NERA
ECONOMIC CONSULTING

Staff Headcount in RP3: A Response to Steer's Analysis

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Project Team

Richard Hern
George Anstey
Michael Dawes

NERA Economic Consulting
Marble Arch House
66 Seymour Street
London, UK W1H 5BT
+44 207 659 8500
www.nera.com

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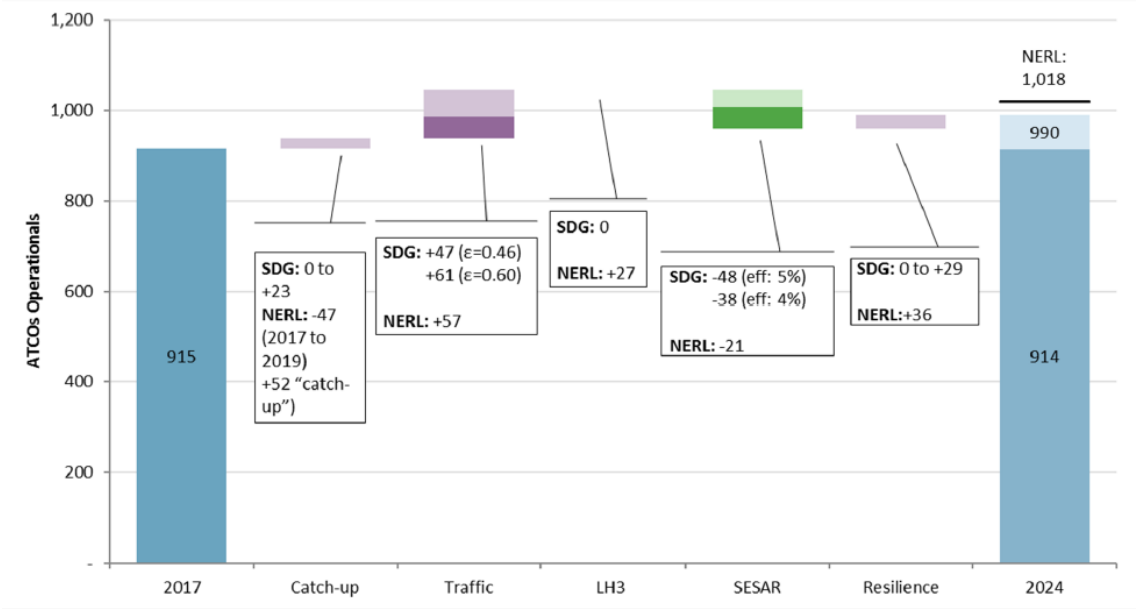
Executive Summary

NERL has commissioned NERA Economic Consulting (NERA) to provide a response to Steer's analysis of NERL's total estimated headcount for Regulatory Period 3 (RP3). In this report, we examine the method used by Steer to derive a new set of estimates for NERL's RP3 headcount. We contrast these new estimates with NERL's original estimates and comment on the suitability of the methods used in order to help inform CAA's assessment of the cost-efficient path for NERL.

NERL and Steer attribute the total estimated change in Air Traffic Controller (ATCO) Full-time equivalent (FTE) headcount to specific factors: traffic growth, catch-up, resilience, the third runway at Heathrow (LH3) and the implementation of the DSESAR capital investment programme. They then aggregate these estimates to forecast the total additional number of ATCO FTEs required in RP3. We summarise this 'bridge' from ATCO FTE headcount towards the end of RP2 to the end of RP3, and the current differences between NERL's and Steer's estimates attributable to each factor, in Figure 1.1 and Table 1.1. NERL estimates an additional 28 to 104 ATCO FTEs will be required in RP3 compared to Steer's estimates.

In addition, Steer estimates the required number of Personal Contract Group (PCG)/Managerial Support Grade (MSG) FTEs and Air Traffic Service Assistants (ATSAs) FTEs for RP3. The differences between NERL and Steer's estimated additional ATSAs and PCG/MSG FTEs is minus 5 to plus 74 and minus 75 to minus 95 respectively. These estimates are based on little or no analysis and Steer does not provide adequate reasoning for its estimates.

Figure 1.1: Headcount bridge exhibiting differences in NERL's and Steer's estimates for total headcount FTE needs in RP3.



Source: NERA Analysis from Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, Figure 6.6.

Table 1.1: Steer's and NERL's estimates of additional headcount requirement in RP3.

	ATCO FTEs						
	Traffic Growth	Catch-up	Resilience	LH3	DSESAR	**Total**	**ATSA FTEs**
NERL	57	52	36	27	-21	**103**	**-46**
Steer	47 to 61	0 to 23	0 to 29	0	-38 to -48	**-1 to 75**	**-41 to -120**

Source: NERA Analysis from Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, Figure 6.6.

Steer's "efficient operator model" for required headcount at NERL is flawed in at least the following respects:

- **Low explanatory power:** Steer's model for forecasting the impact of traffic growth on ATCO headcount only explains 10% of the changes in operating costs and 20% of ATCOs hours in Ops respectively over time. The vast majority of the variation in operating costs and ATCO headcount results from factors which Steer does not explain. Therefore, the model is not sufficiently robust to forecast headcount or costs accurately.
- **Omitted variable bias:** As the low explanatory power of Steer's 'efficient operator model' shows, its approach does not take account of important factors that drive the need for additional staff at NERL. Where these factors are correlated with traffic growth in the sample, their exclusion will tend to understate the responsiveness of headcount to traffic growth. For instance, ATCO headcount is likely to respond to anticipated growth as well as actual growth in traffic and to the changes in the productivity of ATCOs. As a result, Steer's estimated elasticity is unreliable.
- **Double counting productivity improvements:** As a result of omitting important variables from the model and adjusting separately for the impact of DSESAR in its model, Steer double-counts the benefits of productivity improvement. Steer's analysis uses historical headcount data for European ANSPs which reflects the productivity benefits from various investment programmes. Therefore, by including an additional adjustment for DSESAR, Steer's ATCO headcount is understated because it counts the impact of technological progress and change twice: once in a depressed estimate of traffic elasticity and once separately based on its own assessment of the impact of DSESAR for NERL over RP3. Steer should make a smaller adjustment to headcount for DSESAR; its estimate should reflect only the incremental benefit of DSESAR relative to the historical trend in technological progress achieved by European ANSPs.
- **Flawed choice of base year:** Steer's approach of selecting 2017 as the base year for its analysis is not justified. 2017 was not a representative year because there were no material technology or airspace transitions (unlike RP3 when 7 major transitions are planned). Also, the selection of this base year, in which our performance was better than target, does not take variability in our annual service performance into account. In some neighbouring years with similar headcount, performance was worse than target. Therefore, Steer's approach underestimates the extent of resources required for 'catch-up' and resilience, to handle increased traffic and deliver the high-quality service customers require.
- **Material limitations in model philosophy**: Steer's simple model makes a series of unrealistic assumptions that render its conclusions unreliable. We highlight a number of limitations to the model, including: an assumption that the relationship between traffic

and headcount is linear, when in reality it is likely to be stepped; an inability to reflect the replacement of experienced ATCOs with multiple validations with new ATCOs with less experience; no effective adjustments for the higher service quality that NERL provides than comparator ANSPs; the use of changes in independent variables rather than absolute values, leading to a failure to account for the starting levels of each ANSP; and an inability to reflect training lead times.

- **Flawed choice of comparators for MSG/PCG staff:** Due to a lack of information about Steer's approach, we were unable to appraise its method for calculating the elasticity of MSG/PCG staff econometrically. However, even if Steer's method were sensible in principle, it would not be valid to compare elasticity from airports and ANSPs. Such a comparison would require unrealistic assumptions to hold, such as identical trade-offs between capital and labour. Given capacity constraints at airports and the differing proportions of fixed assets and labour used in delivering airport services this is unlikely. As a result, Steer's model is likely to underestimate the number of MSG/PCG staff required.

We have developed improved alternative econometric models which are better able to explain the variation in headcount than Steer's models. However, these models are necessarily limited, top-down exercises which, whilst an improvement on Steer's models, cannot accurately reflect required headcount at NERL.

In addition to flaws undermining each of Steer's estimates of the causes of headcount change set out in Figure 1.1, Steer's 'efficient operator model' relies on assumptions that are mutually-inconsistent. Steer applies separate methods to each of the drivers to derive a headcount estimate. This does not take account of the complexity of NERL's operation or the interdependencies between factors driving headcount changes (traffic growth, resilience, catch-up, DSESAR and LH3) or staff categories. NERL's management expertise provides more accurate estimates of headcount because it takes account of the interrelatedness of these factors , staff categories and the complexity of its business to develop a consistent and deliverable plan. As a result, Steer understates the estimated total headcount requirement for NERL in RP3.

1. Introduction

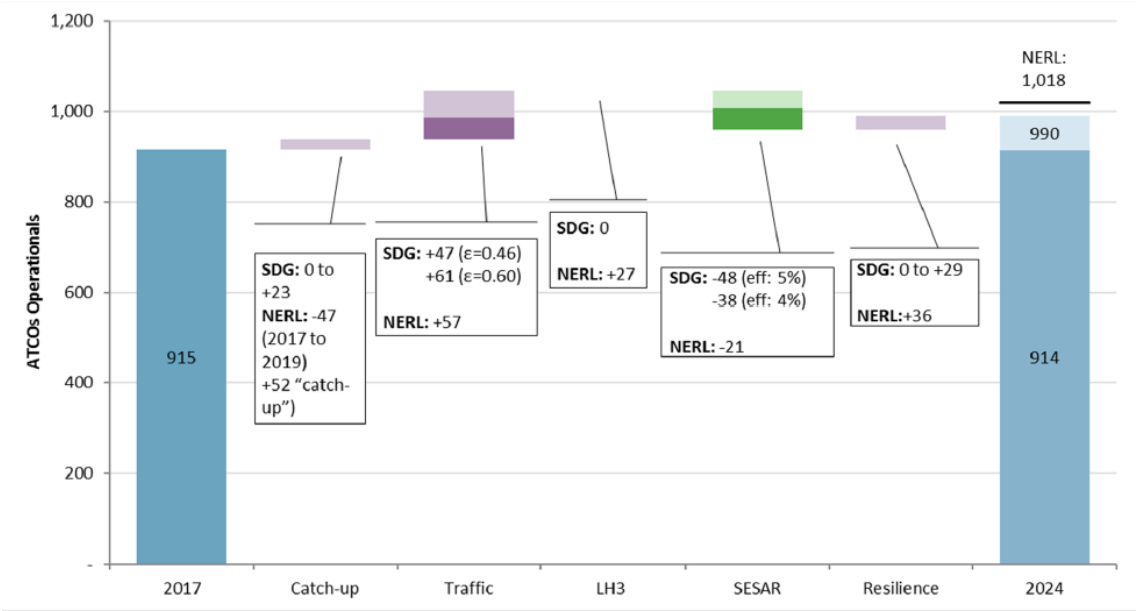
NERL has commissioned NERA Economic Consulting (NERA) to provide a response to Steer's analysis of NERL's total estimated headcount for Regulatory Period 3 (RP3) which runs from 2020 to 2024 (inclusively). We comment on Steer's analysis and the robustness of its methods in order to help inform CAA's assessment of the cost-efficient path for NERL.

