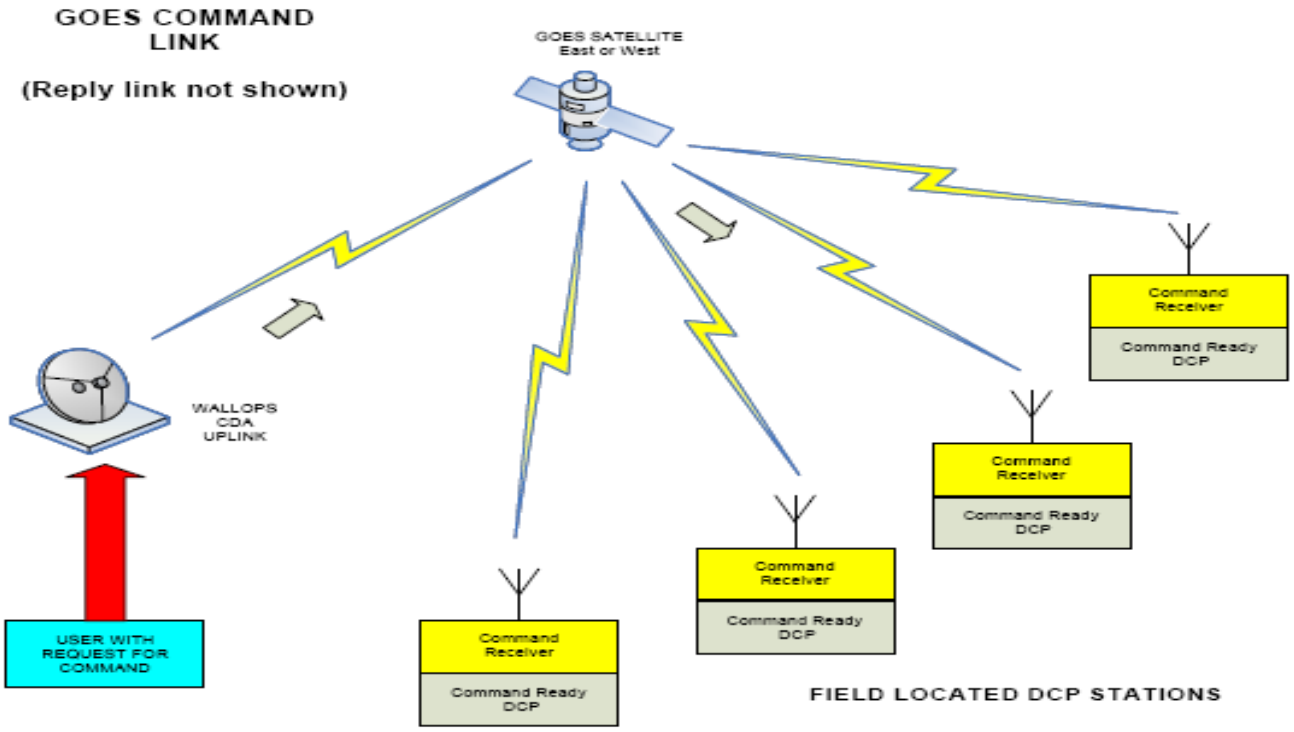
DCP COMMAND

…bringing two-way communications to your DCPs

DCP COMMAND


GOES COMMAND LINK
(Reply link not shown)
GOES SATELLITE
East or West
WALLOPS CDA UPLINK
USER WITH REQUEST FOR COMMAND
Command Receiver
Command Ready DCP
Command Receiver
Command Ready DCP
Command Receiver
Command Ready DCP
Command Receiver
Command Ready DCP
FIELD LOCATED DCP STATIONS

Project Goals

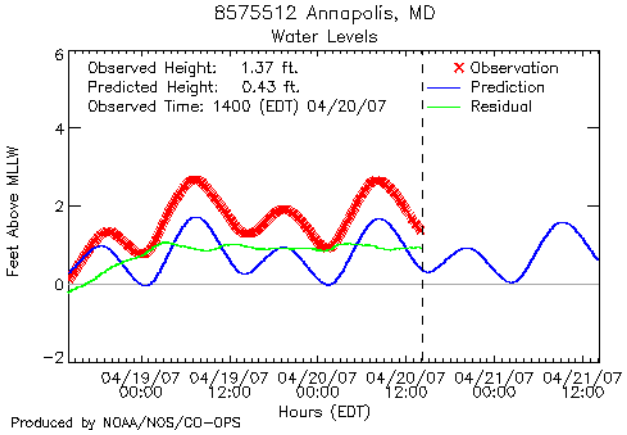
- Bring affordable, reliable two way communications to DCPs
- Facilitate remote management of the DCP including setup and maintenance.
- Facilitate management of the network to remotely control power, channel and transmission times.
- Increase available uplink bandwidth by eliminating the need to transmit redundant data. Missing data can be requested.
- Facilitate new applications driven by two-way communications.
- Utilize a resource that has long been unused.

