Global Ocean Observing System

Intergovernmental Oceanographic Commission
Workshop Report No. 144

IOC-SOPAC Workshop Report on Pacific Regional Global Ocean Observing Systems

Suva, Fiji
13-17 February 1998

GOOS Report No. 53

SOPAC SOPAC JOINT CONTRIBUTION REPORT

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1. ACKNOWLEDGEMENTS

The support of the various sponsors and co-sponsors is greatly appreciated. Without such support the workshop would not have been possible and it is considered a valuable contribution to the Pacific region. The support of the following sponsors is acknowledged:

- The Government of France
- The Intergovernmental Oceanographic Commission (IOC)
- The Netherlands Geoscience Foundation (GOA)

Gratitude is expressed to the Forum Secretariat, particularly John Low, for their willingness to host the workshop at the Forum Secretariat.

Various government agencies supported the travel of participants to the workshop including NOAA, APN, BGS, IFREMER, USP, SPC and SPREP, which is appreciated.

Finally, the workshop recognises the vital role played by the SOPAC Secretariat staff in administering the event. The wizardry of Anna Elaise on the word processor was astounding and resulted in a finished draft report on the final day of the workshop. Andrew Butcher worked tirelessly in organising the various events and Litia Waradi ensured that everyone had total satisfaction with transport arrangements. The others on the staff displayed the same helpful and friendly attitude and they are all thanked.

2. INTRODUCTION

The GOOS Capacity Building Workshop for the Pacific was identified in the GOOS 1998 Plan and it was approved by the IOC Assembly in 1997 and the SOPAC Annual Session in 1997. The IOC and SOPAC were co-sponsors of the workshop and its preparation was co-ordinated by Jan Stel (Chair), William Erb (IOC) and Alf Simpson, Russell Howorth and Andrew Butcher of SOPAC.

The Forum Secretariat hosted the workshop at their conference centre in Suva, Fiji during 13-17 February 1998. Thirty participants attended from twelve countries. Three countries expected to attend (Tuvalu, Federated States of Micronesia and Kiribati) but were restricted from doing so due to airline problems (see Appendix I).

The purpose of the workshop was to identify capacity building needs, interests of organizations serving the region, as well as national interests, and to explore the possibility for establishing a regional GOOS activity. At previous meetings held under the auspices of SOPAC, ORSTOM and SPREP, GOOS was discussed and a Memorandum of Understanding (MoU) between IOC and SOPAC and letters of correspondence between IOC and SPREP have established a basis for cooperation in the development of GOOS in the region.

The Pacific Workshop was built on the experience of previous similar workshops convened in the Indian Ocean, Mediterranean Sea and Africa. The workshop plan resulted in the setting up of two Working Groups to address the issues of:

(i) organization and development of GOOS in the region; and
(ii) capacity building in relation to GOOS.

Plenaries were convened periodically during the workshop to allow interaction between the working groups for assessment of their progress. The recommendations of the Working Groups are included on page 9. A list of the Working Group participants is included in Appendix VI.

3. CAPACITY BUILDING, APPROACHES AND GOALS

Dr Stel introduced the “Lego for Capacity Building” concept. He stated that the implementation of both UNCED’s programme of actions listed under “Agenda 21" and UNCLOS’s various provisions, reflect a number of articles on the rights and obligations of countries. Among other things, the exploration and exploitation of marine resources in the Exclusive Economic Zone (EEZ) is a major policy pull for the development of marine science and technology in the next century. The costs to implement Rio’s 2500 actions are an estimated US $120 billion per year. This is twice the present Oversea Development Aid (ODA) available to the member countries of the Organization for Economic Co-operation and Development (OECD). The major funding mechanism for UNCED is the Global Environment Facility (GEF), a joint programme of the World Bank, UNEP, and UNDP. The first phase of GEF (1992-95) was funded with some US $1.6 billion. For the second,

restructured phase, US $2 billion have been committed by 26 countries, including 8 developing countries.

Dr Stel also briefly introduced the Global Ocean Observing System, and explained that buoy systems (like Seawatch) could be suitable tools for capacity building in relation to GOOS. Seawatch is an on-line, off-the-shelf environmental monitoring and surveillance coastal seas system. Seawatch and systems like it were developed to provide an operational marine environmental surveillance and information system for the management of regional seas.

Dr Stel explained that no clear-cut procedures exist for the development and strengthening of a marine research capability. A number of elements can, however, be identified at different levels. These are: human resources at the level of the individual scientist (micro-level), the necessary institutions (meso-level) and an enabling national environment which is willing to support and sustain a marine research activity (macro-level). These levels must be seen in relation to each other and as expressions of a single research system. Finally, he explained the principle of "Partners in Marine Science" which is based upon the mutual interest (learning by doing) of the scientific communities of the partners in the industrialised and southern countries. As part of a long-term (10 years) bi- or multilateral commitment to joint scientific research programmes, capacity building activities are an intrinsic part of the partnership programmes. While funds for the scientific component of the programmes should be granted by relevant national science foundations, the funding for the capacity building component is sought through national and international ODA organizations as well as sources such as the European Union, World Bank, Asian Development Bank, African Development Bank, GEF, etc. These partnership programmes form a flexible instrument to integrate capacity building activities at the individual, institutional, national and regional level. Within a partnership donors can integrate their activities by "adopting" an institution or country. The linking with science foundations guarantees the transfer of a high quality product.

4. GOOS ORGANIZATION AND PRINCIPLES

The organization, objectives and principles of GOOS were presented to the workshop by Bill Erb, Senior Adviser, IOC. In summary, and simplistic terms, GOOS' primary objective is to transfer the data and information acquired from long term, systematic monitoring of the ocean into products and services required by a wide range of users, including governments, industry, science and individuals.

GOOS is a system consisting of several major components including data collection and, telecommunication systems, data analysis and modelling centres and product development and distribution centres.

Various intergovernmental organizations support the system, including the GOOS sponsors (IOC, WMO, UNEP and ICSU). Major committees of GOOS include the Intergovernmental GOOS Committee (IGOOS), the GOOS Steering Committee (GSC) and several technical panels organized to address major themes (climate, coastal, living resources, health of the ocean and marine meteorological and oceanographic services).

GOOS development has progressed rapidly, expanding from activities already existing in the intergovernmental fora to national, bilateral and regional activities. GOOS in the Pacific can already be identified in the TAO (Tropical Atmosphere Ocean) array and the Global Coral Reef Monitoring Network. Expertise for operating a Pacific GOOS exists in the regional organizations (SOPAC, SPREP, USP, ORSTOM, IFREMER, etc.). Political support within the region is essential for identifying required resources for GOOS implementation and for attracting support from donor nations and organizations. (See Appendix 8 which includes copies of several overheads).

5. GOOS BENEFITS AND COSTS

The economic benefits of GOOS derive from improvement in management and decision-making from improved monitoring and forecasting of the state of the coastal and ocean environment and improved weather and climate forecasts.

GOOS benefits can be quantified in the context of cost-benefit analysis, which is critical for both public support and funding (from both governments and in certain cases, private commercial interests).

Estimated potential economic benefits of marginal improvements in efficiency in marine industries and services worldwide range from $8-$10 billion annually. Benefits of improving management and stewardship of valuable coastal resources may be equally large. Because of the relative importance of marine and coastal sectors in the Pacific region, benefits from GOOS are much more important in relative terms than in other countries like the United States, the United Kingdom or Australia.

Particularly important to Pacific nations are:

(i) fisheries;
(ii) coastal management (health of reefs, beaches, water quality, mangroves, etc.); and
(iii) weather and climate forecasts (of extreme events, conditions for CZM and support for longer term climatic forecasts).

A cost-benefit analysis of the TOGA/ENSO observing system indicates average annual returns on investments in these GOOS systems of 20-25%, well above rates of return in alternative uses.

Cost-benefit analysis can be done in the context of developing GOOS in the Pacific and should be an integral part of the process.

6. GOOS SCIENCE & INTER-RELATIONSHIPS

Consideration of the GOOS programme, its objectives and modular thematic structure, in the Pacific geoscience context, reveals close connections with the needs of the region. Key themes are practical application of science in data acquisition, assessment, stewardship and prediction. The particular geographic situation of the Pacific island countries, their enormous expanses of ocean and large sea/land ratios result in a reliance on marine resources, including the coastal areas. Many of the smaller islands are dominated by "living" natural resources, in the form of coral reefs, mangroves and sea grass meadows, that all contribute significantly to the non-living resource sector. In this context these resources can be regarded as both living and non-living and are influenced by natural as well as human impact. The former are tsunamis, storms, cyclones, earthquakes and volcanic eruptions; the latter are artisanal fishing, aggregate resources, urban development and tourism. Conflicts of usage and unsustainable utilisation result in degradation, highly visible as coastal erosion and recession and destruction of mangrove habitat, although less so in reduction of water quality leading to degradation of reefs and reduction of biodiversity. Local and regional studies on most of the Pacific island groups document these effects, and the large scientific database now available for many of the countries allows for prediction of the effects of both natural and man-made impacts. However, stewardship is political and the available information is still not widely used by administrators and politicians. To achieve a better usage and an improved and sustainable utilisation of resources requires significant capacity building and a greater awareness of the contribution science can make. The GOOS programme is viewed in this context, thematically relating marine and coastal processes in the context of applied science. Global linkages may also be perceived, with shared problems with other oceanic areas such as the Indian Ocean and Caribbean Sea as well as the opportunity for technology transfer from more developed regions. State-of-the-art technology is required in data acquisition in the marine domain, and predictive modelling, using highly sophisticated computer programmes, is perceived as combining oceanographic and geological processes through imaginative usage. However, simpler observation programmes, such as beach profiling, are seen as complimentary and can be effectively carried out locally with modest technology.

7. A GOOS APPLICATION EXAMPLE

Since 1991, New Caledonia has carried out a multi-disciplinary programme known as ZoNeCo with a number of partners including France, Territory of New Caledonia, the three Provinces (North, South and Loyalty), IFREMER, ORSTOM and UFP (French University of Pacific).

The aim of the ZoNeCo Programme is the evaluation of living and non-living marine resources of the EEZ of New Caledonia. The Programme has undertaken the compilation of all existing data in the different disciplines such as geology, geophysics, physical oceanography and fisheries. In addition the ZoNeCo programme carried out swath-mapping bathymetrical and geophysical cruises and exploratory fishing surveys. ZoNeCo has used an integrated approach by involving both decision-makers and resource scientists. The programme has a limited duration and should soon result in practical applications and may be applied in other small tropical island nations. All data and information may be considered as a contribution to GOOS by the region.

