



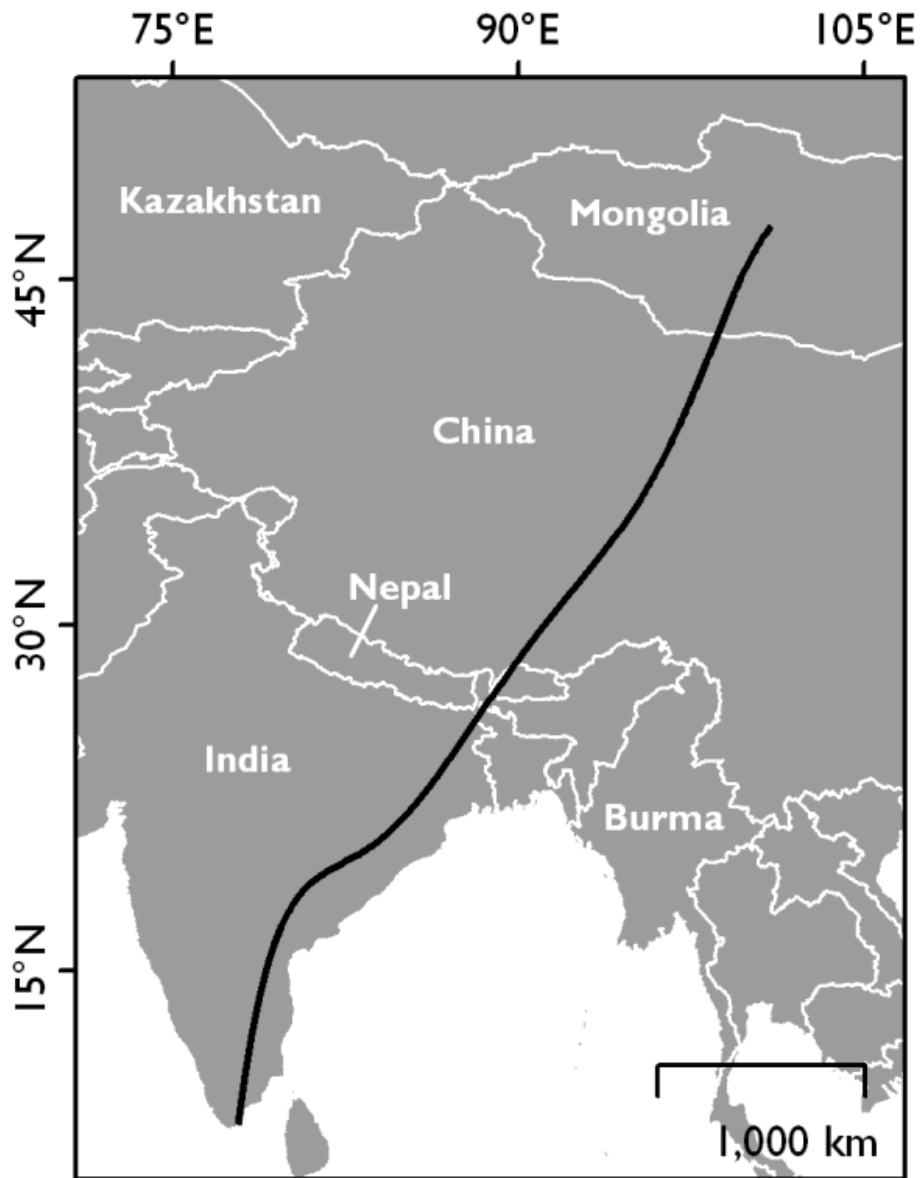
Ultra-light bird tracking system based on BGPS™

Ivan Petrovski, *iP-Solutions,*

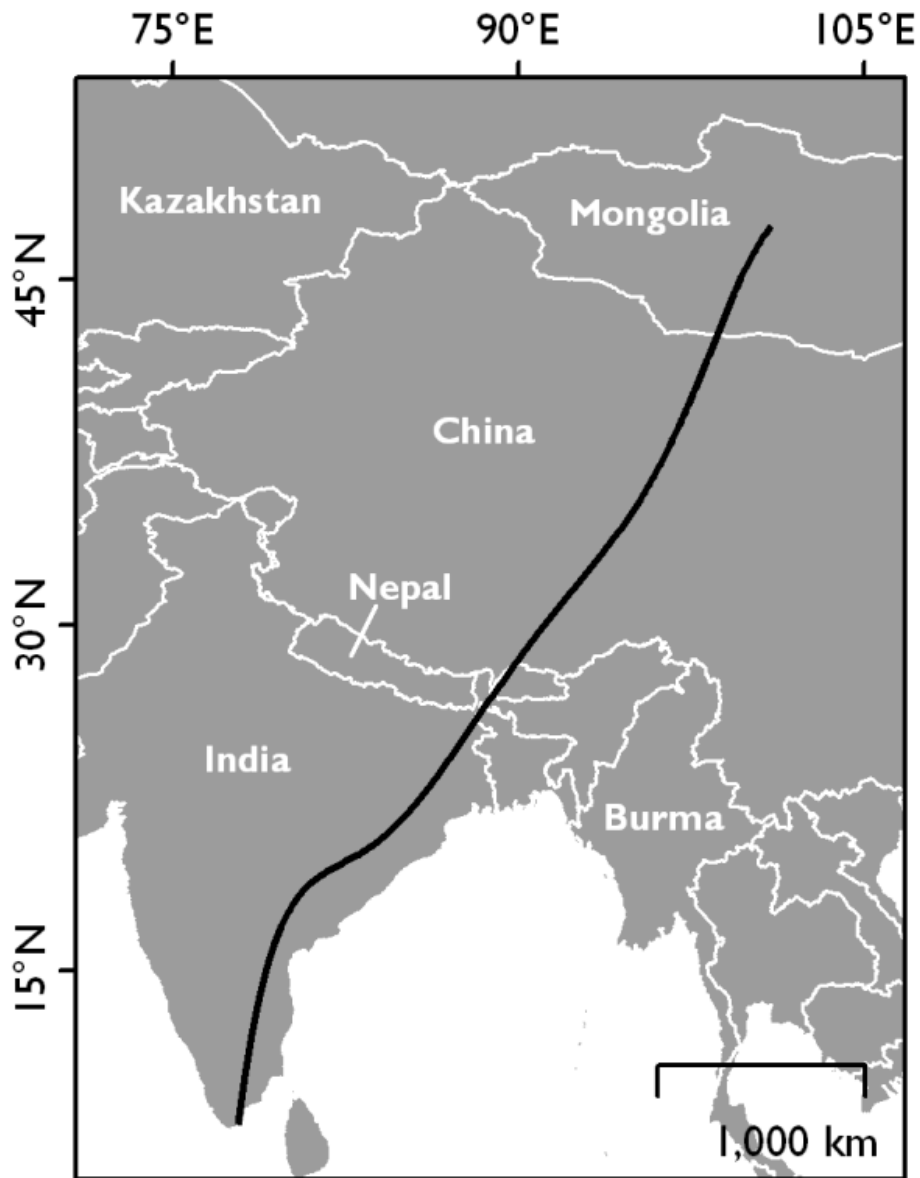
**Charles Bishop, Robin Spivey, *Bangor
University***

