Official History of ISD Operations at ODP

Pre-Leg 100

- The ODP in-house shore based computer capability began in August 1984 with the arrival of 2 DEC VAX 11/750s and 50 DEC PRO350 microcomputers. From April until August, ODP computer support had been provided through the use of a TAMU Geophysical VAX 11/780 using ASCII terminals over dedicated telephone lines. The university committed resources for the new ODP from day one. System 1032 was selected as the database system for ODP scientific data, MATMAN for inventory control, and ODASI for the ODP contact list. The major difference between DSDP and ODP data collection was that DSDP used paper forms to collect and store data while ODP, from the onset, saw the need to move from paper (analog) to digital.

Leg 100 through Leg 113

- The DEC PRO350 microcomputers were connected to the VAX's via asynchronous connections. Software development was done on the VAX systems while the PRO350s were used primarily for standalone word processing and data entry into CORELOG and SAM.
- The shipboard systems, consisting of two VAX 11/750's (one primary and one spare) and 49 PRO350's, were installed on the *JOIDES Resolution* prior to the start of Leg 100. When the ship sailed from Pascagoula, Mississippi on Leg 100, the VAX system and 49 microcomputers were functional. The microcomputers were connected to the VAX via hardwired asynchronous lines. Initially supported applications consisted of the CoreLog program, used to enter core data into the database, and print tracking reports and labels for the core sections. During the shakedown cruise, Leg 100, the CoreLog video display program was used to display information on closed circuit televisions. Other applications were developed and added during subsequent legs.
- Inmarsat A was installed on the ship during Leg 102. This allowed phone calls to be made to shore.
- ODP continued to develop and enhance the initial software applications. Various S1032 databases were developed for various labs (e.g. LEGS) to automate reports required by Publications.
- ODP acquired first Macintosh for use at ODP headquarters.

Leg 114 through Leg 118

- The first Macintosh was placed into service on the ship during Leg 114.
- PMAIL system based on VAX MAIL was developed so that shipboard personnel would have a method of contacting families on a weekly at-cost basis. Before that only ham radio on some cruises was available for personal communications, otherwise there was no contact for 2 months. It was installed on Leg 118.

Leg 119 through Leg 123

- As shore based computing increased, the VAX 11/750 systems were complemented by a DEC VAX 8350 which was configured as a VAX Cluster to permit sharing of peripherals and disks among all the DEC computers.

- In order to meet the request of scientists for IBM PC compatible computers aboard the ship, several systems were installed on shore to acquaint ODP personnel with the systems.
- During Leg 121 port call, 20 IBM PC compatible systems with accompanying word processing and spreadsheet software were installed onboard the JR while 18 of the PRO350 systems were removed. WordPerfect, which ran under all ODP operating systems, replaced CT*OS as the official word processing system, as required by the Publications Group.
- During Leg 121 port call, it became apparent that many scientists wanted Apple Macintosh systems to be added to the shipboard, computing environment.

Leg 124 through Leg 129

- During Leg 124, two MicroVAX 3500's were installed and configured along with the VAX 11/750's in a Local Area VAX Cluster (LAVC).
- Several Macintosh computers and laser printers were donated by Apple Computer Corp. and installed on the shore for training and later installation onboard the ship. These units, along with several PC compatible units, were placed on an AppleTalk Network.
- Approximately ten Macintosh systems with accompanying laser printers and networked with AppleTalk were installed onboard the Resolution during Leg 125.
- The IBM PC compatible units aboard ship were also added to the AppleTalk network.
- The VAX acted as a fileserver for the AppleTalk network and Apple computers became the system of choice among the scientists.