8. RESULTS OF THE REGIONAL GOOS SURVEY

A questionnaire was provided to all countries and organizations in the region prior to the Workshop. The reasons for circulating the GOOS questionnaire were numerous:

(i) to determine what observational infrastructure is already in place;
(ii) to determine a capability profile or equipment inventory;
(iii) to identify what measurements are routinely and periodically taken. These would include meteorological, tidal, chemical or bathymetric measurements;
(iv) to establish whether people within Pacific island countries and regional agencies are aware of GOOS;
(v) to identify any overriding priorities;
(vi) to establish who's who and who does what;
(vii) the compiled responses would serve as a product for discussion.

The questionnaire was based on one used by the WMO for meteorological purposes but was modified to make it more appropriate to ocean observing and the Pacific region.

The questionnaire was distributed to SOPAC, Forum Secretariat Member Countries, SPOCC Agencies and other relevant interested parties. It comprised two parts, firstly a country survey on existing marine observing and communication networks and services and secondly, a country survey on user requirements. A summary of the results of the survey was provided to the workshop participants.

A general summary of responses to questions or topics (in italics) follows:

(i) Existing Marine Observing and Communication Networks and Services Survey

a) Marine Observations

Marine/Vessel Observation Systems?:	Only New Caledonia and Fiji had these available, most Pacific islands have no facility.
Coastal Marine Observation Systems?:	Much more common, 4-5 sites in some cases.
Data Buoys?:	Federated States of Micronesia, Kiribati and New Caledonia were aware of, or were already assisting with the TAO Buoy Array.
Ships of Opportunity?:	A wide range of responses from none to 5 per day.
Other Operational Instruments?:	Tide Gauge/Sea Level Recorder (SLR) Common organized through the National Tidal Facility (NTF) at Flinders University, Adelaide, the University of Hawaii.

b) Communications

Satellite:	Some have use of Peacesat, some access the Geostationary Meteorological Satellite (GMS).
E mail:	About half of those responding had access.
World wide web:	Cook Islands only.

c) Marine Services already provided

Country Specialists:	New Caledonia has several but elsewhere absent or single member of staff.
Computer Models:	New Caledonia only, Papua New Guinea through Bureau of Meteorological Forecasting, Darwin.
Databases:	New Caledonia for Sea Surface Temperature (SST) and salinity.
Services:	Some weather bulletins, some provision of physical/nutrient data.

(ii) User Requirements Survey

General Comments?:	There was some mention of NOAA/World Meteorological Organization activities in the region. Specific and comprehensive requests from Papua New Guinea National Weather Service. Equipment (especially a tide gauge/Sea Level Recorder) requirement in Niue.
User Requirements for GOOS?	These were completed in tabular form with parameters and their user groups recorded by respondents in priority order. A general summary of the findings is attached.
Service Delivery?:	User groups, service types, delivery and contacts were also completed in tabular form. The results of this part of the questionnaire were rather ambiguous and a summary figure has not been included.

(iii) Conclusions from the questionnaire

- There are fundamental gaps in the knowledge and appreciation of the technology, principles and applications of GOOS within Pacific island countries. However, certain elements of GOOS for instance, meteorology, are well understood despite the fact that most countries are dependent on the forecasting centres in Fiji or Australia.

- The training of staff in Pacific island countries with respect to GOOS concepts, technology, methodologies and applications appears to be necessary.

I. Reference was made to activities being undertaken by other agencies within the region that use state-of-the-art technology and techniques in operational oceanography.

- The compilation of existing data, equipment inventories and capacity assessment appear to be crucial first steps in implementing GOOS in the region.

9. REPORT ON WORKING GROUP A : ORGANIZATION AND DEVELOPMENT CONSIDERATIONS

Working Group A met to discuss the organization and development elements associated with the establishment of a regional GOOS programme in the Pacific. The following questions were posed:

- Does the region need a GOOS programme?

- If it does, how would the programme be organized and what would be required to make it effective?

- How would the programme be initiated?

- How would it be funded?

(i) Need for GOOS Programme?

The group discussed the relevance of GOOS objectives in relation to the requirements of the Pacific region, taking note of the presentations given during the opening day of the meeting and recalling the modules of GOOS (Climate, Coastal, Living Resources, Health of the Ocean and Meteorological Oceanographic Services). The modules were regarded as relevant to the region and the following local concerns were identified as of primary importance to local users (fisheries, climate change, sealevel rise, El Niño, coastal management and conflicts in the coastal zone, pollution, coral reefs and the availability and usage of science data). It was recognised that the primary objective of GOOS is to aid the end user.

It was recognised that the Pacific Ocean acts as a major control on global climate. Scientific studies show that ENSO effectively controls and influences world climate rather than climate locally. This importance is reflected in the long-term oceanographic studies carried out in the region by the USA (NOAA) and Japan (JAMSTEC) and the acquisition of oceanographic data from the permanent arrays of buoys in Pacific equatorial regions (TAO array). The data from El Niño also has application to the distribution of fish stocks in the Pacific, potentially tuna.

It was also recognised that linkages to other GOOS regional programmes, such as EuroGOOS and

NEARGOOS, would be beneficial in terms of technology and information transfer amongst the regional programmes. Increasingly sophisticated monitoring, modelling and predictive programmes are being developed in the first world countries participating in GOOS programmes. By formulating a Pacific regional GOOS, an avenue of communication would be opened, thereby allowing the region to benefit from these other regional GOOS programmes.

It was also recognised that there is a significant volume of natural resources observational data in the region, and that this would form the basis of the GOOS programme. At present this data was mainly held by the regional organizations in their sophisticated data management sections. All the regional organizations are linked across the internet. It was recognised that this data and future datasets acquired by regional organizations, outside institutions or individuals, could form part of the GOOS dataset. However, it was agreed that in the future specific GOOS acquisition programmes would be organized as part of a regional GOOS implementation plan.

Having discussed and considered all of the above factors, the Working Group concluded that in both the global and regional context, a regional Pacific GOOS would be relevant and positively beneficial.

(ii) How shall it be organized?

Having agreed that a regional GOOS programme was required in the region, the Working Group then went on to consider how it should be organized and what it should be called.

The Working Group, in its deliberations on the organization of a regional GOOS, considered the extent of the GOOS programme in the region. In its discussion, the different constituencies of the regional organizations, i.e. SOPAC, SPREP, SPC, FFA and USP were recognised, and in this context it was agreed that the programme would extend from the Commonwealth of Northern Marianas in the north to New Zealand in the south, and from Australia in the west to French Polynesia in the east. Whether Hawaii would be included was discussed, but the Working Group, aware of the national USA GOOS programme decided to defer this decision.

Various organizational plans of other GOOS programmes were reviewed including EuroGOOS, which is based upon agreements between European scientific organizations, and NEARGOOS, which is based upon agreements between countries. It was recognised that for the Pacific region, much scientific work is carried out by regional organizations (FFA, SPC, SOPAC, SPREP and USP) and outside institutions (JAMSTEC, HIG, ORSTOM, CSIRO, NOAA, etc.), and that there is a strong regional political framework led by the forum countries. It was therefore agreed to organize the programme through the medium of the regional organizations, mainly led by SOPAC, SPREP, SPC, USP, FFA having agreed to SPC representing their interests at the workshop. During the discussion it was recognised that there is a heavy commitment from institutions outside the region; organizations such as NOAA and JAMSTEC, as well as large institutions within the region, such as the ORSTOM Centre in New Caledonia and Tahiti. The importance to the region of these institutions was recognised and it was agreed that they could make a major contribution to a Pacific regional GOOS; thus, their involvement in the programme would be considered and encouraged in the organizational structure to be devised. Politically, the organization of a Pacific regional GOOS through the existing regional structures, was considered essential if the full support of the forum countries, essential to the GOOS programmes, was to be achieved.

There was considerable discussion on how the membership should be structured. It was agreed that, initially, there should be representation by the regional organizations. The question was posed: should individual country representatives sit on the body? It was agreed that, initially, there was no need for individual country representation since the regional organizations themselves represented the countries, although this could always be reviewed at a later date.

The Working Group decided that the regional GOOS Programme should be led by an Implementation Committee. Regional interests would be represented by SPREP, SOPAC, USP and SPC. This would ensure that regional organizations having responsibility for the areas addressed by the GOOS modules were represented on the Committee. Membership by governmental organizations from outside the region with active programmes in the region was considered to be important. These organizations could include ORSTOM, NOAA, BGS and JAMSTEC. Other organizations could be invited to join the committee based on their interest and potential activity in the programme and the region. National interests and the potential linkage will be provided by representatives of countries currently chairing and vice-chairing the Forum. Finally, the sponsoring organizations of GOOS (IOC, WMO and UNEP) should be members because of their obvious interest, support and knowledge of the programme.

The Working Group discussed the administration of the regional programme and agreed that there should be a programme office housed at one of the regional organizations. Since SOPAC has been recognised as taking a lead role in GOOS implementation, it was proposed that the office could be housed here. The function of the

office would be to co-ordinate the development of GOOS in the region, assisting with drafting plans, addressing the flow of data and information throughout the region and ensuring a strong tie and interaction with the global GOOS functions and committees. There was much discussion on the importance of the data and its use in a meaningful manner. It was agreed that on a regional basis, there should be an emphasis on providing information tailored to the end-user, not dissemination of raw data. This reflects the sophistication of data manipulation available at the regional centres when compared to that of the Pacific Island Countries locally.

The office would be staffed by one person who would also act as Secretary to the Committee and be responsible for implementing the regional strategy.

After careful consideration it was decided that the most appropriate name for the regional GOOS programme would be PacificGOOS. This name is consistent with the recent decision to change the name of the South Pacific Commission to the Pacific Community.

(iii) How to initiate the Programme?

There was much discussion on how to initiate the regional GOOS programme. There was agreement that an *ad hoc* Steering Committee should be formed immediately. The membership of this committee was discussed in depth, and it was agreed that membership would be drawn from amongst SOPAC, SPREP, SPC, USP, ORSTOM and the IOC. It was recognised that activity had to begin as soon as possible, so membership of the Steering Committee was chosen as follows:

SOPAC	- Alf Simpson, Chair
	- Russell Howorth, Secretary
SPC	- Patrick Lehodey
ORSTOM	- François Jarrige
IOC Advisor	- Bill Erb
USP	- Peter Newell

The Steering Committee would oversee the first phases of development, but it was agreed that there were a number of activities that could be identified at the Workshop and should be planned for immediately. These included the following:

The first action would be to formulate a Strategic Plan. This would have to be written by a consultant within the next 6-9 months. It would include the regional GOOS organization *modus operandi,* and the roles of the member organizations. Once the Strategic Plan was formulated and written there would have to be an Implementation Plan, from which would evolve the development of pilot activities.

