REPORT OF COST ASSESSMENT TASK FORCE - ANNEXES

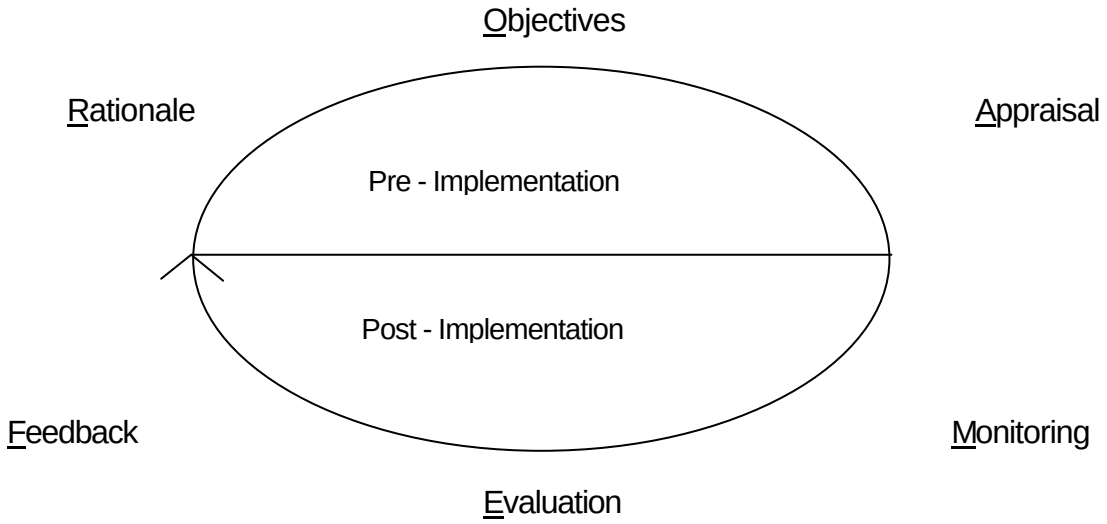
ANNEX 1: WORKING STEPS IN CARRYING OUT COST ASSESSMENTS

UNITED KINGDOM

Both appraisal and evaluation form part of a framework for management of policies and programmes called the **ROAMEF** Framework (see figure 1). **ROAMEF** stands for Rationale, Objectives, Appraisal (of options), Monitoring, Evaluation and Feedback. *Rationale* is the need for the policy or programme. The *objectives* flow from the need identified as being unmet, whilst *appraisal* is the assessment of the possible options to meet those needs. *Monitoring* is the continuous review of the project operation, and *evaluation* is the assessment of the full effects of the project against a previously determined baseline. *Feedback* is communicating the results of evaluation to those concerned with the original project or with related projects. The Treasury (Ministry of Finance) recommend this framework is applied by all Government Departments.

