TWP ARCS-1Site
RESET VISIT-1
Report
17-28 February 1997
PNG NWS Momote Station
Manus Province, Papua New Guinea

CONTENTS:

1.0 INTRODUCTION:

The main goals of the TWP Operations RESET-1 Visit to ARCS-1 at Momote Airport on Manus, PNG were: 1)orienting the new PNG NWS OIC Geasa Stoesel, 2)training the PNG on-site observers to maintain the site using sound ES&H practices, 3)fixing the MPL computer problem, 4)correcting the ADaM port problems, 5)performing general site and Van power diagnostics, 6)doing instrument comparison checks and 7)replacement of "out of calibration" instruments.

This Report is organized according to the planned tasks or work units performed during the RESET Visit. Within these work units the activities accomplished is arranged chronologically. Most of the information was put together by the RESET-1 members based on the actual visit daily reports.

2.0 TWP OPERATIONS/RESET MANAGEMENT

Once an ARCS Site is established the Operations part of TWP is responsible for keeping the site running and reporting data. Operations also coordinates equipment retrofits at these established sites. This is accomplished by the local NWS personnel at the site, routine RESET visits and non- routine RESET visits.

Routine RESET visits are scheduled on approximately six months intervals and are focused mainly on routine maintenance, instrument calibration, instrument replacement and training. A formal audit-in is performed upon arrival and audit -out before departure.

One **non-routine RESET** visit is budgeted for each year. These visits are intended for technical non-routine tasks such as emergency repairs, retrofits or the addition of new instruments.

The work on a RESET visit is performed by the RESET Team, but many times in close coordination with the local On-site Observers. The team has a daily tasking meeting each morning at the site using the proposed RESET visit tasking schedule. After each day's work the team meets to summarize what was done and an assigned team member writes a "Daily Report" to be E-Mailed back to TWP personnel in the US. Because of the time zone differences, necessary calls to instrument mentors in the US are done in the morning.

RESET-1 Members:

- Larry Jones, TWP Operations Manager
- Mark Fiscus, TWP RESET Lead
- Jeff Zirzow, TWP RESET Team Member

PNG On-Site Observers:

- Geasa Stoesel, OIC
- Francis Anuma
- David Akia

3.0 RESET PREPARATION:

Preparation for RESET Visits requires a long lead time to line up reservations, visas, shots, medication, documentation, procedures and training plans. Close coordination with AIS/ATSS, instrument mentors and shipping personnel is critical well before the departure date. Prioritization and task rejection is a difficult and important part of RESET visit preparation.

4.0 TASKS PERFORMED:

A. Site Audit-in:
Upon arrival at the site an inventory is taken to establish the baseline status of the instruments and equipment at the site. All changes during the RESET visit are compared to this inventory.

On 2/17 Fiscus took the RESET Team on a tour of the ARCS-1 Site.

On 2/18 Fiscus, Jones and Stoesel performed a site "Audit-In" using the attached form. Major finds were:

- The MFRSR was out of level.
- The MFRSR was a bit out of adjustment.
- Desiccant needed to be changed for the SMET datalogger, the GNRAD PIR, PSP and the SKYRAD PIRs and PSPs.
- The T/RH filter needed to be changed.
- The ORG needed leveling.
- The SKYRAD IRT box had water inside it.(Fiscus resealed it)
- The SKYRAD power distribution box had water inside it.
- The MPL porthole was very dirty.(Cleaning was done)

(See the attached AUDIT-IN/OUT form for specifics.)

B. Instrument Field Comparison Check :
Newly replacement instruments to be installed are set up for comparison checks with the existing instruments to identify inconsistencies before installation.

On 2/18 we set up the testing verandah on SKYRAD stand. We found only two spare ventilators, so the comparison testing were done with just those.

On 2/20 Fiscus and Zirzow set up the comparison instruments and:

- Verified the zeros on the Cal Logger and the SKYRAD Logger. They were good (<+/-10 micro volts).
- Tested the SKYRAD logger.
- Placed the Calibration logger on the verandah.
- Placed the new PSP#1on the verandah as the Cal Standard-it will be the spare.
- Placed the new PSP#2 on the verandah - it will go to the GRDRAD.
- Placed the new NIP#1 on the tracker. It will be the new
- Placed the existing spare IRT on the verandah
- Placed the existing spare PIR on the verandah without a ventilator. It will eventually go to the GRDRAD stand. This PIR's calibration expired last December.

