

GOES High Data Rate Transition Plan
FINAL - As Approved by STIWG March 2004

I. BACKGROUND

The Data Collection System (DCS) transponder was first flown on the NOAA GOES satellite in 1976. This resource was initially intended only for NOAA agencies, but later opened to other Federal and state agencies when excess capacity was available and multi-agency data sharing was recognized as beneficial. Now GOES DCS has become a critical resource to many agencies, and to the environmental community as a whole. The capacity of the system is stretched due to conservative assignment policies deemed necessary to protect the operational integrity and reliability. In the early 1990's the Satellite Telemetry Interagency Working Group (STIWG) and the associated user community identified the need for additional capability for data throughput. The STIWG commissioned Cyberlink to study the feasibility of transmitting data through the GOES satellite at baud rates higher than 100 bps. The results of the study led STIWG to initiate a contract, managed by NOAA/NESDIS to develop high data rate (HDR) demodulators and transmitters. As a result, the GOES DCS is undergoing a transition to the new technology that will require a cooperative and organized effort by all users and NESDIS management.

II. PURPOSE

STIWG appointed a HDR task group to develop a plan to facilitate an orderly changeover to HDR. The task group is charged to develop a transition plan that balances efficient use of the resource while minimizing the impact to the user community. This plan provides guidance to NOAA/NESDIS personnel in allocating the resources and to the users in preparing for this transition.

III. FACTORS CONSIDERED IN ALLOCATING THE RESOURCE

- A. Conversion Challenge** - The efficiency of the HDR will allow more DCPs to function on each channel. This means that the currently number of (100 baud channels) is more than sufficient to accommodate the same number of HDR assignments. However, a given channel cannot be converted to HDR until all 100 baud DCPs on that channel are removed. This management challenge will need agency cooperation and coordination. Ultimately HDR channels will increase data throughput capability.
- B. NESDIS System Loading** - NOAA/NESDIS commissioned a study to provide guidelines to ensure that spacecraft power limitations are not exceeded. This study provided various combinations of simultaneous transmissions (100/300/1200 baud), and associated possible signal to noise ratios that could cause possible data loss if limits are exceeded. The analysis shows that there

appears to be no limitations in the number of simultaneous transmissions that can be received by the NOAA CDA at Wallops Island.

- C. **Local Down Link Loading** - The above analysis further shows that Direct Readout Ground Stations (DRGS) with small receive antennas may develop limitations as the system loading increases. However, future GOES N satellite series will have greater power capacity that should improve the reception on DRGS systems with small antennas and may possibly eliminate this limitation.
- D. **System Characterization** - A major challenging task that the Task Group tackled was to verify the loading of the current system and to gather up agency estimates into a projection of future HDR use. A web-based survey was developed to obtain information about users' plans for current assignments and future assignment requirements (<http://water.usgs.gov/datarelay/stiwg/survey>). The survey results are not yet complete. The accuracy will dependent upon user community participation.
- E. **Channel integrity**
 - o Both 100 and 300 baud DCPs cannot be mixed the same channel.
 - o Adjacent 100 and 300 baud channels may cause interference. Therefore a guard band (unused channel) will separated the 100 and 300 baud adjacent channels.
 - o To minimize the number of guard bands, the channels of like baud rates are to be grouped together, rather than interspersed.
- F. **Availability of Certified Vendors.** Currently there are three or more manufacturers of certified HDR DCP transmitters. This is enough to provide competition. Some supply their product to other companies for resale.

IV. RESOURCE ALLOCATION STRATEGY

- A. **Rate of Conversion** - As a guideline, each participating agency is requested to reduce their total number of 100 baud assignments by 10-15% each year, with the goal of full transition to HDR by December 2013. Limited numbers of 100 baud assignments may be available through NESDIS through May 31, 2003.
After May 31, 2003:
 - o **100 Baud Assignments** - NESDIS policy states that there will be no new 100 baud assignments given. Exceptions to the rule must be approved by NESDIS, but in no case will new LDR assignments be given on channels higher than 100. 100 baud assignments will be continually compressed into lower channels (initially below channel 100).
 - o **Migration Plan** - Users are asked to move to 300 baud or work with NESDIS to move their 100 baud assignment to a channel below 100 by 12/2005. No 100 baud assignments will be made on channels greater than 100.
- B. **GPS Requirement** - All High Data Rate (300/1200 baud) transmitters must use GPS.

- C. Signal Strength** - It is noted that system capacity is impacted by the signal strength of each transmitting DCP. Users are required to operate their system at or below maximum power levels as defined in the certification standards, with operations at or below nominal values preferred. The following levels are based on the certification standards, but have been modified to maximize system capacity during the transition period.

Data Rate (bps)	Minimum EIRP (dBmi)	Maximum EIRP (dBmi)
100	42	48
300	47	50
1200	50	53

In case of deviation from these recommended ranges, users are asked to contact the respective vendors for correction.

If such correction is not possible (e.g., users who need omni-directional antennas) it is suggested that they notify the NOAA scheduling agency of the specific DCPs involved and the maximum uplink power (EIRP) that can be achieved. If there are a sufficient number, NOAA may be able to re-allocate these DCPs so that they are grouped in the same time slots and in adjacent channels. This will tend to minimize the effect of the increased system loading on the performance of these low level DCPs.

PLEASE NOTE: *These Max/Min EIRP rates have been adjusted to facilitate the transition from LDR to HDR and minimize interference between channels. Users are to follow the certification standards as written once the transition to HDR is complete.*

- D. Message Location** - Users are asked to begin transmissions in the first part of the window rather than centering the message. This will facilitate analysis of system loading as it increases and allow flexibility in adjusting transmission window sizes as necessary.
- E. Transmit Window Size** - Unless justification is approved by NESDIS no assignments larger than 15 seconds at 300 baud will be allowed.
- F. HDR 1200 DCP** - The priority for use of the 1200 baud rests with the agencies that requested 1200 baud be developed (NOAA agencies). Users may request 1200 but the final decision rests with NOAA/NESDIS.
- G. Random Channels** - Random Channels will initially stay at 100 baud until such time that sufficient channels are available.

H. **Redundant Data** - Users are asked to reduce the amount of redundant data per message, allowing the shortest transmission window possible.

V. **CONVERSION TIMELINE**

The DCS bandwidth includes channels 1 through 200. The following is a schedule of conversion to 300 or 1200 baud.

- Channels 180 - 200 Conversion Complete
 - Channels 140 - 179 Conversion Complete
 - Channels 130 - 139 Conversion to be completed by June 2005.
 - Subsequent channels will be cleared starting with channel 129, continuing in descending order at a rate of at least 10 per year.
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- NESDIS will provide no new 100 baud assignments past May 31, 2003 unless; on a case-by-case basis a user justifies a special need to NESDIS. After this date, no 100 baud assignments will be given on channels higher than 100. One hundred baud assignments are always subject to availability.
 - NESDIS will provide 300 baud assignments on channels 1-159 subject to channel and demodulator availability. One hundred and 300 baud adjacent channels will be separated by a guard band or unused channel.
 - Full transition from 100 baud to either 300 or 1200 baud must be completed by all users by May 31, 2013.

Approved by Satellite Telemetry Interagency Working Group:

STIWG Chair

Date