Annual Review of Helicopter Activities

BLACKBURN ENGINES LIMITED

A Low Cost Turbine Engine for Utility Helicopters

The value of VTOL and hovering flight has been well demonstrated for civil and military purposes in the last twenty years An example includes the survey of a 50 mile power line from Kemano to Kitimat Hydro Electric Plant in Canada, across mountains 5,000 feet high Thirty hours' flying did a task which would have taken three years by other means Naval and military duties include air search and rescue, battle surveillance, reconnaissance and transport of assault troops Helicopters have done this work, but because of their high initial cost and expensive operating charges their use has been confined to these specialised roles

A greater lifting efficiency can be obtained by using a rotor to induce a small velocity change in a large mass of air than by using high velocity jet engines In spite of this fact, designers are concentrating on vertical take off aircraft with straight jet or ducted fan engines, because their foreseen future costs appear to offer better economics than the helicopter Undoubtedly the jet offers greater speed, but over short range this should not be a significant factor Means, therefore, of simplifying the helicopter and reducing its operating costs are important to its exponents

A free power turbine engine of simple robust construction, which can be sold in quantity at about £8 per horse power and overhauled at low cost after periods of about 1,000 hours' running would do much to help the helicopter manufacturers reduce costs Such an engine, designated A 129, has been developed by Blackburn Engines, of Brough, who have now acquired a large experience of small gas turbines

Behind the air intake of the A 129 engine a two stage axial compressor supercharges a single centrifugal stage, achieving an overall pressure ratio of 6 5 1 Fuel is fed through the centre of the rotating assembly shaft and centrifuged into an annular combustion chamber A two stage turbine drives the compressor The impellor, combustion system and two stage turbine are derived from other Blackburn engines The free turbine drives a reduction gear box which is a further common component and the principle of standardisation within Blackburn's range of engines is extended to some of the A 129 casings

The use of components in the A 129, already developed for other engines, has permitted Blackburns to keep manufacturing costs low and minimise development running

In spite of simple robust construction, the performance of the A 129 is well up to present day standards for small gas turbines Specific fuel consumptions of the order of 65 lb /SHP/hr at a rating of 1,000 s h p may be expected for a weight of under 400 lb Present engine ratings are based on existing component efficiencies and moderate turbine entry temperatures Developments in both directions should lead to considerable gains in performance and power/weight ratio in the next few years

In designing their P 531 helicopter, Saunders Roe applied a similar philosophy to Blackburns, many components being developed from earlier helicopters The P 531 should have a low purchase price in relation to its performance and equally attractive operating costs

The combination of the Saunders Roe P 531 helicopter and Blackburn's A 129 free power turbine engine will make a significant contribution to the achievement of low initial cost and operating charges in small helicopters It may well start a fashion in the consolidation of present day aviation developments, with the object of reducing the high research and development charges, which have so bedevilled the Aircraft Industry in the last few years

https://doi.org/10.1017/S2753447200004741 Published online by Cambridge University Press

BRISTOL AIRCRAFT LIMITED

During the past year the main effort of the helicopter division of Bristol Aircraft Limited has been concentrated on the twin-engined tandem-rotor helicopter, the Type 192 The single-engined Sycamore has now been phased out of production

The Type 192 is in production for the Royal Air Force at Bristol's factory at Weston-super-Mare, and it will enter Squadron service in 1960 At present four aircraft are flying and an intensive programme of pre-operational assessment and testing is in progress

Powered by two Napier Gazelle free-turbine engines, the Type 192 has an all-up weight of 18,500 lb and a cruising speed of about 140 m p h Normal cruise power of each engine is 980 shaft horse power and the maximum power available 1,650 s h p A synchronising shaft connects the two rotors, keeping them in phase and permitting both to be driven by one engine In an emergency, the Type 192 can take off and cruise on one engine at maximum all-up weight

This helicopter has been designed to operate in a number of military roles, including search and rescue, troop and freight transport, ambulance, paratrooping and supply-dropping duties It could also serve as an anti-submarine reconnaissance aircraft and be used for mine-sweeping and towing

