



THE GLOBAL OCEAN SHIP-BASED HYDROGRAPHIC INVESTIGATIONS PROGRAM

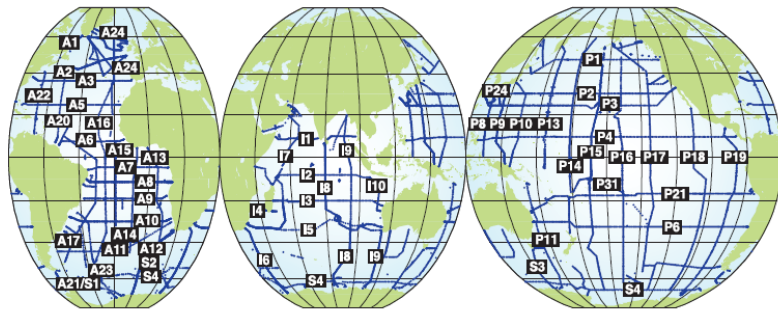
GO-SHIP: 2012-2023 Decadal Survey



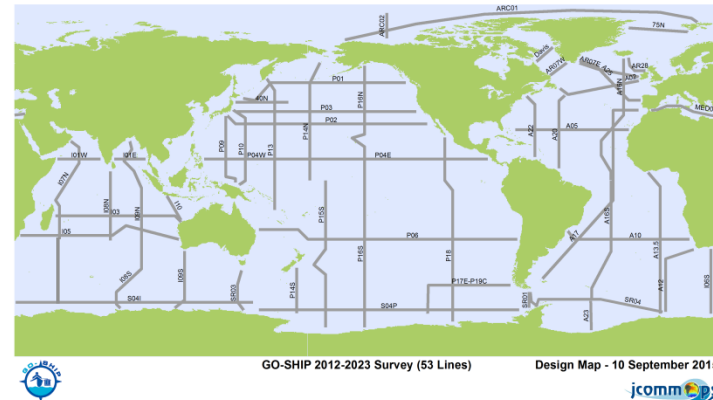
www.go-ship.org

Background

In the late 1970s the Geochemical Ocean Sections Study (GEOSECS) conducted the first global survey, and in 1990s the World Ocean Circulation Experiment (WOCE) and Joint Global Ocean Flux Study (JGOFS) completed a comprehensive decadal ocean survey.



WOCE 1990



After WOCE is was recognised that a sustained decadal survey was required as part of the ocean observations system. The global decadal survey started under CLIVAR has now become the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) . GO-SHIP nows provides the international program oversight and determines the future direction of the sustained decadal survey of the global ocean



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Introduction



GO - SHIP

TOWARDS A SUSTAINED GLOBAL SURVEY OF THE OCEAN INTERIOR

The Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) brings together scientists with interests in physical oceanography, the carbon cycle, marine biogeochemistry and ecosystems, and other users and collectors of ocean interior data to develop a sustained global network of hydrographic sections as part of the Global Ocean / Climate Observing System.



GO-SHIP is part of the Global Climate Observing System (GCOS)/ Global Ocean Observing System (GOOS).



THE GLOBAL OCEAN SHIP-BASED HYDROGRAPHIC INVESTIGATIONS PROGRAM

GO-SHIP Oversight Committees

Project Coordinator: Martin Kramp (JCOMMOPS, IOC-UNESCO)

Executive Group

Bernadette Sloyan (CSIRO, Australia; co-chair)

Rik Wanninkhof (NOAA, USA; co-chair)

Masao Ishii (MRI-JMA, Japan)

Elaine McDonagh (NOCS, UK)

Takeshi Kawano (JAMSTEC, Japan)

Lynne Talley (SIO, USA)

Toste Tanhua (GEOMAR, Germany)

Country Representatives

Leif Anderson (U. Gothenburg, Sweden)

Isabelle Ansorge (UCT, South Africa)

Kumiko Azetsu-Scott (BIO, Canada)

Richard Feely (NOAA, USA)

Masao Fukasawa (JAMSTEC, Japan)

Gregory Johnson (NOAA, USA)

Mauricio Mata (FURG, Brazil)

Herle Mercier (IFREMER, France)

Aida F. Rios (CSIC, Spain)

Mike Williams (NIWA, New Zealand)

Emil Jeansson (BCCR, Norway)

Jae-Hak Lee (KIOST, South Korea)

TBC (Marine Inst, Ireland)



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GO-SHIP: Program Aims

- Document the large-scale ocean water property distributions, their changes, and drivers of those changes
- Determine the distributions and controls of natural and anthropogenic carbon (both organic and inorganic),
- Determine ocean ventilation and circulation pathways and variability using chemical tracers,
- Provide high-quality full-depth reference observations to other components of the observing systems.



