UK RP3 CAA Decision Document: Appendices

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APPENDIX A

Abbreviations

Abbreviations	
3Di	metric that incorporates flight path inefficiencies
ACP	Airspace Change Proposals
ADS-B	automatic dependent surveillance – broadcast system
AIS	aeronautical information services
AMS	Airspace Modernisation Strategy
ANS	air navigation services
ANSL	Air Navigation Solutions Ltd
ANSP	air navigation services provider
ASEPS	advanced surveillance enhanced procedural separation
ASBU	Aviation System Block Upgrades
ATC	air traffic control
ATCO	air traffic control officer
ATS	air traffic services
ATSA	air traffic services assistant
ATFCM	air traffic flow and capacity management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
BAATL	Birmingham Airport Air Traffic Ltd
C1	key performance indicator in the area of capacity - average minutes of ATFM delay
C2	performance indicator in the area of capacity - average minutes of ATFM delay attributable to NERL
C3	performance indicator in the area of capacity - delay impact score
C4	performance indicator in the area of capacity - daily excess delay score
CAAPS	CAA Pension Fund
CAPM	capital asset pricing model
CCWG	Customer Consultation Working Group
CDO	Continuous Descent Operation
CEPA	Cambridge Economic Policy Associates
CNS	Communication Navigation Surveillance

Abbreviations	
CPI	consumer price index
CSU	chargeable service unit
DB	defined benefit
DC	defined contribution
DfT	Department of Transport
DMO	Delivery Monitoring and Oversight
DUC	determined unit cost
EBITDA	earnings before interest, tax, depreciation and amortisation
EoSM	Effectiveness of Safety Management
EU	European Union
FAB	Functional Airspace Block
FAS	Future Airspace Strategy
FFO	funds from operations
FIR	flight Information Region
FMARS	future military area radar service
FTE	full time equivalent
GAD	Government Actuary's Department
GANP	Global Air Navigation Plan
GDP	Gross Domestic Product
HAL	Heathrow Airport Limited
IAG	International Airlines Group
IBP	Initial Business Plan
ICAO	International Civil Aviation Organisation
IFR	instrument flight rules
IR	independent reviewer
KEA	horizontal en route flight efficiency of the actual trajectory indicator
KEP	horizontal en route flight efficiency of the last filed flight plan
KPA	key performance area
KPI	key performance indicator
LAMP	London Airspace Management Programme
MOCCA	Met Office Civil Contingencies Aircraft
LIBOR	London Inter Bank Offered Rate
MOD	Ministry of Defence
NATS	National Air Traffic Services

Abbreviations	
NATSPG	North Atlantic System Planning Group
NERL	NATS (En Route) plc
NM	Network Manager
NOP	Network Operations Plan
NPV	net present value
NSA	National Supervisory Authority
NSL	NATS Services Ltd
OEF	Oxford Economics forecast
OFF	Opex Flexibility Fund
OTS	organised track system
PBO	Pensions Benefit Obligation
PBN	Performance Based Navigation
PI	Performance Indicator
PRB	Performance Review Body
RAB	Regulatory Asset Base
RBP	Revised Business Plan
RFR	risk free rate
RPS	Regulatory Policy Statement
RP2	Reference Period 2
RP3	Reference Period 3
RP4	Reference Period 4
RORE	return on regulated equity
RPI	retail prices index
S&P	Standard & Poor's
SARG	Safety and Airspace Regulation Group
SES	Single European Sky
SESAR	Single European Sky ATM Research
SIP	Service and Investment Plan
SSP	State Safety Programme
STATFOR	(Eurocontrol's) Statistics and Forecasts Service
TANS	terminal air navigation services
TMR	total market return
TSU	total service units
UIR	upper flight information region

Abbreviations	
UPR	user preferred routes
VAAC	Volcanic Ash Advisory Centre
WACC	weighted average cost of capital
WAFS	World Area Forecast System

Note: Unless stated otherwise, all financial figures throughout the appendices are in £2017 CPI prices.

APPENDIX B

Regulatory framework and scope

Introduction

B1 This appendix summarises the legal and regulatory frameworks applicable to our RP3 final decisions in respect of NERL's monopoly activities and the preparation of the broader UK performance plan.

Regulatory framework

The performance and charging scheme

B2 The SES performance and charging scheme is set out in EU legislation and is designed to improve the performance of ANS in four key performance areas (KPAs):

- Safety
- Capacity
- Environment
- Cost efficiency

B3 Detailed requirements of the performance scheme are contained in the RP3 performance and charging regulation (the 'performance regulation'),[1] the main features of which are summarised below.

B4 Member States must adopt performance plans in respect of ANS providers covering a five-year reference period. The current regulatory cycle, Reference Period 2 (RP2), comes to an end on 31 December 2019. Reference Period 3 (RP3) will run from 1 January 2020 to 31 December 2024.

B5 The European Commission (the Commission) must set EU-wide targets in each KPA based on Key Performance Indicators (KPIs), taking account of performance achieved in the previous reference period and inputs provided by

[1] Commission Implementing Regulation (EU) 2019/317 of 11 February 2019 laying down a performance and charging scheme in the single European sky and repealing Implementing Regulations (EU) No 390/2013 and (EU) No 391/2013

certain advisory bodies (the Performance Review Body (PRB), the SES Network Manager (NM) and NSAs).

B6 The performance plans submitted by Member States must contain performance targets for each KPI set at national level that are consistent with EU-wide targets that are set by the Commission.

B7 Performance targets in the KPAs of capacity, environment and cost efficiency should be subject to effective financial incentive schemes to encourage better performance. There are no financial incentives on safety due to its overriding importance.

B8 NSAs must consult on performance plans to ensure the views of stakeholders are taken into account in establishing performance plans and targets.

Finalising the RP3 performance plan

B9 The DfT is required to adopt and submit the draft performance plan to the Commission by 1 October 2019.

B10 Within one month of submission, the Commission will conduct a verification process on Member States' performance plans. If no key information has been omitted, the performance plans submitted by Member States will come into effect on 1 January 2020.

B11 Within five months of submission (1 March 2020 at the latest) the Commission will undertake a formal assessment of performance plans and targets, for consistency with the regulation and EU-wide targets. If any subsequent changes are required, they will be applied retrospectively.

The Transport Act 2000

B12 The Transport Act gives the CAA a primary duty to exercise its functions so as to maintain a high standard of safety in the provision of air traffic services.

B13 In exercising its functions, the CAA must do so in a manner it thinks best calculated:

- to further the interests of operators and owners of aircraft, owners and managers of aerodromes, persons travelling in aircraft and persons with rights in property carried in them;
- to promote efficiency and economy on the part of licence holders;
- to secure that licence holders will not find it unduly difficult to finance activities authorised by their licences;
- to take account of any international obligations of the UK notified to the CAA by the Secretary of State (whatever the time or purpose of the notification); and

- to take account of any guidance on environmental objectives given to the CAA by the Secretary of State.

B14 The Transport Act also places duties on NERL. As the licence holder it:

- must secure that a safe system for the provision of authorised air traffic services in respect of a licensed area is provided, developed and maintained;
- must take all reasonable steps to secure that the system is also efficient and coordinated;
- must take all reasonable steps to secure that the demand for authorised air traffic services in respect of a licensed area is met;
- must have regard, in providing, developing and maintaining the system, to the demands which are likely to be placed on it in the future.

B15 Our approach to economic regulation includes price controls where we specify the maximum amounts that NERL can charge its customers for its regulated services. These amounts depend on how it performs against performance targets. These price controls are given effect through conditions in the NERL licence.

B16 If, in due course, NERL accepts our performance plan and the associated licence modifications that give effect to this, it should only do so on the basis that it is taking full responsibility and accountability for providing an appropriately high quality of service to airlines and their passengers. If NERL were not to consent to our licence modifications, we expect that we would in due course make a reference to the Competition and Markets Authority (CMA) to investigate and report on our proposed modifications.

Scope of the performance plan

B17 The performance plan covers:

- NERL's en route ANS in the Scottish and London Flight Information and Upper Information Regions (FIR/UIR);
- NERL's London Approach combined approach ANS for certain London airports;[2]
- the costs of the UK's contribution to Eurocontrol – referred to as DfT costs in the performance plan;
- the costs of aviation services provided by the Met Office;
- the costs of the CAA's airspace policy and regulation activities; and

[2] See chapter 8 on the London Approach service

- terminal ANS performance requirements.[3]

B18 Under the performance regulation, Member States may decide to adopt plans at the Functional Airspace Block (FAB) or national level. Our final decisions and the performance plan have been developed on the basis of adoption at the national level. Brexit implications aside, there are material differences in terms of size, scope and complexity of UK and Irish airspace and ANS. In these circumstances, national plans provide a more transparent view of respective performance over RP3.

B19 Furthermore, the complexity of the UK airspace and air navigation arrangements mean that it is not appropriate to apply the simplified charging scheme set out in Article 34 of the performance regulation.

B20 The Oceanic price control covers the air traffic services NERL provides to aircraft crossing the North Atlantic. This service is not in scope of the SES performance framework and is regulated under the Transport Act. The regulatory periods are aligned and, where appropriate, we have made similar assumptions in setting the Oceanic and UK en route price controls. Chapter 11 of our main document sets out final decisions for the Oceanic price control.

[3] See chapter 10 on terminal ANS

APPENDIX C

Traffic forecasts

C1 To establish the projections of the DUC's that are central to the UK performance plan, it is necessary to adopt a traffic forecast to use alongside projections of costs and revenues. We have assessed both of the forecasts produced by NERL and Eurocontrol's Statistics and Forecasting service (STATFOR) and the latest versions of these forecasts are not significantly different from each other. In reaching our views on the best forecast to use for RP3, which are set out in chapter 1 of the main document, we have considered the advantages and disadvantages of each forecast. This appendix provides a high-level comparison between the two forecasts.

Comparison of STATFOR and NERL's traffic forecasts

C2 NERL's (May 2019) and STATFOR (February 2019) are not significantly different, with NERL's flights forecast 1.0% above STATFOR's for the RP3 period, and NERL's TSU forecast 0.9% below that of STATFOR. We have considered the advantages and disadvantages of each forecast to identify the best forecast to use with our assumptions on costs and revenues for RP3.

Treatment of excess demand

C3 The main difference between NERL's forecasting methodology and STATFOR's is the treatment of excess demand when airports become constrained. NERL's model re-allocates passengers to viable alternative airports when a particular airport is capacity-constrained. The STATFOR model instead assumes that excess demand is lost, implying that constrained-off passengers would not fly. The NERL approach is theoretically preferable for the UK compared to the STATFOR approach, which is more suited to continental Europe where the impact of airport constraints is significantly lower than for UK, and where rail or road travel may be a more viable alternative to flying.

C4 There are minor differences in scope between how NERL and STATFOR count historical flight numbers, however they generally evolve at the same rate because, by and large, they almost completely overlap. The official Network Manager IFR Flight Counts, as used by STATFOR, were 0.8% higher than NERL equivalent counts. Therefore, to make like-for-like comparisons between NERL and STATFOR, we have derived the NERL forecast using NERL growth rates, but baselined to STATFOR 2018 actual data. It is noted that the NERL financial model uses NERL actual TSUs for 2018, which are about 2000 TSU's lower than shown in Table C.1.

Table C.1 compares the NERL (May 2019) and STATFOR (February 2019) forecasts. All else being equal, in a capacity-constrained environment, as expected for the UK in RP3, the NERL model would be expected to produce higher traffic forecasts. However, for RP3 as a whole, STATFOR's forecast for TSU is 0.9% higher than NERL's forecast.

Table C.1: Comparison of NERL and STATFOR traffic forecast

	Source	2018 A	2019	2020	2021	2022	2023	2024	RP3 (2020-2024)
Overall UK flights (000)	STATFOR	2,558	2,600	2,649	2,685	2,737	2,771	2,802	13,645
	NERL	2,558	2,581	2,630	2,693	2,760	2,827	2,866	13,776
TSU (000)	STATFOR	12,194	12,408	12,648	12,891	13,183	13,406	13,615	65,743
	NERL	12,194	12,299	12,391	12,701	13,043	13,380	13,636	65,150

Source: NERL and STATFOR

2019 baseline

C5 Both forecasts use 2019 to represent the base starting point for the 2020-2024 forecast period. Actuals available for 2019 at the time of the analysis (January – June) point to a more positive outturn than anticipated in NERL's forecast. For flights, year to date growth is 1.7% compared to STATFOR's annual growth rate assumption of 1.7% and NERL's annual assumption of 0.9%. On this basis, the STATFOR forecast appears more plausible.

C6 For TSUs, year to date growth is 3.3% compared to STATFOR's annual growth rate assumption of 1.8% and NERL's annual assumption of 0.9%. For the STATFOR forecast to materialise, the rest of the year would be expected to grow by 0.4%, while for NERL's forecast to materialise, the rest of the year (including the peak summer months) the TSUs growth would have to decline by 1.3%. Both forecasts appear to underestimate the likely outturn for 2019 given the year to date, but NERL significantly more so than STATFOR. This reinforces the conclusions above with respect to STATFOR being a more plausible forecast.