- Tested the NET Radiometer.

On 2/21 Fiscus and Zirzow worked on the SKYRAD stand. They time set the Cal Logger and started taking comparisons data. These ran till **2/24** at which time they did an instrument switchout, turned the GRNDRAD PSP and PIR up as well as removed the shading from the SKYRAD instruments.

On 2/21 at solar noon Fiscus adjusted the MFRSR shading arm.

On 2/21 Fiscus and Zirzow took data off of the SKYRAD and CAL Loggers. They put the data through the Cornwall's ARCS program and attempted to sent it via E-Mail to Cornwall and Mather.

On 2/22 Fiscus & Zirzow:

- Remounted the GNRAD PSP and PIR to look skyward.
- At 2035Z removed the shading arm from the SKYRAD shaded PSP.
- Downloaded data for J54 from the Cal logger and SKYRAD and the last 4 hours of J54 from the GRDRAD.
- Also downloaded J53 from the Cal Logger.
- Replaced the PSP-G and D on the SKYRAD Stand with the new in calibration instruments.
- Reconfigured the SKYRAD Logger.
- Lost SKYRAD data between 0113Z through 0308Z.
- Did not put the shade back on the PSP and turn the GRDRAD Radiometers back downward, due to bad weather.
- E-Mailed data for J53 and J54 to Cornwall and Mather.

On 2/25 Fiscus and Zirzow:

- Remounted the GRDRAD PSP and PIR back to looking downward.
- Replaced the shading arm for the SKYRAD shaded PSP.
- Downloaded data for 55J from the Cal logger, SKYRAD and the GRDRAD
- E-Mailed data for 55J to Cornwall and Mather.

On 2/26 Fiscus and Zirzow:

- Downloaded data for day 56J from the Cal logger, SKYRAD and the GRDRAD.
- E-Mailed data for day 56J to Cornwall and Mather.

On 2/27 Fiscus and Zirzow:

- Downloaded data for day 57J from the Cal logger, SKYRAD and the GRDRAD. Found a split in the uplooking dome of the NET.
- E-Mailed data for day 57J to Cornwall and Mather.
- Calibrated Cal, SKYRAD, GRDRAD data loggers. Fiscus was unhappy with the GRDRAD PIR channel and needed to follow up with Dick Hart.

C. Instrument Replacement:
Instruments, especially radiometers, are calibrated annually and certified for only one year. Therefore they need to be changed out at least each year. Other instruments that are known to be malfunctioning are also replaced.

On 2/19 Fiscus replaced the GRNRAD PIR temporally with the spare between 0020Z and 0120Z to determine if the problem was the instrument splice or the logger. It was the splice, because the instrument worked fine.

On 2/27 All instruments were installed in their final location.
SKYRAD
- Installed new (in calibration) PSPs shaded and unshaded, leaving us with one (in calibration) spare at the site.
- Installed new (in calibration) NIP, leaving us a new (in calibration) NIP as spare at the site.
- Installed spare (out of calibration) PIRs shaded and unshaded, leaving us without a spare on site.

GRDRAD
- Installed new (in calibration) PSP.
- Installed spare (out of calibration) PIR, leaving us without a spare at the site.
- Installed spare (out of calibration) NET, leaving us with the old one as a spare.

On 2/28 Fiscus replaced the damaged domes on the spare NET Radiometer.

(See the attached Audit-in/out form)

D. Data Loggers:
The data logger containers were purged with dry air and resealed.

On 2/24 Zirzow was able to connect the air drier to use in purging the data loggers.

On 2/24 Zirzow purged the data loggers with dry air using the air dryer to the following pressure:
- SMET Data Logger to 2 psi, (There was no perceptible pressure change when first opened.)

- GRDRAD Data Logger to 3 psi (There was no perceptible pressure change when first opened.)
- SKYRAD Data Logger to 3 psi (It only had a small amount of internal pressure when first opened.)

Zirzow found the fittings on the SMET and GRDRAD Logger were loose enough to be removed with fingers.

