NATIONAL AUDIT OFFICE

Report by the
Comptroller and Auditor General

Ministry of Defence

# Training new pilots


HC 880 Session 1999-2000
14 September 2000

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*John Bourn*
Comptroller and Auditor General

National Audit Office
27 July 2000

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For further information about the National Audit Office please contact:

National Audit Office
Press Office
157-197 Buckingham Palace Road
Victoria
London
SW1W 9SP

Tel: 020-7798 7400

email: enquiries@nao.gsi.gov.uk

Web site address: www.nao.gov.uk

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# Executive summary

## Introduction

**1** The Ministry of Defence (the Department) need pilots for aircraft flown by each Armed Service: helicopters for the Army; helicopters and fast jets for the Royal Navy; and helicopters, fast jets and multi-engine aircraft for the Royal Air Force. Training new pilots is a complex process involving: the recruitment and selection of trainees; the delivery of training courses, from the first lessons in a single engine propeller aircraft to operational training ensuring that front line pilots are combat ready; and the deployment and career management of trained pilots. Figure 1 shows this process together with the various influences on the training pipeline. This report focuses on the initial stages of pilot training – from elementary training to the transfer of pilots to their individual Services for operational training.

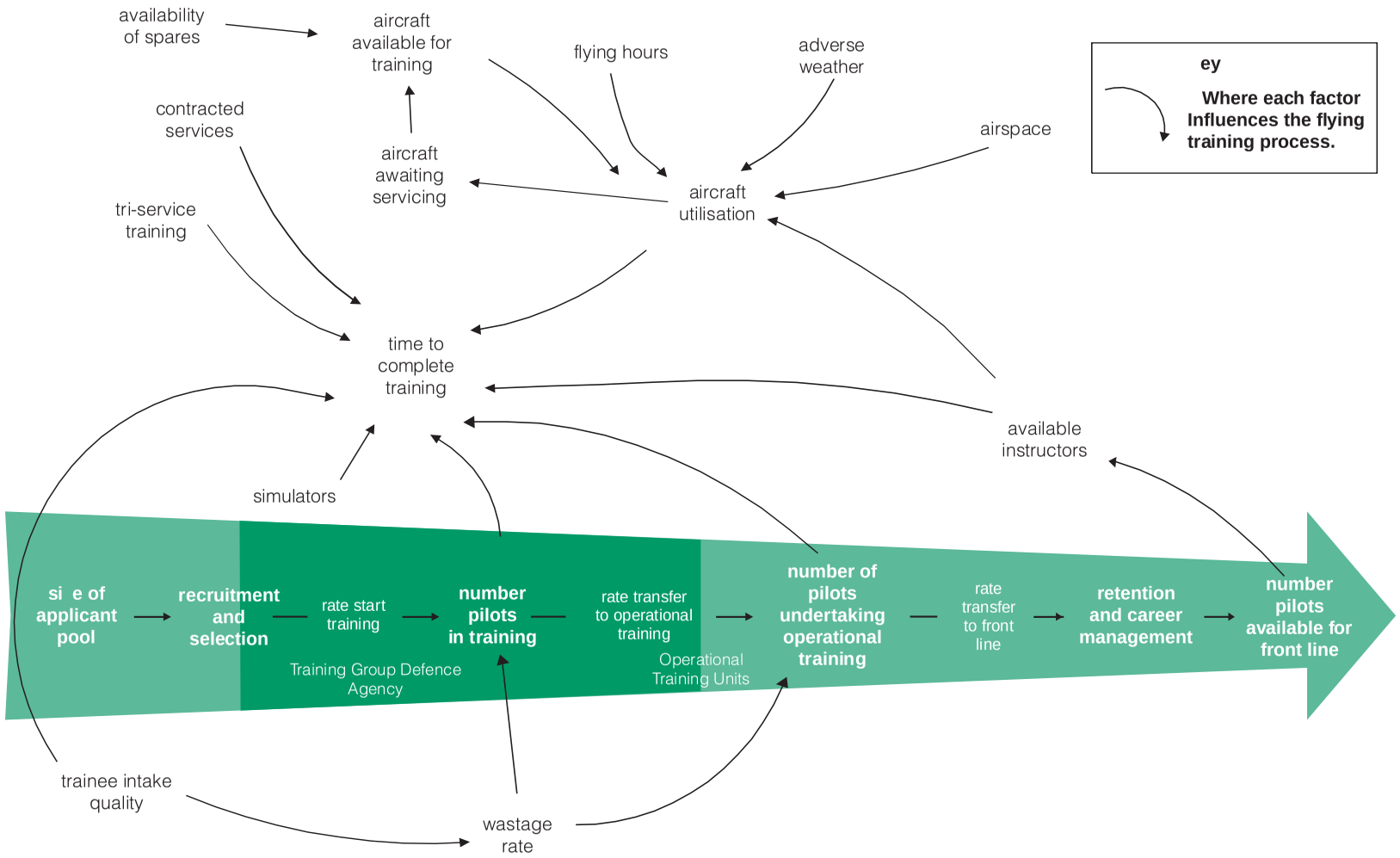
**2** Initial pilot training is handled by the Department's Training Group Defence Agency for all three Services. Pilot training is staged, with all trainees undertaking elementary flying training, following which Royal Air Force and Royal Navy trainees are streamed, according to their assessed aptitude – the Army require helicopter pilots only. Trainees then receive further training dedicated to their aircraft types – fast jets, helicopters and multi-engine aircraft. Individual Services then take responsibility for operational training – when new pilots are trained to fly specific front-line aircraft.

**3** During the five years from 1994-95 to 1998-99, the Services needed some 250 new pilots each year. This figure is set to increase to some 290 in 2001-02. In recent years, the Agency have trained fewer pilots than Service staffing plans indicated were necessary, and some 45 a year (18 per cent) fewer than needed have entered operational service after operational training. This shortfall has in part contributed to an overall shortfall in operational pilots - the retention of pilots is another important factor - and is particularly severe for the stock of fast jet pilots. On present plans, a shortfall in such pilots will continue until 2012, even if output of new pilots meets targets every year. The numbers of trainees entering the training pipeline have broadly met targets but at times during the 1990s there have been severe blockages in the pipeline and the time taken to train pilots has increased.

**Figure 1**

**The major processes influencing pilot training**

*Our study centres on the Agency and Operational Training Unit management of pilot training, but considers broader recruitment selection and retention issues as they affect pilot training.*



**4** Departmental costing systems do not readily identify the costs of flying training, nor the relative importance of the various cost elements. Our analysis of the Department's data estimates the overall cost of initial pilot training in 1998-99 to be some £280 million, with operational training an additional cost. Despite difficulties in achieving targets for new pilots, the Agency have had to contribute to the efficiency savings demanded of the Department as a whole – in the five years to 1998-99 the Agency have reported savings of £50 million against a target of £41 million.

**5** In view of these circumstances, we looked further at the following main issues:

- **recruitment, selection and overall success rates:** the process of delivering new pilots embraces more than just the training activity, it includes general activities such as recruitment, as well as specific selections for pilot training and progression through the stages, which contribute to overall performance. This Part of the report therefore looks at the effectiveness of these activities from the perspective of subsequent pilot training outcomes;

- **fast jet training:** we selected the training of fast jet pilots as a case study because of the combination of a shortfall in desired output and the high cost of this stream of training. The focus on fast jets enabled us to generate better cost and activity data, and to link initial training with subsequent operational training and deployment;

- **managing for quality:** the training process has had to deliver pilots of the right quality while making savings. This Part looks at management measures taken to promote quality and efficiency, including joint-Service initiatives, which contain an element of both quality and efficiency improvement.

## Recruitment, selection and overall success

**6** Recruitment arrangements in the round lie outside the scope of this report but we examined those aspects of recruitment and selection which bear directly on flying training. Trainee pilots may be direct officer recruits, selected serving officers or, in the case of the Army or Royal Marines, selected non-commissioned officers. All Services, however, apply the Agency's aptitude tests as part of their trainee pilot selection processes. While aptitude tests are designed to predict success during elementary training, we found that there was a strong correlation

between higher aptitude test scores and greater likelihood of subsequent success in pilot training. However, there was only a small absolute difference in success rates between very high aptitude test scores and much lower scores. In taking forward their aptitude tests there would be benefits if the tests could discriminate more clearly between those candidates who are likely to do well in future pilot training. We also noted that other countries have developed psychometric testing to help evaluate candidates' fighting instincts.

**7** All Services use direct experience of flying as part of their selection process, to some degree. Royal Navy and Army trainees have 13 hours of flying experience after which they are graded, with the best trainees moving on to elementary training. The Royal Air Force take trainee pilots either after around 90 hours of flying at University Air Squadrons, or from direct recruitment, when candidates often have little or no flying experience, although some candidates may have Air Training Corps experience.

**8** Different approaches led to different results. 12 per cent of Royal Navy candidates failed the flying grading element of selection. The corresponding figure for the Army was 64 per cent – in part because the Army select from a broad range of Service personnel and they place greater weight on grading rather than aptitude testing. But Army wastage rates at later stages of helicopter training remained higher than for the other Services. During elementary flying training the wastage rate for Royal Air Force direct entrant trainees was marginally higher than for the other Services who include flying as part of their selection process. Royal Air Force University Air Squadron trainees were more successful at providing premium fast jet pilots than the direct entrant route, but by less of a margin than targeted – providing 55 per cent of fast jet pilots rather than 70 per cent.

**9** Although wastage rates have reduced overall, and in some areas such as operational training are less than the expected rates used for planning purposes, they remain stubbornly high for fast jet trainees (Figure 2). Comparisons with overseas countries are complicated by differences in standards and processes. But indications are that overall wastage is in line with that in, for example, the United States and Canada.

**Wastage rates during pilot training 1997-98 and 1998-99**

**Figure 2**

*While actual wastage on most courses is less than planned, wastage rates in fast jet training are substantially higher than for other aircraft streams.*

| Type of Training/Aircraft Stream | Joint Elementary Flying Training: 5.8 (15)[1] | | |
|---|---|---|---|
| | Basic | Advanced | Operational |
| | % | % | % |
| Fast Jet | 17.6 (17) | 21.7 (25) | 6.5 (10) |
| Helicopter | 6.0 (6) | 4.1 (9) | 0.4 (3) |
| Multi Engine | 0.0 (NA[2]) | 1.8 (10) | 1.3 (10) |

Notes: 1. Figures in brackets are planned wastage rates.

2. The Multi Engine basic course was introduced in 1997 and the Agency do not yet have a planned wastage rate.

## Fast jet training

**10** We looked to see why there was a shortfall in new pilots in our case study of fast jet training. We found that the reasons for the shortfall centred on the increased length of time taken for pilots to reach operational status - some 5.5 years down from a peak of 6.0 years in 1997-98 compared with just over three years planned, (and which was achieved in the early 1990s) - rather than factors such as recruitment or wastage during training, which have been at or better than planned values. That increase in elapsed time in part reflected factors internal to the training process, such as difficulty in obtaining sufficient qualified instructors, and securing available aircraft and facilities. But in part training delays also reflected external decisions, such as those on commitments to operations, which reduced the pool of qualified pilots to act as instructors. And cuts to Operational Training Units reflected a reduction in the size of the Royal Air Force, even though the number of trainees already in the system was appropriate to its former size. The reduced front line meant that newly trained pilots could not be absorbed, leading in turn to backlogs in the training pipeline and the need for refresher training. A lack of coherence in planning meant that the impact of actions in one part of the training system was not fully appreciated for the system as a whole operating beyond the boundaries of the Agency.

**11** We analysed the cost of fast jet training, the most expensive stream of training, in more detail. That analysis suggested that the cost of training flying instructors was the largest single component (30 per cent), and that the actual training courses made up some 29 per cent of cost. We estimated that wastage, the need to fly more hours than planned (in part as a result of simulators not being available), and costs due to delays in moving trainees through the system contributed 27 per cent to the unit cost of a successful trainee of some £3.8 million.

**12** The costs of operational training are dependent on the particular front line aircraft to which a trainee is assigned. But, because front-line aircraft are more expensive to operate than training aircraft, the cost of such training is significant. As an illustration, we estimate that the cost of an operational training course for a Tornado GR1 pilot adds some £1.9 million to the £3.8 million unit cost of their initial flying training.

**13** Finally, we looked for a measure of the significance of the shortfall in new operational fast jet pilots. Valuing the shortfall as the cost of an operational Tornado GR1 (comprising the flying hours expected of an operational pilot and the cost of maintaining and operating one aircraft), we estimate the cost to be £6 million annually for each vacancy. While this is a crude figure, it shows clearly that the economic effects in one year of a failure to produce a pilot are of the same order as the total training cost of a new pilot. Of course, small numbers of pilot shortages do not mean that the aircraft fleet will be under-utilised and the Department are managing the current shortages of fast jet pilots such that there are no gaps on front line squadrons. Indeed the Department have been able to maintain their operational commitments, in part by increasing the frequency of deployments of trained pilots. There are, however, longer-term consequences as 'over-stretch' may well affect morale and add to the difficulties of retaining trained pilots.

## Managing for quality and efficiency

**14** United Kingdom military pilots enjoy a high reputation internationally, a fact confirmed during our consultation with overseas colleagues and in the performance of United Kingdom pilots in international operations, exercises and competitions. The quality of their initial training has clearly played a part in that outcome. In the past output quality standards throughout the training pipeline have been unclear, but the Agency have made recent progress on agreeing standards for the various aircraft streams and customers. In March 2000 the Agency agreed output standards with Royal Air Force fast jet customers and they expect to agree standards for other aircraft in 2000-01, establishing service level agreements with Royal Navy and Army customers by September 2000.

**15** There are, nevertheless, aspects of the training system which do not sufficiently grip quality issues. The quality target for the Agency is poorly formulated and there has been no credible mechanism for obtaining customer views of quality achieved. The Agency are, however, developing new arrangements for tracking quality. Our survey of Operational Training Units suggests that there are several areas meriting attention. The majority of units considered that the quality of trainees was lower than in the past and that there

were shortfalls in some skills levels. Without clear output standards it is difficult to determine whether these perceptions are firmly evidenced or whether they reflect 'output creep' - a ratcheting up of expectations. An indication of the quality of initial pilot training might be provided by the extent to which Operational Training Units undertake additional training - but the Department do not collect these data.

**16** Similarly, targets for outputs were not in place for all of the Agency's customers, and their 'efficiency target', which they have achieved in recent years, takes the form of a simple economy target - to make savings on expenditure. There is no efficiency measure in place which brings inputs and outputs together. More generally, there is no clear string of customer/supplier agreements running through from recruitment to final output of a trained, operational pilot.

**17** Some of the weaknesses evident in setting targets also show through in other initiatives. The Agency have pursued a variety of site rationalisation and contractorisation projects with mixed results. Weaknesses in specification of services and contract monitoring and enforcement have cost the Department output and money. And similar weaknesses in planning have meant that the implications of site rationalisation were not fully understood, with the result that fewer sites have been sold than planned, and some initially closed have had to be re-opened. Overall, however, contractorisation and rationalisation have contributed towards improved efficiency, if not on the scale originally envisaged.

**18** On more general management matters, the Agency have vigorously pursued a number of externally-framed management initiatives, such as participation in the Public Sector Benchmarking Project and assessment against the European Foundation for Quality Management Business Excellence Model, as well as obtaining ISO 9000 and 'Investor in People' accreditation. Assessment against the business excellence model shows that there is scope for improvement in the management of the Agency, achievement of which is addressed in the Agency's business improvement plan. We welcome the efforts made to assess the quality of management by reference to external benchmarks, and to pursue improvements according to the results of the comparison.

# Recommendations

## On recruitment and selection and the numbers of pilots

**19** While the current recruitment and selection systems deliver candidates in the planned number and overall wastage is less than plans allow for, the training pipeline delivers fewer pilots than required. There is scope for rationalisation of approaches between Services, and improvement of the various mechanisms employed, to help achieve overall requirements for new pilots. The Department should:

- review the way aptitude tests and the grading of trainees following direct experience of flying are applied across the Services, to ensure that best value is obtained from the existing, relatively cost-effective, aptitude tests;

- explore the scope to improve aptitude tests' ability to discriminate between the capabilities required of fast jet, helicopter and multi-engine pilots, to facilitate early and accurate decisions on streaming of trainees; and

- in the light of variation between forecast and actual wastage rates, review planning assumptions which inform the numbers of trainees required.

## On training activity

**20** Training a new pilot takes over three years even in ideal conditions, and involves several stages, and many different trainers and training facilities. And there are many different ways of achieving the same outcomes. In these circumstances, the quality of management information, and the incentives to act on it, are crucial to providing cost-effective training. To improve current arrangements, the Department should:

- ensure that information on training activity, and the performance of trainees, trainers, and facilities, is collected in a standardised way, and made readily accessible, so that analysis of training activity is facilitated;

- recognise the importance of the elapsed time taken for a trainee to qualify, and include elapsed time in monitoring of training performance;

- improve the system for capturing the costs of training, and their major elements, so that monitoring of cost-effectiveness can be attempted, and analysis of possible improvements is more soundly based;

- ensure that current initiatives to set formal output standards for the various stages and types of flying training are quickly brought to fruition, and extended to all stages, streams and customers; and

- make sure that the interactions between activities, resources, standards and outputs are recognised and accurately reflected in analysis which captures the effects on the system as a whole, of varying a given element within it.

## On management of the training system and resources

**21** The training system involves many different stakeholders in public and private sectors, and consumes significant resources - in current and capital terms. Managing a complex system on this scale places a particular strain on the overall coherence of management actions and on the accuracy of planning and project implementation. The Department should improve their performance in these areas by:

- making sure that the customer/provider logic of current arrangements is more fully and consistently applied through the training system, both within the Agency and between the Agency and their suppliers, contractors and colleagues who deal with operational training;

- ensure that the targets set at various stages reflect overall targets and objectives, have a common format, and are soundly based on analysis of current and potential performance;

- revitalise arrangements which provide customer input to target setting and performance monitoring, and charge the 'owner' with more active review of training system performance as a whole;

- continue with current Agency quality management initiatives, to help consolidate and improve the professionalism of Agency management, and consider extending that approach to all elements of the system, to promote a uniform management culture;

- consider the prospects for greater commonality of content and joint delivery of Elementary Flying Training, which should offer cost and operational benefits; and

- make important services to training management, such as contracts expertise, both accessible and responsive, and ensure that local managers who monitor contractors' performance are in full possession of contractual details.

## Concluding comments

**22** The process of training new pilots is complicated and resource-intensive, and must be viewed as a whole if best value for money is to be achieved. Even small changes to the system can result in wasted effort, or money, if those changes have not been set in the context of the overall process. For example, a change to training aircraft maintenance contracts to incentivise higher aircraft availability can result in nugatory payments, even when customers are desperate for more pilots, if there are not sufficient trainees, instructors and airspace to make use of that extra resource. The Department should look at possibilities for making existing arrangements, already drawn together to a good degree in the Training Group Defence Agency, more coherent. They should:

- review the boundaries between personnel commands, the Agency, and operational commands, to ensure they are sensibly drawn, and that a consistent approach to training is maintained across any boundaries;

- make sure adequate information is available to support decision on change, and that analysis covers the full range of implications of change, and known disturbances to the system - such as, for example, the effects of deployments on instructor availability; and

- develop an outline model of the pilot training system, drawing on our work in Figure 1 and Appendix 2, to facilitate understanding of the interactions and dynamics of the system, and to refine the indicators and targets used to manage pilot training.

**23** Moves in this direction should help the Department achieve full value from the resources committed, and from projects undertaken, while also enabling management to form a clearer view on the overall efficiency of the system, and the adequacy of its resourcing. Overall, pilot training has to be seen as part of a

continuous process with a series of customer/supplier relationships crossing commands and all three Services, covering trainee numbers, timetables and quality standards. The output from one stage of training provides the input to the next stage and if an holistic view is not maintained, there is a risk that changes in one stage of training will impact adversely on later, more costly stages of training.

