ACCIDENT

Aircraft Type and Registration:	ASH 25 Glider, 925 (BGA 3909)
No & Type of Engines:	Not applicable
Year of Manufacture:	1992
Date & Time (UTC):	2 September 2007 at 1512 hrs
Location:	Tomintoul, Morayshire, Scotland
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A 1 (Serious)
Nature of Damage:	Glider destroyed
Commander's Licence:	None
Commander's Age:	51 years old
Commander's Flying Experience:	750 hours on all types (estimated) Last 90 days - 30 hours Last 28 days - 24 hours
Information Source:	AAIB Field Investigation

Synopsis

Whilst competing in a gliding competition in Aberdeenshire, Scotland, the pilot (P1) of the glider was attempting to land in a field near Tomintoul, Morayshire. When the glider was on its final approach he realised that it was too high and likely to overshoot the field that he was planning to land in, he therefore entered an orbit to lose the excessive height. During this orbit the glider departed controlled flight at a low height, and crashed into a field. The P1 was fatally injured and the other pilot (P2) was seriously injured.

History of the flight

The P1 was competing in the annual UK Mountain Soaring Championship, based at Aboyne Airfield, Aberdeenshire, Scotland. The task on the 2 September 2007 was to fly a route of 252.5 km, consisting of four legs: from Aboyne via Huntly (Aberdeenshire), Kirkmichael (Perthshire), Grantown-on-Spey (Morayshire) and then back to Aboyne. Thirteen competitors took part in the task. Each glider was fitted with a GPS tracker that would log their route and times.

Glider 925 became airborne on an aero-tow at 1209 hrs, with the P1 in the front seat and the P2 in the rear seat, before being released at 3,500 ft amsl at 1219 hrs. The glider climbed to 12,500 ft amsl and commenced the prescribed route at 1317 hrs. The first

two legs were completed uneventfully. As the glider approached Grantown-on-Spey the pilots discussed the approaching weather and lack of thermals on the route. After turning at Grantown-on-Spey the glider climbed to approximately 3,000 ft amsl, which was an adequate height for it to reach Tomintoul, an area known by the pilots to have suitable fields in which to land.

As the glider approached Tomintoul the pilots confirmed that they were unlikely to be able to gain enough height to return to Aboyne and they decided to land in the vicinity of Tomintoul. When approximately 3 nm north of Tomintoul they agreed on a suitable field, east of Tomintoul, which was virtually into wind, and the P1 positioned the glider on a down wind leg in preparation to land, and completed the before-landing checks. The glider then encountered some rising air and started to climb. The P1 responded by deploying the air brakes, but the glider continued to climb so he selecting landing flap before side-slipping the glider in an attempt to lose the excess height. When the glider was on its final approach it was clear that it was still too high and was going to overshoot the selected field, beyond which were some houses on the edge of Tomintoul. The P1 retracted the air brakes and entered an orbit to the right in a further attempt to lose the excess height. During the turn, at some stage below 230 ft agl, the glider departed controlled flight, entered a near vertical dive from which it did not recover and struck the ground.

Some witnesses and a local ambulance attended the scene soon after the accident. The P1 had received fatal injuries. The P2, who was seriously injured but conscious, was given first aid before being flown to Inverness Hospital by air ambulance about 20 mins later.

Weather

An aftercast was obtained from the Met Office for the area of the accident. It stated that the synoptic situation at 1200 hrs on 2 September 2007 showed a fresh to strong north-westerly flow in a polar maritime airflow. By 1800 hrs two troughs were indicated, suggesting enhanced instability across northern Scotland. Notwithstanding the unstable character of a classic polar maritime air mass, on this occasion there was evidence of some stable layers.

The available observations suggested an air mass visibility of between 30 km and 60 km. There was evidence of both lee-wave cloud and convective activity. The nature of the terrain meant that the wind and temperature would have varied quite markedly over the area. The gradient over Aviemore (15 nm west-south-west of the accident site) measured 24 kt from 320º at 1500 hrs, and over Glenlivet (6 nm north of the accident site) it was measured as 27 kt, also from 320º. The surface wind at Aviemore was from 290º at 6 kt, and that at Glenlivet was from 300º at 17 kt. The 'Hills of Cromdale' to the northwest of the accident site form a ridge with steep sides on both slopes. The ridge is relatively short in length and so whilst some of the flow would be displaced upwards and over the ridge, some may have been forced around each end. It is believed this would have produced marked turbulence over the accident site in the prevailing conditions.