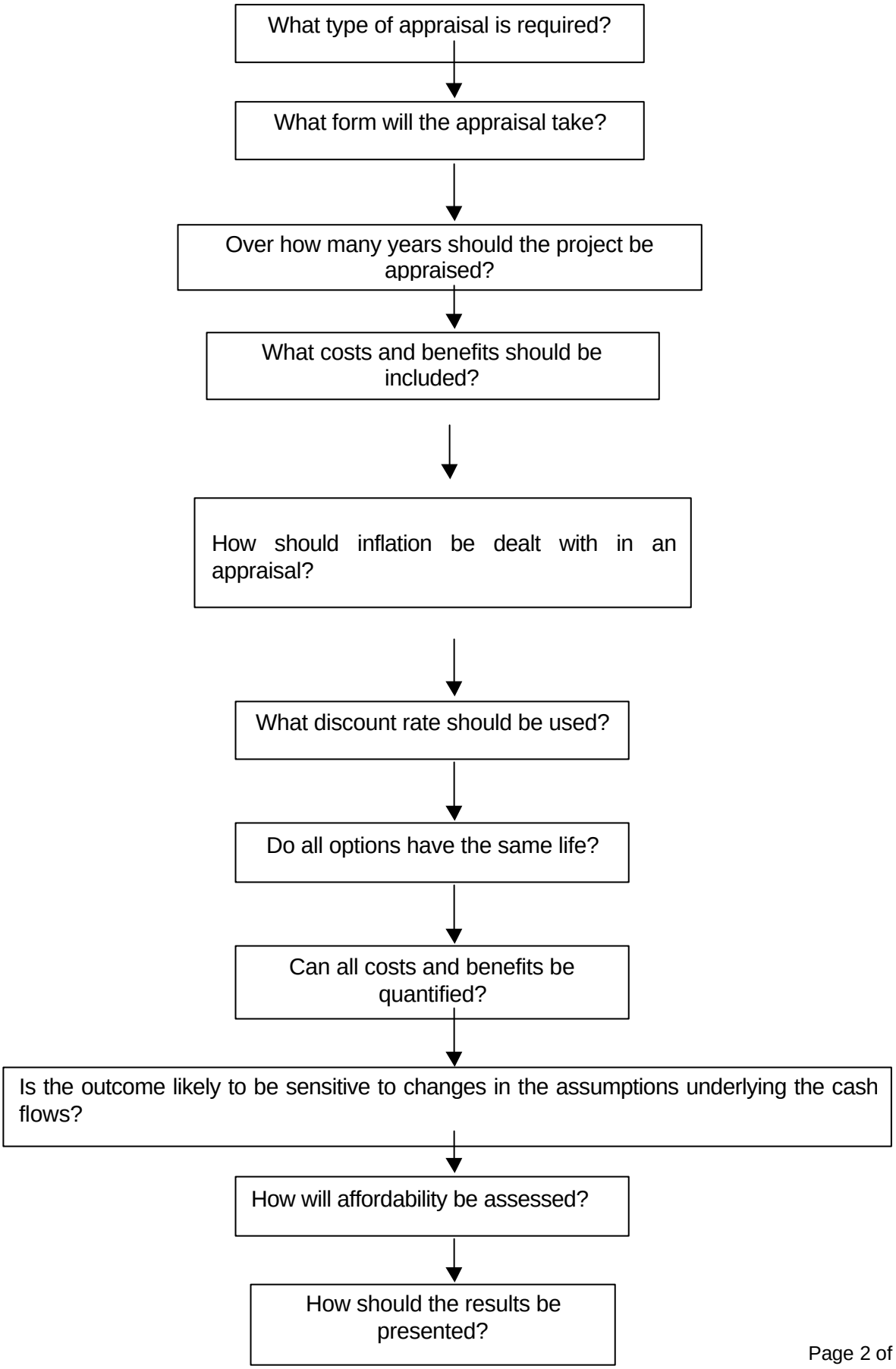
Figure 1

The *ROAMEF* Framework



Figures 2 sets out the stages involved in carrying out an appraisal.

Figure 2: Appraisal Process Overview



GERMANY

The following working steps should be part of the project:

- Identification of requirement/task
- Determination of all possible alternatives/options
- Check of the actuality of assumptions and conditions
- Sorting out of not suitable alternatives/options

- Selection of the most suitable method for the economic analysis
- Collection of relevant data for the remaining alternatives/options
- Performance of the economic analysis
- Documentation/presentation of the results

- Decision on the implementation
- In-service monitoring
- Transfer of “lessons learnt“ to future projects

The report on the economic analysis should contain the following aspects:

- Analysis of the initial situation and the need to act
- Goals, priorities and possible goal conflicts
- Relevant options and their benefits and costs
- Financial effects on the budget
- Suitability of the different options to achieve the goals
- Time schedule for the realisation of the project
- Description of possible risks
- Criteria and method for the cost-revenue control

ANNEX 2: RISK ANALYSIS

It is essential that uncertainties in estimates of costs and benefits are taken into account by, at the very least, undertaking a sensitivity analysis. Sensitivity analysis shows how changes to assumptions affect NPV and option rankings. Sensitivity tests should be well designed; it is not sufficient to show the implications of an arbitrary variation around a particular cost/benefit. Some indication of the likely range of variation is needed. Sensitivity analysis should always be based on plausible variations, wherever possible backed up by detailed market knowledge or previous experience (perhaps drawn from evaluation of previous projects).

The limitations of sensitivity analysis should be recognised; in that it only allows one variable to be changed at a time although a number of the variables may be inter-dependent.

Sensitivity analysis can be taken a stage further by combining individual tests into plausible scenarios (so- called ‘scenario analysis’). For example, one plausible scenario is that pay increases in real terms, and staff savings are less than expected. It can be useful to develop 'best case' and 'worst case' scenarios which bring together all the individual tests which have beneficial or adverse effects upon the individual options which are considered to be plausible.

As a variant of scenario analysis, it may also be useful as a check on the robustness of option rankings to determine what changes in key assumptions would be required for rankings to switch. Robustness can then be discussed in terms of the likelihood of such changes materialising.

As a general rule, when setting up investment appraisals on computer spreadsheets, early thought should be given to the analysis of uncertainties. This will allow key assumptions to be built into models in such a way that sensitivity analysis can be virtually automated.

Types of Project Risk

Availability risk	*The risk that the quantum of the service provided is less than required under the contract.*
Construction risk	*The risk that the construction of the physical assets is not completed on time, to budget and to specification.*
Decant risk	*The risk arising in accommodation projects relating to the need to decant staff/clients from one site to another.*
Demand risk	*The risk that demand for the service does not match the levels planned, projected or assumed. As the demand for a service may be (partially) controllable by the government, the risk to the public sector may be less than that perceived by the private sector.*
Design risk	*The risk that the design cannot deliver the services at the required performance or quality standards.*
Inflation risk	*The risk that actual inflation differs from assumed inflation rates.*
Legislative risk	*The risk that changes in legislation increase costs. This can be sub-divided into general risks such as changes in corporate tax rates and specific ones which may discriminate against PFI projects.*
Maintenance risk	*The risk that the costs of keeping the assets in good condition vary from budget.*
Occupancy risk	*The risk that a property will remain untenanted - a form of demand risk.*
Operational risk	*The risk that operating costs vary from budget, that performance standards slips or that the service cannot be provided.*
Planning risk	*The risk that the implementation of a project fails to adhere to the terms of planning permission, or that detailed planning cannot be obtained, or, if obtained, can only be implemented at costs greater than in the original budget.*
Policy risk	*The risk of changes of policy direction not involving legislation.*
Residual value risk	*The risk relating to the uncertainty of the value of physical assets at the end of the contract.*
Technology risk	*The risk that changes in technology result in services being provided using non optimal technology.*
Volume Risk	*The risk that actual usage of the service varies from the level forecast.*

ANNEX 3: ECONOMIC AND FINANCIAL APPRAISALS

In the survey by the CATF of types of costs used in national cost assessments, the only significant difference between countries appeared to be the explicit inclusion of depreciation and interest charges in the Swedish assessments (and in the German flying hour cost data), when the UK guidance states that these should be excluded. In view of this, the CATF felt it was worth including some guidance on this to help avoid confusion and possible inconsistencies.

