Rex

MEMO TO: Distribution 29 July 1974

FROM: Edward J. Zipser JUL 31 1974

SUBJECT: NCAR Participation in GATE - Interim Report

It is probably not possible to combine wholehearted participation in the field phase of GATE with adequate reporting of what is happening. That does not diminish the need of those who are supporting this effort to have a reasonably accurate knowledge of the events. As the responsible person for the large NCAR effort in GATE, I believe that I should attempt this task, however incomplete it might be. This is especially so because I will not return to NCAR directly after GATE, and I fear that the burden may fall to others, particularly Dan Rex, Al Miller, and Peggy LeMone, who officially are to back me up during my absence. I hope that by preparing a few of these reports between now and the end of the field phase that the job of summarizing NCAR's GATE experience can be made somewhat easier for these others, who will have ample responsibilities of their own. I would appreciate suggestions for the most important items to be included in future reports, as they will be necessarily brief!

About a week ago, Clyde Wyman hand-carried (to Dan Rex) a brief summary of Phase I written by Jim Rasmussen. I recommend that this be reproduced as it is a very useful summary of the aircraft program, in which we are so heavily involved. My own brief review of the aircraft program is also attached.

The NCAR Electra participated in 9 missions during Phase I, not counting two sets of tower fly-bys and two or three intercomparison flights prior to the start of Phase I. From all appearances at this time, the data are likely to be very good from most or all of these flights. All aircraft operators experienced shakedown problems, and although we were no exception, these were generally not serious. The INS performance has been good with the exception of two flights, and we expect to retrieve much information from those as well. There were some problems with the on-board data display which were some inconvenience to the scientists but which are now solved. The gust probe system is working well, according to Peggy LeMone, who has studied some early samples of spectra. The absence of a reverse flow thermometer (both arrived broken) may hamper some of the thermodynamic measurements in rain areas, but another is expected. No doubt the RAF people will want to go into far greater detail and may even object ot some of these generalities. But I should say something that they would find difficult to say: without exception, everyone in RAF involved in the development of the Electra system, with the care and feeding of the Electra, and with its operation, deserves real commendation. I will take the liberty of saying so this early in the program because it is obvious that there is a high level of professionalism, pride and willingness to work on the part of all concerned. Even the Phase I results only will provide a wealth of good data to keep us busy; we look for more and better results in the next two phases.

The most serious problem faced by the Electra operation has had nothing to do with the aircraft itself, but is a shortage of ground power, which makes it difficult to do all that needs to be done on the ground. The scheduled arrival of a new power unit shortly will alleviate but not completely solve this problem.

Attached is an early report on the A-scale analysis program, by Clark Smith, Gordon Dean and T. N. Krishnamurti. I can say here that the driving force of this group, as well as the one who prepared the report, is Clark Smith. What he didn't include in his report is a description of the great difficulties that had to be overcome by this group simply in order to assemble the necessary data, much less analyze it. This set of A-scale maps, which will be microfilmed and distributed very widely immediately after the experiment, will doubtless be the best and most easily available picture of the A-scale situation for one to two years after GATE, and will enable much research to get started early. Clark has made a real contribution here that will only be fully appreciated a year or so from now.

Attached is a report on the GADMAP activities prepared by Al Miller with only minor editing and deleting of expletives. The statement speaks for itself, and the central importance of the GADMAP role needs little comment. It is a real achievement for these four people to have successfully established the calibration tower, intercompared 8 aircraft against the tower, handled the aircraft intercomparisons, established (jointly with NOAA) the Varian computer operation, which has been consistently successful in providing computer output for the Electra and the NOAA/RFF aircraft with less than 24-hour time delay, plus other output, and in being up-to-date on documentation of some 75 flights in Phase I. This was not accomplished by staring into their respective navels.

The NCAR GATE Group scientists have been full participants in the scientific program since they arrived and they already have made a real impact on the program. They have been filling the role of aircraft scientist on the Electra, as well as participating when time permits on other aircraft. During the week just prior to Phase I, which was already taxing enough, some critical scientific manpower shortages developed when tower fly-bys, intercomparisons, preparation of forms, establishment of procedures, briefing of aircrews, and of aircraft scientists, all had to be accomplished at once, while at the same time some key people were missing. Peggy LeMone and Bob Grossman jumped in at this point and exercised real leadership in getting these things done; if they had not done this and done it well, the aircraft program would have gotten off to a late start, or at best a more haphazard start.

Gerry Grams and his group did a most professional job in getting ready for his flights, and with the cooperation of the Electra instrumentation people finished his installation quickly, and through he

cooperation of the flight crew in modifying the flight plan to fly through the dust layer frequently while en route to or from the B-array, he got a number of good cases for analysis.

A subject that needs thought very quickly is how to initiate the early exchange of early GATE results. A number of preliminary, crude but exciting things can already be said, and it is not easy to visualize how we can take advantage of this early enthusiasm, which can only increase, while taking care not to unfairly "jump ahead" of others. The original idea supported by Francis of a newsletter format for such very early results should be pursued immediately, for contributions can be ready before GATE is over.