- Tracking bar-headed geese (*Anser Indicus*) and other types of birds for a period of about one year.
- Funded by the Biotechnology and Biology Research Council (BBSRC), UK





- Winter in India and summer in Mongolia.
- Crossing the Himalaya at altitudes of some 6000m.
- Prolonged ascending flight at high altitudes
- Project is to study these migrations
- Endangered species.

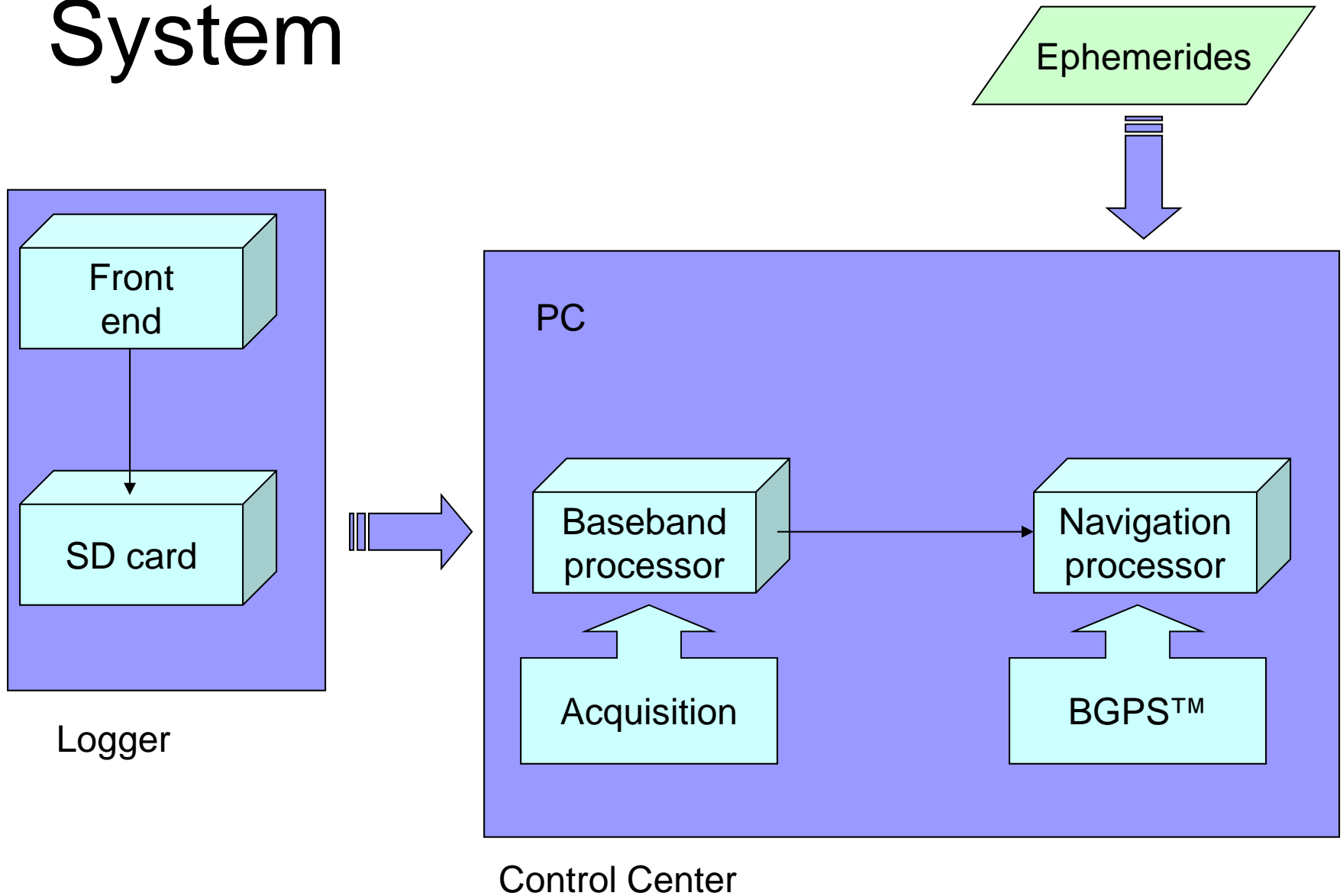


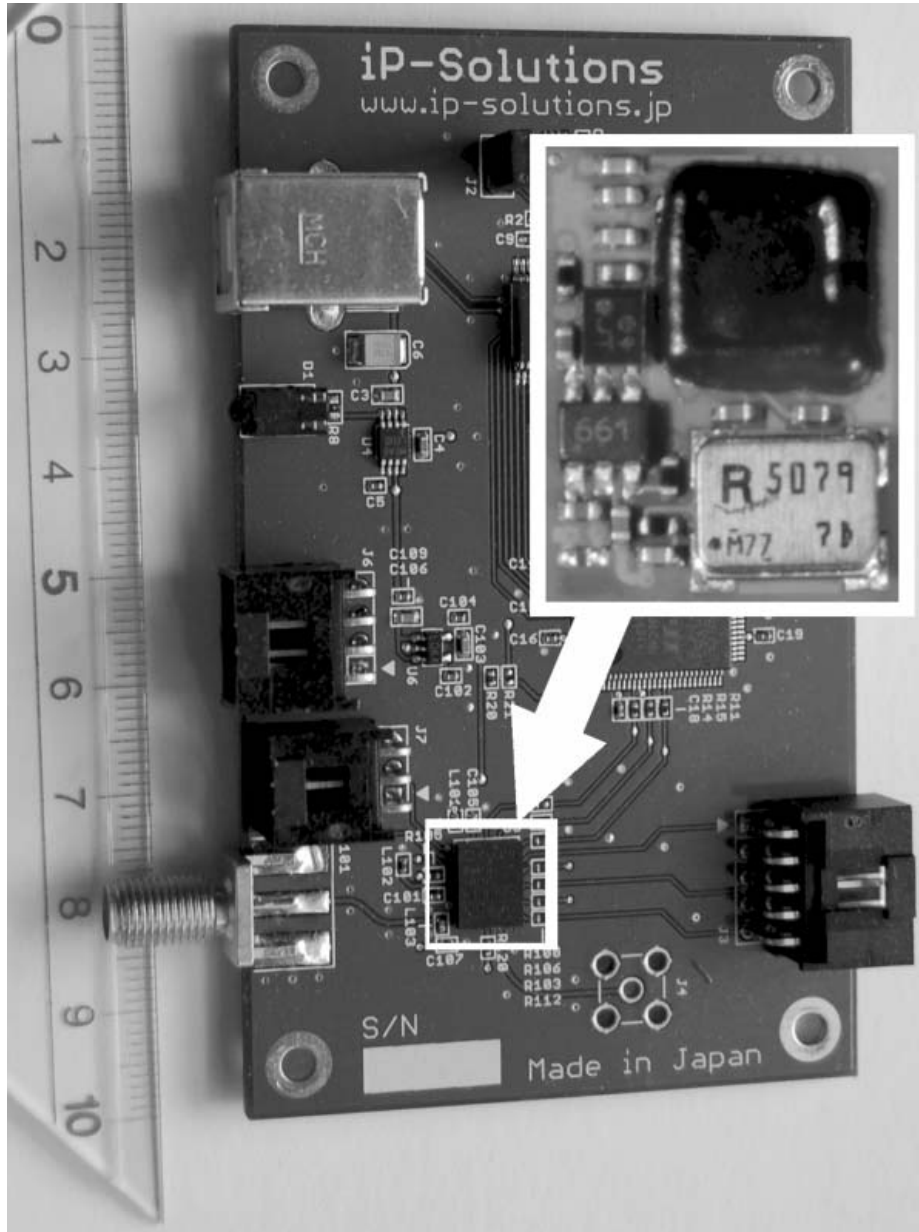
- Initial studies deployed Argos transmitters
- Systems proved somewhat unreliable, and providing at best intermittent results.
- Geese invariably follow a single broad corridor through the eastern Himalayan mountains

System requirements

- - lightweight,
- - low power consumption,
- - durability,
- - aerodynamics,
- - support muscle mechanics or ability to dive or swim underwater ,
- - weatherproof,
- - waterproof,
- - capable of tolerating extreme environments,
- - sufficiently robust to withstand attack by other birds.

