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R.S.R.S. Newsletter

No. 63 July 1966

RADIO EXPERIMENTS IN CLEAR AIR, AND PERSONAL REFLEXIONS ON U.S.A.

Members of the Radio Meteorology group were recently invited by Dr. David Atlas the chief of the U.S. Air Forces Weather Radar Station, Boston, to participate in a $3,000,000 project designed to investigate the problem of Clear Air Turbulence (CAT) and the vexed questions of radar "angels". Our part lasted for seven weeks, out of a planned three years.

The experiments, sponsored by the U.S. Air Force were organized by Dr. D. Atlas and Dr. I. Katz of the Applied Physics Laboratory of the Johns Hopkins University, Baltimore. The experimental site was at the N.A.S.A. Radar Facility, Wallops Island, Virginia, and the experiments were designed around the use of three radars operating on 3, 10, and 71 cm respectively. Brief particulars of which are given in the table.

/Table

RADAR PARAMETERS

	S. Band	X Band	U.H.F.
Dish diam. feet	60	34	60
Gain db	51	58	35
Beamwidth deg	0.48	0.21	2.9
Peak Power Mw	3	1.0	6
Pulse width μ sec	0.1-1.3	2	0.1-6.0
PRF c/s	320	320	320
Min. Det. Sig.-Dbm	112	105	115
Noise Fig.	4	8.5	2
Freq. Gc/s	2.820	9.372	.420

The S. Band Radar was equipped with a bore sight television camera that enables the aircraft or missile being tracked to be seen out to distances of 20 mil or more. The 'X' and UHF band radars share the same mount and dish, which can be operated independently, or made to follow the S. Band mount the usual mode of operation. Klystrons are used as the transmitter power sources and all three radars transmit synchronized pulses.

Variable width range gates enable echoes from a given distance to be selected and examined, the amplitude of each returned pulse being measured and digitized for recording on magnetic tape. In addition the video outputs can be smoothed and plotted against time to give the changes in reflectivity from the volume of air being examined by each radar.

The function of the R.S.R.S. three cavity refractometer which was flown 80 feet below a U.S.A.F. helicopter, was to measure directly the changes in the refractive index of the same volume of air.

Three sensitive hot wire anemometers were mounted on the R.S.R.S. package, at the same spacing as the cavities, to measure the direction and speed of the incident air flow. Two Hay type refractometers were also carried. The information from the R.S.R.S. package was transmitted to the ground for direct recording on paper charts. In addition to the R.S.R.S. data, the outputs of the hot wire anemometers and Hay refractometers were recorded in the helicopter on a high speed 7-track magnetic tape.

Cain and Birnbaum type refractometers were also flown in two aircraft, usually in the same vicinity as the helicopter.

Control of the aircraft was effected through the N.A.S.A. operational control radars and communication center, all points being linked by an inter-communication network. A digitized time code based on WWV was also available at all points for direct recording on to charts and magnetic tapes, GMT being used throughout the exercise.

/An average

An average of 500 polaroid pictures were taken each day. P.P.I. and R.H.I. pictures taken at the beginning and end of each run covered the whole volume scanned by the radars and enabled the helicopter and 'planes to be directed to the most interesting regions.

Some 20 hours of first class records were obtained with the R.S.R.S. equipment which together with the radar data and information from the aircraft form a unique and powerful collection of results for the theoretical study of the various phenomena. The majority of this data is digitized and carries information rates up to at least 1 kc/s; the reduction is being done at the A.P.L. data processing section, where power spectra etc. will be produced directly. Normal working hours were 08.00 to 16.30 with 30 minutes for lunch, with one long day 06.00 to 20.30 each week. Monday was reserved for maintenance.

Previous work on this project includes the detection (for the first time) of reflections from layers at 90,000 feet and the tracking of individual bees, moths etc. up to some ten miles, also a first. Future work will be a continuation of simultaneous radar and refractometer measurements in clear air up to 100,000 feet and the theoretical study of the various phenomena observed during this exercise. Mention should be made of a two hour tour of inspection made by the Air Force General responsible for the funds, complete with 20 staff. Murphy's Law did not operate and all concerned were well pleased.