As a result it was not possible to be certain of the wind at the accident site. As far as can be ascertained, the best estimate of the wind, and its possible variations, are given in Table 1.

These changes in wind might have been encountered over relatively short distances both vertically and horizontally.

Height AGL	Wind Speed & Direction
Surface	270º at 15 kt, gusting 25 kt; locally/occasionally variable direction at 5 kt
500 FT	280º at 20 to 25 kt; locally/occasionally variable in direction at 10 kt
1000 FT	280º at 20 to 35 kt; locally/occasionally variable in direction at 10 kt

Table 1

Possible wind in the area of the accident

Personnel information

Pilot's experience

The P1 was an experienced cross-country glider pilot, who had competed in prestigious competitions on many occasions; he was qualified to FAI[1] Gold and Diamond Certificate level, which are internationally recognised qualifications. He was an Assistant Instructor at the gliding club based at Aboyne Airfield. The investigation was unable to locate his flying log book and his total flying hours have been estimated following discussion with his colleagues; his flying experience during the last 90 days was extracted from the aircraft records.

The P1 is known to have 'landed out' twice in Glider 925 during the 2006 UK Mountain Soaring Championship and on several other occasions in other types of gliders.

Experience of the P2

The P2 had been gliding for approximately 10 years and was qualified to FAI Silver Certificate level. He took control of the glider a number of times during this flight, but was not the handling pilot during the final approach and landing.

Surviving pilot's comments

When it became apparent that the glider was too high to land in the nominated field and the P1 entered an orbit to the right, the P2 noticed that the air brakes had been retracted and the flap setting had been reduced, but he was not certain to what position the flaps had been set. He also recalled that throughout the circuit to land the flying conditions were very bumpy and turbulent. As the glider entered the turn the P2 concentrated on keeping visual contact with the selected field so his attention was directed out of the glider. During the turn he first became aware that something was wrong when the P1 called out. He then looked back out of the front of the glider and saw that the glider was in a near vertical dive immediately before it crashed.

Eye witness

A motorcyclist, travelling north-west towards Tomintoul on the A939, witnessed the accident (see Figure 1). He described seeing Glider 925 straight ahead of him, at approximately 2-300 ft agl, in a steep turn, when he was approximately one mile from the accident site. The glider then "quickly" entered a near-vertical dive before he lost sight of it just before it crashed.

Medical examination

The P1 had signed a declaration of medical fitness to fly which had been countersigned by his general

Footnote

[1] The Federation Aeronautique Internationale is the governing body for air sports and aeronautical world records.

practitioner in February 2003. While this certificate indicated that his next medical assessment was due on 21 February 2006, his declaration would have been valid for 5 years from its date of issue and was therefore valid at the time of the accident.

A post-mortem was carried out by a Crown Office pathologist. It concluded that the P1 had died of multiple injuries consistent with being sustained at the time the glider struck the ground and that the injuries were not survivable. The post-mortem revealed no evidence of natural disease which could have caused or contributed to the accident and toxicological tests for alcohol and drugs were negative.

ASH 25 description

The ASH 25 is a two-seat, mid-wing, high performance glider with a 25 m wing span. It is equipped with a retractable landing gear, air brakes which extend on the upper surface of each wing and five stage flaps that can be set between -9° and +38°. The flap operating handle in each cockpit is fitted with a spigot which locates in one of six holes corresponding to the six flap positions – five stages and landing flap. The four section wing is constructed from Carbon Fibre Reinforced Plastic (CFRP). The inner and outer wing sections join at 3.8 m along the span with a spar in the outer wing locating in a socket in the inner section. Locating spigots are also fitted to the inboard of the leading and trailing edges on the outer wings, corresponding sockets are fitted to the inner wing. The left and right wings are joined at the fuselage by a tongue and fork joint, and two cylinderical main pins. The wings are connected to the fuselage by spigots mounted on the fuselage and sockets on the wings inboard of the leading and trailing edge. Bladders for a water ballast system are located along the spar of each outer wing.

