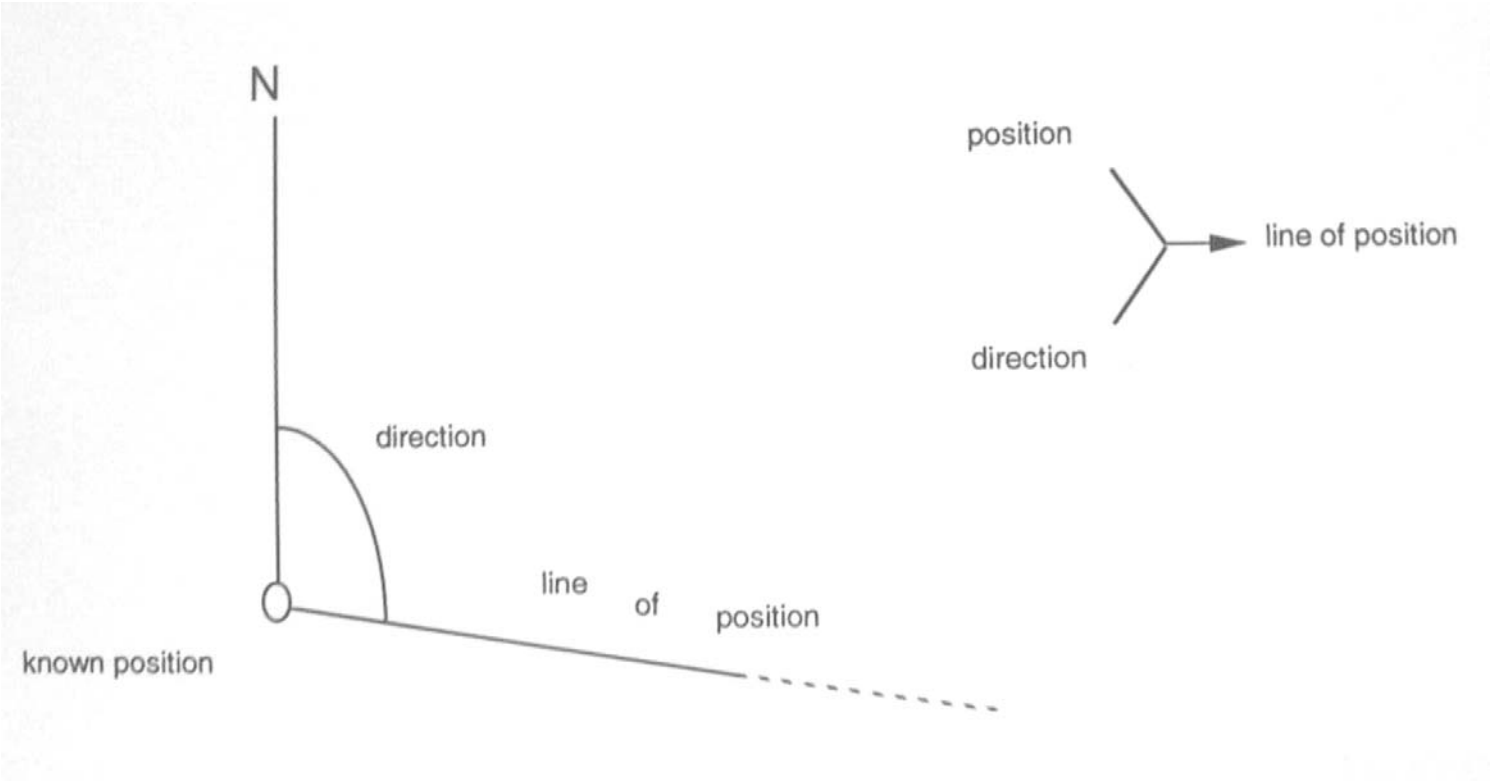
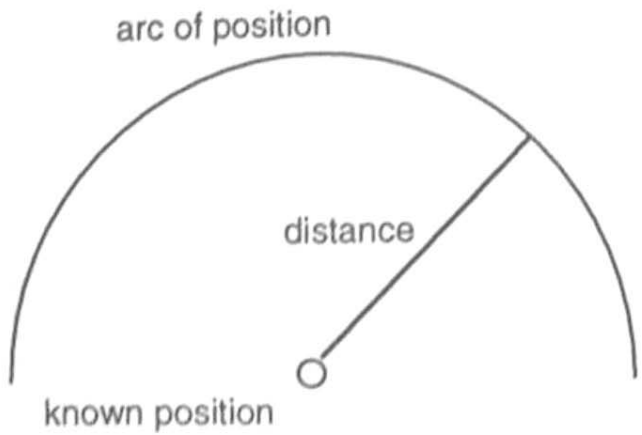
A Computational Perspective on Navigation

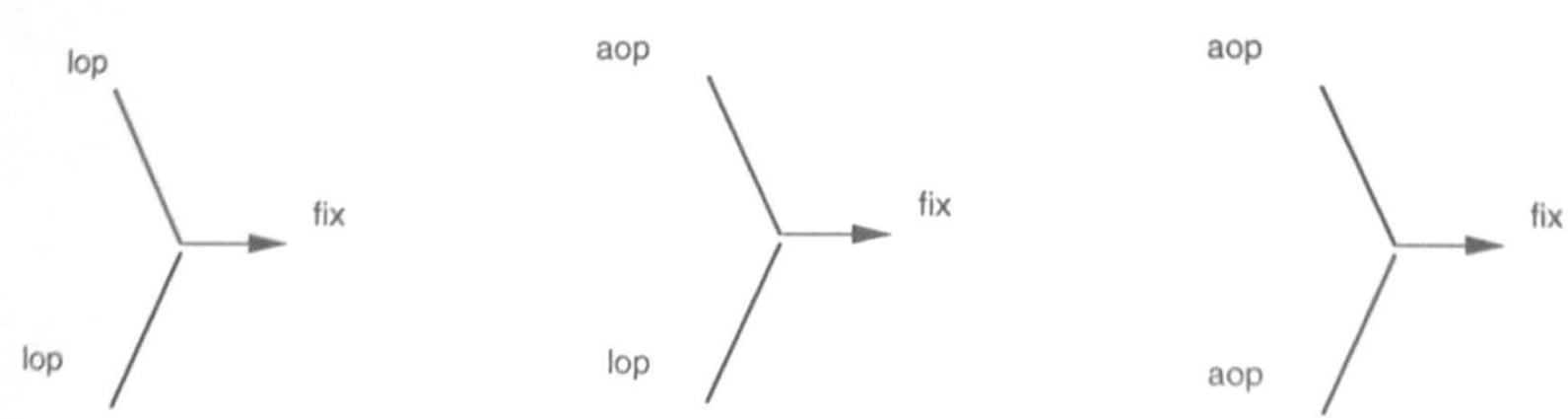
Line of Position



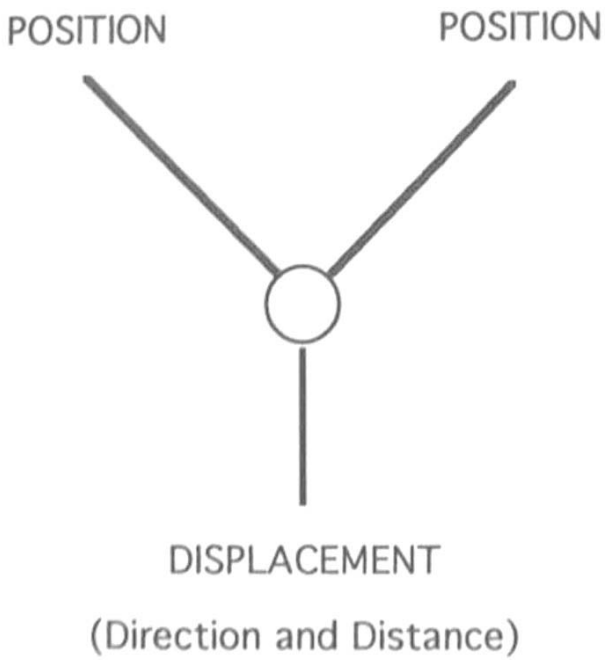
Arc of Position



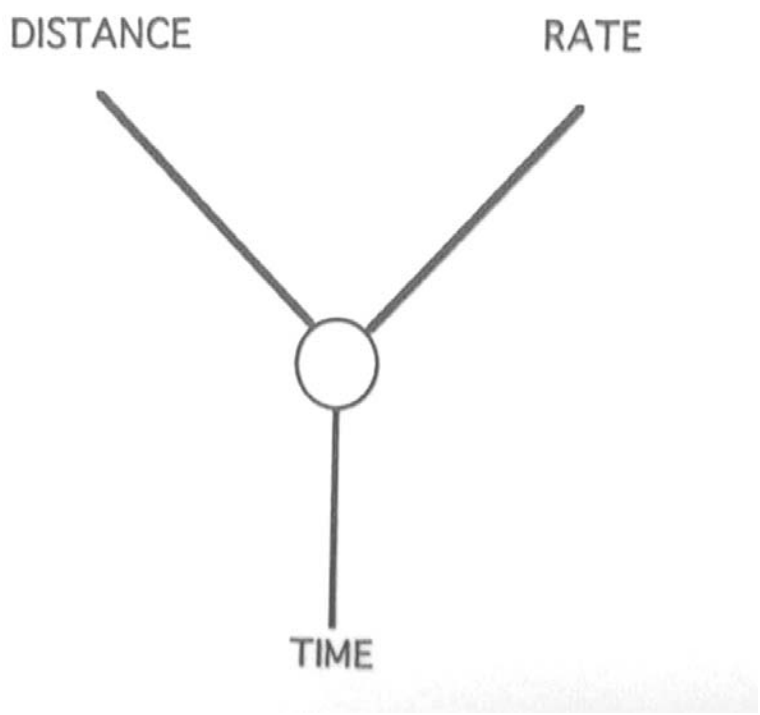
Combining one-dimensional Constraints



Position/Displacement Constraint



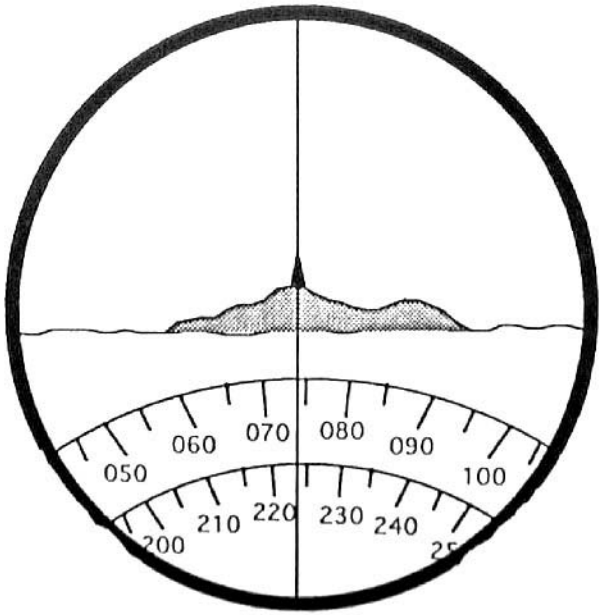
Distance Rate and Time Constraint



Computation via the propagation of representational state.

