Smart Procurement:
Report on Procurement Reform
and Acquisition Reorganisation
in the United Kingdom

RE-98.016

March 1998

Jonathan A.K. Cave, David S. C. Chu, Mark C. Lorell
Preface:

This document summarises the principal comments by RAND Europe team on plans for procurement reform and acquisition reorganisation by the UK Ministry of Defence. These comments were invited by the Ministry in combination with HM Treasury. They should be of interest to individuals involved in the Strategic Defence Review.
TO: Sarah Walker, HM Treasury and Simon Webb, DG Resources, Ministry of Defence

FROM: Jonathan A. K. Cave, David S.C. Chu and Mark C. Lorell

DATE: March 18, 1998

SUBJECT: REPORT ON PROCUREMENT REFORM AND ACQUISITION REORGANIZATION IN THE UNITED KINGDOM

This memorandum outlines the principal comments by the RAND Europe team on plans for procurement reform ("Smart Procurement") and acquisition reorganisation ("Acquisition Organisation Review") by the UK Ministry of Defence. RAND Europe was invited by the Ministry to comment on the McKinsey report, the Smart Procurement draft, and associated documents, in the spirit of a "red team" - i.e., an informed critical review aimed at strengthening the final products and their implementation.

The RAND Europe team presented its comments in briefings at the Ministry of Defence on February 21 and March 17, 1998; copies of the briefing charts we used in the two briefings are appended as Annexes 1 and 2. This memorandum summarises these briefings in terms of four themes.

- Objectives of change should be linked to sources of dissatisfaction with the procurement system.

- Schedule slippage appears to be the most serious failing of the current procurement system.

- The recommendations for reform are sensible, but the McKinsey report's cost savings are optimistic.

- Real competition is central to the future effectiveness of the acquisition system.

The distillation of our comments is importantly informed by the further insights of the UK participants provided in those sessions, for which we are most grateful.

*Link the Objectives of Change to the Sources of Dissatisfaction with the Procurement System*

We were struck by the degree to which process improvement was described in the early drafts as an end in itself, with little discussion of the procurement outcomes desired, or the extent to which the present system fails to provide them. (By contrast, contemporary procurement reform in the US Department of Defence is aimed explicitly at changing outcomes.) In response, the ministry staff crystallised its goals in three specific objectives (Annex 3). We believe these are excellent, both implicitly identifying the shortcomings of the present system and explicitly setting standards for further performance. We urge they
be highlighted in the eventual announcement of reforms, and that the linkage between the specifics of reform and these objectives be delineated.

Two of these objectives emphasise the trade-offs among cost, schedule and performance. It will be important to sketch how you plan to make trade-off decisions, including the extent to which “design to cost” (or “cost as an independent variable”) will now be a coequal objective. Indeed, cost, schedule, and performance outcomes can be the measures of merit for the achievement of reform. They can thus help to drive implementation of the reform agenda. Note that this focus differs from process compliance, or the excellence with which the acquisition process functions.

Schedule Slippage Appears to be the Most Serious Failing of the Current Procurement System

A review of the National Audit Office’s 1996 report suggests that it is schedule slippage much more than cost growth that is the principal failing of the current procurement system. Indeed, by US standards, the cost record is quite respectable (although a proper comparison requires adjustment for quantity changes since program inception or the date of the benchmark estimate, which we urge be part of future cost reviews).

The ministry staff points out that schedule slippage includes all changes since the very start of the program, and that undue haste in the early stages of a program could lead to fielding a faulty system. We concur, but managing this risk successfully will be essential if the MOD is to meet the second of the principal objectives outlined in Annex 2, deploying technologically up-to-date systems.

