

Attitudes to Ada – A Market Survey

Management Summary

This survey was commissioned by Ada (UK) to determine what software managers and developers think of the Ada language and to establish those factors that influence the acquisition of languages.

Of the forty one people interviewed only 5 claimed no experience in buying or using the Ada language and the average personal experience was in excess of 8 years. Of the twenty eight companies involved, only one claimed no Ada experience and their average experience exceeded 11 years. The sample was a broad spread of seniority from software engineers to development directors.

On the whole Ada and the Ada vendors come out of the study rather well. The language design itself comes in for no criticism and the vendors have tended to deliver and support the compilers in a satisfactory way. On the contrary, the language is regarded as safe, reliable and robust. There are also clear indications that Ada makes a positive contribution to project success and bears almost no blame for failure.

The major drawbacks to the success of Ada are not inherent language problems. The two biggest factors cited against using the language are the high cost of the development environment and the shortage of library and tool support.

The report contains a list of volunteered comments that were recorded at the time of the interview. They are not attributable and although too diverse to summarise it is recommended that they be studied because they contain interesting additional pointers to genuine perceptions of the language market.

1. The Survey

The survey was conducted by telephone interview with at least 40 individuals using the questionnaire shown in Appendix 1 of this report. Although the questionnaire formed the basis of the interview, nearly all those interviewed readily and helpfully volunteered additional information that was recorded at the end of each questionnaire. These comments are worth studying because they provide attitudes to other languages such as C, C++ and Java. All the recorded comments are listed in Appendix 3.

The results of each interview were loaded into a spreadsheet and analysed and are presented graphically in the report.

2. The Sample

2.1 Total Interviewed

In total, 41 individuals from 28 companies were interviewed. (It should be noted here that the definition of company includes autonomous divisions, for example, Alenia Marconi Command and Information Systems Group is regarded as a different company to Alenia Marconi Simulation and Training Division). A full list of the companies contacted is given in Appendix 2.

The sample included the equivalent of:

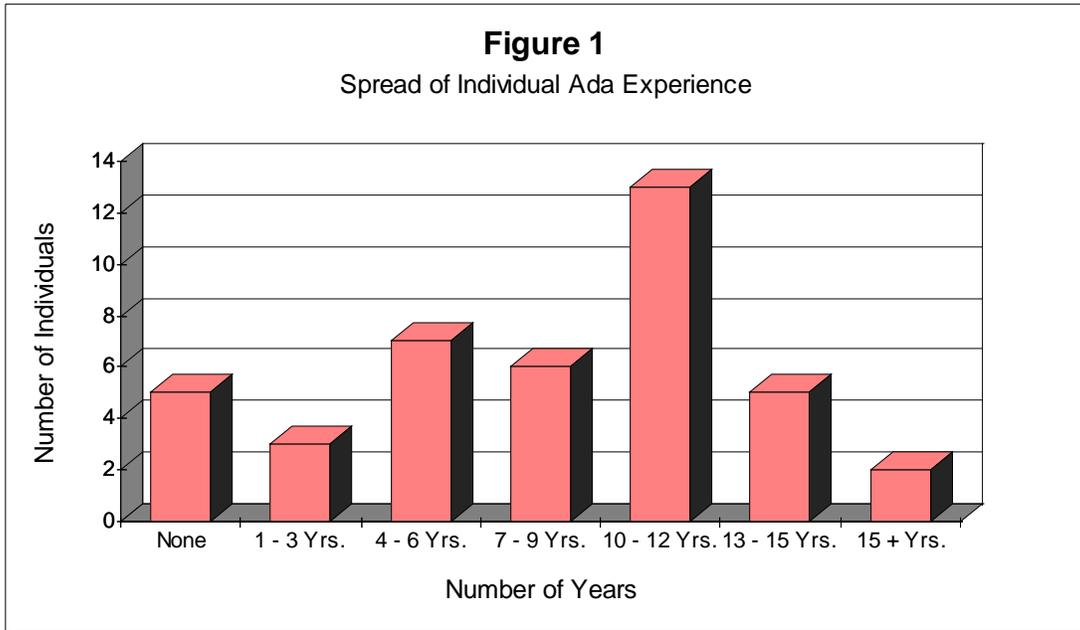
2	Technical Directors
21	Departmental Managers
8	Project Managers
3	Technical Authorities
7	Software Engineers

With this profile of seniority, it is not surprising that the survey revealed a high proportion of decision makers among those interviewed. 39 out of 41 claimed that they were involved in the decisions on language acquisition. Since the sample was drawn from contacts provided by development environment vendors this is not unexpected.

