Fieldbus Foundation Update

“How Changing the Playing Field”

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Current Industry Outlook

- End users are seeking an open architecture for information integration
  - Remove constraints of closed, proprietary systems
  - Free their plant's profit potential
- End users want a truly scalable control solution
  - Integrate installed assets
  - Co-exist with legacy systems
  - Protect valuable investments
Changing the Playing Field

FOUNDATION technology is a unified infrastructure that manages data, communication, plant assets, and plant events while providing highly distributed control functionality and interoperability between devices and subsystems.

- Built from the ground up to be more than just a digital replacement for 4-20mA technology.

- Supplier neutral, standards-based, and provides end users with a common framework to implement and manage strategies for operational excellence and continuous improvement in process manufacturing.

The scope of FOUNDATION technology really makes it a process automation infrastructure... one of the most advanced and scalable available.
Changing the Playing Field

- Extensive Block Model
- Common Data
- Common Time
- Determinism
- Publish and Subscribe
- High availability
- Standards Based Control Network
- Network Management.

FOUNDATION technology incorporates key aspects of what ARC calls the Collaborative Process Automation System.
Changing the Playing Field

• The function block structure of FOUNDATION technology enables control in the field, an enabler for single loop integrity and higher process availability.

• The network management and Link Active Scheduler of FOUNDATION technology ensure that the network will remain up and running. Redundancy is available down to the I/O layer.

• The FOUNDATION safety instrumented function (SIF) concept will revolutionize the way that end users approach safety and critical control systems.

According to NIST (U.S. National Institute of Standards and Technology), the inability of control systems and operating personnel to control critical conditions costs the U.S. economy at least $20 billion a year.
Changing the Playing Field

• Support of business processes, production management, asset management and enterprise level applications is provided through extensive diagnostics and the alliance with the OPC Foundation and incorporation of OPC UA into the FOUNDATION technology scheme.

• FOUNDATION technology provides enhanced capabilities for tracking, tracing, validation, and regulatory compliance both for continuous and batch/hybrid process industries.

FOUNDATION technology provides a high degree of business intelligence at the infrastructural level through publish/subscribe technology.
Changing the Playing Field

• HSE is really the key to the scalability of the technology because it provides a mechanism to connect multiple H1 segments

• No gateways required between H1 and HSE. Same functionality on H1 & HSE.

• FOUNDATION systems can be expanded without the need to shut down the process.

• Devices can be added or “hot” swapped

• Technology supports online firmware downloads and upgrades.

FOUNDATION technology offers unlimited scalability, and can be implemented from the smallest to the largest process automation systems.

The openness of FOUNDATION technology and its non-reliance on a particular operating system or supplier platform make it easy to adopt new standards.
Changing the Playing Field

AN AUTOMATION INFRASTRUCTURE FOR OPERATIONAL EXCELLENCE
Would you buy a brand new car based on 1985 technology?
12 MPG, no air bags, Carburetor, mechanic must troubleshoot by trial and error, shade tree mechanic

Or would you prefer 2007 technology?
Hybrid 45 MPG, Front and Side air bags, Fuel injection, Electric assist, GPS, OBD II diagnostics, factory trained technicians
What about Diagnostics?

Other bus technologies
May have similar diagnostics but you can only get them by request. Requesting diagnostic data from all plant devices over slower networks creates a bottleneck.

FOUNDATION Fieldbus
Diagnostic Data is “pushed” with every transmission not “polled” making predictive maintenance a reality.
Environmentally Friendly Technology

Reduction in Hardware =
Smaller footprint for System
Fewer Panels and cabinets
Smaller room required to hold equipment
Less heat and air conditioning
Lower power consumption
Distribution of Device Types

284 Unique and 425 Total Products Registered

Legend:
- Analytical
- Controller
- Flow
- HSE LD
- Level
- Other
- Pressure
- Temperature
- Valve
- Power Supply
- Power Conditioner Type 1
- Power Conditioner Type 2

Fieldbus End User Seminar
2007

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Market Share

Who’s Changing the Playing Field?
Global Market Distribution

Data from ARC

NA 27%
EMEA 44%
AP 24%
LA 5%
Industry Market Distribution

Data from ARC
Automation must provide solid business value benefits:

- enhanced asset availability
- return on assets
- reduced lifecycle cost
- other strategic and financial objectives
Capital Savings (CaPex)