System





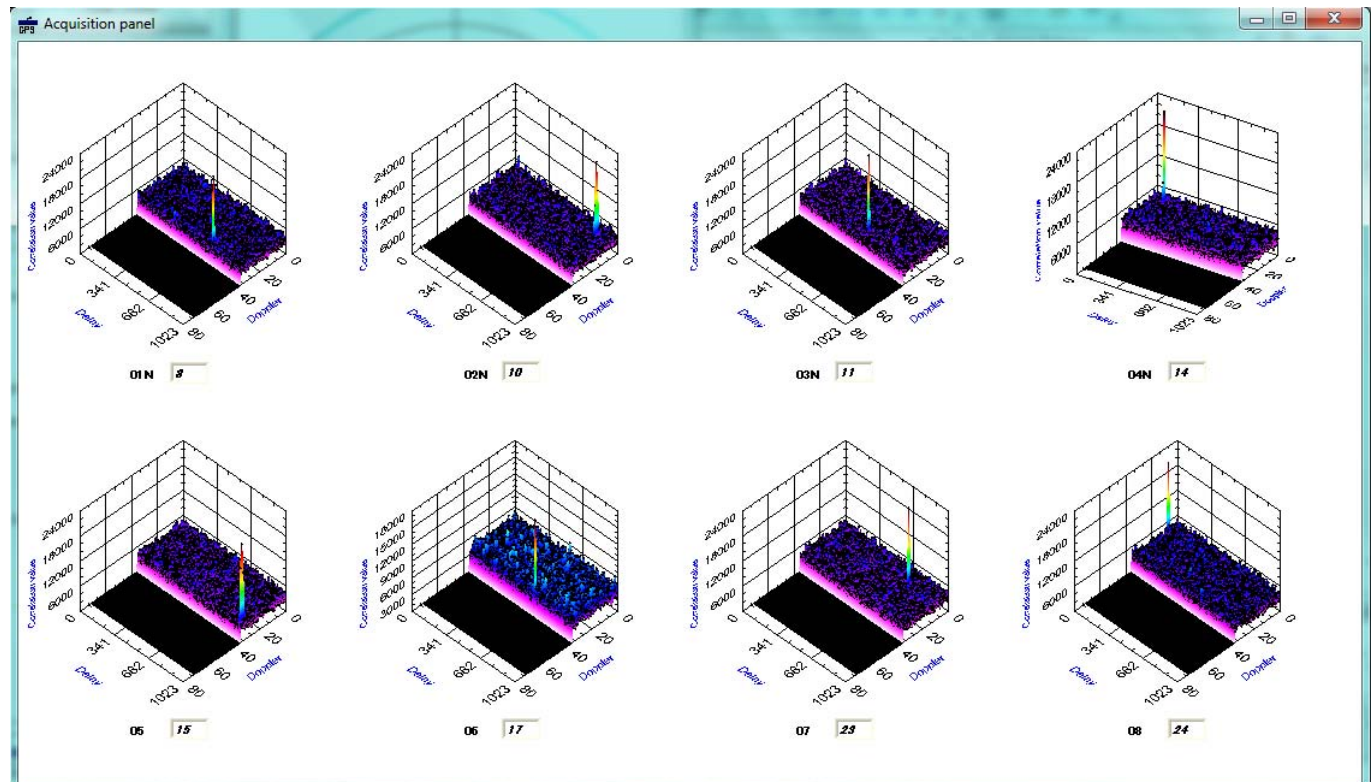
- Initial tests with iPRx receiver and front end.