2.2 Individual Experience of Ada

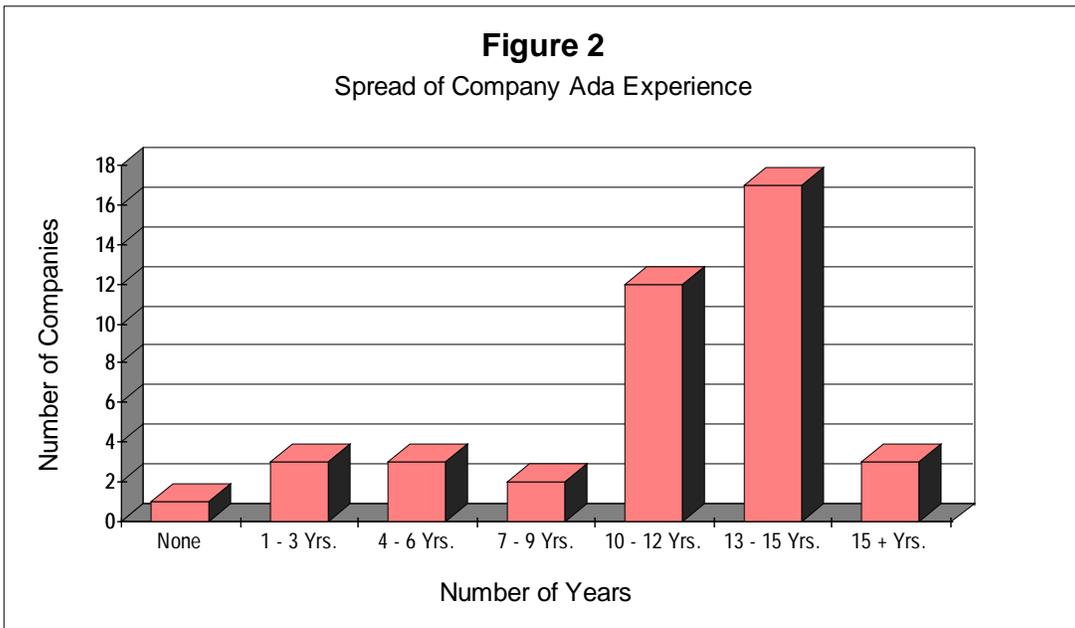
The experience of Ada refers to involvement with the language, not only in design and coding but also in purchasing Ada or running development groups using Ada. A number of the senior managers in the sample were also Ada programmers in a former life.

The sample contained a wide range of experience and knowledge of Ada from None at all through to 20 years, going back to the Stoneman proposals. Figure 1 shows the distribution of this experience among the 41 interviewees. The average individual experience of Ada was **8.34 Years**.



25 people claimed experience in Ada 83 only.
 11 people claimed experience in both Ada 83 and Ada 95.

2.3 Company Experience



The experience of the companies is inevitably far greater as demonstrated by Figure 2. However, there was still one company that claimed no experience at all. The average company experience was **11.29 Years**.

2.4 Ada 83 vs Ada 95

17 people claimed that their company to had experience of Ada 83 only.

22 people claimed that their company had experience of both Ada 83 and Ada 95.

1 person claimed that their company only had Ada 95 experience.

2.5 Prime Contractor or Subcontractor

25 people claimed that their company operated mainly as a Prime contractor.

8 said their company operated as both a Prime and a Subcontractor depending on the contract. Only 8 operated as a subcontractor.

3. Weighting the Data

The spreadsheet contains a set of weighting factors to enable analysis to be carried out by providing less weight to individuals that have less Ada experience and decision making responsibility and companies that have less Ada experience and no choice in the use of Ada.

For an individual these weightings are:

Ada Experience	Points	Decision Maker	Points
0 – 3 Yrs.	1	No	1
4 – 6 Yrs.	2	Yes	2
7 + Yrs.	3		

So for example an individual who is a decision-maker with 10 Years Ada Experience will receive a total point count (p_i) of $3 + 2 = 5$.

An individual weighting factor (w_i) is then obtained by taking the individual point count (p_i) and dividing it by the maximum point count ($\text{Max}(p_i)$), in this case 5.

$$w_i = p_i / \text{Max}(p_i)$$

For a company the weightings are:

Ada Experience	Points	Choice of Ada	Points
0 – 3 Yrs.	1	No	1
4 – 6 Yrs.	2	Yes	2
7 + Yrs.	3		

Again multiplying factors (w_c) are obtained in the same way as for an individual. So

$$w_c = p_c / \text{Max}(p_c)$$

The criterion for adjusting each survey score (S) is based on the assumption that a less skilled opinion adds less bias to a high score by scaling it down towards 3 and less bias to a low score by scaling it up towards to 3. The adjusted score S_a is given by

$$S_a = (S - 3)w + 3$$

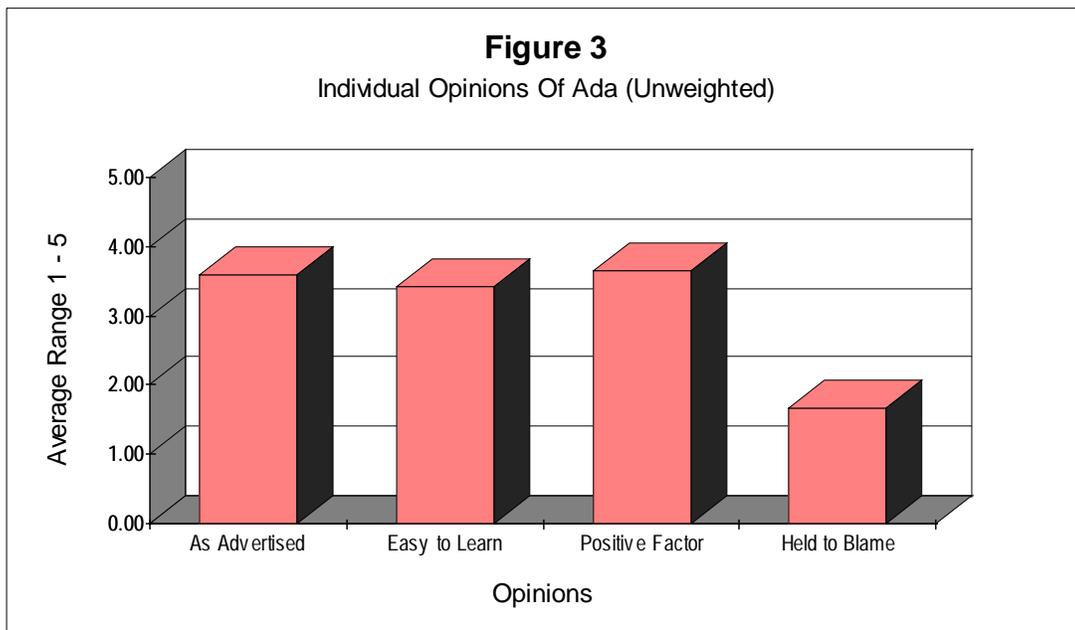
(Note that the points allocated in the tables above are provided as variables in the spreadsheet.)