The fuselage is constructed from a mixture of carbon and aramide fibres, and the fin is constructed from Glass Reinforced Plastic and a hard foam sandwich. The horizontal stabilizer and conventional elevators are fixed to the top of the fin.

With the exception of the rudder, the flying controls, flaps and airbrakes are operated by push rods connected through a series of bellcranks. The rudder is operated by cables and a short push rod that connects the rudder to a bellcrank. Apart from the elevator, the flying controls can all be easily disconnected at the wing root by Hotellier type ball connectors. The elevators are connected to the controls by a tongue which sits in the elevator actuator at the top of the fin.

Because of its high performance, pilots of the ASH 25 generally do not get much practice at 'landing out' in fields. The pilot controls the descent rate by use of the airbrakes and the flaps. The landing flap position should not be selected until a landing in the selected field is assured.

An experienced ASH 25 pilot commented that, with practice, 200 m is a sufficient landing distance in which to land, with no other obstacles present; therefore a field with a minimum landing distance of 300 m should be selected to allow a margin for error. For less experienced pilots he suggested a minimum landing distance of 400 m.

Wreckage and impact information

The glider crashed in an area of marsh land approximately 650 m east of Tomintoul on the west bank of Conglass Water. Sited approximately 150 m to the east of the accident site were pylons carrying 132 Kv electrical transmission lines; the tops of the pylons were approximately 106 ft above the accident

site and the transmission lines ran in the direction 145°/325° M. A second row of pylons, carrying 11 Kv electrical transmission lines, were sited approximately 80 m west of the accident site; these pylons were approximately 29 ft high and ran towards Tomintoul in the direction 200°/020° M. (See Figure 1).

The wreckage trail was approximately 33 m long on a heading of 275° M. The right wing had failed at the wing joint inboard of the airbrakes and the leading edge of the outer section of the right wing had left a deep, curved witness mark in the soft ground. The nose section of the glider was found in a crater approximately 15.5 m from the right wing tip. The left wing was found 4.5 m from the crater with approximately 1.5 m of the wing tip driven under the surface vegatation. The glider fuselage, which was lying on its left side, and the inner section of the right wing were found approximately 4 m from the crater. Both canopy transparencies had shattered and had been thrown forward of the crater in an arc between 140° M and 165°M. Glider structure, instruments and equipment located in the forward cockpit was scattered between the crater and the fuselage.

Ground marks and damage to the wreckage indicate that the glider struck the ground in a very steep attitude with some sideways movement to the left, on a heading of 165°M. There was no evidence that the glider had struck any of the electrical transmission cables or pylons.

Detailed examination of the wreckage

The landing gear was in the down position and the cockpit area forward of the front seat had been extensively damaged; however, the rear instrument panel, the controls and cockpit area were mostly intact. In the front cockpit the control column had broken close to the pivot point, the rudder pedals had broken away from the structure and the flap operating lever had failed close to the P1's seat. The control rods at the wing root had all failed in a manner consistent with the wings detaching from the glider. The elevator bellcrank mounted on the rear face of the cockpit bulkhead and the structure to which it was attached had broken off the bulkhead. The damage indicated that this occurred when the control rods were pushed rearwards in the crash. Access to the control runs was obtained by cutting holes in the structure and the subsequent inspection established that at the time of the accident all the controls were correctly assembled and operated in the correct sense. Additionally, there were no witness marks on any of the controls aft of the front cockpit to indicate that there had been a control restriction.

The five forward flap handle spigot locating holes in the rear cockpit were all round and relatively undamaged, whereas the rear face of the hole corresponding to the landing position had been damaged consistent with the spigot being pushed into it under a high load. The trim around the rearmost locating hole had also come away from the CFRP. It was not possible to establish the position of the airbrakes.

The spar and locating lugs connecting the inner and outer section of the right wing had sheared allowing the sections of the wing to separate. The trailing edge of the right wing root, which contained the wing spigot locating hole, had broken away from the wing and two of the three bearings in the spar tongue and fork assembly had pulled out of the spars allowing the two wings to separate. The spar between the inner and outer sections of the left wing had partially broken through the lower surface; however the two sections of the wings remained connected. The top left side of the fin was damaged and the tailplane securing bolt had pulled

out of the fin. The rudder was damaged but remained intact. There was no water in the wing ballast tanks.