NERL outlines its estimated total headcount of personnel in air traffic management in its proposed RP3 business plan.[1] NERL expanded upon its methodology to reach these estimates in its 'RP3 manpower planning workshop' in August 2018, attended by both Steer and CAA.[2]

Steer provides a response to NERL's business plan in which it aimed to "define an overall cost efficiency path for NERL"[3]. A component of this 'cost efficient path' is the estimated total headcount for RP3.

To estimate Air Traffic Controller (ATCO) FTE headcount, Steer follows NERL and decomposes this total estimated change to changes attributable to certain factors: traffic growth, catch-up, resilience, the third runway at Heathrow (LH3) and the implementation of the DSESAR capital investment programme. The resulting difference in Steer's and NERL's estimates are summarised in the headcount bridge in Figure 1.1.

Figure 1.1: Headcount bridge exhibiting differences in NERL's and Steer's estimates for total headcount FTE needs in RP3.



Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, Figure 6.6.

In this report, we examine the changes in estimated total FTE headcount resulting from each of these factors. We comment on the methodologies used by both Steer and NERL in

1 NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024.

2 NATS (En Route) plc (August 2018), RP3 manpower planning workshop.

3 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.ii.

forming their estimates. We also provide brief comments on the estimated FTE headcount for Air Traffic Control Engineers (ATCEs), Air Traffic Service Assistants (ATSAs) and Personal Contract Group (PCG)/Managerial Support Grade (MSG) staff categories.

We examine each of the factors listed above in turn,

- **Traffic growth:** In Section 2 we examine estimated changes in ATCO headcount due to traffic growth. Steer and NERL reach comparable estimates for the additional number of ATCOs required to manage traffic growth. Steer uses an econometric model to estimate historical elasticities, in other words responsiveness, of ATCO numbers and operating costs to traffic volumes. NERL relies on management expertise and the Position Staffing Schedule (PSS) to estimate the headcount required to manage this increase in traffic.

  Steer's analysis uses historical headcount data for European ANSPs which reflects the productivity benefits from various capital investment programmes. Therefore, by including an additional adjustment for DSESAR, Steer's ATCO FTE headcount is understated since it double counts the impact of technological progress and change. Steer should make a smaller adjustment to headcount for DSESAR or a higher one for traffic growth: Its estimate should reflect only the incremental benefit of DSESAR relative to the historical trend in technological progress across European ANSPs.

- **Catch-up:** In Section 3 we examine estimated changes in ATCO headcount due to catch-up. NERL estimates that it will need to catch-up its current deficit of ATCOs from the levels it forecast in 2019 by increasing headcount by 52 FTEs. Steer argues that 2017 provides a more robust base year. Steer defines a range for catch-up of 0 FTEs, which reflects low delay in 2017, to 23 FTEs, which reflects the full time equivalent of overtime in 2017.

  Given the volatility in delay figures, relying on lack of delay in a single year to select a base year is unjustified. 2017 was not a representative year because there were no material capital investment programmes or airspace transitions (unlike RP3 when 7 major transitions are planned). As a result, Steer understates the estimated additional headcount required to meet current traffic levels.

- **Resilience:** In Section 4 we examine estimated changes in ATCO headcount due to resilience. Steer defines a range for changes in ATCO headcount due to increased resilience. Steer's lower bound is an increase in ATCO headcount of 0 FTEs, because it argues that no further resilience is required in NERL's operation based on performance in 2017. Its upper bound is a 3 per cent increase in ATCO headcount, which is slightly below NERL's estimate. Steer does not justify this departure from NERL's assumptions.

  Steer again relies on 2017 as its base year, which is unrepresentative. The selection of this base year, in which NERL's performance was better than target, does not take variability in NERL's annual service performance into account. In both neighbouring years with similar headcount, performance was worse than target. Steer's estimates are also in direct contrast to CAA's findings in Project Oberon which called for NERL to improve the resilience of its operation in RP3.

- **LH3:** In Section 5 we examine estimated changes in ATCO headcount attributable to LH3. Steer's and NERL's estimated additional headcount related to LH3 differ substantially. Steer assumes that the earliest LH3 will open is 2026 and therefore no headcount is required in RP3. Steer's position does not take account of the lead time in recruiting and validating ATCOs. In particular, Steer does not recognise that there are

there are only five sector positions which can be used to support training for LH3. Therefore, NERL argues that headcount must increase in RP3 for it to become operationally ready for LH3, even if it runs these training positions at full capacity.

- **DSESAR:** In Section 6 we examine estimated changes in ATCO headcount due to DSESAR. Steer claims that NERL can reduce headcount by 2 to 3 per cent more than NERL estimates due to the introduction of DSESAR.

  Steer only cites high-level evidence for this claim and therefore does not substantiate how it estimates these efficiency savings. Moreover, Steer conflates the impact on ATCO headcount with impact on ATCE headcount and realised impact on ATSA headcount. Steer's estimate of the impact of traffic growth already imbues the impact of capital investment programmes in the comparator set of ANSPs. Steer should make a smaller adjustment to headcount for DSESAR or a higher one for traffic growth: Its estimate should reflect only the incremental benefit of DSESAR relative to the historical trend in technological progress across European ANSPs.

- **ATSAs and PCGs/MSGs:** In Section 7 we comment on estimated changes in other headcounts, including ATSAs. The substantial difference in estimates of ATSA headcount also derives from the implications of differences in ATCO headcount for ATSA FTEs. In addition, Steer makes strong and arbitrary assumptions about the use of ATSAs with little reference to realised operational impact.

  Steer's estimates understate the headcount of MSG/PCGs by 75 to 95 FTEs. NERL argues that this will increase the risks associated with delivering DSESAR in RP3.[4] Steer fails to recognise the implications of MSG/PCG headcount in its proposed ATCO headcount attributable to resilience. Moreover, whilst Steer acknowledges NERL's use of MSG/PCGs to substitute for ATCO roles, it does not compensate its estimated ATCO headcount for its proposed reduction in MSG/PCG headcount.

  In Section 7, we also comment on NERL's estimates for RP3 ATCE headcount. However, Steer does not provide an alternative estimated ATCE FTE headcount for RP3.

In each section, we provide details of the proposition made by Steer, Steer's method and justification for its estimates and our view on that method and justification. We then examine the consequences of Steer's estimate for NERL's operational performance and contrast it to the estimate and methodology used by NERL.

Understating RP3 headcount could have serious implications for NERL's ability to provide a safe and satisfactory service for customers throughout RP3 and into RP4. NERL estimates that a reduction of 50 ATCO FTEs from its estimate (less than half the upper bound of Steer's proposed reduction) would increase average delay by 7 seconds per flight and result in an indirect cost of £50m to its customers.[5] In addition, a reduction would lead to significantly reduced operational resilience during a regulatory period that is defined by a high degree of transition activity with the proposed implementation of DSESAR.

NERL also comments that the proposed reductions would reduce its ability to validate new ATCOs for multiple airspace sectors. This would mitigate the risks posed by the retirement

[4] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.76, 6.85.

[5] Includes reactionary delay costs. Source: NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 27.

of experienced employees who are validated on multiple sectors and could impact the potential organisational efficiency of NERL in RP4.

2. ATCO Headcount: Traffic Volumes

ATCO headcount will need to increase to manage the expected growth in the volume of traffic and complexity over RP3.[6] Steer and NERL both recognise this and reach comparable estimates for the expected increase in the number of ATCOs to manage increased traffic volumes. However, the similarity between Steer's and NERL's estimates is largely spurious: Steer's estimated range also includes the impact of capital investment programmes on ATCO headcount and therefore understates the true impact of traffic growth on ATCO numbers. NERL understands this and adjusts its estimate of the impact of capital investment programmes on ATCO headcount accordingly (see Section 2.4.3).

On the other hand, Steer fails to identify the bias arising from its model. Steer uses an econometric model to estimate historical elasticities, in other words responsiveness, of ATCO numbers and operating costs to traffic volumes.[7] It then uses these elasticities to project the required growth in ATCO numbers given forecast traffic growth. Steer estimates that the number of additional ATCOs required to manage the growth in traffic is 41 to 61 FTEs from calculated elasticities of 0.46 to 0.6 respectively.[8]

Steer's analysis uses historical headcount data for European ANSPs which reflects the productivity benefits from various investment programmes. Therefore, by including an additional adjustment to overall headcount for DSESAR, Steer's ATCO headcount is understated since it double counts the impact of technological progress and change. Steer should make a smaller adjustment to headcount for DSESAR or a higher one for traffic growth: Its estimate should reflect only the incremental benefit of DSESAR relative to the historical trend in technological progress across European ANSPs.

NERL relies on management expertise and the Position Staffing Schedule (PSS) to estimate the headcount change necessary to manage this rise in traffic. NERL's approach takes account of the nuances between airspace complexity, the number of airspace sectors, the size and daily operation times of these sectors and the resulting number of ATCOs allocated to each sector.[9] NERL estimates that 57 ATCO FTEs would be required to fulfil the rise in traffic volume.

Depending on the elasticity used from Steer's analysis, the difference between Steer's and NERL's estimates of the number of additional ATCOs required in RP3 range from *minus* 10 to *plus* 4 ATCO FTEs in 2024.

In the next section we outline Steer's proposition and its criticism of NERL's estimate before discussing Steer's method to determine ATCO headcount. We attempt to replicate Steer's econometric model and provide our own alternative model, which is an improvement on Steer's model, but is still limited in applicability. We examine the sensitivity of our improved model and Steer's model to traffic forecasts and model specification. We

6 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.15, Table 3.4.

7 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.49, 5.80.

8 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.26.

9 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.59, 6.22.

summarise NERL's method and highlight that forecasting the impact of traffic necessarily requires management expertise as the complexities cannot be modelled using econometrics.

