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THE INTERSERVICE HOVERCRAFT (TRIALS) UNIT

Part 1

B. J. Russell
Admiralty Experiment Works

Abstract

The military potential of hovercraft became evident after demonstrations of a man carrying hovercraft during 1959 and 1960. In February 1962 the Interservice Hovercraft Trials Unit (IHTU) was established at H.M.S. Daedalus *(at that time H.M.S.* Ariel*). Almost thirteen years later on 31 December, 1974 the Interservice Hovercraft Unit (IHU) was disbanded with the withdrawal of Army and RAF support. The role of IHU was taken over by the Naval Hovercraft Trials Unit, formed on 1 January, 1975.*

During the early days of IHTU the military evaluation of hovercraft was carried out on craft hired from their manufacturers. However in 1964 craft purchased for military trials were delivered to the Unit. Trials have been carried out in twenty two countries, in different climates and over various terrains. One of the first overseas detachments was to the Far East and led to the formation of the Army's 200 Hovercraft Squadron. The original trials craft were the SRN3 and SRN5's, but later SRN6's and BH7 were added to the craft based at Lee-on-the-Solent.

In addition to operational and trials tasks, the Unit has been responsible for the training of all military hovercraft pilots and navigators.

To service the hovercraft there are technical and stores personnel, with suitable facilities for first line servicing and the manufacturing of trials equipment. Full use is made of service and civilian facilities for second line servicing and supply of spares.

Introduction

Many major developments have resulted from small beginnings, as witnessed by the quotation: "Large oaks from little acorns grow". So it was with the hovercraft industry, which had its origins in two coffee tins and a hair drier. For it was with these items in 1954 that Sir Christopher Cockerell first demonstrated the hovercraft principle of supporting a vehicle on "a cushion of air". It was with this demonstration that the dreams of many inventors, of reducing ships hull friction achieved practical fulfilment.

During demonstrations in 1959 and 1960 of the first man carrying hovercraft, the 30ft. long 3½ tons Saunders Roe SRN1, the military potential of this new vehicle was realized. Accordingly in 1961 an Interservice Hovercraft Working Party was set up, and one of their first actions was the establishment of the Interservice Hovercraft Trials Unit (IHTU), at H.M.S. *Daedalus* (at that time H.M.S. *Ariel*), Lee-on-the-Solent in February 1962. Hovercraft work had been executed at H.M.S. *Daedalus* for a few months prior to this date by personnel drawn from other units at Lee-on-the-Solent.

The IH(T)U personnel were drawn from the Royal Navy, Royal Marines, Royal Air Force and the Army, and this has sometimes led to interesting administrative situations. Working in a trials environment not only leads to requirements to work outside normal hours, often under difficult climatic conditions away from base, but also calls for personnel of a high calibre if work is to proceed efficiently. The Unit has indeed been fortunate in this respect, all ranks working well together, for the common good. On the technical side, the different service backgrounds and training has assisted not only in routine maintenance, but also in fault finding.

An additional advantage in the early period was that having completed a tour on the Unit, personnel left and were able to spread "the hovercraft gospel" throughout the services. It was a similar procedure that led to the detachment in late 1967, of a Royal Naval hovercraft to the Falkland Islands.

