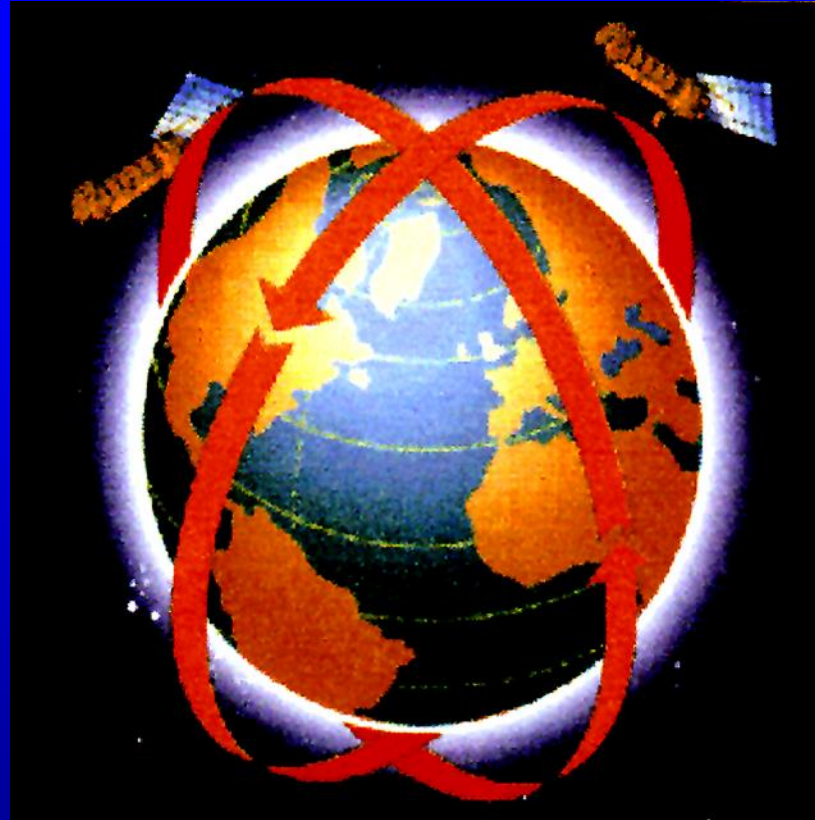


Introduction to Argos



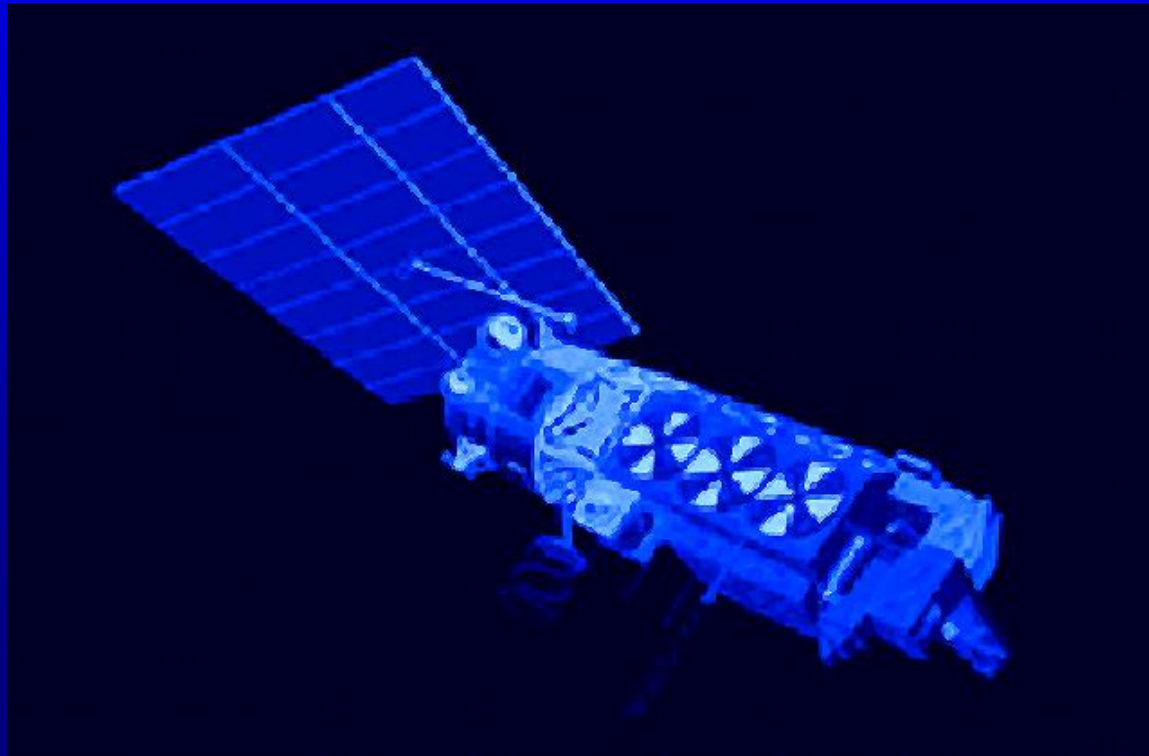
NOAA, Pacific Islands Fisheries Science Center
Marine Turtle Research Program