It was also agreed by the Working Group that to 'kick start' the regional GOOS activity a person with previous “GOOS experience” could be employed in the GOOS office. This person would need to be recruited and could also be the individual who writes the Strategic Plan.

Within the next six months the following activities should be considered:

The Marine Sector Working Group of SPOCC, meets on March 17, with the submission of papers for this meeting on March 2. It is essential to have the draft Workshop Recommendations completed by March 2 to ensure an immediate response from SPOCC and, if accepted, approval from the Forum Heads of Government.

The first meeting of the Implementation Committee would be at the SOPAC Annual Session in September/October 1998.

It was also agreed that at the START Session, taking place at the Annual SOPAC Session, there would be a special session devoted to GOOS activities in the region. Alf Simpson was requested to co-ordinate with Keith Crook, Chair of START.

There are several forthcoming meetings of relevance to the regional GOOS activity at which attendance by a Pacific GOOS representative was considered important:

- PACON meeting in Seoul, South Korea, in June 1998, at which regional GOOS programmes will be discussed.

- A coastal management workshop will be convened by the Government of France and IOC which could have a focus on the Pacific regional GOOS activity. This will be explored by Bill Erb (IOC) and François Jarrige (ORSTOM).

Within the next twelve months there will also be many meetings of GOOS committees such as the GOOS Steering Committee, GOOS Panels on Coastal Areas and Living Marine Resources and a GOOS Agreements Meeting. Also, GOOS is usually discussed at the IOC Executive Council. It is important that the region keep appraised of such meetings and decide which to attend. The purpose is to inform the global community of the potential benefits that the Pacific region can make to the global programme and to identify opportunities, based on lessons learned from other GOOS activities, which can be transferred into the region. The representation of the region at these types of meetings and participation on such committees is necessary to fully benefit from GOOS.

(iv) How can Funding be acquired?

Funding will be required to operate GOOS. The GOOS programme office will need to be staffed. There will be a number of meetings, that will have to be attended. The Strategic Plan will require drafting; the work of a consultant for 6-9 months. Initially, Russell Howorth will manage the GOOS activities at SOPAC but this can only be considered a short-term solution as Russell's time is required elsewhere. There was much discussion on how to raise funds and a few ideas are listed for future reference:

- Private foundations involved in development activity in the Pacific;
- UN organizations with development responsibility – UNDP;
- The World Bank, GEF;
- Member countries with the capability to contribute, i.e. Australia, New Zealand;
- Organizations present in the region who can assist, i.e. ORSTOM, IFREMER, CSIRO, AIMS, NIWA, CRC;
- Outside organizations with programme interest: NOAA, JAMSTEC, KORDI, EU, EuroGOOS.

10. REPORT ON WORKING GROUP B : CAPACITY BUILDING IN RELATION TO GOOS

The ocean is of overwhelming significance for Pacific countries. It is usually the major natural resource and economic base of these countries and its processes daily affect the lives of all in the region. The United Nations Convention on the Law of the Sea has placed substantial obligations on countries for better ocean management as well as providing economic opportunities. The United Nations Convention on Environment and Development (UNCED) Agenda 21, Chapter 17, has identified the importance of improved management and development of the coastal and ocean areas. Therefore it is imperative that understanding of the ocean is maximised and that there is effective dissemination of ocean-monitoring data and end-user products derived from it. At the moment there is not a central clearing house within the region for all data that are available. There is also the continuing doubt about the effectiveness of existing communication systems for making full and timely use of what may be available.

The areas of activity identified as most urgently needing improved ocean monitoring were meteorology, fisheries and coastal management. The meteorological needs include short term forecasting (traditional and marine forecasts and extreme events) and increased predictive capacity about possible long term climate change. Without these additional inputs, climate modelling at the global scale will also remain deficient. There are also potentially significant economic and conservation gains from better knowledge of fish stocks (numbers, migratory patterns, recruitment areas, etc.). This applies to nearshore as well as open ocean fishing and there are few coastal activities that are not daily affected by ocean processes.

Small islands are all 'coastal zone'. Many monitoring and capacity building needs have been identified through the Pacific Regional International Coral Reef Initiative and the Pacific Global Coral Reef Monitoring Network, a component of GOOS, including changes in sea level, beach processes, mariculture, the impact of pollution and sediment and the health of coral reef ecosystems. Better monitoring and observation arrangements are a pre-requisite for developing quality GIS and other decision support activities to support management and for the implementation of action plans.

There has already been considerable effort in defining basic monitoring, capacity-building needs and developing action plans. At the regional level these include the work of regional organizations supplemented by national investigations. Also, global exercises, such as the IPCC process, in the Global Programme of Action for the Sustainable Development of Small Island States and in the Global Programme of Action for the protection of the Marine Environment from Land-based Activities. This past work provides a basis for elaborating in more detail where the needs for improved ocean observation and related follow-up work are greatest and where the greatest

benefits will be for economic progress and societal well-being.

There is a need for further capacity building in Pacific countries if improved monitoring is to become a reality and used productively. This capacity building relates to the build-up of marine science in the region, technical training to meet current and future needs for using and maintaining monitoring systems such as the Seawatch system, for developing user links and for developing and disseminating user products, institution building to support and maintain a GOOS structure and additional hardware for monitoring, and perhaps, communications.

11. SUMMARY OF RECOMMENDATIONS

11.1 ORGANIZATION AND DEVELOPMENT CONSIDERATIONS

The Workshop recommended:

(i) the establishment of a regional GOOS activity for the Pacific region, which will be named PacificGOOS;

(ii) that the membership of PacificGOOS should comprise the regional organizations of the Pacific with an interest in, and a capacity to contribute to GOOS programme activities. In this context it is recognised that the regional organizations represent individual national interests;

(iii) the establishment of an *ad hoc* Steering Committee (SC) to initiate the development of GOOS activities including SOPAC (Alf Simpson, Russell Howorth), SPC (Patrick Lehodey), ORSTOM (François Jarrige), IOC (Bill Erb) and USP (Peter Newell);

(iv) the development of a PacificGOOS Strategic Plan within the year;

(v) the drafting of a PacificGOOS Implementation Plan and a PacificGOOS Memorandum of Understanding;

(vi) that an essential step in the initiation of the PacificGOOS programme is the recruitment of a consultant to draft the Strategic Plan and to initiate GOOS activities in the region;

(vii) that PacificGOOS should be led by an Implementation Committee (IC) that is comprised of regional intergovernmental organizations of the Pacific, agencies from inside and outside the region with programme activities in the region, GOOS sponsoring organizations and the Forum Chair and Vice Chair;

(viii) that a PacificGOOS project office be established at the SOPAC Secretariat in Suva to generate, co-ordinate and implement GOOS activities and to advertise the objectives and aims of GOOS within and outside of the region;

(ix) that as a priority, funding sources for PacificGOOS should be identified by the IC and the SC, because the funding for the activities formulated by the Workshop is considered to be of critical importance for the full development of PacificGOOS;

(x) that delegates from the region should attend impending 'global' GOOS meetings, thereby to advance PacificGOOS activities and the Pacific region's GOOS aspirations;

(xi) that a dialogue be immediately established between the PacificGOOS Project Office and the GOOS Project Office at the IOC in Paris.

11.2 CAPACITY BUILDING IN RELATION TO GOOS

The Workshop recommended:

(i) that an inventory be made of GOOS related data being collected in the region by national and regional bodies, and by countries and organizations outside the region to facilitate development of a GOOS strategy;

(ii) that priority be given to increased observation activities aimed at improved weather and climate forecasting, sustainable and financially beneficial fisheries management, sustainable coastal management and reduced risks from extreme events (i.e. El Niño related droughts, cyclones, etc.);

(iii) that capacity building needed to be defined more precisely by more detailed examination of relevant global, regional and national action programmes, and by country analysis of where the gains will be greatest from improved monitoring and its application (i.e. by applying cost-benefit analysis techniques);

(iv) that greater advantage be taken of marine science courses available in and near the region, for example at the University of the South Pacific and Universities in Papua New Guinea, Australia, New Zealand, New Caledonia, French Polynesia, Guam and Hawaii;

(v) that a regional assessment of communication needs be undertaken, as a basis for overcoming any problems caused by insufficient hardware or lack of local skills and knowledge;

(vi) that focal points be designated in each country of the region, and that any training needs associated with these should be included in the PacificGOOS Strategic Plan;

(vii) that additional monitoring equipment or arrangements be sought to meet identified needs, such as more buoys, receiving stations (for example Seawatch) and better access to satellite services, etc.;

(viii) that awareness building training programmes be established to support PacificGOOS covering monitoring, development and use of end products, data management and modelling using existing arrangements where possible, such as the National Tidal Facility training activities and the proposed APN workshop on developing climate indicators for extreme events.

The recommendations of the workshop will be transmitted to the SPOCC Marine Sector Working Group by the Director of SOPAC.

The Workshop participants wish to bring to the attention of the sponsors of GOOS (IOC, WMO and UNEP) the critical need for funding support at the initial stages of GOOS implementation in the Pacific region. The region believes that the Pacific can provide a positive contribution to GOOS overall, but also realises the importance of having funds available for start-up of activities.

APPENDIX I

LIST OF PARTICIPANTS

I. PARTICIPANTS FROM MEMBER STATES

COOK ISLANDS

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APPENDIX II

WELCOME AND OPENING ADDRESSES*

A. Address by Alf Simpson
Director, SOPAC
(Excerpt from Alf Simpson's speech)

"Honourable Minister, Excellencies, Distinguished Guests,

Over the course of the next four and a half days, the workshop participants will be active in identifying the current capabilities for ocean observing in their respective countries and in the region and developing a foundation for an effective implementation. Parts of the region already have an ocean observing capability administered from external agencies. Invited speakers representing these agencies will assist us in overcoming some of the pitfalls that have been encountered elsewhere in establishing and developing these systems.

At the conclusion of the workshop, this plan will have no status or endorsement of governments, it will only represent the result of several days thinking by people knowledgeable and interested in the potential of a cooperative regional approach in ocean observation for operational purposes. Further advancement of the plan will be left to the leaders of the region to decide."

