

THE Meridian brand name has been a prominent feature of, and a source of some quite radical rethinking about, the hi-fi arena in the UK since it was first launched by Boothroyd Stuart Ltd. in November 1977. Electronics design engineer Bob Stuart and industrial designer Allen Boothroyd had met via a group called Cambridge Consultants (who made the well known Cambridge P40 amplifier) and first worked together for a newly-formed company called Lecson Audio before setting up a consultancy of their own in 1975 to design audio products on a free-lance basis. One of their early collaborations in this capacity was the Orpheus amplifier, shown to UK enthusiasts in 1976, but a remarkable parity in their philosophies regarding what audio equipment should offer in the way of facilities, ease of use and visual presentation soon led them towards the idea of establishing their own company.

The two men talked to Geoffrey Horn about their work in the September 1983 issue of GRAMOPHONE. Much has happened since then, but a repeat of the salient details of their backgrounds will not go amiss. Allen Boothroyd trained originally as a mechanical engineer before taking a course in industrial design at the Royal College of Art. Following this he joined an architectural design group called Hulme Chadwick and Partners through which he made contact with Cambridge Consultants. Bob Stuart took a science degree and followed this with an excellent grounding in electronics at the Marconi Company. His strong feelings for music soon dictated the focus of his interest, however, so that audio electronics and acoustics became the dominant areas of his work (witness a series of articles on audio amplifier design by one J. R. Stuart in *Wireless World* in the early 1970s). After starting Boothroyd Stuart Ltd. in St Ives with the launch of the first Meridian product, an active loudspeaker called the M1, Boothroyd Stuart bought the rights to Orpheus and then re-channelled some of the thinking that had gone into their first range of separate electronics products, the physically small, very elegant and user-intuitive 100 series. This comprised a minimalist preamplifier, a simple FM tuner and two power amplifiers. In 1979 the company moved to its present location in Huntingdon where the range was enhanced with several more active loudspeakers—the M2 (reviewed by GH in August 1981), M3 and M10. By 1982 they had made enough impact to be given a Design Council Award for Outstanding British Product (a recognition of achievement repeated six years later for their work on the current 200 series).

A new range of Component Audio separates was launched in 1982, based on a novel concept whereby almost any combination of switching unit, preamplifier, tuner and power amplifier modules could be bolted together side-on to create a custom-defined unit for any given domestic user installation. External wiring was kept to an absolute minimum by an

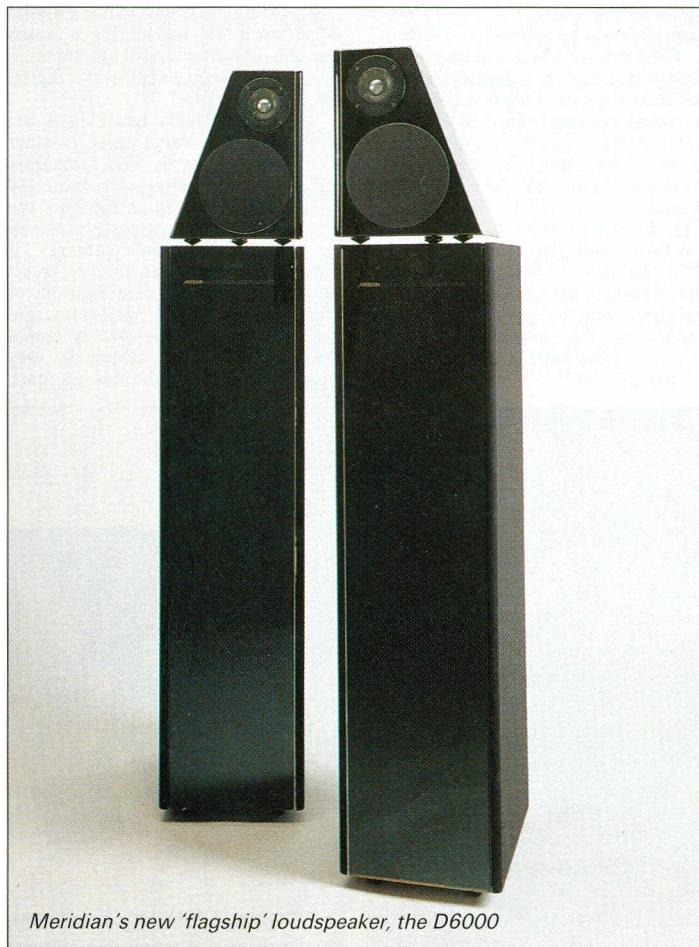
internal multi-pin signal 'bus' arrangement running laterally from unit to unit.

