

Natural Gas Infrastructure Reliability



Overview
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DOE Infrastructure Initiatives

- **Critical Infrastructure Protection**
 - Protect Nation's critical energy infrastructures
 - Assure security of DOE critical assets
- **Energy Grid Reliability**
 - Support electric grid reliability
 - Storage, grid Interconnection, modeling and simulation, power parks, minigrids, and district energy
- **Natural Gas Infrastructure Reliability**
 - Support operational reliability of natural gas network
 - Pipelines and distribution systems, delivery systems and services, and environmental



What NETL Is

Industry Focussed

What We Are

One of DOE's 15 National Laboratories: December, 1999
Government Owned and Operated
Morgantown, WV, Pittsburgh, PA, and Tulsa, OK

What We Do

Shape, fund, and manage extramural RD&D programs
Conduct on-site science and technology research
Conduct analyses to support policy development

Mission

Provide Americans with a stronger economy, healthier environment, and more secure future by resolving the environmental, supply, and reliability constraints of producing and using fossil resources

■ Nearly 700 research activities in all 50 states and 16 countries

- Private Industry
- Universities/colleges
- Not-for-profit laboratories
- DOE National Laboratories
- Other government laboratories

• FY01 Budget of \$722 Million

• Strategic Center for Natural Gas

■ 550 Federal Employees

- Technical Management
- In-House R&D
- Administration
- E&E technical & business services

■ 608 Support Contractors

- 480 On-Site
- 128 Off-Site



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Vision:

By 2020, U.S. public is enjoying benefits from an increase in gas use:

- Affordable supply
- Reliable delivery
- Environmental protection



Mission:

Be the focal point for an integrated gas program:

- Spearhead annual DOE-wide gas RD&D planning and program assessment
- Provide science and technology advances through NETL's on-site programs
- Shape, fund, and manage extramural RD&D
- Conduct studies to support policy development





