

No. 35

El Al, Israel Airlines Ltd., Lockheed Constellation 149, 4X-AKC, was shot down near the Bulgarian-Greek border on 27 July 1955. Report of Commission of Inquiry, Ministry of Communications, State of Israel, released 18 August 1955

Circumstances

The aircraft took off at 2015 hours Greenwich Mean Time on 26 July from London for Tel-Aviv with stops at Paris and Vienna. On 27 July it departed (0253 hours) Vienna with an estimated time of arrival over Belgrade of 0436 hours. While in the area of the Yugoslav-Bulgarian border at an altitude of approximately 18 000 feet the aircraft was fired upon by two Bulgarian fighters. Following two more attacks the aircraft broke up in mid-air at an altitude of 2 000 feet and fell to the ground in flames at a point 3-1/2 kilometres southeast of the junction of the Rivers Strumica and Strumon in Bulgarian territory near the Bulgarian-Greek border, killing all 51 passengers and 7 crew members.

Investigation and Evidence

At 0537 on 27 July Athens Air Traffic Control received an SOS from 4X-AKC on a frequency of 3 481 kc/s. This message was relayed immediately to Lod ATC. However, before search and rescue action could be taken Athens ATC was informed that the aircraft had been observed falling in flames near the Bulgarian village of Tserbanova and notified Lod ATC.

The weather conditions over the route have been divided into three sections as follows:

1. Weather on the Amber 10 Airway between Belgrade-Kraljevo-Skoplje and Gevgelia-Salonika.
2. Wind direction and velocity over the above route.
3. Weather over the South Bulgarian territory.

1. Weather on Amber 10 between Belgrade and Kraljevo

Broken clouds (average 3/8), 3/8 of Strato-Cumulus, 3/8 of Cumulus, cloudbase approximately 2 000 feet, cloudtops about 8 000 feet,

temperature at 500 mlb. level (18 000 feet) -11°C., visibility 10 km., but hazy due to sunrise hour.

Kraljevo-Skoplje

Increasing cloud amounts (6-8/8). 3-5/8 Cumulus and Strato-Cumulus, base at 4 000 feet, 3/8 of Alto-Cumulus base 9 000 feet, but considerable locally isolated build ups of Cumulus and Cumulonimbus reaching to 20-25 000 feet with thunder, showers, lightning, icing and severe turbulence. Spread of these developed Cu and Cb's on west-easterly belt about 80 MILES WIDE and extending at least 100 MILES either side of Airway Amber 10.

These clouds have been reported as "past weather" (last three hours) and as "last hour" and "present weather" at 0600 hours. The international synoptic actual weather for South Yugoslavia and Northern Greece for the 27th at 0500 hours reads: "Fair to cloudy, local overcast with thundery showers mainly to north."

Skopje-Salonika

Weather cloudy to fair, rapid improvement of local cloudy conditions. 1/8 Cumulus at 4 500 feet, 2/8 of Alto-Cumulus at 9 000 feet. Visibility 10-25 km. Temperature at 18 000 feet Minus 11°C.

2. Upper Wind Direction and Velocity on Amber 10 Airway between Belgrade and Yugoslav-Greek Border

The direction of the upper wind (18 000 feet) was constant from 260-270° throughout the 300 MILES stretch.

At Belgrade and up to a point about 50 miles south, the velocity was as forecast about 20-25 knots. From then on, the wind increased sharply to a velocity of 70 knots, due to the development of a large "LOW" pressure area in the North and a "HIGH" pressure area in the South at 18 000 feet level, after that decreasing from the Yugoslav-Greek border southwards.

International Synoptic Report for Upper Winds

South Yugoslavia and Northern Greece -
the 27th, 0500 hours

at 10 000 feet 270°/35 knots

at 18 000 feet 260°/70 knots

Note:- Another JAT pilot flying the same route
at 0900 hours at 12 500 feet reported
wind of 270°/78 knots.

3. Weather over South Bulgaria

The weather was fine, traces of medium
and high cloud. Visibility good. Wind as in
previous paragraph.

Of the weather as discussed above two
factors are most relevant to this flight:

Firstly, the presence of Cumulonimbus
clouds on the route, and secondly, the
sudden unpredicted change of the wind
velocity from 20 to 70 knots.

The Commission immediately on appointment applied to the Bulgarian Legation in Tel-Aviv for visas to enter Bulgaria in order to proceed with the investigation on the spot. Furthermore, the Bulgarian Legation was approached by the Israel Foreign Ministry with the request that the Israel Commission of Inquiry act in conjunction with the Investigation Committee appointed by the Bulgarian Government in accordance with international practice. The answer to the application for visas was that the matter had been referred to Sofia with the request that visas be issued by the Bulgarian Legation in Athens in order to save time. No answer was received to the request to participate in a joint investigation.

