FIATECH Update

Ric Jackson

Director

The FIATECH Consortium

Physical Structures and Systems Interagency Working Group
Washington, DC
May 23, 2004

Outline

- FIATECH
- Capital Projects Technology Roadmap Initiative
- Automating Equipment Information Exchange
- Smart Chips
- Conclusion

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FIATECH Facts

(Fully Integrated and Automated TECHnology for the capital facilities industry)

- Industry-led, collaborative, not-for-profit, RD&D consortium
- Conceived by CII and NIST as Breakthrough opportunity
- Models: SEMATECH and NCMS
- Research, development, ***deployment***
- Professional project managers ***aggressively*** deliver
- 30 products ***delivered*** so far
- Several active projects, more forming
- Developed ***Capital Projects Technology Roadmap***
- More than 45 member companies including owners, contractors & suppliers

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What is FIATECH's Role?

- Accelerating integration and automation
  - Projects
- Developing industry-wide R&D agenda
  - Capital Projects Technology Roadmap
- Coalescing industry, industry associations, and funding agencies around the plan

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FIATECH's Capital Projects Technology Roadmap Initiative

- Create, maintain a technology roadmap for the capital projects industry
- ***Use it*** to guide investments in technology RD&D

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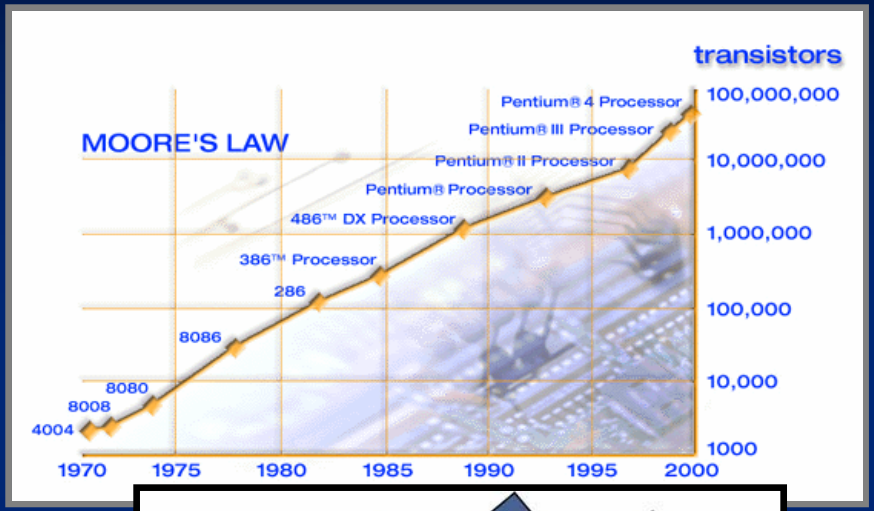
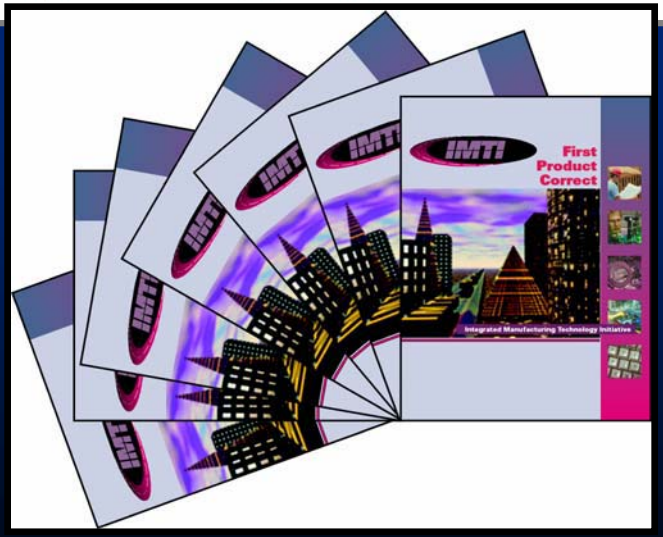
A Little History

- Semiconductor Industry
  - Threat (offshore)
  - Industry coalescence
  - $100M industry funding
  - $100M government funding
  - SEMATECH
  - SIA Roadmap
- Discrete Part Manufacturing
  - Threat (Japan)
  - Industry coalescence
  - $11M government funding
  - NCMS
  - IMT Roadmap
  - National Initiative





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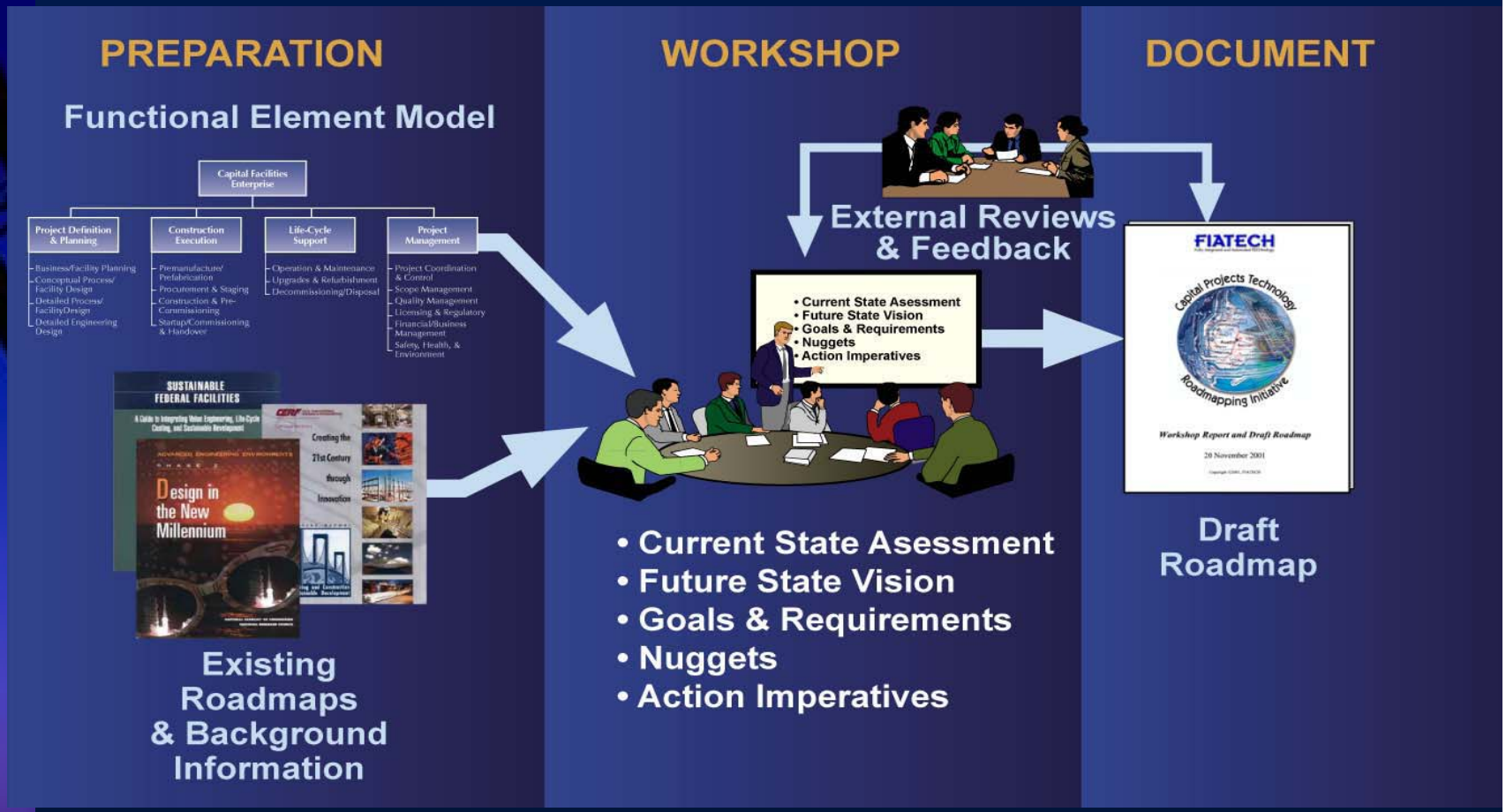
The Roadmapping Process …