Both the P1 and the P2 had been wearing a four-point harness. As a result of the damage to the cockpit area, the attachment points for the P1's lap strap had broken away from the structure during the crash. However this failure would not have affected the survivability of this accident.

Recorded data

Glider 925 did not carry any form of crash protected recorder, nor was it required to do so. However, an HP iPAQ Personal Digital Assistant (PDA) containing a 256 MB Secure Digital (SD) card, together with a glider logger, a Cambridge Secure Flight Recorder model 25, were recovered from the glider. These were analysed for any recordings pertinent to the glider flight. The PDA was damaged and everything in its internal memory was lost. The SD card files were analysed and no traces were found of active logging of the flight.

The glider logger had suffered damage during the accident, but the anti-tamper measures, designed to remove power from the memory if the unit is opened, had not been disturbed. The glider logger was successfully downloaded and provided a recording of the accident flight.

The glider logger recorded position and altitude derived from a GPS, together with an assessment of the estimated accuracy. It also recorded the pressure altitude, noise level[2] and other system-related indicators every 8 seconds; there were also brief periods when the times between samples were reduced. Data from the logger forms the basis of the following description of the flight. All times are given in UTC; local time on the date of the accident was one hour ahead.

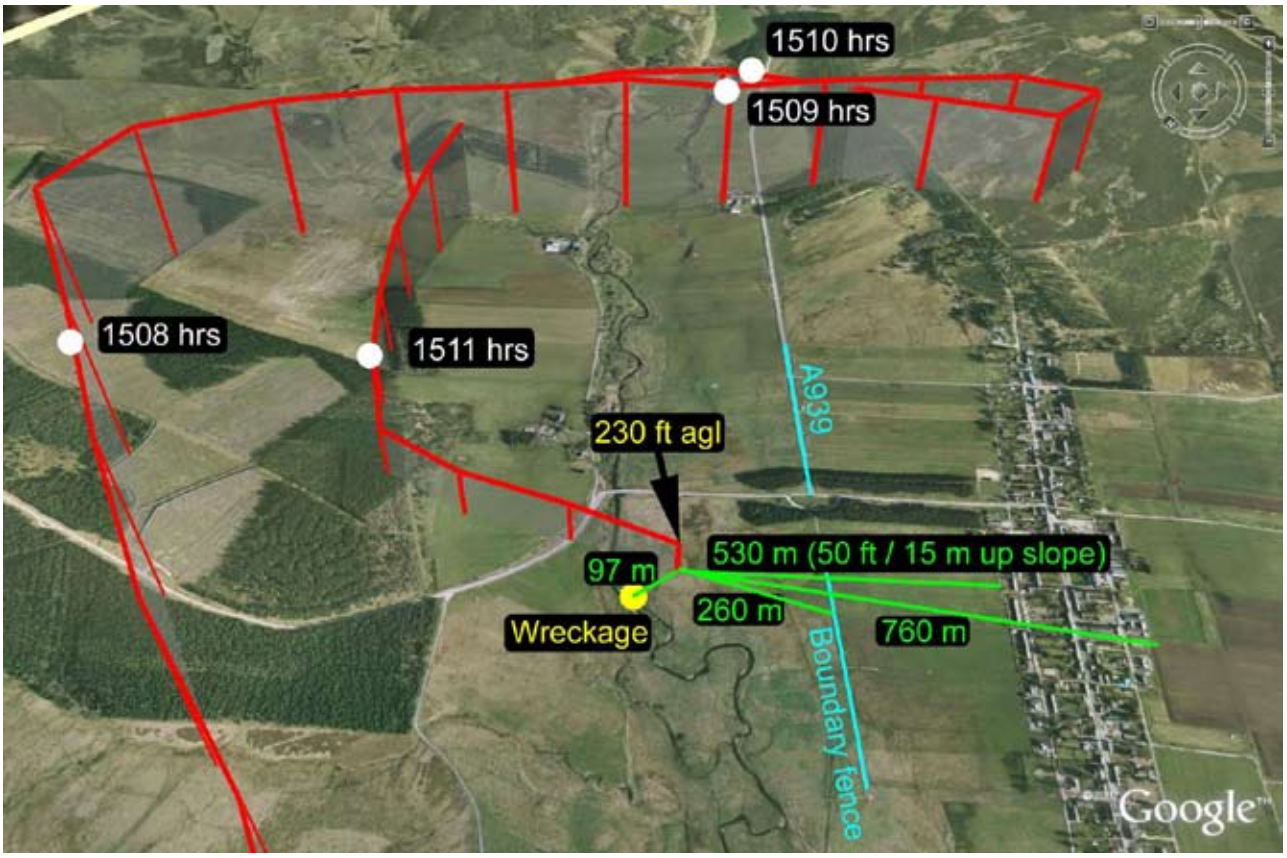
The log commenced at 1158 hrs at Aboyne Airfield. The glider was airborne at 1209 hrs and climbed to nearly 12,500 ft whilst manoeuvring over terrain approximately 4 km north-west of the airfield. The glider then flew north to Huntly, south-west to Kirkmichael, north to Grantown-on-Spey and then south-east to the accident site near Tomintoul. Figure 1 shows the end of the accident flight together with a comparison with other landings recorded on the day by other gliders of various types. Note that the vertical red poles indicate the actual recording points; the straight lines joining the top of these poles give the average track between these points and are not indicative of the heading of the glider at the recording points. It is thus quite possible that the glider was in a turn at the last recorded point rather than tracking straight.

