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TELLUS PROJECT
Joint Flight Experiment UK/1977

Report No. 1
Planning and Execution

P. Reiniger

February, 1977
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APPENDIX
1. **CHRONOLOGICAL SCHEDULE**

April 1, 1977  
2nd TELLUS meeting, Brussels  
Announcement of JFE

June 6  
1st Meeting Working Group 1: Preparation of prelaunch experiments

June 8  
Attribution of credits for JFE

July 1  
Credits for JFE available

July 28  
Publication of tender for flight campaign

**Joint Flight Experiment, UK**

July 19, 1977  
NERC, London. First meeting of UK Co-investigators for planning of JFE/UK

August 17  
Attribution of tender to Spacetec-Flight One

August 25  
NERC, London. Second and final meeting of UK co-investigators and Flight One for planning of JFE/UK

September 2  
Start of operations fixed for Sept. 10, pending favourable weather forecast

September 6  
Weather forecast favourable - operation is launched. Departure of mobile unit

September 8  
Arrival of mobile unit and JRC ground team

September 13  
Night and day overflight

September 14  
Return of mobile unit

September 15  
End of campaign

November 8  
Delivery of computer-compatible tapes and scanner imagery.
2. INTRODUCTION

The Joint Flight Experiment (JFE) of the TELLUS Project was conceived as a preparation for the EXPLORER-A Heat Capacity Mapping Mission with the purpose of acquiring experience in the interpretation of thermal imagery of agricultural land surfaces.

In particular it was the purpose of the experiment to test the algorithms which should permit an evaluation of soil moisture and evapo-transpiration from remotely sensed surface temperatures. An assessment of the atmospheric influences on these surface temperature measurements was only a secondary objective of the experiment.

Accordingly, the conditions for the experiment were set by the first objective and they were the following:

1. Consecutive night and day flights
2. Overflight at the time of the maximum and minimum of the daily surface temperature cycle
3. Clear night and day, no wind at night
4. Relatively high radiation during the day in order to obtain an important temperature amplitude
5. Bare soil, grassland and other crops in the flight area
6. Contrasts in soil moisture and soil type.

These often conflicting conditions and the time necessary for organizing the campaigns narrowed down the suitable period to the month of September, with the radiative flux from the sun being still rather high and wheat fields having already been harvested and ploughed. Likewise, meteorological statistics showed a fair chance for obtaining suitable weather conditions during this month.

As can be seen from the chronological schedule, only five months lay between the decision to carry out the JFE and the first flight; the responsible for the JFE was designated only two months before the campaign.

It was due to the spirit of cooperation and to the effort devoted by all the persons involved that the operation of the JFE could be carried out. This is true for the personnel of the various institutes and organizations who took part actively in the JFE, as well as for the personnel of the JRC-Ispra, at all levels, administrative, technical and scientific.

On this occasion I should like to thank everyone and all of them for their contribution.

P. Reiniger,
Coordinator JFE
3. INSTITUTES AND ORGANIZATIONS

The following institutes and organizations participated in the campaign, either at the organizational or at the executive stage.

Coordination and Sponsor in the UK:

Natural Environment Research Council
Alhambra House
27-33 Charing Cross Road
London, WC2H OAX

A.E.S. MAYER

Co-investigators participating in the planning of the operation, the execution of ground measurements and data interpretation:

Institute of Hydrology
Crowmarsh Gifford
Wallingford, Oxfordshire OX10 8BB
K. BLYTH
R.T. CLARKE
R.J. GURNEY

University of Reading
Department of Geography
2, Earley Gate, Whiteknights Rd.
Reading RG6 2AU
J. HARDY

University of Leeds
Department of Geography
33, Hydeter 2
Leeds LS2 9JT
M.J. KIRBY
S.F. JAGGER

Commission of the European Communities
Joint Research Centre
Ispra-Establishment
I-21020 Ispra
G. MARACCI
P. REINIGER
G. TASSONE

Contractor for airborne operation and pretreatment of scanner data, aerial photography:

Spacetec Datengewinnung GmbH
Heidehang 17
D-4300 Essen
F. KINDLE (Operator)

Subcontractor for flight:

