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PORT MORESBY
PAPUA NEW GUINEA
UPPER AIR STATION

Balloon Release – Port Moresby

TECHNICAL EVALUATION

OF
PRESENT OPERATION AND FUTURE NEEDS

METEOROLOGICAL SERVICE OF NEW ZEALAND LIMITED

9 May 2005

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1 Summary

A brief technical survey was completed on the Port Moresby GUAN station with the agreement of the Papua New Guinea Meteorological Service, and funded by the GCOS Secretariat. The purpose of the visit was to review the ground equipment and infrastructure, and to determine what future support may be needed.

The upper air program has operated intermittently since about the mid 1990s when the cost of upper air consumables became prohibitive for local funding. About 1995 a new upper air complex and technician's workshop were commenced but the project was abandoned partly finished when funding was required for other civil aviation needs. We understand that part of this project was the installation of a (then) new Teledyne hydrogen plant. In 1999, the Balus civil aviation project funded a part refurbishment of the old hydrogen and balloon filling building, together with the installation of the hydrogen plant. A six month supply of radiosondes was donated and the upper air program operated until the radiosondes were depleted. A further six month supply of radiosondes was donated by the Bureau of Meteorology in December 2004, together with an upgrade of the ground station, and these are presently being used.

All systems are operational and while it would desirable to replace the Teledyne with a Proton it is hard to justify that expenditure. Similarly, the "temporary" upper air building is functional, if unconventional, and so it does not seem to be a good use of funds to recommend that the abandoned, new upper air facility be completed.

The recommendations from this visit are that demineraliser cartridges and technical support be made available from the TSP and, if GCOS wishes to ensure continuity of the program, it makes available 300 GPS radiosondes and balloons. This needs to happen without delay as the present supply will be exhausted within two months.

The Papua New Guinea Meteorological Service is well managed and we are sure that an effective operation and good results would ensue if support was provided.

2 Background

2.1 Overview

WMO GCOS Secretariat, through the Technical Support Program, commissioned MetService to undertake a technical evaluation of the present GUAN operation at Port Moresby and to assess future needs. GCOS Secretariat gave MetService discretion as to whether to undertake a complete survey, as has been done for Bauerfield and Honiara, or whether to restrict this to a brief

technical assessment. As the program was presently operating we decided to save costs and only undertake a technical evaluation.

This visit was carried out between 3 and 5 March 2005 by Bill Witham, a senior electronics engineer with MetService.

MetService had completed previous projects with the Papua New Guinea Meteorological Service, most recently in 1999 under the Balus programme, during the corporatisation process of its (then) parent department – Civil Aviation. The Papua New Guinea Meteorological Service has recently been transferred back to the Public Service and appears to be now much more satisfactorily positioned. Under Civil Aviation it had exceptional difficulty obtaining even budgeted funds.

2.2 Objectives

The program of work for this visit was:

- Meet with the Director, Papua New Guinea Meteorological Service and the Technical Manager to determine the upper air program requirements to ensure a functioning and technically sustainable program.
- Inspect and evaluate all upper air equipment to determine requirements to restore unserviceable equipment.
- Determine maintenance requirements of currently serviceable equipment.
- Identify any spares holdings and tools requirements to ensure all equipment can be effectively maintained.
- Determine the work required to:
  - Complete and commission the new hydrogen building, or alternatively
  - Remain in the present temporary hydrogen building.
- Identify any other requirements to enable the upper air program to be re-commissioned and be sustained.
- Cost all requirements.
- Identify any operational and technical training needs.
- Restore any upper air equipment as practicable and as time in-country permits. (This has a secondary priority to all other activity)
- Provide a report on findings.

3 Findings

3.1 Location

Port Moresby upper air station is located as part of the Papua New Guinea Meteorological Service Headquarters and forecasting office on the lower slopes of a low ridge immediately adjacent to the international airport at Boroko. This is some seven miles from the centre of the city.

