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## PRESIDENTIAL ADDRESS

In his Presidential Address at the 53rd Annual General Meeting of the Institute, held in London on 20 October 1999, Air Commodore 'Pinky' Grocott reviewed the deliberations and findings of the second *Way Ahead Group* in 1992, reflected on the continued relevance of the Group's recommendations after seven years and considered the progress made by the Institute in this period.

### The Second Way Ahead Group – Seven Years On

Air Commodore D. F. H. Grocott

1. INTRODUCTION. In January 1992, our then President, Norman Dahl, asked me to chair a Second Way Ahead Group (WAG 2). Council wanted WAG 2 to consider the many changes that were continuing to impact the role of the navigator and the part played by man himself in the art and science of navigation, and to make recommendations on the way forward for the Institute. The aim was simple and focussed directly on Council's concerns:

To examine the Aims, Objects and Structure of the Institute in the light of recent and anticipated developments, and to recommend any changes.

As Chairman of WAG 2, I saw my task as being divided into three phases. First, WAG 2 should identify '*recent and anticipated developments*'. Secondly, WAG 2 should assess the significance of these developments in terms of the navigation of a craft as it goes about its ways. Lastly, WAG 2 should consider the changes necessary to benefit from the positive elements of these developments and to ameliorate the effect of any consequential deleterious implications for the Institute. I was pleased to

have the support of members from a cross-section of the environments, notably T. J. Bartlett, C. M. D. Beatty, Professor J. Kemp, Lt Cdr R. D. Stephenson and the Director, Group Captain D. W. Broughton. Not only were these individuals well aware of recent developments in the navigation and associated information technology and electronic fields, but each in his field of activity had displayed a talent for translating forecast technical developments into significant navigational impact statements.

We are now seven years on from WAG 2, and I thought that the arguments used in 1992 should be put to the test to see if they remained valid and appropriate as we approach the 21st century. Time precludes consideration of all the recommendations made by WAG 2. So I shall confine myself to the backdrop against which the recommendations were made and then focus on what I perceive to be the key recommendations – avoiding, with one exception, those that are primarily of a financial nature.

**2. TECHNICAL DEVELOPMENTS.** WAG 2 held its inaugural meeting on 10 February 1992, and quickly came to the view that the recent and anticipated developments could readily be separated into purely technical developments and those factors that were already causing significant socio-economic change. WAG 2 first considered the technical changes. In 1992, there were already a number of military satellite navigation systems in operation, notably Transit and GPS operated by the USA and GLONASS operated by Russia. These systems allowed users to determine position to an accuracy of about 100 m and designated, authorised users were provided with crypto units that permitted position to be refined to an accuracy of about 15 m. Inexpensive integrated systems had appeared on the scene. Fibre-optic and piezo-electric gyros enabled manufacturers in the USA to offer miniature inertial navigation systems at a cost of less than \$1000 per axis and, as an option, to integrate these miniature inertial navigation systems synergistically with GPS and interactive displays.

The Moore factor (named after the chief executive of Intel) had already been established as a part of computer mythology, with the media headline seekers stressing that the size of computer memories and the speed of computer processors would double every 12 months. Certainly these developments have been phenomenal. They started in the early 1960s when AN/ASN 24 was launched in the USA. By my reckoning, computer memories had doubled every 18 months rather than every 12 months from the time of the 1 kilobit AN/ASN 24 airborne computer up to the time of WAG 2. Similarly, processor speeds had doubled every 18 months, starting from the figure of 160 kilocycles in about 1964. The phenomenal changes in processor speed have been fuelled by a fundamental change in the type of computer processor chip at intervals of about 5 or 6 years. Software programmers were, of course, delighted with the continual growth in computer capabilities and had no difficulty whatsoever in writing programmes that used whatever capability was offered by the hardware developers. WAG 2 considered the implications of these technical developments and, depending on your viewpoint, made either five assumptions or drew five conclusions:

- (i) Technical developments would continue into the 21st century and, indeed, they might even accelerate as the growing band of software entrepreneurs spotted new business opportunities. Miniaturisation would lead to a reduction

in the number of electronic cards in the system and, eventually, the SATNAV element would appear as a single hybrid chip in an integrated Command, Control, Communications and Information System (C<sup>3</sup>I).

- (ii) There would be increased automation in the process of the conduct of a craft as it goes about its ways.
- (iii) Position determination in both commercial transport applications and in the leisure field would become a secondary task in the overall process of navigation.
- (iv) Position finding by SATNAV would become the norm, and accuracy would increase as differential techniques improve.