On 2/28 Fiscus changed the SKYRAD configuration, but because of problems with the logger returned it to the original configuration.

On 2/28 Fiscus replaced the filter on the MET T/RH sensor.

On 2/28 Zirzow fixed the leaky desiccant tube and re-filled it with fresh desiccant.

E. Micropulse Lidar (MPL):
The MPL was hung up and not reporting for several months. A remote fix using phone contact with the observers was not possible. The RESET team needed to come to the site to fix it.

On 2/19 Fiscus unpacked the MPL Computer and it looked ok from the outside, but found that all the computer boards had been jarred loose, especially the multichannel scaler board. He couldn't get the new computer to run with the old multiscaler board.

Fiscus fixed the old computer with the original MSC board just by reloading OS-2. Therefore the old computer is currently in place and running.

After discussing the situation with Conner Flynn (MPL mentor) it was decided to ship the new MPL Computer back to the States.

F. Microwave Radiometer (MWR):
The MWR needed an updated version of the MWR program.

On 2/27 Fiscus updated the MWR with the newest version of the MWR Program. It now has the same configuration as SGP and AIS.

On 2/28 Fiscus put the MWR in tipping mode. Fiscus worked with Geasa to train him to be able to change the mode a month or so after we leave, if needed.

G. ADaM:
We came to Manus with four goals for the ADaM system: First, we wanted to recover all the data from early December until the RESET visit; Second, we

wanted to install some bug fixes and update the Ceilometer data processing module; Third, we wanted to fix the `not writing data to tape' problem; And finally, we wanted to fix the problem with the data ports hanging up and becoming inactive until being reset.

We recovered the data as planned and sent it off to the DMF at PNL. We updated ADaM with the new bug fixes and module upgrades. We found the problem with the `data to tape' problem and fixed that. We were unable to find the data port hanging bug, but we were able to treat the symptoms and so the ports are automatically reset every hour.

On 2/17 Fiscus turned off ADaM & EVE to replace the Cabletron system M5 PSM voltage converter with a new one. This should address the problem of the alarm reporting for several weeks.

On 2/17 when we left the site, everything was running. **On 2/18** when we returned to the D-Van in the morning, MACS was off and the D-Van thermostat was set for 82 degrees.

On 2/19 Fiscus started downloading data to tapes. It still hadn't ejected the tapes.

On 2/20 Fiscus got ADaM to spit out data, but without labels.

On 2/20 Fiscus made a tape of all the data before starting work on the computer. The tape contains all the data since 05/12/96. Fiscus then installed the new ADaM system update.

On 2/21 when we got to the site at 2200Z, MACS was off and not rebooted and the temperature was 82 degrees.

On 2/22 Fiscus fixed the tape labeler.

On 2/23 Fiscus changed the filter in the ADaM Console.

On 2/27 the ADaM tapes spit out as planned on the 7 day cycle, but the "red" alarm signal did not show on the monitor.

On 2/28 Fiscus had the ADaM tapes spit out again to test the label printer. It worked fine. The red alarm also works soon after the tapes spit out.

H. Ceilometer:
We needed to download files off of the Ceilometer computer. The Ceilometer instrument needed to be grounded.

On 2/18 Fiscus started downloading files off of the Ceilometer computer's completely full hard drive.

On 2/19 Fiscus completed the downloading of files. The last data that he found is around mid December. The Ceilometer was not reporting to ADaM and Fiscus didn't know why.

On 2/22 Fiscus and Zirzow grounded the Ceilometer and set the range normalization to "on".

The Ceilometer was found to be hung up when we came in on the mornings of **2/23, 2/24 and 2/26.** We rebooted it each time.

We weren't able to collect raw data from the Ceilometer or change the baud rate on this RESET visit.

I. Electrical Power:

D-Van Photovoltaic (PV) System

- *System Control*

This PV system is designed to provide backup power during rare times when AC power has failed and enough time has lapsed to run down the UPS after AC power has failed (grid down and backup generator isn't running). At other times, this system is in a "standby" or "float" mode.

On 2/17 one of the first things encountered during this first RESET visit was the condition of the PV charging system. At roughly 9 in the morning the battery was already at 15 V and charging at 15 amps.