Distance factor assumptions

C7 The position of the jet stream over the North Atlantic significantly influences distances flown by transatlantic flights, which make up a significant (c.40%) portion of NERL's regulated revenue. NERL assume a decline in distances on the North Atlantic from a peak in 2018 to 5-year average distances by 2020. To date in 2019 this has not been apparent and TSUs continue to grow strongly relative to 2018. Based on outturn traffic to June 2019, it would take a significant

and sustained reduction in average distances on the North Atlantic for the rest of the year for NERL's 2020 forecast to materialise and, while this is possible, we consider it to be unlikely.

C8 We understand that STATFOR shares the NERL view regarding distances on the NAT reverting to long-term averages. However, the STATFOR TSUs forecast is based on a higher flight forecast than NERL's in the early years which raises the TSU forecast above NERL's. Although outturn to June 2019 points to higher TSUs than either STATFOR or NERL, STATFOR compares more favourably with data from 2019.

Aircraft weight assumptions

C9 Analysis of both forecasts suggests that the methodology and assumptions used for calculating the aircraft weight factor do not seem to sufficiently take account of aircraft weight growth. Heathrow and Gatwick airports are both likely to be constrained in RP3 and the NERL forecast would be expected to assume larger aircraft sizes to maximise runway utilisation at constrained airports. However, there appears to be no significant weight factor growth in NERL's TSUs calculation, with flight and TSU growth rates appearing to be almost identical. This could lead to NERL underestimating TSU's growth.

C10 STATFOR assumes some weight growth based on historical data for the UK (not individual routes/airports), which should capture some of the effect of increased aircraft sizes at constrained airports in the UK, but not to the extent we would have expected, meaning that STATFOR's forecast could also understate TSUs. On balance, recognising that the STATOR TSU forecast is higher than NERL's, we consider STATFOR to represent a more plausible scenario.

Economic assumptions

C11 1.11 GDP is a key economic assumption underpinning the forecasts and has been revised down since our draft proposals (although these revisions have not been material). In May 2019, STATFOR issued a new short-term TSU forecast covering only the first year of RP3. For the UK, this represented a 0.2% reduction in TSUs when compared to the February 2019 forecast.

Distance factor methodology

C12 For RP3 a new method for calculating the distance factor will apply for establishing TSUs. In RP2, the distance factor is based on planned distances whereas in RP3, it will be based on actual distances. Neither NERL nor STATFOR forecasts take into account this change in methodology.

C13 In May 2019, the CRCO estimated that the change in methodology will increase the UK TSU forecast by some 0.2%. Recognising the potential limitations of

using forecasts that do not account for the RP3 change in method,[4] taking the impact of the GDP effect together with the implied impact of the change in distance factor, the net outcome is neutral making the STATFOR February forecast still plausible.

[4] STATFOR is expected to issue a new forecast, which will follow the new methodology set out in the performance regulation in October 2019, after the performance plans are submitted to the Commission.

APPENDIX D

Service quality – additional information

D1 The service quality metrics and incentives for the UK for RP3 are based on the performance measures in place for RP2. This appendix provides further detail on the calculation of the service quality metrics for the Environment and Capacity KPAs.

Environment

3Di incentive scheme

D2 The 3Di incentive scheme is established on the basis of the targets discussed in chapter 3. As in RP2, a deadband of ±5% is proposed for RP3 within which no bonus or penalty is triggered. Beyond the deadband, the incentive will follow a smooth sliding scale until +/-25% of the target at which point maximum financial bonus or penalty will be reached.

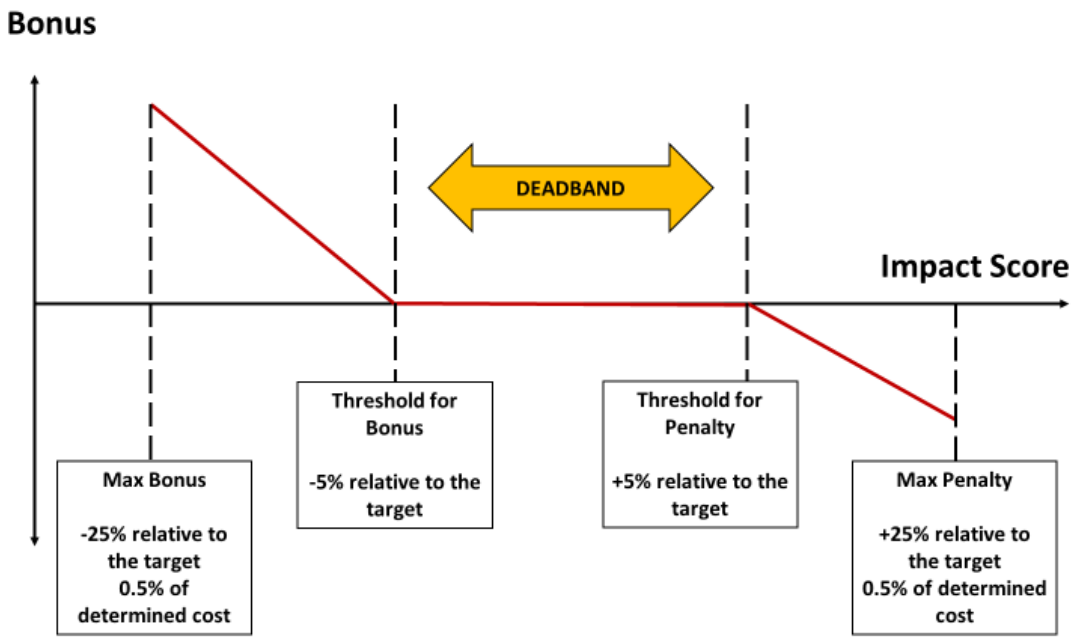
D3 The incentive rate is calculated evenly for each 3Di unit within the range +5% to +25% of the target (and correspondingly between -5% and -25% of the target).

D4 For example, the incentive rate for 2020 is ±0.091% of NERL's Determined Costs for each 3Di unit beyond the deadband, up to a maximum of ±0.5% of Determined Costs. The incentive rate is derived by dividing the overall pot of the incentive scheme (in this case ±0.5% or 0.005) by the units between the ±5% deadband and ±25% maximum threshold. With the 2020 target of 27.8 the deadband for bonuses starts at 26.4 and ends at 20.9 [26.4-20.9=5.5; (0.005/5.5)*100% = 0.091%].

D5 Figure D.1 illustrates the incentive scheme for 3Di.

D6 As in RP2, the 3Di thresholds are not modulated for traffic.

Figure D.1: 3Di incentive scheme



Source: CAA

Capacity - C2

C2 incentive scheme

D7 The C2 is an adjusted metric that is used for the purpose of the mandatory incentive scheme in the capacity KPA. It is referred to as 'pivot value' in the performance regulation.

D8 As indicated in chapter 4, we intend to maintain the proportions of non-ANSP-attributable delay for the calculation of this target vs. the C1 target at levels targeted currently in RP2. Based on past performance, the C2 targets for RP2 represented 78% of the C1 target (meaning 22% of the C1 delay was considered non-ANSP attributable). This proportion was maintained in NERL's business plan and agreed with airlines during NERL's consultation. The RP3 target for C2 is therefore also calculated on the basis of the same proportions. For example, the C2 target for 2020 is the C1 target of 0.26 multiplied by 78% (0.26*0.78=0.20).

D9 The performance regulation requires a symmetric 'deadband' range be applied around the C2 target, so that minor variations in ATFM delay do not lead to bonuses or penalties.

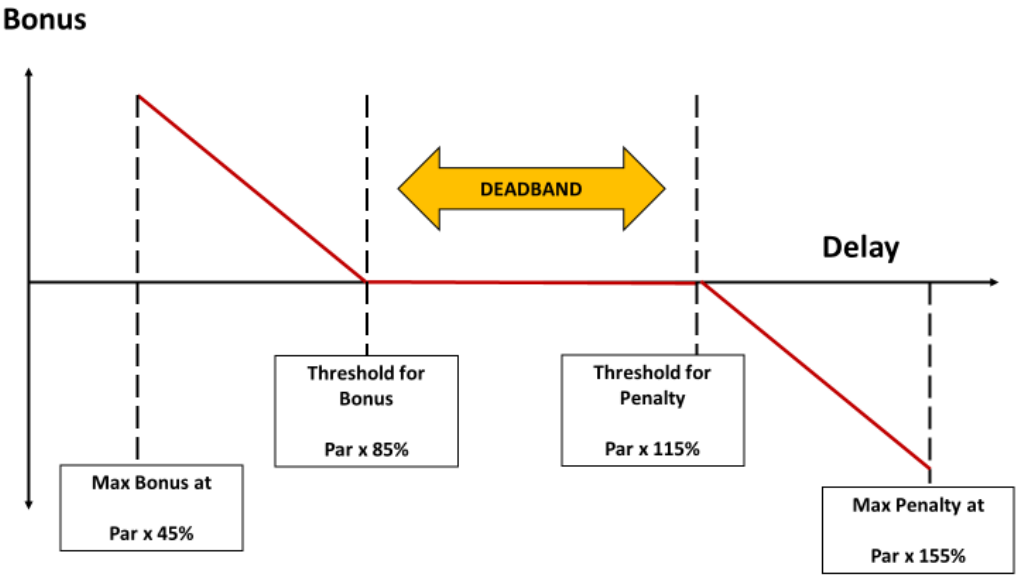
D10 As discussed in chapter 4, the targets seek to balance good past performance, with ensuring appropriate flexibility to support the major transitions planned in RP3. To prevent NERL from gaining undue bonuses if the transitions are delayed (or do not cause the extent of delay anticipated by NERL) as well as strong opposition from airspace users to pay for additional capacity if targets are outperformed, we decided to minimise the potential for bonuses by reducing the

strength of the incentive scheme. With uncertainties related to the transitions, an adjustment was also made to the strength of the penalty for this metric, to align it with RP2 levels. As per our draft proposals, we propose that the deadband is set at ±15%. NERL considered that this would mean penalties will be incurred sooner but the asymmetric deadband in RP2 meant that NERL would start incurring penalties if it deviated from the target value by 10%, rather than 15% proposed for RP3.

D11 This means that NERL would be subject to a penalty should its performance in any year be more than 15% worse than the targets set out in chapter 4 (i.e. for 2020 this would mean ATFM delay of 0.23 minutes/flight or higher). NERL will earn a bonus should its performance in any year be more than 15% better than the targets set out in chapter 4 (i.e. for 2020 this would mean ATFM delay of 0.17 minutes/flight[5] or lower).

D12 As in RP2, maximum allowed bonuses or penalties would be reached if NERL's performance is outside the deadbands by an additional ±40%. The incentive will follow a sliding scale as illustrated in Figure D.2 below.

Figure D.2: C2 deadband and incentives



Source: CAA

Capacity - C3

Calculation of C3

D13 The C3 metric is an impact score, which places greater weight on long delays and delays in the morning and the evening peaks. The targeted levels of the C3

[5] Rounded to two decimal places

impact score are set out in chapter 4. The annual impact score is calculated by weighting ATFM delays in accordance with Table D.1.

Table D.1: Weights for impact score

	Morning peak period	Evening peak period	Other times
Delay > 0 and <= 15 minutes	3	2	1
Delay > 15 and <= 30 minutes	6	3	2
Delay > 30 and <= 60 minutes	9	6	3
Delay > 60 minutes	18	9	6

Source: CAA. Notes: "Morning peak" means flights with an off-block estimated time between 0400 and 0800 UTC in Summer (April –October inclusive) and between 0500 and 0900 UTC in Winter (January – March inclusive and November-December inclusive). "Evening Peak" means flights with an off-block estimated time between 1500 and 1900 UTC in Summer (April –October inclusive) and between 1600 and 2000 UTC in Winter (January-March inclusive and November-December inclusive).

D14 The weights in Table E.1 were developed through consultation between NERL and users for a previous control period (CP3) before the performance regulation applied. It will continue to apply in RP3.

C3 incentive scheme

D15 The thresholds beyond which NERL can earn a bonus or penalty for the C3 metric are determined with reference to C2. That is:

- the (upper) threshold above which NERL is penalised be equal to the C3 score derived from the level of the C2 target; and
- to maintain consistency with RP2, the (lower) threshold below which NERL would earn a reward be set at two-thirds of the upper threshold.[6]

D16 In RP2 a ratio of 2.2 was used to covert C2 value to C3 thresholds. However, NERL's performance so far in RP2 (including its projection for 2018) point to an average ratio of 1.89. We have therefore used a ratio of 2.0 in this determination.

D17 In order to arrive at the C3 value, the C2 target is first converted from minutes/flight to seconds/flight by multiplying the target by 60. It is then multiplied by the conversion factor of 2.0 to reach the upper threshold of C3. For example, for 2020 the calculation is as follows: 0.20*60*2.0=24.

D18 The lower threshold of C3 is then derived by multiplying the upper thresholds by two-thirds. For example, for 2020 the calculation is as follows: 25*(2/3)=16.