2.1. Steer's Proposition

Steer argues that NERL's estimates "appear to derive from management expertise (rather than from a proven algorithm)"[10]. In addition, Steer claims "NERL does not appear to have focussed on trying to achieve efficiencies from the expansion of its operation, but rather to have added resource within existing structures"[11].

In their study, Steer constructs an econometric model for an "efficient operator"[12]. From this model, Steer estimates historical elasticities, in other words responsiveness, of ATCO numbers and operating costs to traffic volumes. It then uses these elasticities to predict future ATCO requirements based on expected traffic growth. Steer estimates that the number of additional ATCOs required to manage the growth in traffic expected over RP3 is 41 to 61 FTEs from calculated elasticities of 0.46 to 0.6 respectively.[13]

2.2. Steer's Justification and Method

Steer examines data from 2006 to 2015 (inclusively) across 31 Air Navigation Service Providers (ANSPs): the 30 ANSPs under the Single European Sky (SES) and Turkey. This data is sourced from ACE Benchmarking Reports and Eurocontrol's Performance Review Reports.[14]

Steer estimates the elasticity of ATCO numbers to traffic growth from two models. Each model uses the "differenced natural logarithm" of each variable. Steer "differences" the data by taking the natural logarithm of each variable and then subtracting the natural logarithm of traffic and ATCO headcount in the previous year. Differencing is a standard econometric procedure aimed at ensuring that the data used is stationary and thereby reduce the risk that any relationship estimated is purely spurious, e.g. because both ATCO headcount and traffic volumes trend up over time.[15] In other words, it takes .[16] Therefore, the estimated relationship (coefficient) can be interpreted as an elasticity: This describes the average percentage change in ATCO numbers resulting from a 1 per cent change in composite flight

[10] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.24.

[11] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.24.

[12] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.54, 6.7.

[13] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.26.

[14] Eurocontrol (May 2018), ATM Cost-Effectiveness (ACE) 2016 Benchmarking Report with 2017-2021 outlook.

[15] When data over time is non-stationary it often follows a 'unit root process'. This means that changes over time appear to follow a trend but actually result from a series of shocks to the process. This provides a challenge for econometric modelling. Differencing the data can remove this problem and lead to a stationary process. Composite flight hours is found to follow a unit root process and is non-stationary.

[16] In the following discussion, we often refer to the variables without specifying that the logarithm is used. This does not change the implications of our discussion.

hours. Each model also uses "fixed effects" which fits an ANSP specific average change (growth rate) in the dependent variable over time.[17] The models are:

1. Model 1: attempts to explain variation in changes in ATCOs in operation hours on duty (ATCOs in Ops) by using contemporaneous changes in gate-to-gate composite flight hours and in en-route delay minutes.
2. Model 2: attempts to explain variation in changes in Operating Costs (including total gate-to-gate ATCO costs, support staff costs, non-staff operating costs but not depreciation, cost of capital or exceptional items) by using contemporaneous changes in gate-to-gate composite flight hours and in en-route delay minutes.[18]

Steer initially includes complexity as an explanatory variable in both relationships but reports that it finds no statistically significant results and therefore decides not to include complexity in its final model.[19] Steer estimates both models and finds the following results:

1. Model 1 (ATCOs in Ops): Steer estimates an elasticity of 0.46 suggesting that on average, across the sample ANSPs between 2006 and 2015, a 1 per cent increase in composite flight hours results in a 0.46 per cent increase in ATCOs in Ops.[20] This would suggest an additional 47 ATCO FTEs will be required to service the increase in forecasted traffic in RP3. This provides the lower bound of Steer's estimate.
2. Model 2 (Operating Costs): Steer estimates an elasticity of 0.32 suggesting that on average, across the sample ANSPs between 2006 and 2015, a 1 per cent increase in composite flight hours resulted in a 0.32 per cent increase in Operating Costs.[21] Steer translates this elasticity to one that describes the average percentage change in ATCO numbers. Steer argues that, because ATCO costs represent "approximately half of total operating costs"[22], it can double its elasticity to 0.6. Therefore, Steer argues that this means a 1 per cent increase in composite flight hours results in a 0.6 per cent increase in ATCOs in Ops.[23] Based on forecast traffic, this would suggest an additional 61 ATCO FTEs will be required to service the increase in traffic. This provides the upper bound of Steer's estimate.

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17 The dependent variables are changes in the natural logarithm of ATCOs in Ops and changes in the natural logarithm of Operating Costs. Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.49, 5.80.

18 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.49, 5.80.

19 In our replication results, we found that by including complexity as an explanatory variable, we were unable to estimate a statistically significant estimate of the elasticity. Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.50, 5.85.

20 This is statistically significant at the 1 percent level. It is unclear how Steer converts its estimated elasticity of the responsiveness of *hours* in Ops to traffic to *headcount* in Ops as we discuss below. Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.50, 5.84.

21 This is statistically significant at the 1 percent level. Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.51, 5.88.

22 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

23 The statistical significance of the coefficient can no longer be applied to this new estimate. It is unclear why Steer rounds the estimate before doubling although Steer do cite similar elasticities estimated by the PRU and the CAA of 0.4 and 0.3 respectively. Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

Therefore, Steer estimates that 47 to 61 additional ATCO FTEs will be required to manage the expected traffic growth in RP3.[24]

2.3. Views about Steer's Justification

Using an econometric model to predict the number of ATCOs required to service traffic growth across RP3 is unwise and does not suitably account for the complexity of, and constraints facing, NERL's operation. NERL's management expertise provides insight and understanding of these issues and enables NERL to adjust these estimates in light of these intricacies, which Steer's econometric model is unable to do.

2.3.1. Econometric limitations of Steer's approach

In this section we outline some of the econometric limitations of Steer's approach:

- **Low explanatory power:** Steer's estimated models have low overall R-squared statistics of approximately 0.2 in Model 1 (ATCO in Ops) and 0.1 in Model 2 (Operating Costs). As Steer itself admits, this implies "that there are significant unmodeled factors driving the number of ATCOs" [25]. In other words, changes in composite flight hours, changes in delay minutes and ANSP specific growth rates only explain 20 and 10 per cent of changes in ATCOs in Ops and Operating Costs respectively over time. Therefore, given that Steer's model is unable to explain 80 and 90 per cent of the variation in changes in ATCOs in Ops and changes in Operating Costs respectively, it does not provide a robust basis for forecasting NERL's headcount or costs with accuracy. Including additional, potentially important, explanatory variables, such as the number of sectors or the need for capacity due to changes in seasonal flight patterns, may improve this explanatory power.

  This does not necessarily translate to a biased estimate for the impact of changes in composite flight hours on the dependent variables. However, given the large number of explanatory variables not included in Steer's model, it is likely that its resulting estimate suffers from bias from these omitted variables.

- **Omitted variable bias:** A reason why Steer's model is unable to explain a large amount of variation in the change in ATCOs in Ops or Operating Costs over time is because it includes just two explanatory variables: changes in composite flight hours and changes in en-route delay minutes. This is concerning because another omitted variable may be driving a simultaneous change in composite flight hours (or delay) and change in ATCOs in Ops or Operating Costs and this is the effect that Steer's estimated elasticity is capturing. This is called omitted variable bias.

  For example, the implementation of an capital investment programme could increase the number of composite flight hours, by increasing capacity, and simultaneously reduce the Operating Costs and the number of required ATCOs in Ops, by making each ATCO more productive. Therefore, the resulting estimated elasticity in Steer's model would understate the true effect of the change in flight hours on the change in ATCOs in Ops or Operating Costs: it is a biased estimate. This is because the model would conflate the response of ATCO numbers or Operating Costs to traffic growth with any simultaneous, but unrelated, improvements in ATCO productivity from the capital investment

[24] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.59, Figure 6.5.

[25] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.50, 5.84

programme. In other words, the model would attribute the fact that fewer ATCOs would be required to fulfil the increase in traffic to a lower elasticity rather than recognising that this is because there is a simultaneous capital investment programme which increased ATCO productivity.

- **Steer's approach is double counting:** A direct consequence of this omitted variable bias is that Steer's approach is double counting. Steer discusses the productivity gain from implementing capital investment programmes, specifically DSESAR, in RP3 as a justification for reducing ATCO headcount.[26] However, in failing to control for ATCO productivity in its econometric model, Steer is already capturing the benefit of capital investment programmes on ATCO productivity in its estimated elasticity.

  In other words, the estimated historical responsiveness of ATCO numbers to traffic growth is low because high-traffic-growth ANSPs are investing in capital programmes to mitigate growth in ATCO numbers: Steer cannot apply this low historical estimated elasticity in addition to arguing for headcount reductions in response to capital investment programmes. Instead, Steer needs to adjust its estimate for additional headcount attributable to the DSESAR capital investment programme to reflect only the *incremental benefit* of DSESAR relative to the historical trend of the benefits of capital investment programmes achieved by the ANSPs in its sample. In fact, Steer acknowledges this but fails to adjust its estimates:

  "while NERL stated at the workshop on 23 August that most of the workload benefits delivered by the new technology are utilised to deliver additional capacity rather than reduce controller numbers, we consider that this is equivalent to saying that the increase in controllers due to traffic growth is higher than stated by NERL (i.e. above the 57 additional controllers identified by NERL). We consider that the improvements in efficiency due to the technology should be explicitly recognised and, if necessary, the increase due to traffic growth adjusted accordingly, so that each adjustment can be considered separately."[27]

  For clarity, one way to interpret the results from Steer's estimated elasticity is: 47 to 61 additional ATCO FTEs will be required to manage the expected traffic growth *after the beneficial effects of capital investment programmes (estimated from historical trends) have been accounted for*.

- **Confusion of inputs and outputs**: Steer assumes that changes in en-route delay minutes cause changes in ATCOs in Ops and Operating Costs. In practice, the relationship is likely to be reversed: When the number of ATCOs or the costs incurred are insufficient, delays will result. This reverse causality also leads to a form of omitted variable bias (discussed previously) and means Steer's estimated elasticity is not representative of the relationship it aims to estimate.
- **Steer's functional form assumption:** Steer assumes a linear relationship between the change in the logarithm of composite flight hours and the change in the logarithm of ATCOs in Ops or Operating Cost. However, this relationship may be non-linear. For example, a positive change in composite flight hours leads to a positive change in

[26] We discuss Steer's proposal and our response in Section 6. Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63.

[27] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, footnote 30.