The last recorded point was at 1511 hrs. The glider was 230 ft agl and descending at approximately 500 ft/min with a ground speed of just under 50 kt. The GPS accuracy was recorded as good. Comparisons with other glider landings that day indicate that the ground speed and rate of descent at the end of the recording were not unusual.

The distance from the last recorded point to the boundary of the nearest field was approximately 260 m. The field was 270 m in length and sloped up, so that the far end of the field was approximately 50 ft higher than the terrain the glider was over at its last recorded point. The shortest recorded distance from a height of 230 ft to touchdown of the other gliders that day was approximately 500 m, indicating that a straight-in approach to land on the field ahead was not viable.

Footnote

[2] The engine noise level parameter records the relative magnitude of ambient noise during a flight to determine whether an engine was in use during a competition flight.



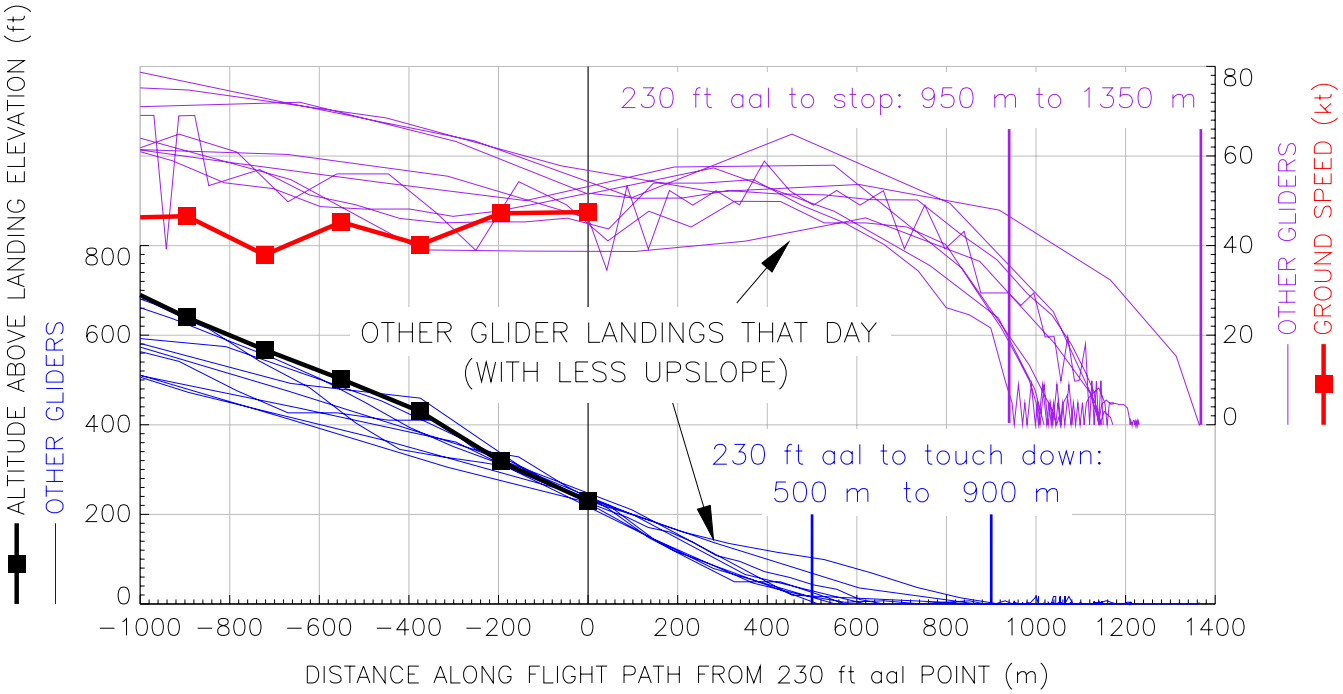


Figure 1

a) Glider path at the end of the flight as recorded by the glider logger
b) Landing data from other gliders flying during the competition

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Beyond the field were houses and then further fields. Taking into account the fact that the last recorded point was only approximately 180 ft above the elevation of the field beyond the housing, a landing there would not appear to have been a viable option since the furthest distance to touchdown recorded on the day was approximately 900 m, and this was over relatively flat terrain.

The wreckage was located 97 m from the last recorded point, to the rear and right of the track direction at that last point. This would indicate that a turn took place after the last recorded point. A circular orbit with a diameter of 97 m would have a track distance of 305 m, making a subsequent approach to the field directly ahead of the glider viable if the descent rate did not decay during the orbit.

Assuming the orbit was started just after the last recorded point, it would have taken less than 8 seconds to reach the wreckage location, making it a reasonable explanation as to why no other track points were recorded. To lose 230 ft before another track point could be recorded would require a descent rate in excess of 1,725 ft/min.

The glider logger recorded increased noise levels starting in the 180° turn onto the down wind leg of the approach. A further increase in noise was recorded when the glider turned onto its final heading. These may be associated with changes in configuration. The levels of noise were consistent with the levels of noise experienced during the towed climb at the start of the flight. Whilst the numbers associated with this noise parameter are not directly comparable with the same parameters recorded using other loggers and on other gliders, it is of note that the other ASH 25 competing that day also had increased noise levels prior to landing, comparable with its noise levels during its towed climb. Therefore, these changes in noise levels do not appear to be indications of any abnormality.