D19 Following the increase of C3 targets as discussed in chapter 4 and given the availability of transitional allowance for this measure (see below), we reviewed

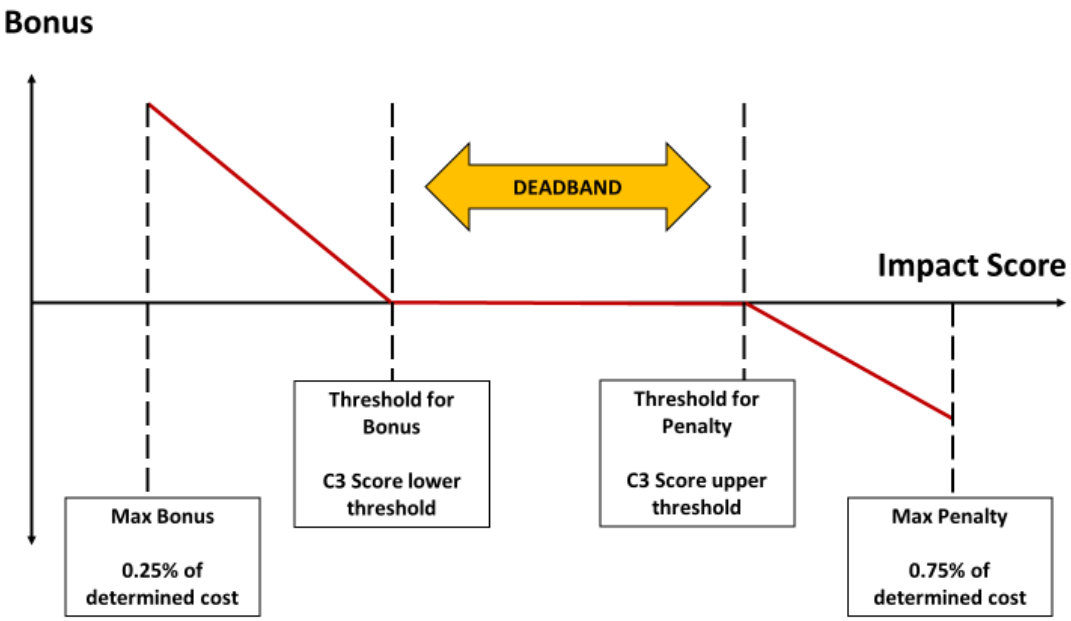
[6] In RP2 the lower threshold was based on delay forecasts in NERL's business plan

and reduced the strength of the incentive scheme. The rate at which NERL's performance would affect any bonus or penalty it earns has been set such that the maximum reward of 0.25% of Determined Costs would be earned if the impact score is zero and the traffic is as forecast for 2020.[7] That rate is £0.038 in 2017 prices. The penalty rate is £0.075 in 2017 prices up to a cap of -0.75% of Determined Costs. The bonus and penalty rate will be indexed to CPI during RP3.

D20 The rates are calculated based on total pot for the incentive (for 2020, based on a Determined Cost of £637.390m in 2017 prices, this is £1.593m for bonuses given the 0.25% maximum cap and £4.780m for penalties given the 0.75% maximum cap) divided by: the C3 score (for 2020, this is a lower threshold of 16 or upper threshold of 24) multiplied by the traffic forecast for that year (for 2020, this is 2.649). The bonus rate for 2020 is calculated as follows: 1.593/(16*2.649)=0.038.

D21 Figure D.3 illustrates the application of the incentive.

Figure D.3: C3 incentive scheme



Source: CAA

Modulation of C3

D22 The same approach to modulating C3 for traffic volumes that was used in RP2 will be maintained for RP3. If traffic is more than ±4% different from the level forecast for that year, the bonus/penalty thresholds will be adjusted. The

[7] The rate is fixed in real terms for every year of RP3 but is calibrated based on 2020 traffic

thresholds will be modulated by the net change in traffic beyond the ±4% threshold, multiplied by an "elasticity factor" of 5.

D23 For example, if the traffic growth in a particular year is 7% higher than forecast, the thresholds will be adjusted upwards by (7%-4%=3%) * 5 = 15%. For example, should this be the case in 2020, the lower threshold would increase from 16 to 18.4 (i.e. 16 * 1.15 = 18.4) and the upper threshold would increase from 24 to 27.6 (i.e. 24 * 1.15 = 27.6).

Capacity - C4

Calculation of C4

D24 The C4 metric (Daily Excess Delay Score) is based on weighted delays exceeding pre-determined thresholds on a daily basis. The targeted levels of C4 are discussed in chapter 4.

D25 C4 is calculated by weighting ATFM delay in accordance with Table D.3. Delay below the lower threshold is weighted as zero.

Table D.3: Weighting of delay to derive excess delay score – weightings

Season	Daily delay thresholds (average delay per flight)		Weighting
Winter	Lower threshold	40 seconds	1
	Upper threshold	80 seconds	2
Summer	Lower threshold	60 seconds	1
	Upper threshold	110 seconds	2

Source: CAA. Note: Summer is April –October inclusive. Winter is January – March inclusive and November-December inclusive.

C4 incentive scheme

D26 C4 is a penalty-only incentive scheme. For RP3 we initially proposed to increase the maximum penalty to 0.5% of Determined Costs but given the overall importance of the AMS and the fact the target level is tightened for RP3, we have reverted to the RP2 strength of the penalty, capped at 0.25% of Determined Costs. The maximum penalty would be incurred if traffic is as forecast for 2020 and NERL's C4 score is 20% higher than the threshold. That rate is -£0.00167094 in 2017 prices.

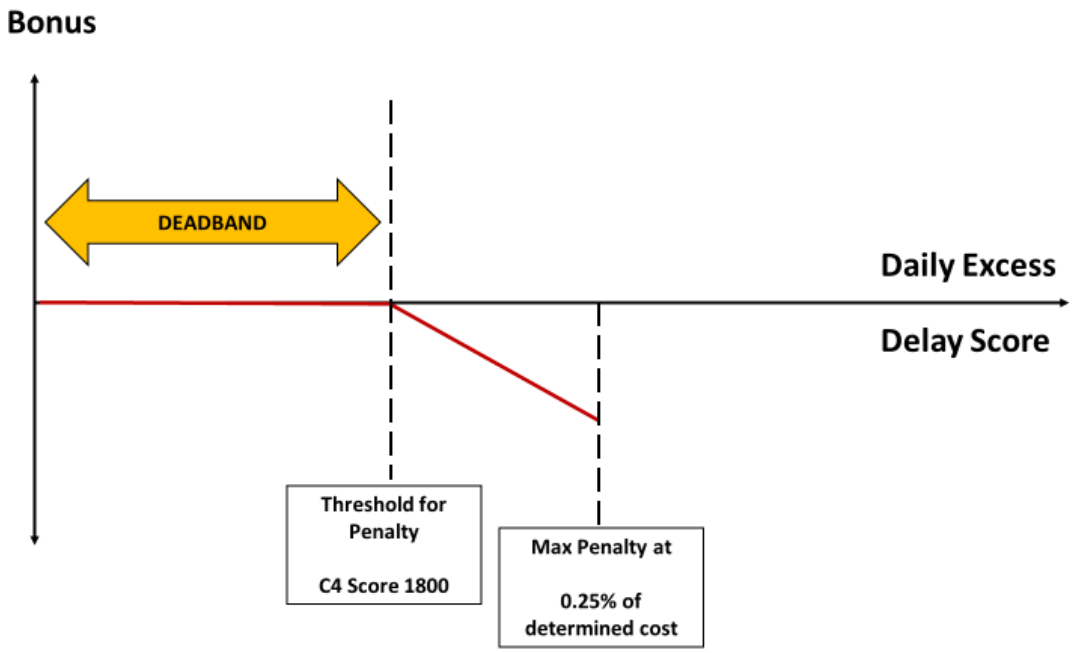
D27 The rate is calculated based on total pot for the penalty (for 2020, based on a Determined Cost of £637.390m in 2017 prices, this is £1.593m given the 0.25% maximum cap) divided by: the C4 score at which maximum penalty will be incurred (for 2020, based on the 20% mentioned above this is 1800*20%=360)

multiplied by the traffic forecast for that year (for 2020, this is 2.649). The rate for 2020 is calculated as follows: 1.593/(360*2.649)=0.00167094.[8]

D28 The penalty rate will be indexed to CPI during RP3. Figure D.4 illustrates the C4 incentives.

D29 As in RP2, the C4 threshold is not modulated for traffic volume.

Figure D.4: C4 incentive scheme



Source: CAA

Exemption days

D30 Principles for the application and use of exemption days:

- the mechanism allows NERL to exclude up to 100 days from counting against the C3 and C4 incentives when major new systems or airspace changes are being implemented and transitions are made;
- the exemption days apply only to the C3 and C4 measures;
- on days when C4 is triggered, the implied penalty applied for that day for C3 and C4 in aggregate will be the higher of either individual penalties for the day;
- the amount of days NERL will be allowed to use towards its transitions is capped at 100 days for the entire five-year period of RP3;

[8] Note the numbers may not add up fully due to rounding of the penalty pot to illustrate the example

- NERL will consult airspace users on the exemption days in advance under currently existing consultation mechanisms (eg. SIP) or targeted consultation;
- the length of any given transition should be limited to three weeks (unless otherwise agreed with users) and will be agreed in advance as well as the amount of days from the overall cap that NERL wishes to use towards this transition;
- the number of days agreed during the consultation will be fixed (unless subsequently revised with the agreement of users) but the particular exempt days within the agreed transition period would not need to be specified as part of the consultation;
- NERL will carry out the transition by means of the detailed steps and timing that are most operationally practical and ex-post nominate the exempt days (up to the pre-agreed maximum) for the transitional period (length of which is also pre-agreed).
- if at the end of the transition period NERL does not need/wish to use the pre-agreed amount of exempt days, these will still count against the overall 100 day cap (i.e. no roll over of unused exclusions).

APPENDIX E

Cost of capital

Introduction

E1 In its RP3 business plan, NERL proposed a pre-tax weighted average cost of capital (WACC) of 5.07%, deflated by the retail prices index (RPI) for the UK en route and Oceanic price controls.[9] This was made up of a vanilla WACC of 4.51% and a tax uplift of 12.7%.[10] NERL's proposed vanilla WACC was higher than we set at RP2 (4.25%), but the pre-tax WACC was lower than at RP2 (5.86%) given the reduction in the corporation tax uplift (37%). NERL commissioned NERA Economic Consulting to advise on the appropriate WACC for RP3. NERL adopted NERA's point estimate, which reflected the mid-point of its low-high range.

E2 In our draft proposals we used a vanilla WACC of 2.57% and a pre-tax WACC of 2.84%, deflated by the retail prices index (RPI) for the UK en route and Oceanic price controls.[11] This was significantly below NERL's proposed pre-tax WACC of 5.07%, particularly reflecting our view that NERL has significantly overestimated the required cost of equity.

E3 In its response to our draft proposals, NERL has made a number of points around our draft proposals for cost of equity, cost of debt and overall WACC.[12] NERL commissioned NERA Economic Consulting (NERA) to advise on the cost of equity and Professor Zalewska to advise on debt betas used to estimate the cost of equity.[13] In its response, NERL proposed a revised vanilla WACC of 4.21% in RPI-deflated terms, a 30bps reduction on 4.51% proposed in its RP3 business plan.

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9 This is consistent with the Regulatory Asset Base (RAB), which is inflated each year to current cost terms using RPI

10 The 'vanilla' WACC uses a pre-tax cost of debt and post-tax cost of equity. The pre-tax WACC includes a tax uplift to the cost of equity, which provides a tax allowance for NERL. Other UK regulators typically use a vanilla WACC to determine an allowed return on the regulatory asset base and then make a separate allowance for corporation tax.

11 CAP 1758 – Draft UK Reference Period 3 Performance Plan proposals, February 2019

12 NERL, NERL's response to CAP 1758: Draft UK reference period 3 performance plan proposals, April 2019

13 NERA, Cost of equity for RP3, April 2019; Professor Zalewska, Estimation of the debt beta of the bond issued by Nats (En-Route) plc, April 2019

E4 In this appendix, we set out our approach to estimating NERL's pre-tax WACC for our final decision, including updates to our draft proposals. We have consulted a wide range of market, regulatory and academic sources to inform our final decision, including the following:

- For our draft proposals, we commissioned Europe Economics to provide advice on areas of the WACC specific to NERL – betas, gearing and cost of new debt.[14] For our final decision, we commissioned Europe Economics to provide updates on these areas and its report is published alongside this final decision.[15]
- We have published a report from PwC that provides responses to issues raised by stakeholders on total market return and debt beta for CAA price controls for NERL for RP3 and for Heathrow Airport Limited (HAL) for the next price control (H7).[16] We have considered the recommendations on market-wide factors – total market return and debt betas – in determining NERL's RP3 WACC. For the avoidance of doubt, the final decision in this appendix is specific to NERL for RP3 and should not be read as a CAA position for H7. We set out further details on the links between the WACC in RP3 and H7 in a separate working paper with our draft proposals.[17]
- We have considered the responses and consultant adviser reports provided by NERL (reports from NERA and Professor Zalewska), HAL (a report from NERA) and International Airlines Group (IAG) (a report from Cambridge Economic Policy Associates (CEPA)),[18] as well as other stakeholder responses.
- We have reviewed recent consultations and determinations from other UK regulators – Ofwat, Ofcom and Ofgem – and the Competition and Markets Authority (CMA).
- We reviewed recent academic reports, including the cost of equity study by Professor Wright et al for the UK Regulators Network (we refer to this report as the UKRN cost of equity report).[19]

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14 Europe Economics, Components of the Cost of Capital for NERL (December 2018)

15 Europe Economics, Comments on NERA/NERL critiques of Europe Economics' WACC analysis, June 2019

16 PwC, Estimating the cost of capital for H7 and RP3 – Response to stakeholder views on total market return and debt beta, August 2019

17 Published at www.caa.co.uk/natslicence

18 NERA, Cost of equity for RP3, April 2019; Professor Zalewska, Estimation of the debt beta of the bond issued by Nats (En-Route) plc, April 2019; NERA, Cost of equity for HAL at H7, April 2019; NERA, Cost of debt for HAL in H7, April 2019; CEPA, Response to CAA consultations on RP3 and H7 WACC, April 2019

19 Professor Stephen Wright et al, Estimating the cost of capital for implementation of price controls by UK

E5 The rest of this appendix provides further details on the CAA's approach to estimating the cost of capital for NERL for RP3. This appendix is structured by topic as follows:

- CAA's overall approach to estimating the cost of capital;
- inflation;
- total market return;
- risk-free rate;
- gearing;
- equity beta;
- overall cost of equity;
- cost and proportion of embedded debt;
- cost of new debt;
- overall cost of debt;
- tax uplift; and
- overall weighted average cost of capital.