Operating Cost. If these changes in traffic are small, they can be absorbed by existing capacity. However, for larger changes, more capacity may be required and this leads to increases in Operating Cost. Therefore, the change in Operating Cost may depend on the *magnitude of the change* in composite flight hours. If the true model is non-linear then Steer's model is econometrically invalid. For instance, the example described may correspond to a stepped model.

- **The impact of using changes and not levels:** Steer estimates the elasticities using the change in the natural logarithm of dependent and independent variables. Therefore, Steer's analysis fails to account for the starting *level* of productivity of ANSPs and therefore the ability of ANSPs to serve additional flight hours with the remaining existing capacity. As benchmarking work undertaken by ACE has shown, NERL is amongst the most efficient ANSPs in Europe and therefore has low organisational slack to accommodate demand growth.[28] Therefore, Steer underestimates the elasticity relevant to NERL by estimating its model using data from across ANSPs without controlling for differences in organisational efficiency.

  In addition, ANSPs across Europe may not be a valid set of comparators. Given this difference in organisational efficiency and the fact that NERL operates in a more complex airspace relative to other ANSPs, Steer makes a strong assumption that there should exist a common relationship between traffic growth and the number of ATCOs among all ANSPs in its sample.[29] Steer's analysis takes no account of differences in performance and service quality by ANSPs.

- **Steer's model does not take account of the time-lag in recruitment:** Steer's model idoes not account for the lag between recruiting and training an ATCO and their deployment. This recruitment and training lead time takes on average three years whereas Steer's model examines the annual change.[30] Therefore, the elasticity that Steer estimates is not examining the change in the number of ATCOs *in response to* the change in traffic growth. Instead, the relevant change would have already been implemented based upon an expectation of traffic growth which may or may not have been realised.

  Steer implicitly assumes that the ANSP can scale deployment of ATCOs at will, and therefore the contemporaneous change observed entirely reflects the ANSP's desired response to realised traffic growth. Instead, the ANSP may wish to respond if traffic grows more than expected but is unable to given the lead time for training. Consequently, Steer's econometric model understates the true response of ATCO numbers to traffic growth.

- **Fixed effects estimator:** Steer uses a "fixed effects" model to estimate the impact of traffic growth on ATCO headcount and and operating costs. Steer's fixed effects model assumes that each ANSP experiences a separate average change (i.e growth rate), known as a "fixed effect", in ATCO operating hours (or operating costs where operating costs is the dependent variable) over time, which has nothing to do with changes in the explanatory variables of interest (e.g. traffic growth). If explanatory variables, such as traffic growth, change broadly consistently for each ANSP over time then fixed effects models are less reliable: The fixed effect for each ANSP will absorb much of the change

[28] Eurocontrol (May 2018), ATM Cost-Effectiveness (ACE) 2016 Benchmarking Report with 2017-2021 outlook, p.49.

[29] Eurocontrol (May 2018), ATM Cost-Effectiveness (ACE) 2016 Benchmarking Report with 2017-2021 outlook, P.153.

[30] NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024, p.36.

in ATCO operating hours or operating costs.[31] Including a fixed effect can therefore mask the impact of explanatory variables and reduce the accuracy of the estimated coefficients on the explanatory variables of interest (such as traffic growth).[32] Relying on a fixed effect will particularly affect variables that change slowly over time and will likely explain why Steer found complexity, which is a key variable underpinning the need for ATCOs, to be statistically insignificant.

Typically, fixed effects are used to remove *unobservable* attributes that affect the *level* of variables in a model. So for instance, if one were estimating the *level* of ATCO headcount, one might wish to include a fixed effect to control for all of the factors that are not in the model but are country-specific. These include geography, typical weather conditions, seasonality of flight demand and GDP. Indeed, Steer justifies a fixed effects estimator because it controls for "entity-unique attributes not included within the analysis (such as GDP)"[33].

However, variation in the level of GDP and other attributes that remain fixed over time are already removed by Steer because it models the *change* in ATCO hours or operating costs based on the *change* in flight hours. The country-specific factors, such as geography, weather, seasonality and GDP, insofar as they affect ANSPs are likely to change only slowly over time (if at all). The benefit of fixed effects in these models is considerably reduced.

The consequence of including fixed effects, as already discussed, is a loss of explanatory variation that can be used to more accurately estimate the relevant parameters. When modelling changes in variables over time rather than levels, analysts typically use a so-called "random effects" model. Random effects models exclude the ANSP-specific "fixed effect". They therefore assume that the growth rate of ATCO hours in operations and operating costs depends only on the explanatory variables in the model (e.g. traffic growth). We estimate both a random effects and fixed effects model in the following section.

This provides a non-exhaustive list of limitations and flaws in the model used by Steer which far from represents a "proven algorithm". This is the result of using a simple econometric model and estimation method (ordinary least squares) to tackle this complex estimation task. Management expertise provides a superior ability to adjust these estimates in light of these intricacies, which Steer's econometric model is unable to do.

2.4. Consequences of Steer's Proposals & Fixing Them

In the following section, we estimate an improved econometric model, which improves on Steer's model but is based on similar underlying assumptions. However, we acknowledge that the applicability of our model is still limited and remains subject to some of the limitations already described. In particular, our revised model double-counts the impact of technology growth in the same way that Steer's does, is a model in changes rather than levels,

[31] De-meaning describes the fixed effects estimator and is when the average change for each variable from 2006-2015 at each ANSP is subtracted from each annual change. The remaining variation in the data describes the changes around this trend. This is called within-variation.

[32] The standard error is a measure of the accuracy with which each coefficient in the model is estimated. If it is inaccurately measured, the standard error will increase and statistical significance will fall.

[33] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.49, 5.80.

does not take account of the lag in recruitment and retains Steer's proposed linear form. We estimate both fixed and random effects models and reduce the omitted variable bias by including additional and material explanatory variables. We contrast the use of econometric models to the PSS method used by NERL and explain that NERL's use of management expertise overcomes the shortcomings of the econometrics and is therefore a superior estimate.

2.4.1. Replicating and improving Steer's model

We begin by attempting to replicate Steer's model. We use data from ACE Benchmarking Reports from 2006 to 2015 for the same ANSPs as Steer.[34] However, we were unable to find ACE's reported en-route delay minutes prior to 2011. It is unclear as to whether Steer has this data or is in fact running data on the subset of the timeframe i.e. from 2011 to 2015.[35] Our results are shown in Table 2.1.

Table 2.1: NERA's replication of Steer's econometric model.

	Replication of Steer Model 1: ATCOs in Ops	Replication of Steer Model 2: Operating Cost
Traffic volume elasticity	0.50*	0.16
Overall explanatory power	14 percent	5 percent

Statistical Significance Level: (*) 10 percent, (**) 5 percent, (***) 1 percent. *Source: NERA Analysis.*

We were unable to replicate Steer's results. We instead estimate a larger elasticity on ATCOs in Ops of 0.50 compared to Steer's estimate of 0.46.[36] We are also only able to explain 14 percent of the variation in ATCOs in Ops. Meanwhile our estimate of the elasticity of gate-to-gate operating costs to flight hours is statistically insignificant. We acknowledge that differences in the underlying data likely generated this response.

In addition, we estimate our own model. Our model uses similar underlying assumptions and structure to Steer's approach for consistency but improves upon Steer's model by correcting for the omitted variable bias and explicitly controlling for ATCO productivity. In addition, we also report a random effects model for comparison.

Our models are similar to Steer's as we take differences in the natural logarithm of each of the dependent and independent variables. Given Steer provides an unsubstantiated case for the conversion of the operating cost elasticity to an elasticity describing the response of ATCO headcount to traffic volume, we elect to only consider a model with ATCOs in Ops as the dependent variable (although we report results using Operating Cost as the dependent variable in the following section). We include two additional explanatory variables compared to Steer's model:

1. NERA Model: attempts to explain variation in changes in the number of ATCOs in Ops (ATCOs in Ops) by using contemporaneous changes in gate-to-gate composite flight hours, in total delay minutes, in ATCO productivity and in employment cost per ATCO.

[34] Eurocontrol (May 2018), ATM Cost-Effectiveness (ACE) 2016 Benchmarking Report with 2017-2021 outlook.

[35] 2016 data was available. However, we estimate our models until 2015 only to produce results that are comparable to Steer's own.

[36] This was found to be statistically significant at the 10 percent level.

We use the number of ATCOs in Ops as our dependent variable because hours enter our productivity measure as an explanatory variable.[37] In addition, we use total delay data to allow us to estimate the model from 2006 to 2016. We estimate this model with both fixed effects and random effects. Our results are summarised in Table 2.2.

Table 2.2: NERA's model results.

	Fixed effects	Random effects
Traffic volume elasticity	0.54***	0.65***
Overall explanatory power	52 percent	52 percent

Statistical Significance Level: (*) 10 percent, (**) 5 percent, (***) 1 percent. *Source: NERA Analysis.*

Our models find consistently higher, statistically significant elasticities. We estimate elasticities of 0.54 and 0.65 for fixed effects and random effects specifications respectively.[38] Our models predict that, on average across the sample ANSPs between 2006 and 2015, a 1 per cent increase in composite flight hours results in a 0.54 to 0.65 per cent increase in ATCOs in Ops. This estimate corresponds to an additional ATCO headcount requirement to manage traffic growth in RP3 of 54 to 65 ATCO FTEs, calculated using STATFOR instrument flight rules (IFR) traffic forecasts.[39]

Furthermore, both our fixed and random effects models explain more of the total variation (around 52 percent each) in the change in headcount of ATCOs in Ops than Steer's models (around 20 percent).

ATCO productivity is statistically significant and negatively related to ATCOs in Ops in both specifications.[40] This provides further evidence that it was an omitted variable causing a downward bias on the elasticity estimate in Steer's models.

Finally, the omission of ANSP specific growth rates (fixed effects) only increases the within explanatory power of the regression by 0.01 percentage points and does not impact the overall explanatory power of the regression.[41] This suggests that by including fixed effects, Steer was forfeiting a large degree of explanatory information for limited explanatory gain and was therefore inefficiently estimating the relevant elasticity.

However, we reiterate that the applicability of our model remains subject to the limitations already described.

2.4.2. Sensitivity of Steer's and NERA's model results

Steer's (and NERA's) econometrically estimated elasticities are not only inaccurately measured, because of the econometric limitations discussed above, but sensitive to the choice

[37] Our productivity measure is defined as the ratio of composite flight hours to total ATCOs hours in Ops.

[38] These results are statistically significant at the 1 percent significance level.