Economic Appraisals

Because Government bodies are concerned with the well-being of the country, appraisals carried out by Government Departments will normally be prepared on the basis of the costs and benefits of using national resources. Here the cost is the 'opportunity cost', or loss of the alternative use to which those resources could be put. Transfers of cash for which no goods or services are provided in return (called 'transfer payments') are not included. These appraisals are called 'Economic Appraisals'.

In some cases economic appraisals will take the form of a *COST BENEFIT ANALYSIS* (CBA), in which all of the costs and benefits of an activity are quantified and valued in monetary terms. The results of a CBA can be used not only to say which option is best, but also to indicate whether this option is worthwhile, i.e. does it provide a benefit exceeding its cost.

Because very few activities within defence produce benefits that can be valued in monetary terms, the use of full-blown CBA is extremely limited. One of the few areas where a CBA would be useful would be proposed health and safety or environmental measures that go beyond statutory requirements.

Instead, most defence appraisals take the form of a *COST EFFECTIVENESS ANALYSIS* (CEA), which estimates the net present cost of alternative ways of achieving the same objective. When there are differences in the extent to which the objective is achieved, these will be noted, and as far as possible quantified, using measures which may be judgemental.

By including the status quo in the comparison of options, a CEA can establish whether any alternative option is worthwhile, as well as which option is best. It cannot though, on its own, establish whether the activity itself is worthwhile.

A highly formalised type of CEA is used by the UK for appraisal of new military equipment. This is the *COMBINED OPERATIONAL EFFECTIVENESS AND INVESTMENT APPRAISAL* (COEIA). Here, the total through life cost of different options to meet a particular requirement are estimated in the *Investment Appraisal*. The individual parameters contributing to overall performance are identified, and each option assessed against each of these parameters in the *Operational Effectiveness Assessment*. The two separate assessments are then combined to identify the overall cost effectiveness of each option.

Financial Appraisals

Financial appraisals include all cash flows, whether or not goods or services are provided in return. Thus, financial appraisals include transfer payments (e.g. Value Added Tax, redundancy payments), which are excluded from economic appraisals. The opportunity cost of goods and services would be included in a financial appraisal only where these were reflected in actual cash flows

The main purpose of a financial appraisal is to assist in the assessment of affordability of a project. Should a project be unaffordable in its current form, the project requirements may need to be scaled down, and the revised requirements would need to be appraised.

Choosing the Appraisal Type

Economic appraisals are concerned with assessing value for money, while financial appraisals are used primarily to assess affordability of proposals. An economic appraisal is nearly always required to assess the choice between options. Only in some rare cases where all the costs and savings were reflected in actual cash flows, value for money could be assessed with a financial appraisal (incorporating a Net Present Value calculation). In cases where transfer payments are significant, a financial appraisal should be prepared in addition to an economic appraisal

Some Issues

Depreciation

There is sometimes confusion about the treatment of depreciation in an investment appraisal. Depreciation is a notional expense in an organisation's accounts to spread the cost of the asset over the number of years that the organisation expects to benefit from the use of that asset. It is not an actual cash flow.

There are two reasons not to include depreciation in an investment/economic appraisal:

a. Depreciation does not involve the consumption of cash; and would lead to double counting if included in an appraisal as well as including the cost of an asset;

b. Including the cost of a fixed asset in full in the year of purchase, or as an opportunity cost, is necessary to reflect the correct timing of that cost to the project cash flows.

In an investment appraisal, depreciation is only reflected in the estimation of the asset's residual value at the end of the project's life. In the absence of an estimate of market value at the end of the project life, the residual value should be calculated by taking the cost of the asset as shown in the investment appraisal, and charging straight-line depreciation over the requisite number of years.

Interest Charge on Capital

The interest charge on capital is another notional expense, rather than an actual cash flow. The NPV approach to investment appraisal implicitly takes all financing cash flows into account within the discount rate used for the appraisal. To include financing charges within the cash flows would therefore normally be double counting. There may be exceptions to this, however, depending upon the type of discount rate/analysis used.

ANNEX 4 : DETAILED COMMENTS ON 'GUIDELINES FOR THE ECONOMIC APPRAISAL OF EATMP PROJECTS'

Main Report

Section 2.2, page 4, third bullet - finding out "who will receive the benefits" is important as part of identifying costs and benefits associated with a proposal but it should be noted that *distributional issues* are usually outside the CBA framework, which is from the perspective of society as a whole. Distributional issues may, however, have more relevance where costs and benefits have an international dimension.