# Part 1: Management responsibilities for training new pilots

## Introduction

**1.1** Each of the three Armed Services operate aircraft in a variety of different roles (Figure 3). In recent years the Department have established joint-Service arrangements for initial pilot training. The Training Group Defence Agency (the Agency), part of Personnel and Training Command, are responsible for this initial training. Trainees then undertake advanced and operational training, run by the three Services, where they are taught how to operate their front line aircraft. It is only when pilots have successfully completed their operational training that they are available for front line operations and are combat ready. And for some Royal Air Force fast jet units it may take a further 12 months after posting for pilots to be assessed as combat ready.

**Figure 3**

**The major roles undertaken by pilots for the Armed Services**

*The Royal Navy and Royal Air Force require fast jet pilots and all three Services require helicopter pilots.*

| Royal Navy | Army | Royal Air Force |
|---|---|---|
| Single seat **fast jet** pilots flying fighter and attack aircraft primarily from aircraft carriers | | Single and two seat **fast jet** pilots flying fighter and ground attack aircraft primarily from land bases with occasional deployment to aircraft carriers |
| **Helicopter** pilots operating combat helicopters from aircraft carriers and major warships undertaking anti-ship, anti-submarine and airborne early warning roles. Also operating utility helicopters for transport and search and rescue | **Helicopter** pilots operating battlefield anti-tank helicopters. Utility helicopters for support and transport tasks | **Helicopter** pilots operating utility helicopters for support and transport tasks. Also operating search and rescue services |
| | | **Multi-engine** pilots for transport, refuelling and reconnaissance tasks |

**1.2** Training new pilots is a complex process involving: the recruitment and selection of trainees: the planning, delivery and co-ordination of the various training courses for all types of aircraft from elementary flying to ensuring that pilots are combat ready; and the deployment and career management of trained pilots. It has taken some five years to train pilots, compared with the Department's target of some three years. The delays are costly - new trainees are not able to progress to the next stages in their courses and have to undertake additional

refresher training. And as pilots spend longer in initial training, less time is available for operational deployments - adding to the pressures at operational units and reducing capability.

**1.3** The process map (Figure 1 on page 2) shows a broad flow of trainees through the training pipeline - from the sources of trainees, through flying training courses, to trained pilots being available for front line operations. The process map also identifies the various influences on the training pipeline which impact on the time taken by trainees to complete their training and wastage rates where trainees fail courses. Key influences include the number of instructors and the availability of aircraft and simulators. Each of these influences is subject to further complexities. For example, the factors affecting the utilisation of aircraft include the numbers of aircraft and the performance of the Department in supplying spares and contractors in maintaining the aircraft.

**1.4** The dynamics of the process map are illustrated by a consideration of instructors. While the overall objective of the pilot training system is to ensure that the Department have sufficient new pilots to meet their requirements for front line pilots and hence have the capability to undertake air operations, front line pilots provide a source of instructors. Increasing the number of instructors might improve the operation of the training pipeline but in the short term there would be a reduction in front line pilots. And training instructors uses resources which would not then be available for trainees. The Department are taking forward our process map work with their consultants to develop a model of the training pipeline which should enable them to quantify the effects of changing key variables - for example the effects of increasing training aircraft or instructors at any stage of training.

## The requirement for new pilots and performance in meeting requirements

**1.5** The Department's annual requirement for new pilots over the five years 1994-95 to 1998-99 was 247 pilots (Figure 4). For the three Services the requirements were:

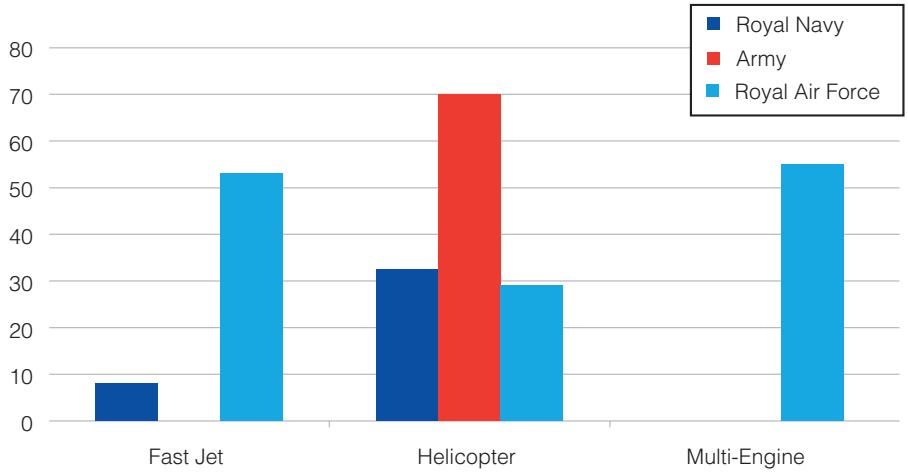
- 137 Royal Air Force pilots, consisting of 53 fast jet, 29 helicopter, and 55 multi-engine pilots;
- 40 Royal Navy pilots, consisting of 8 fast jet[1], and 32 helicopter pilots; and

1 The Royal Navy aim to meet their requirement for fast jet pilots by using the very best new recruits, experienced helicopter pilots, and fast jet pilots on transfer from the Royal Air Force and other countries.

**The Department's annual re uirement f or new pilots from 1994-95 to 1998-99**

**Figure 4**

*The Royal Air Force have the largest requirement for pilots overall (55 per cent), but they comprise less than one quarter of helicopter pilots (22 per cent).*



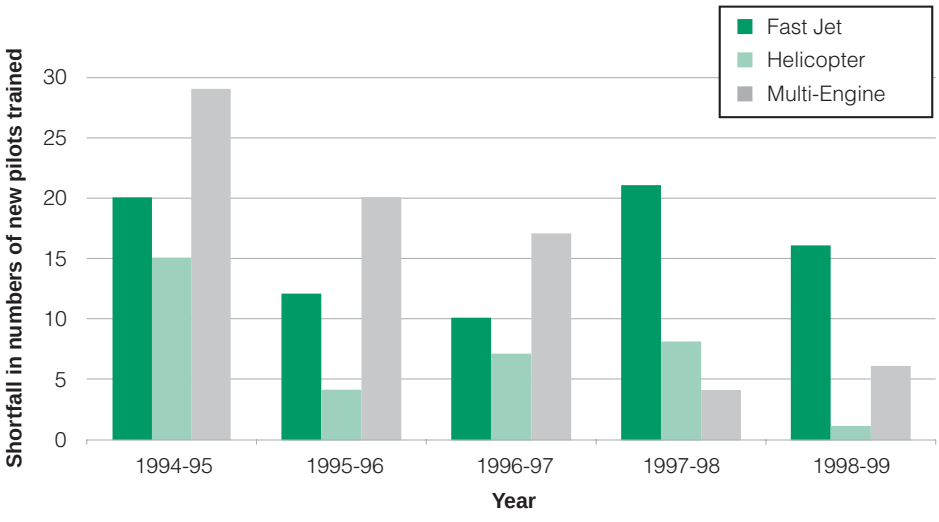

- 70 Army helicopter pilots.

**1.6** We looked at each Service's performance in training pilots to operational standards, starting with the Royal Air Force. They have not achieved their overall target for training new pilots since the late 1980's. Figure 5 shows that there have been shortfalls for all three aircraft streams. The results are particularly

**The Royal Air Force's shortfall in training new pilots broken down by aircraft stream**

**Figure 5**

*There have been shortfalls in the numbers of newly trained Royal Air Force pilots for all aircraft streams, and there remain significant shortfalls of new fast jet pilots.*



significant for fast jet pilots where shortfalls have always been greater than ten pilots each year. There has, however, been a reduction in the shortfall of trained helicopter and multi-engine pilots.

**1.7** We looked at the performance achievements of the other Services in training new pilots:

- While the Royal Navy's annual target has varied, over the 4 year period 1995-96 to 1998-99 they have sought to train 130 helicopter pilots and 32 fast jet pilots. They have successfully trained 122 helicopter pilots, a shortfall of some 6 per cent, and 14 fast jet pilots, a shortfall of some 56 per cent.

- The Army have met their target for training new pilots - successfully training 141 new pilots against a combined target of 140 for the two years to March 1999.

**1.8** The Department have experienced shortfalls of pilots at the front line. For example in April 2000 the Department reported that they were short of 98 junior fast jet pilots - some 18 per cent of their requirement - and that the shortfall would increase to around 135 pilots by 2003. Part of the reasons for the shortage is because the Department have not achieved targets for new pilots but also more pilots are leaving early or not extending their service. As an incentive to encourage pilots with two years' service remaining to complete their service, the Department have introduced a scheme to reimburse the £10,000 cost of gaining a commercial pilot licence. They have also reviewed the future structure of the Royal Air Force's officer corps, to see whether they are developing and retaining the best people.

**1.9** We found that other countries were experiencing similar problems in retaining trained pilots, in part because of changes in operational tempo resulting in more back-to-back deployments of trained pilots and also as a result of the competitive salaries paid by commercial airlines. For 1998, the United States Department of Defence reported pilot shortages as some 7 per cent of the total requirement. They forecast that shortages will increase to more than 10 per cent by 2002. As the Royal Air Force have already done, the United States have attempted to address this problem by reviewing which ground posts need to be filled by pilots and examining how changes to special payments for pilots may improve retention. The Canadian air force have introduced special retention bonuses aimed at encouraging trained pilots to extend their service. They told us that the bonuses had had a dramatic effect on their numbers of trained pilots and

that they were no longer forecasting pilot shortages. The Royal Australian Air Force have introduced a similar scheme, but the Department had heard that the scheme was not meeting all of its objectives.

**1.10** In the light of shortages of front line pilots and forecasts of further shortages, the Services have increased their annual targets for new pilots by some 40 pilots by 2001-02. The Royal Air Force plan to increase the number of new fast jet pilots going to front line squadrons each year to 60 by 2003. This increase reflects what the Royal Air Force see as the maximum number that the front line can support without increasing the ratio of inexperienced pilots to experienced pilots to unacceptable levels. The Royal Navy also plan to increase their numbers of fast jet pilots to 18 by 2010. Following the establishment of Joint Force 2000 the Royal Air Force and Royal Navy Harrier pilots will provide the seed bed for operating the Future Carrier Borne Aircraft. The Army are increasing their requirement for helicopter pilots in the short term but expect their overall requirement to fall following the introduction into service of the Apache attack helicopter and a subsequent reduction in the size of their fleet.

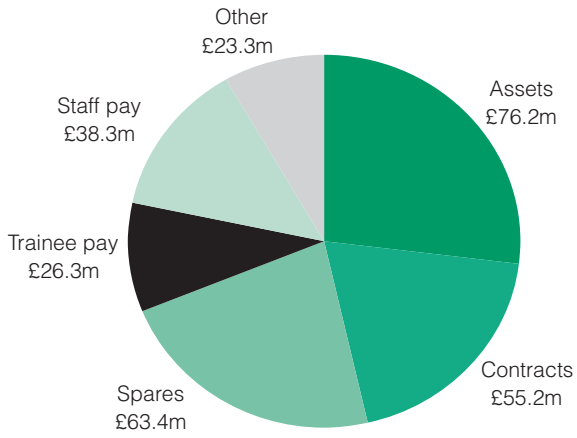
## The costs of training new pilots

**1.11** We looked to identify the full costs of initial pilot training for 1998-99. Although the Department's costing systems do not allow all the costs of pilot training to be accurately identified, we have analysed the available data to show the indicative level of costs associated with pilot training. We estimate that the total cost of initial pilot training in 1998-99 was some £283 million (Figure 6). For 1998-99 the Agency were responsible for costs of some £238 million, including the

**The cost of initial pilot training in 1998-99**

**Figure 6**

*The cost of pilot training assets (mainly aircraft), contracts and aircraft spares make up some 69 per cent of the costs of pilot training.*



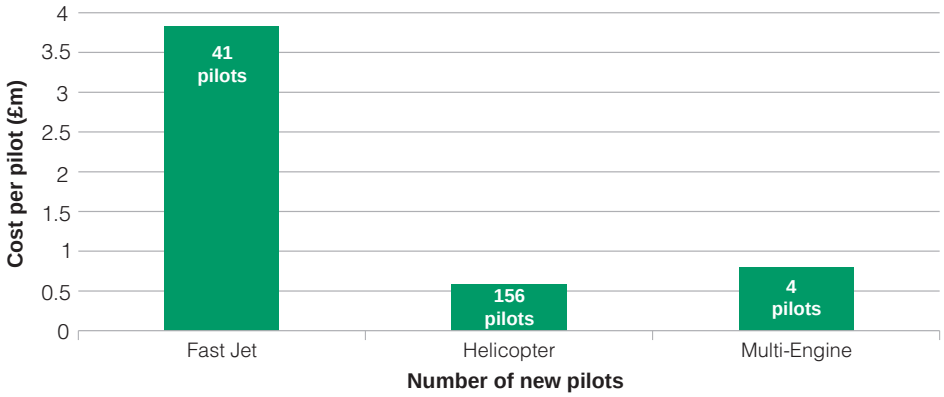
costs of training Royal Navy and Army students who undertake joint Service training courses. Costs managed by other budget holders were £31 million for the Royal Navy (advanced helicopter training and aircraft flying for pilot selection) and £14 million for the Army's advanced helicopter training.

**1.12** Figure 7 shows our estimate of the unit cost of flying different aircraft types based on the full cost of flying stations undertaking initial pilot training and the numbers of pilots successfully completing their training in that year. This is a broad measure of unit cost as training takes a number of years and minor variations in the number of pilots completing their training would clearly impact on unit cost figures. Nevertheless unit costs, and their trend over time, provide a useful tool for monitoring overall efficiency gains in pilot training.

**The unit cost of training new pilots in 1998-99**

**Figure 7**

*The estimated unit costs of training fast jet pilots in 1998-99 was £3.8 million, some six times the cost of other aircraft training.*




Note: The cost of elementary flying training have been split equally between the three aircraft streams.

**1.13** Figure 8 shows the ten main locations for initial pilot training, together with the Agency headquarters. Trainees then undertake operational training to become combat ready. Given the many types of operational aircraft used by the three Services and the need for specific training on each aircraft, the Services provide operational training at a number of establishments across the United Kingdom – not shown on Figure 8.

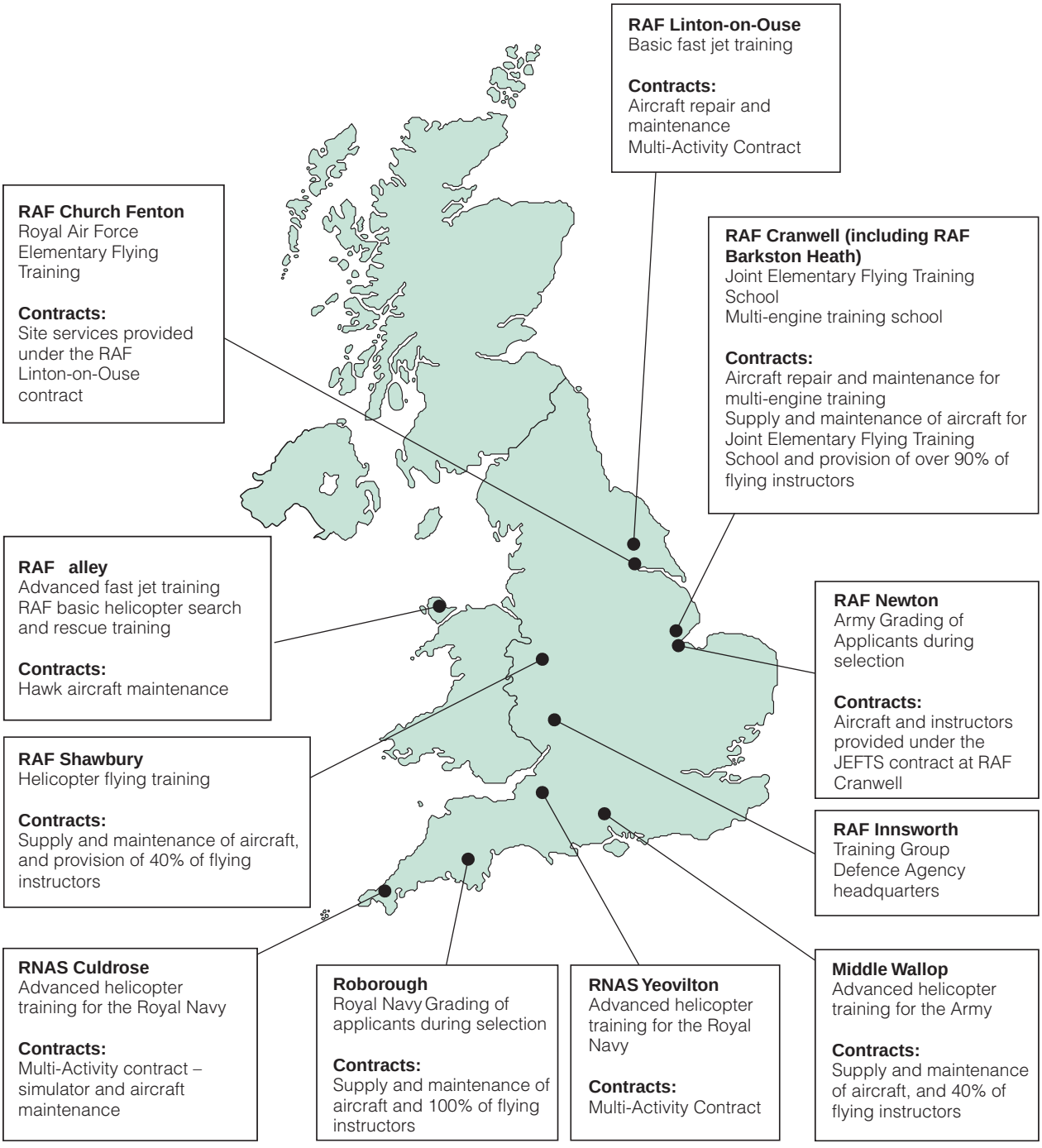
## Issues and methodology

**1.14** The main issues for the Report are:

**Figure 8**

**The principal establishments used for training pilots before operational training**

*The location of the major flying training schools and the Agency's headquarters, and Royal Navy and Army establishments undertaking flying training before operational training.*



- The Agency's management of the training pipeline, including a detailed case study of fast jet training given the critical shortages of pilots and high unit costs; and

- The management of resources and quality issues.

**1.15** We reviewed the Department's management reports and information at RAF Innsworth, the Agency headquarters and the location for Personnel and Training Command as owners of the Agency. We analysed the Department's cost information and personnel systems to examine the costs of flying training and the time trainees spent in the training system. We visited the major training establishments - RAF Cranwell for elementary training and multi-engine training, RAF Linton and RAF Valley for fast jet training, and the Defence Helicopter Flying School at RAF Shawbury. We also visited the Royal Navy's Flag Officer Naval Aviation at RNAS Yeovilton and the Director of Army Aviation at Middle Wallop.

**1.16** To gain an understanding of the customers' perspective, we surveyed all Operational Training Units and visited the Harrier Operational Training Units at RAF Wittering and RNAS Yeovilton. We also held discussions with all the contractors who provide flying training services to the Department. We discussed our work with colleagues from the national audit offices and Air Forces of the United States, Canada and Australia, to explore any common themes in their approach to pilot training. However, direct quantitative comparison between countries is difficult, because of the variety of approaches to issues such as contractorisation and joint Service training. We employed HVR Consulting Services Ltd as consultants to advise on our approach and methodology and to help develop the process map of the training system (paragraph 1.3 and Figure 1).

