Abstract of the paper on
"Energy Security & Security of Oil, Gas & Pipeline Assets"

Learning Objectives

- To understand the threats, vulnerabilities and criticalities of Oil and Gas Assets
- To understand the methodologies to counter the threats, mitigate the vulnerabilities and formulate the policies
- To have effective security measures for security of Oil & Gas Assets

What can legitimately be described as "Energy Security" of a nation? It is the continuous availability of energy in varied forms in sufficient quantities at reasonable prices. Energy security consideration for will require following steps:

• An elaborate distribution network for domestic supplies;
• To grow our energy supply in an environmentally responsible manner;

Country's energy security is directly related to security of its Oil, Gas and Pipeline assets. Security provides oil and gas companies the freedom to find, develop and manage assets and to deliver supplies without interference. While ensuring availability of energy sources becomes prime concern of the Nation, securing its Oil, Gas and Pipeline assets become prime responsibility of all stake-holders.

Major Areas of Security Concerns

- Security of geological survey party, their equipments and explosives
- Pre-camp armed - static security
- Security during movement of drilling equipments and personnel
- Transportation - armed security (rail, air & sea)
- Establishing early oil / gas collection centers and security thereof
- Security of off-shore platforms, receiving terminals, dispatch terminals, compressor stations etc.
- Security of larger installations such as refineries, LPG plants and petrochemical complexes
- Security of supply chain – storage / warehouse, rail / road transportation
- For the Key Infrastructures such as Oil and Gas, security is always a major concern as this sector world over has high probability and vulnerability from terrorist attacks and sabotage.

Strategies for Reliable Security of Oil & Gas Assets

The Operations, Safety, Security, and IT decision-makers of the Oil & Gas industry are well advised to pay attention to following aspects -

Optimizing Assets through Centralized Command & Control
New developments in technology can improve the security of personnel and assets and provide enhanced operational capabilities.

Securing Oil & Gas Control Systems
Sandia National Laboratories, Albuquerque (USA) has served as the lead national lab in Project LOGIIC (Linking the Oil and Gas Industry to Improve Cyber Security). The project was created to keep U.S. oil and gas control systems safe and secure, and to help minimize the chance that a cyber attack could severely damage or cripple oil and gas infrastructures. It works to identify ways to reduce cyber vulnerabilities in process control and SCADA (Supervisory Control and Data Acquisition) Systems). Sandia researchers created two real-time models of control systems used for refinery and pipeline operations.
There is real threat to SCADA from mischief mongers prowling in the web-world and the tech-savvy terrorist and Stuxnet is the example!

Biometric Integrated Safe System of Work
Integrated Safe System of Work (ISSoW) is a key tool in ensuring the safe operation of Oil and Gas installations. High Accuracy Real Time Personnel & Asset Location

Situational Awareness - Securely Integrating Site Data
By using an underlying open data architecture together with security protection system, it can bring these data sources together and share them securely among multiple disparate user groups, and at different locations, whilst ensuring data validity, security, and privacy.

Robust, Secure, Global Communication Solutions
This capability calls for seamlessly connecting all oil & gas installations of an organization and on more higher level , of the Nation by providing highly available, robust, secure, integrated communication networks for critical operational systems.

Less theory more practical discussions on:

- Oil and gas pipeline vulnerability
- Onshore oil and gas operations
- Role of government agencies to provide security for energy infrastructure operated by Foreign companies
- Digital energy security
- Security approaching models
- Risks based security systems
- Community based security systems
- Laws enforcement based security systems
- Security strategic management
- Defining vulnerabilities in transportation security
- Business continuity and disaster recovery plans
- Understanding the key threats to the various energy infrastructures in the global scenario of increasing interoperability
- Examining how technology and efficiency will shape the new critical assets security future
- Evaluating the role of cooperation between nations and between public and private sectors to overcome universal threats to key energy assets

"Energy Security & Security of Oil, Gas & Pipeline Assets"

By: Capt S B Tyagi, FISM, CSC

- **Mexican oil, gas pipelines attacked** - Leftist guerrillas claim responsibility for the bombings. Officials move to boost security at key installations- July 11, 2007: A leftist guerrilla group claimed responsibility Tuesday for a series of bombings of pipelines operated by Pemex, Mexico's national oil company, and authorities moved quickly to protect the nation's oil and gas industry from further attacks. *http://articles.latimes.com/2007*

