Attitudes to Change in ATM Operations -
Introduction of CDA trials at Manchester, Bucharest & Stockholm

Abstract:
This Study seeks to improve the understanding of attitudes to change in ATM. It attempts to delineate the barriers to, and drivers of, such change, within the societal context. For example: how directly and how intensely do ATC personnel and pilots feel community pressure and through what processes? The Study is generic in its approach and is based on 82 structured interviews with controllers and pilots, plus other interviews with airline managerial / training captains, controller supervisors, CDA designers and airport authority representatives. The need is identified to assess attitude to change at both the organisational and individual levels, for both macro-level and micro-level objectives. This Report details the methodology and presents the results from the case studies - the introduction of Continuous Descent Approach trials at Manchester, Bucharest and Stockholm-Arlanda airports.
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FOREWORD

The present EUROCONTROL Experimental Centre Note was devised within the Air Transport Evolution research thread. It is one of several exploratory studies that constitute the foundations of strategic research on air transport evolution. This thread aims to provide material to support the development, deployment and evolution of Agency policies and strategy with an ambition to facilitate informed decisions by policy makers within the Air Transport community.

In the context of growing demand for air transport, experienced from the beginning and forecast to continue, the provision of air traffic management services has to develop new solutions and to adapt to change. At the same time, the public is becoming more and more aware of the impacts of aviation on the environment, and increasing pressure is being put on the aviation system to reduce its adverse impacts.

In Europe, the Single European Sky legislative initiative has triggered a large process of change, integrated with the ATM modernisation project, SESAR.

Understanding and managing change and transition in organisations is, therefore, a cornerstone of the success of SESAR, and of the ability of ATM to allow air transport growth in Europe.

This topic has been addressed by the SESAR Definition Phase (in the Milestone Deliverables D1.1-1.7), complemented by the EUROCONTROL human factors SENSE Programme, focusing on change and transition.

At the EEC, recognising the importance of this issue, and the need to overcome the reputation of resistance to change from the ATM professions, an exploratory study was launched in 2004 to better understand, through case studies, how changes can be successful in the operational context of ATM: it was called the ‘Attitudes to Change’ study.

The case of the introduction of noise abatement procedures at three European airports - the Basic Continuous Descent Approach (B-CDA) project - was chosen to support the ‘Attitudes to Change’ study, and we are grateful to the Manchester, Arlanda and Bucharest airport authorities, and the corresponding ATC units and airline teams for their help and openness in this exercise. We are also grateful to the University of Westminster who performed the study, for the quality and relevance of their work, which used, in the air transport professional context, the EU TAPESTRY project’s Seven Stages of Change model.

The first report has been input into the SESAR Definition Phase, in 2006. The present, final report will be input into both the B-CDA project to help other airports with their processes of change, and into the SENSE Programme to provide concrete examples of such processes of operational change. At the time of finishing this EEC study, we hope that it will contribute positively to the success of operators in charge of implementing change in ATM.

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EXECUTIVE SUMMARY

This Study seeks to improve the understanding of attitudes to change in ATM. In particular, it examines the interconnectivities and dependencies between change in ATM and both the societal impact of such change, and societal influences on such change: these interactions may be two-way processes. It draws on three case studies: the introduction of Continuous Descent Approach (CDA) trials at Manchester, Henri Coanda Bucharest International, and Stockholm-Arlanda airports.

Some changes in ATM may be driven by factors in a ‘top-down’ manner, for example the Single European Sky initiative. Other changes may be driven in a ‘bottom-up’ manner, e.g. noise reductions at an airport, demanded by local residents. Considering ATM change at the most generic level, a library of questions has been generated relating to such change.

The University of Westminster has integrated the Theory of Planned Behaviour constructs into its Seven Stages of Change model, under funding from the EU’s TAPESTRY project. These seven stages represent the theoretical, cognitive and conative ‘process’ through which an individual may move, from one type of behaviour (e.g. not performing CDAs) to another type (e.g. habitually performing CDAs). The process through the seven stages may be viewed as a successful implementation of change. The stages depicted are not necessarily followed sequentially, but nevertheless constitute a valuable framework for developing an understanding of attitudes and beliefs which determine behavioural change. The Seven Stages of Change model was used to develop the questionnaire employed in this Study.

Summarising some key findings from the analysis exploring the Seven Stages of Change model as applied in this CDA context (see Section 1.1), behavioural change appeared more correlated with perceptions of benefits in the case of the pilots. This finding may be partly attributable to the greater external constraints on controller behaviour in the case of CDAs. Whereas pilots tended to ‘package’ together perceived benefits of the new process, controllers were less prone to this. Looking at the relationships between perceived societal and system benefits, however, these particular aspects of this ‘halo effect’ were fairly similar when comparing pilots with controllers. The Seven Stages of Change model also stresses, for example, that changes in attitude can be brought about regarding the importance of elements of change to people (e.g. “I think it is very important to control noise levels”), the perception of elements (e.g. “But I think noise levels here are very low”) and the respondent’s perceived responsibility for the element (e.g. “But noise levels are nothing to do with me anyway”).

This Report explains the overall approach of the Study and presents the full results of the three case studies. In the absence of a ‘before’ and ‘after’ survey, it has not, of course, been possible to strictly map changes in behaviour and attitude over the course of the CDA trial implementations. However, even with this horizontal study, in the context of these case studies, the Seven Stages of Change model has effectively contributed to an increase in the understanding of the associated complex psychological constructs, and their relationships: determining the perception of benefits, and how these are linked to behavioural change, through acceptance of change. It has established a framework both for future questionnaire development, and for gaining deeper insights into the process of motivation, which may be used in the wider context of change implementation, for example within SESAR. Critically important in effectively managing the challenging transitions of behaviour and attitude which will be required within the Single European Sky context, is the need to identify factors which promote change and the key barriers to change: both physical and perceptual.

The Seven Stages of Change model, and the generic questions developed in this Study, were designed to enable a differentiation to be made (where possible) between organisational-level questions (taking a strategic view) and asking about personal actions (e.g. tactical decisions). For example, although CDAs are enabled by the infrastructure, each successful CDA needs appropriate pilot-controller interaction and motivation.

The prompt to adopt a particular course of action may be determined by a macro-level objective (e.g. to increase capacity at a European level), or by a micro-level objective (e.g. to reduce noise complaints at a specific airport). Strategic trade-offs can be made for both macro-level and micro-level objectives, whereas tactical trade-offs are mostly made in the context of micro-level objectives.

A total of 82 full questionnaire, pilot and controller interviews were completed across the three case studies: Manchester (07-09 March 2005; 31 interviews in dataset); Bucharest (21-24 March 2006; 24 such interviews completed), Stockholm (15-17 November 2006; 27 such interviews completed). In addition to this, airline
managerial / training captains, controller supervisors, CDA designers and airport authority representatives were interviewed to add strategic context to each of the case studies. Each case study section should read as a stand-alone report and also build on the case study results of preceding sections.

The Seven Stages of Change model also stresses the importance of asking questions relating to experiential cycles, i.e. how attitudes to particular changes (in ATM) are modified according to experience. For each of the three surveys relating to the CDA trials, the fieldwork took place after the trial had been well established, but the introduction thereof was still fresh in the memories of the respondents, who were not informed of the objective of the Study, so as not to bias their responses, instead, as far as possible, thus allowing the societal impact on ATM change to be expressed in its natural, unbiased context. Neither the Manchester nor the Bucharest trial was introduced in the context of any increase in noise complaints, i.e. these were not driven by societal pressure *per se*. However, it must be noted that there was a clear public complaints culture with respect to noise at Manchester (as elsewhere in the UK), markedly absent in Bucharest. The Stockholm trial was explicitly introduced to mitigate against noise complaints.

Some of the differences in the responses from pilots and controllers across the three case studies will be at least partly attributable to the different methods of executing the CDAs. Other differences were observed between unprompted (open-ended) questions and more structured (fixed-response) questions, such as grid/scalar questions, with the suggestion that the latter may be more representative, on balance, of overall opinion.

In all three case studies, controllers had a poorer perception of the capacity effects of CDAs, compared with the pilots. Equally in Bucharest and Stockholm (less so in Manchester), controllers declared that CDAs increased their own workload more than pilots declared that CDAs increased pilot workload. Pilots were the more likely to express a potential decrease in workload (if the Flight Management System handled CDAs properly). Across all sites, controllers cited traffic volumes and sequencing considerations above all others, with pilots often focusing on fuel savings and technical issues.

Regarding inclusion in the consultation process over the introduction of the CDA trials, responses at all three sites were broadly similar, with a consensus that it had been adequate. Only two respondents, across all three sites, indicated reduced support as the trials progressed.

There was scope in all three case studies to offer better internal feedback to the pilots and controllers, according to the responses received on this issue. Not one respondent, across the Bucharest and Stockholm samples combined, stated that they did not want or need any feedback. Only Manchester had a system in place whereby pilots and controllers had feedback on the CDAs on a flight-by-flight basis.

The dichotomous societal rôle of the airport, particularly in the legislative context, as defender of both the ‘public’ and industry’s interests, has been discussed. Through this Study, numerous channels and processes have emerged through which community pressure may be felt by pilots and controllers. These may be effected at both the macro level, for example through the airport authority and the media acting as focal points and catalysts for communications with the public, and also at the micro level, through staff liaison between the ATM community and the airport authority, and through publicly high-profile initiatives, such as emissions reductions, which may bring the passenger and pilot contexts closer together.

Summary points are presented in conclusion, both across the case study sites, and with specific reference to individual case studies.

Twelve technical annexes offer supporting material to the Report.
ACKNOWLEDGEMENT

The interviews undertaken as part of this Study would not have been possible without the exceptional assistance and support of certain key personnel at the various case study locations. Although many people gave generously of their time (not only during the formal interview process), to whom we extend grateful thanks, we would like to thank in particular those who helped with the tactics of on-site interviews, by kindly providing a location for the interviews and for organising and motivating their own staff, plus helping with local transportation and liaison between organisations. These are, in order of contact made:

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We would also like to express sincere thanks to EUROCONTROL for their excellent advice and support with technical queries, and for facilitating many of the local case study contacts and promoting the survey’s merits to those involved.

Note
The generic term “CDA” has generally been used across a number of technically diverse case studies, usually to denote Basic-CDA. Sometimes this was to conform with the abbreviation used in the corresponding TOI (e.g. for NATS, in the Manchester case study) and sometimes to intentionally encompass both the concepts of Basic-CDA (B-CDA) and Advanced-CDA (A-CDA). Where specific differentiation is required, the terms are used differentially. A further, more detailed note on this, is provided in the context of the Stockholm case study, in Section 4.2.1.
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1. INTRODUCTION

This Study seeks to improve the understanding of attitudes to change in ATM. In particular, it will examine the interconnectivities and dependencies between change in ATM and both the societal impact of such change, and societal influences on such change: these interactions may be two-way processes.

The Study is designed to be generic in its approach to the investigation of change in ATM, and is based on a number of case studies. It is planned that some of these case studies will be similar, focusing on the same type of change, and others will be different. As new cases are added to the programme, the scope of such change will be understood more broadly, and the assessment framework being developed will evolve in the light of new examples.

This Report explains the overall approach to the Study, and presents the results of the first three case studies – the introduction of Continuous Descent Approach trials at Manchester Airport, Henri Coanda Bucharest International Airport and Stockholm-Arlanda Airport.

1.1. REVIEW OF STUDY OBJECTIVES AND METHODOLOGY APPLIED

Demand on European airspace is ever increasing, to the point whereby the delivery of additional capacity can only be achieved by significant changes in the way ATM functions. However, these changes need to be brought about in a sustainable manner that not only focuses on the environment (e.g. in terms of managing air and noise pollution), but also applies to (new) technologies, working practices and the people involved in such change – people within the ATM industry, and society in the broader sense.

Many of the airspace structures in place today were designed at a time when noise and fuel burn were not priority concerns. During later periods of intense growth in air traffic, changes in airspace structures have often been brought about in order to accommodate air traffic demand. More recently, however, greater emphasis has been placed on achieving greater airspace capacity in a more sustainable manner, although starting from a less than ideal position. This means that there are a variety of pressures from both the ATM community and ‘society’, driving such change forward, as well as inhibiting such change.

The central remit of this Study is to understand how sustainable change can be brought about within the context of societal demand: what are the barriers to such change? What are the drivers of such change?

Drivers of change can be split into two broad categories:

- stakeholder influence,
- technology, process and infrastructure.

Even at this high level, such drivers of change are often interconnected. For example, a new process or technology will require stakeholder influence to bring about its introduction. However, the detail of a change, the way in which it is operationally implemented, is primarily driven either by a stakeholder influence, or a new process or technology.
These broad categories can be further divided:

- **stakeholder influence**
  - professional
    - e.g. organisation and ‘culture’
    - e.g. EUROCONTROL
  - society
    - e.g. local authorities

- **technology, process and structure**
  - technology
    - e.g. equipment
  - process
    - e.g. training
  - infrastructure
    - e.g. airspace constraints

Some changes may be driven by factors in a ‘top-down’ manner, for example the Single European Sky initiative driven by EUROCONTROL. Other changes may be driven in a ‘bottom-up’ manner, e.g. noise reductions at an airport, demanded by local residents. Whilst some changes can be brought about with quite a tight focus in one particular area (e.g. a change in a standing agreement between two adjacent ATC sectors), other changes such as the Single European Sky initiative, will have wide implications across many categories of change. These descriptions of categories are not designed to be either prescriptive or restrictive ways of thinking about change, but rather to help think about change in a systematic way. This means that important considerations are taken into account when trying to measure and understand change.

The core focus of the Study definition, as defined by EEC, was to assess:

- **how directly and how intensely ATC personnel feel community pressure and through what processes**

The University of Westminster has integrated the Theory of Planned Behaviour constructs into its Seven Stages of Change model, under funding from the EU's TAPESTRY project. These stages (see Figure 1) represent the theoretical, cognitive and conative ‘process’ through which an individual may move, from one type of behaviour (e.g. not performing CDAs) to another type (e.g. habitually performing CDAs). The process through the seven stages may be viewed as a successful implementation of change. The stages depicted are not necessarily followed sequentially, but nevertheless constitute a valuable framework for developing an understanding of attitudes and beliefs which determine behavioural change. A certain degree of ‘post rationalisation’ might come into effect – i.e. a pilot or controller might have their awareness of an issue increased, or their willingness to accept responsibility for contributing to change, driven ‘after the fact’ by their perception of the corresponding benefits.

This Seven Stages of Change model was used to develop the questions employed in the questionnaire. Also, by measuring maturation on these stages, and understanding the relationships between them, it was possible to gain valuable insights into behavioural motivation. Such understanding can also give implementers of change insights into the likelihood of successful and unsuccessful strategies, highlighting perceptual barriers to change, and drivers of change. A dedicated paper, exploring the case study data in detail and focusing heavily on the Seven Stages of Change model, has been produced by the Study team\(^1\).

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[http://atmseminar.eurocontrol.fr/](http://atmseminar.eurocontrol.fr/)
Figure 1 - Seven Stages of Change model
(with example questions based on CDA)

- **Awareness of issue(s)**
  - e.g. are there existing, perceived problems of noise?

- **Accepting responsibility**
  - e.g. does a controller see the use of CDA procedures as their own responsibility, or should it be left to others to decide?

- **Perception of options**
  - e.g. how are the alternatives to CDA viewed by a pilot? How is controller's perception influenced - by perceived views/endorsement of ATC managers? - by societal pressure?

- **Evaluation of options**
  - e.g. what factors, in addition to safety, are prioritised? Are CDAs considered to be: - worthwhile? - safe? - desirable? - capacity limiting? - time-consuming?

- **Making a choice**
  - e.g. what governs decision-making on a flight-by-flight basis?

- **Experimental behaviour**
  - e.g. how does 'experimental behaviour' (such as participation in trials, first use of CDA) relate to: - previous perceptions? - evaluations? - actual decision-making?

- **Habitual behaviour**
  - e.g. has experimental behaviour increased or decreased the propensity to support CDA procedures? What are the barriers to, and opportunities for, continued and increased implementation?
As also illustrated in Figure 1, it is important to ask questions relating to experiential cycles, i.e. how attitudes to particular changes in ATM are modified according to experience. It is thus also important to set answers to surveys in the context of the stage at which the particular process of change was in, and to try to compare like with like across different case studies (e.g. interviewing pilots and controllers about CDA trials at approximately the same point in the trials, as far as possible).

Changes in attitude can be brought about regarding the *importance* of elements to people (e.g. “I think it is very important to control noise levels”), the *perception* of elements (e.g. “But I think noise levels here are very low”) and the respondent’s perceived *responsibility* for the element (e.g. “But noise levels are nothing to do with me anyway”). These attitudes need to be understood together – knowing that controllers all consider noise levels to be important is put into a much more useful context if it also known that those same controllers did not think noise levels were their responsibility, were of minimal importance compared to safety, were determined by others at the strategic level of decision making, or that aircraft approach noise was in any case very low, for example.

Fundamentally, it is also important to differentiate between organisational questions (taking a strategic view) and asking about personal actions (e.g. tactical decisions). An example would be asking a NATS manager about the ‘corporate’, ‘organisational’ view of CDAs, and asking controllers about the practicalities of tactical implementation (e.g. having to abandon CDAs during very high workloads). Although it is possible to mix these questions with interviewees to some extent, it is better to target particular types of questions to the same interviewee. Questions should be appropriate to interviewee job specification and areas of responsibility.

For each change investigated, the following key questions should be raised and answered, as far as possible:

- How do societal demands contribute to the drive for change?
- At what levels are the drivers?
  - stakeholder – professional / societal? individual / organisational?
  - due to technology / process / infrastructure?
- What changes / tools are required to remove / reduce barriers?

Figure 2 is a general scheme showing processes of change in ATM, against a horizontal axis of time. Imagine that there are three different courses of action: A (no change planned), B (some specific change planned, such as the introduction of CDA) and C (some other change, different from B).

This Study is about understanding change in ATM, focusing in turn on different types of change. For example, one case study might be the introduction of CDA, another might be the automation of a previously manual flow management process. In each case study, course ‘B’ is the planned change under consideration. The available options to decision makers when considering course B may be simplified as doing ‘nothing’ (A), or doing ‘something else’ (C).
Figure 2 - Scheme showing change in ATM

Even the course of ‘no change’ (A) will, sooner or later, involve some sort of ATM change being implemented. No ATM system remains static in the context of ever increasing demands on capacity, and cost pressures. Hence even course A has an arrow downstream showing some sort of specific change.

During time, various events will occur which may have particular consequences for particular courses of action chosen. These are represented by yellow shading. Consider the vertical shading on the right-hand side of the diagram. This could represent a particular phase of the on-going implementation of the Single Sky initiative, such as the introduction of Functional Airspace Blocks. Such a change could have an effect on all courses of action: A, B and C, in some way or another.

Some other generic change, such as national legislation further reducing permitted emissions, might have direct consequences for the ‘no change’ course of action (e.g. because this legislation had not been anticipated) or might have no effect on the planned action B (e.g. because it already included sufficient plans for reducing emissions).

For this reason, some of the yellow shading, representing general, background change in ATM (the broader ‘context’ of change), are not shaded in full strips down every column, because interactions with certain courses of action (A, B or C) may be very weak.

The arrows indicate a change in decision making, to move from one course of action, to another. For example, in the before situation under the ‘no change’ course of action, the yellow shading of the context might represent a background of severe complaints from the public regarding noise, which might encourage the local ATM community to move in the direction of setting up CDA trials (say, ‘B’).

Although Figure 2 is clearly a simplified representation of the process of ATM change, it is helpful in offering a visual representation of the fuller scope of ATM change, and how different courses of action may be compared. This somewhat theoretical, figurative representation will help to define a broad context for a set of completely generic questions about change in ATM. From these generic questions, specific questions about a particular type of change may be devised (see Table 1.3, later).

Using this method of creating questions, questions which are generic by nature, and thus vertically integrated across different phases of the Study, are automatically generated. By producing such questions from a broad, figurative model, it is possible to set such questions into a broad context, thus avoiding the
problem of being too ‘blinker ed’ by the specifics of any particular change in ATM. This more generic question base thus allows better comparisons to be made across different types of change in ATM.

It is also clear that different courses of action will result in different (anticipated) outcomes. A planned course of action may be chosen to avoid particular outcomes (especially those which might result from no change), or to achieve particular outcomes from the planned course of action. The trigger to adopt such courses of action may be set by a macro-level objective (e.g. to increase capacity at a European level), or by a more micro-level objective (e.g. to reduce noise complaints at a specific airport).

Before the planned course of action is adopted, the trade-offs between doing ‘nothing’ (BA) and adopting a different course of action altogether (BC) will usually be considered. These may be termed strategic trade-offs.

Having decided upon a particular course of action, and having fully implemented it, there may still exist tactical trade-offs, during the actual operational practice of the new methods or procedures. For example, a CDA approach, fully endorsed at the strategic level, may be ignored for a given tactical instance, due to other overriding demands (typically those of capacity considerations).

Strategic trade-offs can be made for both macro-level and micro-level objectives, whereas tactical trade-offs are mostly made in the context of micro-level objectives.

Table 1.1 - Level of objectives versus trade-off levels

<table>
<thead>
<tr>
<th>level of trade-offs</th>
<th>strategic</th>
<th>tactical</th>
</tr>
</thead>
<tbody>
<tr>
<td>micro</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>macro</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>

A key focus of this project is to understand how pressures from society impact on these processes of change. Examples of these influences may be used to populate Table 1.2:

Table 1.2 - Level of objectives versus trade-off levels (more detail)

<table>
<thead>
<tr>
<th>level of trade-offs</th>
<th>strategic</th>
<th>tactical</th>
</tr>
</thead>
</table>
| micro               | building a new runway  
(public protest against airport development versus support to local economy from airport) | increase of European capacity  
(public demand for travel versus national / European legislation on air quality) |
| macro               | ✓         | ✗        |

Whereas it is to be expected that (senior) management are more aware of the strategic level trade-offs, controllers and pilots might be expected to be more concerned with the tactical trade-offs (e.g. risking a noise complaint at 0800 in order to manage a surge in demand).

In Table 1.3, some of these concepts have been drawn together to generate a library of questions relating to change in ATM. It is anticipated that these may be added to during the course of the study, and form a key part of the final deliverable, for future reference.

It is to be noted that the questions are completely generic, in that they do not refer to any specific change in ATM (such as a CDA trial), but may be used to generate specific case-study questions. By this mechanism, it is hoped that the questions between study phases will be as vertically integrated as possible, by ‘mapping back’ to the generic concepts in Table 1.3.
Before presenting the actual table, it is worth making some remarks on the terminology used in the table:

‘Change’ used in a general sense to describe either a specific procedure (e.g. CDA) or a more generic process of change, such as staff relocation.

When using the table to develop specific questionnaires, it is very important to appreciate the context of the interview, for both the interviewer and the interviewee. ‘You’ may refer either to the individual being interviewed, or to the corporate/authority point of view. In the context of tactical decision making and attitudes, e.g. when interviewing pilots and controllers, ‘you’ means the individual. In terms of the strategic context, e.g. when interviewing managers, ‘you’ refers to the point of view of the company or authority – i.e. the manager is being asked to be interviewed with the ‘corporate hat on’. It will be valuable to be able to compare and contrast these perspectives, where possible.

Where the term ‘problem’ is used, this may refer specifically to a globally recognised problem, such as CO₂ emissions, or to a far more subjective or parochial issue such as noise levels, or to an issue such as staffing costs, causing a ‘problem’ to senior management in the context of a major cost-cutting exercise, but which controllers being forced to relocate to another ACC may not see as a ‘problem’ in the same sense at all.

Many terms used in questionnaires are subjective, and vary according to the point of view of the respondent, and it is very important to understand these factors, and to be sensitive to them in the context of the interview.

In terms of developing the generic questions, terms such as ‘compliance’ and ‘failure’ have been used to describe the achievement or fulfilment of change. These terms carry subjective overtones which are difficult to remove without making the language of describing the questions artificially laboured.

When turning these ideas into specific questions for questionnaires for interviews, however, it is important to remove as much of the emotive overtone and subjectivity as possible. For example, ‘failure to achieve a CDA’ might be simply replaced with ‘stepped approach’.

This library of questions has been used to produce specific questionnaires for the case studies.
### Table 1.3 - Library of generic questions

#### Conditions before change

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>From what source first heard about (potential) change?</td>
</tr>
<tr>
<td>Credibility of source? Attitude to source?</td>
</tr>
<tr>
<td>Was change described accurately, or did this subsequently change?</td>
</tr>
<tr>
<td>Were there any negative pre-conceptions, e.g. from peers, from other ANSPs?</td>
</tr>
<tr>
<td>Information on success or failure of similar changes? Where? Sources of such information?</td>
</tr>
</tbody>
</table>

#### Disposition and condition of system before change.

- Key descriptors of disposition, in terms of:
  - capacity constraints
  - airspace structure
  - environmental constraints
  - cost-saving requirements
  - societal pressure

#### Was there a problem to fix, or a need for improvement?

- What was the specific, first trigger of change? Would the change eventually have occurred (in one way or another) in any case, without this trigger?
- What pressures were exerted to support the change? Against the change? Sources of such pressures? Which stakeholders? How exerted?
- Who benefits most from the change? Any quantitative evidence of benefit?
- Agree with objectives, or more accept as a trade-off for some other benefit?

#### Interface with public – what effect, if any, from interaction with public? How does such interaction work? Filtered?

- Levels of approval required:
  - national / regulatory authority
  - local assessment (e.g. airport, local govt)

#### Context of introduction

- By whom was final decision to adopt the change announced?
- Decision-making process to adopt change?
- How was change announced by higher-tier management – with endorsement? neutral? as necessity?
<table>
<thead>
<tr>
<th>Topic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing of change c.f. other changes?</strong></td>
<td>Seen as lower / higher priority than would usually, due to other changes taking place / being discussed at same time.</td>
</tr>
<tr>
<td><strong>How did such other change(s) (if any) improve or worsen attitude to the change in question?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Staff motivation? Technical compatibility?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Consultation and facilitation:</strong></td>
<td>For pilots and controllers - level of interest in change? Ownership? Personal responsibility?</td>
</tr>
<tr>
<td><strong>Facilitation of change - same as those exerting pressure for change?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>How well those exerting pressure understand process / able to facilitate it?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Public consultation?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Level of enforcement?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Level of support:</strong></td>
<td>- supporting documentation / information</td>
</tr>
<tr>
<td></td>
<td>- supporting training</td>
</tr>
<tr>
<td></td>
<td>- supporting tools</td>
</tr>
<tr>
<td></td>
<td>- supporting</td>
</tr>
<tr>
<td><strong>Could procedure be adapted, e.g. with more, or less, autonomy of decision making, to allow greater compliance / fulfilment?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Would greater, or lesser, degree of 'systemisation' help?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Context of integration?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Local / national (environmental) constraints?</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Alternative to change**

Considering the specific ‘problem’ the change was trying to address, what alternative changes were formally considered, if any? (Alternatives include either completely different types of change, or different ways of carrying out the actual change adopted).

Why alternatives not adopted in end? Still any scope for such alternatives?

**Consequence of taking no action?** Unacceptable? To whom?

Were/are there any specific (anticipated) disadvantages of planned change?

Again considering the specific ‘problem’ the change was trying to address, to what extent was the adopted change the best way to address the ‘problem’?
**Operational practice**

Is there a weakest link in the chain (e.g. failure to achieve certain interaction) or a common situation (e.g. nearing capacity overload) which results in failure to implement change / use new procedure?

What are the causes of such failures / drivers of compliance?

- (lack of) awareness of objectives? Case where improved awareness = increased acceptance / cooperation?

- (lack of) acceptance of objectives? Why?

- personal (de)motivation? Broader than specific objectives? Does membership of any committee / union / association change personal attitude to change, motivation to encompass change?

- Pressure from line management?

- Other pressures, such as societal?

Compare reasons for isolated, tactical failures (e.g. personal level), with more systemic, strategic failures (e.g. structural / corporate level)?

Any targets set? Realistic? Fair measurement of target? How do environmental procedures integrate with other performance targets, such as declared and achieved capacities? Conflicts of targets? Problems with poorly-specified / qualitative targets?

Mechanism for reporting compliance failure? Credibility/ integrity of such mechanism? Does reporting mechanism fully and objectively reflect operational reality?

Failure taken seriously? (Question only applies in non-safety critical contexts). What type/form of feedback given?

Consequence of failure for individual?

Are ‘failures’ personally attributable?

Operational consequence of failure, by failure modes?

Which failure mode preferred? Formally endorsed?

Safety impact of failure to comply?

Are there any safety impacts of always complying? Workload? Weather?

Any instances of actual / perceived compromise?

**After the change** (or introduction of trial etc)

To what extent, if any, has the change been accepted on its own merits? How have views changed, if at all, compared to before the change? For example, was a change introduced by senior management with doubtful benefits now seen as having merit in its own right? What key factors result in support for a change in ATM?

Is the process now complete? Is there a future a point at which it is felt the change will be better, or worse?

Key things advise another unit to do

Key things advise another unit not to do
1.2. DEVELOPMENT OF THE QUESTIONNAIRE

Clearly it is not possible to include all the question areas listed in Table 1.3, in one specific questionnaire, especially when considering the (often severe) time constraints imposed when interviewing the likes of controllers and pilots - so a selection has to be made. Before selecting specific instances of the general ideas of Table 1.3, and translating them into an explicit questionnaire for the first application within this Study (i.e. the Manchester CDA trial) three phases of development were carried out:

- November 2004: a technical interview with London Terminal Control Centre (LTCC), to obtain independent background information on the development of CDA trials in the UK, based on the initial trials at London Heathrow, and including a discussion of any problems which might be anticipated in transferring the ‘Heathrow protocol’ to Manchester, with an emphasis on the operational perspective of controllers

- December 2004: an interview with TAP’s Chief Pilot at TAP headquarters in Lisbon, to gain an independent insight into the pros and cons of CDAs from the pilots’ point of view, including a discussion of the comparison of cockpit workload for CDAs with other approaches (e.g. at London Heathrow)

- early March 2005: a limited opportunity for review of questionnaire by EUROCONTROL, following which several useful amendments were made to the questionnaire

The primary objectives of the questionnaire developed for the Manchester field study (a copy of which is to be found in Technical Annex 1) were as follows:

- to be as generic as possible, thus covering both controllers and pilots, to allow as direct a comparison as possible between these two groups

- to be usable partly as an interviewer-administered questionnaire (Section B), and partly as a self-completion questionnaire (Section A). This is because it was estimated that for pilots or controllers, only approximately 15 - 20 minutes would be available for an interviewer-administered section (B)

- alternatively, to be usable entirely as a self-completion questionnaire (if required)

- to not generate undue bias (see next section)

- to capture the core questions of Table 1.3. If Section B was too detailed, and had to be rushed by the interviewer, its value would be diminished. If Section A was too long, it was less likely to be completed and returned by the interviewees – again, it is better to ask key questions well, than try to cover too much. This is one of the most difficult tasks facing the data collection phase of the project, due to the limitations of interviewee time (a fact which was appreciated in advance)

- to capture a good qualitative feel for the scope of the issues involved, enabling good illustrative quotations to be used at the reporting stage, whilst developing and testing some questions (particularly in Section A) which might be used in subsequent phases for a (shift towards a) more quantitative approach
Questionnaire development is to be viewed as a dynamic process, whereby changes should always be considered between survey waves, based on feedback from interviewers and interviewees alike, from stakeholders, and from users of the results. Even a perfectly designed and tested questionnaire may not be considered to be set in stone, as these vehicles for collecting information must often be adapted to suit local conditions, and to take account of changing background conditions. The three CDA-trial questionnaires have been included for reference in the Technical Annexes, as follows:

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Technical Annex</th>
<th>Main fieldwork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manchester</td>
<td>1</td>
<td>07-09 March 2005</td>
</tr>
<tr>
<td>Bucharest</td>
<td>2</td>
<td>21-24 March 2006</td>
</tr>
<tr>
<td>Stockholm</td>
<td>3</td>
<td>15-17 November 2006</td>
</tr>
</tbody>
</table>

During the Manchester fieldwork, two respondents questioned the use of the word “infringements” in Question A04 (which was thus changed to a tighter specification) and an explicit trade-off question addressing increased procedural standardisation versus flexibility was also added (both changes to be found in Q14 of the Bucharest questionnaire - Technical Annex 2).

One respondent questioned the use of “low vis” in Question A08 (which was thus changed to refer to “LVP”2) and, due to the number of references to ‘passenger comfort’ as an explicit benefit of CDAs to be rated, this was added as an explicit item (both changes to be found in Q16, Technical Annex 2).

Manchester questionnaire Question A02 was also adapted to ask more explicitly if the consultation process should have included the respondent in the first place, and if better feedback was required (see Q12, Technical Annex 2). The major change made to the Bucharest questionnaire was the consolidation of the two sections (A and B) into a single (somewhat shorter) questionnaire. Question B08 was dropped, as the intended information was substantially furnished in Manchester by responses to B05 and B07. It was felt that whilst a post-back methodology using questionnaires split into two sections worked well in the UK, getting this to operate between the UK and other countries, might be more problematic, and more difficult to ‘chase up’ any missing responses. This simplification also rendered the questionnaire completion instructions more straightforward. A few other very minor changes were made, mostly simplifying somewhat the wording used in some questions, to render them more direct for non-native English speakers (see later commentary in this section on comprehension).

