Target Velocity (metres per second)	Scan Rate (Seconds)	Distance Travelled Between Scans (km)[1]	Dwell Time in 1.5 Degree Beam(Counter Direction)[2](sec)	Dwell Time in 1.5 Degree Beam(Same Direction)[3](sec)
250	10	2.5	0.04[4]	0.04[4]
1000	10	10.0	0.043	0.037
3000	10	30.0	0.052	0.033
6000	10	60.0	0.074	0.027
10,000	10	100.0	0.173	0.023
15,000	10	150.0	0.035*	0.018

TABLE 1-2: RADAR DISTANCE , TIME & DWELL (U)

Notes:

[1] Using the 10 second inspection rate of the UKADR radars.

[2] The number of pulses a radar receives is a function of the antenna beam-width, the PRF and the antenna scan rate. Hence, the scan rate is effectively reduced if the target speed causes it to stay in the beam for a longer period. In the limit both the target and the beam move at the same rate and the reflected pulses from a continuous dwell on-target are theoretically available. For example, at a target range of 20km., when scanning at an angular rate of 36 Degrees per second, equivalent to a linear beam movement rate of ~525m(subtended at 20km range) in millisec, this is equal to a linear beam velocity of ~13,000 metres per second. In this case the radar beam speed is only exceeded by the target speed by the final item* in the list above. Ignoring, the radar sampling algorithms which may be in use and any system limits on the maximum resultant tracking velocities of the system, the UAP detection probability could increase. Before the point of dwell is reached, assuming that the pulses are available for use, for example, when the UAP (moving at 7000 metres per second) is overtaken by the radar beam as it scans, the increased time-on-target would produce about 20 pulses for integration, instead of the designed 11 pulses which would be received (from an aircraft sized target) if the target was only moving at 250 metres per second. However, because of the huge UAP velocities which are possible, by the next inspection time, subject to the geometry, the object could easily move into the overhead dead-space, out of coverage range, have faded to a lower electron density or even disappeared (discharged) completely. Although the opportunities for detection might **apparently** be present (i.e. as would reasonably be expected if an object is within coverage) this alone is not sufficient as detection depends on a combination of factors which do not apply to normal targets.

