

Extending the Mantle of Safety:

The Role of IP-Centric Satellite Communications in Managing Security Risk in Remote Area Mining Operations

Operating a mining operation in a remote area, especially in a country with significant infrastructure shortcomings, presents a series of challenges which must be addressed at a strategic level, in order to ensure the long-term sustainability and viability of such operations. A reliable communications platform directly back to the corporate head office provides a solid foundation for effective command and control, supporting not only day to day administrative and production operations, but also as-needed communications pathways for Emergency Management.

In addition, IP-centric satellite communications provides the flexibility that is required in order to support the cleanly partitioned carriage of traffic for the various arms-length entities operating on a modern mining operation, and to also provide the level of personal entertainment and communications facilities that highly-skilled personnel expect in order to attract and retain their services on site.

This paper briefly examines these aspects, as well as the emerging trend to support off-site operations, minimizing and shifting risk from a remote site to a well understood and controlled environment.

The importance of effective communications in identifying, mitigating, and managing risk, regardless of the environmental specifics, has long been recognised and understood. Especially in remote areas with inadequate, vulnerable and/or unreliable communications infrastructure, satellite communications networking is the natural choice and dominant mode of telecommunications.

The last few years has seen a sea change in the design and implementation of such networks, with a move away from traditional serial services (such as "SCPC"), towards a purely IP-based architecture. As a result, new opportunities are being exploited by progressive mining operators, including cost-effective yet secure sharing of network capacity with sub-contractors on site, direct integration of site telephones into the corporate PBX for reliable, secure and cost effective voice communications, and the aggregation of various security and

administrative functional activities back to a 24 hour "Operations Centre" within the corporate headquarters.

Security of Personnel

Modern satellite systems' ability to provide IP-based communications back to corporate head office facilitates a number of sub-systems that have a direct impact on Security of Personnel:

Direct Command and Control – voice and email integration into the main corporate environment ensures that site management is able to coordinate in a timely and reliable manner with head office, and engenders the regular bidirectional flow of information. This is an important element for good corporate governance during normal operations, but is paramount during abnormal or emergency events.

Medevac - Direct lines of communications, unencumbered by local interdependencies, are critical during a time of medical emergency. Direct access to highly skilled clinicians is often required to authorise the administration of controlled medicines by on-site paramedics, and co-ordination of medical evacuation (usually by air) is also best achieved via a top-down mobilisation authority from head office. Once again, the ability of a satellite based solution to directly integrate the remote site into the parent corporate network ensures that coordination is achieved via the most appropriately aware and authoritative interface.

Personal Communications – One of the challenges facing mine operators around the world, is the ability to attract and retain first rate, highly skilled and experienced personnel. Increasingly, candidates are assessing the facilities that will be provided on-site, and electing to work on the project that meets not only their financial needs, but also meets their “soft” needs. These needs include adequate means by which they can stay in touch with friends and family, or by which family can contact them, as well as the provision of “entertainment” facilities such as FM broadcast radio, and free-to-air TV, pay-TV, and Video on Demand (VOD) services.

In contrast to the expensive call rates to most countries, integration of site phones back into the corporate PBX, and/or to public phone services in North America or Australia, allow site personnel to be contacted whilst off-duty for the cost of a local call. Similarly, site personnel can make calls back home for the cost of a local call.

This has important consequences in terms of the recruitment and long-term retention of site personnel, as it allows them to maintain

their chosen life-balance; it allows them to work on-site without the social isolation or cost penalties that the “tyranny of distance” has traditionally imposed.

In addition to voice services, personnel expect to be provided with adequate personal internet services, to support personal email, web-browsing, internet banking, instant messaging, and increasingly, low-rate video presence (such as Skype and Microsoft Live Messenger). These services are often difficult to secure, and may be fundamentally incompatible with the corporate LAN security framework.

Fortunately, the partitioning capability of modern IP-centric satellite communications systems allows a separate port on site to feed the accommodation and mess areas with a “raw internet” service, completely separate to the corporate network, yet cost-effectively sharing the very same remote site satellite infrastructure. This not only safeguards the corporation from inappropriate exposure to non-corporate, unauthorised programs that personnel may have on their personal PCs, but can also be useful in mitigating regulatory risk; by using an ISP to provide the “raw internet” feed, the ISP handles the obligations for compliance with various legislative needs, relating to viewing of inappropriate content, “wire-tap” interception plans, and liaison with law enforcement agencies. This is usually a set of risks and responsibilities that companies are keen to outsource!

Security of Assets

Allied with Security of Personnel, security of Plant, Equipment and Product is also essential in order to safeguard profitability and long-term viability of a remote area mining operation.