All of these factors, coupled with the disappearance of the professional navigator, would lead to:

- (v) An element of safety being transferred to the design office, which today encompasses hardware, software and firmware. Approving authorities would increasingly face major difficulty in ensuring that the software and firmware within complex systems were tested to a level that would detect errors likely to lead to accidents.

Turning to socio-economic factors: the developments in information technology, such as the ability to store a lot of data, speedy location and retrieval of stored information, the availability of high speed modems, electronic mail, scanners, desktop publishing software and CD's containing high quality art graphics, meant that some people need no longer make the daily trudge to the office. They now had the tools to work from home, to select their working hours, and to transmit the result of their effort to any point around the world. Indeed, some software houses had already started to develop their software on a 24-hours basis, using software experts in India and elsewhere to cover the part of the day when Britons were away from their computer screens.

At the same time as the shift in work pattern was taking place and people were becoming increasingly computer literate, computers were entering leisure activities. Moreover, multi-media entertainment through a computer was becoming possible. For the proportion of the population that would continue to work in cities, there would be the tendency to want to get home and to relax or to be stimulated by operating and interacting with their multi-media equipment. I suggest that the assumptions made in 1992 on technical developments will remain valid for a number of years to come. My reason for saying this so confidently is because the forecast trends made in 1992 show no signs of abating.

Over the past seven years, the determination of position in moving platforms from SATNAV systems has improved from 100 metres to better than ten metres, mainly because ways have been found to counter the built-in errors of GPS selective availability. Furthermore, surveyors – using special techniques – now take for granted the determination of position in static situations to an accuracy of about 2 centimetres. In 1992, hard disk capacity of 300 Mb was extolled as being more than the customer would ever require. Yet today, to install the complete Microsoft Office 97 software programme requires 366 Mb of hard disk capacity and the Corel WordPerfect Office 2000 programme, less clipart and fonts requires 468 Mb. Indeed the complete Corel WordPerfect 2000 programme contains 1 Gb of information. No surprise then that hard disks of 252 Gb came on to the market in June 1999. The same

picture applies to RAM memory – an increase from 16 Mb in 1992 to 4 Gb in mid 1999. Not to be left behind, the standard Pentium processor speed increased from 25 MHz to 550 MHz in the same period. And, to top all numbers, Silicon Graphics in California have designed a computer to test the safety and security of nuclear weapons that carries out 1,600 billion standard operations per second. At NAV 91, I showed a slide (Figure 1) depicting forecast RAM memory development in megabits

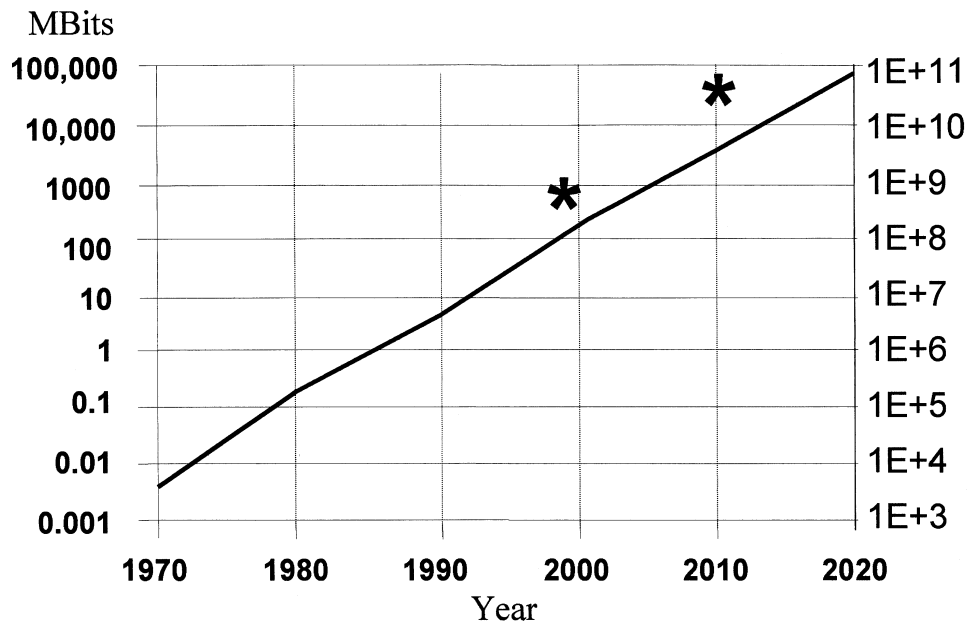


Figure 1. RAM memory development (MBits).

(MBits) out to the year 2020. On this chart, I have superimposed asterisks showing where we stand today and the current forecast for 2010. Both are greater than was forecast in 1991.