[39] STATFOR (September 2018), EUROCONTROL Forecast of Annual Number of IFR Flights (2018 - 2024) September 2018.

[40] The change ATCO productivity was statistically significant at the 1 percent significance level with coefficients of minus 0.55 and minus 0.57 in fixed and random effects specifications respectively.

[41] In fact, fixed effects reduces the overall explanatory power by 0.0007 percentage points.

of traffic forecast. In addition, it is unclear how Steer converts its elasticity relating *hours* of ATCOs in Ops to *headcount* of ATCOs in Ops.

Steer does not clearly state which traffic forecast it uses to project headcount throughout RP3. To determine this, we use Steer's elasticity to estimate the additional ATCO headcount required in RP3, compared to the 2017 base year that Steer adopts, using three different traffic forecasts. We compute similar analysis for our econometric models and estimated elasticities. The results are shown in Table 2.3.

The three traffic forecasts that we examine are: the STATFOR traffic forecast for IFR Flights, for total en-route service units (TSUs) and the NATS forecast for TSUs.[42] For each source, we examine the low, best and high forecasts, if available. We use the latest available forecasts available to Steer at the time of the publication of its report for consistency.

Table 2.3: Sensitivity of Steer's and NERA's model results to traffic forecasts.

Model	Dependent Variable	Independent Variable	Effects Included	Elasticity Estimate	Estimated Additional ATCOs Required in RP3						
					Traffic Forecast Used: STATFOR						NATS
					Units: IFR Flights			*TSUs*			*TSUs*
					Low	*Best*	*High*	*Low*	*Best*	*High*	*Best*
Steer Model 1	ATCOs Hours in Ops	Flight Hours	Fixed	0.46	15	**46**	84	35	70	112	57
NERA	ATCOs in Ops	Flight Hours	Fixed	0.54	17	**54**	98	41	82	132	67
			Random	0.65	21	**65**	119	49	98	158	81
NERA	ATCOs in Ops	IFR Flights	Fixed	0.52	17	52	95	39	79	127	65
			Random	0.57	18	57	104	43	86	139	71
Steer Model 2	Operating Cost	Flight Hours	Fixed	0.60	19	**60**	109	45	91	146	75
NERA	Operating Cost	Flight Hours	Fixed	1.19	38	118	217	89	180	290	148
			Random	1.28	41	127	233	96	194	312	159
NERA	Operating Cost	IFR Flights	Fixed	0.90	29	89	164	68	136	219	112
			Random	1.00	32	99	182	75	151	244	125

All reported estimated elasticities are statistically significant at the 1 per cent level. Source: NERA Analysis.

From this analysis, we believe that Steer used the STATFOR base case forecast for the number of IFR flights to project additional ATCO headcount requirement across RP3. Our projected headcount, using Steer's elasticity and this forecast, was different by 1 ATCO FTE which we assume is because of rounding error. From our projection, Steer's elasticity estimated from using ATCOs in Ops as the dependent variable results in an estimated additional headcount of 46 ATCO FTEs. For the same forecast, NERA's model predicts an additional 8 to 18 ATCO FTEs depending on whether fixed or random effects are included in the model.

In addition, we estimate our improved 'NERA Model' outlined in Section 2.4.1 but with operating cost as the dependent variable. We double the resulting estimate in line with Steer's assumptions and methodology to determine the elasticity. The resulting elasticity from our model was roughly twice that of Steer's leading to an estimate of 118 additional ATCO FTEs in RP3. Applying Steer's elasticity to the traffic forecast (using the STATFOR

[42] STAFOR Data Source: STATFOR (September 2018), EUROCONTROL Forecast of Annual Number of IFR Flights (2018 - 2024) September 2018. NATS Data Source: Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.15, Table 3.4.

base case forecast for the number of IFR flights) results in an estimated requirement of 60 addition ATCO FTEs, 58 fewer than our estimate.

If Steer did use the STATFOR IFR flight forecast, then Steer needed to assume that the number of composite flight hours per IFR flight remains constant over time. This is because the independent variable used in Steer's model is composite flight hours. Therefore, Steer is estimating the elasticity of *composite flight hours* to ATCOs in Ops but applying that elasticity to the *number of flights* to determine estimated additional headcount. If the number of composite flight hours per IFR flight increases over time, Steer understates the required response in ATCO numbers to traffic volumes. This is because the forecasted growth in IFR flights will understate the forecasted growth in composite flight hours, upon which Steer bases its elasticity.

We augment our 'NERA Model' to estimate the elasticity using changes in the natural logarithm of IFR flights as the independent variable. This means our estimated elasticity is consistent with the traffic forecast we are using to estimate additional ATCO headcount. Using ATCOs in Ops as our dependent variable, our model suggests elasticities of 0.52 and 0.57 leading to a predicted additional headcount of 52 and 57 ATCO FTEs depending on the use of fixed effects or random effects respectively.[43] Using Operating Cost as our dependent variable, our model suggests elasticities of 0.90 and 1.00 leading to a predicted additional headcount of 89 and 99 ATCO FTEs depending on the use of fixed effects or random effects respectively.[44] Both of these headcount estimates suggest that Steer understates the additional ATCO requirement and its estimation method may result from omitted variable bias.

The estimates for additional ATCO headcount required in RP3 from NERA's improved model and Steer's model are sensitive to the choice of traffic forecast. Using a TSU based forecast from STATFOR instead of IFR flights means that, for the same elasticity estimated from Steer's Model 1 (ATCOs in Ops), Steer's estimated additional ATCO headcount increases from 46 to 70 ATCO FTEs. Using NATS' base case forecast for TSUs means that Steer's estimated additional ATCO headcount increases from 46 to 57 ATCO FTEs. Even using the high and low forecasts made by STATFOR for IFR flights results in 31 fewer or 38 extra ATCO FTEs compared to Steer's reported estimated headcount.

This sensitivity is observable across all models, especially the Operating Cost models where Steer's estimated range of additional ATCOs for high and low STATFOR IFR flight forecasts is 90 ATCO FTEs. This is equivalent to approximately 87 per cent of the difference in total estimated ATCO headcount across *all factors* between NERL's estimate (1018 FTEs) and Steer's *lower bound* estimate for total headcount (914 FTEs).

This sensitivity further highlights the limitations of a simple econometric approach to estimating ATCO headcount.

2.4.3. The advantages of NERL's method

NERL's method relies on management expertise and the Position Staffing Schedule (PSS). The PSS takes a variety of inputs and information on effective capacity and produces the

[43] Both of these estimates were statistically significant at the 1 percent level.

[44] Both of these estimates were statistically significant at the 1 percent level.

operational requirement and shift/roster options for each airspace sector. It is reviewed at least every 6 months and planning for rostering begins 19 months before the resources are deployed.[45] Inputs relating to sector demand include historical information (e.g. total workload and sector opening times), variations in traffic patterns, predicted traffic (including customer demand and known changes in flight volumes and routings) and business requirements (including delay targets).[46] Inputs relating to effective capacity include the predicted number of validated staff and the roster patterns and constraints.

Using the PSS, NERL forms a template of sectors that will be regularly occupied. Management can then optimise ATCO deployment by extending the operational hours of each sector when traffic is high or combining operation of sectors to ensure efficiency when traffic is low. In addition, management can identify needs for ATCO training and validation on sectors to optimise the response to predicted future traffic growth.[47]

NERL uses this method to examine traffic growth on a sector-by-sector basis, rather than the macro-level approach taken by Steer. This method allows NERL to optimise across interrelated concepts such as the number of airspace sectors, the size and daily operation times of these sectors and the resulting number of ATCOs allocated to each sector. It can therefore more effectively plan and estimate future headcount, understanding the limits on efficiency based upon the number of aircraft and number of validations that an ATCO can manage and hold at once.

2.4.4. Summary

Steer, using its econometric method, understates the estimated headcount in 2024 by 10 ATCO FTEs (using the elasticity from Model 1 of 0.46) or overstates the headcount by 4 ATCO FTEs (using the elasticity from Model 2 of 0.6) relative to NERL's estimate. NERA's improved econometric model estimates that an additional 54 to 65 ATCO FTEs (from elasticities of 0.54 and 0.65 respectively) are required to manage traffic growth in RP3, closer to NERL's estimate of 57 additional ATCO FTEs. However, both econometric methods are sensitive to the choice of traffic forecast used to project headcount.

Steer's analysis uses historical headcount data for European ANSPs which reflects the productivity benefits from various investment programmes. Therefore, by including an additional adjustment for DSESAR, Steer's ATCO headcount is understated since it double counts the impact of technological progress and change. Steer should make a smaller adjustment to headcount for DSESAR or a higher one for traffic growth: Its estimate should reflect only the incremental benefit of DSESAR relative to the historical trend in technological progress across European ANSPs.

Steer states that "NERL does not appear to have focussed on trying to achieve efficiencies from the expansion of its operation but rather to have added resource within existing

[45] NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 31.

[46] NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 30.

[47] NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 32.

structures" [48]. This misunderstands NERL's operation: there are limits on efficiency based upon the number of aircraft and validations that an ATCO can manage and hold at once.[49]

In fact, the consequence of using NERL's method and the PSS instead of Steer's econometric model is to directly address this issue. Management expertise can be used to identify when ATCOs can be more efficiently used. NERL can then reorganise and reclassify airspace sectors to this effect whilst strategically identify needs for training and validation for ATCOs. Instead, using an elasticity to estimate headcount based on historical data does not identify efficiency gains but instead implicitly argues that historical structures and adjustments across the ANSPs are, and will continue to be, efficient, or at least proportionally inefficient. Therefore, we view NERL's method as superior when estimating the headcount.

[48] Steer (February 2019), NERL's forward-loo king capital programme and expenditure efficiency, p.60, 6.24.

[49] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.24.

3. ATCO Headcount: Catch-up

There is a relatively large difference (29 to 52 ATCO FTEs) between NERL's and Steer's estimates in the RP3 headcount for catch-up. NERL estimates that an additional 52 ATCO FTEs will be required to catch-up whereas Steer estimates between 0 and 23 ATCO FTEs are required.[50] This discrepancy is largely derived from the use of different base years by NERL and Steer.

NERL's position is that it will need to catch-up its current deficit of ATCOs to meet the 2019 operational requirement for the forecast traffic level. To calculate catch-up, NERL takes the expected operational requirement in 2019 and subtracts the average forecasted operational ATCO headcount for this period, in addition to an allowance for additional effort provided by non-op staff and overtime.[51]

3.1. Steer's Proposition

Steer "assess that a more robust starting point is the actual staff numbers for 2017"[52]. Steer provides an estimated range of between 0 and 23 ATCO FTEs to cover catch-up.

