No: 12/92 **Ref: EW/C92/8/4** **Category: 1c**

Aircraft Type and Registration:	Socata TB20, G-TDAD	
No & Type of Engines:	1 Lycoming IO-540-C4D5D piston engine	
Year of Manufacture:	1990	
Date & Time (UTC):	22 August 1992 at 1144 hrs	
Location:	Isle of Jura, Inner Hebrides, Scotland	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 3
Injuries:	Crew - Fatal	Passengers - Fatal
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence with Night and IMC ratings	
Commander's Age:	56 years	
Commander's Flying Experience:	About 500 hours (of which about 100 were on type)	
Information Source:	AAIB Field Investigation	

History of the Flight

The flight was planned to Glen Forsa on the north coast of Mull in the Inner Hebrides. On the morning of the accident, the pilot telephoned his destination and was told that the weather there was poor and deteriorating. He was advised that, unless the trip were absolutely necessary, he should consider delaying his departure until the approaching pressure trough had passed through Glen Forsa. He then telephoned the Flight Information Service Officer (FISO) at Tiree airport and said that he had been informed that the weather at Glen Forsa was very bad and that, if he could not land there, he would be landing at Tiree. The FISO advised that the weather at Tiree was 'horrendous' but the pilot told him that he would be leaving for Mull shortly.

The pilot booked out from Blackpool stating his intention of flying VFR to Glen Forsa. He did not file a flight plan and gave no indication of the route that he intended to follow or the heights at which he intended to fly. The computer generated pilot's log, which was recovered at the crash site, indicated that the intended route was; Blackpool - Workington - West Freugh - Machrihanish - Glen Forsa. No en route altitudes were quoted and the column provided to record Minimum Safe Altitudes was blank. ATC radar recordings indicated that the transponder fitted to G-TDAD ('AD') was selected to the

conspicuity code setting but that the altitude encoding function was either not selected or it was not functioning. Since the pilot did not contact any other ATC agency after leaving Blackpool, the aircraft's en route height could not be determined. The radar recordings showed that the pilot had accurately followed his intended route as far as Machrihanish, but he had then turned onto a track of 332°T instead of the required track for Glen Forsa of 352°T (see Figure 1). At 1137 hrs, some two minutes after passing overhead Machrihanish, 'AD' ceased to show on radar due to the presence of high ground between it and the radar head. When it reappeared on radar, 6 minutes 15 seconds later and some three miles to the south east of Jura, the aircraft was on a track of 329°T but this track was displaced six miles to the right of its previous track. The ground speed required to fly directly between the end of the previous radar track and the start of the new track was in good agreement with the ground speeds observed while the aircraft was showing on radar. At about the time that 'AD' reappeared on radar, a witness situated on the south east coast of Jura observed a single engined aircraft below the clouds and flying steadily in a northerly direction. Although it appeared to be flying lower than normal, it was not flying so low as to cause the witness any concern. This witness stated that at the time he saw the aircraft, the visibility was very poor and it was raining heavily.

The final track of 'AD', if maintained, would have taken it to Tiree. The pilot's log recovered from the wreckage indicated that the pilot had intended to use the Tiree VOR/DME as an aid to locating Glen Forsa. The aircraft was equipped with an area navigation system with the facility to offset the position of a VOR to the position of a destination or waypoint other than the VOR. Examination of the non-volatile memory available in the avionics units recovered from the accident site indicated that the Tiree VOR was selected and that the correct offset figures had been entered to give azimuth guidance to Glen Forsa. It was also established that the guidance mode in use at the time of the accident would have indicated full scale deflection with a cross-track error of only 1.25 nm. Having exceeded the maximum cross-track error that was capable of being displayed by the in-use mode shortly after leaving Machrihanish, the aircraft then flew a track that would have ensured that the azimuth guidance display remained at full scale fly right command.

When the aircraft failed to arrive at Glen Forsa, the hoteliers who were expecting the occupants of 'AD' assumed that the flight had been cancelled due to the poor weather and, because no flight plan had been filed, no one was aware that the aircraft was overdue. When it became apparent the next day that the aircraft was missing, an extensive Search and Rescue operation was mounted. The wreckage of 'AD' was located on the southern end of the Isle of Jura at an elevation of 1,700 feet amsl. All four occupants had suffered fatal injuries at impact.