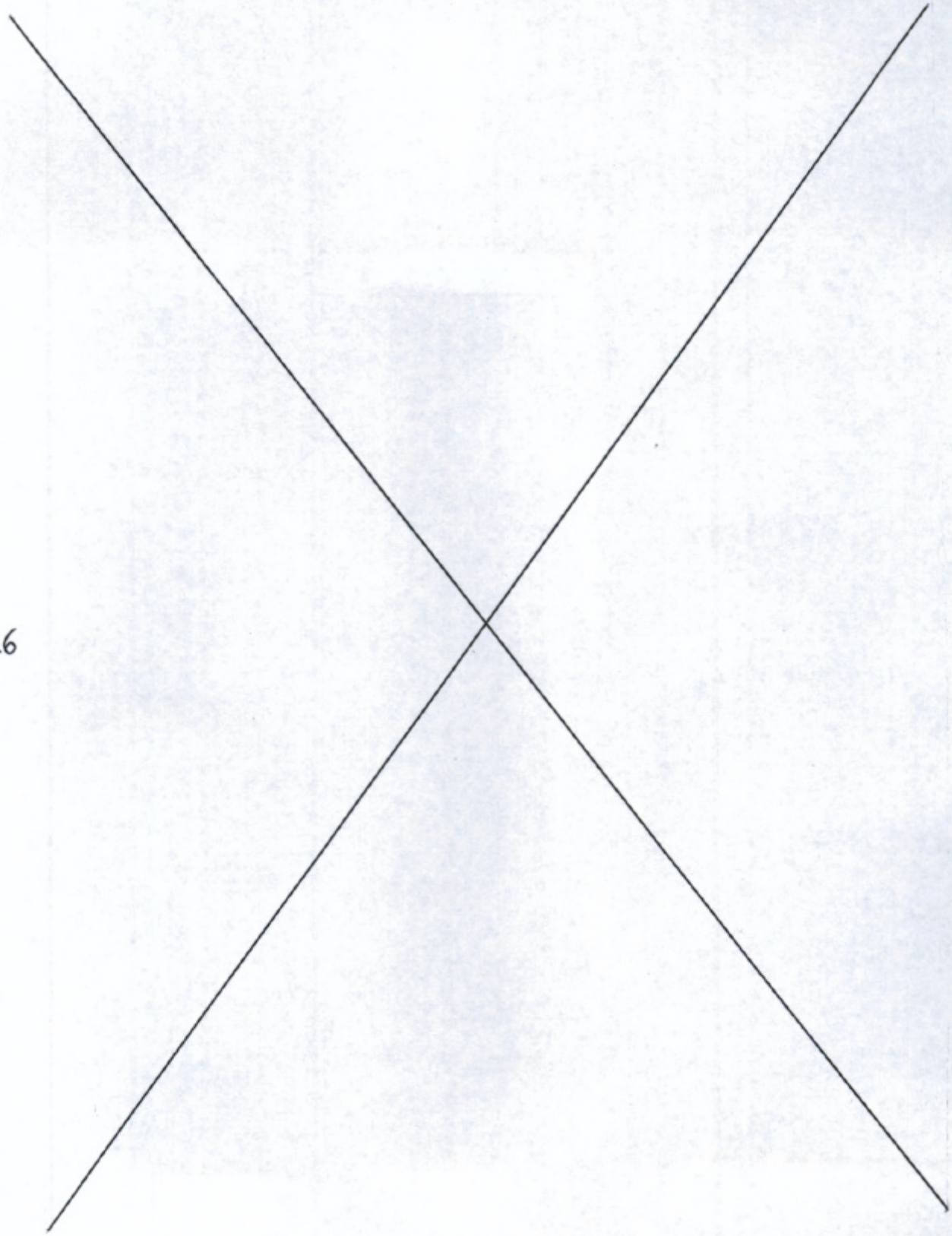
[3] At a target range of 20km but with the target flying across the azimuth beam in the opposite direction to it's rotation the effective scanning time is reduced. In this instance the beam-crossing target is spending progressively less time in the radar beam with increasing UAP velocity. As an example, at a UAP speed of 7000 metres per second the UAP passes through the beam at 20km range at an effective velocity of 20,000 metres per second. The time taken to cross a distance of 525m at this speed is ~0.026sec. and the number of pulses received by the radar would be reduced to 7. In turn, this will reduce the probability of detection, possibly to the point of not crossing the detection threshold. By the time the target velocity reaches 15,000 metres per second, there is only time for 5 pulses to be reflected.

[4] At a target velocity of 250 metres per second the dwell time does not vary significantly whether the target is going the same way as the beam is scanning. This is the normal situation for the speed range of typical manned aircraft.

Moths	1	Wavelengths	10cm	(E/F Band)
Sparrow	15	Wavelengths	10cm	(E/F Band)
Sparrow	1.9	Wavelengths	3cm	(I Band)
Pigeon	80.0	Wavelengths	10cm	(E/F Band)
Pigeon	15	Wavelengths	3cm	(I Band)
Pigeon	11	Wavelengths	0.7m	(A/B Band)

TABLE 1-3: BIRD & INSECT RCS (U)