- Ship position plotting

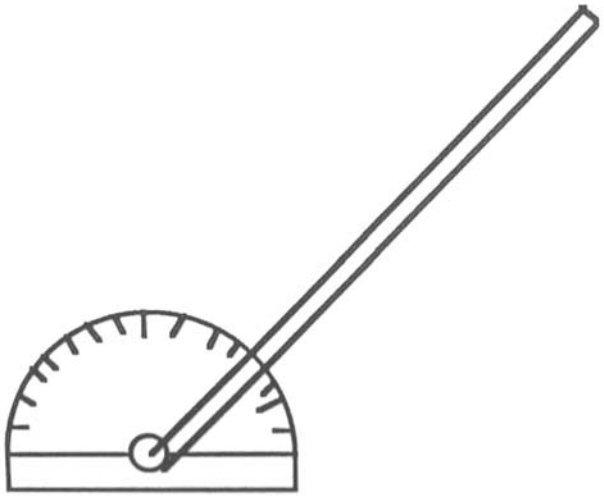
View through the Alidade



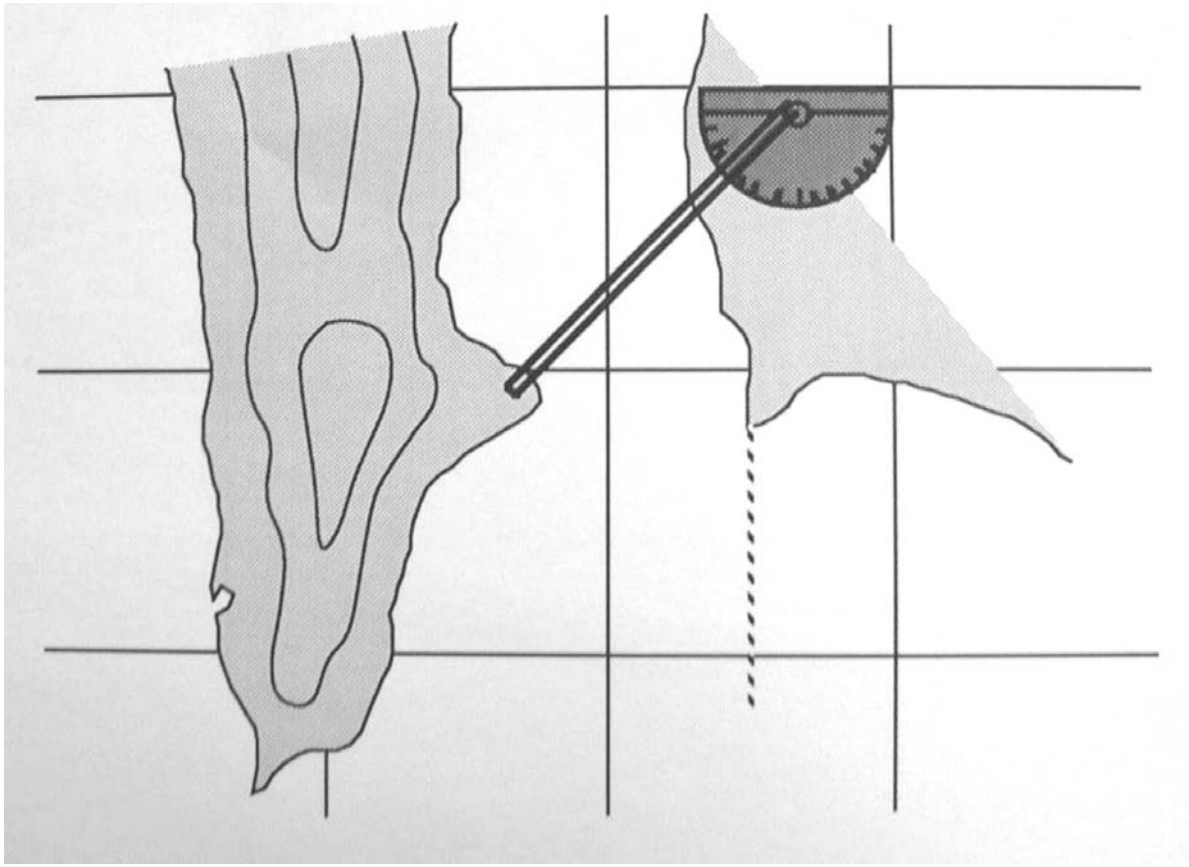
The Bearing Record Book

	Tower	Hotel	Pier	Depth
13:25		008		23
13:28		006	148	27
13:31		006	146	32
13:34		005	143	29
13:37	205	004	139	30
13:40	211	004	135	35
13:43	218	003	130	24
13:46	**224**	003	122	26

The Hoey



Hoey in Coordination with the Chart



Units in the Western System

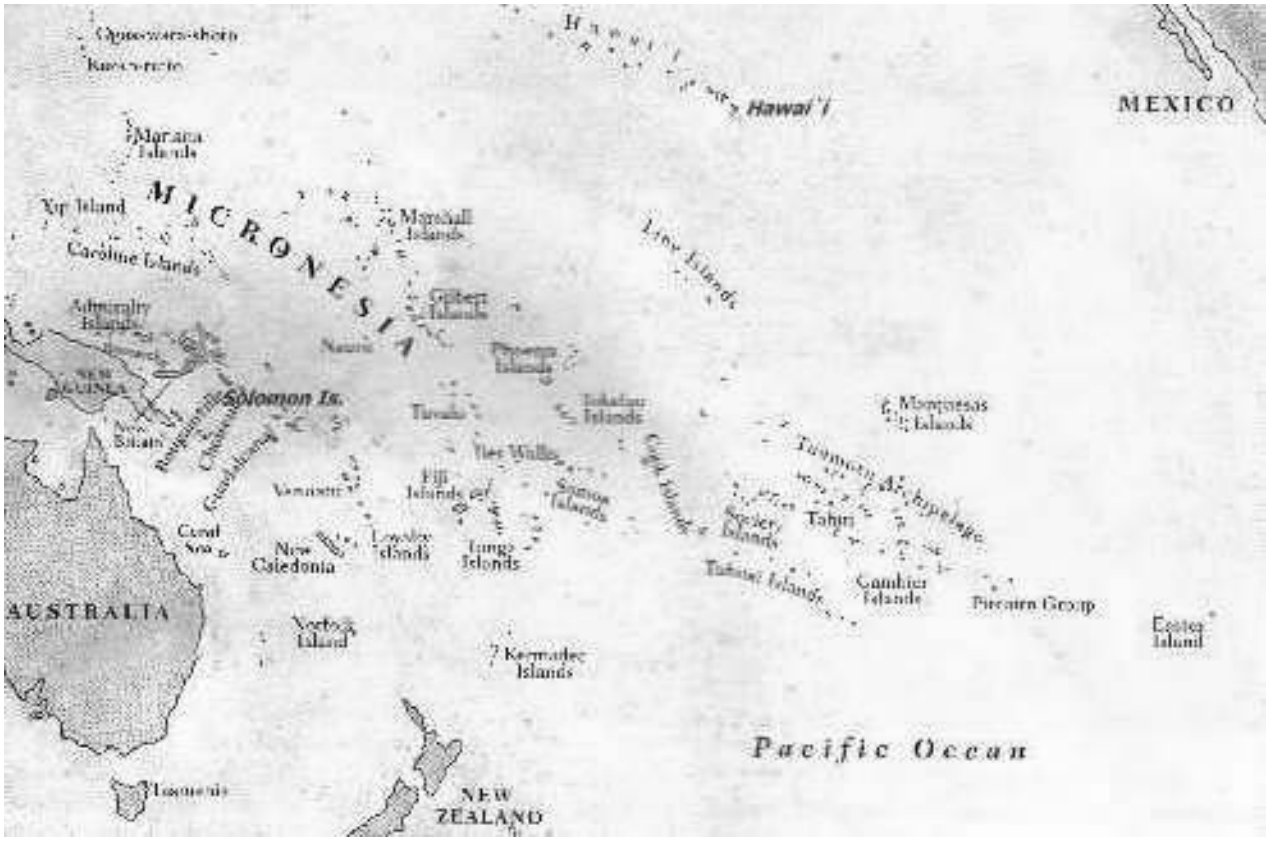
- Geographical position: latitude, longitude
- Nautical Mile
- Time
- Charts, properties of projections

Pre-modern Western Navigation

- Sidereal Compass
- Linear constellations
- Units
  - Day’s Sail
  - Kenning (= etak of sighting)
- Birds
- Latitude Sailing

Micronesian Navigation

South Pacific

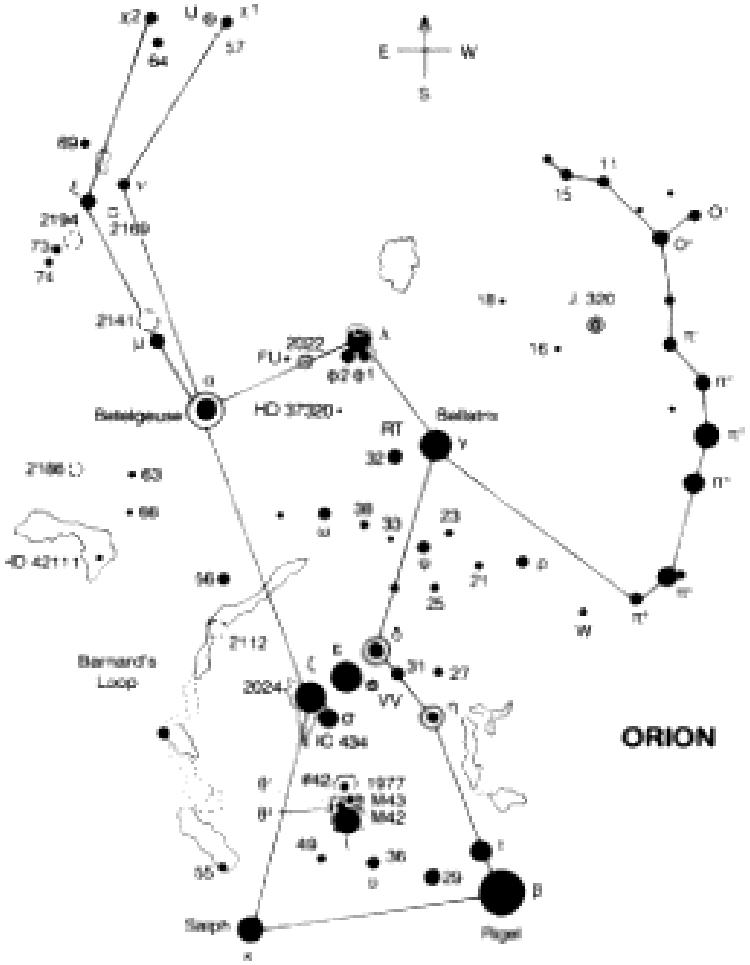


Voyaging requirements

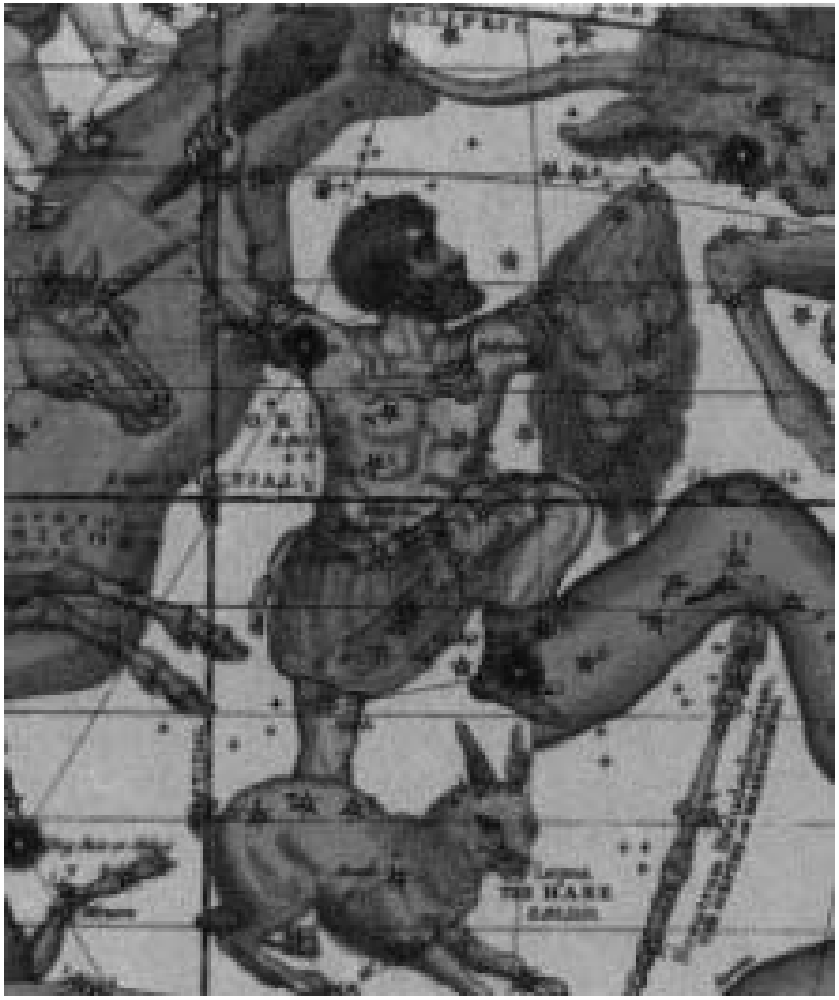
- Set out in the right direction
- Maintain course while travelling
- Determine when to look for the destination

