Main Automation Contractor utilization of

SmartPlant®
Instrumentation

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Implementation Team

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INTERGRAPH

Main Instrument Vendor (MIV)

Main Instrument Vendor

- The intent is to provide and deliver specified Control Systems commodity equipment as defined in the project scope of work. Responsibilities will include the Control Systems equipment engineering support, Control systems commissioning as well as supporting "Plant Startup and Commissioning" .

Why use a MIV?

- **The MIV scope of work and responsibilities are to:**
  - Engineer and supply the specified Electrical equipment
  - Provide technical integrity for the scope of supply
  - Ensure consistency of design
  - Execute scope within schedule and budget
- **The main objectives of the MIV concept are to:**
  - To provide cost savings
  - To execute the project within schedule and budget
  - To utilize available technical resources, skills and expertise of the MIV provider
  - Provide a single point of contact for Control Systems equipment supply
  - Uniformity of Equipment and consistency in documentation

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Main Automation Contractor (MAC)

Main Automation Contractor

•The intent of the MAC is to deliver a complete and operating integrated automation solution which will monitor, control, ensure plant and asset safety, manage plant operations and business objectives.

Why use a MAC?

- **Accountability** – Acts as a single point of accountability for entire automation scope.
- **Experience/Knowledge** – Makes use supplier's expertise in their core area of capability.
- **Integration** – Purchased solutions, not individual components
- **Leverage** – Leverages size and scale in the market (eg. Incremental initial cost savings of +/- 20% over conventional individual bids)
- **Reduced risk** – Improved interoperability of "smart" components critical to guarantee proper connectivity and operability.
- **Total Cost** – Aftermarket and life cycle costs are typically included in scope

Where has it been successful?

- Huntsman, Shell, BP, ExxonMobil and others

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Main Automation Contractor (MAC) Scope

Careful consideration in scope definition is necessary due to:

- Scope size can reduce number of capable suppliers
- Scope definition may result inferior supplier specific products and services

	Percent of Instrument
CONTROL VALVES	24.0%
DCS	22.3%
TRANSMITTERS	11.6%
PLC's (SAFETY SHUTDOWN)	10.8%
GAS CHROMATOGRAPHS	7.7%
LEVEL INSTRUMENTS	6.4%
AUTOMATED VALVES	3.8%
ANALYZERS (GENERAL)	4.3%
FLOW INSTRUMENTATION	2.5%
CORIOLUS METERS	0.8%
PRESSURE INSTRUMENTATION	1.6%
TEMPERATURE INSTRUMENTATION	0.8%
GENERATORS	0.9%
ROTOMETERS	0.8%
ORIFICE PLATES	0.7%
MISC. INSTRUMENTATION	1.2%
TOTAL	**100.0%**

Services range from Engineering to Construction and aftermarket support.

Goods range from DCS through field sensors Up to +/-70% of typical green field instrument spend could be included.

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Typical MAC Scope of Supply (Goods)

A - Distributed Control System –

1. Controllers, servers, power supplies, I/O cards, highways, etc.
2. Graphic and Database development
3. Factory acceptance test, start-up and commissioning

B – Flow Transmitters and Elements

1. Differential Pressure Transmitters (including manifold)
2. Vortex meters
3. Magnetic meters
4. Ultrasonic meters
5. Orifice plates and hookups

C – Level Transmitters

1. Differential pressure
2. Radar
3. Float
4. Exception: Nuclear Level

Typical MAC Scope of Supply (Goods)

D – Pressure Transmitters

E – Temperature Transmitters and elements including thermo-wells

F – Control Valves

1. Positioner
2. Accessories
3. Exception: Sliding gate, Special angle valves

G – Equipment Health Management System

1. AMS

H - Safety Instrumented System

I – Operator Training System (Optional)

J - Fire and Gas Detection System (Optional)

K – Analyzers (Optional)

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Typical MAC Scope of Supply (Services)

A – Functional Design Specification Development (FEED)

1. **SPI** Database design (naming convention, interface requirements, testing requirements, etc.)
2. **SPI** Database Hosting and management for multiple EPC's
3. Network design (security strategy, software patch management, etc.)
4. Operator Interface design (graphics, alarm strategy, hardware layout, etc.)