Gas Infrastructure Reliability

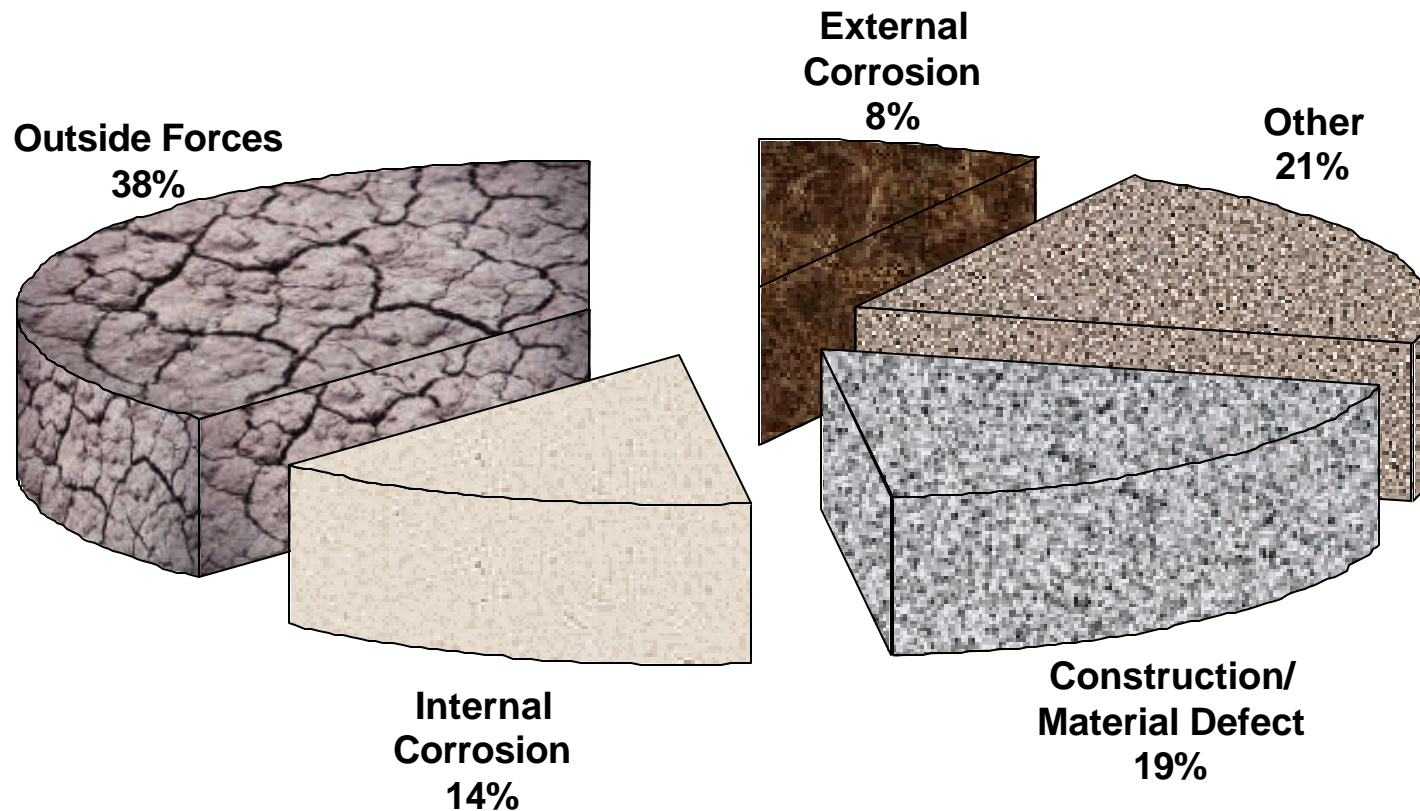


- **New DOE Initiative that builds on NETL's existing gas storage program**
- **Infrastructure includes: transmission, distribution & storage**
- **Program goals are:**
 - Maintain/enhance system reliability and integrity
 - Increase gas deliverability
 - Reduce environmental impact
 - Address interdependencies between gas & electric systems
 - Develop technological foundation for future gas delivery system
 - Support infrastructure security
- **FY01/FY02 Budget: (\$8 million/\$10 million)**
 - \$3 million /\$2.5 million storage technology
 - \$5 million /\$7.5 million infrastructure systems reliability



Causes of Pipeline Accidents

Total Number of Natural Gas Transmission Pipeline Accidents, by Cause 1998

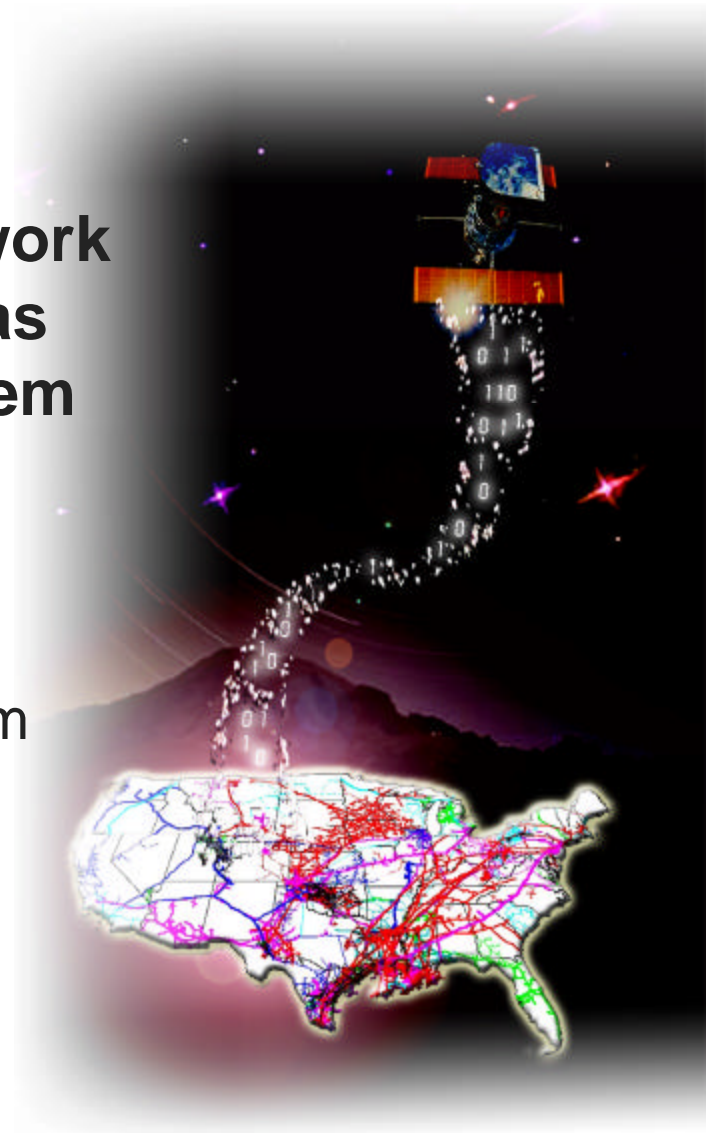


Source: Office of Pipeline Safety, US DOT



Infrastructure Goals

- **Establish the technology framework for our Nation's future natural gas transportation and delivery system**
 - Provide research and technology development
 - Focus federal infrastructure program on public benefit R&D
 - Collaborate with private sector