The constellation Orion

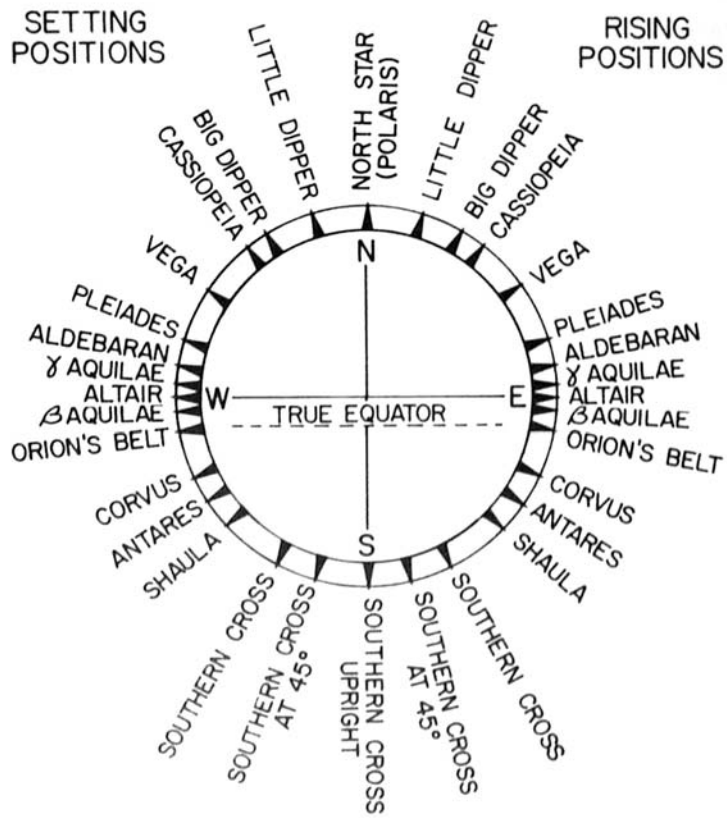
Star Chart of Orion



Orion and Mythology



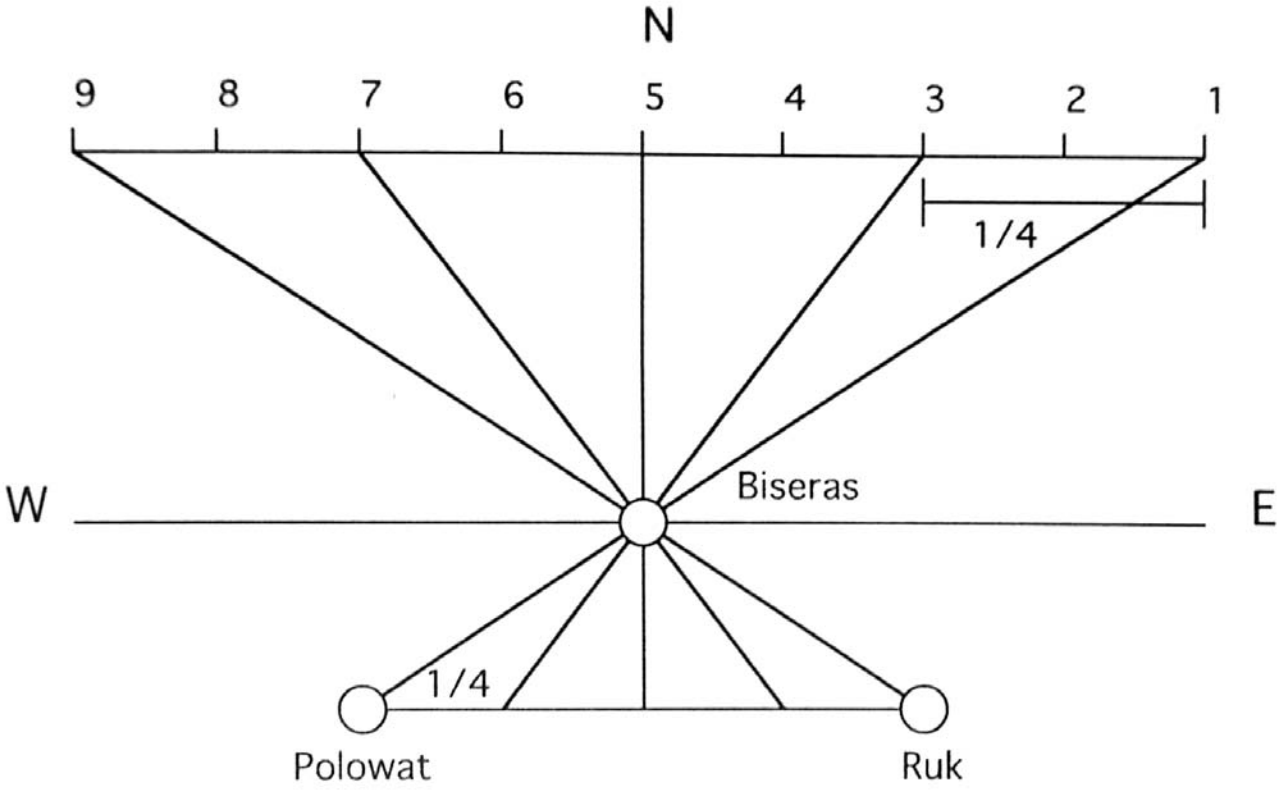
Caroline Island Star Compass



Linear Constellations

- Provide directional reference for course setting
- Allow navigator to maintain course
- Via the concept of ETAK are essential to determining when to look for the destination

Western Conception of Etak



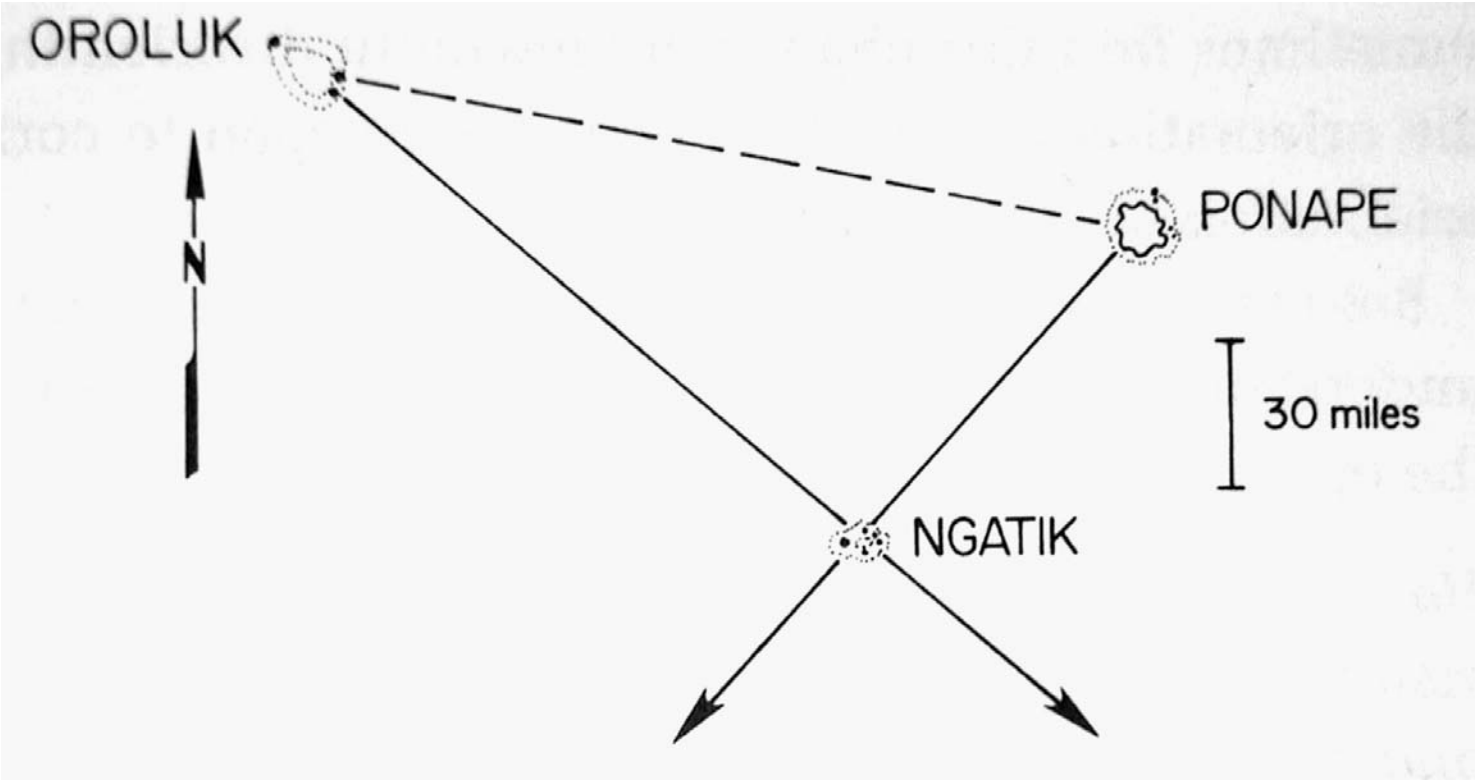
Anomalies

- Square compass - horizon as straight line
- Phantom etak islands
- What is input and what is output
  - Dead reckon position to find etak (Sarfert)
  - Imagine Etak to establish position (Gladwin)
- Near and far Etak islands
- Etak island on both sides of the course
- Etak of sighting and Etak of birds