According to manufacturer's literature, the battery voltage on this system should never exceed 14.1 V (2.35 v/cell) under any temperature condition. Zirzow attempted to adjust the charge controller circuitry for this system, but the results were always the same- once the system started charging, it would not stop. This circuit board had failed.

The recommended float charging voltage for this battery is 13.38-14.10V (2.23 to 2.27 V/cell) @ 25 deg C. Charging voltage is based on battery temperature and should be adjusted by -0.055V/deg C/cell above 25 deg C and in reverse for temperature excursion in the opposite direction. With a maximum temperature in the battery compartment being nearly 35 deg C, this meant a change in voltage of 6(cells) x -.0055V(adjustment in Vs per degree C per cell) x 10 deg C temperature change = -.330 V. This correlated to a battery charge termination setpoint at 13.05 to 13.29V (2.175-2.21 V/cell).

Since the charge controller board had ceased functioning, Zirzow wired in the low limit alarm (not used) to provide charge control for the battery.

On 2/18 Zirzow set the modified use alarm to provide an average of 13.0 V on the battery. After returning from Manus, MACS/COMS report this battery to be running in the 13.0 to 13.3 volt range, nearly ideal to what had been calculated.

On 2/21 Zirzow wired in the PV charge controller low alarm to control the relay that controls battery charging. Set point max is 13.5 volts.

Zirzow will draw up a new schematic, indicating both the original configuration and the current fix in place at Manus. No accurate schematic currently exists for this system.

- *D-Van PV battery load test and health assessment*

After a fix to keep the battery charging properly was completed, Zirzow decided to call on some experts stateside to get an idea if the battery was damaged and if so, to what extent.

Zirzow consulted with John Stevens and Rudy Jungst, experts on this type of battery, at Sandia National Laboratories in Albuquerque. They suggested we perform a load test to the best of our ability. They feared that the battery had been severely damaged due to overcharge. Without some test, we would only be guessing.

On 2/26 Zirzow did a load test using the rental car headlights and taillights as loads. The car battery was disconnected and the PV battery was used as a simulated car battery. After 115 amp hours at an average current of 16.2 amps was taken out of the battery the test was terminated and the battery was then put back on charge. This amount of energy obtained was an encouraging result. If we had more time a longer test could have been done, but the Mazda 626 was needed to acquire supper and sleep.

Results from this test where emailed to John and Rudy. After Zirzow had been stateside for several weeks, John contacted him. The only real conclusion they had was that the system held up for the period of time the current was drawn. John suggested doing a more comprehensive test later to find more information. For now, it looks like the battery has some real capacity. If we assume MACS/COMS draws 2 amps average, this would give us at least 50 hours of run time. Zirzow has a hunch there is more available, but without testing, its only a hunch.

Remote Power Control Problems

On 2/17 when the Dvan PV power system was first looked at, a problem was discovered in the remote power control system. When the PV power was turned off to perform some voltage drop checks the whole Dvan power went down. Fiscus and Zirzow discovered that the Node Data Unit (NDU) internal fuse had blown. Apparently it was related to the power down of the PV system (still do not know why).

On 2/19 Zirzow did some troubleshooting and the problem appeared to be in one of the ADAM 4012 data units in the power control cabinet. Once the bad Adam unit was replaced, the fuse from the NDU held from then on. During troubleshooting the feedback signal to this ADAM unit was modified by utilizing a voltage divider and adding reverse voltage surge diode across the feedback relay coil. Zirzow assumed the ADAM unit failed due to the original PV voltage being too high or possibly a large reverse voltage spike when the relay coil voltage surged in reverse polarity (this is normal when coil voltages are suddenly removed). Consultation with Ray Edwards at BNL indicated no need to make the voltage divider modification and raised some doubt as to the coil voltage surge as a culprit. Ray conferred that neither modification created a problem.

On 2/20 the system was then turned on and off several times without incident, indicating the problem had been fixed.

Zirzow will do a new version of the drawing (DRW (DVA1) 018.000 to document this change.

Kilowatt-hours, Kilovar-hours, Kilovolt-amp-hours and average power factor

On 2/22 these values were read from the power meter located in the Utility Van.