■ Normal receiver operation

- Acquisition – tracking - data decoding – positioning

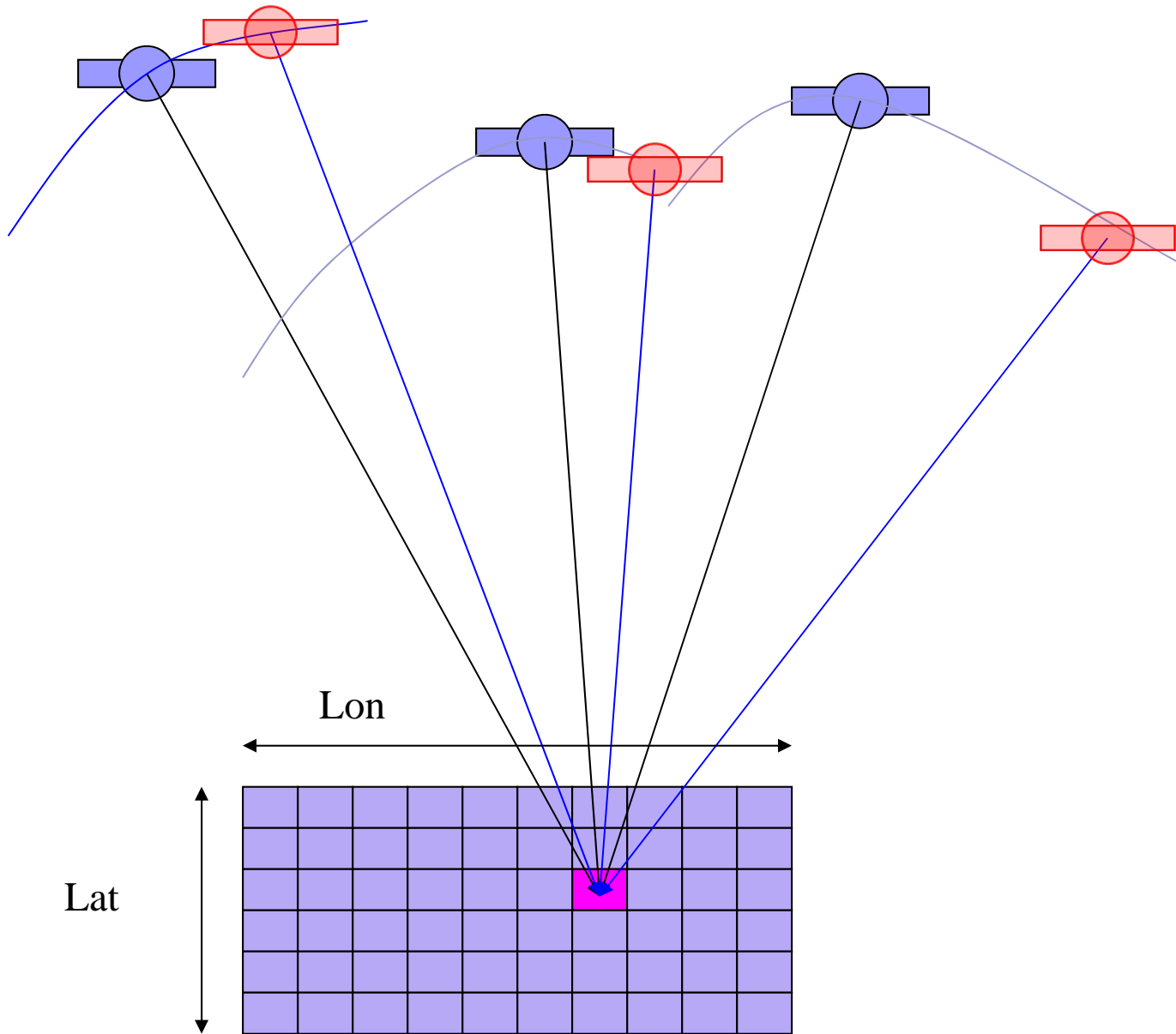
■ Snapshot

- Acquisition – positioning

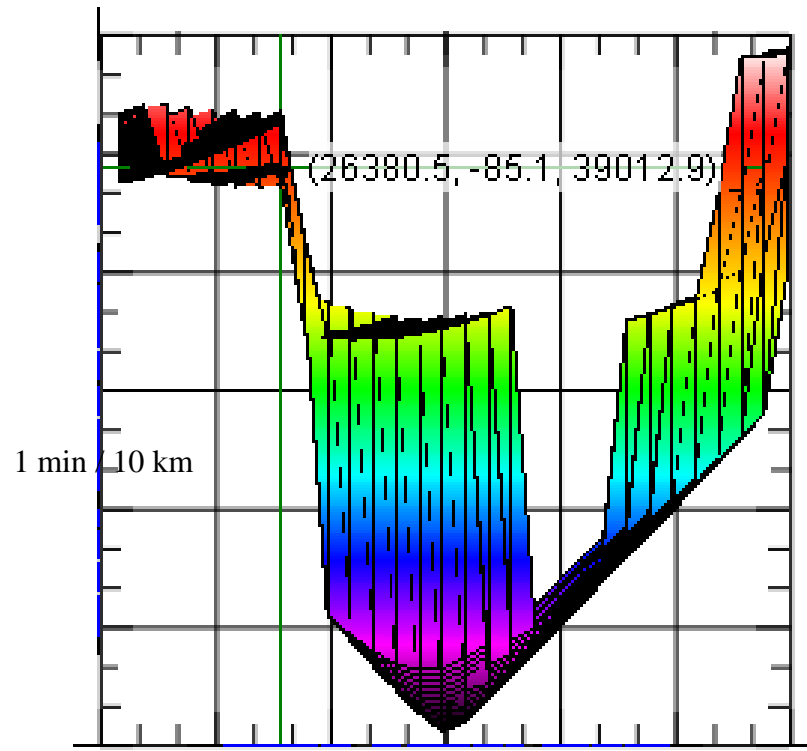
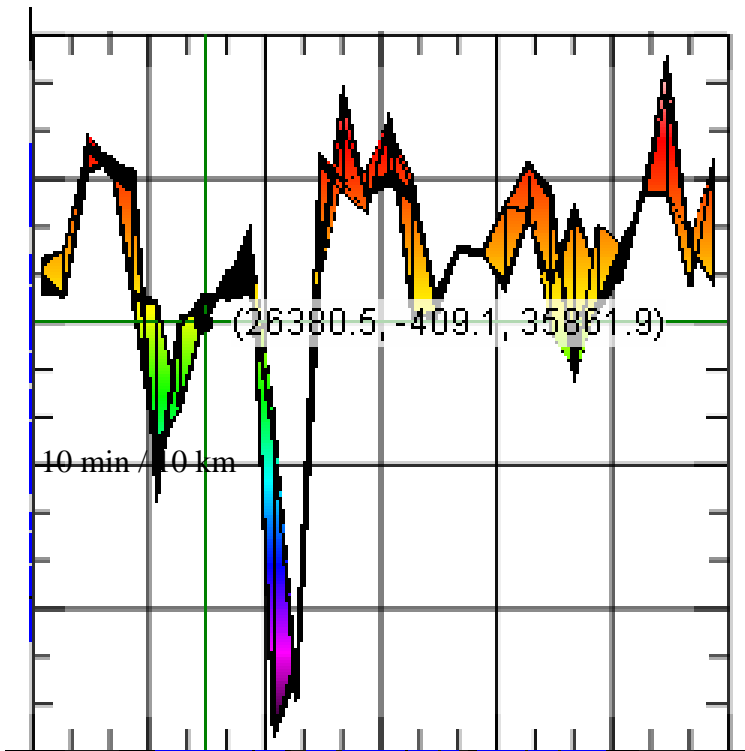


Why BGPS ?