The Commission, immediately on arrival at Athens, approached the Bulgarian Legation which had not yet received instructions to issue the necessary visas. The approach was made through the Israel Legation in Athens. The Bulgarian Legation agreed to endeavour to arrange for visas to be issued at the frontier. Again in order to save time, the Commission proceeded to a Greek border village named Kula, 14 kilometres from the site of the wreckage, where it remained waiting for permission to cross into Bulgaria. During this time it interviewed and took the testimony of a number of Greek eyewitnesses who were stationed at border posts.

The Commission spent 28 and 29 July on the border awaiting permission to enter and was able to observe portions of the wreckage and the activity on the site. The activity was considerable. Trucks were seen moving around in the area and wreckage was being transported to places out of view.

Permission was eventually granted to enter Bulgaria on 30 July, but the number of persons was limited to three and they were obliged to return before sunset.

The team found that

1. many parts of the aircraft had been removed from the places where they originally fell;
2. a most thorough search had been made of the wreckage. Lining had been ripped off and all closed structures had been opened for examination;
3. there were holes of various calibres too numerous to detail in the short time available;
4. all traces of bodies, luggage and personal belongings had been removed;
5. nearly all cockpit equipment, such as radios, instruments, electrical panels, had been removed and were not available for examination. Only one radio compass indicator and some completely smashed radio sets were found.

Before leaving Bulgaria the team requested permission to interview witnesses who could give further information. They requested particularly to see the pilots of the jet fighters who were obviously the only witnesses to give full and detailed information as to what had happened. They further requested permission to interview the Commanding Officer who had ordered the fighters to take off and, in addition, persons along the flight path. They also asked for the return of aircraft parts that had been removed from the site. The response to this request was that it would be referred to the authorities at Sofia. Unfortunately, no answer had been received to these requests up to the time of writing this report and the Commission was obliged to prepare it without this vital evidence being available from Bulgaria. The only Bulgarian evidence is the official communiqué (quoted at the end of this report) of the findings of the Bulgarian Investigation Committee which established beyond any doubt that the aircraft was attacked and brought down by Bulgarian fighters.

The Commission next sought permission to enter Yugoslavia in order to gather evidence there. Visas were duly granted by the Yugoslav authorities at Salonika and at 1400 hours on 2 August four members of the Commission crossed the Greek-Yugoslav border at Gevgelia. The witnesses interviewed by the Commission were all military personnel who had been stationed at points along the Yugoslav-Bulgarian border. One member of the Commission visited Skoplje and Belgrade aerodromes and gathered information from the Civil Aviation authorities. He also interviewed the Flight Control Officer who had been on duty at the time the aircraft passed over Belgrade and a JAT Airlines Captain who had flown the Airway Amber 10 on the morning of 27 July.

Aids to Navigation

The aircraft reported over Belgrade at 0433 hours. Belgrade has the following navigational aids: Two non-directional beacons with call signs BD and ZN. The aircraft used the BD beacon in its flight plan and when reporting. Both beacons were, at this time and date, serviceable. The BD beacon has an aerial output of 1 500 Watt. In addition to these two beacons, Belgrade has a VOR which was working normally.

The next reporting point Kraljevo has no navigational aid.

The reporting point at Skoplje, where Airway Amber 10 changes its direction from 161° (magnetic) to 142° (magnetic), is equipped with a non-directional beacon with an aerial output of 1 200 Watt. This beacon was working normally at the time of the flight. Between Belgrade and Skoplje, a distance of 177 nautical miles, no other radio aid is available either on the airway or abeam of it.

The reporting point at the Yugoslav-Greek border is the town of Gevgelia. There is no navigational facility whatever at this point.

The next navigational aid is a 350 Watt non-directional beacon at Salonika. There is, therefore, a further distance of 107 nautical miles between Skoplje and Salonika without any intermediate navigational aid. It should be mentioned in addition that according to information received from a Pan American Airways flight using the Salonika beacon at this time, reliable reception was limited to a small area over the beacon.

The Constellation was fitted with two serviceable radio compasses (Bendix), each radio compass being an independent unit from the indicator to the loop and sense aerial. There were also two independent VOR units (Bendix) installed in the aircraft. There were, in addition, 1 magnetic compass and 1 Flux-gate compass. These had been swung and adjusted on 18 May 1955. Both pilot positions were equipped with full instrument panels, including 3 directional gyros. There were also 2 ILS installations with 75 Mc/s Marker receivers. One Radar altimeter and a Loran set were installed at the navigator's position.

It is assumed that when within range of the BD beacon and the VOR at Belgrade, these aids were used. The VOR was, no doubt, helpful in keeping the aircraft in the airway for the first part of its flight from Belgrade towards Skoplje. The range of the VOR should not be considered reliable beyond 70-80 nautical miles. The range of the BD beacon owing to thunderstorms could not have been considered reliable for steady course indication. This applies, and even to a greater extent, to the Skoplje beacon which was surrounded by static. The Salonika beacon due to its low output and the possibility of coastal refraction would not have been reliable. It should be noted that the effectiveness of all three non-directional beacons may have been reduced by sunrise conditions.