Flight-One Ltd.
Staverton Airport
Cheltenham, Gloucestershire
P. RAYNER (Chief pilot).
4. TEST AREA AND GROUND INSTRUMENTATION

The test area situated to the west and north-west of London, was composed of two test sites:

Grendon-Underwood (10°W, 51°53′N)
Newbury (10°44′W, 51°20′N)

4.1 Grendon Underwood

Ground operations: Institute of Hydrology, Wallingford (IHW)
Joint Research Centre, Ispra (JRC)

Maps: Ordonnance Survey 1:50,000 First Series, Sheet 165
O.S. 1:10,560 Provisional Edition, Sheets SP 62 SE, SP 72 SW, SP 72 SE.
Soil map 1:10,560

Landscape: Gently sloping land between 60 and 100 m above sea level. Fields bordered by hedges. Size of fields up to 15 ha. Land use is cropland (cereals) and grassland with some forest and market gardening.

The area is part of the Grendon Underwood Experimental Catchment of the river Ray, with one of the longest records established by the Institute of Hydrology.

Soils: Clay soils, alluvium and soils of the sandstone series (Fig. 1)
Grassland - clay of Evensham Series
Cropland - clay of Denchworth Series

Test plots: Two 1 x 1 km plots were delineated on the test site (Fig. 2), one being mainly composed of grassland, the other mainly occupied by cropland. At the time of the flight the cropland was stubble, burnt stubble, or bare soil (ploughed). Ground instrumentation was established on grassland and on bare soil.
Fig. 1 - Soil Map of the Grendon Underwood Experimental Catchment

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR
4.1.1 Met Site - Grassland

Stationary Instrumentation and Measurements

Automatic weather station, recording on magnetic tape cassette at five minutes' intervals (Operator: IHW)

- Solar radiation: 0.3 - 2.5 μm
- Net radiation: 0.3 - 80 μm
- Wind run
- Wind direction
- Rainfall
- Air temperature (wet and dry bulb).

Grass minimum thermometer
Earth temperature thermometers: 60, 120, 240 cm
Soil surface thermometers: 5, 10, 20 cm
Soil heat flux plates: 1 in air at 1.5 cm, 2 at 5 cm depth, 1 at 10 cm, 1 at 20 cm

Mobile data collection unit, equipped with data logger and tape punch, recording at five minute intervals (Operator: JRC-Ispra)

- Solar radiation: 0.3 - 2.5 μm
- Reflected radiation: Exotech radiometer, mounted on tripod at 2 m height over ground surface pointed vertically downward.
- Four LANDSAT-2 compatible bands: 498 - 596 nm, 580 - 706 nm, 687 - 817 nm, 797 - 974 nm
- Reflected radiation from standard panel: LANDSAT-2 compatible radiometer ("Gatelli" radiometer)
- Grass surface temperature: Heiman infrared thermometer mounted on tripod at 2 m height pointed vertically downward. Spectral range 8-14 μm, field of view 20°.

Mobile Instrumentation Used on Both Sites

- Surface temperature: Barnes infrared thermometer PRT-5. Spectral range 9.5 - 11.5 μm, field of view 20°. The instrument was read via a digital millivoltmeter and was used hand-held at about 1.5 m
from the soil surface and at an approx. angle of 30° from the vertical (Operator: JRC-Ispra).

Soil moisture gravimetric (Operator: IHW).

4.1.2 Lower Greatmoor Farm - Bare Soil

Stationary Instrumentation

Data logger with magnetic tape unit (Operator: IHW)

- Albedo: 0.3 - 2.5 μm (20 cm above ground level)
- Wind run
- Thermistor soil temperature probes: sub-surface 2 cm, 5 cm, 20 cm
- Earth temperature (manual) 50 cm
- Air temperature (120 cm above ground level, manual)

Mobile Instrumentation and Measurements

- Surface temperature Barnes infrared thermometer PRT-5
- Spectral range: 8-14 μm, field of view 2°. Operated with power generator, 75 cm above ground level (Operator: IHW)
- Reflectance: Exotech radiometer, pointed alternatively towards the sun and at the ground (Operator: JRC-Ispra)
- Soil moisture gravimetric (Operator: IHW)

4.2 Newbury


Maps: Ordnance Survey 1:50,000 First Series, Sheet 174, O.S. 1:25,000 First Series, Sheets SU 55, SU 56

Landscape: Sloping land between 70 and 200 m above sea level. Fields bordered by hedges. Size of fields up to 12 ha. Land use is cropland (cereals), grassland and woodland and some market gardening.