Recommendations for Reform are Sensible, but the McKinsey Report’s Cost Savings are Optimistic

The McKinsey report’s recommendations for reform are sensible, as are the additional changes you are contemplating. They should improve the functioning of the acquisition system. But - as you likewise appear to believe - we would treat the McKinsey savings estimates cautiously. The McKinsey report provides a fine overview of changes being made to the US Department of Defence (DoD) procurement system, and it builds on them in its recommendations to you. As McKinsey themselves note, the savings estimates are based on what is anticipated, not what has been achieved. They apparently use what DoD calls “cost avoidance;” that is, costs as projected under the old system compared to current projections (after acquisition reform). However, none of the four DoD/USAF/Navy pilot programs they cite has yet gone into production. All too often procurement reform’s achievements are more modest than expectations. You might wish to ask McKinsey or others to track and analyse those of the American initiatives that most inform your own final decisions, both as a guide to potential pitfalls you will wish to avoid, and to improve your estimates of effects and savings.

In analysing the current American experience it would be particularly useful to look beyond the four cases on which the McKinsey report focuses (JSF, JASSM, JDAM, WCMD). There
are now a number of other pilot reform programs under way (e.g. DARPA’s Tier III-/II*, COSSI). These programs are generating “lessons learned” that would allow you to move beyond the theory behind US reform initiatives, to incorporate in your plans the growing body of experience with these ideas.

One of McKinsey’s recommendations moves well beyond contemporary American initiatives: the idea of capability managers. We find this idea an exciting one; there are clearly more or less radical variants with different effects on the current structure of the Procurement Executive. Should you decide to adopt this recommendation in whatever form - which we would urge you to consider- we would also urge that you ask capability managers to focus on life-cycle costs, and not just the acquisition costs of systems.

As we understand the debate over acquisition reform in the MOD thus far, two issues are notable for their omission: the role of the “war-fighter” as the ultimate customer, and the importance of testing. We urge attention to both as you complete your review. In reflecting on the approach to testing, you may wish to consider the forthcoming report on the subject from the Committee on National Statistics of the US National Research Council. We believe its recommendations have great merit. If adopted by the US Department of Defence they will fundamentally revise the American testing paradigm. You may wish to consider their implications for your own reform program.

**Real Competition is Central to the Future Effectiveness of the Acquisition System**

As both you and we have emphasised, it would be difficult to overstate the benefits of competition to the acquisition system. It plays a crucial role in current US reform efforts, which count on competition to give contractors the right incentives to perform well at the same time they are being given more authority over technical and cost decisions than in the past.

The reform proposals create the opportunity to change the relations between the MOD and its contractors in ways that employ the power of contractual, competitive and co-operative relationships to assist the solution of, schedule slippage, through-life reliability and cost management issues identified in the Review.

Contracts create incentives for contractors to collect and communicate information and expend appropriate effort, even when these cannot be independently observed or verified. As noted by yourselves, initial assessments of such “measures of merit” as cost, performance, schedules, reliability and the trade-offs between them are typically subject to revision. Early phases can be informative and narrowing of technological and even contractor options can directly affect these factors. Contracts during these phases serve in part to reallocate and encourage the reduction of technological and financial risk; they are necessarily incomplete. Design features such as payment ceilings, options for transfer of intellectual property rights, renegotiation provisions, warranties and so on can be employed to ensure that the incentives fit the specific situation. In particular, it is important that risks be allocated to parties with the information and ability to mitigate them and in recognition
of the possibility that risk-aversion may lead to inappropriate responses to e.g. exogenous budget risk.

Competition can also assume a variety of forms. As the review documents note, the appropriate degree of competition varies along the procurement cycle and across different types of systems. In particular, competition is likely to be most effective during initial concept formulation, as well as during the “risk reduction” or “dem/val” phase and eventual system maintenance. Costs of competition can be both reduced and reallocated by appropriate competition design, particularly through incentives for contractors to bear a greater share of R&D costs and adopt the right balance among the various measures of merit. During the initial phase, for instance, design competition among a limited number of partially self-funded teams can be particularly useful, with contractual incentives used to keep costs down and contractor efforts focused. By contrast, effective competition during the in-service life of a system can be preserved by a more commercial approach, with co-investment in capital equipment and personnel co-location and rotation used to avoid lock-in and preserve surge capability. Other vehicles such as pre-competitive consortia with competitive procurement contract ‘prizes’ can also be employed to ensure maintenance of an industrial base with capabilities adequate to future needs and a structure that supports effective competition.

