

No. 18

Scottish Airlines (Prestwick) Ltd., York aircraft,
G-AMUL, swung on take-off run and lost a wheel at Stansted Airport,
Essex, England, on 30 April 1956. C.A.P. 139 released by
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Circumstances

The flight was to be via Malta to Habaniyah, Iraq, and was being made on charter by the Air Ministry to carry R.A.F. personnel and their families. On board were 5 crew members, 45 passengers and four babies. The take-off run was begun at approximately 0930 hours Greenwich Mean Time. After travelling some 300 yards along the temporary runway, the aircraft developed a swing to starboard with a consequential skidding movement of the tires so severe that within a further distance of less than 100 yards it left the runway on the starboard side still under the influence of the swing, skidding and travelling at about 45 knots. On reaching a "French" drain some 25 feet from the runway the undercarriage collapsed, the starboard wheel fell clear and the aircraft settled on its belly and on the port wheel. The aircraft finally came to rest pointing back almost in the direction from which it had begun its run. One air craftsman and a 4-year old girl were killed and 4 other passengers were seriously injured.

Investigation and Evidence

Due to the belly of the fuselage, as it settled, being forced to starboard, it met the starboard inner propeller which cut the control lines to the fuel cocks with the result that it was impossible to prevent the escape of some 700 gallons of petrol - a large quantity of which poured into the passenger cabin and onto those who were pinned by the entry of the port wheel. The Airport Fire Brigade was at the scene within a few seconds and laid a blanket of foam over all so that the risk of fire was averted.

Due to reconstruction of the main runway taking place, all aircraft use a temporary runway parallel to the main runway and some 650 feet to the northwest of it. The temporary runway is 5 700 feet long and is composed of the former taxiway of that length with the addition of a strip (called a shoulder) on either side to provide the extra width required for a runway.

The former taxiway was 90 feet wide with a good macadam surface and capable of sustaining the weight of any aircraft. To this has been added on each side a strip or shoulder 25 feet wide constructed of a layer of "Class C Fill" (a kind of compacted gravel) with in places some broken concrete in addition, the whole being covered with two inches of close macadam to form the same surface as that of the former taxiway. Although not so strong as the taxiway, the shoulders are of sufficient strength to support occasional use by aircraft. The width of the runway formed by the old taxiway and the two shoulders is thus 140 feet, being the same as that of the main runway before reconstruction. In practice, however, this overall width is to some extent reduced by American type electric lights standing some 19 inches high fixed to the runway by spikes at intervals along either side and connected together by rubber tubing. These lights are fixed at a distance of 10 feet in from the outer edge of each shoulder so that the width of the runway between the lights is only 120 feet. A broken white line marks the centre of the runway throughout its length and there is also a continuous white line painted on either side at the junction of the old taxiway and the shoulders.

This runway is undoubtedly narrow for an aircraft of the size of a York, which has a wing span of 102 feet and a wheel base of just under 24 feet. A pilot taking off a York from this runway would naturally seek to avoid letting his wheels go on to a shoulder, although, if he did, it would support the weight as it supported that of G-AMUL on the morning in question, whilst if he hit any of the lamps it would be most unlikely to cause the aircraft the slightest damage. Although admittedly narrow for an aircraft of this size, there is no doubt that this temporary runway is serviceable. The captain of G-AMUL had himself taken off York aircraft from this runway without difficulty on at least 10 to 12 previous occasions and stated in the course of his evidence, when asked whether he was at all troubled on this occasion by the width of the runway, that he was "not conscious of any undue narrowness".

On the south side of the temporary runway and 25 feet out from the outer edge of the shoulder is a "French" drain laid parallel to the runway throughout its length. Evidence showed that after the aircraft had left the runway (still swinging to starboard and with its wheels skidding to port) it met the obstacle formed by this drain and the undercarriage collapsed. This drain, which has its counterpart on the north side of the runway, was constructed at the same time as the shoulders. It consists of a trench 3 feet 6 inches deep along the bottom of which a porous cement pipe has been laid on a concrete bed. The trench above the pipe has then been filled with what are termed "rejects". These stones and pieces of concrete are, in fact, those which would not pass through screens used to select the Class C fill and pieces of concrete employed to form the base of the shoulders. Any attempt to ram or roll this filling might result in breaking the pipe and in consequence it was necessary either to leave the filling some inches "proud" to allow for settlement or to top up from time to time as settlement occurred. The filling was left "proud" and now that a year has elapsed since the work was done it is in many places at least 6 inches "proud" whilst the stones at the top are large and in some cases could be described as small boulders.