Surface water gley, on loamy drift, on clay. Wickham Series. Permanent pasture. Water table 1-2 m (Plastow Green).
Brown calcareous soil (rendzina) on chalk.
Arable soil (Hannington).

Test plots: Three 1 x 1 km test plots were delineated on the test site, corresponding to the three different soil types (Fig. 3).

4.2.1 Crookham - Brown earth

Instrumentation

Automatic weather station, data recorded on magnetic tape cassette (supplied by IHW).

Solar radiation 0.3 - 2.5 μm
Net radiation 0.3 - 80 μm
Wind run
Wind direction
Rainfall
Air temperature (wet and dry bulb)
Soil moisture gravimetric (Operator: UR/DG)

4.2.2 Plastow Green - Surface water gley

Instrumentation

Solar radiation 0.3 - 2.5 μm
Reflected short wave 0.3 - 2.5 μm
Net radiation 0.3 - 80 μm
Air temperature (wet and dry bulb)
Wind speed
Soil temperature 5, 10, 20, 60 cm
Soil heat flux plates surface, 10 cm
Soil moisture gravimetric (Operator: UR/DG)
4.2.3 Hannington - Brown calcareous soil

SW corner grid point
SU 540 550
51°17'45"N
1°13'00"W

Land use
arable land, grain wheat, stubble, ploughed.
Instrumentation on bare soil.

Instrumentation
Solar radiation
0.3 - 2.5 μm
Reflected short wave
0.3 - 2.5 μm
Net radiation
0.3 - 80 μm
Air temperature
and humidity
Wind run
Soil temperature
5, 10, 20, 60 cm
Soil heat flux plates
surface, 10 cm
Soil moisture
gravimetric (Operator: UL/DG)

5. AIRCRAFT AND SENSORS

Aircraft:
Twin-Pionee r
Operating speed - possible range 140 - 1.5 km/h
actual 170 - 185 km/h
Altitude
1000 m
Crew:
2 (pilot, navigator)
Airport:
Stavenport, Cheltenham
Flight time to the
20 min
test sites:

Sensors:
Camera
RC - 883
Lens
15 UAG 275
Film
Kodak Aerochrome Infrared
2443, 60% overlap stereo coverage
Infrared thermometer
Barnes PRT-5. Spectral sensitivity 8-14 μm, field of view 2°.
This instrument was mounted vertically aligned with the MSS nadir view and was coupled with a Hasselblad camera (80 mm focal length, 5.6 aperture, 1/500 sec exposure. Ektachrome MS). The signal of the thermometer and of the camera shutter
was recorded on two tracks of the MSS tape recorder.

**Multispectral scanner (MSS)**

Daedalus DS-1250 with 9 channels in the visible and near-infrared and one channel in the thermal range, equipped with a 14-track tape recorder. The operating parameters of the system and the wavelengths of the 10 channels and their possible combination for LANDSAT channels are the following:

**Operating parameters for DS-1250 system:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating wavelength</td>
<td>0.42 - 14 μm</td>
</tr>
<tr>
<td>Aperture</td>
<td>5 inches</td>
</tr>
<tr>
<td>Focal length</td>
<td>6 inches</td>
</tr>
<tr>
<td>Optical aperture (eff.)</td>
<td>f/2</td>
</tr>
<tr>
<td>Scan rate</td>
<td>80 scans/sec</td>
</tr>
<tr>
<td>Total field of view</td>
<td>88°20'</td>
</tr>
<tr>
<td>Gated field of view</td>
<td>77°20'</td>
</tr>
<tr>
<td>Instantaneous field of view</td>
<td>infrared: 2.5 mrad</td>
</tr>
<tr>
<td></td>
<td>visible: 2.5 mrad</td>
</tr>
<tr>
<td>Temp. resolution</td>
<td>infrared: 0.2°C</td>
</tr>
<tr>
<td>V/H</td>
<td>.2</td>
</tr>
<tr>
<td>Roll correction</td>
<td>total: ±10°;</td>
</tr>
<tr>
<td></td>
<td>unvignetted: ±5°</td>
</tr>
<tr>
<td>Reference sources</td>
<td>infrared: 2 controllable</td>
</tr>
<tr>
<td></td>
<td>thermal blackbodies</td>
</tr>
<tr>
<td></td>
<td>visible: 1 fixed voltage</td>
</tr>
<tr>
<td></td>
<td>broadband visible/IR light</td>
</tr>
<tr>
<td>Reference range</td>
<td>infrared: -10°C to 40°C</td>
</tr>
<tr>
<td></td>
<td>with respect to scan head</td>
</tr>
<tr>
<td></td>
<td>heat sink</td>
</tr>
<tr>
<td></td>
<td>visible: 0.42 - 1.2 μm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel</th>
<th>Wavelength, μm</th>
<th>LANDSAT channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.42 - 0.45</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.45 - 0.50</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.50 - 0.55</td>
<td>4 0.50 - 0.60 μm</td>
</tr>
<tr>
<td>5</td>
<td>0.55 - 0.60</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.60 - 0.65</td>
<td>5 0.60 - 0.70 μm</td>
</tr>
<tr>
<td>7</td>
<td>0.65 - 0.69</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.70 - 0.79</td>
<td>6 0.70 - 0.80 μm</td>
</tr>
<tr>
<td>9</td>
<td>0.80 - 0.89</td>
<td>7 0.80 - 1.10 μm</td>
</tr>
<tr>
<td>10</td>
<td>0.92 - 1.10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>8 - 14</td>
<td></td>
</tr>
</tbody>
</table>
Replay of the tapes could produce a quicklook image immediately after the flight. Pixel size for 1000 m altitude 2.5 x 2.5 m; swath width 1600 m.

Operating crew: 1 photographer
1 scanner operator.

6. ORGANIZATION

6.1 Responsibility

The coordinator of the JFE takes the decision when to carry out the operation. In case of heavy ground fog on one of the two sites, the flight will be carried out over one site only.

6.2 Weather Forecasting

A long range weather forecast was obtained from the Royal Meteorological Service at Bracknell three days before the planned date of the operation.

During the stand-by period a forecast for the next 16 hours was obtained every evening at 20.00 h local time from:

Royal Meteorological Service, Bracknell (contact: IHW)
Royal Airforce Met. Office, Benson (contact: IHW)
Royal Airforce Met. Office, Brize Norton (contact: chief pilot)

The RAF Met. Offices supplied a forecast of local weather conditions such as the formation of ground fog.

6.3 Sequence of Flights

The night flight is carried out first, followed by the day flight.

Arguments in favour:
- conditions for night flight critical - clear night, no wind; those for day flight less limiting as some clouds are permitted.
- only 9 hours from minimum to maximum temperature, 15 hours from maximum to minimum; less chance for change of weather.
- quicklook arrives around noon and allows sampling during daylight.

Arguments against:
- maximum and following minimum form a temperature cycle.
- EXPLORER-A sequence is day, followed by night passage.

The aircraft should be over the test site:

night flight: Grendon 05.30
Newbury 06.00
day flight:  
- Grendon 14.00  
- Newbury 14.30

Flight axis:  
- Grendon: ENE to WSW, length 8 km  
- Newbury: N to S, from Kingsclere SSE, length 10 km

Marker lights:  The flight axis for the night flight was marked with yellow flashing lights, battery-operated. The lights were positioned to allow for a 30° to 50° viewing angle. The position of the lights was checked on the ground before the operation to ensure an unobstructed field of view.

- Grendon site: 3 marker lights (circled crosses on Fig. 2)  
- Newbury site: 4 marker lights (circled crosses on Fig. 3).