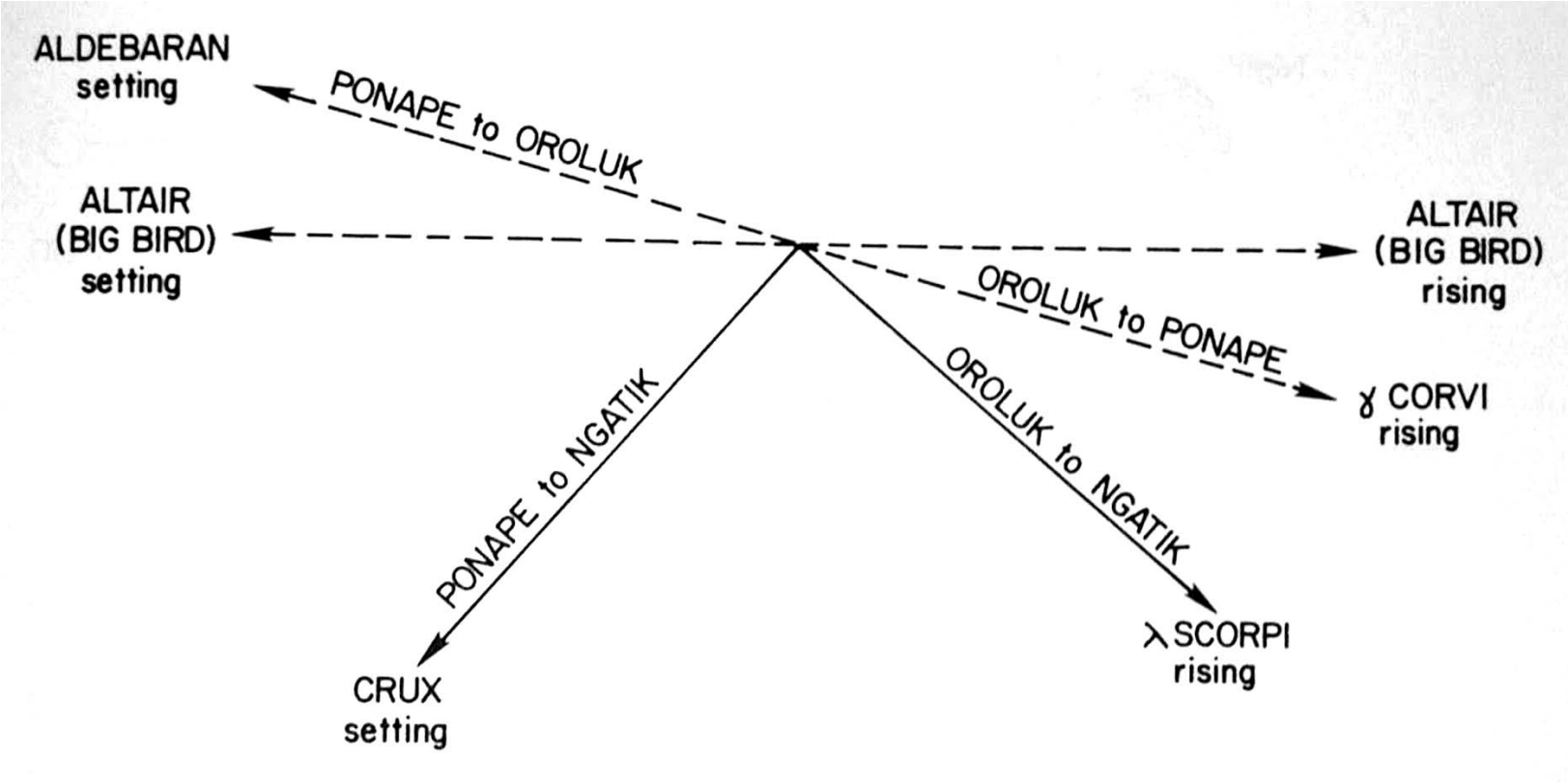
Too quick a conclusion?

- Although ETAK has for us much the quality of a systematic organizing principle or even logical construct, the Puluwat navigator does not let logical consistency or inconsistency, insofar as he is aware of them, interfere with practical utility. (Gladwin, 1970:189)

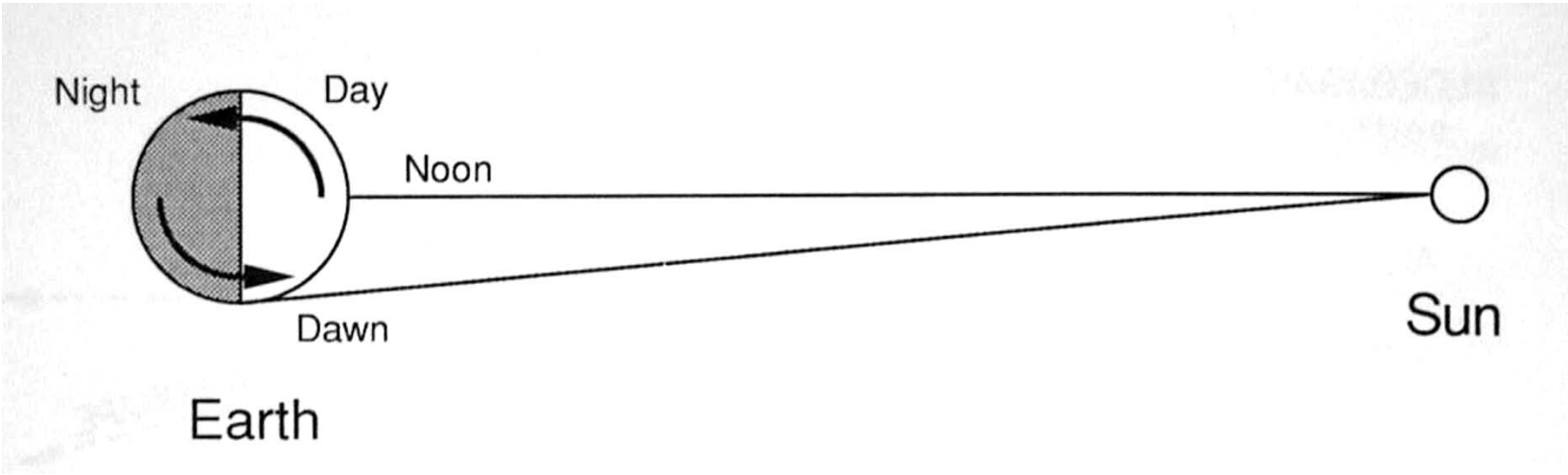
How Lewis located Ngatik



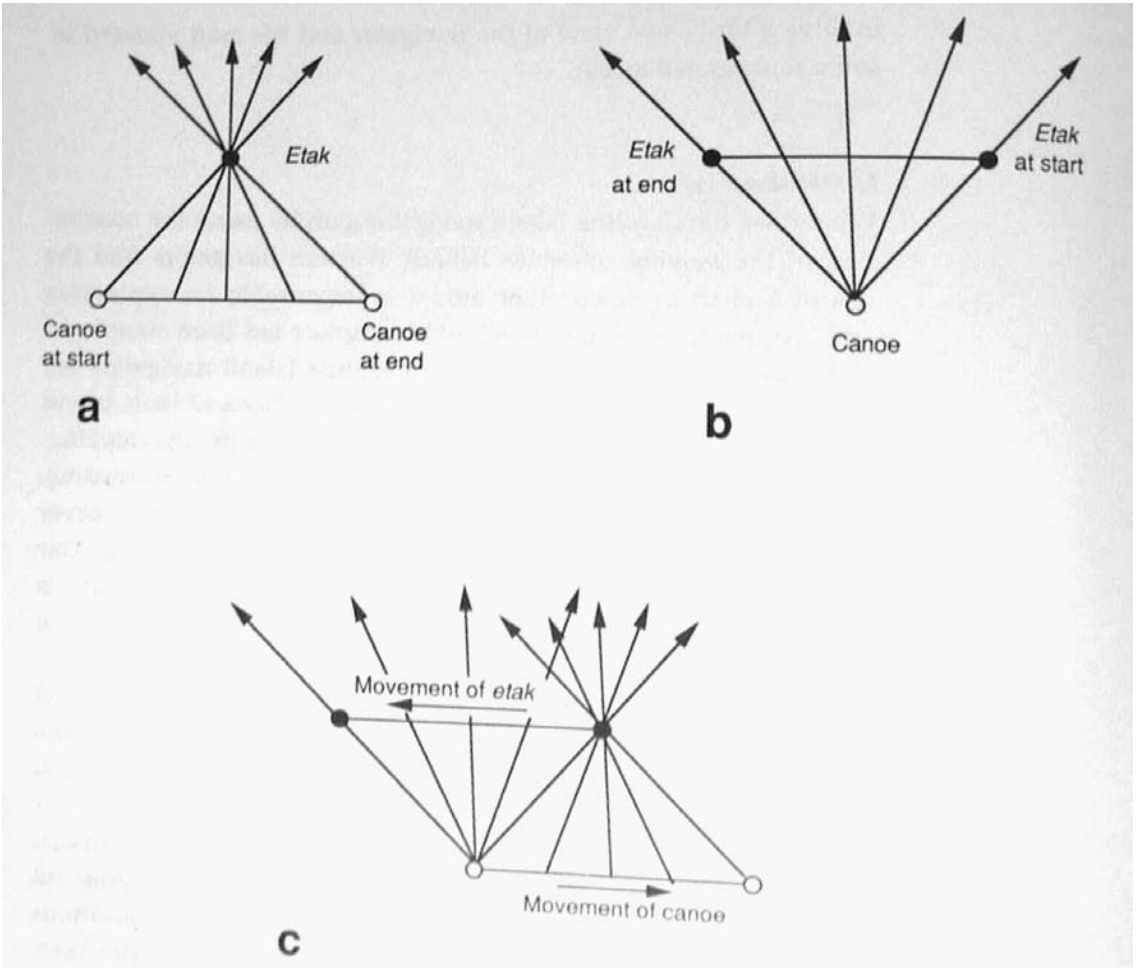
Hipour's star bearings to Ngatik



Point at the Sun Twice

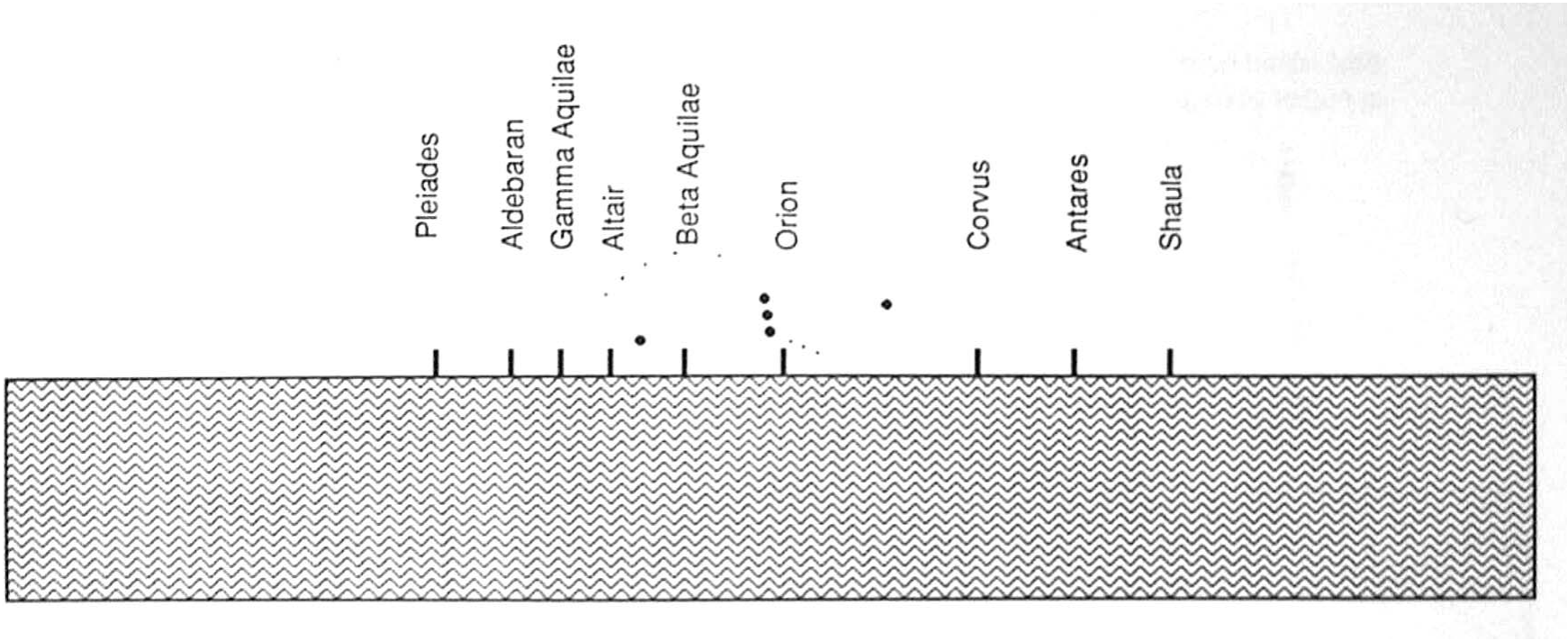


What moves?