Leg 130 through Leg 135

- The technology used at ODP and on the drill ship was brought to the East Coast Repository and West Coast Repository during Leg 132. Each was provided with computer upgrades that included a MicroVAX 3100, PC compatibles, Macintoshes, and a laser printer. These units were networked together at each location. The MicroVAX's were loaded with the System 1032 DBMS and the Corelog and Sample databases. The microcomputers were provided with a complement of software such as word processors, spreadsheets, etc.
- Additional Apple computers were added to the shipboard and shore based computing environment.
- Existing PC's were upgraded with increased memory and larger disk drives and additional PC's were installed.
- Ethernet support was added at ODP headquarters in order to meet increased network usage. Apple computers and PC compatible computers were attached to the new Ethernet network.
- The Visual Core Description (VCD) program ran on the Mac computer.
- The shipboard system managers were transferred to the Logistics Group in time for Leg 135.

Leg 136 through Leg 141

- On Leg 137, the IBM PC compatible units were upgraded with 386 motherboards. Microsoft Windows 3.0 was installed on each upgraded PC in order to provide a more user friendly, graphical interface.
- On Leg 141, a major network upgrade was made to the shipboard environment. A 10 megabits per second Ethernet was built to relieve the network congestion that had resulted from increased usage. The network backbone was Thick-net Ethernet while the desktop machines were wired with 10Base2 Ethernet (coaxial cable). At about the same time, Ethernet was added at ODP/TAMU headquarters in order to meet the increased network usage.
- An Apple file server with a large disk was added to permit better and faster sharing of files among all shipboard users.

Leg 142 through Leg 146

- Last DEC PRO350 microcomputers were taken out of service and sent home.
- The necessity of sailing two system managers on each leg became apparent because of proliferation of computer hardware and software on the ship.
- Older Mac computers were replaced by newer models that included increased memory and disk capacity.
- Upgrade of IBM PC compatible units from 386-based CPUs to 486-based CPU began. The upgrades occurred on an as needed basis.
- Additional PC's and Mac's were attached to the network, as needed which stressed the existing network.
- SUN Unix workstations were acquired for shore based usage and training prior to putting any of the systems on the ship.
- During Leg 146, the Information Services Department (ISD) was created under the direction of John Coyne. The department could provide equal service to all other ODP departments. By organizing data processing efforts under one roof, efforts could be focused on customer service on shore and on the ship. Generally, data processing services have continuously improved and excelled since the reorganization. ISD became an equal partner in the day to day operations of ODP allowing it to compete for resources at the same level as other departments.

Leg 147 through Leg 152

- The need for Unix-based workstations became evident through the scientists' needs to collect and process seismic data. At the time, PC and MAC computers were not up to the task, but Unix workstations were. Thus, during Leg 149, SUN Unix workstations were placed on ship to become a permanent part of the ODP shipboard and shore based computing environments.
- The shore based desktop network was migrated from AppleTalk to Ethernet and Ethernet-based laser printers were added.
- New capability was provided to permit automatic collection and distribution of e-mail using the Internet. The mail was created using VAXmail and transported via SMTP and file transfers back to shore.

- A new, higher speed, satellite system (Inmarsat A) was added during Leg 150 and necessary changes were made to computer software to facilitate higher transfer speeds for e-mail.
- Additional equipment was sent to upgrade the MicroVAX 3500s on Leg 152 in order to be able to remove the VAX 11/750s from service. The equipment was installed and the VAX 11/750's were removed from service, but kept at the ready on the ship in case a problem occurred.

Leg 153 through Leg 158

- VAX 11/750's returned to shore after the MicroVAX 3500s performed without problems.
- The ship desktop network was migrated from AppleTalk to Ethernet.

Leg 159 through Leg 164

- The first "groupware system" (cc:Mail) was introduced to the ship and shore.
- Novell was introduced to the ODP network environment in response to the science community's mandate that the e-mail system be used across all operating systems.
- Leg 162 saw Russ Merrill take the helm of ISD. While he was tasked to oversee the implementation of the Janus project, a JOI advisory committee actually assumed responsibility for the development of the Janus system. JOI worked very closely with Tracor, the software development contractor for the Janus project.
- Planning for an official ODP web site commenced.