… provides a structured methodology for identifying needs, developing plans to fulfill needs, and measuring progress

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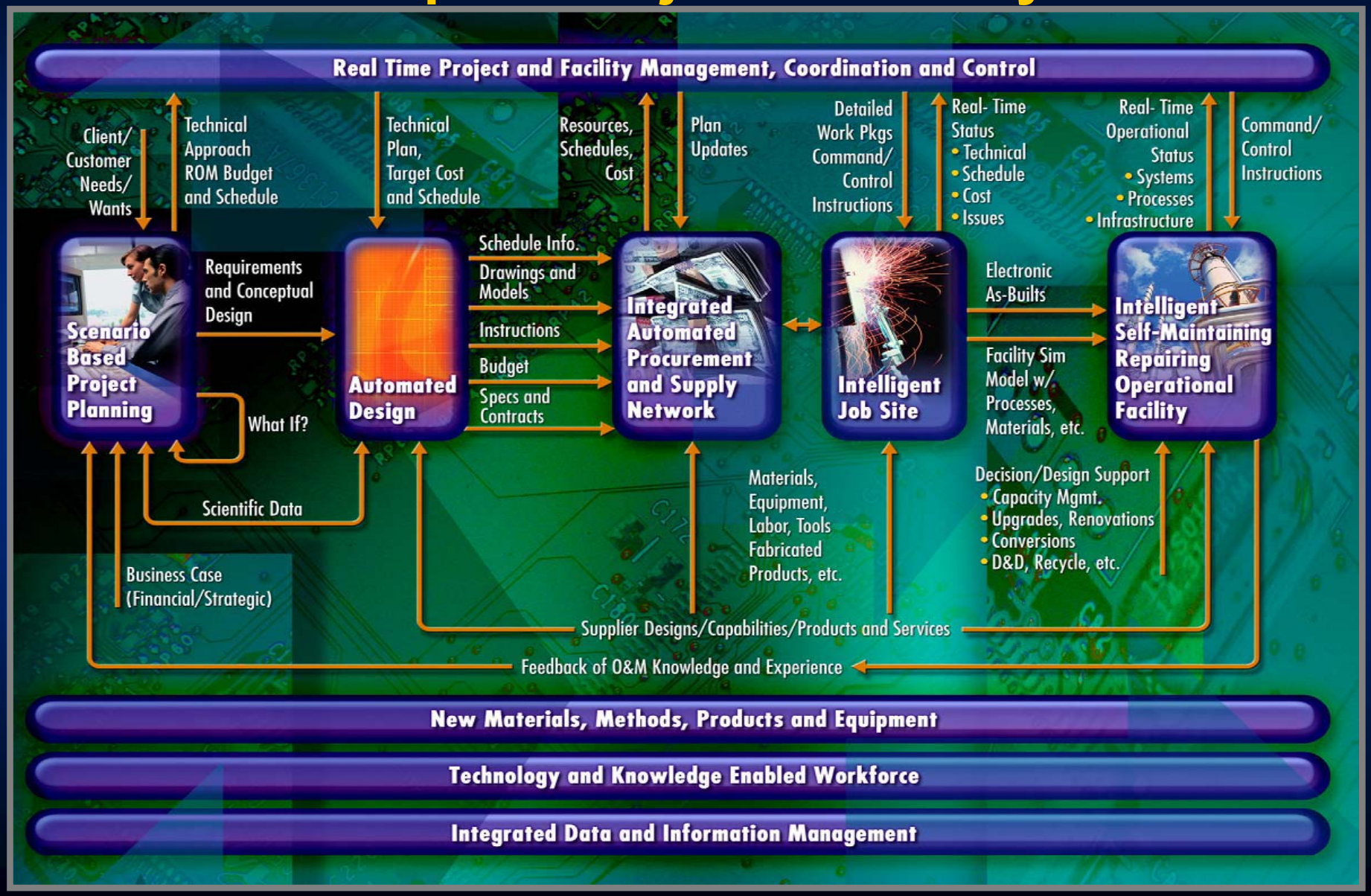
The Vision of an Integrated and Automated Capital Projects Industry



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Companies Leading Development of the Elements of the FIATECH Roadmap

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"Moving from vision to reality"

Vision Diagram Element	Functional Area	Programs
Scenario-Based Project Planning	Conceptual Engineering/ Project Financing	▪Scenario based business planning ▪Conceptual facilities planning/data mapping
Automated Design	Detailed Engineering & Design	▪Automated Capital Projects Design Environment ▪Shared, Interoperable design environment ▪Automated design systems and intelligent design tools ▪Automated systems-level design ▪Security design advisors
Integrated, Automated Procurement & Supply Network	Value Chain Integration	•Integrated Procurement and Supply Network •Transformation of supply chains •Procurement and product delivery system integration
Intelligent Job Site	Construction & Commissioning	▪Intelligent Job Site ▪Information Exchange ▪Pilot for work process transformation ▪Technologies for enhanced data capture and utilization ▪Framework for work force transformation
Intelligent Self-Maintaining/Repairing Operational Facilities	Operations & Maintenance	▪Intelligent Facility Life Cycle Optimization ▪Sensing technologies ▪Facility assessment system ▪Life Cycle facility performance modeling capability ▪3D/4D simulation technology
Real-Time Project & Facility Management/Coordination & Control	Project Management	▪Project controls collaboration
New Materials, Methods, Products, & Equipment	Research and Best Practices	▪New materials assessment ▪Streamlining new materials adoption
Technology & Knowledge Enabled Workforce	Interfaces & Knowledge Management	▪Mobile Computing for Construction, Operations and Maintenance ▪Shared Knowledge Environment ▪Knowledge Validation ▪Material methods & regulatory knowledge management ▪Repository population ▪Security knowledge repository
Integrated Data & Information Management	Life Cycle Data Management/ Document Management	▪Facility Life Cycle Information Management ▪Construction Industry Data/Information/Knowledge Repository ▪Information architecture ▪Tool survey and assessment ▪User interface ▪Application and data interface ▪Prototyping and testing ▪System Evolution