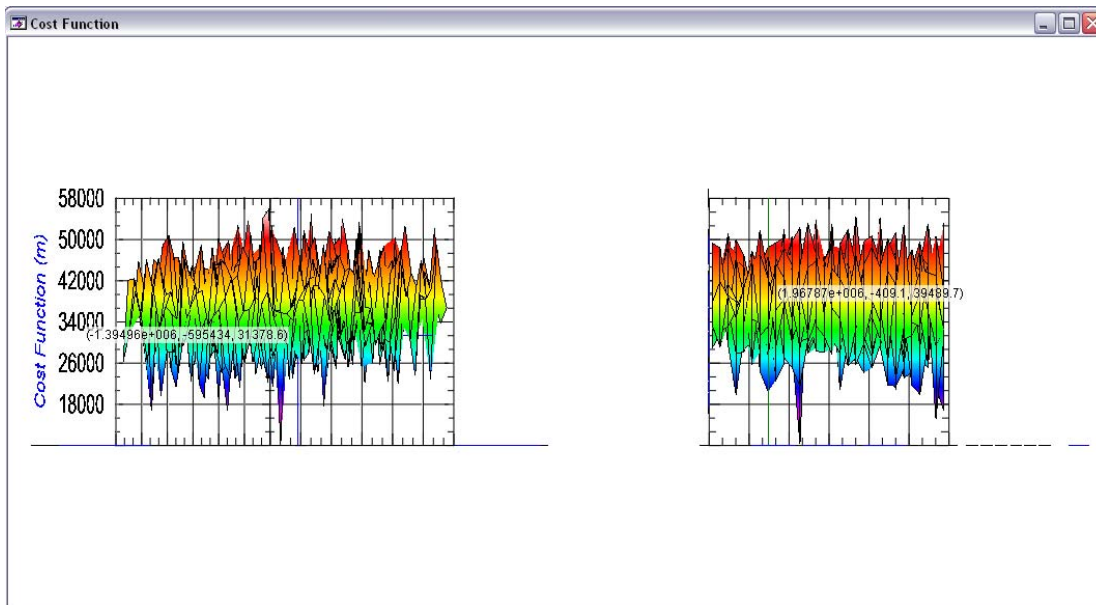
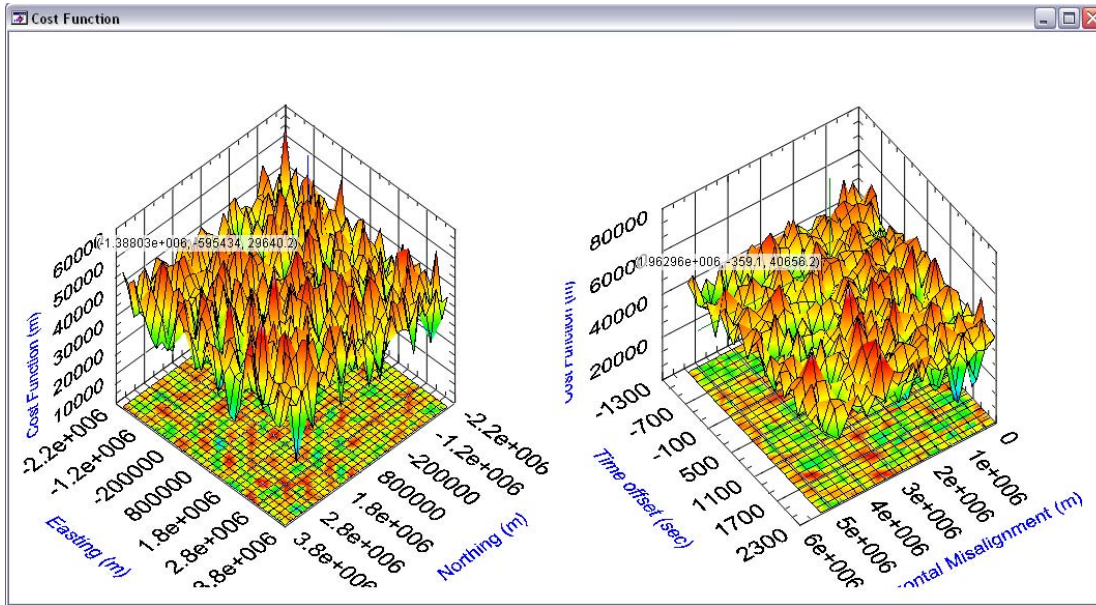
- Instant fix
- No network
- Small snapshot of data
- Cheap, small, light end user device



- Time ambiguity causes multiple local minima



- Cross-sections of criterion in 5D space.



Parameters to define a search area:

Maximum Inaccuracy of Initial Position (km)

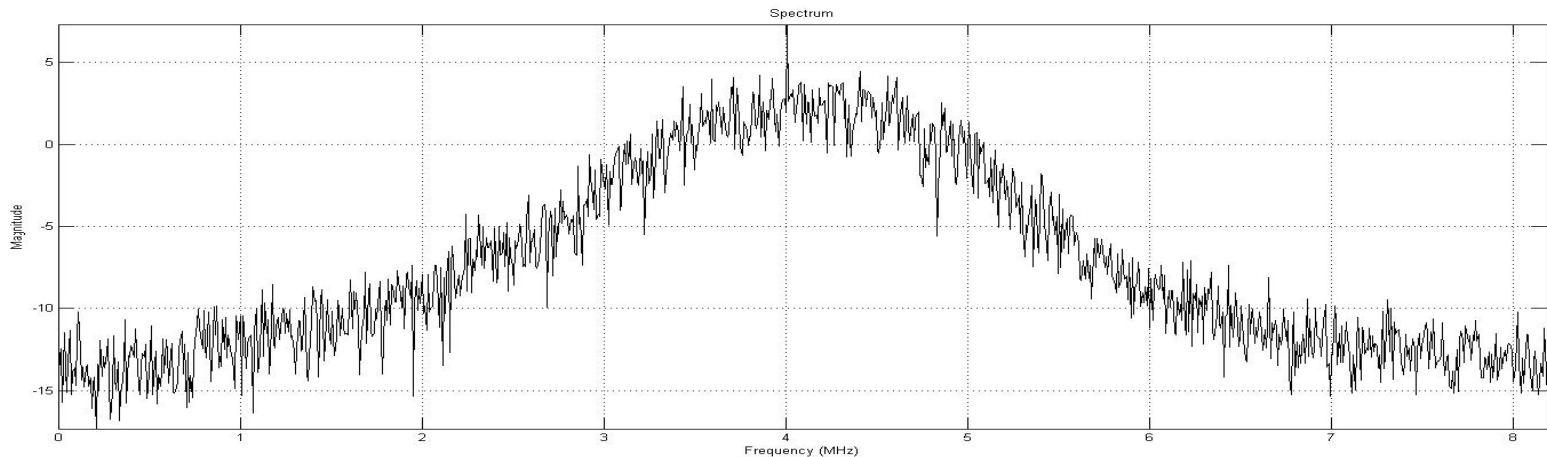
▲ 1000.00 ▼

Maximum Inaccuracy of Time (sec)

▲ 600.00 ▼



- Accuracy : snapshot vs. tracking



- iPRx receiver preliminary snapshot tests in Bangor with home made wire antenna
- Position fixes



■ DIF Simulator to check receiver operation with new settings

DIF Signal Generator

Parameter:	Value	Units
Intermediate frequency	4130.40	KHz
Sampling rate	16368.00	KSPS
Quantization	2	
Bandwidth	2.000	MHz
Window	Hamming	
Output data format	Direct	Q=1 (2)
Decimation	no	

DIF Generator Mode: Single Channel Multi-channel

Signal duration (min):

Simulate front end

Multi-channel | Multipath | **Single channel** | Scintillation | Interference | Signal Mixer

Code PRN

Nav. message

Doppler Hz

Carrier Subcarrier Meander

C/N0 [dBW]

ReGen - GNSS DIF Signal Simulator

File Output!