The Bucharest questionnaire was still to be used as either a self-completion survey, or by means of a face-to-face interview. Even in the latter case, from Question 11 onwards, the interviewer handed the questionnaire to the interviewee, to complete the mostly closed-response questions in the latter part, as this was quicker, and thus increased the amount of information which could be obtained in a short space of time. For pilots and controllers who could not be interviewed directly, questionnaires were left with addressed and stamped envelopes, for direct return to the University of Westminster. In order to secure tight control over the tracking of the postally returned questionnaires from Bucharest (and, subsequently, from Stockholm), two check-boxes were added to the foot of the front cover, to allow the respondent to indicate no experience of CDAs, or if they had mistakenly been approached twice (i.e. interviewed face-to-face and subsequently given a postal questionnaire as well). In either case, the respondent was asked to return the questionnaire in the pre-paid envelope, such that the University of Westminster could track all questionnaires. Commentary on the outcome of this approach is to be found in sections 3.1 (Bucharest) and 4.1 (Stockholm).

After the Bucharest survey, the corresponding survey data were analysed to establish whether there was any evidence to suggest low comprehension of some of the more quantitative questions. Responses to the grid questions in the Bucharest questionnaire (Q14 and Q16) were thus analysed and compared with the corresponding responses to the Manchester questionnaire.

2 Although one must be mindful of local factors, e.g. Manchester operates two stages of LVPs
We can explore three major ways in which lack of comprehension and or cooperation to a question might be manifested, on these assigned 5-point agreement scales. This could be through:

(a) a high item non-response rate
(respondents do not answer the question)

(b) high rates of responses stating “neither agree nor disagree”

(c) high standard errors of the mean
(which could indicate a random scattering of responses)

Taking all of these grid questions, across both the Manchester and Bucharest samples, there were only 15 cases in total of question non-response, which, considering this represents 959 question-respondent pairs, is very low. The highest single item non-response rates were for questions receiving no answer from two respondents, which occurred with three questions: two of these three instances corresponding to the Manchester data, the other one to the Bucharest data.

Rates of “neither agree nor disagree” responses were not appreciably higher in the Bucharest data, and standard errors of means were very similar across the two samples. Whilst standard errors of means reached maxima amongst the Bucharest pilots, this group of respondents also had easily the lowest rates of “neither agree nor disagree” responses, suggesting a genuine division of opinion of pilots at Bucharest, to these grid questions.

Although the low sample sizes involved make it difficult to draw irrefutable conclusions here, the semi-quantitative evidence supports the notion of good cooperation from respondents and suggests no problems of comprehension in the first use of the questionnaire with a target audience whose first language was not English.

The only changes made to the questionnaire for the Stockholm interviews (see Technical Annex 3) were therefore the courtesy phrases being changed from Romanian to Swedish and the LFV prefixing (“... benefits LFV/ ATCC Stockholm” and “… benefits LFV/ Stockholm-Arlanda airport”) used in Question 16, to denote our understanding of the LFV Group ownership issue, in case of any query (although no such problems arose).

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3 See also commentary on this in sections 3.1 and 4.1.
4 See Section 4.2.1
1.3. ESTABLISHING A COMMON METHODOLOGY

Despite the changes described in the previous section, the questionnaires used for the three CDA case studies were very substantially the same, as required for meaningful comparative analysis, and as indeed reflected in the mirroring structures of the results sections, presented in sections 2, 3 and 4 (for Manchester, Bucharest and Stockholm, respectively).

As referred to in Section 1.1, with reference to the Seven Stages of Change model, it is important to ask questions relating to experiential cycles, i.e. how attitudes to particular changes in ATM are modified according to experience. It is thus also important to set answers to surveys in the context of the stage at which the particular process of change was in, and to try to compare like with like across different case studies (e.g. interviewing pilots and controllers about CDA trials at approximately the same point in the trials, as far as possible). For each of the surveys relating to the CDA trials, the fieldwork took place after the trial had been well established, but was still fresh in the memories of the respondents (in Manchester, just before the trial ended; in Bucharest, just after the trial ended, but with CDAs still being carried out; in Stockholm, towards the end of a longer trial).

Interviewees were not told of the objectives of the Study, e.g. to discover societal impacts on change in ATM, so as not to bias their responses - if respondents guess the underlying purpose of a survey, they may sometimes bias their responses somewhat in order to avoid or promote certain outcomes. Instead, to a large extent, these factors must be elicited naturally and find their ‘own place’ in the responses given. Clearly, if all questions asked were about societal demand, the responses would give a very biased impression as to the importance of this issue, and the questionnaire would seem ‘forced’ to the interviewee, missing important points, and resulting in a loss of interviewee confidence and cooperation. The commentary on societal impacts is given in the reporting for each case study, then brought together in Section 5.3.

In the reporting on the case study results, specific question numbers refer to the specific, case-study questionnaires, to be found in the annexes. In some cases, full sentences quoted from interviewees addressed issues raised by more than one question in the questionnaire. To avoid splitting these sentences up into less intelligible fragments, such quotations have sometimes been repeated in full in more than one section of this Report.
2. RESULTS OF THE MANCHESTER STUDY

2.1. GENERAL BACKGROUND, INTERVIEWS AND RESPONSE RATES

The Manchester trial started at the beginning of December 2004 and ran through to the end of May 2005. Face-to-face interviews were carried out in Manchester between 07 and 09 March 2005, by two University of Westminster researchers. A dedicated room was made available on-site by NATS, and controllers were released for interview as shift changes and traffic volumes permitted, on an ad hoc basis. These typically lasted about 15 minutes – controllers were taken through Section B of the questionnaire, and given Section A to return by post.

The second interviewer also met with three managerial / training captains from the airlines during this three day period, at pre-arranged appointments, carrying out more in-depth interviews, typically of about one hour in duration. Twenty questionnaires were left with each ‘AO manager’ to distribute amongst their line pilots (it was decided in situ that this was going to be a superior approach to attempted ad hoc interviews of pilots).

Two of the airlines initially returned quite low numbers of responses from such line pilots. After follow-up from the University of Westminster on 01 April 2005, the corresponding managers prompted line pilots to respond, and more responses followed, up until 18 April 2005. The final response distribution is shown below:

Table 2.1 - Response distribution [Manchester]

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>interviewed face-to-face with Section B</th>
<th>Section A returned by post</th>
<th>Given postal questionnaire: Sections A &amp; B</th>
<th>postal questionnaire returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Line’ controllers</td>
<td>9</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other controllers</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AO managers</td>
<td>3/3 in-depth interviews</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bmibaby line pilots</td>
<td></td>
<td></td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>BA CitiExpress line pilots</td>
<td></td>
<td></td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Thomas Cook line pilots</td>
<td></td>
<td></td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total number of interviewees</strong></td>
<td><strong>41</strong></td>
<td><strong>41</strong></td>
<td><strong>41</strong></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

Of the 41 interviews, one controller worked day shifts only, and thus did not complete Section A (but other views and comments from the face-to-face interview, Section B, were admitted), and two controllers did not return Section A by post.

Two pilots did not complete Section A due to not having completed CDAs at Manchester, but felt qualified to comment on the more general aspects of Section B, since they were aware of the documentation and procedures (so their views were admitted). Three pilots did not complete Section A, but it was not possible to determine definitively why not.

\[\text{one AO manager also flew frequently into Manchester and thus also completed a questionnaire as a ‘line’ pilot, as well as participating in an in-depth interview, so the total number of interviewees is one less than adding up the numbers in the table implies}\]
Four pilots had not carried out CDAs at Manchester but still felt qualified to answer parts of Section A. These responses were admitted, since the Study is more about understanding attitudes to change, than exclusively focusing on issues at Manchester per se. Furthermore, these pilots appeared to be discerning as to which questions they elected to answer. One such pilot answered Question A03, however (relating to who usually initiates a CDA at Manchester), and another such pilot offered one strongly expressed response regarding a particular aspect of CDAs at Manchester. Both of these (item) responses were disallowed during the data analysis.

When reporting the results of Section A, which was designed to be somewhat more quantitative in scope than Section B (or at least to indicate what could be achieved through a more quantitative approach), the common sample size indication ‘pilots (n=21)’ and ‘controllers (n=10)’ is given in the tables, unless a significant departure from these figures resulted from a high (item) non-response rate. Base numbers in Section B should be assumed to be 41 respondents, although this section of the questionnaire has been treated more qualitatively. Due to the more qualitative nature of the approach overall, these sample sizes are to be used indicatively, rather than as bestowing ‘significance’ to particular results.

2.2. RESULTS OF THE MANCHESTER INTERVIEWS

2.2.1. Introduction of CDAs – Context and Consultation

Both NATS management and the Environment Department at Manchester Airport concurred that the introduction of the CDA trial at Manchester was set in the context of a move across Europe of focusing more on arrival noise, a move which had earlier included UK CAA consultation with the airlines. Much effort had already been invested in departure noise control mechanisms – where room for improvement was thus viewed as more limited (see also Section 2.2.6). The trial was not introduced in the context of any increase in noise complaints at Manchester, i.e. not driven by societal pressure per se. (The reader may refer to Section 2.2.8 for a note on noise reporting at Manchester).

The reasons understood by the pilot and controller respondents for introducing the trial (in response to Question B01) were quite varied, many citing fuel savings and noise abatement, some controllers attributing the introduction of the trial primarily to a request by EUROCONTROL, two controllers quoting a drive from the local authority owners of Manchester Airport, and one pilot citing a need to ‘improve traffic flows’.

Initial reactions were mostly positive, or neutral, across all respondents. No distinctly negative initial reactions were reported, although one controller was “suspicious” of how it would work, and one pilot was sceptical about the motivation, but still acknowledged (in responses to Questions B02 and B04) the environmental benefit accrued.

Many controllers had worked at other airports and were already familiar with the CDA concept. Several mentioned a recent FMS trial at Manchester, which, to some extent, carried somewhat negative overtones over into their initial reaction to the CDA trial:

Not another FMS trial – we had that 6 months ago, then heard nothing about it. When I thought about it, though, I thought it [CDA] would be good for noise reduction.

My reaction was neutral really – we try to do them in the day already.

The initial reaction of the three AO managers interviewed was very positive, indeed reflected in a mostly positive response from line pilots, too, many saying that they already attempted CDAs wherever possible, including at Manchester, before the trial started. However, it was repeatedly stated by many pilots (and AO managers) that the CDA should start further out, that AOs consider CDAs as starting at ToD, as summarised by:

My reaction was ambivalent in that we try to achieve CDAs all the time as pilots. Also, it would be of more use if the CD could be coordinated from a higher level, i.e. we often fly level for long periods at 6000ft during approaches to Manchester. There is little change in the present format to most parties because the descent is not continuous from a high enough level and most operators can achieve it from 5-6000ft already, most of the time.

6 Flight Management System. Also commonly referred to, more specifically, as FMC (Flight Management Computer). In this Report, the term FMS is generally favoured, but FMC is used in cases where this reflects the terminology used by the respondent.
One controller believed the trial was actually introduced for the purposes of procedural consistency, and several other controllers saw standardisation of procedure as a distinct advantage. In contrast, a further controller stated that if “forced” to carry out CDAs, this could reduce the flexibility of quickly descending aircraft to maintain vertical separation, especially with the high terrain issue at Manchester, another declaring that CDAs could reduce flexibility during higher traffic volumes. Terrain issues and airspace restrictions were frequently quoted by controllers as restrictive influences (see also Section 2.2.5).

In contrast to the more common controller statements to the effect that procedural standardisation was a positive effect, several pilots, and one of the AO managers, expressed concern that if the CDAs became too procedural (and extended to daytime operations), it may reduce flexibility, such as earlier turn-ons, straight-ins and visual approaches.

In terms of the consultation process, responses to Question A02 suggested that this was generally felt to be adequate as it stood, or not needed. Respondents citing a lack of consultation, and directly stating or implying that such should have taken place, were relatively rare. The AO managers felt that consultation at the strategic level was good.

Although reactions were mixed in response to Question A06, the perceived balance of management endorsement seemed to be on the positive side, and lack of such support was not mentioned as a determining factor in not carrying out CDAs (Table 2.2). Indeed, reasons cited for not carrying out CDAs were quite varied, controllers and pilots each ‘blaming’ each other to some extent, with pilots somewhat more disposed to take the blame upon themselves, and controllers to ‘blame’ (traffic) workloads.
Table 2.2 - Reasons for not achieving CDAs [Manchester]

Concerning the night-time approaches at Manchester which are expected to be continuous descents, in cases where these are not achieved, what would you say are the most common reasons for not making a CDA?

<table>
<thead>
<tr>
<th>Pilots (n=21)</th>
<th>Controllers (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Given direct routeings - reducing track miles”</td>
<td>Workload / maintaining separation (x5)</td>
</tr>
<tr>
<td>Incorrect distance to go from ATC</td>
<td>Remembering to do it</td>
</tr>
<tr>
<td>Lack of understanding between pilot and controller of track distance to go</td>
<td>Airspace restrictions</td>
</tr>
<tr>
<td>Other traffic / sequencing / restrictions (x5)</td>
<td>Terrain considerations</td>
</tr>
<tr>
<td>“Insufficient descent from ATC”</td>
<td>“Other traffic in vicinity (with several a/c on frequency – primary concern is separation and sequencing)”</td>
</tr>
<tr>
<td>Weather / early descent due to wind (x2)</td>
<td></td>
</tr>
<tr>
<td>Busy ATC “since runway operations”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>“Because the pilot is not competent / insufficiently trained or just can’t be bothered to do one”</td>
<td>“This is really a question for pilots”</td>
</tr>
<tr>
<td>Pilot error</td>
<td>Pilot not wanting to carry out a CDA</td>
</tr>
<tr>
<td>Poor planning</td>
<td>Pilot not fully briefed</td>
</tr>
<tr>
<td>Not starting early enough</td>
<td>“Other aircraft / pilot related issues”</td>
</tr>
<tr>
<td>Lack of practice</td>
<td>Pilot requesting early descent</td>
</tr>
<tr>
<td>“The company employing several very new First Officers with little flying experience”</td>
<td>Pilot descending too early</td>
</tr>
<tr>
<td>Speed management</td>
<td>‘Some pilots will just descend straight to 4000ft when given clearance’</td>
</tr>
<tr>
<td>‘Speed at start point of CDA’</td>
<td>“Pilot consciously adjusting rate to level prior to glide slope capture”</td>
</tr>
<tr>
<td>“Misjudgement of time available to cover required distance, combined with anxiety not to get high &amp; fast: leading to a/c lower &amp;/or slower than profile &amp; level segment”</td>
<td></td>
</tr>
</tbody>
</table>
2.2.2. Attitudes to CDAs – Advantages and Disadvantages

In the free response questions B02 and B03, eliciting the advantages and disadvantages of CDAs, just over half the pilots citing benefits quoted fuel savings first, then noise and other environmental benefits, with the remainder quoting the noise and other environmental benefits before mentioning the fuel economy. As might be expected, controllers were slightly more prone to cite the noise and other environmental benefits first, with the fuel saving for AOIs second. This issue of the value of noise reduction is explored further, and more fully, in Section 2.2.6 – ‘CDAs and society’.

Question B04 asked a similar question to B02 and B03, but in a subtly different way – this time asking who benefits, and who disbenefits from CDAs (rather than asking for more generalised ‘advantages’ and ‘disadvantages’).

Personalising the question in this way resulted in a slight shift in responses (relative to B02 and B03). Pilots first declared that the public benefited just about as frequently with primary references to the AO fuel saving, and controllers shifted to being more likely to cite AOIs as beneficiaries (due to the fuel saving).

Interestingly, the AO managers were more likely to anticipate benefits to the airport, in terms of reduced noise complaints, as these respondents (presumably) had rather greater contact with the airport authority. This relates back to the point made in Section 1.1 about the potential difference between ‘organisational’ (strategic) and ‘personal’ (tactical) perceptions. Whilst this is an interesting point, and serves at least to illustrate the difference between the strategic and tactical interactions, it is to be noted that several pilots also first referred to CDA benefits in response to Question B04 as conferring on the airport, even if occasionally slightly more cynical, e.g. offering a “lower noise signature for future planning application”.

Whilst citing airport benefits was not a feature of controller responses to Question B04, Table 2.4 does not support any disparity of view here between controllers and pilots – both apparently equally likely to cite benefit to the airport when prompted in Question A08. This illustrates potential disparities between prompted and unprompted questions. In a similar vein, many pilots cited passenger comfort as a benefit of CDAs (in free response to Question B04) such that had this been included in Question A08, a high rating might have been expected for it.

* Note that several respondents referred to “noise” and “environmental” benefits. Whereas “noise” is often treated in the literature as an environmental issue, this Report has followed the terminology used by respondents, when referring to their responses. Changing respondents’ use of “environment” to, say “air quality”, to differentiate it from issues associated with noise may well instil the terminology with particular meaning unintended by the respondent in certain circumstances.
## Table 2.3 - Attitudes to CDAs [Manchester]

Please indicate your levels of agreement, or disagreement, with the following:

**Achieving continuous descent approaches during night-time operations at Manchester...**

<table>
<thead>
<tr>
<th>of no strong interest</th>
<th>would avoid if free choice</th>
<th>not my responsibility</th>
<th>serious contribution to positive change</th>
<th>little difference if don't do sometimes</th>
<th>OK as step towards better</th>
<th>should extend to day-time ops</th>
<th>recommend way we do at Manchester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilots (n=21)</strong></td>
<td><strong>Controllers (n=10)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

The table shows the responses of pilots and controllers to different statements related to continuous descent approaches (CDAs) during night-time operations at Manchester. The responses range from completely disagree (bottom) to completely agree (top).
Table 2.4 – Benefits of CDAs (1) [Manchester]

Please indicate your levels of agreement, or disagreement, with the following:
Achieving continuous descent approaches during night-time operations at Manchester...

<table>
<thead>
<tr>
<th>benefits people under approach paths</th>
<th>benefits airlines</th>
<th>benefits NATS</th>
<th>benefits airport</th>
<th>increases pilot workload</th>
<th>increases controller workload</th>
<th>limits capacity</th>
<th>less safe than stepped during low vis</th>
<th>too time consuming</th>
</tr>
</thead>
</table>

Pilots (n=21)

Controllers (n=10)
For responses to questions A04 and A08, each response in the questionnaire has been allocated an interval scale from 1 (disagree strongly) to 5 (agree strongly). This has enabled the results to be plotted in tables 2.3 and 2.4 (full item texts in Technical Annex 1). Whilst it is unwise to invest too much meaning in the absolute, mean values obtained (e.g. 4.2 compared to 4.1), it is informative to compare the relative heights of the bars in these tables.

The horizontal grey line across the plots represents a value of 3 (“neither agree nor disagree”) and the pecked vertical bars (”) represent the standard deviations (“variability”) in the responses obtained. It is important to note that the sample sizes obtained do not strictly allow a statistical analysis of the results, and that the standard deviations and relative heights of the bars should be treated as a qualitative aid only, to the interpretation of the results.

Although the remit of this Study was only to offer qualitative analyses of the results, this method of presentation also shows what type of analysis could more formally be possible with slightly larger sample sizes.

Broadly speaking, blue and red bars which are fairly near to the horizontal grey line are more likely to represent neutral opinions from respondents. This is loosely the case even when the blue or red bars are above or below the grey line, if the pecked (”) standard deviations’ bars still overlap the grey bar. Bars above the grey line represent more agreement with the statements, those below indicating relative disagreement.

The immediate impression from Table 2.3 is that many responses are thus quite neutral. The most notable exceptions to this are the responses to “Something I’d avoid if I had a free choice” and “Not my responsibility”, both scoring relatively high in the direction of the disagreement, indicating a positive response from both pilots and controllers alike, in terms of accepting responsibility and adopting an engaged rôle in the trial.

Another pattern is that the controller and pilot responses follow very similar patterns. For example, the only conspicuous example of a red bar being above the grey line, and a blue bar below it, is the case of the response to “Should be extended to day-time operations”.

The pairs of bars marked with an asterisk (*) indicate a greater possibility of real differences of opinions between the controllers and pilots. Carrying out independent t-tests (under assumptions of either equal or unequal variances), differences marked (*) all suggest statistically significant differences (p<0.01 – kindly be reminded that these are only indicative, as these tests cannot be defended statistically due to the low sample sizes). One pattern does seem apparent, however – in each case where there is some suggestion of a difference between pilots and controllers, it seems to be the pilots who are the more positive in their attitude to the trial.

Looking to Table 2.4 for some possible explanation for this potential discrepancy, it is noticeable that the two primary candidates for differences of opinion here are the items “benefits NATS” and “limits capacity”, whereby pilots may be more prone to discern a benefit to NATS, and less likely to discern a capacity limitation. These findings are illustrated by a breakdown of these responses in Table 2.5.
Table 2.5 - Benefits of CDAs (2) [Manchester]

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches during night-time operations at Manchester…</th>
<th>Pilots (n=21)</th>
<th>Controllers (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“… benefits NATS”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>agree strongly</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>“… limits capacity”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>disagree</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>disagree strongly</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Of all the mean scores across tables 2.3 and 2.4, the highest are to be found for the bars on the left of Table 2.4, whereby three of the mean scores are at, or above, a mean score of 4 (not equalled anywhere else in the Manchester tables). These findings are reflected in Table 2.6:

Table 2.6 - Benefits of CDAs (3) [Manchester]

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches during night-time operations at Manchester…</th>
<th>Pilots (n=21)</th>
<th>Controllers (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“… benefits people living under approach paths”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>agree strongly</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>“… benefits the airlines”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>agree strongly</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

These represent very high levels of agreement (the reader is respectfully reminded of the lower number of controllers), and the only “disagree” responses across all respondents for these two items were three controllers, disagreeing with “… benefits people living under approach paths”. This somewhat echoes the possibility of slightly stronger pilot support discussed above. It is also to be noted that agreement levels with “… benefits airport” are also pretty high, for both pilots and controllers.
It is to be noted that, overall, disadvantages and disbenefits cited (in Question B03 and B04, respectively) were rather rarer than advantages and benefits quoted by respondents.

A few respondents (pilots and controllers) saw the CDA trial as a progression towards something better (weakly supported by Table 2.3), examples being better standardisation of procedures in the future (controller comment) and the adoption of P-RNAV procedures (AO manager commenting on the airlines’ desire to keep in pace with all new developments, as it is otherwise easy for an AO to find itself ‘left behind’ in a rapidly changing ATM environment). This ‘progressive’ sentiment was echoed by the Environment Department of Manchester Airport.

Whilst this Section has demonstrated a considerable degree of conformity between responses, there was sometimes disagreement between controllers and pilots, e.g. one controller stating that a disadvantage of CDAs for pilots was slower approaches due to speed reductions, echoed by one pilot, but contradicted by two other pilots (citing faster approaches).

Finally, in this Section, assessing how attitudes towards CDAs changed as a function of experience, Table 2.7 shows that the commonest response to Question A09 was to indicate ‘no change’. Looking at the free-response texts written in answer to Question A09, for half of the controllers a neutral ‘no change’ response was indicated, with two having the same level of support as before the trial:

No real change as I used to do it at Heathrow

No change. I have always endeavoured to give aircraft continuous descent wherever possible. I am not carrying out more or less CDAs since the trial began and think this is true of most of my colleagues.

This attitude is reflected also in the pilot responses, with six indicating the same (continued) support. As was seen in a response to Question A06 (above), airlines may already have been encouraging the use of CDAs in any case:

The company policy is to try to achieve CDAs where possible – even if the specific airport does not carry out CDAs

The above sentiment was expressed very clearly by all three AO managers interviewed more in-depth, and relatively frequently by line pilots at various points throughout their questionnaires.
Table 2.7 - Change in attitude towards CDAs [Manchester]

Has your attitude towards CDAs changed at all as you have gained more experience? Would you say you have become more or less supportive, or no change, since the earlier days of the trial? Why?

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=13)</th>
<th>Controllers (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>less support (= 1 pilot only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(even) more support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no change (see text)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Whilst three pilots indicated a ‘neutral’ ‘no change’ in response to Question A09, the same number of pilots indicated even more support. Two controllers also indicated (even) more support:

- Slightly more supportive of CDAs. Realisation that noise is reduced for surrounding area. Obviously this is a minor issue. The real reason is financial.
- More supportive as CDA less disruptive to my working practices than anticipated.

One controller indicated ‘no change’, but still having reservations about CDAs, and only one respondent in the Manchester sample (a pilot) indicated less support as the trial progressed:

- Slightly less supportive due to the “above” profile used by ATC & associated [work?] increase in final stages of approach

Even this isolated example of less support is only expressed as being ‘slight’. The overall impression furnished from the replies to this question, is that most responses were either neutral or expressing continued/increased support.

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* see controller comment about ‘dive under’ in lower half of Table A10 for similar comment, and see also discussion of rushed approaches in Section 2.2.4
2.2.3. Attitudes to CDAs – workload issues

The bars in Table 2.4 regarding views on whether CDAs increase pilot and controller workloads are quite close to the grey line. This at least supports the view that there is no marked belief with pilots or controllers that CDAs either increase or decrease their own workload, or that of their counterparts. However, at the same time, it should be pointed out that these bars being near the ‘neutral’ grey line hides the fact that there was quite a range of agreement and disagreement on these items, with the net effect being neutral.

Do many pilots and controllers feel that CDAs make workloads easier for their counterparts, but more difficult for themselves? It seems not. No pilots thought that CDAs increased their workload, but reduced the workload of controllers, and only a couple of controllers were of the opinion that CDAs increased their workload, but reduced that of pilots.

Relatively few pilots or controllers mentioned increased workloads (unprompted in Question B03 and B04) for either themselves, their counterparts, or both. Indeed, several pilots declared that there was a workload reduction, for example as a consequence of making descent planning overall more easy. Many declared that workloads were practically unchanged, particularly pilots, as many of these were already used to carrying out CDAs where possible.

Workload was, however, cited by around half of controllers in Table 2.2 as a reason for not achieving a CDA (although, of course, not implying that is a reason half of the time that CDA opportunities are missed).

Several controllers did declare that carrying out a number of simultaneous CDAs made maintaining separation more difficult, especially during higher traffic, or in weather. Many found it difficult to judge exactly how many simultaneous CDAs they could actually manage, especially if the trial were to be extended to busy daytime operations (several being therefore against this), but others indicated that more than about five might be difficult. Mostly it seemed to be a ‘gut reaction’ when there were too many aircraft to monitor at once ‘further out’. Some had managed higher numbers at Heathrow, and were not apprehensive about any extension to daytime operations at Manchester.

2.2.4. Attitudes to CDAs – increased operational complexity

Considering responses to questions A08, B03, B04 and B05, the following were cited as potential causes of increased operational complexity when attempting CDAs, as compared with stepped approaches:

- performing CDAs during low visibility
- increased possibilities of rushed approaches
- less stable approaches
- greater difficulty capturing ILS

The purpose of referring to these perceptions here is to illustrate a potential barrier to the accomplishment of CDAs, if some pilots believe them not to be as desirable as stepped approaches in all conditions, or, for example, more likely to lead to rushed approaches. It is to be noted that rushed approaches, although undesirable, are a managed facet of ATC, with contingencies built into operations to deal with them in a safe manner should they result in a go-around.

Performing CDAs during ‘low visibility’ was mentioned in Question A08, and thus more likely to be cited more often as a result of prompt bias (as was understood at the time of questionnaire design, although a response to this issue was desired in Question A08). These increased complexities may be variously linked, but are not necessarily mutually causal. For example, a less stable approach (e.g. during turbulence) could lead to greater difficulty capturing the ILS, or to an increased possibility of a rushed approach, but may well lead to neither. It is not implied that these issues compromise safety.
Looking more specifically at examples in the questionnaires, responses to Question A08 illustrated that some respondents felt that CDAs were less safe than stepped approaches during ‘low visibility’, although it is to be stressed that the overall distributions were fairly evenly distributed around the neutral mid-point (“neither agree nor disagree”). In response to Question B05, pilots offered:

I always aim for a CDA. The only exception would be prior to a LVP approach or non-precision approach in limiting conditions when I would allow approx 2 miles before descending in the procedure. This gives a little extra time to “settle” the aircraft. During non-normal procedures, where workload is high, then a CDA would be of lesser concern BUT it must be remembered that a CDA profile should be standard operating procedure within a crew exhibiting good situation awareness.

CAT III app[roach] may be easier without CDA

I would rather always perform a CDA except perhaps when required to fly a non-precision approach to minima, when I feel the final descent should be from level flight in an appropriate and stable configuration.

Notwithstanding such considerations, another pilot explicitly stated that CDAs could be advantageous in ‘turbulent’ weather, as they avoided levelling off in ‘turbulent layers’, whilst a further comment declared that a CDA:

Reduces level bust risk simply by having less intermediate level-offs

Concerning rushed approaches, one AO manager referred to the increased possibility of these occurring during attempted CDAs, and several line pilots mentioned the greater likelihood of arriving with too much energy (height/speed), of staying too high for too long due to incorrect track estimates or due to pilot estimation error, and of speed reduction being more difficult, with a greater chance of ending up ‘high and fast’ – and therefore with an increased likelihood of a go-around, as echoed in:

Possibility of rushed approaches in not having intermediate levels-offs to slow down

As explicitly pointed out by both a controller and a pilot, pilots may prefer to be level at 2000ft to intercept the ILS, rather than to capture it from above, during a CDA. Some pilots thus felt that CDAs offered a less certain method of ILS capture. Concurring comments in responses to Question B03 and B04 referred to ATC holding the aircraft above the ‘ideal profile’ for ILS capture, which may result in “having to use speedbrakes – or even worse – the landing gear in the latter stages of the approach to join the glideslope of the ILS”.

Other pilots declared various disadvantages of CDAs to be “lack of stability in approach phase of flight” and the potential of having less correction time or space.

It is important not to make inflated issues of these concerns regarding CDA complexities, but if some pilots (disproportionately) believe that CDA attempts may lead to rushed approaches, for example, there is an opportunity to potentially improve this situation through better awareness and/or improved training and/or more accurate/regular track estimates from ATC.

2.2.5. Possible Improvements to CDA Process

In terms of potential improvements to the operation of CDAs at Manchester, a point made by one AO manager was that pilots need to have confidence in advance that the CDA will be executed, and in a predictable way, and not suddenly abandoned due to ATC instruction:

As workload increases, the accuracy of a CDA may decrease. Only ATC intervention will cause pilot to abandon the CDA, e.g. if suddenly decide to turn the a/c on, pilot will think: “Stuff this, I can’t recalculate the RoD”

As one of the pilots offered:

It’s usually only in later stages that it becomes clear it [a CDA] isn’t going to be achieved.
This point may be broadened into a somewhat wider comment on predictability. An example airport (not in the UK) was cited by one AO manager whereby ATC very often gave sudden turn-ons or directs to the pilots, such that they subsequently very often did not even try to start a CDA in the first place, on approach to that airport. It was further explained that pilot disposition towards a CDA attempt, based on the anticipated likelihood of being able to carry one out successfully, might be determined by previous experience based on the time of day, or the earlier instructions of en-route controllers.

In other words, pilots often ‘second guess’ ATC behaviour, based on local knowledge. One AO manager commented that it was not uncommon for the Intermediate Director at Manchester to give a wider angle than would be expected, but without a range update, from which the pilot would still infer he was going to be path-stretched.

Direct centre fixes from London ACC (before the STAR at Manchester) usually require a more rapid initial descent, making CDAs more difficult, and two of the AO managers also referred to problems coming into MIRSI (being held level for too long, and / or being directed ‘too low’).

In terms of predictability, one AO manager expressed a preference for the ‘gate’ method* (whereby all aircraft intercept the glideslope at the same point) and would have liked to have this coupled with a P-RNAV approach from the STAR (instead of vectoring). Two controllers specifically suggested P-RNAV approaches too, to help manage the CDAs, particularly in the light of the terrain (hills) problem to the south / south east of the Airport, and the fact that maintaining some CDA profiles in practice was not possible as they would require running aircraft below controlled airspace. P-RNAV approaches, it was stated, would give a much greater number of ‘automated vectoring’ points over which to manage the descent profile.

Another controller suggested an analogous, but more manual approach to the problem: by having a set of published altitudes and track distances to act as targets to follow. Although several pilots thought the CDA process could not be improved, most pilots offered suggestions as to how it could be ameliorated. Some of the commonest requests were offered as multiple sets of suggestions, which can best be summarised as:

- better track estimates, coupled with better ATC understanding of the connection between speed and track distance, exemplified by:
  
  *I felt the controllers did not understand how the necessity to slow down during the CDA affects the descent gradient*

- more consistency between controllers (and their instructions)

- better predictability about point of glideslope capture (e.g. ‘gate’ method)

- being told about the CDA possibility earlier on / further out, on first contact with Manchester. Table 2.8 indeed suggests some room for procedural clarification.

