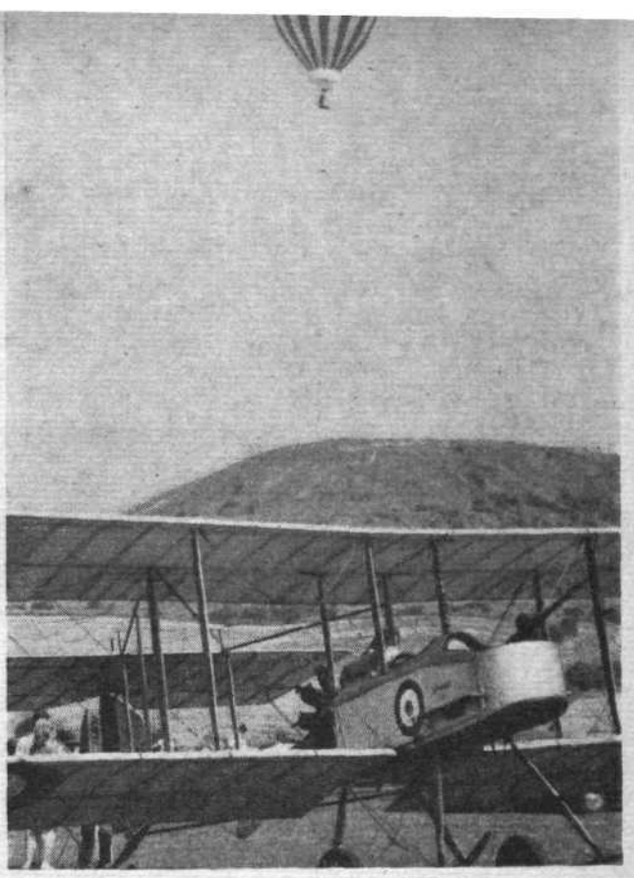
Hot-air Renaissance

STORY AND PICTURES BY TIM GODFREY



SOME YEARS AGO NASA experimented with hot-air balloons for satellite recovery. On re-entry the balloon deployed like a parachute and the burner ignited to arrest the descent, the rate of which could then be regulated by radio control. Three re-entries were effected in this way.

In 1960 Raven Industries Inc, the American company mainly involved, applied the knowledge thus gained to the production of sporting hot-air balloons. There are now about 60 hot-air balloonists in America, and their needs are catered for by two main manufacturers: Raven themselves, and Don Piccard, son of Professor Jean Piccard, who left Raven to form his own balloon-making company.

A British firm, M. A. Brighton & Co Ltd of Blackbushe Airport, Camberley, Surrey, now issues a catalogue on "Montgolfier Air Balloons." The firm's owner, Malcolm Brighton, gained his experience of inflatable fabric structures with RFD, and designed and built the 65,000 cu ft balloon owned by the amateur Hot Air Group.

Modern techniques have turned hot-air ballooning into a safe, frustration-free sport and are even having their impact on gas ballooning. The progress made was convincingly demonstrated at Dunstable over August Bank Holiday. Assembled there were Don Piccard himself, probably the world's leading authority on hot-air ballooning, Malcolm Brighton, Wg Cdr Gerry Turnbull—who runs the RAF Ballooning Club and is this country's only authorised examiner in ballooning—and Anthony Smith of *Jambo* fame. All were able to demonstrate their products and techniques in near-ideal conditions.

The basic configuration of modern hot-air balloons has been refined to the point of general agreement. Longitudinal stress members, usually of proofed nylon webbing, are sewn into the canopy between the gores; to them are attached steel suspension cables leading to the load-ring, on which the burner is mounted. Further wire ropes connect the basket to the load-ring. There is no suspension net and a hot-air balloon need never normally be dismantled.

Canopy material is, in Piccard's case, acrylic-coated Dacron and, in Brighton's case, polyurethane-proofed rip-stop nylon. Weight of both materials, including proofing, is around 2½oz/sq yd. Safe operating temperature is about 110°C. The material starts deteriorating at about 148°C, with more or less instant failure at a little over 200°C.

There are many points of detail difference and two of the accompanying photographs show the most conspicuous, namely canopy design. The two shapes represent different solutions to the problem of hoop stress, which is mainly a function of balloon diameter (material thickness can be discounted). Accurate stressing is extremely difficult (since the balloon is not a perfect sphere and pressure varies considerably inside it) but tension on the fabric at the equator of the Brighton balloon (50ft diameter) is about 11lb/in. Breaking strain of the fabric is about 45lb/in. The margin is considered insufficient for gust and ground-handling loads; furthermore, under this tension any small rip would spread rapidly, with possibly fatal results.

Brighton's solution is to incorporate seven circumferential members which carry tension loads and physically limit tears to safe proportions. Piccard avoids the problem altogether by using gores of near semi-circular cross-section. To stress his balloon one treats the gores as parts of individual circles with diameter equalling gore width. The tension on the fabric works out as almost nil and under these conditions tears will

US and UK configurations: Don Piccard's 42,000 cu ft "Golden Bear" (left) and the 65,000 cu ft balloon designed by Malcolm Brighton for the Hot Air Group. The latter craft is also seen in the heading picture, with Dunstable Downs in the distance and the replica Vickers Gunbus of the Vintage Aircraft and Flying Association in the foreground