S.26



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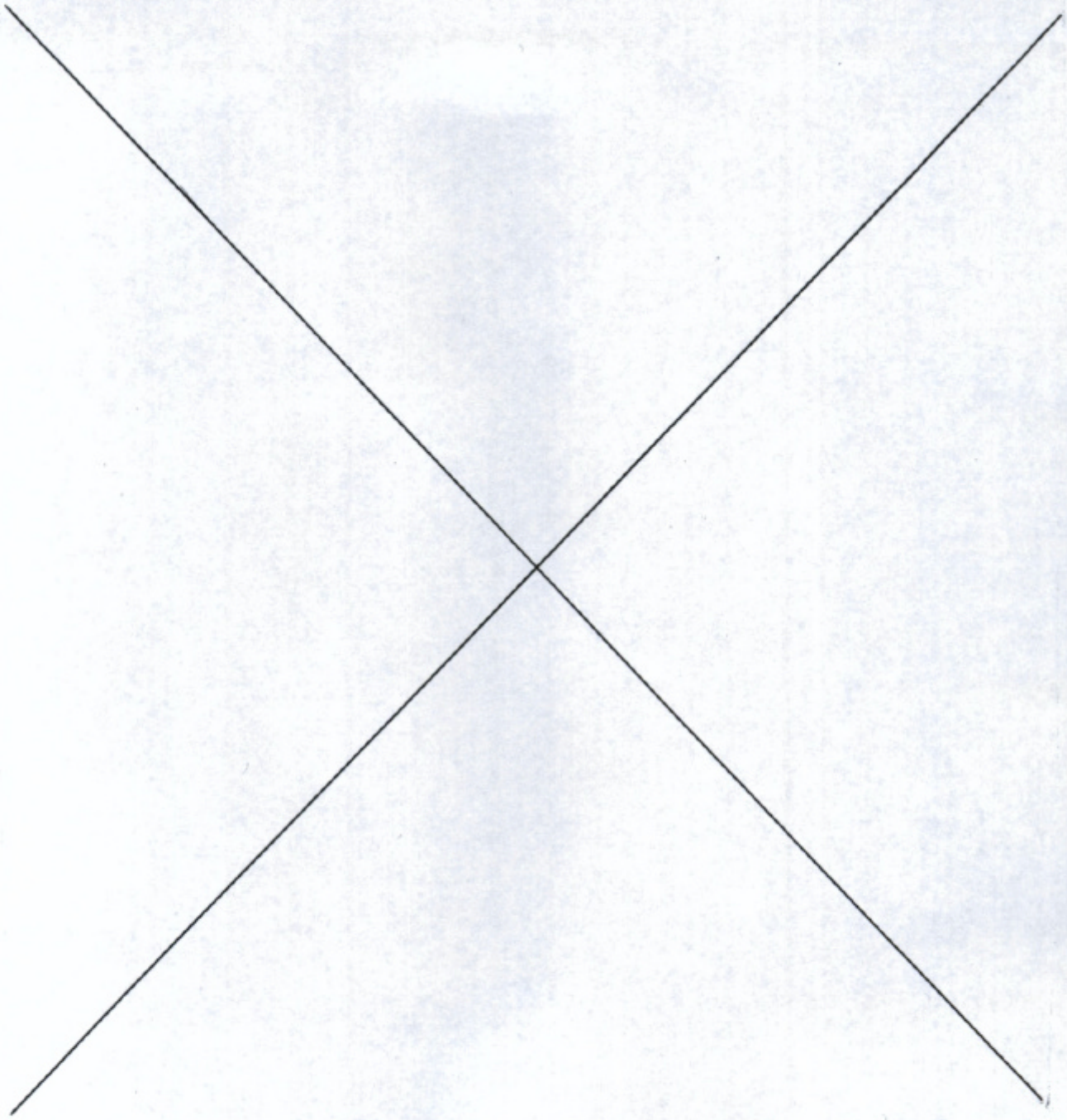