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Measurements: Level 1

Level 1 data

- CTD pressure, temperature, salinity (calculated from conductivity, temperature and pressure)
- CTD oxygen (sensor)
- Bottle salinity
- Nutrients by standard auto analyzer (NO_3/NO_2 , PO_4 , SiO_3)
- Dissolved oxygen
- Dissolved inorganic carbon (DIC)*
- Total Alkalinity (TAlk)*
- pH*
- *(note any two of the above carbon related observations)
- Chlorofluorocarbons (CFC-11, -12) and SF_6
- Surface underway system (T, S, pCO_2)
- ADCP shipboard
- ADCP lowered
- Underway navigation and bathymetry
- Meteorological data.



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- Dissolved oxygen

Simulations, high-quality collection of numerous ocean variables – physical, biogeochemical and biological

- Dissolved inorganic carbon (DIC)*
- Total Alkalinity (TAlk)*
- pH*
- *(note any two of the above carbon related observations)
- Chlorofluorocarbons (CFC-11, -12) and SF_6
- Surface underway system (T, S, pCO_2)
- ADCP shipboard
- ADCP lowered
- Underway navigation and bathymetry
- Meteorological data.



Measurements: Level 2

Level 2 data

- Discrete $p\text{CO}_2$
- ^{14}C (by AMS)
- CCl_4
- $\delta^{13}\text{C}$ of DIC
- Dissolved organic carbon
- Dissolved organic nitrogen
- Fe/trace metals
- CTD Transmissometer
- Surface underway system (nutrients, O_2 , Chl, skin temperature).



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Measurements: Level 2 and 3

Level 2 data

- Discrete $p\text{CO}_2$
- ^{14}C (by AMS)
- CCl_4
- $\delta^{13}\text{C}$ of DIC
- Dissolved organic carbon
- Dissolved organic nitrogen
- Fe/trace metals
- CTD Transmissometer
- Surface underway system (nutrients, O_2 , Chl, skin temperature).

Level 3 data

Any Ancillary measurement (e.g.)

- Chlorophyll
- Primary production
- HPLC pigments
- Experimental continuous analyzers (such as pH, DIC, and TAlk, and O_2/Ar)
- $\delta^{15}\text{N}$, NO_3 ^{32}Si
- $\delta^{18}\text{O}$ of H_2O
- NH_4
- Low level nutrients



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GO-SHIP: Measurements

- **Level 1 data** are of highest priority. GO-SHIP recommends that level 1 data should be collected at least once per decade on all sections. Sections occupied at higher frequencies (yearly, biennial) do not need to undertake all level 1 measurement on all re-occupations.
- **Level 2 data** are highly desirable. GO-SHIP recommends that level 2 should be collected when possible.
- **Level 3 data** are ancillary measurements done according to opportunity and space available. They should not significantly interfere with Level 1 or 2 data collection, and may be regional or specific to an individual cruise.



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Data Requirements: Submission Time-lines

