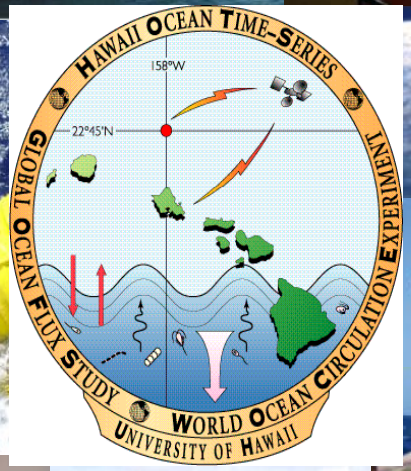
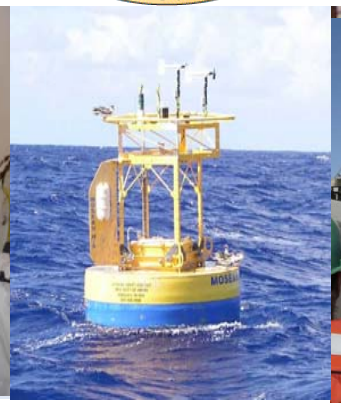
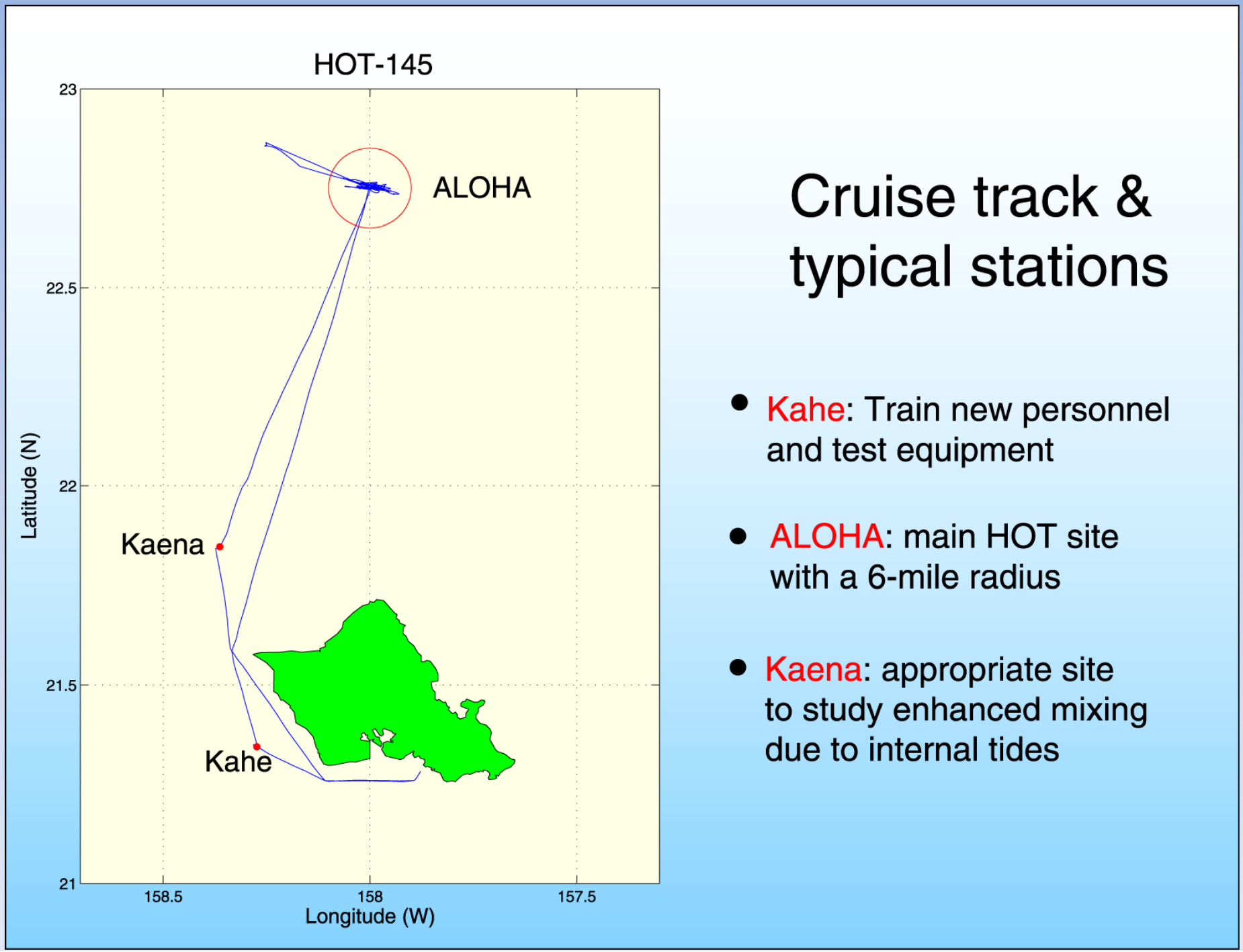
Hawaii Ocean Time-series (HOT) measurements and sampling