Denise M. Parker

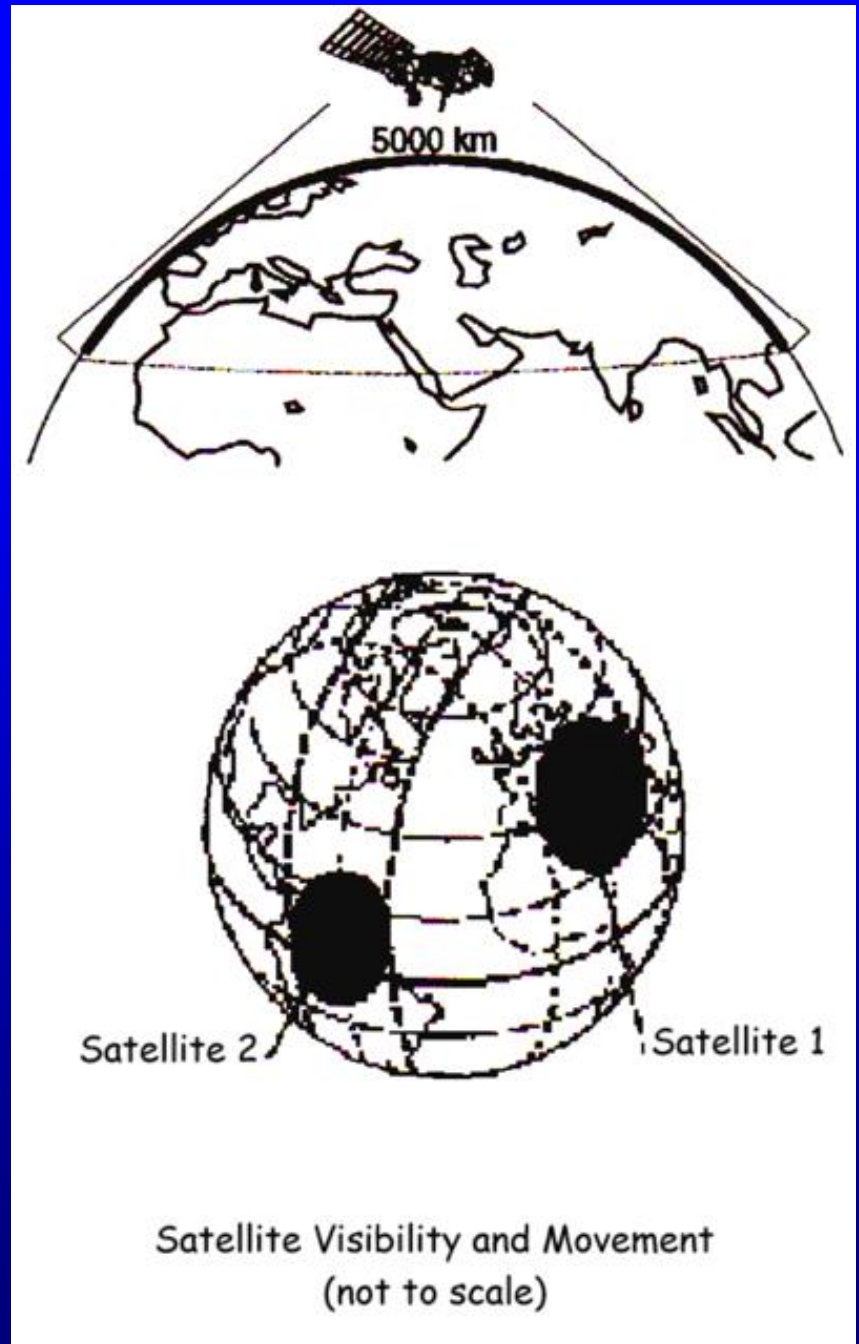
Not for Reproduction

What is Argos?