I also showed a slide of the forecast throughput of airborne computers in terms of millions of instructions per second (MIPS) (Figure 2). The actual throughput achieved today lies more or less on the forecast line (asterisk), but the current forecast for 2010 (asterisk) is slightly less than the forecast made in 1991. The reason for this is quite simple; it is a question of how to cool the increased density processors and so prevent them from burning themselves out. The January 1999 issue of *Signal* magazine pointed out that dissipated power increases with clock speed – with the 450 MHz Pentium 2 processors each dissipating 27.1 watts. In electronics, temperature and reliability are inversely related parameters, and temperature and voltage are directly related parameters. So as dissipated power increases, chip manufacturers are looking at methods such as liquid cooling instead of or in addition to fan cooling, as well as to running processors at lower voltages.

IT technology has seen developments that reveal the unbounded ingenuity of man. Since 1992, the developments in scanners, modems, desktop publishing, high quality graphics, E-mail, CD art clips and precision draw programmes have exceeded the expectations of the most enthusiastic computer buff – and there appears to be no end

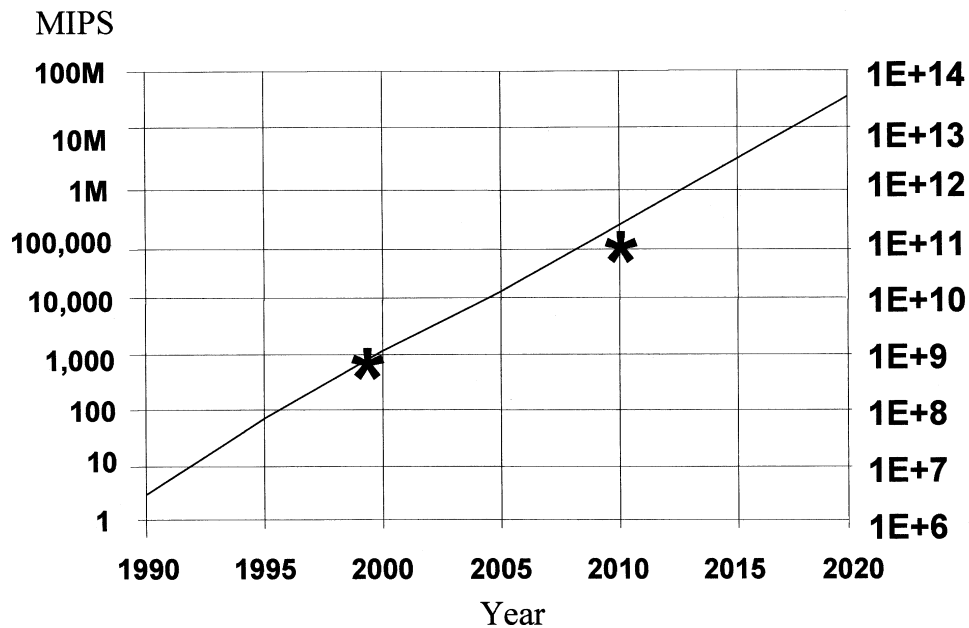


Figure 2. Throughput of airborne programmable computers (MIPS).

in sight to such developments. During the next decade, we shall see the mobile communications community bringing a new dimension to the IT explosion. They will announce a series of developments, including hand-held mobile access with voice and keyboard inputs to completely integrated command, control, communications and information systems. Voice-mail and facsimile messages will appear on hand-held screens and be communicated orally or visually. These messages will also be stored in memory for later recall. Access to data banks will enable executives to make decisions and to monitor progress wherever they are in the world.

Socio-economic developments were if anything underestimated by WAG 2. New software programmes have permitted companies, such as the printing and publishing industry, to move out of London and other large cities into the countryside, where they can rely on self-employed people to input their skills to the dispersed facility by modem. New industries have been created. Some, like telesales of double-glazing and holidays, have been welcomed by employees seeking work but not necessarily by the recipients of repetitive telephone calls. Almost every home in the UK now has a computer, a range of games and learning tools, and many have installed multi-media software and computer global telephone software.

From my perspective, I see no reason to change the basic backdrop of technical and socio-economic developments against which WAG 2 carried out its deliberations. I hope that I have demonstrated the validity of the assumptions made by WAG 2 in 1992. If any reader thinks that WAG 2 underestimated or overestimated the changes, then do please write in to the Institute and make your views known.

So what should be our reaction to the changes? Should we take the Luddite approach and ignore the technical developments and the changing socio-economic factors? Should the RIN continue to be supporters of, and advocates for, the continuation of the good old days when it took an air navigator twenty or more

minutes to determine present position? Or should we accept the technical and socio-economic challenge and change with the changing world? Given that we should change with the changing times, did WAG 2 draw the right conclusions and make the correct changes?