## Previous National Audit Office work

**1.17** We have not looked at initial flying training in the past, although some of our past studies are relevant:

- Ministry of Defence: Low Flying Training (HC201 1989-90), recommended that the Department consider the scope for greater use of simulators to supplement low flying training; and

- Ministry of Defence: Use of Simulators in Training (HC247 1992-93), noted the need for periodic reviews of the balance between simulator and live training and the importance of having simulators in place when the parent equipment enters service.

# Part 2: Recruitment and selection procedures and overall success

**2.1** This Part examines the various approaches to the recruitment and selection of trainee pilots adopted by the three Services. It then examines the overall success rates in training new pilots.

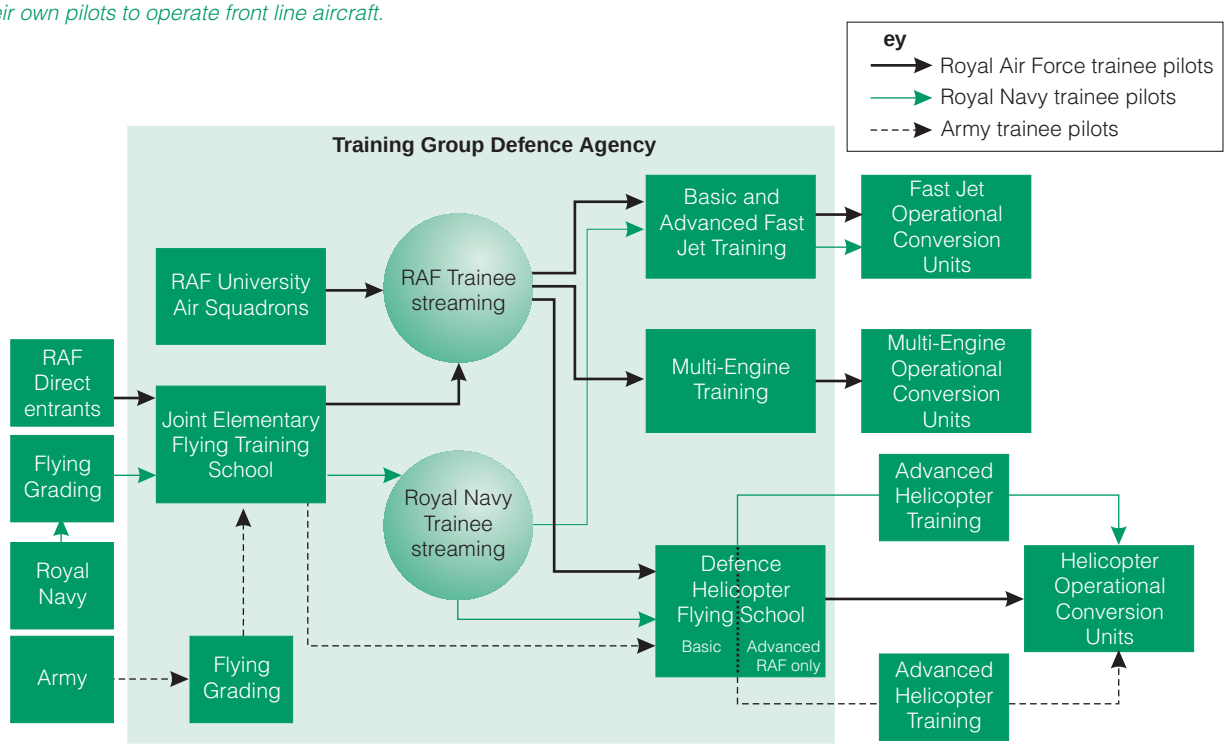
## Overall training pipeline

**2.2** Figure 9 shows the typical arrangements for initial pilot training for the three Services.

**Figure 9**

**The key stages of pilot training**

*The RAF Training Group Defence Agency are responsible for initial flying training for all three Services. The three Services train their own pilots to operate front line aircraft.*




**2.3** The Royal Air Force recruit trainee pilots from two sources: from members of University Air Squadrons who have completed elementary training; and from competitions open to graduates and non-graduates. The Royal Navy and the Army either recruit trainee pilot officers or select serving officers for pilot training. The Army and the Royal Marines also select non-commissioned officers who have four

years' Service experience to train as helicopter pilots. As part of their selection procedures, the Royal Navy and the Army grade their trainees following 13 hours direct flying, with those making the grade being selected for pilot training. Royal Air Force trainees who have not completed elementary training with University Air Squadrons, together with all graded trainees from the Royal Navy and the Army, attend the Joint Elementary Flying Training School.

The Firefly is flown at the Joint Elementary Flying Training School

A trainee and her instructor go through pre-flight checks in the Firefly aircraft

**2.4** Following elementary training, either through the Joint Elementary Flying Training School or through the University Air Squadrons, the Royal Air Force stream all their trainees for fast jet, helicopter, or multi-engine aircraft. Most of the Royal Navy's trainees become helicopter pilots but their most capable trainees are selected to undertake fast jet training to become Harrier pilots. All of the Army's trainees who successfully complete elementary training move on to helicopter training. All fast jet and multi-engine aircraft training prior to operational training is managed by the Agency, as is basic helicopter training for the three Services and advanced helicopter training for the Royal Air Force. However, the Royal Navy and Army manage their own advanced helicopter training, and all three Services are responsible for their own operational training where pilots are trained to fly front line aircraft.

## Recruitment and selection

**2.5** Recruitment arrangements in the round lie outside the scope of this study (paragraph 1.14). We examined those aspects of recruitment and selection for flying training, however, which bear directly on flying training, as opposed to wider Service needs. The three Services select trainee pilots in different ways (paragraph 2.3). All three Services use the Agency's aptitude tests as part of the selection process (Figure 10), although they have different criteria reflecting their different requirements.

**Aptitude Testing**

**Figure 10**

A demonstration of one of the aptitude tests

The Royal Air Force have used aptitude tests to identify suitable candidates for flying training since the early 1940's. The current aptitude tests measure the candidate's mental agility, hand-to-eye co-ordination and general awareness. The Department have been successful in licensing the Royal Air Force's aptitude tests to other countries' Air Forces, including: Indonesia, Norway, Saudi Arabia, Singapore, and Turkey. The Department have also licensed private sector airlines including the Malaysian Airline System and QANTAS to use the tests.

In addition to aptitude tests, candidates undergo a physical examination to determine whether they: fit into aircraft cockpits; have good eyesight; or are suffering from any medical condition which prevent them from flying.

**2.6** We looked to see whether aptitude tests are a good predictor of future flying ability, examining the relationship between aptitude and performance at the first stage of training - aptitude tests are designed to predict how successful trainees will be in undertaking elementary training. We examined records for 1,746 Royal Air Force pilots who began training between 1987-88 and 1998-99 (Annex B to Appendix 1). We found that 710 trainees have undertaken elementary flying training, of which 41 failed the course. The remaining trainees are made up of University Air Squadron entrants, who undertook elementary training prior to joining the Royal Air Force, and trainees who are currently undertaking either initial officer training or elementary flying training. We found that trainees with higher aptitude scores were more likely to pass elementary training, but the differences in pass rate were small - 90 per cent of trainees with aptitude scores of 111 to 120 passed compared with a 98 per cent pass rate for trainees with aptitude scores of 171-180 (Figure 11).

**2.7** We also wanted to move beyond elementary training and examine whether higher aptitude scores were associated with successful completion of all pilot training. Adding University Air Squadron trainees to our sample we found that 816 trainees out of 1,087 have completed training and were available for operational postings (Figure 11). We found that trainees with higher aptitude scores did have a higher success rate. Again the difference in the pass rate was not great - ranging from 72 per cent to 78 per cent.

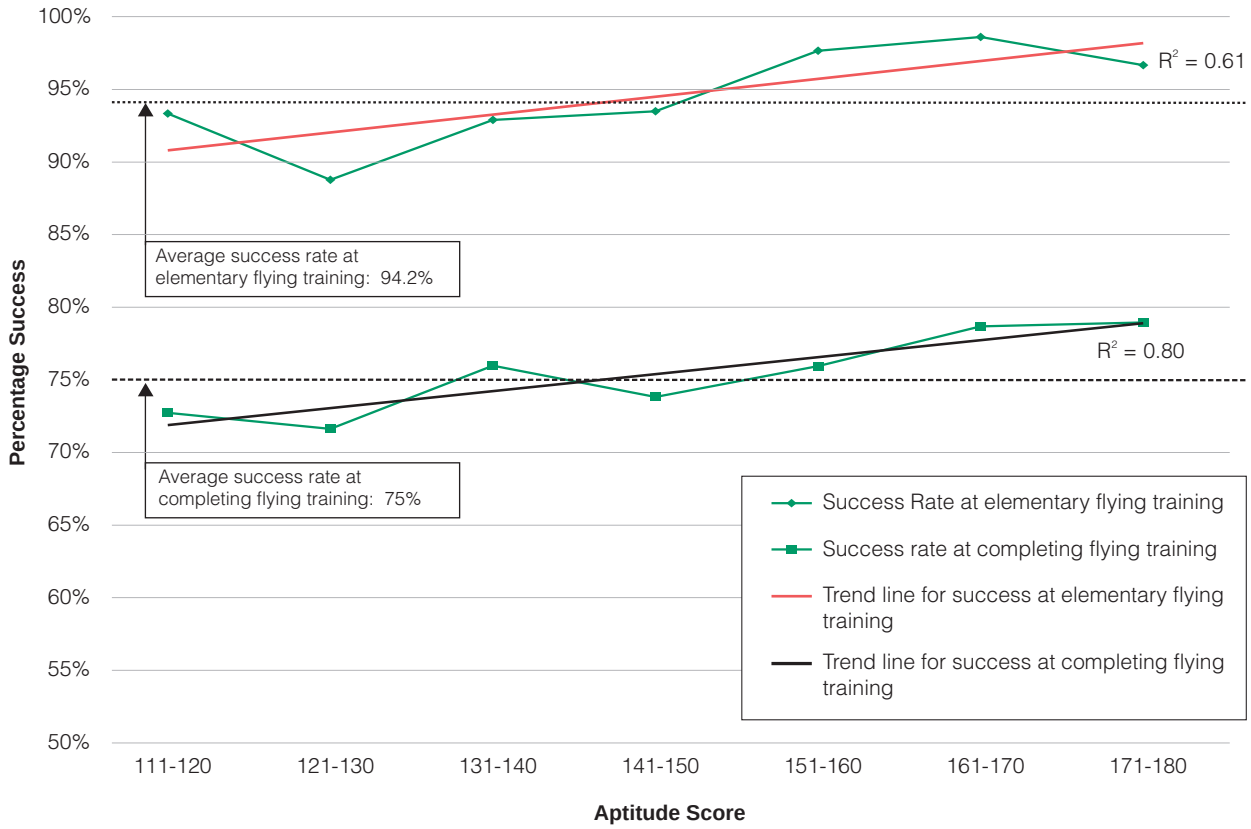
**2.8** We then examined the aptitude scores of trained pilots to see if there were any differences between fast jet pilots and other pilots. We found that while fast jet pilots did on average have a higher aptitude score, the difference is small - a mean aptitude of 143 compared with 140.

**2.9** We looked to see what use is made of aptitude testing by other countries' air forces. Most countries made use of aptitude scores as part of their selection processes - indeed the Royal Air Force have licensed their aptitude tests to a

**Figure 11**

**Success in flying training compared with aptitude score**

*Trainees with higher aptitude scores are on average more successful at elementary flying training, and at completing training. However, in both cases the difference in performance between those trainees with relatively low aptitude scores, and those with high scores is small.*




Note: The two trend lines show the best fit between the various points. A measure of the closeness of the fit is provided by the $R^2$ Statistic - a figure greater than 0.5 shows a good fit. Hence in both cases there is a good fit between the trend line and the data points.

number of other air forces (Figure 10 above). We noted, however, that some countries have extended aptitude testing beyond the Department's immediate concern with pilot aptitude. The Israeli Air Force use aptitude testing to evaluate whether candidates have the fighting instincts necessary to ensure victory in one to one combat. The Swedish Air Force have developed psychometric testing in similar areas and the Canadian Air Force are introducing new aptitude tests designed to measure the rate at which candidates adapt to change, with a forecast 15 per cent improvement in predicting future success.

**2.10** In addition to using the Agency's aptitude tests, the Royal Navy and the Army include 13 hours direct flying when they grade applicants as part of their selection process, with only those making the grade moving on to pilot training. The Royal Navy wastage rate from this preliminary stage is 12 per cent whilst the

Army wastage rate is 64 per cent. The Army told us that the higher wastage rate for the Army reflects their broad selection criteria where they offer preliminary flying training to a large number of non-commissioned officers who have gained significant experience of Army life. The Army accepted soldier candidates who showed potential during preliminary flying even if their aptitude score were lower than trainees from other Services because successful soldier pilots were likely to provide more than 10 years operational flying for the Army. Grading candidates through direct flying is, however, expensive and an approach yielding a 64 per cent wastage is unlikely to be cost-effective.

**2.11** We noted that grading applicants on the basis of direct flying is a selection technique used in many other countries - for example the United States, Canada, Australia and France. Indeed the German Air Force take grading a stage further and stream their trainees after only 18 hours flying. Such early streaming can lead to savings in training costs as fewer trainees undertake the more costly fast jet training, although the savings have to be balanced against the possibility that some trainees might have made the grade as fast jet pilots.

**2.12** For the Royal Air Force there are two major sources of recruits - graduates from University Air Squadrons and direct applicants. University Air Squadrons are an important part of the Royal Air Force's recruitment drive. They offer students some 30 hours a year flying experience and those students who demonstrate sufficient aptitude then complete elementary training and are accepted by the Royal Air Force as trainee pilots - some 90 students a year. However, University Air Squadron graduates make up 47 per cent of the Royal Air Force's trainees. Those trainees who have not participated in University Air Squadrons may have no flying experience at all before joining the Royal Air Force - our analysis of the Department's data indicates that some 20 per cent of trainees have no previous flying experience.

**2.13** The Department consider that University Air Squadrons provide an effective source of trainee pilots and have stated that 70 per cent of their fast jet pilots would initially be trained at University Air Squadrons. We analysed our sample of recently trained pilots, and found that University Air Squadron trainees made up just 49 per cent of the Royal Air Force's new pilots, although they constituted 55 per cent of new fast jet pilots.

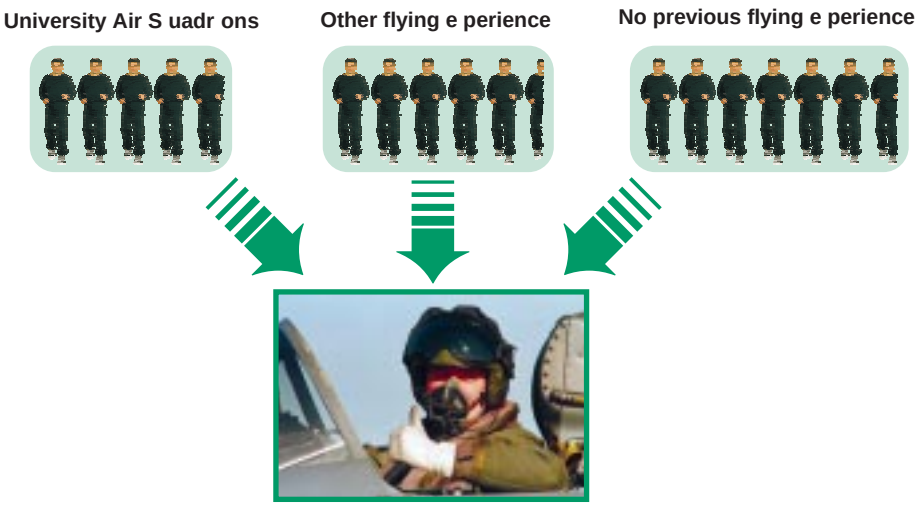
**2.14** We further analysed the Department's data to determine if University Air Squadron trainees were more successful in completing their fast jet training. The results show that University Air Squadron trainees produce more fast jet pilots than either the population of trainees with other flying experience, or the trainees with no previous flying experience. To produce one fast jet pilot for the front line

requires either 4.8 University Air Squadron trainees, 5.5 trainees with other flying experience such as the Air Training Corps, or 6.7 trainees with no previous flying experience (Figure 12).

**Figure 12**

**The relative effectiveness of the University Air S uadr ons in providing fast jet pilots**

*University Air Squadrons are more effective in providing a fast jet pilot than other training routes, although the difference is not great.*




**2.15** The University Air Squadron route still provides the majority of fast jet pilots - although a lower proportion than it used to - and has a higher success rate than other routes of turning candidates into fast jet pilots. It is, however, also the most expensive route, and one that may attract candidates particularly well suited to military flying. In the light of the information available, there is a case for reviewing the cost-effectiveness of the various routes; and for considering the extension of preliminary flying training to non-University Air Squadron candidates. Decisions on recruitment procedures must, however, also reflect broader military needs as well as those of flying.

## Review of wastage rates

**2.16** Analysis of wastage rates offers a perspective on the operation of the selection and streaming arrangements. When planning their recruitment strategy and course numbers, the Department use forecasts of the likely wastage rates. These rates are based on historic performance. For example, the Department forecast a 15 per cent failure rate at the Joint Elementary Flying Training School, and for fast jet pilots failure rates of 17 per cent at basic training, 25 per cent at advanced training and 10 per cent at Operational Training Units. The cumulative effect of these failure rates is that for every 100 new trainees 48 would be expected

to complete fast jet training - an overall failure rate of some 52 per cent. However, those trainees who do not make the grade as fast jet pilots may be re-streamed to other aircraft.

**2.17** Figure 13 shows the numbers of trainee pilots going through the training pipeline during 1997-98 and 1998-99, and their success in passing the various training courses. The most significant wastage rates occurred in fast jet training and were broadly in line with forecast - the case study of fast jet training in Part 3 examines the reasons for these wastage rates. As regards non-fast jet flying training, actual failure rates were consistently less than planned. For example during both elementary and operational training actual failure rates were less than half those used to inform planning assumptions.

**2.18** We wanted to know whether the different approaches adopted by the Services to recruitment and selection affected failure rates for those tri-Service elements of pilot training. During elementary training failure rates were 4.3 per cent for Royal Navy trainees, 6.0 per cent for Army trainees and 7.1 per cent for Royal Air Force trainees. At the Defence Helicopter Flying School, failure rates were 3.1 per cent for Royal Navy trainees, 8.0 per cent for Army trainees and 4.7 per cent for Royal Air Force trainees. The higher Army failure rate was also evident during advanced helicopter training. While differences in wastage rates are not dramatic, they do require careful monitoring and review - if actual wastage rates across the pipeline reflected those achieved by the best performing Service, more pilots would be trained or training costs could be saved. For the Army this might mean six additional helicopter pilots a year at a cost of some £3 million.