Measures to induce greater stakeholder involvement complement these possibilities. Like contracts and competition, partnerships also create vulnerabilities. Fortunately, these three types of mechanism can be employed in a complementary fashion to secure the desired benefits associated with effective competition.

Maintaining competition will be particularly challenging in the future: the smaller procurement budget necessarily implies a more limited industrial base, unless defence firms can form partnerships with commercial enterprises or with overseas collaborators. For collaboration, an alternative will be needed to the Cold War model of sharing in all stages of development. That approach produced extra costs and delays rather than specialisation for efficiency and speedy response. (Perhaps this should be the test of whether collaboration is attractive - i.e., is it horizontal rather vertical?)

Maintaining competition in design will be especially important - and especially challenging as the laboratory base likewise contracts. You may wish to consider whether there are opportunities for laboratory collaboration that parallel those for industrial collaboration.

You asked an excellent question during the course of our February 21st session: How long should competition be sustained in an acquisition program? We believe an analytic, administratively feasible answer can be fashioned by thinking about the problem in terms of the stages for managing procurement. At each upstream stage you can invest in well-structured competition in order to realise performance improvements and savings in later stages, especially in the production stage, where the bulk of acquisition costs typically occur. These improvements come at the expense of greater upstream costs. Thus you want to focus analytically on the relationship between upstream investments and downstream payoffs; administratively, you wish to ensure that payoffs are at least as great as the
investments (or perhaps greater, depending on the nature of near-term budgeting constraints).

As you know from our March 17th session, we have tested a simple version of the analytic construct underlying this idea for US Air Force jet fighter and attack aircraft produced since World War II. The results are encouraging; suggesting there is a positive payoff in production costs for investment in both the design and demonstration-validation stages of development. (This analysis could conceivably be developed to an administratively useful point using available UK and US databases should you wish to do so. Such an analysis would properly include estimating the up-front costs of competition as well as its benefits, and could provide an inventory of competitive tools and techniques appropriate to specific situations.)

Continuing competition is even more important as a source of new ideas. Ongoing RAND research for the US Air Force has established a clear historical link between competition and innovation in the US fixed-wing military aircraft industry. This research traced the technical progress of US military combat aircraft from 1914 to the present, using a large database developed by RAND. The principal findings were two: (1) periods of great technological innovation were characterised by intense competition among a large number of prime contractors (historically no less than 7); and (2) the most revolutionary innovations arose most often from the second rank contractors rather than the dominant leading contractors for any given technology era. Innovation arises from "hungry" lean firms in an environment of intense competition. Maintaining upstream design competition (using both private firms and government labs) will help sustain the "idea base", albeit at higher immediate cost. In the end, it is these new ideas that are the lifeblood of any successful acquisition system, and essential to the achievement of the demanding goals you have set for your Ministry and for the United Kingdom.
Appendix 1: Briefing Charts, 21 February 1998

Smart Procurement

RAND Points for Discussion

20 February 1998

Nominal Structure of a Major Policy Reform Document

- Basic goals, objectives
- Underlying philosophy, basic principles, unifying themes
- Specific policy initiatives explicitly linked to basic goals and underlying philosophy
- Implementation issues and problems
- Expected outcomes; measures of merit
Sharpen, Expand Discussion of Basic Goals?

- More detailed discussion of basic goals necessary
  - To eliminate potential confusion over objectives
  - To better assess proposed means of achieving goals
  - To help formulate measures of merit, judge progress

- Suggest expanding discussion of “faster, cheaper, and better”
  - Example: clarify issue of poor initial cost estimating vs. problem of real program cost growth

Example of U.S. Acquisition Reform: Basic Goals and Objectives

- Reduce real R&D and production costs
- Achieve equal or greater system performance
  - At IOC
  - Throughout system life (“continuous technology insertion”)
- Shorten development time
- Maintain broader industrial base at lower cost
  - Surge, hiatus
  - No monopoly
**Expand Discussion of Basic Principles Behind Policy Initiatives?**