In the course of development flying this year the Type 192 has given a number of demonstrations of its capabilities, particularly as a flying crane At the 1959 Farnborough Air Show it disembarked eighteen fully armed troops and picked up a Bloodhound guided missile and its trolley—a load of about 2 tons , the operation from touch-down to take-off took only 30 seconds The 192 was also used to move a parabolic aerial for a radio telescope belonging to the Mullard Radio Astronomy Laboratory of the University of Cambridge The aerial was too large to be moved by road and too delicate to be dismantled and re-erected It was moved by the 192 from its existing site to a new site six miles away across country in less than five minutes

At an Army exercise on Salisbury Plain the Type 192 helicopter was used in several different roles It flew in reserve troops and on the same sortie carried a netted load of medical supplies and equipment underslung from a strong point underneath the fuselage It evacuated stretcher cases and sitting wounded from the battle zone to a casualty clearing station

The Type 192 can carry a payload of 6,000 lb in its hold or 5,250 lb when used as a flying crane As an ambulance the 192 can carry 8—12 stretcher cases, and for rescue duties, the aircraft is fitted with an upward-opening door incorporating the rescue winch

BRITISH EUROPEAN AIRWAYS

The last report in this journal reviewed the progress of the Helicopter Experimental Unit up to March 1958 Since that date over 2,300 hours have been flown of wh ch 1,400 hours were on commercial charter work and 900 hours on development flying This represents an increase of approximately 35% in rate of flying as compared with the previous period

B E A 's activities in the helicopter charter field have continued to flourish Among the more important jobs undertaken by the Unit was crop spraying in Scotland and East Anglia (where the WS-55 was used for the first time in this role) and aerial supervision of the London-Birmingham motorway The provision of a London heliport facility with the opening of the Battersea Heliport has been particularly welcome and has been used extensively by the Unit

To meet the increasing demand for chartered helicopters, the Corporation acquired a four-seat Bell 47J in April, 1959, to bring the current strength up to five aircraft , 2 WS-55's, 1 Bristol 171, 1 Bell 47B and 1 Bell 47J On 7th January, 1959, the Corporation sent to the Fairey Aviation Company a " letter of intent " indicating that B E A expected, in due course, to place an order for six of a developed version of the Fairey Rotodyne—provided that the aircraft meets our varied requirements This developed version should be capable of carrying approximately 60 passengers at about 200 miles per hour

Development work has continued in preparation for all-weather helicopter operations and substantial progress has been made Trials with an experimental automatic stabiliser and flight director system have shown that a suitably equipped helicopter is capable of prolonged instrument flight in relatively smooth cloud A more reliable production version of the stabiliser and an improved four-channel flight director are now being installed and it is expected that instrument flight in moderate turbulence and steep approaches in weather below fixed wing limits will be possible

Flying on a simulated I L S beam at approach angles up to 20° has established the features required in a helicopter primary approach aid Further trials to include vertical approaches are under way The use of Decca as a helicopter primary navigation aid, and approach aid to moderate weather limits, has continued V O R and A D F have also been evaluated as standby aids

Medium intensity approach pattern lights and two-colour angle of approach indicators have been developed to improve visual guidance for final approach and landing in bad weather and at night Trials to determine a suitable lighting installation for the Battersea Heliport were also undertaken

Operating techniques to minimise helicopter noise and blast effects have been studied and site requirements are being investigated to ensure that multi-engined helicopters can operate safely, in the event of engine failure

A comparison of various greases to reduce wear in rotor head components has lead to increased component life and greater reliability

THE DECCA NAVIGATOR COMPANY LIMITED

The past twelve months have shown a steady increase in interest in the Decca Navigator System by helicopter operators The United States Army in Europe have reached the stage in evaluation of Decca for tactical use that has produced a report which indicates their strong bias towards adopting this type of hyperbolic navigational system

https://doi.org/10.1017/S2753447200004741 Published online by Cambridge University Press

A development contract has been awarded to the Company by B E A , with a view to producing a lighter transistorised version of the Mark 8 and Flight Log, which will be even easier for the helicopter pilot This will mean using information derived from the Decca Navigator to drive a " Zero reader," thus giving a pilot visual " left-right " indication during final stages of the approach

