INTRODUCTION
TO
TRAINING IN INDUSTRIAL AUTOMATION

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IndustriConnect Technologies Pvt Ltd.
www.industri-connect.com

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- *WHO WE ARE*
- *WHAT IS AUTOMATION*
- *WHY THESE COURSES ARE ESSENTIAL*
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WHO WE ARE –CORE TEAM MEMBERS

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WHO WE ARE	A group of experienced professionals from Industry, belonging to different engineering disciplines & having served various industry verticals in India and abroad
OUR VISION	To disseminate the knowledge & experience gained by us to students by conducting training programmes & make them industry ready
FOUNDER & DIRECTOR	Name: Vinay Avanchi Qualifications: B.E.(Electrical),M.E.(Control systems) Experience: Around 38 yrs in Industrial Automation Activities Handled: -System design & Detailed Engineering -Project Completions & Commissioning engineering Employers worked with / industries: -S.Korea:Samsung Heavy Industries (www.samsungshi.com/eng) Offshore Oil & gas (FLNG/FPSO hull side) -India: SAIL (Steel & Fertilizer Plants) (http://www.sail.co.in) MECON ltd.(Steel, Chemical & allied industries)(www.meconlimited.co.in) Memberships : Senior member & Programme Manager-Events, International Society of Automation, Bangalore section, www.isabangalore.org.in Fellow, IETE-Institution of Electronics & Telecommunication Engineers, Bangalore section Contact: vinay_avanchi@yahoo.com, vinay.avanchi@industri-connect.com Mob:+91-7760005270

WHO WE ARE –CORE TEAM MEMBERS

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Senior Technical Advisor (Automation)
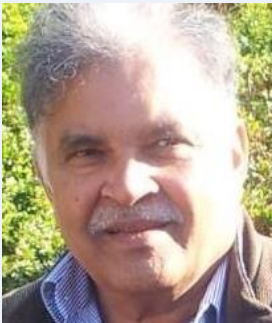
Name: C,B.B. Sarma
Ex. Vice President (Automation & Electrical)
Samsung Heavy Industries, South Korea
Qualifications: MSc. Tech Instrumentation/ Diploma Micro-processors
Experience: Around 44 yrs in Industrial Automation
Activities Handled:
-System design & Detailed Engineering
-FMEA/ Functional Safety/ Onshore/Offshore/Steel Plants/Chemical Plants, Power Management Systems
Employers worked with / industries:
-S.Korea:Samsung Heavy Industries (www.samsungshi.com/eng)
Offshore Oil & gas (FLNG/FPSO hull side)
MECON ltd.(Steel, Chemical & allied industries)(www.meconlimited.co.in)
Memberships : Senior member, International Society of Automation, Bangalore section, www.isabangalore.org.in
Contact: cbbhyd@gmail.com, cbbhyd@industri-connect.com
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WHO WE ARE –CORE TEAM MEMBERS

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MANAGER (AUTOMATION)

Name: SUJIT HARODE
Ex. Manager (ICSS/Automation) E&I Dept. Daewoo Shipbuilding and Marine Engineering
Certified Functional Safety Engineer (TUV Rheinland,Germany)
Certified DCS Programmer (FOXBORO, Invensys)
Qualifications: BE. Instrumentation & Controls (Automation)
Experience: Around 13 yrs in Industrial Automation
Activities Handled:
-Control System design & Detailed Engineering
-Project Completions & Commissioning engineering
-Safety Requirement Specification (SIL/SIS)
-DCS/PLC/Intools- Onshore/Offshore/Refinery/Petrochemical Plant
Employers worked with / industries:
-South Korea : Daewoo Shipbuilding & Marine Eng./ Samsung Heavy Ind. Ltd. /Hyundai Heavy Ind. Ltd
- 	Invensys(Shneider electricals)- India
Contact: sujit.harode@gmail.com, sujit.harode@industri-connect.com
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WHAT IS AUTOMATION

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- There are many definitions found in literature. One of them found suitable to this course is **Creation & application of technology to produce goods & services**:
  - ✓ *With minimum human intervention*
  - ✓ *Ensuring Safety & Efficiency*
  - ✓ *For Monitoring/Controlling/Optimizing equipment/ process/system*
  - ✓ *By Reducing cost, maintaining good & consistent quality and increasing speed*