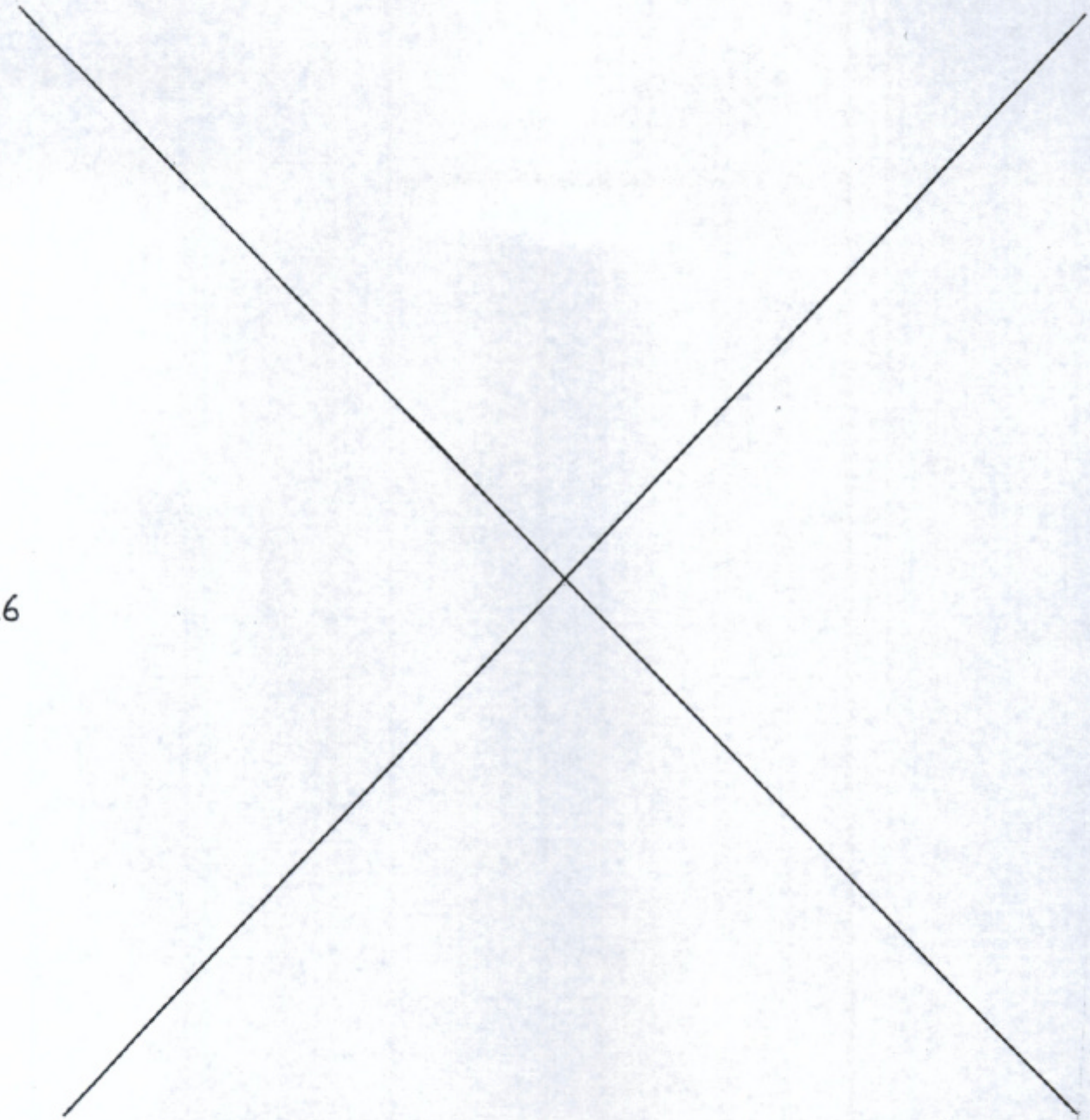
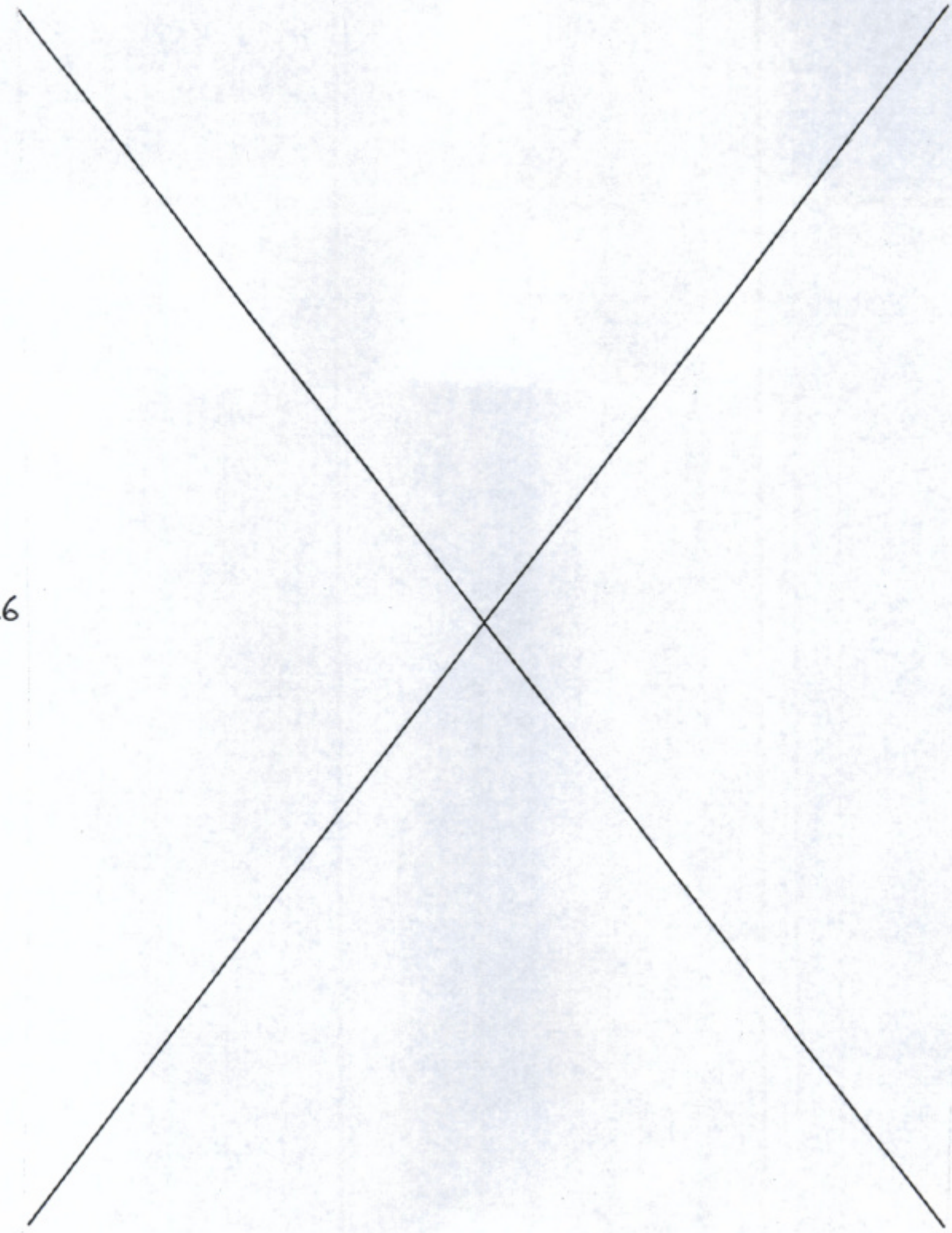