4. Opinions of Ada

4.1 Areas of Opinion

The survey concentrated on four areas of opinion.

1. Did the Ada environment live up to the claims of the Ada vendors?
2. Was the Language easy to learn?
3. Did Ada contribute to the success of development projects?
4. Was Ada held to blame for project failures?



Interviewees were asked to rate their replies in the range 1 – 5. For example, to question 1 – “Did the Ada environment function as advertised ?” a response of 1 would mean “not

at all” and 5 would mean “100%”. Shades of opinion between these two extremes could be given by replying 2, 3 or 4.

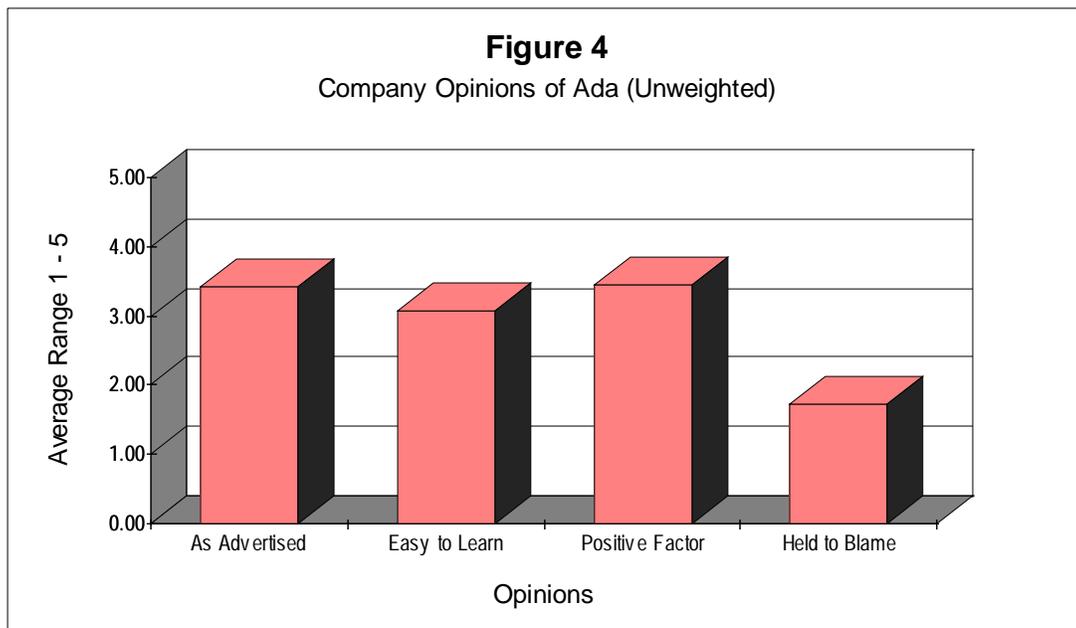
The individuals were asked for their view of their company experience as well as their own. The responses were then summed and averaged for each of the above questions and the results are shown graphically in Figure 3 for individual opinions and Figure 4 for company opinions.

4.2 Drawing Conclusions

“Do Ada environments operate as advertised?”

An average individual score of 3.61 and an average company score of 3.43 as measures of the products living up to their advertised qualities would seem disappointing on the face of it. However, bearing in mind that an extensive piece of software like an Ada compiler is not going to be perfect and therefore unlikely to attract a score of 5 (although interestingly enough there were 3 perfect individual votes and 2 perfect company votes) a score between 3 and 4 is just about satisfactory. Note that 21 individuals and 19 companies voted a 4 and on balance that’s pretty good.

Exactly why the products have not been fully endorsed by the individuals interviewed requires further research. Ada compilers should work to specification because they undergo so much independent testing so it may be dissatisfaction with the level of bugs or performance or may be the customers set higher standards for Ada than for other languages.