Section 2.2. page 4, final para – this paragraph is a little confusing. In particular, it should be clear that, while it could still be used as a *baseline*, "do-nothing" is not an *option* if it fails to meet the requirements.

Figure 2-1, Page 5 – after monitoring, add "evaluation" and "feedback" to complete the ROAMEF (Rationale, Objectives, Appraisal, Monitoring, Evaluation and Feedback) cycle.

Section 2.5, page 7 – there seems to be some confusion here between CBA and Cost Effectiveness Analysis. Least Cost Analysis is a form of the latter. Another use of CBA, or something that can be looked at in a CBA framework, is an analysis of the risks involved in a project (see annex 2).

Section 3.2.6, page 13 – this seems to allow a bit too much of a "get-out" from doing CBA. Even where a decision has already been made, CBA might be useful as part of Post-Project Evaluation to inform future decisions. In addition, this section could make clear that sunk costs are not a reason to carry on with a project without doing CBA. A CBA should be scoped as early as possible in the project process.

Section 3.2.6, page 14 – that resources devoted to CBA should be proportionate to the expected costs/benefits of the project is sensible, although it may be justifiable to do more where there are expected to be lessons learned for future appraisals.

Section 3.2.7, page 14 – these are things to watch out for rather than inherent drawbacks of CBA and therefore perhaps this section should really be headed something like "Possible Pitfalls in Carrying Out CBA". Double counting seems to be a particular potential problem here but the example given is not the most relevant. The biggest danger here seems to be in counting *both* the disbenefits of the baseline case and the benefits of the change options. It might also be worth covering briefly other potential pitfalls, such as the need to exclude sunk costs and transfer payments.

Section 3.4.1, page 18 – there are established methods that may be used to quantify safety and environmental benefits.

Section 3.6.3, page 25 – we would strengthen the recommendation that Net Present Value is the preferred approach over alternatives such as the Internal Rate of Return criterion and the payback period.

Finally, one issue not discussed in detail is the choice of discount rate to be used in the appraisal. A key factor in this is the cost of capital. With long-term interest rates in the UK and the Eurozone very close it should be possible to reach a common discount rate or range of rates.

ANNEXES

Annex B
Yes, these two are the main basic other approaches but they include many variants, especially utility value analysis. The UK MOD's main approach is a version of cost effectiveness analysis.

Annex E
5.2 final indent. Not an easy area but something more than 'requires some form of economic model' would be helpful.

Annex G
G.1, second paragraph. The first point is one of political reality rather than a principle of CBA itself.

Annex H
Final paragraph, last sentence. Yes, the calculations are highly uncertain and should be treated with particular caution but this should not mean that they should be easily disregarded - sensitivity analysis can be used.

Annex J
First indent. The first sentence should be taken out. There is no reason, at least in principle, that benefits could not accrue indefinitely or for a very long time. The point is that the economic life of a project can usually be broadly defined and, in any case, any possible costs and benefits beyond this will be small in present value terms.

Table J-1. Some explanation of why an 8% discount rate has been used would be useful, preferably linked to a wider discussion of discount rates. Is the rate higher because it relates to private (rather than public) sector investment?

In the example the discount rate has been applied to net costs/benefits. It may, however, not necessarily always be appropriate to discount both at the same rate. For example, health and safety benefits in the UK have (effectively) been discounted at a lower rate. It is, however, generally preferable to allow for differences through adjusting valuations rather than varying the discount rate.

It would be worth clarifying that the analysis is done in *real* terms, with only changes in *relative* (to whole economy) prices allowed for.

Annex K
Top of page 33. Yes, large variations in assumptions can widen the results so much as to be virtually useless. However, if such variations are feasible then they should not be ignored.

ANNEX 5: TYPES OF COSTS INCLUDED IN COST ASSESSMENTS

United Kingdom

Undertaking an investment appraisal requires a cash flow model to be produced, covering the whole life of the project. Costs and benefits related to the project should be estimated, normally at yearly intervals. These estimates of capital cost, yearly operating costs and estimated life are the difficult part of the process. The calculations required to appraise these cash flows are relatively straightforward.

All aspects of the activity should be considered whether or not they appear quantifiable. The costs and benefits to include should be those which result from undertaking a particular appraisal option. They are sometimes called the *incremental costs*. They therefore ignore any past costs resulting from previous decisions, which are referred to as *sunk costs*.

One way of thinking about relevant costs and benefits would be to consider the concept of avoidability. An investment appraisal should include all avoidable costs and benefits. Costs or benefits that will not change as a result of the project should not be included in the appraisal.

Items included in Investment Appraisal:

- Capital cost of additional fixed assets;
- Opportunity cost of assets being redeployed to this project;
- Working capital e.g. spares;
- Operating costs / savings;
- Residual value of assets.

See attached checklist for more details of what to include in a cost assessment.

Items excluded:

- Depreciation;
- Finance and finance charges;
- Apportioned fixed overhead costs;

In an investment appraisal, *depreciation* is already allowed for by way of the inclusion of the initial cost of the asset and its residual values at the end of the project's life. The NPV approach to investment appraisal implicitly takes all *financing* cash flows into account within the discount rate used for the appraisal. To include financing charges within the cash flows would therefore be double counting. *Fixed overhead* or *higher formation costs* are usually excluded because they generally do not vary according to alternative options.

