PERA DEVELOPMENT AND UPDATE PROGRAM

A. WHY UPDATE PERA?

PERA is a GERAM (General Enterprise Reference Architecture and Methodology). As such, it has been used for decades by different industries to design, implement, and operate Control and Information Systems from field operations to the boardroom. However, during this time, Enterprise Integration technology has been rapidly evolving. It is therefore time for an update to address new concepts and technologies that were not significant when PERA was originally published.

B. PERA IS UNIQUELY SUITED FOR THIS WORK

PERA addresses all industries, enterprise levels, human roles and lifecycle phases. This makes it an excellent way to integrate new concepts and technologies with existing ones.

For example:

- **Enterprise Integration** - PERA has been used for hundreds of Enterprise Integration projects in many industries and enterprises. It has contributed concepts of systems architecture, plant and corporate data integration and master planning.

- **Cybersecurity** of Automation and Control Systems (ACS) uses the IEC/ISA 62443 standard which is based on a system of "Zones and Conduits". However, cybersecurity of IT systems involves ISO 27001 and this is based on a procedural approach to address individual risks and mitigations. Use of these, plus ISO, NIST and other cybersecurity standards result in a complex set of requirements that are most effectively addressed with the PERA Master Planning Process.

- **Artificial Intelligence** (AI) and Robotics will fundamentally change the relationship between People, Systems and Facilities. PERA specifically addresses these interfaces, so it provides an excellent tool for analyzing and planning for these changes.

- **Networks** , particularly those in industrial facilities, have always been an important part of PERA architectures. It is therefore important to integrate new networking technologies that connect systems among, and between, PERA Levels.

- **Risk Management** concepts have been expanded to include Safety Integrated Systems (SIS/SIL), Project Risks (PMBOK Guide), Environmental (40 CFR), Supply Chain (after COVID), and of course Cybersecurity. These were not included in the original PERA documents; however, it is planned to add these to PERA Master Planning for Enterprises, Programs or Projects.

C. THE UPDATED PERA WEBSITE WILL INCLUDE

C.1 Update of Existing "PERA Concepts" that are common to most industries (as described in the original PERA materials). In updating these, we will also add new practices, deliverables and terminology that may have evolved over time in different industries.

C.2 Significant new "Topics" that did not exist when PERA was originally published. These will be integrated with PERA Principles, especially through User Guides by Industry and Principal Role, such as Owner/Operator or Vendor.

C.3 "PERA User Guides" that address both industry-specific and widely used enterprise integration technology. PERA Guides will include relevant standards, opportunities, and example Master Plans.

C.4 Mini and Micro Learning Modules that are referenced from User Guides and which may be combined into Learning Maps for specific Professional Roles or for general explanations.

C.5 Master Planning Upgrades to simplify use, reduce time and minimize cost. Experience has shown that better planning of enterprises, corporate programs, and projects is an excellent investment. It is therefore planned to encourage this through development of Master Planning Templates, tools, procedures and resources.

C.1 UPDATE OF EXISTING PERA CONCEPTS

PERA is based on the following concepts that apply to all Enterprises: In addition to the new Topics being added, this PERA Update will reaffirm and improve on existing PERA materials with the addition of "proven practices" and new deliverables that have evolved over decades of successful enterprise, program and project experience.

C.1.1 Enterprises are comprised of People, Facilities and Systems. More precisely, PERA defines 3 architectures for an Enterprise:

- **PEOPLE:**
  A Human and Organizational Architecture that is defined by Organization Charts Position Descriptions, and Human workflows. The concept of "Generic Professional Roles" that allow educators to develop materials that are applicable to many industries. These are then applied by companies to their Position Descriptions.

- **FACILITIES:**
  Industrial and Commercial Facilities are defined by Process Flow Diagrams (PFD), Mechanical Flow Diagrams (MFD), physical equipment, facilities drawings, and

various kinds of digital twin and optimization models.

- **SYSTEMS:**
  Control and Information Systems that are defined by various high level system diagrams as well as more detailed hardware and software architecture diagrams. Overview diagrams may be "resolved" into more detailed representations, especially where large systems are involved.

C.1.2 PERA addresses all Enterprise Phases including:

- Studies and **Master Planning**
- **Conceptual Engineering**
- **Preliminary Engineering**
- **Detail Engineering**
- **Construction**
- **Operations**
- **Maintenance** and Turnaround,
- **Renewal** or Demolition.

Note industries or enterprises may combine or rename some of these phases. If so, this may be addressed in the PERA User Guide for that industry.

C.1.3 Human and Organizational architectures include "Principal Roles" including:

- **Owners/**Operators
- **Vendors** of Equipment and software
- **Engineering**, Procurement and Construction (EPC) contractors
- **Maintenance** Services and Operations Support providers
- **Insurers**
- **Regulatory Bodies**
- **Educators** and Training Groups

Note industries or enterprises may combine or rename some of these Principal Roles. If so, this may be addressed in the PERA User Guide for that industry.

C.1.4 During the Master Planning Phase, "Professional Roles" are used for planning human resources; however, as part of the Implementation Phase, these Professional Roles are assigned to Organization Chart Positions.

Positions in companies are usually industry-specific, however during the Master Plan, Engineer, Procure and Construct Phases, PERA typically uses standard Professional Roles that apply to most industries. This makes it possible for:

- **Educational organizations** to develop curricula, degrees and certificates,
- **Vendors or regulatory bodies** to define qualifications to operate or maintain equipment or systems,
- **Educators, Vendors, and Operators** to establish Learning Management Systems (LMS) to test and approve transferable education credits, degrees and R&D classifications.
- **Auditors** to perform equipment acceptance testing, and other approvals to be accomplished by certified personnel.

