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OSD letter, April 12, 1974

By NLT-~~HL~~ NARS Date 10-10-75

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As a matter of interest, if the Americans had not alerted the British the first evidence of activity would have been obtained by the British on the NOCTURNAL flight from Gibraltar on Saturday the 10th of September, and results would not have been obtained before Wednesday the 11th of September, as there is a delay of approximately three to four days in getting the filters from Gibraltar into the laboratory at Harwell.

1. Filter

The filter used for collecting the activity is one of the British standard gas mask filters. The material is made from esparto grass in the form of a cylindrical tube approximately 12 cm in diameter. The filter is mounted in a hollow steel tube, the leading edge of which is shaped to give good aerodynamic properties. This steel tube is bolted onto the wing of an aircraft and usually each aircraft carries a filter on each wing. A wire grid is usually mounted at the front end of the filter to protect it from hail.

The air flow characteristics and the flow efficiency of these filters were calibrated by appropriate tests. Details are given in Appendix II.

2. Counter.

The counter consists of four Geiger counters, each approximately 14 cm long and 1.3 cm in diameter, made of glass 35 mgm/cm^2 , and accepts Beta down to 0.3 mev. The four Geigers are used in parallel and are put inside of the filter on some

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guard rails so that the geometry is preserved from observation to observation. The counter efficiency is 7.6% and a count of 1 per minute is equivalent to 6.0×10^{-12} curies on the filter. (Area 358 cm^2 .)

3. Method of Counting and Elimination of Background

There are three counting units employed, and in one of them is placed the sample filter, in one of the others is placed an unflown filter taken from the same batch as the flown filter. The third counter records counts from an unflown filter which has been preserved and continuously used for counting since observations first began in 1948. The counting time is in every case taken to be sufficient to give a 1% standard error. When a set of readings has been obtained from the three counters, the filters are permuted among the counters and a new set of records taken. By taking averages and permuting again, it is possible to eliminate all statistical fluctuations and variations in counter performance. The results obtained are that the background is 90 counts per minute and the activity of flown filters is expressed in terms of this quantity. The symbol R^1 is used to denote the activity of a filter expressed as a multiple of the background. Thus for example: $R^1 = 1$ means no activity on the filter, but only background; while $R^1 = 2$ means an activity above background exactly equal to the background. The activity collected from the cloud is therefore $R^1 - 1$. Values of R^1 obtained from filters flown on the various flights are given in Appendix I.

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4. Results on Gross Activity

The activity of various filters was measured from day to day with the object of determining the time of origin. By assuming that the activity decreased with time according to an inverse 1.2 power law, it was estimated that the time of origin was between the 26th and 30th of August. There is a slight uncertainty in the exact time of origin and the dates given might need correction of the order of one day if the departures from Ray and Wigner Law are taken into account. However, the spread in time of the original disturbance has been set widely enough to cover this uncertainty.

NOTE: It is perhaps worth noting that the maximum activity collected by the British filters, for flights of equal duration at similar altitudes, was roughly 20 times that obtained for any of the SANDSTONE tests. The maximum activity in the cloud was on September 11th, and was roughly 0.35 disintegrations per minute per cubic foot of air. This flight was at 20,000 ft. About two-thirds of this activity was found at 30,000 ft on September 11th.

5. Radiochemistry

By applying standard radiochemical techniques, three fission elements have been isolated, namely Barium, Cerium and Iodine. Filter B3 on September the 20th was giving an iodine count of 0.8 ± 0.4 while barium is giving 7.8 ± 3 . Further measurements are in progress but all radiochemical results so far obtained are consistent with the time of origin obtained from the gross activity.

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6. Auto-radiographs

The first auto-radiographs gave unsuccessful results, but, by increasing the time of exposure to 4 days, positive results have now been obtained. On filter B10, one fairly large particle and 34 extremely small ones have been located. The large particle is giving approximately 10 disintegrations per minute and is therefore about twice the radius of the largest particles collected by the American observers.

7. Activity Versus Particle Size

The evidence so far obtained is that most of the activity collected by the filters is extremely fine and penetrates to some depth in the filter medium. In the case quoted in the last paragraph, only a small percent of the total activity is due to the one large particle and the 34 small ones. Provided that the large particle proves to be authentic, special measurements will be made on it in the hope of measuring the efficiency.