E6 Unless otherwise stated, the figures in this appendix are presented in retail prices index (RPI) deflated terms, consistent with indexation of the regulatory asset base (RAB). The difference between the consumer prices index (CPI) and RPI forecasts shown in this appendix, are used to express the allowed WACC components in nominal and CPI-deflated terms for comparison where relevant.

E7 The WACC in this chapter refers to both the expected and allowed rates of return for NERL in RP3, as we have not forecast expected outperformance or underperformance for our final decision.

CAA's views on cost of capital for RP3

Overall approach

E8 Our business plan guidance for NERL set out that NERL should assume a cost of capital that is "*no more than the efficient level necessary to compensate NERL for the business and regulatory risks it faces*."[20]

E9 In general, we consider that there is compelling evidence that the efficient level of the cost of capital has reduced between the RP2 performance plan and this

Regulators, An update on Mason, Miles and Wright (2003) (March 2018)

20 CAP 1625 - Guidance for NERL in preparing its business plan for Reference Period 3 (January 2018)

RP3 final decision, even before considering the impact of corporate taxation. This reduction in the estimated cost of capital since RP2 is supported by a review of a range of historical and forward-looking market evidence for investors' required rates of return. Other UK regulators have reflected this in their recent proposals for the allowed WACC.

E10 In our draft proposals, we were concerned that by proposing an increase in the vanilla WACC between RP2 and RP3, NERL's proposals were inconsistent with the broad range of evidence available and significantly overstated the efficient WACC necessary to compensate NERL during RP3. In its response, NERL reduced the vanilla WACC by 30bps to 4.21%. This is similar to the vanilla WACC at RP2 of 4.25% and so is still inconsistent with the expected reduction in the estimated cost of capital since RP2 and significantly overstates the efficient WACC necessary to compensate NERL during RP3. We have therefore provided our own estimate of the pre-tax WACC for this final decision.

E11 In developing our final decision, we have estimated the allowed WACC based on the weighted average of the estimated cost of debt and equity finance, and using the capital asset pricing model (CAPM) to estimate the cost of equity. These approaches are commonly used across UK regulated sectors and are consistent with recommendations in the UKRN cost of equity study and NERA's advice to NERL.

E12 For our final decision, we have considered the points raised on our draft proposals by stakeholders and in supporting consultant reports. For a number of the points raised, we have sought views from our advisers, Europe Economics and PwC, and have published their updated analysis alongside our final decision.

E13 We have considered how the allowed WACC for NERL compares with recent UK regulatory precedent and considered the reasons for differences. We recognise that judgement is required in estimating an efficient WACC and seek to balance the benefits to consumers from using a lower allowed WACC with the significant downside risks for NERL's financeability and incentives to invest if the allowed WACC is set too low.

E14 We discuss below the approach and analysis that has informed our considerations of the different components of the WACC. It is important to note that while we have considered these individual elements, we have also made an overall judgement about the appropriate WACC. In making this judgement, we have considered stakeholder views on the WACC and cross-checked the overall cost of equity and WACC with recent consultations and decisions from other UK regulators, while recognising the differences in the risks that NERL faces. This overall judgement is important to avoid placing undue reliance on individual parameters that require judgement.

Inflation

E15 NERA, in its September 2018 report for NERL, assumed an RPI forecast of 3.2% p.a. to estimate the RPI-deflated WACC. Separately, NERL's RP3 business plan included an RPI forecast that increased from 2.88% in 2020 to 3.54% p.a. by 2024, or about 3.3% p.a. on average. Over the same period, CPI increased from 1.57% to 1.96%, or about 1.8% p.a. on average.

E16 For our draft proposals, we reviewed recent inflation forecasts published by the HM Treasury,[21] the Office for Budget Responsibility (OBR),[22] Bank of England[23] and International Monetary Fund (IMF).[24] We concluded that the inflation forecasts from these sources were broadly aligned and supported an inflation assumption for RP3 of **2.0% p.a. for CPI** and **3.0% p.a. for RPI** (an RPI-CPI wedge of 1.0%), which we used to estimate the WACC in RPI-deflated terms in our draft proposals. RPI forecasts are typically higher than CPI (particularly due to the 'formula effect') and these inflation forecasts were consistent with a wedge between RPI and CPI of 1.0% p.a., which matches the estimate of the long-run difference between RPI and CPI estimated by the OBR in March 2015.[25]

E17 In its response, NERL states that it considers our RPI-CPI wedge of 1.0% to be underestimated based on Oxford Economics forecasts, and recommends a higher RPI-CPI wedge of 1.3% in the last two years of RP3. We note that NERL does not appear to have applied this higher RPI-CPI wedge to its analysis of the RPI-deflated WACC and underlying parameters, in a consistent manner.

E18 We have reviewed recent inflation forecasts from Oxford Economics,[26] the HM Treasury (which includes Oxford Economics within its consensus forecasts),[27] the Office for Budget Responsibility (OBR),[28] Bank of England[29] and International Monetary Fund (IMF).[30] These are summarised in Figure E.1.

21 HM Treasury, Forecasts for the UK economy: a comparison of independent forecasts (November 2018)

22 Office for Budget Responsibility, Economic and fiscal outlook (October 2018)

23 Bank of England, Inflation Report (November 2018)

24 IMF, World Economic Outlook (October 2018)

25 Office for Budget Responsibility, Economic and fiscal outlook (March 2015)

26 Provided by NERL in May 2019 relating to Oxford Economics' March 2019 forecast, published in April 2019

27 HM Treasury, Forecasts for the UK economy: a comparison of independent forecasts (May 2019)

28 Office for Budget Responsibility, Economic and fiscal outlook (March 2019)

29 Bank of England, Inflation Report (May 2019)

30 IMF, World Economic Outlook (April 2019)

Figure E.1: Summary of recent inflation forecasts

Source	CPI (% p.a.)						RPI (% p.a.)						Implied RPI-CPI wedge (% p.a.)
	2019	2020	2021	2022	2023	2024	2019	2020	2021	2022	2023	2024	RP3 average
Oxford Economics (April 2019) – proposed by NATS	1.8	1.8	1.6	1.6	1.8	1.9	2.5	3.2	3.1	3.1	3.3	3.3	1.4 (1.3 in NATS response)
HM Treasury independent average forecasts (May 2019)	1.9	2.0	1.9	1.9	2.0	-	2.6	2.7	3.0	3.1	3.0	-	1.0
OBR Economic and Fiscal Outlook (March 2019)	2.1	1.9	2.0	2.0	2.0	-	2.9	2.8	3.0	3.1	3.1	-	1.0
Bank of England Inflation report (May 2019)	2.1 (Q2)	1.7 (Q2) 1.9 (avg)	2.1 (Q2) 2.1 (avg)	2.2 (Q2)	-	-	-	-	-	-	-	-	-
IMF World Economic Outlook (April 2019)	1.8	2.0	2.0	2.0	2.0	2.0	-	-	-	-	-	-	-

Source: CAA analysis of various sources

E19 Most of the inflation forecasts from these sources are broadly aligned and continue to support an average inflation assumption for RP3 of **2.0% p.a. for CPI** and **3.0% p.a. for RPI**, which we use to estimate the WACC in RPI-deflated terms in our final decision. This is similar to the inflation forecasts we use in the financial modelling. The main difference is the forecasts from Oxford Economics, which show much lower CPI over RP3 than the other sources, and therefore a higher RPI-CPI wedge. We note that the EU charging regulations require the use of CPI forecasts from the IMF. These broadly align with forecasts from HM Treasury, OBR and Bank of England, so we do not place any weight on the forecasts from Oxford Economics.

E20 For our final decision we are proposing a mechanism within the RP3 RAB rules that will true-up allowed returns and depreciation for differences between the expected and outturn RPI-CPI wedge during RP3. Further details are provided in chapter 7. This mechanism will reduce the inflation risk that NERL faces.

Table E.1: Inflation for estimating RP3 WACC

	NERL business plan	CAA draft proposal	CAA final decision	Notes
RPI inflation	3.2% p.a. (from NERA report on cost of capital)	3.0% p.a.	3.0% p.a.	Same as draft proposals, to reflect recent external forecasts
CPI inflation	Not in NERA report (c.1.8% in financial model)	2.0% p.a.	2.0% p.a.	Same as draft proposals, to reflect recent external forecasts

Source: CAA analysis

Total market return

E21 We have used a 'decompositional' approach to estimate cost of equity under CAPM, where the total market return (TMR) and risk-free rate (RFR) are estimated separately to derive the equity risk premium (ERP). The TMR is an estimate of the expected return by investors for the market as a whole. This approach to estimating TMR and RFR separately is broadly consistent with the approaches adopted by NERL and other UK regulators, as the TMR is typically shown to be more stable than the ERP.

E22 In its RP3 business plan, NERL proposed a TMR range of 6.5%-7.1% and a point estimate of 6.8% (in RPI-deflated terms), based on a report by NERA. NERA's range is based on a review of long-run historical estimates from Dimson, Marsh and Staunton (DMS)[31] for different holding periods and averaging approaches, with the bottom end of the range reduced by 0.3% reflecting the ONS' estimate for the increase in the RPI 'formula effect' arising from the 2010 change to the method for collecting clothing prices.

E23 The TMR has been subject to a wide-ranging debate in different regulated sectors during 2018 and 2019, and a range of new information has been published around estimates of TMR using different historical and forward-looking methods. As different methods can lead to very different estimates of TMR, we consider it is appropriate to consider the wide range of evidence and cross-checks available in forming our judgement on the appropriate TMR.

E24 In our draft proposals, we used the wide range of evidence to propose a TMR range of 5.0% to 6.25% and a point estimate of 5.4%. This was based, primarily, on available evidence and TMR ranges from the UKRN cost of equity report, PwC's advice to the CAA for the H7 price review and recent publications from other UK regulators.

E25 In its response, NERL has proposed an updated TMR of 6.25%, reduced from 6.8% in its RP3 business plan. This is based on the intersection between the revised range from NERA (6.2% to 6.8%) based on a new method for adjusting long-run historical UK returns for inflation and the CAA's range in its draft proposals. NERL and NERA have raised a number of issues around the approach in the CAA's draft proposals, which they consider is downward biased. Similar points have also been raised by Heathrow Airport Limited (HAL) and in NERA's report for HAL. We consider the points raised below.

E26 CEPA, in its updated report for IAG, supports the CAA's TMR estimate but raises issues with the top end of the CAA's range of 6.25%, which it considers is not supported by most sources of evidence.

[31] Credit Suisse, Global Investment Returns Yearbook 2017

Evidence of lower expected returns since RP2

E27 In our draft proposals, we used a range of evidence to inform our TMR of 5.4% in RP3 that was significantly lower than the TMR of 6.25% set for RP2.

E28 NERA, in its updated reports for NERL and HAL, considers that there is no evidence that expected returns have fallen since RP2 and that recent market evidence is consistent with broadly constant TMR over time. In summary, this is based on analysis showing:

- upward trends in historical realised equity returns in the US, Germany and Japan and broadly constant returns in France and the UK, which therefore do not support a reduction in expected returns across global equity markets;
- DMS evidence from cross-country data showing an apparent positive relationship between real interest rates and equity returns is driven by a negative relationship between both variables and inflation and the relationship between equity and bond returns during high inflation periods are not relevant in the current low risk-free rate environment;
- forward-looking dividend growth models (DGM) from Bank of England and PwC shows the TMR is relatively stable over the current period and do not show a trend decline since RP2;
- forward-looking survey evidence from Fernandez et al does not show any systematic reduction in TMR in recent periods; and
- the approved return on equity in the US for electricity and gas has remained relatively stable over recent periods, which is contrary to the view that lower interest rates are consistent with lower equity returns.

E29 We have asked PwC to review the issues raised by NERA.[32] This includes the following points in response:

- focusing on the UK, PwC has considered the 10-year trailing average of UK market returns, which it considers is more appropriate than the 30-year trailing average used by NERA. PwC finds that there was a noticeable decline in returns during the 2008-09 financial crisis and then from 2012 onwards, implying a downward trend in realised returns in recent years;
- the DMS analysis does show a clear relationship between real asset returns and interest rates, even when take account of the impact of inflation on real rates;

[32] PwC, Estimating the cost of capital for H7 and RP3 – Response to stakeholder views on total market return and debt beta, August 2019

- TMR estimates from DDM models are important estimates to use in conjunction with other approaches to form a view on TMR. However, instead of focusing on monthly TMR estimates, PwC believes it is better to consider the 5-year moving average as this smooths out monthly fluctuations;
- focusing on the UK survey data from Fernandez et al, this provides a useful cross-check on outputs of TMR analysis. However, PwC cautions against assigning too much weight to survey outputs from one particular year or period; and
- from its review of US electricity and gas returns, PwC finds that the decline in approved return on equity – particularly before 2006 – was more comparable to the decline experienced in the US risk free rate. PwC is also cautious about assigning too much weight to the US example applied to returns in the UK.