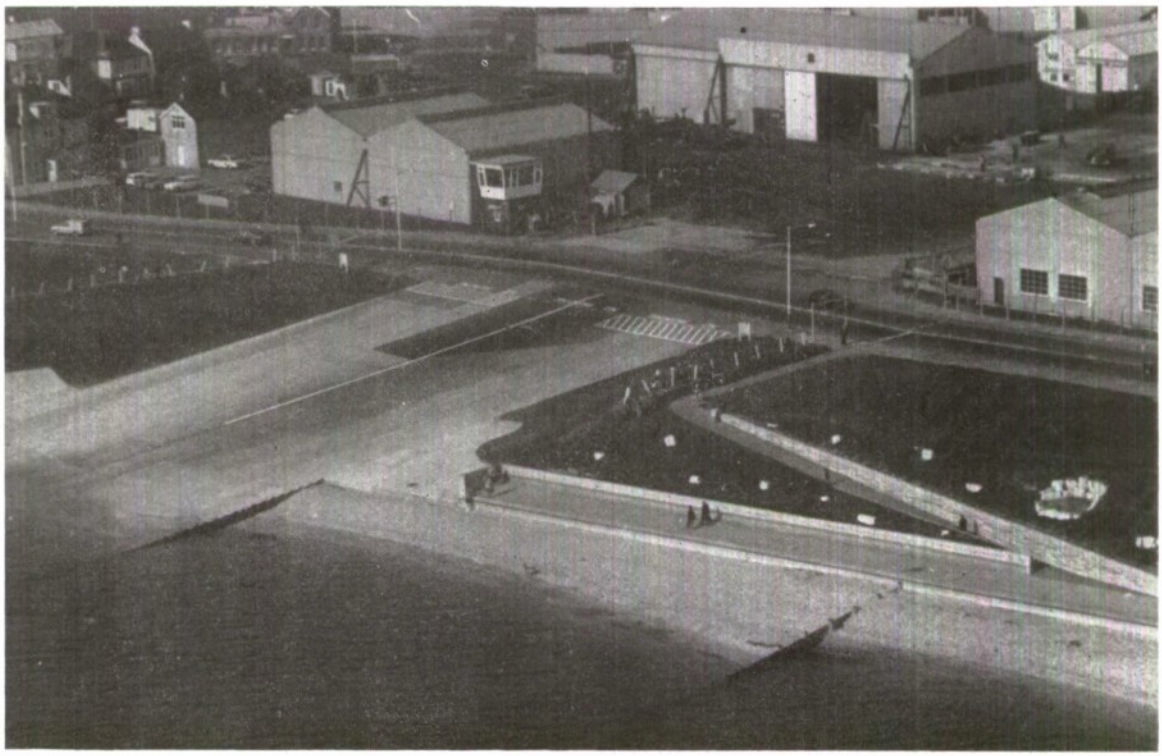

FIG. 1. The Interservice Hovercraft (Trials) Unit.

Nearly thirteen years after its formation the IH(T)U (The Interservice Hovercraft Trials Unit became the Interservice Hovercraft Unit in early 1968, when a training wing was added. For convenience use will be made of the title IHU throughout the main text) was disbanded on 31 December, 1974 and a chapter of military hovercraft history came to an end. During this time, trials and evaluations have been executed in many parts of the world, in differing climates and over various terrains. Trials have been executed in a total of twenty two countries and hovercraft evaluated in a variety of roles, including logistic support, missile firing, fire fighting and rescue, anti-submarine and Mine Countermeasures (MCM).

In this first part of a two part article, the history of the IH(T)U is outlined from its formation in February 1962 to mid 1971, (this date has been flexibly applied in the interests of lucidity) when practical work to investigate the use of hovercraft in the MCM role was commenced.

The Early Days

The IHU was set up under the command of Lt. Cdr. F. A. R. Ashmead, RN at H.M.S. *Daedalus* (then H.M.S. *Ariel*) in February 1962.

The hovercraft was in its infancy at this time and there were three main firms working on experimental hovercraft: Saunders Roe, based at Cowes on the Isle of Wight, Vickers Armstrong based at Southampton and Denny Craft based on the Clyde. (Saunders Roe and Vickers later amalgamated to form the British Hovercraft Corporation Limited (BHC) based at Cowes). The first two firms were developing fully amphibious craft, whilst the third concentrated on rigid sidewall craft, limited to overwater use.

In order to evaluate the military potential of hovercraft, craft were hired from their manufacturers and operated from Lee-on-the-Solent. These evaluations served the double purpose of enabling service personnel to gain experience of hovercraft operations and assist-

ing manufacturers in the development of their craft.

Saunders Roe SRN1

The first major evaluation started on 28 February, 1962 when the SRN1, then fitted with an 18in. skirt, was hired from Saunders Roe by the Ministry of Supply. Initial operations included pilot training, demonstrations, seakeeping and performance trials. Instrumentation to record craft motions was fitted for the trials and the sea state was measured with the aid of the AEW Wave Pole. The craft completed several circuits of a "hoverway" constructed at the Army Camp at Browndown, Gosport and which included steps and "waves" constructed out of shingle.

The craft was returned to BHC on 15 June, 1962, having completed 52 hours with the Unit. Further MOD trials were executed in late October 1962 when the craft was based at RAF Thorney Island to investigate operation over saltings. The craft was fitted with 4ft. 6in. skirts by this time, which improved obstacle clearance, but reduced roll and pitch stiffness. The craft was successfully operated over saltings which included gullies $1\frac{1}{2}$ - $2\frac{1}{2}$ feet deep and between 4 and 15 feet wide.

Saunders Roe SRN2

The $64\frac{1}{2}$ feet long 20 tons SRN2 completed trials at IHU in the period early December 1962 to late February 1963. The trials were divided into three main phases, consisting of general handling and performance measurement in the Solent area, ranging and seakeeping trials from HM Naval Base, Portland and sonar trials in the Solent and Isle of Wight areas. The craft was operated for nearly 47 hours, spread over fourteen days of actual operations.

Even though this craft was one of the first to be built and only had 2 feet skirts, she notched up some notable achievements. These included passage from Cowes to Portland and back, in seas measured to be 6 feet from trough to crest, and circumnavigated the Isle of Wight in calm conditions at an average speed of 58 knots.

IHU were also involved when the SRN2 was demonstrated in Montreal between 3 and 15 May, 1963, when one of the Unit's officers acted as co-pilot. The craft was based at the Royal St. Lawrence Yacht Club, the journeys to and from Montreal necessitating negotiation of the Lachine Rapids.

FIG. 2. SRN2 negotiating the Lachine Rapids.