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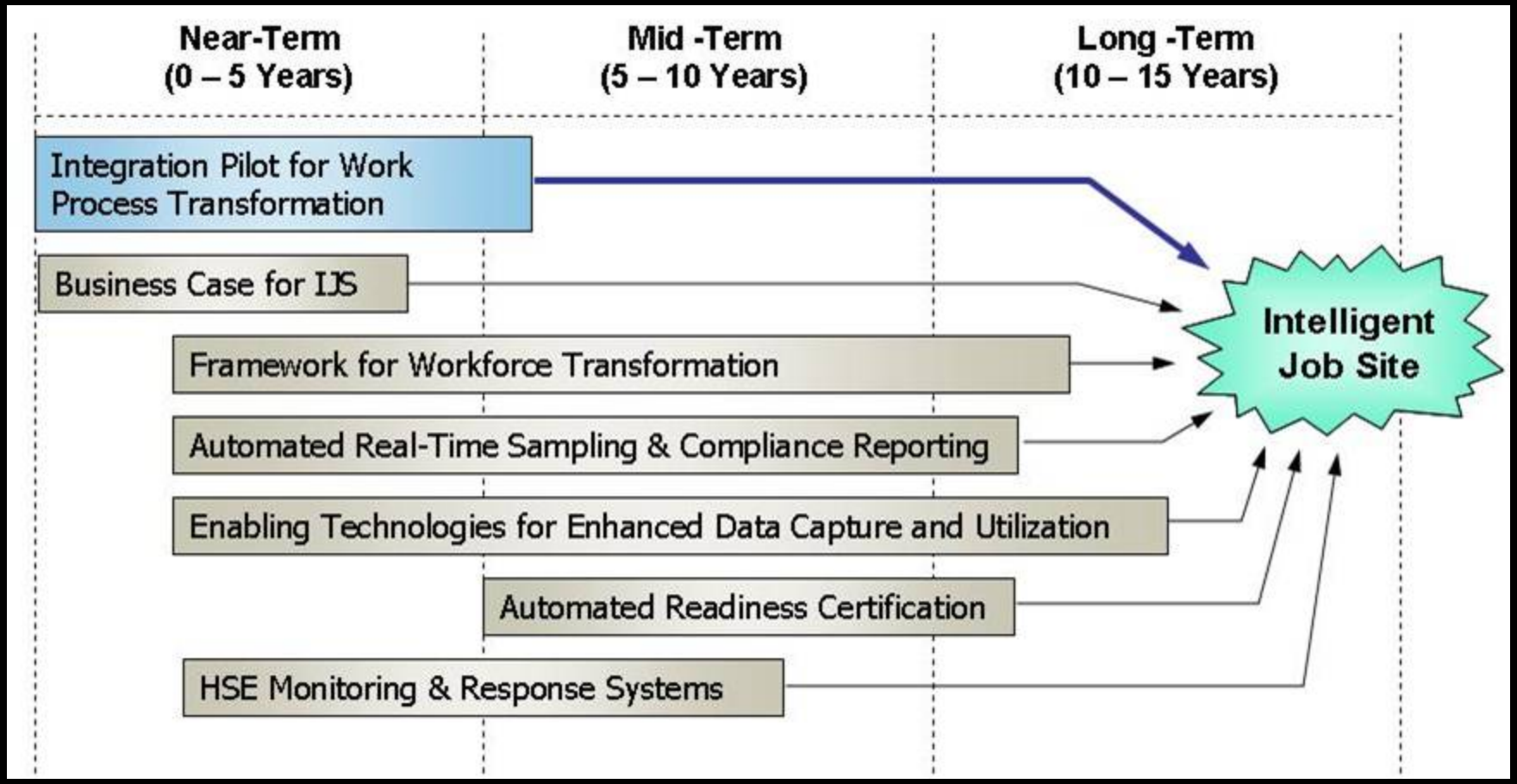

Detailed research, development, and implementation plans are being developed now

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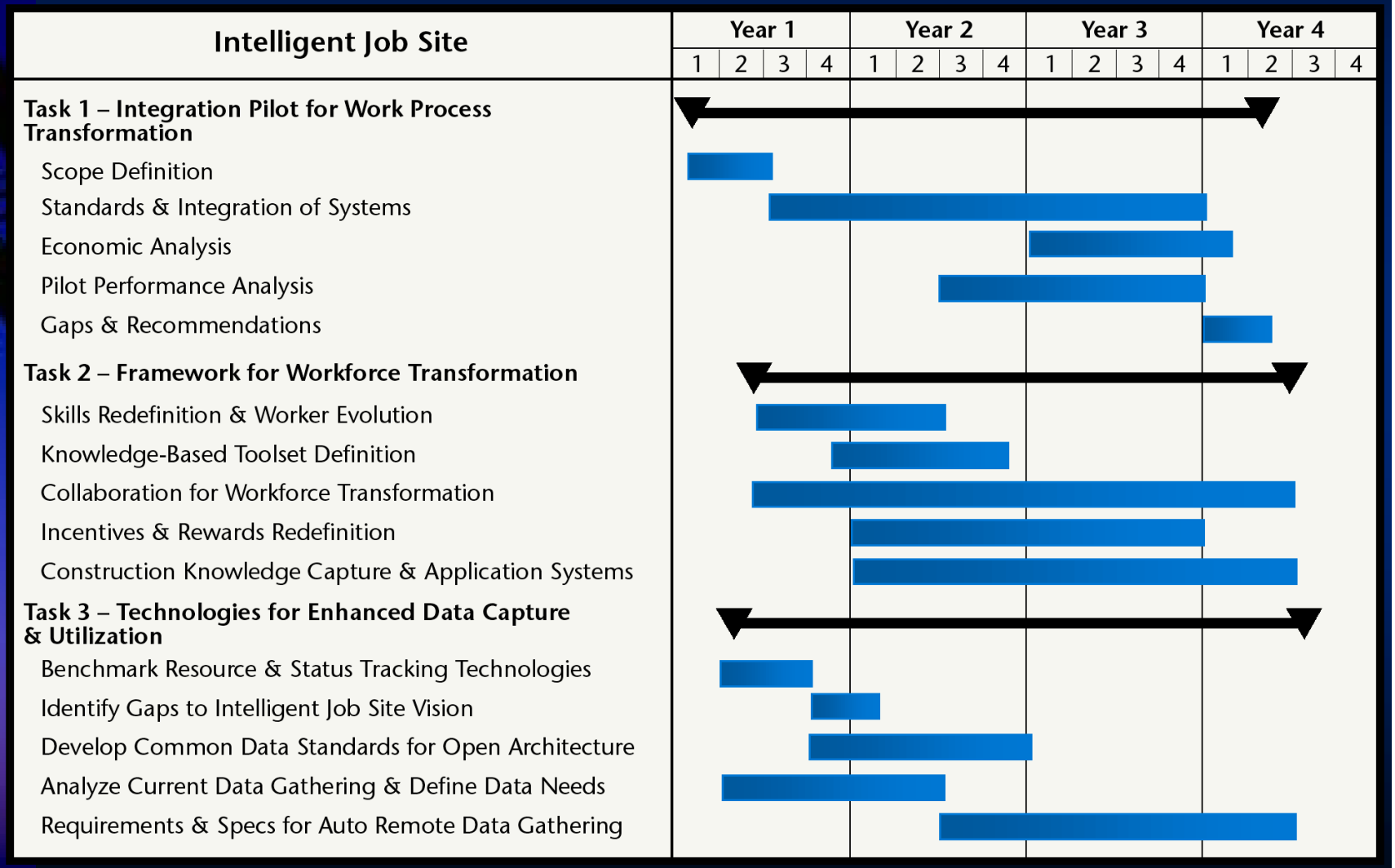
The Backup Detail



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Roadmap Objectives

- Understand what ***needs*** to be done: The Roadmap
- Understand what ***is*** being done: The Database
- Understand what ***isn't*** being done: Gap Analyses
- Coordinate with what ***else*** is being done: Synchronize to Maximize Benefits
- Expand industry support and buy-in
- Create new initiatives to accelerate progress

…build a national consensus

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The FIATECH Standards Web Page

Data Standards and Open Systems - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://www.fiatech.org/projects/idim/default.htm Go

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Data Standards and Open Systems

Project Manager: Nicole Testa, 512-232-9600, testa@fiatech.org

FIATECH Projects

Data Standards Project Home

Data Standards Aligned with the Roadmap

Participants

faqs

sitemap

contact us

member login

This site is intended as a resource for those wanting to understand more about some of the data standards efforts related to the facilities industry and the FIATECH Capital Projects Technology Roadmap. It is meant to help sort out the "alphabet soup" of facility related data standards and standards organizations, by sharing our understanding of the scope, status, intended use, and supporting organization for each of the standard efforts described here.

FIATECH does not endorse any of the standards describe in this site, nor does FIATECH attest to their viability for use in industry. FIATECH cannot guarantee the accuracy of the information in this site.