B – Detailed Design

1. Safety reviews participation (HAZOPs, SIL Studies, etc.)
2. DCS Configuration, programming and graphics
3. General engineering, system hardware and fabrication
4. Field Instrumentation (sizing, selection)
5. DCS Loading and I/O Marshalling using INtools (**SPI**)

C – Project Management

1. Produce and update automation schedule
2. Review or issue purchase orders and quotations (expedite if needed)
3. Manage automation project staffing and budget (status reports, project reports, etc.)

Typical MAC Scope of Supply (Services)

D – Construction

1. Participate in equipment inspection and testing during Factory and Site Acceptance Testing
2. Develop and conduct interoperability tests
3. Provide construction consultation and oversight

D – Commissioning and Training

1. Produce Start-up check lists.
2. Conduct operator, technician and engineering training on **SPI** and Automation systems
3. Participates in commissioning and start-up activities.

E – Post Project Support (1st year)

1. Provide 24x7 Emergency support and back-up.
2. Develop Spare Part Management requirements and program
3. Develop Preventative Maintenance program for **SPI** and Automation systems
4. Develop testing program for **SPI** and Automation systems

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Typical Automation Responsibility Matrix

DELIVERABLE/Task	PMC	EPC	MAC	Owner
Program Automation MOC - procedure	P	R	R	A
Program Automation Specifications-Updates	P	S	S	A
Operator Training Simulator	P	S		A
Program Instrument legends and symbols	P	S		A
Program INtools Seed files and templates	P		S	A
Automation Responsibility Matrix-Update	P			A
Business Network design	P			S/A
Program Automation document register	P			S
Program Automation MAC Bid	P			A
Program Automation Safety review-CHAZOP	P			S
Project Automation Schedule	R	P	S	A
Legacy system revision/migration planning	R		P	A
Program Automation Function Specification	R		P	A
Program Automation Control Network design & system architecture	S	R	P	A
Program Automation Schedule	S	R	P	A
Program Automation Peer/risk review	S			P
Project Process Control strategies and Cause & Effect diagrams		P	S	A

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P = Primary Responsibility S = Support Responsibility R = Review A = Approve

Automation Responsibility Matrix

DELIVERABLE/Task	PMC	EPF	MAC	Owner
Safety Requirement Specification (SIL Analysis, SIS design, etc.)		P		S
Program Maintenance AMS strategy/implementation			P	S/A
Initial estimate DCS and SIS power,heat,weight calc			P	
Program Automation system configuration toolkit			P	S
Reliability and availability calculation			P	
Project Graphics layout		P		S/A
Program INTOOLs database - master/central	P	S		A
Project SIS design validation	P	S		A
Project Alarm Response Manual	R	P	S	A
Program /Project SAT Procedure	R	R	P	A
Program/Project FAT Procedure	R	R	P	A
Project Automation Spare Parts List	R	S	P	
Interface requirements/ testing	S	S	P	A
Project INTOOLs database-client		P	S	R
Project Automation Detail Design		P	S	
Project Master Instrument list		P		R
Project Graphics (Configuration and Build)		S	P	A
Instrumentation Selection - final datasheet spec		S	P	A

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Automation Responsibility Matrix

DELIVERABLE/Task	PMC	EPF	MAC	lOwner
Project configuration of control system		S	P	
Project Data Historian - PI inside		S	P	A
Project Fieldbus Segment design		S	P	A
Automation system Basic Training			P	
Program Automation combined Spare Parts Strategy	P		S	A
Program Data Historian - Master/Central	P		S	A
Project QA/QC inspection and documentation	R	P	S	
Project Process Control System Documentation	R	S	P	A
Program Automation- Back-up Procedure	R		P	A
Program Automation- Disaster Recovery Procedure	R		P	A
Program Alarm KPI - web accessed	S		P	A
Systems integration	S		P	
Project FAT Witnessing		P		S/A
Project SAT Witnessing		P		S/A
Program SIS Turnover compliance documentation	P	S	S	A
Production Reports - web accessed	P			A
Project Automation As Builts		P	S	
Pre-Start up Engineer and technician training			P	
Pre-Start up operator training			P	
Project control loop tuning			P	S
Technical support			P	