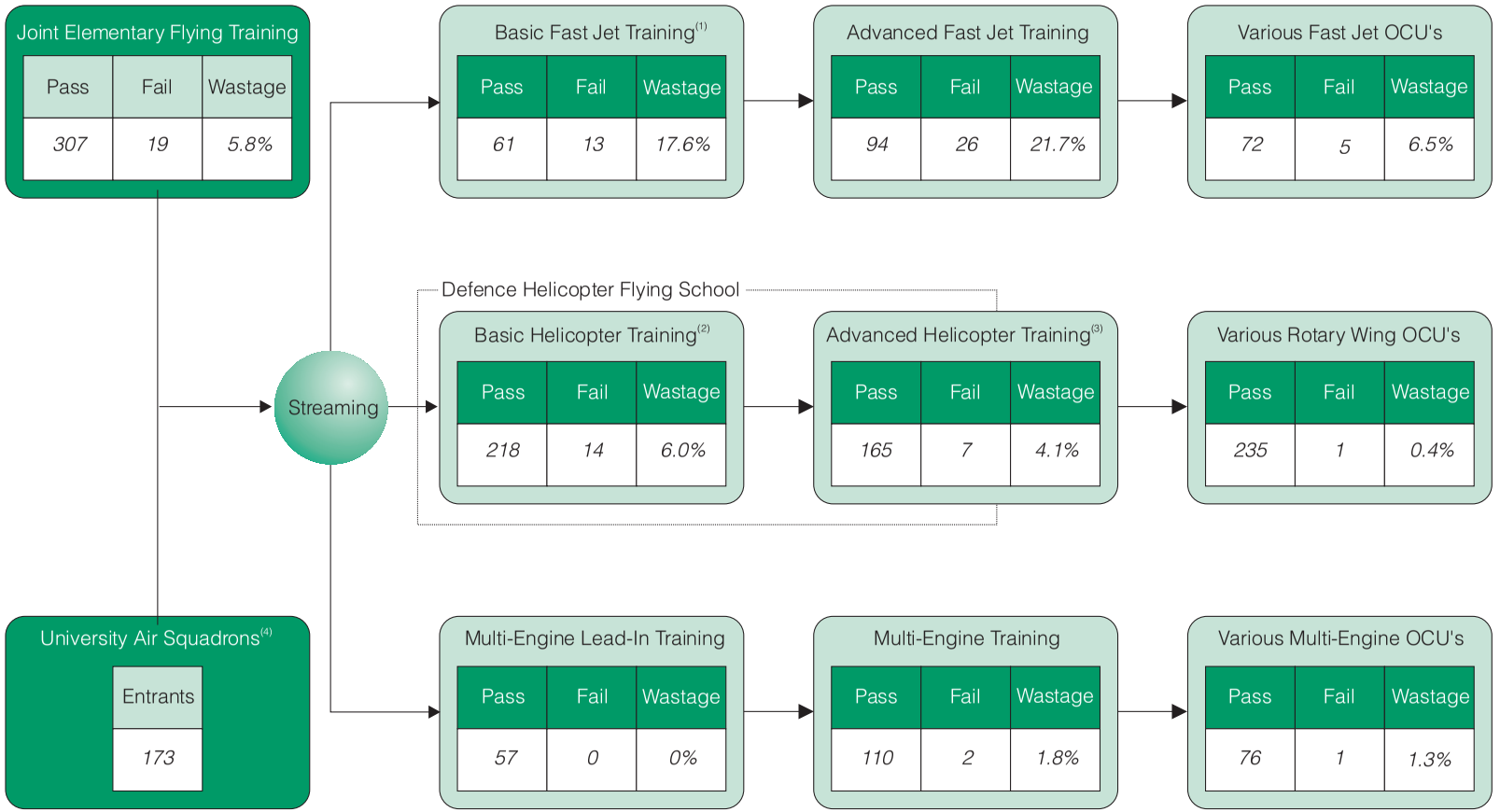
**2.19** Making meaningful international comparisons of wastage rates can be difficult as they will be greatly affected by variations in skill requirements, the time allocated to complete training, and the training resources (including the quality of aircraft and simulators) to undertake training. There are also organisational differences - for example in the United States Air Force trainee pilots exercise some choice over the type of aircraft in which they specialise but there is little scope for re-streaming if they fail to make the grade in their chosen aircraft. We looked at the overall wastage rates for training pilots in other countries. The wastage rate is some 20 per cent in the United States Air Force and 30 per cent in the Australian and Canadian air forces, with most failures occurring in the early stages of pilot training. The Agency have recognised that reducing wastage rates will be crucial to improving the efficiency of the pilot training system and that failures in later stages of training are of particular concern given the investment in expensive training.

**Figure 13**

## Pilot training throughput in 1997-98 and 1998-99

*The most significant wastage rates are in fast jet training - 22 per cent at the advanced stage and 18 per cent on the basic course.*

Key
Pass = Passed the course
Fail = Failed the course, but may subsequently be restreamed to another aircraft type




Note 1 Since April 1997 trainees are streamed after elementary training. Previously streaming took place after training at Linton-on-Ouse – now the basic fast jet course. The figures refer only to trainees selected for the fast jet stream.

2 The Defence Helicopter Flying School was formed on 1st April 1997. The figures refer to trainees undertaking basic helicopter training at the Defence Helicopter Flying School.

3 Advanced helicopter training is provided separately for each of the three Services.

4 The figures refer to the number of students entering Initial Officer Training who have completed their elementary flying training with University Air Squadrons.

**2.20** The analysis of wastage rates shows that as some actual wastage rates are less than half the planned levels, the Department's planning assumptions may require review. During elementary training actual wastage rates are significantly less than planned and it would be useful to investigate what might be the effects on the overall training pipeline if output standards were to be raised during elementary training - in effect downloading training risk to the earlier lower cost training courses. The Department would have to balance the prospects of reduced failure rates at later and more costly stages of training with the potential loss of late developers. Finally the different wastage rates for the three Services underlines the need to review the different approaches adopted by the Services to recruitment and selection.

# Part 3: Case study - training new fast jet pilots

**3.1** Part 1 showed that the Department have not met their targets for training new fast jet pilots and that there are acute shortages of fast jet pilots at the front line. This Part provides a case study analysis of the reasons for these shortages. It analyses:

- Wastage rates during the various fast jet courses
- The time taken to train fast jet pilots
- Personnel implications - both for trainees and trained pilots
- Cost implications

## Wastage rates during fast jet training

**3.2** Trainee pilots are assigned to the various streams of training - fast jets, helicopter or multi-engine - after elementary flying training. Those selected for fast jet training then go for basic fast jet training, undertaken on Tucano aircraft at RAF Linton-on-Ouse. Those successful at that stage then undertake advanced fast jet training on Hawk aircraft at RAF Valley. We looked at the wastage rates at those stages to see what they revealed about the flow of trainees through the system. Figure 14 shows actual wastage rates alongside those used to inform planning decisions.

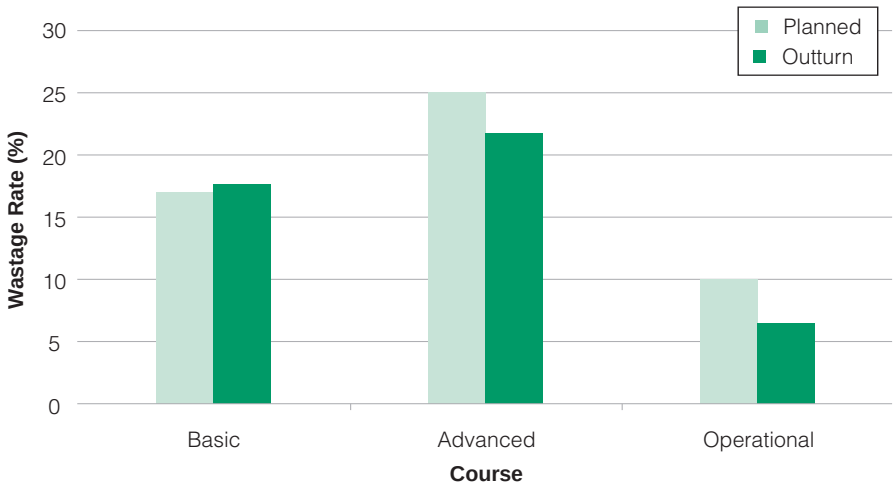
The Tucano is flown on the basic fast jet training course

A trainee and his instructor check their Tucano aircraft

**A comparison of actual and planned wastage rates for fast jet training 1997-98 and 1998-99**

**Figure 14**

*Wastage rates have been less than planned for two of the three stages of fast jet training. Trainees who fail fast jet training are likely to be restreamed to either helicopter or multi-engine aircraft.*




**3.3** At RAF Linton-on-Ouse, the failure rate has fallen from 34 per cent in the past to 17 per cent for 1998-99. Failure rates have reduced mainly because streaming used to take place after basic fast jet training, whereas now only those assessed as suitable fast jet candidates start the course. The Agency consider that the wastage rate has fallen further because of a change in culture where the expectation is that trainees should succeed and where instructors are fully committed to the success of their trainees.

A trainee and his instructor plan their training sortie

**3.4** While the failure rate at basic fast jet training has reduced in recent years, there has been no sustained reduction in the failure rate on the advanced fast jet training course at RAF Valley. During 1997-98 because of problems with the Hawk aircraft the Agency reduced the throughput of trainees at RAF Valley. Only very high calibre trainees were sent to RAF Valley and during this period the Agency reported a reduced wastage rate - from 25 per cent to 14 per cent. Since then the wastage rate has returned to over 25 per cent.

**3.5** In 1997-98 and 1998-99, some 47 per cent of failures at RAF Valley occurred during Phase 1, where trainees learn to fly the Hawk aircraft. Whilst the skills required to fly the aircraft are not significantly different to those learnt at RAF Linton-on-Ouse, the Hawk is the first jet aircraft flown by trainees and is more than twice as fast as the Tucano, and hence there is a need for quicker decision making. The remaining 53 per cent of failures occurred during Phase 2 of the course. This is the advanced tactics and weapons phase during which trainees learn combat and weapons skills that are not taught on any earlier courses in the flying training syllabus.


The Hawk is flown on the advanced fast jet training course.

**3.6** The reasons for high wastage at RAF Valley are partly technical - the Agency have not found a way of testing the full range of qualities required to fly fast jets at earlier stages of training, and so issues of speed and weapons training as noted above provide new challenges to trainees. A further factor may be the approach to instruction - as trainees progress through the training pipeline and

become more experienced in flying, instructors will tend to demonstrate a technique rather than provide detailed instruction of how to complete a task. Trainees then practise the technique and the instructor assesses the trainee's capabilities and capacity to assimilate new and more complex techniques. Such an approach to instruction may not suit all trainees.

**3.7** Instructors at RAF Valley are military staff, drawn from the stock of qualified pilots. They are in two main groups: a selection from the best pilots who have just qualified at Valley, and whose first post-training tour is as an instructor; and experienced operational pilots. To instruct on the advanced tactics and weapons course instructors need to have undertaken a tour with a front line fast jet squadron. Instructors are graded by the Agency's Central Flying School, with experienced instructors assessing the newer instructors. However, their quality is not measured in terms of the success rate of their trainees - because trainees will be taught by several instructors on any given course, and so there is no ready way to monitor the quality of instruction over time. At RAF Valley, there have been instructor shortages from time to time. Partly, that reflects pilot shortages in the Services as a whole. Partly, it reflects the lack of enthusiasm of pilots to be posted to RAF Valley, because of its isolated location, some distance from the main concentration of Royal Air Force Bases in North and East England.

**3.8** Overall, however, wastage in fast jet training is no higher than that planned for in setting recruitment targets - targets which have been met. So although wastage is high enough to warrant continued attention (and the Agency are exploring how they might reduce wastage rates), it does not explain the shortfall in output of trained fast jet pilots.

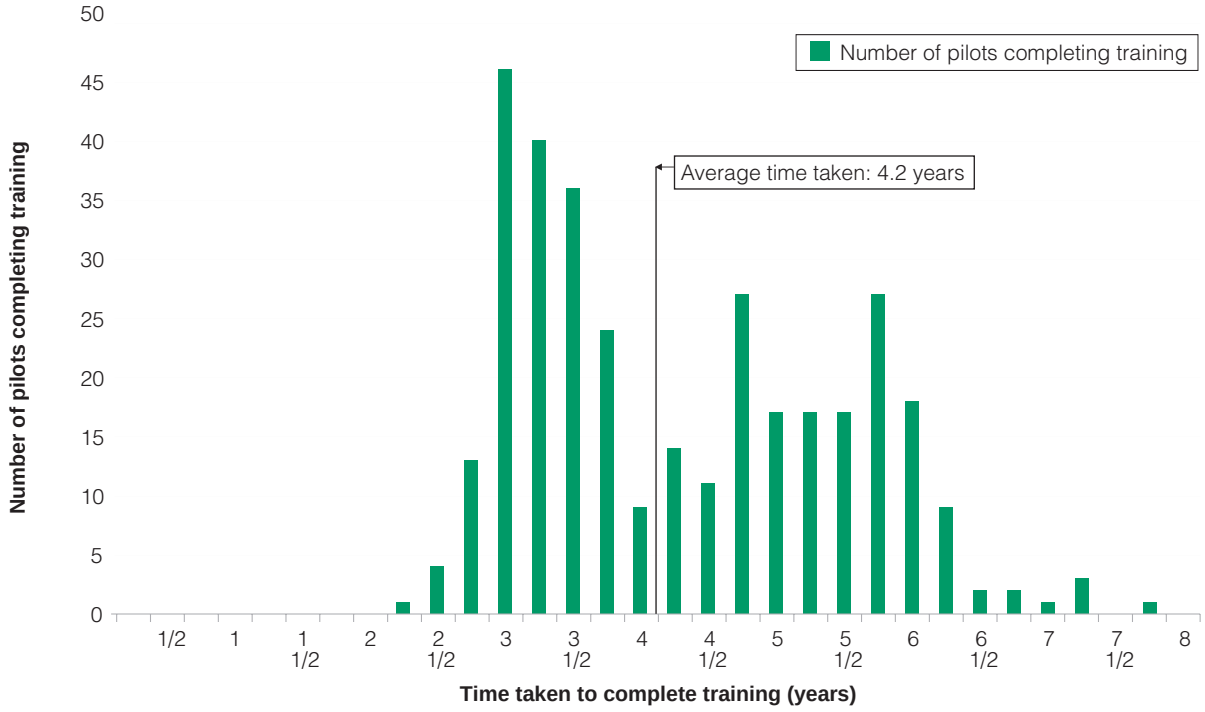
## Elapsed time in fast jet training

**3.9** The time training takes, however, is a key factor in explaining the shortfall. The Department estimate that from the start of initial officer training to pilots being available for front line deployments should take 3.2 years, but they have not analysed the time it actually takes to train their pilots. We therefore collected information on all the Royal Air Force trainees who began pilot training between 1 April 1987 and 31 March 1999 - a total population of 1,746 trainees. Of this total, 339 trainees successfully completed fast jet training - an analysis of the complete data set is at Annex B to Appendix 1. We examined the time taken by the 339 pilots in our sample who had successfully completed fast jet training and found that the average time taken was 4.2 years. Some 59 per cent of the successful pilots took more than 3.5 years, with some 29 per cent taking more than five years. Figure 15 shows the distribution of total training times for all 339 successful pilots.

**Figure 15**

**The time taken by Royal Air Force fast jet pilots to complete their initial training**

*On average the Royal Air Force have taken 4.2 years to train fast jet pilots, compared with their estimate of 3.2 years.*




**3.10** We looked to see if training times had increased in recent years and analysed the time taken for a number of cohorts of trainees. Figure 16 shows the time taken by the successful trainees broken down into six month periods in which they completed training. Those who completed their training in the first half of 1991-92 took on average 3.2 years, but by the second half of 1997-98 this had increased to a peak of 6.0 years, since when the average time taken has fallen to 5.5 years.

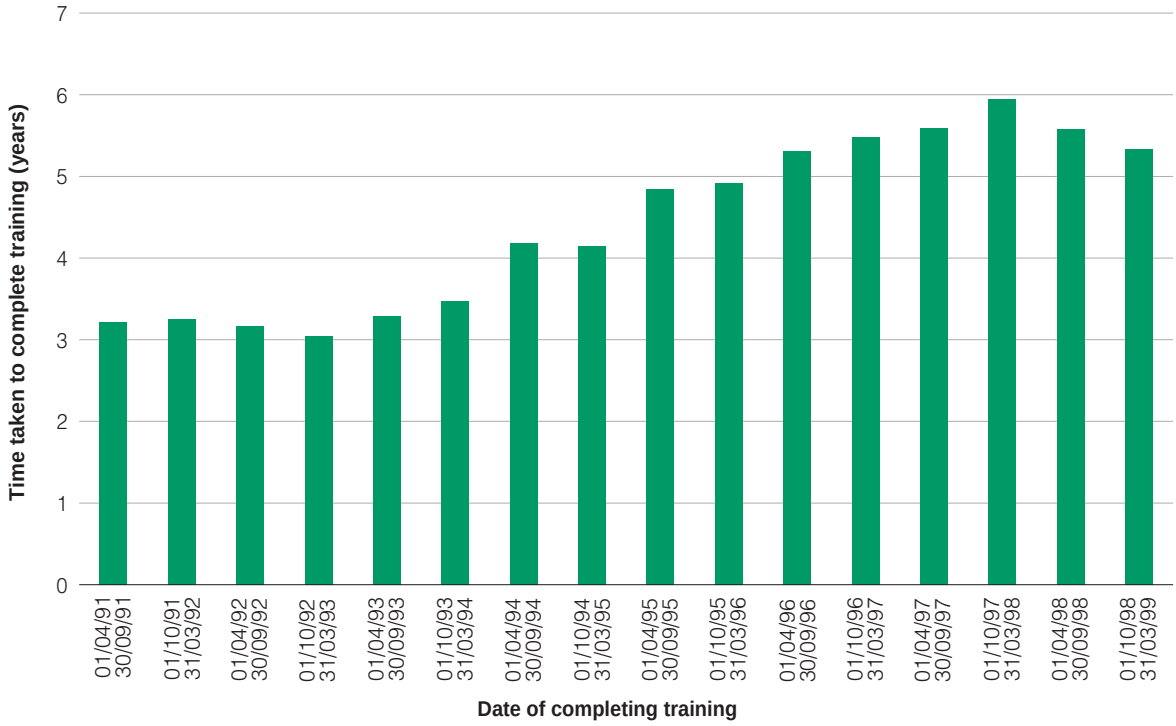
**3.11** There are a number of factors, largely external to the Agency, which explain the increase in the time taken for pilots to complete their training:

- Options for Change in 1990 led to a reduction in frontline squadrons - seven squadrons have been disbanded in the 1990s. The Department retrained, where necessary, qualified pilots from disbanded squadrons, which has taken up training places at Operational Training Units. They have also reduced operational training in line with reduced front line requirements.

**Figure 16**

**The elapsed training time for Royal Air Force fast jet pilots**

*The time taken to train fast jet pilots has increased from just over three years to a peak in 1997-98 of just under six years. For pilots completing in 1998-99 training typically took 5.5 years.*




- Options for Change and other efficiency measures have also resulted in a reorganisation of the flying training organisation, with the closure of several airfields, and the consolidation of training at the remaining establishments. Whilst implementing these changes, there has been some disruption to the training process.

- While the Department reduced their new pilot requirements in the late 1980's and early 1990's, they already had numbers of trainees in the pipeline based on earlier assumptions. Trainees have therefore been held in the system awaiting their next training course.

- Operation Desert Shield in 1990, and the subsequent air campaign, Operation Desert Storm, in early 1991 put a severe strain on the Royal Air Force's Operational Training Units, as instructors, all of whom are experienced pilots, were posted to active duty in the Persian Gulf. This led to many of the Operational Training Units suspending training for several months.

- Reduced availability of Tornado aircraft and the need to accommodate overseas pilots for training as part of sales/lease of Tornado F3 meant that Royal Air Force places at Operational Training Units were limited.

- In 1996-97 the Department experienced difficulties with the Hawk fleet at RAF Valley and restricted the number of fast jet trainees going to RAF Valley. This added to the number of fast jet trainees held in the training pipeline. The position at RAF Valley is discussed in paragraphs 4.25 to 4.28.

**3.12** There is a need for caution when comparing the actual time taken to train pilots between air forces as there may well be differences in skills requirements, local weather and terrain, and the resources available for training. We therefore looked to see whether other countries were meeting their targets for completing training within their specified target times. We were told that training targets were largely met. For example, in the United States, pilots have generally completed training to 'wings' standard in target times of up to two years, although some trainees had taken nine months longer to finish training - because of difficulties in co-ordinating the various training courses and because of problems in the availability of equipments and spares. The Ministry of Defence suggested that there was some spare capacity in the United States training pipeline which facilitated broad achievement of training times.

