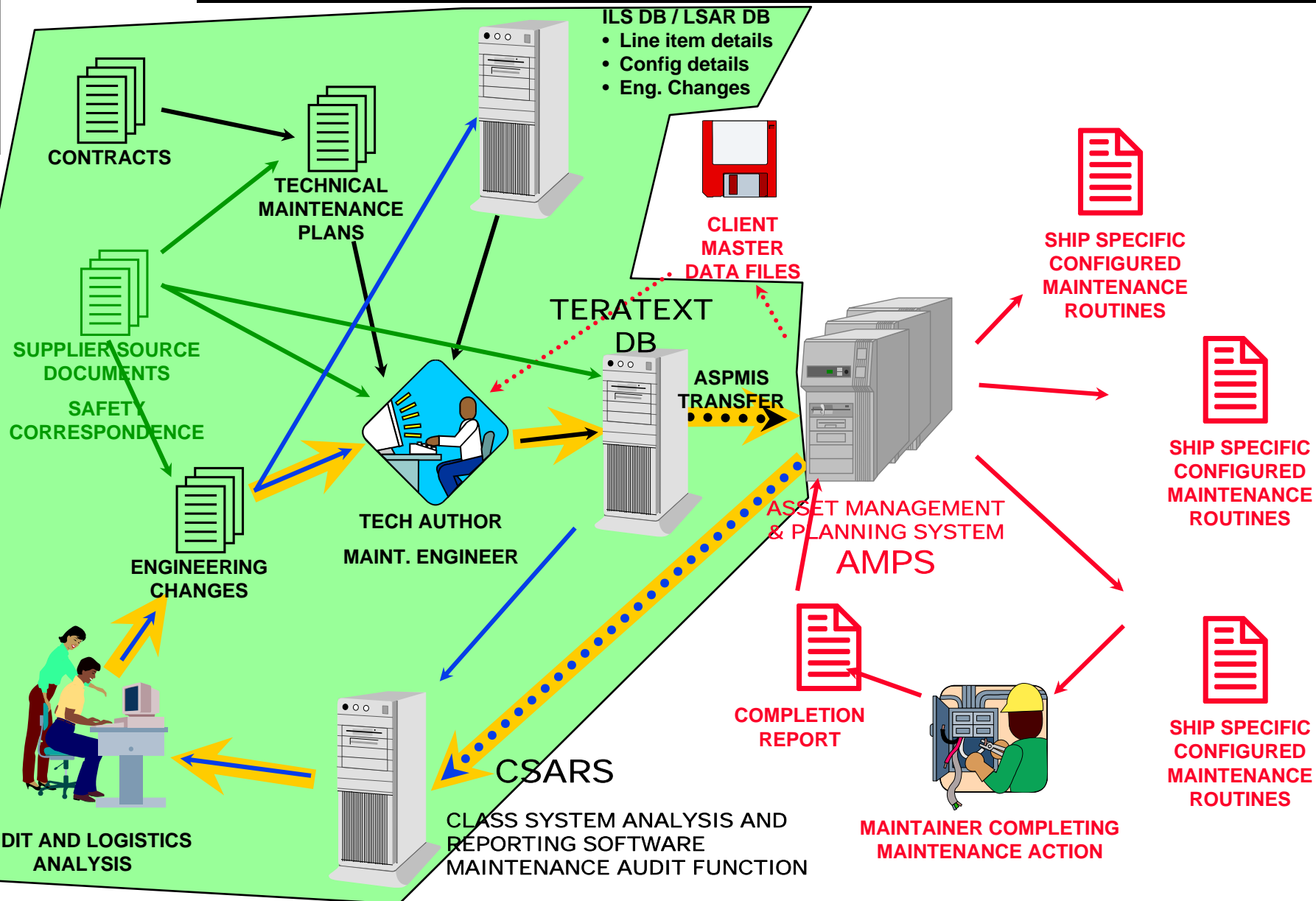
The maximum number of records permitted have been returned.