Vickers Armstrong VA1

The 25 foot long 3 ton Vickers Armstrong VA1 was based at Lee-on-the-Solent from May 1962 until February 1963. Although the craft handled satisfactorily overland and in calm conditions, low obstacle clearance capability resulted in impacts even in small waves. The craft was instrumented to record craft motion and was operated over the Browndown hoverway.

Obstacle crossing trials were conducted on the airfield at H.M.S. *Daedalus*. A series of runs were made over sharp edged ditches made out of straw bales, the effect of speed of encounter, ditch depth and width being investigated.

Vickers Armstrong VA2

Lack of spacious areas suitable for overland trials of hovercraft in the United Kingdom, led to a survey of certain areas in the Near, Middle and Far East in April and May 1963. A decision was taken to conduct trials with the 30 foot long 4 ton VA2, in the Libyan desert, based at RAF El Adem.

FIG. 3. VA2 on H.M.S. *Ariel* (now *Daedalus*) airfield.

The object of the trials was to assess the problems of dust, visibility, sloping ground, negotiation of obstacles, navigation and the effect of abrasive conditions on skirt life. The craft was flown to and from El Adem in an RAF Beverley of Transport Command.

The craft successfully completed the first ever real overland trials of any hovercraft, completing 9 hours operating and covering some 150 - 200 miles. Speeds of up to 38 knots were achieved in great personal comfort compared with the bumpy ride experienced on conventional vehicles operating at considerably less speed in similar conditions. Skirt wear proved to be severe, but neither dust nor the terrain proved to be a problem. The VA2 was unique, being fitted with a two wheeled undercarriage which enabled the craft to stay on heavily cambered roads.

A demonstration was given to the Governor of Tobruk, the first time a Libyan had ridden in a hovercraft.

Denny Craft D2

The 84 foot long 25 tons Denny D2 was a rigid sidewall hovercraft designed to take 70 passengers. IHU conducted two trials with this craft, the first being the measurement of craft drag. This trial was executed in the Clyde in late February 1963, when the craft was towed by H.M.S. *Brave Borderer*.

The second trial was an investigation into performance and handling in the Lee-on-the-Solent area, conducted in December 1963 and January 1964. The craft was driven from Twickenham to Portsmouth in fairly difficult conditions. The D2 completed 20 hours operating on this trial, but unreliability of the propulsion units led to inconclusive results.

During this period IHU officers made visits to overseas hovercraft demonstrations and the areas where hovercraft might eventually operate.

It became obvious from the evaluations of hovercraft hired from their manufacturers that in order to fully evaluate the military potential of hovercraft, IHU would need craft of its own. Accordingly delivery was taken of the 77 foot long 35 ton SRN3 and three 28 foot long 7 ton SRN5's from the British Hovercraft Corporation (BHC) in July and September 1964, respectively.

The Interservice Hovercraft Unit (Far East)

Two of the SRN5's delivered in September 1964 — XT492 and XT493 — were military versions modified for operations in the tropics, to be used by the Interservice Hovercraft Unit (Far East). The Far East Unit was formed under the command of Major Harris, RCT as an independent unit in July 1964 at H.M.S. *Daedalus*, under the wing of IHU. Personnel were drawn from the Army, Royal Navy and Royal Marines.

On completion of acceptance trials, basic training and equipping, the Unit moved at the end of 1964 to Singapore for a two month period of work-up and preliminary trials. The craft were shipped to and from Singapore as deck cargo on merchant ships.

From mid March to mid December 1965, trials, operations and demonstrations were carried out in Eastern Malaysia, Singapore and Thailand. In general, trials included the logistic support of ground forces, naval patrolling, night operations and performance overland and on river rapids.

Logistic Trials

The Unit arrived at Tawau, Sabah in mid March 1965, with the aim of assessing the value of hovercraft as a general military load carrier in the type of terrain encountered in the area. Logistic support was normally carried out by road vehicles, civilian river craft, helicopters or assault boats. Road communications in the area were extremely poor, river craft were hampered by the profusion of floating debris and by shallow water at low tide, and the use of helicopters was strictly limited, in order to conserve hours for more important tasks.

Power loss due to high temperatures was experienced resulting in difficulty in maintaining directional control. However this effect was reduced by limiting the craft all up weight (AUW) to 17,000 lbs in temperatures up to 80°F and 16,000 lbs in temperatures over 80°F. (The empty weight of a military SRN5 is 11,000 lbs).

During the period at Tawau, from March to August 1965, the craft operated for 226 hours, covered nearly 6,400 nautical miles and carried 1,600 passengers and 110 tons of cargo.

Preliminary trials to ascertain the suitability of the craft in the evacuation of stretcher cases, were carried out in Singapore. It was found that stretcher cases could be carried or casualties could be carried on mattresses laid on the floor. On one subsequent occasion the craft was used to transport a seriously ill civilian woman from Kanowit to Sibu, 20 miles up the Rayong River.

Trials with RN Ships and Other Naval Operations

During trials with RN frigates and destroyers, various methods of coming alongside were tried for the transfer of personnel and stores. The best method was found to be for the hovercraft to nose up to the ship's stern, with the ship steaming ahead at around 10 knots.