- aecXML (restarted)
- Automating Equipment Information Exchanges with XML (AEX) (in development; Phase 1 complete; Phase 2 in development)
- CIMsteel Integration Standard (version 2) (completed; commercial implementations available)
- Common Industry Material Identification Standard (CIMIS) (inactive)
- IAI Industry Foundation Classes (IFCs) (commercial implementation in continual development with 18-month review cycle)
- ISO 10303-221 Functional Data and Schematics for Process Plants (draft ISO ballot scheduled for Fall 2003)

Internet

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FIATECH is providing this Technology Roadmapping Initiative as a way to…

- Coalesce industry input
- Coalesce industry associations
- Coalesce academic institutions
- Coalesce technology vendors
- Leverage scarce resources
- Reduce fragmentation, wasteful overlap and competition
- Orchestrate development of a National Initiative in capital projects delivery, operation, and maintenance

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Collaborating Organizations

- American Society of Civil Engineers (ASCE)
- American Society of Mechanical Engineers (ASME)
- Architectural Engineering Institute (AEI)
- Association of Owners and Developers (AOD)
- Civil Engineering Research Foundation (CERF)
- Construction Industry Institute (CII)
- Construction Industry Round Table (CIRT)
- Construction Users Roundtable (CURT)
- Continental Automated Buildings Association (CABA)
- Design-Build Institute of America (DBIA)
- International Alliance for Interoperability (IAI)
- International Council for Research and Innovation in Building and Construction (CIB)
- National Conference on States Building Codes and Standards (NCSBCS)
- National Electrical Contractors Association (NECA)
- National Institute of Building Sciences (NIBS)
- National Research Council of Canada (NRCC)
- National Science Foundation (NSF)
- NIST Advanced Technology Program (ATP)
- The Infrastructure Security Partnership (TISP)
- Uitgebreid Samenwerkingsverband Procesindustrie, Nederland (USPI-NL)

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CPTR Sponsorship and Support

- Financing from
  - NSTC C&B
  - NIST ATP
  - CII
  - NIST BFRL
  - NSF
- In-kind contributions from
  - Several 100 individuals from about 100 firms, agencies, organizations

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CPTR Participants

- Anteon Corporation
- Aramco Services Company
- Arizona State University
- AVEVA, Inc.
- Barton Consutling, Ltd.
- Bayer Corporation
- Bechtel Systems
- Bentley Systems
- Black & Veatch
- Bovis Lend Lease
- Broadband Energy Networks
- Burns and Roe Enterprises, Inc.
- BWXT Y-12
- Carnegie-Mellon University (CMU)
- CH2M Hill
- Chevron-Texaco
- Cisco Systems, Inc.
- Civil Engineering Research Foundation (CERF)
- Construction Industry Institute (CII)
- Constructware
- Continental Automated Buildings Association (CABA)
- DaraTech, Inc.
- Day & Zimmermann
- Dow Chemical Company
- DuPont Company
- East Carolina University
- ePlantData
- Fairfax County Govt.
- Fluor Corporation
- Georgia Institute of Technology
- International Alliance for Interoperability (IAI)
- IMTI
- Impress Software
- Industry Canada
- Intel Corporation
- Intergraph
- International Research Council
- Jacobs Engineering
- JP Step Holding Co.
- KBR
- Lean Construction Institute (LCI)
- McDonough Bolyard Peck

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CPTR Participants

- McGraw-Hill Construction
- Mead Westavo Corporation
- Massachussetts Institute for Technology (MIT)
- Meridian Project Systems
- MOCA Systems
- Morpheus Technology Group
- National Center for Manufacturing Sciences (NCMS)
- National Conference on States Building Codes and Standards (NCSBCS)
- National Research Council of Canada (NRC)
- National Science Foundation (NSF)
- National Institute for Standards & Technology (NIST)
- Operations Management International (OMI)
- Palmer Security Consulting
- Parsons
- PMI
- Procter & Gamble Company
- Purdue University
- Primavera Systems
- Reality Capture Technologies, Inc.
- Rohm and Haas
- S&B Engineers & Constructors Ltd.
- SAP Labs
- SaveEnergy Engineering, Inc.
- Shell Chemical Company
- Smithsonian Institution
- Stanford University, CIFE
- TENG Solutions
- Time Industrial, Inc.
- Turner Aviation Security
- Turner Construction Corporation
- U.S. Army Corps of Engineers
- U.S. Army Engineering Research Development Center
- U.S. Coast Guard
- U.S. Department of Labor, OSHA
- U.S. General Services Administration
- University of California, Berkeley
- University of Florida
- University of Illinois
- University of Texas - Austin
- Virginia Tech
- VTT
- Zachry Construction Corporation

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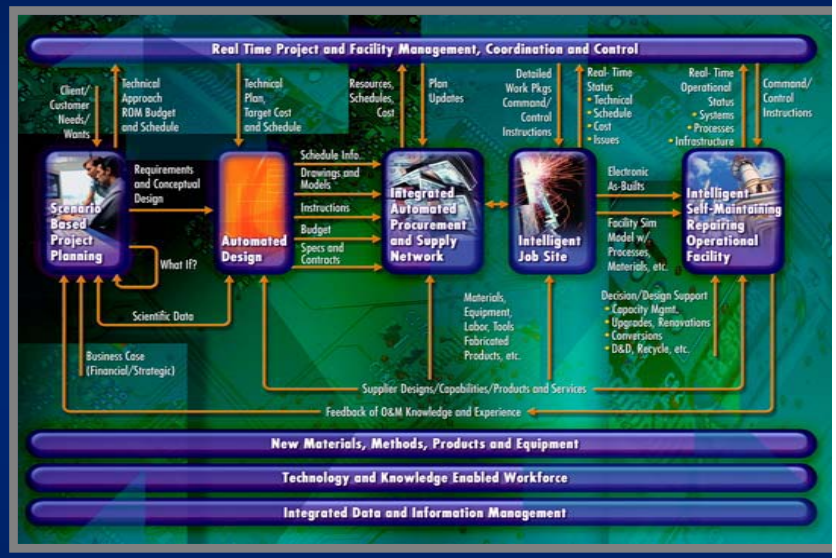
CPTR Next Steps

- Each Element Team:
  - Revise Element text by August 1
  - Refine Element RD&D Agenda by Oct 1
  - Report out at FIATECH Fall Technology Conference Oct 12-13
- Develop FIATECH project agenda for next year
- Pursue projects



The FIATECH Approach to Advancing Interoperability: Find a problem, fix it

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Business Problem

- Multiple participants exchange equipment data to produce the best design at best price
- Transactions are primarily paper based
  - manual transcriptions – time consuming
  - error prone at every step
- Costs industry millions of $ per year
- Eliminate manual re-entry and delays
- Make data available to multiple applications

Benefits

- ***5% reduction in procurement costs!***
  - $375,000/yr on pumps alone for 1 owner
  - Based on input from all stakeholders
  - Similar savings for other equipment
  - ***$1.6-2 billon potential annual savings across all types of capital facilities***
- Eliminate manual reentry & delays
- Data available to multiple applications
  - Increased data integrity, reduced errors
  - Reduced project schedules
  - Streamlined work processes
  - Improved reliability and operations

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FIATECH AEX Project

- Objective
  - Automate equipment design and delivery through software interoperability
- Approach
  - Focus on high value problems
  - Produce XML schema for equipment data
  - Demonstrate incremental working solutions
  - Promote broad industry acceptance
  - Initial focus on centrifugal pumps and shell & tube heat exchangers
  - AEX specifications sent to standards organizations to adopt as standards: API, ASHRAE, Hydraulic Inst., PIP,…