Sweden

Common models are used to appraise military and civil ATM investments. *Yearly* costs covered include:

- cost for premises, rents, electric power etc.
- maintenance (corrective and preventive)
- logistic support
- modification (if not deemed as investment)
- industry support

Yearly capital costs are also included:

- depreciation, depending on type of investment e.g. 5/15/40 per year
- normal market interest rate

Investment costs covered include:

- operating costs, based on total costs for an operational or technical function
  - procurement
  - installation
  - commissioning
  - logistic support

Germany

In Germany data is collected centrally by the central military office (Streitkrafteamt or SKA) for planning purposes and the establishment of claims against third parties. Standard rates for personnel and material are calculated and published each year in the Kostenrichtlinie (Cost Guideline). This includes, for example, rates for:

- different vehicles, e.g.
  - armoured vehicles
  - cranes
  - buses
- personnel rates, for
  - different ranks
  - specialists e.g. crane operators
- services, like
  - repair of electronic equipment
- standards for
  - interests
  - amortization
  - in service life time
- operational costs, e.g
  - flight hour

On a decentralised basis, the German armed forces have in the last few years introduced the process “Kosten-Leistungs-Rechnung” (Cost-Performance-Calculation). This involves the collection of cost data by electronic means on:

- personnel
- material
- infrastructure
- administrative costs
- external services.

The applicable software tools will enable each unit and the commanding offices to calculate and assess the relevant costs. By now around 50% of all units are performing the collection of this data.

Belgium

The main military cost categories used by the Belgian Air Force are listed below. The rationale of these categories reflects the way the budget is broken up into the three considered resources. Personnel forms a separate category and transition costs are included in each category.

INVESTMENT COSTS
- DEVELOPMENT
- ACQUISITION
- MODIFICATION
- ONE OFF
- TRANSITION

OPERATION COSTS
- TRANSITION
- MAINTENANCE
- REPAIR
- ACQUISITION OF NON-SPECIFIC GOODS AND SERVICES
- SUPPLIES
- UTILITIES
- RENTAL
- DISPOSAL
- TRAINING
- RECRUTEMENT
- PR AND RECREATION

PERSONNEL COSTS
- SALARIES
- ALLOWANCES
- PER DIEM
- TRANSITION

CHECKLIST OF FACTORS TO INCLUDE IN INVESTMENT APPRAISALS

INPUTS

Basic Staff Costs	-	pay, allowances, overtime, shift premia
	-	Employer's National Insurance Contribution (ERNIC)
	-	Employer's Superannuation Contribution
Unproductive Staff Time (eg travelling time)	-	can be proxied by staff cost
Personnel Support	-	transport costs, vehicle hire, other travel and subsistence
	-	common services (clerical, typing, managerial, messengers, photocopying)
	-	training
	-	headquarters and administration
	-	other support costs (particularly for Service personnel)

Contract services and services by other branches/departments

Land and Buildings (whether or not they are bought or sold and including Service Accommodation)	-	cost or opportunity cost of land and buildings residual value at end of appraisal period OR rental costs less receipts
	-	construction and fitting out costs
Other Accommodation	-	maintenance
	-	rates
	-	utilities (heating, lighting, water)
	-	services (cleaning), security
Material	-	consumption
	-	stocks
Equipment (including computers)	-	capital costs
	-	operating costs
	-	maintenance and repairs
	-	mid-life updates
	-	disposal costs
OUTPUTS	-	measurable volumes delivered
	-	quality
	-	timing

ANNEX 6: RESULTS OF ATS PROVISION QUESTIONNAIRE

Provision of Air Traffic Control/Management services to military aircraft

In two countries, Germany and Sweden, ATC/M services are provided either wholly or nearly wholly by civil providers. In one country, Belgium, the military provides the service. In France, Italy, Spain, Greece and the UK there is a mix of civil and military provision. In general, the military provide ATC/M services for OAT; the civil sector for GAT.

Where there is ATC/M provision by the civil sector does the military pay for this?

In Germany, the UK and Sweden the military pays either directly or indirectly for ATC/M services provided by the civil sector. In the remaining countries (the question is not applicable to Belgium) the military does not pay. The reply from France noted that a reciprocal arrangement exists between the civil and military organisations i.e. no military aircraft has to pay for services provided by the civil sector and vice versa.

Details on arrangements by which the military pay for these services

In Germany the MOD is billed by the DFS for the provision of ATS to military IFR flight operations within German airspace. For IFR flights performed as General Air Traffic (GAT), en-route charges for military aircraft flying on civil ATS routes will be billed for every individual flight according to DFS charging regulations, terminal charges for civil airports will be billed anyway. Military IFR flights performed as Operational Air Traffic (OAT) are billed on the basis of a common lump-sum annual payment (OAT-charge).

In the UK the MOD pays for the use of National Air Traffic Services (NATS) ATC/Air navigation infrastructure through a MOD/NATS contract.

