

# A Cost-Effective Approach for Data and Voice Transfer in Remote Locations

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**Abstract:** Wireless data-transfer technology has increased the efficiency of the logistics during the nautical charting process. It has produced a cost-effective means through which data and verbal exchange can take place within companies where communications is otherwise nearly nonexistent. Terra Surveys, LLC used this technology during the summer of 2002 while conducting a nautical survey of Kasaan Bay, AK for NOAA. An eight-foot satellite dish was installed at the job site allowing wireless data transfer; phone communications as if employees were in the home office; internet access on the vessels; and real time software and hardware operations on remote field computers by home-office IT personnel. Time is money and Terra Surveys, LLC has found this to be a cost-effective approach.

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## Overview

Terra Surveys, LLC was contracted by the National Oceanic and Atmospheric Administration (NOAA) to conduct a hydrographic survey of Kasaan Bay in Southeast Alaska. Bathymetry ranged from one to 278 fathoms and the project area was approximately 55 square nautical miles.



Operations were based in the village of Kasaan located on Prince of Wales Island approximately 1,000 miles from Terra Surveys, LLC home office. The village of Kasaan had very few technical resources that are typically used in our everyday operations. Local and long-distance telephone service was available, as

was a reliable AC power source. The nearest ISP was located in Ketchikan, AK about 90 miles away on another island. However, access to this ISP was expensive and would have entailed additional long-distance toll connection charges and a wholly inadequate data transfer rate of 56K/bytes per second maximum.

Previous projects for NOAA in Nikiski, Kenai, Ketchikan and Anchorage had utilized local phone and internet resources. These projects were in less remote areas and enjoyed the availability of better communications. In the summer of 2000 Terra Surveys, LLC had surveyed the Tongass Narrows in Ketchikan and incurred large communications costs associated with the project. In spite of the project location in a medium size Alaskan city, internet connectivity was lacking as well. After negotiating with the local phone company, a 128kbps ISDN line was obtained. This line was deemed adequate for supporting collection, but a post collection phase with the needs for constant voice and data access would need more robust capabilities.

In previous years Terra Surveys, LLC post processed data in its Palmer office for many reasons including network infrastructure and communications. We desired to move processing closer to the collection and the lack of adequate communications was the chief impediment to doing that. Kasaan was more remote than any of the previous locations. We needed a solution that was independent of the land based telecommunications network on the island. Telecommunication charges, long distance, cellular and data transfer, for previous years had been as much as \$5000 to \$7000 per month. The communication system we developed allowed us to maintain the quality of communications between the field sites, main office, client and vendors that was needed.

Critical capabilities for the project included the following:

- The ability to transfer data from the Kasaan site to our Palmer office.
- To be able to transfer data from the vessels to the Kasaan site
- The ability to send and receive email.
- Sufficient bandwidth, allowing for full functionality.
- Voice communication between the project site, Palmer office and vessels
- Eliminate, or reduce, long distance phone charges.

In addition to the above critical capabilities, system flexibility that we were hoping to achieve included:

- Integration with our existing phone system, possibly using VoIP.
- The ability to access the Internet and our Intranet site. This would allow for product research, updates and upgrades directly without having to depend on office-to-office land-based mail. Internet access was also good for crew morale.
- The Kasaan office should be a part of the Terra Surveys, LLC local domain. This would allow a single point of network administration.

- IT personnel at the Palmer office needed the ability to remotely control and administer the Kasaan computers if needed.
- Personnel should be able to move data and software between the survey vessels and the land based network wirelessly.
- The vessels should have telephone capabilities.

To achieve the above goals, we determined that we needed two separate systems, one to provide a link between the local networks in Palmer and Kasaan thereby creating a WAN and the other to connect the vessels, even while underway, to the Kasaan LAN, and therefore the Palmer LAN as well.

A dedicated T1 carrier or other high speed connection was not a practical option due to the remoteness.

### **Satellite System**

A satellite link to the Internet appeared to be the best WAN option available. Several satellite systems were available. Of those, only one was a local Alaska provider.