Anti infiltration patrols were executed around Singapore, patrols of over 12 hours were achieved by crew changes and refuelling. The hovercraft with their higher speed proved a much more effective patrol craft than the coastal minesweepers and inshore patrol craft normally employed.

Amphibious Capabilities

The majority of overwater operations were carried out in relatively calm conditions, but while in Thailand winds up to 40 knots, seas up to 7 feet and 5 feet surf were encountered with little adverse effect on operations. Provided there was no strong tail wind, beaching the craft through surf did not present a problem.

The craft were driven up and down river rapids flowing at speeds in excess of 12 knots, with rocky outcrops and through gaps not much wider than the craft. Tight turns in the rivers were often negotiated by using the inflated skirt as a fender against the riverbanks. Part of the trials in Sarawak included a journey of 310 miles along the Rayong River. The first 110 miles were over open river, but from then onwards, commencing with the Pelagus Rapids, the route became increasingly difficult. The journey normally takes 8 to 12 days by long boat — the hovercraft completed the journey in under 8 hours driving time.

Operations in Thailand

Joint trials with the Thai Government were conducted in Thailand from 1 to 5 December, 1965. Preliminary trials were conducted on rivers and offshore, one of the interesting results being the achievement of higher operating speeds along the coastline, in the "twilight zone" above the surf — 45 knots as opposed to 30 - 40 knots.

The hovercraft was operated over rice paddy fields with crops and 30in. to 40in. bunds (the field boundaries) at an average speed of 13 knots. When the craft was operated over the fields at high speeds it caused less crop damage than at low speeds. Obstacles crossed include a steep sided 5ft. 2in. high laterite road, dykes and irrigation ditches. The craft was able to proceed at 20 knots through dense scrub vegetation 7 to 10 feet high.

Achievements of the Far East Unit

During the Far East Detachment, XT492 was operated for 320 hours and XT493 for 350 hours.

The trials with the SRN5 hovercraft proved in principle the value of such craft for military operations.

In Tawau — an effective logistic support craft.

In Sarawak — a suitable craft for crossing dangerous rapids.

Off Singapore — an efficient and effective naval patrol craft, particularly at night.

In Thailand — an excellent amphibious craft over the marshy plains, having superior performance to any conventional amphibian.

Trials

Whilst the Far East Unit was successfully completing its operations, IHU was commencing a trials programme, on its own and hired craft, aimed at evaluating hovercraft for military purposes. The trials were geared to obtaining performance data, or evaluating hovercraft in specific roles, or testing hovercraft against specifications before acceptance into military service.

In order to describe this trials programme, "potted histories" of the hovercraft that have made up the IHU fleet, are presented.

Saunders Roe SRN3

A more complete description of the operations of the 77 foot long 35 ton SRN3 may be found in Reference 1, but a resumé is presented for completeness.

In the course of her trials career, between handover on 2 June, 1964 and her last sortie on 21 February, 1974, the craft executed 570 sorties, completed 1,393 operating hours, and covered an estimated 40,000 nautical miles in German, Danish and UK waters. Despite what may seem to be rather limited operating hours within the span of nearly 10 years, she amply satisfied the objectives for which she was built. She laid the foundation against which subsequent craft have been developed for more specific roles. SRN3 was an experimental machine, and as such was not without her problems.

FIG. 4. SRN 3 operating in the Solent.

After initial pilot training, the craft undertook a series of role evaluation trials for the three services. These included an assessment of the ability of the SRN3 to perform the duties of an RAF marine craft; anti submarine warfare (ASW) trials for the Royal Navy and operations in the logistic role for the Army. Between June and August 1965 the craft was again exercised in the ASW role, this time based at Londonderry. These trials were concluded in late 1968 when the craft was exercised in the Fishery Protection role off the Thames Estuary.

In mid 1966 a series of trials was commenced to assist in the development of the Sealane navigation equipment currently fitted in IHU's BH7, a craft built specifically to continue with Naval Evaluation Trials. These navigation equipment trials mainly consisted of evaluating the Blue Orchid and Decca 71 helicopter dopplers in the hovercraft environment.

Performance trials were carried out during the life of SRN3, initially under a joint programme operated by RAE Bedford and AEW Haslar. During these trials the heave stiffness and hovering efficiency were evaluated and craft sea keeping quantified.

In 1969 - 70 a model correlation trial was conducted, the full scale tests being undertaken by IHU and model tests and subsequent correlation analysis being undertaken by BHC, the craft's manufacturers.

The SRN3 was used in many demonstrations, to military and civilian personnel from many countries, including Hovershow '66 and again at Browndown in June 1972 for delegates from CENTO.

FIG. 5. SRN5 XT 493 operating in Borneo.

British Hovercraft Corporation SRN5's and SRN6's

The SRN3 and later the BHC BH7 featured in the prestige trips abroad, but as with commercial hovercraft ferries, the smaller SRN5 and SRN6 craft have proved to be the "work horses" of the Unit.