A further development of the existing evaluation going on in New York with New York Airways helicopters, is that F A A are shortly to commence a series of trials using twin-engined helicopters, in which Decca has been installed, in order to test out the all-weather capabilities of the rotating-wing aircraft Several Charter helicopter Companies have been invited to participate, and the resources of both the Vertol and Sikorsky Companies have been co-opted These tests, which are expected to continue over a period of at least two years, will do a great deal towards making all-weather operation a reality

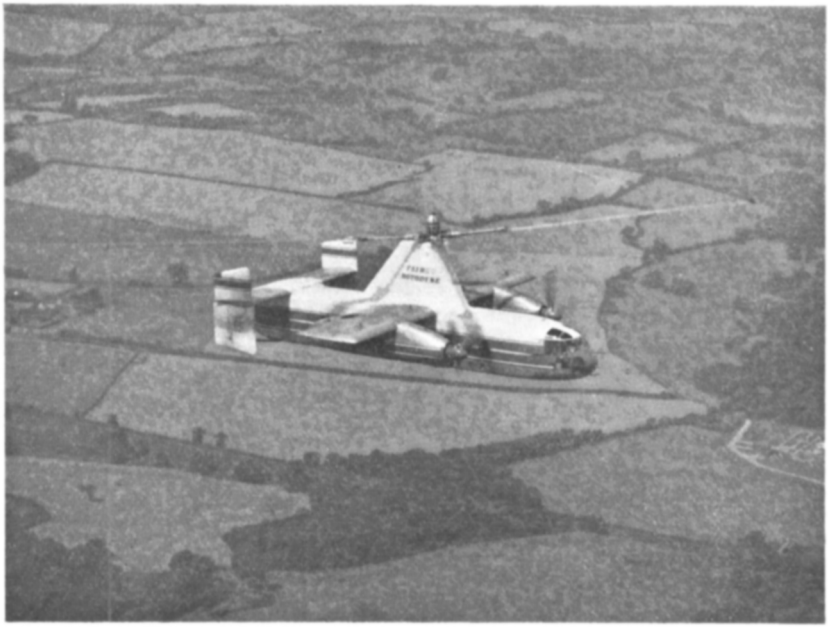
The Decca Navigator Company is stimulating interest in the light helicopter world by the miniaturisation of equipment Light-weight Decca Mark 8 equipment weighing under 50 lb will be available early in 1960

FAIREY AVIATION LIMITED

On January 5th, 1959, the Rotodyne set up a world speed record for rotary wing craft by completing a 100 k m closed circuit course at an average speed of 191 m p h Shortly after this flight the Rotodyne was laid up for about four months while the wing incidence was changed and ailerons fitted These modifications proved successful in improving the handling characteristics at high speed, and only 19 days after flying was restarted the aircraft made its first flight abroad This flight from London Airport to Brussels took 83 minutes, and after being serviced and refuelled by Sabena personnel, the Rotodyne flew to Paris in 58 minutes which was about one half of the normal scheduled journey time While in France the Rotodyne was demonstrated at the Paris Air Show and to members of S H A P E at Versailles

On returning to this country, flight testing was continued and on 24th July, the Rotodyne demonstrated its versatility by laying a bridge measuring 103 ft in length across a river Until this date, the Rotodyne had always been shown as a high speed V T O L airliner, but now its potentialities as an aerial crane were realised Placing this large bulky structure within a few inches of the desired position showed the precision with which the aircraft can be controlled and manoeuvred , the task of the pilot is somewhat easier with the jet driven rotor since power changes do not require compensating directional control changes

Several demonstration flights were arranged throughout the year, on one of these Lord and Lady Douglas were taken over central London, thus showing great confidence in the Rotodyne's safety and reliability The Rotodyne flew into the Hayes factory



yard to have the rear part of the fuselage furnished for the Farnborough Air Display, showing once again the ease with which operations into the centre of built-up areas can be completed After Farnborough the aircraft continued normal flight test work to provide basic data for the design of the larger Tyne-engined version which has been chosen as the production model for both civil and military use The prototype Tyne-engined machine is expected to fly in 1961

THE DE HAVILLAND ENGINE COMPANY LIMITED

During the past year the de Havilland Gnome H1000 turbo shaft engine has been put into production at the Leavesden factory