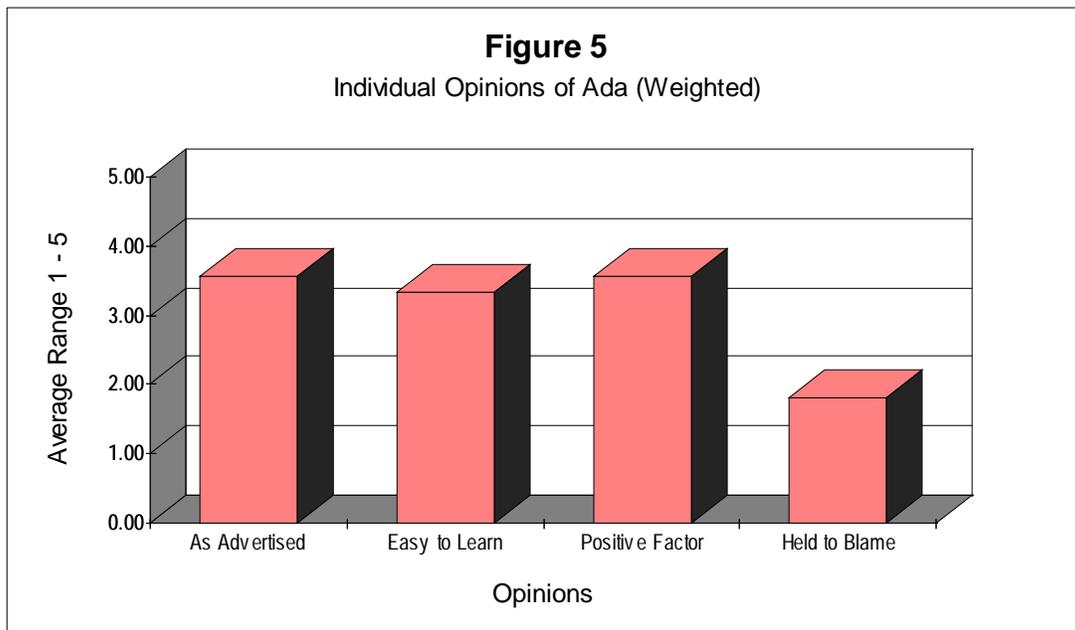


Was the language easy to learn?

An average individual score of 3.43 and an average company score of 3.08 indicates that although the language is not particularly easy to learn, to say it is hard to learn is not true. Various comments made at the time also show that it was the real time aspects of Ada that were the hardest to learn.

Was Ada a positive factor in successful projects?

An average individual score of 3.64 with 20 voting a 4 and 4 voting a 5 (in fact two thirds of those that expressed an opinion) is an impressive vote of confidence in Ada's contribution to successful projects. Two important things emerge. Firstly, the fact that a language has such an impact on project success and secondly, it is management that is saying it. The 3 opinions from the technical authorities scored even higher, 4.25. The company view, average score 3.46, was not quite so definite but still on the positive side.



Was Ada held to blame for project failure?

Looking at the other side of the coin the results are even more significant. The individual average score of 1.67 and the company average score of 1.72 speak for themselves. There were 3 or 4 opinions that Ada was in some measure to blame but this was overwhelmingly eclipsed by 21 individual and 23 company votes of 1, Ada is not in any way to blame for failure.

4.3 Weighted Opinions

Applying the weighting described earlier provides Figures 5 for individual opinions and Figure 6 for company opinions.

5. Future Practice

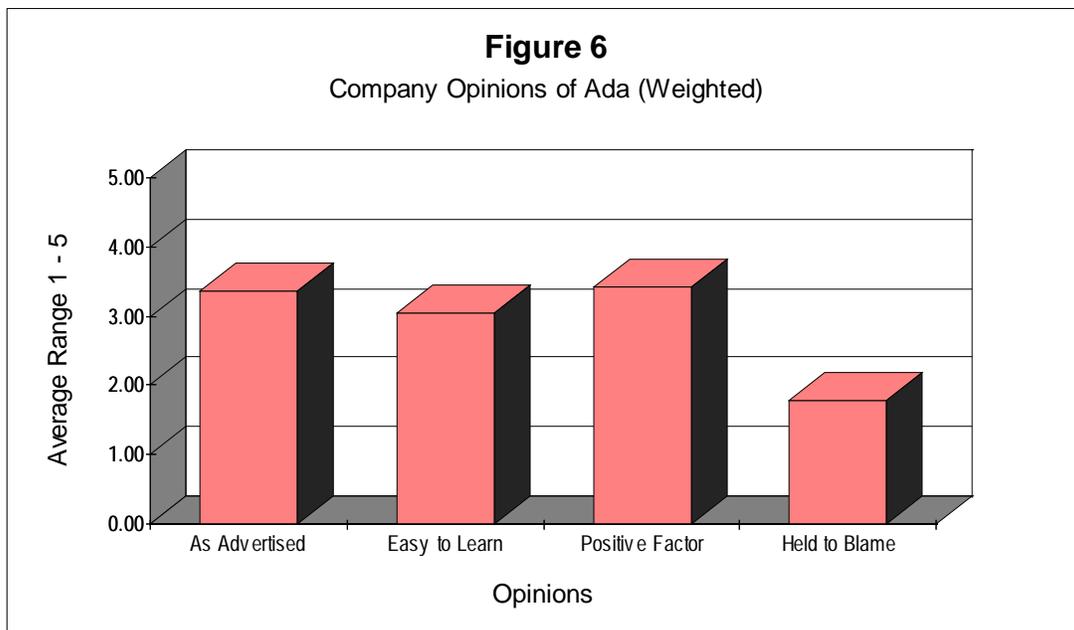
Having established the opinions of Ada the survey then went on to establish what the future practice of each company was likely to be in terms of language choice. First of all it was necessary to find out if the company felt it had a choice in the matter. Only 2 out of the 41 replies said they had no choice in the matter. In one case they were mandated in the foreseeable future to use Ada and in the other they used Ada because they liked it and saw no reasonable alternative.

The fact that the other 39 replies indicated a choice of language meant that the use of Ada is no longer mandatory and the choice of language would be made on technical merit and its suitability to the proposed development.

When asked what alternative languages would be considered three languages dominated, C, C++ and Java. In the order of mentioned future use:

C++ was referred to in 29 interviews, C had 25 mentions and Java had 9 mentions.

There was one mention of Visual Basic (!).