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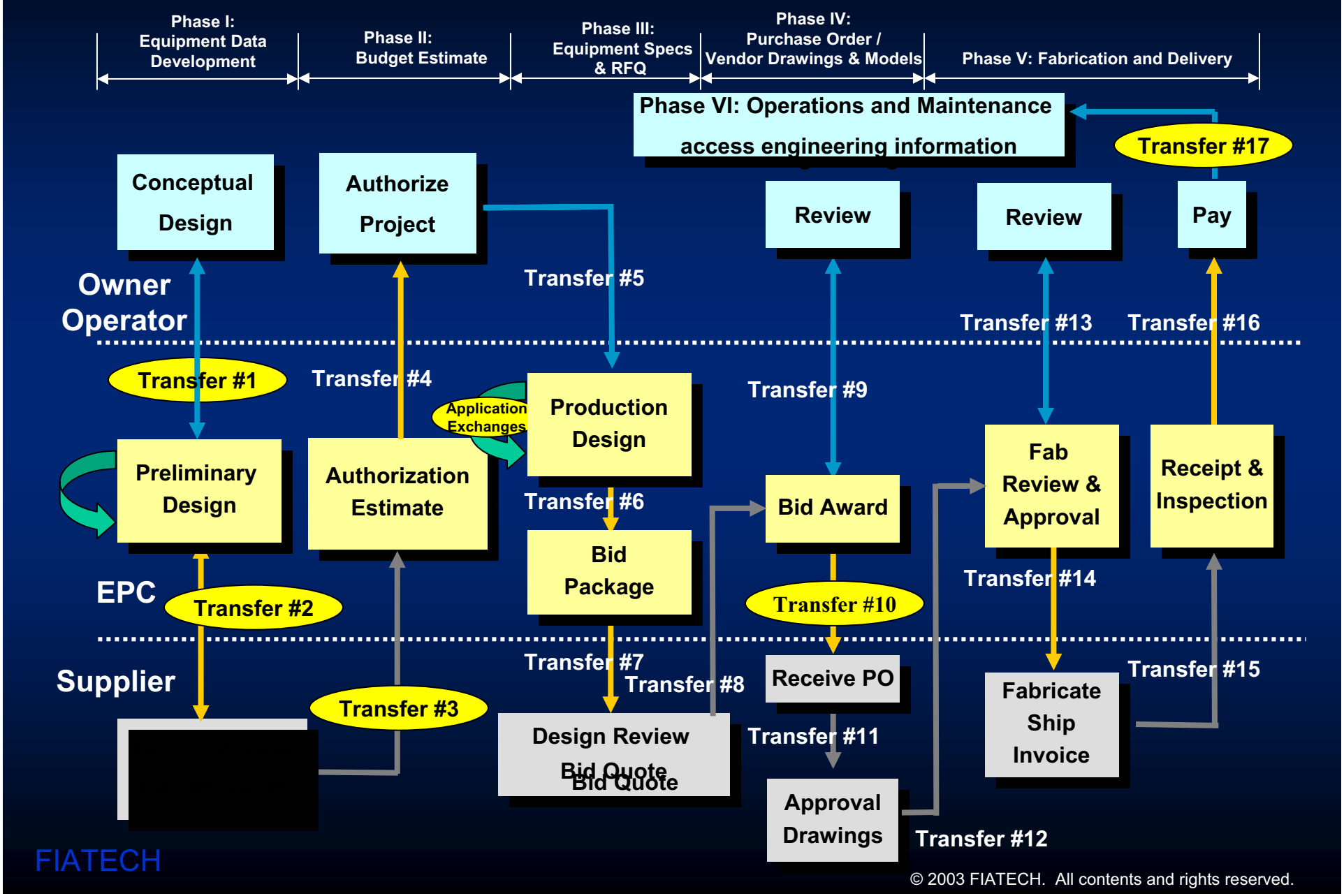
Equipment Life Cycle Work Process



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One Company's Data Sheet

1	Client	ABC Chemical Corp.		Location	Anywhere You Wish, USA			Page	1	of	3
2	Process Unit	Demonstration		Item No.	101-E			Document No.	MC21-101		
3	Job No.	1234-56		Fabricator	Exchangers Ltd						
4	Service of Unit	Stripper Reboiler								No. of Units	1
5	Size	53-288	TEMA Type	NEN (Horizontal)	Connected in	1		Parallel	1	Series	
6	Surface/Unit (Eff.)	8471	ft^2	Shells/Unit	1	Surface/Shell (Eff.)		8471		ft^2	
7	**PERFORMANCE OF ONE UNIT**										
8	Fluid Allocation			(Inlet)	SHELL SIDE		(Outlet)	(Inlet)	TUBE SIDE		(Outlet)
9	Fluid Name				Stripper Bottoms				Heavy Naphtha		
10	Fluid Quantity, Total		lb/hr		794330				1017200		
11		Vapor (MW)	lb/hr			186920					
12		Liquid	lb/hr	794330		607410		1017200		1017200	
13		Steam	lb/hr	-		-		-		-	
14		Water	lb/hr	-		-		-		-	
15		Noncondensable / MW	lb/hr	-	/	-		-	/	-	
16	Temperature		°F	195.8		231.1		322.9		248.9	
17	Density (Vapor/Liquid)		lb/ft^3	2.108	35.238	2.115	36.058	-	50.449	-	52.442
18	Viscosity (Vapor/Liquid)		cP	0.011	0.142	0.011	0.134	-	0.391	-	0.556
19	Specific Heat (Vapor/Liquid)		Btu/lb °F	0.517	0.583	0.526	0.584	-	0.519	-	0.487
20	Thermal Conductivity (Vapor/Liquid)		Btu/hr ft °F	0.016	0.058	0.017	0.056	-	0.056	-	0.06
21	Latent Heat		Btu/lb @ °F		@				@		
22	Inlet Pressure		psig		234.2				70.64		
23	Velocity		ft/s		9.42				3.38		
24	Pressure Drop (Allowable/Calculated)		psi	8.00		7.59		3.00		2.66	
25	Fouling Resistance		hr ft^2 °F/Btu		0.001953				0.002929		
26	Avg. Film Coefficient		Btu/hr ft^2 °F								
27	Heat Exchanged	37854000			Btu/hr	MTD (Corrected) (Weighted)			64.7	°F	
28	Transfer Rate (Required/Fouled/Clean)				69			123		Btu/hr ft^2 °F	
29	ρV^2 - lb/ft-s^2:	Inlet Nozzle		Bundle Entrance		Bundle Exit					
30	**CONSTRUCTION PER SHELL**										
31	Tube No.	1840	OD	0.75	in	NOZZLES - No. Size & Rating					
32	Thickness	0.083	in/BWG (Min./Avg.)		Min		SHELL SIDE		TUBE SIDE		

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Another Company's Data Sheet