In Sweden there is a more indirect (cost-sharing) arrangement, although for military “commercial” GAT flights normal route charges have to be paid. Cost sharing is based primarily on civil respective military requirements on service levels, service quality and hours of operation. This is based on special agreements including analyses on the actual use of the controllers’ working positions. Current military shares are:

- Malmö ATCC 5%
- Stockholm ATCC 4%
- Sundsvall ACC 12%

As noted above, for military flights “X”-marked in the FPL normal en-route charges are to be paid.

Does the military provide ATC/M services to civil aircraft?

The responses from Germany, Belgium, Spain, Italy and the UK indicate that the military provide ATC/M services to civil aircraft when they fly within its areas of responsibility (e.g. in the vicinity of military airfields). Italy and Greece provided details of services.

Description of any arrangement for the recovery of costs of these services

In Belgium, Greece and France there is no recovery of costs for these services. In Spain there are arrangements for the military to recover a percentage of the charge made by the civil ATS provider. In the UK the MOD receives an offset from payments made to NATS. In Italy and Germany provision of ATS services by the military are taken account of in the setting of charges by the civil ATS provider.

ANNEX 7: DATA AVAILABILITY

Information on the availability of flying hour cost data and how it is constructed was provided by Germany, Belgium, Sweden and the UK.

Germany

Germany produces detailed data on costs per flying hour by aircraft type. The data are split into operating and imputed costs. Operating costs are split into industry support, POL (fuel), maintenance and personnel (NDAA, ground staff and crew). Figures for industry support exclude Civil ATC costs but these are available separately (see below). Imputed costs covering amortisation (depreciation) and interest charges. This excludes infrastructure (i.e. flying station) costs.

ATC costs

In the early 1990s German ATC was corporatised as the Deutsche Flugsicherung (DFS) and military ATC was incorporated into this. Military and commercial aircraft fly separate routes, however, and are known respectively as Operational Air Traffic (OAT) and General Air Traffic (GAT). There is a special agreement between the Ministry of Transport and the MoD specifying the costs for the provision of ATC services for OAT. MoD pays the DFS by way of a lump sum payment. (This differs from charges for GAT which take the form of approach/departure charges at main civil airports and enroute charges for every individual flight.) OAT charges consist of:

Personnel costs + Operational costs + Depreciation for/in:

- DFS headquarters
- Regional and local ATS units
- Technical facilities (navigation, communication etc.)
- Flight inspections
- ATC training

Military service staff working at DFS HQ, as flight data operators and in control centres are paid 100% by MOD, except those whose position relates to both military and civil purposes who are paid in proportion to the OAT/GAT volume. Operating costs and depreciation are incurred by the MOD in respect of buildings, technical services, NAV facilities, special projects with a military portion and other installations (e.g. test and evaluation centre, general warehouse).

Belgium

Flying hour cost data by individual aircraft type are also available in Belgium.

They are constructed from the cost of inputs. Inputs included are:

- maintenance
- fuel consumption
- handling & landing fees
- insurance
- per diem

Inputs not included are:

- capital expenditure/depreciation
- salaries
- overheads

Maintenance costs are estimated using observed expenditure in the previous five years, the current year and expected costs over the next four years, related to actual and expected flying hours. Specific versus non-specific maintenance costs are distinguished. Specific maintenance costs can directly be allocated to the concerned weapon system. Non-specific maintenance costs cannot. Their allocation is based on the number of flying hours per aircraft type and the weight of the considered weapon system in the overall specific maintenance cost. Assumptions are made about inflation. *Fuel* costs are more straightforward to assess, at least historically, because data on specific fuel consumption and cost of fuel per litre are available. *Handling and landing fee* costs are assessed from the previous year's expenditure, analysed by total flying hours and weight ponderation/aircraft type. *Insurance costs* are assessed from a fixed insurance fee per passenger, analysed total flying hours and passenger transport capacity ponderation per aircraft. *Per di*em costs are not included in the flying hour price as such, but are recorded on a case by case (i.e. per reimbursed flight) base.

In aggregating costs, 100% of non-specific maintenance, fuel, handling & landing and insurance costs are treated as flight-related costs. Specific maintenance costs are split 50/50 between fixed and flight-related costs.

Such cost data are used for "hard charging" in the case of air transport services rendered to other departments or third parties. It also has uses in negotiation for recovery of costs from other countries and aid organisations in international operations. Tariffs are also subject to MOD directives, such as uniform tariffs for the same weapon systems, discounts for humanitarian relief (tariff based on only the flight-related costs) and preventing unfair competition with civil sector providers.

Sweden

Military and civil ATM are fully integrated in Sweden, i.e. the Swedish CAA is responsible for military air traffic as well as civilian.

Cost per flying hour data are produced for budgetary purposes. Costs included are:

- fuel

- spare and replacement parts
- maintenance
- industry support
- logistic support

Costs not included are:

- airframe (capital costs)
- preparation for flight
- pilot costs
- administrative costs
- ATC and A/AD costs

Costs not included are generally fixed, i.e. not flight-related, costs.