6. Buying Factors

6.1 The Specified Factors

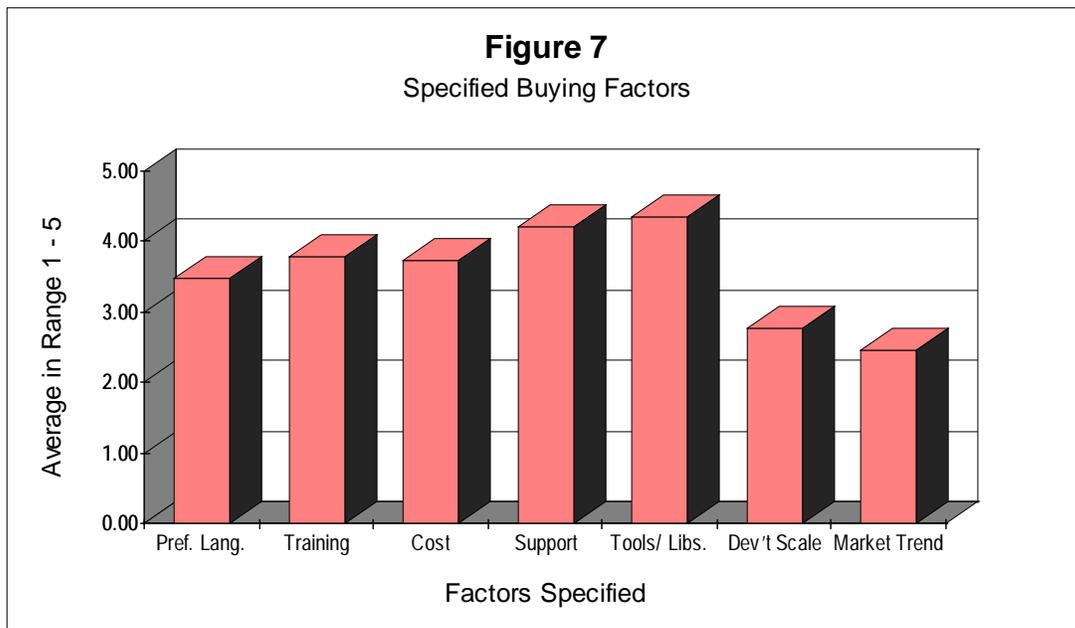
Having established opinions, the survey went on to determine the factors that are taken into consideration when choosing the appropriate language for the project. The interviewee was asked to rank a series of specified factors, again with a score in the range 1 – 5, where 1 means that the factor is not considered of much importance up to 5 which is a vital consideration. The specified factors were

1. Comfortable with a Preferred Language
2. The Availability of Trained Staff
3. The Cost of the Development Environment
4. The Availability of Long Term Support
5. The Availability of Tools and Libraries
6. The Scale of the Proposed Development
7. Market Trends

The interviewee was then invited to specify other factors of importance in the buying decision.

6.2 An Analysis of the Specified Factors

Figure 7 represents the relative importance of these factors and they are considered in order of importance.



6.3 Availability of Tools and Libraries.

An average score of 4.34 with 17 votes for 4, and 19 votes for 5, sets the need for supporting tools and libraries as the most important consideration in choosing a development environment. There was a recurring theme that C and C++ tools were more readily and cheaply available on the internet.

6.4 Long Term Support.

Another high-scoring factor with an average score of 4.20 with 13 voting 4 and 19 voting 5. This is to be expected from companies engaged in long term military and high-tech civilian projects.

6.5 Staff Training

With a rating of 3.78 the need for ready trained staff ranked third in the specified factors. There were numerous comments about the shortage of Ada trained staff particularly Ada trained graduates. More recently graduates were coming out of university trained in C, C++ and Java but not in Ada. It was also noticeable from comments made that programmers were keen to learn C, C++ and Java to broaden their career prospects but there was no such enticement to learn Ada.

6.6 Cost of the Development Environment.

Almost as important as staff availability and with a score of 3.73 the up-front investment in the development tools was an important consideration. As will be seen later in this report the cost of Ada development environments was one of the most common factors cited as a disadvantage.

6.6 Comfortable with a Preferred Language

An average score of 3.46 and 21 votes of 4 and 3 votes of 5 indicates how important having a preferred language is thought to be.

6.7 Scale of Development

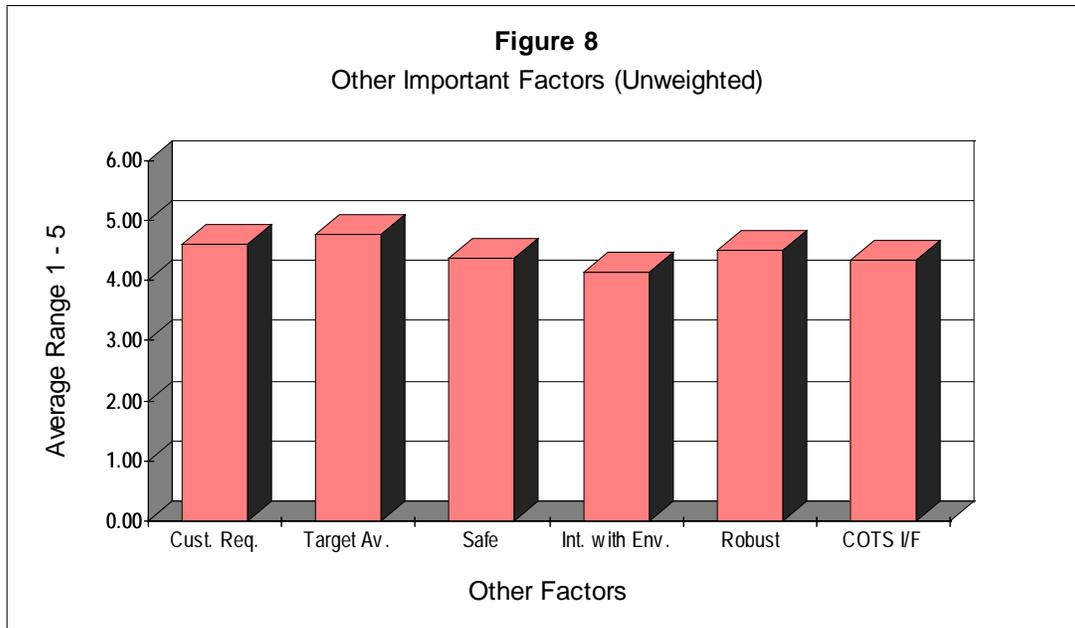
Not regarded as an important factor. An average score of 2.78 and 21 votes of 2 means that the ability of Ada to cope with large developments is not perceived as important.