3. **IMPLICATIONS FOR THE INSTITUTE.** The Study Groups were the first area that came under the microscope. WAG 2, like WAG 1, viewed the Study Groups as being the centres of expertise within the Institute. To reflect this status to the membership at large, WAG 2 recommended that the groups be known by the more descriptive term of Special Interest Groups (SIGs). In 1992, there were four active SIGs – Land Navigation, Marine Traffic, Small Craft and the UK Civil Satellite Group. Three others existed as committees only. It is not surprising that the four active SIGs developed in their own special way adopting different administrative and financial arrangements. For example, the largest SIG – the UK Civil SATNAV Group – comprised 88 Corporate Members paying £150 per year and 45 Individual Members paying £35 per year. It published four newsletters each year. On the other hand, the Small Craft Group had 82 members paying £15 per year, and used *Navigation News* as their communications medium. The four active groups attracted many members from outside the Institute, some of whom subsequently joined the Institute.

There is little doubt that the SIGs enhanced the status of the Institute and have been the catalysts for two of the NAV series conferences, bringing considerable financial benefit to the Institute. They have also organised their own half-day and one-day meetings. On the debit side they increased the workload on the Institute's staff and regrettably did not increase the membership of the Institute to the degree expected. To encourage members of the groups to become full members of the Institute, WAG 2 recommended that SIG members should become Associates of the Institute at a lower subscription rate than ordinary members. WAG 2 also recommended a number of administrative and financial measures designed primarily to protect the charitable status of the Institute. Now we all know that trying to carry out any change in the UK brings out the bulldog fighting spirit of the Queen Victoria rules brigade with their battalion cry of 'but we've always done it this way'. This was certainly true regarding the proposed changes in the administrative and financial procedures of the SIGs. However, Council backed the WAG 2 recommendations and the minimum necessary changes were made to our Working Rules.

Far from reducing membership of this Institute, WAG 2 thought that the spread of SATNAV offered the Institute opportunities to broaden our membership base. Given instantaneous and accurate position, more people would be carrying out off-road activities such as car journeys across featureless or uninhabited regions and on-foot orienteering. Law enforcement agencies would become interested in SATNAV to plan reinforcements and complex operations requiring precise position. Farmers would become increasingly interested in SATNAV to avoid over-fertilising, over-spraying or over-seeding the land. The tracking of animals by satellite opens up another fascinating area with potential for recruiting new members. There is the obvious conservation interest in knowing where tagged animals are located and that they are moving and hence presumed alive. But there are also possible applications in the tourist area. For example, one can foresee the day when a visit to a safari park in Africa or even at Windsor would involve being provided with a hand-held flat

electronic screen giving the location of all the large animals in the park – and all the watering holes.

WAG 2 considered that, as accuracy improved, the division between position location and surveying would become quite blurred, again providing the Institute with a fertile area for increasing membership. There has always been a link between those interested in navigation and hardware system designers. WAG 2 considered that this link should now be extended to cover software system designers, who have the responsibility of working out all of the ‘what-if’ cases and offering technical solutions. Exploration is almost in the same category as off-road navigation and orienteering. It brings another group of people into the catchment area from where we should be able to attract members to this Institute. And, finally, there is the special aspect of animal navigation involving people with impaired vision. This group of people could gain so much from a specially programmed SATNAV or Loran C system with audible outputs and possibly activated by voice inputs.

WAG 2 considered that there was scope for even more centres of expertise within this Institute. We suggested Commercial Aviation Navigation, Merchant Ship Navigation, Naval Ship Navigation, Orienteering, Agricultural Navigation, Animal Navigation and Exploration.