Core Areas & Issues

- **Pipelines and distribution systems**

- Third-party damage
- Integrity Assessment
- Leak detection
- Guided boring technology
- Underground facility location
- Compressor technology
- Aging pipeline and distribution systems
- Growth of distributed power
- Internal pipe inspection/repair
- System automation and control

- **Environmental**

- Environmental impact
- Federal permitting process



Natural Gas Industry Background

- 250,000 miles of transmission pipelines
- 1,000,000 miles of distribution pipelines
- ~\$10 billion/yr investment in new infrastructure
- Energy companies dominating the industry
- R&D viewed as expense rather than investment
- FERC-funded R&D loss
- No historical government role in R&D
- Security difficult with dispersed assets



Security Issues

Gas

- Dispersed
- Hidden
- Line packing
- Obvious vulnerabilities
- Quickly repairable
- SCADA vulnerable
- Critical energy supply

Electric

- Dispersed
- Visible
- Just in time delivery
- Obvious vulnerabilities
- Quickly repairable
- SCADA vulnerable
- Critical energy supply



Infrastructure Setting

- ☞ **Gas demand to increase by 60% (to 35 tcf) by 2020 ***
- ☞ **Electric generators demand for natural gas to triple (grow by 8 tcf *)**
- ☞ **Aging infrastructure inadequate to meet future demand**
- ☞ **Consolidation and competition limits gas industry investment in long-term public benefit R&D**
- ☞ **Distributed power will require infrastructure changes**
- ☞ **Gas is *critical* for U.S. climate change strategies**
- ☞ **Increasing environmental sensitivities**
- ☞ **Heightened security concerns**



*Annual Energy Outlook 2001

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FY01 Infrastructure Activities

Goals

- ☞ Elicit stakeholder input
 - Vision
 - Technology needs & opportunities
- ☞ Determine government role

Interagency Workshop

March 22 & 23, Washington, DC
DOE, DOT, FERC, EPA, DOI

Visioning Workshop

May 3, Pittsburgh, PA
15 industry executives

Roadmapping Workshop

June 6 & 7, St. Louis, MO
40 industry experts

National Lab Call

9 Projects Selected
Multiple Labs
Focus on Innovation

Competitive Solicitation

11 Projects Selected
Multiple awards
Various stages of development

Broad-Based Financial Assistance

10 Projects Selected
Multiple Awards
Various stages of development



Roadmapping Workshop Results

R&D Timeframe

Near Term

- Locatable Plastic Pipe
- Laser Methane/ethane Detectors
- Imaging and locating underground pipes
- Improve the permitting process

Mid Term

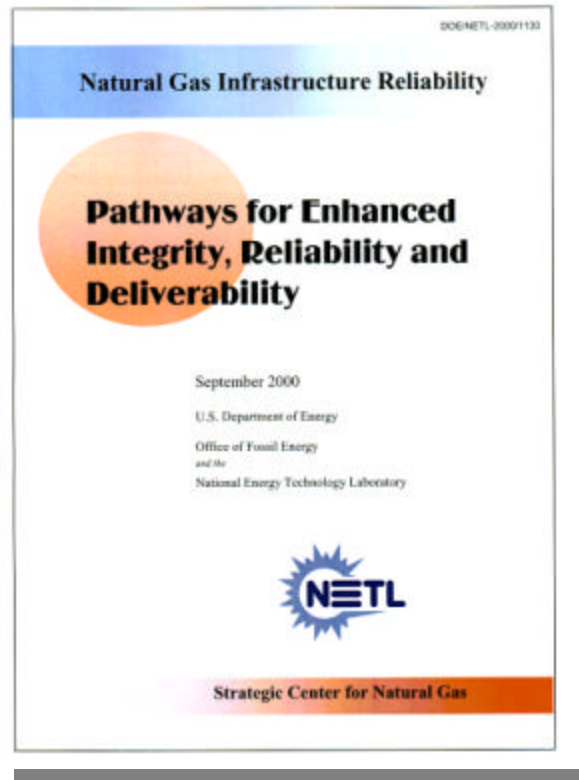
- Sensor on guided boring tool
- More sophisticated underground directional drilling
- Warning system on excavation equipment
- Integrity assessment
- New composite materials

