NASA TDRSS S-band IP Service Developments

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Space Internet Workshop

June 6, 2003

Outline

- Introduction
- CANDOS Support
- GRID Update
- TDRSS Demand Access Services
- Proposed TDRSS SGLT IP Modifications
- Summary

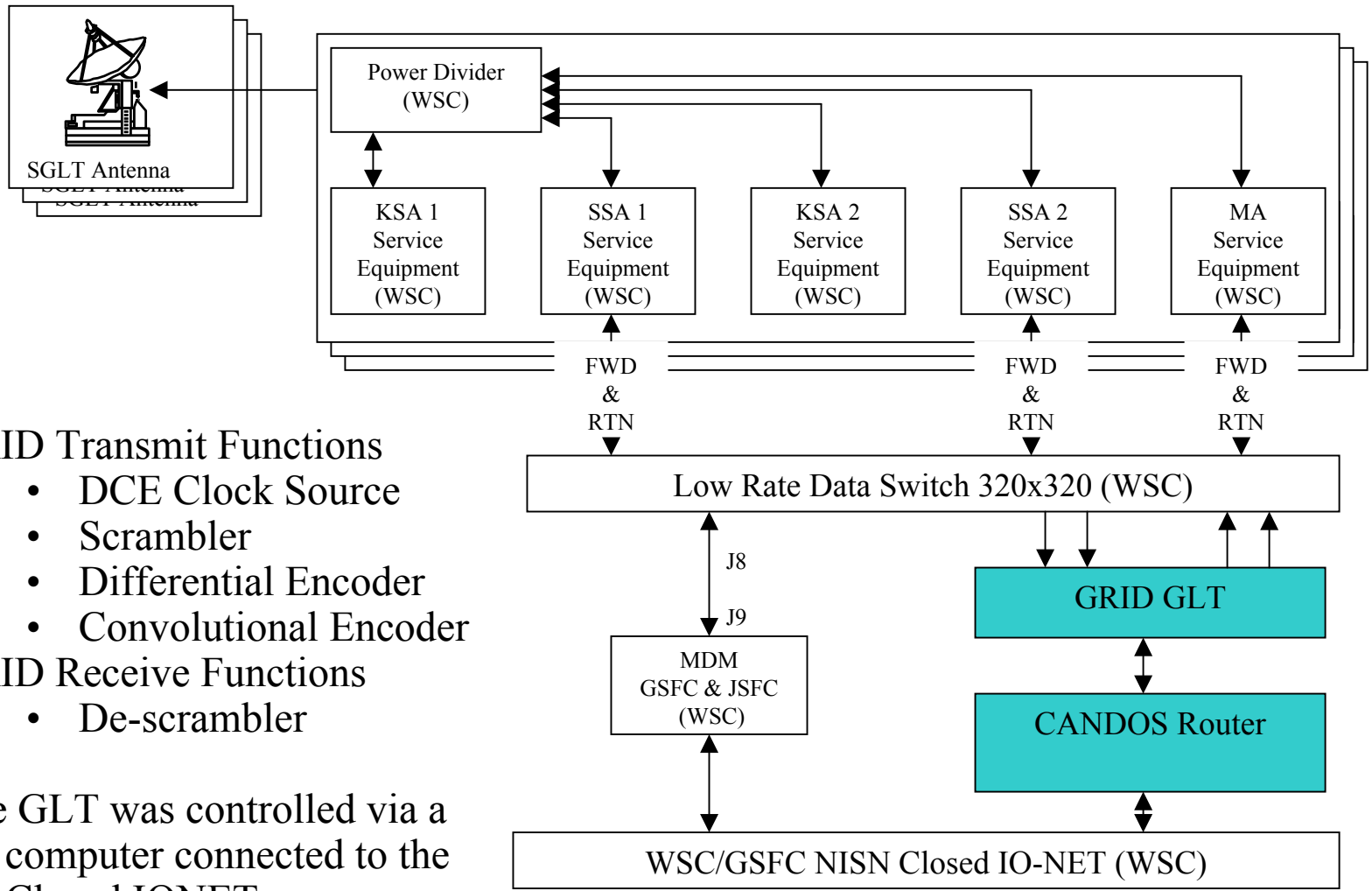
Introduction

- TDRSS has been supporting an IP connection to the South Pole since 1997 (South Pole TDRSS relay (SPTR))
- Multiple ground demonstrations and activities have been done since
- The LPT CANDOS experiment onboard STS-107 demonstrated TDRSS IP support to an orbiting user
- Activities to support future IP mission requirements as standard operations have begun