- kWhrs = 70,153
- kVarhrs = 58,315

A value of 91,225 kVAhrs was calculated from the two values above. An average power factor of .76 was computed from kWhrs/kVAhrs.

Balancing power phases

On 2/25 two changes were made on the whole system.

- The first change moved the ISS van feed from phase B to phase A at the junction box to the North, just outside the utility van.
- The second changed moved the 5 kVA transformer feed in the Evan from phase A (breaker location 2) to phase C (breaker location 12). The hole left from the vacant breaker was covered with a metal plate, to assure no accidental contact with live parts could be made.

Power measurement under-reporting

On 2/22 Fiscus and Zirzow found that the power measurement under-reporting problem discovered was related to a multiplier in the param.dat file in MACS/COMS. The original multiplier used was for one-phase only. **On 2/24** Zirzow fixed the problem by changing the existing multiplier by increasing it by a factor of 3 to report correctly for a 3 phase system.

- *Miscellaneous Electrical Power Activities*

On 2/21 Zirzow replaced the GRDRAD battery box charge controller. This unit was not working properly as evidenced by the low voltage condition of the battery. After replacement the battery began to move back up to a point where it should be. Current MACs/Coms reports indicate the new unit has fixed the problem.

Zirzow checked all the battery boxes. All checked out ok except for the GRNDRAD box. He also placed all the battery temperature sensors between the batteries to accurately adjust battery voltage as a function of temperature.

During our visit we had power outages at the site on 2/19, 2/20, 2/21, 2/23, 2/25, 2/26, 2/27 and 3/1

J. Observer Training:
One of the main goals of this RESET visit was to take the new PNG NWS Officer-in-charge and the other On-Site Observers through a basic training module.

On 2/18 and 2/19 the new Officer in Charge(OIC) Geasa Stoesel was walked through the Daily Rounds and Audit-in to familiarize him with the site and instruments as well as the required daily tasks.

From 2/19 through 2/29 Jones took Geasa Stoesel, Francis XX and David XX through the "On-Site Observer" training using the 9 unit Training Manual-MAN(OPS)-003.00. The units are as follows:
1)ARM Program Overview
2)Safety and the Environment
3)ARCS-1 Instruments
4)Daily Rounds
5)Site Data Log
6)Filing and Record keeping
7)Procedures
8)Office Equipment
9)General

The three Observers all received training certificates upon completion of the training.

K. Site Data Log (SDL):
The SDL software needed an upgrade to make it more user friendly and able to transmit useful data back to the US.

On 2/24 Fiscus installed the update of the SDL developed by Brad Perkins. The program, as installed, does not allow us to bring up the “AUDIT” option.

L. ISS Ingest:
Paul Johnston from NOAA gave us instructions for fixing the problems with the ISS instruments at Momote. We were to replace a bad monitor, install a new GOES transmitter and update certain programs on their Communications computer. We searched for the new monitor and the new transmitter. It wasn't until we returned to the states that we found out that the transmitter had already been installed by the P. Kametan, the NWS OIC. And the new monitor was still stuck in customs in Port Moresby.

On 3/1 Fiscus tried to work with the existing file structure and programs on the NOAA Communications computer but they did not resemble the expected configuration on the instructions. The telephones were on the fritz at this time, so we were unable to contact Paul for any clarification. Deciding that discretion was the better part of valor, we decided leave the NOAA upgrades for more skilled and knowledgeable people, Paul Johnston and/or Dave Carter.

M. Security:
Because the solar panel displays for the SKYRAD, GRDRAD and SMET stands were stolen last winter, we decided to more securely fasten the very critical panels located atop the D-Van.

On 2/27 Jones finished re-bolted the Solar Panels to the D-Van supports with replacement tamperproof bolts that requires a special tool.

As a follow up upon the solar panel heist of last year, no one cut the fence. They probably just hopped over it.

The locks on the battery boxes - Fiscus noted that the latches on the boxes can be opened easily with a screw driver without removing the padlocks. We never did find the keys for the locks.

N. Packing/Shipping/Supplies:

On 2/17 we unpacked the replacement instruments that were shipped over. They look ok, but some of the shields and cases they were shipped in were bent and dented.