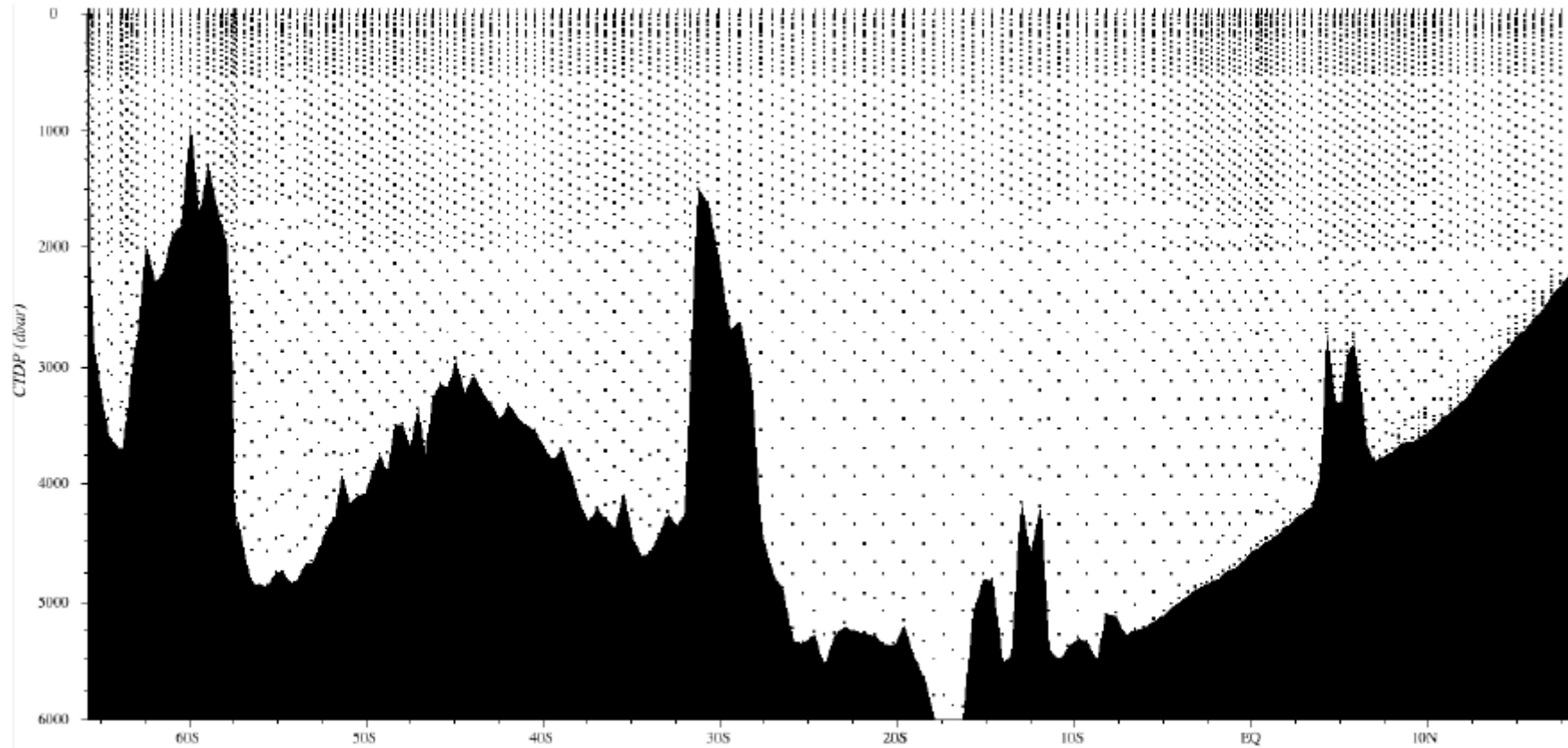
The GO-SHIP data policy is stringent and geared toward rapid, open dissemination, with a clear structure for all data to undergo quality control and to be sent to and available from recognized data centers. The policy includes:

- 1) All Level 1 and 2 observations, cruise reports, and metadata are made public in preliminary form through a specified data center soon after collection (“early release”), with final calibrated data provided six months after the cruise, with the exception of those data requiring on-shore processing.
- 2) All data collected as part of the program are submitted to a designated data management structure for quality control and dissemination for synthesis.



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Typical Sample Strategy for discrete Bottle measurements



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GO-SHIP Measurement Reference Manual



The Global Ocean Ship-based Hydrographic Investigations Program
www.go-ship.org

GO-SHIP Repeat Hydrography Manual: A Collection of Expert Reports and Guidelines.

IOCCP Report No. 14

ICPO Publication Series No. 134

Version 1, 2010



<http://www.go-ship.org/HydroMan.html>



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GO-SHIP: Section Definitions

1. GO-SHIP Decadal Repeat

- Coast-to-coast, coast-to-sea ice
- Full depth
- All data level 1 parameters
- Comply with data access policy

2. GO-SHIP High Frequency

- On GO-SHIP line end to end
- Full depth
- Limited parameters
- One decadal full GO-SHIP cruise
- Comply with data access policy

These two classes have been in operation since GO-SHIP inception.