B. Address by Jan Stel
Chairman, GOOS Capacity Building Panel

When the 'Pathfinder' at Mars stopped transmitting information to the Earth, that was news covered by all media. Early last year one could have found at the Internet a forecast of the present El Niño in the Pacific. At that time, however, this was not seen as news by the media or as something of general interest by the public at large. However, when the forest fires in Indonesia turned into havoc this summer, the media proclaimed the present El Niño, a "disaster", and its economic and social consequences have since then become world news.

The United Nations have identified 1998 as the *International Year of the Ocean*. Through this initiative, which was proposed by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, one hopes to create awareness about the ocean with the public at large with policy makers and with politicians. The role the ocean plays in our daily lives has to be explained in order to create support for governing the ocean assets wisely. Hopefully these activities, will facilitate that ocean issues will be taken more seriously by governments, like the one in Indonesia, and the general public. By this the economic loss and human misery due to the El Niño "disaster" which in my opinion is just an expression of a natural phenomenon, might be mitigated.

Every morning we see a weather forecast on the television. We take this for granted, as we take the cost to collect the underlying data and information as well as the "translation" of the information into easy to understand presentations in the media. Most people do not realise how complex the data gathering system through the global World Weather Watch System is. Most people are not aware of the costs of the data and information exchange system of the lower part of the Ocean of Air, which we call the atmosphere. Why don't we have such a system for the Ocean of water?

I think that is mainly due to the fact that we live at the bottom of the Ocean of Air, which is some 50 km deep. The phenomena which we call weather are only expressions of processes taking place in the lower nine to ten kilometres of this ocean. If we were fish instead of land animals, we would certainly have developed a world weather observing system for the upper part of the ocean instead of the lower part of the atmosphere. Many people, scientists, operators of coastal monitoring systems, policy makers and politicians think however, that the time has now come to create such a monitoring network for the collection and exchange of ocean data and information for the creation of the Global Ocean Observing System. GOOS data will be used for climate forecasting as well as for a better understanding of the ocean and an improved and more efficient sustainable use and management of the marine resources.

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* *These addresses appear in the order that they were presented.*

In 1994 each coastal and island state obtained a present from the UN, being a stretch of the sea of at least 200 miles. Again it is important that the general public will be informed about what is happening during the

exploration and exploitation of their national Ocean Space areas. Again I want to stress the importance of *the Year of the Ocean* as an instrument to reach the public. An interesting initiative is the OCEAN98, a NGO activity supported by the IOC, WMO and UNEP, in which awareness creation and education of young people is united in an attractive package. I think that countries should use the *Year of the Oce*an to advocate among others, the concepts, benefits and implementation steps of GOOS on a national, regional and global level.

Why are we doing this? Why are we trying to build GOOS at all? Why are we discussing in Fiji issues such as capacity building, awareness creation, cost-benefit analysis, regional co-operation, etc.? I think that we do this because we are convinced of the need and reality of GOOS, because we have the vision that GOOS might make the future of next generations brighter. Hopefully GOOS will help them just as we do that today with "disasters" such as hurricanes in the Ocean of Air, to cope with and mitigate the effects of a natural phenomenon which we call El Niño. GOOS will help us to understand expressions of processes in the life supporting system of our Planet and by this will make the lives of future generations better.

C. Keynote Address
Honourable Mr Vilisoni Cagimaivei
Minister of Urban Development, Housing & Environment

Esteemed Guests, Ladies and Gentlemen,

On behalf of my Government I would like to take this opportunity to welcome you all here to Suva for this first meeting relating to the establishment of a Pacific component to the Global Ocean Observing System. It is a particular pleasure to note the number of countries, international, regional and national agencies, together with donor support agencies represented here today.

In recognition of the importance of the ocean, the marine environment and its resources for life on Earth and for sustainable development, the United Nations has declared 1998 as the International Year of the Ocean. The global implementing agency for the year will be the Intergovernmental Oceanographic Commission of UNESCO. This provides a window of opportunity for governments, organizations and individuals to become aware of the ocean issues and to consider the actions needed to undertake our common responsibility to sustain the greatest common heritage we have and without which we cannot exist.

The overall objective is to focus and reinforce the attention of the public, governments and decision-makers at large on the importance of the oceans and the marine environment as resources for sustainable development.

The activities associated with the International Year of the Ocean in the Pacific Region are being coordinated by the South Pacific Applied Geoscience Commission (SOPAC) starting with this particular workshop on 'Ocean Observing Systems'. I am however, pleased to learn that all regional agencies and Pacific Island countries support this cause and I urge them to participate in and contribute to the programme of activities during the year and beyond.

Other international organizations involved in ocean-related issues, notably the United Nations Environment Programme and the World Meteorological Office have planned or co-sponsor contributions to the 1998 International Year of the Ocean.

We should understand that the International Year of the Ocean should not be considered as an event lying purely within anyone's particular interests. The cultural, educational and community dimensions should also be taken into account, in the sense that efficient ocean management implies that all citizens are aware of the problems and understand the benefits of management.

The major aim of the joint efforts during 1998 will be to create awareness and obtain commitments from governments to take action, provide adequate resources and give the priority to the ocean and coastal areas which they deserve as finite economical assets. The actions will also aim at increasing public awareness of ocean issues.

It is noted with interest that last year was the International Year of the Coral Reef. I think that whilst the programme of activities during the year are important in themselves, perhaps the most important aspect of these 'designated years' is that they raise the level of public awareness and sustain this through continued activities. Under no circumstances should our concerns and energies in these matters be allowed to tail off once 1999 approaches. Activities during the year and beyond have to be tailored to the region's needs, capacity and interests and also to individual Pacific island country requirements.

Such programmes require a co-ordinated mobilisation of means and funds from a number of agencies and programmes. Interested parties should realise that many of their ongoing activities may easily fit the criteria for being considered a part of the Ocean Observing System and the International Year of the Ocean.

This is most important, in view of the increasing threats of sea-level rise, climate change, pollution, population pressure, excessive fishing, and coastal zone degradation to the finite resource the ocean represents. Without a healthy ocean, the life-supporting system of Earth would be seriously endangered.

I understand that the theme of the International Year of the Ocean is "Ocean, a Common Heritage" I think we will all endorse the view that the programme gives a unique opportunity to increase awareness of the ocean, to demonstrate that the ocean is a vital element of life on planet Earth, and that there is a need to become constructive participants.

This year's programme imposes a special sort of responsibility on Pacific island states and their regional Agencies to bring knowledge and experience, goodwill and resources together in focus, in order to meet the International Year of the Ocean objectives in the most effective way.

Turning to this meeting in particular, anyone dealing with the ocean or whose life is affected by how the ocean behaves should be interested in a Global Ocean Observing System and should be a recipient of the outputs from any Ocean Observing System. We in the Pacific experience change: climate change, changing marine stocks, coastal erosion, reef growth, droughts, to mention a few.

We must accept and admit that we do not fully appreciate the fundamental reasons for change or how to most efficiently mitigate the effects of such change. Without endorsing and participating in data gathering, the chances of modelling or predicting the future becomes progressively less likely.

In launching the International Year of the Ocean in the Pacific and declaring this meeting open, may I on behalf of the Government of Fiji wish you every success not only with your deliberations over the next few days but also with in all your activities during the International Year of the Ocean 1998.

Vinaka Vaka Levu

APPENDIX III

AGENDA

Friday, 13 February 1998

09:00-09:15	Welcome by Alf Simpson, Director of SOPAC.
09:15-09:30	Workshop Objectives - Jan Stel, Chairman of Workshop and GOOS.
09:30-10:00	Opening Ceremony of International Year of the Ocean 1998 by the Minister of Urban Development, Housing & Environment, Honourable Mr Vilisoni Cagimaivei.
10:00-10:30	Coffee
10:30-11:00	Capacity Building Panel Objectives. This will be the general game plan of the workshop. Identify what we want to get out of it. Time to handle questions about the format or agenda. Logistical questions.
1100-1130	GOOS Capacity Building Goals, Jan Stel . Jan will explain how capacity building works using models from other regions, own experience, and suggestions for South Pacific.
11:30-12:00	GOOS Organization, Principles, Bill Erb.
1200-12:30	GOOS Benefits- Rodney Weiher, Chief Economist, NOAA GOOS will result in real economic benefits to region. What are they, value, costs, examples. TAO factor.
12:30-13:30	Lunch
13:30-13:50	GOOS/Inter-relationship Dave Tappin, British Geological Survey. How science can lead to improved management in the coastal areas and health of the ocean considerations.
13:50-14:20	GOOS Applications Jean-Marie Auzende, IFREMER. GOOS related to geology - are there connections?
14:20-15:00	Regional Questionnaire Summary Andrew Butcher, SOPAC Secretariat. Andrew will present the results in summary form attempting to identify trends, differences, priorities.
15:00-15:30	Tea
15:30-17:00	South Pacific Island country statements on GOOS needs, interests, capability. Each country will have an opportunity to present the above and/or their views on GOOS development, organizational concerns, insights relative to their individual interests.
17:00-	Social Event/Cocktail in Forum Secretariat reception area.

Saturday, 14 February 1998

9:00-10:00	South Pacific Island Country Comments: To include problems, interests, needs, GOOS inputs: Representative from each country.
10:00-12:00	Organizational Interests: SPC, SPREP, SOPAC, FFA, CSIRO, NIWA, ORSTOM, IFREMER, USP, JAMSTEC, EW, CENTER VU WELLINGTON, UAUCKLAND, AGS, MLML, BGS.
12:00-13:00	Lunch
13:00-15:00	Working Group to address requirements (monitoring, info/data network, product development) organizational considerations and capacity building needs.
15:00-15:30	Tea
15:30-17:00	GOOS Data Deliver Product Roundtable: Les Allinson & Staff.

Sunday, 15 February 1998

10:00 to 17:00 Barbecue and Volleyball, Nukulau Island.

Monday, 16 February 1998

08:30-12:30 South Pacific GOOS .
Working Groups continue.

12:30-13:30 Lunch

13:30-17:00 Presentation of working group reports by chairmen.

Tuesday, 17 February 1998

08:30-12:00 Finalise South Pacific GOOS Working Group Reports and Recommendations.