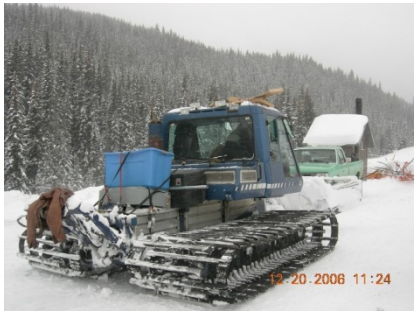
How does it work?

- The DCP COMMAND operates through the existing satellites on the old DCP I channels. The uplink originates at Wallops Island.
- A gateway at Wallops provides a way for users to send commands to their DCPs. The gateway performs authentication and security to control and regulate what commands are given to DCPs.
- In the field, a DCP COMMAND receiver connects to your DCP. The receiver listens for COMMANDS and communicates to the DCP using a standard protocol/interface.
- The command format allows for individual and group addresses. This allows a single command to affect all the DCPs in a group.
- The protocol supports predefined commands for common operational and maintenance functions. All manufacturer DCPs can support the same commands. A file transfer command allows for vendor specific data to be sent to a DCP.
- Replies are made on DCP channels set aside for DCP COMMAND or on normal DCP Channels

Why do users want 2 way communications to DCPs?

- Data, Data, Data
  - Request missing data.
  - Request additional data.
  - Change alarm thresholds.
  - Get digital pictures from the field.
- Fewer trips to the field $$$
  - Perform remote diagnostics.
  - Request special transmissions.
  - Adjust transmission settings.
  - Communicate with technician in the field.
  - Trips to the field can be dangerous and expensive





DCP COMMAND is also needed for system management…

- DCS is currently trying to free up 100 bps channels for their reassignment as 300 baud channels.
- Currently it takes months even years to get a channel reassigned.
- Imagine doing the entire system in a day.
- DCP COMMAND makes it possible!
- DCS may already be too big to manage without DCP COMMAND and it is only getting larger!

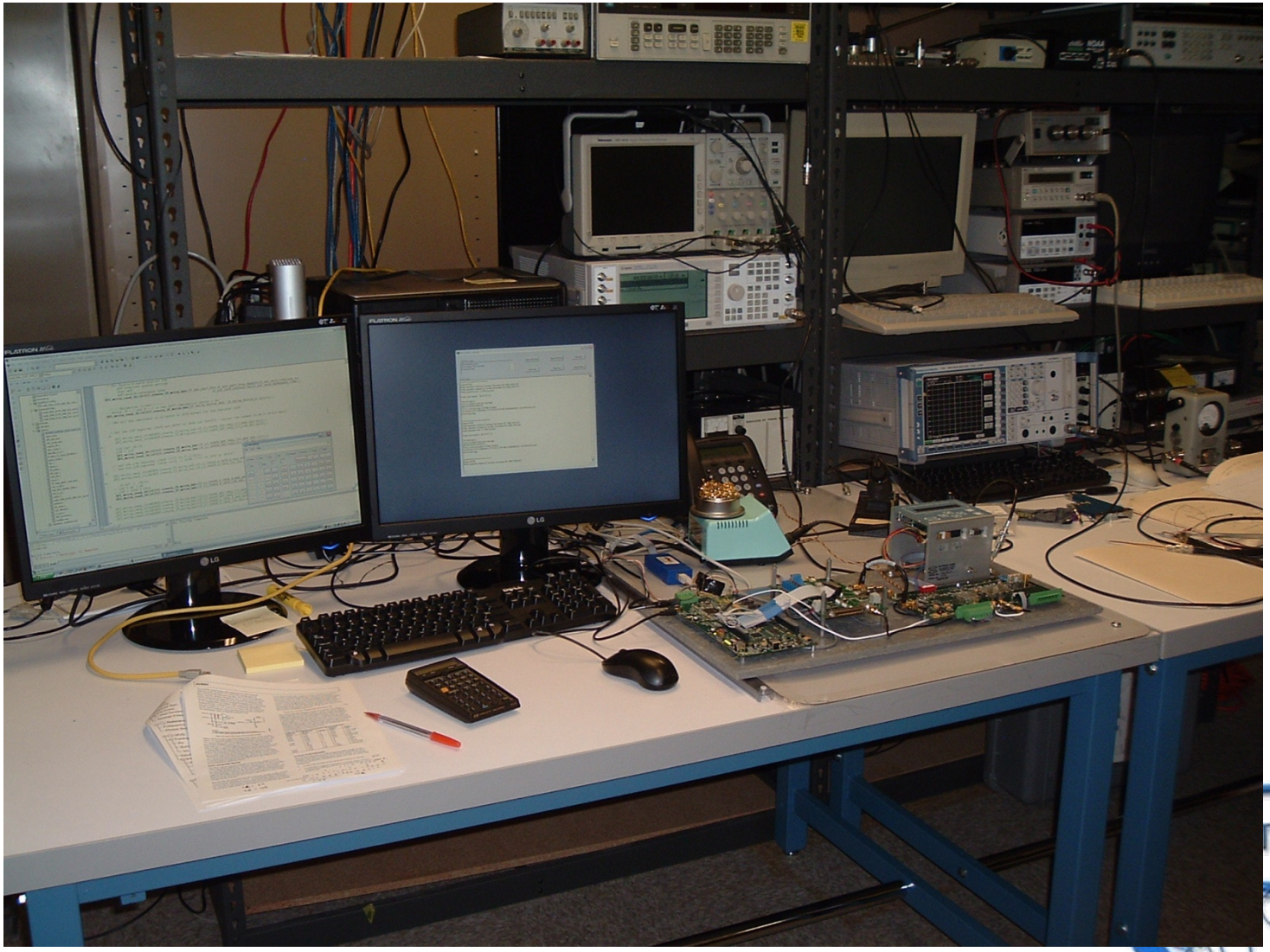
How is DCP COMMAND different from DCPI?