E30 In summary, PwC considers that its additional analysis indicates that there has been a decline in realised equity returns in the UK in recent years, contrary to NERA's findings.

E31 Ofcom, in its recent Statement for the business connectivity market review (BCMR),[33] did not accept BT's arguments that the TMR is stable with no relationship to lower real risk-free rate. Ofcom sets out evidence from Europe Economics, which found a statistically significant relationship between the real TMR and real RFR in CPI-deflated terms, and the 2019 DMS Yearbook, which concluded that future returns on all risky assets are lower when real interest rates are low.

E32 We conclude from the response from PwC and Ofcom, as well as further evidence on investor expectations presented below, that there is some evidence to suggest that the TMR expectations will have fallen since RP2. This is still consistent with the TMR being relatively more stable than the equity risk premium and the reduction is not one-for-one with the reduction in real interest rates. This is consistent with a lower TMR at RP3 than we set at RP2, in contrast to the proposal from NERL for the same or higher TMR than at RP2.

UKRN cost of equity study, use of inflation measures and predictability of returns

E33 In our draft proposals, we considered the cost of equity study by Professor Wright et al for the UK Regulators Network (UKRN),[34] which recommended that the TMR is based on long-run historical averages taking into account both UK and international evidence. Based on their analysis of long-run historical returns

[33] Ofcom, 2019 PIMR and BCMR Statement: Annex 21, June 2019

[34] Professor Stephen Wright et al, Estimating the cost of capital for implementation of price controls by UK Regulators (March 2018)

in the UK and other markets, the authors propose a TMR range of 6-7%. This is based on long-run historical geometric average returns of not more than 5%, increased by 1-2% to account for serial correlation of returns. The authors note that the case for an adjustment to geometric average returns as large as 2% is weakened if regulators are setting returns on a consistent basis at a relatively long (e.g. 10-year) horizon.

E34 We understand that the 6-7% range for the TMR in the UKRN cost of equity study was estimated in real-CPI terms, using the long-run historical CPI series estimated by the Bank of England.[35] To obtain an equivalent estimate in RPI-deflated terms, we reduced the TMR for the RPI-CPI wedge estimated above (1%) to 5-6% in RPI-deflated terms. This is consistent with the approaches recently taken by other UK regulators.[36]

E35 NERA, in its report to NERL, stated that the CPI measure used by the UKRN report authors is unreliable and that the historical real TMR should be estimated using RPI inflation. We disagreed with this in our draft proposals, as the back-cast CPI series from the Bank of England appears to be a reasonably consistent time series, in contrast to historical RPI where there have been structural changes, meaning historical RPI series will not be an accurate indicator of future RPI-deflated returns. We considered evidence provided by NERA and PwC in our draft proposals and concluded that the CPI series from the Bank of England, while not perfect in terms of providing a consistent time-series from a single underlying source, represents a reasonable basis for deflating historical nominal returns.

E36 NERA considers that the historical TMR in the UKRN report is understated due to the authors incorrectly interpreting a historical inflation series as CPI and applying an excessive adjustment for long holding periods and alleged predictability of returns. Correcting for these, NERA estimates a TMR range of 6.2% to 6.8% in RPI-deflated terms, by:

35 Bank of England, A millennium of macroeconomic data for the UK, Research datasets (2018)

36 For example, Ofgem (RIIO-2 Sector Specific Methodology Annex: Finance, December 2018) confirmed with study author Professor Wright that it is fair to interpret the TMR range of 6-7% in CPI-terms as 5-6% in RPI terms; and Ofcom and Ofwat both express the 6-7% TMR range as CPI-deflated (Business connectivity market review, Annex 21 Cost of capital (June 2019) and PR19 draft determinations (July 2019))

- concluding that average holding periods of 1 to 5 years is supported by market evidence, below the estimates from the UKRN report and PwC, and this supports historical TMR of 6.8% to 7.1% in RPI-deflated terms using historical RPI. NERA has used the arithmetic average of long-run historical returns to estimate the TMR. NERA states that established methods developed by Blume or Jacquier, Kane and Marcus (JKM) to provide unbiased estimators of the TMR for long investment horizons with serial dependence would support downward adjustments of 10 to 40 bps, substantially below the 100bps assumed by the UKRN report for a 10-year holding period;
- adjusting the result for the estimate of the historical RPI-CPI wedge to estimate CPI-deflated returns. NERA uses a range for the historical RPI-CPI wedge based on historical RPI and back-cast CPI between 1950 onwards (47bps) to the RPI-CPI wedge from 1989 onwards (72bps);
- then adjusting the CPI-deflated returns for the forward-looking RPI-CPI wedge of 100bps to calculate the return in RPI-deflated terms, thus correcting for structural changes in RPI data over time.

E37 NERA states that the change in its TMR range since its September 2018 report for NERL is based on new evidence on different inflation indices raised in the UKRN cost of equity report.

E38 PwC has reviewed NERA's new approach and does not consider this to be a robust way of accurately capturing the differences between RPI and CPI. In its view, this approach does not accurately capture the differences between RPI and CPI back to 1899 when the DMS dataset, which is used to calculate TMR, begins. In creating the historical CPI series, the Bank of England has maximised use of consumer price indices and minimised use of the implied consumption deflator. As some parts of the series are neither CPI nor RPI, but have no evidence to adjust either way and there is evidence to suggest the historical RPI-CPI wedge is small, then PwC prefers the Bank of England CPI series to calibrate forward-looking real returns.

E39 Ofwat has reviewed the approach to deflating historical average returns for its PR19 draft determinations.[37] Ofwat compares the inflation series in the 2019 DMS Yearbook and two CPI series in the Bank of England Millennium dataset and concludes that the two Bank of England series are preferred as reasonable estimates of long-term CPI inflation.

E40 In its recent BCMR Statement,[38] Ofcom found that the difference between UK CPI and RPI has been relatively modest on a historical basis, but more significant in recent years, at 0.7% on average since 2000. Ofcom concludes that

[37] Ofwat, PR19 draft determinations, Cost of capital technical appendix, July 2019

[38] Ofcom, 2019 PIMR and BCMR Statement, Annex 21, June 2019

the UKRN cost of equity report and deflated returns from the DMS dataset can be used to provide reasonable estimates of ex post CPI-based returns to inform future expectations. Ofcom concludes that ex post evidence would support a TMR of 6.0-7.3% in CPI-deflated terms (about 5.0-6.3% in RPI-deflated terms).

E41 Ofgem, in its RIIO-2 methodology decision,[39] is not persuaded by evidence from regulated companies that the Bank of England CPI inflation data cannot be relied on to provide a reasonable estimate of long-term CPI inflation. In Ofgem's view, the Bank of England series overcomes problems in the DMS approach up to its 2017 publication of using out-of-date expenditure weights, and structural changes in RPI since 2010.

E42 For our final decision, based on the information presented above from PwC and other UK regulators, we continue to consider that the Bank of England CPI series provides a suitable estimate of ex-post real returns as the basis for calibrating forward-looking real returns for use with CPI inflation. These estimates need to be adjusted using the forward-looking RPI-CPI wedge to estimate returns in RPI-deflated terms, which we estimate to be around 1% based on information above.

E43 On holding period and adjustment for serial correlation, the UKRN cost of equity report suggests that UK regulators estimate TMR starting from the long-run geometric averages, adjusted upwards by 1-2% depending on the extent to which regulators wish to take account of serial correlation of returns, rather than calculating arithmetic averages directly. The reports' authors are concerned that arithmetic averages can generate spurious differences, especially when returns are affected by exchange rate fluctuations.

E44 In analysis published with the CAA's draft proposals, PwC examined the variance in returns, including reviewing the UKRN cost of equity study from 2003 and performed additional econometric analysis on the UK equities market. PwC concluded that there is evidence of predictability of returns at longer horizons (e.g. 10 years), which points to a smaller adjustment to the geometric mean for a longer-term holding period. PwC's analysis would support an upward adjustment to the geometric mean of around 0.4-1.3% for a 10-year holding period, or 0.7-1.5% for a shorter 5-year holding period, towards the lower end of the 1-2% range in the UKRN cost of equity report. Applying a volatility adjustment of 1-1.5% to the average historical UK CPI returns in the UKRN cost of equity study gives an RPI-deflated TMR range of 5.2%-5.7%. This analysis suggested that NERA's approach to using arithmetic returns may overstate the measure of expected returns.

E45 NERA criticises analysis on predictability of returns at long horizons and dividend discount models. NERA has used the arithmetic average of long-run historical

[39] Ofgem, RIIO-2 Sector Specific Methodology Decision – Finance, May 2019

returns to estimate the TMR. NERA states that established methods developed by Blume or JKM to provide unbiased estimators of the TMR for long investment horizons with serial dependence would support downward adjustments of 10 to 40 bps, substantially below the 100bps assumed by the UKRN report for a 10-year holding period.

E46 PwC, in its updated report for CAA, recommends that the CAA should use a longer-term perspective to estimate the TMR and should adjust for the predictability of returns at long horizons, consistent with the recommendation in the UKRN cost of equity report.

E47 Ofwat, for its PR19 draft determinations, finds that it is appropriate to focus on holding periods of longer than one year given evidence that infrastructure investors focus on holding periods longer than 10 years and investment advice that longer holding periods help to manage the risk of volatility in returns. Ofwat estimates the JKM optimal estimator (a weighted average of geometric and arithmetic returns) and assumes a holding period of 5-10 years to estimate a real TMR range of 6.5-6.7% in CPIH terms (about 5.5-5.7% in RPI terms).

E48 Given the recommendation in the UKRN cost of equity report to start from geometric average returns and adjust upwards for serial correlation of returns, Ofwat also cites PwC analysis on the impact of serial correlation with holding periods of 5-10 years, which leads to a TMR range of about 5.5-6.6% in CPIH terms (about 4.5-5.6% in RPI-deflated terms).

E49 Ofgem, in its RIIO-2 methodology decision, considers that it is appropriate to follow the approach from the UKRN cost of equity study of uplifting geometric average returns.

E50 For our final decision, based on the information presented above from PwC and other UK regulators, we continue to consider that the approach and TMR range in the UKRN cost of equity report remain appropriate for informing the TMR for RP3. We have considered NERA's and NERL's views on the average historical TMR. However, based on our review of the further evidence above on the treatment of inflation and predictability of returns, we consider that the historical average returns in the UKRN cost of equity report provide a reasonable basis for estimating average historical returns in CPI-deflated terms.

E51 The resulting range of 5-6% in RPI-deflated terms, when taking into account the OBR's forecast for the future RPI-CPI wedge, is further supported by recent reviews from other UK regulators (Ofwat, Ofcom and Ofgem) and a range of advisors (UKRN cost of equity report authors, Europe Economics, PwC and CEPA). Many of these sources draw on the same underlying DMS dataset of historical average returns, but may vary slightly in terms of treatment of inflation (e.g. using the DMS' series or CPI from the Bank of England), method of averaging (e.g. geometric or arithmetic averages), and adjustments (e.g. for

serial correlation). In general, most sources showed TMR estimates varying between 5-6% (in RPI-deflated terms), depending on the method applied. This supports a TMR of 5.0-6.0% in RPI-deflated terms and potentially a point estimate towards the lower end of this range based on PwC's analysis on the serial correlation of returns.