Confluence of	Technologies involved
Electrical engineering	Sensors & instrumentation
Electronics engineering	Process control & safety systems
Communication science	Expert systems
Measurement & control Eng'g.	Telemetry & communications
Information technology	Robotics
	Cyber security & many more

WHY THESE COURSES ARE ESSENTIAL

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- Smart innovations are increasingly becoming necessary in every segment of the industry that can be thought of today. Few examples

  - ➢ *Oil & Gas, ship building , Continuous & batch process industries*
  - ➢ *Energy & Utilities, Pharmaceuticals*
  - ➢ *Automotive, factories, heavy equipment, industrial machinery*
  - ➢ *Aerospace, marine, defense*
  - ➢ *Smart cities*

- For implementing these innovations, understanding of the concepts of Professional engineering & Management of Automation projects as practiced in the industry is essential.

- Our Training courses aim to provide these concepts to
  - ➢ Students belonging to various engineering disciplines to become industry ready
  - ➢ Industry professionals to enhance their skills to boost their career growth

HOW THESE ARE DIFFERENT FROM OTHERS..

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- Based on the decades of practical knowledge & experience gained by professionals who have worked in various industry segments

- Cover concepts of Professional engineering & Management of real life Industrial Automation projects

  - ✓ *These essentially cover the conceptualization & preparation of Functional documents required during detailed engineering, installation, testing and commissioning phases of any project.*

  - ✓ *These set of documents are **Essential Prerequisites** for any automation system vendor to conceptualize and design the hardware and software aspects of Automation equipment and systems for any given project*

- Include Practical course material & case studies from various Industry segment

- Provide direct interaction with expert professionals through classroom sessions & continued support even after course completion.

BENEFITS TO STUDENTS & INDUSTRY

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- On successful completion of this course students can easily and quickly adopt to actual industry requirements and hence their potential for seeking employment will increase

- Students belonging to Electrical, Electronics, Chemical & Mechanical engineering disciplines will have the following specific benefits:
  - ✓ *They can continue to work in their own disciplines and when required they will find it easy to automate the respective industry segments in which they work*
  - ✓ *Those interested in Automation can further learn more about Automation and switch over to Automation discipline as their career*

- Industries employing these pre-trained students can save considerable time in imparting the in house trainings to these candidates when they are recruited in the respective industries.

WHERE IS AUTOMATION APPLIED

TYPICAL INDUSTRIES FOR EMPLOYMENT

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- Automation vendors
- Engineering Consultancy
- Oil & Gas
- Petrochemicals & Fertilisers
- Chemicals & Pharma
- Mining & Metals
- Energy, Utilities
- Cement
- Paper & Pulp
- Healthcare

- Hospitality Industry
- Industrial Software
- Information Technology
- R & D Labs
- Food Processing
- Construction – Building Automation
- Consumer Goods
- Paints & Dye Stuffs
- Breweries
- Automotive

List of
lustries-few examp

COURSES OFFERED

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Our courses are mainly intended to cover the ***Concepts of Professional Engineering & Management of real life Industrial Automation projects***. These have been designed to meet the requirements of different cross sections of participants right from college students, fresh industry professionals to senior executives requiring more detailed explanations on specific topics of interest

These include:

➤ ***Crash Course*** *(Typically of 5 to 6 hours/day duration for one or two days)*

➤ ***Short course*** *(Typically for 3 hours/day duration in the evening for 5 days)*

➤ ***Regular Course*** *(Typically for 120 hours duration, on week ends, over two & half to three months)*

For details , please refer brochures for respective courses

TYPICAL COURSE MODULES

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1. *Concepts of Design & Engineering*

2. *Standards & Recommended practices*

3. *Interdisciplinary coordination*

4. *Vendor Management*

5. *Installation, testing & Commissioning*

TYPICAL DESIGN & ENGINEERING DELIVERABLES

DCS & Field Instrumentation Engineering

- Tagging
- P&ID
- I/O list
- Function specifications & Control Logics
- Cause & Effect diagrams
- Mimic diagram
- FF segment design
- Loop schematics
- Interface definition with 3rd party control system

- FMEA reports (By others)
- Instrument data sheets
- Cable & JB schedule
- External connection
- T/W wake frequency calc.
- IS Loop calculations
- Voltage drop calculations
- Hook up drawings
- Orifice & Control valve sizing
- Control room layout