Returning to the first of the above bullet points, pilot opinion on the utility of ATC in assisting CDAs varied (in fact, note that the first two comments are from the same pilot):

- *When tired at end of long day, it is sometimes better to have someone helping you (i.e. controller). Tiredness would lend itself to incomplete CDA.*

  c.f:  *Controllers might be able to handle aircraft in their zone more effectively if pilots take responsibility for CDA. Controllers would have (better) more time on overall picture*

  *For ATC to instruct the aircraft crew during a CDA is like a passenger without a driving licence sitting in the back of [a] bus telling the driver what to do whilst using a mobile phone. A CDA requires a 3° descent profile (approx) so that is what is required by the crew*

This latter sentiment was echoed by another pilot*, stating that ATC needed to better understand the manoeuvrability of different aircraft, and a controller*, explaining that it was often difficult to anticipate pilot’s descent rates, as pilots in a given sequence do not all behave alike.

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* It was reported that the Airport had preferred not to use this method, so as not to focus approach noise.
I always put an extra element of safety in. I would not clear from 5000ft to 2500ft if traffic ahead – because they might get straight down. You can’t always trust them to stay up.

Table 2.8 - Initiating CDAs [Manchester]

<table>
<thead>
<tr>
<th>During approach, is a CDA usually:</th>
<th>Pilots (n=14)</th>
<th>Controllers (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>specifically requested first by the pilot (= 1 respondent only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>suggested first by the controller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>left as an implicit possibility (e.g. within pilot autonomy, based on descent clearances)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>other (= 0 respondents)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Another controller expressed their opinion (in response to Question B05) that the trial was not set up well, and also suggested that the descents should not be initiated by the controller (‘who has least real knowledge of when the descent should begin’) but should be left to the aircraft crew.

Controllers generally offered fewer suggestions for improvements to the trial than the pilots, but several mentioned the problems of local terrain and airspace restrictions, and several others felt that an extension of the CDA trial to daytime operations would be difficult or unworkable (as discussed already in Section 2.2.3, as a workload issue). Other comments from controllers included an agreement with many of the pilots that CDAs should start much further out, and, furthermore, that pilots should be better briefed.

All in all, whilst there is clearly a balance to be struck between dealing with operational challenges through increasing standardisation of procedure, at the expense of flexibility, it appears that there was an overall preference, amongst pilots and controllers, for greater standardisation.

Finally in this Section, recommendations to other airports (asked at Question A10, partly as a proxy question to further catch any perceived shortcomings in the Manchester trial) were somewhat varied - and more were offered by pilots, than by controllers. Considering the number of pilots who had elsewhere commented that CDAs should be more predictable and start further out, it might be surprising that similar comments were not made frequently in response to Question A10. This could well have been because this question occurred towards the end of the questionnaire, and respondents may thus have felt that certain points had been already covered.

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* The issues of terrain and airspace restrictions, and of standardisation of procedures, was also mentioned in Section 2.2.1, where the context of the introduction of the trial was considered.
Table 2.9 - Recommendations to other airports [Manchester]

As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Manchester?

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=21)</th>
<th>Controllers (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilots</strong></td>
<td>“Use the Manchester trial as an ideal way to introduce the trial”</td>
<td>“If we introduce it for every a/c, all day, every day then we can realise the benefits. I would recommend that other airports use it for all flights, not a very small percentage”</td>
</tr>
<tr>
<td></td>
<td>“It really does make little difference to the day-to-day operation of a professional crew”</td>
<td>“Carry out a trial procedure before settling on the definitive”</td>
</tr>
<tr>
<td><strong>Controllers</strong></td>
<td>“Accurate distances to run &amp; indication of position to join localiser/glideslope to assist in planning profile.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Controllers need to be trained to appreciate the various factors which affect our descent gradient.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Tell the airlines to urge their flight crews to carry out CDAs &amp; practice them at uncluttered airports where visual approaches are permitted”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“[They should be] advertised!!! Removal of ALT restrictions and speed restrictions. Constant track mile updates.”</td>
<td>“Ensure inbound/outbound routes are separate so you don’t have to ‘dive under’ outbounds which negates the whole point”</td>
</tr>
<tr>
<td></td>
<td>“Be aware that different aircraft have different speed and descent ideal profiles”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Plan ahead better. Produce viable approaches + publish them. Be realistic.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Make them ‘normal’, if we all did them all the time it would get easier. It would mean greater coordination between ATC agencies which would be a good thing (if within controllers’ workload capacity).”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Enough controllers with expertise”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“They should start from much higher”</td>
<td></td>
</tr>
</tbody>
</table>

Since common controller issues with CDAs were to do with traffic volumes and terrain, which are difficult to change, this may explain their relative lack of expression in answer to this question. The question generated no comments on improving benefits to the public.
2.2.6. CDAs and Society

As mentioned earlier, respondents were not told that the interviews were aimed at investigating the impact of societal influences on behaviour, in the context of change in ATM. Had this been declared, this would have very likely led to response bias, i.e. resulting in the societal influence being mentioned, or stressed, more strongly than it would otherwise have been, thus not giving a true representation of its effect. As far as is possible, therefore, the adopted approach sought to allow the societal impact to find its natural, unbiased context in the feedback.

Question B05 (“When deciding on a case-by-case basis whether to try for a CDA, how would you summarise the key factors you are trading-off, e.g. your workload versus what?”) was asked partly to see how many pilots and controllers would mention trade-offs in consideration of noise, and local residents.

Controllers mentioned the trade-off between increased workload and maintaining separation, for example stating that it was not possible to give all aircraft a CDA, as proximity became a factor, or that they would not give a CDA to one aircraft if it hindered other flights. Many controllers again mentioned airspace and terrain restrictions at Manchester as being a limiting factor (“you can’t always descend them from 5000ft to 3000ft”). Pilot cooperation and requests for early descents were also raised.

In terms of trade-offs, the AO managers, in particular, again stressed that CDAs were already the expected ‘norm’ of descents (as mentioned in Section 2.2.1) although pilot inexperience and, in certain cases, lack of appropriate training, might be a factor acting against achieving CDAs, as indeed expressed by a line pilot:

*Inexperienced pilots have to learn the procedure as it’s not learnt during basic training.*

One AO manager thought an increasing reliance on computerisation might lead pilots to feel that CDAs involved too much extra work. Indeed, workload and fatigue were mentioned in response to this question by a number of pilots, although many also declared that extra workload was not a factor, for example:

*[it is] just a different workload.*

Since Question B05 specifically asked for trade-offs, it might be expected that these references to workload, taken at face value in terms of frequency of responses, might over-represent the balance of views. Indeed, the reader is reminded that in Section 2.2.3, extra workload was pretty much a neutral issue taken across the whole sample.

Benefits quoted echoed those described earlier in Section 2.2.2, including reductions in fuel burn, time savings and passenger comfort. Negative factors in the trade-off equation for pilots included a need to prioritise the avoidance of bad weather / wind, and the possibility of rushed approaches and, in some instances, not favouring CDAs under LVP (see Section 2.2.4). One pilot mentioned a consideration of controller workload as a negative aspect in the trade-off.

Safety was mentioned in this context by one pilot only, although it did not appear that the inference was in any way that CDAs were less safe. The comment seemed to imply more that prevailing conditions might sometimes not be compatible with a CDA:

*Safety – i.e. high ground, tailwinds – affecting decent rates – turbulence – operational reasons relating to any particular “technical” areas – GPWS warnings – to go around high ground east of MAN.*

So, in response to Question B05, where does noise, and the corresponding societal considerations, appear specifically in the trade-off consideration? Only three pilots mentioned noise as a trade-off issue:

*Less noise disturbance to those on ground*  
*Lower noise signature + local resident public relations*  
*Less noise on ground*
The latter pilot qualified this comment by saying that the benefit of noise reduction was *secondary* to those of smoother flights for passengers and to fuel savings, since the aircraft was very quiet anyway - a comment which was echoed in responses to Question B07, and by another pilot (in response to Question B05) which appears to be somewhat negative toward CDAs:

> The type of aircraft I fly (Dash 8 turboprop) is not noisy during the initial and intermediate parts of the approach. Given this, I would be somewhat reluctant to trade off the CDA benefit of lower noise profile – with any increase in workload during a busy phase of flight.  

However, in Section 2.2.2 (‘Attitudes to CDAs – advantages and disadvantages’) a clear benefit towards the public was perceived from both pilots and controllers (as evidenced in Table 2.4 and Table 2.6, for example).

Responses to Question A07 suggested that concerns about noise complaints *per se* were less marked. Fourteen pilots declared that they were ‘seriously concerned’ or ‘somewhat concerned’ about ‘the potential of noise complaints being generated by the public in the event of night-time CDAs generally not being used’, and two controllers expressed the same levels of concern.

Table 2.10 illustrates that quantifiable benefits had not yet filtered back to the pilot and controller communities, as might be expected, considering the stage of the trial during the interviews. This serves to reiterate the point that the timing of the interviews for the various project case studies is an important context in which to set results, as has been mentioned in Section 1.1. No reductions in noise complaints were mentioned in response to Question A11, nor had the Environment Department at Manchester Airport expected any drop in such numbers at this stage – complaints further than approximately 8 miles out were quite rare. With Manchester Airport not having a night curfew, residents were less sensitive to night movements (i.e. during the time the trial was in operation) than, say, they might be at Heathrow. Furthermore, December to January (i.e. just after the trial’s introduction) is a period of relatively low night-time traffic at Manchester.

(It is worth noting in passing, that since many AOs encourage CDAs wherever possible, including at Manchester before the trial started, this led one AO manager to raise the issue of needing to be careful when using ‘before’ or ‘non-CDA’ baseline FDR data for calculating fuel savings).
Table 2.10 - Awareness of quantifiable benefits [Manchester]

<table>
<thead>
<tr>
<th>Are you aware of any quantifiable benefits which have resulted from CDAs at Manchester – e.g. fuel savings, reduced complaints about noise from the public?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilots</strong> (n=21)</td>
</tr>
<tr>
<td>No (x14)</td>
</tr>
<tr>
<td>“Fuel savings” (x4)</td>
</tr>
<tr>
<td>“Not yet”</td>
</tr>
<tr>
<td>“A more ‘professional’ approach”</td>
</tr>
<tr>
<td>“Passenger comfort”</td>
</tr>
<tr>
<td>“Engine wear reduced”</td>
</tr>
<tr>
<td>“None – would like to know though”</td>
</tr>
</tbody>
</table>

Responses to questions B07 and B08 gave a specific insight into the attitudes of the respondents regarding the core focus of the Study definition, as defined by EEC, which was quoted in Section 1.1, i.e. to assess: “how directly and how intensely ATC personnel feel community pressure and through what processes”. Indeed, responses to these questions indicated a distinct lack of immediate community impact on either the pilots’ or controllers’ day-to-day behaviour.

Selected responses to Question B07, include:

**Please could you outline the extent to which you feel personally that the public response to aircraft noise affects your day-to-day decision making when it comes to trying to achieve continuous descent approaches?**

From pilots:

- *It crosses my mind – what drives my behaviour is efficiently flying the aircraft, which, in turn, means less noise.*
- *On a departure, I am much more concerned about noise footprints.*
- *Continuous descent is … more for reasons of passenger comfort and fuel saving.*
- *We fly a company and legal profile … changes must be made at organisational level.*
- *Because I live on the approach to Manchester Airport, I believe I probably think more about the effect of aircraft noise. However, my company has very specific Standard Operating Procedures which limits how much scope we, as pilots, have in reducing aircraft noise on approach.*
- *I know when I’m on the ground I don’t like it and by keeping the public happy I help to safeguard my job. Besides, from a professional point of view, it is more rewarding to fly an efficient CDA than not to do so.*

From controllers:

- *Noise is at the back of my mind – but not a priority.*
- *Separation is everything.*
Selected responses to Question B08, include:

In what ways do you consider your job, as regards approaches at Manchester, is more difficult compared to approaches at some other European airports, where there are no / very few people living under the approach path of inbound aircraft?

From pilots:

- It is more complex at Manchester because of all the speed, descent and crossing constraints required at a busy airport set within a large conurbation ²⁹

- Very little … fuel saving … just happens to coincide with a minimum in noise level ⁹

From controllers:

- It’s more of an airport thing – they decide what’s OK. We accept what we get, and deal with it as it comes in. ⁵

- Only affects departures … approaches have to come in straight. Only make a lot of noise when climbing. CDAs are there to save fuel. Further out they don’t notice – flaps are noisiest on approach. Only on final approach do a/c follow exactly the same tracks. ¹²

One pilot ³⁵ commented that “our children + their children will benefit most if we reduce fuel consumption” and in response to Question B02, another pilot ⁴⁰ made a rare comment regarding the benefits of CDAs with respect to “local relations with neighbouring towns / villages”.

Only one respondent ²⁸ across the pilots and controllers mentioned safety in response to questions B07 and B08, declaring that too high a focus was placed on noise concerns, as echoed by one controller ¹⁵ in response to Question B05.

Similarly, in response to Question B08, respondents might have said that considerations of the noise impact on people living underneath approaches made such approaches over built-up areas more difficult, but this issue was apparently of very little concern to respondents, in the context of this response.

Towards drawing qualitative conclusions from this Section, it is clear that concerns regarding societal impact and noise are distinctly low in the list of priorities for pilots and controllers alike. Whilst safety is of paramount importance across the whole respondent base, the economies of fuel saving (in particular) and the ‘professionalism’ (e.g. increased passenger comfort) of CDAs were also important to pilots.

It can be said that generally, to the extent that CDAs were compatible with existing priorities of pilots (safety, economy) and controllers (primarily separation and expedition), they were accepted by both sets of respondents. This was tempered somewhat by actual annoyance by some respondents that noise issues near airports received such a high profile.

There was also some evidence for a somewhat persistent ‘departures culture’ regarding noise (see also Section 2.2.1 - ‘Introduction of CDAs – context and consultation’), with arrivals noise less of an issue, and with some pilots stating that their aircraft were in any case very quiet (especially in response to Question B07).

In answer to the latter part of the question posed at the start of this Section (“how directly and how intensely ATC personnel feel community pressure and through what processes”), it can be suggested that there is some deferment of this responsibility from pilots and controllers to the ‘system’, as established at the strategic level, illustrated by two responses to Question B08:

- No difference – I fly the approach plate ⁵ [pilot]

- The airport is the interface, ATCOs are not bothered about noise ⁶ [controller]

Of course, this sentiment cannot be substantiated quantitatively, but it is indeed supported by views expressed by the respondents, and it is difficult to find contradictory acceptance of personal responsibility for noise per se.

The theme of societal context is explored again in Section 5.3.
2.2.7. Internal Feedback and Dissemination of the Study’s Findings

Whilst comments on the quality of the internal feedback processes were somewhat split between the negative and positive from the controller perspective, the clearly predominant response from pilots was lack of awareness of such feedback processes, or declaring that they did not exist – with a rather more negative overtone overall, echoing somewhat a pilot comment in response to Question A02:

*No personal consultation with myself or other line pilots ... this has led to no input from those using the system most & no opportunity for ideas / suggestions in its completion*

Whilst it is to be remembered that, as already pointed out, responses to Question A02 suggested that the consultation process was generally felt to be adequate as it stood, or not needed, an opportunity exists in the next phase(s) of this project to ask more explicitly if better feedback opportunities are desirable, in order to better quantify the issue of internal feedback.

In fact, the system for feedback at Manchester was that NATS supplied the Airport with a list of flights which should have achieved a CDA, and the corresponding tracks were then returned to NATS with an indication if the trajectory was CDA-compliant, or not. Controllers were then able to offer feedback (to NATS management) on non-compliant CDAs, on a flight-by-flight basis. Whilst the Airport also made these tracks available to the airlines, there was not a flow of information between NATS and the airlines, and both the Environment Department at Manchester Airport and NATS management agreed that a more focused, tripartite (or multipartite, e.g. including EUROCONTROL) feedback / communication mechanism would be beneficial, although there were some reservations about how much work this would involve and about the practicalities of organising such interactions whilst the flight-by-flight instances were still fresh in both pilots’ and controllers’ memories.

There is insufficient evidence to support this need, at this stage, from the pilot or controller perspective, although several controllers declared (in response to free-response Question B03) that a disadvantage of the CDA trial was the actual feedback forms.

~*~

In terms of offering the stakeholders at Manchester a formal feedback session on the results of this Study, Table 2.11 shows that there was a distinct lack of consensus on the type of feedback required, and that, ultimately, the EUROCONTROL plus University of Westminster dissemination process at Manchester should perhaps cover the Study as a whole, in addition to at least some focus on the CDA trials.
This Study will be looking at other CDA trials in Europe, and rather broader types of change in ATM. We would like to return to Manchester to offer a brief presentation of some of the key findings resulting from the Study. Which of the following best describes your reaction to such a feedback session:

<table>
<thead>
<tr>
<th>Feedback preference</th>
<th>Pilots (n=21)</th>
<th>Controllers (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would probably not have time to attend</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would prefer a focus on CDA trials at Manchester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would prefer a focus on CDA trials at Manchester and elsewhere in Europe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would prefer a broader presentation on ATM change in general</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No particular views / preference</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.11 - Feedback preferences: hearing about the Study [Manchester]
2.2.8. Update Since the Interviews

Whilst the Manchester results indicated that pilot and controller concerns about noise levels in particular, and about societal impacts of ATM, were overall very low, it has also been noted that in addition to its existing undertaking towards the mitigation of environmental impacts, NATS is committed to further work in raising environmental understanding throughout the organisation. It has been suggested in this Report that there may be some deferment of social responsibility from pilots and controllers to the ‘system’, as established at the strategic level, in which the Airport may play a special rôle.

Indeed, following the reporting on the Manchester case study, an intranet dialogue facility for pilots and controllers was established, to facilitate stakeholder communications, which has met with considerable success.

We also note the on-going activities of Manchester Airport in its established community liaison programme. An extract from its latest Environment Plan⁷ explains that:

COMMUNITY LIAISON, MITIGATION AND COMPENSATION POLICIES AND TARGETS

N28 We will continue to liaise regularly with the local community through regular meetings, outreach visits and by phone and to produce relevant information and responses to complaints. We have a target to respond to 95% of community complaints within 5 days.

The reader may refer to Technical Annex 11, whereby we show a page from the Manchester Airport website⁸, where members of the public may file a complaint about noise, on-line. This may be compared with the analogous facility at Stockholm-Arlanda, shown in Technical Annex 12.

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⁷ Environment Plan - Part of the Manchester Airport Master Plan to 2030 (under “AIRCRAFT NOISE POLICIES AND TARGETS”)
⁸ www.manchesterairport.co.uk/noisecomplaints.nsf/cf?openform
3. RESULTS OF THE BUCHAREST STUDY

3.1. GENERAL BACKGROUND, INTERVIEWS AND RESPONSE RATES

An introductory meeting was held on 22 September 2005 at Henri Coanda Bucharest International Airport (formerly Otopeni International) between the University of Westminster and several members of the B-CDA Group (key representatives were present from the Airport Authority⁹ and TAROM - ROMATSA¹⁰ and the Romanian CAA¹¹ were not present). The meeting was facilitated by Stefan Fotescu (TAROM). There was strong support around the table for the University of Westminster mediated interviews. Tactics for the planned interviews were discussed – taking into account the fact that ROMATSA APP is based some distance away from Henri Coanda. Frequent exchanges were made over the following months, between the University of Westminster and the B-CDA Group, channelled through the cooperation of Stefan Fotescu.

After securing the permissions needed and agreeing a suitable interview period, face-to-face interviews were carried out in Bucharest between 21 and 24 March 2006 (inclusive), by two University of Westminster researchers. A dedicated room was made available on-site at both ROMATSA and TAROM. Controllers were released for interview as shift changes and traffic volumes permitted, during the morning of each interview day. Most TAROM interviews took place in the afternoon or early evening, with some morning interviews. Pilots were requested to participate in an interview just before, or after, their duty shift.

It was possible to complete the interview comfortably in 15 minutes. All respondents were asked at the outset how long they had available, and if this was less than 15 minutes, five minutes was spent by the interviewer outlining the objectives of the survey, and stressing the importance of a good response rate. The interviewee was then left with a questionnaire and a pre-paid envelope for return to the UK. Actual face-to-face interviews lasted between 15 and 45 minutes - longer interviews occurred in cases where pilots or controllers were particularly keen to offer more extensive feedback.

Of the 26 TAROM pilots with experience of a CDA, 15 had experience of at least three CDAs, and these 15 pilots were targeted as a priority for interview. Over the four days, 10 of these were fully interviewed, and a further three were left with a questionnaire for posting back to the UK, after initial interviewer contact (unfortunately none was returned). A further 10 questionnaires and pre-paid envelopes were left with TAROM for distribution, with a return-by date of 06 April 2006 (with no further returns, notwithstanding University of Westminster reminders and excellent TAROM managerial cooperation).

At ROMATSA, there were 32 APP controllers, with approximately equal experience of CDAs, and four supervisors. 13 controllers were interviewed face-to-face, and a further 15 questionnaires and pre-paid envelopes were left for distribution, with a return-by date of 06 April 2006 (with one further return accepted on 26 April 2006, following University of Westminster reminders.) It was not possible to distribute questionnaires to all controllers due to leave of absences. It was also noted that other survey work had taken place at ROMATSA in recent months, which may possibly have had a negative effect on the postal response rate, but every effort was made by the supervisor to secure good cooperation in this respect.

⁹ Compania Nationala "Aeroportul International Henri Coanda-Bucuresti" SA
¹⁰ Administratia Româna a Serviciilor de Trafic Aerian
¹¹ Autoritatea Aeronautică Civilă Română – AACR
Table 3.1 - Response distribution [Bucharest]

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Interviewed face-to-face</th>
<th>Postal returns</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line pilots</td>
<td>10</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Controllers</td>
<td>13</td>
<td>1</td>
<td>14</td>
</tr>
</tbody>
</table>

Total number of interviewees = 24

In addition to these interviews, others were carried out, of up to one hour, at a more senior level (e.g. with supervisors and managers), and with the Airport Authority, to further inform the Study. These interviews have not been counted above towards the totals analysed from the line pilots and controllers, but have been used to add further detail and valuable context to the results.

Linguistically, some respondents found the interview process easier than others, but answers to all questions were forthcoming. Some appeared to find Question 11 onwards a little easier to complete (see also commentary on comprehension in Section 1.2), as the questionnaire was in front of them, although we do not propose a wholly self-completion method should be adopted in future, as often valuable insights are gained through the process of discussion itself, and, indeed, through points of clarification, where needed.

As might be expected, respondents with particularly fluent English and/or who had been involved in the design of the trial, tended to have more in-depth comments to offer. The cooperation and responsiveness of all respondents, without exception, was of the highest standard. Considerable time was spent studying the semi-quantitative, self-completion section of the questionnaire, with no respondent simply rushing through and ticking options at speed to conclude the interview quickly. All evidence pointed towards a very high quality of considered responses.

Although the absolute response numbers were lower than in Manchester, it should be borne in mind that only one airline was participating in the CDA trial in Bucharest. The low number of postal returns partly supports the advisability of face-to-face interviews, and it is to be remembered that two-thirds of the more CDA-experienced pilots were interviewed, and two-fifths of the approach controllers.
3.2. RESULTS OF THE BUCHAREST INTERVIEWS

3.2.1. Introduction of CDAs – Context and Consultation

The CDA Working Group at Bucharest was chaired by the Airport Authority, which took the initiative for this introduction following suggestions from Manchester Metropolitan University (with which it had particular contacts) and EUROCONTROL, thus demonstrating a desire to be pro-active and keep pace with such emerging developments. In particular, Henri Coanda Bucharest International Airport Authority stressed its major rôle in creating a clear direction for wider environmental protection, with a legal emphasis placed on airports, putting them in a special position, considering the relative actual impacts generated by airlines, under the control of ATC.

ROMATSA stated that the trial had been suggested to them by the Airport Authority, the Romanian CAA and TAROM, the primary motivation being fuel savings, followed by noise and pollution reduction. The Airport Authority, TAROM, ROMATSA are all responsible to the Ministry of Transportation for service provision.

ROMATSA was not consulted at the CDA design stage with regards to speeds and profiles per se, it declared. In terms of setting contextual background, it was explained that a number of managerial changes had taken place within ROMATSA in the period during the operation of the CDA trial, but this was not referred to by any of the interviewees in response to Q01 (addressing the context of the CDA change), so presumably was not an impacting problem.

The introduction of P-RNAV in the Bucharest TMA due for October 2005 had not taken place, which had also prevented the introduction of P-RNAV SIDs and STARs, but this was not felt by any respondents to have any effect on the success rate or operation of the CDAs, apart from the potential in future to add in a few more waypoints to improve profile accuracy.

The Airport Authority is required by law to make environmental data available to the public: it was commented by the authority that whilst noise and LAQ were taken seriously, and monitored by the Local Environment Agency both were well within the set limits, whereas the management of waste water was a major on-going concern.

Noise regulations are set at a national level. Noise complaints from the public would go to the Airport Authority, but none were ever received, as this was a very low priority for Romanian citizens, it was declared. This statement is strongly supported in a qualitative sense by focus groups carried out in Bucharest, for EUROCONTROL, by the University of Westminster, exploring the societal impacts of air traffic growth.

There were no NPRs at Henri Coanda Bucharest International Airport, nor any immediate plans to introduce such, although they would be needed at some point in the future, the Airport Authority stated. Despite some controllers mentioning during the interviews that fines were going to be introduced by the Airport Authority for noise infringements, this was not actually the case, and the Airport Authority did not, in fact, have the power to impose such fines.

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12 Ministerul Transporturilor, Constructiilor si Turismului
13 Agenția Locală de Mediu
STARs were the natural choice of CDA at Bucharest, since other approaches were by default also STARs, and vectoring was rarely required, although directs onto the runway from various points within the STAR were often given. The CDAs officially began at the start of the STAR between FL100-120 (although pilots often began a continuous descent profile rather further out, often at ToD, e.g. FL290), with three entry points (TUSET to the east, through which most such approaches were made, and VALPA plus OBUGA in the south), each feeding onto RWY 08L or 08R, making six distinct profiles in all. An example of the profile descriptions circulated within TAROM is shown in Technical Annex 9. It is to be noted that Henri Coanda Bucharest International Airport has 24-hour operations, and that TAROM was the sole airline participating in the trial, with both its B-737 and ATR-45 fleets.

The CDA trial started on 19 September 2005 and officially finished on 31 December 2005, although CDAs were still being carried out in practice at the time of the interview period (March 2006).

In response to Q02 (“From whom did you first hear about the introduction of CDAs at Bucharest, and what was your initial reaction to this? For what reasons was this introduced?”), initial reactions were mostly positive (from the majority of both pilots and controllers alike), and, less commonly, neutral. No distinctly negative initial reactions were reported. Several controllers qualified their positive reaction by saying the desirability of CDAs depending on traffic conditions. Controllers also expressed a somewhat more detailed set of descriptions of their initial responses to the trial, on first hearing about it:

- I accepted it as an experimental procedure which could be implemented later on
- Something unknown, but positive
- An unknown procedure to me
- Something new we would like to try
- Neutral – I waited to see what happens
- It was initiated by the Ministry of Transportation, then included the airport, pilots, ROMATSA and the AACR

The trial was first heard about internally, initial information being received as documentation (one controller saying this was “from TAROM”), or by word of mouth from an ATC Supervisor / Chief Pilot, manager or colleague. One line pilot declared he had first heard of the trial in the context of the simulations at Amsterdam, another pilot interviewed had been involved in the design of the procedures. One controller had also been involved in the set-up, stating that the future reduction of NO\textsubscript{x} emissions was part of the original reason for the trial, but that this had been dropped, leaving the priorities of noise reduction and fuel savings. These two factors were most commonly cited across respondents as the reasons for the introduction of the trial. Controllers were more prone to offer such reasons, and more of a range of reasons, which included delay reduction, passenger comfort, smoother trajectories to reduce engine wear, and reduction of pollution, none of which were cited by the pilots. One pilot stated that the purpose of the trial was to reduce ATC communications, and another two that it was to improve regulations and procedures.

In response to Q12 on inclusion in the consultation process regarding the introduction of the CDA trial, most of the pilots (seven) declared that they had been included and had wanted to be included. Six controllers stated that they had been included, this number being evenly split between whether they had wanted to be, or not. Only one respondent (a pilot) had not been included, but had wanted to be. In response to Question 07 (“Do you feel that CDAs are strongly endorsed by your managers, or that it is not of special consequence whether they are generally achieved or not?”), the response from one controller:

- No – it’s for the pilots

was not typical. Overall, there was a clear picture of support from ROMATSA expressed, but with an equally clear view emerging that if controllers did not offer a CDA, this decision was respected by managers, with
expressions such as “they respect our voice” and “there is not a pressure”. There were several references to the fact that this was (‘only’) a trial, such as:

This is a trial – to see what is good and bad with the procedure

It’s only a trial – we do if we can

A ROMATSA supervisor interviewed estimated that around 10% of in-scope CDA approaches were not achieved due to high traffic volumes constraining controller flexibility to carry out a CDA. Success rates estimated by controllers were variably estimated, from:

The success rate now is 40-50% - better than early on when pilots did not know what to do, and the controllers too, to some extent

To:

I didn’t refuse a single CDA during the whole trial, I will reduce another aircraft if I have to

I nearly always give if an aircraft requests

The feedback from the pilots on this issue was very similar, with firm support for the procedure, even if qualified by:

Most important is the fuel saving

It is recommended – but pilot decision. It is never a problem if we cannot do it

and with very similar comments that pressure was not imposed to carry out CDAs, in that decisions not to were respected.

From time to time they [TAROM managers] remind us not to forget – we cannot forget. The controllers help us very much

When asked in Question 06 for reasons for not achieving CDAs, where these were intended, the most cited reason across pilots and controllers was clearly high traffic, and the problems of sequencing during higher volumes (e.g. an ATR-45 starting a CDA at one entry point, then a faster B-737 arriving at another entry point. Several controllers made the point that even if a CDA was given, they were able to abandon it if needed). In some contrast, another controller declared:

Speed is not a problem – you just need to monitor and tell the pilot

One controller expressed a view that TAROM pilots sometimes used the procedure in an inappropriate way to their own advantage, causing greater difficulties in maintaining separation minima, and thus resulting in unsuccessful CDA attempts:

Being at home (in Bucharest TMA), TAROM pilots didn’t follow the CDA procedure as it was designed … they tried to get some advantage from this procedure … they applied [the procedure] the way they wanted, putting a lot of pressure on ATC to get CDAs. Sometimes the pilots didn’t follow the instructions … Also, a few times, a lack of experience of a young APP controller could be a reason

These sentiments were echoed somewhat by:

Pilots don’t always understand what they are supposed to do. They ask for a B-CDA, get clearance, then ask [ATC]: ‘What level should I be at?’

Pilots are instructed to do a CDA – [they] think they have priority from cruising level to landing. Pilots understand the CDA procedure different from us [Question 07]
There were slightly more complaints about pilots from controllers, than vice versa, although one pilot declared, in response to Question 07:

*I'm not sure if Approach are always honest in the reason they give if they refuse! Sometimes they give a different reason, maybe for safety reasons, they prefer to increase the separation*

Overall, however, there was a clear impression that (in-scope) CDAs were only rarely not carried out, when the descent was expected to be as such, as was consistent with responses to other questions (e.g. a pilot citing 90-95% success rates, in response to Question 04).

Notwithstanding the above commentary, mutual blame for failures between pilots and controllers was generally low - both pilots and controllers readily cited traffic and, to a lesser degree, weather, as reasons for not carrying out CDAs (on the rare occasions this happened).

**Table 3.2 - Reasons for not achieving CDAs [Bucharest]**

| Concerning approaches at Bucharest which are expected to be continuous descents, in cases where these are not achieved, what would you say are the most common reasons for not making a CDA? |
|---|---|---|---|
| **Pilots** (n=10) | **Controllers** (n=14) |
| **High traffic (x6) / ATC instruction (x2)** | Traffic/sequencing (x12) |
| “90% of the time it is OK” ² | “Only happened one or two times” ³³ |
| “Traffic – but I think this problem will disappear, or reduce by more than 80%, when everyone does a CDA. There is no reason to do a stepped descent.” ⁸ | “Forced to make vectors” ³³ |
| **Weather/turbulence (x4)** | “Need to vector when three or four aircraft are landing” ²⁴ [Question 04] |
| “Weather – a pilot* decision” | Weather (x4) |
| “Something to avoid when Charlie Bravo† or weather” | “Rarely due to weather – normally it is stable” ²⁴ |
| | “If a pilot* wants to avoid a Charlie Bravo†” ³₂ |
| | “If we give clearance but CDA not achieved, the pilot is responsible” ²³ |
| | “LVP – some pilots are not aware that B-CDA should not take place if LVP” ²⁷ |

* A controller ³² explained that ATC did not have a meteorological radar, such that APP was not aware of weather / CBs.