Estimates of average historical returns

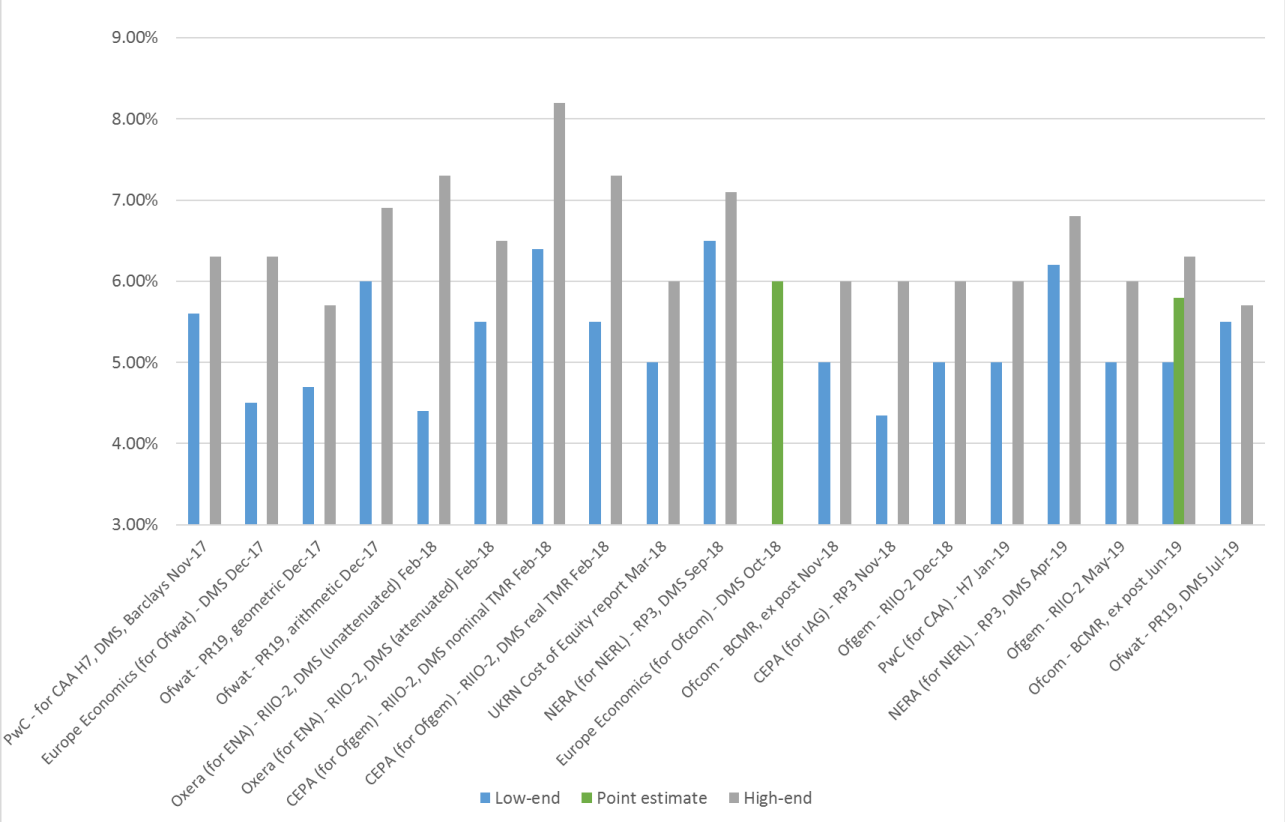
E52 In our draft proposals, we presented our review of the long-run historical average returns from a range of published sources. Where necessary, we adjusted published estimates for the expected 1% RPI-CPI wedge and used our expected RPI inflation forecast of 3%. This is summarised in Figure E.2 below.

E53 In addition to the historical average approaches from the DMS dataset, other recent sources include:

- PwC, in its work for the CAA, reviewed the long-run historical average returns from Jorda et al.[40] This provides an arithmetic average of historical TMR of 7.2% in CPI-deflated terms, or 6.2% in RPI-deflated terms (assuming a 1% RPI-CPI wedge). However, PwC states that the Jorda study does not provide a comparable expected TMR, e.g. adjusting for serial correlation. Taking into account the new evidence available on long-run returns from the UKRN cost of equity report and Jorda et al, PwC considers a range of 5-6% is appropriate and that evidence of predictability at longer horizons supports a point estimate towards the lower end of this range.
- CEPA, in its report for IAG, estimated historical ex ante returns using the historical average returns from DMS dataset, adjusted for one-off factors and inflation. CEPA estimates a range of 5.5-6.0% on an arithmetic average basis and 4.35-4.8% on a geometric average basis, in RPI-deflated terms. NERL has responded that CEPA's estimates are flawed as they do not apply the established methodologies, misinterpret historical DMS data and do not use a reliable measure of inflation.
- In its PR19 draft determinations, Ofwat reviewed international evidence on historical average realised returns from the 2019 DMS Yearbook. Ofwat finds that international TMR has been somewhat lower than in the UK historically at around 6.0-6.5% in CPI-deflated terms (or about 5.0-5.5% in UK RPI deflated terms).

[40] Jorda et al, Rate of return on everything, 1870-2015 (2017)

Figure E.2: CAA review of recent analysis on average historical returns (in RPI-deflated terms)



Source: CAA analysis of range of published sources.

Forward-looking estimates of TMR

E54 In our draft proposals, we presented a range of evidence from UK regulators and advisers on forward-looking methods, such as dividend-discount models (DDM) or dividend growth models (DGM) and market-to-asset ratios, that had been used to inform or cross-check estimates of TMR. We showed that recent DDM/DGM analysis by Ofwat, Ofcom, Europe Economics, CEPA and PwC suggested forward-looking estimates of TMR around 4.0-6.3% (in RPI-deflated terms). In its January 2019 report, PwC estimated a TMR range of 5.3-6.2%, with the upper end of the range driven by the current DDM estimate, which tends to be more volatile, and considered that its proposed TMR of 5.1-5.6%, based primarily on forward-looking methods, remains appropriate. PwC considered that Bank of England models, being focused on movements in analyst expectations of equity returns rather than levels of returns, made them unsuitable for informing views on the forward-looking TMR.

E55 Based on this analysis, we considered that estimates from forward-looking methods provided relevant evidence to inform the appropriate estimate of the TMR, in addition to the TMR estimates from historical average returns. We noted that there is a degree of overlap between some estimates of TMR from long-run

historical averages and forward-looking methods, with a range of 5-6% in RPI-deflated terms.

E56 NERA, in its report for NERL, recommends treating estimates of TMR from DGM with caution given the relative sensitivity of results. NERA recommends relying on historical returns as primary evidence with forward-looking evidence as a cross-check.

E57 NERA considers that PwC and other consultants have understated returns from dividend growth models (DGMs) by:

- using UK GDP growth to estimate future dividend growth which ignores UK companies' exposure to international markets with higher growth; and
- ignoring analyst forecasts of dividend growth, which is higher than GDP growth and is used by others, such as by the Bank of England.

E58 NERA recommends using analyst forecasts as basis of short-term dividend growth forecasts and using GDP growth from countries where FTSE companies derive their earnings for longer-term growth. NERA cites Bank of England analysis of DGM using this approach, which produces a forward-looking TMR of 7.2% to 8.1% in RPI-deflated terms, above the evidence from historical returns.

E59 For its updated report, PwC has reviewed NERA's response. PwC considers the use of analyst forecasts is not appropriate for regulatory purposes as they have been found to be both biased and inefficient, and regulators are concerned with setting longer-term parameters that are suitable for the price control period. PwC also considers that adjustments would be required to convert global assumptions to a UK cost of capital (e.g. differential real yields or forecast inflation), so prefers to use UK based parameters, and proxies, wherever possible to avoid the need for further adjustments.

E60 In its PR19 draft determinations, Ofwat presents evidence from four different ex ante approaches on the basis that averages of historical returns may provide an upward-biased guide to current return expectations. Ofwat estimates a wider prospective TMR range of 5.0-6.9% in CPI-deflated terms, or a narrower range of 5.6-6.6% based on Fama-French and DMS approaches. This is broadly equivalent to 4.6-5.6% in RPI-deflated terms.

E61 Ofwat commissioned PwC and Europe Economics to provide updated estimates of forward-looking TMR from Dividend Discount Models (DDMs). This included two different Europe Economics models based on GDP and dividend yield growth assumptions. The PwC DDM estimate produces a TMR range of 5.7-7.2% in RPI-deflated terms, though concluded that some of the rise since previous estimates may not persist over the medium-term so recommended a 5-year trailing average estimate closer to 5.1-5.8% in RPI-deflated terms. The Europe Economics DDM estimates were 5.1-5.2% for the GDP-based approach

and 5.5-6.4% for the historical dividend-based approach, in RPI-deflated terms. Ofwat puts the most weight on 5-year rolling average estimates to estimate an overall TMR range of 5.1-5.8% in RPI-deflated terms.

E62 Ofwat also considers its earlier analysis on market-to-asset ratios (MARs), which imply a TMR of around 5.3-6.5% in CPIH-deflated terms (about 4.3-5.5% in RPI-deflated terms). Ofwat considers that the MARs analysis and investor survey evidence (see details below) justify a small downwards adjustment to the lower end of the DDM range to 6.0-6.8% in CPIH-deflated terms (or 5.0-5.8% in RPI-deflated terms).

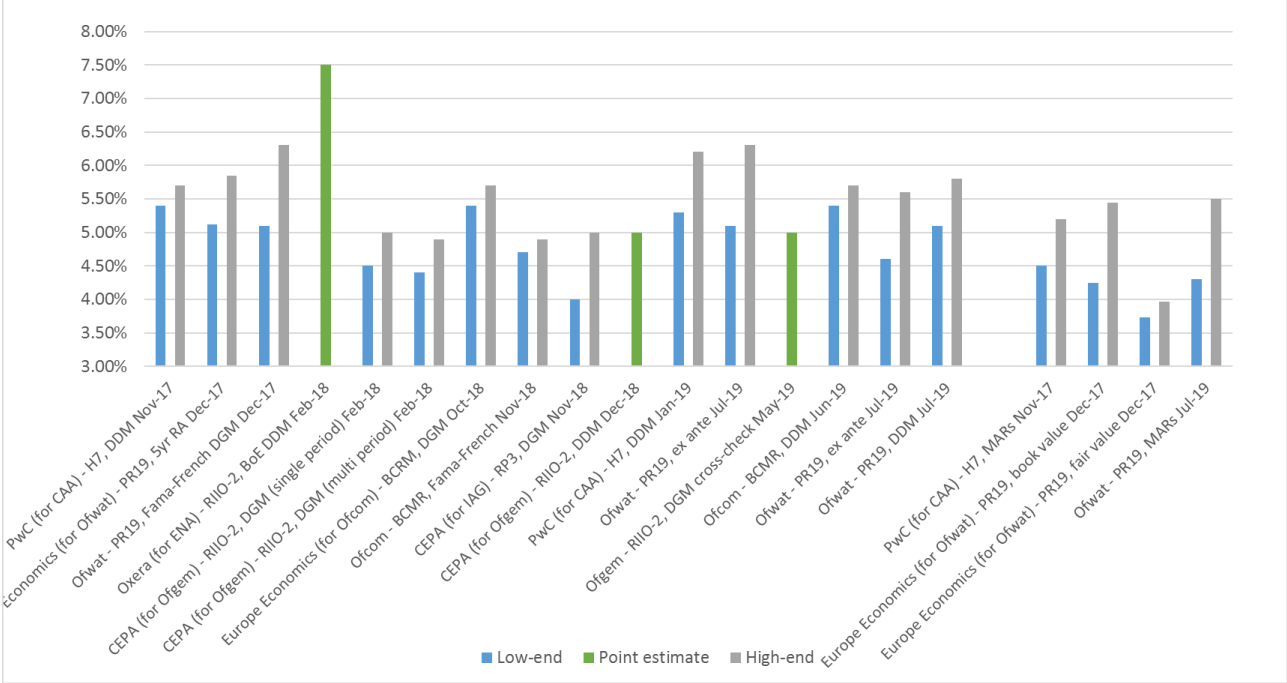
E63 In its recent BCMR Statement, Ofcom estimates TMR using two historical ex ante approaches: (i) the Fama-French approach of estimating returns from average dividend yields and dividend growth rates, which leads to a TMR of 5.7% or lower in CPI-deflated terms; and (ii) the DMS approach to separating historical equity risk premiums into elements that correspond to investor expectations from those that relate to good or bad luck that are non-repeatable. This leads to a TMR of 5.9% or lower in CPI-deflated terms. Therefore, these approaches both suggest TMR below 5.0% in RPI-deflated terms.

E64 Ofcom references Europe Economics DGM analysis from October 2018, which found a TMR of 6.4-6.7% in CPI-deflated terms (about 5.4-5.7% in RPI-deflated terms). Ofcom considers comments from BT that it should put weight on alternative DGM analysis from the Bank of England and Bloomberg, but concludes these are not as robust as the analysis from Europe Economics and will give results that are upwardly biased.

E65 In its RIIO-2 methodology decision, Ofgem also prefers to use the DDM analysis from CEPA as a cross-check rather than analysis from the Bank of England, which provides a TMR of around 5% in RPI-deflated terms.

E66 For our final decision, we have considered the full range of evidence available from UK regulators and various advisors. We agree with other views expressed above that the Bank of England DDM analysis may not be a good indicator of expected TMR for RP3. Other recent DDM analysis and historical ex ante analysis supports a TMR range of 4.6-6.3%, with most estimates in the range 5.0-5.8% in RPI-deflated terms.

Figure E.3: CAA review of recent analysis on historical ex ante and forward-looking returns (in RPI-deflated terms)



Source: CAA analysis of range of published sources.

Recent regulatory precedent

E67 In our draft proposals, we reviewed the recent UK regulatory precedent for TMR, converted to RPI-deflated terms, finding a range of 5.2% to 5.7% from Ofwat, Ofcom and Ofgem. This showed that TMR estimates from other UK regulators have reduced significantly since previous price reviews and there is broad consistency in the estimated TMR.

E68 We also presented TMR ranges published by a range of specialist advisors to regulators and companies, which showed that NERA appeared to be an outlier in proposing an RPI-deflated TMR above 6.5%.

E69 NERA stated that these UK regulator decisions were affected by the same problems as CAA's estimates and are significantly below the recent precedent from the CMA from its 2014 NIE and 2015 Bristol Water determinations, which support a TMR of 6.5%.

E70 For its PR19 draft determinations, Ofwat has estimated a TMR of 6.5% in CPIH-deflated terms, or 5.47% in RPI-deflated terms, based on the overlap between the ranges from ex-post, ex-ante and forward-looking approaches. Ofwat has not placed more weight on one type of approach than another and it is broadly the mid-point of ranges recommended by both Europe Economics and UKRN cost of equity reports. This is supported by a report from Europe Economics, which recommends a range of 6.0-7.0% in CPI-deflated terms.