CANDOS Support

- Equipment was temporarily installed at the WSC ground terminals to support the LPT CANDOS experiment on STS-107
  - Ground station Router Interface Device (GRID) GLT
  - Cisco router with mobile IP
- Many TDRSS IP operations were successfully demonstrated (see “STS-107 Mission – End-to-End IP space communication results”)

CANDOS WSC Implementation

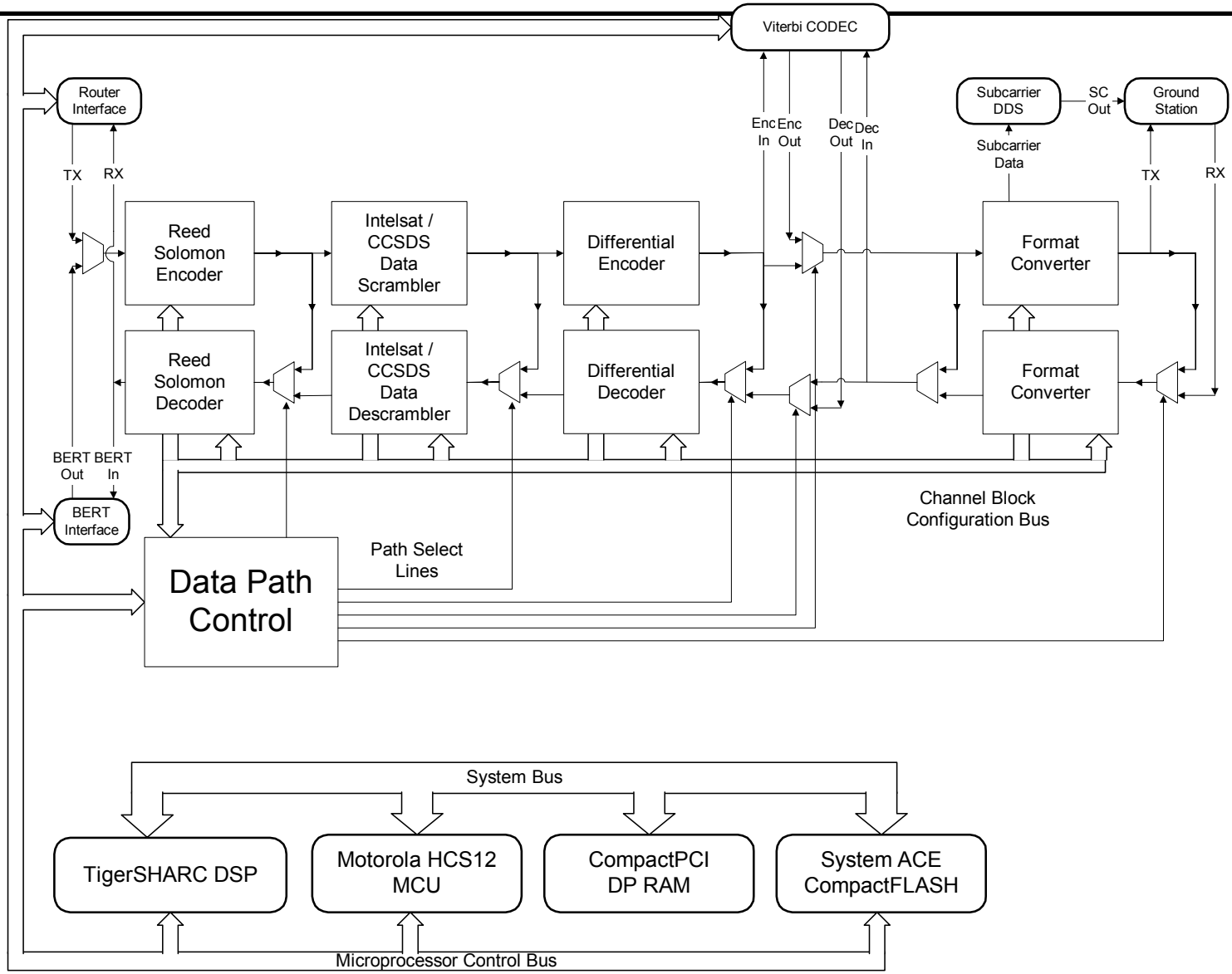


GRID Transmit Functions
- DCE Clock Source
- Scrambler
- Differential Encoder
- Convolutional Encoder