## Implications of delays in training pipeline

**3.13** When trainees have experienced delays between the various stages of training the Agency try to ensure that they are engaged in worthwhile temporary work on active Royal Air Force bases, although this has not always been possible. In any case, trainees may not be able to maintain their flying skills at the required level, and so must then attend refresher courses. Such courses are a further drain on the Agency's resources, and we cost them in the next section.

**3.14** The increase in training pipeline times has also had an adverse affect on the likely career length of pilots post qualification. The average age of pilots when they have their first operational posting has gone up, which on average reduces the time they can give to the Service post-training. The Royal Air Force estimate that the length of time junior officers will serve after they complete training will decrease from around 8.7 years to 6.9 years over the next decade.

**3.15** Finally, delays in progress through training can damage the morale and motivation of the trainees themselves. Wastage due to trainees simply electing to drop out of the programme was very low. And the trainees we spoke to were highly motivated to complete their training successfully: there is no alternative to a career in the military if trainees want to fly fast jets. Delays, however, had induced feelings of frustration, which may contribute to later pilot retention problems.

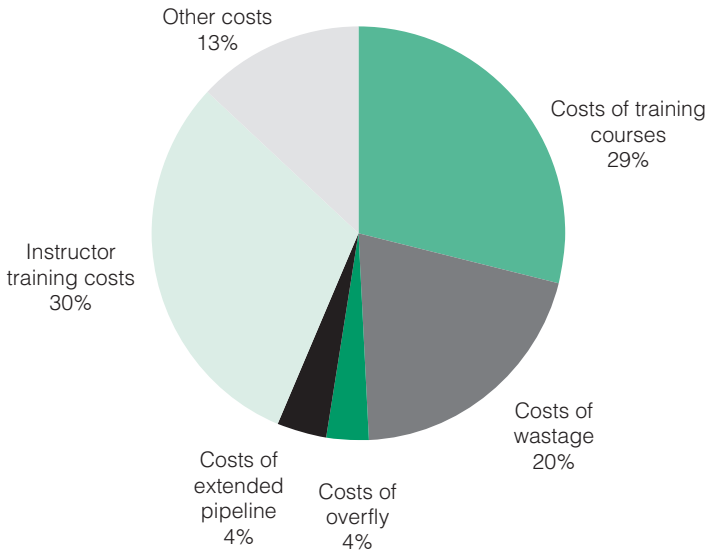
## Costs of fast jet training

**3.16** Costs of training are important when designing training systems and managing training operations. In the absence of readily available summary cost data, we estimated 1998-99 costs for initial fast jet training, from initial officer training to successful completion of the fast jet course at RAF Valley and divided by the number of new pilots produced in that year. Since the numbers of fast jet trainees has been broadly constant for the past 5 years, this approach can give a useful indication of the scale of unit costs. The result was a unit cost of some £3.8 million, which as Figure 6 in Part 1 shows is some six times more expensive than training helicopter or multi-engine pilots. Figure 17 analyses some of the key cost components, including costs relating to delay and wastage.

**An analysis of the unit cost of training fast jet pilots in 1998-99**

**Figure 17**

*The major cost components of training new fast jet pilots, based on training costs in 1998-99 and 41 pilots (the number completing training in 1998-99).*




Note: other costs include flight safety testing and miscellaneous flying activities.

**3.17** The major cost elements of fast jet pilot training are:

a) **Instructor training costs.** When costing a pilot training course the Department include the cost of employing instructors. However, they do not include the costs of instructor training. Based on the Department's planned flying activities we estimate that flying training for new and existing instructors costs some £1.2 million per pilot (30 per cent of the total training costs).

b) **Pilot training courses.** Following selection pilots undertake a standard training programme, and are employed as military personnel during their training. Each pilot should complete elementary flying training, and fast jet training on the Tucano and Hawk aircraft, with no need to repeat any element of the training programme. The Department estimate that the fast jet training programme should take some 3 years to complete when the training pipeline is working smoothly. Based on data on the costs of training courses and trainee pay costs, we estimate that these core training activities cost some £1.1 million per pilot (29 per cent of total fast jet training costs).

c) **Trainee pilot wastage.** A number of trainees fail at each stage of the training process. This adds to the cost of fast jet training but produces no fast jet pilots, although re-streamed trainees may succeed as helicopter or multi-engine pilots or as navigators. Based on the Department's forecast of failure rates at each stage of training, we estimate that the cost of fast jet trainee pilot wastage is some £0.8 million per pilot (20 per cent of total fast jet training costs).

d) **Additional flying training.** For each training course, the Department plan the number of hours required to train pilots to the necessary standard. The Department allow some extra flying for unforeseeable factors, such as changes in weather or aircraft operating problems. However, RAF Valley's experience has been that there is a need for additional flying as trainees are unable to achieve all the courses' training objectives within the planned hours. At RAF Valley pilots on average fly some 20 hours more than the planned course length. We estimate that the cost of this additional flying training is some £135,000 per pilot (4 per cent of total fast jet training costs).

e) **Extended training pipeline times.** For the pilot completing fast jet training in 1998-99, the average time taken to complete training was some 5 years, two years longer than if the training pipeline were to operate smoothly. Additional pay costs are some £120,000 for each pilot. Extended pipeline times may also result in trainees being given some refresher training. The Department do not, as a matter of course, hold data on how much refresher training they provided to pilot trainees in 1998-99, although they planned to undertake refresher training courses costing some £50,000 for each pilot. We estimate the total cost of extended training pipeline times as some £142,000 for each pilot (4 per cent

of total fast jet training costs). Extended pipeline times mean pilots spend less time at front line operational units (see paragraph 3.25 for an estimate of the value of lost operational output).

**3.18** The value of each cost element will vary from year to year. In 1998-99 because of problems with Hawk aircraft the number of trainees at RAF Valley were constrained and instructors therefore accounted for a higher proportion of the Station's cost. Nevertheless, the analysis at Figure 17 shows that wastage rates in fast jet training are costly. For example, we estimate that each pilot who fails during their operational training and is re-streamed will have completed all initial fast jet training, costing some £1.1 million. The Agency recognise the cost of such failures. They have set themselves the objective of reducing training wastage rates from 1999-2000, although they have not set any specific targets for pilot training.

**3.19** In addition to the savings that may arise directly from managing the training process better, reducing wastage rates, overflying and training times would decrease the total flying training hours required. This in turn would reduce the number of flying instructors required. The flying training system is complex and our process map in Figure 1 illustrates how the various parts of the flying training system and the operational flying organisation influence each other. The Department are constructing a model of the pilot training system which they consider will allow them to quantify more fully the effects of individual changes on the whole training system. One example of how costs might be affected by changes in the training process is that reducing by one the number of Hawk flying instructors required would save some £177,000 a year in instructor continuation training.

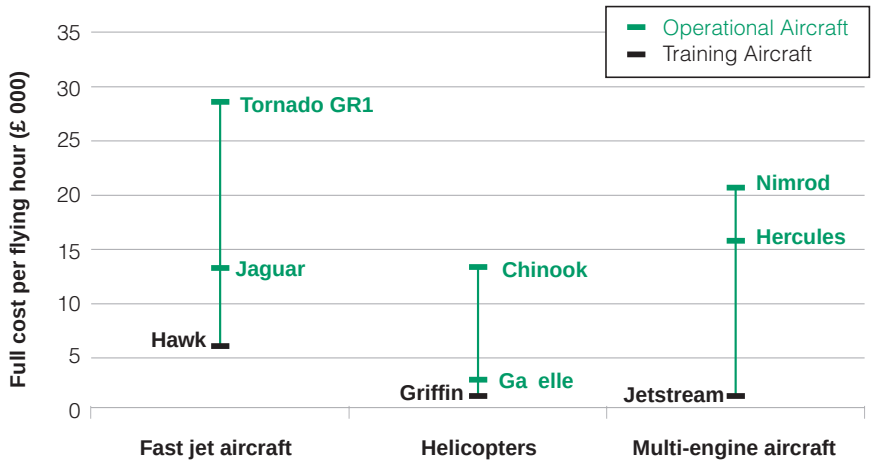
## The cost of operational training

**3.20** During initial flying training, the Department instruct pilots in all essential flying skills. At Operational Training Units, they teach skills required for a specific operational aircraft before pilots are considered to be front line proficient. Training on operational aircraft at Operational Training Units is generally much more expensive per training hour than initial pilot training (Figure 18). The costs of each aircraft type are different, and demand for new pilots for each type varies over time, which means that good local cost data are essential to obtain a good view of operational training costs.

**The hourly cost of flying operational aircraft compared to training aircraft**

**Figure 18**

*For all three aircraft streams operational aircraft are always more expensive than dedicated training aircraft.*




**3.21** The Department do not have up to date cost data for operational aircraft as they have not undertaken any costing for Operational Training Units since 1995-96. Where the Department require cost estimates, they uprate 1995-96 figures to current prices. These costs do not therefore reflect any modifications or upgrades to aircraft since 1995-96. Of the Royal Air Force's 15 operational aircraft simulators, the Department have cost data for only five.

**3.22** The lack of up to date cost information on operational aircraft means that the Department are unable to assess the cost effectiveness of downloading training to initial pilot training. Such information is particularly important when considering the benefits of buying new training aircraft. Without this information, the Department are unable to allocate financial resources to the most appropriate stage of training.

**3.23** Figure 18 shows that the cost of operational aircraft varies significantly within each stream, and therefore the cost of training pilots to the specified operational standard will depend on the type of aircraft they fly and the amount of flying required to complete the course. For example, we estimate that the cost of training a Tornado GR1 pilot, from initial officer training to completion of operational training is some £5.7 million. The full cost of initial fast jet pilot training is £3.8 million and the cost of the operational training course is some £1.9 million. The cost estimate for the operational training is based on the planned hours of the courses and the hourly costs of the aircraft. Hence it does not include the costs of instructor training, additional flying, wastage rates or any refresher

training. These factors could add significantly to the cost of training. For example, the estimated cost of additional pilot training for each trainee on the Tornado GR1 in 1998-99 is some £400,000.

**3.24** We looked at the costs of pilot training overseas. The United States Department of Defence estimate that the cost of fully training a military pilot with the requisite operational experience is some £5.5 million. The NATO Flying Training Centre in Canada provides a possible benchmark as it provides a suite of training courses for fast jet pilots, and the Department have contracted places for 20 trainees to undertake fast jet training, broadly equivalent to the second half of pilot training at RAF Valley. The full costs for the training course in Canada are some £445,000 for each pilot. Comparing pilot training costs between countries is difficult as there may be significant differences in training standards, operating conditions and training equipment, and different approaches to accounting for costs. Nevertheless there is scope for the Department to benchmark their pilot training costs.

## Value of defence output lost through shortfalls in pilots trained

**3.25** We considered what the effects might be on defence capability if the Department had an additional pilot available for front line operations, assuming there was also under utilisation of front line aircraft. Valuing the output is complex but in circumstances such as these, where there is no obvious market value, the usual approach is to value the output at its costs - subject to the proviso that the output valued has been endorsed by the military planning process. The assumption here is that, given rational planning, the value of the output would be at least equal to its cost. Using this approach, the value of a pilot's output therefore depends on the number of flying hours expected of each operational pilot and the cost of maintaining and operating the aircraft fleet. Using these data, we estimate that the value of the output of each Tornado GR1 pilot is some £6 million a year.

**3.26** In other words, given an actual shortfall in available trained pilots together with under utilised front line assets, a 12 month reduction in the time taken to train Tornado pilots would result in an increase in defence output of £6 million a year for each extra pilot reaching the front line. The Department would then no longer be maintaining costly assets and infrastructure - the annual full cost of holding each Tornado is some £5 million - to support a front line capability that could not be utilised because of a critical shortage of trained pilots.

**3.27** Despite an overall shortage of trained pilots - the Department reported a 6 per cent shortfall of fast jet pilots in April 2000 - they have been able to maintain their operational commitments. They have done so by reducing their planned ratios of pilots to aircraft, drawing on experienced pilots from several units to deploy on operations, and reducing the time pilots spend between operational tours. However, if pilot shortfalls were to continue at this level there could be long term implications with 'over-stretch' affecting morale and increasing retention problems.

# Part 4: Managing for quality and efficiency

**4.1** The Agency have pursued a number of quality management and efficiency initiatives over the years but there has been no examination of the overall effects on service quality and whether savings have been achieved. This Part therefore examines the Agency's quality targets and the results of the various quality initiatives. It also examines the impacts of their efficiency initiatives, focusing on the closure of establishments and contractorisation.

## The Agency's quality targets

**4.2** Figure 19 shows the Agency's quality of output targets and reported performance in each of the six years 1994-95 to 1999-00.

**Figure 19**

**Quality of Output targets**

| Financial Year | Target Description | Achievement criteria | Reported Performance |
|---|---|---|---|
| 1994-95 | To evaluate the quality control mechanisms across all areas of training, and make recommendations for implementation during 1995-96 | N/A | Took forward ground training courses, work on flying training courses put on hold pending outcome of defence cost study |
| 1995-96 | By 31 March 1996 to take forward the recommendations of the Quality Management Workshop Report | N/A | Four ground training units achieved ISO 9000, work has resumed on flying training courses |
| 1996-97 | Maintain the present levels of quality in the Agency's outputs | Maintain present levels | Achieved |
| 1997-98 | Achievement of customer satisfaction with the quality of graduate trainees as reflected in Customer Advisory Committee reports to the Air Officer Commanding in Chief | 95% | Achieved |
| 1998-99 | Achievement of customer satisfaction with the quality of graduate trainees as reflected in Customer Advisory Committee reports to the Air Officer Commanding in Chief | Development of a Quality Monitoring System by 31 March 1999 | Achieved |
| 1999-2000 | Customer satisfaction with the quality of graduate trainees as reflected in an assessment based on a matrix of measures | To achieve a rating of satisfactory in the Agency's customer satisfaction matrix for the quality of 100% of graduate trainees | |

**4.3** We looked to see whether the Agency's target setting and reporting of performance reflected best practice:

- In the first two years, milestones were set but achievement criteria were not specified.

- In 1996-97 the Agency's target was to maintain their present levels of quality. However, they had not previously conducted quality assessments against which to compare their performance, nor did they have an agreed mechanism for measuring the quality of their outputs.

- For 1997-98 and 1998-99 the Agency have sought to assess quality by reference to their Customer Advisory Committee. Whilst the Committee was set up in April 1994, it did not meet until October 1997 and there was no high level mechanism for quantifying levels of satisfaction. There was therefore no audit trail to substantiate the reported performance. The Agency told us that their assessment of 95 per cent satisfaction was based on there being no complaints.

- As part of their quality target for 1998-99 the Agency undertook to establish a framework for monitoring quality which they reported as having been achieved. Their 1999-00 target refers to assessing quality against such a framework but in August 1999 the framework was not in place.

**4.4** We investigated the extent to which the Agency's customers voiced their concerns at the shortfalls in new pilots and quality aspects. The Agency's Owner has established an Advisory Board and a Customer Advisory Committee but the Board did not meet until December 1998. The Customer Advisory Committee met for the first time in October 1997 and its remit is more concerned with the quality of the Agency's output rather than the extent of shortfalls in output. During the first five years as an Agency, therefore, there was no formal mechanism for customers to articulate their concerns regarding the shortfall in output. There were, however, a number of steering committees which met to review progress on pilot training. Review was conducted in two ways: by aircraft stream - for example the Fast Jet Aircrew Steering Committee; and by school - by the Customer Advisory Committees of the Joint Elementary Flying Training School and the Defence Helicopter Flying School. These brought together those responsible for training - senior instructors at the various establishments - and the key customers such as the commanders of Operational Training Units, or the commanders of the advanced flying training establishments.

**4.5** The Agency emphasise the importance of meeting the needs of their customers for timeliness (as well as for quantity and quality) but they do not monitor how long trainees actually spend in the training pipeline. Our analysis has shown that training times increased significantly - from three years to six years, but have since fallen to some 5.5 years. The Agency consider that the factors contributing to the extended training times, described in paragraph 3.11, no longer apply, and that pilots should complete their training within the target times. Time taken is a useful metric and provides an indicator of the overall efficiency of the training process.

## Quality of output standards for flying training

**4.6** At a more detailed level, we looked to see what accepted quality standards the Agency had in place to define the required pilot standards at intermediate and final stages. In the past output quality standards throughout the training pipeline have been unclear, but the Agency have made recent progress on agreeing standards for the various aircraft streams and customers. In March 2000 the Agency agreed output standards with Royal Air Force fast jet customers which set out the level of proficiency required of newly trained pilots across a range of flying and mission skills. The Agency expect to agree similar standards for other aircraft in 2000-01, and to establish service level agreements with Royal Navy and Army customers by September 2000.

**4.7** Responsibility for the content of individual training courses historically rested with the commanders of the various training establishments. More recently the Agency have looked to provide a co-ordinated overview, considering the impact of any proposed changes on other parts of the system before taking action. However, syllabus content is linked to output standards and strong co-ordination is essential if the Agency are to identify training activities that can be downloaded to earlier stages of pilot training.

**4.8** These findings show clear weaknesses in the Department's arrangements for setting appropriate quality targets and standards and monitoring their achievement. The weaknesses are particularly exposed by the adoption of purchaser/supplier organisation structures that have found formal expression in the creation of the Agency. That model of operation depends for full success on the purchaser specifying the performance needed, and the supplier having freedoms within the performance 'contract' to achieve that performance by a variety of means.

## Customer satisfaction with the quality of new pilots

**4.9** To develop a broad picture of the quality of the Agency's output of trained pilots we conducted a survey of the 22 Operational Training Units who are the Agency's immediate customers, 19 units (86 per cent) responded. In the two years 1997-98 and 1998-99, Operational Training Units received a total of 263 newly trained pilots from the Agency, of which 211 passed their course, 44 are still in training, and 8 failed. We looked to obtain customer's views on the quality of trainees and the causes of any failures at Operational Training Units.

**4.10** On the overall quality of trainees, customers stated that some 96 per cent of trainees were at least broadly equipped to start the course, 39 per cent of trainees being fully equipped to start the course. We asked the Operational Training Units whether trainees in the past two years were as well prepared for life in the military as trainees in the past. Fourteen units said that recent trainees were well prepared, although some units felt that this reflected the fact that trainees in recent years have been on average older than in the past. Overall, 14 units felt that the quality of trainees was lower than in the past, while four units felt that the quality of trainees had improved. Without clear output standards it is difficult to determine whether these perceptions are firmly evidenced, or whether they reflect 'output creep' - a ratcheting up of expectations.

**4.11** The skill most commonly identified as lacking amongst trainees was basic aircraft handling. Broader aspects such as mental capacity to handle the demands of front line aircraft, and airmanship - general skill 'in the air' - were shortfalls. However, there were also shortcomings in navigation and instrument flying. Figure 20 sets out the most common responses.

**Commonly identified skills shortages**

**Figure 20**

*Aircraft handling was the most commonly identified skill shortage.*

| Skill | Number of Units that felt the skill was lacking |
|---|---|
| Aircraft Handling | 7 |
| Mental Capacity | 6 |
| Airmanship | 4 |
| Navigation | 3 |
| Instrument Flying | 3 |

**4.12** We asked the Operational Training Units to identify any changes that they have made to their courses in response to shortfalls in the skills possessed by trainees as set out in Figure 20 above. Nine units reported making changes to their courses in the two years 1997-98 and 1998-99. Three of these units now assess new trainees, and put together a tailored package of training to address their specific needs.