Either refine your search criteria or click on the Access/Excel icons above to retrieve the full result set.

	Config Part No ^ v	Config Part No Rev ^ v	Item ID ^ v	CI Description ^ v	Ship ^ v	Occurrence No ^ v	Compartment Code ^ v	Group Flag ^ v	CMC ^ v	IMS ^ v
	(4)G70005-B0034-L0\$6Z122\$	00	509\$00	EMERGENCY STOP PANEL 3K0 (AFT PUMP ROOM)	01	1	null	N	null	3312
	(4)G70005-B0034-L0\$6Z122\$	00	509\$00	EMERGENCY STOP PANEL 3K0 (AFT PUMP ROOM)	02	1	null	N	null	3312
	(4)G70005-B0034-L0\$6Z122\$	00	509\$00	EMERGENCY STOP PANEL 3K0 (AFT PUMP ROOM)	03	1	null	N	null	3312
	(4)G70005-B0034-L0\$6Z122\$	00	509\$00	EMERGENCY STOP PANEL 3K0 (AFT PUMP ROOM)	04	1	null	N	null	3312
	(4)G70005-B0034-L0\$6Z122\$	00	509\$00	EMERGENCY STOP PANEL 3K0 (AFT PUMP ROOM) [3313009A007]	05	1	null	N	null	3312
	(4)G70005-B0034-L0\$6Z122\$	00	509\$00	EMERGENCY STOP PANEL 3K0 (AFT PUMP ROOM) [3313009A007]	06	1	null	N	null	3312
	001_1\$0_\$3_01D\$266	00	\$12600	OIL DOUBLE PUMP	01	1	null	N	LB-A-MT-D-0112X	
	001_1\$0_\$3_01D\$266	00	\$12600	OIL DOUBLE PUMP	02	1	null	N	LB-A-MT-D-0112X	
	001_1\$0_\$3_01D\$266	00	\$12600	OIL DOUBLE PUMP	03	1	null	N	LB-A-MT-D-0112X	



