# Reporting Methods

The GOES DCS system design had several factors. First is to be able to perform reliable two-way communication between unmanned small stations and synchronous satellites. The basics of that technology were confirmed with ATS 1 operation in December 1966. Operational SMS 1 was May 1974 applied those lessons.

DCS Reporting covers three topics. There are the methods of sending reports. That is what causes reports to be sent, and how is the capacity shared among users. Second is the data rate within the messages, and third is the message format. All of these have an impact on the usability and capacity of the system capacity is expressed in terms of DCPs reporting, and the number of messages per day reporting. A related data set is the number and types of users and applications.

The initial GOES DCS was defined to include two types of reporting. These are self-timed and Interrogate. In 1980 Random reporting was initiated. The Magnavox purchase with the GOES DCS system buy about 1973 was entirely Interrogate Systems. NWS managed the buy along with NASA. A quantity of about 100 was the initial set.

Self timed message transmissions are initiated by a GMT clock

Random operation is initiated by sensor activity

Interrogate messages are initiated by commands from the base station(s).

Some characteristics of the earliest remote Data Collection Platform were:

* Full Duplex communication
* Required a 12 dB helix antenna with UHF Duplex Cavity Filters.
* Case was cast aluminum weighing about 50 pounds.
* Power consumption was about 1 watt (needs check data)
* Additional units were $25,000 each.

The system had substantial capability that had not been previously available.

In the hydrologic community (USGS and COE) comparative costs during those times were:

* Annual stream gaging cost $4000
* Cost of the recorder and timing was $1000
* Data was manually collected once every 4 to 8 weeks.
* Some stations had landline connections, and additional $1000 in equipment and $100 to $200 annual cost.

These costs provide an approximate budgeting capability of the related agencies. The $25K was only possible in the most extreme cases. Another issue was the quantum step in technological field capability to install and maintain a network. Overall the hurdles to operational use looked daunting.

The alternative approach was self-timed operation. The USGS and others based data collection on punching paper tape on a timed basis. So that approach had familiarity. The problem was that the timing accuracy had to be improved from 10 minutes a month to better than 1 minute per year. The USGS and others worked with Ball Brothers (Boulder, Colorado) and McCoy Oscillators (Mt Holly Springs, PA) to show that this was feasible in 1973. These 5 MHz oscillators were used in subsequent DCP procurements. The crystal was a 5MHz, 3 Over Tone, glass cased unit. Power consumption was 5 ma at 5 volts. These and related units were used for nearly 20 years.

The cost of Self timed operated DCPs was $2500 to $3000. This was a cost number that could be absorbed by most of the operation environmental agencies.

DCPI continued on a low level and was mostly justified by the NIST supported Time Keeping service which maintained microsecond level time synchronization. This was discontinued about 2005 when GPS time to nanosecond capability at modest cost became widely available.

Currently at this writing (July 2016) NOAA is supporting redesign of the Interrogate (2-Way) capability. The challenges of cost, power consumption, and reliability are the same as in 1966. However the technology has enabled considerably lower cost and reliable approaches that did not exist earlier. Prototype operation is anticipated in FY 2017.

The operating mode capability in 2017 is expected to any combination of Self Timed, Random, and Interrogate Operation.