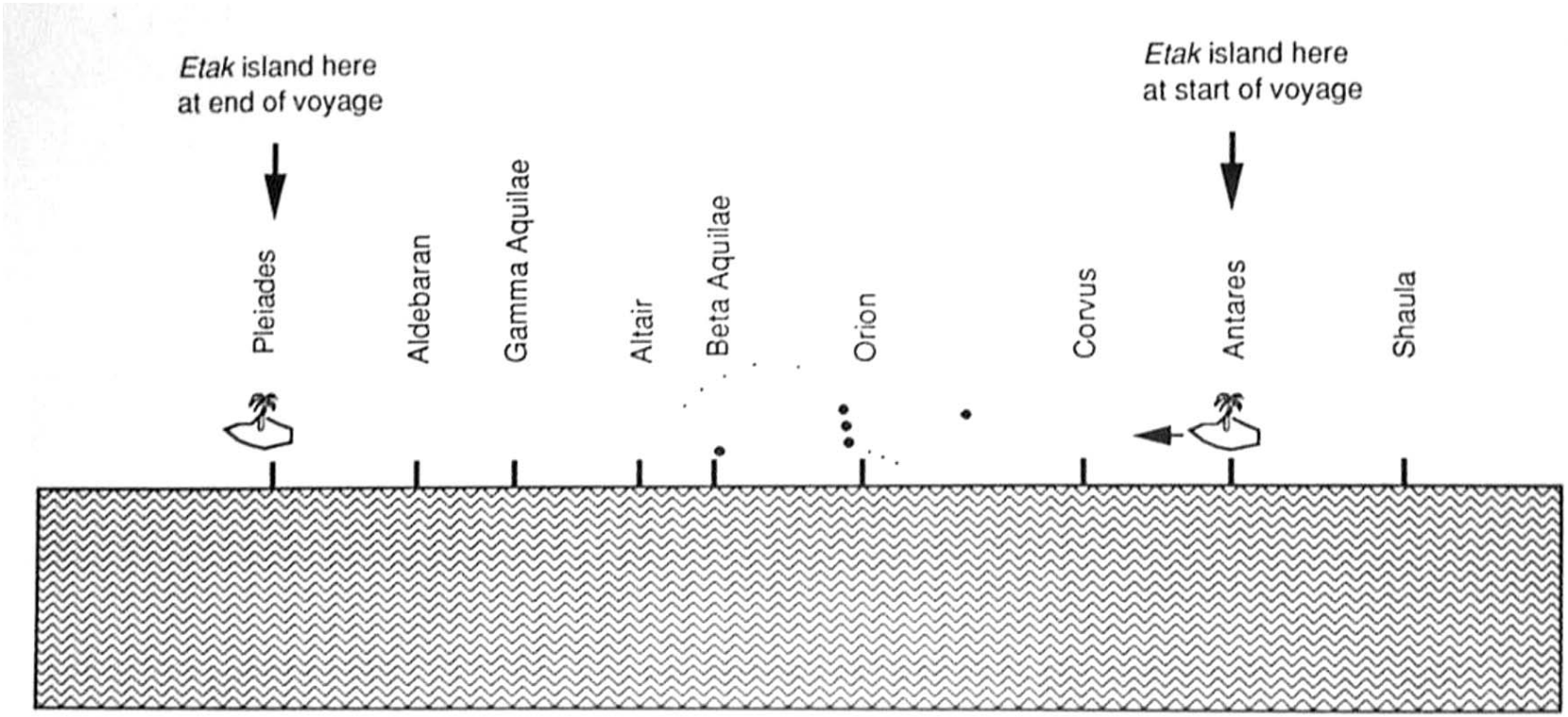

Etak
Canoe
at start
Canoe
at end
a
Etak
at end
Etak
at start
Canoe
b
Movement of etak
Movement of canoe
c

