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**SIXTH MEETING OF THE IOC ADVISORY BODY OF EXPERTS
ON THE LAW OF THE SEA (IOC/ABE-LOS VI)**

Málaga, Spain, 3-7 April 2006

**Argo Project &
IOC Resolution XX-6 Implementation**

**Argo Information Centre,
JCOMMOPS (IOC/WMO)**

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This document follows the report on the Argo project development provided to ABE-LOS at its first meeting (Paris, 2001 <http://ioc.unesco.org/unclos/#abelos1>).

It presents the status of Argo after 5 years of development and the practices related to the implementation of a global array of oceanographic instruments, through national initiatives, and under the auspices of the IOC of UNESCO.

ABE-LOS is invited to:

- Note and comment on the information contained in this document
- Provide feedback to the Argo TC regarding the implementation of a notification procedure for profiling floats.

1 Argo Status

Argo is an international programme using autonomous floats to collect temperature, salinity and current data. Argo will soon reach its target of 3000 floats delivering data within 24 hours to researchers and operational centres worldwide.

- **Argo infrastructure** is made of an international Steering Team (national representatives), a Project Office Director, and a Technical Coordinator (IOC employee) managing the Argo Information Centre. An international Data Management Team deals with data and metadata issues.

- **Argo is a truly international project.**

Many countries have joined the original 10 that launched floats in 2000. At the latest count 23 countries have operated floats (Argentina, Australia, Brazil, Canada, Chile, China, Costa Rica, Denmark, European Union, France, Germany, India, Ireland, Japan, Korea, Mauritius, Mexico, Netherlands, New Zealand, Norway, Russia, Spain, UK, USA). Other countries have assisted with float deployments (e.g.: Iceland, Indonesia, and South Africa) or facilitated the access to their Exclusive Economic Zone (e.g.: most of Pacific Islands, Mozambique).

Under the auspices of the IOC of UNESCO, Argo organizes donor programmes, to stimulate new participants (e.g.: Mauritius, Costa Rica, Chile, Brazil, Argentina, and Mexico).

This permits to facilitate the implementation of a global network, to modestly initiate transfers of marine technology and to give visibility to local scientists.

Contact the TC for more information on Argo donor programmes.

Each country finds its own funding and sets its own priorities for where floats are deployed in consultation with other countries.

Many countries are now making the transition from short term research-based funding to more sustained mechanisms.

- **Argo has reached 80% of its completion.**

In February 2006 Argo had a global array of 2400 floats in the ice-free areas deeper than 2000m (see map below).

- **Argo provides free, unrestricted and operational data distribution.**

Data are delivered in real time to the Global Telecommunication System of the WMO and to the Internet (at Argo Global Data Centres – mirrors in USA and France).

Data sharing (on the two distribution channels) is a condition *sine qua non* to be part of Argo. A long term archival centre has been established at the US NODC.

Regional Data Centres promote data use on a regional basis.

85% of the data are published within 24h.

At a time t, 95% of the fleet distribute data as appropriate.

JCOMMOPS monitors in real time these remaining 5% and assist as appropriate to get all data published. A minimum of time is required to decode original floats (e.g. with additional sensors) or to assist programmes that don't have the capability to do data processing.

- Environment

Argo does its best to minimise the probability of incident or hazard. Instruments that come ashore are safely recovered.

The AST agreed that the cost of, and responsibility for, the retrieval should be borne by the float owner. While this may be expensive, it is a necessary overhead of the Argo project.

To facilitate the retrieval, a label is affixed on floats:

*“This is scientific equipment; it is not military materiel and has no commercial value. This float is used for ocean predictions and provides valuable information to many communities including fishermen. **For your safety do not open this instrument.** If found please contact the Argo Information centre ...”*

About 20 floats have been recovered so far.

It is an excellent opportunity to establish regional contacts and strengthen the support to Argo. In Sri Lanka (e.g.), where fishermen found some floats, the AIC has collaborated with the national Oceanographic Institute to ship back the float to its owner and following this, some local scientists have started to use Argo data and some deployment opportunities have been proposed .

-Operational Centres in France, Japan, UK, Australia, USA now routinely produce global and regional analyses of subsurface ocean properties based largely on the real time Argo data stream. These are available on the www and will give early warning of significant temperature and salinity anomalies and changes in ocean circulation.

- Research applications:

Never before have oceanographers and climate scientists had access to such a comprehensive subsurface ocean data set and the publications based on Argo are growing rapidly (45 in 2005). The range of applications is enormous.