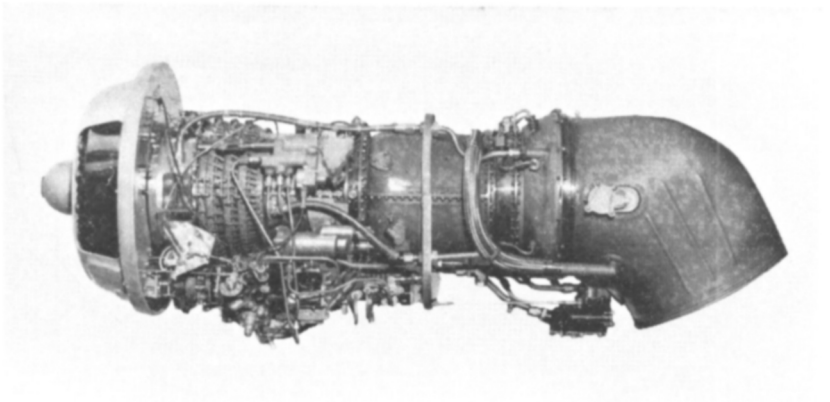
Following an initial period of test bed running with a General Electric T58, from which the Gnome is derived, the first all-British engine ran on June 5th, only eleven months after receipt of the drawings from America Another T58 engine, which had been flying in a converted Westland S-55 Whirlwind, was replaced by a Gnome engine in August this year following successful completion of a 25-hour Special Category Flight Clearance Test By the time this is published some 500 hours development running should have been completed on the test bed, rotor rig stand and in the Whirlwind, this running including an officially-observed 150-hour Military Type Test

Complementary to this British programme of development testing, General Electric have now completed over 23,000 hours running on test beds and rotor rigs as well as 2,250 hours flight testing in the Vertol H-21D and Model 107 (YHC1-A), the Sikorsky Models S-58 (HSS-1), the S-61 (HSS-2) and S-62, and the Kaman HU2K-1

During the past twelve months General Electric have obtained Type-Approval by the Federal Aviation Agency for the CT58-100, the civil counterpart of the T58-6 and have also successfully completed a 50-hour acceptance test on the T58-8 This uprated version of the T58 has achieved power outputs in excess of 1,350 s h p and has a 30 minute minimum guaranteed rating of 1,250 s h p

The experience gained as a result of this extensive development testing by

https://doi.org/10.1017/S2753447200004741 Published online by Cambridge University Press



General Electric is available in the Gnome, and the de Havilland Engine Company will be type-testing the uprated version of the engine, designated the Gnome H1200, towards the end of 1960

Other variants of the Gnome will start development running next year, in particular the turboprop version for V T O L , S T O L and conventional fixed wing aircraft Engines in the turboprop series have been designated the P1000 and P1200

The Gnome has been specified for installation in six designs of helicopter and two designs of fixed wing aircraft, and further installations are under discussion Among these helicopter installations are the latest products of Sikorsky Aircraft and the Vertol Aircraft Corporation which are to be offered for export with Gnome engines The Gnome is in fact interchangeable with the T58 engine and applicable to all existing and projected aircraft for which the American engine is specified

de Havilland Gnome Turboshaft Engines

	H1000	*H1200*
30 minute rating	1,050 s h p	1,250 s h p
Fuel Consumption	0 64 lb /hr /s h p	0 63 lb /hr /s h p
Weight (less gear box)	298 lb	319 lb
Power Weight ratio	3 63 s h p /lb	3 92 s h p /lb
Dimensions (both versions)	54 8 in long, 19 6 in high and 18 2 in wide	