† “Charlie Bravo” is the code term used for cumulonimbus cloud, which pilots always wish to avoid. ATC vector aircraft around these, once they know where they are.
3.2.2. Attitudes to CDAs – Advantages and Disadvantages

In response to Question 03, controllers were rather more prone to cite disadvantages of the CDAs, than were pilots. Pilots declared that disadvantages included increased workload if the FMS could not manage an automatic RoD calculation, that CDAs were slower than stepped descents (although this was “not a serious problem”) and that ATC sometimes did not give clearance. However, advantages cited clearly outnumbered these relatively minor disadvantages, with seven pilots (and, indeed, six controllers) spontaneously citing the associated fuel savings, and seven declaring that the pilot workload was reduced (one qualifying this by saying this was only the case if the FMS could handle an automatic RoD). One pilot said that the CDA was easy to input into the FMS and this procedure allowed closer sequencing, four pilots cited decreased communications with ATC as an advantage, and three referred to improved passenger comfort. One pilot referred to noise reduction in response to this question, and none to broader environmental impacts, as compared with a mixed, spontaneous response from controllers to this theme:

> When low he makes the same noise as when higher

> For people living within TMA and around the airport … reduces pollution

> [An advantage? -] The environment, maybe?

 Whilst two pilots stated that CDAs allowed quicker descents, one controller said that the Airport Authority had stated that CDAs allowed quicker arrivals, but that they did not believe this to be true, and another did not agree with ‘pilot opinion’ that CDAs were quicker.

Controller feedback on the workload implications of CDAs was rather variable. Two spontaneously referred to a reduction in communications, one saying this was a reason for introducing STARs in the first place. Another declared that communications were shorter, rather than fewer. Two thought that CDAs did not create any more work than a stepped approach, but rather more declared a range of disbenefits in this respect:

> There are no benefits for the traffic unit

> Separation and spacing are more difficult, we have less control

> We may need to vector an aircraft following another one on a CDA to slow the following one down

> It is impossible to give CDAs to some aircraft if vectoring others

Other problems cited were pilots not respecting speed restrictions, and the difficulties of allowing CDAs during strong tailwinds or headwinds, or when the approaches were not from the west.

Some controllers made the interesting point that during ‘light sequences’ (periods of non-heavy traffic), they preferred CDAs, but when traffic was higher, they preferred stepped descents. A point raised by one controller was that during the simulations, only one CDA was simulated at any given time, when in practice, they would be trying to handle three at once, and not with three aircraft of the same type. This should have been part of the simulation, it was felt.

One controller cited an advantage of CDAs being that pilots understood what to do better, with two pilots declaring that less work for pilots and controllers improved safety, with the additional, associated comment that:

> We can keep vertical navigation during descent

Another pilot explained that since 1980 he had been descending with engines reduced as much as possible ‘from the top, to the runway’, well before hearing about CDAs, stating that he ‘liked to practice’ this type of operation, and:

---

16 see footnote in Section 2.2.1
It’s a pleasure for the pilot to practice this procedure. Also:

It [CDA] is normal in Europe, e.g. in Heathrow ATC is very professional. [Question 04]

With reference to Table 3.3, we observe the responses to a more prompted, and structured question set (i.e. the grid question, Question 14). An explanation of how to interpret this type of chart, and the meaning of the grey bar and pecked vertical lines, was given in Section 2.2.2. Further commentary on statistical testing is in Section 5.4.

Table 3.3 shows that, overall, responses from pilots and controllers to Question 14 were similar. Indicative exceptions (we cannot statistically test these low sample sizes) were that pilots were more inclined to express a view that achieving CDAs was ‘of no strong interest’, although pilots seemed more likely to disagree that the CDAs reduced flexibility due to greater proceduralisation, on which issue the controllers were more neutral. Comparing across Table 3.3 with the corresponding Manchester results (Table 2.3, Section 2.2.2), we observe that the Bucharest feedback is overall remarkably similar.

Turning to Table 3.4, again, remarkable similarities with the corresponding Manchester data (Table 2.4, Section 2.2.2) are evident. Whilst controller and pilot responses across the Bucharest data of Table 3.4 do display many similarities, pilot perceptions of the benefits to the airport, and to ROMATSA, are more pronounced than those indicated by the controllers. Concerns about controller workload, capacity disbenefits and the time-consuming nature of CDAs are also somewhat more evident amongst controllers. This echoes earlier comments that controllers were possibly somewhat more critical of CDAs than pilots.

Table 3.5 shows that levels of controller belief regarding CDA benefits to ROMATSA, and capacity limitations, echo very closely those of their counterparts in Manchester (compare Table 2.5, Section 2.2.2). Most Bucharest controllers (twelve), neither disagreed nor agreed regarding any benefit to ROMATSA, whilst six either agreed or agreed strongly that CDAs limited capacity, supporting the points made above. Absolute numbers in Table 3.5 for the Bucharest pilots are all also very close to those of the Manchester pilots, but based on approximately half as many pilots in Bucharest.
Table 3.3 - Attitudes to CDAs [Bucharest]

Q14. Please indicate your levels of agreement, or disagreement, with the following:

Achieving continuous descent approaches at Bucharest...

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=10)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>of no strong interest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>would avoid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not my responsibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>serious contribution to positive change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>little difference if don't do sometimes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OK as step towards something better</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reduces flexibility due more procedural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>recommend way we do at Bucharest</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The bar chart indicates the levels of agreement or disagreement for both pilots and controllers. The chart uses red and blue bars to represent different levels of agreement, with red bars indicating strong agreement and blue bars indicating strong disagreement.
Q16. Please indicate your levels of agreement, or disagreement, with the following: **Achieving continuous descent approaches at Bucharest**...

<table>
<thead>
<tr>
<th>benefits</th>
<th>people under approach paths</th>
<th>benefits TAROM</th>
<th>benefits ROMATSA</th>
<th>benefits airport</th>
<th>increases pilot workload</th>
<th>increases controller workload</th>
<th>limits capacity</th>
<th>less safe than stepped during low vis</th>
<th>too time consuming</th>
<th>increases pax comfort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilots (n=10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controllers (n=14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3.5 - Benefits of CDAs (2) [Bucharest]

Q16. Please indicate your levels of agreement, or disagreement, with the following:

Achieving continuous descent approaches at Bucharest…

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=10)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“… benefits ROMATSA”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>agree strongly</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>“… limits capacity”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>disagree</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>disagree strongly</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Comparing Table 3.6 with Table 2.6 (Section 2.2.2), indicates that controller agreement that CDAs ‘benefit people living under approach paths’, and benefits TAROM, was more pronounced than the corresponding opinions of controllers in Manchester, although it should be noted that greater overall differences than this, between mean sample scores, may be observed elsewhere in the data. Again, considering the lower number of pilots interviewed in Bucharest, the results are approximately comparable with those of the Manchester pilots.

Table 3.6 - Benefits of CDAs (3) [Bucharest]

Q16. Please indicate your levels of agreement, or disagreement, with the following:

Achieving continuous descent approaches at Bucharest…

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=10)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“… benefits people living under approach paths”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>agree strongly</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>“… benefits TAROM”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>agree strongly</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>
Assessing how attitudes towards CDAs changed as a function of experience, we saw in Table 2.7 (Section 2.2.2), that the dominating response from Manchester was one of no change, whereas that in Bucharest (Table 3.7) was of gaining more support. Although invited to indicate reasons for change in attitude in Question 11, very few respondents offered any text here, exceptions being, from two pilots:

*I became more comfortable when I do the CDA*[^6]

*… after two or three flights I understood it was a very good procedure. I asked colleagues – they told me it’s not too good to change level on descent …[CDA] is not so difficult.*

With comments from two controllers:

*Just because I saw it can work and I really wanted to do it*[^20]

*I gained more experience and also I’ve been involved in designing the procedure*

### Table 3.7 - Change in attitude towards CDAs [Bucharest]

<table>
<thead>
<tr>
<th>Q11. Has your attitude towards CDAs changed at all as you have gained more experience? Would you say you have become more or less supportive, or no change, since the earlier days of the trial?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilots</strong> (n=10)</td>
</tr>
<tr>
<td>![Pie chart showing attitude change among pilots]</td>
</tr>
<tr>
<td>[Less supportive]</td>
</tr>
<tr>
<td>[More supportive]</td>
</tr>
<tr>
<td>[No / little change]</td>
</tr>
</tbody>
</table>
3.2.3. Attitudes to CDAs – Workload Issues

As we have noted in Section 3.2.2, controllers were rather more prone to cite disadvantages of the CDAs, than were pilots. In specific terms of workload, pilots declared that disadvantages included increased workload if the FMS could not manage an automatic RoD calculation, although seven pilots declared that their workload was reduced, and four pilots cited decreased communications with ATC as an advantage of CDAs. We also noted in Section 3.2.2 that controller feedback on the workload implications of CDAs was rather variable.

Two controllers spontaneously referred to a reduction in communications, one saying this was a reason for introducing STARs in the first place, another declared that communications were shorter, rather than fewer. Two controllers thought that CDAs did not create any more work than a stepped approach. Some controllers preferred CDAs during light sequences.

Table 3.4 informed us that concerns about controller workload were somewhat more evident amongst controllers themselves. Investigating these responses in more detail\textsuperscript{17}, only two controllers and two pilots agreed with the statement that CDAs increased pilot workload. Indeed, most controllers (nine) and most pilots (eight) disagreed with this statement.

Whilst five controllers and three pilots agreed with the statement that CDAs increased controller workload, no controllers disagreed with this (most of them, nine, neither agreed nor disagreed). Six pilots disagreed with this.

Although there were generally fewer spontaneous comments on this subject in Bucharest, as compared with the Manchester case study, the following summary points may be made in relation to both trials:

- there were relatively few references to increase in workload declared by either pilots or controllers
- pilots were more likely to express a potential decrease in workload (if the FMS handled CDAs properly)

Notwithstanding the first point, it should be noted that in both trials, traffic volumes were cited as the most common reason for controllers not starting CDAs, or having to break them off.

\textsuperscript{17} data not shown
3.2.4. Attitudes to CDAs – Increased Operational Complexity

In the Manchester case study, we observed (see Section 2.2.4) that the following were cited as potential causes of increased operational complexity when attempting CDAs, as compared with stepped approaches:

- performing CDAs during low visibility
- increased possibilities of rushed approaches
- less stable approaches
- greater difficulty capturing ILS

None of these factors were specifically mentioned by controllers or pilots at Bucharest, and this may be attributed to lower traffic densities in the Bucharest TMA and the use of STARs (Bucharest) instead of vectoring (Manchester).

Safety was referred to in a positive context during the Bucharest interviews (as noted in Section 3.2.1) in that one controller cited an advantage of CDAs being that pilots understood what to do better, and with two pilots declaring that less work for pilots and controllers improved safety. More detailed comments were offered by pilots in response to questions 08 and 10, respectively:

*This procedure is very good for safety – you have more time to do something else, your mind is more free to watch other aircraft around and hear about weather.*

*The pilot’s priorities are safety, then workload. Noise is not a concern … Safety improves in its own right due to the strict, well-defined procedures, and due to a decrease in workload.*

As also commented upon, one controller expressed a view that TAROM pilots sometimes used the procedure in an inappropriate way to their own advantage, causing greater difficulties in maintaining separation minima, and another controller declared that pilots on a CDA thought they had priority from cruising level to landing.

Furthermore, with regard to the Bucharest trial, the most cited reason for non-execution of CDAs (although relatively rare) was clearly high traffic, and, more specifically, due to the problems of sequencing during higher volumes – the generic ATC challenge of faster aircraft following slower ones. The proximity of the Baneasa Airport runway to Henri Coanda was also sometimes a complicating factor. (Some other operational issues are explored explicitly in the broader context of societal concerns, in Section 3.2.6).

However, all in all, it would appear that issues associated with operational complexity, which might interfere with the successful completion of CDAs, or reduce support for such from pilots and controllers, were rather less prominent at Bucharest, than at Manchester. Again, we refer the reader to the relative complexities and traffic volumes of these TMAs, to qualify this statement.
3.2.5. Possible Improvements to CDA Process

Handover of communications from en-route (area) to approach control, typically occurs about five miles before the STAR, with official handover of control at the entry point of the STAR (although this could occur earlier). According to the phraseology stated in the B-CDA procedure, it is the pilot who makes the B-CDA request to the en-route (area) controller (i.e. before reaching the entry point of the STAR). Only after a telephone coordination between area and approach controllers (and the result being written on the corresponding strip) does the aircraft receive a message such as the following (from the area controller):

**TAROM 123, Bucharest radar, expect TUSET 2E arrival B-CDA 08 Left**

The actual clearance is always given by an approach controller, as no sector is entitled to issue such a clearance without prior coordination with the adjacent sector. This means that approach knows about the B-CDA intention before actually assuming control of the aircraft. (Should such a procedure became mandatory some sort of electronic coordination may be put in place). The (formal) B-CDA should be offered only from the actual start of the STAR and the pilot is responsible for the descent profile, with ATC typically offering only two instructions from the STAR to touchdown, the second being the landing approval\(^\text{18}\):

**TAROM 123, Bucharest ground, cleared landing 08 Left**

Whereas in the Manchester case (Table 2.8, Section 2.2.5), we noted some room for procedural clarification, every respondent at Bucharest (pilots and controllers) correctly indicated that CDAs should be requested by the pilot (as shown in Table 3.8).

Table 3.8 - Initiating CDAs [Bucharest]

<table>
<thead>
<tr>
<th>Q15. Concerning approaches at Bucharest which are expected to be continuous descents, during approach, is/was a CDA usually:</th>
<th>Pilots (n=10)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>specifically requested first by the pilot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>suggested first by the controller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>left as an ‘open’ possibility (e.g. within pilot’s choice, unless ATC instructs otherwise)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{18}\) Landing clearance is given by the tower (only in poor meteorological conditions, with visibility at 4km or below, is landing clearance given by an approach controller).
Responses to Question 10 (see Table 3.9) covered a wide range of suggestions from Bucharest respondents, particular from the controllers. The question asked:

As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Bucharest? In what ways could the CDA procedures at Bucharest be improved (if any)?

Many responded that each airport and TMA had to be considered in its own right, taking into account local restrictions and conditions. As with the responses from the Manchester pilots (Table 2.9, Section 2.2.5), there was a cross-section of different constructive comments, several saying that the procedures at Bucharest were good enough as they were, and with several references to the fact that an improved arrivals route structure would be welcomed. One pilot remarked that the STARs should be as straight as possible: on OBUGA-FLR-DILAS, for example, pilots may ask ATC for a direct to DILAS (to acquire the ILS there) after passing OBUG A, in order to cut out FLR and save some time. Although the time saving was small, it was “a human thing to ask”, whereas pilots would not ask for directs on the TUSET STAR, because it was straighter anyway (see Technical Annex 9: Bucharest TUSET 08R CDA profile). In short, better design may reduce the tendency to ask fordirects. With reference to Technical Annex 9, the same pilot referred to the points labelled with white boxes (indicating height and/or speed restrictions) as ‘gates’, saying that these could be refined more, e.g. to differentiate between Classic and Next Generation Boeings, even adding extra gates for greater control of the profile. It was pointed out, however, that the gates should not be too close together, otherwise the FMS might behave in odd ways if it had too much work to do (too much change) in too short a distance. Another, Senior Pilot within TAROM suggested that a good way to introduce CDAs was to start with a limited introduction, to demonstrate that they were not difficult to execute, and to subsequently build up cooperation and support from pilots, rather than by trying to impose them everywhere right from the start. Whilst this is clearly a valid insight (supported in particular by one controller in the free response section at the end of the questionnaire, also saying STARs should avoid populations underneath, even when it means they were longer) the responses also suggest that a sufficient degree of enthusiasm can lead to a demand for wider implementation, before there has been time to introduce it, such that such trials can be a victim of their own success.

There was a considerable number of comments from controllers in response to Question 10, more so than with the corresponding question posed to Manchester controllers. As will be seen from Table 3.9, Bucharest controllers variously cited a need for:

- better simulations and training (notably simulating more than one aircraft on a CDA at once)
- better tools, or separate routes, to handle mixes of faster and slower aircraft
- common training between pilots and controllers, and more regular meetings, with better awareness from the start of the trial
- more CDA STARs and/or more entry points to the existing ones (echoed by the pilots)

As we remarked upon in Section 2.2.5, this could well have been because this question occurred towards the end of the questionnaire and respondents may have felt they had covered such points already. Furthermore, since common controller issues with CDAs at Manchester were to do with traffic volumes and terrain, which are difficult to change, this may explain a relative lack of expression in answer to this question, in the Manchester case.

As we commented in Section 3.2.2, a point raised by one controller was that during the simulations, only one CDA was simulated at any given time, when in practice, they would be trying to handle three at once, and not with three aircraft of the same type. This should have been part of the simulation, it was felt. Similar points are echoed in Table 3.9.
Table 3.9 - Recommendations to other airports [Bucharest]

Q10. As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Bucharest? In what ways could the CDA procedures at Bucharest be improved (if any)?

<table>
<thead>
<tr>
<th>Pilots (n=10)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Possibly to have an entry point from the east, to enable CDAs from the east. Flights arrive in the morning and at night on this side, for example at NETUL or IDARU.” ⁶</td>
<td></td>
</tr>
<tr>
<td>“[We could] … look for any possibility to perform a CDA from all points of approach on different routes.” ⁸</td>
<td></td>
</tr>
<tr>
<td>“We need more [CDA] routes – I have asked my colleagues.” ²</td>
<td></td>
</tr>
<tr>
<td>“They recommend us to use the FMC* for this procedure … FMC will do speed from ToD … we can do a lot with the FMC. Now it is not a big problem at Otopeni, but traffic will increase … FMCs can do a lot, so all aircraft could do a CDA one after another – the work for the controller will be lower … it is necessary to change something in the arrival routes … in such a manner to resolve traffic problems … it will be good for everybody.” ¹⁰</td>
<td></td>
</tr>
<tr>
<td>“We could add points [STARs] east of Otopeni – for example, onto 26L” ²¹</td>
<td></td>
</tr>
<tr>
<td>“Maybe at some airports you can’t do a full CDA, but it’s better to do whatever you can within the limitations.” ⁹</td>
<td></td>
</tr>
<tr>
<td>“When you come into Romanian airspace you are told to descend to FL310 or FL290 – I’m not sure why, probably due to other traffic. It would be better to stay higher for longer, like in Spain.” ⁸</td>
<td></td>
</tr>
<tr>
<td>“I only experimented with one aircraft, not four or five aircraft – we should simulate that. Training could be improved. … We should also introduce new CDA routes here [at Bucharest].” ³³</td>
<td></td>
</tr>
<tr>
<td>“We cannot simulate at ROMATSA. Would be better if we could simulate two aircraft on CDAs at the same time, to show that it can work. At the moment I don’t do that because of separation. … P-RNAV would also be good here, it has been set up here but it is suspended.” ²⁰</td>
<td></td>
</tr>
<tr>
<td>“We need another STAR for B-CDAs, maybe from the other direction, we’ve only got three now.” ²²</td>
<td></td>
</tr>
<tr>
<td>“We could add points [STARs] east of Otopeni – for example, onto 26L” ²¹</td>
<td></td>
</tr>
<tr>
<td>“We could have separate routes for low- and high-speed aircraft, like they do in Miami, so we don’t have to sacrifice a low-speed aircraft if there is a high-speed one behind him.” ³³</td>
<td></td>
</tr>
<tr>
<td>“We should use alternative procedures or vectoring too – using a STAR alone is not sufficient.” ²⁵</td>
<td></td>
</tr>
<tr>
<td>“We need better tools to monitor compliance and to let us vector a faster aircraft behind a slower one and give him a distance to go.” ²⁷</td>
<td></td>
</tr>
<tr>
<td>“It would be easier if more aircraft did CDAs in the same sequence, instead of trying to mix them up with non-CDAs onto the same [single] runway.” ³⁰</td>
<td></td>
</tr>
<tr>
<td>“There should be more regular meetings between line pilots and controllers, not just the designers and instigators.” ³¹</td>
<td></td>
</tr>
<tr>
<td>“There should be common training, not just ROMATSA training the controllers and TAROM training the pilots, separately.” ²⁷</td>
<td></td>
</tr>
<tr>
<td>“Maybe more training for ATC and discussions ATC-pilots.” ⁰²</td>
<td></td>
</tr>
<tr>
<td>“Controller and pilot awareness could have been made better from the start.” ³⁰</td>
<td></td>
</tr>
</tbody>
</table>

* see footnote in Section 2.2.1
Although Q10 was designed to elicit ways in which CDAs might be improved, there is clearly an underlying tone of support, indicated by the need to add new entry points and additional STARs, for example. This is in modest contrast to the Manchester controller feedback, whereby several felt that an extension of the CDA trial to daytime operations would be difficult or unworkable. As we noted in Section 3.2.2, some Bucharest controllers made the interesting point that during light sequences they preferred CDAs (but when traffic was higher, they preferred stepped descents).

If we further compare the right-hand side of Table 3.3 (Section 3.2.2) with that of Table 2.3 (Section 2.2.2), where we asked if respondents agreed with the statement “I would recommend the way we do it at [Manchester/Bucharest], to a similar airport”, the mean agreement scores were higher for Bucharest (controllers = 3.71; pilots = 4.30) than for Manchester (controllers = 2.90; pilots = 3.42).

As with Manchester, this question generated no comments on improving benefits to the public.
3.2.6. CDAs and Society

In order to avoid response bias, as with the Manchester case study, respondents were not told that the interviews were aimed at investigating the impact of societal influences on behaviour, in the context of change in ATM. Question Q04 asked: “When deciding on a flight-by-flight basis whether to try for a CDA, what are the key factors you are considering, about whether to try for a CDA or not?”, to determine how many pilots and controllers would mention trade-offs in consideration of noise, and local residents.

Controllers cited traffic and sequencing considerations above all others (sometimes described more literally in terms of spacing and speed, faster aircraft following slower ones, etc – entering the TMA too fast could be a “big problem”). More specific responses included:

- *If from the south, OBUGA, it is more difficult, because I need to turn the aircraft … may need to reduce so it does not conflict with another CDA on TUSE**

- *I know he wants a CDA before he gets to my area … 10 minutes before my area* [21]

- *Honestly, not that I don’t care – but it depends on traffic* [33]

One controller declared that just because it was ‘busy’ was no reason not to attempt CDAs, since “it is my job”, another explained that he considered whether he was likely to have to cancel a CDA later on, before initially clearing it. Weather was mentioned as a determining factor only infrequently in response to this question (by either controllers or pilots). It was also mentioned in this context that it is the responsibility of the pilot to request the CDA, not for the controller to offer it [24, 26]. (Table 3.8 has already demonstrated the clarity of procedural comprehension on this issue). One pilot specifically mentioned fuel savings.

Two pilots gave particularly technical responses to this question, one explaining that he needed to consider (higher level) winds, altitude calculations, temperatures and runway winds (tailwind, crosswind, windshear etc), with another detailing that the ‘700NG’ (737-700 Next Generation) required the manual operation of speedbrakes to correlate altitude, speed and RoD to achieve a CDA. He went on to explain that due to the proximity of the Baneasa Airport runway to Henri Coanda, sometimes APP cancelled a CDA at FL800 or FL900 in order to accommodate traffic (this had happened twice, he declared).

One pilot specifically referred to safety considerations, whilst another technical response given by a pilot referred to workload:

- *I keep the aircraft under control and watch TCAS – closest aircraft on the screen – any time I want to talk to ATC, it’s not a problem, as the conversation has already been reduced: this is a benefit* [8]

---

21 This was explained in Section 3.2.5
22 As detailed in Section 3.2.4
It is of note that these responses followed somewhat of a technical theme, with any reference to broader, or societal issues, being limited to the single comment that noise was not a concern. As we mentioned in Section 3.2.1, whilst noise and LAQ were taken seriously by the Airport Authority, both were well within the set limits, and noise complaints were never received, as this was a very low priority for Romanian citizens. It is important to set this context, also when looking at responses to Question 05, whereby we asked pilots and controllers:

*Please could you outline the extent to which you feel personally that the public response to aircraft noise affects your day-to-day decision making when it comes to trying to achieve continuous descent approaches?*

This context might lead us to expect low levels of concern or influence regarding noise, but this was not the case. Whilst several controllers either declared that separation was their only concern (and not mentioning noise further), or, that their primary concern was separation but also mentioning noise as a secondary issue, others did reflect a somewhat fuller consideration of the issue:

*It is good for those underneath, for noise and the environment, but I don’t know how many live around the airport* 26

*It is better for those on the ground [in terms of noise]* 25

*Maybe a good thing for those living near the airport* 33

*Sure – I think about the noise* 32

One controller 27 was not really sure about this, but aware that CDAs were supposed to be better for noise levels, whilst another gave a mixed response, showing awareness, but not accepting personal responsibility:

*Yes, I think of those underneath, but it is not my fault the City is growing with houses near the centreline – it was their choice … it is not my problem … I have to think of safety and passengers first*

On the other hand, a couple of controllers stated that there were no noise problems at Otopeni, which was echoed by several pilots (one commenting that it could be in the future, another that the effect at 2500 feet was small and nobody lived near the ILS anyway). Whereas a couple of pilots gave rather functional answers, such as:

*I just follow the B-CDA* 4

*I keep noise in mind, it is easier for us anyway to do a CDA than not to* 9

Others were more concerned, it would appear:

*Of course noise is important* 5

*This procedure is very good for noise abatement* 10

and one, having mentioned several benefits in preceding questions, particularly those related to workload reduction, but not mentioning noise, then responded to Question 05 that:

*… noise reduction is another benefit* 8
This last response in particular, and these responses in general, underline again the importance of prompted versus unprompted questioning. It is clear that even in the context of there being practically no noise problem at all at Bucharest, this was still an issue in the minds of pilots and controllers alike. Certainly it could not be said to be prominent, but nor could it be described as insignificant.

In response to Q08 ("Who is responsible for controlling the amount of aircraft noise/pollution at Bucharest?"), a couple of controllers thought it was “maybe” the government, three did not know at all, and three said it was the Airport Authority. One controller offered:

*Pollution is not a problem from aircraft now, I think, maybe in 5 years’ time* 23

Pilots gave a similar mix of responses, three did not know at all, four said it was the Airport Authority, one that it was the AACR.

However, there was a distinct tendency for controllers to adopt a broader view on the issue of responsibility, in response to this question, which was intentionally left partly open to interpretation:

*Controllers and pilots – we are both responsible* 32

*Maybe it is TAROM, I’m not sure, but ROMATSA can take a hand [sic]* 29

*I think ROMATSA have an obligation [regarding noise], but I don’t know* 24

*All of us have responsibility* 22

*Everyone is responsible* 21

Compared with some pilots’ comments:

*I don’t know, currently, not anybody. Maybe the Environment Agency, but that’s just a guess* 3

*No one is* 8

*ATC Approach, and the Airport Authority* 9

*Close to the airport there are lots [of people] who are very important and don’t like noise* 10

*CDAs won’t have any impact on pollution, I believe* 3
In response to Question 17, seven of the ten pilots, and ten of the fourteen controllers were ‘seriously concerned’ or ‘somewhat concerned’ about ‘the possibility of noise complaints from the public, if CDAs were generally not being used’. Only three pilots and four controllers were ‘not particularly concerned’, and no respondent was ‘not at all concerned’. Although this response demonstrated fairly high levels of concern, it should perhaps be viewed in the wider context that noise complaints were very seldom made by the public, such that this possibility of complaints may have appeared somewhat hypothetical.

As evidenced by Table 3.10, awareness of fuel savings amongst TAROM pilots was very high, supporting a statement from a TAROM Senior Pilot that the fuel saving benefits of CDAs from ToD had been communicated to pilots, with many citing actual figures: these were typically 150-200kg per ‘CDA’ (from FL300). One controller pointed out that, strictly, for the B-CDA procedure, the fuel saving should be calculated from FL100 – 120, not from ToD, and that TAROM estimates were thus ‘too high’. Even controller awareness was notable.

Table 3.10 - Awareness of quantifiable benefits [Bucharest]

| Q09. Are you aware of any quantifiable benefits which have resulted from CDAs at Bucharest – e.g. fuel savings, reduced complaints about noise from the public? |
|---|---|
| **Pilots** *(n=10)* | **Controllers** *(n=14)* |
| Confidence that data existed: *(x10)* | No *(x8)* |
| Actual figures quoted: *(x5)* | 40-60 kg in TMA *
| “Much fuel is saved” | “I’ve probably seen some figures, but I don’t remember” |
| “Time is less and fuel is less” | “That’s not my job” |
| “I can see the trip fuel in the FMS, compared to planned” | “I’ve heard about it – but don’t have any information” |
| “Estimate about 50-60kg TUSET-OBELA, but this distance is too short” | “No idea” |
|  | “There must be” |
3.2.7. Internal feedback and dissemination of the Study's findings

A ROMATSA supervisor explained that for each flight whereby the pilot requested a CDA, the controller filled out a form which was shared with TAROM, but that there was no feedback process on a flight-by-flight basis. Expanding on this, in response to Question 07, a controller explained that a form was completed for each CDA started, even if later abandoned, whereby the controller would explain why, but without a feeling of blame or pressure from ROMATSA (see also Section 3.2.1).

In response to Question 13, one pilot and one controller did not know whether there was an internal feedback process or not, and one pilot declared that there was no feedback. Most (ten) controllers declared that the feedback process "worked as I wanted", as did half of the pilots. Three controllers and three pilots stated that although they were aware of a feedback process, it had not worked as they had wanted, with only two of these six (both pilots), volunteering more information:

- Should take account of pilot comments
- All TAROM wanted was fuel saved information

Although hard quantification of this issue is difficult in terms of a comparison with Manchester, it seems the general response was somewhat more positive at Bucharest, in terms of internal feedback, although still with room for improvement. It is likely that this is also somewhat easier in this case, since only one airline was participating in the trial.

~*~

In terms of offering the stakeholders at Bucharest a formal feedback session on the results of this Study, Table 3.11 shows a fairly strong preference for feedback regarding CDA trials. Comparing Table 3.11 with the corresponding Manchester results (Table 2.11, Section 2.2.7), where there was a distinct lack of consensus on the type of feedback required, the Bucharest responses are also noteworthy in the total absence of respondents declaring that they probably would not have time to attend such a feedback session. This sentiment, combined with the interest in CDA-specific feedback, may reflect a somewhat stronger interest in the CDA trial at Bucharest.
Table 3.11 - Feedback preferences: hearing about the Study [Bucharest]

Q18. This Study will be looking at other CDA trials in Europe, and rather broader types of change in ATM. We would like to return to Bucharest to offer a brief presentation of some of the key findings resulting from the Study. Which of the following best describes your reaction to such a feedback session:

<table>
<thead>
<tr>
<th>Pilots (n=10)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>I would probably not have time to attend</td>
<td>I would prefer a focus on CDA trials at Bucharest</td>
</tr>
<tr>
<td>I would prefer a focus on CDA trials at Bucharest and elsewhere in Europe</td>
<td>I would prefer a broader presentation on ATM change in general</td>
</tr>
<tr>
<td>No particular views / preference</td>
<td></td>
</tr>
</tbody>
</table>

Overall
4. RESULTS OF THE STOCKHOLM STUDY

4.1. GENERAL BACKGROUND, INTERVIEWS AND RESPONSE RATES

A CDA Group Kick-Off Meeting was held at Arlanda on 19 May 2005. In attendance were Berit Gustavsson (LFV Group, Norrköping/Stockholm – CDA Trial Project Leader); Nadine Pilon (EEC); Alan Melrose, Dick Smith and Terry Symmans (all EHQ); and Peter Larsson (NUPII+23 Project Leader, SAS). Regular updates on progress were subsequently made to EUROCONTROL. The initial suggestion for the University of Westminster mediated interviews was proposed to the Group by EUROCONTROL, with support expressed. Subsequent liaisons were frequently made between the University of Westminster and Berit Gustavsson, then Peter Larsson, to organise a suitable timetable for the interviews.

Face-to-face interviews were carried out in Stockholm between 15 and 17 November 2006 (inclusive), by two University of Westminster researchers. A dedicated room was made available on-site at both LFV (ATCC Stockholm) and at the SAS Crew Base (Stockholm-Arlanda). Controllers were released for interview as shift changes and traffic volumes permitted, on the first and third days. SAS interviews took place on the second day, in combination with an extended technical interview with Peter Larsson.

All respondents were pre-informed that the interview would take 15 minutes (or longer, if they had time), with interviews actually lasting between 15 and 50 minutes - longer interviews occurring in cases where pilots or controllers were particularly keen to offer more extensive feedback. A further 10 questionnaires (and pre-paid envelopes) were left each with LFV and SAS for distribution, with a return-by date of 04 December 2006. No further returns arrived from LFV, notwithstanding a University of Westminster reminder and excellent LFV managerial cooperation. Nine further questionnaires were received from SAS, by the final cut-off date imposed, of 15 December 2006, one of which was excluded due to lack of CDA experience.

Table 4.1 - Response distribution [Stockholm]

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Interviewed face-to-face</th>
<th>Postal returns</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line pilots</td>
<td>5</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Controllers</td>
<td>14</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>

Total number of interviewees = 27

Absolute response numbers were thus similar to those of Bucharest, in which case there was also one participating airline. In addition to these interviews, a meeting with three representatives from Stockholm-Arlanda Airport24 was also carried out, which added valuable additional insight into the case study.