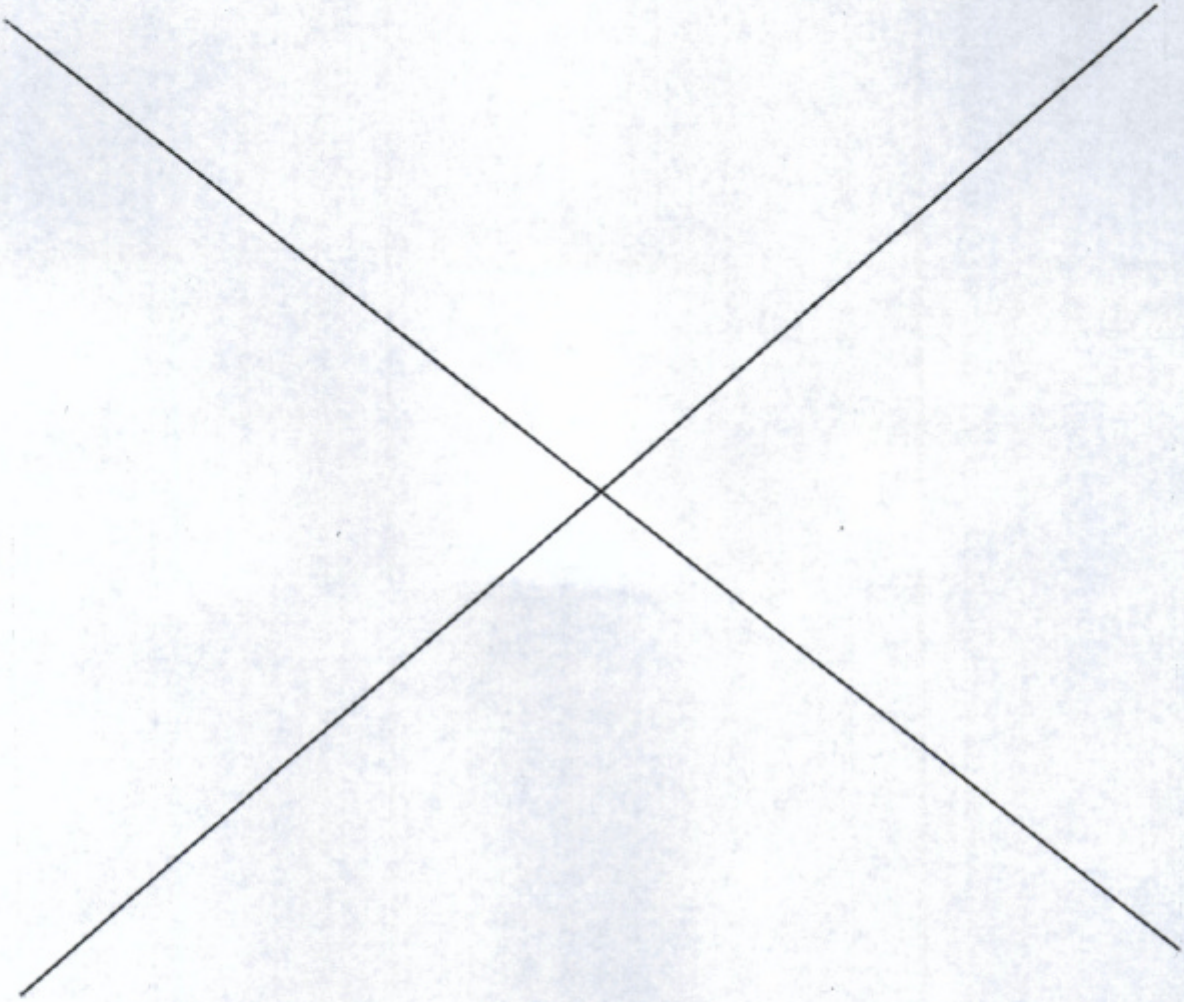