Boothroyd Stuart were very quick to recognise the importance of digital audio in general, and Compact Disc in particular, and in 1984 brought out their first CD player, an enhanced version of the original top-loading Philips CD100 and CD101 machines. Further work soon culminated in the MCD-Pro, a model highly respected in audiophile circles, in which the original Philips chassis, re-painted in grey Nextel, was mounted on top of a second cabinet containing Meridian's own proprietary D/A circuitry.

In 1985 the current 200 series was launched with a brand new CD player/preamplifier, the 207-Pro, a separate analogue preamplifier, the 201, the 204 FM tuner/timer, 209 remote control handset and 205 mono power amplifier (this sold, of course, in pairs for stereo). New

active loudspeakers, the M20, M30 and M100 were introduced, followed by the D600 "Digital Active Loudspeaker" (reviewed in July 1989) in which drive units, power amplifiers, electronic crossover, a D/A converter and an analogue preamplifier were all combined to produce an unobtrusive centrepiece ideally suited to multi-room applications, a field Boothroyd Stuart had by now entered with some style. More recently the 206 CD player was added and earlier this year the 208 player, which replaces the 207 and uses an enhanced version of Philips' Bitstream D/A conversion (the 208 was reviewed last month). As a range of separates the 200 series can easily satisfy the discerning audiophile, whilst as a complete system the various component parts can be bus-linked within the fabric of a building if required to provide room-to-room sound and control. Various ancillary units such as the 212 Remote Sensor

MEET THE MANUFACTURER NO. 34: MERIDIAN IVOR HUMPHREYS VISITS BOOTHROYD STUART



Meridian's new 'flagship' loudspeaker, the D6000

and 220 Wall Panel control unit are employed to facilitate these 'higher level' functions.

Boothroyd Stuart Ltd. was absorbed into the AGI (Electronics) Ltd. group in 1987 and thus now operates under the same umbrella as KEF Electronics Ltd. This move gave the company an enhanced financial base to work from and enabled a useful pooling of technical resources. It has also freed Bob Stuart from the active day-to-day running of the company, enabling him, as Technical Director, to concentrate his efforts on electronics and acoustical design. At Huntingdon he now works alongside Managing Director, Douglas Watson and Production Director, Ian Meredith.

In addition to his work for Meridian, Allen Boothroyd has been responsible for the industrial design on a large number of outside contracts, including the original Acorn computers—the BBC microcomputer and Atom models—as well as for other audio companies. He now runs his own company, Cambridge Product Design which is also part of the AGI Group, and has added responsibility for the physical design of the KEF range to his portfolio. He remains entirely responsible for the look of all Meridian products.

I visited Huntingdon in June shortly after Bob Stuart and the Chairman of AGI, Peter Gaskarth, had returned from the Chicago CES exhibition and talked to them about the latest developments in the Meridian range and their future plans. No less than three new products were shown at Chicago and will receive their official launch in the UK at the Penta Hotel Show, Heathrow next month.

Bob Stuart (RS): "What we showed at Chicago were the first two products of a new range that we are calling the 600 series—the 602 CD transport and 603 digital processor—and a new flagship digital loudspeaker called the D6000. We feel that digital audio is the core of the future and intend to be the leader in that area, or at least share that position. Whilst we feel the 208 is the best CD player that you can buy at present, we know how to make ones that sound a bit better, but that is more expensive to do. So the 600 series is an up-market range of digital separates. The 602/603 combination will retail for about twice the price of the 208, in other words £3,000.