3.2. Steer's Justification and Method

Steer does not provide further justification for its choice of base year.

Steer states that its lower bound, 0 FTEs, is a "no catch-up requirement"[53]. It justifies its lower bound by observing that delays were within target in 2017 and therefore argues that no catch-up is required. On the other hand, Steer recognises that an equivalent of 23 FTEs of overtime were worked in 2017 to achieve this target and therefore estimates that 23 FTEs forms its upper bound.

3.3. Views about Steer's Justification

Steer's method relies solely on its unjustified choice of base year. NERL argues that 2017 is not a robust base year because no major transitions occurred.[54]

In this section, we examine the transitions that occurred in the period 2016 to 2019 and whether 2017 is a representative base year given the transitions expected to occur in RP3. We also examine the inconsistency in assumptions that Steer makes across its estimates for catch-up and traffic growth.

3.3.1. Transitions in the period 2016-2019

Steer does not recognise that 2017 was an unusual year because there were few technology programme transitions or airspace transitions relative to 2016 and 2018. The only major transition activity in 2017 was the start of the implementation of ExCDS. This began in November for Transition Limited Operational Service (TLOS) 1 with the majority of the

50 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, Figure 6.6.

51 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.59, 6.22.

52 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.26.

53 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.26.

54 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.60, 6.26.

programme being implemented in 2018.[55] On the other hand, in 2016 and 2018, NERL's implementation of major programmes resulted in delays caused by transition activity. More specifically, in 2016 NERL implemented iTEC in Prestwick Upper Airspace and in 2018, NERL implemented the remainder of its ExCDS programme for TLOS 2 to 5, began implementation of its Second Voice System (SYS), and made changes to its route structure to align with new Dutch airspace arrangements (SAIP AD4).[56]

NERL argues that the impact of transition activity due to capital investment programmes is likely to continue into RP3 with the completion of the DSESAR capital investment programme and airspace modernisation. The remainder of iTEC and DSESAR will be implemented in 2019 and will dual run with existing systems until 2022.

In fact, whilst NERL met its delay target in 2017, it missed delay targets in 2016 and 2018. In 2017, average delay was 6.8 seconds per flight compared to 12.7 seconds per flight in 2016 and 12.5 seconds per flight in 2018.[57]

Given the transition activity that is expected in 2019 and RP3, a base year that reflects a representative amount of transition activity should be used to determine catch-up. In fact, Steer's lower bound is formed on the logic that no catch-up headcount is required in RP3 because NERL met its delay target in 2017. Applying Steer's same method for determining catch-up to 2016 or 2018 would instead conclude that catch-up is necessary for NERL.

3.3.2. Consistency with Steer's traffic growth model

As we have discussed, Steer is unclear on how it moves from an elasticity between ATCO *hours* in Ops and traffic growth to one of ATCO *headcount* in Ops and traffic growth when it applies its estimated elasticity from its traffic growth model. To apply this conversion, Steer makes an assumption on the conversion of hours to FTEs. It is unclear that Steer can make this conversion and assumption without contradicting its assumption over the range of allowed catch-up. Steer may convert hours to headcount through two approaches:

1. Steer takes the percentage increase (from applying its elasticity to the percentage increase in traffic growth) and multiplies it by headcount in a base year. In doing so, Steer implicitly assumes a level of overtime which it deems acceptable. This is the level that is equivalent to the overtime provided in that base year e.g. by the 23 FTEs in 2017. Therefore, if Steer was to apply its traffic growth model from a 2017 base year, Steer's resulting estimated headcount would be inconsistent with the upper bound of its catch-up estimate. Steer's upper bound for catch-up relies on the assumption that headcount in 2017 was too low by an amount equivalent to 23 FTEs.
2. Steer divides the additional number of ATCO hours (estimated by applying its elasticity to traffic growth) by a constant number of ATCO hours based on a normal working week. This is inconsistent with Steer's lower bound of its catch-up estimate, which implicitly assumes that headcount in 2017 was correct. In other words, if Steer applied this same conversion to the realised 2017 headcount it would conclude that there were too few

[55] NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 19.

[56] NATS (En Route) plc online, Last Accessed: 22/03/19, Link: https://www.nats.aero/environment/consultations/saip-ad4-uk-dutch-interface-aviation-stakeholders/

[57] NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 19.

ATCOs. Therefore, if Steer is applying Approach 2, it must assume some catch-up is necessary.

In both cases Steer fails to provide consistent assumptions across its estimates for additional ATCO headcount changes resulting from traffic growth and catch-up.

Steer does acknowledge that its model forecasts begin with 2017 actual data and so it is "unable to replicate the reduction in ATCO numbers shown by NERL for 2018 and 2019"[58]. However, Steer argues that "the difference in our catch-up assumptions compared to NERL's, as described above, accounts for this discrepancy over the longer term"[59]. It is unclear how this is enacted given Steer provides a lower estimated headcount for catch-up than NERL.

3.4. Consequences of Steer's Proposals & Fixing Them

Steer's choice of unrepresentative base year understates the number of additional ATCOs required for catch-up by 29 to 52 ATCO FTEs. In addition, Steer appears to make a contradicting underlying assumption in the construction of its estimate of additional ATCO headcount required for catch-up relative to its estimate of additional ATCO headcount required for traffic growth.

Catch-up should be calculated such that at the start of RP3, NERL has the number of ATCOs to service *current* traffic levels (ie traffic levels in 2020) and provide a safe and satisfactory level of service to customers. The environment within which NERL operates is complex, and the resulting service depends both on traffic levels and transition activities. These transition activities include capital investment programmes which often bring short term disruption along with long term efficiency gains.[60]

Therefore, the choice of base year to evaluate NERL's capacity to provide this service for current traffic levels should consider transition activities in that year. Moreover, these transition activities should be comparable to the expected level of transition activities that will occur in RP3. RP3 is different to previous regulatory periods because of the high expected amount of transition as NERL implements DSESAR.

Steer's choice of base year does not do this. 2017 was an unrepresentative year characterised by much lower levels of transition, and resulting disruption, compared to both surrounding years and forecasted transition in RP3. Therefore, Steer understates the number of additional ATCOs required to manage current traffic levels.

Instead, NERL argues 2019 is a representative base year that has similar amounts of transition activity that is forecast in RP3. This is because NERL will begin to implement DSESAR in 2019 and continue this implementation throughout RP3 to 2022. As a result, NERL's estimated headcount for catch-up is higher at 52 additional ATCO FTEs.

[58] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, 6.28.

[59] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, 6.28.

[60] NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024, p.47.

4. ATCO Headcount: Resilience

NERL's and Steer's estimates for additional ATCO headcount to improve the resilience of NERL's operations are comparable at the upper bound of Steer's estimated range. NERL estimates that an additional 36 ATCO FTEs will be required to improve resilience across RP3 whereas Steer estimates between 0 and 29 ATCO FTEs.[61]

4.1. Steer's Proposition

Steer estimates that the additional number of ATCOs required to improve the resilience of NERL's operation is between 0 and 29 ATCO FTEs.

4.2. Steer's Justification

Steer states that its lower bound of 0 additional ATCO FTEs is based on observing that delays were within target in 2017 and therefore no additional resilience is required.

Steer justifies its upper bound of 29 ATCO FTEs:

> "we have assumed that an additional 3% of staff would be required for resilience, similar to the allowance applied by NERL, but applied to the lower overall forecast level for ATCOs"[62]

Steer provides no other justification for its choice of base year or its choice of a 3 per cent staff margin for additional resilience.

4.3. Views about Steer's Justification

Steer's lower bound of 0 additional ATCO FTEs is unjustified because of its choice of base year. This is because little transition activity and disruption occurred in 2017 and therefore it is unrepresentative of operations in surrounding years and in RP3. In fact, whilst NERL met its delay target in 2017, it missed delay targets in 2016 and 2018. We have substantiated our claim that 2017 was an unrepresentative base year when discussing Steer's estimate for headcount relating to catch-up (see Section 3.3.1).

Moreover, it is not suitable to use a base year to estimate the additional headcount required for improved resilience. The very nature of resilience means that is that it is only tested in exceptional circumstances. Should NERL have the resilience in resources to meet the additional demand, delays will be minimised, otherwise delays will result. Therefore, in order to evaluate the ability of NERL to remain resilient in operations to these circumstances, a longer time-frame must be examined.

Relying on a base year, as Steer does, risks evaluating a year with minimal disruption and misunderstanding NERL's exposure to exceptional circumstances. Steer's underestimation of the additional headcount required for improved resilience is because its choice of timeframe fails to capture these exceptional circumstances.

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[61] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, Figure 6.6.

[62] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.62, 6.26.

In addition, Steer's justification of its upper bound of 29 additional ATCO FTEs is predicated on two assumptions.

1. Steer's first assumption is the assumed resilience requirement of 3 per cent of staff. Steer's method and justification for this number are not provided. Steer notes that this number is "similar"[63] to the 3.5 per cent of headcount that NERL's estimate corresponds to. However, this does not account for NERL's method of estimation. NERL's method does not lead to an estimated headcount attributable to resilience that is a constant percentage of total estimated headcount. Therefore, the derived percentage of staff that Steer uses as its lower bound should change when the total headcount changes.
2. Steer's second assumption is that its remaining estimates for NERL's additional headcount requirements in RP3 is correct. This provides the total estimated headcount upon which Steer applies its 3 per cent to calculate the upper bound for resilience. Steer's total headcount underestimates the number of ATCOs that are required across RP3. Therefore, by using a higher ATCO headcount, Steer's estimate of the upper bound for headcount required for resilience will increase.

As a result, Steer's lower bound is unsubstantiated and appears to arise from arbitrarily administering a haircut to NERL's estimate and applying the resulting percentage to Steer's (lower) estimated total ATCO headcount in 2024.

4.4. Consequences of Steer's Proposals & Fixing Them

Steer (incorrectly) assumes that there is no need for additional resilience based on its choice to examine 2017 as a base year. This contradicts CAA's findings from Project Oberon, the final report of which was released in July 2017.