Long Term

- Intrusion detection device
- 3-D subsurface facility locating techniques
- Multi-functional sensors (residual life, third party damage, & mapping)
- High pressure composite transmission pipe



Roadmap Final Report



Available on the SCNG Website at:

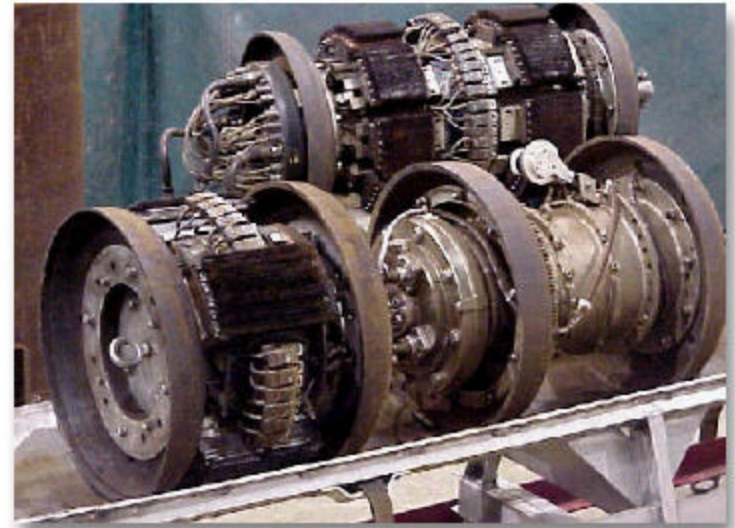
www.netl.doe.gov/scng/publications/naturalg.pdf



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Collaborations

- **Gas Industry**
 - All
 - Project participation, proposal and project review
- **Natural Gas Organizations**
 - AGA, APGA, NYGAS, INGAA, GMRC, PRCI, etc
 - Stakeholder input, communication channel for products, cost share
- **R&D Organizations**
 - GTI, Battelle, SwRI, National Labs, universities, etc
 - Project participation, innovation, technical issues
- **Federal**
 - DOT/OPS
 - Share experience, cost share, joint strategy