Modern mine productivity systems, including assaying, geotechnical, mine stability, and ore movement systems, are all IP-enabled, and immediately lend themselves to integration and tightly integrated upstream reporting and monitoring via a suitably dimensioned IP-centric satellite system. The knowledge that data from each system is reported or archived off-site, provides mine management with an auditable set of objective evidence of the progress and productivity of the operation.

Mine Management Systems that include localised vehicle and key asset tracking (including underground operations), can also have remote consoles viewable from a central location.

Access Control systems can also be remotely monitored, allowing the location of personnel to be tracked via swipe card movements, or by RFID tags. Such tags can be embedded in each miner's safety helmet, and can include sensors such as "man down", or can be externally inferred due to prolonged periods of no physical movement, etc. These systems can either actively prevent access to unauthorised areas, or can passively report when an individual was detected to have entered an area to which they were not entitled.

Closed Circuit Television (CCTV) has also become IP-enabled, and it is now a regular event for a central "Operations Centre" to monitor the CCTV footage over key installations either on a 24 x 7 basis, or during "stand down" time at a remote site. Together with motion detection algorithms, a single operator can monitor in the order of one hundred cameras across multiple sites; a significantly lower cost solution compared to local provision of such monitoring, and often

utilising an existing security resource at Corporate head office.

The effective delivery of site information to the Corporate network provides management at all levels with the knowledge that data is made readily available to those with the expertise to process it, and provides a degree of transparency that hitherto was not possible in remote site operations. Similarly, the widespread knowledge across site that such monitoring is in place, can act as a significant deterrent to those considering misappropriation of equipment or product.

Information Security

The modern mining operation is highly dependent on Information Technology in order to achieve the efficiencies and productivity that keeps the bottom line in the black. Whilst significant assumptions are made during the planning phase that IT systems will be heavily used, securing these systems and the invaluable data within them, is usually an after-thought late in the commissioning phase.

There are several key requirements that must be met in order to provide adequate Information Security, and these are ideally met by an IP-centric satellite communications system. Salient points include the following:

Segregation of data networks – It is common for a mining operation to be executed in concert by several different entities operating at arms length. Each entity has similar requirements; usually, to access various IP-based business applications on their respective corporate environments.

It is important that each entity is kept isolated from its peers' networks... a requirement that is usually imposed from each entity's

corporate IT department in any case. Traditionally this has meant that multiple satellite dishes appear on site, each providing a relatively low data rate for each entity. Alternatively, one entity may attempt to “tunnel” through the prime contractor’s network using a VPN, however throughput is usually in the order of 33% of the possible throughput, due to the inability of the VPN to leverage various acceleration techniques.

The modern solution is to implement a single satellite solution for the entire site, with each entity being presented a dedicated Ethernet port over which its traffic is carried as a completely separate partition. Traffic prioritisation ensures that each entity is provided with the agreed baseline bandwidth, yet can enjoy the ability to “burst” to higher data rates during periods of low utilisation by the other entities.

Redundancy – Depending on the specifics of the site, an alternative data path can be provisioned via a second satellite link, or the satellite link may represent the official redundant path to protect against loss or degradation of the terrestrial service. In either case, the need for redundancy recognises the importance of having reliable and continuous IP-based communications between the remote site and the Corporate office.

Off-Site Backups – Key data, including assaying, drilling, blasting, ore recovery and shipping reports, and even financial transactions, are gathered on site. It is essential that this data is backed up, to mitigate against corruption or catastrophic loss. This is especially the case when remote site IT equipment is often operated in areas with unreliable mains power and high humidity.

Off site backups held at the Corporate head office mitigate against such catastrophic loss, and can be achieved via a continuous low-bandwidth background synchronisation task, or as a nightly batch job during periods of low network utilisation. Once safely in the main corporate environment, the data can be archived on a secure Storage Area network or similar enterprise grade solution that would be inadvisable to deploy on site.

User Administration – With tight integration of the corporate network and site, it is possible for the remote site to hold a user authentication and authorisation database that is cascaded from the enterprise-wide system. This user database can be integrated to the Human Resource Management (HRM) package, ensuring that new users are automatically created with appropriate authorisation as they are recruited, and that similarly, users are automatically de-activated on site as they leave the employ of the company. This elegantly addresses the issue of user accounts lingering for months or years after the employee and company have parted ways.

Patch Management – The ever evolving series of vulnerabilities in Operating Systems and the myriad exploits against these vulnerabilities, means that it is essential that the same IT Management principles are employed on site as are used in the main Corporate environment. This includes the controlled administration of patches to Operating Systems, Applications, routers and firewalls, and anti-virus updates.