APPENDIX IV

COUNTRY REPORTS

COOK ISLANDS

The small islands of the Cook group are scattered over a vast area of the ocean. Hence, the Global Ocean Observing System (GOOS) presents many potential benefits to our nation. Our low lying islands are vulnerable to climate changes of which GOOS can help mitigate. Furthermore, ocean information will assist in better management options during the extreme conditions that occur during El-Niño and La Nina events. The ocean and coastal areas support our marine resources and marine services and products are needed to better manage these resources. The distribution of our tuna fishery appears to be influenced by oceanographic variables. Understanding this relationship may enable improved forecasting of the location and abundance of fish stocks. Offshore exploration and development of our ocean seabed resources will benefit largely from information collected by a GOOS network. In this respect, we should not forget that the Cook Islands also possess large atoll lagoons with mariculture opportunities. The cultured pearl industry is one such successful example. Perhaps GOOS can offer some insights into the complex nature of atoll lagoon waters. This information will be valuable in developing an ecological monitoring programme of the industry and producing better quality products.

FIJI

Most of the 300 or more islands lie at the southern edge of the tropical Pacific Ocean, between 15° and 20°S. Fijian Islands represent a large landmass covering a total area of 18,376 km^2, stretching across 500 km of the Pacific. Most coast lines have fringing reefs. There are several large barrier reefs. Fiji claimed a 200 nautical mile EEZ in 1977. In 1981 Fiji accepted responsibility for Marine Resources in an area of 1,290,000 km^2. Fijian EEZ shares a common border with the EEZs of six Pacific Island nations or territories. More than 40% of the EEZ borders are international waters. It is the eighth largest of the region's eighteen fishing and economic zones, representing 4% of the total area of the region's zones.

In Fiji's inshore waters, Fijians have been fishing for oceanic tunas. Artisanal catches are taken by the commercial fishermen. Also fishing is done around a Fish Aggregation Device (FAD). Other activities include sport fishing for pelagic species. This is conducted by chartered boats at tourist resorts. The types of fishing in Fiji's Ocean involves industrial fishing of tuna by pole and line vessels, EEZ foreign fishing vessels, domestic long lining for sashimi tuna markets, subsistence fishing, aquaculture and mariculture. Marine farming concentrates on growing pearl oysters, clams, prawns and edible seaweeds in protected bays.

Fiji has now prepared a Sustainable Development Bill which when approved, covers various Ministries and Organizations responsible for the Environment (Marine Pollution, Navigation, Fishing, Coastal Zone Management, etc.). The following line Ministries are responsible for some specific activity in Fiji:

- Mineral Resources Department - mining and drilling for oil and other activities in the sea.
- Department of Meteorology - climate, weather, hurricanes.
- Department of Environment - development/marine activities.
- Department of Energy - hydropower, electricity.
- Marine Department - marine navigation.
- Navy - enforcement.

PALAU

Palau has one coastal marine station located 50 miles north of Koror, which is the Republic Centre and location of the Weather Service. The marine station observes and reports to the weather service twice daily (099/1500WTC) the following parameters: sky condition, visibility, wind dir/speed, state of sea height/period of sec, air temperature and tide. The weather service maintains and operates a sea level recording station in the Koror area for the University of Hawaii (UH). The station is also monitored by satellite at the Sea Level Centre in Hawaii. These are the only stations that record marine data in Palau.

The weather service has been approached by Tokyo University about the possibility of observing sea

surface temperature. This would expand marine observations in Palau and would also contribute to the GOOS programme in the Pacific. Palau looks forward to participating with GOOS member nations in any marine-related programmes to help broaden the scope of GOOS programmes to benefit all islands in the Pacific.

PAPUA NEW GUINEA

GOOS related activities are carried out in Papua New Guinea by:

Department of Works and Transport - Office of National Weather Service (NWS)
National Fisheries Authority (NFA)
Department of Environment and Conservation
University of Papua New Guinea

Major users include:

NWS
Office of Civil Aviation
Office of Transport (Marine)
NFA
National Disaster and Emergency Service

And in future:

Dept of Mineral Resources
Dept of Petroleum & Energy

Papua New Guinea requires more coordination amongst its operating agencies. The agencies also require more resources to upgrade facilities and capacity.

NIUE

The Niue Meteorological Service is responsible for synoptic observations and climatology for one coral island - Niue. Assistance is received from the Nadi Weather Forecasting Center in the form of two types of bulletins; the normal forecast and the marine weather bulletins, we amend these bulletins to local conditions. A QFAX system was recently set up which provides satellite images for the Pacific region. A small automatic weather station is used for on-land phenomena. The CLIC6M system is used to store data in Niue.

In relation to GOOS the only project in which Niue is involved is the Sea Level Climate Change at the Flinders University in Adelaide. Niue reports visual observations in the area but without a tide gauge there is no measurement of current, swell movement, sea level and other data. Fax and Email communication is used for relaying observations and data.

SAMOA

The Independent State of Samoa is comprised of 10 islands and is completely surrounded by sea. Despite its limited EEZ, its present and future socio-economic development depends heavily on products and harvests from the sea.

Principal organizations involved with marine and ocean activities are:

Meteorological Division - provides coastal and marine weather forecasts, sea level monitoring and climate activities.

Fisheries Division - all fisheries and related activities, advisory and monitoring.

Ministry of Transport - all shipping, air and marine transportation.

To maximize its potential benefits from its small sea area, improved ocean and coastal observing systems should be in place. Such a system and service can be provided by GOOS.

SOLOMON ISLANDS

Some GOOS-related activities are already carried out by the National Meteorological Service: weather data products for instance, are disseminated to a large number of clients such as the tuna fishing industry, Gold Ridge Mining Industry, forestry farming and ICLAM (a giant clam farming activity). The data used for forecasting is taken directly from the Australian Bureau of Meteorology through a Digital Facsimile Link (DIFACS) as well as from a very limited surface observation network.

The development of GOOS in the region would greatly improve the capacity to improve forecasts for the marine industry and the services sector and hence improve the country's economy. The lack of a good observation network and communication facility is the major problem.

TONGA

The Kingdom of Tonga comprises an archipelago of 171 islands scattered over 700,000 km^2 of territorial water in the South Pacific Ocean. The total land area is about 750 km^2 . The population is some 100,000 people. The Tongan economy is based primarily on agricultural and fishing activities with tourism cropping up as a secondary source of income for this insular nation.

In the early seventies, Tonga extended its economic activities to include mineral resources. Hydrocarbon exploration is on top of Tonga's mineral resource agenda. In the eighties a lot of deep sea marine resources exploration was going on. The AusAID funded sea-level rise monitoring programme installed a tide-gauge in Tonga in 1993. The data is sent by satellite to Flinders University in Adelaide, Australia. During the last 58 months, a 27 mm rise has been recorded in Tonga.

The highest point in the main island of Tongatapu is about 45 m above the mean sea level. More than half of the people residing at the main island settle in coastal areas. Consequently beach erosion caused by sea-level rise and other national disasters pose a threat to the people of this island nation. A Norwegian wave energy project was also partly implemented in Tonga in the eighties.

APPENDIX V

REGIONAL Organization REPORTS

Asia Pacific Network for Global Change Research (APN)

The APN is an inter-governmental organization fostering increased developing country capacity and involvement in global change research. It has a small Secretariat in Tokyo, Japan, and operates through annual Inter-Governmental Meetings, a Steering Group and a Scientific Planning Group. The global change research programmes, the START regional committees and the International START Secretariat have been involved in APN activities since its inception. APN activities embrace all aspects of global change, involving biodiversity, including human population, land use, land cover and land form, toxification of ecosystems by pollution and atmospheric composition contributing to climate change and to tropospheric and stratospheric ozone problems.

The value of APN to the research community is that it is regional in scope, provides direct links with governments and a means of participating in the global change research programmes. There is no single or simple approach taken in APN activities, as they must accommodate the great diversity of situations in the region. There are many priorities common across the whole of the Asia-Pacific region and there are linking phenomena such as ENSO. The APN is also concerned about the need to improve communication systems and networks in the region. It, however, is not a funding agency, but limited funds have been available for some workshops and projects and for people to attend relevant international meetings. At the moment most countries in Asia and Australia and New Zealand have participated in APN activities. There is interest in increasing participation, including from the Pacific area. This could be involvement in APN meetings and projects, or selectively in specific activities of particular interest. Countries could participate individually or through a relevant regional organization.

Forum Secretariat

The Forum Secretariat was established over 26 years ago by the South Pacific Forum, the highest ranking political body in the region, comprising the Heads of the 16 independent and self-governing nations.

In 1995 at the annual meeting of the South Pacific Forum, the Forum Secretariat’s functions and responsibilities were reviewed and restructured to reduce duplication with other regional organizations and better respond to the needs of its members.

As a consequence the *vision* of the Secretariat was redirected to "provide its members with prompt access to the most effective policy advice, programme coordination and advocacy services on issues within our mandate".

Our *mission* then is focussed on "supporting our members to enhance their economic and social well being by fostering cooperation between governments and between international agencies, including representing the interests of our members".

Also as a consequence of the realigning of the Secretariat’s functions, all technical programmes previously handled by the Secretariat such as in energy and communications were to be transferred/absorbed within other regional organizations.

Our restructured organization focuses its coordination and policy advisory *responsibilities* on issues pertaining to trade (TID), economic development (D&EPD) and international relations (PIA).

How does the Forum Secretariat contribute to the goal of Sustainable Development?

Of particular importance to this meeting is the role of the Development and Economic Policy Division of the Secretariat. One of its principal responsibilities is to "facilitate the coordination of sustainable development issues across key sectors and among regional organizations”.

This responsibility we are discharging through a number of mechanisms, including:

(a) under the Pacific Regional Strategy;
(b) ongoing liaison with regional & multilateral agencies;
(c) by providing policy advise in sectors such infrastructure, natural resources & social issues of a regional character, and ***which complements the activities of other specialised agencies;*** and
(d) through the provision of policy & institutional support to the South Pacific Organizations Coordinating Committee (SPOCC).

University of the South Pacific

The Marine Studies Programme of the University of the South Pacific is to provide necessary opportunities for Pacific Islanders to understand, conserve, develop, manage and utilize their living and non-living resources. The Marine Studies Programme administers the Marine Affairs Programme, the Institute of Marine Resources located in Honiara, Solomon Islands, and the Atoll Research Programme located in Tarawa, Kiribati. Research is a principle focus of the Marine Studies Programme and includes two broad programmes; one on coral reefs and the other on atolls. The current research areas are: post harvest fisheries, fisheries biology, coral reef ecology, marine sedimentology, marine phycology, marine natural products, pollution monitoring and integrated coastal zone management.