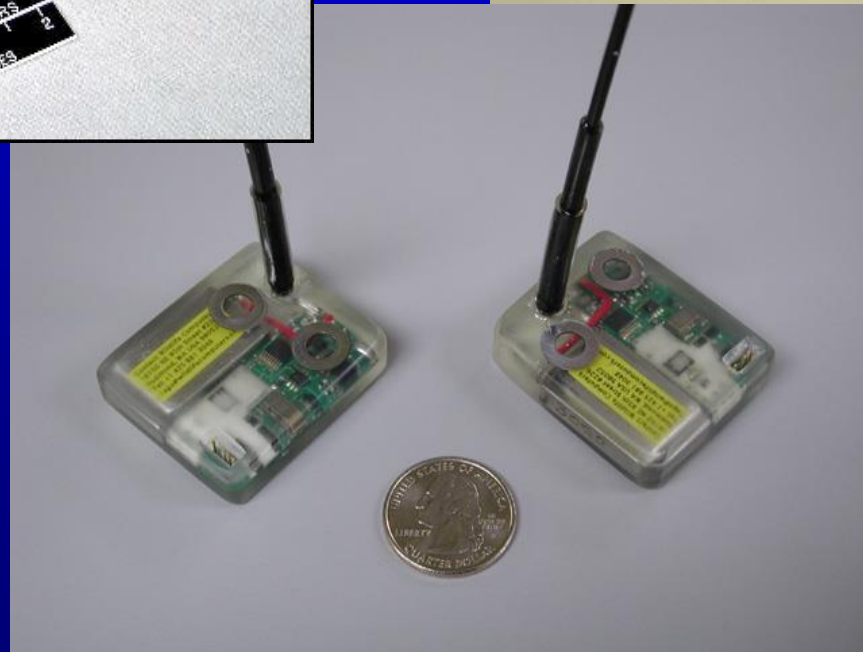
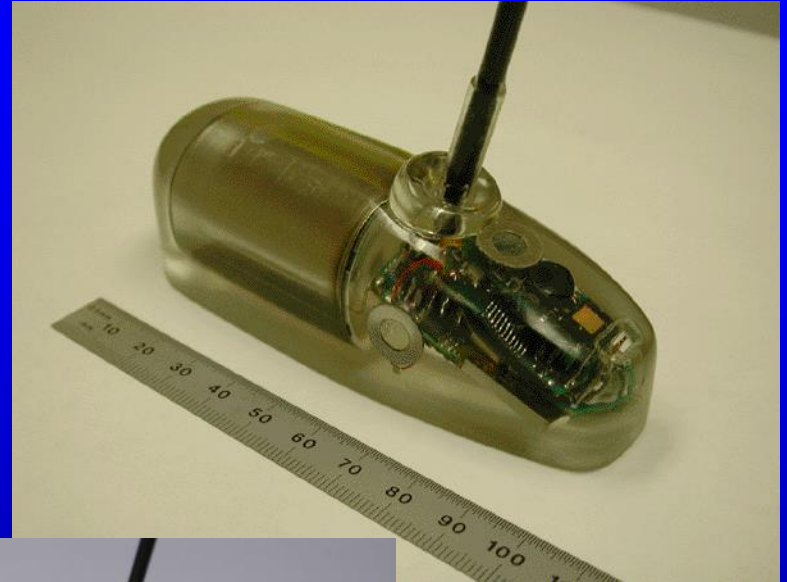
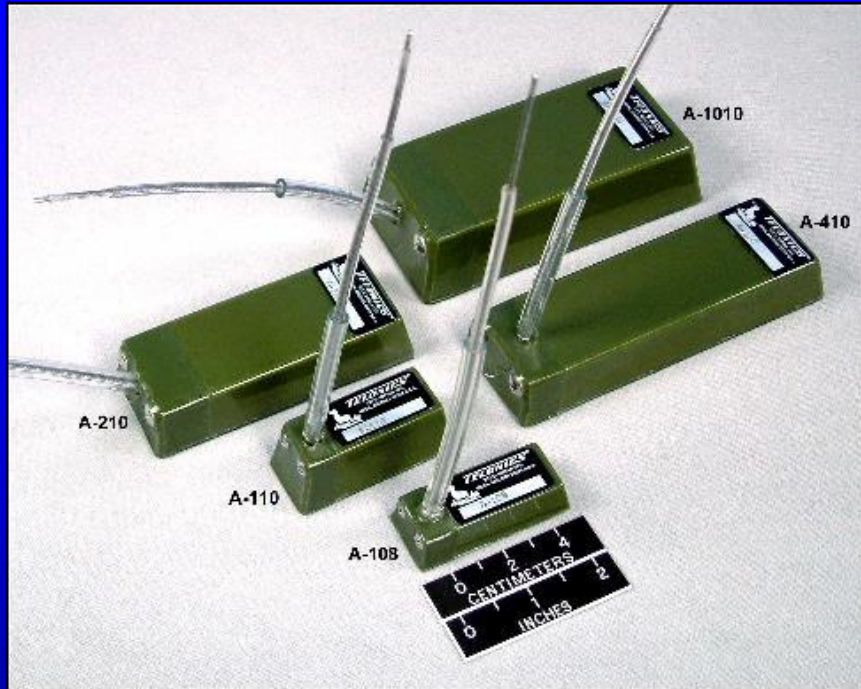
- Satellite based location and data collection
- France & US cooperation for collection
- Argos system on NOAA satellite



- Two satellites are simultaneously in service
- Polar orbiting at 850 km altitudes
- 5000 km visibility, average 10 min
- Moves 25 deg W each revolution (2800 km)
- Approximately 14 passes a day/satellite



Transmitters (PTTs)



How locations are calculated

- Satellites measure Doppler shift on the transmitter
- Doppler shift is the change in frequency of sound or electromagnetic wave as the source and observer are moving relative to each other.
Example: Sound train or race car makes as it approaches and moves away.
- Processing centers compute possible positions
- Standard location processing need 4 or more messages to compute a position
- ALP will also calculate positions from 2 or 3 messages

Websites

Sites for Argos and transmitter information

- <http://www.argosinc.com>
- <http://www.telonics.com>
- <http://www.wildlifecomputers.com>

Examples of turtle tracking

- <http://www.seaturtle.org>
- <http://www.cccturtle.org>
- <http://turtletrax.org>
- <http://www.nagoyaaqua.jp/topics/20050118/index.html>
- http://www.kare11.com/extras/extras_article.aspx?storyid=74726

Analyzing Argos Data



NOAA, Pacific Islands Fisheries Science Center
Marine Turtle Research Program
Denise M. Parker

What to do

- Collect and compile Argos data
- Mapping
 - Hand mapping
 - Internet on-line options
 - Other options
- Assess positions for “accuracy” and finalizing maps

Example of raw Argos Data

19591 Date : 18.10.04 16:12:07 LC : A IQ : 00
Lat1 : 21.691N Lon1 : 157.938W Lat2 : 25.648N Lon2 : 176.545W
Nb mes : 003 Nb mes>-120dB : 000 Best level : -128 dB
Pass duration : 090s NOPC : 1
Calcul freq : 401 647958.8 Hz Altitude : 0 m
171 1652 734 28
00 00

19591 Date : 18.10.04 21:37:51 LC : B IQ : 00
Lat1 : 21.681N Lon1 : 157.844W Lat2 : 24.062N Lon2 : 169.272W
Nb mes : 002 Nb mes>-120dB : 000 Best level : -127 dB
Pass duration : 044s NOPC : 1
Calcul freq : 401 647941.4 Hz Altitude : 0 m
171 795 716 29
00 00

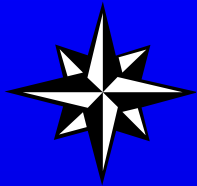
19591 Date : 19.10.04 01:04:43 LC : Z IQ : 00
Lat1 : ???????? Lon1 : ?????????? Lat2 : ?????????? Lon2 : ??????????
Nb mes : 001 Nb mes>-120dB : 000 Best level : -134 dB
Pass duration : ? s NOPC : ?
Calcul freq : 401 650000.0 Hz Altitude : 0 m
172 542 716 29
00 00