- Approximately monthly cruises to Station ALOHA since October 1988
- Deep ocean (~4740 m) observatory
- 4-day cruises, 36-hr burst (3 hr interval) vertical sampling (0-1000 m)
- Shipboard and remote measurements of ocean physics, chemistry, and biology, including nutrients (organic and inorganic), particulates (carbon/nitrogen/phosphorus), primary production, biomass (plankton abundances, pigments)





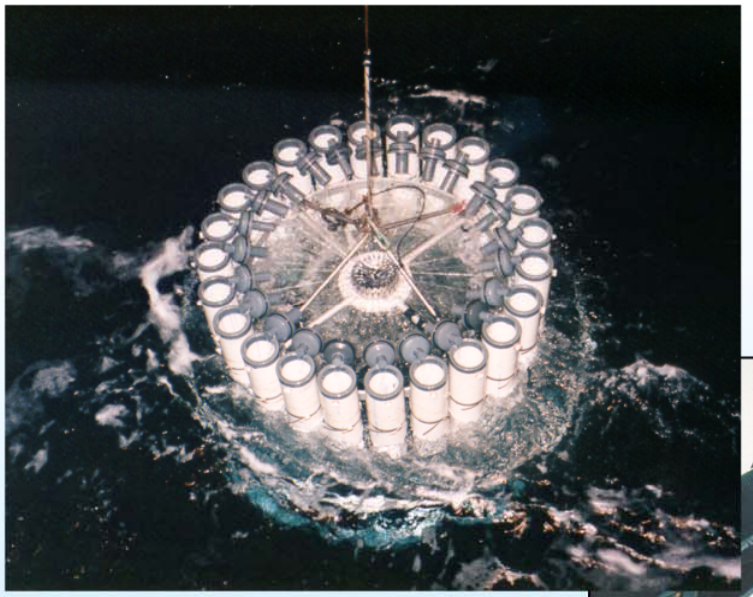


Cruise track & typical stations

- Kahe: Train new personnel and test equipment
- ALOHA: main HOT site with a 6-mile radius
- Kaena: appropriate site to study enhanced mixing due to internal tides

CTD stats.

- SeaBird CTD package with dual temperature, conductivity & oxygen sensors along with a SeaPoint Fluorometer
- 24-place rossette with 12L niskin bottles



Sampling stats.