Marine studies also offer two Bachelor Degrees specialising in marine topics:

- a Bachelor of Arts (Marine Affairs);
- and Bachelor of Science (Marine Science).

Postgraduate studies in marine studies are available for Postgraduate diploma, MSc, MA and PhD. Postgraduate students conduct research in various field of marine science such as marine pollution, marine ecology, fisheries biology and marine natural products.

The Marine Studies programme has a newly built world-class marine facility for research and teaching. The new complex has teaching laboratories, seawater tank research area, post-harvest fisheries laboratories, lecture theatres, computer laboratories and on-site accommodation.

Secretariat of the Pacific Community

The oceanic and coastal fisheries programmes of the Secretariat of the Pacific Community (SPC) use many sources of oceanic environmental data in the analysis and development of models for fisheries. The results of these studies allow for scientific advice to member countries possibly regarding the status of the stocks of the exploited marine resources in their EEZ. A good example is given by a study of the relation between tuna and the environment. Recent work (Lehodey et al. 1997: *Nature* 389) demonstrates that apparent spatial shifts in the skipjack population are linked to large zonal displacements of the Pacific "warm pool" that occur during ENSO (El Niño - Southern Oscillation) events. Such a relation can be used to predict the area of highest skipjack abundance -within a fishing ground extending over 6,000 km along the Equator- with the help of an Oceanic General Circulation Model (OGCM). This model is also able to forecast El Niño events.

Outputs of OGCM are in fact already used in the development of a spatial stock dynamic population model based on a habitat index. That index combines the effects of different environmental parameters which influence the tuna behaviour (e.g. temperature, oxygen concentration). The presence of food is considered as a major factor to explain tuna distribution. A coupled physical-biological model is also developed to simulate the large scale distribution of a surface tuna forage index. These examples show that SPC will immediately benefit from GOOS as it will provide improved ocean observations, data assimilation and the diffusion of these data. The spatial stock dynamic population model based upon environmental data could be proposed as a pilot project for a Pacific Island GOOS. SPC can also contribute to GOOS by providing outputs of its own fisheries models. Some of this information is already available through the SPC web site.

South Pacific Applied Geoscience Commission

The SOPAC Governing Council has recently approved a new organization structure as part of a review

of the future role and direction of SOPAC. Within the new organization structure, the work programme areas of direct relevance to GOOS include activities within the Ocean, Coastal, Information Technology and Human Resource Development Units.

Recently completed, ongoing and planned future activities were reviewed including:

- the completed ocean wave energy assessment project in Cook Islands, Fiji, Samoa, Tonga, Tuvalu and Vanuatu;
- ongoing beach profile monitoring in Tuvalu, Kiribati, Marshall Islands and the Federated States of Micronesia;
- TRITON buoy deployment in the Federated States of Micronesia by mid 1998;
- ongoing oceanographic data collection during research vessel cruises;
- ongoing nearshore, lagoon and coastal surveys.

Presentations were also given on: (i) SOPAC's new capability in lagoon modelling studies, which should be of value in pollution monitoring; (ii) SOPAC's developing capability in information technology including data storage, data handling (GIS), and SOPAC's data dissemination and communications capability.

UNESCO Apia (Excerpt from letter sent by Edna Tait, Director, UNESCO, Apia)

"First let me emphasise our full support to the GOOS endeavour. We are only too aware that many Pacific people and Pacific economies depend on marine resources and marine transport for their well being. The effects of marine pollution, coastal erosion, sea level rise and changes in climate are potentially devastating for coastal communities. The role of GOOS in providing the data to assess, understand and predict these effects is vital. We wish you well as you work out how to set up viable GOOS components in the Pacific.

How can the UNESCO Office Apia help GOOS? In my *representative role* I work very closely with the National Commissions for UNESCO in the fourteen Member States of the Pacific. I regularly report to them on UNESCO activities in the region and they consult me on their input to the UNESCO governing process. This exchange helps maintain political support for UNESCO activities and for continued membership. For IOC and GOOS to benefit from this, it is most important that my staff and I are kept fully up-to-date on all plans for GOOS activities in the countries that we cover.

Through our office, GOOS could take advantage of our *networking* in a number of fields. We have close links with leaders in Pacific education and the media. We work closely with the regional organizations. We have particular interest and experience in relating technical issues to the political, social and cultural realities of the Pacific to achieve sustainable ways of living for example, we are starting new community activities under UNESCO's CSI project on 'Environment and development in coastal regions and in small islands'. We would be happy to use our experience and contacts to help GOOS.

I particularly want to mention our special inter-sectoral project "Youth leadership for a culture of peace in the Pacific". This will equip young people to meet the challenges of a world in rapid change. Many of these challenges, like climate change, conserving the environment, managing natural resources and facing disasters, have links to the ocean. Preparations are well in hand for the major regional youth workshop to be held in Brisbane, Australia in May 1998. I hope we can arrange input on ocean problems and how IOC and GOOS can help with them. "

ORSTOM

The presentation provided to the Workshop focuses on El Niño phenomenon which is the result of fluctuations in the position and heat content of the huge heat reservoir located north of New Guinea; the so-called "warm pool". When the warm pool drifts eastwards, droughts appear in the western part of the Pacific Basin (PNG, Australia), floods in the eastern part (Chile, Peru, California) and tropical cyclones in the central (French Polynesia) part.

An index of this phenomenon, called the Southern Oscillation Index (SOI), has been calculated. The 1937 to 1997 time series of this index shows that El Niño occurs irregularly but with an average of about three years.

El Niño was studied in different ways. During TOGA (1985-1994) cruises have been carried out twice a

year, along 165°E from 5°N to 20°S. These cruises made it possible to establish a reference for the phenomenon and, also, underpinned the need for long term observations. During TOGA the observing system for the Pacific equatorial basin included drifting buoys, the TAO network, ships of opportunity and satellites.

The observing efforts of the ORSTOM Centre in Noumea was mainly devoted to a ship of opportunity network. Some fifteen merchant ships were permanently equipped with XBTs (expendable bathy-thermograph) systems. From 1985 to 1993, some 78,000 temperature profiles down to 700 m were recorded. By this it was possible to monitor some characteristics of the Pacific intertropical ocean related to El Niño such as the depth of the lower part of the warm surface waters. Based on this study the monitoring effort needed for forecasting through modelling was determined. The 97 El Niño event is a good illustration of the present forecasting skills. It can also be used to validate the present observing system.

ORSTOM will continue its efforts on ocean observations by a ship of opportunity network and by introducing new equipment. At present, XBT data are transmitted in real time through the ARGOS systems, and moreover, some ships are equipped with a thermosalinograph which continuously record sea surface salinity. Recent studies have shown the importance of sea surface salinity as a tracer of precipitation. These observations are also important for modelling purposes. The ORSTOM Centre in Noumea developed a thermosalinograph which is highly reliable. A network of fixed stations with thermosalinograph will also be implemented in the south Pacific Islands region.

Satellite instruments will be used more extensively. Altimetry data collected by Topex-Poseidon (US-French satellite) are used to calculate anomalies of the surface currents in the equatorial Pacific Basin. A complete map of these anomalies can be obtained within 15 days. A NOAA satellite receiving station was installed in the ORSTOM Centre of Noumea one year ago. It offers the possibility to map SST around New Caledonia (about 1000 km apart) once a week with a ground resolution of 1 km.

SPREP

SPREP, the South Pacific Regional Environment Programme, is interested in the development of GOOS as a decentralised but co-ordinated network. Programme areas that may be used to develop GOOS in the Pacific relate to climate change and sea level rise, climate ocean interactions, coral reef monitoring, marine pollution and information clearinghouse. The activities under the Climate Change programme primarily deal with the science and impacts of climate change. Key examples are the *South Pacific Sea Level and Climate Monitoring Project* which monitors and measures sea level rise with 12 satellite linked monitoring stations across the region and the *Atmospheric Radiation Monitoring* Project which assesses and monitors the amount of solar radiation and role of cloud types in global warming. Various meteorological service projects have been set up to upgrade and provide training in the use of meteorological instruments, data archiving and strengthening of regional cooperation between meteorological directors as well as the WMO.

The *Global Coral Reef Monitoring Network,* a module of the GOOS, is in the early stages of development in the Pacific region. Nodes are being established to assess the status and trends of coral reefs and determine how and where reef damage is occurring, the causes of the damage and what can be done to prevent coral reefs declining. Other SPREP programmes such as the *SPREP IMO Strategy for the Protection of the Marine Environment in the South Pacific Region* have recently been initiated to characterise the water quality of ports, monitoring of ship sourced marine debris and monitoring of introduced marine species. Water quality is also a significant component of the *Global Programme of Action for the Protection of the Marine Environment from Land Based Activities* and the *GEF International Waters* project.

In terms of information management and dissemination, SPREP works with member countries to develop the *State of the Environment (SOE) Report*. The SOE is a framework that supports the generation of environmental indicators, helps integrate multi-sectoral data, identifies areas where data is inadequate and highlights the weak links in institutional networks that need strengthening. SPREP is also a collaborating institution for the *Pacific Environmental Natural Resource Information Centre*. The Centre supports the generation, analysis and dissemination of information to SPREP member countries for environmental assessment.

APPENDIX VI

GOOS WORKING GROUPS

The meeting participants were divided into two Working Groups : Group A was chaired by Freddy Ferah (Solomon Islands), and Group B was chaired by Savae Latu (Tonga). Dave Tappin (BGS) and Nelson Quinn (APN) acted as rapporteurs for Working Groups A and B respectively.