By directly integrating the remote site into the corporate network, the Standard Operating Environment (SOE) can be deployed to all IT plant on site, without requiring a duplication of effort. This also ensures that standard

build notebook PCs of visiting staff are compatible with the remote site's LAN, and neatly integrate into the system in a productive and secure manner.

Emergency Management

The ability to connect from a remote mine site back to an industrialised country in one single, well controlled link, ensures that communications are available even when local terrestrial telecommunications networks are down; regardless of whether such terrestrial outages are due to man-made events, or from natural disasters.

Satellite communications therefore plays an essential role in safeguarding the monitoring of welfare and instigation of corrective actions or resourcing, during times of emergency.

In addition to the usual IP based systems, including telephony, it is possible to integrate the two-way radio system back into a "Despatch Console" or "Emergency Response Console" in the Corporate offices, using techniques such as Cisco's Land Mobile Radio (LMR) over IP. This would allow emergency management crews on-site to communicate from anywhere on site that has two-way radio coverage, and to co-ordinate with a well-resourced emergency co-ordinator in the Corporate Operations Centre; or to even be cross-patched to adjacent operations to request relatively local assistance.

Project Life Cycle

In order to deliver the best possible project outcomes, and to minimise project risk, it is essential that the satellite communications system is incorporated at the earliest possible point in the high level strategic design.

Effective communications should be viewed as one of the first pieces of critical infrastructure to be commissioned on site, and one of the last to leave; "first in, last out".

By establishing a communications facility on site during the early pioneering works, the later stages of the exploration phase and the entire Pre-Feasibility Study and Detailed Design phases can benefit from the direct integration into the corporate network.

The small cadre of staff on site during the pioneering works require communications in any case; modern IP-centric satellite solutions allow a given size dish and transmission equipment to be utilised during this phase at the desired bandwidth, and then scaled upwards to handle the multiple entities and large personnel numbers that exist during the Design and Construction phase... and to then be optimised to the bandwidth mix required for the long term operations phase.

The ability to re-dimension the link to track the organisational needs through the project life cycle, strongly differentiates the modern IP-centric satellite solutions from traditional "leased line" circuits. Together with the ability to provide separate partitions into appropriate corporate WANs and/or "raw internet" and/or MPLS tail circuits for each separate legal entity operating on site, this "whole of life" approach delivers significant cost savings and operational efficiencies that exceed the disparate approaches commonly taken.

Security via Social Sensitivity

A range of social, governmental, and cultural sensitivities must be addressed when operating in remote areas, and telecommunications is no exception to this. Opportunities do exist to meet these requirements, and to deliver back into the local community, whilst still meeting the company's need for reliable communications. These opportunities include:

Operating in monopoly carrier environments

- Developing nations often have a policy encouraging or mandating the use of their terrestrial telecommunications infrastructure. Unfortunately, these legacy systems tend to be technically inadequate for the support of modern corporate needs, and may also be unreliable due to copper loss, failure of mains power at any one of a number of cascaded sites, or suffer from over-subscription and hence heavy congestion.

Whilst wishing to safeguard their local monopoly telecommunications carrier, governments are also keen to safeguard the revenue that mining operations can bring, and hence are usually willing to allow a redundant corporate network configuration whereby the terrestrial network is configured as the primary route, with satellite providing the redundant route, carrying traffic whenever the terrestrial link is effectively unavailable.

Training – Another policy desire of governments in developing countries is to see the technology transfer and up-skilling of the local population. In concert with various industrialised countries' economic development programs, ITC Global has successfully trained local technicians or tertiary qualified engineers such that full in-

country or even on-site technical support is available in every country in which services are provided.

This has proved crucial in developing goodwill within the country, demonstrating a long-term commitment to the economic development in that country. The approach also provides improved interaction with locals in areas other than communications, and provides a degree of support that very few other companies can parallel.

Community Development - Education plays a key role in the development of any nation. Subject to any local regulatory constraints, a separate "raw internet" partition can be delivered from the site's satellite terminal into the local school via a wireless link. Together with modest supporting resources, this usually represents a quantum leap for the local school, and hence greatly improves the long-term prospects of the local community. Such an action can provide a very real and visible demonstration of the company's commitment to the local community, and engender improved relations.

Conclusion

Modern IP-Centric Satellite systems have a key role to play in delivering operational efficiencies, and mitigating project risk for remote site mining projects.

By incorporating the satellite communications solution into the high level strategy as early as possible in the project lifecycle, the benefits can be realised from as early as the pioneering works on site, and help extend the mantle of safety that in turn attracts and retains the key resources to ensure long term project success.

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