The Flight

There is no doubt that, when the aircraft reported over Belgrade, it was, in fact, over the reported position. This was confirmed by the Control Officer at Belgrade who stated that he had heard the aircraft overhead at the time of its report. The radio facilities at Belgrade described earlier and the airborne equipment available would ensure that the aircraft could not be off course at this point.

Belgrade to Point 0510 (Vicinity Skoplje)

From Belgrade the aircraft heading would be along the Airway Amber 10, that is to say on a magnetic course of 161°. The winds forecast for this part of the route and used in the flight plan were 270°/20 knots at an altitude of 18 000 feet. The altitude for which the aircraft was cleared was 17 500 feet. The wind as forecast required a correction of 4° to the right, giving a heading of 165°. This was the heading used in the flight plan. The time for the leg

Belgrade-Skoplje calculated in the flight plan was 44 minutes. The planned arrival over Skoplje was, therefore, 0517. The actual reporting time over Skoplje was given as 0510, that is to say 37 minutes elapsed between the report over Belgrade and the report over Skoplje. The wind for the first half of this leg was, in fact, as forecast.

Plotting the aircraft's position after completion of the first half (70 nautical miles) of the leg on the basis of an indicated airspeed of 200 statute miles per hour at an altitude of 17 500 feet with an outside temperature of -11°C ., which gives a true airspeed of 230 knots, we arrive at the point marked 0451 1/2. (See Figure 20).

From this point on the winds actually encountered were $260^{\circ}/70$ knots. The winds forecast were $270^{\circ}/20$ knots. The pilots could not have been aware of the wind increase and would not, therefore, have made any correction to the course. The aircraft must, therefore, have continued on the same bearing as before (165°) until reporting over Skoplje (at 0510). At this time the aircraft would, in fact, have left the airway and arrived at the point 0510. (See Figure 20). The premature report over Skoplje beacon was probably due to an erroneous indication of the radio compass influenced by the thunderstorms which were well developed near the actual flight path. It should also be noted that the easterly trend of the flight path could not have been checked by air to ground observations owing to the fact that the aircraft was passing over clouds.

In the section of this report dealing with the weather it was noted that from Kraljevo to south of Skoplje there were considerable build-ups and isolated cumulonimbus reaching great heights with lightning, icing and severe turbulence. Encountering these conditions, the pilots would, as a matter of ordinary airline practice, make small detours wherever possible, to avoid passenger discomfort. In reconstructing the flight path it has not been possible to reflect slight variations of course due to such detours but these should be borne in mind in evaluating the accuracy of the reconstruction.

Vicinity Skoplje (Point 0510) to Vicinity
Yugoslav-Bulgarian Border (Point 0528)

Assuming they were at Skoplje beacon, the pilots at 0510 altered course to the new heading of the airway, namely 142° corrected for the forecast winds to 146° . They steered this course for 18 minutes before reporting

over the border at 0528. Plotting the course taken during the 18 minutes with allowance for the actual wind, we arrive at the point 0528. (See Figure 20). We conclude this was the aircraft's actual position when it reported over the Yugoslav-Greek border. It was, in fact, close to the Yugoslav-Bulgarian border at a point approximately 26 nautical miles north of the Greek border. Continuing on this course for a further few minutes, the aircraft would cross into Bulgarian territory.

The place of this crossing corresponds to the position where the Yugoslav eyewitnesses observed the aircraft.

At this stage we feel obliged to refer to the findings of the Bulgarian Investigation Committee (quoted at the end of this report) which were to the effect that the aircraft entered Bulgaria at the town of Trn and after penetrating Bulgarian airspace for 40 kms, turned south and flew over various Bulgarian towns. South of the town of Stanke Dimitrov the plane was intercepted by two Bulgarian fighters which warned it to land. Having regard to the fact that the town of Trn is on a bearing of 135° (magnetic) from Belgrade and at a distance of 147 nautical miles from it, such a course is quite unrelated to the pilots' flight plan or to the direction in which they were making. The winds in this region were as predicted. The pilots were assisted for 70 miles out of Belgrade by reliable track indicating navigational aids (VOR). They were experienced pilots familiar with the route. We are satisfied that they could not have flown for some 41 minutes on an entirely arbitrary course, then turned sharply south on an entirely new course without apparent reason, and thereafter reported without comment over the Greek border.

It is stated in the above findings that the fighters warned the aircraft to land "in conformity with established international regulations. In spite of this it would not obey and continued in its flight towards the south in trying to escape". It is inconceivable that an unarmed civil aircraft with an experienced crew having 51 passengers aboard would not obey orders adequately given by two armed fighters. Further, the subsequent behaviour of the fighters is inconsistent with any previous warning having been given. The fighters attacked the aircraft a second time when it had lost considerable height and was evidently seeking for a place to land. A last attack was carried out at a time when the course of the aircraft was northward heading further into Bulgarian territory; the aircraft had already

been hit and was obviously making an approach for a forced landing either in the Strumon valley or on an abandoned airfield further north. Finally, no radio warnings on the frequency fixed by the International Civil Aviation Organization for aircraft communication in this region were intercepted by either Greek or Yugoslav aeronautical stations keeping watch.