During each Enterprise Phase, Professional Roles produce standardized "Deliverables". Deliverables are typically associated with projects, studies or programs, and while some may be industry-specific, most electrical, mechanical, civil, control systems, and network deliverables are standardized across industries.

C.2 SIGNIFICANT NEW CONCEPTS AND TECHNOLOGIES

C.2.1 **Enterprise Integration** developments such as Cloud Computing, Industry 4.0, remote maintenance and technical support.

C.2.2 **Cybersecurity** including Firewalls, Network Monitoring, Configuration Management, and cyber defenses.

C.2.3 **Artificial Intelligence (AI)** of all kinds such as Large Language Models (LLMs), robotics, control algorithms, and process optimization agents.

C.2.4 **New Networks** such as mesh radio, new industrial networks, satellite, IoT and IIoT.

C.2.5 **Risk Management** including human and organizational risks, facilities and equipment risks, and Control and Information Systems risks)

We have added new "TOPICS" to the left-hand menu of the PERA website home page to address these additions, and we plan to encourage experts to help us develop this material.

C3 PERA USER GUIDES

These User Guides focus on practical planning, and the application of new technologies in an industry. To accelerate understanding, they will use terminology, lifecycle phases, and professional roles that are common in that industry group.

User Guides will include links to a relevant set of:

C.3.1 **Industries** (like Oil & Gas Production, Oil Pipelines and Oil Refining)

C.3.2 **Principal Roles** (like Owner or Vendor). A unique User Guide is provided for each Industry/Principal Role combination)

C.3.3 **Professional Roles** (like Control Engineer or CISO)

C.3.4 **Opportunities** (that are likely to prove cost-effective for that Industry/Principal Role)

C.3.5 **Standards** (that are selected for use by that company)

C.3.6 **MLMs** (and perhaps White Papers) that explain or support the above

C.4 MINI and MICRO-LEARNING MODULES (MLMs)

MLMs may be 3 to 5 minute Micro Learning Modules, or 5 to 10-minute Mini Learning Modules. They may be MP4 videos, PPTX presentations, or pdf documents.

MLMs are created using Instructional Design (ID) practices and a well proven set of software tools and formats. A key objective is easy integration into Learning Management Systems (LMS) for long-term use and support by companies, educators, or individuals.

MLMs may be organized as follows:

C.4.1 **By Technology** (e.g., Neural Net Optimizers or Dynamically routed Industrial Networks)

C.4.2 **By Professional Role** (e.g., a Learning Map for Control Engineers or CISOs)

C.4.3 **By Standard** (e.g., ISA 62443 or NIST 800)

C.4.4 **By Opportunity** (e.g., Implement Cybersecure Maintenance Procedures)

C.4.5 **By Work Process** or deliverable (e.g., Engineering of Cybersecure ACS / ICS networks)

Since PERA is focused on enterprise integration, MLM that support Professional Roles such as Control Systems and IT are particularly important. For topics such as Control and Information Systems we are therefore providing MLMs from BOTH ACS and IT perspectives. In our experience this is the best way to address the "communication gap" for subjects such as cybersecurity, "Zero Trust" and OT systems where ACS and IT staff must work together to provide effective solutions.

MLMs may be combined into graphical Learning Maps that may also be organized according to C.4.1 to C.4.5 above. Thus, a Learning Map may be prepared for a certain Professional Role (e.g., a Control Engineer or CISO). Alternatively, a Learning Map may be used to describe a standard such as IEC/ISA 62443.

C.5 MASTER PLANNING

PERA originally included a "Master Planning Handbook (300 pages) and a 19-page Master Planning Guide. However, the Master Planning Guide was "generic" (for all industries) and it addressed primarily the Owner/Operator (rather than a full set of Principal Roles including Owner, Vendor, EPC, Service Provider and other secondary ones.

A set of "Master Planning User Guides" is being prepared for Major Enterprise Classes including Generic Process Industries, Generic Manufacturing Industries, etc. (see MLM-004-A PERA Enterprise Classes). For each of these a set of report templates, Principal Roles, Professional Roles, Opportunities, and Standards will be provided as "plug-ins" for each Industry User Guide. The Template and MLMs will use terminology commonly used in that Industry (where generic terms may not be easily understood. Together these Master Planning User Guides should dramatically reduce the learning curve, time, and cost of doing Master Plans for:

- New Enterprises,
- Programs (such as Cybersecurity Programs), or
- Projects.

The current plan is to complete a full set for Generic Process Industries by January 2026. At that point, others with experience in specific industries may use the Process Industry User Guides as a "go-by" to create User Guides for other Enterprise Classes and Industries.

D. OPEN-SOURCE VS COPYRIGHT

Increasingly, new software is being developed and distributed on GitHub, and teaching materials are being delivered on YouTube and Internet blogs. This "Open Source" approach is even more common in Artificial Intelligence. The PERA website has over 40 years of proven enterprise integration practices and resources that have been managed as open source or "Creative Commons". That makes the PERA website a good choice for expert information to train AI agents. It can also retrieve information for end users with the proposed "PERA

Librarian" (see existing PERA Chatbot). Updating and expanding PERA resources makes more sense than attempting to create a new "GERAM".

Efforts are also underway to engage Universities, IT and ACS educators, consultants, and influencers in this work.

In the long term, our goal is to establish a new and better way to support enterprise integration for operators, vendors, service providers and engineers. New technologies in cybersecurity, AI, Robotics and industrial networks are developing so quickly that they are outpacing the ability of current practitioners and new graduates to keep up. We therefore plan to release updated PERA materials as "Creative Commons", and to encourage the development of AI tools to speed implementation.