6.4 Time Table

Time indicated is local time (British daylight saving time) = GMT + 1

- Sun rise: approximately 06.30; new moon
- 20.00 h Weather forecast is communicated to coordinator JFE. Takes go-decision after consultation with chief pilot. Informs IHW and UR/DG of decision. One on-the-ground observer is sent to each test site to check local weather conditions. In case of adverse conditions, i.e. heavy ground fog, inform coordinator at 03.20 h.
- 03.30 h Operation can be cancelled by phoning to chief pilot.
- 04.30 h Take-off - 30 min. Last opportunity to cancel flight by phoning to Flight-One, Staverton Airport.
- 05.00 h Take-off.
- 05.00 h Ground team operational on the test sites. Marker lights in position.
- 05.30 - 06.00 Overflight.
- 09.00 h Car from UR/DG at airfield to pick up and disseminate quicklook to test sites.
- 12.30 h Coordinator contacts Flight-One at Staverton Airport for decision on day flight.
- 13.30 h Take-off.
- 13.30 h Ground team operational on test sites for day flight.
- 14.00 - 14.30 Overflight.
- 15.30 h Contact Flight-One, Staverton Airport for results of the day flight.
7. DESCRIPTION OF THE CAMPAIGN

Thur. Sept. 8  Arrival of JRC mobile unit and ground team. HQ in Aylesbury, 20 km from Grendon site. First visit of Grendon site. Aircraft arrived at Staverton Airport.


Sat. Sept. 10  Check of ground instrumentation. Weather forecast negative.

Sun. Sept. 11  Cloudy in the morning, getting bright and sunny in the afternoon. Weather forecast predicts clouds coming up in the second half of the night. Possibility of suitable weather conditions for 12/13.

Mon. Sept. 12  Weather forecast was right. Cloudy. Intercalibration of IR-thermometers: Heiman, PRT-5 JRC, PRT-5 IHW. Weather forecast at 20.00 positive. Predicts suitable conditions for flight, possibility of ground fog in low-lying areas later in the morning. Operation is started.

Tue. Sept. 13  No negative reports from on-the-ground observers on test sites at 03.20. Operation continues. Ground teams arrive at test sites on schedule. Marker lights on. On Grendon site most eastern light on late, on Newbury site one light not on all the time. Take-off 04.45 h.

<table>
<thead>
<tr>
<th>Passes over Grendon:</th>
<th>05.26 h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>05.34 h</td>
</tr>
<tr>
<td></td>
<td>05.43 h</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Passes over Newbury:</th>
<th>06.01 h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>06.12 h</td>
</tr>
</tbody>
</table>

Landing: 07.00 h

Landing was made difficult by ground fog.

On Grendon Met site ground fog formed at around 06.00 h, dissipated at 07.20 h.
Measurements with mobile IR-thermometer between 05.15 h and 06.45 h on both Grendon sites. Failure of one battery of airborne PRT-5 noted by operator during first passage over Grendon site.

Quicklooks ready at Staverton Airport 09.30 h, arrive at Grendon 12.30 h.

Weather clear and sunny, light wind. Operation continues with day flight.

Take-off: 13.15 h
Passes over Grendon: 13.47 h 14.00 h
Passes over Newbury: 14.25 h 14.33 h
Landing: 15.10 h
Contact Staverton Airport 15.30 h

Again battery failure of airborne PRT-5; all other instruments worked correctly, including Hasselblad camera connected to PRT-5. Due to fatigue of operator day flight quicklook will be ready only next morning.

On Grendon site ground measurements with mobile IR-thermometers and Exotech from 12.30 to 17.15 h. Soil moisture samples at both sites until late in the afternoon.

Wed. Sept. 14 Recalibration of airborne PRT-5 at Staverton Airport. Dismantling of Hasselblad camera. Quicklooks ready in late morning, judged satisfactory: operation does not have to be repeated.

Dismantling of instrumentation on test sites. In the afternoon departure of the JRC mobile unit.

Thur. Sept. 15 Departure of JRC ground team. End of campaign.

Tue. Sept. 20 De-briefing of JRC ground team at Ispra.

8. REMARKS AND CONCLUSIONS

8.1 General

A number of conclusions of a general organizational nature could be drawn from this first campaign. Part of these conclusions came up during the de-briefing of the JRC ground team.
Sufficient transport turned out to be vital for the success of the campaign. The "mobile" unit of the JRC turned out to be stationary once the instruments installed on the site. One station-car hired at the start of the campaign proved to be inadequate, a second car was rented too late the day of the flight.

Lodging:
Not all the members of the JRC ground team found rooms in the same hotel for the whole duration of the campaign. Some of them had to change rooms or hotel. This had a negative effect on the moral and cohesion of the team and should be avoided in future operations.