The local satellite system would not work for the following reasons:

- They did not have adequate uplink speeds or dedication of bandwidth. Bandwidth was based on availability.
- VoIP, the technology necessary for the remote phone system to work, was not available due to proprietary encryption and compression during the satellite transmission process.

General factors pertaining to the other systems were:

- Most systems had high download speeds but not effective uploads. These systems were primarily designed to provide a good Internet connection to a remote location, and did not provide the needed upload speeds.
- Some did not allow VoIP.
- Initial cost and monthly expenses were a major factor. Most companies that offered the specifications we needed were not cost effective.
- Some required that their technicians do the installation, others required we attend an installation class.
- Most were based the cost on the bandwidth reserved. In other words, they provided a broadband pipe and we paid for the pipe, not how much we used it.

The satellite system we chose met all of the specifications we needed, plus the cost was based upon how much data was actually transferred, not the speed of the transfer. The package was based upon annual usage and was paid in 12 monthly payments

## **Wireless Data Connection**

Wireless LAN equipment was readily available. Key features we needed included wireless access points that were reliable, and had good speed and range. Initial factors that directed our attention to Cisco products included:

- Range specifications of 5-25 miles, depending on antenna configuration (we achieved a 9-mile range with CISCO wireless equipment on another job later in the season, using the antenna required for only a 5 mile range).
- Adequate bandwidth.
- Good technical support.
- A history of quality.

## **Benefits To Network Administration**

A single point of network administration always has its positives and negatives. The main factor that determined this was ease of administration. Often the simplest way is to let each site have local administration; there are issues on conformity and the cost of having trained personnel at each site.

Since there were not extensive administrative duties to perform, using a single point of administration was a great benefit to us and allowed us to remain uniform in our procedures.

The satellite and wireless systems gave us the capabilities to:

- Control and administer any computer in the remote office or on a survey vessel.
- Deploy antivirus servers that would automatically update virus definitions once across the WAN, then push them down to the clients on the LAN. This lowers WAN traffic, and ensures that all our computers have the latest virus definitions.
- If either the land based phone system, VoIP system or the computer systems failed we could still communicate.
- Keep continuity in Terra Surveys, LLC network administration. Having the remote office as part of the Terra Surveys, LLC domain allowed for a single point of administration. Whether items were modified in Kasaan or Palmer the changes were reflected at both sites. Examples of these changes and modifications are:
  - Adding or deleting users accounts or groups
  - Applying group policies
  - Changing permissions or other account information
  - Replication

- Have a domain controller at the remote site. This enhances security by disallowing unauthorized access to resources. This enhances the utilization of the WAN because all authentications are done within the LAN and not across the WAN.
- The satellite transmitter and receiver acted as a gateway and isolating the Local Area Network from the Internet making it more secure.

### **Abilities And Capabilities These Systems Gave Terra-Surveys**

Terra Surveys, LLC gained a robust and flexible information system. These new abilities affected many aspects of our project. The everyday use of the new features became second nature to us and often they were so useful and helpful we forgot how hard it was to function without them. The satellite system was the foundation that made it all possible. All of our requirements and wanted capabilities we specified were provided.

The following highlights a few of these features:

- Transfer of data between our offices and vessels.
- E-Mail
- Internet and Intranet access
- High speed bandwidth
- Phone System
  - Integration with our existing phone system using VoIP technology.
  - Extensions worked everywhere. No matter where you were, if you connected to a person's extension we could talk to them regardless of their location.
  - Reduced long distance phone charges.
  - Phone calls from Kasaan to any Palmer, AK telephone were local calls.
  - Vessels had phones.
- Wireless Network
  - Data and software was transferred to and from the vessels to the remote office or Palmer office.
  - Data and software was moved wirelessly between the survey vessels.
  - Remote administration of computers on vessels.
- Benefits to software management
  - Software is subject to updates and issues that arose during the processing of survey data. The WAN gave us the ability to quickly identify issues and process any required updates to software from either site.
  - In-house software has been developed to augment capability or efficiency found in commercially available software. Upgrading and debugging this software requires the availability of surveying instrumentation and software that is used alongside the in-house software. Having the survey vessel computers and survey instruments

available in a real-time, real-world environment allowed the programming staff to resolve runtime issues and provide upgrades and fixes to the field in a timely manner.