Meteorological information

A copy of the METFAX forecast for 0500 hrs to 1300 hrs on 22 August 1992 covering England, Wales and Northern Ireland was found in the aircraft wreckage. Although the forecast for the Scottish region was not found, it is assumed that the pilot had obtained it at the same time as as he had obtained the forecasts for the other regions. The forecast for the Scottish region for the relevant time indicated that the pilot could expect a wind of 170°/30 kt at 3,000 feet, a general visibility of 20 km in occasional rain, a cloud base of 1,500-3,000 feet and a freezing level of 7,000 feet. The forecast also indicated the possibility of visibilities as low as 3,000 metres in heavy rain and a cloud base of 600 feet. An aftercast supplied by the Meteorological Office at Bracknell was in general agreement with the forecast, but tended to indicate that the poorer weather quoted in the forecast predominated in the accident area.

The pilot had obtained his IMC rating on 27 January 1990, but no evidence could be found to indicate whether or not it had been renewed following the expiry of its 25 month period of validity.

Examination of the wreckage

The accident site was an outcrop of quartzite 270 feet below the 1,844 feet summit of Glas Bheinn at the southern end of the Isle of Jura. The ridge skyline was five feet above the impact point and approximately 15 feet beyond it. The aircraft had impacted with a bank to the right of 7°, and a single propeller slash in heather just before the bare rock of the impact point gave a heading of 330° M, but was insufficient to establish the speed; pitch and yaw attitude could not be determined. The ground speed was established from the radar plot to be 160 kt, and this speed was consistent with the heavy damage suffered by the aircraft.

The impact had been taken initially by the engine and the left wing, and the aircraft had disintegrated. The debris trail continued over the skyline and extended for about 1,000 metres to the remains of the engine, which had come to rest in a stream 300 metres below the impact point. The limited time available on the accident site and the nature of the terrain precluded a flying control run lay-out, however all the components found had failed from overload. Additionally, information about the aircraft attitude derived from the impact site, the report of a local witness and subsequent analysis of the radar plot, all indicated that the aircraft was under control until impact.

The engine sump and all the accessories had been destroyed in the initial impact. The engine carcass was found at the bottom of the wreckage trail and the absence of the sump gave visual access to the main bearings, which looked clean and undamaged. However, the crankshaft would not rotate because of external damage to the engine casing. The dual magneto had broken open but all contacts

looked clean and gear wheels intact, although separated by impact. The propeller was found with one blade attached to the hub and the other blade loose; the blade on the hub had lost its tip, but nevertheless showed pronounced forward bending at the end. The other blade was severely damaged with the end fracture surface showing failure in rearwards bending at a point 24 inches from the hub; the leading edge close to the fracture point showed indications of forward bending. This evidence, together with the local witness who described a constant engine note, and the radar trace which gave a speed of 160 kt, indicated that the engine had been under power at the time of the accident.

The VHF transceiver and the KNS 81 RNAV were recovered in a badly damaged condition; the data in their non-volatile memory chips were read using serviceable slave components. The in-use VHF frequency corresponded to Machrihanish Radar although Machrihanish airfield was not open at the time of the accident. The in-use waypoint data in the KNS 81 corresponded to the Glen Forsa offset from the Tiree VOR, with the RNAV Approach mode selected.