In Sweden there is a *cost sharing* agreement between the Air Force and the CAA. Operational costs are shared on utility only and there is a yearly settlement of accounts. Investment costs are shared on the basis of capacity, quality requirement and a degree of utility. Take the building of a new tower at a military airport used also by civil traffic as an example of an investment costs:

> *The total investment cost is divided into two equal parts. For the cost sharing calculation the first one addresses the need of the tower, and the second one the utilisation of it. First the two parties (LFV and SweAF) have to decide if one or both requires the tower. In the example both parties need the tower so they have to take equal parts of the first half of the investment, which is 25% of the total each. The other half of the investment is divided among the parties in relation to their utilisation of the tower. In the example it may be agreed that the military party will use the tower more than the civil party. Let us assume 2/3 for the military and 1/3 for the civil party. That relation will then form the base for cost sharing of that second half of the investment. That will be 33% of the total sum for the military and 17% for the civil party. In total the military will then pay (25+33) 58% and the civil (25+17) 42% of the investment.*

United Kingdom

Currently, there is no single database giving cost data by individual aircraft type. However, using COEIAs and capitation rate data it is possible to provide cost ranges by platform class (e.g. whether fast jet, multi-engined etc.).

The data can be generally broken out into:

- Direct operating costs (e.g. aircrew, fuel)
- Maintenance: 1st (squadron) to 4th (industry) line
- Attributable overheads (e.g. admin, utilities)
- Fixed/Variable costs

The UK identified a number of issues/difficulties:

i) costs can vary greatly by role/task, not just platform type;

For example, a transport aircraft and a reconnaisance aircraft may be of the same platform type but can have very different costs because of different numbers of crew, avionics etc.

ii) the existence of “outliers”;

i.e. there may be some very old aircraft being phased out that are very costly to fly, which, if included, could distort the data.

iii) how to allocate costs as fixed versus overhead;

Variable costs are those which are flight-related, i.e. if one did not fly they would not be incurred. Fuel is the obvious example. But there are grey areas. One is maintenance. Broadly speaking, maintenance away from the flying station (3rd and 4th line) is more likely to be variable than 1st and 2nd line maintenance. Personnel costs are usually treated as fixed. However, if, say, a reduction in flying hours was so large as to be achieved with fewer aircraft then personnel costs could be variable. In other words, they could follow a step function: fixed in shorter-term; variable over the longer-term.

iv) the allocation of overheads;

This is, again, a grey area. Overheads are only included if they can be attributed to a particular option, e.g. a platform or equipment. Administrative costs associated with running a flying station would be allocated but not those of, say, MoD headquarters.

v) data are constantly changing.

Historical costs are not necessarily appropriate to the present or future. For example, in the past maintenance was typically done “in-house”; now it is typically done by industry.

Italy

In Italy costs relating to flight assistance services (including Air Traffic Service, Meteorological Service, Telecommunications and Logistic Support) are analysed for the purpose of obtaining the refund of expenses sustained by the military in providing flight assistance to civil aviation. In such analyses the cost types considered are similar to those set out in the EATMP guidelines. The process is not straightforward. Often, costs are not shown directly in the balance sheet but need to be extracted from general costs. Sometimes even this is not possible and it is necessary to use statistical or mathematical models. Different cost assessment mechanisms are used to compute different cost types.

ANNEX 8: QUANTIFYING "OTHER BENEFITS"

Safety, Health and the Environment

Valuation techniques have been developed to enable money values to be placed on some costs and benefits which have traditionally been viewed as unquantifiable. For health, safety and the environment such valuations are likely to involve the inference of a 'price' revealed by consumers' behaviour, or derived from their stated willingness to pay. The former approach is often described as '*revealed preference***'** and the latter as '*stated preference***'**. Revealed preference is based on evidence from market transactions, for example the lower prices paid for houses subject to greater disturbance from noise. (This type is also known as 'hedonic pricing'). 'Stated' preferences are normally obtained by means of specially constructed questionnaires and interviews designed to elicit estimates of the willingness to pay (WTP) for, or willingness to accept (WTA) a particular outcome. (These are obtained as averages across income groups.) Both approaches seek to measure the value the user places on the facility or service, rather than the value to those providing it. Various methods are employed to value such things as recreational facilities, pre-school education, travel time saved, accident deaths avoided, the environment and historic buildings.

The results of previous studies may be used (transferred) to estimate the economic value of changes stemming from current programmes or policies. There will be increasing scope for using such **'**benefit transfer' as databases expand. Environmental valuation source documents for the UK are listed on the Department for the Environment, Food, Regions and Agriculture (DEFRA) website. Environment Canada's Web based "Environmental Valuation Reference Inventory" (EVRI) database website (www.evri.ec.gc.ca) describes one such information base. It is intended primarily as a tool to assist policy analysts concerned with estimating values for environmental goods and services or human health.

Sometimes an implicit maximum or minimum value of a damaging impact can be estimated from the extra cost which would be incurred to avoid it: a judgment can then be made as to whether it really is worth that extra cost, or loss of other benefits, or whether a lower valuation should be put on the damage.

It is usually better to provide a range of values, as well as point estimates, in view of the inherent uncertainties of these measures. The range can then used in sensitivity analysis.

The Value of a Prevented Fatality (VPF) or Prevented Injury

The starting point for such valuation is a measure of the individual's willingness to pay (or, where relevant, their WTA). The willingness of an individual to pay for small changes in their own risk of loss of life or injury is then extrapolated to arrive at a 'value of a prevented fatality' (VPF). The changes in the probabilities of premature death or of serious injury are generally small and the population at risk covers a broad cross-section of the community. Thus unnamed persons' marginal changes in risk are valued rather than the 'lives' of named individuals.