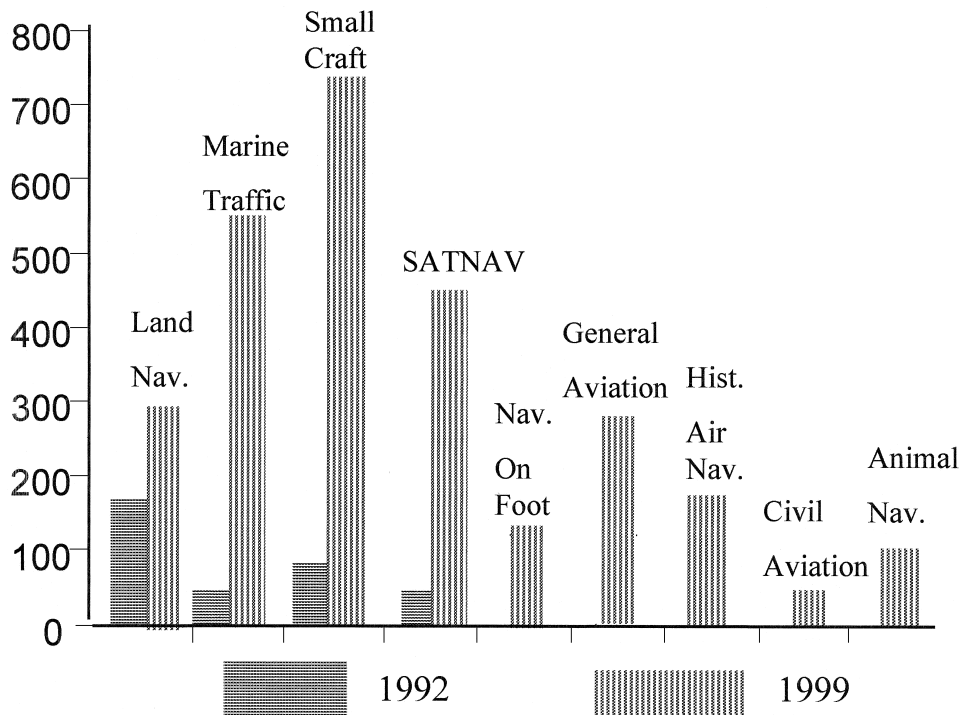


Figure 3. Membership of Special Interest Groups.

Today we see evidence of the ‘proof of the pudding’. Membership of SIGs has increased by an order in seven years. The SATNAV Group has increased from 45 individuals to nearly 500, and membership of the Small Craft SIG has increased from 82 members to over 700. A Civil Aviation Group has been formed, Merchant Ship

Navigation has been subsumed into the Marine Traffic Group, an Orienteering Group – now known as Navigation on Foot – has been formed, and an Animal Navigation Group is in being and already has an international standing. Whether additional SIGs are formed is up to the membership at large. Members must tell the Technical Committee that a group with a common special navigation interest wish to meet from time to time to discuss this interest. Together with this stated interest, there is a parallel need to identify an individual who is prepared to lead the group and someone prepared to act as secretary.

The RIN has embraced and will continue to embrace the developments taking place in IT. E-mail has become the dominant method of communication, and the Satellite Navigation Group has created a mail-base for the exchange of information via the internet. In future, we intend to create mail-bases for other SIGs, starting with the Animal Navigation Group whose members are drawn mainly from universities around the world. The library can now be accessed via the internet, and we intend offering the conference proceedings of NAV 99 on CD. The Journal is now online and available in full to Cambridge University Press subscribers, and we are looking to make this same service available to members with internet access.

4. STRUCTURES OF THE INSTITUTE. At this point in the debate, WAG 2 decided to step back a pace and to look at the broad picture again to see if the structures within the Institute should continue in their pre-1992 form, and we started with our pattern of ordinary meetings. I for one had been most disappointed with the poor attendance figures for Ordinary Meetings of the Institute. The reason for the poor attendance has not been analysed scientifically. It is probably the result of the changing socio-economic factors mentioned earlier, coupled with the reluctance of members to stay in London – no doubt not helped by the timing of a particular meeting. The location of our members spread mainly and widely over the area from Grimsby to Land's End does not help. Whatever the reason, WAG 2 recommended that the annual programme of meetings in London should be cancelled. In its place should be the existing Summer Meeting, the existing Open Meeting of the Technical Committee, the existing joint meetings with the Nautical Institute, the Honourable Company of Master Mariners, the Royal Aeronautical Society and the IEE, plus a series of half-day or one day meetings linked to an optional reasonable cost social function. WAG 2 suggested that some of these meetings should be linked with a Branch or Corporate Member and should include at least one paper from one of the Special Interest Groups. Venue for these meetings should vary and should reflect where there is a reasonable density of members (Figure 4).