19595 Date : 18.10.04 17:49:40 LC : 2 IQ : 56
Lat1 : 41.408N Lon1 : 166.632E Lat2 : 39.218N Lon2 : 178.009E
Nb mes : 007 Nb mes>-120dB : 000 Best level : -127 dB
Pass duration : 413s NOPC : 2
Calcul freq : 401 646917.8 Hz Altitude : 0 m
22758

19595 Date : 18.10.04 18:00:47 LC : 3 IQ : 66
Lat1 : 41.411N Lon1 : 166.629E Lat2 : 31.682N Lon2 : 144.892W
Nb mes : 012 Nb mes>-120dB : 000 Best level : -128 dB
Pass duration : 551s NOPC : 3
Calcul freq : 401 646917.8 Hz Altitude : 0 m
22758

19595 Date : 18.10.04 19:41:25 LC : 0 IQ : 58
Lat1 : 41.405N Lon1 : 166.590E Lat2 : 41.188N Lon2 : 167.706E
Nb mes : 009 Nb mes>-120dB : 000 Best level : -124 dB
Pass duration : 807s NOPC : 2
Calcul freq : 401 646913.3 Hz Altitude : 0 m
22758

Where to obtain paper maps



PACIFIC MAP CENTER *+
560 N NIMITZ HWY STE 206-A
HONOLULU, HI 96817
Phone: 808-545-3600
Fax: 808-545-1700
E-Mail: pacmapctr@att.net

* Agents handle Canada Map Office Charts.

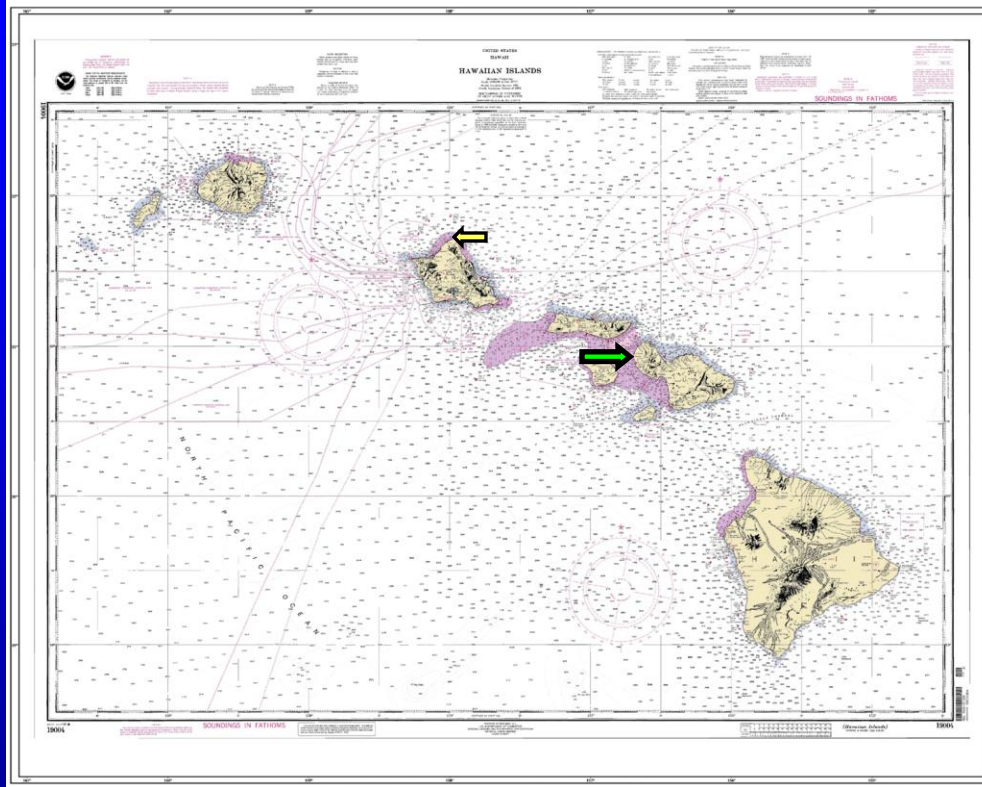
+ Agents handle certain National Geospatial-Intelligence Agency (NGA), formerly the National Imagery and Mapping Agency (NIMA), public sale charts



Order on-line at:
<http://www.amnautical.com>

Hand Mapping

- Obtain a paper map for the area of interest



- Convert daily Argos data into degrees, minutes and seconds. Take the number after the decimal X 60 = decimal min
21.691N 157.938W = 21 deg 41 min 27.6 sec N 157 deg 56 min 16.8 sec W
- Plot on Map

On-line Mapping

- http://www.aquarius.geomar.de/omc/make_map.html
Or <http://www.planiglobe.com/>
 - Good for rough maps and quick plots of data
 - Simple and relatively easy to input data, some work required

OMC: Create a Map - Netscape

File Edit View Go Communicator Help

Location: http://www.aquarius.geomar.de/omc/make_map.html

The OMC input form

If you are about to generate your first map with the OMC, please visit the ["How-To"-page](#).