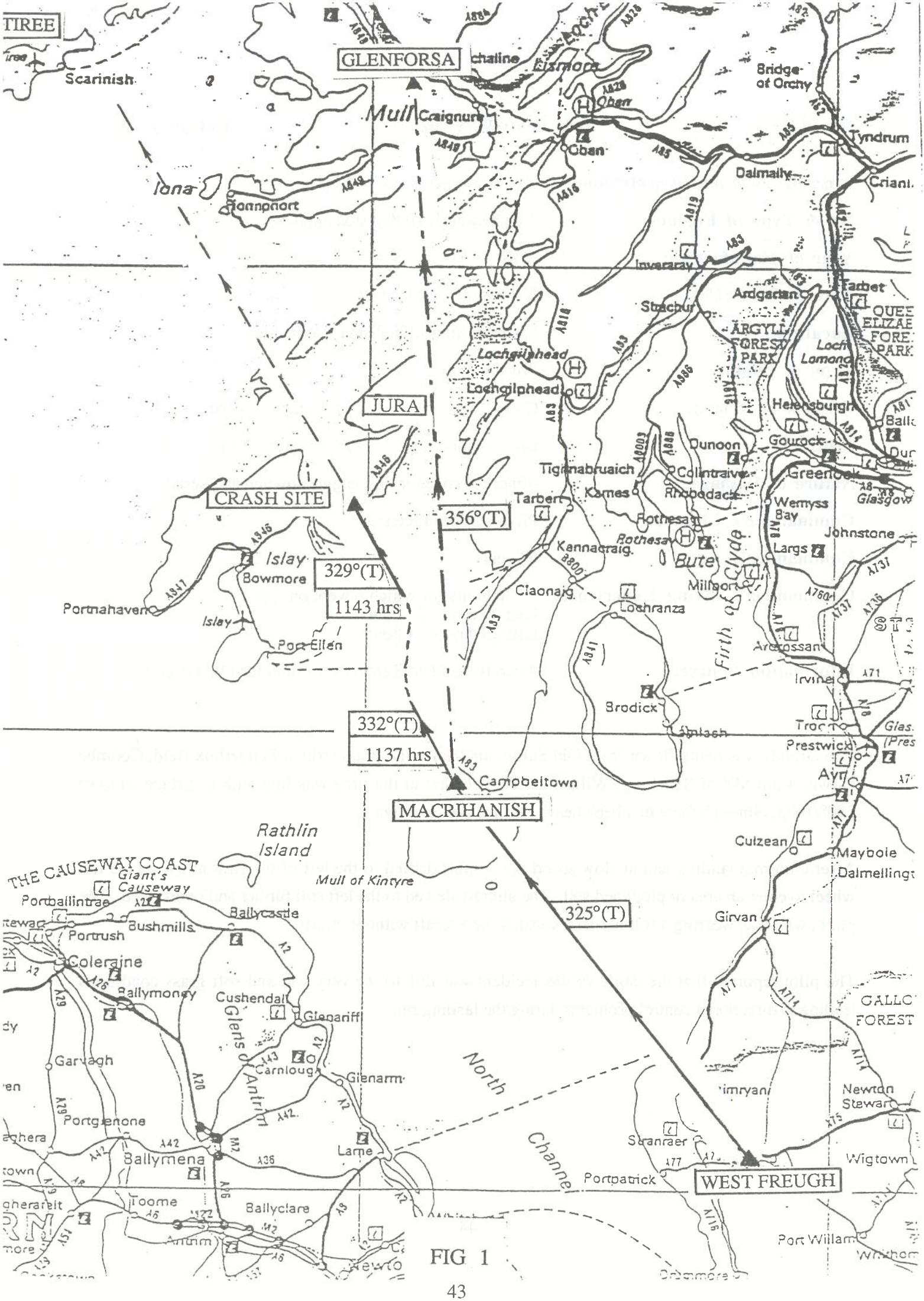
TIREE
Scarinish
GLENFORSA
Mull
Craignure
Oban
Bridge of Orchy
Tyndrum
Dalmally
Iona
Fionnphort
Inveraray
Ardgartan
Strachur
Lochgilphead
JURA
Loch Lomond
Helensburgh
Dunoon
Gourock
Greenock
Glasgow
Tighnabruaich
Colintraive
Kames
Tarbert
Rhubodach
Wemyss Bay
Rothesay
Bute
Largs
Johnstone
CRASH SITE
356°(T)
Islay
Bowmore
329°(T)
1143 hrs
Portnahaven
Port Ellen
Kannachraig
Claonaig
Lochranza
Millport
Firth of Clyde
Ardrossan
Irvine
Brodick
Troon
Prestwick
Ayr
332°(T)
1137 hrs
Campbeltown
MACRIHANISH
Rathlin Island
Mull of Kintyre
325°(T)
Culzean
Maybole
Girvan
THE CAUSEWAY COAST
Giant's Causeway
Portballintrae
Bushmills
Ballycastle
Portrush
Coleraine
Ballymoney
Cushendall
Glenariff
Glens of Antrim
Carnlough
Glenarm
Garvagh
Portglenone
Ballymena
Larne
North Channel
Stranraer
Portpatrick
Newton Stewart
Wigtown
WEST FREUGH
Toome
Ballyclare
Antrim
Port William

FIG 1