Conclusion

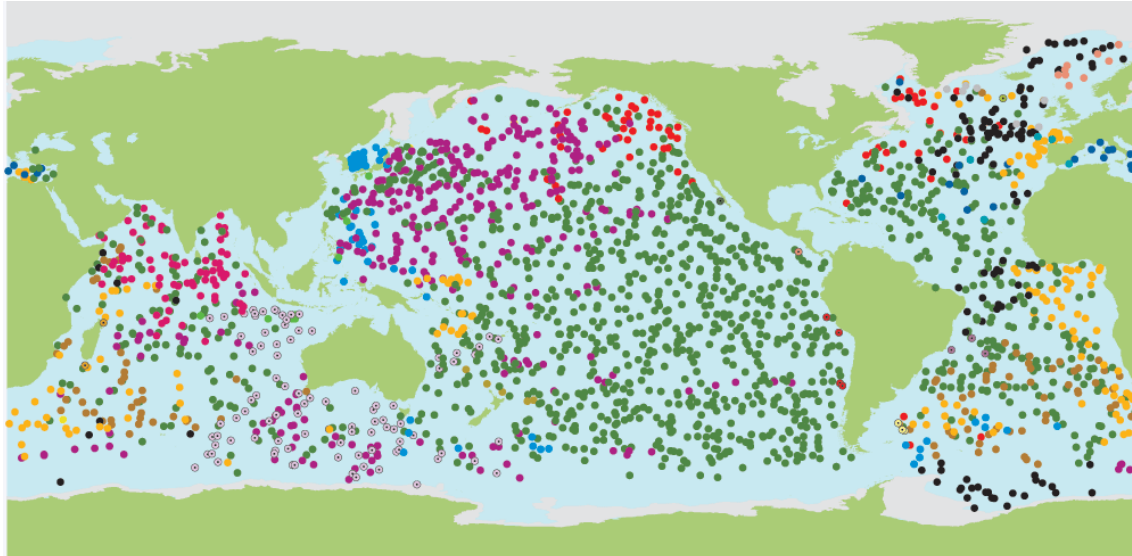
In a few years Argo has revolutionised the collection of information from inside the oceans.

It is already the mainstay of the in-situ ocean observing system and its data have made possible research and operational activities that were previously impossible and have started to shed light on some of the key questions about the ocean's role in the earth's climate system.

The question of Argo's transition from research program toward an operational program was discussed at the last AST meeting (Hyderabad, Feb. 2006). Argo is implemented by a coordinated group of national consortia with widely varying degrees of research and operational participation. It was developed largely by research efforts, but it provides a dataset that satisfies the requirements of operational users for coverage, sustainability, timeliness and quality.

Beyond the achievements, Argo still faces financial, logistical and technological challenges:

- It is needed to sustain the funding to complete and maintain the array.
- International cooperation is capital to deploy instruments in EEZs and remote areas
- The profiling float is still a complex instrument that requires a continuous cooperation between research and operational communities to be improved.



Argo Network, as of February 2006

2415 Active Floats

● ARGENTINA (3)	● COSTA RICA(1)	● JAPAN (348)	● NORWAY (9)
● AUSTRALIA (92)	● EUROPEAN UN. (23)	● KOREA, REP. OF (83)	● RUSSIAN FED. (3)
● BRAZIL (3)	● FRANCE (162)	● MAURITIUS (2)	● SPAIN (6)
● CANADA (69)	● GERMANY (127)	● MEXICO (1)	● UNITED KINGDOM (97)
● CHILE (4)	● INDIA (74)	● NETHERLANDS (7)	● UNITED STATES (1286)
● CHINA (9)	● IRELAND (1)	● NEW ZEALAND (5)	



2 Argo Information Centre

2.1 Background

The AIC was established in Feb. 2001, by the IOC Secretariat, in close cooperation with its WMO partner, to fulfil the requirements of the IOC Resolution XX-6 and provide international technical coordination for the Argo project.

The AIC, staffed with one Technical coordinator, is funded by USA, France, Canada, UK and Australia and is a component of JCOMMOPS.

JCOMMOPS provides coordination for drifting/moored buoys, XBTs and floats programmes.

Support provided by IOC secretariat is fundamental:

Additionally to the administrative functions of the IOC regarding the TC position, secretariat asks, ever year, funding countries to renew their contributions to the AIC.

IOC resources are modest and this support to the AIC, Argo TC position and so Argo is substantial.