Savings in engineering & design..................... 50%
No additional cost in documentation........... 85%
Savings in commissioning & start up......... 80%
Reduced overall start up time.................... 72%
Reduced wiring cost................................ 77%
Savings due to reduced footprint.............. 77%
Achieved return on investment in less than two years.............................................. 75%

Data from ARC
Operational Savings (OpEx)

Enhanced device diagnostics ........................................ 90%
Enhanced process diagnostics ...................................... 72%
Reduction in unnecessary trips to field .......................... 72%
ID problems before they happen .................................... 70%
Tighter control of the process ....................................... 60%
Enhanced effectiveness of the system ............................. 61%
Increased system availability ........................................ 59%
Operator effectiveness enhanced .................................... 85%
Ease of device replacement .......................................... 85%

Data from ARC
Core Business Value Proposition

At ARC, we see the same business issues being mentioned repeatedly in the process industries:

- increasing process availability
- need for actionable business intelligence
- need for a common environment that can be scaled down to very small process applications or scaled up to large, critical applications that require integration of multiple control domains

✓ FOUNDATION Technology addresses all three of these issues, and should be approached as a system in order to achieve the benefits.
2007 Seminars

**Europe/Middle East**
- Neuss, GER - Jan
- Maul, GER – Feb
- Bolton, UK – Feb
- Middlesborough, UK – Feb
- Denmark - Mar
- Kuwait - April
- (3) Netherlands – April
- Hanover, GER – April
- Belgium – TBD
- France – May
- Hungary – Oct
- Italy – TBD
- Bahrain - Dec

**Americas**
- Sarnia, ON - Feb
- Lake Charles, LA - March
- Boston, MA - April
- Long Beach, CA - May
- Calgary, AB - June
- Sao Paulo, Brazil - July
- Overland Park, KS - Sept
- San Juan, PR - Oct
- Greenville, SC - Nov

**Asia Pacific**
- Melbourne, AUS - March
- Perth, AUS - March
- DalianCan, China - June
- Beijing, China – July
- Chengdu, China - November

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Regional Training Centers
Technology Update
### SYSTEM ARCHITECTURE
- System Architecture

### FUNCTION BLOCKS
- Function Block Part 1 – Model
- Function Block Part 2 – Basic
- Function Block Part 3 – Advanced
- Function Block Part 4 – Multiple I/O
- Function Block Part 5 – Flexible

### DEVICE DESCRIPTION
- Capability File
- DD Language (DDL)

### UTILITY
- Common Download

### H1 FIELDBUS (31.25 KBIT/S)
- Network Management
- Data Link Services
- Data Link Protocol
- Fieldbus Message Specification
- Fieldbus Access Sublayer
- System Management
- Profile

### HSE FIELDBUS (100 MBIT/S)
- Ethernet Presence
- Field Device Access
- System Mgmt
- Redundancy
- Network Mgmt
- Profile

### SIF REQUIREMENTS
- Safety Requirements Specification

### SIF SYSTEM ARCHITECTURE
- SIF System Architecture Overview

### SIF FUNCTION BLOCKS
- SIF Application Model

### SIF FIELDBUS (31.25 KBIT/S)
- SIF Protocol
SIF Demonstration

- Catalyze Development of Critical Mass of SIF Products
  - Development of Best Practices and Guidelines
  - Quantify Reduction in Total Cost of Ownership
    - CAPEX - Less Hardware, Less Power, Smaller Footprint, Faster Commissioning
    - OPEX - Advanced Diagnostics, Reduced Test Interval, Improved Asset Management

**Demonstration Sites**
- BP – Gelsenkirchen, Germany
- Chevron – Richmond, CA
- Saudi Aramco – Dhahran
- Shell Global Solutions – Amsterdam

<table>
<thead>
<tr>
<th>SIF Logic Solvers</th>
<th>SIF Transmitters</th>
<th>SIF Valves</th>
<th>SIF Consultants</th>
<th>Other Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerson</td>
<td>ABB</td>
<td>BIFFI</td>
<td>Risknowlogy</td>
<td>Fieldbus Diagnostics</td>
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<tr>
<td>HIMA</td>
<td>E+H</td>
<td>Emerson</td>
<td>TÜV</td>
<td>Moore</td>
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<tr>
<td>Honeywell</td>
<td>Emerson</td>
<td>Metso</td>
<td></td>
<td>MTL</td>
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<td>Invensys - Triconex</td>
<td>Magnetrol</td>
<td>TopWorx</td>
<td></td>
<td>P+F</td>
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<td>Yokogawa</td>
<td>Moore</td>
<td>Westlock/Tyco</td>
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<td>Softing</td>
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2007
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SIF Demonstration Schedule

