7 January 1977

MEMO TO: Cliff Murino

FROM : V. E. Lally

SUBJECT: GAMP Monthly Report - December 1976.

Equatorial Wind Experiment (EWE)

A design review was held in Boulder on 6-7 December. NOAA representatives attending were W. Keenan, O. Scribner, and F. Stetina.

The status of equipment development follows:

Balloons: The procurement package for the balloons was sent out and bids have been received. The low bidder is Raven Industries; the contract is scheduled to be let in January for 320 balloons.

Transmitter/Oscillator: The procurement package was completed and sent out. Bids are due before mid-January. Since power output is dependent upon antenna polarization and radiation efficiency, it has been necessary to request bids on both a 1-watt and a 3-watt transmitter, pending approval by CNES of our antenna design.

Encoder/Temperature Sensor: The encoder circuit has been designed and breadboard-tested. Final design must await decision of which transmitter will be utilized.

The temperature sensor circuit design is completed. It employs linearizing resistances in conjunction with the thermistor, a 10-mil bead, and two reference resistors. These resistances are individually computed for each thermistor. This permits the use of a uniform calibration curve for all the temperature sensors. The final design must await the final design for the power supply.

Power Supply: Additional testing and evaluation of solar cells is proceeding. Sealed lead-acid batteries have been selected as the energy storage device. Supply system circuits have been breadboarded. Final design of the complete supply system is dependent upon transmitter output.

Antenna: Clarification of several key elements is being obtained from CNES plus certification of the quadrifilar helix antenna for use with the ARGOS platforms. A tentative approval for the antenna and 1-watt transmitter configuration has been received. An official reply is expected in January 1977. Additional design consideration for optimizing this type of antenna were arrived at in a conference between M. Exner of NCAR and C. Kilgus of Johns Hopkins Applied Physics Laboratory.

Cutdown: Testing under environmental temperature/pressure conditions of the magnetometer-activated cutdown circuit has determined that the resolution of the device is 10 mGauss and that negligible phase shift

occurs in fields of up to 2.2 Gauss. The timing portion of this device is being tested. It will activate the magnetometer circuit 0.2 hrs/day. Final design must await determination of the power supply characteristics.

The baro switch-activated cutdown design is delayed due to later-than-expected delivery of the prototype baro switches.

Thermal Package: Thermal evaluation of three designs has been completed. Improvements in the thermal coupling between the batteries and the water thermal ballast and in the water container have resulted in the redesign of the package. Testing is scheduled for January.

Launch Support Equipment: Modifications to existing TWERLE launch vehicles will make it possible to employ these for the launches of EWE flight systems.

Ground System: By utilizing a micro-computer as the central item, the ground system has acquired the flexibility to perform as an electronics fabrication aid, a thorough preflight checkout unit, and a data collection, processing, and archives system. It will consist of three receivers, a real-time clock, the Tektronix 4051 micro-computer with hard-copy unit, and a computer back-up RCA 1802 micro-processor, probably with a Texas Instrument Silent 700 teleprinter/recorder. The receivers will be for acquiring TIROS/EWE signals for first-day data acquisition, NIMBUS/TWERLE signals for flight tests of the balloon-borne equipment, and TIROS beacon signals for acquisition of data from balloons in the immediate vicinity of the site.

In the electronics fabrication stage, the system will perform temperature sensor calibration and completed circuit checkout. It will output a 117 code wiring map and then check the code output following hard wiring. Finally, it will certify the encoder operation.—

All preflight electronics checkouts will be performed by the system, including the logging of checkout results. It will also set and check the magnetic cutdown clock.

Procurement

Procurement plans are that the balloons and the transmitter/oscillator and possibly the solar panels be obtained by fixed price contract. The option on the solar panel is to construct them in-house. Assembly contractors, using NCAR-supplied parts, will be utilized for producing the cutdown, power system, data encoder, temperature sensor assembly, and antenna. The thermal package will be produced via an assembly contract. Final assembly and checkout will be done in-house.