23 North European ADS-B Network Update Programme, Phase II (formerly known as “NEAN”).
24 Formally, “The LFV Group, Swedish Airports and Air Navigation Services” (see Section 4.2.1.) We will henceforth refer to this authority, in terms of the interview carried out, and the rôle it plays, as “Stockholm-Arlanda Airport”.

62 EEC Note No. 08/07
As with Bucharest, linguistically, some pilots and controllers found the interview process easier than others, but answers to all questions were forthcoming, and overall cooperation and comprehension was undoubtedly very high. One or two controllers appeared to find Question 11 onwards a little easier to complete (see also commentary on comprehension in Section 1.2), as the questionnaire was in front of them, a phenomenon also observed at Bucharest. In both of these case studies, it seems the questionnaire had been appropriately designed to suit the audience.

4.2. RESULTS OF THE STOCKHOLM INTERVIEWS

4.2.1. Introduction of CDAs – Context and Consultation

A number of context-setting points are worth making with this technically advanced case study. On 01 January 2005, Luftfartsverket (also known as the ‘Swedish Civil Aviation Administration’) was restructured. The Swedish Aviation Safety Department and the Aviation and Public Sector Department, were combined, becoming the new Swedish Civil Aviation Authority (Luftfartsstyrelsen).

Resolving some previous issues of “conflict of roles”, the service provider was thus separated from the regulator. The business areas were separated off under the new “LFV Group”, (formally written as: “The LFV Group, Swedish Airports and Air Navigation Services”, more informally still known as “Luftfartsverket” or “LFV”).

The LFV Group remains 100% State-owned and runs as a business without any support from government taxes. It operates and develops State-owned civil aviation airports (such as Stockholm-Arlanda) and is also responsible for air navigation services.

ATCC Stockholm is divided into two parts – the ACC (Area Control Centre) and the TCC (Terminal Control Centre). The TCC handles traffic to and from Stockholm-Arlanda, Stockholm-Bromma and Uppsala airports, although (somewhat unusually for an Area Control Centre) the ACC itself is more involved in airport traffic, than overflights. Twelve sectors are managed by one or two controllers per sector (depending on traffic), with a number of assistant and shift (watch) leader/supervisor positions.

Interestingly, the initial motivation for SAS was the fuel savings and corresponding CO₂ reduction - the even greater financial advantages of improved predictability and integration with CDM was apparent later, and this coordinated well with much prior investment by SAS into improving operational predictability.

The STAR-CDAs at Stockholm were introduced mainly to tackle a large increase in noise complaints, in 2002, from a previously low level. This increase resulted from the use of the third runway (01R/19L) from early spring, 2002: combined with repairs to runway 01L/19R, and unusual winds in the summer of 2002, 01R/19L was in use for approaches rather more than anticipated. STAR-CDAs was one of twelve measures investigated to deal with this problem. In addition to ATC training, each controller was fully briefed by the Airport Authority on the issue of noise in 2005, as an important part of the trial implementation and education process.

From the airline perspective, SAS explained that the “Green Approaches” (see later) had created a lot of media interest, with very frequent enquiries from journalists, helping to substantially improve the public image of SAS. SAS believed that the greatest operational challenge was to LFV, in terms of getting controller buy-in into a project which was of less direct benefit to the ANSP, but that the positive media attention had helped the cause. Indeed, this had also helped to promote the signing of an agreement between SAS and LFV to move towards completely STAR-based approaches at all Swedish airports in the future.

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In March 2005, a new ATC system had been installed at Stockholm-Arlanda (“Eurocat 2000E”, also referred to under an earlier name of “S2000”), which allowed stripless operation. Although a reduction in capacity was imposed during the implementation phase, capacity was fully back to normal at the time of the interviews. Furthermore, the operation of independent parallel runways was planned for Spring 2007. Neither of these operational changes, nor the reorganisation of LFV, featured significantly in responses during the pilot and controller interviews, although the recent financial difficulties of SAS were mentioned frequently by pilots.

SAS was the sole participating airline in the trial (with around 50 pilots involved) and there were between 40 and 50 rated controllers. Four STARs are operated onto each of the runways 19R, 01L and 26, starting from FL110 to FL190 (see Technical Annex 10), making twelve continuous descent approaches in total. These could be flown as conventional (instrument) STARs, as B-CDAs (P-RNAV only) or as A-CDAs (4D-trajectories, known to all stakeholders in Stockholm as “Green Approaches”). In order to comply with local terminology, as used by pilots and controllers, we will refer to B-CDAs as “STAR-CDAs” and to A-CDAs as “Green Approaches”. This is to facilitate the reading of this Report by local stakeholders, and also to facilitate the use of quotations from the pilots and controllers. Some arrivals into Arlanda are non-STAR, fully vectored approaches, but these are not the subject matter of this Report. Initial plans were to handle some CDAs by pure vectoring during heavier traffic, but this was not implemented, as there had been insufficient time to accommodate this into the trial (and which would formally have required a change to the Transition Altitude – currently at 5000ft), although some controllers do manage to vector B-CDAs, nonetheless.

The “Green Approaches” aimed at achieving a continuous descent approach from ToD to the runway. This involved 4D-trajectory management, using Required Times of Arrival (RTAs), managed through an ACARS dialogue with the appropriately equipped (B737) aircraft, initiated from any time just after take-off at the origin airport, through to three or four minutes before ToD (since a revised ToD might be calculated by the FMS\textsuperscript{26}, to manage the continuous descent approach – although SAS commented that the ACARS message was sometimes not received until after ToD). It was designed to operate without controller intervention, being managed wholly by the FMS, and formed part of the NUPII+ project.

In prior consultation with LFV, it was agreed in advance of the interview period that the questionnaires would refer simply to “CDAs”, as continual differentiation between the two types would make the interviews intractable. This caused no problems, and the interviewers were able to provide points of clarification where needed, using the accepted terminology of “STAR-CDA” and “Green Approach”, as mentioned above.

Interviews took place towards the end of a long trial - the full trial began on 16 March 2006 (with earlier testing from January 2006) and was planned to continue until 18 January 2007. CDAs operated in low traffic, e.g. at night, and in good weather. By the time of the interviews (mid-November, 2006) some 1400 STAR-CDAs had been achieved, and around 600 Green Approaches. LFV estimated that around 15 – 20% of attempts had to be aborted (‘broken off’), usually due to traffic volumes and or sequencing problems. Green Approaches were more difficult to manage, in no least part due to the fact that they started so much earlier in the flight, often before a full picture had evolved integrating the intended Green Approach flight into the arrivals management picture (in MAESTRO – see below). For both types of CDA, the procedural recommendation was that there should be a five minute separation onto the runway, before and after the CDA-intended aircraft. CDAs were offered at ATC discretion, although the situation was somewhat complicated by the two types of CDA and the way they may be initiated. We next offer a concise account of these mechanisms, such that comments from the controllers (in particular) may be better understood in the following sections, where we continue to report on the interviews proper.

\textsuperscript{26} see footnote in Section 2.2.1
For a Green Approach, the Tactical Supervisor (TS-T) operated the CIES (Collaborative Information Exchange System\textsuperscript{27}), which was needed to initiate the ACARS dialogue with the aircraft. This would be done after appropriate verbal coordination (via intercom) with the corresponding en-route (area) sector(s), and the Approach Coordinator (APP-C). The Tactical Supervisor could also initiate a STAR-CDA (again, after coordination with the Approach Coordinator and en-route). Although a STAR-CDA could be offered by ACARS, by the Tactical Supervisor’s CIES, it would usually be offered by radiotelephony (RT) through an en-route controller clearing the aircraft onto the STAR.

Usually, it would be the Approach Coordinator who initiated a STAR-CDA (again, only after coordination via intercom with en-route and the Tactical Supervisor, if the latter post was occupied) and only by RT through an en-route controller clearing the aircraft onto the STAR, since the Approach Coordinator’s position did not have a CIES interface. The Approach Coordinator might also propose a Green Approach, but this would have to be activated by the Tactical Supervisor’s CIES interface. Having been assigned either a STAR-CDA or Green Approach, the aircraft label on the radar screen would be annotated (by en-route) with either “SC” or “GR” (or no such tag), respectively\textsuperscript{28}.

Above both the Tactical Supervisor and Approach Coordinator is the Watch Supervisor. The Watch Supervisor could propose either type of CDA, but would rarely get involved at this level of control.

Turning to the airport context, Stockholm-Arlanda Airport was heavily engaged in community liaison and consultation, in a similar fashion to Manchester Airport. Airside Operations at the Airport had the responsibility for noise complaint issues, with the ‘Arlanda Report Centre’ being the front line for this. Further investigations and analyses were made in cooperation with Stockholm ATCC, ATS, the Airport’s Environmental Department and the Acoustic Department (depending on the nature of the complaint). Airport environment managers were involved in the CDA trial design.

LFV Group was the first major Swedish business group to become climate neutral, illustrating a strong corporate commitment to greener practices, although it did not consider that it had received the same positive media attention as SAS regarding such policies, as the Swedish public remained somewhat sceptical of airports per se, although not as much public criticism was actively directed at Stockholm-Arlanda Airport as might be witnessed in the UK. Regular meetings were held with the local community regarding airport activities, including noise issues. No drop in the number of noise complaints had been observed after the introduction of CDAs. Nevertheless, awareness of the CDAs within the local consultation groups was thought to be very high, although not reflected in the wider public.

Stockholm-Arlanda Airport calculated noise levels itself and monitored flight tracks as required, reporting these to the government body Stockholm County Administration Board\textsuperscript{29} on a quarterly basis, with permitted noise levels set by national legislation, with corresponding Acts passed in 1991 and 1993, with noise abatement procedures imposed by the National Environmental Agency\textsuperscript{30}.

In Technical Annex 12 we show the on-line feedback form provided by Stockholm-Arlanda Airport, dedicated to aircraft noise. Although there is an “English” tab on the webpage, there is no need to provide this particular page in English, such that it is available only in Swedish. The header “synpunkter på flygbuller” means “feedback (lit. ‘points of view’) on aircraft noise” and the three tickboxes which users may select (“klagomål”, “synpunkt” or “fråga”) allow the selection, respectively, of “complaint”, “feedback” or “question” - with various options for being contacted back by Stockholm-Arlanda Airport. (This may be compared with the analogous facility at Manchester Airport, shown in Technical Annex 11).

\textsuperscript{27} an LFV-developed tool (itself fed by the MAESTRO arrivals management tool) which integrates FMS and ATM data

\textsuperscript{28} “Ga” could not be used, in case it caused confusion with “Go Around”.

\textsuperscript{29} Länsstyrelsen i Stockholm

\textsuperscript{30} Statens Naturvårdsverk
In response to Question 01, regarding the context of the introduction of the trial, and any other parallel changes taking place, ten controllers cited no such significant context, one controller mentioned that “S2000” implementation was taking place at the same time, but that this had had no great effect at all, and two mentioned staff shortages:

> It was done at a good time … although there was a staff shortage at first

> There has been a shortage of people at approach control for a long time … for the past four years … so when the CDA trial started it was too much extra to do, but now we’re used to [staff] shortage.

Whilst most (seven) pilots recalled no such changes, the need to save fuel was cited by three pilots, one saying this gave increased importance to CDAs, another that it was also linked to a need for quicker turnaround times and general financial difficulties. Indeed, a few pilots referred to the recent financial troubles of SAS, another citing the ‘usual’ on-going, tough union negotiations. Only one pilot specifically mentioned any decreased focus on the CDA trial as a result of parallel events:

> There were big changes in our company: reorganisation, increased working hours, … CDA trials were not so highlighted during this period.

Question 02 asked respondents about when they first heard about the CDA trial, initial reactions thereto, and the reasons understood for its introduction. Pilots mostly first heard about the trial from operations, middle management, or a briefing, or, less often cited, from other pilots, from ATC, or by letter. Whilst one pilot felt neutral towards the trial, initial reactions were mostly positive, or at least expressing interest:

> It shows a belief in the future … anything which improves our status with society is positive

> It should have been done five or six years ago.

c.f.

> Will this really work? 

> It’s the way we pilots want to operate … didn’t expect too much.

Fuel saving was (marginally) the most commonly cited reason for the introduction of the trial (x7), but with many references to capacity and or traffic flows (x6), and specifically the environment (x5). Further comments demonstrated only one suggestion of any ulterior motivation, but even this pilot was distinctly supportive:

> The public reason was to show the new concept of approach, but the real reason was a means of introducing VDL-4 by the Swedish CAA

> Saving fuel and time … cutting costs.

> I thought it was for noise at first, later ‘realised’ it was for fuel & arrivals.

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31 VDL Mode 4 is an ICAO-standardised VHF datalink technology designed to support communication, navigation, surveillance and air traffic management (CNS/ATM) digital communications services.
To allow new (‘curved’) approach paths

Controllers first heard about the trial from a variety of sources, most commonly from colleagues (x6), with the majority of reactions being positive, but with some scepticism:

I was sceptical, due to the mix of aircraft, there’s always the risk of the aircraft being marked incorrectly, then you get a surprise: ‘Oh! Why did he do that?!’

Before … something new is always difficult but it’s very easy – they manage themselves, you just let them go … the other traffic has to move out of the way, though there’s not much traffic when we attempt it

I was a little sceptical: controllers in general are like this, you know!

A bit sceptical … some sense of futurism, so I was positive about the future with this

Sounded like a good idea, I could see how it would be useful and that it would need to be in low traffic … the way of the future

Whilst fuel savings were mentioned by seven controllers, noise (and, to a lesser extent, pollution) was mentioned by the same number and discussed at more length and often before other factors:

Noise is much more of interest here in Stockholm with the public … they don’t care if it means longer term more pollution, they care more about noise

Noise … with fuel second

Noise and pollution

Noise and fuel savings

Better arrival predictability was mentioned twice as a reason behind the trial, and shorter descent profiles and a furtherance of environmental benefits specifically under the NUP project, once each. One controller later commented (in response to Question 03) that maybe the trial had been entered into somewhat too quickly, due to timescales imposed by the NUP project. On a different note, also later on in the questionnaire (in response to Question 07), another controller commented:

The managers did an OK-ish job to explain the benefits: the focus was on punctuality

Regarding consultation before the trial, half of the controllers declared that they were included in this process, whereas this applied to only two of the pilots. However, of the pilots not included, only one had wanted to be included, and this applied to only two of the ‘excluded’ controllers.

As mentioned, a form was completed by controllers for each CDA, successful or not, with reasons recorded for those which were broken off. In terms of assessing management endorsement, one controller declared that this depended on which part of management one was talking about, some were more aware of benefits than others, and that it was normally the Watch Supervisor who “wants as many as possible”. It was overwhelmingly clear from controllers that there was no undue

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32 as “SC” or “GR” – see earlier comments
33 North European ADS-B Network Update Programme – see earlier comments
34 see similar comment in Section 4.2.5
management pressure to complete CDAs, although they were endorsed and the benefits were generally well known. Typical comments were as follows:

The trial has been going on for a long time now, so the enthusiasm has gone down a little, even with the managers.

They told us it’s perfectly OK to abort, no problem, they won’t blame us. It’s still on trial. The benefits are clear to us, they told us the benefits, but no problem if we need to abort.

It was made clear from the managers – be sure to break-off if they get too close.

Completely fine – they made this very clear that CDAs do not have any priority.

No problem if we break some off.

Two exceptions to this occurred in comments made in response to questions 01 and 03, respectively:

One supervisor is pushy about CDAs – every SAS should make a CDA, so when he starts to make decisions for you, controllers get a bit irritated.

It can be a disadvantage: if someone else jumps in and makes a decision for you (e.g. the watch supervisor).

and there was some sense, that such pressures might increase in the future:

It’s a controller decision, there have been no questions so far if we need to abort – it would be very bad if they questioned us like this. Even if we abort half-way, it still saves quite a lot of fuel.

Not any problem at this stage, not sure how it would be in the future.

This was echoed by another controller, saying there were no problems at the moment but maybe in the future this would be more problematic.

Much the same feedback overall was obtained from the pilots, largely declaring (strong) management endorsement, although several pilots actually commented on a lack of management endorsement, which was not the case with any controllers.

It’s not an issue - I always accept CDAs.

The pilot has the power to choose – the company won’t question it, but it may try to convince us.

Not a great impact if I don’t fly them, but we understand the benefits.

c.f:

There is no particular endorsement for CDAs through management.

I don’t think CDAs are strongly endorsed.

I have no idea [if CDAs are strongly endorsed].

Not strongly endorsed – just “if possible.”
We are encouraged to make CDAs but not strongly endorsed

With pilots, there were also a few comments which were frank about the perceived motivation:

Everybody knows what they are about: less fuel is more money for the company, and they’re good for the environment, which is popular at the moment

Cutting costs is our management’s driving factor, and CDAs are a way to do that, environmental issues are secondary objects and just a side-effect of the above

Table 4.2 - Reasons for not achieving CDAs [Stockholm]

<table>
<thead>
<tr>
<th>Reason</th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High traffic / traffic mix (x11)</td>
<td></td>
<td>High traffic / traffic mix (x13)</td>
</tr>
<tr>
<td>Being broken off to avoid slowing other traffic / unexpected vectors from ATC (x3)</td>
<td></td>
<td>Flight late – pilot prefers vector for speed (x4)</td>
</tr>
<tr>
<td>“Arrival patterns too complex - from four directions”</td>
<td></td>
<td>Slow-climbing departures</td>
</tr>
<tr>
<td>“Some controllers don’t like it”</td>
<td></td>
<td>Some STARs too long – pilot requests direct (even after given CDA)</td>
</tr>
<tr>
<td>Not being initiated by ATC</td>
<td></td>
<td>Pilot non-compliance</td>
</tr>
<tr>
<td>Weather (e.g. CB*)</td>
<td></td>
<td>Weather (e.g. CB*)</td>
</tr>
</tbody>
</table>

* see note for Table 3.2

Whilst traffic volumes were clearly the most common reason cited by controllers and pilots alike for non-achievement of expected CDAs, one controller pointed out that this was not normally a problem and the possibility of having to break it off (abort) later, did not act as a deterrent from starting one – it was always better to try in the first place, and this was closely echoed by three colleagues.

One pilot felt at the start of the trial that aircraft on CDAs were slowing down others, and whilst he was no longer of this opinion, thought that some other pilots may have still had the same negative impression, as indeed reflected in Table 3.2 by three pilots in comments relating to being broken-off.
4.2.2. Attitudes to CDAs – Advantages and Disadvantages

Pilot responses to Question 03, discussing the advantages and disadvantages of CDAs at Arlanda, who benefits and who disbenefits, covered a wide range. The responses tended to be somewhat technical in content, with four pilots expressing the view that the new approaches were longer, or too long, with one pilot adding that controllers would sometimes try to give a shortcut to a point later in the STAR, and that these had been made too long by the “regulatory authorities”, who had been over-cautious with regard to the design. Several pilot responses related to the FMC:

Commanded speeds from the FMC are too slow, so need to apply extra thrust to make the time – probably the way it was programmed.

The big problem for the moment is the 737 FMC software. It works as long as you are early on schedule and can accept very low descend speeds. Disadvantages – basically none, if you solve the FMC software problems.

There shouldn’t really be any disadvantages when all software is fully adjusted.

Need to fly with speed intervention because the FMC is not programmed properly.

c.f.

I can only see advantages from the pilot’s view.

Improvements in predictability and/or cooperation with the airport were mentioned as often as fuel consumption benefits and noise reduction (all four times each), as well as a couple of references to reduced RT (which would help both the airline and ATC; only one controller made the same comment, however). CDAs also made it easier to plan the descent, if given the clearance in good time (i.e. at or above FL 150), it was remarked. One pilot felt there were no environmental benefits, that CDAs produced the same net effect as stepped approaches; another cited increased capacity as a benefit, and another, reduced flexibility as a disbenefit, which was explicitly mentioned by only one controller in response to this question:

I can’t be so creative as a controller.

Passenger comfort and/or smoother approaches were notably mentioned by pilots half a dozen times, and there were a few references to the possibility of other traffic being disadvantaged:

Other traffic might be worse off.

Other airlines might feel disadvantaged.

In a similar vein, one pilot commented (in response to Question 07) that the real benefit would only be realised when all were using CDAs, i.e. that if only SAS 737s fly them, with all other traffic “going around”, then it was not so beneficial. Also, disadvantages for controllers were cited by pilots:

Those who will not benefit - might be the ATC personnel.

if they have to lay off personnel due to easier vectorings.

Maybe the controllers will need to adapt.

---

35 It was later explained by LFV that Version 10.6 of the FMC software calculated the (slower) speed required just before acquiring the ILS as too slow, which caused a speed profile error to be projected back all the way to just after ToD. This had been corrected in Version 10.7. (See also footnote in Section 2.2.1).
Airline companies and society benefits, but a challenge for ATC to make it work?

Improvements in predictability (for SAS and/or the airport) were cited by five controllers. Most controllers cited noise and pollution reduction as benefits (slightly more than pilots in response to this question), and, here, ten controllers cited fuel consumption benefits (again, more than the pilots did). In terms of workload, four controllers said CDAs were easier than conventional approaches due to not having to vector:

For a Green Approach we just say ‘Clear’!

You can just follow the whole arrival to touchdown on the screen

although one went on to qualify this by saying that CDAs were only carried out in low traffic conditions, when handling the traffic was easier anyway, and two made comments about uncertainties as to where the base turn would be, although both said they had got used to this and it wasn’t any great problem. Another controller said that although CDAs were ‘OK’ in low traffic, there were no advantages for controllers; this controller was one of two making references regarding pilot compliance / understanding:

The pilots think they have priority if they have been given a Green Approach, sometimes we have to reduce them or vector aircraft behind to stop bunching

Some pilots are reluctant, especially if the cockpit is already prepared for a conventional approach – they need to re-do it for a CDA

The most commonly cited disadvantage, mentioned by eight controllers, was trying to perform CDAs with mixtures of traffic and/or having to reduce/vector other aircraft:

We do not gain anything if we let somebody else fly for eternity

These comments included some regarding conflicts with departure traffic:

The approach coordinator makes the first decision quite early on – a lot can happen in the [remaining] time: a heavy aircraft departing Arlanda could make a conflict with arriving traffic

It maybe makes things more difficult for departures

the latter comment being explained further by the controller in that this would mean aborting the CDA or taking the heavy aircraft off the SID early.

In summary, both controllers and pilots were generally positive about CDAs, more readily citing advantages than disadvantages. As one controller put it:

Who can be against it? It’s a win-win thing

However, support was qualified in the case of many controllers in that CDAs were not free of problems in higher traffic situations, by pilots in terms of longer approaches and FMC problems, and by both with regards to negative effects on other (non-CDA) aircraft. Attitudes towards CDAs, and the perceived benefits and disbenefits, are illustrated in some detail in tables 4.3 and 4.4. These show responses to the more prompted and structured grid questions, i.e. questions 14 and 16. An explanation of how to interpret this type of chart, and the meaning of the grey bar and pecked vertical lines, was given in Section 2.2.2. Further commentary on statistical testing is in Section 5.4.

36 i.e. reduce the aircraft’s speed
Table 4.3 - Attitudes to CDAs [Stockholm]

Q14. Please indicate your levels of agreement, or disagreement, with the following:
Achieving continuous descent approaches at Arlanda…

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>of no strong interest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>would avoid if free choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not my serious contribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>to positive change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>little difference if don't do</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sometimes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OK as step towards something</td>
<td></td>
<td></td>
</tr>
<tr>
<td>better</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reduces flexibility due more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>procedural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>recommend the way we do at Arlanda</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

agree

disagree
### Table 4.4 - Benefits of CDAs (1) [Stockholm]

Q16. Please indicate your levels of agreement, or disagreement, with the following:

**Achieving continuous descent approaches at Arlanda…**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>People</th>
<th>Under</th>
<th>Approach</th>
<th>Benefits</th>
<th>ATCC Stockholm</th>
<th>Benefits</th>
<th>Airport</th>
<th>Increases</th>
<th>Pilot</th>
<th>Workload</th>
<th>Increases</th>
<th>Controller</th>
<th>Workload</th>
<th>Limits</th>
<th>Capacity</th>
<th>Less Safe</th>
<th>Than Stepped</th>
<th>During Low</th>
<th>Vis</th>
<th>Too Time</th>
<th>Consuming</th>
<th>Increases</th>
<th>Pax</th>
<th>Comfort</th>
</tr>
</thead>
</table>

![Bar Chart]

- **Pilots** (n=13)
- **Controllers** (n=14)
Table 4.3 shows that, overall, responses from pilots and controllers to Question 14 were similar (which is broadly true of Table 2.3 and Table 3.3, for the corresponding Manchester and Bucharest results, respectively). The most noticeable exception (although we cannot statistically test these low sample sizes) is that pilots are less inclined to express a view that CDAs reduce flexibility too much, due to increased procedural standardisation. A similar difference was observed in Table 3.3, with the Bucharest responses. This question was added after the Manchester case study, so a direct comparison cannot be made, but it has already been pointed out that in the Manchester feedback, in contrast to the more common controller statements to the effect that procedural standardisation was a positive effect, several pilots, and one of the AO managers, expressed concern that if the CDAs became too procedural (and extended to daytime operations), it may reduce flexibility, such as earlier turn-ons, straight-ins and visual approaches. All in all at Manchester, however, it appeared that there was an overall preference, amongst pilots and controllers, for greater standardisation, and, indeed, looking at the semi-quantitative data, the greatest single difference between pilot and controller ratings in Table 2.3, is the greater pilot preference to extend the CDA trial to day-time operations. Regarding cross-site attitudes to flexibility, it is worth reminding ourselves that CDAs at Manchester were achieved through vectoring.

Comparing perceptions of benefits and disbenefits, in the cases of Bucharest (Table 3.4) and Manchester (Table 2.4) we have already commented on the marked similarities, overall. In Bucharest, pilot perceptions of the benefits to the airport, and to the ANSP, are more pronounced than those indicated by the controllers, whereas in Stockholm and Manchester the group of benefits were assessed rather more similarly by controllers and pilots (although Manchester pilots rated the benefits of CDAs to people under the approach paths rather higher than did their controller counterparts).

In all three case studies, the poorer perception of capacity effects in the opinion of controllers, compared with pilots, was the (equal) greatest divergence of opinion between pilots and controllers in response to this grid question. A further comparison of these two grid questions, is to be found in Section 5.1.2, with comparative plots of the responses across the case-study sites in Table 5.2 and Table 5.3.

Pilot-perceived benefits of CDAs, for ATCC Stockholm, were similar to those expressed by pilots in Bucharest, for ROMATSA (compare Table 4.5 with Table 3.5). Rather different, however, is the notably higher levels of corresponding controller-perceived benefits in Stockholm, compared with either ROMATSA (Table 3.5) or NATS (Table 2.5) controllers, despite no controllers in Stockholm disagreeing that CDAs limit capacity (this time similar to both Bucharest and Manchester: two such controllers in each case). Also, fewer pilots in Stockholm disagreed with such capacity limitation than in Bucharest, each having similar sample sizes and STAR-based procedures.

This interesting finding is supported by tables 2.4, 3.4 and 4.4, whereby controllers in Stockholm perceived the benefits of CDAs to ATC to be higher than did controllers in Manchester or Bucharest, despite the fact that Stockholm controllers also perceived the capacity limitations to be worse than did their counterparts in either of the other two case studies. This is not on account of controllers falling into differing groups, as might be expected. In fact, whereas five controllers in Stockholm neither agreed nor disagreed that CDAs limit capacity, no controllers disagreed with this. Of the majority (nine out of fourteen), who agreed or strongly agreed that CDAs limit capacity, six also either agreed or strongly agreed that CDAs benefit ATCC-Stockholm.

37 Taking the absolute difference between the mean score for pilots and the mean score for controllers, for each question in this grid, then taking a global mean of these differences, gives a value of 0.72 for Bucharest, with lower values of 0.55 and 0.42 for Stockholm and Manchester, respectively.
Table 4.5 - Benefits of CDAs (2) [Stockholm]

Q16. Please indicate your levels of agreement, or disagreement, with the following:

**Achieving continuous descent approaches at Arlanda...**

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>...benefits LFV/ ATCC Stockholm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>agree strongly</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>... limits capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>disagree</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>disagree strongly</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.6 - Benefits of CDAs (3) [Stockholm]

Q16. Please indicate your levels of agreement, or disagreement, with the following:

**Achieving continuous descent approaches at Arlanda...**

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>... benefits people living under approach paths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>agree strongly</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>... benefits SAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>agree strongly</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>
For both pilots and controllers alike, comparing Table 4.6 with Table 3.6 (Bucharest), despite a few more responses in the “agree strongly” category for Stockholm with respect to the perception of benefits for those living under the approach paths, the overall valuations (Table 4.4 and Table 3.4) for this benefit, and for benefits perceived for the airlines, were rather similar for the two case studies.

Assessing how attitudes towards CDAs changed as a function of experience, we saw in Table 2.7 that the dominating response from Manchester was one of no change, whereas that in Bucharest (Table 3.7) was of gaining more support. Table 4.7 shows the overall responses from Stockholm to be positive, with a relatively high number of additional responses, largely supportive in nature. Pilots indicating no change offered comments such as:

- *But I've been very supportive from the start* 72
- *Temporarily negative due to FMC problems … but basically no change* 78

Whilst a number declared increased support due to different reasons:

- *In the beginning, lots of problems, bugs etc, misunderstandings* 76
- *Free speeds are often granted nowadays* 74
- *The idea and target is good. Saves fuel and hopefully environment* 79
- *Good for environment. Less noise, pollution, higher pax comfort, safer cockpit work* 82

Controllers expressing increased support also sometimes re-stated the perceived benefits:

- *Very important to save fuel, protect the environment and stop noise* 58
- *Trials have shown that it can be very handy during off-peak hours as a way of keeping the traffic in the same route, thus not spreading the noise over a large area* 59
- *As long as I, as a controller, can decide which a/c should make CDAs, they are effective & environmentally-friendly* 82

and

- *More information, and also the experience of having done it for a while* 81

Only two respondents (both controllers) declared decreased support for the trial as it progressed, citing capacity-related and implementation issues:

- *With much traffic, I feel that the controllers can do the job more efficiently* 71
- *Implemented during a too long time period that results in a lack of interest and creativity from the controller* 73
Table 4.7 - Change in attitude towards CDAs [Stockholm]

| Q11. Has your attitude towards CDAs changed at all as you have gained more experience? Would you say you have become more or less supportive, or no change, since the earlier days of the trial? |
|---|---|---|
| **Pilots** *(n=13)* | **Controllers** *(n=14)* |

<table>
<thead>
<tr>
<th></th>
<th>Less supportive</th>
<th>More supportive</th>
<th>No / little change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controllers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Given the levels of controller concern described above about capacity constraints, it could have been expected that more than two of the fourteen controllers interviewed might have expressed decreased support, possibly suggesting again that the perceived benefits counteracted this perceived disbenefit.
4.2.3. Attitudes to CDAs – Workload issues

As we have noted in the previous Section, four controllers said that CDAs were easier than conventional approaches due to not having to vector, although CDAs were normally carried out in low traffic conditions anyway. The most commonly cited disadvantage, mentioned by eight controllers, was trying to perform CDAs with mixtures of traffic and/or having to reduce/vector non-CDA aircraft, the latter point being echoed by pilots,

\begin{quote}
If everybody was using the system it would be fine, but it’s just us and 737s
… everyone wants to overtake us, it’s like driving a car at thirty on a motorway
\end{quote}

who additionally cited longer approaches and (earlier) FMC problems as an issue, with one workload comparison from a pilot declaring (in response to Question 10) that for CDAs it was similar to stepped approaches:

\begin{quote}
With speed intervention, the work is about the same as a stepped approach
\end{quote}

One controller\(^{35}\) (in response to Question 07) declared that it was necessary to attempt CDAs when traffic conditions were heavier than the ‘low traffic’ conditions operationally specified, otherwise CDAs would never be performed. This was similarly reflected in another controller\(^{36}\) comment:

\begin{quote}
We could do more than we do now
\end{quote}

Table 4.4 suggested that pilot concern about workload was lower than that of controllers, with respect to both pilot and controller workload. Investigating these responses in more detail\(^{38}\), only one controller and no pilots at all agreed with the statement that CDAs increased pilot workload. Most controllers (eight) were neutral in response to this statement, and most pilots (eight) disagreed or strongly disagreed. Regarding an increase in controller workload, half the controllers (seven) agreed that CDAs increased their workload, although four disagreed. Only one pilot agreed with this statement, with six offering a neutral response, with additional comments such as:

\begin{quote}
Those who will not benefit? - might be the ATC personnel, if they have to lay off personnel due to easier vectorings
\end{quote}  \(^{75}\)

\begin{quote}
The controllers will have to learn new procedures and adapt to changes, but this is normal in life
\end{quote}

There was also a suggestion that the number of CDAs carried out had fallen off somewhat, by pilot comments such as:

\begin{quote}
We don’t do them particularly often
\end{quote}  \(^{79}\)

\begin{quote}
We used them for a while – for me, I flew a few, then they ceased to be
\end{quote}  \(^{75}\)

which may add additional context for the pilot workload feedback (for example, if the survey process captured some pilots who had performed fewer CDAs recently, although we cannot determine this quantitatively).