BASIC PARAMETERS

Map Boundaries:
North:
West: East:
South:

Map Projection: Mercator

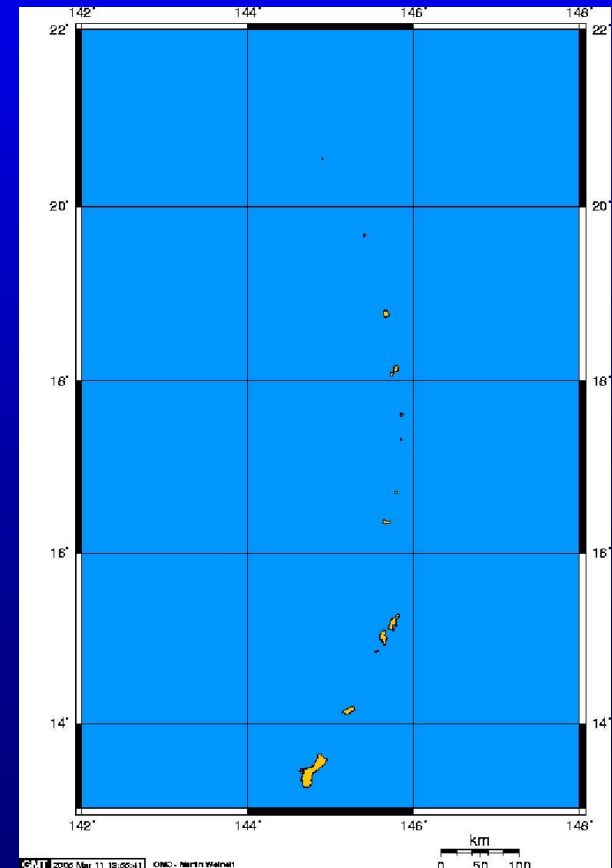
Options:
 grid on map
 [national boundaries](#)
 state and province boundaries of the Americas
 rivers and channels

Download:
 download disabled
 Postscript (EPSF)
 Adobe Illustrator

PLOT LOCATIONS
 plot some cities
 plot [DSDP](#) sites
 plot [ODP](#) sites

[plot user defined locations](#)
Please give **DECIMAL CO-ORDINATES**:
longitude1, latitude1, name 1
longitude2, latitude2, name 2 ...

Document: Done



On-line Mapping

- <http://www.seaturtle.org/maptool/index.shtml>
 - Excellent flexibility and multiple options available to plot
 - Can plot bathymetry, SST, and other oceanographic features
 - Need to be a seaturtle.org user – simple registration
 - Good output, requires some work, overall best on-line option

The screenshot displays the SEATURTLE.ORG Maptool interface within a Netscape browser window. The interface is divided into several sections:

- Data Source:** Includes a "Select file(s) to map:" field, a "Create Map" button, and links for "Upload File" and "Create New File".
- Output Options:** Features checkboxes for "PDF" (checked), "JPEG", and "TIFF".
- Base Map:** Contains a "Projection" dropdown menu set to "Mercator", a "Buffer" checkbox, and input fields for "Min Lat" (6.7), "Max Lat" (7.8), "Min Lon" (134), and "Max Lon" (135). It also includes checkboxes for "Lock", "Land" (checked), and "Water", along with "Rivers", "Country Names", and "Feature Names" options.
- Map Scale:** Includes a "Map Scale" dropdown set to "fancy", a "Gridlines" checkbox, "Convex Hulls" checkbox, and a "Scale Length" input field set to "20 km".
- Borders:** A dropdown menu set to "None".
- Coastline:** A dropdown menu set to "solid".
- Pen Width:** A dropdown menu set to "0.1".
- Inset Map:** A dropdown menu set to "none".

The main map area shows a geographical map of the Philippines with a color-coded bathymetry overlay. The map is framed by a coordinate grid with longitude (134° 00' to 135° 00') and latitude (6° 50' to 7° 40') markings. A scale bar at the bottom of the map indicates 0, 10, and 20 km. The browser window title is "SEATURTLE.ORG Maptool - Netscape".

On-line Mapping

- <http://srv-2001-web.argosinc.com/customer-web-interface>
 - Need to have an Argos account, User name, and password
 - Only good for rough maps – no flexibility in creating map
 - Plots all platforms that are currently transmitting

The screenshot shows the 'Argos Web Data Server' interface. The main header features the 'ARGOS' logo with the tagline 'data on line'. Navigation buttons include 'System Use Agreement', 'Account Management', and 'Access Results'. A yellow box in the top right corner displays user information: 'Date: 2005/03/11 18:41:33', 'Account: BALAZS', and 'Last Login: 2005/02/07 04:52:38'. Below the header, the 'Access data' section contains a left-hand menu with categories: 'Access commands' (Views, Quick Table, Quick Fix, Quick Track, Customize View) and 'Downloads' (COM, PRV TX, PRV DS, DIAG, Customize Download). The main content area provides instructions on how to use the menu and a glossary of terms for 'Views', 'Downloads', and 'Customize Download'. The footer contains copyright information: 'Copyright © 2003 CLS. All rights reserved.' and 'Latest Update: 2003/06/01'.

ARGOS
data on line

System Use Agreement Account Management Access Results

Date: 2005/03/11 18:41:33
Account: BALAZS
Last Login: 2005/02/07 04:52:38

Contact Exit

Access data

You can access your data by using the menu bar on the left. The menu includes "views" for displaying data and options for downloading.

Here is a glossary of the terms used in the menu on the left to help you get started for the first time. You can consult the glossary at any time by clicking on the icon in the upper right hand corner.

Views: Display data in one or many of the several different ways listed below.
You can E-mail or download these views.

Quick Table: Display in table format the latest results from each of your platforms.

Quick Fix: Display on a map the latest positions calculated for each of your platforms.

Quick Track: Display a tracking of the positions from the latest 9 days plus the current day being calculated for each of your platforms.

Customize View: Personalize your data selection and display. Once you create one or several new customized views, they will appear in the left menu bar.

Downloads: Download your results without displaying (same as classic Argos distribution formats).