The IHU SRN5's and SRN6's have been used for trials and for initial hovercraft pilot training. An additional task, when 200 Hovercraft Squadron was in existence was the testing of trial installations on an SRN6 MK2 on loan from the Army for this purpose.

SRN5 XT657 — Trials Craft

XT657 first put to sea on 30 October, 1964 and was delivered to IHU on 5 March, 1965, fitted with a jet skirt. One of the first tasks for the craft was in the production of a film illustrating obstacle crossing and rough terrain performance. Shortly after the craft was returned to BHC for the fitting of a new instrument panel, Decca 202 Radar, Marconi Doppler and military standard radios.

This hovercraft had a double association with Royalty, the first at the Amsterdam Trade Fair in June 1965, when Queen Juliana and Prince Bernhardt of the Netherlands and Princess Margaret were among the people who went for a ride on the craft. The second was in July 1965 when XT657 was used to transport HM Queen Elizabeth from Yarmouth, on the Isle of Wight, to RAF Thorney Island, near Chichester.

Overland Trials — Aden 1965

Trials including the measurement of hoverheight, static thrust, acceleration, stopping distance and turning circles were executed. The sand ingestion problem, when operating over desert, was severe and the two gas turbine engines used on this trial had an effective life of only a few hours. Although this problem significantly curtailed the trials, valuable data was collected on operating in a desert environment. Maximum measured overland speed was 52 knots.

Crash Rescue Trials

The craft was fitted with fire fighting equipment, including a 200 gallon water tank in the rear of the cabin, and external platforms to carry survivors and equipment. Trials carried out in March 1966 successfully demonstrated the potential of the SRN5 as a fire fighting and rescue vehicle, the demonstration at Hovershow '66, when approximately 50 survivors were "rescued" from a simulated vessel fire at sea, being extremely convincing.

The craft overturned in the Solent in calm conditions on 8 July, 1966 and during the subsequent refurbish at BHC, a comprehensive instrumentation package to investigate craft characteristics was fitted.

Performance Trials

These were a joint exercise by RAE Bedford and AEW Haslar and were to evaluate the SRN5 performance when fitted with various designs of hovercraft skirts.

During the RAE trials, static tests to measure propeller thrust, control forces, pitch and roll stability, lift system efficiency, hoverheight and daylight clearance were executed. Sea trials included performance measurements to enable the variation of drag components with forward speed to be obtained, and control effect investigations. These tests were only executed with a jet skirt fitted.

Seakeeping trials were conducted by AEW, at three different craft weights, runs at various headings to the wind and sea being executed. Craft motion data was recorded and the sea state measured. These tests were executed with a jet and 30% fingered skirt fitted.

The craft was fitted with the latest skirt development, the 50% fingered skirt, in December 1968. After a general assessment the craft was employed on general trials, including the collection of turning data to assist in the development of BH7, and a model/full scale correlation trial.

FIG. 6. SRN6 Mk 2 XV 614 operating in surf on the north Devon coast.

Conversion

Various Army exercises had indicated that a hovercraft capable of carrying small vehicles would be a useful addition, and accordingly the SRN5's XT657 and XT493 (see next section) were converted during October 1971 to June 1972 to the SRN6 MK5 variant.

SRN5 XT493 — Trials Craft

On return from the Far East, XT493 was refurbished and employed on general logistic and training tasks.

Surf Trials

In November 1967 the craft was prepared for its first major trial in the United Kingdom, which was to investigate hovercraft operation in surf at Saunton Sands on the North Devon coast. The craft was transported from Portsmouth to Appledore by the RFA *Robert Dundas* between 14 and 16 February, 1968, and moved under its own power to the operating base at RAF Chivenor.

XT493 was instrumented to measure craft motion and accelerations, and the aim of the trial was to find the best ways of approaching and leaving a beach in surf. The best method of approach was to position the craft between surf crests and adjust speed until the craft and surf approached the beach at the same speed. Leaving the beach proved to be best on a track at 45° to the surf.

FIG. 7. SRN 6 Mk 2 XV 617 operating over the cross country hoverway, Longmoor, Hants.

Trials were prematurely curtailed on this craft when it suffered damage when proceeding to the trials area. The craft became airborne when it took off from the crest of a large wave and "pancaked" into the trough. The upper surface of the plenum chamber and supporting structure was damaged, but the craft was able to return to base, including transit through 8 to 10 foot surf and climbing the 10 foot sea wall around the RAF station.

Other Trials

After repairs, the craft was employed on a trial to measure the mooring forces on hovercraft when in a tidal stream. This was executed in the mouth of Langstone Harbour, where the maximum tide flow was measured at nearly 3½ knots.

The next major trial was executed between mid September and mid November 1969, with the Institute of Aviation Medicine, and was known as the Physiological and Psycological Trial'. This complex sounding trial (usually known as the Phys and Psyc trial or something similar!) was aimed at quantifying the deterioration of radar operators execution of their task, in increasing sea states.