**4.13** Where trainees failed the course, five units stated that the reasons for at least some of the failures could have been identified earlier in the training system. However, only two units have taken specific action to question why the trainees had been permitted to proceed to their unit. In similar vein, we asked the Operational Training Units whether any aspects of their courses could usefully be introduced to the trainees earlier in their training. While many of the units felt that trainees would benefit from more flying experience, only five units identified specific skills which the trainees would benefit from learning earlier, and which would possibly lead to a reduction in the length of the Operational Training course. Four units pointed to the lack of night vision goggle experience (Figure 21) and one unit pointed to insufficient live weapon firing experience.

**Night flying**

**Figure 21**

Night Vision Goggles allow pilots to see in extremely low light conditions

Operational flying is often conducted at night, and front line fast jet and rotary wing pilots are expected to be proficient in the use of night vision goggles. These are image intensifiers which allow the pilots to operate their aircraft in extremely low light conditions. Night vision goggles are heavy and using them can be disorienting. It is important for pilots to master this skill before they reach the front line. Training in the use of night vision goggles is variable across aircraft streams.

For fast jet training, the Hawk fleet used at RAF Valley is not suitable for use with night vision goggles, without a cockpit upgrade. The cockpit displays cannot be dimmed, and the resulting light levels in the cockpit interfere with the sensitive night vision goggles, making them unusable. The Agency do not have any definite plans to upgrade the Hawk cockpit to allow the use of night vision goggles. Two Royal Air Force fast jet Operational Training Units have doubled the night flying training given to pilots to compensate for a reduction in night flying undertaken earlier in training.

As regards helicopter training, the Agency postponed the planned purchase of night vision goggles in 1998-99 for the Defence Helicopter Flying School as a savings measure. However, this decision did not take account of any costs incurred by Operational Training Units who provide this training. In February 2000 the Agency purchased night vision goggles for use by Royal Air Force trainees on the Griffin. The Royal Navy undertake night vision goggle training during advanced helicopter training at Yeovilton on Sea King or Lynx helicopters. The Army undertake night vision goggle training as part of their advanced helicopter training on the Squirrel at Middle Wallop, downloading five hours training from the Lynx helicopter - a full cost saving of some £16,000 for each trainee.

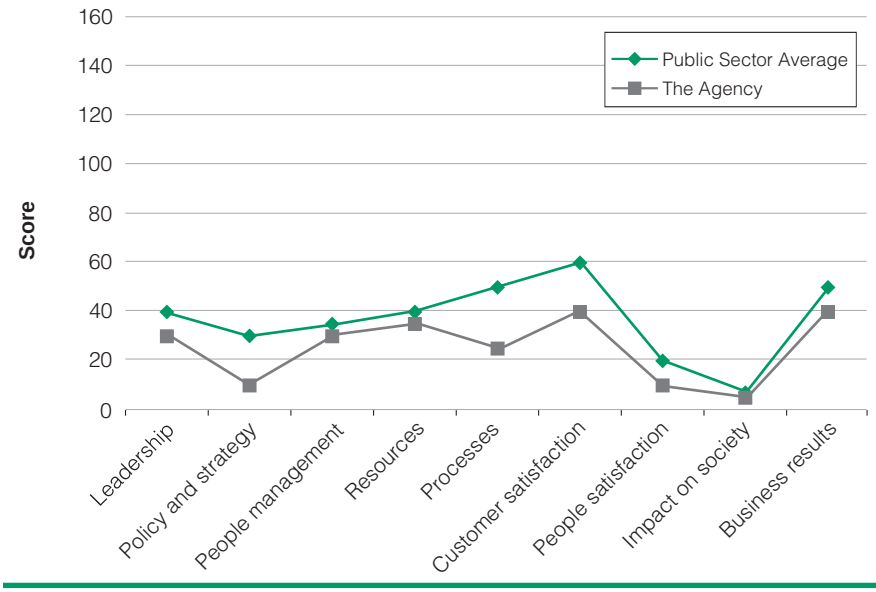
## Quality management initiatives

**4.14** At a corporate level the Agency have pursued a number of initiatives to improve quality. They have assessed their headquarters and their flying stations using the European Foundation for Quality Management's Business Excellence Model, which provides for assessments to be made on 9 main headings, and which can then be benchmarked against other organisations' scores (Figure 22). The Agency have also used the Business Excellence Model to structure their corporate and business planning.

**Business E cellence Assessments**

**Figure 22**

*While the Agency scores are below average, they broadly follow the pattern for public sector organisations.*




**4.15** For the Business Excellence Model to be used effectively, organisations need to be self-critical. It is to the Agency's credit that in undertaking their assessments they were prepared to identify and publish a number of weaknesses. They concluded that:

- Key processes are not identified, owned, or managed;
- There are no mechanisms for measuring the satisfaction of graduate trainees, customers or other stakeholders, nor are there mechanisms for measuring people satisfaction;

- The existing performance management framework is concerned with scrutiny rather than improvement, performance indicators are backward looking and focus on inputs, and the measurement of non-financial business results is immature; and

- There is little external benchmarking of the Agency's methods.

**4.16** As the Agency recognise from their Business Excellence Model analysis, feedback up and down the training pipeline between the training establishments is not systematic. For ground training, the Agency have put in place an Integrated Training Quality Management System, and in 1998-99 they piloted the system for flying training at RAF Linton-on-Ouse. The trial consisted of a survey of trainees who had recently completed the basic fast jet training course at RAF Linton-on-Ouse, their instructors from that course, and their instructors on the advanced fast jet training course at RAF Valley. The system is intended to identify any shortcomings, or wasted effort in the training at RAF Linton-on-Ouse, and also to develop a culture of feedback. While the trial was broadly successful, it did highlight the scale of the task the Agency face in changing the management culture. They sought the views of seven RAF Valley instructors on the standard of students provided by RAF Linton-on-Ouse, but received only three completed questionnaires. During 1999-00 the Agency extended the training quality management system to the remaining flying training establishments and Strike Command Operational Training Units.

**4.17** The Agency have also adopted other external quality standards. By 31 March 1999 the majority of the Agency's training establishments had been awarded 'Investor in People' status, and the Agency plan to obtain accreditation for their other establishments by November 1999. The Agency are also looking to improve their training processes and achieving ISO 9000 accreditation. To date four of the Agency's training establishments have achieved ISO 9000 accreditation, but these are not involved in the delivery of flying training. And the Agency have participated in the Cabinet Office's Public Sector Benchmarking project which utilised the Business Excellence Model and provided opportunities for benchmarking results with other public sector organisations and the private sector. The Agency's assessments broadly follow trends of other organisations with lower ratings for people satisfaction and impact on society. Their assessments tend also to be lower than those of comparators (see paragraph 4.14 and Figure 22).

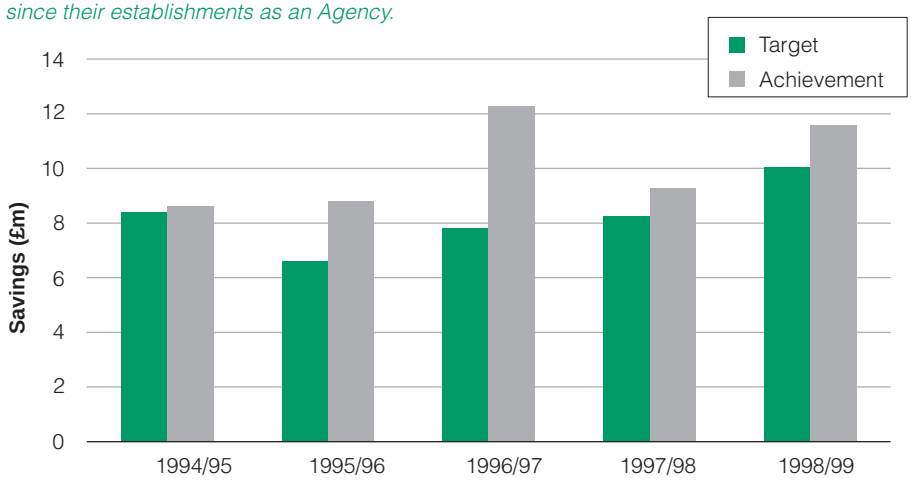
## Efficiency initiatives

**4.18** The Agency's efficiency target is to achieve the savings identified in their contribution to the Department's overall efficiency plan. Figure 23 shows that since becoming an Agency reported savings have exceeded target in each year. The Agency, however, score efficiency savings based solely on financial savings, not improvements in outputs. There is no attempt to measure efficiency in terms of unit costs, taking account of changes in the quantity and quality of output as well as the cost of delivering outputs.

**The Agency s efficiency targets and achievements**

**Figure 23**

*The Agency have reported that they exceeded their efficiency savings target in all five years since their establishments as an Agency.*




**4.19** Over the last 10 years, the Department have restructured much of their organisation to meet changes in defence requirements arising from the end of the Cold War (Figure 24). These changes have included reviews of the way in which they train new pilots. In 1992 the Department decided to concentrate advanced fast jet training on one site. In 1994, as part of the Department's series of Defence Costs Studies, the Department forecast that on flying training they would achieve savings of some 20 per cent of annual costs by 2003-04. Since the Defence Costs Studies, the Agency have sought further savings from the Competing for Quality programme and Public Private Partnering arrangements. The Department have also looked to adopt common approaches to training across the three Services. These tri-Service arrangements might also bring economies of scale, paving the way for rationalisation and possible contractorisation.

**Proposed efficiency improvements in pilot training**

**Figure 24**

| Proposed Measure | Forecast annual savings (£M) | Paragraph reference |
|---|---|---|
| Concentration of advanced fast jet training at RAF Valley | 25.5 | 4.22 |
| Contractorisation of multi-engine pilot training | 15.5 | 4.41 |
| Reduction in basic fast jet training through earlier streaming | 11.5 | 4.22 |
| Closure of RAF Linton-on-Ouse as a result of reduced basic fast jet task and spare flying capacity at RAF Cranwell | 11.5 | 4.22 |
| Tri-Service selection of pilot trainees | 11.5 | 2.5 - 2.11 |
| Tri-Service helicopter pilot training | 9 | 4.31 |
| Contractorisation of aircraft maintenance at RAF Valley | 4 | 4.28 |
| **Total** | **88.5** | |

Note: Savings estimates at 1998-99 prices

**4.20** The Department have not reviewed whether all their efficiency proposals have been implemented, nor what savings have been achieved. We therefore looked to see if the Department had implemented all the proposals and what savings they had made, covering:

- the closure of flying training stations;
- the contractorisation of flying training, and its support; and
- the quality of contract management.

## The closure of flying training stations

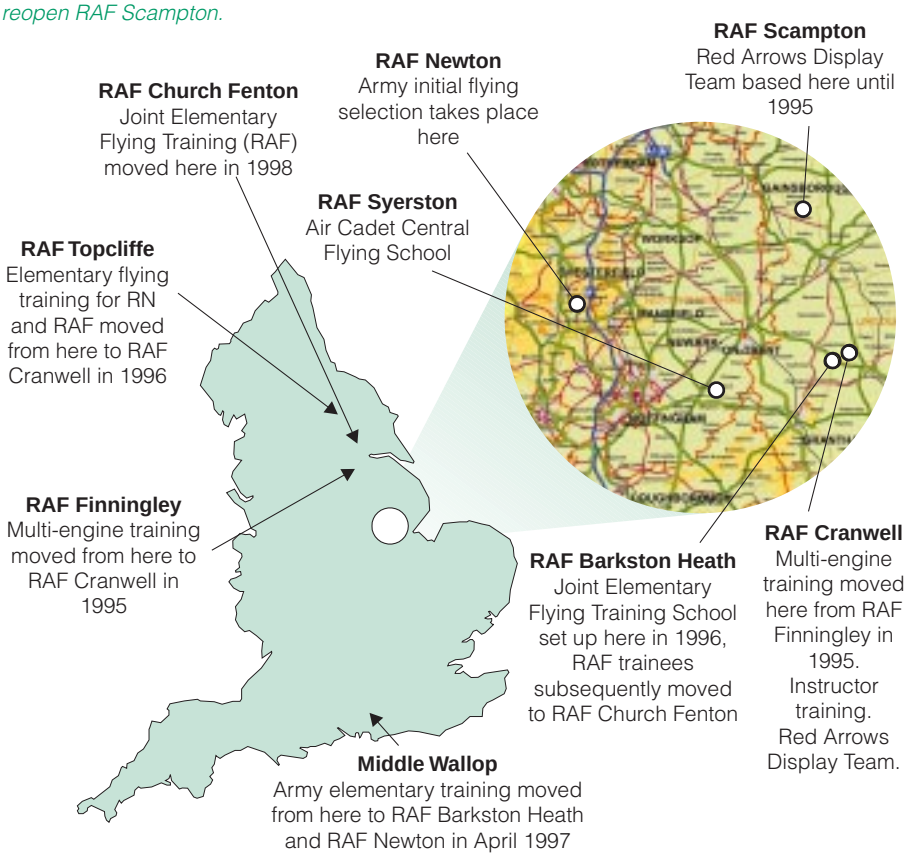
**4.21** The Department have identified measures which allow them to concentrate flying training at fewer locations and close establishments, resulting in one off savings from the disposal of surplus sites and reduced annual running costs.

**4.22** As part of the rationalisation of flying stations, the Department have concentrated fast jet training at RAF Valley, resulting in the closure of RAF Chivenor and RAF Brawdy. They also examined the scope for concentrating flying activities at RAF Cranwell and the immediately surrounding airfields - Barkston Heath, Newton, Scampton and Syerston (Figure 25). Transferring activities to RAF Cranwell would then allow them to close surplus establishments. However, air

**Flying activities transferred to and from RAF Cranwell and surrounding air stations**

**Figure 25**

*The Department closed five stations. They have reopened RAF Church Fenton, and they are to reopen RAF Scampton.*




space and runways are key constraints - runways are heavily used for flying training where trainees practise take off and landing - and the Department have experienced difficulties in achieving their plans.

- The Department decided to locate the Joint Elementary Flying Training School at RAF Barkston Heath, transferring Royal Air Force and Royal Navy trainees from RAF Topcliffe and Army trainees from Middle Wallop. They found, however, that there was insufficient capacity, and in 1999 they transferred Royal Air Force trainees to RAF Church Fenton.

- As part of the Defence Costs Study the Department decided to concentrate multi-engine training at RAF Cranwell and transferred the activity from RAF Finningley, allowing the Royal Air Force to close the station.

- The Department transferred the Red Arrows to RAF Cranwell enabling them to close RAF Scampton. However, they have found that this has reduced significantly airspace available for training at RAF Cranwell and are to re-open RAF Scampton.

- The Agency have continued to operate the Central Gliding School at RAF Syerston which is used largely for Air Cadet experience and have invested in the facilities.

**4.23** While the Department have ceased flying training at five air stations (Brawdy, Chivenor, Church Fenton, Finningley, and Scampton), they have been unable to manage the overall flying training task within the planned capacity. They have consequently reopened RAF Church Fenton and are to reopen RAF Scampton. They have also experienced significant difficulties in responding to changes in requirements and are contracting out some fast jet training to the NATO Flying Training Centre in Canada because of capacity constraints. The cost for 20 trainees a year over 10 years is £89 million.

## Contractorisation of flying training

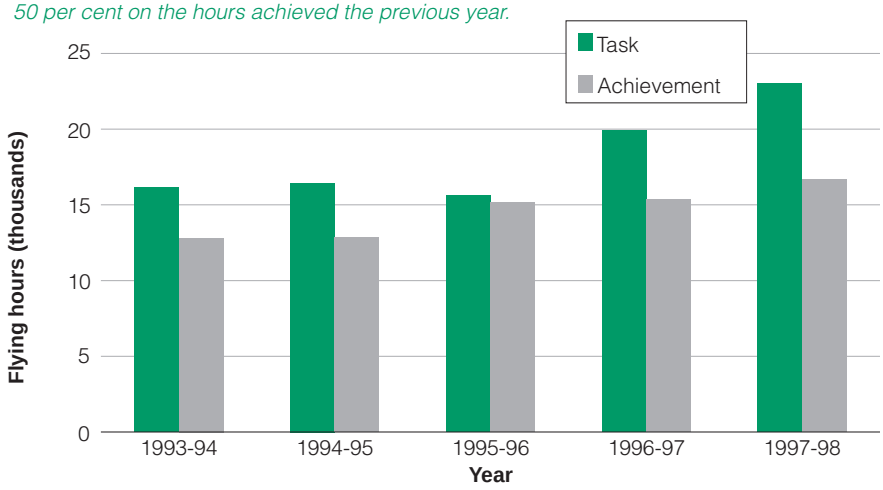
**4.24** Contractorisation has covered both support and training delivery. In the following paragraphs we explore the extent to which contractors have provided the desired quality and quantity of output by reference to three of the most significant contracts - that covering aircraft maintenance at RAF Valley; the full contracting-out of training at the Joint Elementary Flying Training School; and similar arrangements for the Defence Helicopter Flying School.

**4.25** Aircraft maintenance for the **Hawk** at RAF Valley has been contracted out since April 1997 to BRAMA. The contract specified the annual flying hours to be delivered but BRAMA were responsible only for the maintenance of aircraft. The Department retained responsibility for aircraft numbers, spares, instructors and trainees - all key factors in determining the volume of flying hours. For 1997-98 the target for the number of flying hours was set at 23,000, an increase of 50 per cent on the flying hours achieved in the year before contractorisation. In 1997-98 actual flying hours were 16,600 hours, less than the target number, but an increase of 8 per cent on the previous year, and better than the number of hours achieved in previous years (Figure 26).

**Flying hours at RAF alley 199 -94 to 1997-98**

**Figure 26**

*The flying task was not achieved in any of the five years, but the task in 1997-98 increased by 50 per cent on the hours achieved the previous year.*




**4.26** We examined the reasons for the shortfall in flying hours. In their bid BRAMA had included proposals for a contract phase-in period when BRAMA personnel would work alongside Royal Air Force personnel. In the event this period of overlap did not take place in line with the proposals in the contractor's bid. BRAMA experienced an initial shortfall of trained engineering staff but they had made clear in their bid that successful management of the contract would entail the creation of a dedicated training programme. Through local technical colleges BRAMA have been successful in establishing engineering training schemes which have helped them recruit and train the staff needed. And both contractor and local economy are set to benefit over the long-term from the links established. The Department accepted that BRAMA could not be held responsible for the shortfall in hours flown as a number of key factors were outside the contractor's control including the numbers of aircraft and instructors, the availability of spares and the deterioration of the aircraft - all of which were below the levels specified by the Department in the Invitation to Tender:

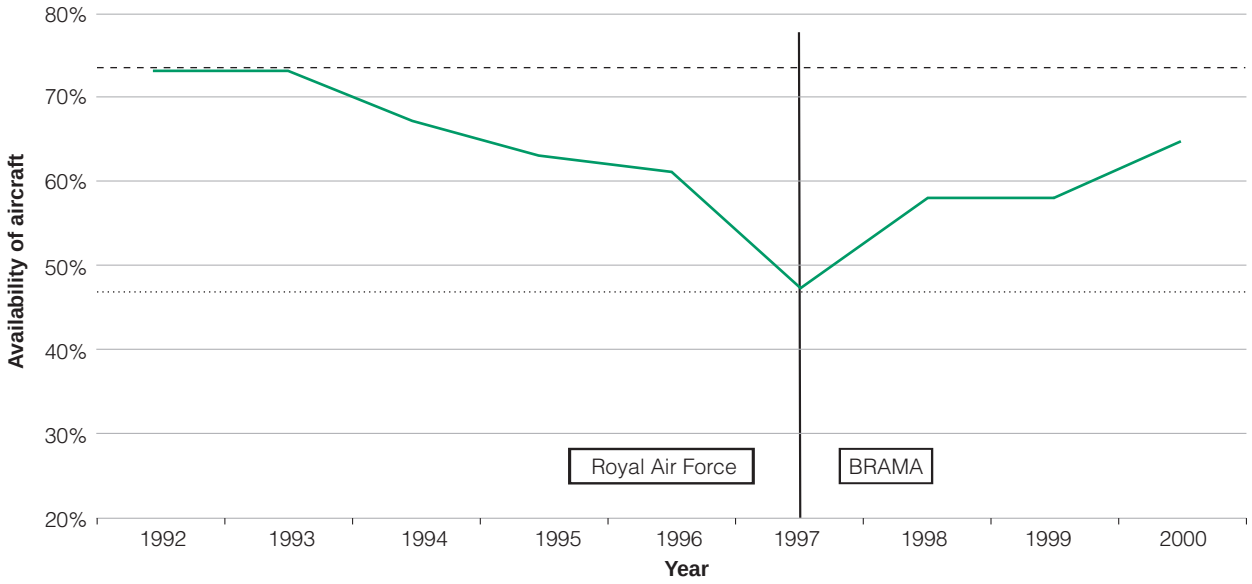
- The Department were required under the contract to provide 71 aircraft. In fact they provided 63 aircraft.