6.8 Market Trends

Following the market direction did not appear to be an important factor, average score 2.46. Most interviewees downplayed the influence of market trends and emphasised that choice was made on the technical merits of the language and its supporting systems. However, tool and library developers tend to follow market directions for good marketing reasons so, in a way, the fashionable languages tend to attract good supporting tools and libraries.

From various comments made it was clear that a programmer's career prospects also depend on learning fashionable languages and so training establishments and universities tend to turn out C and Java programmers. Bearing in mind that the highest and third highest rated factors are tool/library support and availability of trained staff it is

inevitable that developers are influenced by market direction even though may not explicitly say so.



6.9 An Analysis of Other Factors

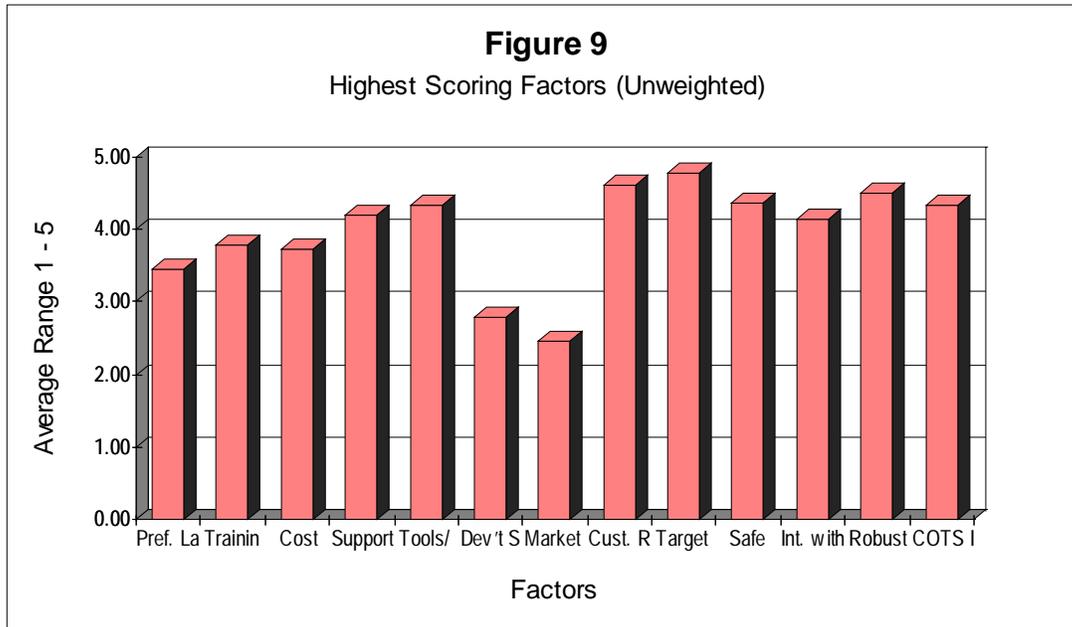
The questionnaire offered an opportunity to all interviewees to provide additional factors that were important in buying development systems. These were many and varied and they have been collected into 25 categories and entered into the spreadsheet. In order of importance, based on total number of votes, with the most important at the top, these factors are listed below.

The top 6 were voted for by more than 2 individuals.

Other Buying Factors		Total Votes
1.	Customer Requirement.	46
2.	Availability of language on chosen target.	43
3.	Support for Safety Critical Systems.	35
4.	Integration with other Environments.	29
5.	Robustness and Integrity	27
6.	Interface to COTS products	13

The average scores of these factors are shown in figure 8.

The comparison of the average scores of these top 6 factors with the specified factors is shown in Figure 9.



The next 19 factors were voted for by only 1 or 2 interviewed.

7.	Real Time Support	10
8.	Reusability of code	9
9.	Support of the design methods	8
10.	Efficiency of generated code	8
11.	Maintainability	7
12.	Total cost of ownership	5
13.	Portability	5
14.	Fashion	5
15.	Stability of the language definition	5
16.	Automatically Generated Source Code	4
17.	Life expectancy of the language	4
18.	Strong Typing	4
19.	Tailorable Run Time Systems	4
20.	Aerospace Vendor	4
21.	Productivity	4
22.	Availability of existing code	4
23.	Number of Vendors to choose from	4
24.	Speed of tools (e.g. editors etc.)	3
25.	Availability of training	3

7. Factors For and Against Ada

The interview went on to ask what particular factors would swing the buyer towards or away from Ada.

