The Strategic Center for Natural Gas

GASNET™

Gasline Sensor Network System

Project Introduction

AUTOMATIKA

SCNG Workshop
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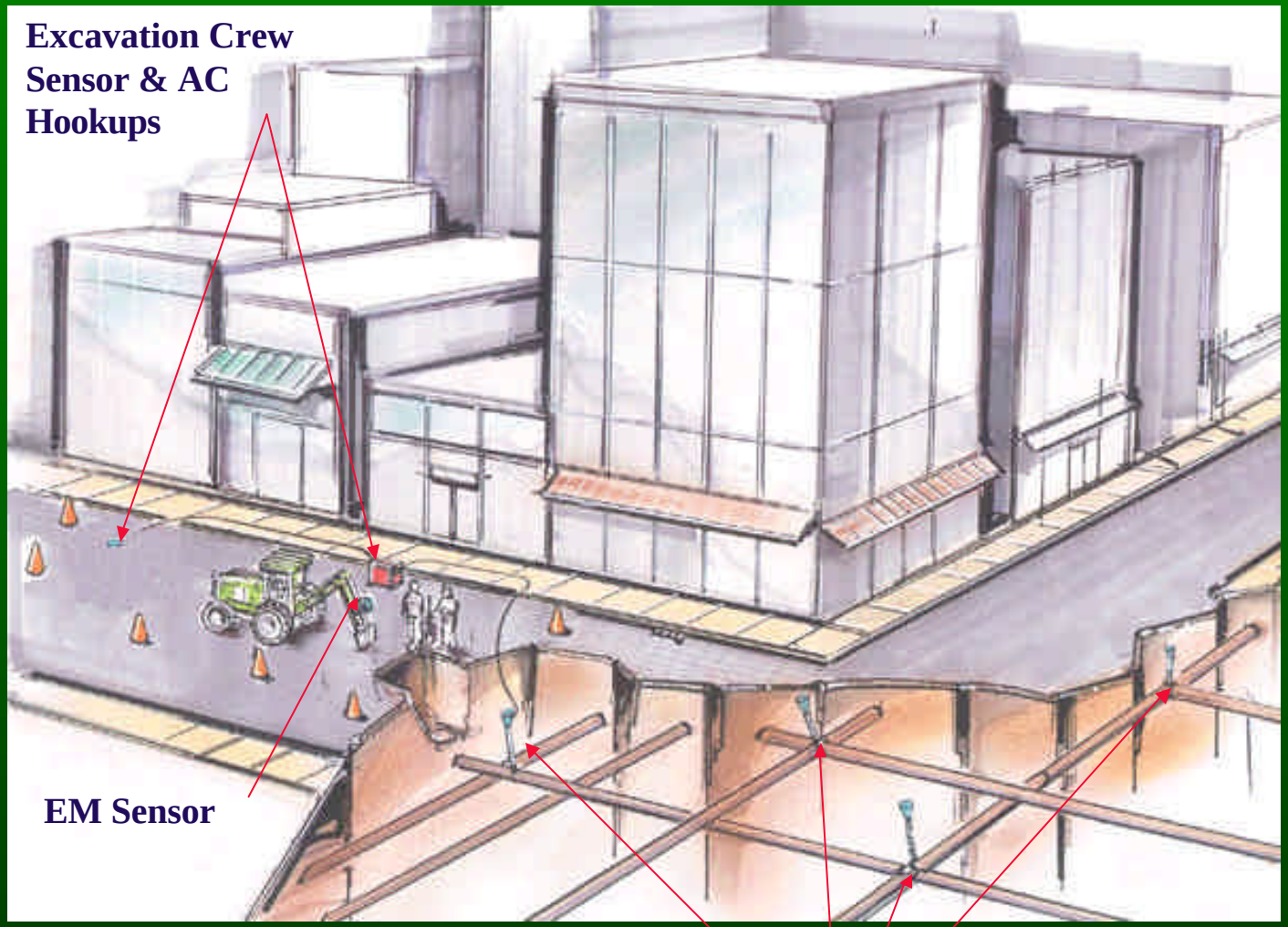
Overall Project Objectives