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TYPICAL DESIGN & ENGINEERING DELIVERABLES

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Safety Systems Engineering

- Tagging
- HVAC D&ID(Ducting & Instrument)
- I/O list
- Function specifications & Control Logics
- Cause & Effect diagrams
- Mimic diagram
- Loop schematics
- Interface definition with 3rd party control system

- Field detector(F&G) data sheets
- Fire panel Interface
- Cable & JB schedule
- External connection
- IS Loop calculations
- Voltage drop calculations

TYPICAL DESIGN & ENGINEERING DELIVERABLES

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Package Systems Engineering

- Tagging
- Package P&IDs
- I/O list
- Function specifications & Control Logics
- Cause & Effect diagrams
- Mimic diagram
- FF segment design
- Loop schematics
- Interface definition with DCS/ESD/F&G system

- Instrument data sheets
- Cable & JB schedule
- External connection
- IS Loop calculations
- Voltage drop calculations
- Hook up drawings
- Orifice plate & Control valve sizing

TYPICAL DESIGN & ENGINEERING DELIVERABLES

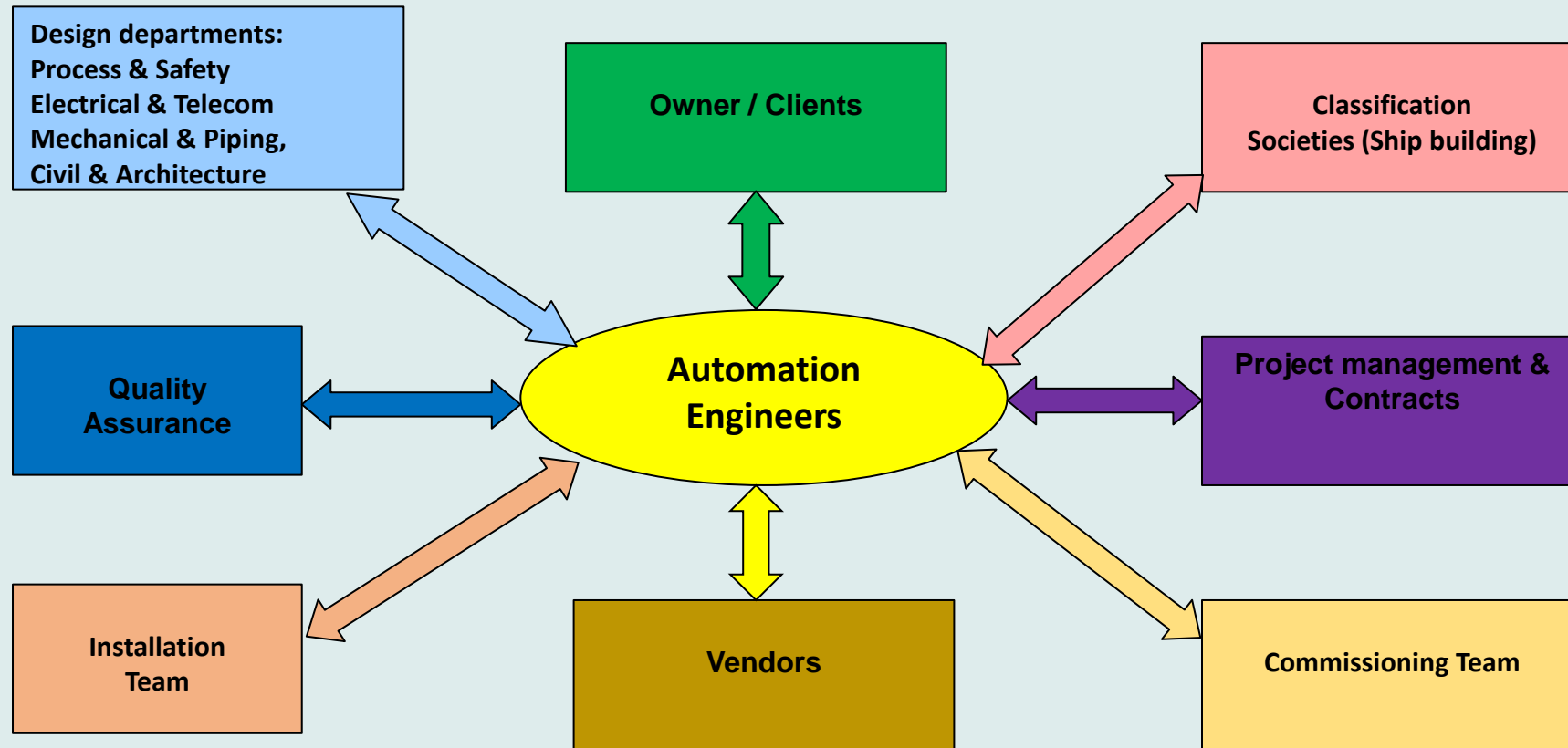## Completions and Commissioning Engineering