Papua New Guinea Meteorological Service Headquarters and Port Moresby GUAN Station

Although the site is security fenced and locked at night with security guards employed, the meteorological service staff are still subjected to periodic robberies and assaults – the most recent of which occurred during the night hours shortly before this visit. During this event equipment was stolen, including the PC and printer required for the upper air program.

Headquarters, end of abandoned partly-constructed technical building – right hand side, security fence

3.2 Port Moresby Staff

Mr Kevin Luana is the Director.

3.3 Contact information

3.3.1 Staff

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3.3.2 Contact details

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3.4 Observing programs

3.4.1 Upper air program

The upper air program is presently operating using a supply of Vaisala RS80-15GA (GPS) radiosondes that were donated by the Bureau of Meteorology. At the time of the visit they had one month remaining of the first (three months) supply. A final supply of three months is still to come from the Bureau which will provide sufficient radiosondes until about June when the program will again stop. The balloon size is 350 grams.

Since the mid 1990s the program has only operated spasmodically whenever a supply of donated radiosondes could be sourced. As part of our work in Papua New Guinea in 1999 we installed a hydrogen generator and the program operated for about six months using donated radiosondes. We understand that pilot balloon flights have continued when radiosondes were unavailable.

3.4.2 Climate TEMP messages

We understand that these are being completed.

3.5 Upper Air Equipment

3.5.1 Upper air ground station specifications

Make / model: Vaisala Digicora I

Software level: Upgraded by the Bureau of Meteorology for RS92 radiosondes

3.5.2 Serviceability

3.5.2.1 Digicora

Fully serviceable and recently upgraded for RS92 radiosondes. It should be noted however, that almost no spares for this are held by the meteorological service and Vaisala have announced the discontinuation of support for this model from, we believe, 2007. (Some spares from the TSP Digicora Mk II pool are able to be used in the Mk I).

Digicora operation

3.5.2.2 PC and Printer

Both items were stolen a few days before the visit. With assistance from the local technicians, our engineer managed to reconfigure an old surplus PC. With TSP funds we purchased a replacement Epson LX300+ printer locally. The program was re-commissioned and only four flights were missed.

3.5.3 Flight data communications

The upper air ground station is in the same building as the main forecasting office. Dissemination of upper air bulletins is by email to the RTH, Melbourne. The Papua New Guinea Meteorological Service has a good Internet network system throughout the offices, but like most Pacific countries, external communications performance is limited to the capability of its ISP. Sabotage of the internal building wiring is also a problem – this occurred again during our engineer's visit.

We have no first hand experience of communications issues at Port Moresby and hesitate to pass comment on whether an alternative satellite communications system, such as we are providing to Tarawa and Funafuti, is required. The periodic instances of robbery are another consideration as to whether a satellite phone, the communications vehicle in the system, should be provided.

For now we suggest that communications performance is kept under review and that a satellite system is not provided.

3.6 Surface Observing Equipment

The upper air facility is at the main forecasting and observing office. All instruments required for the upper air program are available.

3.7 Hydrogen Generation Facilities

3.7.1 Generation plant type

Teledyne Altus 20.

Teledyne hydrogen plant and power supply

3.7.2 History

During a previous MetService visit in 1999, this generator was found in its original packing case in the car park at the meteorological service headquarters. It had been purchased five years earlier, but no attempt had been made to install it, mainly because the construction of the new buildings to house the balloon launching facilities had been abandoned part way through when allocated funds were used for other more urgent civil aviation needs. The funds were not subsequently replaced. Although suffering from corrosion, it was in reasonable condition, and was temporarily installed in the old building (after considerable repair work to the balloon filling room using aid funds from the Balus Civil Aviation restoration project). A 400 gallon, 125 psi storage tank was included in the consignment, but no generator spares.