The drain follows a line formed at the point where the grass sloping down from the outer edge of the shoulder makes a dip with the slightly rising ground further to the south. It is accordingly sited at a point where drainage is obviously necessary both for the ground south of the runway and in order to take away surface water from the runway itself and water which might otherwise accumulate below the shoulder.

Ideally, perhaps, a runway should have on either side an expanse of grass large enough to ensure that an aircraft leaving the runway in any foreseeable circumstances will be able to run its course unimpeded by any obstacle. In practice this is obviously impossible. This drain was of a type which appears unobjectionable and in accordance with standard practice. It was properly sited and necessary and the investigator does not think that the fact that some criticism may be made of the manner of filling made any real difference in this particular case. This aircraft left the runway in most unusual circumstances and it is considered that the blame for what

occurred cannot be put upon the drain. If this incident had occurred in wet weather and there had been no drain so that the ground would have been water-logged a similar result would have occurred whilst if on this occasion it had swung to port instead of to starboard there were many obstacles with which it might have collided as well as taxiways and hard standings which would have had a similar effect.

The aircraft was properly and efficiently maintained and entirely fit to carry passengers on the flight contemplated. It had been properly loaded and trimmed, the brakes had been carefully tested and tests carried out after the accident served to prove that no engine failure or failure of controls occurred.

The legs of the undercarriage were fractured at their top points of attachment. Calculations and inspection of the fractures made at the Royal Aircraft Establishment at Farnborough after the accident show that the stresses imposed on the undercarriage when it met the drain were increased to the order of some three or four times those which it was already undergoing and to an extent which no undercarriage is designed to support whilst the fractures disclosed no sign of fatigue but, on the contrary, tensile strength very much above the specified minimum.

A York aircraft, in common with many aircraft, has a tendency when rolling to pull to port. This tendency is, of course, well known to all experienced pilots and is not difficult to correct. The aircraft while on the ground can be controlled in three ways; firstly, by the use of the throttles, secondly, by the brakes which can be applied either to the port or starboard wheel or both and thirdly, by the rudder which is operated with the feet.

There are four throttles (one for each engine) consisting of four levers projecting downwards from the throttle box which is fixed rather above the first pilot's head and to his right front. It is, of course, to the left but otherwise in a similar relationship to the position of the second pilot. The method of operating the throttles is for the pilot to grasp all four in his hand inserting his fingers between the levers so that he can push these forward to open the throttles or pull back to close them, whilst by an inclination of his hand to one side or the other as he opens the throttles he can advance the port throttles ahead of the starboard or vice versa. In taking-off there is normally

no question of closing the throttles and the pilot is occupied in pushing them forward until he attains the desired speed - correcting his course by advancing one pair of throttles beyond the other as may be necessary. Thus, to correct the York's tendency to roll portwards it is generally necessary to advance the port throttles slightly in front of the starboard. The pilot, once he has got the aircraft rolling straight and at the desired speed, requires his right hand to join his left with which he has been holding the control column and accordingly the practice is for the second pilot to keep his left hand close behind the right hand of the pilot and ready to take over the throttles when the pilot relinquishes them.

The handles operating the brakes are fitted on either side of each control column, there being one provided for the pilot and another for the first officer. The brakes can be operated equally or differentially and are extremely powerful.

The effect of the rudder is negligible until there is sufficient speed or power to provide a stream of air over it. As the aircraft makes its run and the speed increases so the effectiveness of the rudder will gradually increase.

The captain's evidence was that he lined up the aircraft on the threshold of the runway straddling the white line but pointing 5° to the left of it. After carrying out the usual pre-take-off checks, he received permission to take-off and the aircraft moved forward.

What happened thereafter is described by the captain as follows:

"It (the aircraft) moved slightly to the left. I corrected the take-off run. The aircraft seemed to come straight. Then I felt a violent swing to the right. I did not like it. I pulled everything (meaning the throttle levers) off and continued on. The aircraft seemed to roll fairly well. After I had got my hands off the throttles I was preparing to use control of the brakes to pull the aircraft up. The aircraft seemed to roll off. The next thing we were off in a 180° turn. Then of course we sat down."