- Full discussion of unifying themes, basic principles, overarching philosophy
  - Provides unity, overall coherence, and basic rationale for specific policy initiatives
  - Aids integration with other initiatives, policies
- Example of US acquisition reform: basic principles/philosophy offered in core documents:
  - Perry: "A New Way of Doing Business" (1994)
  - Federal Acquisition Streamlining Act (1994)
  - Kaminski: "Cost As An Independent Variable" (1995)

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**Example of U.S. Acquisition: Basic Philosophy, Principles, Unifying Themes**

Develop a more "commercial-like" defense procurement:

- Make cost/price a key system requirement
- Transfer more cost, design & technology control, *and responsibility*, to contractor
- Exploit commercially developed parts, components, technologies, processes, and infrastructure (dual-use)
- Reduce regulatory burden, decrease intrusive government control and oversight
Clarify Organization & Presentation of Specific Reform Measures?

- Prioritise specific reform measures and link them to basic objectives and principles
- Current presentation has “laundry list” quality, offering eclectic mix of differing importance and magnitude
  - General “motherhood measures” (“holistic” approach, system engineering)
  - Best business practices with vague or unclear application (SPTs like IPPTs?)
  - Some apparent contradictions/confusion (treatment of competition, long term fixed price)
  - Too much focus on process? (electronic commerce)

U.S. Example: Measures Prioritised & Linked to Basic Objectives, Philosophy (1)

- CAIV (treating cost as a factor equal to performance and schedule in trade-off analysis)
  - Ensure only “must-have” performance
  - Provide only mission performance needs, no detailed technical solutions
  - No Mil-Specs required; encourage commercial
  - Contractor proposes design, technical solutions
- Regulatory relief (no CDRLs, TINA, etc.)
  - Focus on price, performance; not cost, technology
  - Top level cost data in contractor format; commercial accounting rules
U.S. Example: Measures Prioritised & Linked to Basic Objectives, Philosophy (2)

- Promote competition
  - Encourage new entrants through commercial approach, regulatory relief, profit
  - Encourage cost-sharing by contractors
  - Form government-industry IPPTs with each contractor; share government information
  - Rolling down-select
  - Employ past performance indicators
- Use commercial style warranties, non-performance penalties
  - Permit trade-offs of price, warranties, support

U.S. Example: Measures Prioritised & Linked to Basic Objectives, Philosophy (3)

- Production price commitments (PPCs) as key element in down-select
  - Solicit AUPPC/PPCCs before down-select
  - If AUPPC: performance, reliability met; no cost auditing, data package; single source
  - If not: MilSpec cost, data packages; must qualify second source
- More contractor sustenance
  - Consider long-term fixed price contractor support with configuration control
  - No cost auditing to encourage “tech insertion”
Many UK Measures Similar to Key US Reforms, But Do They Share Underlying Principles?

Common Elements:
- Cooperative Stakeholder Teams (IPPTs?)
- Partnering (co-operative rather than an adversarial relationships with contractor and subcontractors)
- Past performance evaluation
- Remedies for unsatisfactory performance (liquidated damages): do these work the same as warranties?

But.....
- Core of U.S. approach is new emphasis on price and transferring authority and responsibility to contractor
- Same for UK?

International Collaboration: What Are the Smart Solutions?

There are few specific remedies for coping with collaboration problems that block efficient acquisition
- Differing requirements, schedules
- Management by committee, consensus
- Participation of all partners at all levels of R&D
- Non-rational, inefficient division of work
  - Allocation of R&D and production work determined by anticipated acquisition share
  - Specific work often goes to least capable partner (technology transfer)
- Multiple duplicative R&D, test, production facilities
Should Smart Procurement Principles be Extended

- Some “smart procurement” practices might be applicable to procurement beyond major systems
- Other practices could enhance the procurement of spare parts, commercial products, etc.:
  - Issuing credit cards for minor purchases, replacing current forms and paperwork with credit card billing
  - Creating a web page of catalogue offers from vendors with MOD contracts
  - Web page could be interactive, specifying a ceiling price charged to any MOD buyer, but allowing negotiations between MOD buyers and vendors for specific orders
- Developing a search engine capable of accessing commercial catalogues