- More throughput -- 300 baud vs 100 baud
- More data – up to 64K bytes vs 12 bits
- More reliability – 10^{-10} error rate vs high error rates
- More security – message authentication
- Predefined and standard functions
- We could live without DCPI – we can't live without DCP COMMAND!

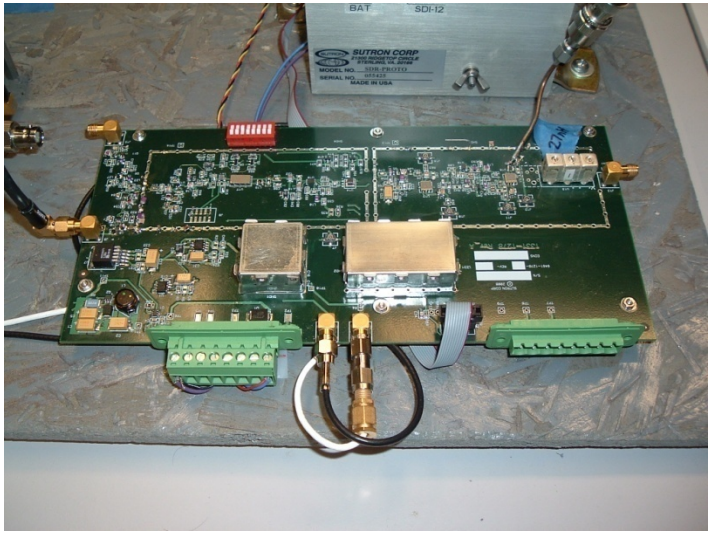
Project Status

- Work Obj 1: Develop Demodulator Software on PC
  - Status: complete
- Work Obj 2: Develop New Receiver Board
  - Status: complete
- Work Obj 3: Develop Test Modulator
  - Status: complete
- Work Obj 4: Port Code to DSP
  - Status: complete
- Work Obj 5: Develop Prototype DCPC Receiver
  - Status: underway, complete by June 2009
- Work Objective 6: Wallops Island Testing
  - Status: underway, complete by June 2009