The captain was insistent that he had not at any time used his brakes but thought

that he might have used his rudder instinctively. When he closed the throttles he did so because he had decided to abandon the take-off run in view of the swing which had developed. Asked what could have been the cause of the violent swing to starboard he said: - "I cannot think of one myself. The only possible thing I could think of was that I must have somehow over-corrected." He added that he was "not conscious of having over-corrected" and that at the time he closed the throttles, which was before the aircraft crossed the centre line, he thought his speed was "fast enough to cause trouble but not too fast to get out of it."

The first officer's account is that as the aircraft left the threshold he had his head down watching the instruments. He said - "I was aware we were moving to the left of the centre line - it definitely was not a swing in any way but a slight movement to the left of the centre line. The boost pressures were at this time +16 lbs. each approximately. I put my left hand up by the captain's right hand. I anticipated taking over from him and had my hand I think on the throttles and I felt him using differential throttle and still juggling with them and I looked up to see why. I saw that we were on the left-hand side of the runway - I would not know how much but towards the left. The captain pulled the throttles back and put his right hand on the control column. Almost immediately I pulled back No. 1 throttle - the port outer - because it was not fully closed." He went on to describe the increasing severity of the swing and the outcome and stated that the port outer throttle was "not as much as half open" when he himself closed it but more than would have been the case if it had merely bounced back a little on being closed. He was not conscious after putting up his left hand that the captain made any violent or abnormal movement of the throttles.

The investigator states that, in the light of the evidence, he cannot think that this swing can have developed without some grave error on the part of the captain. The violent swing at so early a stage of the aircraft's run could only result from a correction of the portward course due either to a sudden and excessive differential use of the throttles or to a momentary application of brake to the starboard wheel or to both these factors. The captain was not conscious that he did either of these things. The investigator has no doubt that the captain over-corrected violently and excessively when he used the throttles to bring the aircraft straight and that this caused the beginning of the swing. In the light of the starboard wheel

mark * and despite the captain's belief to the contrary, the investigator is inclined to think that he must at the same time have also applied the starboard brake. The latter supposition is necessarily speculative but nothing else in the investigator's opinion accounts for the sudden development of so severe a swing that even before he crossed the centre line he decided to close all throttles and to abandon the take-off. The fact that in closing the throttles he left the port outer open would, since it had been at 16+ boost, serve to accentuate the swing, but the effect of this error was quickly corrected by the first officer.

It is difficult, without experiencing the violence of the swing as the captain did, to attempt to judge whether his decision to close the throttles and to abandon the take-off was the right decision. Equally, it is not easy to criticize what he did or failed to do after he had closed the throttles. In the latter stages of the swing use of the rudder would hardly have influenced his course whilst experienced pilots who gave evidence expressed the opinion that it was better at this stage not to use the brakes.

In these circumstances the investigator is not prepared to condemn the captain's decision to close the throttles or his subsequent failure to control the course of the aircraft. The error was committed earlier when he started to correct his portward course.

Probable Cause

An over-correction of the portward course of the aircraft possibly accompanied by some application of the starboard brake caused the aircraft to swing to starboard off the runway and to encounter the "French" drain with the resulting failure of the under-carriage. The over-correction by the pilot, whether or not accompanied by some application of the starboard brake, should be termed a grave error of judgment and skill rather than a wrongful act or default.

Recommendation

Whilst the investigator did not think that the manner in which the "French" drain was filled had any significant effect in the circumstances of the accident, it must be recognized that if the top of the trench is left over "proud" to the extent that it was left in this case and if the stones at the top are of the size employed here, danger could still arise if an aircraft had left the runway in more normal circumstances. There can be no justification for a filling which involves risk to an aircraft if it runs off the runway for a distance as short as 25 feet. It is recommended that, in the case of this particular drain, steps should be taken to reduce the extent to which it is over "proud" to at most two inches and to substitute for the top layer of stones at present in position, smaller stones less likely to cause damage. It is suggested that since this method of filling is apparently employed at other airfields, all necessary steps should be taken to check the top layer in these cases also.

* It was observed from the track of his tires that the initial tire mark was that of the starboard wheel and that at this point the width of the track was over 24 feet and accordingly somewhat wider than the normal track width of 23 feet 9 inches. Although the wheels are so set that they can float to a tolerance of some inches, the start of the track and the fact that the starboard wheel track was the first to appear are in the investigator's opinion important factors.