- 1-2 deep casts to 4800m
- ~14 "shallow" casts to 1000m

Partial List of Shipboard Time-series Measurements at Station ALOHA

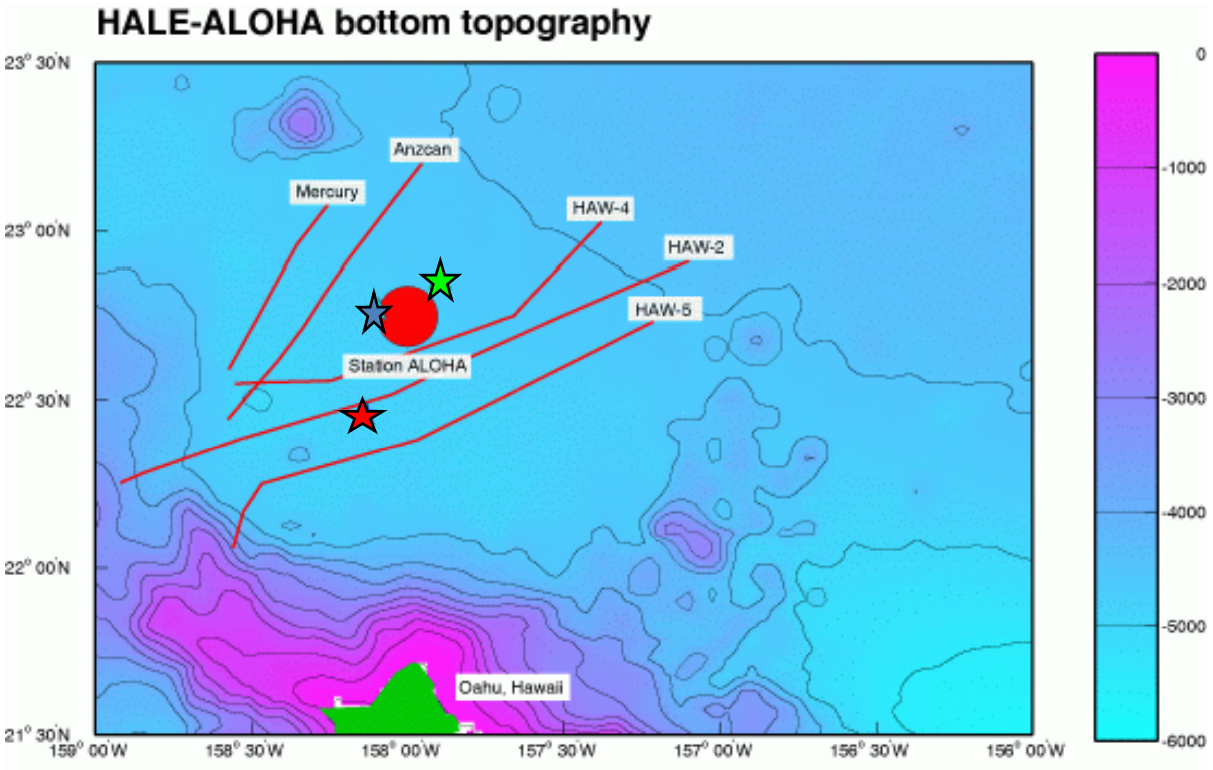
- Temperature, Conductivity, Oxygen, Fluorescence (CTD)
- Bottle samples for:
  - dissolved O_2, dissolved inorganic carbon, pH, alkalinity,
  - Dissolved inorganic nutrients (nitrate, nitrite, phosphorus, silica)
  - Dissolved and particulate organic nitrogen, carbon, and phosphorus
  - Pigments (including HPLC accessory pigments and fluorometric chlorophyll)
  - Primary production
  - ATP (biomass)
  - Plankton cell abundances (*Prochlorococcus*, *Synechococcus*, non-pigmented picoplankton).
  - Particle export (carbon, nitrogen, phosphorus fluxes)

HOT DOGS

(Hawaii Ocean Time-series Data Organization and Graphical System)