Interface | **Time/Position** | Options

Start coordinates:

Latitude:
 Longitude:
 Altitude:

Simulation start time (GMT):

Date:
 Time: Leap seconds:

Static user: Dynamic user:

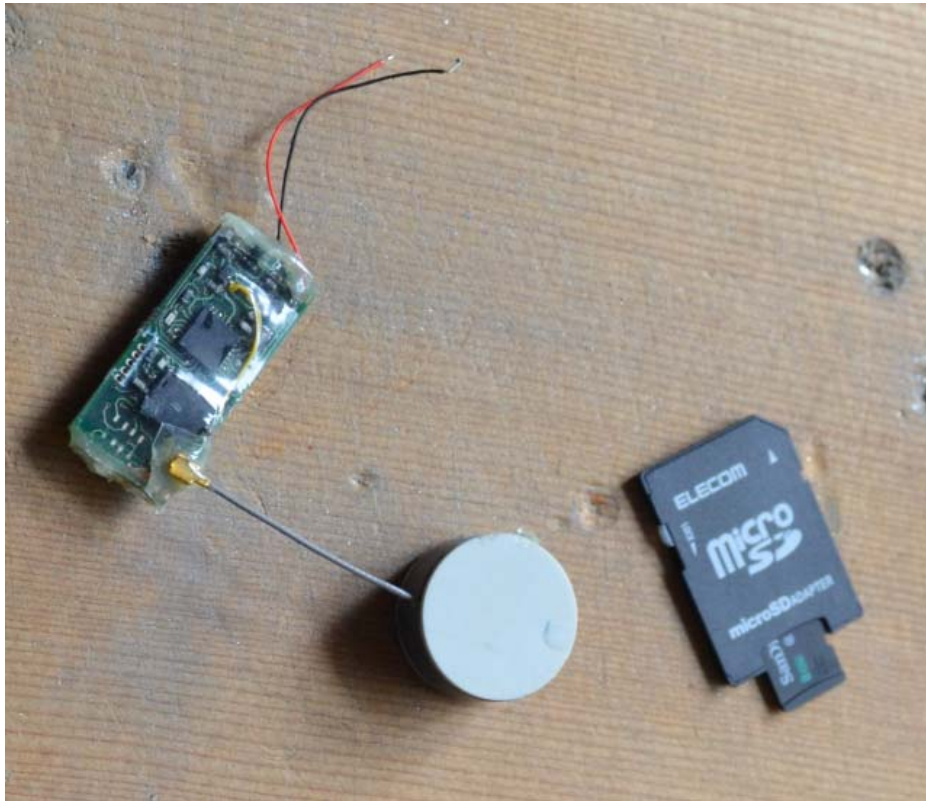
Duration (min): Mask angle:

Generate Stop

GPS Week: Sec of GPS Week:

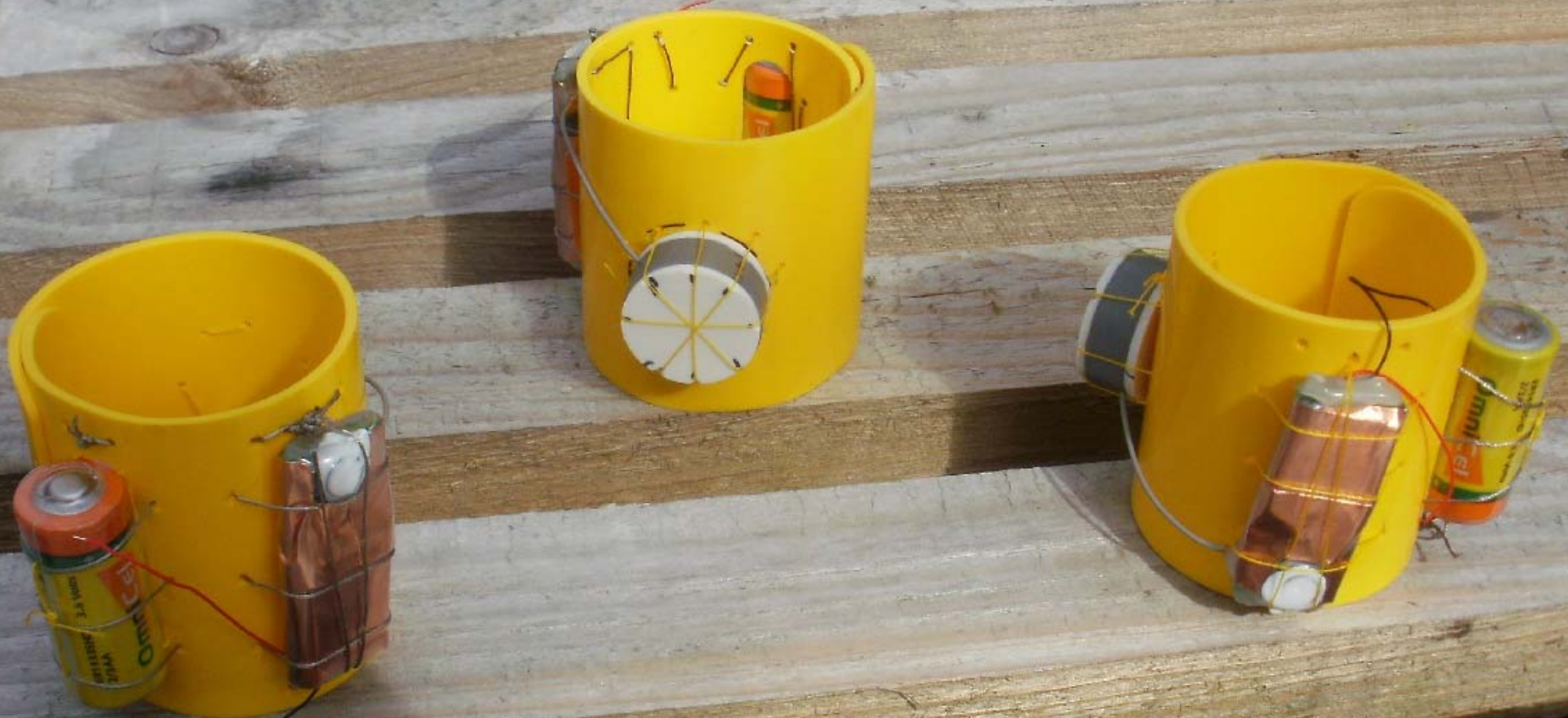
GPS L1 C/A
 L1C
 GPS L2C
 GPS L5
 GLONASS L1 SP
 GLONASS L2 SP
 BOC (,)