The full fleet knowledge management environment

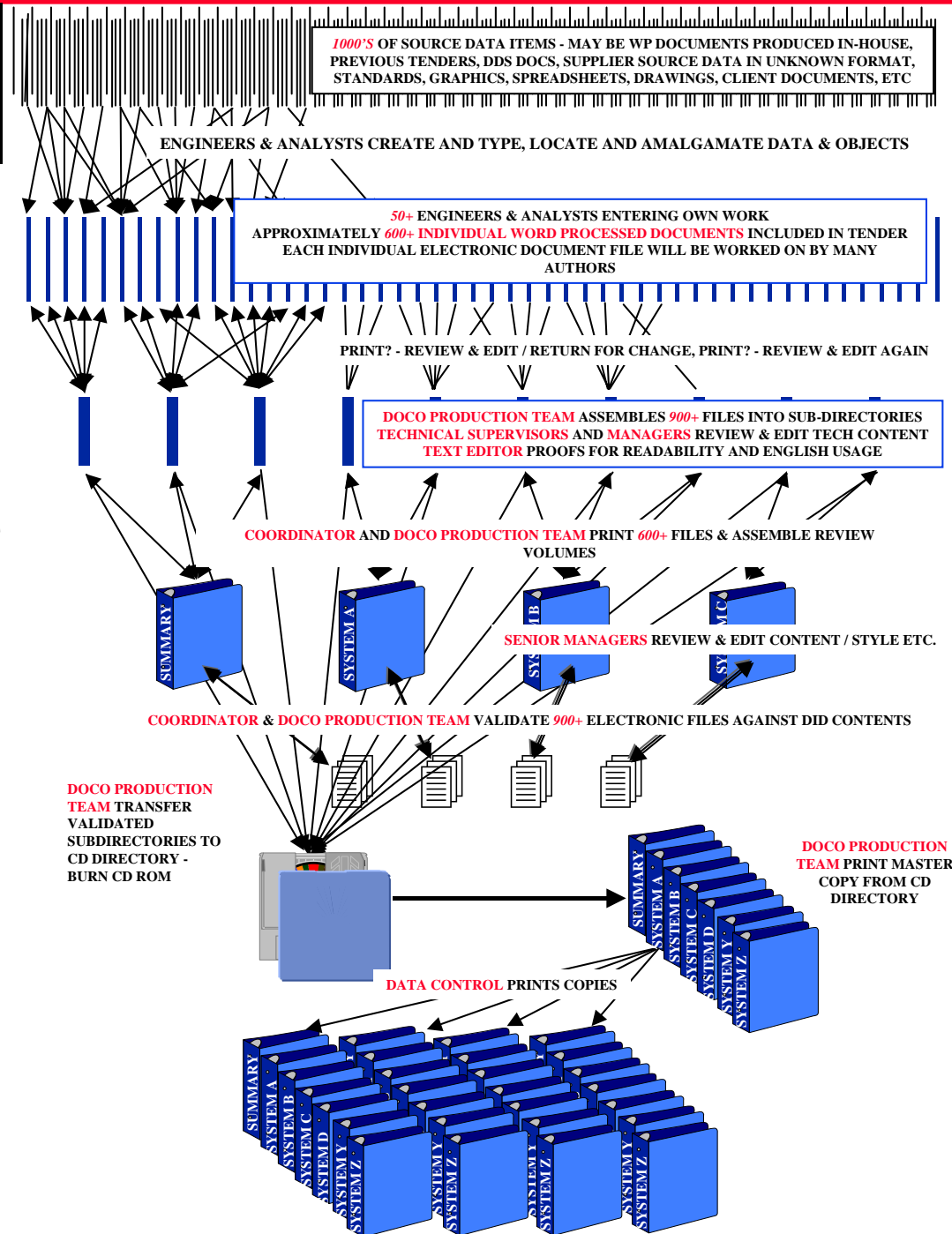


[illegible]

- **20 - 50 year lifecycle**

Streamline bidding documentation funnel

- ◆ **Huge task**
 - Uses production resources
 - Don't reinvent knowledge
- ◆ **Conflicting views of time**
 - Supplier: crushing deadline
 - Client: inordinate delay
- ◆ **Word processing friction**
 - multiplies task magnitude
 - wastes resources & time
 - major source of delay
- ◆ **Delay generates crisis**
 - disorientation
 - panic
 - error





Prime contractor production/mgmt issues

- ◆ **Effective contract management critical to business**
- ◆ **Prime contractor multiplies all process inefficiencies many times over!**
 - Customer presents wants, supplier must offer solutions
 - Tender won must pay for all lost tenders (× 5 to 10)
 - Contract flows down to many subcontracts (× 10 to 100)
 - Comparatively unskilled authors (× 2)
- ◆ ***Client pays for all suppliers' inefficiencies!***



SpeedLegal Pty Ltd

- ◆ **Independent software developer, Queen St., Melbourne**
 - <http://www.speedlegal.com>
- ◆ **Significant relationships**
 - Oasis eContracts WG
 - CCH Australia/Wolters Kluwer Pacific
- ◆ **SmartPrecedent**
 - XML based precedent management and intelligent authoring system
 - Round trip between XML and RTF
 - Based on a DTD for the structural hierarchy of contractual documents

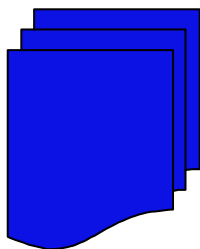


Document Assembly - defined

A **template document** is a document which may contain certain blanks and pieces of optional text.

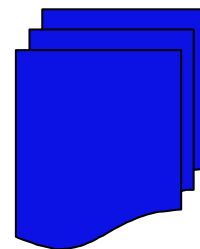
It captures what is common, and what may differ, between a set of similar instance documents.