What the navigator sees

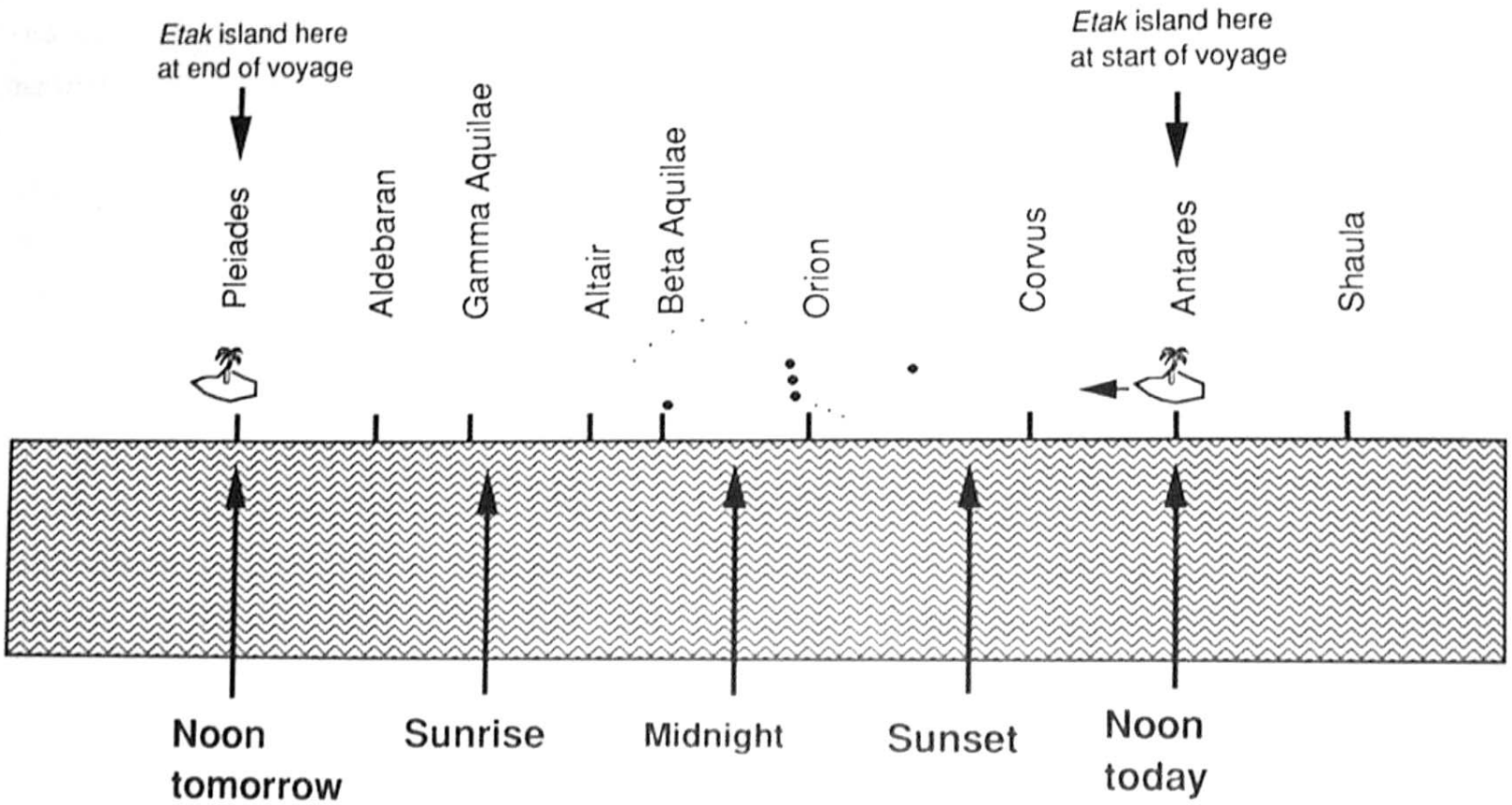
Horizon with Star Points



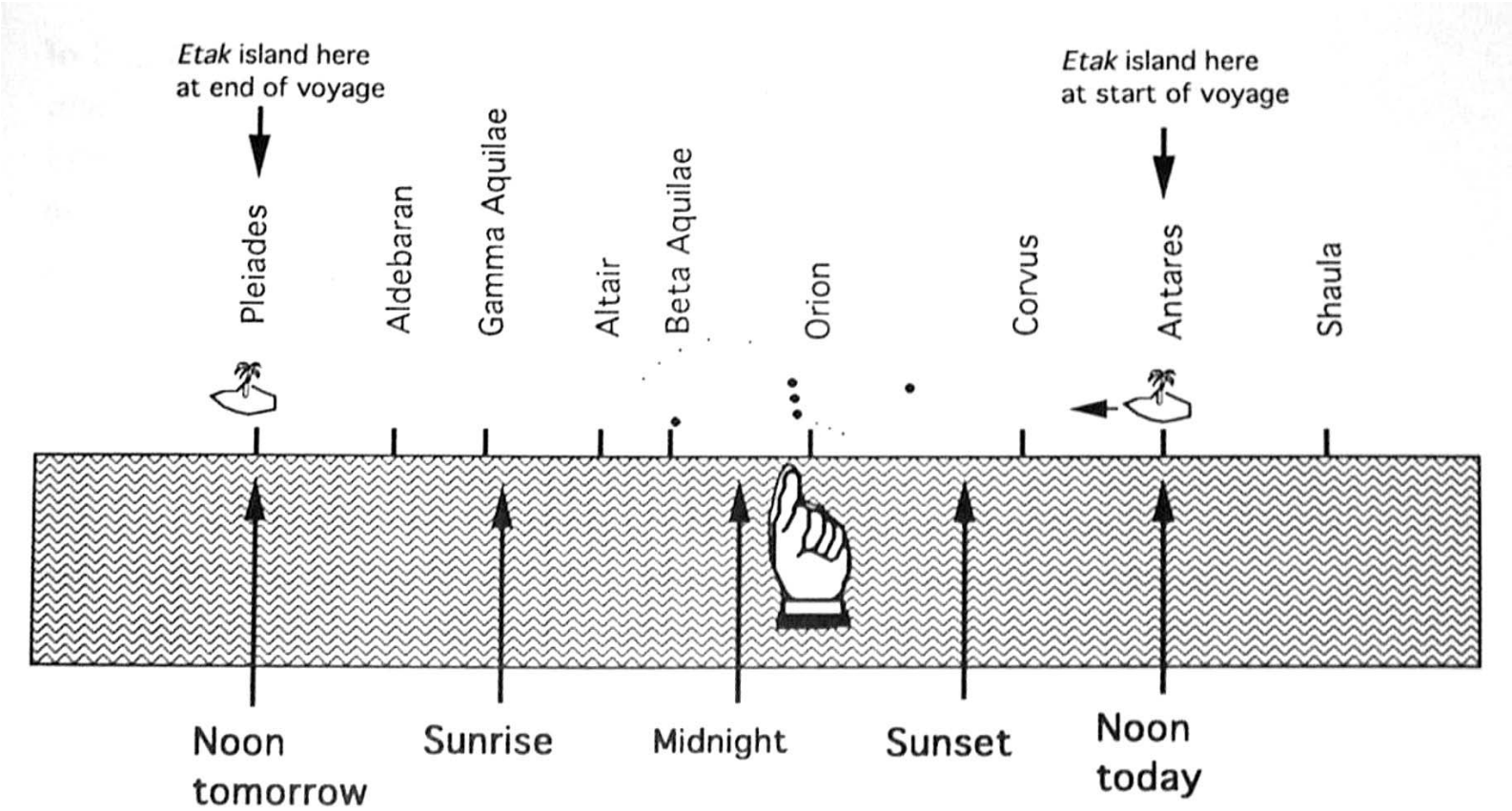
Etak bearings on the Horizon



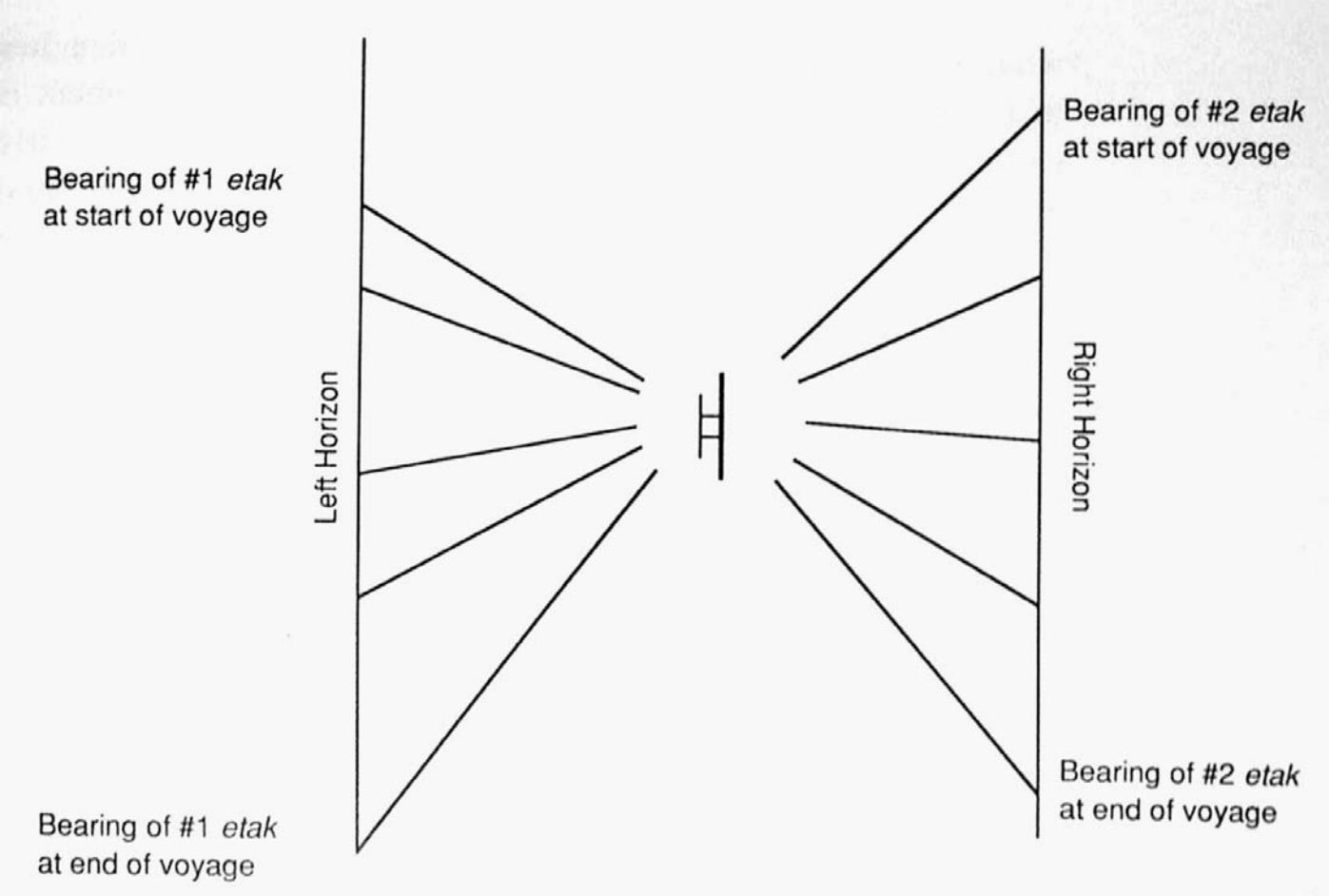
Horizon with temporal landmarks



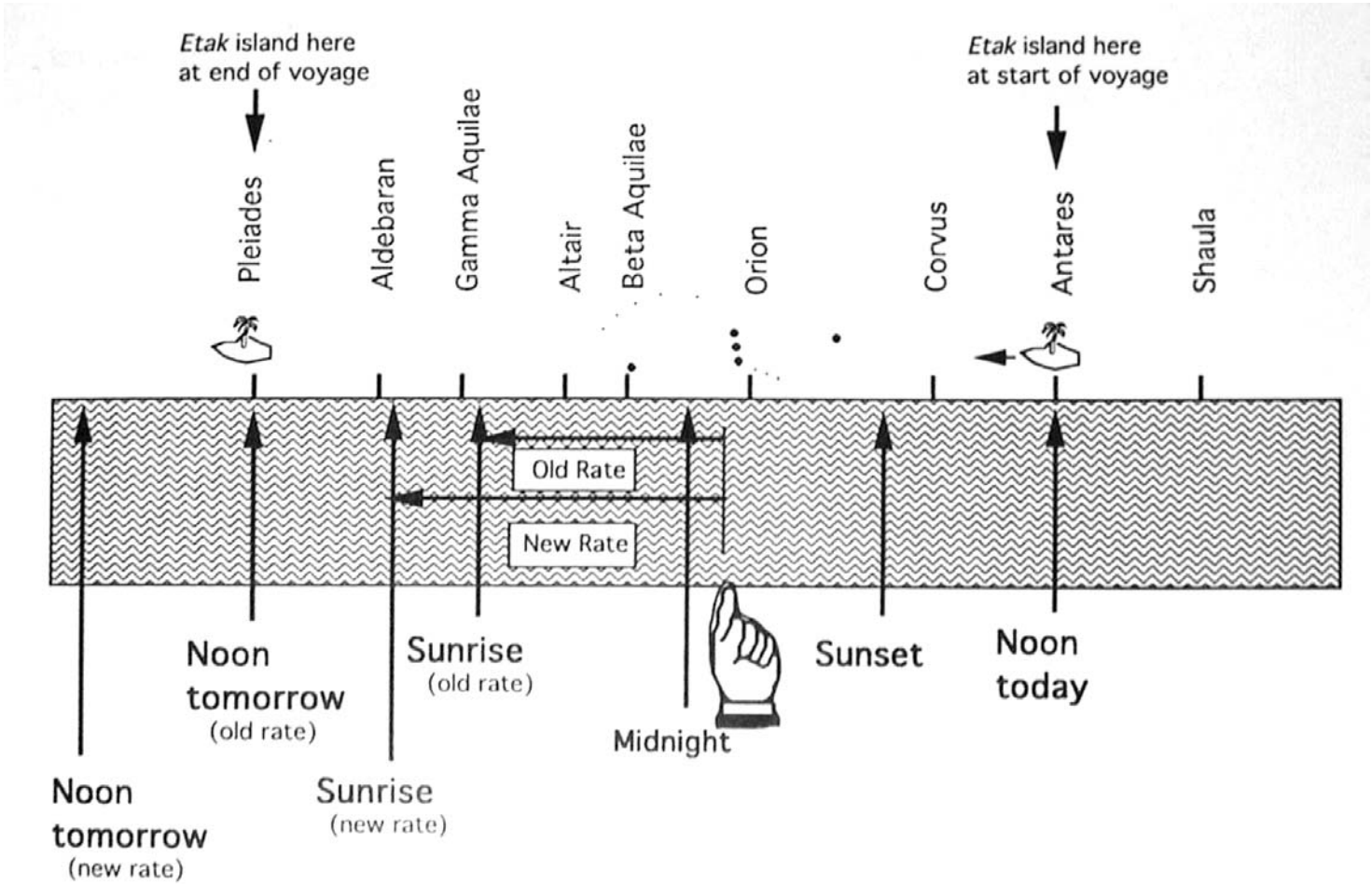
Pointing to the Etak island just before midnight