Completions philosophy

- Setting up of Completions Database (CD)
- System subsystem definition
- Colour marked up boundary documents
- Population of CD
- Mechanical Completion Work Packs (WP)
- Pre-Commissioning WP

- FAT procedures(by vendors)
- SAT procedures(by vendors)
- Commissioning Test Procedures for ICSS
- Commissioning Test Procedures for process & utility systems
- Operation Manuals(By outside agencies)
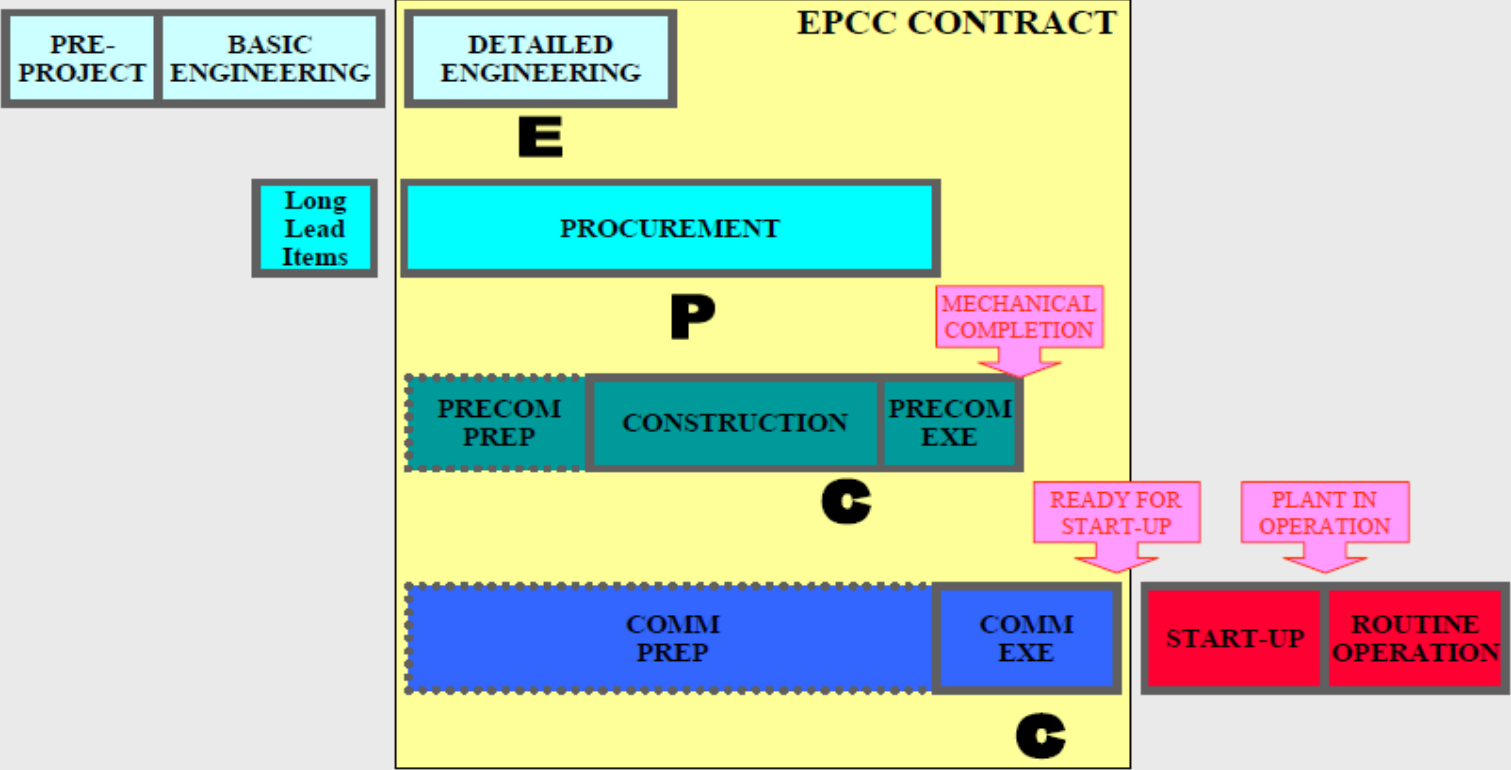- FMEA proving procedure(By others)