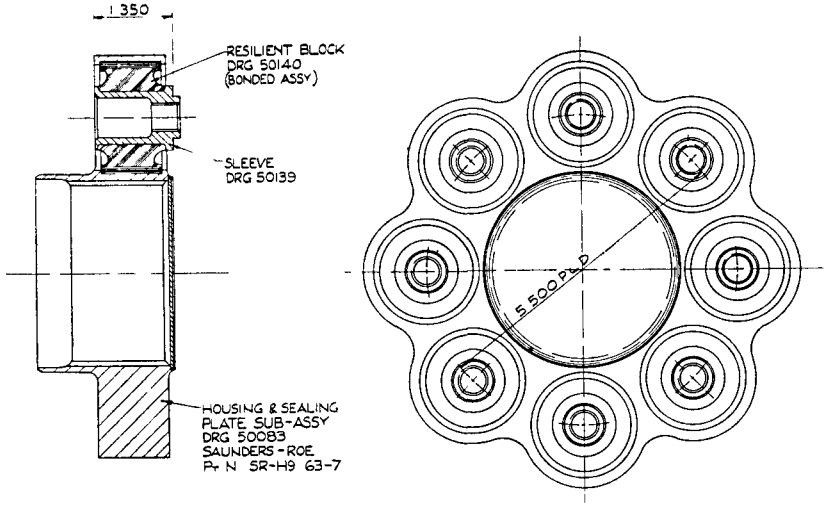
LAYCOCK ENGINEERING LTD

This Company, a member of the Birfield Group, has recently extended its factory area from 7 to 14 acres or thereabouts, to meet its rapidly growing production needs Whilst its plant facilities are largely devoted to the Motor Industry a not inconsiderable portion is allocated to the needs of the Aviation and Guided Missile field Considerable sub-contract machining is undertaken for the leading Aircraft engine builders and the Drop Forging Section is skilled in producing high quality Stainless Steel Stampings The main interest in the Helicopter field is the well tried and proved Layrub Flexible coupling used by Bristol Aircraft Co Ltd and Saunders-Roe for the main drive from gearbox to rotor It is also widely used in wing type aircraft for auxiliary drives

The principles of the Layrub Flexible Coupling—also a true universal joint in certain forms—have been previously fully described in this Journal but the main points are given once more

The housing carries 4, 6, 8 (or variables of these numbers according to torque requirements) specially shaped rubber trunnions under compression and these are the flexible medium between driving and driven members of a transmission line

https://doi.org/10.1017/S2753447200004741 Published online by Cambridge University Press



The trunnions accommodate angular deflections and axial movements Further there is no metal to metal contact in the coupling thus lubrication problems are eliminated Transverse stability on the coupling, is of a high order and centring devices—always a source of trouble—are quite unnecessary This applies even when the rotating speeds are over 10,000 r p m The use of Layrub couplings on British built helicopters for a considerable number of years has undoubtedly been noted by foreign designers as several overseas enquiries have been received during recent months

Laycock Engineering say that following their experience of rubber elements in flexible couplings over a period exceeding 20 years they have been encouraged to design variations of the Layrub type to meet current changes in transmission and now have under static and service tests an entirely new form of coupling It is at present called C R type—short for Compression Ring—but full details will not be published until all tests and production arrangements are completed

The illustration shows only a variation of the conventional Layrub type recently designed for Saunders-Roe Ltd

D NAPIER & SON LIMITED

Napier engines power four of Britain's most modern helicopters The Eland single shaft, single spool turbine has been developed in two forms one, for the Rotodyne (2 Elands) has 3,000 s h p In the Rotodyne installation the Eland both provides compressed air to rotor tip combustion units for vertical and hovering flight, and drives the propellers in forward flight The whole of the Rotodyne's development programme was carried out with the Eland, and visitors to the S B A C show had a chance to see the Rotodyne in a new role—with its payload of nurses

The Westland Westminster (2 Elands which, in production form will give 3,500 s h p take-off power), of which two " Flying Crane " versions at present exist, was also at Farnborough, and demonstrated its heavy duty potentialities by transporting a fully tracked 103 ft bridge and placing it accurately in position Civil versions of the Westminster are projected and plans for a " pod " type of fuselage were recently revealed For the Westminster Napier developed a special rear-drive version of the Eland

The Napier Gazelle free turbine recently type tested at 1,650 s h p became the first engine in the world to receive Ministry of Supply 150 hour Helicopter Type Approval under the revised schedule The Gazelle is the standard powerplant for

both the Bristol 192 tandem-rotor helicopter (2 Gazelles) and for the Westland Wessex Anti-Submarine helicopter (1 Gazelle) Both types of helicopter were present at Farnborough—the 192 with its missile lift, and payload of troops, and the Wessex lifting vehicles and also demonstrating its extraordinary manoeuvrability The Gazelle is an extremely versatile engine with an excellent power weight ratio From the first it was designed for helicopter applications and can be installed at any angle between the horizontal and the vertical In the Wessex the angle of installation is 30°, while the 192's two Gazelles are mounted vertically The Gazelle for the Wessex has left hand rotation of the output shaft