Using two Etak islands



Adjusting for a change in speed

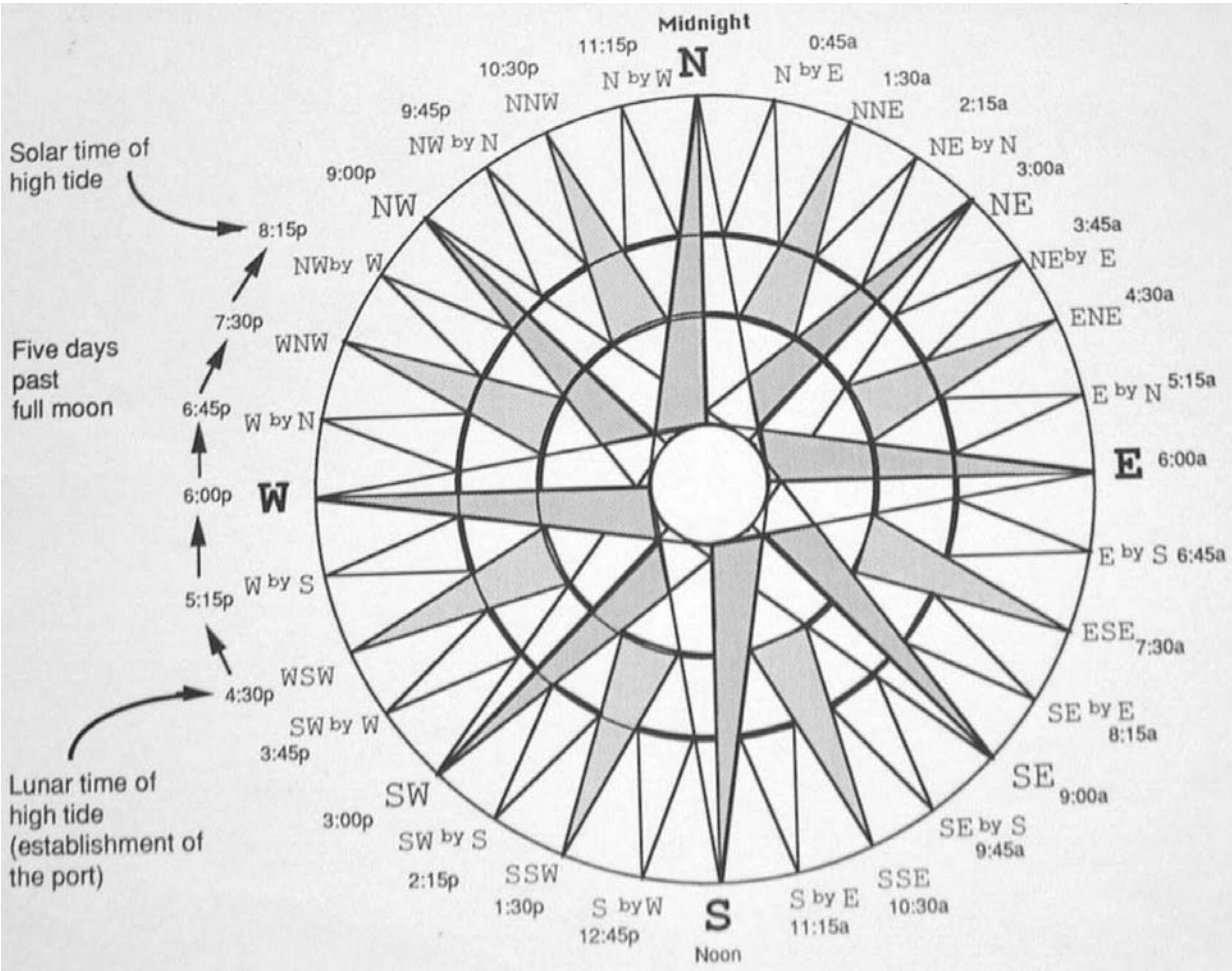


The divergence of traditions

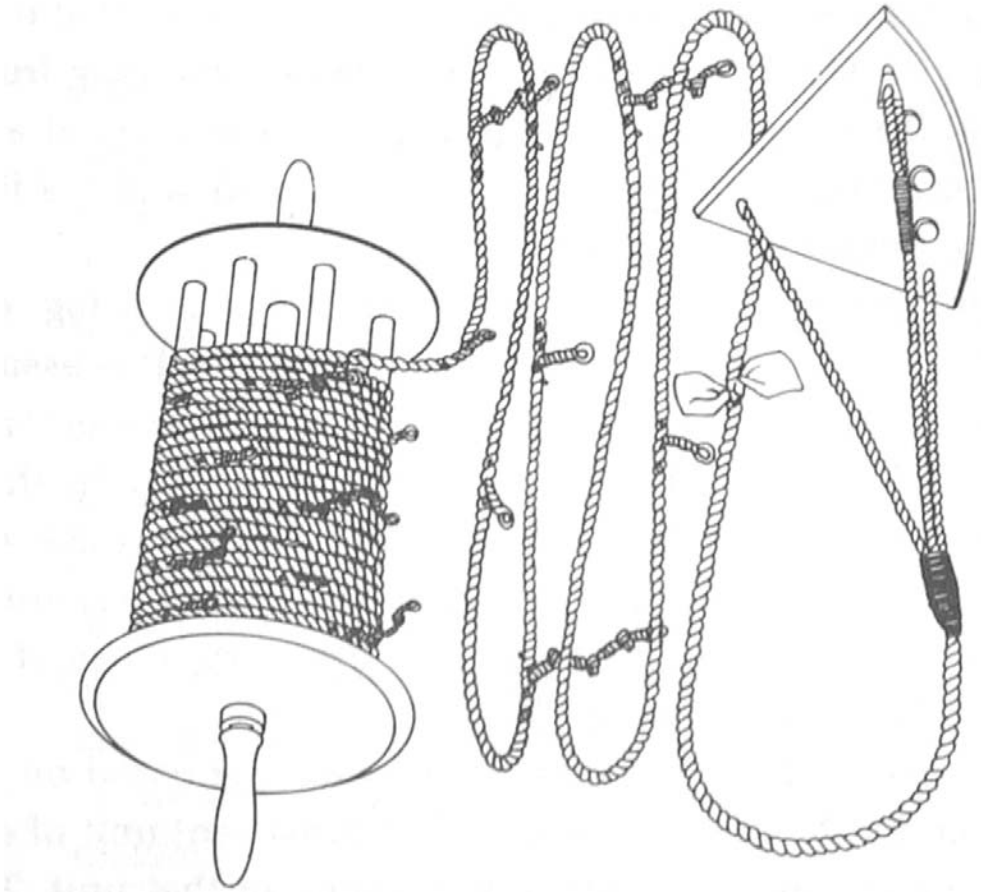
- Crystallization of knowledge and practice in physical artifacts
- Measurement and analog/digital conversions
- Digital computation
- Chart as the model of the world

