

6 December 2016

## **Imperial Airways between UK and South Africa 1932**

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On this occasion my report has to be more reflective than reactive. My desire is not to offer a first-person sketch of the evening's programme, but I will note my promise to describe the machines and the personnel who operated this service by using simulation and modelling techniques to examine how the understanding of aircraft operating limitations stimulated the evolution of essential, and now well established, operating procedures, and to exemplify airline staff resourcefulness by looking into typical problems and solutions.

The scene was set with a review of Imperial Airways formation through mergers in 1924. It was stressed that 'Empire' operations would be government subsidised for mail only, but passenger-carrying capability was expected, and a review given of how the poor safety record of the inherited fleet led to an all-new fleet by 1929. All the new types were three-engine aircraft, had open cockpits and had limited range. As engine reliability was a major safety issue a third-phase fleet, all with four engines, was introduced from 1932. These were the aircraft types used to launch the 'Empire' routes to South Africa.

The presentation stressed the need to evolve the aircraft and airline alongside land and flying-boat base development, and a radio-based operational information service, This included 'direction-finder' capability as homing support at many remote locations. The ground-based facilities were developed using UK Government assets and had been enabled as early as 1919 when the so-called 'all-red route' programme saw UK Army Engineers evolve 44 'landing grounds' – ostensibly to serve any need to deploy military aircraft into Africa. This proved to be the backbone of the commercial service over a decade later. The Government also sponsored flight surveys, conducted by Sir Alan Cobham.

On commencement in 1932 the published timetable for the route, after leaving Croydon, declared 18 stages to Cape Town, but included a footnote stating that "a call will be made at the following places if inducement offers and circumstances permit : ...": analysis showed that all of these locations were either essential or often desirable (considering weather aspects) refuelling stops. A list with the probable refuelling stops is shown below:

<b>Europe</b>	<b>Northern Africa</b>	<b>Central/Southern Africa</b>	
Croydon	Cairo	*Nairobi	... *Johannesburg
*Paris	*Wadi Halfa - via Luxor	Dodoma	Kimberley
*Brindisi	Khartoum	*Mbeya	and either:
Athens	*Juba – via Malakal	Broken Hill	Victoria West or
via Mirabella(Crete)	Entebbe	*Salisbury	Beaufort West
to	to	Bulawayo	to
*Alexandria	Kisumu	contd....	Cape Town.

This was a 10-day schedule, it covered 7,922 statute miles, and there were night-stops at the 9 locations marked \* (of these the Paris and Brindisi 'stops' were on a train which departed Paris late on day 1 and arrived at Brindisi in time for an early departure on day 3).

The presentation summarised numerical analyses of the three aircraft types. These were to verify the most likely performance of the aircraft in payload-range terms, and to determine their probable

operational performance: distinct from the brochure performance that routinely will comprise the maximum (but rarely compatible) data on attainment. These were developed with generous support from organisations<sup>1</sup> that ensured the best possible data was used. Example payload-range data for Handley Page HP42W and HP42E, Short S17 Kent (flying boat) and Armstrong Whitworth AW15 Atalanta are shown below (and plots attached to the report). The distinction between HP42W and HP42E proved to be crucial to understanding the refuelling regime. (the W and E were an airline designation used to highlight the regions on which the types were used). A data summary is thus:

	<b>Passenger seats</b>	<b>Fuel capacity (imp.gallons)</b>	<b>Max weight (lb)</b>	<b>Payload/range (lb/n.m.)</b>	
				<b>Max p/load</b>	<b>max fuel</b>
<b>HP42W</b>	38	500	29,500	8,750/277	7,960/369
<b>HP42E</b>	24	650	28,000	7,000/387	5,890/515
<b>S17 Kent</b>	15	684	32,000	7,200/310	6,212/402
<b>AW15 Atalanta</b>	9-11	460	21,000	5,500/228	3,100/571