There is no doubt but that the cancellation of the Ordinary Meetings in London was a good move, as was the introduction of half-day and one-day meetings outside London. These meetings are attended by an average of about 40 to 50 people, all of whom have a direct interest in the topic or topics being presented. The question now is what else should we be considering? Should the Technical Committee, the Special Interest Groups or a special team put together a series of presentations to give outside London? Topics are not difficult to find. We could for instance summarise what went on during the latest NAV series Conference. We could spread the message about SATNAV natural and man-made interference. We could talk about the progress being made on the road to GNSS 2 – or explain why progress has not been as fast as some would wish. And we could select topics of current interest to the leisure



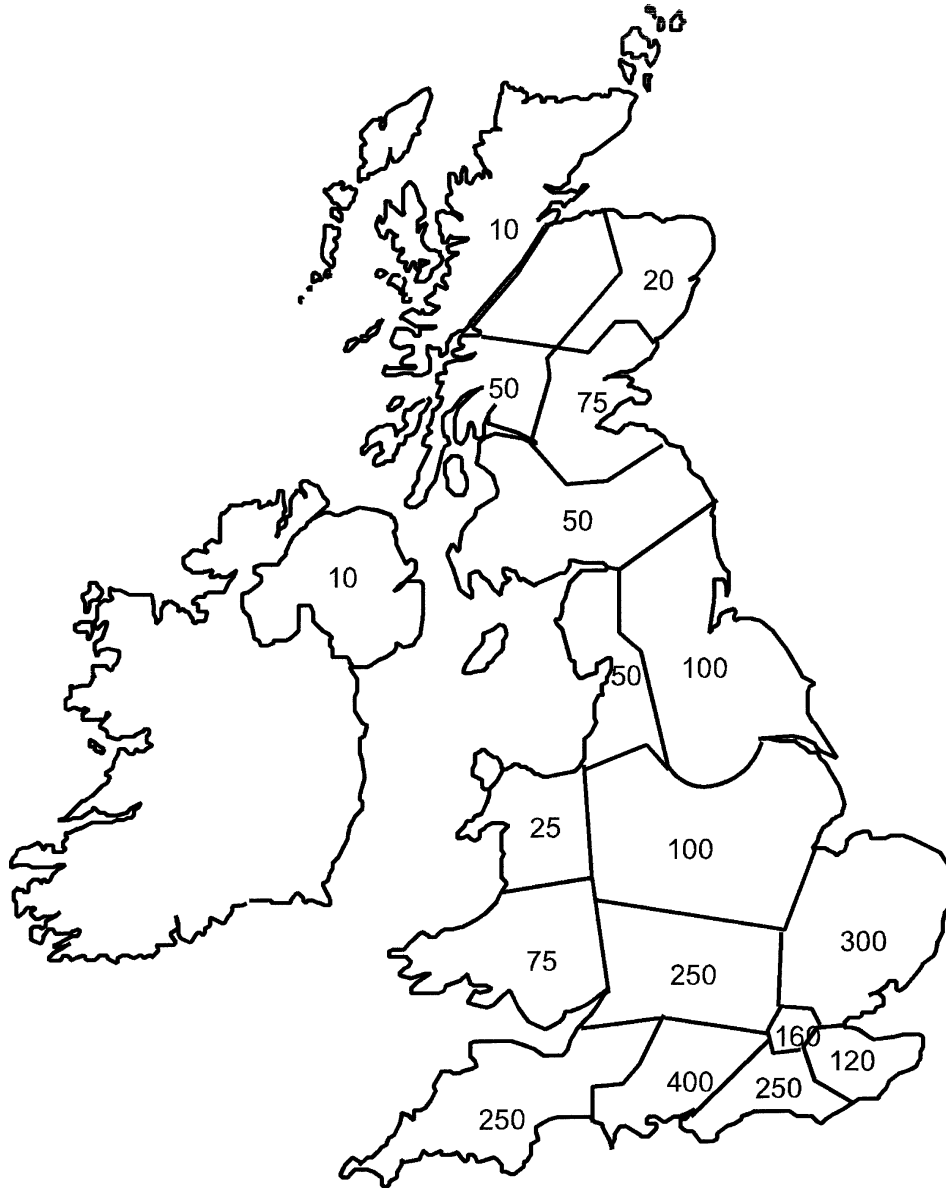


Figure 4. Geographical distribution of members.

navigators at the yacht clubs and certain schools. If any of you have other ideas please take the time out to drop a line by E-mail, FAX or even by an old-fashioned letter, to the Director.

I should now like to turn to the Technical Committee. Recognising that the centres of expertise now reside in the SIGs, WAG 2 considered that the chairmen of these Groups should automatically be members of the Technical Committee. Moreover, as the SIGs would not cover all of the disciplines embraced under the heading of 'navigation', it would be necessary to add members with such backgrounds. These

two changes were intended to bring about a culture change in the Technical Committee with the aim of gradually changing it from a programming and technical administrative committee to one able to focus on safety of navigation issues. WAG 2 also recommended that the Technical Committee should consider particularly the changes to the annual lecture programme and give consideration to the formation of additional SIGs.