In the last half of 1970 the craft was employed on a trial to assess the effectiveness of Closed Circuit Television as a driving aid. It was demonstrated, that given an optimum presentation, it was possible to drive a hovercraft from a flat screen presentation.

XT493 completed its service with IHU carrying out preliminary investigations in the MCM role, when it was used to tow an RPL (Ramp Powered Lighter) and drogues being developed as calibrated drag loads.

Conversion

Between October 1971 and June 1972 XT493 underwent a similar conversion to XT657.

SRN5 XT492 — Training Craft

On return from the Far East XT492 was operated by 200 Squadron from April 1967 to February 1970. The craft was loaned to the Army, initially to work up the recently formed hovercraft squadron, whilst delivery of their SRN6 MK2's was awaited, and later in lieu of the SRN6 MK2 XT614 which was based at IHU for trials.

Between February and November 1970 the craft was refurbished at RNAY Fleetlands, dual controls being fitted during this period. The dual controls enabled the craft to be driven from the pilot's or commander's position, immediately behind the pilot. This enabled the pilot to sit and drive the craft, as soon as he commenced training, from the normal position for standard SRN5's and SRN6's.

Since November 1970, XT492 has been employed on pilot and navigator training, and local logistic tasks. She has also been used to give familiarization trips to visitors to IHU and demonstrations to various RN ships during their "families days". The craft has also been used to give "rides around the airfield" during H.M.S. *Daedalus* Air Days.

When IHU took delivery of an SRN6 with dual controls, XT 492 became superfluous to requirements and was placed in suspension pending disposal. The last service sortie was executed on 23 October, 1975, at which time the craft had completed just over 3,020 operating hours.

SRN5 XW246 — Training Craft

XW246, then SRN5 006, first flight was on 17 November, 1964. After demonstrations in Japan and New Zealand, and use by BHC as a charter, training and demonstration craft, XW246 was delivered to IHU on 5 November, 1968.

The craft was purchased to cope with the additional pilot and navigator training commitment when 200 Hovercraft Squadron RCT was in operation. XW246 was fitted with dual controls, and to assist with navigator training, a nine inch slave radar display was fitted at the rear of the cabin, at a later date.

As well as the training task, the craft was also used to survey hovercraft landing sites in the local area, to be used in the event of a "SOLFIRE" — a major collision or fire at sea.

The craft also played an important part in the evaluation of the Optical Navigation aid, which enabled the hovercraft navigator to align a transparent map with the radar display and consequently identify navigation marks. Trials executed included transfer of fuel and personnel from Royal Navy ships and a docking trial with H.M.S. *Fearless*.

XW246 was used extensively for demonstrations, including a visit to Koksyde Air Station, Belgium in 1971. However the craft will probably be remembered best by the many people who had "rides around the airfield" during H.M.S. *Daedalus* Air Days 1971 to 1974. In fact it was on the occasion of the 1974 Air Day on 22 July that XW246 was last used by IHU.

In September 1974, the craft was sold to Hoverwork who have refurbished it at their works at St. Helen's, Bembridge, Isle of Wight. The craft left IHU on 30 September, 1974, having completed 2,250 hours operating in service colours and being used in the training of over fifty hovercraft pilots.

British Hovercraft Corporation SRN6 MK2's

The Far East detachment played an important part in the decision taken by the Army to form a hovercraft trials squadron, to evaluate the potential of hovercraft in the execution of various military tasks.

It was decided to purchase four 48ft. long, 9 ton SRN6 MK2's from the British Hovercraft Corporation. IHU conducted the acceptance trials on behalf of the Ministry of Technology (Mintech) and initial trials conducted in August and September 1967 showed that craft performance was below specification. Various modifications were incorporated, including skirt component changes, reduction in the rudder bleed area, extended engine exhausts, repositioning of the engine air intakes, engine uprating, repositioning of fuel tanks, life raft and batteries to achieve a forward movement of the centre of gravity, and the craft re-tested. Although performance was improved it was still below specification in moderate sea and turning performance, but it was decided to accept the craft into service. Three of the craft were delivered to 200 Squadron, the remaining craft — XV614 — being retained at IHU for trials purposes.

The first major trial was executed in February and March 1968 when XV 614 executed surf trials, with SRN5 XT493, in North Devon. Instrumentation and results were as described for the SRN5.

The second was in the last two weeks of June and the first week of July 1968 when the craft was used in Naval Trials at Portland. These trials were to evaluate the capability of the SRN6 MK2 to perform as an anti FPB training craft and as a Helicopter Safety Boat, and to perform various exercises with ships working up with Flag Officer Sea Training. The craft performed satisfactorily in these roles, but the limited moderate sea and turning performance reduced the capability in seas over 3 foot significant height.

Hoverway Trials

Between mid May and the end of July 1969, IHU, in conjunction with the Royal School of Military Engineering executed a Hoverway Trial at Longmoor, Hants. XV614 was the hovercraft employed and the trials objective was to determine the criteria for a hoverway that could be produced with the minimum of engineering effort and would enable a hovercraft to proceed over rough terrain. The craft was instrumented to record performance, craft motion and control use. Because operations would be in dust laden conditions, engine air was drawn from the plenum chamber. The trial was divided into three phases, operation on a straight course, operation on a test curve and the final phase over an overland hoverway incorporating the lessons learnt during the first two phases.