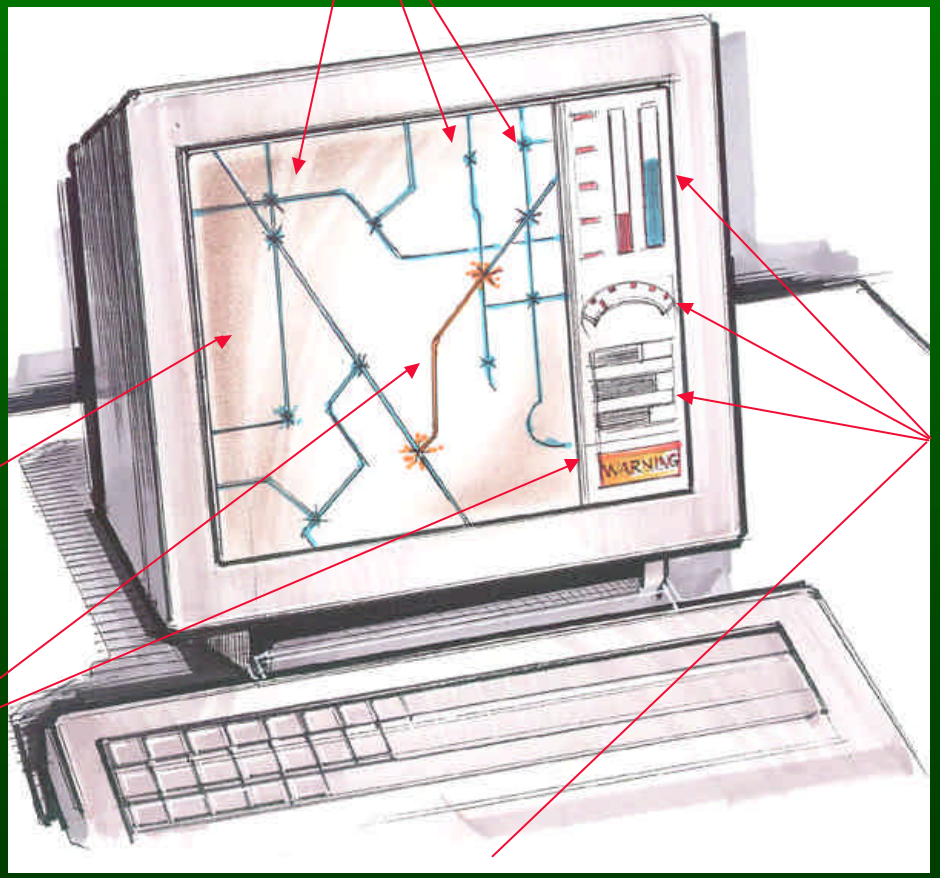
- Develop keyhole installable gas main sensors measuring distributed process-data (P, Q, RH, etc.) capable of wireless relay-communications.
- Field keyhole installable self-reliant units with zero-excavation repair-, replace-, & upgrade-capability
- Gather distribution network data in real-time at a central control point for monitoring, evaluation & processing