The Commission, therefore, after careful consideration cannot accept the findings on this point as set out in the official Bulgarian Communiqué.

The Yugoslav witnesses made their observations from points along the Yugoslav-Bulgarian border. One of the three witnesses stationed at the point marked "A" on Figure 20 saw a large aircraft flying in a southeasterly direction over Bulgaria and two fighters approaching it from the east. One of the fighters took up a position between the large aircraft and the Yugoslav-Bulgarian border. The other fighter manoeuvred around the large aircraft. All three witnesses at the point "A" heard bursts of machine-gun fire but none of them saw signs of a hit. The two witnesses stationed at the point "B" heard an aircraft to the northeast of their position and heard bursts of machine-gun fire. They then observed the aircraft moving in a southeasterly direction towards the Greek border. After this they heard more machine-gun fire. The aircraft was flying in a southeasterly direction and was about 7 kilometres distant from the observation post when it disappeared from view. A witness stationed at the point "C" also saw the aircraft to the northeast of his position and observed it flying to the southeast and losing height. He heard machine-gun fire but did not observe fighters or smoke from the plane when it disappeared over the mountain marked on Figure 20 with the co-ordinates 41°28'N 23°04'E.

The next witnesses to see the aircraft were the Greek observers along the Greek-Bulgarian border. The first group of observers (3 witnesses) stationed at the point "O" (see Figure 21) saw the aircraft approach over the mountain from the northwest. When it appeared, smoke was coming from its right side. Before the aircraft came into view one witness heard what he took to be heavy gun fire and another what he thought was thunder. The aircraft was seen flying southeast losing height but under control.

South of Petrici the aircraft started to turn towards the northeast, heading for the plain north of hills 224 and 281. A little beyond

this to the north there is an abandoned military airfield. All three witnesses at this post state that when the aircraft was over hills 224 and 281, it broke up and fell in pieces. Part of the debris fell on the northwestern slopes of the hills and burned for a short time. The other part fell on the southeastern slopes and continued burning for more than an hour. When the aircraft broke up in mid-air, it was at an altitude of approximately 2 000 feet.

Other witnesses stationed at points "2" and "3" (see Figure 21) further east along the same border heard machine-gun fire before the aircraft appeared and then saw it coming low over the mountain with fire and smoke at the root of the right wing. They generally confirmed the previous witnesses regarding the path the aircraft took. However, they saw, in addition, two jet fighters above the aircraft. One of the jets disappeared immediately after the aircraft turned north but the other accompanied it right up to the time when it broke up. After this it circled and flew to the north. These witnesses heard a loud explosion at the time the aircraft broke up.

Three other witnesses, civilians, made their observations from the vicinity of Promachonos marked 4 on Figure 21. One of them heard shots immediately before the aircraft broke up. The attention of the others was drawn to the aircraft by what they described as "noise". Of this group of witnesses two saw the fighter.

Vicinity Yugoslav-Bulgarian Border (Point 0528) to Break-up

In the light of the evidence of the eyewitnesses, both Yugoslav and Greek, the reconstruction of the flight path may now be continued from the point 0528. As mentioned before, the aircraft may be presumed to have continued to the Yugoslav-Bulgarian border without altering course. The distance from the point 0528 to the mountain over which it first appeared to the Greek eyewitnesses is 17 nautical miles. The mountain is about 6 000 feet high and the aircraft was described as coming low over it. We assume, therefore, an altitude of some 8 000 feet. As the aircraft had reported at 18 000 feet over the point 0528, it must have lost approximately 10 000 feet of altitude over a distance of 17 nautical miles. This means that the aircraft must have reduced speed to the minimum in order to make a rapid descent. It must have averaged about 150 knots over this distance which it would then have covered in 7 minutes, bringing it over the mountain

at 0536. Loss of pressurization as a result of damage to the fuselage caused by one of the earlier bursts of fire may account for the very rapid descent. (It will be remembered that the Yugoslav witnesses heard machine-gun fire before the aircraft came into view.) As the Yugoslav witnesses heard fire when the aircraft disappeared from their view and the Greek witnesses heard fire just before the aircraft appeared smoking into their view, it seems that the aircraft was hit for a second time and a fire started as the aircraft came over the mountain. The SOS message was received at 0537 which would be immediately after the fire started.

Why no SOS message was received earlier is a matter for conjecture. The cause of the sudden loss of pressurization may not have been immediately apparent to the captain: His first action would have been to lose height as rapidly as possible. At the same time he would have tried to find out the cause of the loss of pressurization. It may be that it was only at the second attack that he realized that the aircraft was under fire.