1	CUSTOMER:	ABC				EQUIPMENT NO.:		0-T-100				
2	PROJECT:	XYZ				UNIT :						
3	LOCATION:	City, State				REQ'D NO. :		1				
4	SERVICE OF UNIT:		Effluent Cooler			MANUFACTURER:						
5	SIZE:			TYPE		POSITION		CONNECT IN		PARALLEL		SERIES
6	SURF/UNIT (GROSS/EFF.)			FT²	SHELLS/UNIT			SURF/SHELL (GROSS/EFF)				FT²
7	PERFORMANCE OF ONE UNIT											
8	FLUID ALLOCATION					SHELL SIDE				TUBE SIDE		
9	FLUID NAME					Chilled water (25% propylene glycol)				Effluent		
10	FLUID QUANTITY, TOTAL				LB/HR	19957				21402		
11						IN		OUT		IN		OUT
12	VAPOR				LB/HR							
13	L[illegible]				[illegible]							
[illegible]	S[illegible]				[illegible]							
[illegible]	V[illegible]				[illegible]							
[illegible]	M[illegible]				[illegible]							
[illegible]	T[illegible]				F	45		68		90		68
18	MOLECULAR WEIGHT, VAPOR											
19	MOLECULAR WEIGHT, NONCONDENSABLE											
20						LIQ	VAP	LIQ	VAP	LIQ	VAP	LIQ	VAP
21	DENSITY				LB/FT³	63.6		63.7		63.76			
22	VISCOSITY				cP	3.3		2.8		0.335			
23	SPECIFIC HEAT				BTU/LB-F	0.91		0.92		0.892			
24	THERMAL CONDUCTIVITY				BTU-FT/HR-FT2-F	0.24		0.24		0.32			
25	LATENT HEAT				BTU/LB @ F							
26	INLET PRESSURE				PSIA	85				30		
27	VELOCITY				FT/S							
28	PRESSURE DROP ALLOW./ CALC.				PSI		5 /				10 /	
29	FOULING RESISTANCE				HR-FT²-F/BTU		0.001				0.001	
30	HEAT EXCHANGED			see note 2,3		420,000	BTU/HR			MTD (CORR) (WTD)		F
31	TRANSFER RATE, SERVICE							CLEAN				BTU/HR-FT²-F
32	CONSTRUCTION OF ONE SHELL											
33							SHELLSIDE				TUBESIDE	
34	DESIGN /TEST PRESS.				PSIG		150 /				100 /	

Same Data - different terminology and format

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AEX Phase 1 Results

- XML Schema Development Guidelines
  - assess evolving methods; use the proven
  - adopted by other initiatives: IAI / aecXML, ASHRAE
  - common process for cohesive results
- XML schemas for mechanical equipment and detailed XML schemas for:
  - centrifugal pumps
  - shell & tube heat exchangers
- Trial implementations: Data Sheets and Quote
- XML schemas made freely available
  - industry review and comment cycles

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Recent Successes

- Demonstrated AEX software to industry
  - Process Industry Practices (Jan. 2004)
    - PIP Data Sheet Viewer/Editor with AEX interfaces
  - AHR Expo – XML Symposium (Jan. 2004)
  - Hydraulic Institute (Feb. 2004)
- New partnerships with major stakeholders
  - Hydraulic Institute established team to work with AEX
  - extensive use of web meetings
- New participants on the AEX project
  - Autodesk
  - BigMachines
  - Intelliquip
- Development and testing web site for international collaboration on AEX schemas

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Equipment Priorities for Phase 2

"Top 10"

Centrifugal Compressor
Reciprocating Compressor
Air Cooler
Centrifugal Fan
Induction Motor
Control Valve
Relief Valve
Storage Tank
Pressure Vessels
Transmitter

"If resource available"

Scroll Compressor
Motor Control Center
Variable Speed Drive
Axial Fan
Steam Turbine
Block Valves
More types of pumps

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Participation in AEX Phase 2

- Sponsors: Owners, EPCs and Software Suppliers
  - Bechtel, Citadon, DuPont, ePlantData, Impress, NIST, PlantSTEP, Smithsonian Institute
- Additional Project Participants:
  - Autodesk, AVEVA (Cadcentre), BigMachines, Intelliquip, Jacobs, S&B and Xynchron
  - Hydraulic Institute, Process Industry Practices
  - Pump manufacturers: Flowserve, Goulds, Grundfos
- Project Sponsor Fees for 2004 (for FIATECH members)
  - EPCs and Owners
    - $10,000: Gross Annual Revenue > $1B
    - $5,000: Gross Annual Revenue < $1B
  - Equipment and Software Suppliers: $2,000
  - Non-FIATECH members: 2X project sponsor fee
- Industry review cycles: open to all

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What have we learned about standards and interoperability?

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What Have We Learned From Interoperability Initiatives?

- Many interoperability standards programs have faltered due to insufficient attention to:
  - work process and supply chain requirements
  - current software usage
  - changing business dynamics
  - incentives for implementation
  - deployment and industry adoption

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Keys to a Successful Standard

- Solves the problem it was meant to solve
- Is developed in a timely manner
- Achieves widespread adoption and use
- Anticipates and allows for future technological change
- Constrains future development as little as possible

Source: William Behrman, CIFE

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The Minimalist Approach

- Values simple standards and rapid adoption by the user
- Bottom-up approach in which standards start out small
- Development process places heavy emphasis on
  - Experimentation
  - Testing
  - Iterative improvement
  - In applications before adoption
- Once gain acceptance, further developed as needed

- Examples:
  - TCP/IP, HTML, C programming language, SQL database language, FIATECH AEX Project

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The Structuralist Approach

- Values comprehensive and complete standards
- Top-down approach
- Development process starts with high-level model, proceeds with elaboration of more and more detail
- Process is often daunting and lengthy

- Examples:
  - Open Systems Interconnection (OSI), ADA programming language, Integrated Services Digital Network (ISDN), the Standard for the Exchange of Product model data (STEP)

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Lessons Learned

"Although any specific approach to standards must be sensitive to particulars of the relevant technology, applications, and markets, the one emerging from the standards community reflects these lessons:

- ✓ collect a small group of vendors,
- ✓ write a small, simple specification that covers the important functions,
- ✓ omit nonessentials,
- ✓ leave room for both new technologies and possible backtracking,
- ✓ identify real-world test-beds for the standard, and
- ✓ get it out the door as soon as possible."

…Martin Libicki, 1995

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The FIATECH Approach to Advancing Automation: Find a problem, fix it

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FIATECH Smart Chips Project

Smart Technologies for the Construction Site and Operating Facility

- Realistic Industry Specific Pilot Studies
- Industry Relevant Technology Workshops
- Outstanding Sponsor Value

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SMART CHIPS PROJECT
Some History

- Conceived by CII - 2002
  - Breakthrough Strategy Committee
  - Chips are high value opportunity
    - Construction industry lagging others
    - Applications could be adapted to Construction
    - Addresses CII technology needs assessment
- FIATECH awarded CII seed funds
  - Conduct pilot studies of chip technology
  - Generate self sustaining project in FIATECH

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SMART CHIPS PROJECT Objectives

- Mission
  - Expedite use of chip technology in Construction
- Short term goals
  - Identify potential high return applications
  - Assess applications in realistic field trials.
  - technical capabilities, economic feasibility
  - Publicize results so that potential users can make informed decisions about commercial products
- Long term Goal
  - Guide/direct smart chips stakeholders to produce E&C industry value added

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SMART CHIPS Project
Field Technology Pilot Studies

- ***Realistic*** field pilot studies
  - Hosted by Smart Chips sponsors
  - Report out to broad industry audience
- Advantages of collaborative pilots
  - Good cooperation from suppliers
    - Low/no cost technology, good support
    - Limited sales pressure or steering
  - Participation fee less than cost of one independent pilot demonstration

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2004 SMART CHIPS Sponsors

- Bechtel
- ChevronTexaco
- DuPont
- Fluor
- Intel
- Jacobs
- KBR
- Proctor & Gamble
- Aramco Services
- Zachry

Collaborators: NIST, Carnegie-Mellon, U of Texas, U of Kentucky, Tulane, MIT Auto ID Center, AIM, Identec Solutions, Phase IV Engineering, Trimble, SAT Corp., Data Scan, Nomadics Labs, Engius

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Field Implementation Studies of Smart Chip Applications: Two Success Stories

- Real Time Concrete Strength and Quality System

- RFID Technology for Tracking Fabricated Pipe

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Use of the Concrete Maturity Method Construction of Industrial Facilities

- Advanced data loggers to predict real time strength of concrete using concrete maturity method
- Conducted under active project conditions by Fluor field personnel for the Amgen Opus Program Project, Puerto Rico
- Multiple concrete design mixes and pour types
- Pilot testing in parallel with traditional QC methods for comparison