Potential Cost Analysis Initiatives

- Create an independent cost estimating capability
- Focus on cost distributions rather than point estimates
- Create a production database
- Apply new tests (e.g. Rayleigh distribution) and/or create new tools.
Using Thresholds to Trigger Review

- Focus on performance, cost and schedule
- Distinguish between objectives and threshold values
  - Threshold would cause program to be reconsidered
  - Turning points could trigger foreseen optional changes
- Emphasise outcomes and outputs over engineering parameters

Using Performance Measures To Drive Organizational Change

- A way to keep the focus on the desired performance of the acquisition system:
  - Are users satisfied with the capabilities of equipment delivered?
  - Do they believe delivery is timely?
  - Do the costs imply good value for money?
  - How well do actual capabilities, schedule and cost compare with forecasts/promises?
- A way to focus attention on the specific initiatives of Smart Procurement
- A potential basis for writing performance contracts with institutions and executives
Appendix 2: Briefing Charts, 17 March 1998

Smart Procurement

RAND Europe Comments
17 March 1998

Outline

- Comments on specific documents
- General observation on procurement reform
- Competition, intellectual property, performance measures
  - Theoretical considerations
  - Empirically-based analysis
Observations from the 1996 NAO Report

- Cost record (once appropriate adjustments for quantity are made) could be quite respectable
- Main problem appears to be slippage of in-service dates:
  - Mostly due to budget-induced delay, technological problems:
    - How much will proposed reforms resolve?
    - Does risk allocation follow information, incentives?
  - Real price is loss of operational effectiveness

Analytical Puzzles in NAO Report:
Linkage between cost growth, schedule slippage

- NAO Major Project Report cost growth findings:
  - Relatively modest (8-10%)
  - Main causes: program changes due to increased cost (circularity?); inflation adjustment (spillovers?)
- NAO Major Project Report schedule slippage findings:
  - Serious problem (80% fail to attain planned ISD)
  - Main causes: technical difficulties; budget problems
- Two puzzles
  - Don’t schedule delays have major cost implications?
  - How can acquisition reform affect the causes?
Comments on McKinsey Report

- Generally sensible recommendations
- Savings figures probably optimistic
- Need for more than one EAC approval point in some cases
- Some surprising omissions:
  - Role of ultimate customer ("warfighter," ultimate user)
  - Improving cost, schedule estimation
  - Testing regime (esp. for suitability)
  - Interaction of organisational, contractual, competition reforms.
- Capability managers - a potentially far-reaching change worthy of greater emphasis

Comments on McKinsey Report, II

- Segmentation: not just size of purchase, risk
- Front-end: trade-off between timing, size of payments, timing of delivery; treatment of uncertainty
- Revised cycle:
  - timing of option, contractor selection, fund commitment
  - reliability as an overt (contractual) requirement
  - influence of industry in planning phase
  - clarity needed on e.g. past performance indicators
  - measures to induce early cost-sharing
  - non-uniform impact of cost control over time
Comments on McKinsey Report, III

- Approvals process:
  - type I/II errors
  - price - quantity etc. schedules
- Contract incentives:
  - many design alternatives for different situations
  - other effects (VOP spillovers, renegotiation, benchmarks)
- Collaboration motives include:
  - Scale economies, profit distribution, agglomeration
  - industrial structure, competition

Comments on McKinsey Report, IV

- Collaboration models:
  - typology assumes single contractor
  - teaming, EU procurement rules
  - possible reverse causality, self-fulfilling prophecy
  - use of multi-principal/agent models?
  - potential hold-up, learning problems with Type I
- Minor projects:
  - number of units, unit costs, distance from market, leading consumer role.
- Maintenance:
  - who does what, when, where, how and for how much?
Observations on Procurement Reform

- Reductions in operating costs promise biggest prize

- In principle, everything is tradable provided missions are accomplished, including:
  - key performance parameters;
  - cost limits in “Design to Cost;”
  - order of consideration (cost, performance, reliability);
  - allocation of risks, returns.