The NAV series of conferences are international and recognised in the conference calendar as being good value for money by providing views that are free from company or political bias. At the time of WAG 2, income from conferences was particularly buoyant, increasing the Institute's income by £130 000 in the period 1990 to 1992, although the longer-term average was just a little below £20 000 per year. WAG 2 members were torn between two approaches. First, they would have liked to have been able to recommend that members be allowed to attend the annual NAV series of conferences at rock-bottom prices. But the counter-argument that the Institute needed the income derived from these conferences won the day. Without such income, annual subscriptions would need to rise by about £7 based on the long-term average or by £14 based on the most recent short-term average. WAG 2 did however sound a note of caution. Organisers of the NAV series of conferences should keep in mind the need to balance the requirement to earn money for the Institute against the second object of the Constitution concerned with the advancement of the science and practice of navigation. WAG 2 also stressed the importance of selecting both the conference theme and the optimum timing for that theme.

In the past seven years, Council has reviewed conference policy on several occasions. Each time Council has expressed concern at the variability of conference income (Figure 5). The longer-term average has held at about £22 000, but the average

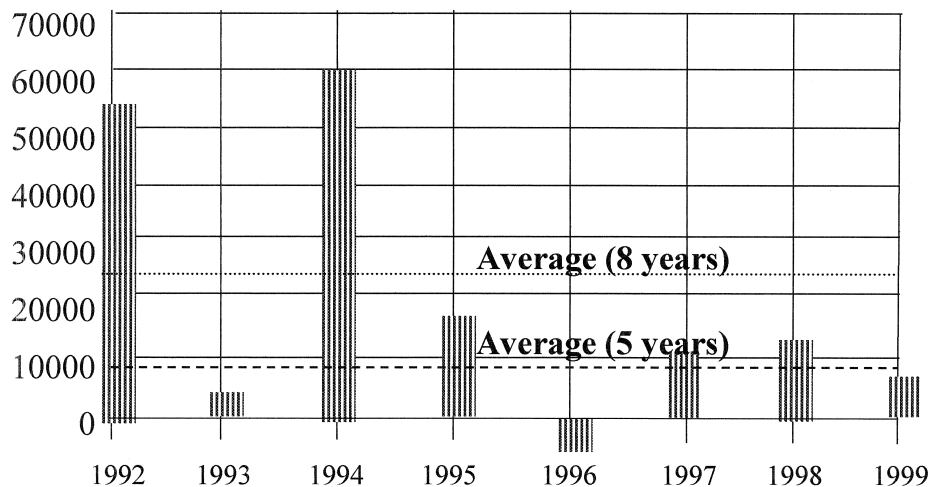


Figure 5. Conference income 1992–1999.

over the past 5 years has fallen to £7,500. For NAV98, the Institute experimented by working with a commercial conference organiser who had a database of 30 000 conference attendees. This experiment proved successful and could well form the basis for cooperation on some future conferences. In general, Council has concluded

that although the WAG 2 policy was still valid, minor changes to improve the financial return from the major NAV series of conferences should be considered.

The RIN series of conferences had developed into conferences for members of the Institute, the charge being set at about the £100 mark. WAG 2 considered that this trend should be encouraged and effort should be devoted by the Technical Committee to finding topics that would be attractive to one of the Special Interest Groups and to members of the Institute at large. WAG 2 stressed the importance of venues with reasonably priced university accommodation coupled with tourist appeal, – such as York, Oxford and Cambridge. This view is equally valid today.

Turning to publications, the *Journal* has an excellent reputation, and the product brings great credit to the Institute. WAG 2 endorsed in principle the policy that has evolved over the years. It is our reference library and corporate memory. It caters for all disciplines within the Institute, the articles tending to be placed in the *Journal* in order starting with one or two that have wide appeal and ending with those that appeal to academic members and the more technically minded. WAG 2 considered that a small touch on the tiller should be made to attract more articles on operational matters, if necessary by inviting particular papers. WAG 2 also thought that the Forum section of the *Journal* should be allowed to evolve into an ideas section with carefully selected contributions from members of Special Interest Groups. Looking back on the *Journal* recommendations, I have great sympathy with the present and past editors of the *Journal*. All have been in favour of articles on operational matters. The difficulty has been in obtaining the articles from very busy people and then ensuring that the articles met the required literary standard.

*Navigation News* is one of the success stories of the first Way Ahead Group. It is particularly popular with the leisure navigator. WAG 2 recommended that *Navigation News* should be used by the SIGs for popular articles and for news about meetings. WAG 2 also thought that *Navigation News* should be the interim communication vehicle for newly formed SIGs. But WAG 2 were adamant that the magazine should not become a vehicle solely for ‘church notices’. This view holds good today.