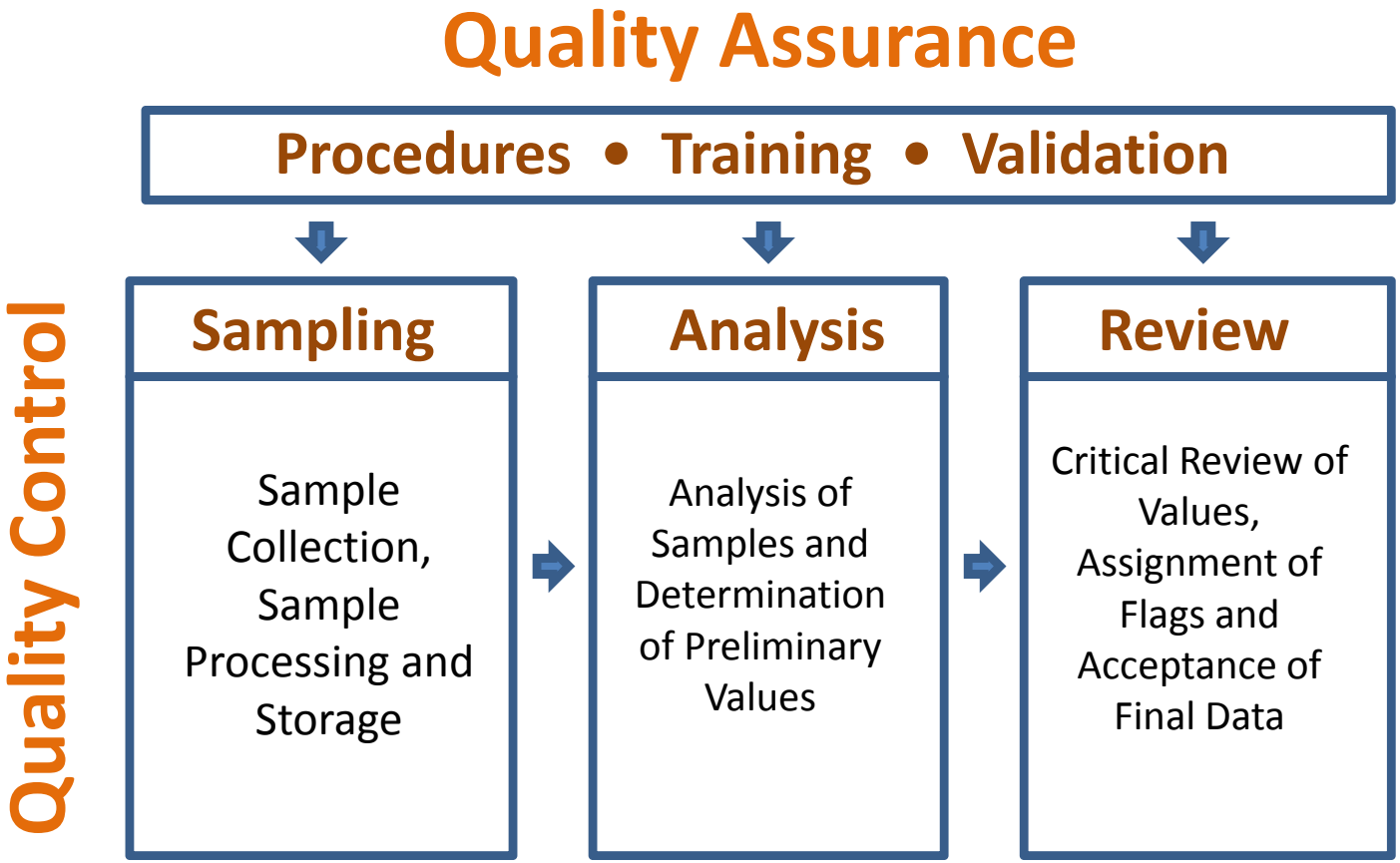
- Data Types
  - CTD: Seabird sensor package
  - Bottle: 24-place rossette and 12L PVC bottles
  - Particle Flux: floating sediment traps
  - Primary Production : *in-situ* incubated ^{14}C
- Data Modules
  - Data Extraction: text columns of data
  - Display: vertical profiles
  - Standard Depths: summary & comparative plots
  - Time-Series: integral, means & horizons

http://hahana.soest.hawaii.edu/hot/hot-dogs/interface.html



★ **HALE-ALOHA**	**(D. Karl, P.I.)**	**(1997-2000)**
★ **MOSEAN**	**(T. Dickey, P.I.)**	**(2004-2007)**
★ **WHOTS**	**(R. Weller, P.I.)**	**(2004-present)**

Subsurface mooring data from ALOHA also available


Quality Assurance
Procedures • Training • Validation
Quality Control
Sampling
Sample Collection, Sample Processing and Storage
Analysis
Analysis of Samples and Determination of Preliminary Values
Review
Critical Review of Values, Assignment of Flags and Acceptance of Final Data

Quality Assurance

Procedures • Training • Validation

- **Establishment and use of written Standard Operating Procedures**
- **Maintenance of equipment (including documentation of repairs/changes)**
- **Calibration of equipment to traceable standards**
- **Training and cross-training of analysts and field technicians**
- **Standardization of spreadsheets and programs**
- **Intra- and inter-laboratory comparison exercises**
- **Periodic review and audit of procedures**
- **Validation and documentation of changes to methodology**

Quality Control

Sampling

- Pre-cruise preparation of sampling equipment and supplies
- Field test of equipment and sample collector training (e.g., Station Kahe)
- Order of sample collection (e.g., gases first)
- Use of appropriate sample containers and preservatives
- Documentation (e.g., console logs, cast sheets, incubation logs)
- Individual bottle temperatures and salinities (to identify mistrips)
- Field replication
- Appropriate sample storage and transfer conditions

Quality Control

Analysis

- Primary standards of highest quality
- Order of analyses (e.g., low to high concentration)
- Blank assessments
- Reference materials (certified and/or in-house)
- Control charts to monitor performance
- Analytical replication
- Standard additions
- Documentation of analytical conditions/events
- Identification of bad and suspect analyses

Quality Control

Review

- Property vs. pressure, property vs. density plots (historical envelope)
- Property vs. related properties plots (oceanographic consistency)
- Visual and/or statistical identification of outliers
- Investigation of individual outliers (including review of metadata)
- Quality flagging of bad and suspect data
- Final review and acceptance of data by responsible P.I.
- Posting of data by I.T. specialist to secure but accessible database
- Posting of metadata explaining raw and derived parameters