The aircraft continued on towards Petrici accompanied by the two fighters. It was losing height steadily. After crossing the Strumica River, it turned left between Petrici and the Greek border. It then headed in a northerly direction towards the Strumon valley until it reached the hills 224 and 281. Right up to this point the aircraft appears to have been under control and the pilot was making for a landing in the Strumon plain and possibly on the abandoned military airfield north of the hills. One of the fighters accompanied the aircraft to the end.

From the report on the wreckage and technical investigation it can be seen that certain damage was inflicted in the air immediately before the break-up. Explosions of large calibre projectiles in the rear part of the fuselage damaging the control mechanism of the elevators and rudders would not have permitted the aircraft to maintain controlled flight. Furthermore, projectiles had penetrated the tanks of the right wing and it was clear from the scatter of the pieces that the wing had exploded in mid-air. The left wing tanks had also been hit by bullets which must have started a fire followed by an explosion. The technical investigation points to the aircraft having exploded and broken up over the hills as a result of a final attack. The eyewitnesses' evidence supports this conclusion. Nearly all of them saw the aircraft break

up in mid-air and some saw a fighter accompanying it. The witnesses to the west and south of the hills did not hear either the explosion or gun-fire. Those a little further to the east along the frontier heard the explosion and some of them also heard gun-fire.

The failure of some of the witnesses to hear the sounds of the explosion and gun-fire may be due to the strong westerly wind which was blowing at the time.

From the condition of the wreckage and the eyewitnesses' description of the break-up of the aircraft in mid-air together with the statement of the Bulgarian Government, it may be conclusively presumed that there were no survivors.

Summary

1. The first firing took place in the area of the Yugoslav-Bulgarian border at an altitude of approximately 18 000 feet. The Commission is satisfied that the aircraft did not receive any warning prior to this firing.
2. Several minutes later the second firing took place over Bulgarian territory at an altitude of approximately 8 000 feet. The aircraft was then evidently in process of descent seeking a place to land and was showing signs of fire. Nevertheless it continued in controlled flight. At the time of this attack it had covered some 17 nautical miles within Bulgarian airspace.
3. After approximately five minutes the third attack took place at an altitude of about 2 000 feet. The aircraft was still under control, heading northward deeper into Bulgaria and making for a forced landing. As a result of this last attack, the aircraft broke up in mid-air.
4. The aircraft entered Bulgarian airspace being approximately 35 nautical miles off track on a course which would have brought it to the Bulgarian-Greek border after traversing approximately 26 nautical miles (6 to 7 minutes flying) of the southwestern corner of Bulgaria. The Bulgarian statement as to the course and track of the aircraft is inconsistent with the facts as proved.

5. In the circumstances of wind and weather on this flight, the crew could not have been aware of the aircraft's drift from track. In any event, the cause of the disaster was not this deviation but the action of the Bulgarian fighters in shooting down the aircraft.

A. Description of the Wreckage

(The total time spent on Bulgarian territory by the three investigators was only slightly more than seven hours of which approximately 3-1/2 hours were spent on travelling and formalities. Thus, they were able to carry out only a limited survey and could not make a complete investigation.)

The location of the wreckage was near the Greek-Bulgarian border on Bulgarian territory about 9 km N.E. of Petrich. The wreckage was found on hill 224/281 on the western bank of the River Strumon. The wreckage was scattered on the S.E. and N.W. descents of the hill over an area of approximately 35 000 sq. metres. The topographic height of the hill is 232 metres.

The South-East Side of the Hill

The major part of the wreckage was on the S.E. descent of the hill. The aircraft debris was found scattered, some parts broken into thousands of fragments. It was impossible to examine all the parts which were lying around. Therefore, only those parts were examined which in the opinion of the committee appeared significant.

The following parts and components found in this area were noted:

1. Four engines. One engine had been disassembled and many parts had been removed including 17 out of the 18 cylinders. A second engine was found in the water near the river bank. A third engine was in the river partly submerged. The fourth engine was on the slope of the hill.
2. Two parts of the centre section of the fuselage were found partly in the water. They were punctured by numerous inward pointing round and jagged holes of various sizes. Interior lining was missing from the cabin walls and was scattered on the ground. The lining showed no signs of fire.

One part of the fuselage was the section where the wings are attached. There were several holes in the fuselage that had penetrated into the cabin in the vicinity of the right heater compartment. There were several large and small holes in the right heater compartment situated in the right wing root. Part of the heater assembly itself - the Janitor Combustion Heater - made of stainless steel was missing. It had not broken off by impact but had evidently been dismantled.

In the heater compartment there was a clear indication of a fire in flight with a "blow-torch" effect: aluminium alloy parts had melted away with diminishing effect along a straight path against the direction of flight.

3. The left wing, broken off from the fuselage at the wing attachment fittings, was lying on the ground in one piece. The underside and ribs of the wing had been partly gutted by fire. Nearly all the ribs had sheared off. Part of the wing was less seriously damaged but even here some rivets of the ribs and lower wing skin were sheared off.

There were a number of jagged and round holes on what remained of the wing skin.