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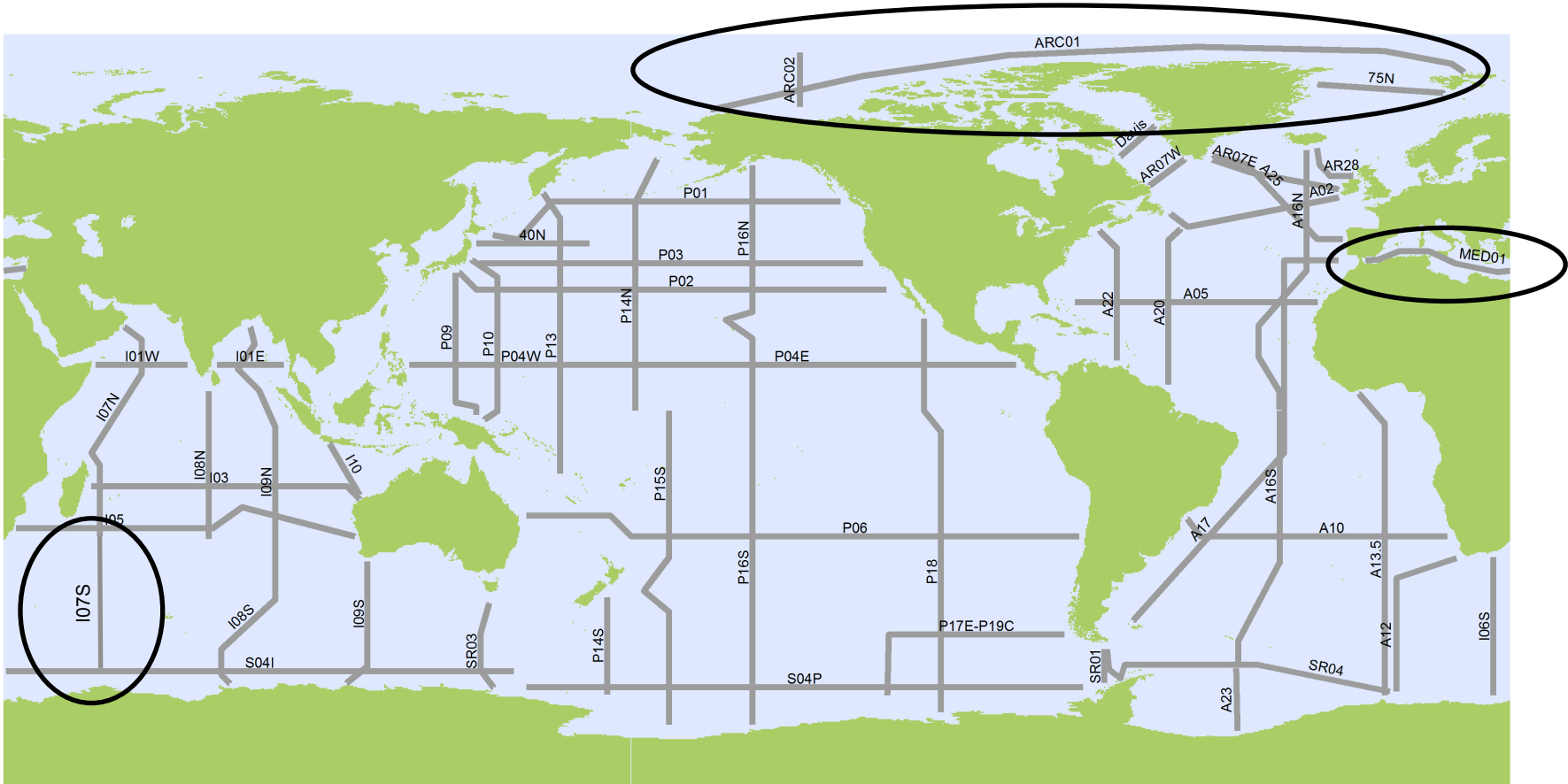
- On GO-SHIP line end to end
- Full depth
- Limited parameters
- One decadal full GO-SHIP cruise
- Comply with data access policy

3. GO-SHIP Associated (by GO-SHIP committee 14/09/2015)

- High quality –full depth station below 2000m at least every 240 nm.
- Repeated on decadal frequency or more
- Not necessarily coast to coast, coast-to-sea ice
- At least 60 nm resolution minimum
- At least once per decade full Level 1 parameters
- Comply with data access policy