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Timing is everything

- High growth period for EPC business market and their Suppliers
- The execution of numerous grass-roots mega-projects simultaneously
- Project locations throughout the world with little or no existing infra-structure
- Project cycle times may be very short
- Limited internal resources
- Multi EPC Involvement

Owners must work more efficiently to manage project activity levels

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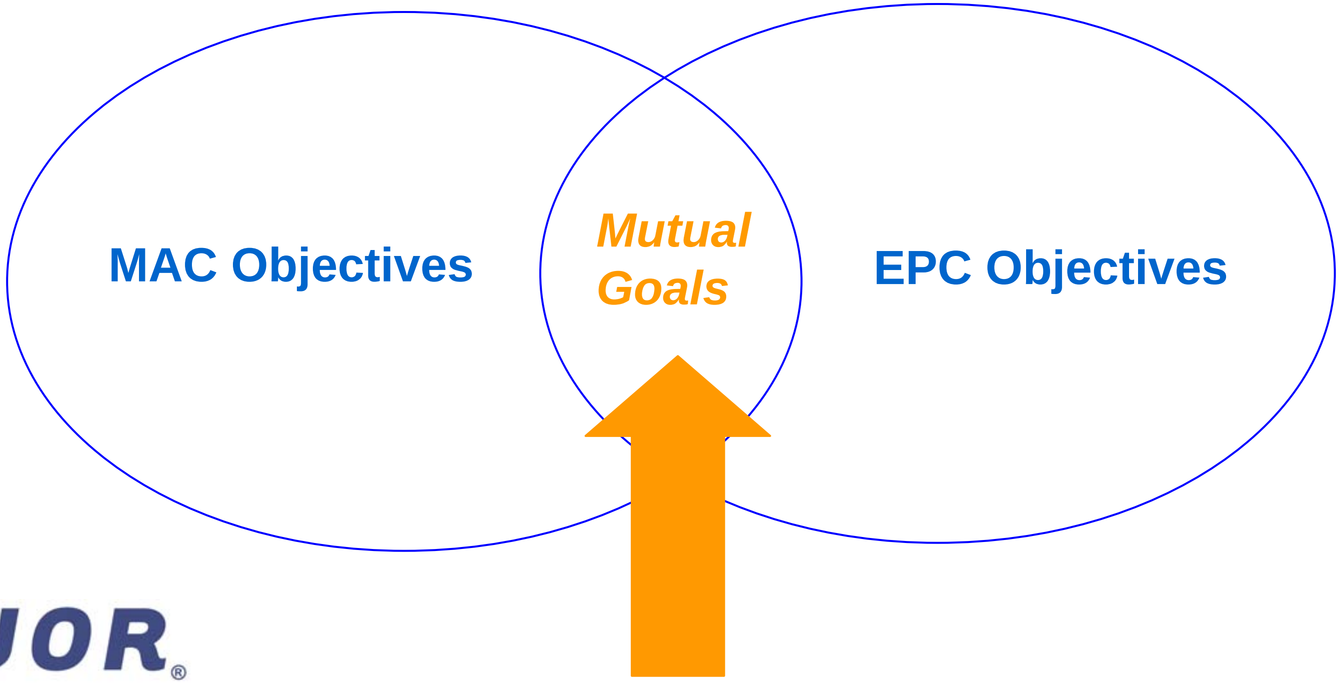
MAC Selling Strategy

- Joint Project Execution
- Different market place selling technique
- End User receives more than just products
- Contracting terms should be established prior to execution to support calculations – not negotiations



A Fit for all Projects?