S.26



S.26



S.26

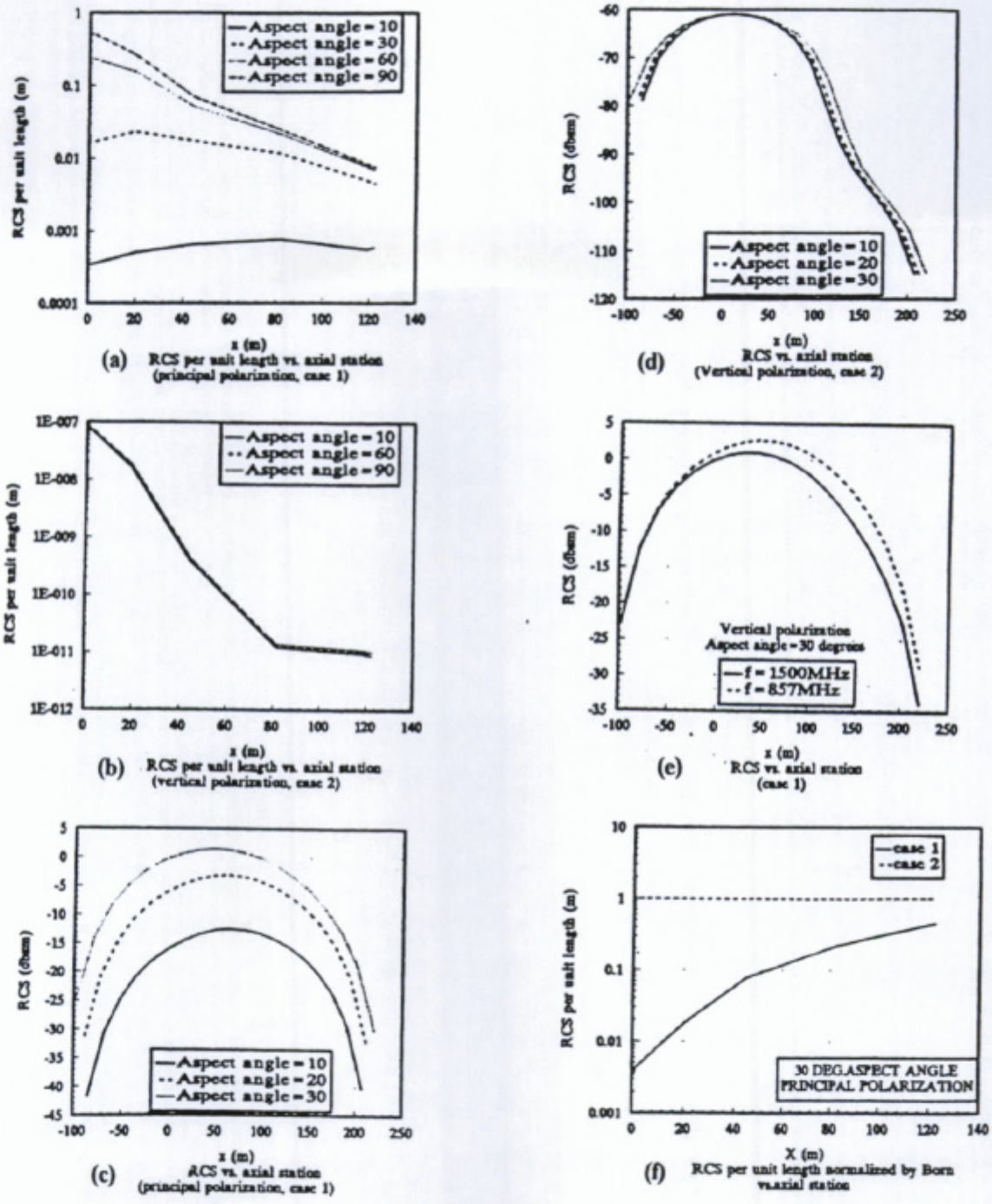


FIGURE 1-4 RADAR CROSS SECTION OF CYLINDRICAL PLASMAS(U)

CHAPTER 2 - POTENTIAL UAP HAZARDS TO AIRCRAFT

RATIONALE

1. A brief investigation has been made into the potential of UAP events as possible hazards. With assistance from the Inspectorate of Flight Safety (RAF Bentley Prior), all unexplained aircraft accidents on the RAF accident database were identified and then further filtered to isolate those which had apparently impacted the surface, due to what appeared to be sudden and inappropriate control inputs by the crew. Apart from isolated reported encounters (with what is apparently ball lightning) with both civil and some military aircraft, the investigation concentrated on the following scenarios:

- The possibility of aircrew suddenly being confronted with the phenomenon immediately ahead of the aircraft, especially when flying in Instrument Meteorological Conditions (IMC).

- The likely reaction of the pilot and the possibilities of distraction or disorientation.

- The possibility of this occurring at very low altitudes - leaving little margin for manoeuvre in proximity to the ground (or sea).

(R)

2. An examination of hundreds of UAP reports suggests that many occur (are reported) by witnesses at low altitudes and often in relatively low visibility. The UAP, in arriving near the surface, has undoubtedly descended from a higher altitude, whatever its origins. Although it is assumed that UAP may be encountered at any altitude, as shown by the infrequent reports from civil and military flight crews, there are no indications that any aircraft at high altitude has suffered an accident in UK airspace due to the presence of a UAP.(R)

3. In the absence of any reports of surviving aircraft crews having to take violent avoiding action, the investigation followed the logic that if violent manoeuvre has been carried out at low level by RAF aircraft, this could, potentially have caused fatal accidents. If these cases exist then there would be no crew report as to the cause of their sudden departure from the planned flight profile. However, none of the reports on file indicate a similar scenario for slow light aircraft or helicopters which one might assume could have time to recover after a sudden event. There is a dearth of sudden event reports from slow and low aircraft. However, many factors can be shown to possibly influence the behaviour of UAP, including, it is believed, the electrical charge on the aircraft. As charge is proportional to velocity and vehicle size, it may be the case that UAP are not generally seen in close proximity to small craft. This may explain the lack of reports. It should also be noted that many UAP events may be present of which crews are unaware because:

- They may not be visible in daylight.

- They may not occur in the Field of View (FOV) of the cockpit.

- They occur fleetingly and are not seen on a subsequent scan of the same spot.

- In IMC they may not be visible unless they are immediately ahead.