3.7.3 Present Condition

No further work has been done on the new buildings, and the temporary installation remains. The plant is still working, although the corrosion is a lot more advanced. It is obviously not designed for this tropical environment, as the panels, frame, and other items are made of painted mild steel and not stainless steel. Its design includes some undesirable features such as corrosive electrolyte, lack of combustible gas detection for leaks, and questionable intrinsic safety. Some internal components (cooling stacks, etc) are also showing signs of corrosion.

Teledyne cooling stack – some corrosion

The hydrogen production rate is well down (eight cubic feet per hour instead of 20). Apparently some time ago the supplies of mixed bead resin (demineralising chemical) were depleted and to keep the plant operating it was necessary to temporarily isolate the water purity monitor circuit and use untreated water. We suspect that this has damaged the cell stack and is causing the poor production outputs.

The hydrogen storage tank, on visible inspection, is in good condition, but it has not been pressure tested since its manufacture in 1993.

3.7.4 Spares

There are no spares, and the TSP only provides spares for Proton units.

3.7.5 Long term viability

Our only involvement with this unit was during installation and the inspection during this visit. It is an orphan in the region, appears unsuited to the environment, and not readily supportable. However, it is still serviceable and appears to have some operational life remaining. While we would, ideally, want to recommend a replacement now with a Proton unit, the most pragmatic option would be to keep it running for as long as practical and then look to replace it. A Proton unit would ensure that support could be provided under the TSP spares.

We do believe it is important that some form of water purification or filtration system be provided. Ideally, we would recommend an Aqua Solutions unit, as would be necessary (in our view) for a Proton unit. Funds can be saved, though, by simply ensuring that a supply of mixed bead resin cartridges are made available. These are not overly expensive and can be supported from the TSP resources. We are planning to do this.

3.8 Filling Bay

3.8.1 Description

The balloon filling bay appears like a cube with one side completely open. This was the modification completed under the Balus funds which involved removing the existing unserviceable doors at either end, installing a wall where one door had been located, installing battens on the ceiling and leaving the site of the other door completely open. This seems to work as winds are generally not strong and the prevailing wind usually ensures the opening is on the downwind side. Ventilation is fine, as any gas escapes through the gaps between the battens and into the ceiling of the bay where a ventilation duct runs the length of the building at the roof apex.

A standard Australian balloon filling table is sited in the centre of the bay.

350 gram balloons are presently being used but this bay would easily be able to accommodate the larger 700 gram balloon.

3.9 Hydrogen storage

3.9.1 Description

The hydrogen storage tank is situated outdoors on a concrete foundation at the side of the building adjacent to the walled-up door. It is fenced for safety and has a roof over it

Hydrogen tank, walled up side of balloon filling bay

3.9.2 Maintenance / Safety

The tank was manufactured in 1993 and is in good physical condition. There is no record of any testing or inspection since then and we believe that none has been done.

Normal inspection requirements under New Zealand regulations for a tank of this size are an annual visual inspection, 10 yearly pressure testing and pressure relief valves testing and certifying every five years. An ultrasonic inspection is recommended every five years. This work should be carried out by suitably qualified personnel.

The Papua New Guinea regulatory requirements pertaining to this were unknown and the meteorological service staff agreed to investigate this further. As with other developing countries we suspect that there will not be any. If any work is required then funding assistance would be necessary. We suggest that this be considered pending the outcome of the meteorological service investigations and upon any request for assistance being made.

3.10 Water Supply

The water supply for the plant is derived from the Port Moresby "town supply". As reported, it has recently been supplied directly to the Teledyne and appears to have damaged the cells. We are supplying demineraliser cartridges to ensure that the water is suitably treated before use in the plant.

3.11 Buildings - considerations

3.11.1 Temporary Building

The temporary hydrogen / balloon filling building is located adjacent to the main office building in which the ground equipment is located. This was the original building that was partly refurbished to allow the upper air program to resume in late 1999. The refurbishment, described in 3.8.1, was unconventional but likely determined by the funds available at the time. The work included installing and commissioning the Teledyne hydrogen plant.