- **MAC evaluation process**
  - 95% of Western Europe and North America projects are modernization and revamp
  - Do not usually have EPC involved
  - Suppliers have to have capability to support these brown-field projects
  - EPM and EPC will need to develop minimum criteria to consider MAC concept for projects
  - Must be financially viable (large project TIC)
  - Should be repeatable (if single, smaller TIC)
  - Client is “mega” Buyer of EPM services and products

~15% of prospective projects may be potential for MAC

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Common Scenarios for Selection

Project Client

Framework Agreement

Main Automation Contractor

PMC or EPC

Project Client

Prime Contract

PMC or EPC

Main Automation Contractor

SUB Contract

Lessons Learned

- **Mutual Expectations**

  Understanding and managing expectations between the MAV and other parties is very important . What each party brings to the table and what each party is expected to do should be clearly communicated and understood to avoid misunderstanding. The learning curve has to be shortened and meshing of the many cultures of client, contractor and MAC has to be achieved quickly.

- **Objective**

  Objectives of MAC and Contractor could be different, and may not be shared objectives for the project. One party may be interested in selling more products or services while the other party may not need these services. Also MAC has to be objective and use the best solution possible, not just provide the solution favorable to them.

Lessons Learned

- **Resources**

  Resources must not be allocated to other objects, which may impact or jeopardize project. MAC must have enough resources or backup to address normal manpower turnovers and unexpected work load management, It may be necessary for the Contractor to provide, support, add experience and other resources, which MAC may lack.

- **Costs**

  Cost management is a key lesson as well. MAC and contractor must work together, mutually to keep costs under control and communicate very openly and honestly, and discuss work processes or deliverables, in order to minimize or avoid rework, or wasted effort. It may be necessary to review and manage work processes where costs are kept under control

Lessons Learned

- **Communication**

  Communication in a team relationship with MAC and Contractor is also extremely important. There should be no surprises. MAC and Contractor has to work as team, and each team member must know what other is doing, and what is expected, what needs to be done, and what is not needed. They must be flexible to each others needs relating to information, data, timing and wasted effort.

- **Use of SmartPlant Instrumentation**

  Control and access to the **SPI** database needs to reside with the entity with the most expertise. When sharing **SPI** resources the . MAC and Contractor has to work as team, and each team member must have the **SPI** skills to support their portion of the work. A comprehensive **SPI** implementation plan must be defined so all players know what their work area and what deliverables they are expected to produce with **SPI**

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Remote Connection to SPI

- The following slides represent some data associated with operating SPI Remotely in an Owner/Operator Mode.
- What are Owner Operators doing now?
- Project costs related to Remote access
- Remote access to SPI database via Citrix or MS Terminal Services
- Citrix Vs MS Terminal Services Costs
- Remote SPI execution Pros & Cons
- Remote access downtime costs

Some of the following information was furnished by Chris Ducote of WINK Companies, Inc.

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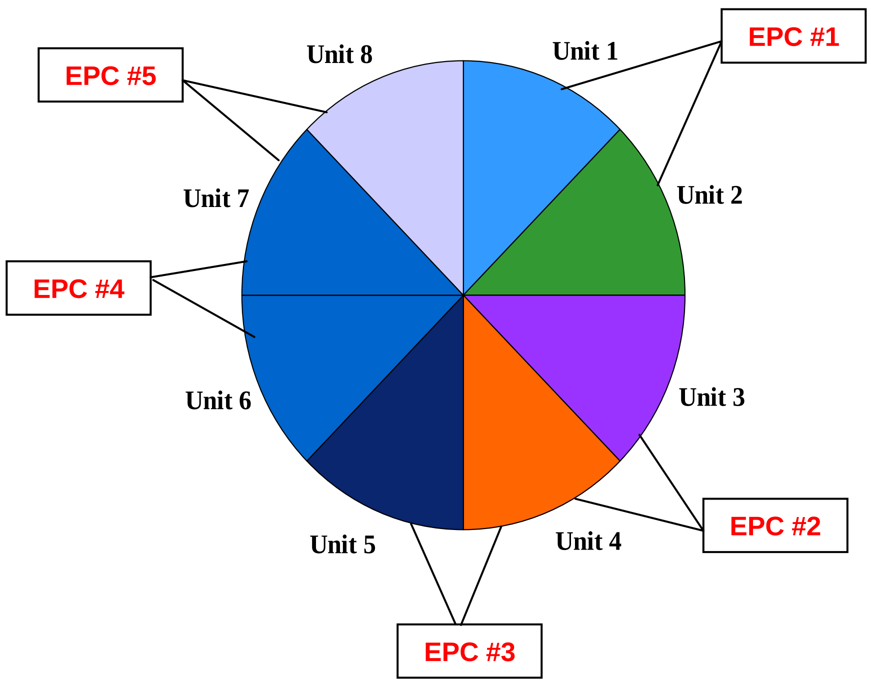
SPI in Owner Operator – As Built Mode