---

Brief Technical Description

Rotodyne/Eland N EL 3 Basically, this version of the Eland is a standard engine to which has been added a hydraulic clutch and an auxiliary compressor It has a take-off rating of 3,000 e h p and powers the prototype of the twin-engined Fairey Rotodyne vertical take-off airliner A more powerful version of this engine, the N EL 7, has a rating of 3,500 e h p

Westminster/Eland E 211 This engine will power the production twin-engined Westland Westminster helicopter It has a maximum rating of 3,500 s h p a one hour rating of 2,850 s h p , and a maximum continuous rating of 2,650 s h p It has no propeller or reduction gear and drives the rotor shaft through a two-stage reduction gear forming part of the airframe equipment The **Eland E 229A** which at present powers the Westminster, has a maximum (2½ min) rating of 3,150 s h p , a one hour rating of 2,600 s h p and a maximum continuous rating of 2,400 s h p

Gazelle The Gazelle has an eleven-stage axial-flow compressor, six combustion chambers, a two-stage turbine coupled to the compressor and a single stage free turbine which drives the helicopter rotor through a reduction gear It can be mounted at any angle between the vertical and horizontal, and can be supplied for either left-hand or right-hand rotation of the output shaft The control system automatically compensates for loss of power in one engine of a twin engine installation by increasing output of the other engine up to 30 per cent above its one-hour rating The Gazelle has an emergency rating of 1,800 s h p , a one-hour rating of 1,450 s h p and a maximum continuous rating of 1,200 s h p

---

SAUNDERS-ROE LIMITED

Helicopter Division Activities, 1959

The Division has been occupied with three main helicopter types during the past twelve months , these are the Skeeter, the P 531 and the Hiller Rotorcycle

The Skeeter The type is the Mk 12, Army Air Observation Post version, which is being operated with marked success by the Army Air Corps No new marks of the Skeeter have been developed, but development of an exhaust-driven Turbo Supercharger installation has been undertaken under contract to the M O S , to provide improved high temperature/altitude performance

The P 531 It is on this aircraft that outstanding progress has been made during the past year Three P 531's with Turmo 601 engines built to prototype standard are being supplied to the Royal Navy

Two entirely new prototypes have been built which represent the Mk 1 production version of the P 531 Fitted with a Blackburn A 129 engine, the first of these made its first flight on the 9th August and was demonstrated at the S B A C Show at Farnborough

The Mk 1 differs in several respects from the original prototype aircraft It has a new transmission system capable of absorbing up to 650 s h p , increased fuel capacity, a deeper windscreen, a skid undercarriage, and an all-up-weight of 5,000 lb This airframe, when fitted with a de-rated engine in the 1,000 s h p class will be capable of performing to full military requirements of operation under severe conditions of high temperature and operating altitude

The Hiller Rotorcycle The Division is building a batch of these machines under contract to Helicop-Air, Paris The first of these production machines made its first test flight on the 15th October of this year

---

SHELL-MEX & B P LIMITED

Shell Helicopter Operations

The helicopter is a hard-worked vehicle in the Royal Dutch Shell Group, and is used to support oil exploration in seven principal areas as widely scattered as Latin America and the Far East

Shell generally tends to contract rotary-wing work out to experienced operators, and at present the only exception to this rule is Qatar in the Persian Gulf, where two Group-owned Westland WS 55s are based Even in this case the aircraft are operated and maintained under contract

Each Shell company is responsible for deciding its individual requirements and can, if necessary, call upon a London-based advisory unit, Shell Aircraft Limited, for technical guidance

Considerable helicopter support has been given during the past year in Colombia to seismic and drilling teams Here, Shell Condor operate a total of 10 locally-contracted Bell 47-Ds and Gs split into two groups in concessions, one lying in the centre of the country near the Magdalena River and the other in the vast plains of the Llanos

The terrain is difficult , in one month the detachment of four 47-Ds flew 6,541 sorties moving drills, supplying them with mud and water, carrying dynamite, moving fly camps and keeping them provisioned Reconnaissance and personnel flights are also a routine duty