INTER DISCIPLINARY COORDINATION

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Typical example

Design departments:
Process & Safety
Electrical & Telecom
Mechanical & Piping,
Civil & Architecture

Owner / Clients

Classification Societies (Ship building)

Quality Assurance

Automation Engineers

Project management & Contracts

Installation Team

Vendors

Commissioning Team

BRIEF EXPLANATION OF MAJOR DELIVERABLES

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Tagging philosophy	*It defines:* ➤ *List of items to be tagged* ➤ *Procedure of tagging*
Function Design specifications / Control Narratives / Function Analysis Specifications	*Most important document which defines the functional requirements of Automation. Based on this, the ICSS vendor develops the application software. As a minimum, it includes:* ➤ *Description of the process system* ➤ *Reference to P&IDs* ➤ *Block diagram of system control* ➤ *Shutdown signals* ➤ *Control philosophy and control tables* ➤ *Control logic flow chart*

BRIEF EXPLANATION OF MAJOR DELIVERABLES

I/O list	1. Hardwired I/O & Serial I/O
	➢ Switchboard interface
	➢ Process
	➢ Vendor package
	2.Inter-node I/O
	This is prepared to help the ICSS vendor to see that unnecessary traffic on the internode bus is avoided
Cable Voltage drop calculation	This is done to decide the size of the cables that energize the solenoid valves, MCC relays etc
IS loop calculations	This is done to prove that the cable used and its length does not dilute the IS rating of the barrier.

BRIEF EXPLANATION OF MAJOR DELIVERABLES

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Thermo well(TW) wake frequency calculation	*To ensure that the designed TW can withstand the stresses that it will be subjected to when it is subjected to process flow in pipeline. TW that are exposed to flow can fail if the wake frequency comes within 20% of the natural frequency. Wake frequency calculations are executed per ASME PTC19.3 TW-2010 Stnd.*
Completions database	*A Software tool for executing installation, testing and commissioning activities. It is populated on an individual Tag basis by inputting all the information relevant for the particular tag. Once populated, various check and test sheets can be printed out for carrying out installation, testing and commissioning. It also has the provision to generate progress reports, punch list management, issue the required certificates etc.*

BRIEF EXPLANATION OF MAJOR DELIVERABLES

Commissioning Test Procedures(CTP) for ICSS	These are prepared based on the SAT procedures furnished by the ICSS vendors.
	It involves the procedure for carrying out the following activities and is done prior to the loop test activities
	➢ Installation checks
	➢ Powering up
	➢ Hardware testing
	➢ Software testing
Commissioning Test Procedures(CTP) for Process systems	Each Process system that is controlled by ICSS has to be commissioned following a CTP. This is developed by process engineer, with the assistance of Automation engineer.

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BRIEF EXPLANATION OF MAJOR DELIVERABLES

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Operation Manuals	*Provides an understanding of how the FPSO systems have to be operated in detail and to guide the production personnel in their operations. It can also be used as a training guide before start-up*
FMEA (Failure Mode & Effect Analysis) Reports & Proving procedure	*A systematic analysis of the systems to demonstrate that no single failure will cause an undesired event. It identifies potential design and process failures before they occur and to minimize the risk of failure by either proposing design changes or, if these cannot be formulated, proposing operational procedures.*
	FMEA proving procedure is also developed to prove the FMEA Analysis carried out.
	These are very specialized deliverables and are normally carried out by third party agencies.