- During the competition the Department provided data on past performance which showed availability of aircraft was running at some 70 per cent. However, in the six months before contract implementation availability had fallen below 50 per cent. Since then availability has increased to 65 per cent (Figure 27).

**Figure 27**

**Availability of aircraft at RAF alley 1992 to 2000**

*Aircraft availability fell significantly in the years before contractorisation. Since then availability has increased to 65 per cent.*




Notes

Aircraft availability at competition baseline - 73 per cent

Aircraft availability at contract let - 47 per cent

**4.27** The Department have renegotiated the contract for aircraft maintenance. From April 1999, the Department require BRAMA to have 60 per cent of the Hawk fleet at RAF Valley available to meet the daily flying task. This represents an improvement of 10 percentage points on aircraft availability immediately prior to contractorisation. In addition the contractor is required to demonstrate an ability to sustain a sufficient level of availability throughout the flying day to meet the planned daily task. Where aircraft are not available for training, the Department and the contractor will agree the reasons. When the shortfall is a contractor failure, a remedial payment based on lost hours will be made at the end of the year. Where the contractor provides aircraft in excess of the determined level, the contractor is entitled to an incentive payment.

**4.28** The Department estimated that they would save some £4 million a year following contractorisation of aircraft maintenance and other support tasks at RAF Valley. In revising the contract to define the contractor's role more clearly, the Department agreed to increase the contract price by £0.75 million a year to reflect the extra resources required. This reduced the expected savings from contractorisation at RAF Valley to some £3.25 million a year. Outputs have, however, increased with improved availability of aircraft (up from less than 50 per cent to 65 per cent) and increases in annual flying hours from 16,000 prior to contractorisation to more than 18,000 in 1998-99.

**4.29** The **Joint Elementary Flying Training School** is fully contractorised - the contractor (Hunting Aviation) is responsible for the delivery of the training courses, the majority of instructors and aircraft. The Agency determine the syllabus and 20 per cent of the instructors are military personnel. However, the School is joint in name only as it provides separate courses for the three Services at two locations. Royal Air Force and Royal Navy trainees are taught a 60 hour course whereas Army trainees follow a 40 hour course. The Royal Navy and Royal Air Force trainees require extra time to increase the evidence available to support decisions on streaming - with those demonstrating sufficient capacity progressing to fast jet training. Army trainees progress only to helicopter training. Army and Royal Navy trainees are taught in temporary accommodation at RAF Barkston Heath. But as there is insufficient air space there to teach Royal Air Force trainees, they are now taught at RAF Church Fenton. Given the split locations and different courses, there is little attempt to engender tri-Service working. The contract is due for re-let in 2003 and this provides an opportunity to review progress and compare arrangements with the Defence Helicopter Flying School which does provide successful tri-Service training as set out in the following paragraphs.

**4.30** The Defence Helicopter Flying School was established in 1997 and provides joint training for all three Services before delivering bespoke training as set out in Figure 28. FBS won a 15 year contract in November 1996, some four months before the formation of the school, to provide and operate 47 helicopters, deliver training courses, and provide qualified helicopter instructors at three separate military bases in the United Kingdom - RAF Shawbury, Middle Wallop and RAF Valley.

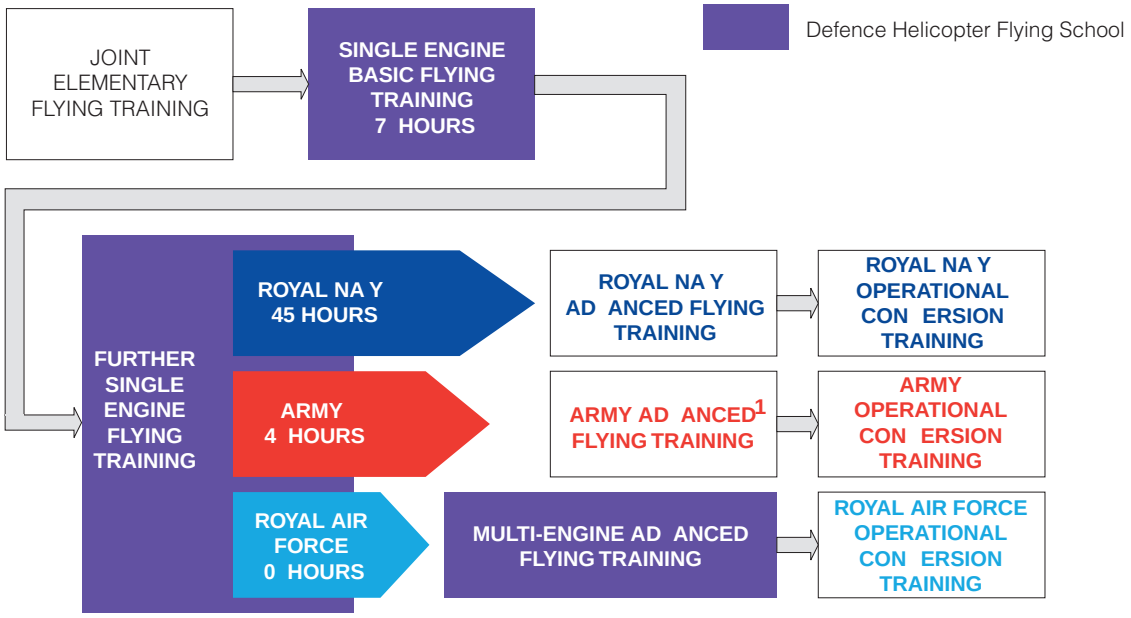
The Squirrel is flown on the basic helicopter training course.

The Griffin is flown on the Royal Air Force's advanced helicopter training course

**Figure 28**

**Helicopter training for the three Armed Services**

*While trainees do undertake joint helicopter training at the outset, more advanced training is provided on a single Service basis.*




Note: 1. Army advanced flying training is undertaken at Middle Wallop, but the aircraft, associated maintenance, and 40 per cent of the instructors are supplied under the Defence Helicopter Flying School contract. The school also provides search and rescue courses from RAF Valley for Royal Air Force helicopter trainees.

**4.31** The creation of the School was based on a detailed investment appraisal which estimated savings over the 15-year life of the contract of £77 million - which averages some £5 million a year. In a review of the initial phases of the project, they have revised the savings from down to just £26 million (some £1.7 million a year), for the reasons set out in Figure 29.

**4.32** As regards quality, the Department concluded in their project review that the Royal Navy and Army were generally content with the output quality of trainees from the School. In contrast the Royal Air Force considered that there had been a significant diminution of quality since the establishment of the School, and that the School made fewer demands on trainees. Some RAF graduates from the School had difficulty maintaining an accurate hover (both during the day and at night) and navigation skills were less developed. The Royal Air Force considered that the very low wastage rate at the School meant that training risk had been passed to Operational Training Units. They pointed to an increase in the wastage rate at Operational Training Units and the need to provide additional flying hours for some trainees. For their part, however, trainees were impressed with the School.

They rated highly the standard of accommodation, the new aircraft and the emphasis on military ethos, and contrasted their experience at the Helicopter School with that of the Joint Elementary Flying Training School.

**Revised estimate of forecast savings from the establishment of the Defence Helicopter Flying School**

**Figure 29**

*The Department's forecast savings have fallen by two thirds - from £77 million to £26 million.*

| Savings | £M |
|---|---|
| **Original estimate of savings** | **+77** |
| Receipts from disposal of Lynx and Gazelle helicopters not realised | -19 |
| Unforeseen Gazelle training for Army pilots and staff costs at RAF Shawbury | -19 |
| Additional flying at Joint Elementary Flying Training School for Army trainees | -10 |
| Contract amendments | -5 |
| Additional works projects at RAF Shawbury | -4 |
| Over estimate of cost increases through the Variation of Price clause (applies to contract payments in years 6 to 15) | +6 |
| **Revised forecast of savings** | **+26** |

## Contract management arrangements

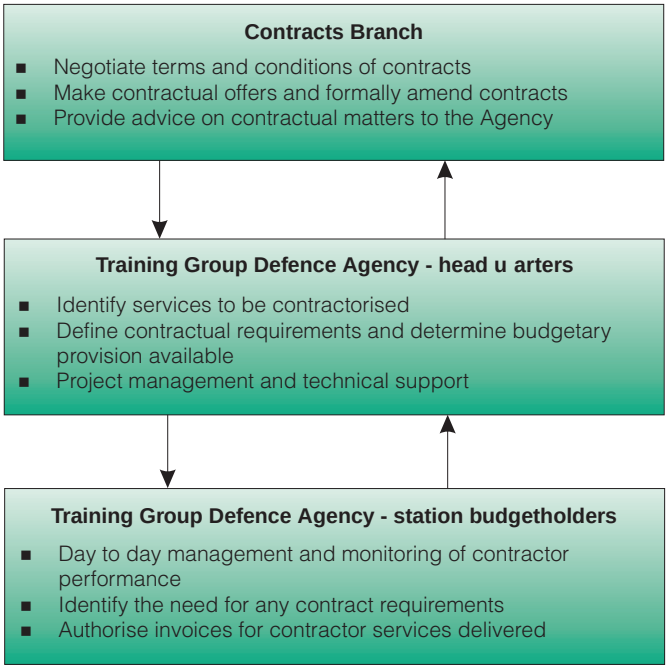
**4.33** Figure 30 shows the main responsibilities for contract management. The Agency determine which services to contractorise, following Departmental policy guidance, and manage the competitive tendering process. Day to day responsibility for managing the contract lies with the flying station budgetholders, with the Agency setting budgets. Contracts Branch, part of the Chief of Defence Logistics Organisation, negotiate the terms and conditions of contracts and provide advice on contractual matters to the Agency.

**4.34** The contracting process has proved unwieldy, with contract amendments taking many months. For example, the Department agreed the price of changes in work volume on the Cranwell contract for 1997-98 in February 1999 - some 11 months after the end of the financial year. There have also been significant numbers of contract amendments outstanding - 74 of the 141 contract amendments raised in 1997-98 were outstanding in May 1998. While the Department have dealt with these contract amendments, in November 1999 there were 52 contract amendments pending.

**Responsibilities for managing contracts for flying training stations**

**Figure 30**

*The responsibilities for the management of the Agency's contracts are shared.*




**4.35** We found that responsibilities for contract management were not clearly defined:

- When negotiating contract amendments or agreeing prices for changes in workload, station budgetholders identified the total budget. However, Contracts Branch undertook negotiations with contractors and agreed prices but did not gain budgetholders' agreement to the final figure.

- Contracts Branch informed budgetholders of the overall contract price, but they did not provide them with full data on the constituent elements. And when agreeing prices for changes in workload, Contracts Branch informed budgetholders of the total price but not the prices of individual line items.

**4.36** As part of their Smart Procurement initiative, the Department are creating integrated project teams containing budgetholders and contracts staff. The Department have issued guidance defining more clearly the roles of budgetholders and contracts staff. This guidance states that:

- Contracts staff should enter into negotiations to let or amend contracts only when requested to do so by the budgetholders;

- Price negotiations with contractors should include budgetholders and any relevant specialist advisors. Budgetholders should advise contracts staff on any technical issues and cost/quality trade-offs.

**4.37** The need for alert and coherent contract management was reinforced by our findings on a number of contracts - where delays or weak pursuit of contractual rights had cost the Department money. Savings are less than forecast at RAF Linton-on-Ouse, for example, as the Department failed to give the required three months notice to extend the contract for years four and five, based on original prices. The contractor (Bombardier) has required the Department to re-negotiate these prices. The additional costs arising from these re-negotiations are some £2 million a year. The Department consider that the deteriorating condition of the aircraft would have required an increase in the contract price in any event. We note, however, that because the Department did not give the required notice to extend the contract they were negotiating from a position of weakness.

**4.38** At the Defence Helicopter Flying School, the contractor (FBS) has not provided the number of aircraft specified. In 1998-99, FBS provided an average of 22 Squirrel helicopters a day (against a contract target of 24) and an average of seven Griffin helicopters a day (against a target of eight). Outputs through 1999-00 were improved - averaging 24.8 squirrels and 7.8 Griffins. The contract allows the Department to withhold 'reasonable' sums if the contractor does not deliver the specified service. The Department did not seek to reduce payments to the contractor as they considered that overall aircraft availability was sufficient for the numbers of trainees. We noted, however, that the Department's monthly monitoring reports on occasions reported that availability was unsatisfactory. In addition, when negotiating the contract terms, the Department had reduced the overall numbers of aircraft proposed by the contractor and considered that they therefore shared some of the risk for service delivery - which in turn reduced their scope to seek full recompense for unsatisfactory performance.

**4.39** FBS was also required to provide a new simulator for the Griffin helicopter, together with other synthetic training aids. The simulator was operational in July 1999, three months late. During this period FBS provided extra flying hours, valued at £84,000, at no cost to the Department who withheld a milestone payment of some £100,000 until the contractor handed over the simulator. However, the Department paid £90,000 a month for the synthetic training facilities (of which the

simulator was the major element) as part of the overall contract. The monthly cost covers both the running costs and a contribution towards the capital cost of the simulator. The Department specified that the simulator should have a sophisticated, state of the art, display unit which was under development when the contract was awarded. There has been some slippage in the software, and FBS has provided an interim visual unit. This is comparable with other simulators used by the Department, and provides a usable training facility. A fully compliant simulator package is not now expected to be available before July 2000, 15 months late. Meantime, the Department continue to make the full monthly £90,000 payments for the synthetic training facilities.

**4.40** To deal with inevitable uncertainties over the precise volume of training required, the Department have attempted to pass some of the associated risk to the contractor. In letting contracts the Department use the number of annual flying hours of each aircraft fleet as a key measure of activity. Typically, if there are variations in annual flying hours of more than 10 per cent, the Department would be able to negotiate a change to the contract price.

- In 1997-98 the Department underflew their aircraft fleets at RAF Linton-on-Ouse (Tucano) by 30 per cent and Cranwell (Jetstream and Dominie) by 16 per cent. However, when negotiating the value of changed workloads for 1997-98, the Department were not able to reduce prices given the decrease in aircraft activity. The arrangements for varying contract prices were complex, and they did not specify prices for variances greater than 10 per cent. The Department also considered that if they were to negotiate price reductions during a temporary reduction in the flying task, the contractors would then have to reduce their costs, particularly labour costs. In the Department's view such action would jeopardise the contractors' ability to respond to any subsequent increases in the flying task.

- For the Defence Helicopter Flying School, in addition to the fixed price if hours flown are within 10 per cent of forecast, the Department agreed fixed prices for bands either side of 10 per cent variance. However, the Department might have been able to incentivise the contractor by agreeing price variations - a proposal put forward by the contractor (FBS).

**4.41** The Department are examining scope for further contractorisation and extending partnering arrangements with the private sector. In July 1998 they concluded a private finance arrangement with Bombardier for the replacement of

the Bulldog aircraft. Bombardier will supply Grob 'Tutor' aircraft and maintenance services to University Air Squadrons. The Department expect to consider similar private finance options when they replace the Tucano and Hawk aircraft. The Defence Costs Study recommended that initial pilot training for multi-engine pilots should be civilianised. In February 1999, the Department invited proposals for a restructured and civilianised multi-engine initial pilot training system, based on a long term private finance contract. The Department have not progressed these proposals as they are currently reviewing options for closer industry involvement in the delivery of flying training.

# Appendix 1

## Methods used in the report

**A1.1** This Appendix sets out the key methods we have used in undertaking our work on pilot training.

### Mapping the process of training new pilots

**A1.2** With our consultants, HVR Consultancy Services Limited, we prepared a process map which describes the system for training new pilots in diagrammatic form and the various influences on the system. Appendix 2 gives full details of the process map.

### Reviewing the Agency's key targets

**A1.3** We examined the Agency's key targets for each year since 1994-95, when the Agency was established. We looked to see whether the targets were set in line with best practice, and the extent to which the Agency's reported performance could be verified. (Paragraphs 4.2 to 4.3 and Figure 19; Annex A to Appendix 1)

### The time taken to complete training

**A1.4** We obtained data on 1,746 Royal Air Force trainees from the Department's Personnel and Training Information System. This database records all of the training courses Royal Air Force personnel undertake throughout their career and the outcome, together with some basic information on their background prior to joining the Royal Air Force. We analysed the data to determine the average time taken to train pilots. We undertook further analysis to determine if the time taken has increased in recent years, and whether it takes longer to train fast jet pilots compared with other pilots. (Paragraphs 3.9 to 3.12, and Figures 15 and 16; Annex B to Appendix 1).

### Analysis of aptitude scores

**A1.5** For our sample of 1,746 Royal Air Force trainees, we obtained data on their original aptitude scores when initially selected. We then sought to examine whether aptitude tests are a good predictor of future flying ability. We conducted three analyses:

- We compared the aptitude scores for trainees who passed elementary flying training with the aptitude scores for those trainees who failed elementary flying training (Paragraph 2.6 and Figure 11).

- To see whether aptitude scores are a good predictor of overall success in completing pilot training, we compared the aptitude scores of pilots who completed training with the aptitude scores of those trainees who failed to complete their pilot training (Paragraph 2.7 and Figure 11).

- We also examined whether aptitude scores for fast jet pilots were higher than those of other pilots (Paragraph 2.8).

### The customer satisfaction survey

**A1.6** We undertook a survey all 22 Operational Training Units in the Department to obtain their views as the primary customers of the Agency's output of trained pilots. The survey sought to compare the quality of the Agency's output of pilots in the two years 1997-98 and 1998-99 with previous years (Paragraphs 4.9 to 4.13 and Figure 20).

### Costing pilot training

**A1.7** The purpose of the costing exercise was to:

- Identify the cost of pilot training, splitting this out from the costs of other activities undertaken at flying stations (such as navigator training and support for lodger units).

- Identify a method for calculating unit costs, apply this to our cost information on pilot training, and to analyse the unit cost into its key components.

- Show the comparative cost of initial and operational pilot training.

- Indicate the value of potential lost output from a shortage of operational pilots.

**A1.8** To identify the cost of pilot training, we drew on cost data from the Training Group Defence Agency's flying stations, the Army at Middle Wallop and the Royal Navy at Yeovilton. We also obtained data from Strike Command to calculate the cost of operational aircraft. We gathered data on actual activity levels at each establishment where available. Where outturn data were not available, we used the Department's planning numbers as broad indicators of activity levels.

**A1.9** To cost the implications of delays in the training pipeline and the resulting shortage of operational pilots, we estimated the value of a fast jet pilot. Using revealed preference theory and assuming rational allocation of resources, the value of output is equivalent to the cost of resources used to produce that output. Fast jet pilots would be expected to complete a number of sorties each year and the Department have cost estimates of the hourly cost of these sorties. Alternatively, where the Department have a shortage of pilots, they have to maintain additional capacity. The cost of ownership of that capacity provides an estimate of the lost output.

# Annex A to Appendix 1

## The Training Group Defence Agency's performance against output targets

**1** We examined the Agency's performance against their key output targets in each of the six years 1994-95 to 1999-00 (Figure A1).