Exploration headquarters in Bolivia are based at Cochabamba, and from here are directed the extensive topographical and gravity surveys now in progress in Shell concessions Three Bell 47-Gs often fly up to 100 hours a month each in conditions of strong wind, poor visibility and high temperature and humidity, supplying parties up to 110 kilometres in the jungle

One geological party, for example, working the Rio Rapulo, could get no further with its loaded boats, so a helicopter moved the entire camp to a more accessible point 20 km upstream Locally recruited " pica " cutters (who hack straight traverse lines through the jungle for gravity measurements) are carried by air, and the geophysical teams can be flown to the area in the morning and brought back at the end of the day, rather than camping on the job

Such roads as exist are frequently impassable, even for tractors, and many trips are made moving and supplying several field camps simultaneously

In January, a notable rescue operation was performed by the helicopters in the disastrously flooded Camiri and Charagua areas at the request of the Bolivian Government Thousands of pounds of food and clothing were distributed and the Bells enabled the authorities to size up the situation in days rather than weeks, which would have been the case had ground transport been relied upon

An entirely different type of operation is carried out in Venezuela where a sizable fleet of Group-owned fixed-wing aircraft is operated , here, chartered Bell 47-Gs and Js are used to transport senior staff to the drilling platforms in Lake Maracaibo

Four Westland S 55s are kept busy in Nigeria ferrying personnel for rig transport and airstrip construction in and around the Niger Delta A daily on-demand service is maintained to various locations in the swamps of the delta as well as to the interior During a typical month 1,100 passengers and 46,000 lb of freight are shifted with an average flight time of 25 minutes

Operations on the Trucial Coast and the Qatar peninsula are undertaken by the two Shell-owned WS 55s This year these have consisted principally of gravity

survey party transport, astro surveys, camp moves and reconnaissances Sorties are made, for instance, to check gravity meter readings at intervals of 10 km along a base line, a 3-hour job which would take a truck two days to perform

Shemal conditions—dust and sand storms—aggravate rotor blade and engine wear and a close watch has to be kept on oil consumption The aircraft are now working between the mainland and the " Seashell " drilling rig in the Gulf

Two contracted Bell 47-D1s are busy on seismic survey work to the north of East Pakistan In the remaining area currently using helicopters, Borneo, a contractor operates two S 55s on scheduled crew change trips between the offshore marine platforms, and special flights are made to outstation drilling locations Up to 500,000 lb of passengers and freight are carried monthly

TEDDINGTON AIRCRAFT CONTROLS LTD

During the past year the activities of this company have continued in the field of helicopter engineering, particularly with regard to the design and manufacture of control equipment to suit the special requirements of airframe and power plants The range of available Teddington equipment is wide and has been built up and proven over the years on a great variety of installations, a number of which are directly connected with helicopters

Hot air valves and pressure regulators, time switches, transistor amplifiers, fuel tank pressurisation systems, cabin air conditioning and anti-icing controls are but a few of the many components and systems with which the company is experienced, and it is against this background of experience that new control problems are solved, or as frequently occurs requirements are met by the simple adaptation of some standard item of equipment and, as rotary wing aircraft come into more general use, it is anticipated that association with this expanding branch of the industry will become even closer

The following is a brief technical resume of those items of Teddington equipment of current interest and in use on Helicopter power and flight systems -

Fairey Rotodyne

Rotor Tip Jet Ignition Control Time Switch—Type FHM/A91 This switch has a 12—29v D C , 6,000 r p m , constant speed governed motor, driving a bank of switch cams via a 5,926 1 reduction gear box and an electro magnetic dog clutch Two seconds after initiation and clutch engagement a pair of 5 amp contacts " make " the ignition circuit and hold on for five seconds On completion of the duty cycle the clutch disengages and a clock spring resets the switch The mechanism is contained in a sealed cast light alloy case and weighs approximately 2½ lb Ambient range, —45°C to +90°C

Napier " Eland "/Rotodyne and Westminster

A D C motored start sequence switch Type FHM/A/63 similar in principle to the one just described, operates relays which short out, in sequence, three starter motor slow engagement resistances wired in series Service contacts controlling the relays close at 5, 10 and 17 seconds respectively and on completion of cycle the switch resets