SPI Database
Operating Owner



MAC will work across all Units

WHAT ARE OWNER/OPERATORS DOING?

Of ten Owner/Operators considered…

- **Two of them are operating in Engineering Mode**
  - Executing projects via dial-in connection
  - Using Citrix Metaframe servers
- **Two of them are operating in Engineering Mode**
  - Executing projects on backup seed files
  - Using Citrix Metaframe servers
- **Two of them are operating in Operating Owner Mode**
  - Executing major projects via dial-in connection
  - Using Citrix Metaframe servers
- **Two of them are operating in Operating Owner Mode**
  - Executing major projects via dial-in connection
  - Using MS Terminal Services
- **One of them is currently operating in Operating Owner Mode expects 3rd party access via Citrix soon**
- **One of them Executing projects on backup seed files and migrating data into Plant As-Built**

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PROJECT COST COMPARISONS

OWNER/OPERATOR	ENGINEERING COMPANY
◆ Data Migrations – Small projects avg. $10K - $25K – Large projects avg. $50K - $75K	◆ 3rd Party Access – No extra cost involved when moving data
◆ Licensing – Lease – approx. $250/mo. – Purchase – approx. $6K	◆ Licensing – Sufficient licenses are secured for project work for the Owner/Operator
◆ Project Maintenance & Support – An on-site administrator performs these tasks along with outside consulting support. $$$$$$$$$$$$	◆ Project Maintenance & Support – These tasks are taken care of by the Engineering Procurement Company (EPC) for each project

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TERMINAL SERVER vs. CITRIX

Terminal Server

– Access to the user's server "desktop"
  - Network printers may not be available (depending on the Windows Server version)
  - Additional licensing may be needed per user (depending on the Windows Server version)

Citrix Connection

– Citrix is software that is installed on top of and adds additional functionality to Terminal Servers including
  - Improved printing
  - Added security
  - Server management tools
  - Application publishing

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RELATED COSTS

TERMINAL SERVER		CITRIX CONNECTION	
License Needed	**Approx. Cost**	**License Needed**	**Approx. Cost**
◆ Microsoft 2003 Server License	$1029 (includes 5 CAL's)	◆ Microsoft 2003 Server License	$1029 (includes 5 CAL's)
◆ Microsoft Server Client Access Licenses (CAL's)	$799 (Qty. of 20)	◆ Microsoft Server CAL's	$799 (Qty. of 20)
◆ Microsoft Terminal Server CAL's	$749 (Qty. of 5)	◆ Microsoft Terminal Server CAL's	$749 (Qty. of 5)
		◆ Citrix Concurrent User (CCU) License	$350-$600 per user

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3rd PARTY ACCESS

PROS	CONS
◆ Multiple projects can work simultaneously with consistent monitoring	◆ Lost connections result in down time for all projects – Typical downtime ranges from 2-8 hours. On rare occasions, there have been major issues causing downtime of up to 3-4 days. Note: O/O & EPC **must** have strong IT departments capable of diagnosing and repairing issues.
◆ Seamless project execution for all parties	
◆ No external data migrations	
◆ Control of all projects by O/O	

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3rd PARTY ACCESS

Costs associated with downtime vary from project to project. For example, on an example project, a lost connection downtime of 4 hours might end up with a cost of the following…

Project Personnel	# of people	Rate	Hours Lost	Totals
IT Dept.	2	$75	4	$600
Designer	5	$75	4	$1500
Engineer	5	$100	4	$2000
				$4100

Advertised average downtime for most Hosts < 1%

Questions

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