- **Turkey pipeline blast rekindles security concerns -** Los Angeles, 7 Nov. 2008 -- Oil has resumed flowing through one of the twin Kirkuk-Ceyhan pipelines following an explosion on one of the lines near the town of Bozova, in the mainly Kurdish province of Sanliurfa in southeastern Turkey. http://www.ogj.com/display_article

Global energy demand is expected to rise by as much as 50 percent over the next 25 years. This combined with depletion of existing oil and gas reserves will mean extensive exploration and production activities by the oil and gas industry in the years to come. 75 percent of this increased requirement is expected to come from the developing world.

in the backdrop of above, the importance of energy from oil and gas assets can be summarized by quoting the Indian Prime Minister, Dr. Man Mohan Singh –

"...Energy is the lifeblood of our economy. Without sufficient and predictable access, our aspirations in the social sector cannot be realized.... I believe that the needs of the people of India must become the central agenda for our international cooperation and so must our concern for energy security."

What can legitimately be described as "Energy Security" of a nation? A 1999 UNDP report defined Energy Security as the continuous availability of energy in varied forms in sufficient quantities at reasonable prices. For India, the Parikh Committee report stated that a country is energy secure when it can supply energy to all its citizens and meet their demand for safe and convenient energy at affordable costs at all times with a prescribed confidence level considering *shocks and disruptions* that can be expected.

India's Economic Rise & Energy Consumption

The relationship between energy consumption and growth of a nation is well documented. In fact, it is the steady economic rise of India and China that in substantial measure has placed the issue of energy security on the forefront. This growth is also inaccurately and simplistically portrayed as one important cause for the unprecedented price rise in the world oil market.

> "With nearly a sixth of the world's population in India, it should be appreciated that India's energy consumption remains modest at a fifth of world average per capita energy consumption. Thus India consumes 520 kilograms of oil equivalent (KGOE) per capita of primary energy compared to 1090 by China and 7,835 by the USA."
>
> **Shri Murii Deora**
> Minister of Petroleum and Natural Gas

Energy Security for India

Energy security consideration for India will require following steps:

- Ensuring availability of energy sources through domestic efforts or through long term supply agreements or through buying assets abroad;
- An elaborate distribution network for domestic supplies;
- Development of infrastructure to cope with the growing demand in terms of storage, import terminals etc;
- To grow our energy supply in an environmentally responsible manner;
- Above all, institutional and policy mechanisms to ensure an equitable supply of energy both in terms of reaching underdeveloped regions and in terms of the economically backward sections of the Indian society.

Energy Security & Security of Oil, Gas & Pipeline Assets

Country's energy security is directly related to security of its Oil, Gas and Pipeline assets. Every step needs to be taken to ensure uninterrupted production; processing and protection of supply chain in this sector which can be termed is 'Key-infrastructure Sector' for country's steady growth, sound economy and sustainable energy independence.

Security provides oil and gas companies the freedom to find, develop and manage assets and to deliver supplies without interference. Being secure stems from having the correct strategy, translated through innovative technology into a robust implementation which is supported by rigorous systems management. While ensuring availability of energy sources becomes prime concern of the Nation, securing its Oil, Gas and Pipeline assets become prime responsibility of all stake-holders.

Major Areas of Security Concerns

The production of Oil and Gas is a major logistical operation from locating and investigating new sites to the movement of personnel and establishment of facilities. It takes an enormous amount of resources to establish such sites and all the operators have to rely on a sound cloak of security to prevent theft of equipment, extortion, sabotage and kidnapping of work force. There are following major areas of security concerns –