E71 Ofcom, in its recent BCMR Statement, puts the most weight on historical ex post approaches, which gives a TMR of 6.0-7.3% in CPI-deflated terms and picks a mid-point estimate of 6.7%, about 5.8% in RPI-deflated terms based on RPI inflation of 2.8% for 2020/21 (we note this is lower at around 5.6% in RPI-deflated terms if using our RP3 RPI assumption of 3%). Ofcom also notes that historical ex ante approaches would suggest lower numbers, potentially below 6% in CPI-deflated terms, and forward-looking evidence from DGM would support a range of 6.4-6.7% in CPI-deflated terms.

E72 In its RIIO-2 methodology decision, Ofgem focuses on long-run average returns and considers that the UKRN cost of equity report range of 6-7% in CPIH-deflated returns is appropriate. Ofgem places some weight on TMR cross-checks: the DGM cross-check where the TMR is about 6% in CPIH-deflated terms and expert forecasts where the TMR is about 5.5% in CPIH-deflated terms. Ofgem presents a working assumption TMR range of 6.25-6.75% in CPIH-deflated term, which we calculate to be around 5.2-5.7% in RPI-deflated terms. Ofgem notes this range is conservative in light of the range of reasonable evidence.

E73 Looking outside the UK, Europe Economics, in its work for Ofwat in 2017, reviewed international regulatory precedent. Europe Economics concluded that this supported a TMR range of 6.3-7.8% in real CPI terms, which would be around 5.3-6.8% in RPI-deflated terms.[41] PwC also reviewed the airport charges agreement for Charles de Gaulle Airport, concluding that this is consistent with a TMR of 6.3% in RPI-deflated terms.[42]

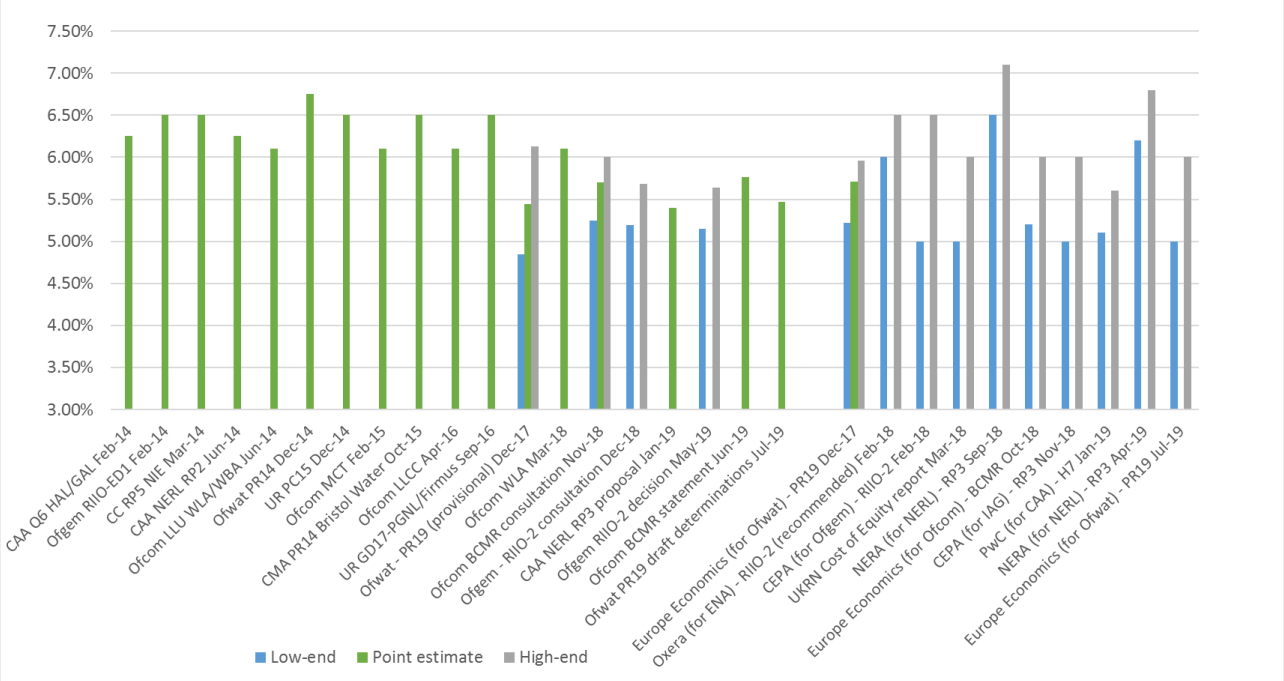
E74 Since the draft proposals, ADP has published its 2019 business plan with a nominal vanilla WACC of 5.6%,[43] which is towards the lower end of the range proposed by PwC. ADP has proposed a nominal TMR of 8.0%, which appears to be comparable to a 5.0% TMR in RPI-deflated terms. This is at the low end of the range in the CAA's draft proposals.

41 Europe Economics, PR19 – Initial Assessment of the Cost of Capital (December 2017)

42 PwC, Estimating the cost of capital for H7 – Response to stakeholder views (January 2019)

43 Groupe ADP, Public consultation document: Economic regulation agreement 2021 – 2025, April 2019

Figure E.4: CAA review of regulatory precedent and advisor views on TMR (in RPI-deflated terms)



Source: CAA analysis of range of published sources.

Professional investor studies

E75 In our draft proposals, we summarised information from Ofgem's review of market returns forecasts from asset managers and financial organisations. This review found that investors should expect returns over the medium to long-term of a range from 4.5% to 7.75% (nominal terms), or around 1.5-4.7% in RPI-deflated terms, with an average of 3.6%. We also cited McKinsey Global Institute, who concluded in 2016 that annual returns are likely to be significantly lower than historical returns over the past 30 years. Overall, the review of market returns forecasts seemed to support lower expectations for future returns than the analysis on DGM and historical average returns.

E76 NERA, in its report for NERL, presents forward-looking survey evidence on TMR from Fernandez et al, which shows that the average TMR has increased from 10.7% in 2013 to 11.6% in 2019 on average for the 39 countries included in the survey.

E77 PwC, in its update for CAA,[44] shows Fernandez's estimates of TMR for the UK, noting that the estimates move around from year to year, potentially due to changes in survey participants or particular market events. PwC used the 2017 estimate of 8.1% (in nominal terms) as a cross check for TMR estimates in our

[44] PwC, Estimating the cost of capital for H7 and RP3 – Response to stakeholder views on total market return and debt beta, August 2019

December 2017 report and observed that the 2019 estimate of 8.3% remains within its TMR range of 5.1-5.6% in RPI-deflated terms (assuming RPI inflation of 3% p.a.).

E78 Ofwat also noted in its 2019 draft determinations, that the median of the Fernandez survey results for the UK is slightly lower than the average at 7.9% in nominal terms (about 4.9% in RPI-deflated terms).

E79 Ofgem, in its RIIO-2 methodology decision, provides updated analysis from its survey of investment manager forecasts, which includes an uplift to geometric average returns. This finds an expert expected average return of 7.65% in nominal terms (when excluding outliers), which would be about 4.6% in RPI-deflated terms assuming RPI of 3%.

Overall CAA view on TMR

E80 In our draft proposals, we considered the broad range of evidence on TMR, including historical average returns, forward-looking returns, current market information and regulatory precedent, to form our judgement on the appropriate TMR for the RP3 WACC. We considered that the broad range of evidence supported a TMR range of 5.0% to 6.25% in RPI-deflated terms. The low end of the range was based on the UKRN cost of equity report, estimates of forward-looking returns from PwC and other advisors and recent regulatory precedent, while the high end of the range is our estimate for RP2 and Q6 price controls. We also noted that most sources suggest a TMR of no more than 6%.

E81 We used a point estimate of 5.4% in RPI-deflated terms to inform our overall WACC estimate, towards the lower end of the 5-6.25% range, based on analysis of average historical returns (being near the mid-point of the range from the UKRN cost of equity report), supported by estimates from forward-looking methods and regulatory precedent – it was close to the mid-points of the ranges from Ofgem for RIIO-2, Ofwat's guidance for PR19 and PwC's advice to CAA for H7.

E82 NERA, in its updated report for NERL, considers that the CAA has been selective in the evidence it has used, mainly relying on evidence from the UKRN report and advice from PwC, and putting no weight on alternative evidence including a range of academic papers and evidence from the Bank of England, which would lead to higher values of the TMR. NERA recommends using a range of 6.2% to 6.8% using historical estimates as primary evidence, with forward-looking evidence as a cross-check.

E83 NERA also states that regulators have typically erred on the side of caution and considered the mid-point or top end of a range for TMR to avoid the cost of capital being set too low.

E84 In its response, NERL considers that selecting a point estimate of 6.25%, at the upper bound of our draft proposal range, would be more consistent with latest CMA precedent of aiming up within total market return ranges and reduce the risk that the CAA's current point estimate is underestimating the total market return, while still being consistent with the CAA's range overall. NERL believes the available evidence from NERA supports a higher range than our draft proposals and the TMR of 6.25% from RP2 remains appropriate for RP3, albeit towards the lower end of the plausible range.

E85 For our final decision, we have considered the broad range of evidence available on TMR, including NERL's response and further publications and evidence from UK regulators. As presented above, the most recent evidence from other UK regulators and a wide range of advisors has shown a broad degree of consensus around a TMR range of around 5.0% to 6.0% in RPI-deflated terms (consistent with the UKRN cost of equity report), with UK regulators proposing TMR ranges or point estimates of between 5.2% to 5.8%. This lies significantly below the updated range from NERA of 6.2-6.8% and TMR proposed by NERL of 6.25%. This difference is expected as NERA does not put any weight on the range from the UKRN cost of equity report or forward-looking approaches. NERA appears to be an outlier in terms of its proposed range, even with the downwards revision of its range of 30bps since its September 2018 report for NERL.

E86 As set out in the above sections on historical and forward-looking approaches, we consider that the new evidence from NERL and its advisors does not appear to be compelling or support the TMR they are proposing, which appears to be significantly higher than the required TMR. We have not seen strong evidence for a substantial increase in the TMR in our draft proposals.

E87 Overall, we consider that retaining the TMR of 5.4% in RPI-deflated terms appears to be consistent with our review of the available evidence, as it is around the mid-point of the ranges from different sources and approaches. In particular, historical average returns appear to support a range of 5-6%, while the forward-looking evidence appears to support a range of around 5.0-5.8% (similar to the 5.1-5.6% recommended by PwC for CAA). Other cross-checks, such as MARs, investor surveys and international precedent appear to support a TMR towards or below the lower end of these ranges. We therefore use a **TMR of 5.4%** to inform our overall WACC estimate in this final decision.

E88 We note that a TMR of 5.4% is also broadly consistent with estimates of the TMR from Ofwat (at 5.47%) and Ofgem (around 5.1-5.7%) in recent publications and is marginally lower than the estimate from Ofcom (around 5.8%), when expressed in RPI-deflated terms. A marginal increase in the TMR to the levels set by Ofwat and Ofcom would have a small impact on the vanilla WACC (of around 2 to 14 bps).

E89 We recognise NERL and NERA's point that it is important that the cost of capital is not set too low. We consider that our TMR is conservative and there is a range of forward-looking evidence suggesting that TMR expectations for RP3 may be substantially lower. As explained in our draft proposals, there is limited evidence to support a TMR above 6% and we have not seen a strong case why a TMR of 5.4% would be insufficient to attract equity investment during RP3 and therefore why the CAA should deliberately aim up to the top end of a range.

Risk-free rate

E90 The risk-free rate (RFR) is an input to the cost of equity under CAPM.

E91 In its RP3 business plan, NERL proposed an RPI-deflated RFR of 0.46%, just above the mid-point in NERA's range from -1.1% (based on UK 10-year government yields in August 2018 and forward rates to mid-point of RP3) to 1.5% (based on long-run historical market evidence adjusted for current market conditions).