GASNET™ Deployment Concept



GASNET™ Operations Concept

GASNET™ Sensor Nodes



Urban Network Map

Faulty-Line Detection

Pressure, Flow Gauges

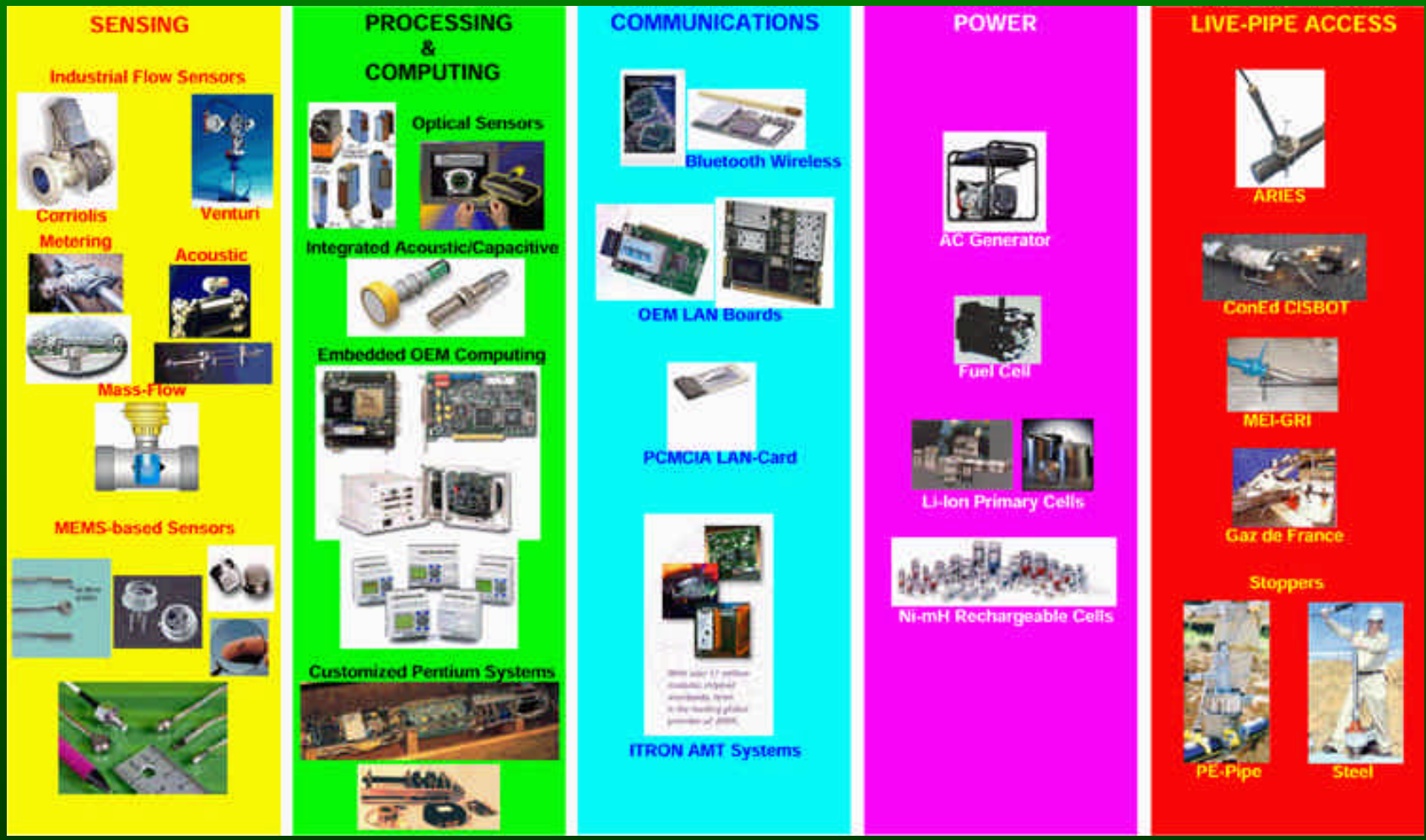
System Features

- Service-tap installed system
- Self-reliant/Wired power supply
- Miniature sensor-modules (P, Q, T, RH, etc.)
- Minimal low-power computing
- Wireless hardware or cell-/pager-interface
- Custom sampling & relaying software
- No-dig sensor upgrade/exchange
- Relaying-node for other in-pipe systems

Technology State-of-the-Art

- Sensing
  - MEMS and other sensing elements – COTS to Custom
- Computing
  - Low-cost/max-capability embedded PC system
- Communications
  - Acoustics, Current-loop, Wireless, Cell/Pager, etc.
- Power
  - Rechargeable batteries and/or hardwired
- Graphical User Interfaces
  - Design using tools and Data Structures

Technology Pot Pourri



Critical Technology

- Communications Link
  - Technology Options under evaluation
    - Electro-acoustic pipe-void transmission
    - Current-loop pipe-wall conduction
    - Wireless RF-communications link
- Relay/Hopping Comm-Software
  - Smart low-power relaying
  - Failure-tolerant dynamic (re-)routing

Phase I Sensor Selection

- LP CI Mains (Feasibility Demo only)
  - Pressure
  - Temperature
  - Moisture
  - Humidity
  - Flow
  - Vibration

Industry Benefits

- Real-time distributed process-, billing- and safety-data relaying from across the entire network to a central control-station without additional infrastructure reliance
- Increased capacity-utilization monitoring
- Potential network lifespan extension through proactive and preventative maintenance
- Out-of-spec safety monitoring & alerting
- Third-party access-monitoring and control
- As-built network-design verification
- Relaying-nodes for other in-pipe systems (sensors, robots, etc.)

Project Profile

- Three Phase program
  - Phase I: 12 months
    - Pre-Prototype Design & Prototyping
    - Pre-Prototype (~10x) Field-Trials with utilities
  - Phase II: 12 months
    - Commercial Prototype Design & Fabrication
    - Keyhole Installer & Multi-unit (~10x) Field Trials
  - Phase III: 12 months
    - Sensor Augmentation/Modification: Design & Fabrication
    - System Integration (~50x) & User Interface Software Development
    - Extended-term Field Trials & Data Analysis

Phase I Milestones, Deliverables

- Overall Milestones
  - ***February.'02: Kickoff***
  - ***Mar.'02: Specs & Concept Review***
  - ***Jul.'02/Aug.'02: Design Review***
  - ***Oct.'02: Test-Loop Acceptance Demonstration***
  - ***Nov.'02: Northeast Utility Field-Trials***
  - ***Jan.'02: Preliminary Revised Design & Report Review***

- Field demo of multiple (~10x) COTS computing, communication, power & enclosure systems interfaced to full-excavation installed open-hole sensor wands gathering & communicating data over ~1 mile run with wireless in-field data-gathering & processing.