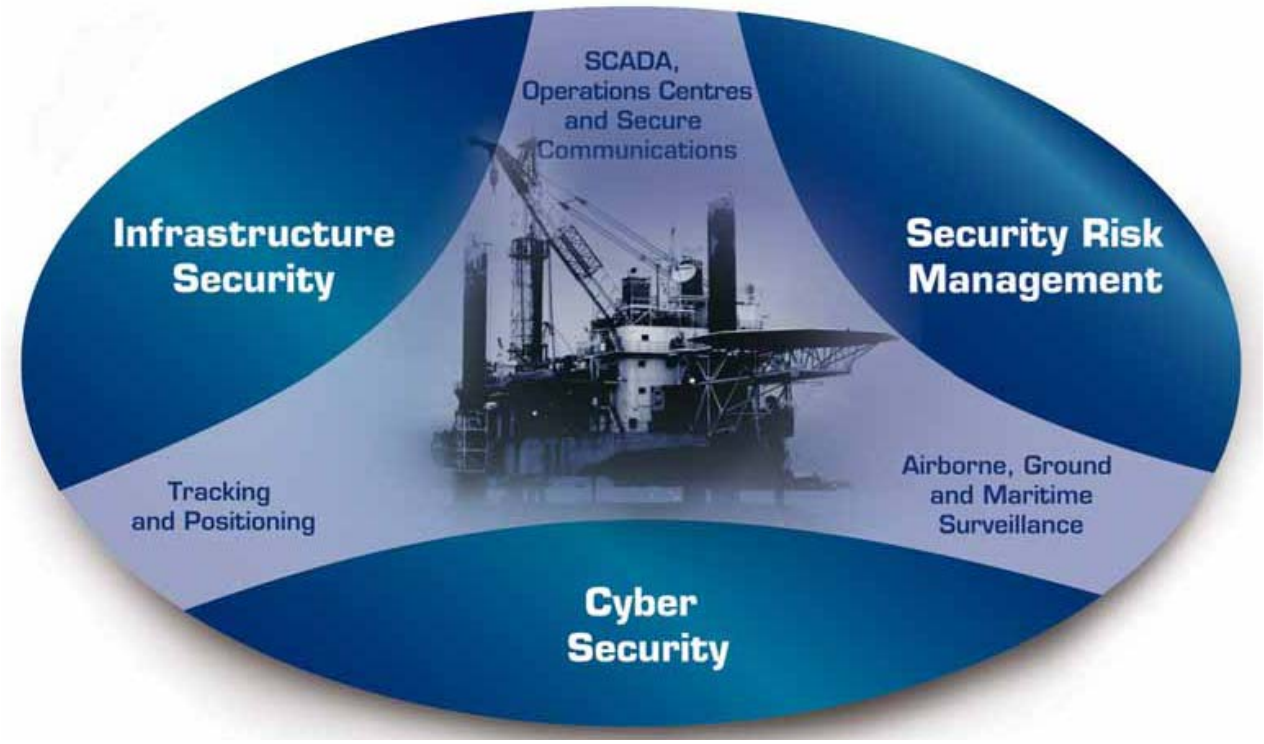
- Security of geological survey party, their equipments and explosives
- Land acquisition and establishing camp sites
- Pre-camp armed - static security
- Security during movement of drilling equipments and personnel
- Executive and employees travel protection
- Transportation - armed security (rail, air & sea)
- Commencement of drilling / pipeline laying activities
- Establishing early oil / gas collection centers and security thereof
- Security of off-shore platforms, receiving terminals, dispatch terminals, compressor stations etc.
- Security of larger installations such as refineries, LPG plants and petrochemical complexes
- Security of supply chain – storage / warehouse, rail / road transportation
- Intelligence gathering and disaster planning
- Constitution of Emergency Response Teams

For the Key Infrastructures such as Oil and Gas, security is always a major concern as this sector world over has high probability and vulnerability from terrorist attacks and sabotage. Their operations also have high criticality. Following are the specifics of the security management of this sector -

Security of Offshore Platforms

Examples of recent attacks on oil pipelines and offshore oilrigs have included those carried out in Nigeria, Columbia, and the facilities of ExxonMobil in the Aceh region of Northern Indonesia. Though the number of such attacks has considerably dropped from 200 to 45 last year, there still lurk the threats to numerous oil rigs, supply depots and refineries as well as loading terminals; further demanding a deeper insight on measures for enhancing security and safeguarding the larger oil infrastructures.

Another aspect that “has made offshore oil-rigs or oil platforms all the more vulnerable is their potential target value for terrorism-for-profit, rather than terrorism-for-political ends, as the majority of the world would like to believe.” http://www.primedefence.com



This phenomenon can be observed in the countries of Angola, Gabon and The Ivory Coast and though of lesser significance; in South Africa as well. With concerns for profit rather than politic motives becoming common, and the popularity of networks such as the Al-Qaeda, there is now a much more likely chance that this phenomenon will spread in other regions of the world.

Off-shore platforms are highly vulnerable, high risk installations having high probability of attacks of terrorist which may be equipped with some of the best technical capabilities. Somalian sea-pirates have well demonstrated that now-a-days any one can get any thing provided they have sufficient funds! It is therefore very important that beside sturdy infrastructure security and the security risk management mechanism including airborne, maritime and ground surveillance, these platforms have very reliable and impregnable communication and cyber security measures. Tracking and positioning of manpower and material is equally important.