The 'models' (on MS Excel spreadsheets) were used to plan operations for flight simulator re-enactments. This involved adding the actual sites of aerodromes/flying-boat bases to the flight simulator database, and was made possible by data from Shell maps of the 1930s. Flight-plan routes were based on Imperial Airways published route maps. Several examples were used to illustrate the resolution of key operational issues often being encountered for the first time, and they led to the adoption of techniques still found in methods used today. Examples were:

- The use of alternative routes on Croydon-Paris to provide a trade-off between speed and safety: the former involving a water-crossing up to one-hour that the airline was reluctant to use routinely (engine reliability was still high on their anxiety list).
- The scheduling of the Brindisi-Athens-Alexandria sectors to ensure that the aircraft (not able to conduct a night landing) was able to fulfil the timetable without running unnecessary risk: this led to different timetables for summer and winter.
- The adoption of a formal 'point of no return' (PNR) policy for the Mirabella to Alexandria water crossing for the long water crossing, which had no diversion options – it was 'continue to destination' or 'return to base.'
- The use of navigation 'short-cuts' included the practice of following the Sudanese railway line across the Nubian Desert south of Wadi Halfa, and an adopted technique for reaching a destination when there were no landmarks (e.g.: over the sea) was to fly deliberately to one-side of track and to know whether the destination was to the right or left at the point of reaching the coast (vital if radio-based support was unavailable).
- It has become apparent from trials (and recent availability of maps used by crews) that the main navigation features used by the crews were rivers, railways and roads.

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<sup>1</sup> Archives of the Bristol Aerospace Trust, British Airways (Archive), HP Association, The RAeS (National Aerospace Library, Farnborough), Shell (Archive – Shell Aviation News), Rolls-Royce Heritage Trust and 'The Aviation Historian' editorial and support team.

In presenting data over the three regions, the European sectors (Days 1 to 3) were explained to be the more problematic with regard to endurance and scheduling, as they were the most west-east orientated sectors, and thus had time zone influences. The need to travel by rail from Paris to Brindisi was due to unresolved diplomatic clearances - this issue dogged many airlines until international agreements were ratified worldwide in 1935.

Time-zone issues were less significant over the African sectors, as the sectors were largely north-south orientated, and all the land overflown was, at that time, British Empire territory. The route was entirely overland, and landplanes was used on all the sectors.

Days 4 to 6 – up to mid-day - were flown by HP42E, involved night stops at Wadi Halfa and Juba and overall in 26:01 flying hours and 21,663lb fuel (in still air assessments) and covered 2,157n.m. At Kisumu (Kenya) the passengers and mail transferred to the AW15 and in the afternoon they flew to Nairobi to complete Day 6.