Phase 1

Vee sections are easier to construct and were tried first, but did not constrain the craft which often ran off the 1,000 foot long track. It was found necessary to produce a "slot" section track, approximately 20 foot wide and with 2½ foot to 3 foot high walls.

Phase 2

The cross section of the test curve was similar to the straight track, but with a super elevation for a speed of 25 mph. The craft was satisfactorily constrained and proceeded around the turn without use of hovercraft controls provided that engine and propeller conditions were maintained.

Phase 3

A hoverway some 0·83 miles long with curves, ascents and descents was constructed and the craft driven many times over this

course. Once the pilot was confident that the craft was satisfactorily constrained by the hoverway banks, the target of a mean block speed of 25 knots was achieved.

About 30 hours operating was achieved during the trial and skirt wear was found to be less than would occur in normal cross country operation. Considerable wear to both the propeller and propeller erosion strips occurred, most of which must have happened when towing the craft to and from the test site and during turns, when the craft was enveloped in a dust cloud. This cloud was left behind, however, when operating at speed on the hoverway.

British Hovercraft Corporation BH7

It was during the development and acceptance of the IHU 77 foot long, 47 ton BH7 that the most comprehensive of hovercraft trials programmes was undertaken. Originally it was planned that the Contractors trials would be completed before the MinTech acceptance trials were commenced. However in the event only limited Contractors trials were completed before the craft was transferred to IHU on 28 September, 1970, from which date the two trials programmes proceeded in parallel.

The craft was fitted with a comprehensive automatic observer panel (AOP) with instruments monitoring engine and gearbox conditions, craft motion, speeds, etc, and Seafix pattern indicators. This panel was photographed at regular intervals by a 70 mm camera, for subsequent analysis. The Seafix data was also recorded as an alpha numeric printout and on punched tape for subsequent computer analysis. A Waverider receiver was carried to record sea conditions when trials were being executed adjacent to a Waverider Buoy.

Before transfer to IHU, static tests to measure roll and pitch stiffnesses, rise heights and skirt compartment pressures were conducted at BHC. Some performance trials to measure speed and acceleration in calm and moderate sea conditions were also executed. In calm conditions the craft achieved a sustained speed of over 60 knots. Anchoring trials and life raft deployment trials were executed near the Prince Consort Navigation Buoy in the Western Solent.

After transfer, Contractors and acceptance trials were conducted in parallel, the craft usually carrying a joint BHC and IHU team. Further speed and acceleration trials were executed in calm and moderate conditions, the craft achieving 40 - 45 knots, depending on the heading relative to sea, in a sea measured at just over 3 feet significant. The crafts turning performance in calm and moderate conditions was measured and behaviour during emergency stops was examined.

The safety of the craft when wallowing and drifting in gale force winds and significant seas of over 8 feet was investigated, craft motion being recorded. Roll motion was of the order $\pm 4°$ and pitch $\pm 3°$ and it is understood that the crew members did not always refer to the trial by its formal title.

After acceptance of the craft by MinTech, the craft embarked on a series of Naval Evaluation Trials, which will be described in Part 2.

Evaluations

As well as conducting trials on their own craft, IHU have conducted evaluations of light hovercraft (those less than 20 feet long and with AUW's below 3 tons). These evaluations were conducted for two reasons, to assess the craft

FIG. 8. BH 7.

FIG. 9. SKIMA 4. The author (left) enjoying a trial.

for possible military operations and to give IHU knowledge and experience to talk authoritatively on small craft to other interested parties. A typical example of a possible military operation would be to transport a four man patrol (each man with equipment weighing 250 - 270 lbs) at 30 knots over a range of around 65 miles.

Craft that have been evaluated are the *Pindair* (Gosport, Hants) craft, — the 10 foot long 200 lbs *Skima* 2 and the 13 foot long 650 lbs *Skima* 4; the 20 foot long 1·4 ton *Air Vehicles* (Cowes, Isle of Wight) AV2 and the *Sealand* (Millom, Cheshire) craft — the 10 foot long 220 lbs *Skitabug* and the 20 foot long 2·5 tons SH2. These evaluations took the same form in that the craft were hired from their manufacturers, the period being one week for the smaller craft and three weeks for the AV2 and SH2.

On receipt of the craft, an engineering assessment would be carried out, covering structures and system. Attention would be paid to design, ease of operation and effectiveness of controls.

Static Tests

Static tests would include roll and pitch stiffness measurements, clearance height and propeller thrust. During these tests the skirt would be checked for uniform inflation. In addition, internal and external noise measurements would be taken, as envisaged roles require a relatively quiet craft.

Overland Tests

These would commence with a handling assessment in confined places, followed by a gradient climbing assessment and obstacle clearance tests on Lee-on-Solent airfield.