Under Project Oberon, the CAA investigated complaints that NERL breached certain licence conditions under the Transport Act 2000. Stanstead Airport and Ryanair complained that NERL had "failed to provide adequate resources to manage the performance of the London Terminal Manoeuvring Area properly"[64]. Specifically, the complaints related to adequate contingency plans for ATCO absences.[65]

CAA found that, whilst there were increased delays in 2016, "NERL had not failed to take all reasonable steps to meet demand"[66]. However, CAA also found:

> "delays in the London Approach Service increased in 2016 as a result of a lower resilience within the staffing of that service, put simply, there were too few operational staff available to provide normal resilience levels."[67]

Consequently, CAA made a number of recommendations to NERL to improve resilience.[68] These recommendations included placing a greater focus on sensitivity analysis and arguing

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63 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.62, 6.26.

64 CAA (August 2017), CAP 1578, p.4, 1.3.

65 CAA (August 2017), CAP 1578, p.11, 2.15.

66 CAA (August 2017), CAP 1578, p.5, 1.7.

67 CAA (August 2017), CAP 1578, p.6, 1.8.

68 CAA (August 2017), CAP 1578, p.7,1.15.

that NERL should develop a further understanding of how resource shortfalls will impact users at a more granular level.[69]

In preparation of its RP3 business plan, NERL was advised by CAA that:

> "Stakeholders have made clear that delivering a robust level of technical and operational resilience is a key priority for RP3 and is fundamental to ensuring capacity performance."[70]

Given the increasing complexity of the airspace NERL operates and the advice of CAA, future improvements in resilience are necessary. Therefore, Steer's assumed lower bound that no additional resilience is required, based upon its choice of an unrepresentative base year, is flawed. In addition, Steer's upper bound is unsubstantiated and appears to arise from arbitrarily administering a haircut to NERL's estimate and applying the resulting percentage to Steer's estimated total headcount in 2024.

Instead, NERL, through its continued consultation with CAA, is uniquely placed to understand this rise in complexity and the associated continuity risks that the rise in airspace complexity places on its daily operation. NERL also incorporates projections of future workforce flexibility into its estimated headcount requirement for resilience. For example, NERL has identified that to mitigate the risks of the projected retirement of a large proportion of its workforce who are validated on multiple airspace sectors, it will need to increase the training of single validated ATCOs to develop its supply of new ATCOs who are validated on multiple airspace sectors.[71] This requires that current ATCOs have sufficient time for training and forms part of NERL's resilience estimate.

[69] CAA (August 2017), CAP 1578, p.8,1.15.

[70] CAA (January 2018), CAP 1625, p.24, 3.18.

[71] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.66, 6.39.

5. ATCO Headcount: LH3

The requirement for additional staff to support the third runway at Heathrow (LH3) is one of the larger differences between Steer's and NERL's estimates of ATCO headcount for RP3 (27 ATCO FTEs).

Steer's estimate is predicated on its statement: "our understanding is that there is no possibility that LH3 could open before 2026"[72] and therefore Steer argues that additional staffing is not required in RP3.

On the other hand, NERL estimates that 27 additional ATCO FTEs would be required for LH3 in RP3. This is because NERL understands that there is a lead time to recruit and train new ATCOs.

5.1. Steer's Proposition

Steer proposes that no additional ATCOs are required for LH3 in RP3.

5.2. Steer's Justification

Steer argues:

> "our understanding is that there is no possibility that LH3 could open before 2026, well after the end of RP3, and there are considerable risks that the implementation date slips till later. Therefore, even allowing for training times between LH3 opening, we do not consider there to be a need to include additional staff during RP3."[73]

Steer provides no further evidence for these claims.

5.3. Views about Steer's Justification

Steer's proposition misunderstands the lead time in hiring and training ATCOs for deployment. NERL understands that there are risks which may result in a delayed implementation date for LH3. However, NERL recognises it has a responsibility to ensure that it is ready for the implementation of LH3 and therefore must work to the current date of 2026. Otherwise, should LH3 be implemented in 2026 and NERL not act, NERL would not have the ATCOs available to ensure a safe operation of the runway.

5.4. Consequences of Steer's Proposals & Fixing Them

If Steer's proposals were enacted, there is a possibility that LH3 opens and NERL does not have the required number of trained ATCOs to operate the runway safely.

NERL estimates that it will be required to recruit and train an additional 27 ATCO FTEs for LH3. Each of these ATCOs must become validated on the relevant sector for LH3. NERL states that there are five sector positions which can be used to support training. NERL states:

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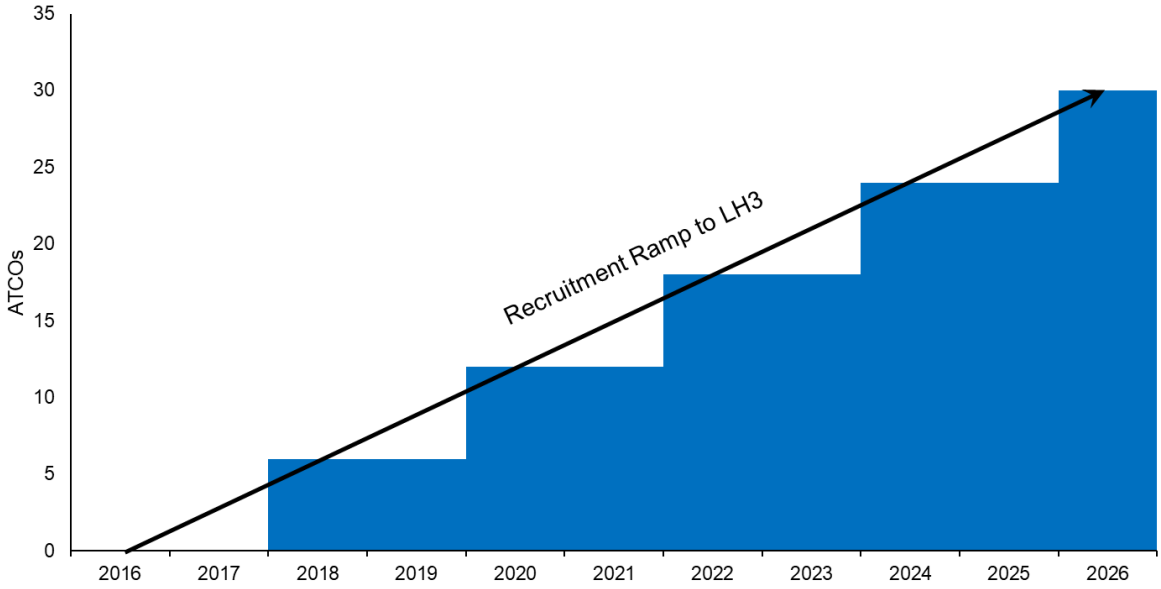
72 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

73 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

> "Training and replacing our experienced ATCOs takes on average three years, with a further two years needed to achieve the same multivalidation level as an experienced retiree."[74]

Making the strong assumption that an ATCO could be validated for LH3 within two years, the recruitment 'ramp' that NERL faces is shown in Figure 5.1.

Figure 5.1: NERL's recruitment ramp to LH3.



Source: NERA Analysis.

Therefore, if we assume that no further ATCOs retire from their positions in the same sector as LH3, then NERL would need to begin operating its training platform at full capacity in 2016 to meet the LH3 2026 deadline. NERL recognises this 'ramp' and therefore makes allowances for additional headcount in RP3 to deliver on LH3.[75]

5.4.1. Trainee ATCOs

Steer argues that the number of trainee ATCOs would be reduced relative to NERL's business plan assuming Steer's ATCO total headcount estimates for RP3. More specifically, NERL stated it would require 411 additional ATCO FTEs comprised of new validations from training centres (95 percent), external recruits and internal transfers for RP3.[76] This would be reduced under Steer's total headcount estimates to between 308 and 385 additional ATCO FTEs.[77] Steer argues that this will have consequent implications for other headcounts e.g. ATSAs who are used as trainers (discussed in Section 7).[78]

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74 NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024, p.36.

75 NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 13.

76 This includes 389 new validations, 6 external recruits and 16 internal staff transfers. Source: NERL (June 2018), "Response to Steer questions on operational manpower and planning", p.11.

77 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.66, 6.38.

78 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.66, 6.38.

Steer understates the number of trainee ATCOs required in its total headcount estimate. This is because Steer continues to understate the constraint that the lead time for validation places on ATCO training and recruitment. As with LH3, Steer fails to recognise that trainee ATCOs will be included in the headcount for RP3 despite only becoming of validation level in RP4.

In addition, NERL is attempting to improve this lead time and allow for additional flexibility in its workforce for future regulatory periods.[79] NERL aims to increase the number of ATCOs who are validated on multiple airspace sectors. This will allow for increased resilience and will also allow for NERL to mitigate the risk associated with the projected retirement of a large proportion of its workforce who are validated on multiple airspace sectors. However, should the ATCO headcount for RP3 be significantly below NERL's estimate, then new ATCOs would be required to deliver the service under their trained validation and would not have additional time to become validated on multiple airspace sectors. This argument also constitutes part of NERL's estimate for additional headcount due to resilience. Steer recognises this impact in its response to NERL's comments.[80]

[79] NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024, p.36.

[80] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.66, 6.39.

6. ATCO Headcount: DSESAR

There is a relatively large difference (17 to 27 ATCO FTEs) between Steer's and NERL's estimated ATCO headcount reduction resulting from the implementation of DSESAR in RP3.

DSESAR is a capital investment programme that implements modern technology to replace legacy systems to manage the increased traffic and complexity of the future airspace.[81] It commenced during RP2 in recognition of the limitations of existing equipment to meet future requirements. DSESAR systems are currently being implemented will dual-run with existing systems until 2022 when these will be withdrawn. The expected cost will be £750m to £850m across RP2 and RP3. DSESAR is NERL's implementation of technology aligned with the outcomes set out in the SESAR ATM masterplan.

NERL estimates that the implementation of DSESAR will reduce the required ATCO headcount by 21 FTEs.[82] This represents a 2 per cent efficiency saving on total estimated ATCO headcount. NERL argues that these efficiency savings are generated from two sources:

1. 1 per cent efficiency saving from dynamic sectorisation.
2. 1 per cent efficiency saving from sector team operations.

In addition, NERL recognises that the implementation of DSESAR in RP3 will lead to a 22 per cent ATCE headcount reduction.[83] This is discussed in more detail in Section 7.

6.1. Steer's Proposition

Steer estimates that the DSESAR capital investment programme will lead to a reduction of 38 to 48 ATCO FTEs representing an efficiency saving of 4 and 5 per cent of Steer's total estimated ATCO headcount respectively.