TEMPLATE DOCUMENT

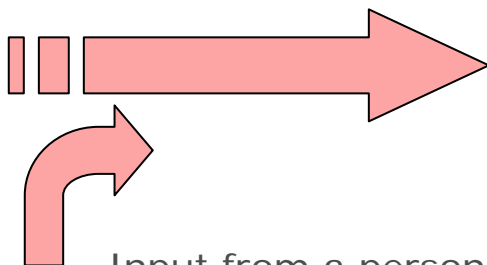


Document assembly is the process by which an instance document is produced from a template document.

INSTANCE DOCUMENT



An **instance document** is a document created to meet a particular need in some transaction.



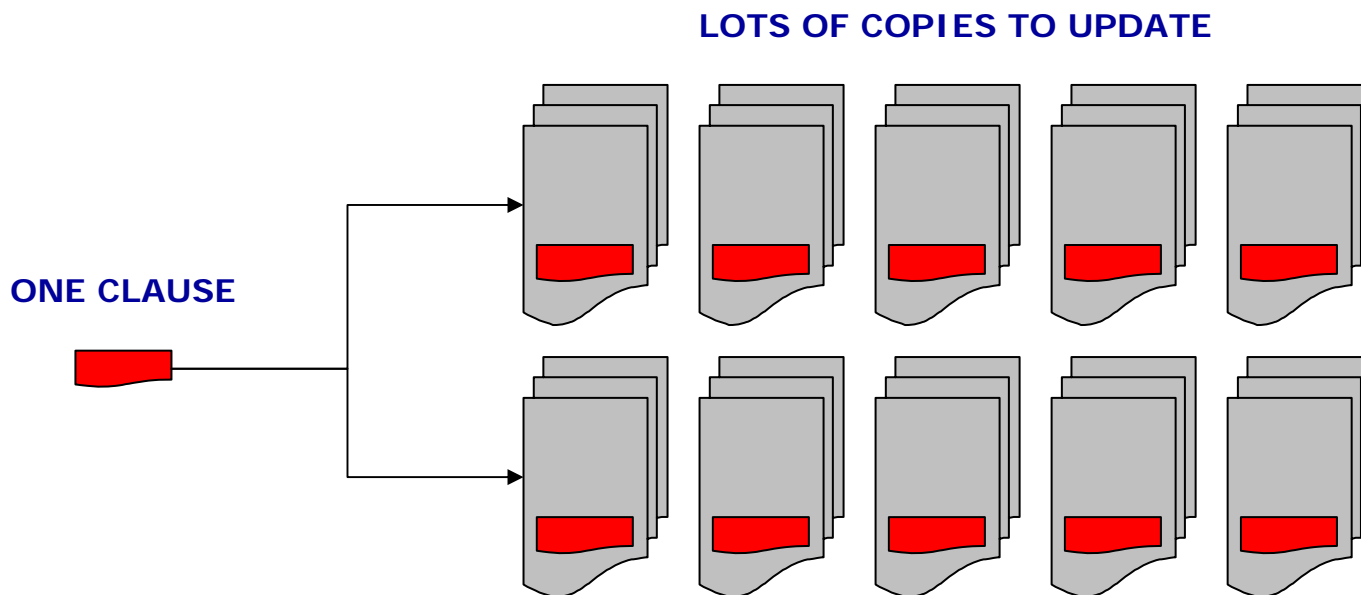
Input from a person or database is required in order to fill in the blanks and choose between the optional texts.



issues and frustrations – keeping things up-to-date

the maintenance monster

- clauses copied across hundreds of documents
- dependent on technical support for updating
- hard to get end user feedback