7.1 Factors in Favour of using Ada

The responses were many and various and they are listed below:

Factors in Favour of Ada		Total Votes
1.	Reliability and Robustness	8
2.	Customer Requirement	4
3.	Support for Real Time/Concurrency	4
4.	Availability of a Safe Subset	3
5.	Readability/Ease of use	3
6.	Language Structure/Modularity	2
7.	Readability	2
8.	Reusability of Code/Portability	2
9.	Strong Typing	1
10.	Integrity of Compilation	1
11.	Certification/Formal Language	1
12.	Low through-life costs	1

7.2 Factors Against the use of Ada

Factors against Ada		Total Votes
1.	Cost of the Development Environment	15
2.	Lack of Tool Support	8
3.	Lack of Support	3
4.	Not fashionable for programmers	3
5.	Lack of availability for Platforms/Targets	3
6.	Lack of Skilled Staff	2
7.	Lack of Vendors	2
8.	Lack of COTS/Graphical I/F	2
9.	Poor Run Time code	1
10.	Run Time Licenses	1
11.	Size of Language	1
12.	Unsuitable for Small Programs	1
13.	Unsuitable for Low Level Coding	1

8. Comments from the Interviews

As part of the interview each individual was invited to make comments outside of the formal mechanism of the questionnaire. These comments were quite revealing and they can be found recorded at the end of each questionnaire. The individual questionnaires are not appended here, however, the comments have been collected in no particular sequence in Appendix 3.

It can be seen that there is almost no criticism of the language itself, on the contrary, it has many supporters. It is essential for mission and safety critical development and the availability of a useful safe subset was mentioned as a welcome initiative.

C and C++ seem to be the most popular choice because of the availability of a wide range of cheap tools and libraries and of trained staff. However, there is a distinct lack of comment about C and C++ as a good and reliable language and in some cases there is criticism, particularly its suitability as a safe language.

The comments, though, reinforce the clear message that comes out of the survey. Ada is too expensive and lacks supporting tools and libraries and there is a shortage of Ada trained staff. In addition, there are only a small number of vendors and Ada compilers are not available for the many host and targets that are being used by the developers.

Appendix 1
The Questionnaire

Name:

Organisation:

Date:

1.1 EXPERIENCE OF ADA

1.1.1 How many years experience have you personally had of the Ada Language?

And in What Particular Role?

Has this experience been with Ada 83, Ada 95 or both?

1.2.1 How many years experience has your current company had of the Ada Language?

Has this been as a prime contractor or a sub-contractor?

Has the experience of your company been with Ada 83, Ada 95 or both?

1.2 OPINIONS OF THE ADA ENVIRONMENT

1.2.1 From your Personal Viewpoint based on past experience: 1 2 3 4 5
On a Range 1 – 5 where 1 means No and 5 Yes did the Ada Environment function as advertised?

On a Range 1 – 5 where 1 means Hard and 5 means Easy Was the Language Hard or Easy to learn?

If the project was a success and On a Range 1 – 5 where 1 means No and 5 means Yes was the choice of Ada a positive Factor?

If the project was not a success and On a Range 1 – 5 where 1 means No and 5 means Yes was the choice of Ada held to blame?

1.2.2 From your Organisations Viewpoint based on past experience: 1 2 3 4 5

On a Range 1 – 5 where 1 means No and 5 Yes did the Ada Environment function as advertised?

On a Range 1 – 5 where 1 means Hard and 5 means Easy Was the Language Hard or Easy to learn?

If the project was a success and On a Range 1 – 5 where 1 means No and 5 means Yes was the choice of Ada a positive Factor?

If the project was not a success and On a Range 1 – 5 where 1 means No and 5 means Yes was the choice of Ada held to blame?

2. OPINIONS OF ADA LIKELY TO AFFECT FUTURE PRACTICE

2.1 Considering future projects, is it likely that there will be a choice of Ada or other languages?

2.2 If the answer above is **NO** Please specify reason(s):

2.2.1 Is the Customer dictating the choice? (Can you name the Customer?)

Is the Language not a factor of choice for the hardware environment already selected. (e.g. only one compiler available for target)

What other reasons? (specify)

2.2.2 Is Ada or some other language to be used? If so which?

2.3 If the answer above is **YES** will you personally be involved in the decision?

2.3.1 On a Range 1 – 5 where 1 means Not much and 5 means A lot, Which Factors will/would most affect your choice?

1 2 3 4 5

‘Feel Comfortable’ with preferred language

Availability of ready-trained staff

Cost of Development Environment

Need for Long Term Support

Availability of supporting tools/libraries

Perceived scale of Development

Perceived Direction of marketplace

Other (Please Specify)

2.3.2 Which Factor would most swing you towards Ada?

2.3.3 Which Factor would most swing you against Ada?

Appendix 2

Companies Contacted

Airsys ATM
Alenia Marconi Systems Ltd., Command & Information Systems
Alenia Marconi Systems Ltd., Dynamics Division
Alenia Marconi Systems Ltd., Simulation and Training Division
Alenia Marconi Systems, Donibristle
Alenia Marconi, Strategic Systems Ltd.
Alstom Signalling Ltd.
BAe Defence Systems
BAe Military Aircraft
Datel Defence Ltd.
Datel Technology Ltd.
DSaS Data Systems and Solutions
EDS, Defence Systems Division
GEC plc, Stanmore
Logica plc
Logica, Defence and Civil Government
Marconi Avionics Ltd., Stanmore
Marconi Avionics, Edinburgh
Marconi Avionics, Radar and Countermeasures Systems
Marconi Avionics, Rochester
Marconi Communications Ltd.
Marconi Underwater Weapons
Matra BAe Dynamics
Matra Marconi Space UK Ltd.
Meggitt Avionics
Rolls Royce Aero-Engines
Smiths Industries
Ultra Electronics

Appendix 3

Comments from Completed Questionnaires

They use C, C++ because richer availability of tools and targets. More COTS use, seem to be less graduates trained in Ada. Not employing OOD at the moment some years ahead. Not influenced by future market trends because their product development will remain in current language.