On the other hand, close collaboration with international organizations and initiatives (as GOOS), facilitates contacts established by TC, donor programs or float retrieval coordination, and further participates in enhancing the international support to the Argo project.

2.2 Information System

A centralized information system has been implemented gradually to facilitate international coordination by TC, information spreading and Argo network monitoring.

The system is made of a relational database providing content to dynamic web applications and a Geographical Information System (GIS).

The AIC acts as a clearing house:

On-line statistics and tools permit to monitor the efficiency of the Argo array, of national programmes and individual floats

Data flow is monitored on a daily basis to make sure that all float data are distributed as appropriate.

All information is publicly available at <http://argo.jcommops.org>.
The website counts about 11 000 visits per month.

The AIC is an independent metadata collecting centre:

Each float deployment is registered in the system by float operators.

Float locations are gathered directly at the Telecommunication Centres (mainly Argos).

The AIC collects and “quality control” essential metadata for each float, and make them available in various formats.

Various tools are provided to track the floats:

- A real-time interactive map particularly permits to track the floats regarding EEZs:

<http://w4.jcommops.org/website/Argo>

Data are accessible from this application which is linked to the Argo GDACs.

- Text files, GIS files, Google Earth files are provided bi-daily to feed national or regional monitoring systems.

EEZ data are provided by a private company (General Dynamics Advanced Information Systems) and updated one or twice a year:

<http://www.gd-ais.com/capabilities/offerings/sr/gmbd.htm>

A Member State asked IOC to modify a few details on the interactive map. This has been done as well as a disclaimer:

The depiction and use of boundaries, geographic names and related data shown on maps and included in lists, tables, documents and databases on this website are not warranted to be error-free nor do they imply official endorsement or acceptance by the Intergovernmental Oceanographic Commission of UNESCO or by the Argo Information Centre.

2.3 Notification Procedure

Rational planning is fundamental to implement and maintain an array of 3000 platforms and to answer to the IOC Resolution XX-6 requirements.

A notification system has been implemented by the AIC and is operational since July 2001 and rigorously applied by all float operators for all floats deployments (**condition *sine qua non* to be part of Argo**).

About 3500 floats deployments have been notified through this system.

It is to be noted that if the IOC Resolution only concerns deployments in high seas, the procedure is applied for all deployments.

This procedure is the heart of the AIC information system. Essential metadata are gathered during the notification procedure that permits to provide an accurate status of the network. This can explain the success of the procedure. Oceanographers have seen the benefits for the programme coordination itself and not only for the compliance with international rules.

Two steps are required to properly plan a float deployment:

Step1: Regional Planning (6 months in advance) The Argo Steering Team designated regional coordinators to plan deployments for the Atlantic, Pacific, Indian and Southern Oceans, in order to avoid overlapping and share deployment opportunities targeting a 3°x3° array.

This step is being rationalized and AST is encouraging float operators to update such plans as often as possible. Plans are publicly available on Argo websites.

Step 2: Formal Notification (in advance)

Each Argo programme has designated a float operator to apply the notification procedure. Practically this float operator fills a password protected web form before the deployment, information is recorded in the database and a notification is sent by email to all IOC Members States via their designated Argo Focal Point.

Procedure can be evaluated at:

<http://w3.jcommops.org/cgi-bin/WebObjects/Notification>

The application can be used in read-only mode (without password) to search and inspect all notifications.

The notification (email) includes:

- Programme name
- Contact point
- Country
- Platforms identifiers (Ids)
- Float model
- Deployment date, latitude, longitude
- Notification Date
- Float cycle (drifting/profiling depth)
- Eventually information such as deploying platform or extra sensors
- The appropriate links to track the floats in real-time and get access to data.
- The link to the IOC-Resolution XX-6

Practically the notification is done from a few weeks before to a few weeks after the deployment. With the time and a better organisation of deployments, float operators start to be used to notify in advance.

If the deployment date or location has changed (sometimes it is not so simple to be at a location x,y and at a time t in the ocean) the notification can be updated with exact date/location.

Generally, float operators update their records when they receive feedback from the cruise.

Notifications are finally checked by the Argo TC.

As soon as the first location is received the float will enter as “active” in the monitoring system. Its data and metadata will be publicly available.

Beyond the overall success of the procedure, here are the lessons learnt:

- Notifications could be done more “in advance”.
- Not all IOC Member states designated a focal point
- More metadata are required for a better programme monitoring
- Notification system has inspired other panels (e.g. DBCP)

Hence an upgraded system has just been released. It particularly permits to directly load the regional plans in the system. This should encourage float operators to improve their planning and to notify more in advance.