5. MEMBERSHIP. WAG 2 was disturbed to note the skewed distribution by age of the membership of the Institute (Figure 6) and considered that the failure to attract younger members must be addressed with vigour by the Officers and Council.

To encourage more younger members, WAG 2 considered a two pronged approach. There should be an annual competition for undergraduates, possibly named after a distinguished President, and a one-year free Associate status membership to instructors and graduating professional and leisure navigators at recognised training establishments. Although the annual competition for undergraduates has not yet been implemented, I know that it is under active consideration by the M&F committee. The second of the membership recommendations has been implemented and has been running for several years. Thanks to our improved membership database, we shall shortly be able to assess the cost-effectiveness of this particular recommendation.

WAG 2 spent a considerable time agonising over Associate status. If the subscription was set at 50% of the normal membership level, then for a break-even situation it is clearly necessary to obtain two Associates for each full member opting to switch to Associate status. WAG 2 expressed the view that the Institute should not

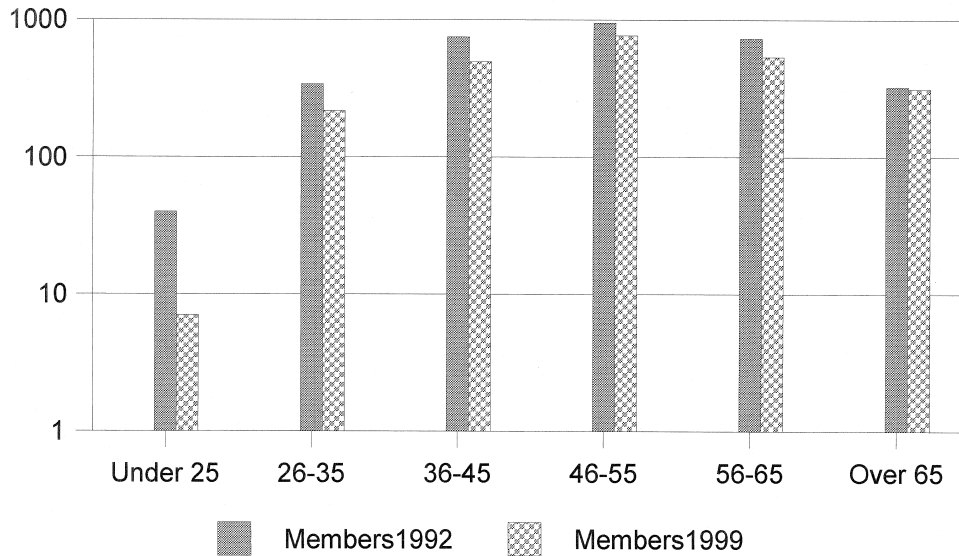


Figure 6. Age distribution of ordinary members.

go down this path. Instead, and recognising the ladder of success argument, WAG 2 recommended a uni-directional upward ladder progressing from Associate to Member to Fellow classification. WAG 2 failed to reverse the slight downward trend in membership. Although considerable effort has been put into recruiting and many new initiatives tried, this year's Annual Report shows that this effort has not really held the line. But, of course, had the effort not been made, the membership of this Institute would have fallen by 200 members each year. Pursuing Corporate membership at a time when industry is restructuring is not easy. WAG 2 knew that the Institute must convince accountants that membership would be in the commercial interests of the Company. WAG 2 therefore recommended that there should be two rates of subscription, the levels being based on the number of employees within the navigation related sector of the company concerned. Tangible benefits should also be related in quantity to the rate of subscription, the higher rate of subscription company receiving six copies of the *Journal* and *Navigation News*, and allowed to send six people to meetings of the Institute. The intangible benefits would include the presentation of bronze plaques or framed vellums, the display of company logos inside the covers of publications and at conferences. WAG 2 also recommended that a recruiting drive within the C<sup>3</sup>I software community should take place. However, pressure on the staff within the Institute has meant that this recommendation had to be placed on the back burner. I consider that the timing is now opportune to re-visit this particular recommendation.

6. CONCLUSIONS. What conclusions do I draw from this review, a review which has covered less than 70% of the items considered by WAG 2? It is that technology related to navigation and C<sup>3</sup>I continues to change at an ever-increasing rate and knows no bounds. We must keep a weather eye open for these changes, and we should look to the Chairman of the Technical Committee to advise Council on

their significance. It is then up to Council to decide whether their significance merits changing the structures within the Institute.

My personal view is that the backdrop against which WAG 2 carried out its review is still valid and will remain valid for a number of years. Therefore I would recommend that the Officers review the technology scene biennially and, when necessary, give no more than a gentle touch on the tiller. I see no need to rush into a WAG 3.