2006
✓ Full Team Kickoff – Hosted by Shell Global Solutions Amsterdam  Apr
✓ Full Team Meeting – Hosted by Shell Global Solutions Amsterdam  Sep
✓ SIF Management Team WebEx  Nov

2007
✓ SIF Management Team WebEx  Jan
✓ SIF Management Team WebEx  Feb
✓ SIF Management Team WebEx  Mar
✓ SIF Management Team WebEx  Apr
✓ Full Team Meeting – Hosted by ABB Instruments Lenno, Italy  May
■ Beta SIF Devices delivered to End User Demo Sites  4Q

2008
■ Demonstration and Press Day at Shell Global Solutions - Amsterdam  May 19-20
■ Lab Evaluations Complete  mid year
■ First FF-Registered, Safety-Certified SIF Products  3Q
■ Saudi Aramco and Shell Plant Evaluations Complete  Dec
EDDL Cooperation Phase 1

Phase 1 - Completed

- Graphing – Use EDDL for graphical display of static Y-t and XY data
- Charting – Use EDDL for graphical display of real-time data from device
- Enhanced User Interface – Use EDDL to describe screen layout
- Enhanced Data Storage - Use EDD to securely store data on the host

Phase 1 Technical Specification is IEC 61804-3
Phase 1 Interoperability Guideline is IEC 61804-4
EDDL Cooperation Phase 2

Enhanced Procedural Support for Complex Devices

Access to Multiple Blocks Off-Line Configuration Modular Devices

Step 1 – Data Acquisition
- Trend/Historian
- Operator HMI
- Configuration/Maintenance

Step 2 – User Interface
- Remote I/O
- Complex Devices
- Web Services
- OPC UA Protocol
- OPC UA
- EDD
- EDDL Cooperation Project
- HSE, Profinet Protocol
- Client Applications
- OPC UA Clients

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EDDL Phase 2 Schedule

2006
✓ Specification development meeting hosted by PNO  Jan
✓ Specification development meeting hosted by HCF  Mar
✓ Specification development meeting hosted by OPCF  Jul
✓ Specification development meeting hosted by PNO  Aug
✓ Specification development meeting hosted by FF  Sep
✓ Validation of Access to Multiple Blocks with IDE  Dec
✓ Begin Validation of OPC UA Step 1 Information Model  Dec

2007
✓ Specification Development hosted by HCF  Jan
✓ Specification Development hosted by FF  Mar
  ✓ Begin Development of OPC UA Step 2
✓ Specification Development hosted by PNO  May
■ Specification Development hosted by OPCF  Jul
EDDL Cooperation Team
Rivals Join Efforts

- March 6, 2007: FDT Group and ECT agree to work on unified solution for device integration
- FDT Group will join ECT as a voting member

Front Row: Hans Georg Kumpfmueller (Siemens), Ron Helson (HCF), Flavio Tolfo (FDT Group), Martin Zielinski (Emerson), Dieter Schaudel (E+H)

Back Row: Edgar Kuester (PNO), Klaus Peter Lindner (E+H), Richard Timoney (FF), Thomas Burke (OPCF), Achim Laubenstein (ABB)

Not Shown: Hartmut Wuttig (ABB), Helmut Walraffs (Invensys)
Current Situation

- Platform independence
- Robustness
- Ease of use
- Uniform look and feel

+ Flexibility
+ Unlimited Functionality
+ Unique Features
+ Nested Communication

But two Technologies means twice the effort
Field Device Integration Framework

DOM: Device Operation Model; DIM: Device Integration Model
Why Join Together?

Combine the benefits of both technologies into one common standard

- Platform independence
- Robustness
- Ease of use
- Uniform look and feel
- Flexibility
- Unlimited Functionality
- Unique Features
- Nested Communication

One Solution means also only one development effort
Common Objectives

- Client server architecture using OPC-UA technology
- Platform and operating system independent
- Backwards compatible with existing EDDL and DTM based device descriptions
- Applicable to any field device communication technology
- Applicable for hierarchical and heterogeneous network topologies
- Open specification that will become an international standard
Timing and Ownership

- Technical team will be established to develop specification based on end user use cases
- Goal is to have draft specifications and prototypes developed by the end of 2008
- The ECT will maintain ownership and development of this field device integration model (FDI)
OPC UA Client Applications