The matter assumes high significance from the perspective of national security as there are major oil producing assets along the coastline of Maharashtra and Gujarat in Western Offshore. These have an investment of around USD 24 billion with production of 3,35,000 barrels of oil per day and gas of about 56 million standard cubic meters per day (mmscmd).

To devise an action plan to combat attacks on its offshore installations. Potential terrorist-related crisis situations should be incorporated in the CMP (Crisis Management Plan) along with the response mechanisms/capacity building required to handle such situations. Vessel Automatic Tracking and Monitoring System for the security of large oil infrastructures in high sea areas assume greater importance to rule out attack capabilities of Somalian like out-fits which might draw their attention to the vulnerabilities of these assets.

Strategies for Reliable Security of Oil & Gas Assets

The Operations, Safety, Security, and IT decision-makers of the Oil & Gas industry are well advised to pay attantion to following aspects -

Optimising Assets Through Centralised Command & Control

Integrated command and control systems must be positioned to provide an integrated solution, which captures and validates data that can be used throughout the organisation during normal operation, whilst providing relevant, useful information in difficult and emergency situations. This approach will enable operators of critical national infrastructure to optimise their assets whilst maintaining their investment in legacy systems. New developments in technology can improve the security of personnel and assets and provide enhanced operational capabilities.

Securing Oil & Gas Control Systems

More and more reliability on Local Area Network (LAN), Wide Area Network (WAN) and Broadband Global Area Network (BGAN) brings increased threats to operations of organizations using them. The networks are suseptible to attacks aimed to disrupt and destroy them. Such an attack by viruses, worms or other forms of cyber-terrorism on oil and gas industry process control networks and related systems could destabilize energy industry supply capabilities and negatively impact the national economy.

Sandia National Laboratories, Albuquerque (USA) has served as the lead national lab in Project LOGIIC (Linking the Oil and Gas Industry to Improve Cyber Security). The project was created to keep U.S. oil and gas control systems safe and secure, and to help minimize the chance that a cyber attack could severely damage or cripple oil and gas infrastructures.

It works to identify ways to reduce cyber vulnerabilities in process control and SCADA

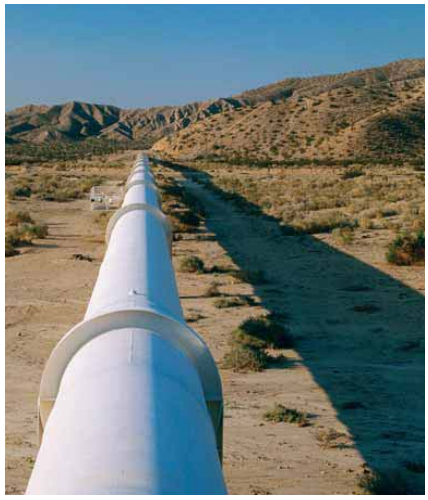
(Supervisory Control and Data Acquisition) Systems). The goal of the project was to identify new types of security sensors for process control networks. Sandia worked with project partners to create a simulation test bed and apply this environment to counter potential threats to the oil and gas industry using hypothetical attack scenarios. Sandia researchers created two real-time models of control systems used for refinery and pipeline operations. The trials have come out with very encouraging results and technology is ready for deployment.

Biometric Integrated Safe System of Work

Integrated Safe System of Work (ISSoW) is a key tool in ensuring the safe operation of Oil and Gas installations. However, such systems can only be truly effective if user identities can be quickly validated and definitively authenticated. For this to be implemented in practice in providing advanced authentication and identity management, the biometrics based access contrpol solutions are found to be very reliable. There are many solutions aviable solution where worker identities can be positively and accurately registered, identified and managed securely throughout their lifecycle.

High Accuracy Real Time Personnel & Asset Location

Therer is need to have a system that improves the safety of workers in hazardous environments and helps to improve the effectiveness of emergency response measures. There are systems availble which can locate an individual, or asset, to within 1 metre in 3D (e.g. in a multi-storey/multi-level facility) and it can do this up to 1km from a base station. The system provides a position update every second and, for example, could be used to track a lone worker or road tanker's progress through a plant or ensure that personnel are moving towards the correct muster points in an emergency. Such system do not not require large amount of infrastructure or extensive cabling and is therefore easily installed in an existing plant at minimal cost.