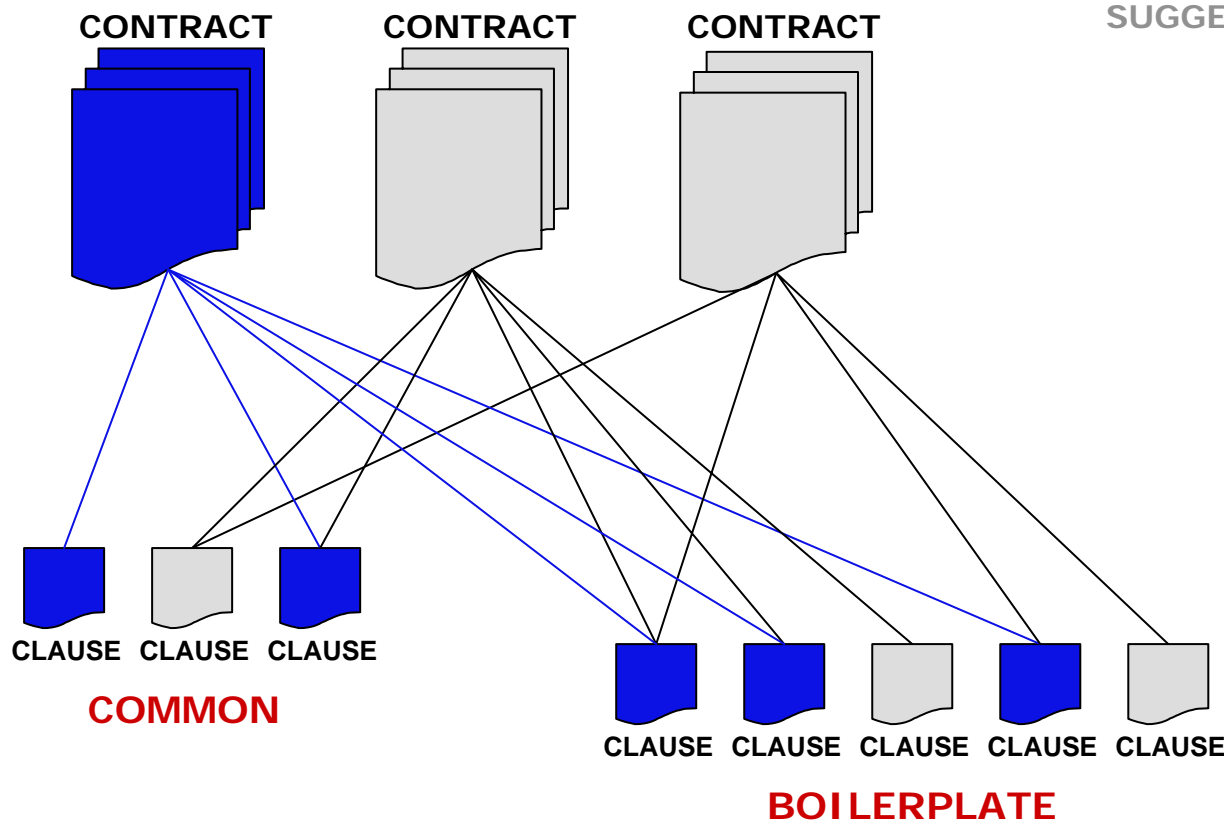




Strategies and solutions – easier maintenance

shared clause libraries

- ✓ LESS DEPENDENCE ON TECHNICAL SUPPORT AND CODING SKILLS
- ✓ IMPROVED CAPTURE OF FEEDBACK & SUGGESTIONS FOR IMPROVEMENT



**update
boilerplate &
other common
clauses in one
place**



CONCLUSIONS

- ◆ **Electronic content management is revolutionary technology that is reinventing the nature of humanity (to say nothing of organizations).**
 - **(Barring differences in the language of expression) one person can access the persistent memory of our entire species for specific knowledge**
 - Google can do it in milliseconds!
 - I use Google many times every day when I want to know something
 - ISI's Web of Science is better for more specific and detailed knowledge - searches may take minutes and you may still have to resort to paper (economic issues not technical ones)
 - **An increasing number of cognitive processes are already automated and many more are in the process**
 - Indexing
 - Semantic retrieval
 - Alerts
- ◆ **The revolution may be essentially complete within my own lifetime. It will affect everything we do and are as humans.**