On the personal side, the trip had been talked about for the previous ten months, but it was not until the receipt by Messrs. Lane, Fowler and Champion of some 57 individual copies of an order from the Secretary of the Air Force inviting the person named to proceed to the Joint AFNASA (JAFNA) Facility, Wallops Island on temporary duty for approximately 50 days, that it appeared definite.

Last minute trouble with Military Air Transport's flight from Mildenhall to Mcguire, left us to take a comfortable trip by T.W.A. from L.A.P. to Washington via New York. Weather on the other side was poor and nothing was seen from the air of the famous Manhattan sky line or of Washington.

An official order for the hire of a car was put in effect at Washington and produced a brand new Dodge Coronet 440, with automatic transmission and power steering etc. This proved a very comfortable and easy type of car to drive, however, it was discovered after the first day that we had no trunk key. Application to the car hire firm failed to produce it so with due apologies another brand new Dodge was produced in lieu! This was to cover 2700 miles before its return.

Contact was made with the A.P.L. contingent, one of whom, taking his life in his hands, volunteered as navigator on the 130 mile trip from Washington to Wallops on the eastern shore of Virginia, 70 miles from the tip of the Delaware-Maryland-Virginia peninsular (Delmarva for short). This proved an easy trip, lane discipline being good and speed limits obeyed. Limits vary from town to town and road to road, e.g. 25 m.p.h. in Washington, 65 on the Interstate highways, 55 on most dual carriage ways, with a 40 m.p.h. minimum.

/Most

Most of the peninsular is flat and sandy, agriculture being the main occupation, chickens, potatoes, corn and strawberries being the major crops! We were interested to see notices, 'Pick your own peaches' outside some of the farms. Heavy mixed forests cover large areas.

The general impression gained travelling along the roads is one of great untidiness, hundreds of hoardings, garish signs, power, and telephone lines and broken down shacks. Wood is the major building material away from town centres.

However, the interior of the road side diners (Jocks Cafe types) are invariably spic and span and service is good, a glass of iced water being provided immediately, followed by the production of a large menu card. The major foods on Delmarva were eggs, chicken, crab and steak (issued in square feet). One such establishment had a selection of 50 milk shake flavours including Grasshopper, not sampled by yours truly!

Accommodation was found at a Motel on Route 13 - this was a very modern and comfortable establishment complete with its own swimming pool, later put to good use, but for the first three weeks, empty - too cold for the locals to think of filling.

Delmarva is a rural community, the usual ideas of American bustle being completely absent, accents could have been West Country in origin; clothes and hair styles, apart from the Beatle influence on the very young generation, very conservative. Place names are English or American Indian. Salisbury, the largest town, has a population of some 10,000 and was 30 miles north, while the nearest town, Pocomoke City (pop. 3000), 3 miles north, is situated on a fair sized river of the same name ("Muddy Water").

Chincoteague Island ("The beautiful land beyond the water"), just north of Wallops Island, was where most of the A.P.L. contingent stayed. It is a popular deep-sea fishing spot, invaded every week-end by "Deep" sea fishermen, complete with everything including boats. The prize for the "mostest" went to a car towing a trailer carrying four large fibre glass dinghies (one each?) A refugee from Chelsea was discovered in one of the hotels, she had no desire to return and just loved the fishing!

Visits were made to various local country and sea side villages including the local "Southend", Ocean City. This place has everything except mud, eels and whelks; instead, glorious white sands, crabs, oysters and popcorn were offered together with the ubiquitous Coca-Cola. Souvenirs are of a standard such as to make Windsor's Gift Shops look like Harrods, while antique shops abound, all full of Victoriana, a good commode for example, fetching $30-50.

Opportunity was taken on our return to Washington to travel via the Chesapeake Bay Bridge Tunnel, a magnificent engineering project comprising 15.5 miles of bridge and two separate one mile tunnels linking the Delmarva peninsular to Norfolk, Virginia. Toll $5, but well worth it for the experience.

/The

The Norfolk end of Virginia is the cradle of the U.S.A. and James Town, Williamsburg and York Town were visited. The National Parks Commission has done an excellent job in preserving these sites and keeping the commercial interests at bay. Very modern information centers are provided, these include a museum section film theatre and comfort stations.