"To start with, the range has to be finished even more expensively, with better detail; in a sense more glossy—bright, hard anodised black instead of a painted finish. It uses more glass, gold-plated buttons, more expensive displays—a matrix display instead of the seven-segment ones we've used until now so that the message comes across in upper and lower case plain English! The units will be the same physical size and will use the same extrusions as the 200 series. It's also going to be more 'audiophile' in that the equipment has fewer controls. But I do think it's very important that there should be a tactile interface, that you should be able to use it when, as Ross Walker [Quad Electro-

acoustics Ltd.] puts it, the cleaning lady has hidden the remote. So the CD player has Open, Play, Stop, Pause, Next and Previous, but that's it; it doesn't have all the other levels of complex displays etc., because we see this approach as more compatible with what the high-end user requires. The default display of all our CD players is Track, not Time, because none of us here likes to see displays ticking away. The listener I really don't understand is the one who has remaining time showing; here is someone 'enjoying' the music and wondering when it's going to end!

"We're completely committed to Bitstream, yes; I'm sure it's the right technology. But for the 603 we have used more multi-layer boards, with better isolation. In the case of the transport, for example, we've used more powerful amplifiers driving the digital outputs so that you can get a better result at the end of the cable. Another feature is what we call Optical Comms—as you know our products connect to each other, they talk to each other and become unified in terms of either single-room or multi-room use. Well we've now done that using optic fibre instead of an electrical link so that you can actually set up and optimize the grounding for each one to get the very best possible sound over your entire installation without having any compromises.

"We call the 603 the analogue preamp of the system, but it has two Bitstream digital inputs. You can have four analogue sources and the two digital sources and programme it to name them how you like. So you could call one of the digital sources 'LP' if you had such a thing as a digital turntable. You can tell the machine that when you press Tape you want it to be called a 'Cassette Recorder', 'DAT' or whatever. That's all memorized in non-volatile memory. It's very consistent with some of the things we do in the multi-room systems. It allows you to define what the sources are and also to 'throw away' the ones you're not using, so that you can't then select a source you haven't physically connected, which is a very nice thing for the customer. It has full remote con-



Largest of the 'M' series of loudspeakers, the M100

trol and it's also able to extract the time-code from any digital source, working automatically from 32–50kHz to cope with CD, DAT or other digital signals. It can display the coded information, which is relevant in multi-source or multi-room applications where the source component might be in another room.

"The next product will be a simple D/A box, a high-end digital converter for four sources. This is a black-box in function except that it has switchable digital inputs—there's a big market for that in Japan and America; right now they need three digital inputs: DAT, Satellite and CD. After that there will be an A/D converter and also a digital tuner." Why an A/D converter? "For our new flagship, the D6000 digital loudspeaker, which only has digital inputs, so the remaining analogue sources of the present will need to be converted first."

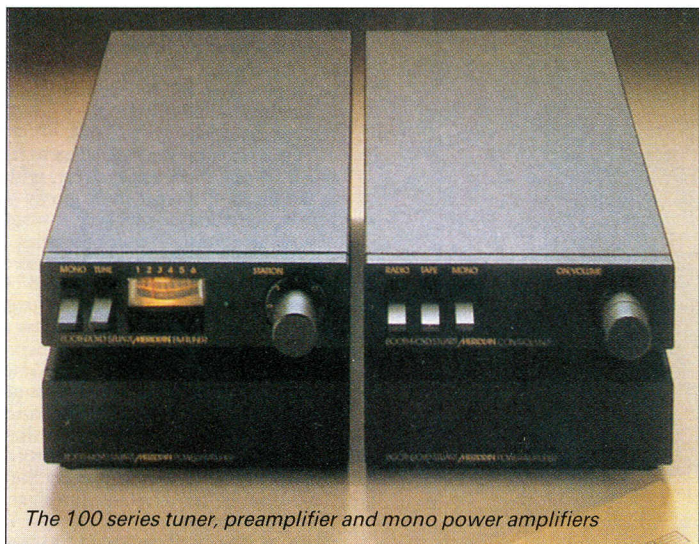
Peter Gaskarth: "On the D6000 all the equalization is done digitally; everything is done in the digital domain until it's finally turned back into analogue straight into the power amps, straight into the drive units. It's incredibly dynamic and quiet. The existing D600 design has a digital input but it also has analogue inputs and the crossover is still analogue; in the D6000 we go as far in the digital domain as we can."