Launch Sites

The proposed launch sites are, for Special Observing Period I, Christmas Island (Indian Ocean) and Canton Island, with Ascension Island

as a back-up; and for Special Observing Period II, Canton Island and Ascension Island. The use of Christmas Island is still being investigated. The status of Canton Island is undetermined, at present, as is shipping to it. The present contract for island operations expires in December 1978.

Schedule

Test flights will be made in January and June, 1977, and in January 1978. In the first series three flights are planned from Christmas Island. These will use GHOST electronics and will be made to check circulation patterns from this site. In the second series, six flights from Ascension Island, using TWERLE transmitters, will test the thermal design, cutdown operation, and balloon altitude. In addition, the launch equipment operation will be tested and the ground system evaluated. The 1978 series of three flights will be made from Palestine. In particular, the thermal package will again be tested as will the performance of the ground system.

Fabrication of all electronic sections will be complete by April 1978. All balloons will be produced by October 1978 and site shipments completed shortly thereafter. The launch periods are scheduled for December 1978 to February 1979 (SOP I) and April to June 1979 (SOP II).

Safesonde

In the early part of this quarter, analyses of the system test flights made in the previous quarter were completed. These confirmed that from all aspects the sonde performed exceptionally well.

The Safesonde's exceptional telemetry performance at Wallops Island demonstrated conclusively the tremendous advantage of using narrow-band systems. The analyses also showed that the cross dipole antenna, which provides circularly polarized signals, is significantly superior to the more conventionally used vertical antenna. The results warrant investigation of its use on FGGE sondes. Also, the synchronous commutation of the met data has provided exceptionally high quality data with virtually no telemetry induced errors.

The Barnes and Passi algorithms were compared; they provide similar 4-station position accuracies. Several flights were analyzed. These show that the wind accuracy will exceed system goals.

Five additional test flights were made from Wallops Island, Virginia, in the period of 6-10 December. The objectives were to 1) test a launch technique employing a pole, 2) test experimental fast-ascent balloons, and 3) test our ability to perform a self-survey of the network.

The pole launch technique was devised to overcome the problem of loss of cycle count just before and after launch, due to line-of-site interference. The pole launch technique successfully overcame this problem.

The experimental neoprene fast-ascent balloons achieved ascent rates which exceeded those of conventional radiosonde balloons. However, they did not achieve the design goal rate of 8 m/sec.

The self-survey test consisted of moving a Safesonde transmitter between bench-marks, which were located at 1-mk spacing. The results were that receiver station locations were verified to within 1-2 m accuracies. Bench mark spacings of approximately one-third of the network dimensions would be required to provide survey data better than 1-m accuracy.

Although the five flights were executed successfully, the tests were plagued by a variety of failures at the separate receiving sites when temperatures fell below freezing. Design modifications are required to correct this deficiency.

Based upon our previous flight test experience, we are confident of excellent correspondence between radar and Safesonde data. We expect to receive the radar data shortly.

A major problem area was identified as a result of this flight series. The difficulties of obtaining a clean launch from a surveyed point in high wind conditions are too severe. A major modification of the system is required to simplify initialization. This modification will provide a sub-carrier which will permit unambiguous location of the sonde within a 50-m radius. M. Exner/NCAR and M. Poppe/Cambridge Engineering, have analyzed this modification to the basic Doppler approach. They have concluded accuracies similar to those presently obtained can be achieved.

The software systems for computing wind and other met parameters have been tested on the NCAR CDC 7600. The Barnes and Passi algorithms have both been successfully transcribed to a desk-top micro-computer (Tektronics 4051, on loan from NOAA).

Long-lived Atmospheric Monitoring Balloon (LLAMB)

The prototype balloon is being fabricated by Sheldahl. Upon completion it will undergo complete testing prior to shipment to New Zealand. The testing is scheduled for mid-February and the launch for May 1977.

Electronic systems to monitor balloon performance have been designed and are being fabricated. These include systems to telemeter data to both the presently-in-orbit NIMBUS-6 satellite and to the TIROS-N satellite, which will replace NIMBUS-6 in 1978. Fabrication of the gondola is underway. A letter requesting use of the ARGOS system on the TIROS-N has been sent to CNES.

Carrier Balloon System

The three-volume Final Report has been printed.

END OF MEMO

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