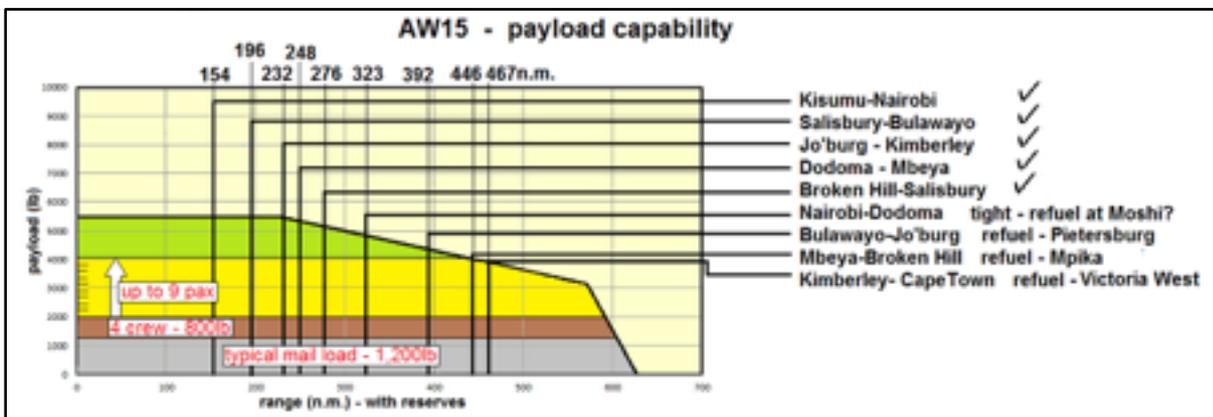
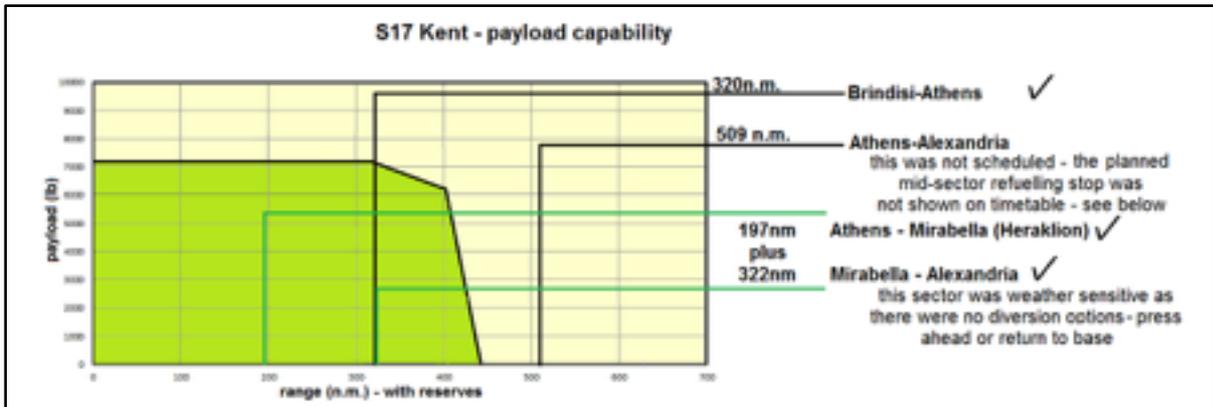
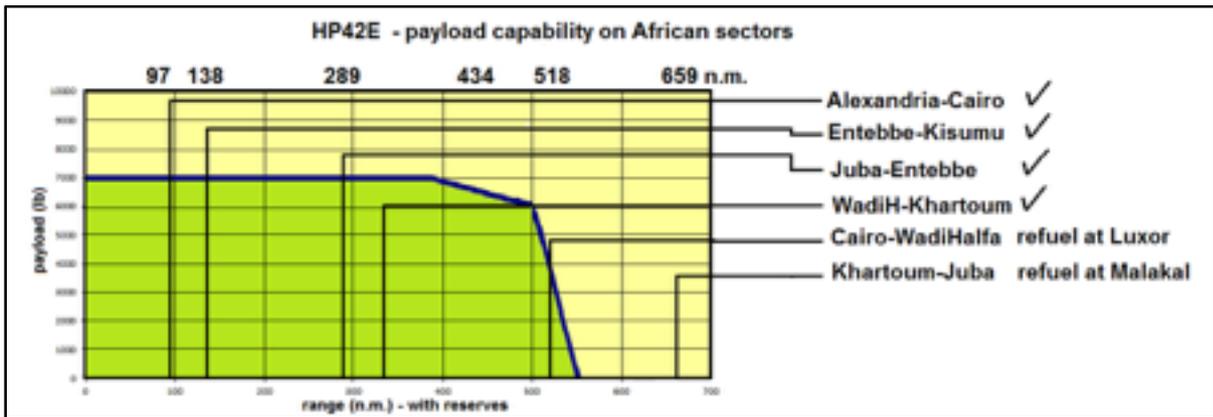
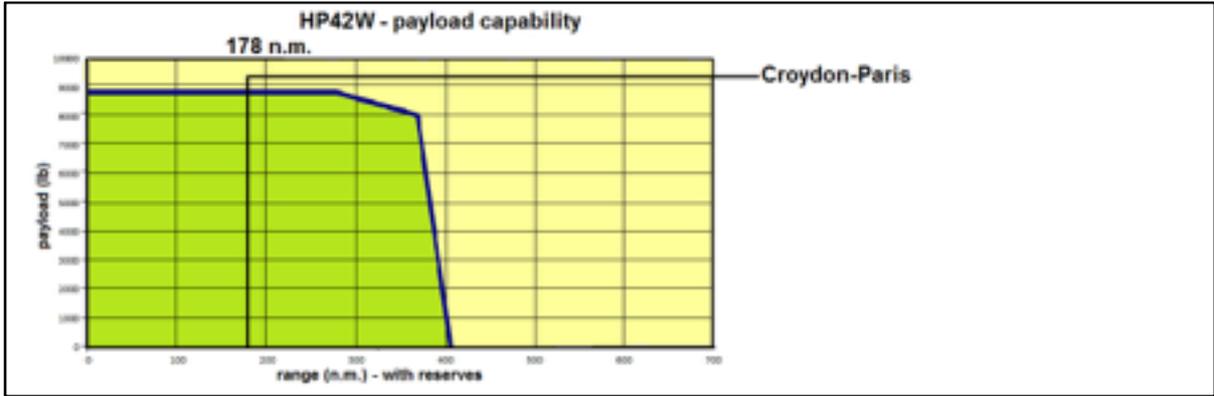
Days 7 to 10 retained the AW15 Atalanta and typically involved two sectors per day. A sector analysis using the same criteria shows 26:40 flying hours, a 14,868lb fuel requirement, and 2,534n.m. flown, and night stops at Mbeya, Salisbury and Johannesburg. This was the smallest of the types, and had the simplest engines (normally-aspirated), yet flew all its sectors, except as it approached Cape Town, between aerodromes in the order of 4,000ft (some near to 6,000ft) above sea level. Having not served the UK directly (its other sphere of operation was between Karachi and Singapore in the Far East) it has received little attention in UK aviation history, but its safety record was good, and its capability was exceptional for an aircraft of its genre.