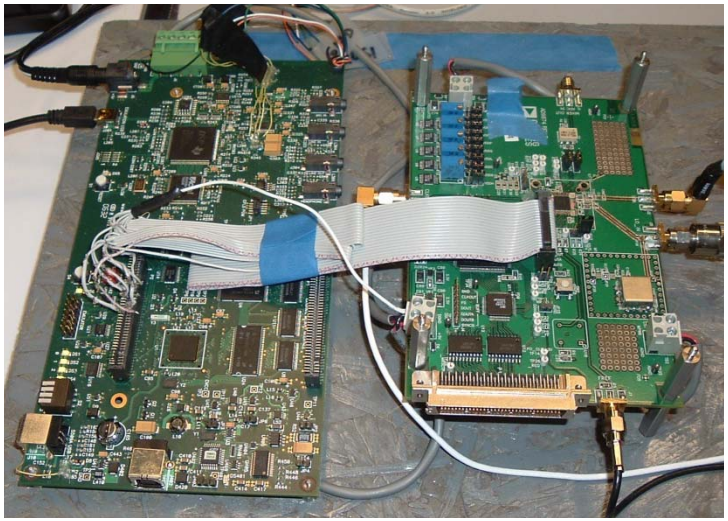
Development Bench



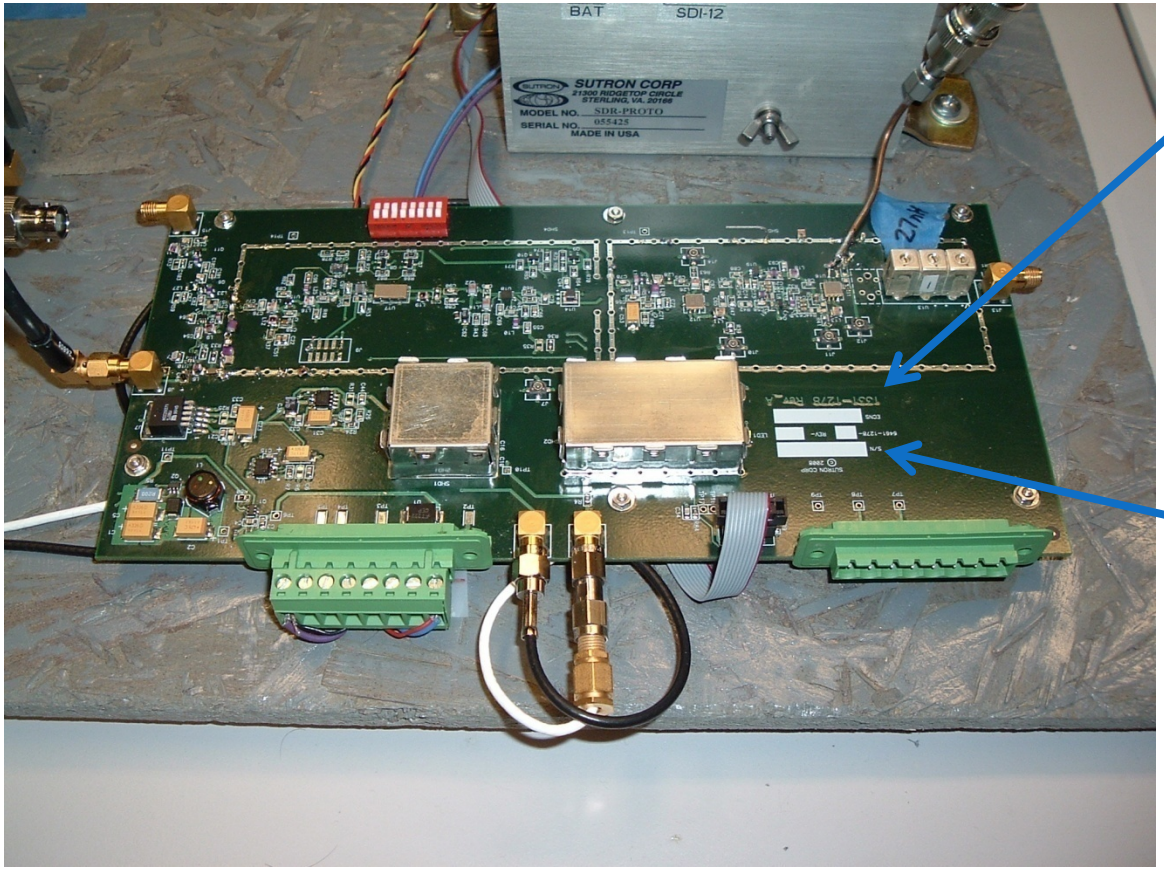
Breadboard Receiver

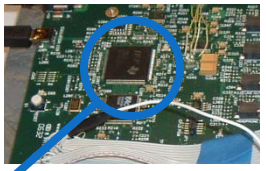


Breadboard DSP



Prototype Board



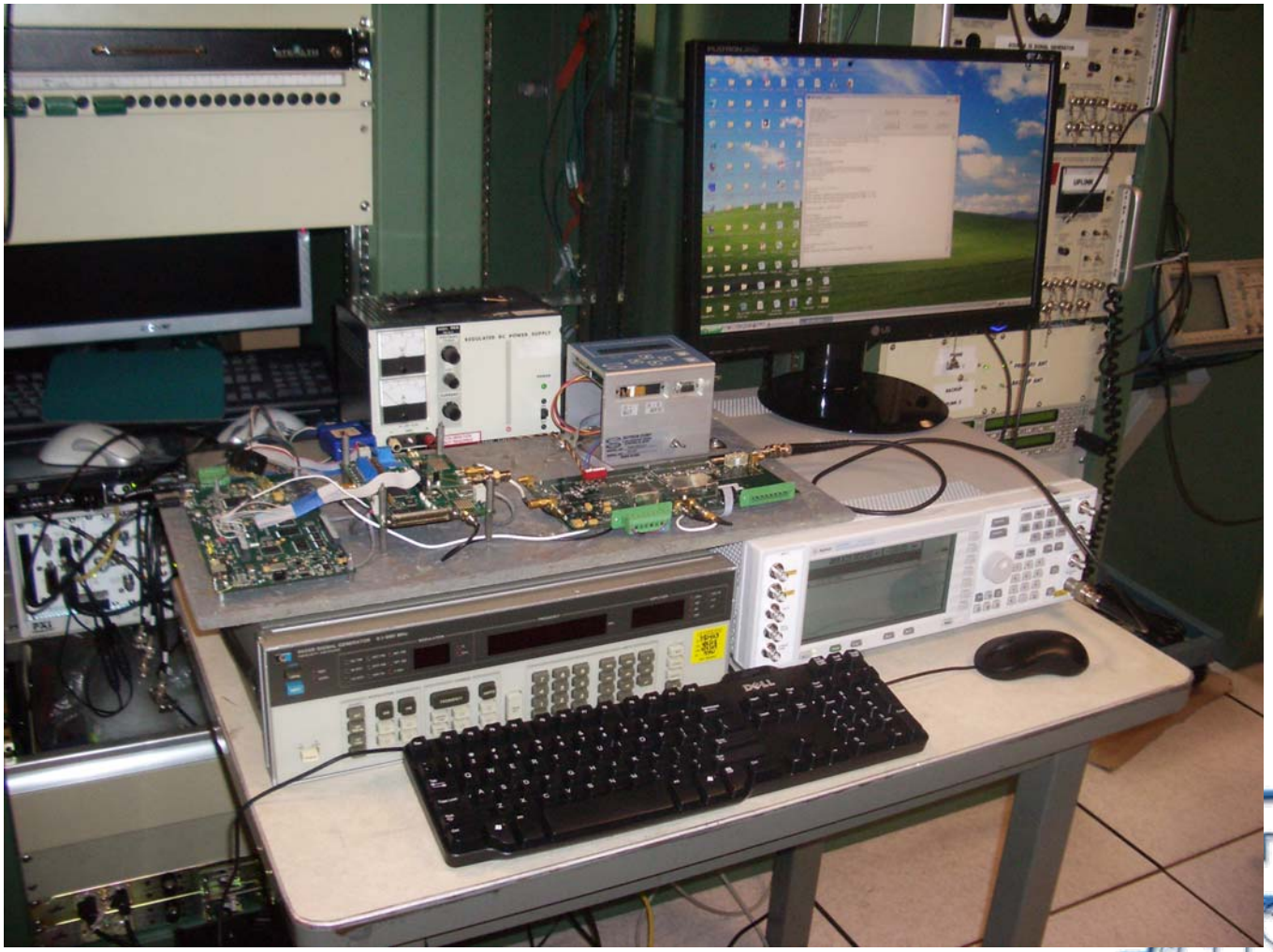


Move DSP to Receiver

Move A/D to Receiver

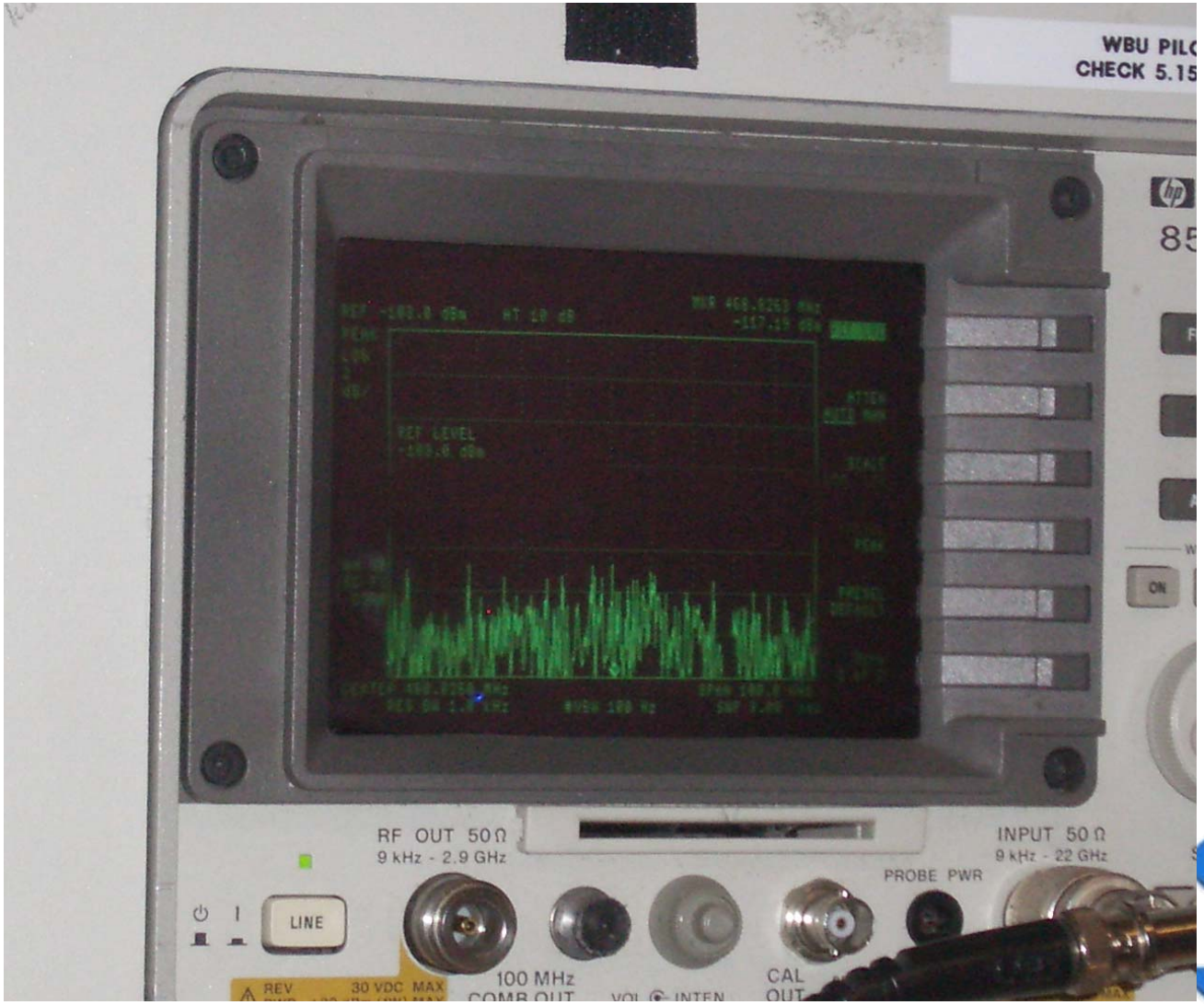
Prototype DCP Command Receiver

Wallops Island Tests

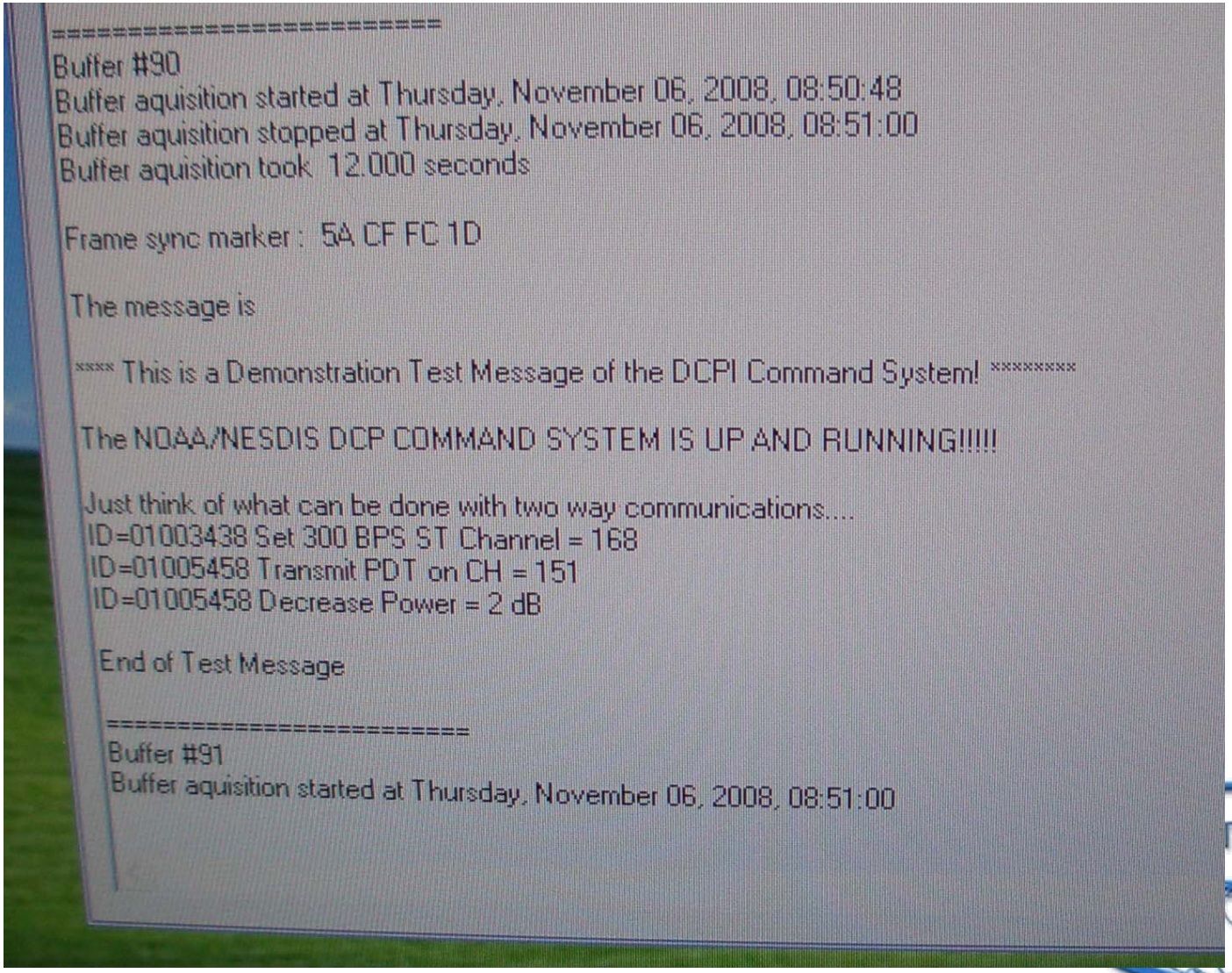