Ada is perceived as a dying language by most software engineers. Difficult to recruit Ada programmers. C++ is the other language most likely to be used in future.

Reliability and Integrity of Ada is well recognised. C++ has never really gained acceptance in this respect. Ada is excellent for safety criticality not C++. Tool suppliers are expensive though. It is doubtful that Java will become a safety critical language.

Chosen C++ because of tools availability. Could not use Ada with current generation of object-oriented tools because the better tools have no plans to support Ada.

Cost of Environment + run times + maintenance makes project expensive and offsets added value of using the language. Less and less Ada skills available in market. C, C++ skills more available.

Company chooses between C++ and Ada. Ada is more productive but cost of environment prohibitive. Sometimes Compiler not transferred to new operating systems (eg Digital).

Upfront cost causing a move away from Ada. Not enough tools available "in your face" as with C, C++, Java. Therefore staff not keen to use Ada.

Moving towards Windows NT. Ada vs C++ in his company. C++ more available on Windows NT. Ada benefits include ease of integration and removal of bugs at compile time. Ada front ends are sound but i/f to third party software causes problems. PC's bring lower pricing.

Product reliability is most important and strong typing is essential. C, C++ not as good but programmers see it as career language. Some customers insist on C, C++ because they expect to receive the source code and engineers are in short supply. Use Greenhills/VxWorks because it is cheaper.

Very impressed with the work that's gone into Ada 95. Management needs encouraging to use Ada.

Cost of Ada environment too heavy, eg has paid a large sum for TI C40 compiler and must pay again for a TIC32 target. Run times also expensive. So going to C. Staff availability also a problem. Graduates know C and Java.

Would not use Ada by choice, prefer C, moving to C++. Ada is high cost and lacks Libraries and Tolls. However, would use Ada if customer demanded it. Cannot see Java replacing C++.

The need for commonality in the Avionics business means that the customer dictates the choice of Ada.

Personal experience of Ada good, not so good with vendors. Likes to use legacy code where possible. Prefers COTS Run times eg VXWorks. Will use C if special or awkward shape processor card and sizeable production run. Ada and C have similar productivity.

Moving away from Ada because lack of availability on certain platforms. Moving towards C++ which they find satisfactory and customers are requiring it.

Methods must be separated from Languages. Ada 95 supports OOD well. Tool support better in Java. C++ is a hackers language. Future may be Java Shells with C inside. Languages should provide additional support to the Project Manager e.g. measurement, defect rates etc.

C doesn't find favour because it does not easily fit with Mascot Design methods (eg tasking and need for generics). There are vast libraries for C++ but likes Ada 95 and is particularly impressed with the recent Ada safe subset.

Cost of buying the environment prohibitive in Ada particularly when the target is changed. Personally likes Ada 95, finds OO implementation awkward. Tools supplied don't fit as easily with Ada as C. Java being considered but immature and not well controlled.

Company putting on him pressure to use C.

Ada is essential for mission and safety critical software. C is better for bread and butter small programs. Shortage of trained staff means that contracting programmers charge a high price.

C, C++ being enhanced to support Mascot structures. C++ not safe enough yet. Java needs more time.

The choice of language was driven by the nature of the application and the nature of the target processor. A well defined stable language was also considered important. Availability of training also important.

Quality of generated target code is important. Also would be attracted to a design system that generated C, C++ source.

Ada not fashionable any more. Delphi and Java more so. Young programmers learning Java. But Java does not yet have supporting environments. Java close to Stoneman Requirements.

Safety criticality is most important. Just reviewing Java as a real time language now.

Ada shines with the larger projects. Use of COTS and graphical I/F's may affect choice. Space use special chips (SPARC 7 variant?) which restrict availability of Ada. Pressure to use C++. Choice of language is based on technical merit not market trends although they are concerned that Ada is not increasing in popularity.

Not an Ada user. Use C, C++ because of availability of tools and targets covered. Java not mature enough. Concerned about availability of trained staff. Portability not a big issue.

Ada's future doesn't look good because of market forces. Will the Ada market sustain the development of tools required?

Ada was the engineering choice in one instance for Air Traffic Control Application but customer refused because too much investment in another language. Languages of the future must be complete. (Not like Pascal, for example which had no I/O).

C should be banned. His current Ada compiler is superb. Likes Ada because of its safeness as a language eg. Readability, maintainability, coverage etc.

Company moving away from Ada towards C++ because of cost. He believes that Ada has advantages over most languages. Some programmers regard Ada as not "wizzy" enough.

Interested in bindings to underlying architectures. Uses C, C++ and considering Java. Mandate for Ada is less strong.

Customers like MoD moving away from Ada. But he would choose Ada if they had the choice. Ada market is declining. Increasingly more difficult to find Ada trained staff.