- Simple and complex device integration requires only EDDs
- Advanced requirements may need Optional OPC Device Application

Step 1 – Data Acquisition

HMI, Trending, Diagnostic Applications

Step 2 – User Interface

Optional OPC Client Device Application

OPC UA Interface

OPC Unified Architecture (OPC UA)

Simple Devices

Complex Devices

OPC UA Interface

EDD  EDD  EDD  EDD
Standard Transducer Blocks

- Pressure Block Completed and in ITK 5.0

Next Blocks for Final Specification Release
- Temperature

- Flow
- Positioner with Partial Stroke Testing
- Standard Diagnostics (based on NE107 requirements)
System Integration and Maintenance (SIM) Working Group

- HIST support for ITK 4.6 and 5.0 (and future versions)
- HIST profiles/classes for mandatory and optional features
- Interoperability and Versioning guideline for DD technology.
- Roadmap for introduction of enhanced DD technology which includes:
  - ITK 5.0 with support for new DD extensions (improved testing)
  - HIST with support with new DD extensions (improved testing)
  - Develop HIST revision strategy
Wireless Concept Study

☑ Develop use cases and requirements for device wireless communication in monitoring, control and safety applications that is interoperable using function blocks and EDDL. Use cases and requirements for host wireless applications such as hand held configuration and maintenance devices may also be developed.

☒ Develop an implementation plan which includes:

- Solutions to the use cases and requirements using wireless communications technologies developed in accordance with ISA SP100 and future IEC work. The solutions must include requirements for device interoperability and network configuration.
- Development and validation of profile specifications
- Development of device interoperability test and registration procedures
HSE-Remote I/O

- Develop use cases and requirements for High Speed Ethernet Remote I/O (HSE-RIO) including discrete I/O and gateways to other lower level networks (e.g. HART, Profibus, Modbus, ASI, DeviceNet, etc.) that are interoperable using function blocks and EDDL. Use cases and requirements for related applications may also be developed by the team.

- Develop an project plan for HSE-RIO

- Obtain Technical Steering Committee (TSC) approval and execute the project plan

- Demonstrate interoperability of HSE-RIO devices at end user sites.
So where’s this going?

Market Research Results
ARC study: *Fieldbus Foundation dominates fieldbus protocols in process industries*

- Survey shows fieldbus protocols have gone “mainstream”
  - Process fieldbus market reached USD $831.7 million in 2006
  - Market covers protocols included in the IEC 61158 standard
  - FOUNDATION technology accounts for over two-thirds of process fieldbus revenue
ARC study: *Growth will expand fieldbus market to USD $2,279 million by 2011*

Fieldbus Foundation leadership will increase with double-digit growth rate

FOUNDATION technology no longer confined to early adopter industries; it is becoming the “solution of choice” in power, pulp & paper, pharmaceuticals, etc.

- Members report fieldbus sales increasing
- Fieldbus is now major portion of supplier business activity
Latest Market Research (Cont’d)

- ARC study: *Fieldbus has made its way into process automation culture*
- Users moving beyond early “nuts and bolts” concerns to achieve lifecycle benefits
  - Plants are realizing Op. Ex. advantages due to quality improvements
  - Improved maintenance and operations productivity are greatest benefits to date
Latest Market Research (Cont’d)

- ARC study: *Worldwide fieldbus growth attributed to robust functionality*

- Fieldbus will expand in functionality to fit broader range of applications
  - Integration of field data with asset management applications
  - Connectivity to safety systems via technologies such as OPC
ARC study: **Key fieldbus advantages exist in maintenance and operations**

- Technology is not a cost saver, but an enabler of increased asset management effectiveness
  - Significantly lower operating costs
  - Increased operational excellence
ARC study: Brazil, Russia, India and China will be fastest growing markets

Asia/Pacific will be “fieldbus growth engine” like automation industry at large
- Estimated CAGR: 32%

Latin America will also see rapid adoption of combined IEC protocols
- Estimated CAGR: 34%
Latest Market Research (Cont’d)

- ARC study: *Value proposition of fieldbus is powerful in hybrid industries*
  - Food & beverage
  - Pharmaceuticals

- Technology is key to integrating lower-speed field device networks and high-speed control networks
Thank You for Helping Us Change the Playing Field!
Workshops

Changing the Playing Field

- Open Scalable Integration
- Business Intelligence
- Process Integrity