For the UK, the government department responsible for transport (DEFRA) values the reduction of the risk of death in the context of road transport at about £1m (€1.6m), a value also used by the Health and Safety Executive (HSE), the organisation responsible for workplace health and safety. Besides willingness to pay measures, these estimates include lost output, medical, ambulance and police costs, insurance costs, damage to property, and human costs. In the context of road safety improvements, the number of deaths avoided typically depends on small changes in the probability of individuals becoming involved in fatal accidents. Values are uprated in line with assumed changes in GDP per head. The DEFRA and HSE also use explicit monetary values for non-fatal casualties, based on a willingness to pay approach.

Values for the avoidance of premature death and the cost of injuries in road safety applications may not be directly applicable to other programmes. Of course, aeroplane accidents involve greater potential damage to property and poses risks to those on the ground as well as aircraft passengers. Furthermore, there is clear evidence that individuals are not indifferent to cause and circumstances of injury or fatality – WTP/WTA risks relating to air travel are unlikely to be the same as for road travel. However, if tailored to these circumstances, the general approach may have wider applications.

Valuing Health Benefits

In policy areas which mainly affect health, an approach has been developed to take account of changes in life expectancy (including expected life years where lives are lost or saved) and, wherever possible, changes in the quality of life. The quality-adjusted life year (QALY) is the most commonly used measure of health benefit. It weights life expectancy for health-related quality of life over time. Health interventions being compared may have similar or different clinical effects. The former may be contrasted by cost-effectiveness analysis, the benefits being measured in natural units such as blood pressure, for example. The latter may be compared by 'cost utility analysis', the benefits being measured by QALYs.

Yet such assessments cannot determine whether a programme should be funded and how large it should be, unless the further step is taken of estimating a 'Willingness to Pay' value for QALYs in different circumstances. Only with monetary valuation is it possible to compare marginal cost of an intervention against marginal benefit.

Furthermore, when health impacts have to be weighed against non-health effects it is necessary to set a monetary value on the health impacts. A number of techniques of monetary valuation are applicable to health. For instance, a survey approach could estimate the public's willingness to pay for certain health impacts.

Valuing Environment Impacts

A wide range of valuation techniques is available to estimate the economic value of environmental impacts. User values can be estimated using either stated preference or revealed preference techniques. Non-user[1] (i.e. 'option') values can only be estimated through stated preferences in surveys.

Techniques based on market prices include the replacement cost technique, which uses an estimate of the cost of restoration to original state. The replacement cost technique should only be used in contexts where agreed standards must be met. Where different levels of pollution are possible, the dose-response technique can be used to estimate the impact of certain 'doses' of pollution, and market prices can be used to place a value on these impacts where they are measured as changes in a marketed output (for instance agricultural crops). Other techniques attempt to estimate an implicit price for environmental attributes by looking at markets in which those attributes are effectively traded (especially as reflected in property values).

The household production function approach uses expenditure on commodities which are substitutes (such as 'avertive expenditure') or complements (for instance travel) to an environmental characteristic to value changes in that characteristic. For example, noise insulation is used by people as a substitute for reduction in noise at source, whereas travel to a particular site can be a complement to recreation at that location.

All the foregoing valuations of costs and benefits in principle are based on users' valuations. When a programme has multiple outputs, or outputs with different dimensions, they should be added up with weights reflecting marginal valuations or marginal willingness to pay, in order to compare different options. This approach allows the comparison of alternative proposals that have multiple outputs.

Sometimes a number of outputs can be combined into a single overall measure, in advance of valuation in money terms. The widely used the Noise and Number Index (NNI) for instance combines the average loudness of aircraft and their number, the object being to provide an overall indicator of disturbance affecting individuals exposed to aircraft noise. Essentially this is a 'short cut' approach to producing an acceptable set of weights, in this case by assuming equal weights. This is a good index to the extent that it is highly correlated with evidence of individuals' dissatisfaction with noise derived from surveys. It is a potentially useful basis for deriving WTP values for noise reduction. Hedonic price studies around airports have used this technique.

[1] Non-user or option values measure the benefit to people of having the 'option' of using an amenity, i.e. the value of knowing it is available.

“Upgradeability”

The EATMP guidelines include “upgradeability” as an additional qualititative possible benefit of EATMP projects. This refers to the opening up of future possibilities, e.g. for further capacity, that a project or programme might bring.

This seems to be similar to the value of what is known as a “real option”. Real options are used in industries such as oil and pharmaceuticals where the costs of extracting or developing a product are typically high and there is considerable uncertainty over potential future returns. The price of a real option represents the value of having the choice at a later date to, say, initiate, expand, defer or abandon investment or production. The price of a real option is, like that of a financial option (e.g. the right to buy or sell foreign exchange or shares), determined by fairly complex mathematical formulae (e.g. Black-Scholes). Unlike financial options, however, the value of the individual components of these formulae may be more difficult to determine for real options. These include, notably, an estimate of the value of the underlying asset and a measure of its volatility. It may therefore be unrealistic at this stage to expect that the benefit of “upgradeability” may be fully quantifiable but it may be worth further research.