\(^{38}\) data not shown
4.2.4. Attitudes to CDAs – Increased Operational Complexity

In Section 3.2.4 we compared potential causes of increased operational complexity when attempting CDAs, as compared with stepped approaches, as cited in the Manchester case study, mentioning that none of these factors were specifically mentioned by controllers or pilots at Bucharest, which may be attributed to lower traffic densities in the Bucharest TMA and the use of STARs (Bucharest) instead of vectoring (Manchester). Indeed, safety was referred to in a positive context during the Bucharest interviews in that one controller cited an advantage of CDAs being that pilots understood what to do better, and with two pilots declaring that less work for pilots and controllers improved safety (although one controller expressed a view that TAROM pilots sometimes used the procedure in an inappropriate way to their own advantage, causing greater difficulties in maintaining separation minima). The safety improvement theme was echoed in the Stockholm case study, in a pilot response to Question 07:

Avoidance of many intermediate ‘level-offs’. This gives better flight safety.

Risk of level busts decreases

and in a controller response to Question 03:

Fewer questions on RT for the pilot means he has better awareness

and also a pilot response to Question 11 (previously cited):

Good for environment. Less noise, pollution, higher pax comfort, safer cockpit work

One Stockholm controller (in response to Question 01) said that CDAs were getting closer to departures in some runway configurations (other references to departure traffic issues were made in Section 4.2.2), and that having two different arrival routes was detrimental. (The proximity of the Baneasa Airport runway to Henri Coanda was sometimes a complicating factor cited in the Bucharest trial; see Section 3.2.4).

Other comments were made by controllers in response to Question 03, to the effect that matters were sometimes made more complicated by having two different types of CDA, one saying that it was complicated to initiate a Green Approach and to coordinate between en-route and approach, and that STAR-CDAs were about as complex, whilst another echoed these sentiments, saying it was difficult to know when to initiate a CDA and how many could be offered, especially if offering one delayed non-CDA aircraft.

In summary, issues associated with operational complexity, which might interfere with the successful completion of CDAs, or reduce support for such from pilots and controllers, were less prominent at Bucharest, than at Manchester or Stockholm, but could not be described as severe in any of the trials. The relative differences are likely to be attributable to some considerable degree to the different complexities and traffic volumes of these TMAs (Manchester and Stockholm being the busier), and the methods of executing the CDAs. The reader is also referred to the separate, but interconnected, discussions on workload issues (sections 2.2.3, 3.2.3 and 4.2.3). It is noted that safety improvements associated with CDAs were mentioned by respondents in both the Bucharest and Stockholm trials, but featured less prominently in the Manchester case study (although it is important to note that this in no way implies the Manchester procedure was in any way less safe, and one must further be very careful when comparing these dissimilar procedures).
4.2.5. Possible Improvements to CDA Process

Considering the distinctly supportive and positive feedback regarding the CDA trial at Arlanda, the responses to Question 10 (Table 4.9), asking for potential improvements to the trial and regarding recommendations to other airports, may at first seem quite critical in places. However, it is more probable that these very detailed responses were more reflective of a willingness to improve the process and to engage in the trial process. Only three pilots and three controllers had no such suggestions to make. However, it is clear that there were some perceived shortcomings of the trial at Arlanda, particularly with regard to the routeings being too long (pilots and controllers) and inflexible (mostly pilots). Some of these comments were set in the context that changes were already being made and that it was a trial process, so should be viewed as such. Controllers made several references to better pilot briefings, although compare this with a pilot’s response to Question 11:

In the beginning there was too much information among all the other info. Keep the info very short and brief and build on it later

An (early) motivational process was recommended, and pilots again cited FMC issues, as expected, considering the earlier comments in Section 4.2.2. Two controllers suggested better controller understanding of the pilot perspective would be beneficial.

One controller, in response to Question 10, declared that he felt that the NUP group had been pushing for CDAs too much, and there was a need to better understand the controller perspective, and controller difficulties, with regard to managing CDAs. This reflects a similar comment made by another controller, as referred to in Section 4.2.1. As with Manchester and Bucharest, Question 10 generated no comments on improving benefits to the public.

Table 4.8 shows that the procedure of CDAs being initiated by ATC was clear to all the pilots. Of the two controllers specifying ‘other’, both explicitly specified this to mean initiation by a supervisor (see Section 4.2.1) in a supplementary comment. The clarity of the procedure for initiating CDAs was clearly not a problem at Arlanda.

Table 4.8 - Initiating CDAs [Stockholm]

<table>
<thead>
<tr>
<th>Q15. Concerning approaches at Arlanda which are expected to be continuous descents, during approach, is/was a CDA usually:</th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>specifically requested first by the pilot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>suggested first by the controller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>left as an ‘open’ possibility (e.g. within pilot’s choice, unless ATC instructs otherwise)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>other (specified as by supervisor, i.e. can also be taken as suggested first by controller)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 4.9 - Recommendations to other airports [Stockholm]

Q10. As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Arlanda? In what ways could the CDA procedures at Arlanda be improved (if any)?

<table>
<thead>
<tr>
<th>Pilots</th>
<th>Controllers</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n=13)</td>
<td>(n=14)</td>
</tr>
</tbody>
</table>

#### Recommendations re. motivation

- "Sell / promote as more positive. Better if you can convince the pilots that they're not causing a problem for other aircraft ... ensure the approach is not very slow and don't give the feeling of slowing others." 71
- "At the moment there is some pilot and controller reluctance, maybe we need to increase environmental awareness to encourage them more" 71
- "Need to tell controllers first / explain first the benefits – make sure everybody is on the train" 56
- "Give pilots reasons for doing the trial" 56
- "A good thing is to get everybody involved at the beginning in the process, then it's better, easier to accept it ... there are always people who oppose new procedures" 52

#### Shorter / more flexible routes

- "Sell / promote as more positive. Better if you can convince the pilots that they're not causing a problem for other aircraft ... ensure the approach is not very slow and don't give the feeling of slowing others." 71
- "There's no re-routeing, due to the CDA" 78
- "Sell / promote as more positive. Better if you can convince the pilots that they're not causing a problem for other aircraft ... ensure the approach is not very slow and don't give the feeling of slowing others." 71
- "There's no re-routeing, due to the CDA" 78
- "All I need is the turn-in point ... if I do it myself, it's easier and shorter without a designed approach ... or vary the [turn-in] point(s) so they are usable from as many directions as possible" 76
- "Need to ... be able to disregard the crossing altitude [restriction] at entry point to the STAR ... it's too strict to manage a Green Approach" 77
- "They should have an entry point from each sector with straight lines / directs and fly-over waypoints forming a 'Y' [onto the ILS] using ETAs over each [sector] entry point (as a way of sorting the aircraft out), given two hours before, or at start-up" 72
- "Redraw some of the arrival routes, so that the pilot will not say 'no' because of having to fly a longer route. They should be shorter." 52
- "One is a little bit too long – but it is going to be changed. It's important they are short." 54
- "Make the procedure as simple as possible to minimise coordination" 56
- "STAR-CDA from south onto 19R is too long" 64

#### Better pilot briefing

- "Some pilots do not know what to do, they are not briefed enough ... and need to understand they do not have priority over other aircraft" 74
- "Several pilots do not know what to do, they are not briefed enough ... and need to understand they do not have priority over other aircraft" 74
- "Some SAS pilots now think LFV is trying to do a Green Approach all the time" 63
- "Tell the pilots they might need to be aborted and why we might need [to do this]" 65
- "The main thing is that pilots and controllers should work together, we need more pilot awareness, a lot of pilots are not exactly sure what they are doing, some pilots want a direct vector. The controller does not want to enter into an RT discussion about this, and cannot do that ... it is annoying to explain the Green Approach to the pilot: it's not my job and I am too busy." 67
Table 4.9 - Recommendations to other airports [Stockholm] [cont’d]

Q10. As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Arlanda? In what ways could the CDA procedures at Arlanda be improved (if any)?

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improvement of scoping and procedure</strong></td>
<td>“Could be a more ‘firm’ implementation, used to a greater extent”</td>
<td>“Would be better if the controller did not have to initiate (or abort) … better if all aircraft at a certain time, for example when it is quiet, and with the equipment to do a CDA, all did a STAR-CDA … the mixture is difficult”</td>
</tr>
<tr>
<td></td>
<td>“Have it more direct to the final turn, and a mix of different arrivals with ETAs [at Final Approach Fix] … which means automatic separation, even the older MD80s can manage this ±15 seconds.”</td>
<td>“Radar vectoring and STARs is not a good combination”</td>
</tr>
<tr>
<td></td>
<td>“It would be better in the long-run for all traffic instead of fast speed and holding”</td>
<td>“Make it 100% clear which aircraft have been offered a CDA … a shift could change, even on two sectors, like West and TMA … need to be sure they are labelled39 properly”</td>
</tr>
<tr>
<td></td>
<td>“The concept is great, but make the approaches with higher, more realistic speeds”</td>
<td>“Need stricter criteria when to do them, and how many to offer, so the controller feels more secure with the whole system” (in reply to Q03)</td>
</tr>
<tr>
<td><strong>FMC issues</strong></td>
<td>“In some way related to FMC software … altitude constraints with large margins [on the] natural descent profile, e.g. OK for light/heavy aircraft, tail/headwind etc.”</td>
<td>“Try to make a clearer understanding of when we should be trying and when not, and don’t set the goal too high … be more realistic … only possible at certain times”</td>
</tr>
<tr>
<td></td>
<td>“Overall it’s good at ARN, but the FMC needs to be better”</td>
<td>“Some conflicts with departures, sometimes”</td>
</tr>
<tr>
<td></td>
<td>“Need correct programming of the FMC ready in advance of the trial, before we start trying to do it”</td>
<td>“Arrival routes should be as straight as possible, if first aircraft following complicated STAR and second is vectored … this mix is difficult to manage”</td>
</tr>
<tr>
<td></td>
<td>“I think the CDAs at Arlanda are OK. It’s only the software in the a/c (B737) that is not fully to my content.”</td>
<td>“In the future, would be better for aircraft to control their own separation”</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>“There is a need for a better update concerning winds during descent”</td>
<td>“Controllers are not as aware as they could be about what the pilot can do, for example with speed”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“More info to ATC to understand how FMC works, and from the pilots’ point of view”</td>
</tr>
</tbody>
</table>

39 see Section 4.2.1 for an explanation of the CDA initiation and labelling process
4.2.6. CDAs and Society

As with Manchester and Bucharest, in order to avoid response bias, respondents were not told that the interviews were aimed at investigating the impact of societal influences on behaviour, in the context of change in ATM. Question 04 asked: “When deciding on a flight-by-flight basis whether to try for a CDA, what are the key factors you are considering, about whether to try for a CDA or not?”, to determine how many pilots and controllers would mention trade-offs in consideration of noise, and local residents, for example.

In response to this question, one controller explained that the latest point at which a STAR-CDA could be offered was the entry point to the TMA, and that judgement had to be used, as controllers could often judge better than MAESTRO (as echoed by a colleague with reference to other controllers, and another controller with reference to their own ability to better predict traffic evolution further out) – sometimes not offering a CDA even when the separation was greater than five minutes (as prescribed), sometimes offering one even when it was less. This controller went on to add an interesting human dimension:

*I might forget to offer one if it’s just after lunch. Let’s look to see who’s the Tactical Supervisor today – it’s a people thing, too*

Other issues mentioned were conflicts with Arlanda and Bromma departure traffic, and overflying aircraft. It is interesting to note the various nuances of responsibility and engagement in the CDA process described by various controllers. Whilst we have noted that some controllers considered they had a better insight than MAESTRO, and could make their own decisions, several others answered this question more formulaically, directly referring to the decision being led by consultation with MAESTRO, being determined by traffic conditions, or dictated by a supervisor:

*TS-T makes the decision, I am told to do a CDA*

This, however, compares with another response, that although the Tactical Supervisor decides, this was in consultation with the Approach Coordinator, then the controller had the final decision, and would not hesitate to abort the CDA if this were deemed appropriate. Another controller opined that the Tactical Supervisor or Watch Supervisor always made a good decision regarding CDAs, and that he himself was also able to autonomously decide to offer a CDA in low traffic.

This is not to say that controllers did not follow procedures correctly, rather that their description of the process sometimes revealed a more pro-active attitude and the human component of the decision-making process.

Although it is clear that all pilots and controllers have safety paramount in their minds, in response to this question, one controller explicitly mentioned safety, as did one pilot. There were a few references by controllers to avoiding delays to other aircraft, a theme picked up by pilots, in comments such as:

*If late on schedule – – – no CDA*

*Scheduling, i.e. if we’re late*

although these comments were rather outweighed by counter-comments, such as:

*I take it for granted that I won’t be later and almost never am, in fact … I never decline, it is trial, that is a reason to try, to test*

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40 which only had two wind settings, for example (see also Section 4.2.1)
41 Tactical Supervisor (see Section 4.2.1)
I always accept it – it’s always in low traffic so it’s never an issue to be delayed by the CDA … it’s good, we have some benefits in the end

I always accept it to try to help the trial

I always accept … to make a contribution to the trial … to help develop the trial

I have not been unable to fly a CDA … I could fly faster but we have to try them

Always trying if we have the opportunity. The main question is how to [adjust] the FMC to keep reasonable speeds … due to our timetable and to conform with other traffic

Again, the rather positive attitude by pilots specifically to the process as a trial is illustrated by these comments. Pilots also mentioned descent profiles, speeds, and traffic mixes, with three references to the weather: one (postal response) saying that “other aspects” came into play in the winter (but not elaborating on what these were) and another saying that a visual approach could be considered, if the weather was appropriate. Three pilots simply said that ATC took the decision about CDAs.

Also in response to this question (Question 04), there were no references to noise, nor, indeed, any other specific benefits, either to ATC, SAS, or the local community, from either pilots or controllers. The next question (Question 05), elaborated on this, asking:

Please could you outline the extent to which you feel personally that the public response to aircraft noise affects your day-to-day decision making when it comes to trying to achieve continuous descent approaches?

Both controller and pilot responses to this varied across the full range, but with apparently (see later, however) more consideration of the issue expressed by controllers, albeit qualified by traffic conditions and the time of day:

In the low peak and early morning I give more consideration, but not in the peak. I’m not sure what’s underneath … can’t see the towns on the screen, but I try not to drop them too early

If busy I don’t think about the people on the ground
- if quiet I can keep them higher for longer

Yes, I think a lot about the people

A little consideration – the less traffic I have, I think more

In the daytime – only separation, at night, I think more about noise

I try to think about noise – especially early in the morning and at night

I am very aware of the population and the benefits of CDAs

Separation is the overall priority, but I try to consider noise, especially at night

No, not the people underneath, maybe I should

42 although a controller (in response to Question 05) said that visual approaches had been prohibited at Arlanda because they were generally too noisy
One controller also explained about the increasing pressure from the public, especially regarding early morning and late at night, commenting that many local areas were developed after the airport, but people still moved there and then complained, although he was still sympathetic towards them, and considerate of their case (which contrasts somewhat with some Manchester comments with regard to this issue, with annoyance expressed by some respondents that noise issues near airports received such a high profile). Other controllers made particular references to the sources of social pressure:

I am more and more aware of the people: there are a lot of complaints, we see them in the newspaper and on TV, and it puts pressure on us. Sometimes it takes time to get this through an organisation, for example to get pilots to actually follow it, even though they know why they should do it.

I try to keep them up at a level as much as possible, then give them a glide … easier in non-peak traffic … we are very aware of small towns around Arlanda that are complaining a lot … controllers are aware of the places that do complain – they do get heard.

The managers tell us a couple of times a week to think about them. I’ve seen what people in Upplands Väsby write on their website about noise.

c.f.

It’s better for the environment, but I’m not aware about any complaints about noise.

Two controllers again remind us that the demarcation between ‘society’ and ‘industry’ is often difficult to draw:

In severe volume there is no time at all, otherwise, yes, I do, I live in the area and I think a lot about the people.

Of course we think about them, I live near.

Moving on to the pilot feedback to this question, one pilot thought that CDAs were more for passenger comfort than for noise, another said he always tried to perform a CDA whenever possible. Pilot feedback apparently (again, see later) expressed a little less concern compared with the controllers, in one case delegating this responsibility somewhat to the approach designers:

Not necessarily. We always know SIDs/STARs were trying to avoid people living near the airport … if three are coming in at the same time, we win some and lose some … we can circumnavigate on some approaches to benefit those on the ground … I have to rely on the people designing the approaches, although sometimes they make them more complicated [and longer] than they need to be.

I never think about those living around. My priority is the flight itself.

Not very much.

Not at all.

Not in a big way as the main part of the noise complaints are from the final approaches, e.g. RWY centreline.

c.f.
As a professional, I always try to make a CDA … if allowed [by] ATC

Of course, it’s a big advantage. Good for everyone

and with two final responses qualified in yet different ways:

I’m not personally concerned about people [bothered by] aircraft noise, but the airport might suffer further restrictions if too many people complain. So, due to that fact, I always try to make a descent with low power regardless of [whether] I’m making a CDA or a normal approach.

There is too much focus on noise. Should concentrate more on pollution … I do think a bit about noise

Notwithstanding the apparent lesser concern of pilots with regard to noise, in terms of governing their behaviour (in response to the qualitative Question 05), when this was measured semi-quantitatively in response to the intentionally similar Question 17, there was practically no difference in the responses between the controllers and pilots.

Q17. How would you describe your personal concern about the possibility of noise complaints from the public, if CDAs were generally not being used?

- seriously concerned
- somewhat concerned
- not particularly concerned
- not at all concerned

No respondent indicated that they would be “not at all concerned”, very similar numbers responding to the central two options, and only three respondents, notably all pilots, indicated “seriously concerned”. Again, this illustrates the important contrasts which can be revealed through comparative uses of qualitative and quantitative question types.

Despite the controller briefings on noise, as described in Section 4.2.1, as an important part of the trial implementation and education process, the noise issue cannot be said to have really persisted in controllers’ minds, based on their feedback in the interviews, and this may well be attributable to a greater focus, particularly in the media, on the Green Approaches.

In response to Question 08 (“Who is responsible for controlling the amount of aircraft noise/pollution at Arlanda?”), although four pilots and one controller declared they did not know, all other respondents made some suggestion, often describing interactions between more than one body in the case of the controllers.

Pilots cited the local community and government, LFV / Stockholm-Arlanda Airport, ‘ATC’ and the Swedish Civil Aviation Authority (Lufthärtssstyrelsen). One pilot even (correctly) identified the Stockholm County Administration Board. The most common response from controllers was some

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43 see Section 4.2.1 for corporate structuring
44 Länsstyrelsen i Stockholm
combination of (an) LFV (body) and Stockholm-Arlanda Airport - often with a liaison with ATCC Stockholm cited. Other controller comments included:

The ‘Environment Guy’, don’t know who he is. Also, X 45 is always smashing us on our figures if we don’t do a CDA! 45

We can contribute by doing as many CDAs as possible 52

Everybody needs to pitch in, ATC needs to play its rôle 53

In short, both pilots and controllers were reasonably knowledgeable regarding responsibilities for controlling the amount of aircraft noise/pollution at the airport. In addition, the controllers sometimes expressed their own responsibility in this respect. This exact question was not asked at Manchester, but the response profile in Stockholm was in many ways similar to that of Bucharest (see Section 3.2.6).

Widening the context to responses to other questions, in terms of the broader question put to respondents in Question 13 (“How would you assess the feedback / monitoring process within your company…”; see next Section) only in Stockholm was there any request for feedback about noise. As already cited, in addition to many positive comments, there were also a few pilot remarks which were frank about the perceived motivation:

Everybody knows what they are about: less fuel is more money for the company, and they’re good for the environment, which is popular at the moment 75

Cutting costs is our management’s driving factor, and CDAs are a way to do that, environmental issues are secondary objects and just a side-effect of the above 77

c.f.

If people live underneath, then there is a third46 benefit 75

It shows a belief in the future
... anything which improves our status with society is positive 71

This latter quotation was already cited in Section 4.2.1, and reminds us again of the particular wider societal context of the Stockholm case study. This pilot went on to say (in Question 03) that the CDA trial also helped to turn media relations from being negative to positive.

‘Societal’ factors may also work at the other end of the scale, e.g. in terms of one-to-one interactions within the ATC unit. In response to Question 07, regarding management endorsement of CDAs, one controller 52 explained that the Watch Supervisor was a key motivator for the carrying out of CDAs, but even when a Watch Supervisor was not required to be present (e.g. at night), he would try to carry out CDAs “to help the people sleeping on the ground”. As we have also observed before:

Let’s look to see who’s the Tactical Supervisor today – it’s a people thing, too 64

---

45 An LFV Manager at ATCC Stockholm, name removed
46 i.e. ‘third benefit’ after fuel savings and pollution reduction; in response to Question 07
### Table 4.10 - Awareness of quantifiable benefits [Stockholm]

Q09. Are you aware of any quantifiable benefits which have resulted from CDAs at Arlanda – e.g. fuel savings, reduced complaints about noise from the public?

<table>
<thead>
<tr>
<th></th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>“Yes”</strong></td>
<td>“Yes” *</td>
<td>“SAS made a report about fuel savings and how much CO₂ was not released into the air … the figures were good” *62</td>
</tr>
<tr>
<td><strong>“100 kg”</strong></td>
<td></td>
<td>“200kg-300kg compared with a stepped approach: I asked a pilot myself” *55</td>
</tr>
<tr>
<td><strong>“I am only aware of fuel savings, that [are] passed through to us from management”</strong></td>
<td></td>
<td>“200kg was estimated per aircraft” *64</td>
</tr>
<tr>
<td><strong>“Yes, I frequently get them”</strong></td>
<td></td>
<td>“200-300kg per aircraft” *60</td>
</tr>
<tr>
<td><strong>“We are shown them and they are continuously updated”</strong></td>
<td></td>
<td>“200kg per approach” *58</td>
</tr>
<tr>
<td><strong>c.f.</strong></td>
<td></td>
<td>“300-400kg (if a perfect CDA)” *67</td>
</tr>
<tr>
<td><strong>No (x5)</strong></td>
<td></td>
<td>“200kg for a 737 Green Approach” *56</td>
</tr>
<tr>
<td><strong>“No – there hasn’t been [any] feedback”</strong></td>
<td></td>
<td>“I saw a presentation about Heathrow benefits – fuel and noise” *51</td>
</tr>
<tr>
<td><strong>“No. Not informed. Have not [sought] the info.”</strong></td>
<td></td>
<td>“I saw some fuel numbers”</td>
</tr>
<tr>
<td><strong>“I haven’t seen any documents … haven’t heard that there are any benefits, not because of CDAs”</strong></td>
<td></td>
<td><strong>c.f.</strong></td>
</tr>
</tbody>
</table>

* although no value given (postally) or on prompting (during face-to-face interviews)

Thought to be benefits, but no actual figures known (x4)
Recalling any quantifiable benefits which had resulted from CDAs at Arlanda, such as fuel savings and reduced complaints about noise from the public (in response to Question 09), one controller commented that he had seen some secondary data about fuel savings, but he thought that the fuel saving was about the same if the aircraft was given a direct approach, and he believed that some pilots thought the same.

One pilot actually made a related comment, in that he felt there was no fuel saving for a Green Approach compared with a stepped approach, and that speed was the important factor. Another pilot pointed out that the SAS fuel saving programme was broader in scope than just the CDAs, so that CDA-specific savings were not necessarily separately identifiable by the pilots, although more general figures were disseminated. Table 4.10 shows that figures were not readily quoted by pilots, whereas controllers had a remarkable knowledge of the fuel savings. There was no mention of any reduction of noise complaints in this context, although one controller said such feedback was bound to have been given somewhere, although he had not seen it.

4.2.7. Internal feedback and Dissemination of the Study’s Findings

During the interviews, two controllers explained how a form was completed by controllers for each CDA, successful or not, with reasons recorded for those which were broken off (similar to the Bucharest reporting process). The feedback process from pilots was ad hoc for STAR-CDAs. Plans for pilots to complete a mandatory feedback form for each Green Approach were dropped by SAS, due to pressures on time, this being replaced by a short, internal survey. Again, as with Bucharest, there was no feedback process on a flight-by-flight basis.

In terms of the question put to respondents in Question 13:

*How would you assess the feedback / monitoring process within your company, e.g. to inform you of progress and allow you to offer your views on the CDA implementation and ways in which it might be improved? Was such a process: in place, adequate, fair, acted upon?*

twelve respondents declared that they did not know if there was any feedback process, with two pilots adding:

*I would like feedback, both from company regarding fuel etc, also from ATC with their experience – do we act as they want / expect, are we delaying traffic?*

*A lot of face-to-face communication between involved parties*

and nine that “there was a feedback process, but it did not work as I wanted” (in both cases, with approximately even splits between pilots and controllers). Of the latter group, two controllers offered further comments:

*If you got hold of the right person you also got the appropriate information, but as a general feedback, there was none!*

*No feedback about the noise around the airport. Has it improved with CDA approaches? Feedback about fuel saving has not been shown either.*

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47 indeed, as mentioned in Section 4.2.1, there had not actually been any such reduction in complaints
48 this response was in a postal return, so it was not possible to seek clarification. It appears to be a request.
Table 4.11 - Feedback preferences: hearing about the Study [Stockholm]

Q18. This Study will be looking at other CDA trials in Europe, and rather broader types of change in ATM. We would like to return to Arlanda to offer a brief presentation of some of the key findings resulting from the Study. Which of the following best describes your reaction to such a feedback session:

<table>
<thead>
<tr>
<th>Feedback Preference</th>
<th>Pilots (n=13)</th>
<th>Controllers (n=14)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would probably not have time to attend</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would prefer a focus on CDA trials at Arlanda</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would prefer a focus on CDA trials at Arlanda and elsewhere in Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would prefer a broader presentation on ATM change in general</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No particular views / preference</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two respondents (also both controllers) declared that there was no feedback process, one offering a further comment:

It would be interesting to receive more feedback from LFV or our local people working with these matters

Although the trial was still on-going at Arlanda at the time of the interviews, it seems there was plenty of demand for feedback from both pilots and controllers. One pilot repeated at the end of the questionnaire how he wanted more feedback, especially from LFV on how they felt the trial was working.

Not one respondent, across the Bucharest and Stockholm samples combined, stated that they did not want or need any feedback. Despite the responses above, two controllers and two pilots at Arlanda said that there was a feedback process and it had worked as they had wanted (c.f. fifteen in Bucharest, out of twenty-four respondents).

~*~

Finally, in terms of offering the stakeholders at Stockholm a formal feedback session on the results of this Study, Table 4.11 shows a fairly strong preference for feedback regarding CDA trials in general: which was thus similar to the Bucharest results (Table 3.11).

In the corresponding Manchester results (Table 2.11), there was a distinct lack of consensus on the type of feedback required. Of some note, was the fact that only 11 respondents across the entire sample of 82, declared that they probably would not have time to attend such a feedback session (this comprised one Manchester and two SAS pilots, eight Manchester controllers, and nobody in Bucharest).
5. SUMMARY AND CONCLUSIONS

5.1. GENERAL CONCLUSIONS AND CROSS-SITE COMPARISONS

This Section draws together the major conclusions from the interviews. General conclusions and comparisons across and between the sites are made, followed by selected, site-specific comments. Some of the semi-quantitative results from across the sites, discussed in detail in the main body of the Report, and summarised here, are also illustrated in Table 5.2 and Table 5.3. Finally, concluding comments on societal impacts on the trials, a key focus of the Study, are discussed in Section 5.3.

5.1.1. Key Methodological Summary Points

- Summarising some key findings from the analysis exploring the Seven Stages of Change model as applied in this CDA context (see Section 1.1), behavioural change appeared more correlated with perceptions of benefits in the case of the pilots. This finding may be partly attributable to the greater external constraints on controller behaviour in the case of CDAs. Whereas pilots tended to ‘package’ together perceived benefits of the new process, controllers were less prone to this. Looking at the relationships between perceived societal and system benefits, however, these particular aspects of this ‘halo effect’ were fairly similar when comparing pilots with controllers.

- For each of the three surveys relating to the CDA trials, the fieldwork took place after the trial had been well established, but the introduction thereof was still fresh in the memories of the respondents. Respondents were not informed of the objective of the Study, so as not to bias their responses, instead, as far as possible, thus allowing the societal impact on ATM change to be expressed in its natural, unbiased context.

- Many respondents offered detailed and exhaustive feedback, sometimes even with supporting diagrams - strongly underscoring their commitment to this exercise and the quality of the responses. 82 full questionnaire interviews were achieved with pilots and controllers, across the three sites. In addition to this, airline managerial / training captains, controller supervisors, CDA designers and airport authority representatives were interviewed to add strategic context to each of the case studies.

- The questionnaire developed seemed to work well in eliciting the type of information required for the Study, both in terms of extracting in-depth and semi-quantitative responses. It was well comprehended by non-native speakers of English.

- In each set of interviews, some differences were observed between responses to the unprompted (open-ended) questions and the more structured (fixed-response) questions. This was part of the experimental design of the questionnaire, as it is instructive to observe how a particular theme features spontaneously in responses (e.g. how often certain benefits of CDAs are mentioned), compared with the relative rating such a specific item may receive in the context of a grid/scalar question. Neither response profile is right or wrong - each needs to be considered in the context of the other. As examples, in response to open-ended questions, Bucharest controllers and Manchester respondents were rather more prone to cite disadvantages of the CDAs, than were Bucharest pilots. Whilst quotations (intentionally) serve to illustrate the breadth of opinion, there is a natural human tendency to complain rather than praise, such that summary data, based on grid/scalar questions can be more representative, on balance, of overall opinion. A good example is the responses to Question 05 and Question 17 in the Stockholm case study, as discussed in Section 4.2.6.
5.1.2. Cross-site Summary Findings

Different trial contexts are important contributors to understanding the results

- Neither the Manchester nor the Bucharest trial was introduced in the context of any increase in noise complaints, i.e. these were not driven by societal pressure per se. However, it must be noted that there was a clear public complaints culture with respect to noise at Manchester (as elsewhere in the UK), markedly absent in Bucharest. The Stockholm trial was explicitly introduced to mitigate against noise complaints.

- Some of the differences in the responses from pilots and controllers across the three case studies will be at least partly attributable to the different methods of executing the CDAs (Manchester - vectoring; Bucharest - STAR; Stockholm - P-RNAV STAR and A-CDA) and to the relative TMA traffic volumes and complexities (Manchester and Stockholm having the higher throughputs). In Bucharest and Stockholm, although CDAs were often cited as being ‘easier’ than conventional approaches due to the absence of, or reduced need for, vectoring, it is important to bear in mind that such CDAs were normally carried out in low traffic conditions anyway (i.e. where the analogous vectors would also have been easier than those required in high traffic).

- Interviews took place in Manchester at a stage when quantifiable benefits of the CDA trial had generally not been assessed and fed back to the controllers or pilots, although in Bucharest, awareness of fuel savings amongst TAROM pilots was very high, and even controller awareness was notable here. SAS pilots cited the quantitative fuel benefits of CDAs less than did their TAROM counterparts, although controllers’ knowledge of the fuel savings was remarkable in Stockholm.

Benefits & workload

- In all three case studies, controllers had a poorer perception of capacity effects, compared with the pilots. In Bucharest and Stockholm, pilots were less inclined to express a view that CDAs reduced flexibility too much, due to increased procedural standardisation. In Manchester, there was a greater pilot preference to extend the CDA trial to day-time operations, and it appeared that there was an overall preference here, amongst both pilots and controllers, for greater standardisation (noting again the use of vectoring at Manchester for the CDAs).

- In Bucharest, pilot perceptions of the benefits to the airport, and to the ANSP, were more pronounced than those indicated by the controllers, whereas in Stockholm and Manchester the group of benefits were assessed rather more similarly by controllers and pilots. Controllers in Stockholm perceived the benefits of CDAs to ATC to be higher than did controllers in Manchester or Bucharest, despite the fact that Stockholm controllers also perceived the capacity limitations to be worse than did their counterparts in either of the other two case studies.

- For neither controllers nor pilots, was ‘I would recommend the way we do it at [airport], to a similar airport’, significantly correlated with ‘benefits the airport’.

- Of the four variables: ‘benefits people living under approach paths’, ‘benefits the airline(s)’, ‘benefits the ANSP’ and ‘benefits the airport’, the highest net rating was for the airline benefit perceived by pilots; the lowest was the ANSP benefit perceived by controllers.
Although there were fewer spontaneous comments on workload in Bucharest and Stockholm, as compared with the Manchester case study, the following qualitative summary points may be made:

- **overall**, there were relatively few spontaneous references to increases in workload declared by either pilots or controllers

- pilots were more likely to express a potential decrease in workload (if the FMS handled CDAs properly)

- In response to grid/scalar questions (see Table 5.1 and Table 5.3):
  - equally in Bucharest and Stockholm (less so in Manchester), controllers declared that CDAs increased their own workload more than pilots declared that CDAs increased pilot workload. In these two sites, controllers also rated the increase in their own workload higher than they rated the increase in pilot workload.
  - at all sites, pilots rated the increase in controller workload somewhat higher than the increase in their own workload. Controllers rated their own workload increase similarly across the sites.
  - both pilots and controllers at Manchester rated higher pilot workload increases, as compared with the other two sites. Controllers in Manchester rated the increase in pilot workload practically the same as their own.