**Figure A1**

**The Agency's performance against their output target**

| Financial Year | Target[1] | Reported Performance |
|---|---|---|
| 1994-95 & 1995-96 | No output target specified | N/A |
| 1996-97 | To deliver the number of trained personnel as set out in the RAF 1996-97 manning plan | Failed, fast jet pilot output was 19 pilots short. Target met for other aircraft streams |
| 1997-98 | To deliver 96% of the RAF's requirement for trained aircrew | Failed, fast jet pilot output was 14 pilots short. Target met for other aircraft streams |
| 1998-99 | To deliver 96% of the RAF's requirement for trained aircrew | Failed, 78.8 per cent achievement overall, the target was not met for any aircraft stream |
| 1999-00 | **Number of new pilots provided to Operational Training Units** | |
| | Fast Jet Pilots 59 | [Not yet available] |
| | Multi-Engine Pilots 46 | |
| | Helicopter Pilots 33 | |
| | **Other customers and refresher training - number of training places** | |
| | Royal Navy, Army, Refresher and Instructor training 819 | |

Note: 1. Targets for aircrew as a whole were applied pro rata to major groups of trainees, including pilots.

**2** The Agency's key targets do not fully reflect Departmental targets for new pilots:

- As the Agency are responsible only for initial training, their targets are based on providing new pilots to the operational units rather than providing trained pilots available to front line posts.

- The Agency output target for delivering trained pilots is restricted to the Royal Air Force's needs, the other Services are accorded only input targets - the availability of training places.

- In 1997-98 and 1998-99 the Agency's output target for the Royal Air Force was to achieve 96 per cent of the flying training requirement rather than the 100 per cent as set in 1996-97. While the Agency stated that 96 per cent reflected historical performance and was challenging, bare achievement of the target would not meet overall Royal Air Force requirements, leading to further shortages of front line pilots.

- Agency targets for production of Royal Air Force fast jet pilots rise from 59 in 1999-2000 to 67 by 2003-04. Only at the end of the period will the Agency be providing sufficient pilots, given around 10 per cent wastage in Operational Training Units, to satisfy current Royal Air Force requirements for 60 operational fast jet pilots each year.

# Annex B to Appendix 1

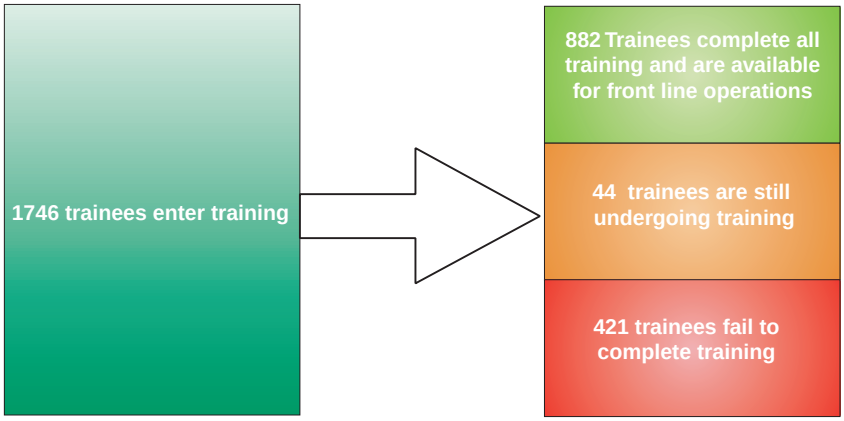
## The time taken to train Royal Air Force pilots

**1** In Part 3 we analysed the reasons for the Department's shortfall in training new fast jet pilots. This analysis was based on data obtained from the Royal Air Force's Personnel Training Information System. We collected information on all the Royal Air Force trainees who began pilot training between 1 April 1987 and 31 March 1999 - a total population of 1,746 trainees. Figure B1 shows what has happened to the trainees since they joined the Royal Air Force.

**Figure B1**

**Breakdown of Royal Air Force trainees entering pilot training from April 1987 to March 1999**

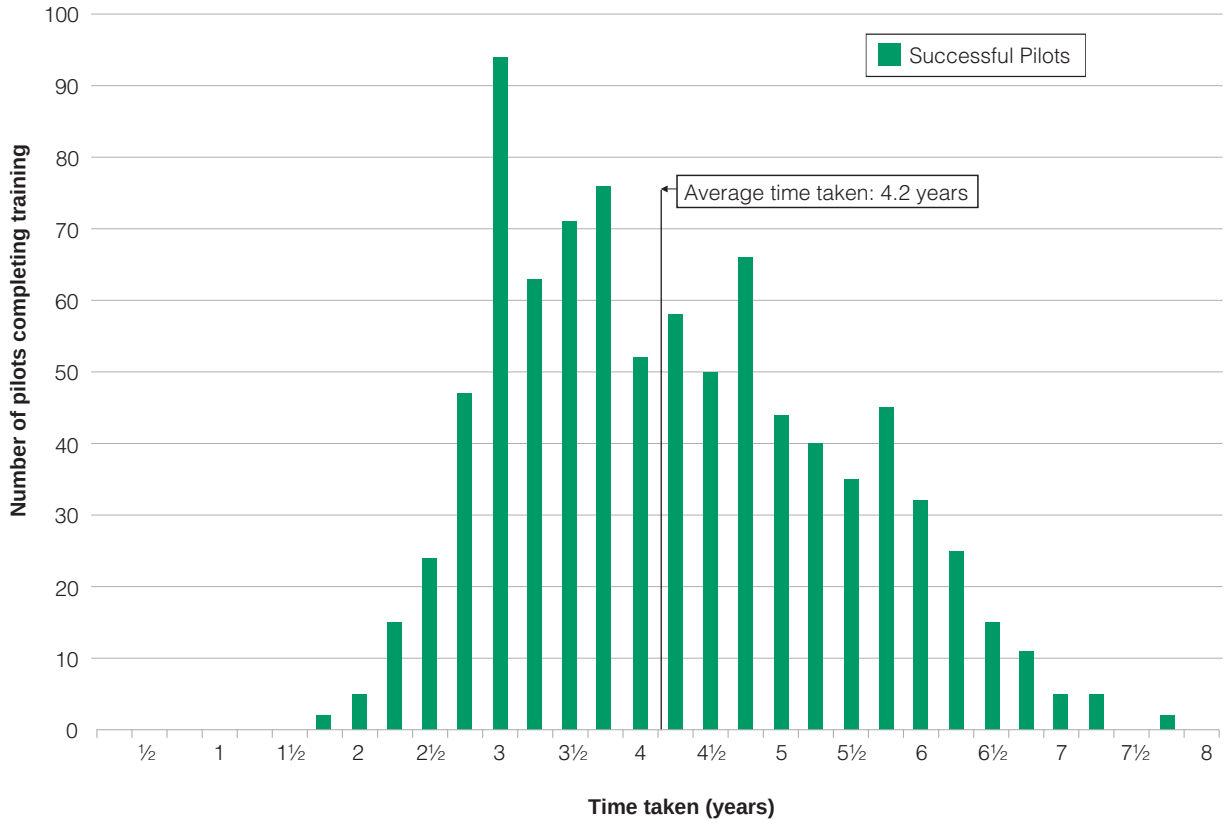
*Some 51 per cent of trainees entering pilot training have completed training, with a further 25 per cent still undergoing initial training in March1999.*




**2** Of the 882 successful pilots, 339 are fast jet pilots, and form the sample analysed in Part 3 (Paragraphs 3.9 to 3.12). We conducted the same analysis for all 882 successful pilots and found that the average time taken was 4.2 years. Some 65 per cent of the successful pilots took more than 3.5 years, with some 25 per cent taking more than five years. Figure B2 shows the distribution of total training times for all 882 successful pilots.

**Figure B2** **The time taken by Royal Air Force pilots to complete their initial training**

*On average the Royal Air Force have taken 4.2 years to train pilots, compared with their estimate of 3.2 years.*




**3** We looked to see if training times had increased in recent years and analysed the time taken for a number of cohorts of trainees. Figure B3 shows the time taken by the successful trainees broken down into six month periods in which they completed training. Those who completed their training in the first half of 1991-92 took on average 3.1 years, but by the second half of 1996-97 this had increased to a peak of 5.6 years, since when the average time taken has fallen to 4.8 years.

**The elapsed training time for Royal Air Force pilots**

**Figure B3**

*The time taken to train pilots has increased from just over three years to a peak in 1996-97 of 5.6 years. Training times have since fallen to just under five years.*

# Appendix 2

## Mapping the pilot training process

**A2.1** As part of our work, we developed an overview of the pilot training process. This process map helped to structure our subsequent analyses, and provided assurance that no critical areas were omitted from our investigations. This Appendix sets out the results of our process mapping exercise (Figure A2.2), and explains how the map can be used to explain the relationship between different parts of the training pipeline. We employed HVR Consultancy Services Ltd as consultants to assist us.

**A2.2** We prepared a draft process map using documentary evidence, and discussed the draft in a workshop with personnel from the Agency. The aim of the session was to obtain views on the draft process map, and assurance that it accurately depicted the problems associated with pilot training. The workshop focused on two issues:

- How can delays in the training process be reduced?
- How can the throughput of trained pilots be increased?

**A2.3** We then refined the process map, taking account of the comments made at the workshop.

### How the process map works

**A2.4** The process map broadly illustrates the dependencies between training times, the retention of trained operational pilots, and the ability to meet future training targets, subject to resource availability. The map uses influence diagram notation to depict the cause and effect relationships between variables (Figure A2.1).

**Figure A2.1** **Influence diagram notation**

Influence diagram notation consists of an arrow, to show the direction of the influence (i.e. the variable at the tail of the arrow exerts an influence upon the variable at the head); with + and - signs to depict the sense of the influence.

Thus a positive (+) influence implies that if the tail variable increased in value, then the head variable would also be expected to increase. Equally if the tail variable reduced then so would the head.



A negative (-) influence suggests that if the tail variable increased in value, then the head variable would be expected to reduce. Equally if the tail variable reduced then the head variable would be expected to increase.

Chains of cause and effect can be established by tracing influences between several variables. It is then necessary to observe that, if there are an even number of negative influences in the chain, pairs of negative influences cancel out and yield a positive effect. Thus if 'a' has a negative influence on 'b' and 'b' negatively influences 'c', then 'a' is capable of exerting a positive influence on 'c'. Powerful insights into system behaviour can be obtained by analysing the consequences of closed chains (loops) of influences.

**A2.5** The main flow in the process map (Figure A2.2) is shown by the large green arrow, running from left to right. The flow commences with the applicant pool. Applicants are accepted into the basic flying training course at a rate determined by the acceptance standards, training targets, instructor availability and the size of the applicant pool. Applicants then progress through basic training and operational training to become front-line pilots. Finally operational pilots leave after completing one or more tours of duty.

**A2.6** The remainder of the process map captures the multitude of factors that impact upon the rates of progression through training and subsequent retention of operational pilots. Numerous loops can be observed in the diagram. To the left end of the green arrow showing the flow of trainees, the applicant pool, acceptance standards and training start rate are connected in a simple loop. More complex examples are:

- the number of operational pilots influences the training target, which ultimately influences the number of operational pilots; and
- the number of instructors available influences the time to complete training, which affects number of operational pilots and hence instructors available.

## Results

**A2.7** Analysis of the process map shows that the training pipeline has a number of critical factors that limit the Agency's ability to meet their targets. These are as follows:

- The largest single factor influencing the training process is the allocation of resources to complete the syllabus, covering equipment, facilities and staff. Training schedules are planned with little or no leeway so if any slippage occurs (through aircraft availability, simulator down-time, instructor absence) it is extremely difficult to catch-up.

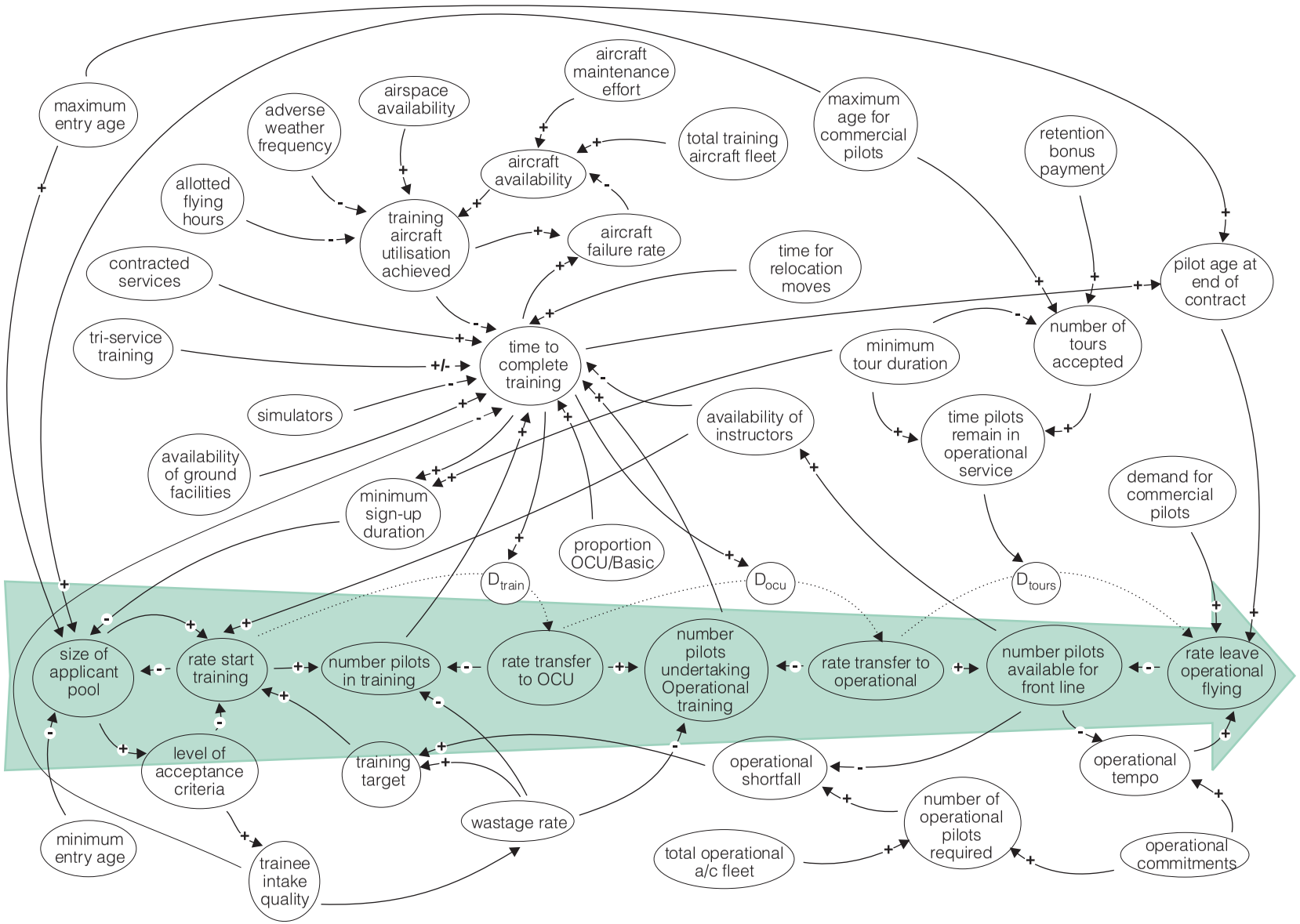
- The drive towards contractorisation for the provision of training facilities at set output levels is resulting in extremely limited flexibility in the overall process. For example, the contracted logistics support process can result in significant delays in the provision of spares needed to ensure a sufficiently high level of aircraft availability to cope with peaks in demand.

- There is no overarching policy on the use of synthetic training equipment. Such a policy needs to recognise the considerable value in using simple, cost effective training systems (e.g. procedural trainers on relatively low cost computer equipment), which will potentially free-up the more complex and expensive simulators for the more demanding elements of the training programme.

- Shortages of operational pilots impacts on instructor availability, which in turn both limits the number of trainees taken on and affects training time. Because training targets have to be increased to correct the shortfall of pilots, the Agency are faced with a difficult balance to strike, for example reducing the input standards at selection so as to increase the number of trainees entering training. If pilot numbers are low the increased operational tempo results in more pilots seeking to leave and hence the pilot shortfall is aggravated.

- The ability of the training system to correct pilot shortfalls is always delayed by the total time required for training. This lag in the system's ability to respond means that if pilot numbers fluctuate rapidly, as pilots leave operational service, the training system will inevitably require time to catch up. Increasing the minimum sign-up time for pilots, to ensure that more tours of duty are served, might help resolve the problem. However, this creates a disincentive to future applicants, reducing the applicant pool size, which, again, causes the situation to degrade in the long term.

**Figure A2.2** The factors affecting the pilot training process



# Appendix 3

## Comparison of contractual arrangements

| Contract | Joint Elementary Flying Training School | Linton | Cranwell | Defence Helicopter Flying School | alley[1] | Light Aircraft Flying Training (Bulldog replacement) |
|---|---|---|---|---|---|---|
| **Year let** | 1993 | 1995 | 1997 | 1997 | 1997 | 1999 |
| **Contractor** | Hunting Aviation | Bombardier | Hunting Aviation | FBS | BRAMA | Bombardier |
| **Length of contract** | 5 years plus 5 years extension | 3 years with options for further 2 years<br>Extended to October 2001 | 5 years + options for further 2 years | 15 years | 5 years with options for further 2 years | 10 years |
| **Multi activity contract** | No | Yes | Yes | Yes | Yes | Yes |
| **Flying related services provided by the contractor** | Aircraft<br>Spares<br>Aircraft engineering<br>80% of flying instructors | Aircraft engineering | Aircraft engineering | Aircraft engineering<br>Aircraft<br>Spares<br>40% of flying instructors<br>Simulator | Aircraft engineering | Aircraft engineering<br>Aircraft<br>Spares<br>Air Traffic Control Services<br>Ground Radar maintenance |
| **Flying related services provided by the Department** | 20% of flying instructors | Aircraft<br>Spares<br>Flying instructors<br>Simulator (under separate contract) | Aircraft<br>Spares<br>Flying instructors | 60% of flying instructors | Aircraft<br>Spares<br>Flying instructors<br>Simulator (under separate contract) | Flying instructors |
| **Payment mechanism** | Number of flying hours, adjusted for variations +/- 10% of annual planned flying hours. Value of adjustments to be negotiated. | Number of flying hours. A change to the contract price "will be considered" where flying hours are planned to vary by more than 10% for more than 6 months. Value of adjustments to be negotiated. | Number of flying hours, adjusted for variations +/- 10% of annual planned flying hours. Value of adjustments to be negotiated. | The contract price is based on a firm price for a flying task baseline +/- 10%. If flying hours are outside this 20% bracket, then there is either a price reduction or price increase based on changing rates in the contract.<br>Changes in numbers of aircraft or instructors to be negotiated.<br>Flat rate charge for the simulator, with no variation for usage or availability. | Payment based on the percentage of planned sorties achieved, not on the number of flying hours or sorties actually achieved. | Guaranteed payment for 70% of planned flying task with defined amount for every extra hour flown above this minimum. |
| **Remedial payments[2]** | None | None | None | The Department are entitled "to withhold reasonable amounts against any individual payment until the contractor's contractual obligations have been satisfactorily performed". Department currently negotiating flying hour 'credits' for late delivery of simulator.<br>No mechanism for withholding contract payments for simulator in the event of non-availability. | Specified sums retained where sorties not achieved due to contractor related reasons. | Specified sums retained where sorties not achieved due to contractor related reasons. |

Notes:
1. Prior to April 1999, the payment mechanism of the Valley contract followed the same format as that for the Cranwell contract.
2. All contracts contain standard Departmental clauses for recovery of losses where the Department hold the contractor in default.