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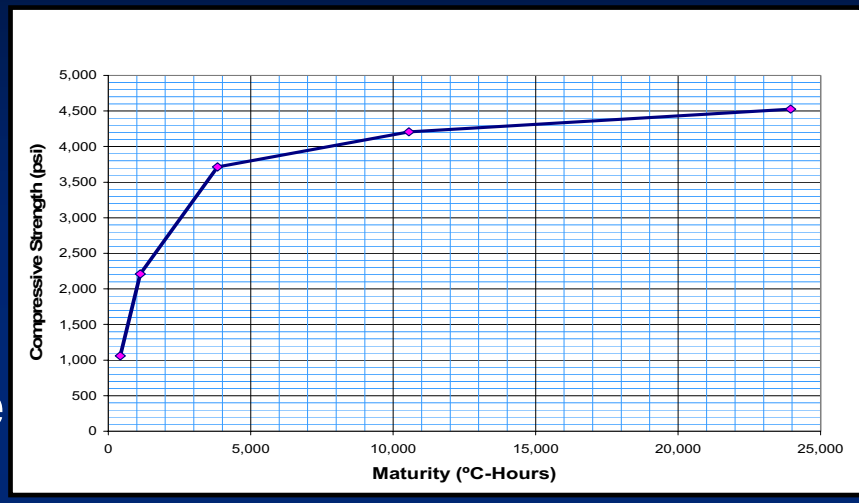
What is Concrete Maturity?



- A proven, non-destructive, strength estimation technique
- Uses time and temperature measurements to determine strength gain of in-place concrete
- Originally developed in the late 40's & early 50's
- Accidents in the 70's resulted in further maturity research
- Interest increased in the 80's as companies looked for ways to accelerate construction
- Wide spread adoption in the U.S. over the last 10 years

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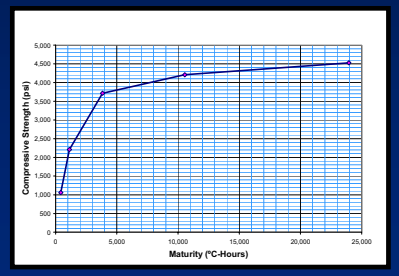
Implementation Steps

- Generate a mix-specific relationship curve
  - Curves calibrated/confirmed by sample cylinder break



- Imbed sensors in structure

- Take maturity measurements:
  - Established Relationship Curves
  - Real Time Concrete Maturity Values
  - Download as frequently as needed

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Maturity Logger and Reader

Hand held reader stores data; plots curves

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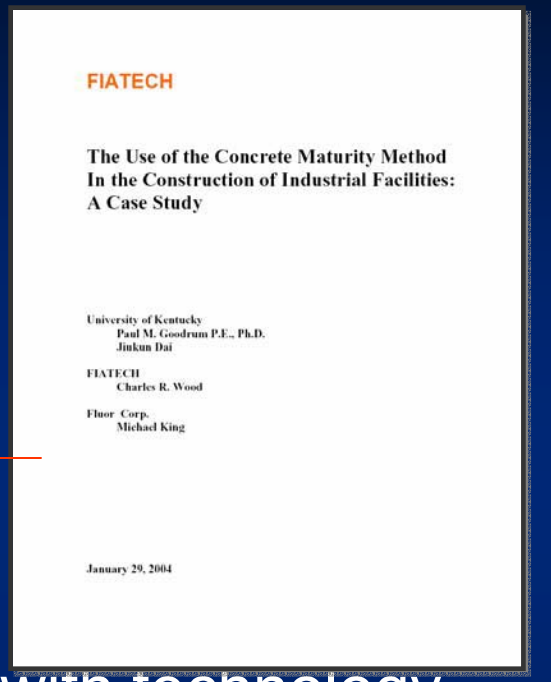
Great Results

- FIATECH Report: ***The Use of the Concrete Maturity Method in the Construction of Industrial Facilities: A Case Study***, January 2004

  www.fiatech.org



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The Use of the Concrete Maturity Method In the Construction of Industrial Facilities: A Case Study

University of Kentucky
Paul M. Goodrum P.E., Ph.D.
Jinkun Dai

FIATECH
Charles R. Wood

Fluor Corp.
Michael King

January 29, 2004

- Simple, accurate, reliable, cost effective, high value
- Created corporate supplier agreement with technology supplier
- Rapid results: ***<u>pilot to global deployment in less than six months</u>***

"We are saving money every day."

Gary Chanko, Fluor

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RFID Technology for Tracking Fabricated Pipe

- Two Phase Field Trials
- Phase One: test RFID read capability in static controlled field environment
- Phase Two: conduct trials of RFID technology in realistic dynamic application

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Phase One Results

- Current active RFID technology works very well in congested, metal intense construction field environment
- One reader sufficient to read all tags when placed in central location.
- Proved RFID tags work around metal pipe for identification of spool pieces.

Identic Solutions RFID tag

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Phase Two: Testing Through A Portal

- Is it possible to record tags on spool pieces loaded on a truck as the truck is driven through a portal?
- Technology and equipment furnished from Phase IV Engineering

Reader RFID Tag

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Tagging the Spool Pieces

Truck and trailer loaded with spool pieces

Spool pieces with tags attached to the flange ends

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Trailer Passing Through the Portal

Antenna locations circled in red

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Phase Two Results

- Able to write and read data on a tag.
- One reader sufficient to read all tags, when placed in a central location.
- Able to pass load of tagged spool pieces through a portal and read all tags.
- Able to vary the load structure and tag placement and still read all tags.
- Developed a repeatable procedure for 100% read.

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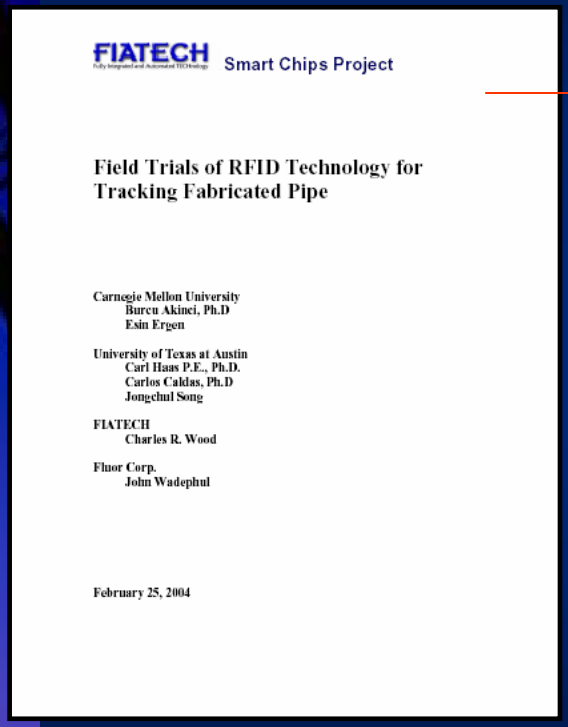
For more information



FIATECH Smart Chips Project

Field Trials of RFID Technology for Tracking Fabricated Pipe

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February 25, 2004

FIATECH Report

Field Trials of RFID Technology for Tracking Fabricated Pipe
www.fiatech.org

RFID JOURNAL

Found at: http://216.121.131.129/article/articleprint/720/-1/80/

Case Builds for RFID in Construction

Fluor Construction found that active RFID tags could track large metal pipes stacked on a truck with 100 percent accuracy. But there are issues to overcome before the technology is widely used in the construction industry.

By Jonathan Collins

Jan. 5, 2004—In September, an RFID trial was conducted at a pipe fabrication plant in Houston, Tex., to determine whether RFID could help automate the shipment and delivery of key materials from fabrication plants to construction sites. One key goal was to see if the technology could stand up to the rigors of harsh construction industry environments.