Overwater Tests

These tests would occupy the largest part of any evaluation and areas investigated would be craft acceleration, maximum speed in various sea conditions, turning performance and stopping distances.

Some Examples of Test Results

To illustrate the evaluation aspects of confirming manufacturers specifications and assessing military potential, some examples of IHU trial results are presented.

During the evaluation of the *Pindair Skima* 2, measured distance runs were performed adjacent to the Lee-on-Solent shore, over a distance of 790m. In a 6 inch sea a speed of 19 knots was achieved, suggesting that in calm conditions the manufacturer's specification figure of 26 knots would have been achieved.

Part of the *Pindair Skima* 4 evaluation was an assessment of endurance — against the possible 65 miles requirement. This was done on a circumnavigation of the Solent area, when a block speed of 16 knots was achieved for a 28 nautical mile journey, using four gallons of fuel. Weather conditions varied from glassy calm to a 6 inch sea in certain areas. Fuel consumption for the journey, was 9·7 litres/hour, in close agreement with the manufacturer's quoted figure of 10 litres/hour.

In an exercise off the North Devon Coast, the Air Vehicles AV2 was used to transport Special Air Service personnel and their canoes from the beach to an area outside the surf line. Using techniques established during the SRN5 and SRN6 surf trials the AV2 found no problems in operating in the type of surf encountered.

Benefits

As well as providing data against possible government agency or military requirements, the IHU provides a completely unbiased and independent report, which the manufacturer is free to use for publicity purposes.

The IHU trials are aimed at operating the craft continuously, perhaps for the first time, and the manufacturer may benefit through the possible highlighting of weak design areas.

Training

Although the training procedures for hovercraft pilots and navigators has been developing since the Unit was formed, the basic concepts have remained the same.

Hovercraft Pilot Training

Prior to November 1970, when the first dual control SRN5 was delivered to IHU, training was done on a standard SRN5.

Hovercraft handling training is divided into Basic, *ie*, pre-solo and Advanced stages. During the basic stage the pilot is familiarized by lectures and demonstrations, where appropriate, with emergency drills, the effects of all controls and gentle manoeuvres. The trainee pilot will then progress onto more rigorous manoeuvres, emergency stops and slipway approaches, and eventually to manoeuvring the craft in the confines of the hardstanding at Lee-on-Solent.

All these exercises will have been completed in favourable weather conditions and will have taken around ten operating hours. The pilot then executes his first solo flight and proceeds *via* a five hours Solo Consolidation Stage to the Advanced Stage.

The Advanced Stage occupies around a further thirty five hours, and includes operation in strong winds and high seas, navigation under radar control, operation in poor visibility and extended Navigation Exercises away from base, around the Isle of Wight or to Portland. The pilot will then be acquainted with the techniques of approaching buoys, coming alongside vessels and operating over various terrains. Towards the end of this period night operations will be executed and a "Rule of the Road" examination taken, the successful pilot being given a Hovercraft Type Certification of Qualification.

The times quoted for the various stages are for guidance, flexibility catering for individual pilots' aptitude or previous experience.

Having completed the training course on the SRN5, the pilot would then usually progress to the SRN6, and complete a ten or twelve hour conversion course. Depending on the position held within IHU, the pilot would then act as an SRN6 pilot throughout his tour, or be trained to drive either SRN3 or BH7. The procedure for these conversions would be similar, craft and control familiarization during the basic stage, followed by solo operation in moderate conditions, operation in rough conditions and at night completing the conversion training course.

Hovercraft Navigator Training

Hovercraft navigator training commences with a period on a simulator, either at H.M.S. *Dryad*, or more recently at RNAS *Culdrose*. During this period the trainee navigator is acquainted with the use of radar and its use in techniques such as collision avoidance and parallel indexing.

Training continues at IHU with lectures and practical hovercraft navigating. The lectures commence with Radar Theory, and cover such topics as Principles of EM Propagation, radar interference, transmitter and receiver circuits and controls, stabilized and unstabilized displays and relative motion. The lectures are backed with practical demonstrations on the Decca 202 marine radars fitted to the IHU training craft. Recently a dual radar display has been fitted, to facilitate navigator training.

In parallel with the radar training, the navigators learn the "Rules of the Road", which include steering and sailing rules, seamanship aspects, charts and their symbols and use, and tides and the use of Tide Tables. At the end of this phase, an examination on this aspect is taken.

Inter-Linking Summary

In Part 1 of this article, the history of IHU has been described, more or less covering the period from formation in February 1962 to mid 1971. The early days, the Far East Unit, Trials, Evaluations and Training have been outlined.

The second part will cover the period from mid 1971 until the closure on 31 December, 1974, topics including IHU Facilities, Organization and Tasking, Recent Trials, Naval Exercises and the MCM Hovercraft Project will be described. The future and the first year of the Naval Hovercraft Trials Unit will also be covered.

Reference

[1] "The Operation of the SRN3 Hovercraft at the Interservice Hovercraft (Trials) Unit" *J.R.N.S.S.*, No. 6, Vol. 29, 1974.

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