- Industry membership in IPTs raises important issues:
  - governance;
  - revelation of information;
  - reliance investments.

Observations on Procurement Reform (continued)

- Tenure of project managers (throughout phase?)

- Use of civilian managers to allow incentive compensation

- Implementation of sophisticated contractual tools

- Design of better ‘auctions’ to enhance contracts, substitute for missing competition, improve balance of objectives

- Where do new, transforming ideas come from?
**Competition: Means and Ends**

Theoretical mechanism design considerations:

- **Goals**: allocation, production, dynamic efficiency; cost; timeliness; equity; industrial base; political.

- **Environment**: information; incentives; law; technology; military; politics; economics.

- **Tools**: contracts; auctions and other quasi-competitive mechanisms; combinations

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**Contracts**

Segmentation, best-practice, design

- **Value** and **cost**: may be uncertain, unverifiable; affect choices re: renegotiation, liquidated damages formula.

- **Reliance**: either party may make investments that enhance value of project to all parties. Incentives affected by damages, renegotiation.

- **Risk allocation**: risk aversion favours cost-plus contracting (with ceiling), reduced damage formulae. General prescription of risk transfer should be tempered.

- **Asymmetric information**: poses major problems that are not easy to resolve without partnership

- **Outside markets**: may affect ideal level, type of damages, utility of contract options
**Contract Related Issues**

- **Collaboration:** jurisdictional and related issues and general question of multiple principal - multiple agent contracting. Agglomeration effect of liberalised or otherwise multilateral contracting.

- **Probabilistic breach:** expectation damages lead to optimal performance, excessive investment, but renegotiation weakened.

- **Intellectual property rights:** balance between hold-up and threat-point effects determines value of option contracts, specified performance remedies.

- **Exogenous uncertainty:** role of donative contracts

- **Structural implications:** relational and framing contracts

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**Competition**

**Auctions, partnerships, teaming**

- **Optimal auctions** (and others): first-, second- or average-price selection. How to auction multiple lots.

- **Connections** between competition and incentive contracts

- **Built-in overruns**, slippage due to selection bias, past performance and/or specific inflation indicators, monitoring costs, information correlation.

- **Hybrid mechanisms** with succeeding rounds of:
  - contract-based development, production, maintenance
  - competitive down-selection, reallocation
### Use of Competition for Major Systems:
The US Patterns

<table>
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<tr>
<th>Stage of Procurement</th>
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<tr>
<td>Design</td>
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<tr>
<td>Demonstration/Validation</td>
<td>Occasional</td>
</tr>
<tr>
<td>Engineering Manufacturing Development</td>
<td>Unusual</td>
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<tr>
<td>Production</td>
<td>Sometimes</td>
</tr>
<tr>
<td>In-Service Support</td>
<td>Frequent</td>
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### How Long Might Competition Pay?
An analytic approach

- **Thesis:** Competition at early stages of procurement yields downstream cost and performance benefits
- **Analysis:**
  - Estimate learning curve for each system based on observed results
  - Estimate effects of early stage competition on the (predicted) cost of the unit, controlling for other factors
  - Calculate the maximum competition investment that is financially appropriate to a new system
  - Analyse contributing factors to generalise
### How Long Might Competition Pay?

**USAFL Fighter And Attack Aircraft Used In Competition Data Analysis**

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USAFL R&D Competition: 1 = Yes; 0 = No

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### How Long Might Competition Pay?

**Test Equation For USAFL Fighters**

**Dependent variable:** Predicted cost of the 100th aircraft

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Adjusted R-square: **.47**
Appendix 3: MOD Statement of Goals and Objectives

Acquisition Organisation Review: Objectives

- To shorten the time between the emergence of a key new technology and its availability to front-line forces; and particularly to beat the competition in doing so.

- To deliver programmes within the performance, time and cost band declared when the major investment decision is taken.

- To replace the system of meeting requirements as soon as technically feasible and if the system is affordable by a system acquiring military capability to meet a range of missions and tasks by an optimised trade-off between performance, time and through-life cost.