In the area of the upper surface at No. 2 tank, just behind the rear spar, there were inward pointing holes. In the rear spar web there was a round inward penetration, measuring 14 mm. in diameter.

4. One complete undercarriage, with wheels in retracted position, was found in the river.

The wheel assembly of the second undercarriage was on the eastern bank of the river.

5. The only radio equipment found were two radio sets badly smashed. There were no radio dials.
6. Of the instruments there was only one radio compass showing a heading of 114° and a needle setting of 88°.

7. Some twisted seat structures were found but these accounted only for a small part of all the seats. The rest were missing. A partly burned safety belt was noted with the lock in closed position.
8. Two propeller hubs were found, on one of which there was an entirely undamaged blade.
9. An electrical high tension line of about 6 000 volts, running on the western bank of the river, was found severed, lying on the debris. Two broken wooden poles were on the site, one of them strongly burned.
10. Of the many panels lining the front and rear cargo compartment in the body of the fuselage, only one was found, a vertical panel. It was pierced by 12-15 round holes up to 15 mm. in diameter.
11. Many smaller pieces lying around, not specified above, were pierced by round and jagged holes.
12. There were indentations on the ground where heavy parts had been imbedded but the parts were found quite a distance away, unrelated in their location to the original imprints in the ground.
13. The right wing was broken off at the attachment fittings from the fuselage and broken in three large parts which were lying at a distance of about 80 metres one from another. At the inner part of the inner wing, the skin was separated from the few ribs remaining. The tank area of this part of the wing, between the front and the rear spar, was almost entirely burned out and the metal of sheets and extrusions was melted down. The ground below the wing showed a fire running downhill, obviously fed by the remaining fuel of the wing at the time of impact. In the outer part of the inner wing, in the vicinity of the engine nacelles, there were indications of a less intense fire and there was less destruction than in the inner part. Here it was still possible to find and identify some holes caused by the penetration of projectiles. (Some of these were of large calibre.)
14. The fuselage between the wing trailing edge and the rear pressure bulkhead was smashed into several pieces, all of them strongly distorted and almost beyond recognition. Here, again, a number of holes of different sizes were noted. All fibre glass and fabric lining of the accessible cabin sections was stripped from the inside of the fuselage. The steward's call button box cover was found unscrewed and open.
15. Three blankets were found near the fuselage, each pressed into a tight plug-like bundle. The smaller end of each bundle was charred.
16. Two complete inner flap sections, lying separately, showed a number of round holes.
17. The rear part of the fuselage was severed from the main body at the rear pressure bulkhead. There was an inward pointing hole on the lower part of the right side aft of the bulkhead. The hole was broad, oval in shape, with a minimum diameter of 85 mm. The direction of penetration was approximately 15° from the rear to the horizontal centre line of the aircraft. No corresponding outlet to this hole could be found.

The rear pressure bulkhead in this part of the fuselage however was pierced by a great number of round and jagged holes most of them pointing outwards. There was also a large opening torn in the pressure bulkhead.

The bottom segment of the second ring from the tail cone attachment point was pierced by two holes from rear to nose measuring 63 mm. and 75 mm. respectively.

The North-West Side of the Hill

On this side the wreckage was more widely scattered than on the southeast side and consisted mainly of major parts.

13. The right wing was broken off at the attachment fittings from the fuselage and broken in three large parts which were lying at a distance of about 80 metres one from another. At the inner part of the inner wing, the skin was separated from the few ribs remaining. The tank area of this part of the wing, between the front and the rear spar, was almost entirely burned out and the metal of sheets and extrusions was melted down. The ground below the wing showed a fire running downhill, obviously fed by the remaining fuel of the wing at the time of impact. In the outer part of the inner wing, in the vicinity of the engine nacelles, there were indications of a less intense fire and there was less destruction than in

The walking beam of the elevator was found detached from its bracket.

The fuselage structure in the area of attachment of the empennage showed a number of holes.

On the bottom of the fuselage underneath the walking beam attachment brackets there was a jagged opening in the skin with a diameter of 170 mm.

There were indications of a not very intense fire around the emergency elevator booster system apparently sustained by the hydraulic fluid of the main hydraulic system and the emergency booster system including the accumulators situated in this area.

18. The empennage of the aircraft was broken into three pieces which were found 150 metres apart.

Most of the stabilizer and the centre fin were lying near the bottom of the hill. A smaller piece of the stabilizer with the left fin and rudder were close to the top of the hill. The right part of the stabilizer, the elevator and the right fin and rudder were near the bottom of the hill, not severely smashed. Pieces of this section, adjoining the fuselage had been cut away with cutting tools and could not be found.

In the structure of the empennage, where it attaches to the fuselage, there were a number of holes.

19. Deicer boots were clearly cut by sharp instruments and some of the sections of regular rectangular shape were missing.
20. The six high pressure oxygen bottles and one walk-around oxygen bottle were found intact.
21. Many major components and sections could not be found. Conspicuously missing was the section of the fuselage from section 290 forward which includes the cockpit.
22. In addition to the holes mentioned in the above description there were many other holes of sizes ranging from 8 to 85 mm.