Williamsburg, the old Colonial capital, has been reconstructed by the late J. D. Rockefeller in 1780 style, 85 of the original buildings remain. All motor vehicles are kept out of the old town, a shuttle bus service operates from the information center to points on the perimeter. Shops staffed by contemporarily dressed assistants demonstrate the old crafts, printing, book-binding, wig-making etc. while horses and carts plod by.

The peace, however, was shattered every now and then by an enthusiastic gunner in period uniform firing his muzzle-loading cannon, no particular care seemed to be taken in where he pointed this. The University of William and Mary, est. 1693, still functions. It was very interesting to see the combined Union Jack and Stripes flag, flying on the public buildings.

Our trip co-incided with one of the hottest days we had experienced, we learned later the temperature was near 95°F. That night in Richmond a torrential rainstorm accompanied by lightning and thunder deposited 2 inches of rain in an hour, a tornado warning being given on T.V., however, this did not appear.

Before our departure we managed to visit the A.P.L. some 16 miles north of Washington. This was very impressive and a lightning tour left us somewhat bemused and foot-sore. Apart from the analogue and digital processing equipment which can deal with information rates of up to 15 kc/s, the most impressive single item of equipment was a V.H.F. receiver for data reception from Tiros type satellites capable of receiving signals at levels 160 db below a milliwatt. No further details were forthcoming on this equipment.

Our departure from the U.S.A. was scheduled at 2000 Local Time from Dulles Airport, which is some 30 miles out of Washington. This is the airport of the future, at present it is very lightly used. The two-storey building is most impressive, the roof consisting of a single sheet of concrete hanging as a catenery from supports along the front and rear edges, at a guess covering about the same area as the land covered by the four spurs and corridor of our building. On passing through the appropriate departure gate one seats oneself in a carpeted salon about the size of the large spur offices and holding about 50 people. When filled, the door closes and the whole "room" moves off round the taxi strip to where the aircraft are waiting. A gangway is extended from the front of the vehicle and adjusted to the height of the plane's door and one simply walks aboard. A similar procedure is adopted for incoming passengers. A very comfortable flight saw us at L.A.P. by 0800 B.S.T., 0300 Washington time - breakfast was not required! A further week was required by Champion - who as the non-driver of the party was naturally responsible for the car - to complete 15 individual copies of the claim forms, only to have them returned as not valid. The form number had been altered and an extra line added; 15 further copies, of the new form are now required. On reflection, or reflexion, perhaps our administration is not so bad.

C. S. Fowler

STAFF NEWS

Congratulations to:

Barbara Kaiser and David Petrie who were married at Falmouth on 25th June.

Mr. C. S. Fowler now M.I.E.R.E.

Welcome to:

Mr. P. C. Chong	T/Tech. Officer	(Singapore)
Mr. C. W. Chapman	T/Labourer	(Winkfield)
Mr. G. Woodworth	T/Labourer	(Winkfield)

Resignations

Mr. M. G. Simmonds	T/Labourer	(Winkfield)

SPORTS AND SOCIAL CLUB NEWS

Log of Rowing Evening

Date: Thursday, 14th July, 1966.

Place: Cookham, 51° 30' N, 0° 40' E on the River Thames.

Weather: Sunny, and dry.

18.00 hrs. Congregated outside Turk and Sons Boathouse. Surrounded by swans and ducks with eyes and greedy beaks focussed on our sandwiches.

18.30 Pursuing a somewhat erratic zig-zag course upstream, having often to steer sharply starboard to avoid oncoming motor launches.

19.00 First dinghy was entering Bourne End. Half-an-hour later the fourth and last boat arrived - but - they had done their good deed for the day - they had taken pity on a young man whose boat had run out of petrol!

20.00 Refreshed by a stop at "The Quarry" we cast off for the return journey downstream.

Noted one of our number making effective use of a black umbrella as protection against amateur oarswomen's splashings and as a pusher-offer off the banks.

20.30 Safe and sound on firm, dry land.

21.45 Enjoying 'grog' in the Ferry Hotel.

K.R.D.P.C.S.

/Cricket

C R I C K E T

An entertaining evening's "cricket" was enjoyed here on Friday 1st July, 1966 when an American-Staff-at-Winkfield XI met the challenge of the R.S.R.S. XI. The laws of the game were waived slightly to allow for the visitors' inexperience, each man in the R.S.R.S. side being asked to bowl and each batsman in the American side being given two chances before he was out.