COM: Download the latest results for each of your platforms.

PRV: Gives your results for the day on which you connect in and the previous nine days

PRV TX: Download the most significant message per pass.

PRV DS: Download all messages received by the satellite.

DIAG and PRVIA: For rejected locations and diagnostic information, download locations in classes 3, 2, 1, 0, A, B and sensor data.

Customize Download: Create a personalized data selection and format for downloading. As with the customize view, the customize downloads that you create will appear in the left menu bar.

Copyright © 2003 CLS. All rights reserved. Latest Update: 2003/06/01

Other Mapping Options

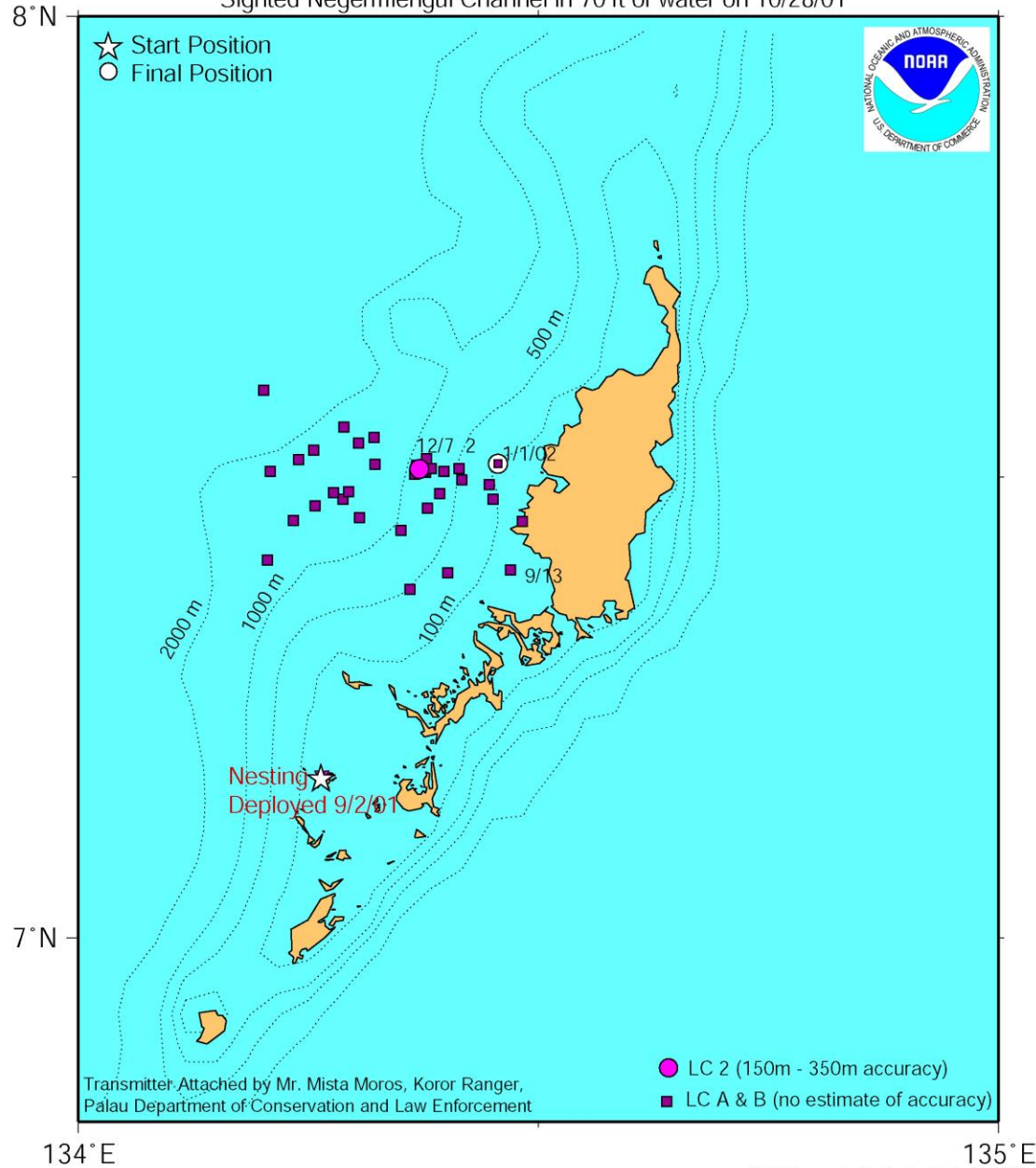
- GMT – General Mapping Tool
- <http://gmt.soest.hawaii.edu/>
 - Requires Unix server or Windows version is available
 - Some programming needed; either C++ or DOS
 - Very flexible and map output is determined by programming
- ArcView
 - ERSI product <http://www.esri.com/products.html>
 - Requires some knowledge of product and database set up to input data
 - Wide variety of GIS tools and geographic data sets available