23. Despite the large number of holes no projectiles or fragments of projectiles were found.

B. Discussion

The item numbers used in this Discussion refer to the numbers in Description A above.

1. Nothing was found in the wreckage available for inspection to indicate that there had been any defects or failures due to malfunctioning.

2. There was considerable evidence that the wreckage had been interfered with before the committee's arrival. It had been noted that many parts had been removed, including nearly all radio equipment and instruments. (Items 5, 6.) These may have provided useful information. In addition, many parts had been dismantled, cut away and/or removed. Among these were engine cylinders (Item 1), interior lining (Items 2, 14), the heater (Item 2), most of the seats (Item 7), portion of the empennage (Item 18), deicer boots (Item 19), and the whole of the cockpit (Item 21).

Furthermore, marks on the ground indicated that heavy parts had been shifted from the positions in which they had fallen. At least part of the interference above could not have been occasioned by rescue operations.

In spite of the extensive interference with the wreckage it could be determined that some of the parts were lying where they had fallen. For example, the three pieces of the right wing were in their original position. This was clear from the fact that the fire that had burned in one of the pieces extended to the adjacent vegetation and melted material from all three pieces was lying on the ground beneath the places from which the metal had melted away.

3. There was a clear indication of a fire having started some time before the final break-up and having continued in flight for several minutes. The evidence for this was the condition of the heater compartment (Item 2). The fire here must have burned some time in flight in order to have melted the aluminium along a straight part running from fore to aft. The melting of the aluminium decreased along the path. This fire was intensified by the slipstream to which this area was exposed by reason of the holes in the compartment. The

size of the projectiles that had entered could not be determined owing to the deformation of the material through heat and impact.

4. The three blankets, bundled into plugs and charred at one end (Item 15) suggest that smoke and fire were entering the cabin and efforts were being made to stop the holes. This supports the view expressed above, that a fire had started some time before the break-up. It further indicates that pressurization must have been lost at this earlier stage.

5. The condition of the left wing (Item 3), indicated an explosion. Ribs and rivets were sheared off in a manner that could not have been caused by fire or impact. The round holes in the skin of the wing and in the area of the upper surface of the tank behind the rear spar and the hole in the rear spar web appear to have been caused by bullets. Bullets hitting in this area would cause a fire followed by an explosion. It is probable therefore that the attack on the aircraft, in the course of which these bullet holes were inflicted, occurred at, or immediately before the final break-up.

6. There was evidence that the right wing had exploded and that the explosion had taken place in mid-air. Rivets holding the ribs to the skin had been sheared off. The three pieces of the wing were lying at a distance of about 80 metres one from the other. As explained before, the pieces were where they had originally fallen and could not have been so widely scattered except by mid-air explosion.

7. The numerous holes in the cargo compartment panel (Item 10) were caused by bullets of different calibres. Only one could be measured with reliability from the photographs. Its diameter was 14 mm. These holes were round and the panel they penetrated had been in a vertical position. They must therefore have been caused by bullets fired from a direction more or less horizontal to the aircraft.

8. The rear part of the fuselage (Item 17) was heavily pierced by holes, including some of large diameter. One of these larger holes was caused by a projectile entering the unpressurized part of the fuselage at an acute angle from the rear. It must have then exploded, cutting the many outward pointing holes in the skin and the forward pointing rents in the rear pressure bulkhead. One of these was a large rent 40 X 90 cm. From the angle of penetration it can be concluded that the projectile was fired from an aircraft. Its size and explosive effect suggest a rocket.

The two hits in the second ring from the tail cone in this area were also caused by large calibre projectiles. They must have been fired from the rear.

The damage they caused could not be clearly determined. They may have brought about the detachment of the walking beam. They may have also caused the fire noted around the emergency booster system.

The explosive effect of these three large projectiles behind the rear pressure bulkhead, where most of the elevator and rudder control mechanism is situated, would prevent the aircraft from being flown under control.

9. The request to the Bulgarian Government to allow a second access to the wreckage of a committee or two, including the armament expert, was not granted. The conclusions arrived at as to the type and size of projectiles which hit the aircraft were reached by the Commission after the armament expert had examined photos and sketches and had received reports on this aspect of the investigation from the three members of the Commission who had had access to the wreckage.

Probable Cause

The aircraft sustained a hit or hits which caused loss of pressurization and a fire in the heater compartment. The aircraft broke up in mid-air due to explosion caused by bullets hitting the right wing and probably the left wing together with a projectile or projectiles of large calibre bursting in the rear end of the fuselage.

Recommendations

Throughout the European and Middle East regions there are a number of airways which are not adequately equipped with radio navigational aids ensuring that pilots are given a reliable tracking when they need it most, that is to say, in bad weather. Non-directional beacons are inadequate aids unless supplemented by other navigational aids such as radar surveillance of the kind provided, for example, in England. With NDB's alone pilots will be unable to avoid deviations from the airways. The International Civil Aviation Organization has recommended a more extensive use of VOR's which not only give an adequate track but are also unaffected by bad weather (static).