SAMPLE DELIVERABLES-P&I DIAGRAM
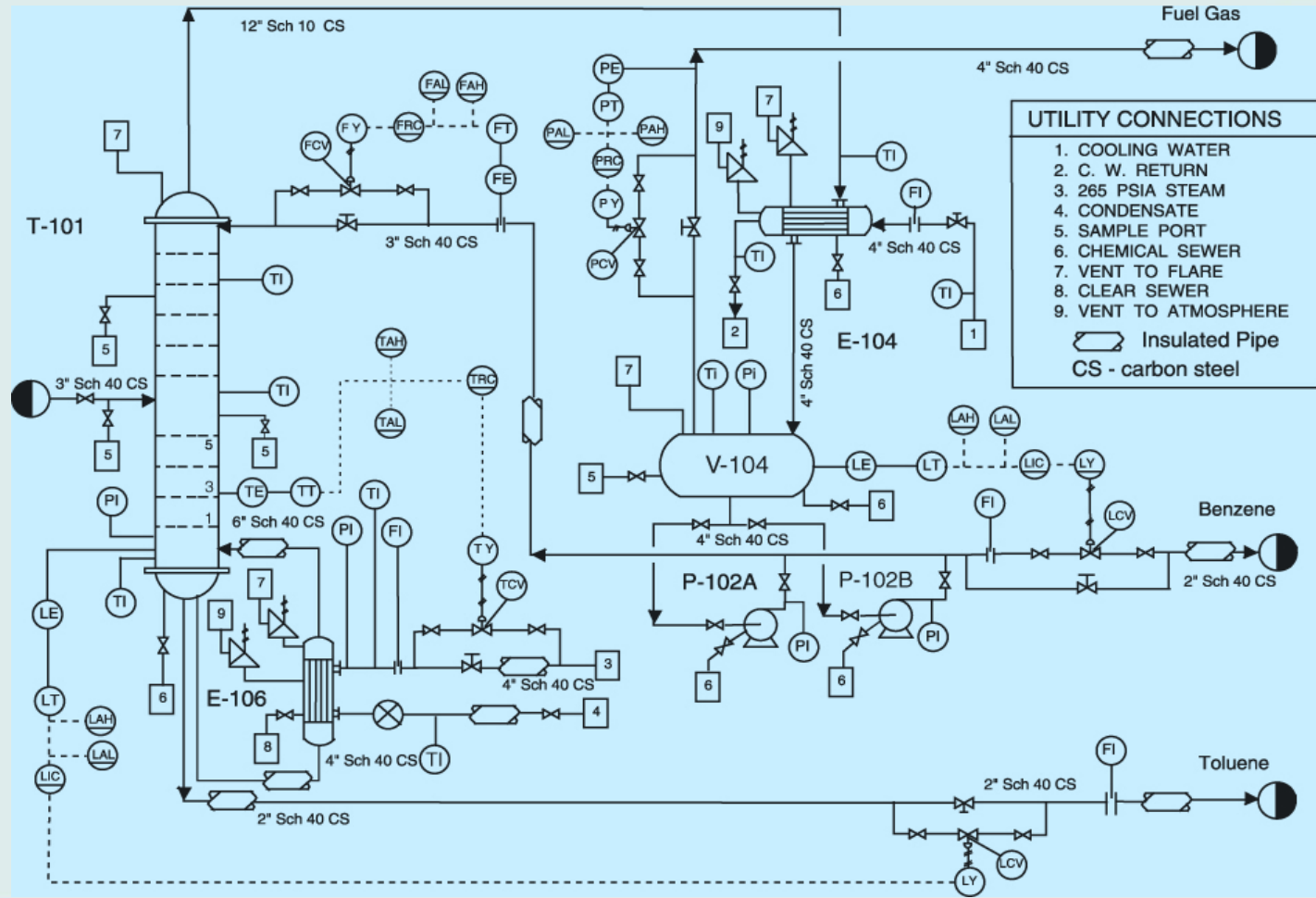
SAMPLE DELIVERABLES-ARCHITECTURE DIAGRAM