- Database administration was facilitated by having real-time access to the databases in the field. All database administration, regardless of location, was accomplished from the Palmer office where the database administrator and programmers were located.

## **Conclusion**

Improved communications allowed more post-collection processing to be performed at the project site. This allowed near real-time information to be conveyed to the surveying vessels. This enhanced the ability to collect data in an efficient manner.

Voice communications between the project site and the main office were improved. Data transfer capabilities allowed pictures and images, as well as text messages, to be transferred. Computer maintenance and administration did not require an IT staff onsite.

Overall, we found this system, as a whole, to be very beneficial to the project.

Having email and internet access along with easy voice communication for the remote staff was valuable in preventing some of the isolation that is present in very remote locations. Having the ability to get relatively fast feedback on survey data quality and coverage for the vessel crews allowed the vessels to get more than adequate data without the over collection of data that was utilized in previous projects.

The ability of the Palmer staff to resolve issues with the network and software saved immeasurable time for the field crew.

We intend to continue with this concept and enhancing its capabilities in the future.

## **Future Enhancements**

Install a remote access server and services and virtual private network connection to aid in the replication of network information and database replication.

Install a network of wireless relay points and access points to give full coverage within the project boundaries for communication from the vessels.

Allow dial-up access to the remote network as a backup for email and internet access.

Investigate different satellites and transmission bands (Ku vs. C) for enhanced bandwidth and lessened susceptibility to environmental interference.

## **System Specifications**

### Satellite system:

- 3-Meter Dish
- Ku Band Satellite transmitter and receiver
- 1500 Kbps Download speed
- 384 Kbps upload speed
- Cost is based on a annual usage
- Upgradeable usage levels to avoid excess usage fees
- Current at a 15 Gigabyte level of data transfer a year (30 cents per megabyte over limit)
- Excellent Tech support. On-site installation class, assisted us in final deployment and fine tuning, and are available round-the-clock for troubleshooting
- Public IP Addresses for connection to WAN

### CISCO Wireless Access points

- 1000 – 11000 Kbps connection speeds
- External Omni Directional antennas
- Separate IP address aided in troubleshooting
- Relay station capabilities
- Basic 1-mile range. Up to 5 miles with external whip antennas
- Web interface administration

### Approximate hardware cost

- \$ 12,000 for VSAT equipment
- \$ 10,000 for Phone system equipment
- \$ 3,000 for test and installation equipment
- \$ 5,000 for wireless system

### Operational Cost

- 1 day installation
- \$5000 operational cost for 5 months

## Glossary

AC .....Alternating Current

ASCII .....**American Standard Code for Information Interchange**

Gigabyte ..Approximately 1,024,000,000 characters of ASCII data.

IP.....Internet Protocol. A communications protocol commonly used to connect computers to allow transfer of data

ISDN .....Integrated Services Digital Network. A telephone service that provides for high speed data and voice transmission of up to 128 Kbps per second

ISP .....Internet Service Provider. A service company that provides dialup and wide-band internet connections

IT .....Information Technology

Kbps.....Kilo bits per second. 1024 bit of data transfer per second

LAN.....Local Area Network. A group of computer and devices in close proximity generally connected by hard cabling or wireless technology

Mbps.....1,000 Kilo bits (1,024,000) per second

NOAA.....National Oceanic and Atmospheric Administration

T1.....A telephone service that provides for high speed data and voice transmission of up to 1.2 Mbps per second

VPN.....Virtual Private Network. A network connection using the internet. Allows remote computers to connect to a LAN as a node.

WAN.....Wide Area Network. Two or more LAN's connected via a combination of the Internet, satellite technology, or the public telephone system.

VoIP .....Voice Over IP. A protocol which allows voice voice communications ov an IP network

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