8. Plutonium and Uranium

Information sent by cable and therefore necessarily brief, showed that on September 19th it had been established that the amount of Plutonium on one of the most active filters was less than 3×10^{-12} . The results on Uranium were very unsatisfactory because of the relatively large Uranium concentration in the filter. All that can be said is that the amount of Uranium collected might have been approaching 10^{-7} gms.

It was planned to make two further measurements on alpha emitters. The first was to attempt to get alpha tracks in a photographic film and from standard methods to determine the energy of the alpha

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particle. A second method was to concentrate the Uranium from the filter and see if the isotopic ratio 235:238 departed from normal. In neither case has any result yet been reported.

9. This interim report has been written on the evidence existing at Harwell on Saturday, September 17th, supplemented by fragmentary information communicated by secret cable. A proper report of the British work will be written later when the experimental measurements have been more fully digested, and a copy of this report will be forwarded to AFOAT-1.

22 September 1949

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APPENDIX 1

SUMMARY OF BRITISH FLIGHTS, SEPTEMBER 10-16

| Filter No. | Plane Type | Take Off Date & Time | Land Time | Route | Counted Date & Time | Count Excess | Activity (7-1) | Remarks |
|------------|------------|----------------------|-----------|---------------|---------------------|--------------|----------------|----------------------------|
| B.1 | Hal | 10 2100A | 0100A | C | 11 1500 | 110 | 0.236 | |
| B.2 | Hal | 10 2300A | 0425 | C | 11 1600 | 85 | 0.395 | |
| B.3 | Mosq | 11 0750 | 1130 | A | 11 2100 | 301 | 0.343 | |
| B.4 | Mosq | 11 1430 | 2000 | A | 11 2200 | 224 | 1.031 | 30,000 ft. |
| B.5 | Hal | 11 1928 | 0112 | C | 12 0900 | 64 | 0.735 | |
| B.6 | Hal | 11 1937 | 0112 | C | 12 1100 | 45 | 0.504 | |
| B.7 | Mosq | 11 0450 | 1714 | B | 12 2000 | 60 | 0.796 | |
| B.8 | Hal | 11 0925 | 1817 | D | 13 0200 | 42 | 0.500 | |
| B.9 | Mosq | 12 1355 | 2000 | B | 13 0500 | 74 | 0.801 | |
| B.10 | Mosq | | | Round Britain | 14 0100 | 33 | 0.455 | Counted every 10 Min. |
| B.11 | Hal | 13 0115 | 0955 | D | 13 1630 | 39 | 0.413 | |
| B.12 | Line | 13 0836 | 1815 | D | 14 0230 | 103 | 1.133 | |
| B.13 | Line | 13 2023 | 0935 | D | 14 2000 | 204 | 2.216 | |
| B.14 | Line | 14 0900 | 1700 | D | 14 0500 | 350 | 3.024 | |
| B.15 | Hal | 14 1017 | 1713 | F | 15 0730 | 30 | 0.403 | BIRMINGHAM Met Flight |
| B.16 | Mosq | 15 1100 | 1500 | Round Britain | | | | Short Flight Round Britain |
| B.17 | Line | 14 0817 | 1115 | D | 16 0230 | 35 | 0.390 | Abortive |
| B.18 | Hal | 15 0305 | 0725 | BIRMINGHAM | 16 1400 | 50 | 0.574 | BIRMINGHAM Met Flight |
| B.19 | Line | 15 1700 ? | 0230 ? | D | | | | |
| B.20 | Mosq | 16 1055 | 1500 | Round Britain | | | | Same as B.17 |
| B.21 | Line | 16 | | D | | | | |

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APPENDIX EI

Particulate filtering and flow efficiency of Filters

1. Filters normally tested at 3 cu. ft. per minute air flow against a standard methylene blue cloud (90% of particles under 0.5 microns) giving efficiency averaging 99%. Efficiency falls off slightly with increased air flow, but is not expected to fall below 95% at 60. cu. ft. per minute - no measurements available at this speed.

2. Flow through the filter equals $1.764 v$ litres per second where v is the air speed in the filter entry. The air speed in the filter entry is given by the formula - (where V is the aircraft speed).

$$\frac{1}{2} \rho v^2 = \text{Pressure drop} = A \frac{\rho}{\rho_0} v^2 \quad B \frac{\mu v}{\mu_0}$$

where ρ and ρ_0 and μ and μ_0 are the density and viscosity of air at the altitude concerned and at sea level. The values of A and B found by experiment are 0.349 and 1.826 respectively. The air flows deduced have been given you in a separate memorandum.

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