The (radiosonde) upper air program has been resumed using this facility following the donation of a six month supply of radiosondes and balloons by the Bureau of Meteorology. It appears to be functioning satisfactorily using this facility.

3.11.2 Abandoned New Building

This "purpose-built" facility is located some 30 metres away from the temporary building on the boundary of the meteorological service grounds. It comprises a balloon filling bay, without doors, and a few adjacent rooms that are unfinished and, we understand, without power or water. We believe that there would be perhaps USD 10-15,000 to complete this complex and it seems hard to justify such expenditure when the program is presently operating satisfactorily from the existing site.

Abandoned partly-constructed new hydrogen building

3.12 Technical Support

3.12.1 Technical capability

Our engineer, Bill Witham, who completed this visit, has worked before with Papua New Guinea Meteorological Service's Kevin Minopu during the Balus consultancy in 1999. The main constraint in maintaining systems is the lack of spares – a consequence of funding difficulties.

We believe that with support from the TSP – spares (as possible) and a technical visit as required, then the technical requirements of sustaining the program should be largely met.

3.12.2 Workshop facilities

The building immediately adjacent to the temporary hydrogen and balloon filling building is the uncompleted technical workshop facility. It is open to the weather and considerable expenditure would be needed to finish this.

As part of the Balus Restoration projects, MetService supplied a basic tool kit. The technician still has these tools and we do not see any requirement to supply new or further tools.

Abandoned partly-constructed new technical accommodation

4 Program support

4.1 Overview

We understand that the Director has budgeted for upper air consumables in the upcoming financial year (commencing 1 January 2006). However, we wonder whether this significant budget line item will be approved, as funds are not available for much lower cost items such as a replacement printer and demineraliser cartridges. Papua New Guinea has not been able to fund its own upper air consumables for many years. If it is approved, then there will be a discontinuation to the program of about nine months from when the existing stocks are depleted (about June) and new stocks can be ordered and delivered. If the budget is not approved then the program will soon stop indefinitely unless further upper air consumables are donated.

The upper air ground systems – Digicora and Teledyne, are both without any local spares. For now, we think it best to provide support through the TSP and evaluate the cost of repairing any future failed components on a case by case basis.

5 Recommendations

5.1 Upper air consumables

Regardless of whether Papua New Guinea is able to meet its own requirements in 2006, the program will stop for nine months when present stocks are depleted in June 2005. Subject to GCOS funding priorities, we recommend that 300 balloons and radiosondes be provided as soon as possible to ensure program continuity. If GCOS wished, subject to funding being made available, MetService could arrange this supply – as it does for Tarawa and Funafuti programs. Further GCOS supplies may be needed depending on whether Papua New Guinea is able to fund its own supplies.

5.2 Ground station

The Vaisala Digicora I ground station will soon be "officially" unsupported by Vaisala. It was recently overhauled and upgraded by the Bureau of Meteorology. No spares are held on site. For now we recommend that the TSP provides parts and technical support to the extent possible, and that any failures that are unable to be supported by TSP resources at the time be subject to a support decision on a case by case basis.

5.3 Hydrogen plant

We recommend a similar approach as that for the Ground Station except, of course, the TSP will not hold any spares. This includes an on-going supply of demineraliser cartridges funded by the TSP.

5.4 Ground equipment replacement

We recommend that this be deferred and reconsidered when the existing equipment becomes unsupportable, not cost-effective to continue maintain, or (for the hydrogen plant) unsafe.

5.5 Buildings

We recommend that the existing arrangements remain.

5.6 Communications

We recommend that this be reconsidered if existing communications become a problem in delivering upper air information to meet GCOS requirements.

6 Point of contact

The MetService point of contact for the project is:

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We thank Papua New Guinea Meteorological Service for allowing us to be involved in this evaluation.