Napier " Gazelle "/Wessex

" *Vernatherm* " *thermostatic power element—Type FHS/A/9 For Fuel heating system* Nominal operating range +15° to +20°C Ambient range, —40°C to +90°C Weight, 12½ oz Piston travel at 30°C , 0 35″ The element sensing head is a finned cup containing a wax, which expands rapidly over a narrow " change of state " temperature band, embracing the control range Movement obtained is amplified via a rubber diaphragm and tapered plug which becomes extruded through a narrow bore , driving a piston which in turn operates a fuel heating valve shutter, through linkage Working force is high, and dependent on size the Vernatherm will operate against loads of up to 100 lb

Oil Cooler Anti-Surge Valve—Type FFA/A/504

This unit is a type of sensitive relief valve, the action of which positively protects the cooler matrix under cold oil surge conditions experienced during starting This is achieved by a double seat spring loaded shuttle valve which closes the port to cooler progressively as the by-pass port is opened, until at 120 p s i the cooler port is fully closed The valve is of compact design and weighs 1 lb 4½ oz Total flow for normal operation, 1,600 g p h Full flow (surge case) 900 g p h Working fluid, DERD 2487 (EEL 3 Oil) Fluid temperature range +130°C to —55°C Max oil pressure 250 p s i

Blackburn A 129/Saunders-Roe P 531 Mk 2

Electro magnetic general purpose " ON/OFF " Valve—Type FAW/A/330 This type of valve is in quantity production and has many variants It can be used to control the flow of fuel, water or gas, and is a simple 24v D C solenoid operated device The spring loaded armature carries a valve seat, and a range of outlet metering jets can be fitted to suit individual flow requirements On the Blackburn engine it has three applications, as a main fuel valve, idling fuel valve and for torch ignitors Weight is 12 oz with terminal block and typical dimensions are 3 7″ × 1 5″ × 2 2″ The coil is continuously rated at 29v D C at ambient of +40°C The basic type valve which opens upon energisation will flow 51 g p h at a pressure of 30 p s i

---

WESTLAND AIRCRAFT LIMITED

The recent linking of Westland and Saunders-Roe interests now results in an extremely powerful organisation with an appreciable background of design, production and operational experience Moreover, this pooling of resources will be of material benefit to the Industry and to its customers, for current joint effort includes work on six distinct types of single main rotor helicopters, all of which are flying No less than five of these are powered by a different type of gas turbine

Concurrently with a steady production flow during 1959 of Whirlwind and Widgeon helicopters to meet Service and Civil requirements, production of the Wessex has been accelerated, and a second Westminster " crane " transport has also been built and flown

To meet a potential demand for an amphibious type of helicopter, Westland has acquired a licence to construct the Sikorsky S 61 In its Military form this type incorporates a boat hull, and has a twin turbine installation

The lack of a helicopter landing site in the London area has been rectified by the construction as a private venture of the Westland Heliport at Battersea Opened officially in April last, its regular use by Civil operators and all three Services has fully endorsed the need for such a facility

---

ADDITIONS TO THE ASSOCIATION'S LIBRARY

American Helicopter Society Publications

Newsletters Vol 5, Nos 8, 9, and 10 August to October, 1959

Journal Vol 4, No 4 October, 1959, containing the following papers

- " A Note on the Effects of Longitudinal Cyclic Pitch Control Variations on the Forced Aero-Elastic Response of a Helicopter Rotor Blade " by Peter F Leone
- " Evaluation of Some Flight Safety Aspects of the Single-Engine, Unloaded Rotor, Winged Helicopter " by Robert E Head
- " Research Studies on a Ducted Fan Equipped with Turning Vanes " by A W Gilmore and W E Grahame
- " Helicopter Stabilization and Handling Characteristics Improvement by Mechanical Means " by Melvin Vague and Charles M Seibel
- " Main Rotor Blade Design and Development " by Robert M Kee
- " Piloting Procedures and Some Human Factors Aspects of the VTOL—Transition Cycle of the X-13 Aircraft " by Peter F Girard

Aerospace Industries Association

List of American Helicopter Operators