The three-phase trial was hosted by Fluor Construction, one of the world's largest, publicly owned engineering, procurement, construction and maintenance companies. Fluor turned to one of its materials fabricators, Shaw Industries, to help deploy the RFID trial at Shaw's plant.

Also overseeing the project was Flatech, a nonprofit consortium of construction companies, material suppliers and academics focused on speeding the development and deployment of technologies in the construction industry. Flatech was formed by the Construction Industry Institute, the University of Texas and the National Institute of Standards and Technology's Building and Fire Research Laboratory.

In addition to providing expertise, "Flatech brings other construction companies, fabricators and clients into the examination of the potential for RFID in the construction industry," says John Wadephul, supervisor of field materials management at Fluor, which is based in Aliso Viejo, Calif., and has offices in more than 25 countries across six continents.

Flatech was cautious regarding the technology. "We had heard of trials years ago where passive RFID failed to demonstrate any advantage over bar codes," says Charles Wood, project manager at Flatech. "RFID readers had to be so close to the tags to get a reading that they required the same kind of manpower and line of sight as bar codes."

For the trial, Fluor wanted to tag spools. A spool is a unique section of steel or carbon steel piping that is later welded to other spools on the construction site to create pipes that meet exact design specifications. Spools can range from two inches to eight inches in diameter and be up to 40 feet in length.

"We wanted to tag the items that we have a hard time keeping track of," says Wadephul. "These pieces stand on top of each other. There is no line of sight."

At present, spools are bar-coded at the fabrication plant and then shipped to the construction site, where the delivery is checked. But that process is far from perfect. "Most spools have a bar-coded label on the spool and one on the packing list, but rather than locate the label [on each spool], it is usually easier to identify each spool visually and later, inside the office, use the bar code on the packing list to record the delivery," says Wadephul.

The potential advantage of RFID is to automate and speed up the delivery and inventory identification process and eliminate the need for visual checking or line-of-sight reading that bar codes require—especially given that these pieces are not neatly stacked when they are transported. If RFID technology worked on spools, the potential market would be significant. "A single project can use between 1,000 and 10,000 spool pieces," says Wadephul.

The first phase of the trial sought to see if tags could work in an environment surrounded with metal. Radio waves used by RFID bounce off metal, creating the potential for reading errors when tagged objects are metallic and are read in environments containing lots of other metal. Fluor and Flatech turned to Identec Solutions for its active tags and readers. "This is the worst environment you can put a tag in," says Barry Allen, president of technology at Identec.

In the first phase of the trial, the goal was just to find a tagging technology able to meet the demands of the environment. Between 20 and 30 spools were tagged with Identec's iQ active tags to see if the tags could be read from a distance of 10 feet. The 2-by-4-by-half-inch tags operate at 915 MHz with a read rate of up to 100 tags per second (identification code only) or up to 35 tags per second (128 bits of data). In addition, the readers can handle of up to 2,000 tags in the read zone and offer a read-write range of up to 100 meters (328 feet) in free air.

"If RFID technology worked on spools, the potential market would be significant."
-Fluor's John Wadephul

http://www.rfidjournal.com/article/articleprint/720/-1/80/ 1/8/04

RFID Journal, Jan 2004

Case Builds for RFID in Construction
www.rfidjournal.com

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SMART CHIPS Project: next field technology pilot studies

- Material/Supply Logistics with RFID
  - Owner (ChevronTexaco), Supplier (Phase IV Engr)
  - Using RFID and wireless to track materials offshore
  - New Orleans shore base facility supplying GOM platforms
  - Target Start 4/2
- Field Material Locating with GPS
  - EPC (KBR) with preliminary approvals
  - Locate received materials in laydown using GPS
  - Handheld guides workers to item in yard
  - Suppliers committed
  - GPS (Trimble), wireless interface (Data Scan)
  - Initial tests 3/15, site target start 4/15

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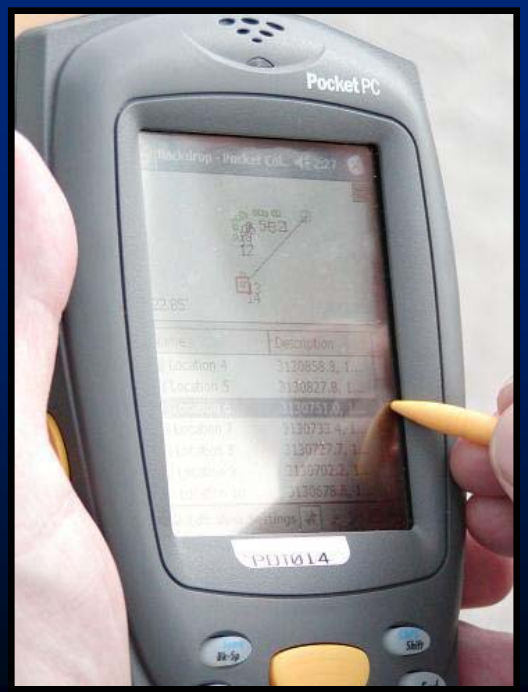
Field Material Locating with GPS

- KBR with Trimble, Data Scan
- GPS handheld gives map location, bearing, distance
- Pilot will locate pipe spools, measure time and reliability
- In field April 2004



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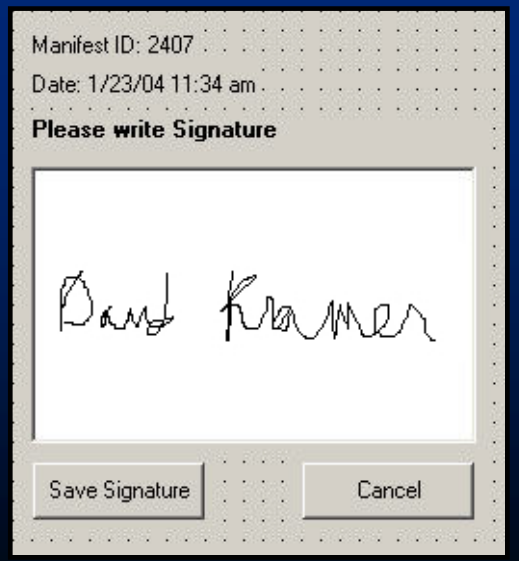
Offshore Material Logistics with RFID

- ChevronTexaco w/Phase IV Engineering
- RFID systems track materials/supply from shore warehouse to distribution on platforms
- Automates ship/receive documents and signoff
- In the field April 04



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SMART CHIPS PROJECT
Sponsor Value Case

- Online Technical Workshops
  - Top academic & technical speakers, interactive Q&A
  - Sponsor fee = cost of 2 people @ 1 conference
  - Unlimited sponsor company attendees – no travel
- Realistic Industry Specific Pilot Studies
  - Low cost, sponsor selected pilots
  - Sponsor fee is fraction of cost of one in-house pilot
  - Good supplier cooperation- no sales
- Past Pilot Studies
  - In Plant Asset Tracking Using RFID
  - Equip Data Collection – Construction / Turnover
  - Concrete Curing w/ sensors and RFID
  - Fabricated Pipe/Steel Tracking Using RFID
  - Laydown Yard Logistics w/GPS

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Smart Chips Project: more technologies to investigate

- Ground Penetrating Radar
- LIDAR
- Laser Scanning
- Motes and MEMS for analyzing structures
- RFID for improving supply chain efficiency

Most of this technology is available, in particular at NIST; we just need to prove to the industry it works and saves money.

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Request to the PS&S

- FIATECH and its projects are a success
- Need to do more
- Need financing for more projects
- Seeking help from you as:
  - Individuals
  - Agencies
  - Working Group
- Need to find $100k per year for three years
  - Yield: at least two field studies per year

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"We will either find a way or make one!"

…Hannibal

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