On 2/28 we packed all the items we wanted shipped back to the States(7 boxes):

- Out of calibration instruments (4 PSPs, 2 NIPs, 1PIR).
- Hubble connectors (3)
- New MPL Computer
- Cavity Radiometer
- Voltage Standard.

On 2/26 we connected with Dick Pearse to prepare for shipping the MPL, Hubbell Power Connectors, Cavity Radiometer, Voltage Standard and the "out of calibration" instruments.

On 2/27 we visited Dick Pearse to give him specifics on boxes to be shipped. Also gave him some cash to deal with the shipping and customs and be available for emergencies if we need him.

New supplies purchased for the site:

- file cabinet for E-Van.

O. Sondes:
We gathered information on the present Sonde deployment system at Momote.

Sonde specifics are as follows:

- the Sonde # is RS 80-15 NH
- the balloons are 200 grams
- 28 empty helium cylinders and 40 full at the site.
- Francis says that they get 6 to 7 balloons out of each cylinder of helium.

The Hydrogen Generator is currently in need of repair.
Specs:

- Model M20XT435AUS
- OUTPUT 20 CFH AT 100 PSIG
- INPUT 3 PHASE 50 CYCLES 415 VOLTS 10 AMPS
- Rectifier Output 12 Volts DC, 250 amps, 3.0KW, Serial #1595.

Parts needed according to Ken Zorika and Kevin Minopu:

- Two 250 AMP Electrolizer cells
- Two Bacharach Fyrite Gas analyser
- Five Fyrite Fluid (5 Bottles)

P. Other:

On 2/17 Geasa and Jones went to the Phone Company (Telikom) to get phone service reconnected to the ARCS site. The phone has been out for several weeks. Philip at Telikom sent someone out. According to Philip we now have a dedicated line - not the party line like we had before. The phone at the NWS at the airport works and we are using it when we need to call out.

On 2/21 Fiscus and Zirzow installed the new diesel fuel tank plugs.

On 3/1 we had high winds at 0130Z that blew the roof tin off the shed attached to the X-Van. They blew over top of our car and the D-Van and landed by the old weather instruments at the SE portion of the site. The doors blew open on the balloon/helium tank building. Some tanks were knocked over.

Jones and Fiscus opened a new checking account at the PNG Banking Corporation Bank.

We were interviewed at the local radio station by Helen Pamolok. Geasa took a major role in the interview.

After 68.2 mm of rain, Fiscus checked the Quazite boxes and they were wet but no standing water. We were pleased.

Francis says that they do get mist 2 or 3 times a week in the early morning. When they do daily rounds they wipe it off if the sun hasn't already evaporated it.

A drum of diesel here holds 44 gallons.

Q. Site Audit-out:
Upon departure from the site an inventory was taken to identify the changes made during the RESET Visit and list resupply issues to be addressed upon our return.

On 2/28 we reviewed the Inventory list to identify items we have used at the site or need and performed the Audit-out walk through.

(See the attached AUDIT-IN/OUT form for specifics.)

5.O NEXT RESET VISIT:
The following items should be considered for inclusion in the task planning for the next RESET visit:

- A more extensive test of the D-Van PV batteries should be performed on the next RESET visit.
- Fiscus and Zirzow opened the MFRSR Logger box and found that water is getting in. Something needs to be done on the next RESET visit.
- Note that the IRT Fiscus resealed is dry as a bone inside, while the unsealed comparison IRT case was filled with water after only one week. Some changes need to be made.

6.O LESSONS LEARNED:
The following observations were made by the RESET members that should be considered for future TWP installations and operations:

- We need more durable shipping cases as several instruments arrived damaged.
- The tamperproof bolts used for the solar panel supports on the D-Van use a special tool to remove them. This is effective only where the bolts are installed into a treaded socket. If there is a nut involved the nut can be removed without using the special tool in many cases. The only way we could see to really make the connections tamper proof would be to peen the threads after installing the nut. We did not do this.
- Communications with the US is hard at best. An improved telephone type means of communication would be very helpful for future RESET visits. The phone system reliability at ARCS-1 is very poor.
- When at Manus, the RESET members should drive to and from the site with the windows down to promote openness and visibility of the RESET team representing the TWP.

7.O ATTACHMENTS:

- Audit-in/out form