RS: "The D6000 has a bass bin containing four drive units, two per side facing outwards, and a separate midrange/treble enclosure mounted on the top. The top of the bass bin and its front panel are plate glass and the midrange/treble cabinet is finished in black piano lacquer, so it's a very interesting combination of finishes—high gloss head unit and high gloss front. The display comes through the glass, which is very elegant. And then the sides are matt,

because of the fabric covering the bass drivers. These are side-firing (it's irrelevant which way they face because the crossover frequency is 200Hz). The bass drivers are horizontally opposed—which is the way we did it in the M100—so the cabinet doesn't move; it's a very stable system. All the electronics are in the back of the bass bin and each one has four power amps of between 70 and 80 Watts each, two for the bass system, one for the midrange—which is a very important range, 200Hz to 2.6kHz—and one for the tweeter. The tweeter is a new design that we've developed which has an aluminium dome with a silver voice-coil and a short horn for loading. It's very sweet, very detailed, and its resonance is above the cut-off frequency of 48kHz.

"In the D600 we had a D/A converter on board and we followed that with an analogue preamp which managed the tone controls, the volume control and the active crossover—which is still a very good proposition because you're bringing the digital signals right up to the loudspeaker. And of course the D600 could also take mixed sources, analogue or digital. Nevertheless, you've still got quite a lot of analogue electronics and there are a lot of benefits in doing it all digitally.

"What we have inside the D6000 is the four Class AA power amplifiers fed by four D/A Bitstream converters—for the bass system, for the midrange and for the tweeter. And then prior to that there's a DSP [digital sound processing] circuit which does the signal processing. The benefits of a digital crossover are, first of all, that you can generate a crossover that you simply can't make in the analogue domain: you can make the speaker linear phase, you can give it high slopes so that the tweeter isn't 'pushed' where it shouldn't be and you can cut out all the nasty happenings at the top of the midrange. You can get it perfectly time-aligned. But there's another whole set of benefits to do with the fact that because the DSP circuit is running a program, that program can be adjusted and you can calibrate each individual



The 100 series tuner, preamplifier and mono power amplifiers



The 'mix and match' Component Audio series

loudspeaker. So at the testing stage it can talk to the calibrating computer and each unit can be set up individually; you put in a calibrating 'word' for each driver. So that's a benefit. Obviously in terms of sound we have the ultimate short analogue path—and there's the D/A power amp and then the drivers.

"We can bring in a whole series of really appropriate tonal adjustments too because in the digital domain we have phase-independent controls. We can put in all manner of contouring without throwing anything away; whenever you did that before you had to put in a whole analogue stage with all its complications and compromises to give you what you wanted. But with digital there's no loss, you just pick up the signal, play with it until you're happy and then put it down again."

So what controls will the user get? "Treble and bass tilts, overall tilts, bottom end corner shaping—quite large increments of change in the 'Q'—and bottom shelving for the room interface. There will also be image steering—in other words you can sit down and move the image to where you want it to be, because we have full ability now to change the delays in the phase response; so you can move the image up or down and indeed left to right. One of the really interesting things about a digital system is that with the balance control you can delay the feed to each loudspeaker as well as attenuating it, so for the first time you have the prospect of a balance control that will really work."

"The other thing that we're putting in as a user option is psycho-acoustic compensation, in other words an appropriate kind of Loudness function. You can see the interesting thing about this is that the circuit is absolutely calibrated so the loudspeaker 'knows' how loud the sound is; it's not like a conventional amplifier where we don't know within 10dB what the sensitivity of the rest of the system is. We can actually trim it quite well, so it will allow a more realistic performance above and below the normal level settings. Also the DSP circuit can predict exactly the temperature of each voice-coil at any point in time, decompress it and protect it."

"That's the electronics. The acoustics are another whole area because we had to design a loudspeaker that had a dynamic range of 117dB and was truly revealing of detail over that dynamic range on an instantaneous basis, and that means very low coloration. Yes it's a sealed enclosure for the bass, which is the first time we've done that—we had enough volume and power available here to do it. It also allows us to equalize right down to a -3dB point at 20Hz. But by constructing the loudspeaker as two completely separate cabinets we were able to have absolutely no compromise on the most important part, which is the midrange. If you make a big speaker in one box you can't stop the wooden panels colouring the midrange. By putting the high frequency drivers in a separate box which is constructed in a completely different way



The new 602 CD transport and 603 converter

you can overcome that. The bass bin is made of MDF, tightly braced, and it's well damped inside. The mid-range/treble enclosure is an asymmetric plywood box which is braced in a very different way and then covered in this hard lacquer. With this approach you can choose directivity as well; we have a narrowness of the cabinet where it's needed to give the required dispersion." The D6000 will retail in the region of £6,000.