Leg 165 through Leg 170

- A DEC Alpha cluster was installed during Leg 165 to hold the Janus database system.
- The last Appleshare server was retired.
- Mac and PC compatible file sharing was exclusively handled by Novell Netware.
- AppleTalk cabling soon disappeared from the ship except for a couple of strands left behind so that old MAC laptops could connect to the Ethernet network.
- A fiber optic cable (network backbone) was run between the computer equipment room and the labs and provided 10Mb network service on Leg 170. The installation of the fiber cable set the stage for future network upgrades and allowed the 100Mb service found on the ship today.

Leg 171 through Leg 176

- The Janus project began during Leg 157. The work was done in an accelerated mode. The new system officially went on-line on LEG 171A and full production began on Leg 173. Implementation of Janus required that ODP migrate to a DEC ALPHA cluster running the TRU-64 UNIX operating system and the Oracle relational database management system (RDBMS). It effectively marked the end of S1032 and the VAX's at ODP in regards to scientific data. The project's success stemmed from its three-way management structure: a steering committee to represent users, Tracor Corp. to develop the best system they could, and ODP to ensure the system was robust and included all necessary utilities. Working together (and, at times, strongly guarding their own interests), they developed an excellent data management system.
- Tracor sailed programmers for several legs before ODP took full responsibility.

- The ship network backbone was activated and the slow process of replacing Thin-net cables with twisted pair cables began.
- Janus integrated the data collected on the ship and made it available to the ship's participants in near real time.
- ODP developed a large number of web queries to complement the data collection and storage capabilities of Janus. Since Leg 171, continuous enhancements and additions to this repertoire of computer programs has been made.
- The long involved task to migrate ODP data into Janus for legs 101 through 170 began during Leg 171 with CoreLog and Sample data. However, due to a staffing shortage, the major data migration effort really began during Leg 181 with MST data. By Leg 204, all MST, PHYS PROPS, and chemistry data (carbonates, interstitial water, and XRF) were migrated. Remaining chemistry data (gas and XRD) and miscellaneous data (paleomag, down hole temperature, splicer, and MCD) are expected to be completed by the end of fiscal 2004. Paleontology data migration has been under way and is targeted for completion by the end of fiscal 2007.
- The ECR and WCR were migrated from Micro VAX's and Novell servers to Windows NT servers for file and print services. Additionally, they hosted a scaled-down Oracle Janus database that was used primarily for sampling. Also, an identical Windows NT environment was created at the BCR.

Leg 177 through Leg 182

- A new, higher speed, satellite system (Inmarsat B) was installed. It eventually paved the way for high-speed communications between the ship and shore, enabling ODP to send large logging files and e-mail at a reduced rate.
- The Novell servers were upgraded from 100 MHz workstation-quality to 400 MHz server-quality PC's with RAID 5 storage to enhance disk reliability.
- PC workstations on the ship were upgraded from MicroSoft Windows 3.1 to MS Windows NT 4.0, which greatly increased the reliability and stability of the ship computing environment.
- Logistics inventory database (MATMAN) gets merged with engineering database (BASE471) to become SIMAN, a PC-based application that allows for the removal of the VAX's from the ship.

Leg 183 through Leg 187

- Dave Becker became Manager of ISD during Leg 185 port call. A focus on a unified vision, integration of hardware and software systems, and teamwork give the department a new direction through the end of the program.
- During dry dock, a new lab is added to the ship's lab stack and is connected via fiber optic cable to the computer equipment room. Level 5 cable is installed throughout the new lab including the conference room. This was the first project to install 100Mb, Level 5 cable on the ship.
- GroupWise e-mail system replaces cc:Mail on the shore.

Leg 188 through Leg 193

- SR volumes were made available in HTML format for the first time.

- GroupWise e-mail system replaces cc:Mail on the ship. The cost of e-mail was greatly reduced due to the use of GroupWise with the high speed Inmarsat B system.