The route Belgrade-Salonika (Airway Amber 10) over a distance of 284 nautical miles is equipped with only one VOR (at Belgrade) and 3 NDB's (at Belgrade, Skoplje and Salonika) but has five compulsory reporting points (Belgrade, Kraljevo, Skoplje, Gevgelia and Salonika). In practice, the Airway Amber 10, when flown from Belgrade in bad weather, can be followed with accuracy only for the first 70 miles with the aid of the Belgrade VOR.

It is, therefore, recommended that:

- a) Navigational aids which are not affected by static should be introduced along Airway Amber 10 to supplement the present NDB's and should cover the whole Airway.
- b) All compulsory reporting points should be equipped with radio navigational aids.

As far as the Commission is aware, no communication watch on ground to air frequencies, used by aircraft on this route, is kept by the Bulgarian communication centres nor are they obliged to keep such a watch.

It is, therefore, recommended that:

- a) A continuous watch be maintained on appropriate ground to air frequencies by those governments which have established prohibited areas in proximity of international airways.
- b) There is also need for a standard air to air code of visual signals in the absence of radio communications and/or a common language.

Finally, the Commission is of the opinion that there is urgent need for co-ordinated international action to prevent the shooting down of civil aircraft.

The Commission, therefore, recommends to the Government to examine what steps may be taken to this end through the UN, ICAO and otherwise.

"Bulgarian Note of 4 August 1955

Ministry of Foreign Affairs

NOTE VERBALE

The Ministry of Foreign Affairs of the Bulgarian People's Republic presents its compliments

to the Legation of Israel in Sofia and, in reply to the latter's note No. V/0485/02, has the honour to communicate the following, on instructions of its Government:

The following facts have been established beyond doubt by the ministerial commission of inquiry:

At 0710 hours (local time) on 27 July 1955, an aeroplane of the Israeli airline "El Al" penetrated Bulgarian airspace without notice in the area of the town of Trn. After penetrating into Bulgarian territory to a depth of 40 kilometres, the aeroplane then flew over the towns of Breznik, Radomir, Stanké-Dimitrov and Blagoevgrad and proceeded towards the South. It flew over Bulgarian territory for a distance of approximately 200 kilometres.

South of the town of Stanké-Dimitrov, the aeroplane was intercepted by two Bulgarian fighters which had received orders to compel it to land at a Bulgarian airport.

The fighters warned the aeroplane to land, in accordance with established international rules. In spite of this, the aeroplane did not comply, but continued to fly southwards, attempting to escape across the Bulgarian-Greek frontier.

In the circumstances, the two fighters of the local Bulgarian air defence forces, surprised at the actions of the aeroplane, opened fire, as a result of which the aeroplane caught fire and crashed a little later in the vicinity of the town of Pétritch.

In adopting the conclusions reached by the special ministerial commission instructed to inquire into this incident, the Bulgarian Government admits that the causes of the unfortunate accident to the "El Al" aeroplane can be summarized as follows:

1. The aeroplane deviated from its route, violated the State frontier of Bulgaria and penetrated deep into the interior of the Bulgarian airspace without warning. Equipped as it was with perfect air navigation devices, the aeroplane cannot have been unaware of the fact that it violated the State frontier of Bulgaria. Even after it had been warned, it failed to comply and continued to fly southwards in the direction of the Bulgarian-Greek frontier.

2. The Bulgarian air defence forces acted with some hastiness and did not take all necessary measures to compel the aircraft to surrender and land.
3. The Bulgarian Government considers it necessary to draw attention also to the fact that, for many years, certain parties, failing to respect the sovereignty of the Bulgarian People's Republic, have systematically been violating the Bulgarian frontiers. In recent years many illegal crossings of the Bulgarian frontiers by aeroplanes "of unknown nationality" have been recorded. During these illegal flights, subverters equipped with arms, radio stations and other supplies were parachuted into Bulgarian territory. The Government of the Bulgarian People's Republic protested several times to the Secretariat of the United Nations Organization. Unfortunately, however, this produced no results. All these factors created a tense atmosphere which made it necessary to take steps to safeguard the security of the State. It was this tense atmosphere that made possible the unfortunate accident to the Israeli aeroplane.

The Bulgarian Government and People express once again their deep regret at this great misfortune which caused the death of entirely innocent persons. The Bulgarian Government fervently hopes that such misfortunes will never recur. It will discover and punish those responsible for the catastrophe in which the Israeli aeroplane was involved and will take all necessary steps to ensure that similar catastrophes do not recur in Bulgarian territory.

The Bulgarian Government extends its deep sympathy to the relatives of the victims and is ready to undertake to pay compensation due to their families, as well as to bear its share of the material damages.

Ministry of Foreign Affairs
of the
Bulgarian People's Republic"

Sofia, 4 August 1955

The Legation of Israel
Sofia.