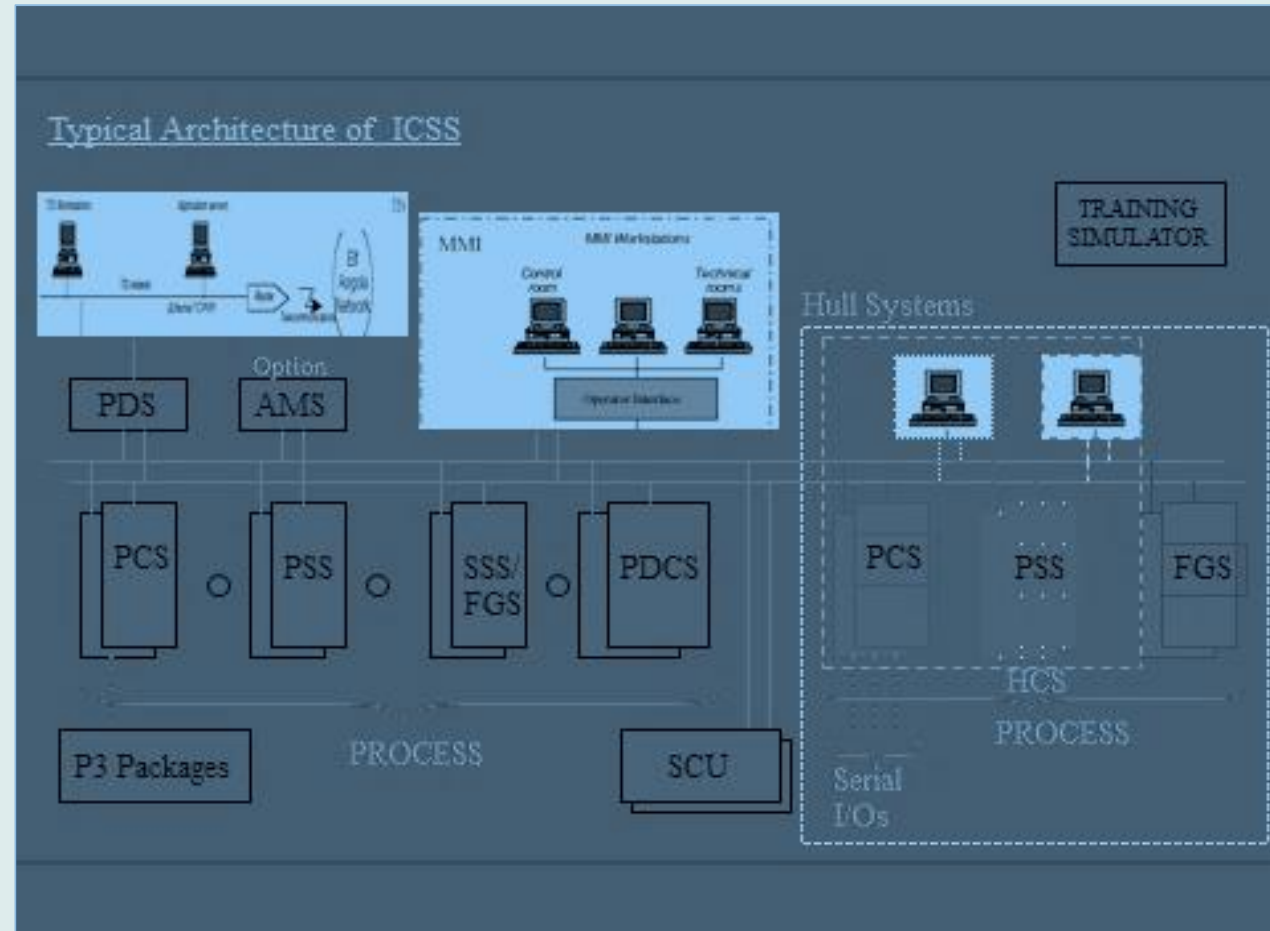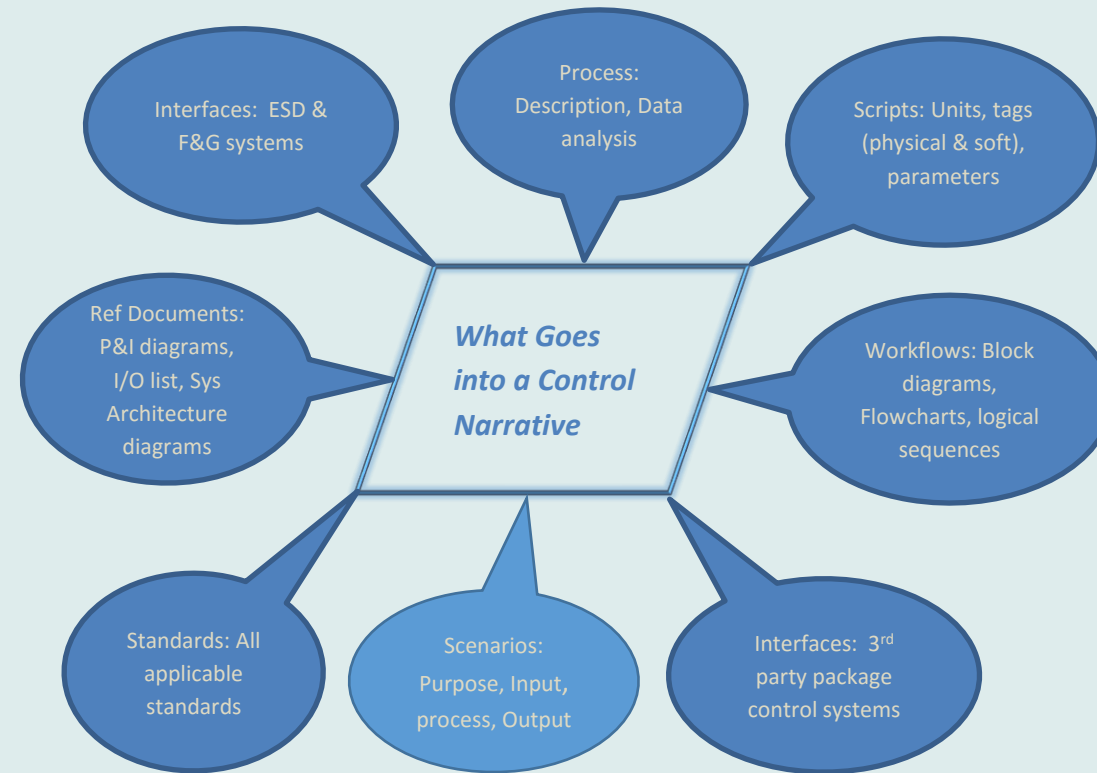
SAMPLE DELIVERABLES-LOOP TEST SHEET