Leg 194 through Leg 199

- ODP hosted the Distance Learning Program from the ship using the Inmarsat B communications system to spool real compressed video to a server at Texas A&M University. The video and audio was then made available via the WEB to 17 middle schools in Texas and one in Florida.
- 10Base2 cabling (10Mb Thin-net) was replaced on the ship with 100Mb level 5E cabling.
- The venerable DEC Alpha cluster was replaced by a SUN Cluster with the Oracle DBMS. The Janus database and all WEB queries were migrated to the new hardware on the ship.
- New Novell servers with an upgraded operating system and much more disk capacity replaced aging hardware on the ship.
- A Geotek Digital Imaging system was deployed on the ship. The images produced by the imaging system were integrated into the ODP web site using a new compression algorithm licensed by Lizard Tech, Inc. and marketed as MrSID.
- Nearly all CRTs were replaced with TFT flat screens, which greatly increased desk space in many areas of the ship. They have proven to be far more reliable than the CRTs, which means that fewer monitors needed to be sent back and forth from the ship.

Leg 200 through Leg 206

- The shore based, DEC Alpha cluster was replaced by a SUN server cluster. The Janus database, the ODP WEB site, and all the WEB queries were migrated to the new hardware.
- Twelve shore Novell servers were consolidated to three new Novell servers running Netware 5. All file, print and e-mail services were migrated to the new platforms.
- Digital Imaging required that we add larger disk farms to all the servers on the ship. Both the Database and Novell server received a significant drive space upgrade.
- A new image analysis software tool from Geotek was installed on the JR during Leg 202 port call in addition to upgraded digital imaging system acquisition software.
- A testing lab was created in the ODP office to allow new software and hardware to be tested onshore prior to deploying it either onshore or offshore.
- Because of the greatly increased storage space that was now available on the ship, the entire ODP web site was sent to the ship at the beginning of each new leg.
- The network infrastructure on shore was upgraded from 10Mb service to 100Mb service.

Leg 207 through Leg 210

- Leg 207 was quite momentous as we started 24x7 VSAT service. Five phone lines were installed as an extension of the TAMU phone system to allow local exchange calls between the ship and ODP/TAMU. Access to the Internet was achieved and offered to sailing staff. E-mail services were enhanced and sailing staff could access their e-mail accounts on shore.

- One of the by-products of installing VSAT services was the ability to "re-network" the JR to a legal sub domain of the TAMU network.
- On Leg 209 we installed a ship-shore management station which allowed easy access for ship-shore troubleshooting.
- The TAMU headquarters building saw the installation of 802.11b wireless networking for all ODP/TAMU portable computer users.
- Bathymetry, PDR records were scanned and stored digitally for legs 208 through 210 and replaced the need for microfilm archives.

- An end of program snap shot of the ODP computer systems follows.

Netware Servers

2 – Compaq DL380 G1 PIII GHz single processor servers:
2.1 GB RAM
6 - 36.4 GB Wide Ultra3 SCSI 10K rpm hard drives
1 - Smart Array Controller 5304
1 - Fast Ethernet PCI 10/100 NIC
2 - Ultra/Fast/Wide SCSI-2 cards

(One of these also had a 64 bit Dual Channel Wide Ultra3 SCSI card with a Compaq MSL5026 25-slot SDLT Tape Library attached to it, and an external 14 slot cabinet populated with 5 additional 36.4 GB drives.)

2 – HP DL380 G3 Xeon 2.4 GHz dual processor servers:
2.5 GB RAM
6 - 72 GB Ultra320 SCSI 10K rpm hard drives
1 – Smart Array Controller 6402
2 - PCI - X Gigabit NICs

(All 4 servers were running the Novell Netware 6 Service Pack 3 operating system and McAfee's Netshield 4.5 for virus scanning. They were all configured with RAID Advanced Data Guarding (ADG). One server had ArcServe 7.0 running for backups, and one server had GroupWise 6.5 running for e-mail services.)