I trust that no one who has not been mentioned as yet will be wounded, and that no one will be under any delusion that this attempts to be comprehensive. More later.

End of Memo

Distribution

John Firor
Jack Hinkelman
Akira Kasahara
Margaret LeMone
Wes Melahn
Al Miller
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Enclosure

Summary of GADMAP Activities through End of Phase I

24 July 1974
Al Miller

The efforts of preparation for the field phase of GATE by NCAR's GATE Aircraft Data Management Program (GADMAP) personnel began to come to fruition about 4 June 1974 when, with half the GADMAP contingent here, we started to build the aircraft calibration tower near the town of Thies. The actual tower erection was accomplished by a hard-working crew of 6 human monkeys with some help (both on the tower and the ground) from GADMPA personnel. After the actual site was located prior to building the tower, considerable work had to be done in preparation for the tower and its affiliate complex. The actual time required to build the tower (156') was less than 6 hours however, this tower being the tallest Bilby tower ever erected, buying each leg two directions from two levels, fence building, shed building and instrumentation consumed the better part of two weeks for the NCAR personnel. As anticipated, tower fly-bys were looked upon as somewhat unnecessary, or hazardous, or both by some aircrews and there was some reluctance to accomplish them. Subsequently the NCAR/RAF flight crew made several runs by the tower to check on range safety aspects, in some cases with personnel from other aircrews along for the experience. These initial NCAR fly-bys were adequate to convince the reluctant crews that in fact it could be done quite safely and could be thought of as fun at the same time. The key element as far as safety was concerned was the presence of both Al Rodi and an Air Traffic Controller on the tower during the actual operation. One modification to the usual fly-by routine used at NCAR was the addition of 2 meter square panels of irridescent (day-glo) material surveyed in every 0.5 kilometers for about 5 kilometers which gave the pilots a safe track to fly if visibility was less than optimum, which was most of the time. From the top of the tower these panels could be seen out to their origin save one which was over the brow of a hill.

Subsequent to the inaugural flight, six days have seen the tower in active use. All instrumented GATE aircraft which were here for the start of Phase I have been calibrated against the tower.

Also in early June, the NOAA/GATE/GADMAP on-site computer arrived in Dakar so efforts were begun to get it located on the second floor of the GOCC and in operation. In this endeavor, all GADMAP personnel were involved for several days. The operation of the computer was complicated by power problems at which time Dick Bobka of FOF came to the rescue and put the computer room on a separate spare generator NCAR has been requested to bring.

Upon the arrival of the I. S. M. G. team, GADMAP was requested to take over on their behalf, the international aircraft data management which we have done with their assistance. The International Data Manager, Terry de la Morniere was of great help during this period. Although we weren't anxious to do this we could see no other way to keep the aircraft data coordinated and so assumed the role secretly wearing our Convection Sub-Program hat. Just prior to Phase I, and

just after the tower fly-bys had started, the GADMAP plan for aircraft intercomparisons was put into effect, and all aircrews were briefed by a combination of NCAR GATE Group Scientists and Terry de la Morniere, with the GADMAP taking over after the tower fly-bys ended. Subsequently, GADMAP, assisted by NCAR GATE, and university scientists, and UCAR student help, took over the documentation and analysis of the intercomparisons. Although all the intercomparisons desired have not been accomplished yet, they are ongoing during the phases and can be planned into some missions, often at GADMAP's instigation. GADMAP will forward a copy of the intercomparison analysis report when the first phase interim report is finished.

With the start of Phase I, the computer group which had successfully set up the computer and had checked out all the necessary programs began running daily all U. S. aircraft tapes (except NASA) for quality control purposes and for copy purposes. When the ships started experiencing difficulties with rawinsondes the NCAR/RSF dropwindsonde program took on new impetus and near-real-time importance. With Govind's help software was developed by GADMAP to make use of the on-site computer to calculate winds from the dropsondes.

For the bulk of Phase I, GADMAP has conducted almost all of the debriefings, and has accumulated the documentation on all flights, some 75 in all. This has involved working with Terry to develop suitable forms for Pilots, Navigators, Data Managers, Aircraft Scientists and Airborne Mission Scientists, and then at debriefings seeing to it that these are completed. Often, considerable police work is necessary to round up all the material before it disappears, as it tends to, and to place burrs under saddles of those who supply inadequate documentation. With help from the UCAR students, GADMAP has been constructing flight tracks for each and every mission and sortie, which are being used by the Special Analysis Group and which will also form the basis for the early documentation of the GATE flight program which will hopefully have quick and wide distribution.

As of the end of Phase I, it can be said that neither the four GADMAPers nor the 5 UCAR students assigned to the NCAR/GATE/GADMAP staff have had either significant or sufficient time to let their hair down. In Phase II we will not be taking on any new or unanticipated tasks, hopefully, so that we will be able to keep up with GATE events with no more than a 1 day lag, as in Phase I.