Communications:
Communications from the Grendon site where the coordinator of the JFE was stationed, with the airport and the other test site, proved to be inadequate. They were in fact assured by a public phone booth about 500 m from the mobile unit.

In future operations a telephone connection directly from the field station should be established. Likewise, walky-talkies should be used for communication between various ground teams on one site. An emergency radio connection with the aircraft would also be advisable, though VHF should not be employed by the aircraft during the overflight so as to avoid disturbing the scanner signal.

8.2 Ground Measurements
Flight campaigns such as the JFE require an important concentration of personnel and instrumentation on the ground to match and properly exploit the wealth of data obtained by the airborne instruments. Though an important effort in this direction had been made, greater means should be deployed on the ground in future campaigns.

The precise layout and execution of the sampling schemes and measurements was left to the competence of the various team leaders, i.e. IHW, JRC-visible, JRC-thermal, etc. A more thorough discussion of the scheme would be recommendable in future operations, though the initiative should remain with the team leaders. Measurements of emissivity should be included in the future.

The precise localization of mobile ground measurements, i.e. soil moisture, radiometric measurements, is a problem to be solved. Numbered markers left on the ground may serve to this purpose as their exact position may be measured beforehand or later and not during the "heat of the action".
While data for atmospheric corrections could be obtained from a tethered balloon not far from the test area, more particular attention should be given to these measurements in future campaigns.

The thermal quicklooks were used only to a limited extent in deciding the sampling of soil moisture. This is partly due to lack of experience and difficulties in handling transparencies in the field. Heliographic prints should be more useful and daytime quicklooks should show more contrasts than nighttime thermal images.

The quicklooks proved extremely valuable, if not indispensable, for establishing an up-to-date landuse map of the test area.

8.3 Weather Forecasting

The weather forecast, both from the Royal Met. Service at Bracknell and from the RAF Met. Offices, proved to be very reliable and accurate.

While the day of the overflight appeared to be bright and clear from the ground, weather-satellite photographies obtained retrospectively by the IHW showed the passage of thin clouds over the test area. While these did not interfere with the measurements from the low-flying aircraft, data from weather satellites should certainly be consulted in future under-flight experiments.

8.4 Flight

The execution of the flight operation by a small company employing subcontractors for the aircraft and aerial photography proved on the whole to be very satisfactory. The organization was flexible, there was a direct contact with the people doing the job and there was a complete absence of red tape.

In future operations, the rule that only one person deals with the chief-pilot should be enforced more strictly. This would have avoided some confusion with the format of quicklooks and the delivery of aerial photos.

Operation of airborne instruments:

The operator was apparently not familiar with the PRT-5 infrared thermometer as this instrument is usually not installed in the aircraft. In this case, precise written instruction should, in the future, be given to the operator.

Both the scanner data and the aerial photographies were of high quality.
Execution of the flight:

The precision of the flying was very high and the passages over the test areas were on schedule.

On the Grendon site the flight axis of the day flight was rotated relative to the night flight by 0.6° only. The night axis was shifted to the SE relative to the day axis: 205 m at the entrance to the axis (Hogshaw);

284 m at the exit from the axis (SW of Grendon).

The planned centerline of the flight path lies between the actual day and night flight axes and it intersects the actual day flight axis at the Grendon Met site.

The erroneous position of one marker light on the Grendon site is certainly responsible for part of this slight divergence.

A similar precision was obtained on the Newbury site.
APPENDIX

Aircraft Personnel

P. Rayner        Chief Pilot        Flight-One
J. Allinson      Navigator         Flight-One
R. Wood          Photographer      Fairey Surveys
F. Kindle        Scanner Operator  Spacetec

Ground Team

Grendon Site

F. Bertona       JRC-Ispra
K. Blyth         IHW
E. Gatelli       JRC-Ispra
G. Maracci
P. Reiniger
J. Sentoll
G. Tassone
R. van Wijk
G. Williams      IHW

Newbury Site

P. Brice         UR/DG
G. Goodhind
C. Gurney
J. Hardy
S. Jagger        UL/DG
C. Justice       UR/DG
D. Milton
R. A. G. Savigear
R. Thompson
H. Walkland
D. William
M. Wooding