The application will gather more metadata including:

- New Ids (manufacturer serial n°, Institutions internal Ids)
- Data processing centre(s)
- Deployment Ship
- Deploying country if different

- Deployment method
- Deployment type (Air, M/V, R/V, SHIP)
- Deployment Height
- Package Type (expendable box, dedicated box)
- Ship call sign and cruise Id
- Ship speed
- Sea State (WMO standards)
- Wind speed (Beaufort)
- CTD at launch

Additionally to the web based monitoring system, a warning system can be set up for the Member States that need to be effectively warned of the floats entering or approaching their EEZ.

To that end please contact the TC.

Member States are invited to designate an Argo focal point if this has not been already done. Current list of Argo NFPs is available here:

<http://w3.jcommops.org/cgi-bin/WebObjects/Argo.woa/wa/gp?gp=NFPs>

Please send the contact details to IOC:

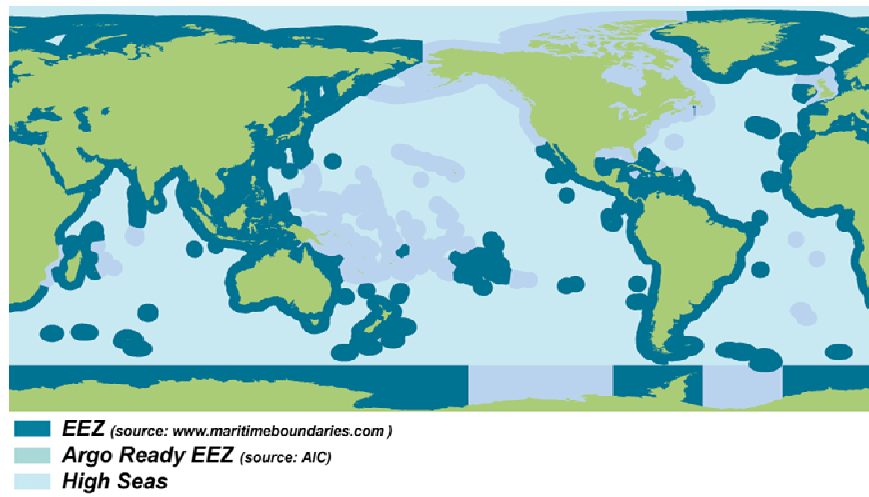
Boram Lee, b.lee@unesco.org

Fax: (33) (0) 1 45 68 58 12

Deployment directly into EEZs

Some global concurrences have been provided by some Member States to deploy floats directly into their EEZs (e.g. most of Pacific Islands, USA, UK, Mauritius, Mozambique, Canada – on going) under the condition that the deployments are officially notified through the AIC and data made freely available (see map below).

This contribution is capital for the implementation and the maintenance of a global network such as Argo.



3 JCOMMOPS & ABE-LOS

The existing Notification procedure is in a preliminary phase.
It needs to be evaluated and consolidated.

ABE-LOS is invited to provide further instructions to the Argo TC, keeping in mind that the resources to implement the resolution are modest.

TC is working part time on this issue with a limited funding, used to maintain the information system (hardware, software licences).

Practically it is impossible today to write an official letter or send a fax for 1000 deployments per year without additional secretariat support.

That is why the “appropriate channels” have been interpreted by “email”.

Until now only one country has expressed some reserves regarding this email based notification procedure.

It is to be considered that there is no long term funding for JCOMMOPS and the AIC.
Funding is done on a yearly basis through national voluntary contributions.

After 5 years of operations, it seems timely to make an assessment of progress and future challenges of JCOMMOPS.

Argo, DBCP, SOOP and IOC/WMO start thinking of JCOMMOPS as a more cohesive unit instead of two independent TCs developing synergies. New resources from other observing systems (VOS, GLOSS) will be investigated.

Hence, in the coming months, JCOMMOPS will be reviewed in order to optimize its efficiency, and allow staff to be given a unified work plan, priorities and measurable objectives.

ABE-LOS could provide inputs to that group of review, via the IOC, on the necessity to carry out essential functions as the Notification procedure, and under which conditions.

Acronyms:

AIC: Argo Information Centre

GLOSS: Global Sea Level Observing System

GOOS: Global Ocean Observing System

DBCP: Data Buoy Cooperation Panel

JCOMMOPS: Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) *in situ* Observing Platform Support centre (JCOMMOPS)

NFP: National Focal Point

SOOP: Ship of Opportunity Program

VOS: Voluntary Observing Ships