**Telemetry for Hydro-meteorological Applications**

Real time Transmission of hydro-meteorological data had been in use since more than 40 years. The very early systems that utilized data relay relied on land lines. A solutions based on Line of Sight (LOS) radio were used, and this technology still works rather well in the plain, but where the terrain is complex, the use of LOS radio becomes prohibitively expensive. LOS radio frequencies as well as nearly the entire radio frequency spectrum are under pressure to provide the capacity to drive rapidly expanding telecommunication industries, such as the mobile phone industry. LOS radio systems were the workhorse of hydrometric telecommunications over the past 40 years.

Over the past 15 years we have seen the INTERNET and mobile communications lead the charge. Only now are hydrometric systems beginning to benefit from the new technologies in communication. It is quite probable that over the next 5 to 10 years the advancements in telecommunications will gradually make their way to field of meteorological and hydrometric data relay.

There are two general methods of relaying data in real-time today. One method is terrestrial-based data relay solutions, while the other is satellite-based (See Figure 1 below for details). Each system has relative advantages and disadvantages. Terrestrial-based systems are a bit more common, while satellite-based systems have shown considerable growth over the last 20 years. The primary reason satellite communications has grown so much is because satellite based data relay systems provide communications from remote regions where terrestrial based system are either not available or not as feasible. This is especially the case in mountainous regions there the terrain obstructs many terrestrial-based solutions.

Figure Telemetry options and Technologies available for Hydro-meteorological application in India

The detailed discussion on INSAT based, VSAT based and GSM based telemetry methods are available in HIS manual. In this document, a comparison (Table 1) is provided for two satellite based methods; VSAT and INSAT Radio based telemetry in order to assist the implementing agencies in selection of appropriate communication media.

Table : Comparison\* of VSAT and INSAT Radio based telemetry

|  |  |  |  |
| --- | --- | --- | --- |
| Feature | INSAT Radio  | VSAT | Comment |
| Availability | Above 99% | Above 99% | The availability is very high for both technologies |
| Transmission interval | Fixed at one hour | User selectable | In VSAT, user can configure communication interval from as low as one second to even once per day |
| Communication Direction | One Way | Two Way |  |
| Data push and Pull | Push Only | Both Push and Pull | The data transmission missed may be retrieved in case of VSAT only. **See explanatory note 1** |
| Initial cost at each remote Site | 90,000 | 1,20,000 | The cost of all indoor and outdoor equipment |
| Initial cost for Data Reception Centre | 1,00,00,000 | 1,20,000 | No special Data Receive centre is required at user end in case of VSAT. |
| Cost of software | High (around 1 Crore) | Low (below 30 Lakh) | Since VSAT provides data directly as shared folder or FTP, no special software is required to decode data whereas INSAT radio needs specialized software for decoding and reading data |
| Annual Operational cost per site | 4,000 | 2,000 | INSAT needs WPC license cost and Royalty Charges |
| System cost for 100 Remote Stations with One Data Reception Centre | 3,10,00,000 | 1,61,20,000 | Including Infrastructure hardware and software for Data Reception Centre, and operation cost for five years |
| Satellite Bandwidth | Provided by ISRO or IMD | Provided by service provider | In VSAT, user does not require any bandwidth to be allocated on satellite, as service provider already has bandwidth allocated in bulk |
| WPC Permission and License | Required | Not Required | VSAT service provider takes care, no permission required at user end. INSAT radio application needs NOCC, WPC license and permissions from DoT. |
| Permission for additional station | Required every time new station is added or location is changed | Not required. | User can increase number of remote stations or change location of any existing station, just need to buy additional equipment for new remote site. |
| Power Requirement | Low | High | Typical INSAT system needs 40 W solar panels and 60 AH battery whereas VSAT needs 120 W panels and 300 AH battery |
| Space requirement | Low | High | INSAT Radio can be installed in same box and pole where other equipments like data-logger are installed whereas VSAT system requires space for battery and mounting antennae. |
| Suitability for SCADA system | Not suitable | Suitable | SCADA system require two way an frequent communication, whereas INSAT radio has only one way communication at fixed one hour interval  |
| Diagnostic for problems | Difficult | Easy | **See explanatory note 2** |
| Knowhow of Technology | Very Limited | Wide applications | **See explanatory note 3** |

\*The desirable indicators are shaded in green color.

**Explanatory notes**

1. **Push and Pull:** Data push means; the remote site sends data twice (One transmission and only one re-transmission attempt after 30 minutes) to data centre. It has no method of acknowledgment or feedback; which means, the remote site would never know if the data has been received at data centre or not. If data centre fails to receive data at that moment of time, there is no other way to resend the data but to visit the remote site and collect data manually via pen drive. In Pull method, the server can decide to pull data from remote site at any time and for any number of records. In case the transmission could not be achieved at scheduled time, the server can pull data at later time (whenever the system is available again) and recover all missed data.
2. **Diagnostics for Problem:** In case of VSAT, service provider has full control and responsibility of system and can provide support within days. The problems for INSAT Radio have to be reported to IMD or ISRO, user has no control over system and support could take months to resolve. Since up to 1800 stations (installed by various agencies like IMD, ISRO, CWC, and SASE etc.) work on same frequency slot, even one problematic station could result in interference with transmission of all stations.
3. **Know-how of Technology:** The technology using INSAT radio is applied only in hydro-met data applications; the technological know-how is very limited even with vendors of equipment. VSAT is used in various industry applications including Internet access, distant education, telemedicine, telephone, video-conferencing, Banks, ATMs, VPN and news media etc. The skilled manpower for operation and maintenance of VSAT is easily available in market.