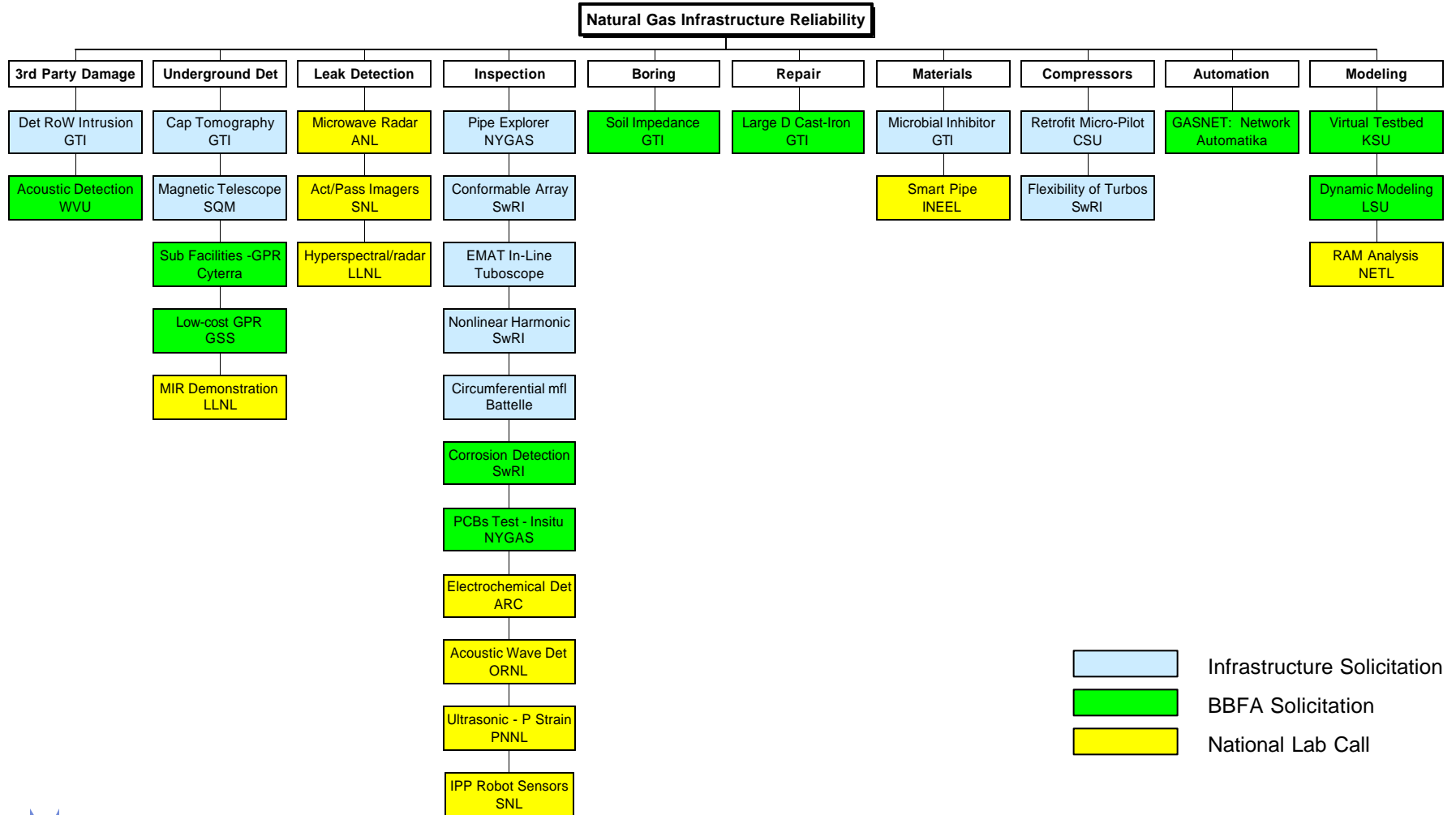


Implementation Strategy

- **Balanced R&D program**
 - Distribution, transmission, & crosscuts
- **Most funding dedicated to private sector projects**
- **National laboratory efforts focused on innovation**
- **Industry participation**
 - Projects
 - Proposal review
 - Project review
 - Roadmap Update
- **Collaborations & cost sharing**
- **Focus on high risk, innovation, and leap frog technologies**
- **Some quick wins to demonstrate progress**



Project Portfolio

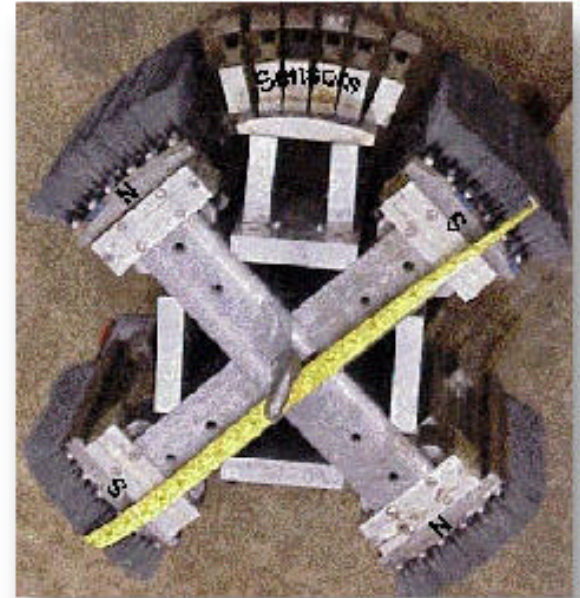


Recent Articles



FY02 Planned Activities

- Formalize collaboration with DOT/OPS
- Complete awards for initial 31 projects
- Update Natural Gas Infrastructure Roadmap (January)
- Release new solicitation based on revised roadmap (March)
- Award additional R&D contracts
- Evaluate options for 2 university consortia
- Maintain a strong R&D infrastructure in the US



NATIONAL ENERGY TECHNOLOGY LABORATORY
STRATEGIC CENTER FOR NATURAL GAS

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March 19, 2001

The Strategic Center for Natural Gas

Integrating All Elements of DOE's Natural Gas Research From Borehole to Burner Tip

Methane Hydrates Solicitation
 The Strategic Center for Natural Gas is seeking applications for the solicitation titled, "Methane Hydrates" The closing dates for submission of proposals is April 24, 2001. [Read More!](#)

Honeywell Hybrid Fuel Cell Tech. To be Added to DOE/SCNG R&D Program
 DOE has selected Honeywell International to begin developing a new type of "planar solid oxide fuel cell" hybrid power system. [Read More!](#)

Lasers Studied for 21st Century Oil, Natural Gas Drilling
 DOE and the natural gas industry are exploring whether lasers could be the next revolutionary advance in oil and gas drilling. [Read More!](#)

Strategic Planning & Policy Support
 Exploration and Production
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 Gas Processing & End Use

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Internet Location: netl.doe.gov/scng/index.html

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