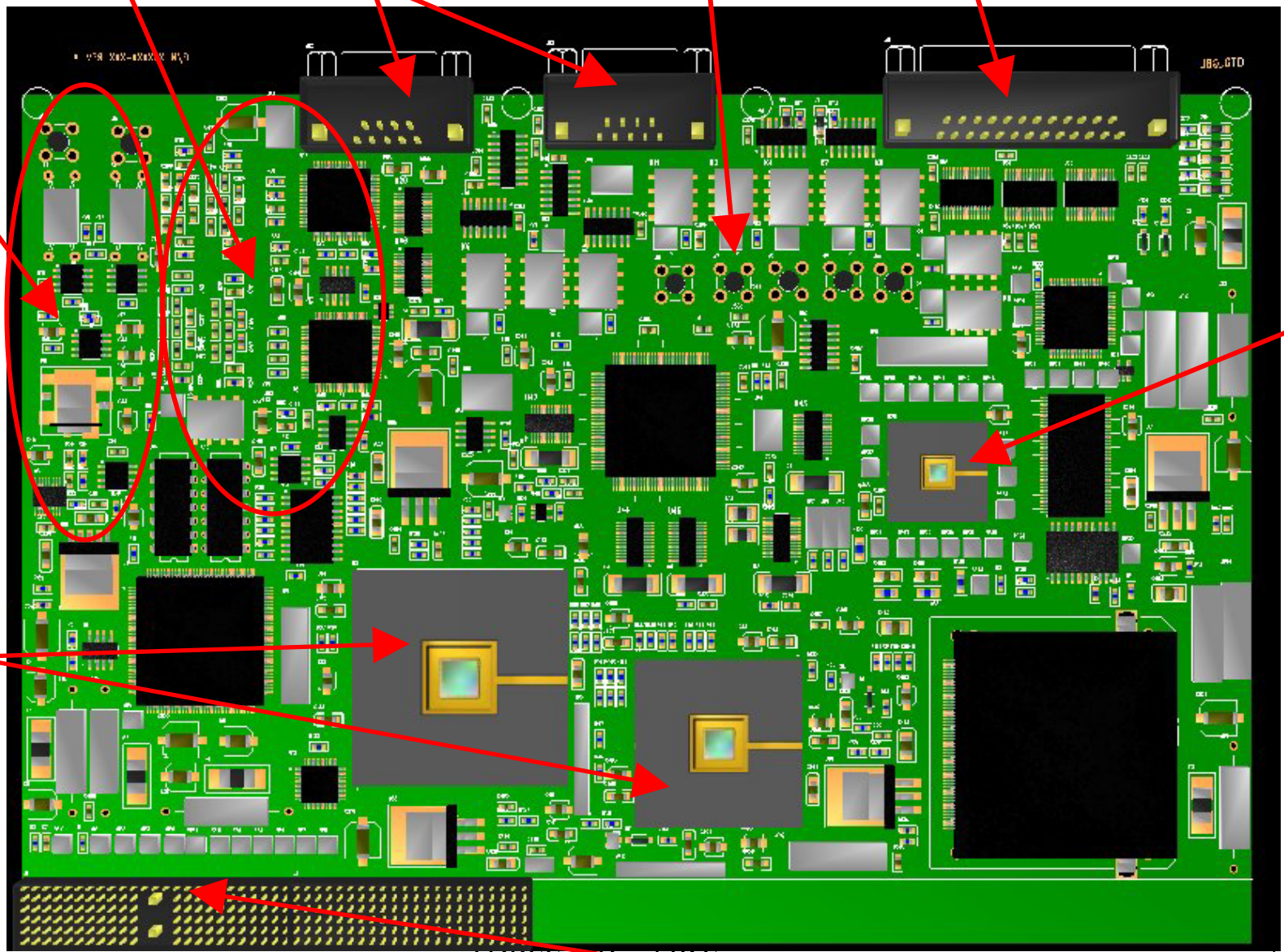
GRID Receive Functions
- De-scrambler

The GLT was controlled via a computer connected to the Closed IONET

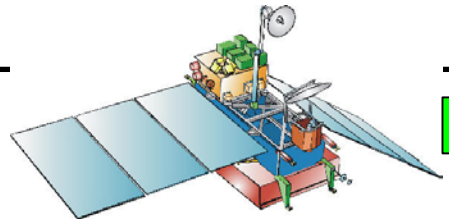
GRID Channel Card Data Path



Initial GRID Channel Card Place & Route



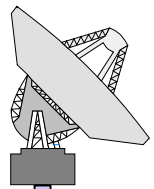
Demand Access Service (DAS) Return Link Current Configuration