Exhibit

# PRELIMINARY REPORT OF A-SCALE ANALYSIS

## PHASE I

July 24, 1974

## I. Review of A-scale Analysis Requirements

The A-Scale effort called for six levels of streamline analysis and a surface pressure chart. The analysis levels were: Surface (ocean only), 500/600 meters, 850, 700, 500 and 200 mbs.

The area of analysis was 10E to 40W and 5S to 25N. The times of analysis were 0000 and 1200 GMT. (0600 and 1800 GMT charts plotted and analyzed were used for continuity).

The purpose of the program at Dakar was to preserve through near real-time analysis as much of the sense of the synoptic situation as possible for future scientific reference.

Analysts for the 1st phase were Dr. T. N. Krishnamurti, Gordon Dean, and Clark Smith. This is their joint report.

## II. Analysis Procedure

All analyses were based on observations taken by conventional instrumentation. The present state of the art of satellite interpretation from single photographs does not yet permit the introduction or adjustment of synoptic systems in an analysis. Satellite vectors, not received during Phase I, on the other hand, are to be plotted on the A-scale charts and an integrated analyses obtained.

## III. Deficiencies in the A-scale Network

While deficiencies in the synoptic network are well-known, the consequences to the post-analysis program deserves some mention. Receipt of data over West Africa, considering the area of analysis only, was approximately 56% of the combined potential of both rawinsonde and pibal reports. This statistic was determined from a count of reports on the charts at 000 and 1200 GMT at the 850 mb level (also at 500 mb) for the phase period. The potential was determined from the normal receipt of reports in the area and did not include stations planned for GATE, but not implemented, such as Conakery.

This difficulty resulted in incomplete analysis in many instances and a real problem in tracing potentially traveling systems over Africa. During the Phase two traveling disturbances were traced with some confidence. This condition applied to disturbances which passed near

the latitude of Dakar and those passing off the Guinea Coast. With reference to the latter region, early in the phase it was recognized that the lack of planned coastal stations produced an unmanageable network gap extending to the AB ship array. Introduction of the Charterer at 8N and 16W improved the coverage, but due to the fact that the ship was still relatively isolated, upper winds from the omega system could not be properly evaluated. The Charterer winds, however, were drawn for and in most instances yielded continuity.

It should be also mentioned that analysis of upper air charts was not extended west of about 30W due to loss of wind reports from the two Brazilian ships at the 35th longitude.

Finalyzing of the A-scale charts has been delayed in the hope of receiving missing reports from Africa and ATS-III satellite vectors. The latter are to be applied at the 850 and 200 mb levels.

IV. Synoptic Summary in the A-scale area during Phase I

The mean position of the daily surface asymptote in the wind field was near 5½N at 30W and at 8.5N at 20W. This position was determined from surface wind charts at six hourly intervals for the phase period. In July the long term mean position lies near 10N at 30W and near 12N at 20W. Over the Atlantic Ocean at 300 and 200 mbs westerly winds were observed much farther south than usual. Above the ITC easterly winds only on occasion extended as far west as the Caribbean. Although a subjective opinion, rainfall over the continent was minimal and associated with thunderstorms rather than traveling disturbances.

A count of the number of vortices tracked over the ocean in the region from the African coast through the AB ship array was made. An average of two vortices were found on each 6-hourly chart at the 850 mb level during the phase. Averages at the surface, 700 mb and 500 mb levels, respectively were 1.0, 1.2 and 0.70. The reason for the difference between the number of vortices found at 850 mb and the surface can be partly explained by the trajectories of the cyclonic systems. Most systems tracked through the AB ship array had their origin on the Guinea Coast. Although some systems moved westward, the most prevelant movement was first to the northwest and then to the west and later SW. During the latter portion of their trajectory low tropospheric disturbances passed over the highly difluent surface northeasterlies and trade inversion and hence found no expression at that level. The average time the systems could be tracked before either passing west of the AB array or dissipating within the region was about two days.

An attempt was made to trace disturbances from the continent over the ocean. We have already mentioned data deficiencies in the A-scale network which prevented absolute assurance of the continuity of traveling disturbances. Nevertheless, our interpretation of the data indicates few instances of passage of systems entering from the continent to the ocean and subsequently the AB ship array. Wind from NE-SE shifts at Dakar can be misleading if interpreted as being soley induced by wave or system passages.

During the first 10 days of July there were only two wind shifts (NE to SE). From July 11 to 16 there were approximately 5 wind shifts (NE to SE) which are accounted for by the moving cyclones up the Guinea Coast affecting the winds at Dakar.

V. Analysis of Omega Winds

In an effort to estimate the quality of omega derived winds, (both duration and speed) Gordon Dean and Dr. Reid reviewed three days of omega winds at 6-hourly intervals from ships in the B-scale array. The context was the surrounding AB radar wind reports. They concluded that 50% of the reports were good, 25% were indeterminant because of light wind speeds and 25% were poor.