(U)

4. In sudden evasion at low altitude it is assumed that in mountain or hilly terrain the pilot would preferably try and fly over or under any object appearing suddenly ahead, rather than possibly turn into terrain. Hence, the possibilities of over-stress, out of envelope attitudes on pull-ups, and the possibility of wings level impact, if attempting to under-fly a UAP, all exist.(R)

5. Although it is fairly certain that at least some types of UAP emit either magnetic or electric fields, or both, it is assumed, in the absence of evidence to the contrary that aircraft systems are probably not adversely affected. Either they are adequately screened from the fields that a UAP may produce or will not remain within the field for sufficient time to have an effect. (see Working Paper No 25 Vol. 2).(R)

6. The rationale for the investigation was that a sudden appearance of fast - closing lights especially with, white green or red colours, or all three at once would almost certainly result in a sudden control input. In such a scenario it is easy to see that a collision with a solid object might be assumed imminent and evasive action would precede any radio call. It is often the case with UAP reports that red, green and white lights are reported, To an aircraft crew this would indicate the unexpected close presence of another aircraft. In undulating or rough terrain, when at very low altitude and high speed this involuntary response could be disastrous, especially if the turn was tightened as the object appeared to move in the same direction - which it could do if it was an electrically charged body (plasma), attracted by the aircraft's electrical charge.(R)

7. **Unexplained Accidents** Over the past 30 years, some 128 RAF aircraft accidents have not been completely explained. Those not occurring in the UKADR have been ignored. A careful examination has shown that many can be rejected from the UAP hypothesis because:

- There was adequate evidence to show that some form of mechanical event was the cause which was, nevertheless, not finally resolved.

- Some accidents occurred in close proximity to airfields where other observers should have noticed a UAP, if one was present.

- Some accidents happened away from base but when within visual range of other co-operating aircraft (e.g. on CAP or low altitude Fighter Affiliation exercises or near ships).

(C)

8. [redacted] S.26

9. After the initial filtering twenty one unexplained accidents remained. For these dates the available UAP data-base was examined for any reports which occurred on the same dates and in the same approximate locations where the accidents occurred. However, on ten of these occasions (between 1970 and 1978) no UAP records are available [as many of these earlier reports were destroyed before the current department assumed responsibility for UAP matters].(R)

10. On four occasions there were no UAP reports at all in the UKADR on the days of the air accidents. Two of these accidents occurred in 1987 Wales, which is one of the most fruitful areas for UAP reports. It must be noted, however, that UAP might have been present and gone unreported on these dates. The other 2 events occurred in the N. Sea and Cumbria, respectively in July and December 1982, where there were no other witnesses to the accidents.(C)

11. There were finally seven unexplained accidents:

Phantom 1400hrs 17 Dec. 1975 (ID 757231) Solway Firth, Cumbria. 1500ft Nearest (reported) UAP events were at Seven Trent 1840Z and South York's at 0905Z. [Accident Report: Loss of control but technical possibility]

Harrier 1215hrs 12 Feb. 1982 (ID 820629) 12nm NW Oswestry 8nm S Corwen. [Accident Report: probable distraction leading to disorientation] UAP reported at 0130Z with erratic motion at Redditch - not far in UAP terms from Oswestry.

Tornado 1204hrs 12 Dec. 1985 (ID 854334) Flamborough Head. Low flying. [Accident Report: No definite cause suggested] Reports of UAP activity were received from Andover. Increased UAP activity was noted in Northumberland on previous days up to 12 Dec.

Jaguar 1405hrs 27 Nov. 1986 (ID 863936) 11nm SW Hawick (5519N 00304W) 1500 ft. [Accident Report: Disorientation, inappropriate decision, Wings level, NIL weather, nose down into forest] No UAP activity reported on this day but reports from Reading on the previous day.

Tornado 1116hrs 1 Sep. 1994 (ID 942069) Glen Ogle, Killin Scotland 500 ft 480 Kt. [Accident Report: Inappropriate response to startling event]. Only one UAP report was received - from Northamptonshire at 2245 hrs.

Phantom 1445hrs 20 Apr. 1988 (ID 881174) 25nm 080° Leuchars. Low level CAP. [Accident Report: Probably sensory illusion in deceptive weather conditions]. Two UAP reports in England at Huddersfield, York, and Stockbury (M2 motorway).

Hercules 1530hrs 27 May 1993 (ID 931653) 8nm NW Blair Killecrankie, Scotland, Low flying. [Accident Report. Flew into ground]. No UKADR UAP reports anywhere on this date.

(UKR)