6.2. Steer's Justification

Steer provides a high-level discussion of evidence that it interprets leads to a larger efficiency gain than the one estimated by NERL. However, Steer does not substantiate its claim that efficient savings will be 4 or 5 per cent of total estimated ATCO headcount. Instead, Steer states that:

> "we consider that these benefits of DSESAR, identified but not quantified by NERL, could lead to efficiency gains in the range of 2% to 3% during RP3"[84]

Steer then adds these efficiency gains to the 2 per cent already identified by NERL.

6.3. Views about Steer's Justification

The high-level evidence provided by Steer does not substantiate Steer's claim that it would expect 2 to 3 per cent efficiency savings *in addition to* the 2 per cent estimated by NERL.

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81 NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024, p.16.

82 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.63, Figure 6.6.

83 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.76, 6.88.

84 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.62, 6.26.

More specifically, we respond to the evidence cited by Steer:

- Steer cites an efficiency saving of 12 per cent from the SESAR Joint Undertaking's proposal on the content of a Pilot Common Project.[85] This estimated saving was provided in 2013. NERL states in its workshop for CAA in 2018:

  "The supporting analysis noted that the assessments were based on some exercises and on project team expert judgment with only 25% of the claimed performance improvement having been demonstrated through validation."[86]

- Steer questions the value for money arising from "such a limited productivity gain"[87] (of 2 per cent estimated by NERL) as the product of "a very large investment of several hundred million pounds in DSESAR"[88]. Steer does not recognise that DSESAR leads to substantial savings in ATCE headcount (of a net reduction of £17m). More importantly, Steer does not consider the counter-factual and the resulting increase in headcount and costs that would be required if the legacy system would be sustained into RP3 and future regulatory periods.
- Steer provides a high-level discussion on the implementation of the iTEC suite and ExCDS resulting in efficiency savings.[89] Savings from the iTEC suite will occur with the implementation of DSESAR and are included in the savings for ATCE and ATCO headcount estimated by NERL.

  However, the final deployment of ExCDS occurred in June 2018 and will result in a reduction of ATSA headcount by 23 FTEs.[90] NERL reports that ExCDS will not lead to a reduction in ATCO headcount.
- Steer also states that the introduction of FourSight will lead to efficiency savings.[91] However, Steer recognises these will not occur until RP4.

Therefore, it is unclear where Steer derives the basis for estimating efficiency savings beyond those already estimated by NERL.

6.4. Consequences of Steer's Proposals & Fixing Them

The consequence of overstating the impact of DSESAR is that Steer underestimates headcount by between 17 and 27 ATCO FTEs. By overstating the expected efficiency gain in RP3, NERL will be understaffed to manage the transition to the new technology system. As previously discussed, this increases the susceptibility of NERL's operation to complications in this transition which may lead to delays and an unsatisfactory service for consumers.

85 SESAR (May 2013), Proposal on the content of a pilot common project, p.34.

86 NATS (En Route) plc (August 2018), RP3 manpower planning workshop, slide 53.

87 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

88 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

89 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

90 Business plan Appendices p.88.

91 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.61, 6.26.

In addition, Steer imbues the impact of capital investment programmes in its traffic growth model. Capital investment programmes directly impacts headcount estimates related to traffic growth, catch-up and resilience. Steer should make a smaller adjustment to headcount for DSESAR or a higher one for traffic growth: Its estimate should reflect only the incremental benefit of DSESAR relative to the historical trend in technological progress across European ANSPs.

NERL relies on management expertise to understand this interrelatedness. More specifically, NERL understands how capital investment programmes like DSESAR simultaneously ATCO efficiency (based upon the number of aircraft and number of validations that an ATCO can manage), the resulting sector operational hours/grouping (which determines the capacity) and the resulting implications for resilience and catch-up of its operation.

On the other hand, Steer applies separate methods to estimate the resulting change in ATCO headcount resulting from each of these concepts. It therefore double counts the impact of technological progress and change across its estimates because it does not control for this interrelatedness.

7. Other Estimated Headcounts

In this section, we briefly examine differences between NERL's and Steer's estimated additional FTE headcount for RP3 for Air Traffic Control Engineers (ATCEs), Air Traffic Service Assistants (ATSAs) and Personal Contract Group (PCG)/Managerial Support Grade (MSG) Staff.

7.1. ATSA Headcount

Steer estimates that substantially fewer ATSA FTEs will be required by the end of RP3 compared to NERL's corresponding estimate: Steer estimates that, based on its 'efficient operator model', ATSA headcount in 2024 should be 8 to 23 per cent lower than NERL's estimate of 516 ATSA FTEs.[92] In total, NERL estimates that ATSA headcount will fall from 562 to 516 FTEs (minus 46) in RP3.

Steer provides the following reasoning for its estimate for each of the three profiles of ATSAs identified in NERL's business plan:

- **Operational ATSAs:** Steer assumes a rate of reduction of 5 to 10 FTEs per year across RP3. This assumption appears solely based on the realised reduction in RP2 and therefore does not account for the large reduction of ATSA FTEs observed since 2007.[93] Given the justification provided, Steer's assumption that it "should be possible"[94] for an efficient operator to reduce headcount of Operational ATSAs relies on arbitrary assertion rather than a consideration of the services that those ATSAs would provide.
- **ATSAs for ATCO Training**: Steer assumes a lower headcount estimate for ATSAs for ATCO training because it assumes fewer ATCOs require training in RP3 than NERL (see Section 5.4.1). Steer fails to recognise the lead time in training ATCOs and therefore underestimates the number of trainee ATCOs, and ATSAs to train ATCOs, required in RP3.
- **Non-Operational ATSAs:** Steer argues that non-operational ATSA headcount after 2020 should be reduced 1.25 to 1.5 times faster NERL suggests.[95] Steer does not further justify this assumed rate of reduction.

Steer's estimates understate the ATSA headcount required in 2024 by 41 to 120 ATSA FTEs. Steer does not provide credible reasoning for these estimates which appear to be largely arbitrary and not founded upon the operational impact of ATSA staff on NERL's service. Therefore, in understating the estimated ATSA headcount, Steer does not appear to consider the impact on performance and delay. Moreover, it is unclear that Steer considers the fact that ATSAs provide a complementary service to ATCOs and therefore the resulting estimated headcounts should be interrelated.[96]

Consequently, Steer fails to recognise that lower ATSA headcount would risk lower service performance and potential delay of programme implementation due to insufficient resources

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92 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.70, Figure 6.12.

93 NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024, Appendix K, p.88.

94 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.69, 6.53.

95 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.70, 6.53.

96 NATS (En Route) plc (October 2018), RP3 Business Plan 2020-2024, Appendix K, p.89.

to support training for ATCOs. On the other hand, NERL's approach incorporates these needs into its business plan more effectively and therefore provides the more accurate headcount estimate.

7.2. MSG and PCG headcount

MSG and PCG fulfil three categories of roles at NERL: operations support, technical services support and other support staff.[97] Steer estimates a substantially lower headcount than NERL for MSG and PCG FTEs through RP3: NERL estimates a total headcount of 718 FTEs compared to Steer's estimate of 623 to 643 FTEs (a difference of minus 75 to minus 95).[98]

Steer estimates the required number of MSG/PCG FTEs by estimating the historical elasticity, in other words responsiveness, of their headcount to traffic growth. Steer estimates this elasticity for NERL and two 'comparator' organisations: Steer uses airports, for data availability reasons, as its 'comparator' organisations.[99] Steer does not explain its method for estimating the elasticity, which makes the precise method difficult to appraise econometrically.

However, even if traffic growth elasticities, and Steer's opaque method in particular, were a sensible way to estimate staff requirements, comparing the resulting elasticity to one estimated from an airport is invalid. For airports to provide a relevant benchmark, one would need to believe that the trade-offs between capital and labour are identical between air traffic control and airports. The capacity of an airport is constrained by its physical infrastructure and depends crucially on the additional deployment of physical capital. On the other hand, the airspace can become more complex to increase traffic, which requires additional headcount. As a result, it is likely that Steer's traffic growth elasticity estimated using airport data is likely to underestimate the responsiveness of headcount for an ANSP.

Consequently, Steer's estimates understate the headcount of MSG/PCGs by 75 to 95 FTEs. NERL argues that this will increase the risks associated with delivering DSESAR in RP3.[100] Steer fails to recognise the implications of MSG/PCG headcount in its proposed ATCO headcount attributable to resilience. Moreover, whilst Steer acknowledges NERL's use of MSG/PCGs to substitute for ATCO roles, it does not make a compensating adjustment to its estimated ATCO FTE headcount for its proposed reduction in MSG/PCG FTE headcount. Therefore, Steer's method is inconsistent across headcount estimates for different groups of staff.

7.3. ATCE Headcount

Steer does not estimate the headcount requirement for ATCEs throughout RP3, arguing that:

97 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.74, 6.72 and 6.73.

98 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.76, Figure 6.15.

99 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.75, 6.79.

100 Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.76, 6.85.

> "Due to the highly technical nature of these roles, together with the introduction of new technology at NERL during RP3, it has been difficult to assess the technical staff numbers in isolation."[101]

Steer's recognition that the numbers of staff in technical roles may not be assessed in isolation is warranted. Many of NERL's staff operate in highly technical roles which deliver services collectively and with some degree of substitution. Accordingly, Steer cannot effectively appraise total headcount using an efficient operator model which applies separate methods to each staff role (and even to separate drivers within each category of staff).

Understanding the trade-offs between different staff types and approaches to operating the business necessarily requires detailed management expertise. As part of a holistic assessment of the staffing needs of the business, NERL estimates that ATCE headcount will decline throughout RP3 from 721 FTEs in 2019 to 565 FTEs in 2024: A decline of 22 percent.[102] The DSESAR programme facilitates this reduction in headcount (see Section 6). NERL states that this is an equivalent net reduction in costs of £17 million.

Given that Steer has acknowledged the need to assess technical staff numbers in conjunction with overall headcount, Steer should have taken account of ATCE headcount reductions in its forecast requirements for other staffing categories. For instance, Steer justifies its proposed reduction in ATCO headcount with reference to a need to provide evidence of cost reduction as a result of investing in DSESAR. However, it failed to take account of the reduction in ATCE headcount associated with the DSESAR programme.

[101] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.76.

[102] Steer (February 2019), NERL's forward-looking capital programme and expenditure efficiency, p.76, 6.88.

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NERA
ECONOMIC CONSULTING

NERA Economic Consulting
Marble Arch House
66 Seymour Street
London, UK W1H 5BT
+44 207 659 8500
www.nera.com