Wallops Island Tests: Checking Uplink Signal

Wallops Island Tests: Checking Received Signal



Wallops Island Tests: Test Message Received



Preparing for DCP Command

- Procure and Install DCP Command Gateway at Wallops Island
- Begin discussions on DCP Command receiver interface.
  - Initial versions of the receiver will be separate from the DCP.
  - An Interface Control Document (ICD) will document the interface and allow operation with any manufacturer DCP.
  - Required commands define the minimum functionality for the DCP to operate with the receiver.
  - Optional commands may be supported and define standard ways for users to interact with DCPs regardless of manufacturer.

Uplink Gateway Phase 1

- Provides uplink system for operation of prototype receivers.
- Continuous data stream with user specified commands.
- Allows users to become familiar with system and gain confidence in its operation and usefulness.
- Supports ongoing test, evaluation and operation of command receivers.
- Off the shelf equipment – minimum cost.
- A step to the operational system.
  - Does not try to integrate to DAPS/DADDS
  - No redundancy in design
  - No system tracking, management …

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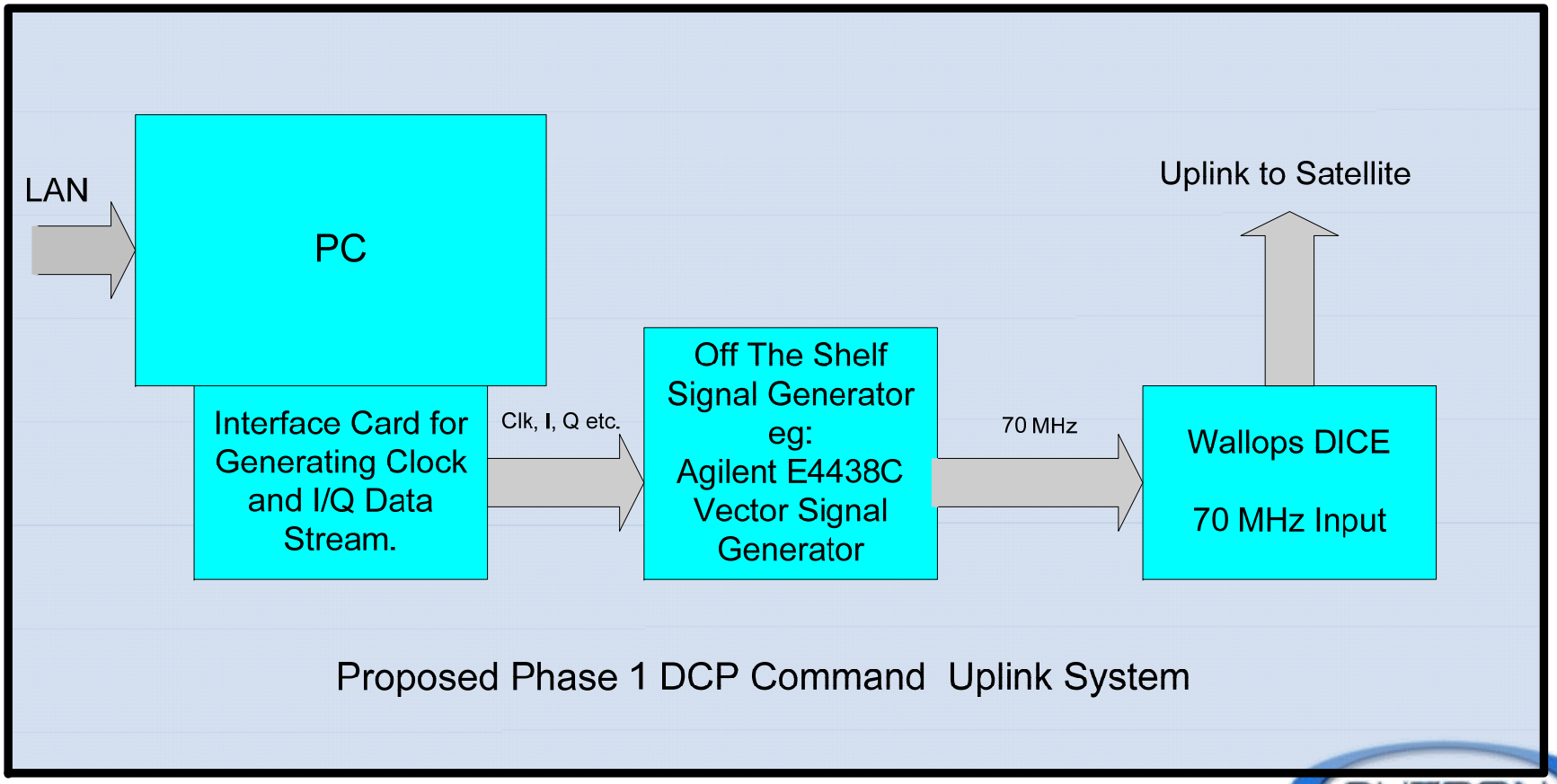
Uplink Gateway Phase 1 Design



