

RAX-2 On-Orbit Communication Performance

James W. Cutler, John Springmann
University of Michigan

Primary Link is UHF, backup is S-Band

UHF

- 437.345 MHz
- Lithium-1 transceiver
- 9.6 kbps / GMSK

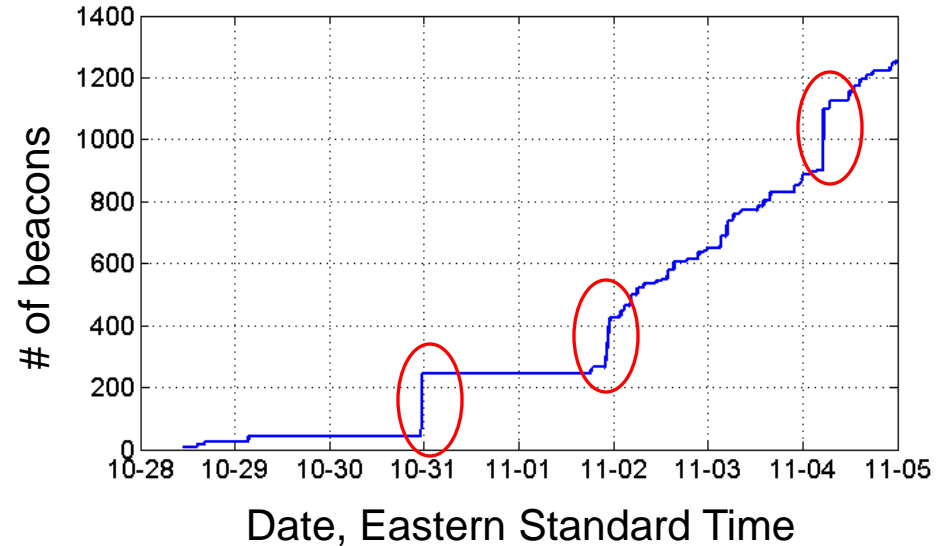
- Global beaconing, 10 s interval
- Scheduled downlinks over MI, CA, and partnering stations.

S-Band

- MHX 2400
- Max speed, 100 kbps
- Have not yet attempted downlink.

Successful launch, initial beacons heard hours after launch

The cumulative number of **beacons** heard over the **first week**:



Circles indicate batch uploads to the database, which are common early in the mission as HAMS begin using the RAX-2 client. Nominally, beacons are uploaded immediately after decoding.

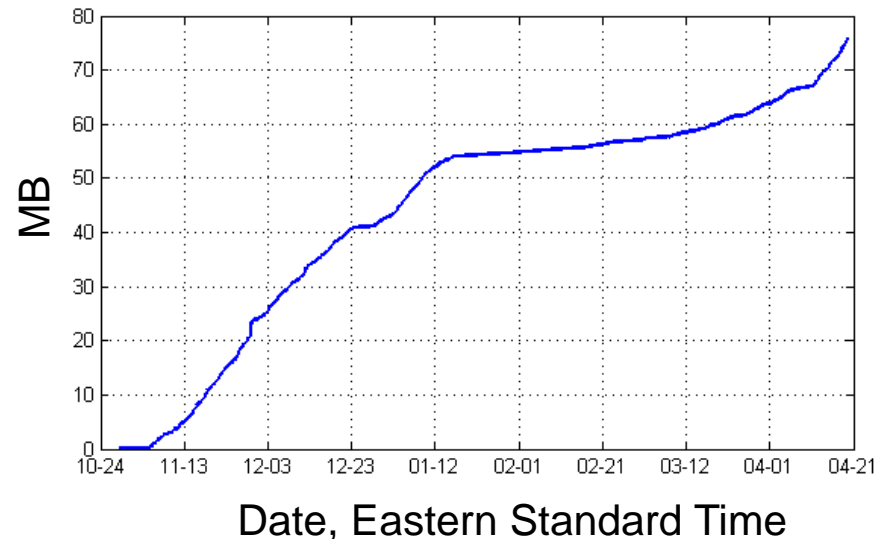
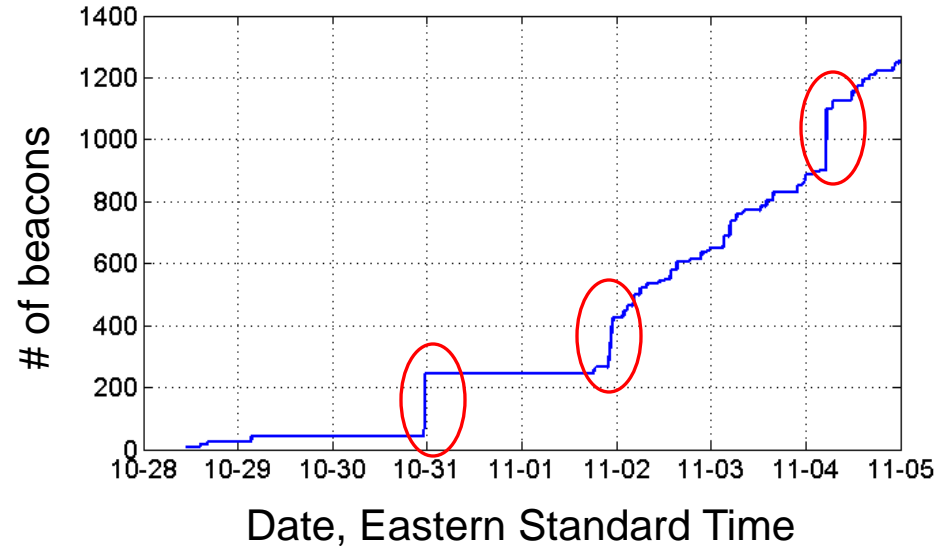
Successful launch, initial beacons heard hours after launch