MA Return

SGL

TDRS
SGLT



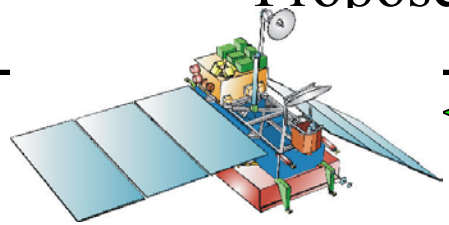
Closed IONet

PTP

Demod

Beamformer

Demand Access Service (DAS) Forward Link Proposed IP Option



MA Forward

SGL

TDRS
SGLT

Closed
IONet

Step 4
DFC forwards queued packets to be modulated onto the MA forward link

DAS F/L
Controller (DFC)

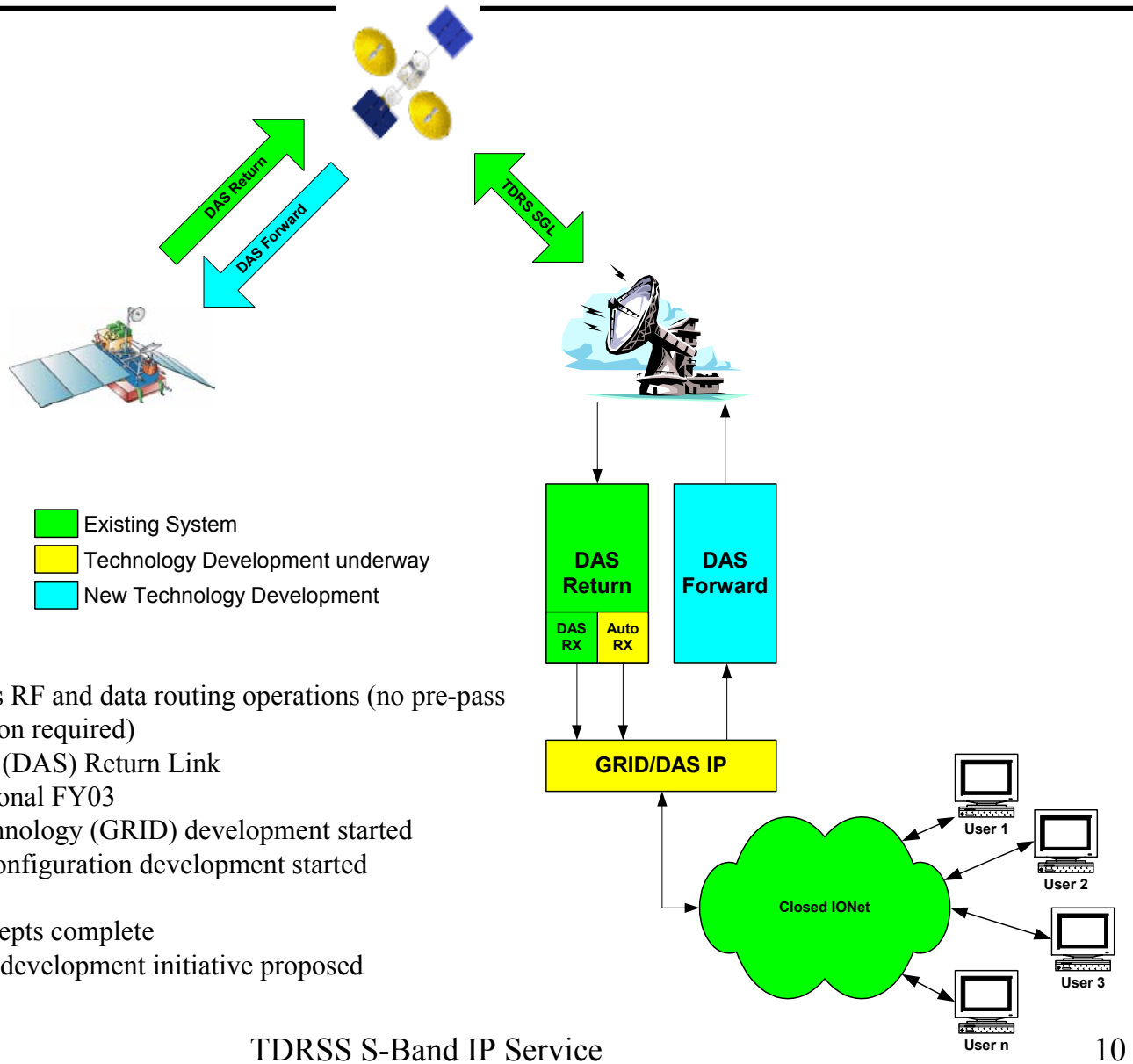
WSC
ADPE/
TDRS TTC

Step 1
Data addressed to spacecraft DAS F/L address intercepted by DAS F/L Controller (DFC)

Step 2
DFC queues intercepted packets and submits schedule request

Step 3
ADPE notifies DFC when MAF event is active.
WSC system commands TDRS onboard beamformer and WSC equipment for user

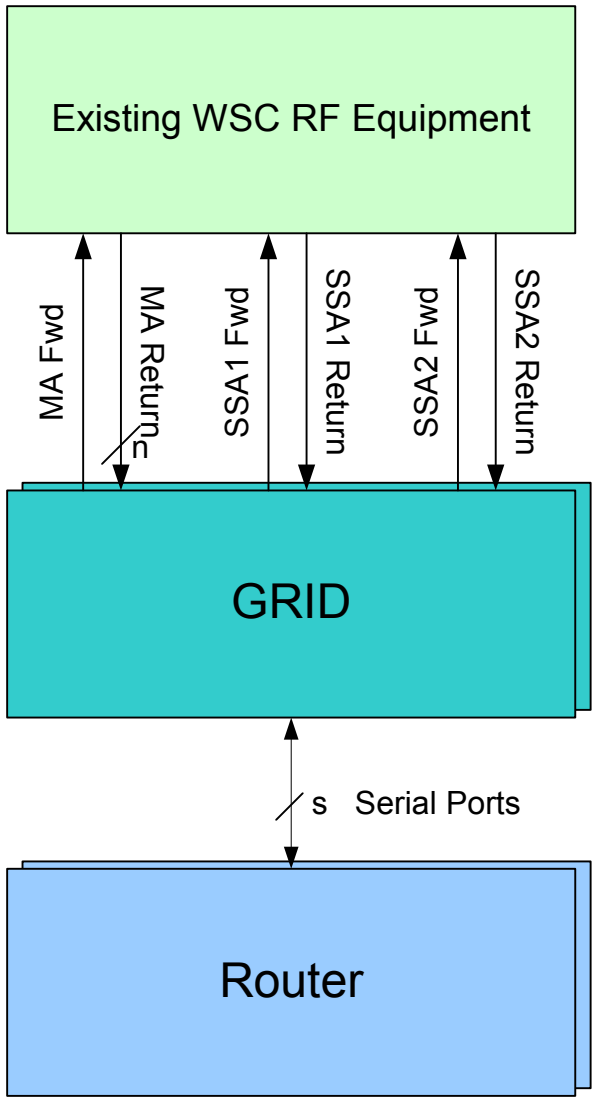
Two-way DAS IP Technology Development



•Goal: Fully autonomous RF and data routing operations (no pre-pass scheduling or configuration required)
•Demand Access System (DAS) Return Link
- •Baseline Operational FY03
- •IP capability technology (GRID) development started
- •Receiver Auto-configuration development started

•DAS Forward Link
- •Basic study concepts complete
- •New technology development initiative proposed

Proposed TDRSS Space-to-Ground Link Terminal (SGLT) IP Modifications



- No change to existing WSC RF Equipment
- New data interfaces between data switch and GRID

- GRID performs all remaining coding functions (RS, etc)
- Line Outage Recording function at GRID input
- Multiple GRIDs/GCCs as required by number of links and redundancy needs
- GRID configured based on schedule by WSC ADPE
- GRID reports lock, DQM status

- Number of routers/router serial ports determined by number of links and redundancy needs
- Router configured as Mobile IP foreign agent
- Router connected to Closed IONet

Summary

- The effort to make IP support an operational TDRSS service has begun
- First operational IP user GPM is scheduled for a 2008 launch
- Work for the ground station includes some technology work besides upgrade activities