The ship hosted the same services on:
2 – Compaq DL380 G1 PIII GHz single processor servers:
2.1 GB RAM
6 - 36.4 GB Wide Ultra3 SCSI 10K rpm hard drives
1 - Smart Array Controller 5302
1 - Fast Ethernet PCI 10/100 NIC

(The installed software was the same between ship and shore with the exceptions that GroupWise was at version 6.0 and the disk arrays were operating at the RAID

5 level, the highest the 5302 Smart Array Controller supports. Each server had one Digital 35/70 DLT IV tape drive attached to it for backups.)

SUN/Solaris Environment

2 – SUN Microsystems Enterprise 220R servers with two 450MHz processors
2.048 GB RAM
2 each – 36 GB internal disk drives
2 - A1000 disk array with five 18 GB and seven 36 GB disk drives
Redundant ETHERNET 10/100 NIC
Solaris 8 OS

The shipboard and shore based environments were almost identical with a few major differences noted below. The heart of the system consisted of 2 identical SUN Microsystems Enterprise 220R servers in a SUNCluster 2.2 High Availability (HA) configuration. They were rack-mounted along with a shared drive array in a single cabinet. The shared drive array was housed in two fully populated SUN StorEdge A1000 shelves. The cabinet included dual power distribution units. Each E220R and StorEdge A1000 shelf, in turn, contained dual power supplies. The primary objectives, using this system configuration, was to provide a platform for enterprise database and web services and to minimize downtime with fail over and redundancy, while maximizing throughput speed and availability of data.

Each E220R had two internal 36 GB disk drives. Normally, each node was booted off the primary internal drive while the secondary internal drive was "cloned" from the primary on a weekly basis to provide an alternate boot disk in the event of a failure. Each A1000 disk array contained a RAID controller, five 18 GB disk drives and seven 36 GB disk drives, yielding a total of ~540 GB of raw disk space. However, in order to maximize availability and fault tolerance all volumes on the shared array were protected by hardware RAID5 within each A1000 and software RAID0 (Veritas Volume Manager v. 3.0.4) across the A1000 units. In addition, a 36 GB disk drive in each A1000 was set aside as a hot spare. The net result was that the system provided ~235 GB of useable disk space.

The SUNCluster hosted the following high (HA) services:

ORACLE Server (RDBMS) 8.1.7
iPlanet Web Server 4.1
iPlanet Directory Server 4.13 (LDAP)
DNS server
NFS server

In the normal running configuration, the Oracle database service was hosted on one node while the remaining services, including the ODP/TAMU production web server, were hosted on the other. In the event of a system failure, automatic service fail over would occur and either cluster node was capable of running all services until repairs could be made. In addition, DHCP services were hosted on one of the cluster nodes – usually the same one that hosted DNS services.

On shore, a third server (a SUN Microsystems Enterprise 450), not a cluster member, provided several other key services. It was a rack-mounted system in a single cabinet with triple power supplies and included a CMD CRD-5500 hardware RAID controller and drive array. The drive array was housed in four StorageWorks shelves. The cabinet included dual power distribution units and the StorageWorks shelves also contained dual power supplies. The E450 had the following specifications:

CPU: 2 X UltraSPARC-II 400MHz
1.536 GB RAM
6 – 18 GB disk drives and 18 – 9 GB disk drives
ETHERNET 10/100 NIC
Solaris 9 OS

The E450 had two internal 9 GB disk drives. Normally, it was booted off the primary internal drive while the secondary internal drive was "cloned" from the primary on a weekly basis to provide an alternate boot disk in the event of a failure. The RAID controlled disk array contained six 18 GB disk drives and eighteen 9 GB disk drives, yielding a total of ~270 GB of raw disk space. However, with hot spares and hardware RAID5 volume protection the net useable disk space provided was ~150 GB.

The following services were provided on the E450:

User accounts
Print services
SAMBA server
FTP server
Majordomo list server
JumpStart Solaris install server
CVS server
iPlanet Web Server 4.1

A fourth server (a SUN Microsystems Enterprise 220R) was used as a test bed for patches and upgrades to the Solaris operating system and other software. It had the same specifications as the cluster nodes and could be employed as needed as a replacement node for the shore cluster or ship cluster.