<table>
<thead>
<tr>
<th>Mean scores to derived questions</th>
<th>Manchester</th>
<th>Bucharest</th>
<th>Stockholm</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Increases my workload'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pilots</td>
<td>2.7</td>
<td>2.3</td>
<td>2.2</td>
</tr>
<tr>
<td>controllers</td>
<td>3.2</td>
<td>3.4</td>
<td>3.2</td>
</tr>
<tr>
<td>'Increases others’ workload'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pilots</td>
<td>3.2</td>
<td>2.6</td>
<td>2.5</td>
</tr>
<tr>
<td>controllers</td>
<td>3.1</td>
<td>2.5</td>
<td>2.6</td>
</tr>
</tbody>
</table>

- Issues associated with operational complexity, which might interfere with the successful completion of CDAs, or reduce support for such from pilots and controllers, were less prominent at Bucharest, than at Manchester or Stockholm, but could not be described as severe in any of the trials.

**Endorsement & noise concern**

- Across all sites, controllers cited traffic volumes and sequencing considerations above all others, with pilots often focusing on fuel savings and technical issues, such as FMS capabilities and Rate of Descent calculations. Earlier FMS problems were prominently commented upon in Stockholm.
• Each site demonstrated clear managerial support of the trials. Although some pilots at Stockholm commented on a perceived lack of management endorsement, this was not generally reflected in reduced pilot support. There was no evidence of a management ‘blame culture’ at any site - failure to achieve a CDA was accepted as a consequence of operations and the decision making of the pilots and controllers was fully respected. This was a clear message at each site. A few controllers at Stockholm suggested this might become somewhat less relaxed after the trial period.

• In Bucharest, the majority of pilots and controllers were ‘seriously concerned’ or ‘somewhat concerned’ about ‘the possibility of noise complaints from the public, if CDAs were generally not being used’. Although this response demonstrated fairly high levels of concern, it should perhaps be viewed in the wider context that noise complaints here were very seldom made by the public, such that this possibility may have appeared somewhat hypothetical. The majority of pilots in Manchester were similarly concerned, but only two controllers at Manchester fell into this category. In Stockholm, there was practically no difference in the responses to this question between the controllers and pilots: no respondent indicated that they would be ‘not at all concerned’.

• Only two respondents, across all three sites, indicated reduced support as the trials progressed. (Both of these were, in fact, controllers at Stockholm, although this did not reflect the broader, positive attitudes of the Stockholm controllers).

Feedback & consultation

• Regarding inclusion in the consultation process over the introduction of the CDA trials, responses at all three sites were broadly similar, with a consensus that it had been adequate.

• There was scope in all three case studies to offer better internal feedback to the pilots and controllers, according to the responses received on this issue. Although it was not possible to make strict comparisons across the sites, for a number of reasons, demand for such feedback seemed already relatively well served in Bucharest, and with particular further potential in Stockholm (although the trial had not ended at Arlanda at the time of the interviews). Not one respondent, across the Bucharest and Stockholm samples combined, stated that they did not want or need any feedback. Only Manchester had a system in place whereby pilots and controllers had feedback on the CDAs on a flight-by-flight basis.

Problems & way forward

• The generic ATC challenges of traffic volumes and sequencing (e.g. faster aircraft following slower ones) was cited across all sites. Particularly mentioned by controllers and pilots at Stockholm was a concern regarding having to intervene on (reduce/vector) non-CDA aircraft, to their disadvantage, to allow CDA aircraft to achieve the desired descent profile.

• Reasons cited for not starting CDAs, or having to break them off, were quite varied in Manchester - controllers and pilots each ‘blaming’ each other to some extent, with pilots somewhat more disposed to take the blame upon themselves, and controllers to cite traffic and sequencing. A somewhat lesser degree of mutual ‘blame’ between pilots and controllers was evident in Bucharest. Stockholm controllers made several references to better pilot briefings being desirable.
• Partly through suggestions for new STARs, and new entry points for existing STARs, Bucharest feedback denoted support for an extension of the CDA trial. This was in modest contrast to the Manchester controller feedback, whereby several felt that an extension of the (night-time) CDA trial to daytime operations would be difficult or unworkable. For both pilots and controllers, the declared tendency to recommend the existing procedures to other airports was highest at Bucharest and lowest at Manchester; with the Stockholm ratings falling between the two (see Table 5.2).

• Both Manchester and Bucharest feedback supported the use of STARs (vectoring only was in use at Manchester and some felt that STARs would reduce flexibility). Several suggestions were made at Manchester favouring the introduction of P-RNAV STARs, fitting in with an expressed wish there of better predictability (which was not such an issue at Bucharest, and already very important at Stockholm). There were some perceived shortcomings at Stockholm, particularly with regard to the routeings being too long (pilots and controllers) and inflexible (mostly pilots): some of these comments were set in the context that changes were already being made and that it was a trial process, so should be viewed as such.

• At Manchester, there was a strong suggestion from pilots that CDAs should start further out (higher), which was not echoed as strongly in Bucharest, and not really applicable at Stockholm, since the Green Approaches were already starting at Top of Descent.

• In terms of offering the survey respondents a formal feedback session on the results of this Study, there was a fairly strong preference for feedback regarding CDA trials in general (i.e. regarding all three case studies), in both Bucharest and Stockholm. There was a lack of consensus on this issue in Manchester. Only 11 respondents across the entire sample of 82, declared that they probably would not have time to attend such a feedback session. Nine of these were in Manchester; none in Bucharest.

Final comments on Table 5.2 and Table 5.3

Some of the semi-quantitative results from across the three sites, discussed in great detail in the main body of the Report, particularly in Section 4.2.2, and summarised above, are also illustrated in the following tables. These combine tables 2.3, 3.3 and 4.3 (in Table 5.2), and 2.4, 3.4 and 4.4 (in Table 5.3). Overall, responses from pilots and controllers were broadly similar at each of the sites. We conclude this Section with a few remaining comparisons.

Comparing pilots across sites, and controllers across sites, the largest differences were between operational comparisons of CDAs in low visibility conditions (compare pilots in Manchester and Stockholm); the relatively higher perceptions of benefits to ATC by TAROM pilots compared with those in Manchester, and the higher perceptions of benefits to the airport by Stockholm controllers, compared with those in Bucharest (see Table 5.3).

The greatest difference of all such comparisons was the responses to “achieving continuous descent approaches at [airport] ... of no strong interest to me one way or another”, where SAS pilots demonstrated rather greater declared interest levels than those expressed by TAROM pilots (see Table 5.2).
Table 5.2 - Attitudes to CDAs - cross-site comparison

Please indicate your levels of agreement, or disagreement, with the following:
Achieving continuous descent approaches at [airport] ...

<table>
<thead>
<tr>
<th>of no strong interest</th>
<th>would avoid if free choice</th>
<th>not my responsibility</th>
<th>serious contribution to positive change</th>
<th>little difference if don't do sometimes</th>
<th>OK as step towards better</th>
<th>reduces flexibility due more procedural*</th>
<th>recommend way we do it here</th>
</tr>
</thead>
</table>

| **Pilots** | Manchester (left; n=21); Bucharest (middle; n=10); Stockholm (right; n=13) | | | | | | |
| **Controllers** | Manchester (left; n=10); Bucharest (middle; n=14); Stockholm (right; n=14) | | | | | | |

* except Manchester, where question was: “should be extended to day-time operations”
Table 5.3 - Benefits of CDAs - cross-site comparison

Please indicate your levels of agreement, or disagreement, with the following:
Achieving continuous descent approaches at [airport] ...

<table>
<thead>
<tr>
<th>benefits people under approach paths</th>
<th>benefits airline(s)</th>
<th>benefits ANSP/ATCC</th>
<th>benefits airport</th>
<th>increases pilot workload</th>
<th>increases controller workload</th>
<th>limits capacity</th>
<th>less safe than stepped during low vis</th>
<th>too time consuming</th>
<th>increases pax comfort*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilots</td>
<td>Manchester (left; n=21); Bucharest (middle; n=10); Stockholm (right; n=13)</td>
<td>* except Manchester: see text</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controllers</td>
<td>Manchester (left; n=10); Bucharest (middle; n=14); Stockholm (right; n=14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2. POINTS OF SUMMARY – BY SITE

5.2.1. Key Manchester-Specific Points of Summary

NB: These comments are not meant to summarise the key findings from Manchester, but to identify particular characteristics, which fit less well in the cross-site summary presented in Section 5.1.2.

- At the strategic level, both NATS management and the Environment Department at Manchester Airport concurred that the introduction of the CDA trial at Manchester was set in the context of a move across Europe of focusing more on arrival noise, a move which had earlier included UK CAA consultation with the airlines, although there was still some evidence of a somewhat persistent ‘departures culture’.

- Airlines expressed the view that CDAs should begin at Top of Descent, and should be initiated and managed from this point, and in a predictable way.

- Key barriers to change, for controllers, were:
  - Local airspace / terrain restrictions
  - Workload (especially if extended to daytime operations; otherwise not a major issue)

- Potential barriers to change, for pilots were:
  - Inadequate track updates from ATC
  - Concern about possible rushed / missed approaches

- A key driver of change for many (but not all) respondents was procedural standardisation, even at the expense of flexibility.

- Whilst safety was of paramount importance across the whole respondent base, the economies of fuel saving (in particular) and the ‘professionalism’ (e.g. increased passenger comfort) of CDAs were also important to pilots. It can be said that generally, to the extent that CDAs were compatible with existing priorities of pilots and controllers, they were accepted by both sets of respondents. This was tempered somewhat by actual annoyance by some respondents that noise issues near airports received such a high profile.

- Pilot and controller concerns about noise levels in particular, and about societal impacts of ATM, were overall very low.

- Notwithstanding the previous point, it is worth noting that in addition to its existing undertaking towards the mitigation of environmental impacts, NATS is committed to further work in raising environmental understanding throughout the organisation, and has an Environmental Manager who will continue to work closely with airports and en-route centres alike, to further develop such awareness.
5.2.2. Key Bucharest-Specific Points of Summary

NB: these comments are not meant to summarise the key findings from Bucharest, but to identify particular characteristics, which fit less well in the cross-site summary presented in Section 5.1.2.

- Despite a positive attitude towards the CDA trial in Bucharest, a number of suggestions were made by controllers regarding potential improvements, which included:
  - better simulations and training (notably simulating more than one aircraft on a CDA at once)
  - better tools, or separate routes, to handle mixes of faster and slower aircraft
  - common training between pilots and controllers, and more regular meetings, with better awareness from the start of the trial
  - more CDA STARs and/or more entry points to the existing ones (echoed by the pilots)

- STARs should be as straight as possible, to reduce pilot tendencies of requesting directs. This tendency might also be reduced by better explaining the need for the existing structure of the STAR (e.g. where straighter structures were not practical).

- It is clear that even in the context of there being practically no noise problem at all at Bucharest, this was still an issue in the minds of pilots and controllers alike. Certainly it could not be said to be prominent, but nor could it be described as insignificant.

- It was suggested that a limited introduction of a new procedure (such as STAR-based CDAs), gradually demonstrating viability, may be preferable to a more extensive initial implementation. This may, however, lead to demand being greater than supply – a trial may thus start to become a victim of its own success.

- In response to the open question, asking who was ‘responsible’ for controlling the amount of aircraft noise/pollution at Bucharest, awareness was fairly mixed, but the Airport Authority was the most commonly cited response across pilots and controllers. There was a distinct tendency for controllers to adopt a broader view on the issue of responsibility.
5.2.3. Key Stockholm-specific Points of Summary

| NB: these comments are not meant to summarise the key findings from Stockholm, but to identify particular characteristics, which fit less well in the cross-site summary presented in Section 5.1.2. |

- The CDA trial at Stockholm was differentiated from the other two trials in two important respects. Firstly, it was the only one of the three explicitly introduced to mitigate against noise complaints. Secondly, it had the longest inception and development period: only in Stockholm was the timescale over which the trial was introduced explicitly mentioned in the interviews. However, it seems that whilst this can be a factor in attitudes towards the trial, it can be difficult to strike the right balance, as exemplified by one controller saying that maybe the trial had been entered into somewhat too quickly, and another (as quoted earlier) declaring that the implementation was too long, resulting in a “lack of interest and creativity from the controller” and that “the enthusiasm has gone down a little, even with the managers”. Compare this with Bucharest, where it seems that a sufficient degree of enthusiasm can lead to a demand for wider implementation, before there has been time to introduce it, such that such trials can be a victim of their own success. This is not to suggest lower controller support at Stockholm, compared with Bucharest.

- Of particular note, is the fact that the initial motivation for participation in the CDA trial at Stockholm for SAS was the fuel savings and corresponding CO₂ reduction: the even greater financial advantages of improved predictability and integration with CDM became apparent later, and this coordinated well with much prior investment by SAS into improving operational predictability. During the interviews, pilots mentioned improvements in predictability and/or cooperation with the airport as often as fuel consumption benefits and noise reduction. Improvements in predictability, for SAS and/or the airport, were also often cited as advantages by the controllers.

- More than in either of the other two case studies (although echoed in Bucharest), there was a distinct undercurrent of reference to the fact that the CDA trial was exactly that: a trial. This seemed to have a positive effect, however, engendering an open mind to the trial, and a willingness to try it out. The frequently detailed and predominantly constructively critical comments regarding recommendations and improvements, made by respondents at Stockholm (see Table 4.9), were likely to be reflective of a willingness to improve the process and to engage in the trial.

- To some extent, but noticeable, there was with some respondents a sense that they were involved in a project which was, to quote one controller, “the way of the future”, which instilled in some a sense of confidence and positiveness. This was probably promoted by the operation of two types of CDA (both STAR-CDA and Green Approaches) at the same time, the wider NUPII+ project context, the relatively advanced use of the FMS, and the media interest in the Green Approaches.

- The Green Approaches created a lot of media interest, with very frequent enquiries from journalists, helping to substantially improve the public image of SAS. SAS believed that the greatest operational challenge was to LFV, in terms of getting controller buy-in into a project which was of less direct benefit to the ANSP, but that the positive media attention had helped this cause. Indeed, this had also helped to promote the signing of an agreement between SAS and LFV to move towards completely STAR-based approaches at all Swedish airports in the future.

- The Stockholm trial also raised a number of special and positive issues regarding the societal context of change, which are discussed in the next Section.
5.3. CONCLUDING COMMENTS ON SOCIETAL IMPACTS

Quantitatively, when asked about “the possibility of noise complaints from the public, if CDAs were generally not being used”, levels of concern (from pilots and controllers combined, to make suitably sized sample sizes) ran in the order: Bucharest > Stockholm > Manchester, with no statistically significant difference between Stockholm and either of the other two, but with concern at Bucharest significantly higher than at Manchester (Mann-Whitney U test, p=0.03). Although this response demonstrated fairly high levels of concern at Bucharest, it should perhaps be viewed in the wider context that noise complaints here were very seldom made by the public, such that this possibility may have appeared somewhat hypothetical.

The quantitative perspective is here not as revealing as other factors, however. Important direct and indirect societal effects through the airport were manifested across the trial sites. As we have noted in the Bucharest case study, noise complaints were not high on the agenda in the Romanian context, with, indeed, responses to the question “When deciding on a flight-by-flight basis whether to try for a CDA, what are the key factors you are considering, about whether to try for a CDA or not?” indicating that noise was not an issue in this respect (although we have already noted that the CDA Working Group at Bucharest was chaired by the Henri Coanda Bucharest International Airport Authority, having itself taken this pro-active initiative in coordination with developments in the UK and EUROCONTROL). Despite the different complaints context, this was echoed in Manchester with responses to analogous questions indicating a distinct lack of immediate community impact on either the pilots’ or controllers’ day-to-day behaviour.

In Manchester, a view suggesting the airport as the guardian and representative of the public interest, from the controller and pilot perspective, was in keeping with the experience of the Environment Department at Manchester Airport, which also stated that not only might controllers and pilots take this view, but that the public also was more likely to see the airport as responsible for such issues as noise and pollution, rather than complaining to NATS or to the airlines. This potentially infers a somewhat peculiar rôle on the airport – as a target for complaints from the public, yet also as a protector of the public interest in the eyes of the ATM community. It is to be noted that the airport at Manchester is also wholly owned by the ten local authorities (local government bodies) of Greater Manchester, representing a direct societal link, as elected representatives of the public.

We have also previously noted that the LFV Group was the first major Swedish business group to become climate neutral, illustrating a strong corporate commitment to greener practices, although it did not consider that it had received the same positive media attention as SAS regarding such policies, as the Swedish public remained somewhat sceptical of airports per se, although not as much public criticism was actively directed at Stockholm-Arlanda Airport as might be witnessed in the UK. The airport acting as a community focal point is evident in both Manchester and Stockholm, whereas the positive relationship between SAS and the media seems, so far, to be a special case, although other European carriers are trying to court public favour regarding their ‘Green’ credentials.

In initial reporting for this Study, Figure 3 was devised to represent the various relationships between stakeholders in the complex interactions involved in ATM change, and to help understand the place of societal influence within that structure. Based on the preceding commentary, it is possible to hypothesise a revised structure, shown as Figure 4, with the airport authority and local government holding a more central position in terms of acting as an interface between ‘society’ and the ATM community, with the media playing a key rôle as catalyst: able to represent the industry in a positive or negative light.

Of further interest in Bucharest, we remind ourselves that in response to the open question, asking who was ‘responsible’ for controlling the amount of aircraft noise/pollution, awareness was fairly mixed, with the Airport Authority being the most commonly cited response across pilots and controllers, yet with a distinct tendency for controllers to adopt a broader view on this issue of responsibility. Both pilots and controllers in Stockholm were reasonably knowledgeable regarding
official responsibilities for controlling the amount of aircraft noise/pollution at the airport, whilst the controllers also cited internal liaisons between ATCC Stockholm and Stockholm-Arlanda Airport, and sometimes also expressed their own responsibility in this respect. Whilst this exact question was not asked at Manchester, the response profile in Stockholm was in many ways similar to that of Bucharest, although some Stockholm controllers notably made particular references to the sources of social pressure: the media, local communities and managers.

At this point, we may revert to an observation made in Section 1.1, where we discussed macro-level and micro-level effects. ‘Societal’ factors may also work at both ends of this scale, e.g. in terms of one-to-one interactions within the ATC unit, and macro-level effects such as the relationship with the media and Stockholm-Arlanda Airport. In response to Question 07, regarding management endorsement of CDAs, one Stockholm controller explained that the Watch Supervisor was a key motivator for the carrying out of CDAs, echoed by:

*Let’s look to see who’s the tactical supervisor today – it’s a people thing, too.*

At this micro level, one SAS pilot recalled being asked by a passenger if he had just flown a Green Approach and what the fuel saving was. (Commanders on SAS B737s regularly announce to passengers when a Green Approach is being performed). This pilot went on to say that the CDA trial also helped to turn media relations from being negative to positive.

As touched upon, apparently more strongly felt in Stockholm than elsewhere, based on several of the controllers’ interviews, was the personal liaison between ATCC Stockholm and Stockholm-Arlanda Airport, providing another, albeit indirect, channel of dialogue between the outside community and the ATM community. We may speculate that this closeness of contact contributed to some of the particularly ‘societally aware’ characteristics of the controller responses, which were, in contrast, echoed with SAS more through the ‘macro’ media effect, although reflected on occasion at the passenger ‘micro’ level.

The core focus of the Study definition, as defined by EEC, was to assess:

| how directly and how intensely ATC personnel feel community pressure and through what processes |

The dichotomous rôle of the airport as a focal point in this process, and its special place as an interface with the public, may also be considered in the context of EU legislation coming into force in 2010 on NO\textsubscript{2} levels, which is bound to heighten airport attention on environmental issues and stakeholder interactions and already presents a significant constraint on airport expansion in some cases. As mentioned, Henri Coanda Bucharest International Airport Authority stressed, in particular, its major rôle in creating a clear direction for wider environmental protection, with a legal emphasis placed on airports, putting them in a special position, considering the relative actual impacts generated by airlines, under the control of ATC.

Through this Study, numerous channels and processes have emerged through which community pressure may be felt by pilots and controllers. These may be effected at both the macro level, for example through the airport authority and the media acting as focal points and catalysts for communications with the public, and also at the micro level, through staff liaison between the ATM community and the airport authority, and through publicly high-profile initiatives, such as emissions reductions, which may bring the passenger and pilot contexts closer together.
Figure 3 - Earlier illustration of interactions between stakeholders
Figure 4 - Revised illustration of interactions between stakeholders

- Pressure groups
- Public
- Media
- ATM service delivery
- Controllers
- FMP/planning
- ATC managers
- Local government
- Airport authority
- Airlines
- Dispatch
- Pilots
- Airline managers
- ANSPs
- Regulators
- Infrastructure
- Eurocontrol

'Society'

Attitudes to Societal Demands in ATM Operations - Introduction of CDA trials at Manchester, Bucharest & Stockholm

EEC Note No. 08/07
5.4. FOOTNOTE ON STATISTICAL COMPARISONS

In Section 2.2.2 we noted that responses illustrated in tables 2.3 and 2.4 could be compared by allocating an interval scale from 1 (disagree strongly) to 5 (agree strongly) to the responses. We also noted that whilst it was unwise to invest too much meaning in the absolute, mean values obtained (e.g. 4.2 compared to 4.1), it was informative to compare the relative heights of the bars in these tables, and although the sample sizes obtained did not strictly allow a statistical analysis of the results, independent t-tests were used as an indicative tool. This approach was not justifiable with either the Bucharest or Stockholm data, due to the lower sample sizes, where the standard deviations and relative heights of the bars should be treated more as a qualitative aid to the interpretation of the results. (Relatively higher standard errors of the means associated with responses from the Bucharest pilots were discussed in Section 1.2, where this was not judged to represent any problem).

Although the remit of this Study was to offer only qualitative analyses of the results, this method of presentation also showed what type of analysis could more formally be possible with slightly larger sample sizes.
TECHNICAL ANNEXES
Technical Annex 1: Questionnaire for Manchester CDA Trials

The questionnaire used at Manchester is shown on the following pages.

Please note that page numbers referred to in the text of the questionnaire were correct in the actual version used, but have been overwritten on incorporation into this Annex, otherwise duplicate numbers will appear (e.g. two page “1”s – one at the start of this Report, and another at the start of the questionnaire).

Some spaces for responses are shorter here, and some responses broken slightly differently (e.g. “dis-agree” c.f. “disagree”) due to the font and margin settings of this Report.
Questionnaire for Manchester CDA Trials

University of Westminster

Harmonised version: for completion by pilots or controllers

Thank you for agreeing to take part in this survey. The University of Westminster is working on a study commissioned by the EUROCONTROL Experimental Centre, which aims to understand what factors affect the way ATM change is brought about. The objective is not to assess CDAs at Manchester, per se, but to explore the process of change.

This questionnaire is designed to be used either as a fully self-completion form, or with Section B administered by an interviewer from the University of Westminster.

The reference number on each page is only so that we know the provenance of the questionnaire, e.g. who carried out the interview (if an interviewer was used) and to match up Section A and Section B (when separated by the interviewer).

By default, your response is confidential and anonymous

The survey is being carried out in accordance with the Code of Conduct of the Market Research Society. Where interviewee names are recorded (off the questionnaire) by University of Westminster interviewers, it is only to prevent the same respondent from being asked for an interview twice. Individuals' names will not be quoted in reporting.

Kindly note that we are necessarily working with relatively small sample sizes for this Study, so each response, and its completeness, is of particular importance to us. All answers and comments will be studied with utmost care and consideration, and used to inform the wider reporting for this international Study.

If self-completion: Please start the questionnaire on page 7!

Please return in Freepost envelope provided, kindly by Friday 18 March

Thank you very much indeed
Section A

If you are completing the whole questionnaire as a self-completion questionnaire, please complete Section B first (which begins on page 7), then return to this section.

If you were interviewed by a University of Westminster interviewer for Section B, please complete Section A now and return it to us in the Freepost envelope provided.

A01. Please could you outline any relevant context in which the CDA trials at Manchester were introduced, for example any other changes taking place at around the same time, such as in management structure, working hours, or other company plans, which may have made the CDA trial either more or less important in such a context?

A02. Regarding the CDA trial, do you feel there was sufficient consultation (including you) before its introduction? If not, what were the shortcomings of such consultation?

A03. During approach, is a CDA usually:

- specifically requested first by the pilot
- suggested first by the controller
- left as an implicit possibility (e.g. within pilot autonomy, based on descent clearances from ATC)
- Other, please specify:
### A04. Please indicate your levels of agreement, or disagreement, with the following:

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches during night-time operations at Manchester…</th>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>disagree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Of no strong interest to me one way or another</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Something I’d avoid if I had a free choice</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not my responsibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A serious contribution to positive change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little difference if infringements now and then</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OK as a step towards something better</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be extended to day-time operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would recommend the way we do it at Manchester, to a similar airport</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### A05. Concerning the night-time approaches at Manchester which are expected to be continuous descents, in cases where these are not achieved, what would you say are the most common reasons for not making a CDA?

### A06. Do you feel that the night-time CDAs are strongly endorsed by your managers, or that it is not of special consequence whether they are generally achieved or not?

### A07. How would you describe your personal concern for the potential of noise complaints being generated by the public in the event of night-time CDAs generally not being used?

- seriously concerned
- somewhat concerned
- not particularly concerned
- not at all concerned
**A08.** Please indicate your levels of agreement, or disagreement, with the following:

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches during night-time operations at Manchester…</th>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>disagree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>… benefits people living under approach paths</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>… benefits the airlines</td>
<td>☐</td>
<td>☐</td>
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<td>… benefits the airport</td>
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<td>… significantly increases pilot workload</td>
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<td>… significantly increases controller workload</td>
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<td>… limits capacity</td>
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<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>… is less safe than stepped approach during low vis</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>… is too time consuming</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**A09.** Has your attitude towards CDAs changed at all as you have gained more experience? Would you say you have become more or less supportive, or no change, since the earlier days of the trial? Why?

**A10.** As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Manchester?
A11. Are you aware of any quantifiable benefits which have resulted from CDAs at Manchester – e.g. fuel savings, reduced complaints about noise from the public?

A12. How would you assess the feedback / monitoring process within your company, e.g. to inform you of progress and allow you to offer your views on the CDA implementation and ways in which it might be improved? Is such a process: in place, adequate, fair, acted upon?

Please use the box below for any other comments or questions you may have. Kindly remember that if you wish us to respond to any questions, we will need your contact details in the box on the next page.

Sharing the results of our Study with you

A13. This Study will be looking at other CDA trials in Europe, and rather broader types of change in ATM. We would like to return to Manchester to offer a brief presentation of some of the key findings resulting from the Study. Which of the following best describes your reaction to such a feedback session:

- I would probably not have time to attend
- I would prefer a focus on CDA trials at Manchester
- I would prefer a focus on CDA trials at Manchester and elsewhere in Europe
- I would prefer a broader presentation on ATM change in general
- No particular views / preference

Please tick one option only
For questionnaire tracking purposes ONLY, we already know your airline’s identity or the controller shift you were working when interviewed, but even this information will NOT be used in any way to identify your responses. However, should you wish to identify yourself such that we can contact you for any brief points of elaboration, or because you have asked a question you wish to be answered, please enter your contact details in the box below:

Your response remains completely anonymous, whether you complete this box or not

Interviewee contact details (IF wish to offer)
Please underline any preferred method of contact (e.g. e-mail address)

End of Section A

Please return the questionnaire in the Freepost envelope provided, kindly by Friday 18 March.

On behalf of the EUROCONTROL Experimental Centre
and the University of Westminster,
sincere thanks for your invaluable cooperation.

Please direct any questions or enquiries in the first instance to:

Dr Andrew Cook, at the University of Westminster:
+44 (0)20 7911 5801 (direct line)
or by e-mail, to: airspace-research@westminster.ac.uk
Section B

Either asked by interviewer, or: Self-completion (please write in your responses)

B01. From whom did you first hear about the introduction of CDAs at Manchester, and what was your initial reaction to it? For what reasons was it introduced?

B02. What do you now see as the advantages of continuous descent approaches (if any)?

B03. … and the disadvantages (if any)?
B04. Who benefits the most from continuous descent approaches (if anybody)? Who suffers any disbenefits?

B05. When deciding on a case-by-case basis whether to try for a CDA, how would you summarise the key factors you are trading-off, e.g. your workload versus what?

B06. In what ways could the CDA procedures at Manchester be improved, e.g. from the perspective of your workload / your ability to achieve CDAs?
B07. Please could you outline the extent to which you feel personally that the public response to aircraft noise affects your day-to-day decision making when it comes to trying to achieve continuous descent approaches?

B08. In what ways do you consider your job, as regards approaches at Manchester, is more difficult compared to approaches at some other European airports, where there are no / very few people living under the approach path of inbound aircraft?

**End of Section B**

*Self-completion interviews*: please now return to Section A, on page 2.

For interviews conducted by University of Westminster staff: remove Section B, and give Section A to interviewee to return using Freepost envelope. Give opportunity for free comments now, and remind also of opportunity in Section A.

* please see note at start of Technical Annex 1
Technical Annex 2: Questionnaire for Bucharest CDA Trials
University of Westminster Questionnaire for Bucharest CDA Trials

De completat de catre pilotii sau controlorii de trafic, numai daca au efectuat procedura CDA la Bucuresti

Thank you in anticipation of your help with this survey. The University of Westminster (London) is working on a study commissioned by the EUROCONTROL Experimental Centre, which aims to understand what factors affect the way ATM change is brought about. The objective of this survey is not primarily to assess CDAs at Bucharest, but more to explore the process of change, of introducing the CDAs.

This questionnaire is designed to be used either as a fully self-completion form, or administered by an interviewer from the University of Westminster.

Raspunsul dumneavoastra este confidential si anonim

The survey is being carried out in accordance with the Code of Conduct of the UK’s Market Research Society. Individuals’ names will not be quoted in reporting.

Please return in the stamped envelope provided, kindly by:

vineri 07 aprilie 2006

If you do not have experience of a CDA at Bucharest, please tick this box and return this questionnaire blank, anyway, so we can keep track of our questionnaires.

If you received this questionnaire, although you had already been interviewed by an interviewer from London, please tick this box and return the questionnaire blank, anyway, so we can keep track of our questionnaires.

Va multumim foarte mult pentru amabilitate
Q01. Please could you outline any relevant context in which the CDA trials at Bucharest were introduced, for example any other changes taking place at around the same time, such as in management structure, working hours, or other company plans, which may have made the CDA trial either more or less important in such a context?

Q02. From whom did you first hear about the introduction of CDAs at Bucharest, and what was your initial reaction to this? For what reasons was this introduced?

Q03. What do you now see as the advantages and disadvantages of continuous descent approaches at Bucharest? Who might benefit and who might be worse off?

Q04. When deciding on a flight-by-flight basis whether to try for a CDA, what are the key factors you are considering, about whether to try for a CDA or not?
Q05. Please could you outline the extent to which you feel personally that the public response to aircraft noise affects your day-to-day decision making when it comes to trying to achieve continuous descent approaches?

Q06. Concerning approaches at Bucharest which are expected to be continuous descents, in cases where these are not achieved, what would you say are the most common reasons for not making a CDA?

Q07. Do you feel that CDAs are strongly endorsed by your managers, or that it is not of special consequence whether they are generally achieved or not?

Q08. Who is responsible for controlling the amount of aircraft noise/pollution at Bucharest?
Q09. Are you aware of any quantifiable benefits which have resulted from CDAs at Bucharest – e.g. fuel savings, reduced complaints about noise from the public?

Q10. As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Bucharest? In what ways could the CDA procedures at Bucharest be improved (if any)?

Q11. Has your attitude towards CDAs changed at all as you have gained more experience? Would you say you have become more or less supportive, or no change, since the earlier days of the trial?

   More supportive ☐
   No / little change ☐
   Less supportive ☐

If any change – why?

Q12. Regarding the CDA trial, do you feel there was sufficient consultation (including you) before its introduction?

Q12a. Please tick one option only:

   I was included in consultation ☐
   I was not included in consultation ☐

Q12b. Please tick one option only:

   I wanted to be included ☐
   I did not feel a need to be included ☐
Q13. How would you assess the feedback / monitoring process within your company, e.g. to inform you of progress and allow you to offer your views on the CDA implementation and ways in which it might be improved? Was such a process: in place, adequate, fair, acted upon?