2001 Post-nesting movement of Palau Hawksbill 4808, Ms. Ngerukeuid

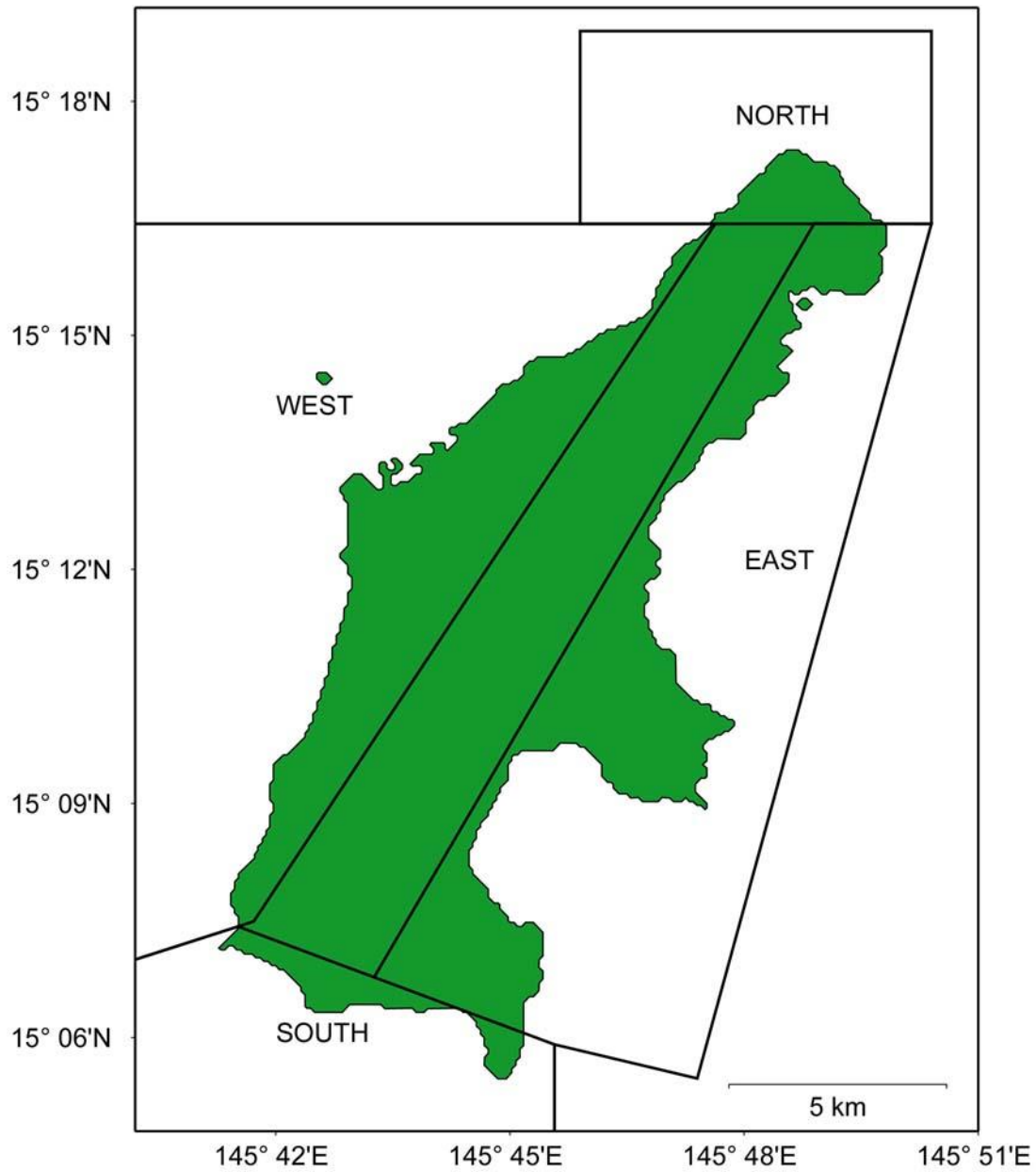
ST-14 Duty cycle 9 hours on, 3 hours off

Days transmitting: 139 days Distance Traveled: 38 km

Sighted Negermlengui Channel in 70 ft of water on 10/28/01



SAIPAN



MAP 1. Saipan Geographic Divisions

Other Mapping Options

- GMT – General Mapping Tool
- <http://gmt.soest.hawaii.edu/>
 - Requires Unix server or Windows version is available
 - Some programming needed; either C++ or DOS
 - Very flexible and map output is determined by programming
- ArcView
 - ERSI product <http://www.esri.com/products.html>
 - Requires some knowledge of product and database set up to input data
 - Wide variety of GIS tools and geographic data sets available

Data Crunching (see handout)

- Daily – input data by hand into Excel or Word and save as a text file – data should be set up as longitude, latitude, identifier (date and LC)
- Weekly or longer – Cut and paste each daily Argos file into one text file. Convert data either with Argos Data converter in the Seaturtle.org website or as outlined in handout.