Group A : Organization & Development Considerations

Freddy Ferah	Solomon Islands (Chair)
Dave Tappin	BGS (Asst Chair)
Ben Ponia	Cook Islands
Subodh Sharma	Fiji
Stevie Nion	Papua New Guinea
Tim Pickering	USP
Patrick Lehodey	Pacific Communities
Rodney Weiher	NOAA GOOS
Alf Simpson	SOPAC
Robert Smith	SOPAC

Group B : Capacity Building in Relation to GOOS

Savae Latu	Tonga (Chair)
James Aston	SPREP (Asst Chair)
Hiab Mesubed	Palau
Nelson Quinn	APN
Faama Utalo	Niue
Faatoia Malele	Samoa
Veikila Vuki	USP
Russell Howorth	SOPAC
Andy Butcher	SOPAC
François Jarrige	ORSTOM

APPENDIX VII

LEGO FOR CAPACITY BUILDING

CONTRIBUTION
for the Fiji Workshop Report

Dr Stel introduced the 'Lego for Capacity Building' concept. He said that the implementation of both UNCED's programme of actions listed under 'Agenda 21' and UNCLOS's various provisions reflected a number of articles on the rights and obligations for countries for, among other things, the exploration and exploitation of marine resources in the Exclusive Economic Zone (EEZ) is a major policy pull for the development of marine science and technology in the next century. The cost to implement Rio's 2500 actions is an estimated US $120 billion per year. This is two times the present official development aid (ODA) from the member countries of the Organization for Economic Co-operation and Development, OECD. However, since 1970 the ODA effort of the OECD has more or less remained at the same level of some 0.3% of GNP. Only four countries (Denmark, the Netherlands, Norway and Sweden) of the Development assistance Committee of the OECD have consistently met the the UN accepted 0.75 target since 1970. The major funding mechanism for UNCED is the Global Environment Facility (GEF), a joint programme of the World Bank, UNEP, and UNDP. The first phase of GEF (1992-95) was funded with some 1.6 billion US $. For the second, restructured phase, a US $2 billion has been committed by 26 countries, including 8 developing ones.

Dr Stel also introduced the Global Ocean Observing System, (GOOS) which is a joint effort of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). GOOS will provide long-term oceanographic data based on a globally co-ordinated strategy. GOOS will be based on the results of research programmes which identify strategies, modelling needs, and new technologies. He said that the system will be built as far as possible on present global, regional, and national systems through an integrating process. GOOS will consist of a number of modules to address specific objectives such as (1) Climate Assessment and Prediction, (2) Marine Living Resources, (3) Coastal Zone Management and Development, (4) Health of the Ocean, and (5) Marine Meteorological and Oceanographic Operational Services. It will provide a reliable description of the state of the ocean, which will be regularly updated and will serve as an input to a wide range of operations, such as coastal protection, marine resource exploitation, safety, monitoring the marine environment, and pollution control.

In Dr Stel's opinion the Seawatch system offers a unique instrument for capacity building in relation to GOOS. Seawatch is an on-line, off-the-shelf environmental monitoring and surveillance system. Seawatch was developed to provide an operational marine environmental surveillance and information system for the management of regional seas. It consists of the following modules: data acquisition; data storage; analysis and presentation; environmental modelling and forecasting; distribution of data; forecasts and user relevant information. The data acquisition module includes a network of moored marine environmental data collection buoys. The Seawatch buoy is a vertical stabilised automatic buoy. The buoy is presently equipped to collect the following parameters: air pressure, air temperature, wind speed and direction, wave parameters, sea current, vertical temperature and salinity profile, oxygen saturation, nutrient contents, particle or algae concentrations and radioactivity. As the buoy is made as a flexible system, suitable new sensors could be included as they become operational. The buoys also include data logging equipment, on-board processing (data analysis, quality control) and a data transmission system. The data are transmitted through a two-way satellite communication system (Argos or Inmarsat) to a shore station.

In the shore station the data are further checked, analysed, distributed and stored. The buoy data are integrated with information from other sources as input to various numerical models, such as current, transport and oil slick models. Results from these models are combined with information from the buoy network to generate user-tailored forecasts. One important aspect of the system is the use of the data with operational fore-casting models for ocean currents, pollution transport and impact assessments. All data and results from the various models, are collected in a processing centre where the results are quality checked, and thence used for monitoring and forecasting purposes. This centre could be compared with processing centres in weather bureaus.

Seawatch provides marine environmental information quickly, thus giving us the opportunity to make informed decisions when crises occur. The Seawatch forecasts and environmental data are distributed to clients whose livelihood depends on reliable information from the marine environment, such as: public authorities, aquaculture/fish farming, commercial fishing, tourist industry, research institutes, navy and coastguards. The Seawatch system is now operative in Norway, Thailand, India, Indonesia, Spain and Bangladesh, will be installed

in Morocco and Greece and has aroused considerable interest in coastal states all over the world (Sweden, The Netherlands, Italy, Mexico, China, Phillipines, the Republic of Korea, USA, etc.).

Dr Stel explains that no clear-cut procedures exist for the development and strengthening of a marine research capability. A number of elements can, however, be identified at different levels. These are: human resources or the level of the individual scientist (microlevel), the necessary institutions (mesolevel) and an enabling national environment which is willing to support and sustain a marine research activity (macrolevel). These levels must be seen in relation to each other and as expressions of a single research system.

On the level of individual scientists, the following capabilities and requirements are important:

- the capacity to formulate a research problem and to carry out the entire research cycle (including transferring the results to the public at large, policy makers and politicians);

I. appropriate qualifications through further academic training (MA and PhD);
II. motivation, and the opportunity to undertake research;
III. external contacts (national and international), networks, and membership in professional associations;
IV. access to information (libraries, databases, etc.) and scientific equipment;

At the level of the institutions, capacity is needed for:

- the development of a research policy; the development and management of research projects and programmes (priority-setting, research co-ordination, monitoring, and the publication and dissemination of results);

I. the acquisition and management of research funds;
II. the training of scientists, and staff development;
III. the provision of adequate incentives and working conditions for scientists (time, financial resources, salaries, libraries, laboratories, equipment, funds for travel, etc.);
IV. a network of external contacts, which provide links to other research centres, funding agencies, voluntary organizations, business, government bodies and;
V. monitoring and evaluation.

An 'enabling national environment' concerns such aspects as:

- commitments at the national level to a policy and a set of measures aimed at promoting and maintaining a marine research capacity, including adequate and sustained funding of institutions, infrastructure and programmes;

I. mechanisms for steering marine research towards topics that are of relevance to the economic, social, cultural and political development of a society, and possibilities for various groups to articulate their interest;
II. links between research, policy, and practise (involvement of research users in prioritising, implementing and disseminating research);
III. a professional environment, including formal associations, standards, mobility, incentives, and a research tradition.

Some countries have succeeded in bridging the knowledge gap by developing a research policy leading to heavy investments in a national research capacity. The economic success of the Republic of Korea, Singapore and Taiwan is partly due to their effort to promote R&D for the benefit of industrial development. These countries did not blindly invest in a science capability in the belief that this would automatically lead to economic growth. Their science and technology policies were based on such factors as international market demand, foreign technology and foreign investment. In a policy research report (1993) of the World Bank on the East Asian miracle, it is again demonstrated that focused investments in a science capability is one of the policy interventions leading to the extraordinary growth of the eight high performing asian economies (Japan, Hong Kong, Republic of Korea, Singapore, Taiwan, Malaysia and Thailand). As a result of this rapid shared growth, human welfare has improved dramatically. The East Asian miracle is often seen as a promising paradigm for other developing countries. But in many developing countries government expenditure on education and research has been curtailed since the early eighties. As a consequence these sectors have become highly dependent on development aid. The development and support of any science capability has become a long-term goal for most developing countries and, even in coastal states, the priority given to the development of a marine science capacity is low and lagging far behind the traditional donor activities in medicine and agriculture.

Although the responsibility for the development of a marine science capacity rests ultimately with each individual country, countries with a well-developed marine science capacity have a responsibility to assist in the development of similar capabilities in less fortunate countries. The Netherlands Partners in Marine Science

programmes respond to the present lack of co-ordination and co-operation in this sector. While formulating co-operative scientific research, the partnership programmes are essentially based upon the mutual interest (learning by doing) of the scientific communities of the partners in the industrialised and southern countries. As part of a long-term (10 years) bi- or multilateral commitment for joint scientific research programmes, capacity building activities are an intrinsic part of the partnership programmes. While funds for the scientific component of the programmes should be granted by relevant national science foundations, the funding for the capacity building component is sought through national and international ODA organizations as well as sources such as the European Union, World Bank, Asian Development Bank, African Development Bank, GEF, etc. These partnership programmes form a flexible instrument to integrate capacity building activities at the individual, institutional, national and regional level. Within a partnership donors can integrate their activities by 'adopting' an institution or country. The linking with science foundations finally, guarantees the transfer of a high quality product.

The partnership model is also supported by the OECD in its DAC Development Partnership Policy Statement of 1995. "Acceptance of the partnership model, with greater clarity in the roles of partners, is according the OECD, one of the most positive changes we are proposing in the framework for development co-operation. In a partnership, development co-operation does not try to do things for developing countries and their people, but with them. It must be seen as a collaborative effort to help them increase their capacities to do things for themselves. In a true partnership, local actors should progressively take the lead while external partners back their efforts to assume greater responsibility for their own development".

APPENDIX VIII

GOOS ATTACHMENTS

GOOS...

- **is an integrated, scientifically-based system for the coordinated monitoring and subsequent prediction of environmental and climatic changes nationally, regionally, and globally.**

- **includes long-term systematic measurements of physical, chemical and biological properties of the ocean and the analyses and distribution of data and data products for environmental monitoring.**

- **is being implemented by national facilities and services.**

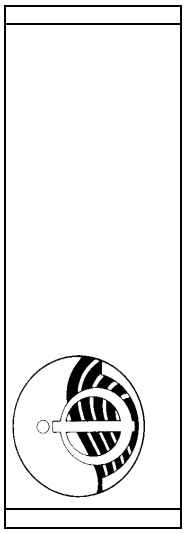
- **will be coordinated by the IOC in co-operation with WMO, UNEP and ICSU.**

APPENDIX VIII

GOOS ATTACHMENTS

GOOS Strategy

- **Identify Stakeholders, assess needs.**
- **Define scope of each module.**
- **Plan and design *ad hoc* observing system.**
- **Initiate operational demonstrations built on existing systems.**
- **Integrate on regional scale.**
- **Develop resources, promote long term commitments.**
- **Extend globally.**
- **Continuously assess and improve the system.**



APPENDIX VIII

GOOS ATTACHMENTS

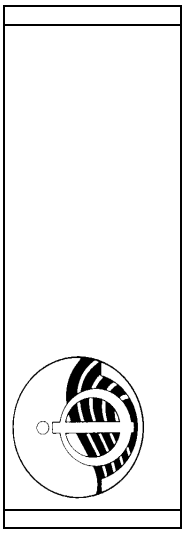
MAJOR GOOS OBJECTIVES

The major objectives of GOOS are:

- **The monitoring, assessment and prediction of environmental and climate changes.**