Boothroyd Stuart formerly used KEF drive units in their loudspeakers but after absorption into the AGI Group moved on to units made by the Norwegian manufacturer SEAS. PG: "As soon as KEF and Meridian got together one of the house rules was that they wouldn't use KEF drivers any more. KEF are pretty stretched to make what they require for themselves and I think the only OEM that we're seriously doing now is for the LS3/5a design."

Boothroyd Stuart have made big investments into automatic test equipment (ATE) and have now implemented a most impressive regime for testing all of their

products. Flow soldering is used to mount the 'routine' components on the printed circuit boards, the most exacting or difficult-to-mount components being hand-soldered afterwards. The completed boards are then sent to the ATE workstation where any error or fault is immediately located and either corrected there and then or noted and the board sent back to the assembly line. Completed units are 'burned in' for three days in a special room where the temperature is cycled up and down and the supply voltage varied. The CD players are also 'exercised' via a communal remote control transmitter which also opens and closes all the transport shuttles some 100 times. Each unit then goes on to a computerised test set-up, the software for which was written in-house.

RS: "One of the things we do that is really unique in the UK is design and make our own microprocessors using EPROMS [Erasable, Programmable Read-Only Memory]. We write our own code for all the products we make—we're the only company which isn't the size of

Philips or Sony to do that; all the others buy-in microprocessors. By far the most interesting one is the CD player. It allows us to provide a whole range of functions which are unique to us. Like, for example, the 602's user-programmable wait time between tracks of up to six seconds. Our circuit will also seek to three seconds before the track and lock before the music starts; quite a few machines clip the start of the required track because they don't do this. One thing you can do with our machines, which you can't do with many others, is program them 'on the fly': if you're listening to track 2 and select, say, track 8 and store it, it will carry on playing to the end of what you're listening to (track 2) before moving on to track 8, whereas with most machines as soon as you hit the track button it goes there. Half the code in our CD players is only accessed while it's on test in the factory; the test set-up interacts with the machine and will tell us about the displays, functions, etc. We can also get a CD player tested in two minutes in this way."

With the impact of their new 200 series and the latest active loudspeakers, and under the new company structure, Boothroyd Stuart have made important strides in the last couple of years. Separate marketing companies, both called Meridian Audio Ltd., have been set up at the KEF premises in Maidstone and the USA in order to streamline the sales and marketing functions and as a result of all this activity Boothroyd Stuart/Meridian as a group achieved a turnover of some £3.5M last year, doubling its productivity over the previous 12 months. The growth pattern looks set to continue, if not at quite that rate then certainly at least 50 per cent in 1990 over 1989. New manufacturing premises in the Huntingdon area are actively being sought, since the existing twin factory units are now fully stretched. The UK is their biggest single market, with Japan the biggest export market and the USA next after that, but steadily growing.

For the future, we can expect to see more developments in the 600 series plus a range of "more affordable" components, derived from them and from the 200 series, which will address a correspondingly wider clientele. The essentially modular and 'Comms-compatible' approach to all Meridian products gives a logical upgrade path so that the existing user need not be left behind with each new development. The Meridian Grand Plan, as Allen Boothroyd puts it, is to provide the best possible sound quality in a form usable by non-technical people; simplicity in control allied to supreme technical competence. Seven years ago in his interview with GH, noted at the start, Bob Stuart said that "In any field of endeavour there is always room for a specialist who is trying to provide something a little bit different, a little bit better . . .", a remark which could well encapsulate the company philosophy. They might usefully borrow the title of Arnold Schoenberg's book *Style and Idea*, to complement that as their motto.



His Royal Highness the Duke of Edinburgh, left, with Allen Boothroyd and Bob Stuart at the British Design Awards 1988