Analysis

The P2's recollections and eyewitness accounts indicate that the glider departed controlled flight whilst in a right turn and with insufficient height to make a safe recovery. It was established that the glider struck the ground right wing first in a very steep attitude with the landing gear in the down position and the flaps most probably set at the landing position. The cockpit was destroyed in the accident, and whilst the possibility of a control restriction within this area could not be eliminated, the investigation could identify no engineering reason why the accident should have occurred.

In a turn to the right, the right wing, on the inside of the turn, would have had a slower relative airflow over it compared to the left wing. As such, the right wing would have been closer to its stalling speed and would thus have been more susceptible to stalling before the left. A stall in this situation would have caused the glider's right wing to drop, which would have led to autorotation and a steep nose-down attitude. In addition, the wind at the time was likely to have been turbulent and variable in strength and direction. This may have had the effect of producing differing levels of lift along the glider's long wing and may also have masked the initial indications of a stall, which includes light buffeting of the aircraft.

The P1 had 'landed out' in an ASH 25 and other types of glider before, and, as such had some experience of the glider's handling and performance in this situation. It appears, however, that the glider was too high on the approach to the selected field and was unlikely to

reach the field beyond the houses. The P1 therefore entered an orbit to the right in an attempt to lose the excess height.

Assuming the orbit was started just after the last recorded point, it would have taken less than 8 seconds to reach the wreckage location, possibly explaining why no other track points were recorded. To lose 230 ft within that time-frame would require a descent rate in excess of 1,725 ft/min, which is not unrealistic for a glider that has stalled and is in the attitude described by both the P2 and the eyewitness.

Whilst the P1 received fatal injuries the P2 sustained injuries of a serious nature. The difference in their injuries was most likely due to their relative seating positions. The front cockpit is likely to have effectively absorbed a significant proportion of the impact forces during its deformation, with the consequence that the peak deceleration experienced by the P2 would have been less that that of the P1.

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