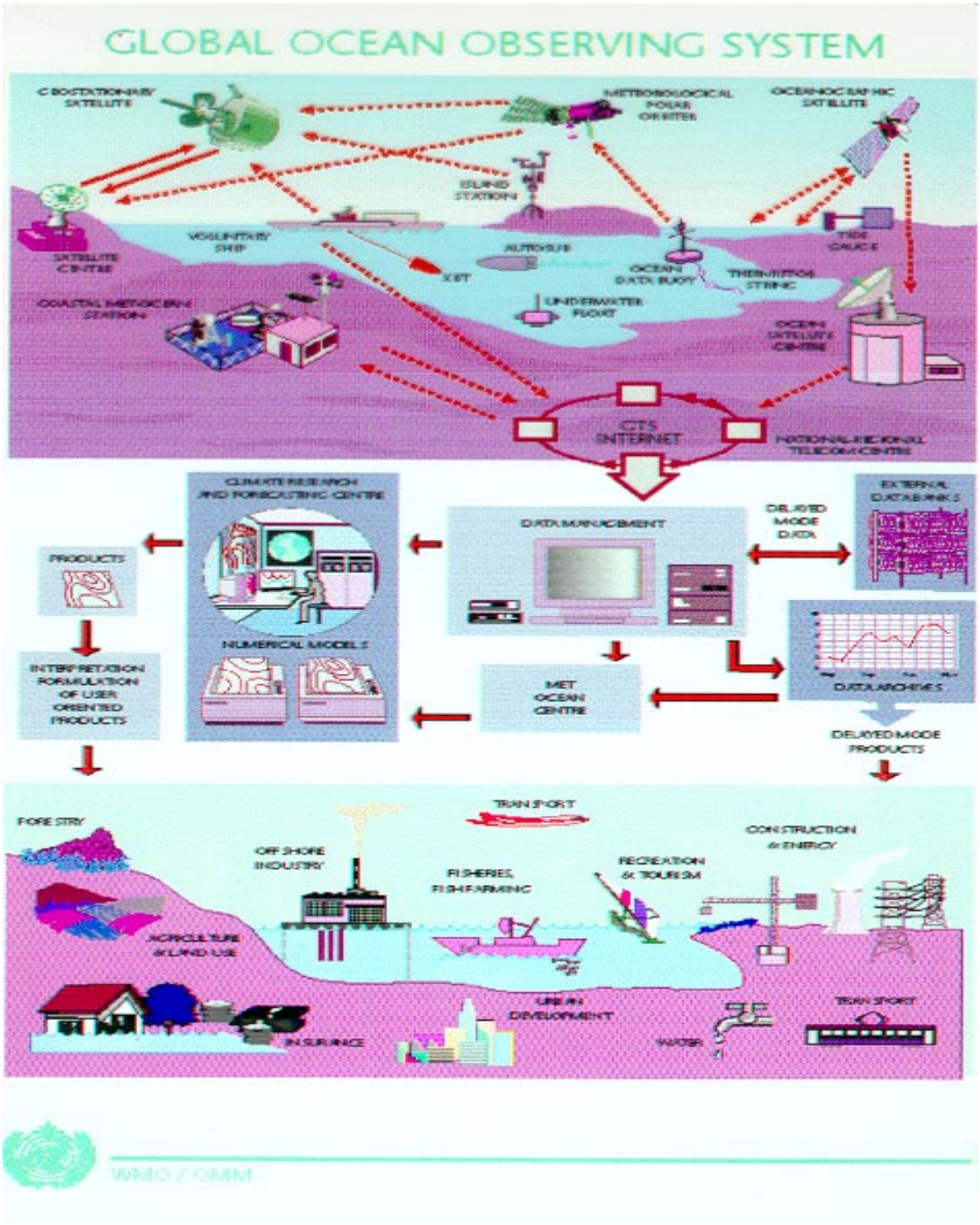
- **The production and exchange of data and data products required by a broad spectrum of end-users for use in assessing ocean resources, protecting the marine environment, managing the coastal zone and for use in other economic applications.**

- **Fostering research towards improving our knowledge about the global system, developing ocean modeling, applications and products as well as new technologies.**



APPENDIX VIII

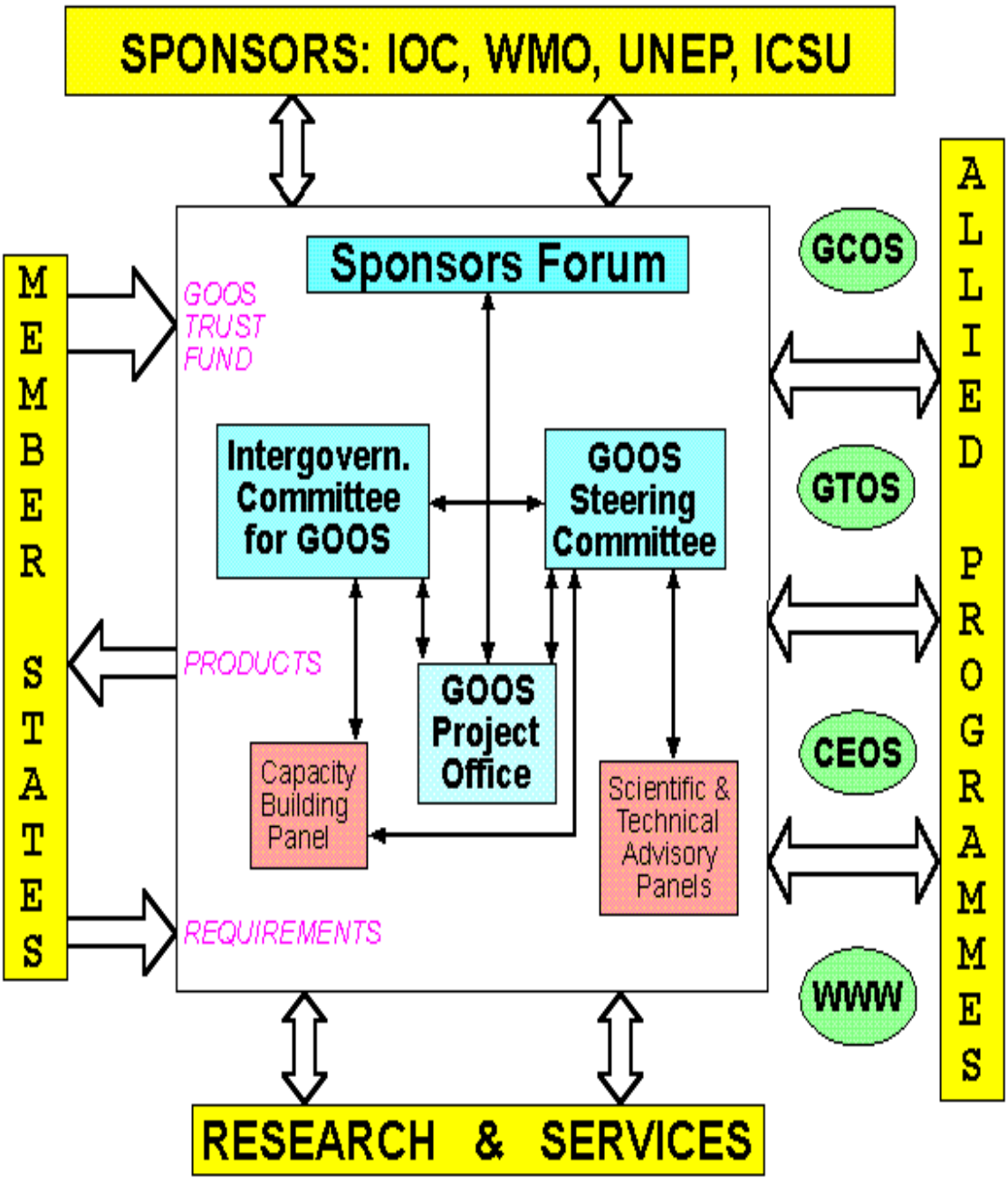
GOOS ATTACHMENTS



APPENDIX VIII

GOOS ATTACHMENTS

GOOS ORGANIZATION



APPENDIX IX

LIST OF ACRONYMS

AIMS	Australian Institute for Marine Science
APN	Asia Pacific Network for Global Change Research
BGS	British Geological Survey
CRC	Coastal Resources Center (University of Rhode Island, USA)
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CZM	Coastal Zone Management
DAC	Data Assembly Center
DIFACS	Digital Facsimile Link
EEZ	Exclusive Economic Zone
ENSO	El Nino Southern Oscillation
EU	European Union
EuroGOOS	European GOOS
FAD	Fish Aggregation Device
FFA	South Pacific Forum Fisheries Agency
GEF	Global Environment Facility
GIS	Geographic Information System
GMS	Geostationary Meteorological Satellite
GOOS	Global Ocean Observing System
HIG	Hawaii Institute of Geophysics (USA)
IC	Implementation Committee
ICLAM	Giant Clam farming Activity
ICSU	International Council of Scientific Unions
IFREMER	Institut français pour l'exploitation de la mer
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IPCC	Intergovernmental Panel on Climate Change
JAMSTEC	Japanese Marine Science and Technology Centre
KORDI	Korea Ocean Research and Development Institute
NEARGOOS	North-East Asian Regional GOOS
NFA	National Fisheries Authority
NGO	Non-Governmental Organization
NIWA	National Institute of Water and Atmospheric Research Ltd (NZ)
NOAA	National Oceanic and Atmospheric Administration (USA)
NTF	National Tidal Facility
NWS	National Weather Service
ODA	Oversea Development Aid
OECD	Organization for Economic Co-operation and Development
OGCM	Oceanic General Circulation Model
ORSTOM	Institut français de recherche scientifique pour le développement en coopération
PACON	Pacific Congress on Marine Science and Technology
SLR	Sea Level Recorder
SOE	State of the Environment
SOI	Southern Oscillation Index
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
SPOCC	South Pacific Organizations Coordinating Committee
SPREP	South Pacific Regional Environment Programme
SST	Sea Surface Temperature
START	Global Change System for Analysis, Research and Training
TAO	Tropical Atmosphere Ocean Array
TOGA	Tropical Ocean and Global Atmosphere (WCRP)
TOPEX/POSEIDON	Ocean Topography Experiment/Poseidon (NASA-CNES Altimetric Mission)
UFP	French University of Pacific
UH	University of Hawaii
UNCED	United Nations Conference on Environment and Development (Brazil, 1992)
UNCLOS	United Nations Convention on the Law of the Sea (Montego Bay, 1982)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USP	University of the South Pacific
WMO	World Meteorological Organization
XBT	Expendable Bathythermograph