There was no feedback process
There was a feedback process, but it did not work as I wanted
The feedback process worked as I wanted
I did not want/need any feedback process
I don’t know if there was a feedback process

Please tick as many as apply

Any other comments about feedback / monitoring …

Q14. Please indicate your levels of agreement, or disagreement, with the following:

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches at Bucharest…</th>
<th>agree</th>
<th>agree nor disagree</th>
<th>disagree</th>
<th>disagree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Of no strong interest to me one way or another</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Something I’d avoid if I had a free choice</td>
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<tr>
<td>Not my responsibility</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>A serious contribution to positive change</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little difference if some CDAs are not achieved</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>OK as a step towards something better</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Reduces flexibility too much, due to increased procedural standardisation</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I would recommend the way we do it at Bucharest, to a similar airport</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q15. Concerning approaches at Bucharest which are expected to be continuous descents, during approach, is/was a CDA usually:

- specifically requested first by the pilot ☐
- suggested first by the controller ☐
- left as an ‘open’ possibility (e.g. within pilot’s choice, unless ATC instructs otherwise) ☐

Other, please specify: ______________________________________________________

Q16. Please indicate your levels of agreement, or disagreement, with the following:

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches at Bucharest…</th>
<th>agree strongly</th>
<th>agree nor disagree</th>
<th>disagree</th>
<th>disagree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>… benefits people living under approach paths</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>… benefits TAROM</td>
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<tr>
<td>… benefits ROMATSA</td>
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<tr>
<td>… benefits the airport</td>
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<tr>
<td>… increases passenger comfort</td>
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<tr>
<td>… significantly increases pilot workload</td>
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<tr>
<td>… significantly increases controller workload</td>
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<tr>
<td>… limits capacity</td>
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<tr>
<td>… is less safe than stepped approach during LVP*</td>
<td>☐</td>
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<td>☐</td>
</tr>
<tr>
<td>… is too time consuming</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
</tr>
</tbody>
</table>

* Low Visibility Procedures

Q17. How would you describe your personal concern about the possibility of noise complaints from the public, if CDAs were generally not being used?

- seriously concerned ☐
- somewhat concerned ☐
- not particularly concerned ☐
- not at all concerned ☐
Sharing the results of our Study with you

Q18. This Study will be looking at other CDA trials in Europe, and rather broader types of change in ATM. We would like to return to Bucharest to offer a brief presentation of some of the key findings resulting from the Study. Which of the following best describes your reaction to such a feedback session:

- I would probably not have time to attend
- I would prefer a focus on CDA trials at Bucharest
- I would prefer a focus on CDA trials at Bucharest and elsewhere in Europe
- I would prefer a broader presentation on ATM change in general
- No particular views / preference

Please tick one option only

Please add any further comments, or questions, in this box

If you do ask a question, please tell us how to contact you, as this questionnaire will be anonymous

Please now return the questionnaire in the stamped envelope provided, kindly by:

**vineri 07 abrilie 2006**

On behalf of the EUROCONTROL Experimental Centre
and the University of Westminster:

*va sant foarte recunoscator pentru timpul acordat.*

Please direct any questions or enquiries in the first instance to:

Dr Andrew Cook, at the University of Westminster:

+44 (0)20 7911 5801 (direct line)  airspace-research@westminster.ac.uk
Technical Annex 3: Questionnaire for Stockholm CDA Trials
University of Westminster Questionnaire for Arlanda CDA Trials

Frågorna besvaras endast av piloter och flygledare som har erfarenhet av CDA på Arlanda flygplats.

Thank you in anticipation of your help with this survey. The University of Westminster (London) is working on a study commissioned by the EUROCONTROL Experimental Centre, which aims to understand what factors affect the way ATM change is brought about. The objective of this survey is not primarily to assess CDAs at Arlanda, but more to explore the process of change, of introducing the CDAs.

This questionnaire is designed to be used either as a fully self-completion form, or administered by an interviewer from the University of Westminster.

Ditt svar behandlas konfidentiellt och anonymt

The survey is being carried out in accordance with the Code of Conduct of the UK’s Market Research Society. Individuals’ names will not be quoted in reporting.

Please return in the stamped envelope provided, kindly by:

måndag 04 december 2006

If you do not have experience of a CDA at Arlanda, please tick this box and return this questionnaire blank, anyway, so we can keep track of our questionnaires

If you received this questionnaire, although you had already been interviewed by an interviewer from London, please tick this box and return the questionnaire blank, anyway, so we can keep track of our questionnaires

Tack så mycket för din medverkan
Q01. Please could you outline any relevant context in which the CDA trials at Arlanda were introduced, for example any other changes taking place at around the same time, such as in management structure, working hours, or other company plans, which may have made the CDA trial either more or less important in such a context?

Q02. From whom did you first hear about the introduction of CDAs at Arlanda, and what was your initial reaction to this? For what reasons was this introduced?

Q03. What do you now see as the advantages and disadvantages of continuous descent approaches at Arlanda? Who might benefit and who might be worse off?

Q04. When deciding on a flight-by-flight basis whether to try for a CDA, what are the key factors you are considering, about whether to try for a CDA or not?
Q05. Please could you outline the extent to which you feel personally that the public response to aircraft noise affects your day-to-day decision making when it comes to trying to achieve continuous descent approaches?

Q06. Concerning approaches at Arlanda which are expected to be continuous descents, in cases where these are not achieved, what would you say are the most common reasons for not making a CDA?

Q07. Do you feel that CDAs are strongly endorsed by your managers, or that it is not of special consequence whether they are generally achieved or not?

Q08. Who is responsible for controlling the amount of aircraft noise/pollution at Arlanda?
Q09. Are you aware of any quantifiable benefits which have resulted from CDAs at Arlanda – e.g. fuel savings, reduced complaints about noise from the public?

Q10. As you probably know, other airports in Europe are considering CDAs. What key recommendations would you make to other airports relating to the way CDAs are introduced, drawing on your personal experience at Arlanda? In what ways could the CDA procedures at Arlanda be improved (if any)?

Q11. Has your attitude towards CDAs changed at all as you have gained more experience? Would you say you have become more or less supportive, or no change, since the earlier days of the trial?

- More supportive
- No / little change
- Less supportive

If any change – why?

Q12. Regarding the CDA trial, do you feel there was sufficient consultation (including you) before its introduction?

Q12a. Please tick one option only:

- I was included in consultation
- I was not included in consultation

Q12b. Please tick one option only:

- I wanted to be included
- I did not feel a need to be included
Q13. How would you assess the feedback / monitoring process within your company, e.g. to inform you of progress and allow you to offer your views on the CDA implementation and ways in which it might be improved? Was such a process: in place, adequate, fair, acted upon?

<table>
<thead>
<tr>
<th>Feedback Process Assessment</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>There was no feedback process</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>There was a feedback process, but it did not work as I wanted</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>The feedback process worked as I wanted</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>I did not want/need any feedback process</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>I don’t know if there was a feedback process</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

*Please tick as many as apply*

*Any other comments about feedback / monitoring …*

---

Q14. Please indicate your levels of agreement, or disagreement, with the following:

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches at Arlanda…</th>
<th>agree strongly</th>
<th>agree nor disagree</th>
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<tbody>
<tr>
<td>Of no strong interest to me one way or another</td>
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<tr>
<td>Something I’d avoid if I had a free choice</td>
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<td>I would recommend the way we do it at Arlanda, to a similar airport</td>
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</table>
Q15. Concerning approaches at Arlanda which are expected to be continuous descents, during approach, is/was a CDA usually:

- specifically requested first by the pilot  ☐
- suggested first by the controller  ☐
- left as an ‘open’ possibility (e.g. within pilot’s choice, unless ATC instructs otherwise)  ☐
- Other, please specify: ______________________________________________

Q16. Please indicate your levels of agreement, or disagreement, with the following:

<table>
<thead>
<tr>
<th>Achieving continuous descent approaches at Arlanda…</th>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
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<tbody>
<tr>
<td>… benefits people living under approach paths</td>
<td>☐</td>
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<tr>
<td>… benefits SAS</td>
<td>☐</td>
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<tr>
<td>… benefits LFV/ATCC Stockholm</td>
<td>☐</td>
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</tr>
<tr>
<td>… benefits LFV/Stockholm-Arlanda airport</td>
<td>☐</td>
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<tr>
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</tr>
<tr>
<td>… significantly increases pilot workload</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
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<td>☐</td>
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<tr>
<td>… limits capacity</td>
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* Low Visibility Procedures

Q17. How would you describe your personal concern about the possibility of noise complaints from the public, if CDAs were generally not being used?

- seriously concerned  ☐
- somewhat concerned  ☐
- not particularly concerned  ☐
- not at all concerned  ☐
Sharing the results of our Study with you

Q18. This Study will be looking at other CDA trials in Europe, and rather broader types of change in ATM. We would like to return to Arlanda to offer a brief presentation of some of the key findings resulting from the Study. Which of the following best describes your reaction to such a feedback session:

- I would probably not have time to attend
- I would prefer a focus on CDA trials at Arlanda
- I would prefer a focus on CDA trials at Arlanda and elsewhere in Europe
- I would prefer a broader presentation on ATM change in general
- No particular views / preference

Please tick one option only

Please add any further comments, or questions, in this box

If you do ask a question, please tell us how to contact you, as this questionnaire will be anonymous

Please now return the questionnaire in the stamped envelope provided, kindly by:

**måndag 04 december 2006**

On behalf of the EUROCONTROL Experimental Centre
and the University of Westminster:

tack så mycket för din medverkan

Please direct any questions or enquiries in the first instance to:

Dr Andrew Cook, at the University of Westminster:
+44 (0)20 7911 5801 (direct line)   airspace-research@westminster.ac.uk
**Technical Annex 4: ATC Glossary**

**underlined terms** = distinct controller(s)

| **AAC** [twr] | Air Arrivals Controller = looks after last part of “final approach”, i.e. a/c already on ILS and not intending to adjust direction. No further instructions to be passed from Final Director, so hand-off to AAC frees up the FD’s frequencies. AAC is a visual (not radar) function, and not classified as part of approach control. Gives final clearance to land. Hand-off → GMC. 
[Note. When volumes are low at LHR, AAC and ADC rôles combine to single rôle: “Air Controller”] |
| **ADC** [twr] | Air Departures Controller contacted as (runway) holding point approached, gives clearance to: enter active runway, line-up and take-off (hand-off → TMA controller [for LHR, will clear through London Terminal Control Area]). Normally hand-off occurs before reach departure fix. May actually pull off SID and give more direct vector. At FRA, a/c may be vector directly to departure fix, w/o following SID. |
| **AIC** | Aeronautical Information Circular: official update to AIP, and usually incorporated into next edition of AIP [See also TOI and SI] |
| **APC** (‘approach’) | Approach Control - from reporting at Initial Approach Fix / arrival fix. This is start of “initial approach” (some texts refer to as “intermediate approach”). Complexity determined by configuration of airport and traffic volume (see also “straight-in”) 
At LHR, approach vectoring by:  
- Intermediate Director North (Lambourne & Bovingdon) [has executive control over ID South] 
- Intermediate Director South (Ockham & Biggin) release from hold (usu. at MSL) and give initial descent clearance, producing 2 crude flows (hand-off → Final Director) 
Final Director combines into 1 flow and turns onto ILS (hand-off → AAC) When quieter, ID may vector onto ILS. 
At MAN, Approach Radar Control from 3 x stacks onto ILS (hand-off → Aerodrome Controller) |
| **arrival fix** | = Initial Approach Fix |
| **arrivals** | = AAC 
(officially, arrivals = final part of approach procedures, although may be handled by controllers at a different location) |
| **base leg** | leg which follows downwind leg, usually at (appx.) 90º to it. See also base turn. |
| **base turn** | turn from downwind leg, onto base leg (note, however, that term ‘base turn’ is rarely used). The full sequence is as follows: downwind leg – base turn – base leg - 40º leg – final turn (‘turn on’) – establish on ILS |
| **clean configuration** | aircraft with zero-flap and gear up. Unless speed restricted, a/c can reach ILS from MSL whilst retaining a completely clean configuration, be that a stepped descent or CDA. |
### Delivery

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMP</td>
<td>Ground Movement Planner will give start-up approval and SID (NB at LHR may actually be given SID during taxi-out) but not pushback clearance (hand off GMC)</td>
</tr>
</tbody>
</table>

### Departure Fix

Term not commonly used, but is reporting point at end of SID. Under control of ADC (but hand-off usually before end of SID).

### Departure Radar

= APC [or APR (Approach Radar)]

### Departures

= ADC

### Direct (s)

= direct track(s). See RNAV.

### 'Dive and Drive'

e.g. when leaving MSL, ATC might clear a/c down to 3000ft to intercept ILS. Pilot could decide to attempt B-CDA, or at any point to ‘dive and drive’ straight down to 3000ft. A minimum rate of descent is specified in AIP but not always adhered to, unless ATC gave specific instruction such as ‘descend to 3000 feet, leave 70 now’. (Note ‘mixed’ reference to Flight Level 70 and 3000 feet – see ‘transition altitude’.)

### DME

Distance Measuring Equipment (see also under ILS and VOR). Only gives straight line distances (i.e. from it to aircraft) so not (usually) of any use calculating remaining track distances during approach vectoring.

### En-Route Holding

does not appear to be a well-defined term, e.g. “en-route holding” used in UK AIP to label racetrack holds in intermediate part of STARs, although these can also just be labelled as “holding”. May also be used to describe reducing airborne speed as a means of managing capacity, e.g. occurs in France for inbound CDG, and more strictly “en-route” (e.g. over Wales for inbound LHR/LGW (from North America), by ‘flying between beacons’, i.e. instructed to go back to previous beacon – could be ‘called on’ at any time by ATC. (NB holding configuration in a STAR may also happen to have two beacons in it, but usually fixed from just one). For racetrack holds, hold is usually (but not always) left at lowest level, i.e. descent clearance usually given from MSL. See also “holding”.

### Final Approach

('finals' / 'in the slot')

When a/c established on ILS. A/c is lined-up and is not intending to adjust direction. Could be 15-20NM out if a/c on a straight-in approach.

### GMC

[tor]

Ground Movement Controller looks after arriving a/c mvts once a/c clear of active runway, to stand, and then from pushback clearance to holding point for departures (hand-off ADC)

### GMP

[tor]

Ground Movement Planner will give start-up approval and SID (NB at LHR may actually be given SID during taxi-out) but not pushback clearance (hand off GMC)

### Ground

= GMC

### Holding

Arrival management. Usually some form of extended approach (e.g. ‘trombones’ at FRA); less commonly, stacks are used (e.g. at LHR). See also “en-route holding”.

---

EEC Note No. 08/07 135
<table>
<thead>
<tr>
<th><strong>ILS</strong></th>
<th>= ground-based beacons giving two radio transmissions:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- the ‘localizer’ = indicates centre-line of runway</td>
</tr>
<tr>
<td></td>
<td>- the ‘glide path’ = beam angled at 3° to indicate correct angle of approach</td>
</tr>
<tr>
<td></td>
<td>a/c ‘lock’ or ‘establish’ on ILS from last vector, which lines them up with ILS. For LHR, AIP AD-2-EGLL-8-1 notes that “ranging information is provided by ILS-dedicated DME facilities”. If ILS fails, a surveillance radar approach may be provided by approach control, i.e. vectoring to mimic function of ILS, until cloud broken, then a visual approach is completed. A/c are usually established on the ILS at around 3000ft, but sometimes this will be further out (and higher), sometimes closer in (and lower). N.B: CDA finishes at the point where the a/c is established on the ILS</td>
</tr>
</tbody>
</table>

| **Initial Approach Fix (IAF)** | reporting point at end of STAR (generally in UK, but not referred to as such at LHR). Under control of approach. Initial approach starts from here |

| **MSL** | Minimum Stack Level (e.g. for four LHR holds, at end of STARs, usually FL70 or FL80, depending on QNH) |

| **Own navigation** | a/c is said to be on “own navigation” when it is following chart headings between navigation beacons, or following a SID or STAR. See also “radar heading”. |

| **Path stretching** | occurs during radar vectoring, e.g. between the IAF and the ILS. ATC may ‘widen out’ or ‘tighten up’ a heading (e.g. from 270° to 280°) and/or instruct an a/c to fly a longer track (e.g. an extended downwind leg), in order to avoid sequencing two a/c onto the ILS without the required separation. May be changed dynamically according to changes in wind and a/c responses to ATC instruction. When path stretching, ATC should ideally revise the track miles estimate to the pilot. |

| **Planning** | = GMP |

| **QNH** | sea level atmospheric pressure. See also transition altitude. |

| **Radar heading** | a/c is said to be on “radar heading” when it is being “vectored”, as compared with on “own navigation”. |

| **Reporting point** | these may or may not be ‘compulsory’ reporting points (i.e. a/c must contact APC before reach) depending on particular flight and ATC instructions. Often coincide with VOR. // For LHR arrivals, Lambourne & Bovingdon (to north) plus Ockham & Biggin (to south), are sometimes described as ‘the’ four reporting points all have warnings in AIP not to proceed beyond without reporting to ATC. Note, however, that actually these are the end points of STARs, with other reporting points ‘up-route’ in the STAR (but with no such reporting requirement actually stated on these reporting points, except when they act as alternates for end-points of the STAR). This suggests the term ‘reporting point’ (in UK AIP at least) should not be taken to indicate a compulsory reporting point. See also ‘significant point’. |

| **RNAV** | Area Navigation. For example, an increasing number of a/c are now routeing on direct tracks instead of on the Upper Air Routes in the UIR (UIR in UK from FL245, rest of Europe typically FL245 – FL285, although some exceptions). Often GPS-based and allows a/c to track away from Upper Air Routes (i.e. away from between beacons). Increases capacity, may well save fuel. |
**significant point (almost the same as 'waypoint')**

if represented by a five-letter identifier (e.g. KONAN, FERDI, BUPAL) then it has no associated ground-based navaid – it is just a geographical coordinate. If it has a three-letter identifier (e.g. DVR, KOK, SPI) then there is an associated ground-based navaid (e.g. DME). NB. In UK AIP chart symbology [GEN 2.3] all of these are shown by white triangles, and designated as "reporting point" (the term "significant point" is not used). See also "reporting point".

| stack swapping | e.g. when primary stack at LAM is full, to send a/c to BIG. Secondary option is to use holding further back in the STARs. |
| standing agreement | e.g. whereby one sector always hands-off to adjacent sector at a given, pre-agreed flight-level |
| STAR | designator = final reporting point (at LHR, all = holding points) + letter code, e.g. BIG 3B, LAM 3A. Determined by international convention. Groups of STARs terminate (rather than begin) at a given point, e.g. "STARs via BIGNIN" all terminate at BIG VOR. UK AIP states standard routes may be varied at discretion of ATC, and each STAR has "descent planning" instruction, e.g. for BIG 3B = "FL150 by TIGER", for most others = "as directed by ATC". In UK, STARs often start as far out as UK boundary. No special term for start of STAR, and not usually a compulsory reporting point. STARs in UK terminate at IAF, often a co-located VOR and DME. STARs elsewhere in Europe finish at FAF. |
| straight-in | approach may vector a/c "straight-in" if get early enough before arrival fix (occurs rarely at LHR, e.g. very early in morning; more common at MAN). |
| SI | Supplementary Instruction: permanent amendment to Manual of Air Traffic Services (not part of AIP, but subject to it). [See also TOI and AIC] |
| THR | (e.g. in AIP charts) threshold of runway (= near end from perspective of landing direction). Could be an off-set marking on tarmac, i.e. not necessarily the start of the tarmac |
| TOI | Temporary Operating Instruction – temporary amendment to Manual of Air Traffic Services (not part of AIP, but subject to it). [See also SI and AIC] |
| transition altitude | height below which altitude is referenced to QNH. If ATC instructs a descent from above the transition altitude, to below it, the altitude to which the a/c is instructed to descend is always given in feet, and the pilot informed of the QNH setting. Above the transition altitude, flight levels are used, based on standard atmospheric pressure (1013.25 millibar). |
| ‘turn on’ | turn from base leg onto 40º leg - see under base turn |
| vectoring | a/c is ‘vectored’ when following a (series of) heading(s) given by ATC, e.g. when not using a SID / STAR, or when not following chart headings between navigation beacons. Also referred to as a “radar heading”. See also “own navigation”. NB. the UK AIP defines, for example, the “Radar Vectoring Area” for “London Heathrow” [AD 2-EGLL-5-1]. |
| VOR | VHF omnidirectional range – (radio navigation) beacon. Three-letter abbreviation. Note that often VORs and DMEs are combined, as in case of LAM/BNN/OCK/BIG. |
Technical Annex 5: Extract from UK AIP GEN2.3 – Chart Symbols

Initial Approach Fix ................................................................. ✖
Intermediate Fix ................................................................. ✖
Final Approach Fix ................................................................. ✖

VHF Omnidirectional Radio Range ............................................ VOR  ◐
Distance Measuring Equipment .............................................. DME  
Co-located VOR and DME ....................................................... VORDME  ◢
UHF Tactical Air Navigational Aid .......................................... TACAN  ◎
Non-directional Radio Beacon .............................................. NDB and NDB(L)  ◡
Radio Marker Beacon or other Navigational Aid ................... ◢
UK Typical Arrival (Heathrow LHR and Manchester MAN primarily) - standard arrival rather than CDA

Technical Annex 6: Comparison of stepped/standard approach and B-CDA

- **Stacks:**
  - LHR = 4 (min stack level = FL70)
  - MAN = 3 (min stack level = FL60)

- **Nth/Sth Intermediate Directors “INT” (LHR):**
  - Initial streaming of a/c from stacks into preliminary sequence and issues descent clearance (LHR Nth has control over Sth when organising flows) - this is start of initial approach

- **Final Director “FIN” (LHR and MAN):**
  - Accurately sequence a/c (1 flow) onto ILS at optimum speed/spacing for max runway utilisation. Final Director responsible for feeding a/c onto ILS.

- **Appropriate min arrival spacing between a/c achieved by vectoring instructions/speed control

- **ILS:**
  - Ground-based radio guidance system - transmits two directional radio beams: localiser and glide path

- **Localiser aerial at end of runway:**
  - Aligned with centreline - transmits signal which extends >25NM out along approach path defining centreline of runway

- **North/South Support Controllers (LHR only):**
  - Control 2 stacks each (2x North; 2x South) - receive a/c from TMA Controller, and control a/c up to the lowest level in stack - release a/c to Intermediate Directors (ie North Support Controller to North Intermediate Director)

- **LHR Support Controller:**
  - Shares same frequency with Intermediate Director

- **Nth/Sth Approach Radar Controllers (MAN):**
  - Initial streaming of a/c from stacks into preliminary sequence and issues descent clearance (LHR Nth has control over Sth when organising flows) - this is start of initial approach

- **Missed approach if no landing clearance received before 2NM from touchdown (or other range/height agreed with Aerodrome Control):**

- **Air Arrivals Controller (LHR):**
  - Aerodrome Controller (MAN)
  - Visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

- **Visual controller in Tower:**
  - Give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

- **North/South Approach Radar Controllers:**
  - Initial streaming of a/c from stacks into preliminary sequence and issues descent clearance (LHR Nth has control over Sth when organising flows) - this is start of initial approach

- **Final Director “FIN” (LHR and MAN):**
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- **LHR Support Controller:**
  - Shares same frequency with Intermediate Director

- **Nth/Sth Approach Radar Controllers (MAN):**
  - Initial streaming of a/c from stacks into preliminary sequence and issues descent clearance (LHR Nth has control over Sth when organising flows) - this is start of initial approach

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  - Visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

- **Visual controller in Tower:**
  - Give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)
(DIAGRAM NOT TO SCALE)
UK CDA Arrival (Heathrow LHR and Manchester MAN primarily) - CDA arrival

CDA - descend from 6000ft to interception of ILS glideslope without stepping (1NM level segment).

STACKS:
- LHR = 4 (min stack level = FL70)
- MAN = 3 (min stack level = FL60)

STACKS:
- LHR = 4 (min stack level = FL70)
- MAN = 3 (min stack level = FL60)

FINAL DIRECTOR “FIN” (LHR and MAN)
- accurately sequence a/c (1 flow) onto ILS at optimum speed/spacing for max runway utilisation. Final Director responsible for feeding a/c onto ILS.

ILLUS - ground-based radio guidance system - transmits two directional radio beams: localiser and glide path

AERODROME CONTROLLER (MAN)
- visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

AIR ARRIVAL CONTROLLER (LHR)
- Aerodrome Controller
- visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

MISSED APPROACH if no landing clearance received before 2NM from touchdown (or other range/height agreed with Aerodrome Control)

AIR ARRIVAL CONTROLLER (LHR)
- Aerodrome Controller
- visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

NTH/SOUTH INTERMEDIATE DIRECTORS “INT” (LHR)
- initial streaming of a/c from stacks into preliminary sequence and issues descent clearance (LHR Nth has control over Sth when organising flows) - this is start of initial approach

AIR ARRIVAL CONTROLLER (LHR)
- Aerodrome Controller
- visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

AIR ARRIVAL CONTROLLER (LHR)
- Aerodrome Controller
- visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

CDA could start here

20 to 15NM (stack) - CDA usually starts here

10 to 7NM - LHR
14 to 6NM - MAN

4NM (final approach fix - LHR)

Ground Movement Controller (LHR)
- takes over after landing as a/c clears runway - directs a/c to stand

Slightly different at MAN if runway 08R is used for arr - Aerodrome Controller hands over to Dep Controller who hands over to GMC

ILS - ground-based radio guidance system - transmits two directional radio beams: localiser and glide path

initial approach (final director):
- LHR = 2 flows (Nth/Sth) into 1 flow
- MAN = 2 flows into 1 flow (normal)
- ATC continually plan sequence during initial approach

CDA ends at “significant point” of STAR’s name (eg MAN’s “ROSUN” - do not proceed beyond ROSUN without ATC clearance)

North/South Support Controllers (LHR only)
- control 2 stacks each (ie 2xNorth; 2xSouth) - receive a/c from TMA Controller, and control a/c up to the lowest level in stack - release a/c to Intermediate Directors (ie North Support Controller to North Intermediate Director)

NTH/SOUTH INTERMEDIATE DIRECTORS “INT” (LHR)
- initial streaming of a/c from stacks into preliminary sequence and issues descent clearance (LHR Nth has control over Sth when organising flows) - this is start of initial approach

AIR ARRIVAL CONTROLLER (LHR)
- Aerodrome Controller
- visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)

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AIR ARRIVAL CONTROLLER (LHR)
- Aerodrome Controller
- visual controller in Tower - give clearance to land (control immediate vicinity of airport, dep and arr, when busy roles split at LHR)
Attitudes to Societal Demands in ATM Operations - Introduction of CDA trials at Manchester, Bucharest & Stockholm

(DIAGRAM NOT TO SCALE)
Technical Annex 7: ATC Structure for Manchester shifts

NATS Airport Services - Manchester

<table>
<thead>
<tr>
<th>General Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodrome</td>
</tr>
</tbody>
</table>

Separate functions, however focus on Aerodrome at Manchester

Manager Air Traffic Control (Jon Proudlove)

Watch Managers (x5)

5 Watches, ≈10 controllers (approach and tower positions) per watch

“A”
“B”
“C”
“D”
“E”

Training Manager

Operations Manager (anything to do with operations e.g. a Royal Flight; sorts out changes to procedures)

Example of “A” Watch - 10 day cycle for the ≈10 controllers

<table>
<thead>
<tr>
<th>Watch</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A”</td>
<td>M</td>
<td>M</td>
<td>A</td>
<td>A</td>
<td>N</td>
<td>N</td>
<td>S</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>“B”</td>
<td>O</td>
<td>O</td>
<td>M</td>
<td>M</td>
<td>A</td>
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</tr>
</tbody>
</table>

M=morning shift  typically 8 work this shift; with 2 on leave
A=afternoon shift typically 8 work this shift; with 2 on leave
N=night shift  only 4 work this shift; another 4 supplement other shifts (2 work morning; 1 works afternoon; 1 works “day late”); with 2 on leave
S=sleep  i.e. sleep all day to catch up
O=off  i.e. 3 days off at end of cycle
Technical Annex 8: AIP extracts relating to ILS capture

London Heathrow  (Extract from UK AIP AD-2-EGLL-8-1)

Climb to 3000 - straight ahead until passing 1578(1500) or I-AAA DME zero whichever is later, then left onto track 040°M. Continue as directed. RADI0 FAILURE: On passing LON DME 10 proceed to NCB CHT at 3000.

Note small level segment at 2500ft prior to joining ILS, which ends at the Final Approach Fix. Referred to in procedural approach instructions in AIP.
Technical Annex 9: Bucharest TUSET 08R CDA profile

TUSET BCDA
RWY 08 R

TUSET
BAM10 = BAREM - 10 NM
10 NM
BAREM
10 NM
OBELA
RWY 08 R

FL 120
FL 100
(min)
v = 280-240 Kts
v = 250-210 Kts
v = 150 - 110 Kts

10 NM
10 NM
1.5 NM

v = 250-210 Kts

Alt = 2500 ft
V_{max} = 210 KTS

FL_{min} = 4000 ft
FL_{max} = 5000 ft
V_{max} = 230 KTS

FL_{min} = 7500 ft
FL_{max} = 8500 ft
V_{max} = 250 KTS
Technical Annex 10: Stockholm-Arlanda STARs

01L P-RNAV STAR

(from Swedish AIP Supplement: “sup_1_06.pdf”)

AIP SUP 1/2006 Evaluation of basic CDA STARs at Stockholm/Arlanda

http://www.lfv.se/templates/LFV_InfoSida_70_30___2594.aspx

01L/01R STAR

(from Swedish AIP: “ES_AD_2_ESSA_4_7_en.pdf”)

STAR RWY 01L/01R (ESSA-4-7)

http://www.lfv.se/templates/LFV_InfoSida_70_30___37039.aspx
**REMARK**

Note 1: Aircraft to STOCKHOLM/Arlanda shall not be operated at an airspeed of more than 250 kt IAS below FL100 unless otherwise instructed.

Note 2: When established on ILS final approach track, maintain 100 kt IAS or more until passing 90 AGL, unless otherwise instructed. If unable, inform ATC immediately.

Note 3: In case of radio communication failure, see AD 2.22 para 1.3.

Note 4: Pilots are requested to plan their descent so as to perform a continuous descent approach (CDA) from at least FL100.

**Prescribed Coding of P-RNAV STAR for RWY 01 at Stockholm/Arlanda (ESSA)**

<table>
<thead>
<tr>
<th>STAR</th>
<th>Path term</th>
<th>To fix</th>
<th>WPT desc</th>
<th>HDG/ Course</th>
<th>Turn Dir</th>
<th>Best Alts</th>
<th>Speed Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILT/LOL (ILT/LOL)</td>
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<td>ILT/LOL</td>
<td>E</td>
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<td>+FL110</td>
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<tr>
<td>TF</td>
<td>SA101</td>
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<td></td>
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<tr>
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<td>SA30B*</td>
<td>E</td>
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<td>E</td>
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</table>

*Unmarked WPT, due to different coding/naming conventions at navdatabase suppliers.*

**STAR instruction:** EILT/LOL (FL110 or below) - SA101 (FL100 or above) - L1A (FL70 or above) - SA30B (5000 ft or above) - SA30B* - FAP0IL

---

**Prescribed Coding of P-RNAV STAR for RWY 01 at Stockholm/Arlanda (ESSA)**

<table>
<thead>
<tr>
<th>STAR</th>
<th>Path term</th>
<th>To fix</th>
<th>WPT desc</th>
<th>HDG/ Course</th>
<th>Turn Dir</th>
<th>Best Alts</th>
<th>Speed Limits</th>
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<tbody>
<tr>
<td>HAMMAR (HMAR)</td>
<td>DF</td>
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<tr>
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<td>SA65*</td>
<td>E</td>
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*Unmarked WPT, due to different coding/naming conventions at navdatabase suppliers.*

**STAR instruction:** HMAR (FL100 or below) - SA15 (FL100 or above) - SA65 (FL70 or above) - TEB - SA65* - FAP0IL

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**Information:** Swedish Civil Aviation Authority
### Prescribed Coding of CP-ESSA Star for RWY 31 at Stockholm/Arlanda (ESSA)

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**STAR instruction:** TROSA01 (FT/FL150 or below) - SAB07 (FL100 or above) - SAB06 - SAB05 (FL70 or above) - SAB04 (5000 ft or above) - SAB03 - SAB02 - SAB01 (2500 ft or above) - FAP01L

* Unnamed WPT, due to different coding/naming conventions at navdata base suppliers

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**STAR instruction:** XILAN01 (FT/FL150 or below) - SAB01 (FL100 or above) - SAB02 (FL70 or above) - FAP01L

* Unnamed WPT, due to different coding/naming conventions at navdata base suppliers
Technical Annex 11: Manchester Airport complaint procedure

www.manchesterairport.co.uk/noisecomplaints.nsf?openForm

(NB. “Type of Complaint” options: “Noise”; “Off-Track”; “Odour/Air quality”; “Other”)
Technical Annex 12: Stockholm-Arlanda complaint procedure
Attitudes to Societal Demands in ATM Operations - Introduction of CDA trials at Manchester, Bucharest & Stockholm

EEC Note No. 08/07
Any enquiries regarding this Report, and other case study progress, will be welcomed by the Study team. Please ask for Dr Andrew Cook or Graham Tanner at the University of Westminster:

telephone: +44 (0)20 7911 5801 (direct)
e-mail: airspace-research@westminster.ac.uk