Proposed Phase 1 DCP Command Uplink System

Uplink Gateway Phase 1 Operation

- Client program runs on user PCs
- Clients authenticate connection to uplink server.
- Client builds intended command and sends it to the uplink server.
  - Specify ID, command, command data, reply request, etc.
- Server formats commands into the uplink data stream.
- Server generates filler frame when no data is present to keep receivers synchronized and support BER/reliability testing

Uplink Gateway Phase 2 – Complete Operational System

- The phase 2 system implements a complete set of requirements to support the operation and management of the system. These requirements will likely include:
  - High availability hardware/software design
  - Maintain database of all receivers
  - Maintain database of system operation
  - Interface to DAPS/DADDS to get platform/channel assignments.
  - Interface to DDS to get reply messages.
  - Web page for users to support all commands and view relevant operation data
  - Web page for NESDIS to support system commands and view operation data
  - Command buffering/prioritization
  - Authentication Generation.
  - Reply processing.
  - Redundancy/failover
  - Potential Time Code stream insertion
  - Potential Automatic Frequency Control (AFC) loop. (future option)

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Receiver to DCP Interface

- RS232 or RS485 to interface to DCPs.
- 9600 Baud or higher Asynchronous 8N1
- RS232 includes RTS/CTS handshake for wakeup and flow control
- RS232 is turned off when not in use to conserve power.
- Master/Slave – Command/Reply protocol
- The receiver sends commands to the DCP only if the command is intended for the DCP

Receiver to DCP Command

- SYNC SYNC characters to wake up DCP – first may be dropped by UART
- Address
- Command
- ReplyRequestyes/no
- [ReplySlot] to specify baud, channel, time, length.
- [Optional Count of Command data, CommandData]
- Error checking

DCP to Receiver Reply

- Command: echo of command
- Response: Ack/Nak
- [Optional Count and Optional Data]
- Error checking

Required Commands

- AreYouThere -- Initiated by receiver to find out the ID and status of the DCP connected to it. The request includes the receiver time, validity. The reply includes ID, time, and command version supported.
- *Reset DCP – power off and on again (sends command to DCP and/or receiver operates a relay)
- Reset failsafe –
- *Set transmitter mode – disabled, ST, RR, ST/RR
- *Set TX schedule – type, time, interval, channel, baud, duration
- *Set TX power – up/down or absolute
- Transmit Receiver setup – command includes receiver setup so the DCP can transmit it.
- Transmit Receiver stats -- command includes receiver statistics so the DCP can transmit it: Eb/No,RS corrections/failures, Estimated power, Osc freq offset, #times lost sync day, week, month, authentication failures, uptime, lock time metrics
- Transmit group list -- command includes the group list stored in the receiver so the DCP can transmit it.

* requested by STIWG

Optional Commands

- Receive file – named file transfer for sending up to 64K bytes to the DCP.
- Ack random – tells the DCP that Wallops received a random transmission. Since most DCPs will repeat a random transmission 3 times to make sure it gets through, this ACK can be used to eliminate unnecessary retransmissions.
- *Set Data Acquisition mode – defined by the DCP
- *Control – turn things on/off
- *Command – initiate command defined by the DCP
- Measure – make the requested measurement.
- *transmit status (includes location)
- *transmit test message
- *transmit setup
- *transmit tx format metadata
- *transmit diagnostic info
- *transmit data – command specifies what data to transmit – could be the last transmission or data missing from a previous transmission.
- Passthru – this is for vendor defined commands. The Receiver simply passes the data to the DCP.