Despite some unorthodox styles our opponents managed to notch up 79 for 14 wickets declared! Our opening batsmen took command of the pitching, sorry bowling, and with the aid of a fine knock of 44 from Barry Jones we passed the visitors' total **without** loss.

The evening carried on until bad light stopped play with the remainder of the R.S.R.S. side having a knock. Needless to say there followed a lively discussion on the pros. and cons. of the game over a flagon of "ye olde Englishe ale" in the bar afterwards.

We look forward to the return match in this series, later in the summer, when we shall be meeting the challenge of the Americans, this time at base-ball. A notice will appear on the Sports and Social Club Board giving warning of this event and we hope as many people as possible will come along and give us their support.

John Cathrew

MENTAL EXERCISE

If you are one of the number of people who enjoy trying to solve puzzles you may like to try your skill on the following problems.

It is hoped that you may find some amusing, but you may also find some baffling or even provoking the comment, 'It can't be solved'. Whether you can prove any problem to be unsolvable is, as is so often stated in text books, 'left as an exercise for the reader'.

A bottle and its cork cost together 1s 1d. The bottle costs a shilling more than the cork. How much does the cork cost?

2. A glass contains a pint of water and another glass half a pint of milk. A spoonful of water is removed from the first glass and placed in the milk. The mixture is thoroughly stirred. A spoonful of this mixture is then placed in the water. Is there more water in the milk than there is milk in the water, or more milk in the water than there is water in the milk?

3. A young lady went into a jeweller's shop, chose a ring worth £2, paid for it and left. She returned to the shop the next day and asked if she could exchange the ring. This time she picked up a ring costing £4 and started to leave the shop. The jeweller naturally asked for a further £2. However the young lady silenced him by pointing out that yesterday she had given him £2, that she had just returned a £2 ring making a total of £4, so she owed him nothing. With that she stalked out of the shop leaving a perplexed jeweller counting his fingers. Would you dare to do what the young lady did?

/4.

4. A cylindrical hole six inches long is drilled straight through the centre of a solid sphere. What is the volume remaining in the sphere?

5. Readers are invited to construct on a plane surface a coloured map that requires five colours to prevent any two adjacent countries being the same colour.

6. We all know of solutions to the equation $x^n + y^n = z^n$ when n is equal to 2 and x, y and z are integers. Can you find a solution to this equation when n is equal to 3 (or any greater number) for integral values of x, y and z?

7. A hunter walks one mile south, turns and walks one mile due east and then walks one mile due north. He finds himself back at his starting point. Where may his starting point have been?

8. A prisoner is shut in a cell which has two doors. With him in the cell are two guards. The prisoner knows, as do the guards, that if he leaves the cell by one of the doors he may safely escape, but if he leaves by the other door he is certain to be killed. He also knows that one guard always tells the truth and that the other always lies. To enable him to choose which door to escape through to safety he is allowed to ask one question which he may put to either guard. What form would his question take?

9. The white, diagonally opposite corner squares of a chess board are removed, thus leaving 62 squares. Given this chess board and 31 dominoes each of which exactly covers two adjacent squares of the board, could you cover the 62 squares with the dominoes. If not, why not?

Answers next month.

M.C.

LETTER TO THE OUTSTATIONS

Dear Colleagues,

Those of you having an ornithological turn of mind will be pleased to learn of some new interests at Ditton Park. They may be seen swimming in the moat nearly every lunch time. They are cygnets, jealously guarded by their parents against a mini-armarda (armadillo?) of ducks determined to eat all the bread fragments thrown by passers-by.

A pike of reasonable size has been caught by one of the staff and rain falls heavily. All-in-all an English Summer such as you all remember - what else could so harden your resolve to go abroad?

Still in the Park, so to speak, the newspapers report that ten new laboratories were recently opened at the A.C.O., sufficient they say for some forty scientists. There is, as well, 'A flat roof for celestial observation or any other work which may be more conveniently carried out in the open air'. So there we are, back again to summer bird-watching and, the newsletter space being filled after a fashion, a sigh of relief from,

Yours sincerely,

The Editor