GANDER

- Original mission defined to provide operational near real time monitoring of global sea state.
  - Not optimised for SSH Measurements.
- Issues
  - Orbits
    - Knowledge, maintenance, *height, specification*.
  - Ionospheric / Atmospheric corrections
  - Altimeter Specification
  - Data Rates

Orbit Knowledge - 1

- Accurate orbit information essential
  - Original spec. NORAD / Ranging gives ~5km, require < 1 km.
- Laser Retro-reflector
  - Low cost, can be accommodated
  - Requires significant effort from tracking community
- GPS
  - Power ~ 5W, Mass ~ 2kg, low extra data rate.
  - Affordable option can give +/- 15m (3 σ).
- DORIS
  - JASON version requires too much power, mass
  - More recent, lower power & mass, versions available?

Orbit Knowledge - 2

- X-Over Analysis
  - Analysis of X-overs with JASON-1, ENVISAT, GFO could provide more accurate orbit solutions.
- Conclusions
  - GPS or DORIS preferred, and probably could be accommodated at a cost.
  - X-over analysis would improve orbit knowledge - but to what level?

(To the extent that GPS / DORIS are not required?)

Orbits

- Orbit Maintenance / Repeatability
  - Baseline can provide +/- 2 km orbit maintenance / repeatability.
- Orbit Height
  - Nominal height 650 km - higher drag, less stable orbit
  - Orbit at ~800 km preferred - easier to maintain orbit
    - Altimeter power implications
    - Uplink/downlink budgets
    - Launch / end of life orbit decay implications

Corrections

- Ionosphere
  - Baseline is single Frequency (Ku).
  - No direct estimates of ionospheric delay.
  - DORIS could provide estimates.
  - Models may be accurate enough (with extra information from JASON / ENVISAT)?
  - Ka band would minimise correction.
- Wet Troposphere.
  - Baseline is no radiometer on-board.
  - Separate radiometer not feasible within current design.
  - Models not accurate enough?
  - Altika proposal has combined Ka altimeter/radiometer.

Altimeter Specification

- Nominal Pulse Repetition Frequency 500Hz
  - Enhancements may be required.
  - May have power implications
- Data rates
  - If 50Hz waveforms required; implies 50 x nominal data rate
  - Also increased on-board memory (present baseline 128Mbytes)
  - Increased downlink rates or more frequent downloads -> more ground stations.
- Clock
  - Range measurement requires USO

Conclusions

- Some options can be included within original concept without significant cost
  - GPS / LRR / DORIS - Analysis of cross-overs with JASON/ENVISAT?
  - Small improvements to altimeter capability.
  - Would get satisfactory orbits, but would not allow direct estimates of iono / wet trop. corrections.
  - Would altimeter performance be satisfactory?
- Other options are higher cost and would effect economic feasibility
  - Higher performing solar panels. Could increase power from 48W to 70W at four times cost of Si panels
  - Significant improvements to altimeter:
    - Altika (with radiometer).
    - Doppler delay
  - May imply significant contribution from public funding