Situational Awareness - Securely Integrating Site Data

This aspect deals with the need to simply and securely integrate data from a wide variety of systems to show site leaders and managers the overall condition of their site - and what is happening on it. This capability brings together data from operational, security and work management systems and merges this private data with public information from the internet to provide a complete picture. By using an underlying open data architecture together with security protection system, it can bring these data sources together and share them securely among multiple disparate user groups, and at different locations, whilst ensuring data validity, security, and privacy. As well as the complete picture, it can also provide custom views for users such as maintenance teams, emergency services and even the media and general public in the event of a major incident.

Upstream Collaboration

Collaborative working can generate significant benefits to improve time to market, reduce risk and increase productivity with the upstream energy business. It allows any combination of knowledge workers on and offshore, the ability to collaborate on any document or application with video anywhere in the world.

A true collaboration environment seeks to make decisions and resolve issues faster. It allows plant engineers to share photo evidence and discuss issues with the head office, risk management office to comply with HSE requirements; Upstream exploration processes linking a remote geological survey unit to share seismic data and structure a next stage of exploration programme; and plant design and build to allow large scale programmes to collaborate on critical design and project build processes with all parties, creating a effective way of delivering complex projects.

Robust, Secure, Global Communication Solutions

This capability calls for seamlessly connecting all oil & gas installations of an organization and on more higher level , of the Nation by providing highly available, robust, secure, integrated communication networks for critical operational systems. A number of communication solutions are avialble which provide robust connectivity and communication helpful for protection of assets and personnel in environments where a high standard of inherent safety is a mandatory requirement. There are resilient telecommunications networks such as Broadband Global Area Network (BGAN), which allow for simultaneous voice & communication data communications and secure access to applications from almost anywhere in the world.

Communication Technology: Legacy v/s Ethernet

Everyone is trying to monitor and control remote assets without sending personnel out to distant locations. It's expensive to send someone on a three to four-hours' drive several times a day to check an oil-well. People want to get the same benefits without leaving the office, and Ethernet technology allows personnel to be virtually on location. Processes can be started and stopped, gas production levels can be monitored, and tank levels can be checked, just as if someone were physically at the location of the asset. Radio is the key that allows us to create a link in the office and do all this.

After investing millions in legacy serial communications systems - and in many cases, millions more in older SCADA RTUs (Remote Terminal Units) and EFMs (Electric Flow Meters) — many oil and gas producers are in a fix? Because they are now being driven by IT to convert these systems to Ethernet! The benefits of Ethernet usually make it worthwhile. The first

advantage is people have been using licensed radios in the oil and gas industry for almost 20 years, and the frequency allocations are pretty well used up in areas where there's a large oil and gas production. New frequencies just aren't available.

"With spread-spectrum radios, we now have the ability to put in radio systems that don't need licenses. And with some of the newer products, there are new allocations of frequency, so we've opened up a new world for people to purchase a license and have their own dedicated frequency. In addition, Ethernet allows producers to easily manage remote assets."

Jim Gardner, Business Development Manager of Oil and Gas for FreeWave Technologies, a manufacturer of 900 MHz and 2.4 GHz license-free spread spectrum radio modems and licensed-band radio products

Security is one of the best reasons to make the switch. Serial radios can't provide all the security features of Ethernet. One can supplement serial to get certain levels of security, but it is still not as secure as Ethernet. With Ethernet technology, the radios themselves become individually addressable, and you know that you are talking only to that radio. You can also create a "white list" or "black list." The white list would include TCP addresses that are authenticated on the system and are permitted to talk. This prevents someone from finding or stealing a radio and talking with a major oil company's network. Users have to be authenticated or the system won't respond. This feature makes it very useful for police and law enforcing agencies as this enables their communication highly secure compared to conventional radio communication.

While above are the main strategies for securing the oil and gas assets, constant improvement and improvisation need to be carried out to make security measures reliable as well as cost effective, as in present phase of economic melt-down no organization will take decision with out working out the ROI (Return on investment). Dedicated manpower ready to face the disaster would always be central consideration for any security and disaster response plan. To keep them constantly motivated and updated is also another prime responsibility of the Management as otherwise even the best plans are doomed to fail. Only those will succeed in this sector who foresee and fore-plan and rehearse thereafter their security and emergency response plans!

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