Astrolabe

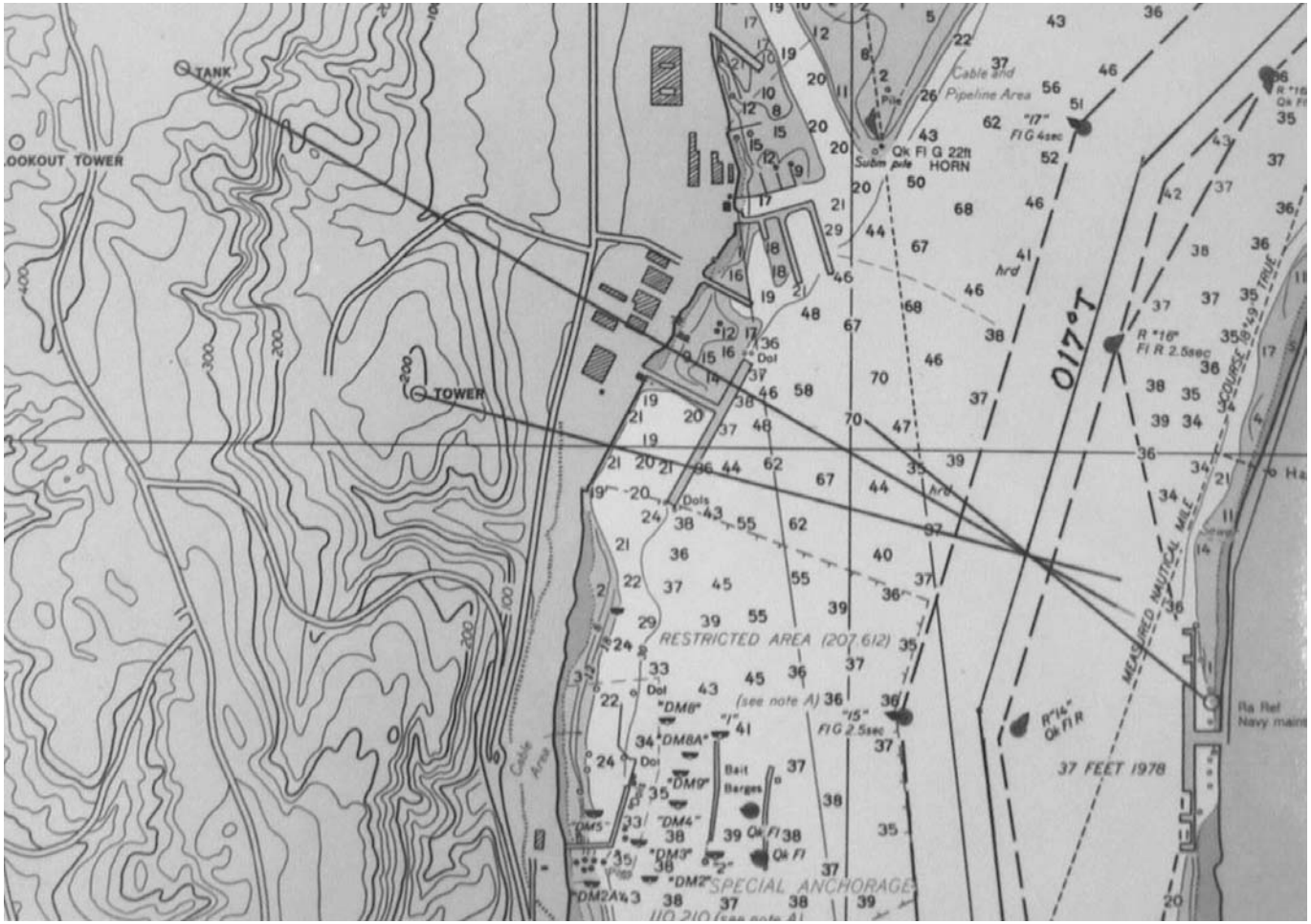
Medieval Tide Computer



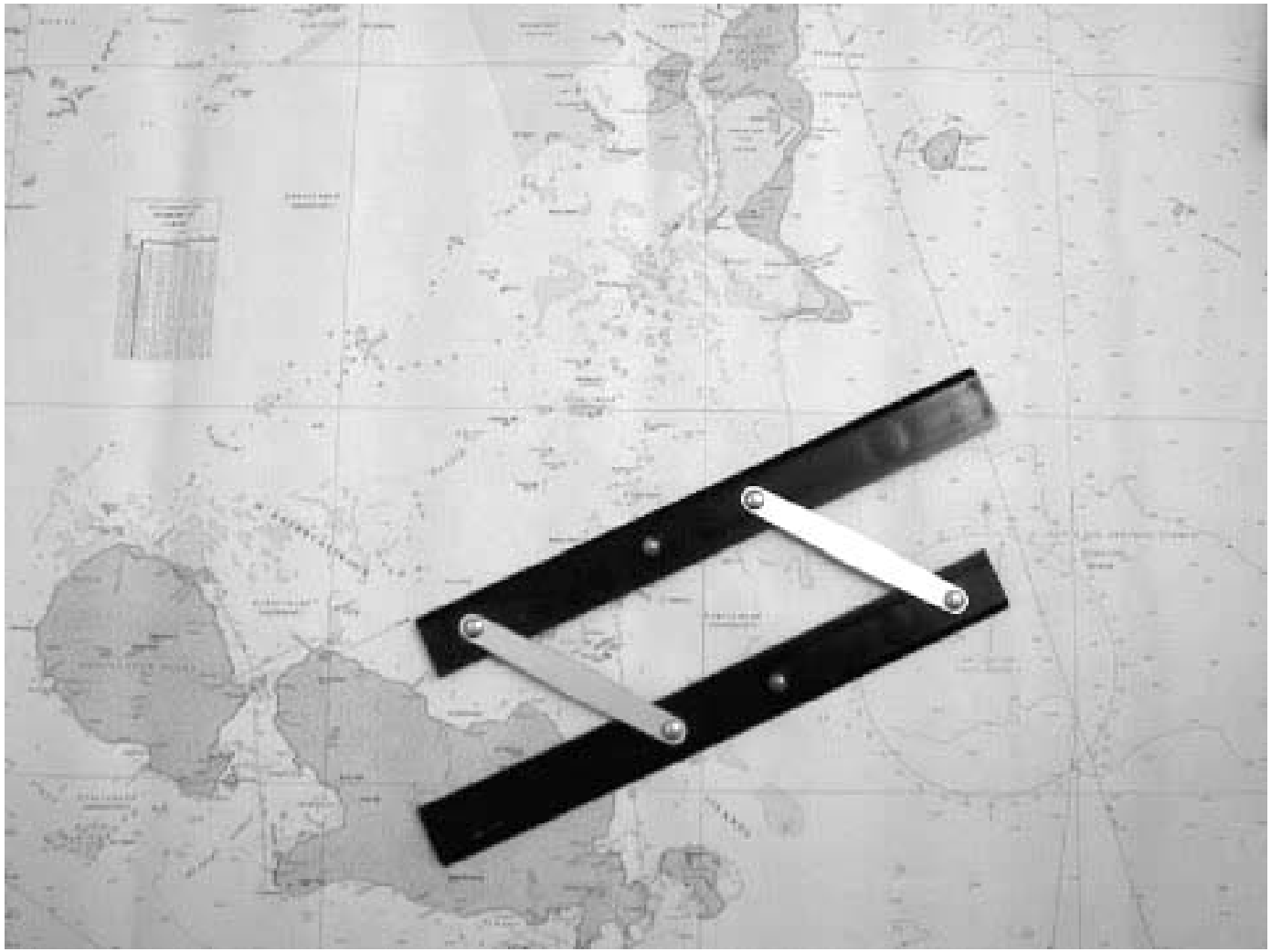
Chip Log



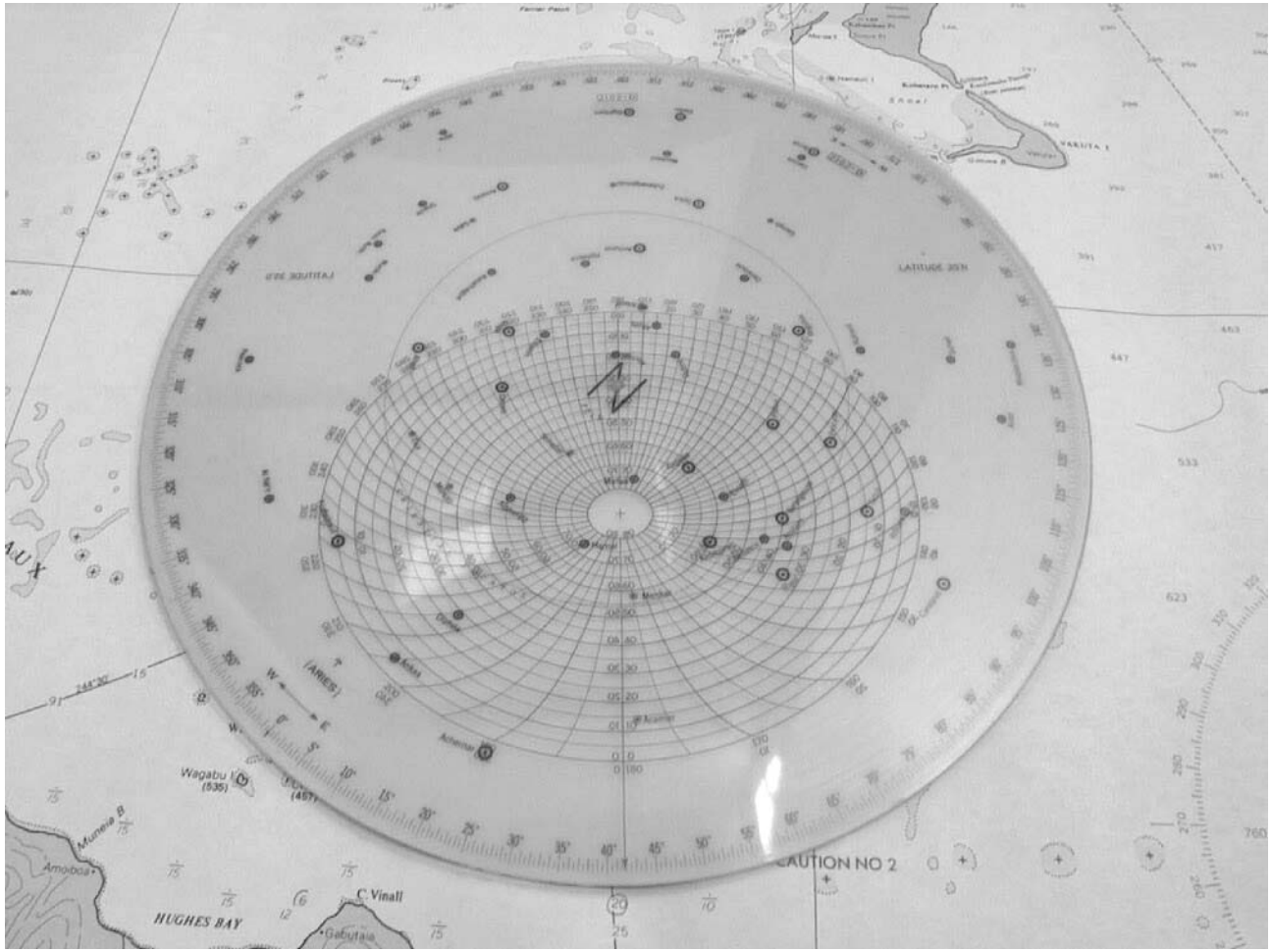
Navigation Chart



Parallel Ruler

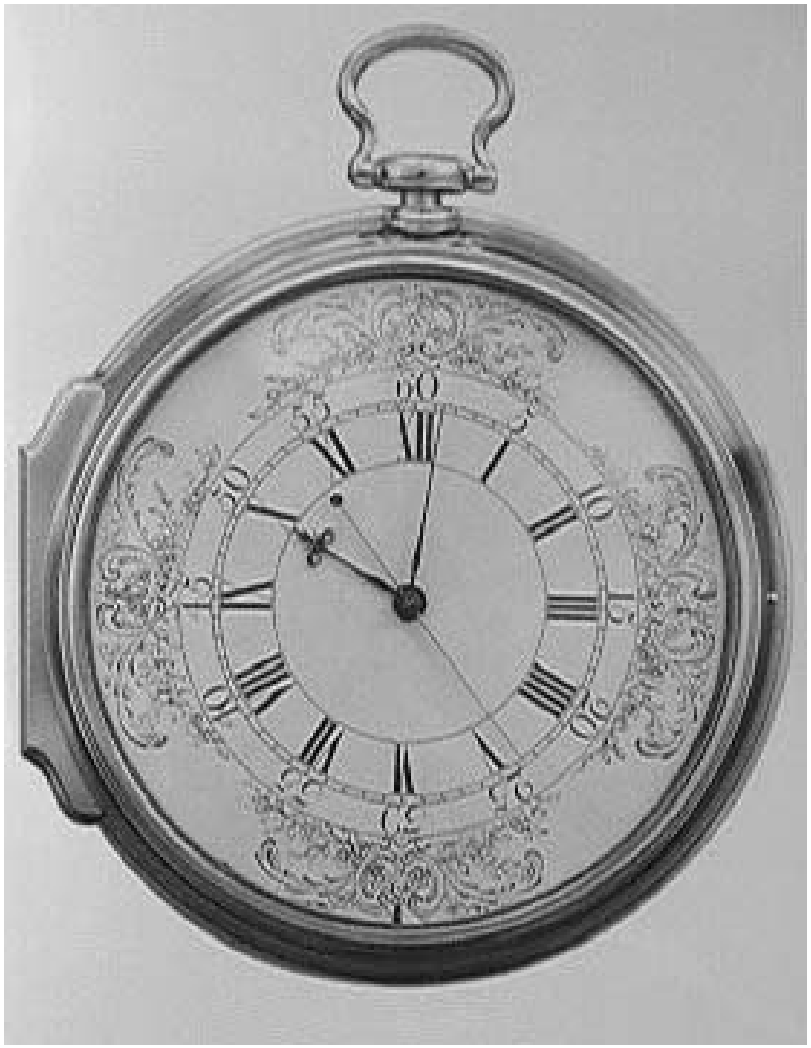


Star Finder (descendant of Astrolabe)



Sextant

Harrison’s Marine Chronometer



The Discovery of Longitude

An Historical Account of

Maritime Navigational Practice

and the subsequent Invention of the Chronometer

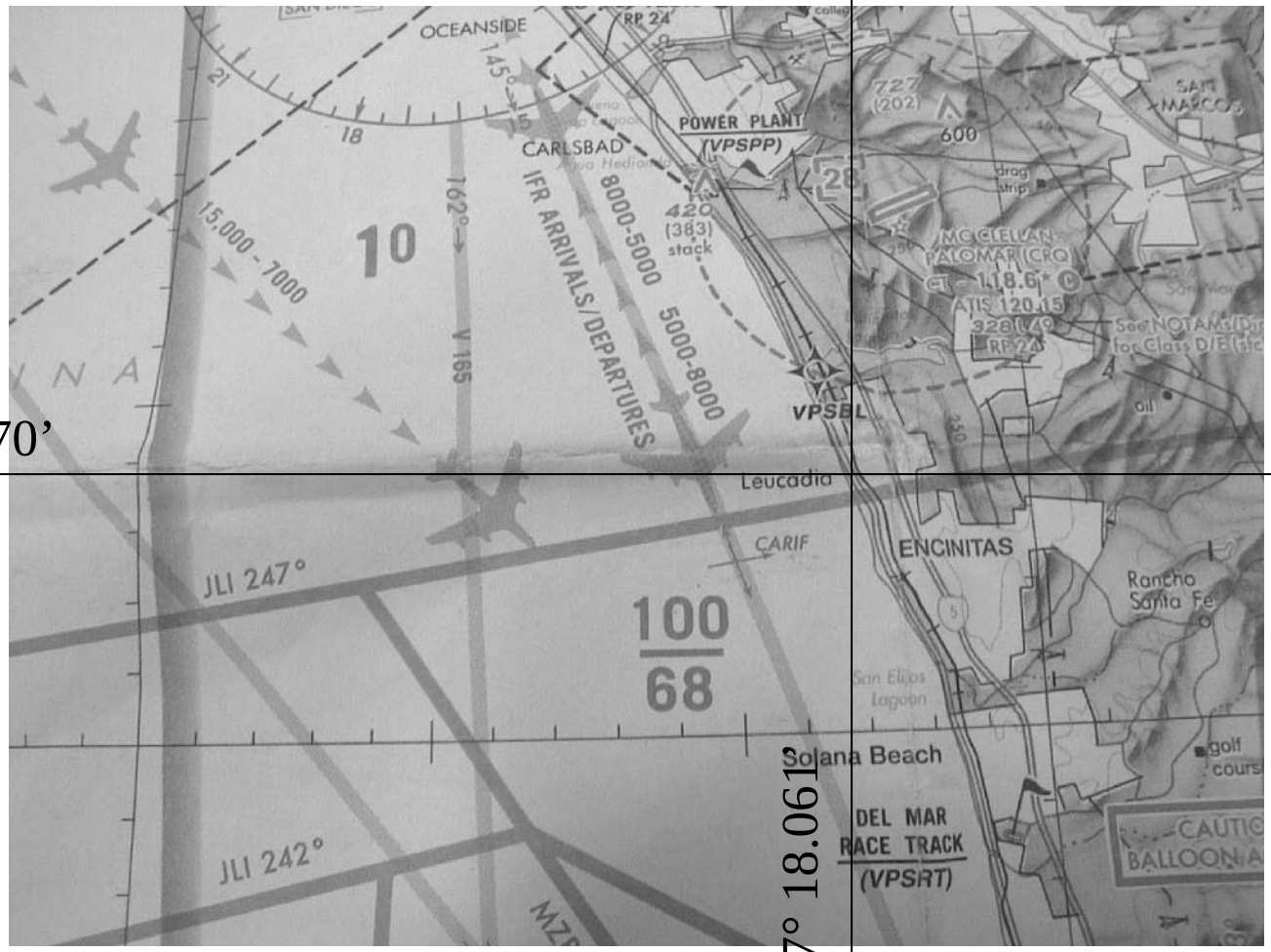
by Jonathan Medwin

http://rubens.anu.edu.au/student.projects97/naval/

Aeronautical Sliderule

Global Positioning System (GPS)

Plotting Latitude and Longitude



33° 03.470’

117° 18.061’

GPS Moving Map Display

Dependencies in the Cognitive Ecology of Navigation

- Parallel ruler and chart projections
- Astrolabe and star finder
- Sextant, tables, chronometer
- GPS and moving maps