Hardware



- Logger
- Antenna
- SD card with reader

- Assembled collars
- Logger
- Antenna in closing
- Battery



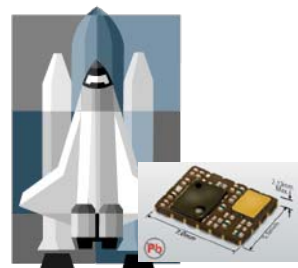
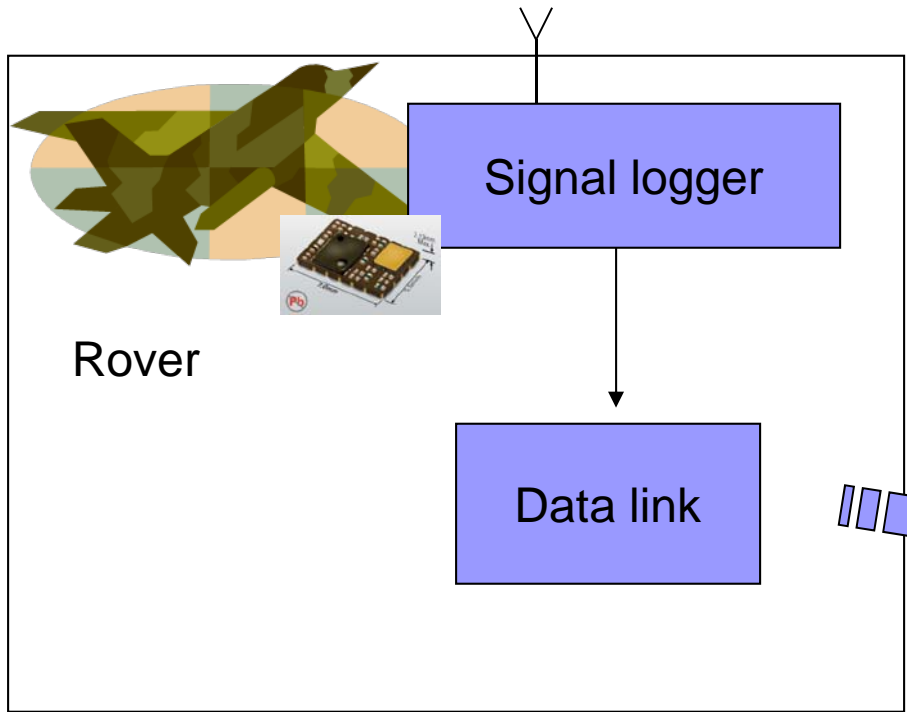
- Gees with collars



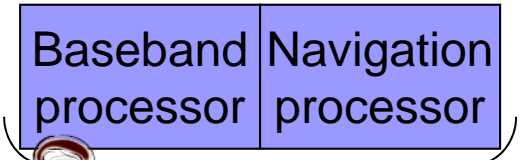
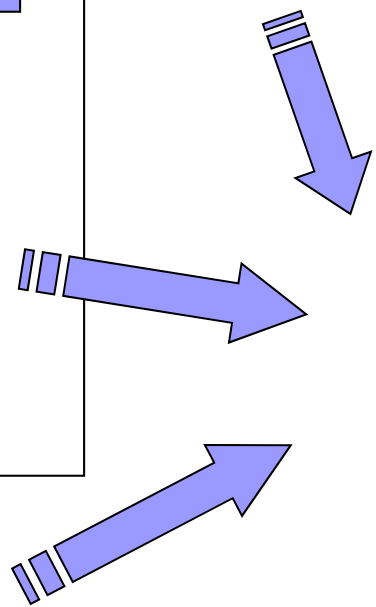


- Recapture of geese is possible without causing stress to the geese.

Other types of fleet management



Sounding rockets for ionospheric study
IAE (Instituto de Aeronautica e Espaco).



Control center

Ephemerides data

Project is the result of a collaboration

- Bangor University
- the Max Planck Institute for Ornithology
- the Mongolian Academy of Sciences
- the University of Birmingham
- the University of British Columbia
- the United Nations Food and Agriculture Program
- US Geological Survey
- the University of Tasmania
- iP-Solutions

- iPRx software receiver
- DIF simulator
- BGPS software and technology
- Front ends