The cumulative number of beacons heard over the *first week*:

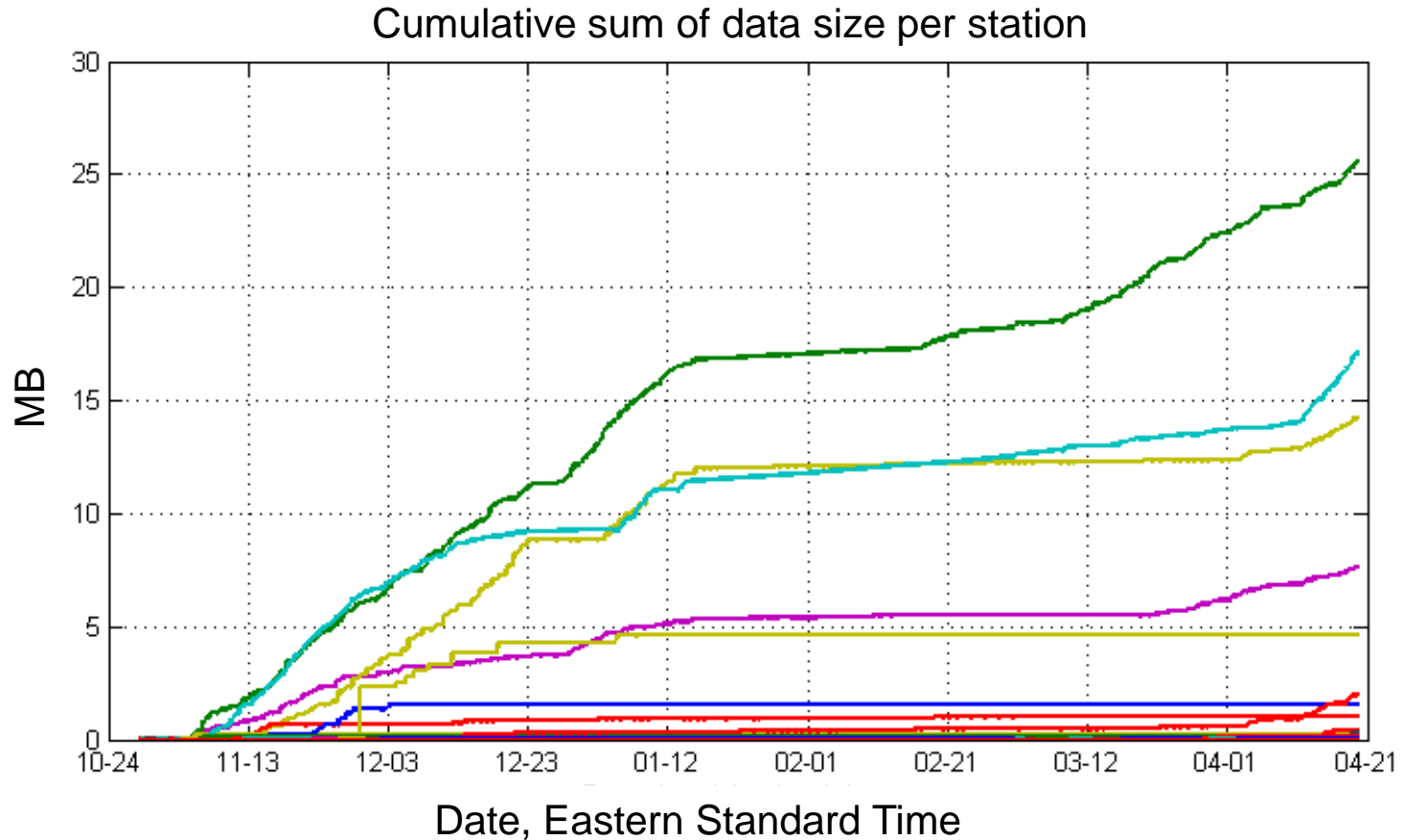
Cumulative sum of total data received, as of **4/19/12**:

138,673 beacons and counting

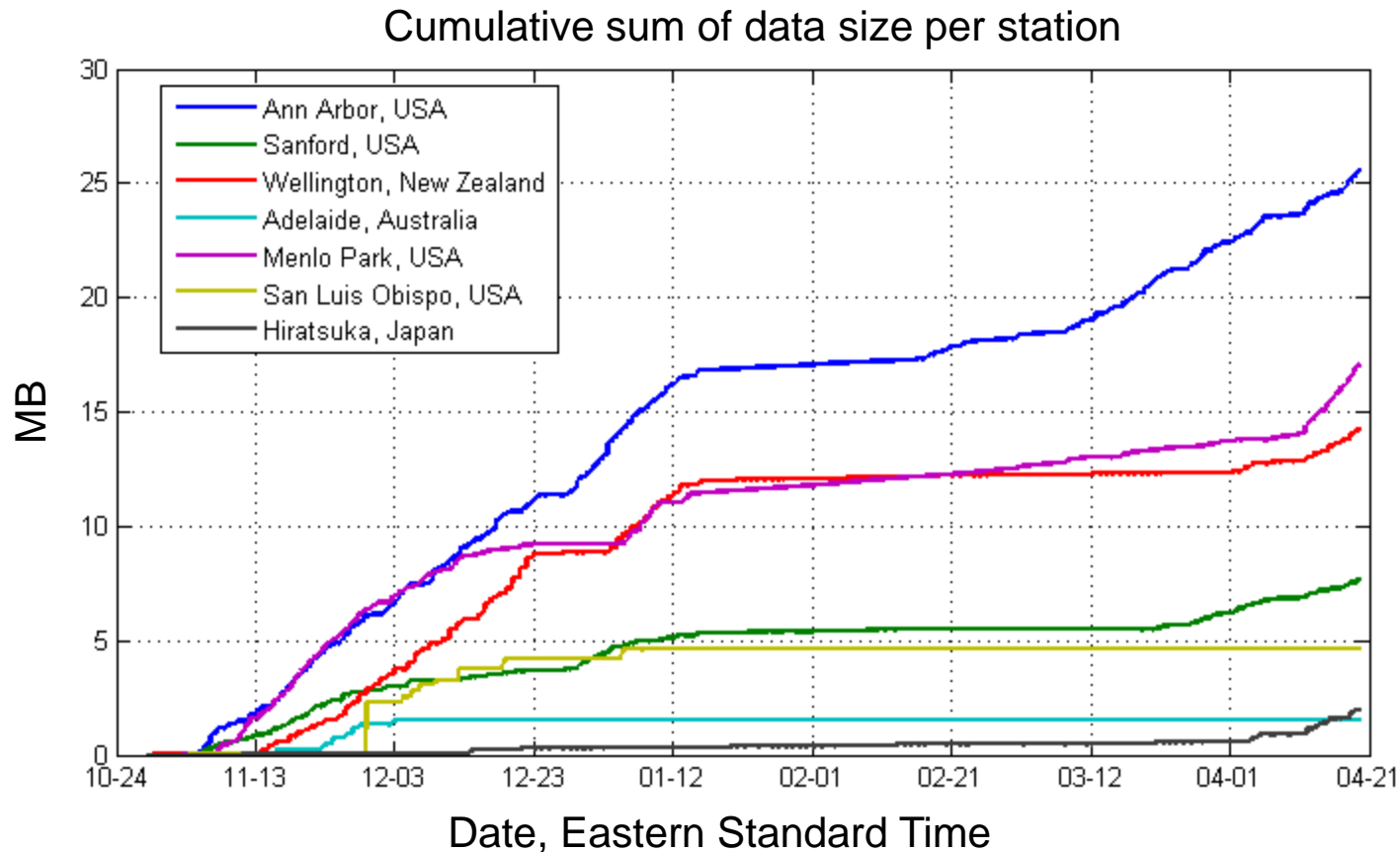
76 MB of data



Amount of data received by individual stations

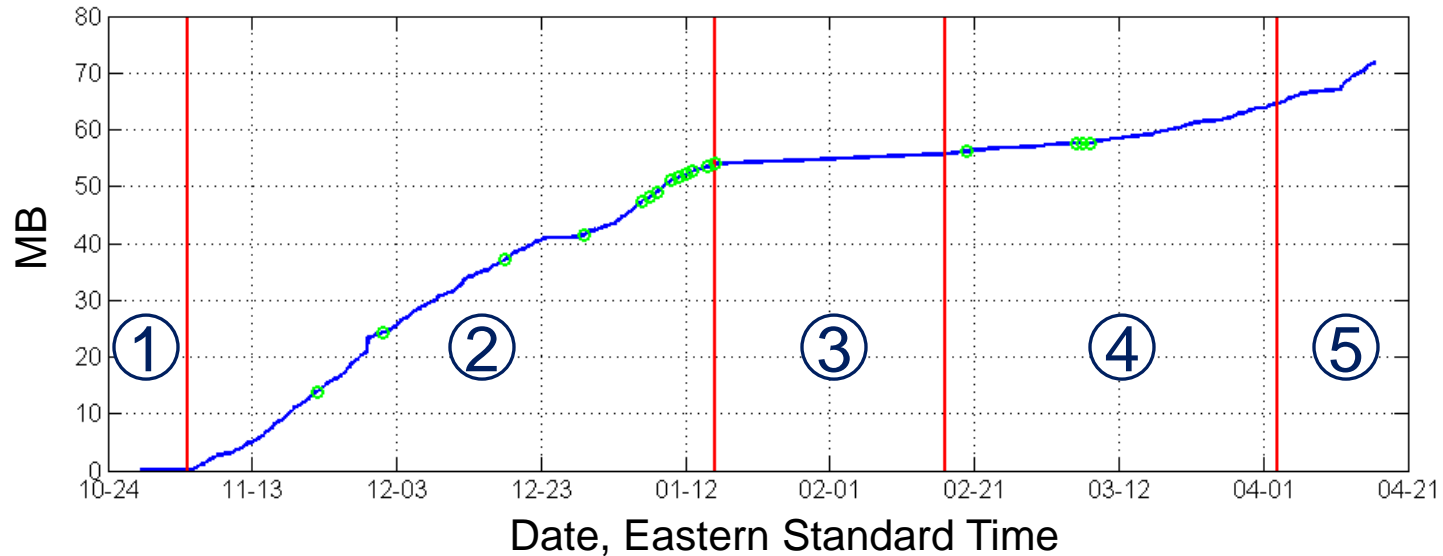


Amount of data received by individual stations – top 7 stations



Very dynamic operational history requires adaptive ops team

Cumulative amount of data downloaded



- ① Initial acquisition, beacon collection , basic commands
- ② Full checkout moving to nominal operations. Data downloads scheduled over global HAMs
- ③ SD card debugging
- ④ Science capabilities restored. Experiments and downloads resume
- ⑤ Full command scheduler implemented without SD card. Aggressive download of Expt1017 raw data begins

Operationally, RAX-2 system is working well, though we could always use more bandwidth.

Successes

- Good, strong, reliable contacts
- Global HAMS tracking
- Easy client installed to forward data
- Online performance analysis tools

Challenges

- We want LOTS of raw data.
- Long duration downlinks generate heat.
- GENSO?