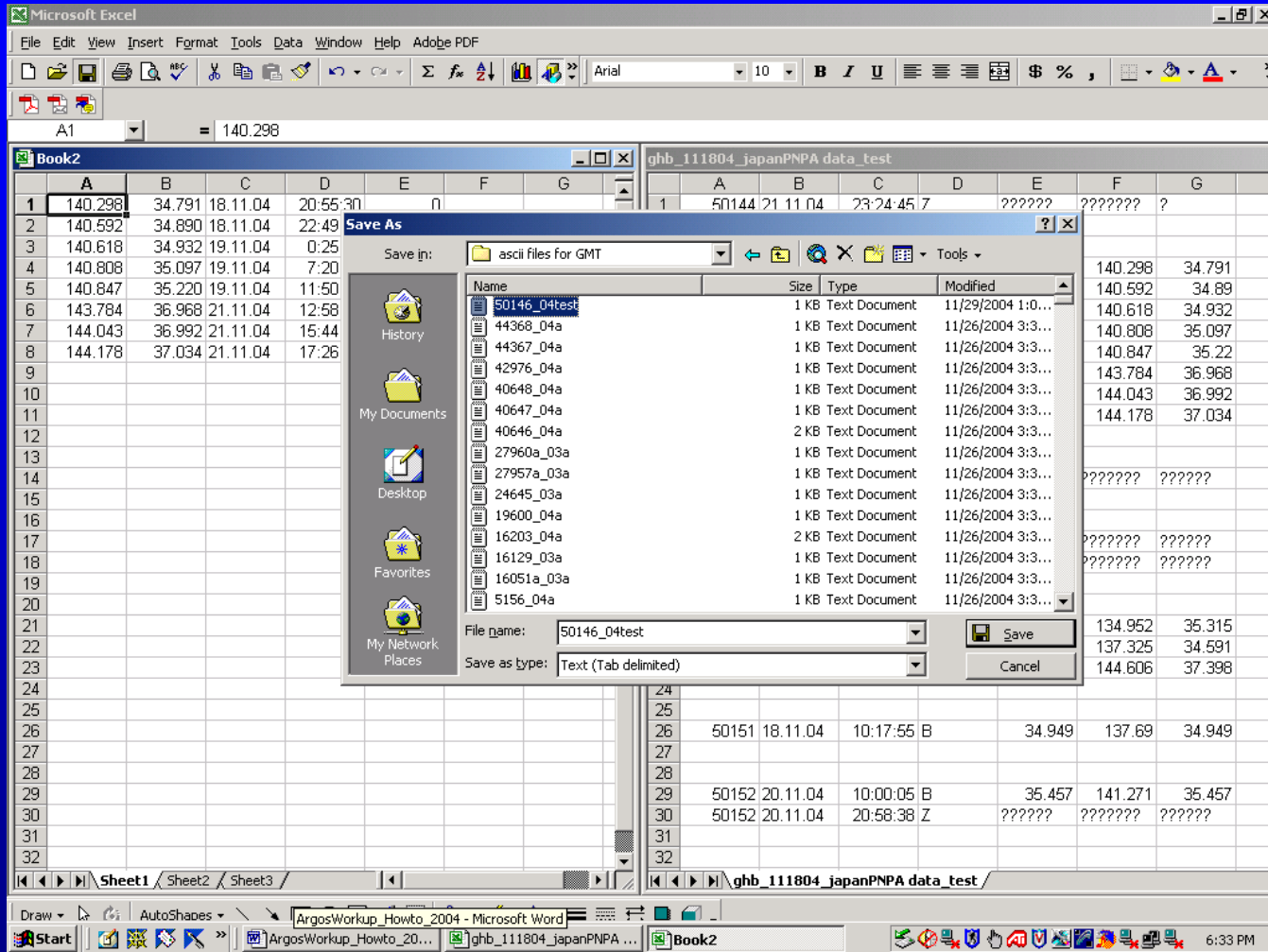
Data Crunching (see handout)

- Data should be sorted by ID number and a new text file should be created for each ID with data setup as above

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	50144	21.11.04	23:24:45	Z	??????	?	??????	?	??????	?	??????	?			
2															
3															
4	50146	18.11.04	20:55:30		0	34.791	N	140.298	E	32.031	N	154.158	E		
5	50146	18.11.04	21:07:08	Z	??????	?	??????	?	??????	?	??????	?			
6	50146	18.11.04	22:49:55		1	34.89	N	140.592	E	31.546	N	156.472	E		
7	50146	19.11.04	0:25:24		2	34.932	N	140.618	E	41.745	N	108.755	E		
8	50146	19.11.04	7:20:38		0	35.097	N	140.808	E	32.712	N	128.978	E		
9	50146	19.11.04	8:13:56	Z	??????	?	??????	?	??????	?	??????	?			
10	50146	19.11.04	8:28:05	Z	??????	?	??????	?	??????	?	??????	?			
11	50146	19.11.04	11:50:14	B		35.22	N	140.847	E	26.845	N	101.493	E		
12	50146	21.11.04	12:58:54		3	36.968	N	143.784	E	33.306	N	126.162	E		
13	50146	21.11.04	15:44:49		0	36.992	N	144.043	E	27.312	N	171.088	W		
14	50146	21.11.04	17:26:44		2	37.034	N	144.178	E	37.679	N	141.095	E		
15															
16															
17	50148	18.11.04	20:58:57	Z	??????	?	??????	?	??????	?	??????	?			
18															
19															
20	50149	18.11.04	18:07:08	Z	??????	?	??????	?	??????	?	??????	?			
21	50149	18.11.04	20:58:49	Z	??????	?	??????	?	??????	?	??????	?			
22															
23															
24	50150	18.11.04	10:17:18	B		35.315	N	134.952	E	37.76	N	147.802	E		
25	50150	18.11.04	18:05:35	B		34.591	N	137.325	E	36.136	N	129.449	E		
26	50150	22.11.04	10:55:05		0	37.398	N	144.606	E	44.931	N	175.921	W		
27															
28															
29	50151	18.11.04	10:17:55	B		34.949	N	137.69	E	36.431	N	145.663	E		
30	50151	18.11.04	18:07:57	Z	??????	?	??????	?	??????	?	??????	?			
31															
32															
33	50152	18.11.04	10:17:48	Z	??????	?	??????	?	??????	?	??????	?			
34	50152	18.11.04	18:28:24	Z	??????	?	??????	?	??????	?	??????	?			

Data Crunching (see handout)



- Data should be compiled consecutively to create final tracks

Data Crunching

- Determining if a position is “good”

Class	Estimated accuracy in latitude and longitude
3	≤ 150 m
2	$150 \text{ m} < \text{accuracy} < 350 \text{ m}$
1	$350 \text{ m} < \text{accuracy} < 1000 \text{ m}$
0*	> 1000 m
A	no estimate of location accuracy
B	no estimate of location accuracy
Z	(invalid locations)

- Either only LC 1, 2 and 3 data should be used in maps or researcher needs to use judgment to determine which data points to map
- For LC A or B – Is it on land? Are positions close to an LC 1, 2 or 3? Is speed between any 2 positions not plausible?

THE END