The final part of the presentation was an illustration of operating the final sector, between Beaufort West and Cape Town. It is as close as we can get to replicating the events of 1932-36, until – and if ever – a replica aircraft is created. It is hard to say this was a particularly scenic flight, as there is so much to see through all the sectors, but this flight took place from the foot of South Africa's 'Great Escarpment', proceeded across a desert, through the Cape Mountains, and over a precipitous pass, then approached its sea level destination, dominated by the great bulk of Table Mountain – as unmistakable a landmark for aviators as it has been for mariners for several millennia – and all in the space of barely two hours. There can have been few flights that would offer such a fabulous welcome.

I attempted to answer a number of questions from the audience. Regarding ticket costs I could not give specific figures but looked them up after the meeting and they are attached hereto as an appendix. They show that the one-way London to Cape Town fare was £130 - equivalent to around £8000 today - actually not so different from current business class fares. I reiterated that the bulk of the operational costs were covered by mail contracts - passenger numbers were fairly low, the average load factor being 18% (see appendix for some details). This was the explanation for the fact that the route could be operated by a mixture of aircraft with different seating capacities (between 9 and 38). Ending the meeting with his vote of thanks, Captain Tony Irwin nostalgically recalled flying the route decades later in B747 aircraft.

Presentation notes by the speaker, Mike Hirst

Representative payload-range plots, with distance shown for the sectors they flew



A screenshot selection (all simulator generated – hoping they look real!)



Handley Page HP42W  
en route from Croydon to Le Bourget - overflying Beauvais Cathedral.  
(MSFS aircraft model – freeware by Derek Palmer)



Short S17 Kent flying boat  
Moored adjacent to Imperial Airways motor yacht, MV Imperia, in Mirabella Bay, Crete.  
This was a refuelling stop between Athens and Alexandria.  
The town of Elounda is in the background.  
(MSFS freeware model by Jens Christensen)



Handley Page HP42E

Having just entered the tropical zone, it is being prepared to fly to Entebbe.  
(MSFS aircraft model – freeware by Derek Palmer)



Armstrong Whitworth AW15 Atalanta

Emerging from above the precipitous Hex River Pass in the Cape Mountains: now less than one hour away from the service destination – Cape Town.  
(MSFS freeware model by Jens Christensen)