LOOP TEST SHEET

System:		P&ID:		Project:	
Loop Number			Description		
Alarm Settings	L =	LL =	H =	HH =	
Actual alarm values	L =	LL =	H =	HH =	
Alarms needing reset					

Post test statement		Signed
The loop is installed as shown on the P&ID and loop diagram	YES NO	
The loop will perform as designed	YES NO	

Field Labelling	OK – N/A	Instrument			
Motor push buttons		Air Isolation correct			
Motors		Accessible			
Control/On-Off Valves		Location correct per Loop diagram and P&ID			
Instruments and cabel		Input continuity check			
Orifice Plates		Calibration			
Junction Box		Range check with Control system			
Marshalling Cabinet		Loop direct/reverse action			
DCS/PLC Panel		Serial number correct			
Local Panels		State change OK on control system			
General electrical wiring		**Control- On/Off valves**			
Other		Position	0% =	mA =	
MCC Room		Position	25% =	mA =	
Starters and push buttons		Position	50% =	mA =	
Lighting suitable		Position	75% =	mA =	
Accessibility of terminations		Position	100% =	mA =	
Fuse/breaker lock box available		Valve positioner operates correctly			
Heating adequate		State change OK on control system			
Cooling adequate		Fail position checked			
Cabinet air fan acceptable?					
Labels on cabinet door correct		**Interlock tested**			
Wires labeled					
Cables labelled		**Documentation**			
Other		Interlock data on loop and P&ID correct			
DCS and or I/O Room		All loop diagram data correct			
DCS/PLC panels labelled		Master copy red lines for final mark up			
Termination panel access suitable		Control room has copy until as built issued			
Termination drawing suitable					
Fuse in place					
Motor					
Megged/rating					
Rotation					
State change OK on control system					

Signed for Instrument/Control / Electrical		Date	
Signed for process		Date	

TRAINING ON AUTOMATION EQUIPMENT /SYSTEMS

➤ These courses are:

  ✓ On Automation Products & systems (PLC/DCS/SCADA/Embedded Systems etc).
  ✓ Typically cover the hardware and software aspects
  ✓ Conducted by **other** Training institutes
  ✓ Cover different topics & are of varying durations

➤ Our courses on Professional engineering & management of Industrial Automation projects are recommended as pre-requisite for the above courses because:

  ✓ These essentially cover the conceptualization & preparation of Functional documents required during detailed engineering, installation, testing and commissioning phases of any project.

  ✓ These set of documents are **Essential** for any automation system vendor to conceptualize and design the hardware and software aspects of Automation equipment and systems for any given project

➤ On completing our courses, we assist students in selecting the appropriate courses and training institutes that offer courses on PLC/DCS/SCADA/Embedded Systems etc

THANK YOU