GO-SHIP: Program Evolution



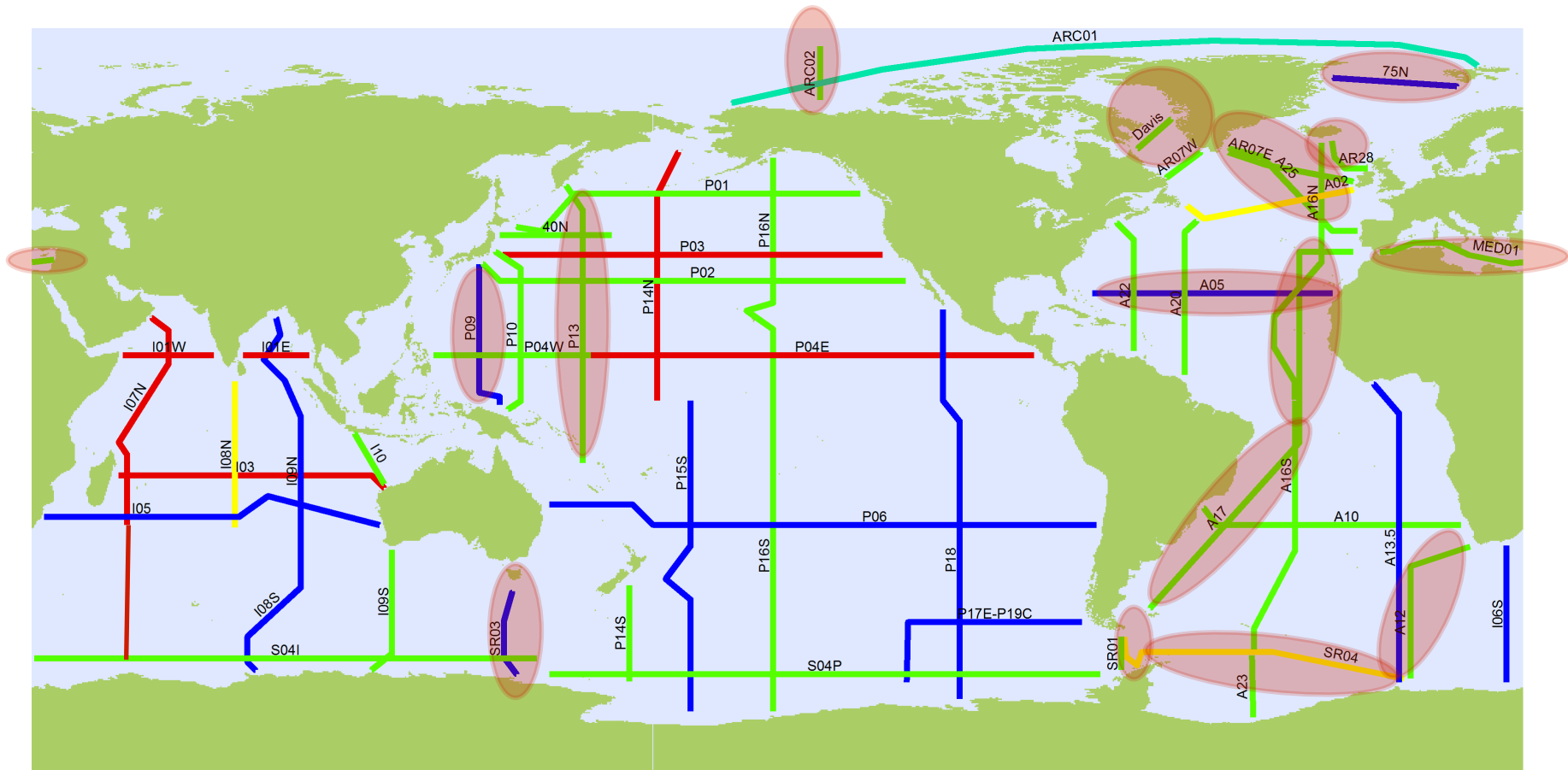
GO-SHIP 2012-2023 Survey (53 Lines)

Design Map - 10 September 2015



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GO-SHIP: Current status



GO-SHIP 2012-2023 Survey (53 Lines)

Status Map - 10 September 2015



— completed
 — at sea
 — funded
 — planned
 — not planned yet



Three voyages at sea: ARC01, DAVIS, ARC02.



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GO-SHIP: Contacts

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