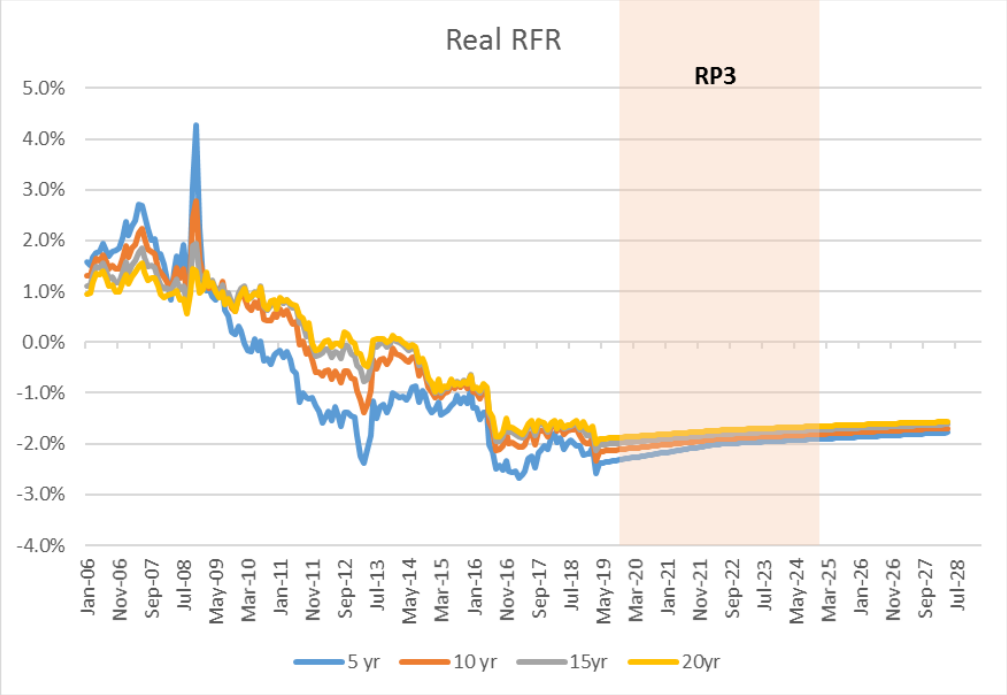
E92 In our draft proposals, we estimated an RPI-deflated RFR of -1.4%. We used an approach recommended in the UKRN cost of equity report of using the yield on index-linked gilts (ILGs) to derive the RFR. Based on market evidence at the end of September 2018, we produced implied forward-gilt yields at different maturities for a period covering RP3 (2020-2024). At the mid-point of RP3 (July 2022), we estimated a RFR of -1.4% based on 10-year ILGs, which we found only changed slightly based on different estimation methods (e.g. cross-checking using spot values from the prior six months and using a 10-year trailing average) or maturities (5, 15 and 20-year ILGs).

E93 CEPA, in its updated report for IAG, suggested that CAA could place greater reliance on current unadjusted spot rates and use indexation over the price control period. This would lead to a lower estimate for the RFR. NERL agreed that our assessment of the RFR was not unreasonable and adopted our -1.4% estimate in its response. No other major issues were raised by stakeholders in response to our draft proposals.

E94 For our final decision, we have adopted the same approach to estimating the RFR as our draft proposals, updated for more recent market information. We noted that CEPA has proposed a different approach to indexation of the RFR, which we understand to be in line with Ofgem's proposed approach for RIIO-2. We discuss this further below.

E95 We have reviewed more recent market information on ILGs published up to end April 2019, to produce implied forward-gilt yields at different given maturities for a period covering RP3 (2020-2024). The results are set out in Figure E.5 below.

Figure E.5: Forward rates for index-linked gilts over 5-year to 20-year horizons



Source: CAA analysis of gilt yields published by the Bank of England. Spot market data used: 30th April 2019.

E96 More recent market estimates have suggested slightly lower ILG yields over RP3 than at the time of our draft proposals, which we understand may be related to Brexit-related risks increasing demand for low risk assets.

E97 By and large, the chart demonstrates that markets anticipate that yields on ILGs will increase slightly from current market values over RP3, but that yields will remain low and negative for an extended period. At the mid-point of RP3 (July 2022), we estimated a RFR of -1.9% based on 10-year ILGs. We note that spot rates, as suggested by CEPA, would be below this. However, we consider that forward rates should be used to forecast spot rates where indexation is not applied to true-up for forecast errors. We do not consider that RFR indexation is a relevant consideration for NERL, as we have assumed a fixed TMR for RP3 and an equity beta close to one, meaning that correcting for unforeseen changes in the RFR during RP3 would add complexity but would not be material in practice.[45]

E98 We have also checked the change in 10 to 20-year spot rates relative to the September 2018 spot rates used to derive our draft proposals RFR (-1.4%) and tested the sensitivity of 3 and 6-month average spot rates with forward rate

[45] Under CAPM with a fixed TMR and indexed RFR, changes in cost of equity will be equal to (1 – Equity beta) * change in RFR. With an equity beta close to or equal to one, the impact on cost of equity is therefore close to or equal to zero

adjustments. These results point towards a slightly lower range of -1.7% to -1.8% for the RFR at the mid-point of RP3.

E99 Given the volatility in ILGs in the last 6 months and the uncertainty associated with Brexit-related impacts, we propose a point estimate for the RFR of -1.7%, towards the higher end of the range above.

E100 We note that nominal gilts would lead to a higher estimate for the RFR (closer to -1.3%), though this was sensitive to the assumed level of inflation and would be a departure from the approach recommended by the UKRN cost of equity report.

E101 We have checked that the estimated RFR of -1.7% appears broadly reasonable when compared with the -1.3% to -1.95% range suggested by other recent estimates:

- Ofgem's May 2019 decision on RIIO-2 used a RFR at the start of RIIO-2 of -1.8%. Ofgem plans to index the RFR to actual ILG yields during RIIO-2;
- Ofwat's July 2019 draft determinations for PR19 used a RFR of -1.42%. However, Ofwat notes that this is based on a data cut-off of end February 2019 and that, had it used a data cut-off of end June 2019, its RFR would have been 55bps lower in nominal terms, which we calculate would have produced an RPI-deflated RFR of -1.95%; and
- Ofcom's May 2019 business connectivity draft statement used a RFR of -1.3%. Ofcom has placed more weight on recent market evidence for 10-year index-linked gilts, though its estimates also draw on other sources of evidence.

E102 Based on the review of empirical evidence and regulatory precedent, we use an **RFR of -1.7% (in RPI-deflated terms)** to inform our overall WACC estimate in this final decision.

Gearing

E103 In its RP3 business plan, NERL proposed a gearing level of 60% to calculate its cost of capital, in line with the rate set by the CAA in RP2. In NERL's RP3 business plan, actual gearing increases from around 30% in 2017 to around 60% by 2024.

E104 For our draft proposals, we used a notional gearing of 60% following our financeability assessment, which showed that NERL should be able to maintain a strong investment-grade credit rating at this notional level. This was also consistent with advice from our advisers, Europe Economics, who recommended starting from an initial notional gearing of 60% for NERL, after considering trends in gearing in the UK corporate sector and UK utilities.

E105 No issues were raised by stakeholders in response to our draft proposals. We note that a notional gearing level of 60% appears broadly consistent with wider UK regulatory precedent. For example, both Ofwat and Ofgem have adopted notional gearing on 60% in recent PR19 and RIIO-2 publications.

E106 We have used a **notional gearing assumption of 60%** to inform our overall WACC estimate in this final decision. As shown in chapter 7, our financeability testing for these draft proposals indicates that this level should allow NERL to maintain a strong investment-grade credit rating.

E107 We note that a notional gearing of 60% also provides reasonable headroom to the gearing cap of 65% in NERL's licence. However, we emphasise that 60% gearing, also cited in the licence, should not be interpreted as a target level of gearing set by the CAA and responsibility for maintaining an investment grade credit rating sits firmly with NERL's management. We have proposed a licence modification with this final decision to address this point.

Equity beta

E108 The TMR represents the returns required by investors on equities of average risk. Under the CAPM framework, the equity beta measures the systematic risk of a particular equity investment. The higher the equity beta, the larger the required compensation equity investors require for bearing the additional systematic risk. In general, UK regulators have estimated the equity beta based on estimates of the underlying asset beta and debt betas, re-levered using the notional level of gearing.

E109 In its RP3 business plan, NERL proposed an asset beta of 0.61, a debt beta of 0.05 and an equity beta of 1.45. This is the mid-point of NERA's equity beta range for NERL of 1.33 to 1.58. The lower bound of NERA's asset beta is based on the two-year asset beta of Aeroports de Paris (ADP), which NERA considered provided a similar traffic risk to NERL, and the upper bound is based on the two-year asset beta from a subset of international listed airports. NERA's range is significantly above the CAA's allowance for RP2 (0.505 asset beta, 0.1 debt beta and 1.1125 equity beta).

E110 In our draft proposals, we used an asset beta of 0.46 (range of 0.46-0.51), a debt beta of 0.13 (range of 0.1-0.19) and equity beta of 0.96 (range of 0.87-1.11). The asset beta was mainly based on advice from Europe Economics,[46] which found that the asset beta should be consistent with a comparator range from ENAV, the Italian ANSP, and constraint ranges from utilities (at the low end) and UK airports (at the high end). More generally, as NERL is a monopoly with significant

[46] Europe Economics, Components of the cost of capital for NERL, December 2018

protection against volume risk and pension deficit costs, we considered that there was very limited evidence to support an equity beta above 1.

E111 In its response to our draft proposals, NERL proposed an asset beta of 0.57, a debt beta of 0.05 and an equity beta of 1.35, below the level set out in its RP3 business plan. This was based on:

- An updated range from NERA of 0.53-0.58 for the asset beta,[47] with a debt beta of 0.05. The debt beta has been informed by a report from Professor Zalewska[48] that provides empirical estimates of the debt beta for NERL.
- Previous ranges of the asset beta from RP2 (0.49-0.52) and RP1 (0.50-0.60) and taking account of general increases since RP2 in asset beta for relevant listed airports and utility companies. NERL and NERA disagree with Europe Economics that UK airports form an upper bound on NERL's risk.
- Higher risks at RP3 due to Brexit and asymmetric downside incentives for capacity and environment (though NERL does not provide estimates for these impacts on beta).
- Corrections to the Europe Economics analysis on asset beta, including measuring the beta against the wider European market index only, and correcting an error where en route services have a higher beta than terminal services. NERL adopts Europe Economics' estimate for the impact of NERL's greater operational leverage than its comparators.

E112 NERL, based on advice from NERA and Professor Zalewska, raised a number of issues and some new evidence in response to Europe Economics' report. We asked Europe Economics to review the points raised in NERL's response and review the latest market information for the ENAV comparator.[49] PwC has also reviewed the evidence provided on debt beta.[50] We summarise below the responses to the points raised and additional evidence that we have used to inform our final decisions.

Asset beta

E113 NERL and NERA have criticised the use by Europe Economics of the local Italian market index to estimate betas. NERA considers that the local index does not reflect the investment universe of the marginal investor, that the index should include the company under consideration and the wider European benchmark is

47 NERA, Cost of equity for RP3, April 2019

48 Professor Zalewska, Estimation of the debt beta of the bond issued by Nats (En-Route) plc, April 2019

49 Europe Economics, Comments on NERA/NERL critiques of Europe Economics' WACC analysis, June 2019

50 PwC, Estimating the cost of capital for H7 and RP3 – Response to stakeholder views on total market return and debt beta, August 2019

more similar to the UK FTSE than local indices. In its updated report,[51] Europe Economics does not accept the points raised by NERA. Europe Economics responds that it is appropriate to put weight on the beta estimated using the domestic Italian index, particularly as the equity beta will be applied to the domestic UK index and equity risk premium (ERP), which is likely to be higher than the European ERP. Europe Economics does agree that it is appropriate to also put weight on the beta estimated using the European market index to provide an appropriate range. We also note that the Thessaloniki Forum in 2016 recommended estimating beta by reference to the national index and stated that, as a general rule, when dealing with a regulated airport the risk should be lower than the market (equity beta below one).[52]

E114 NERA has criticised the approach by Europe Economics to apply a downward adjustment to ENAV's beta for en route services on the basis of terminal services being higher risk. NERA provides evidence that terminal services are lower risk than en route services and correcting for this error supports an upward adjustment to ENAV's en route beta. Europe Economics considered the points raised by NERA, including considering new evidence from the most recent Eurocontrol Performance Review, which allows for some limited comparison of the operational leverage of terminal and en route services. While Europe Economics finds some evidence that terminal services appear to be less operationally leveraged than en route, Europe Economics concludes that the effect appears to be small and so does not recommend a change in its approach. However, for reference, Europe Economics also sets out an alternative approach where it excludes the adjustments for terminal services and operational leverage.

E115 NERA considers that Europe Economics' operational leverage assumptions lie at the bottom end of a plausible range of adjustments applied by the CMA, so is at the lower bound on the necessary adjustment. Europe Economics did not consider that further analysis was required, as NERA appeared to accept Europe Economics' estimate for its own calculations.

E116 NERA disagrees with Europe Economics that UK utility betas are relevant comparators for NERL, even as a lower bound, given UK utilities are regulated under a revenue cap framework which protects them from volume risk and also have lower operating leverage compared to NERL. Europe Economics considered that utilities remain relevant comparators for the 'constraint range' for NERL's beta and is consistent with previous work for the European Commission. In its previous report, Europe Economics concludes that the lower bound of UK

[51] Europe Economics, Comments on NERA/NERL critiques of Europe Economics' WACC analysis, June 2019

[52] Thessaloniki Forum of Airport Charges Regulators, Recommendations for the Setting and the Estimation of the WACC of Airport Managing Bodies, December 2016

utilities reflects utilities with a share of non-regulated revenues, so is above pure regulated utilities, reflecting the greater level of risk faced by NERL.

E117 NERA disagrees with Europe Economics' that UK airport betas represent an upper bound on NERL risk, given NERL is exposed to more internationally diversified traffic from overflights and is also subject to risk sharing. NERA reviews traffic volatility to show that NERL has experienced higher volatility than UK airports and NERL is exposed to greater cash-flow volatility due to its greater operational leverage. Similar to its response above, Europe Economics considers that UK airports remain relevant comparators for the 'constraint range' for NERL's beta and is consistent with previous work for the European Commission. We note that NERA's conclusion that NERL faces higher risks than UK airports seems to be inconsistent with asset beta estimates by NERA for NERL in RP3 (0.53-0.58) and for HAL in H7 (0.55-0.60),[53] where NERL has a lower beta range than HAL.

E118 NERA repeats its previous position that NERL's beta should be estimated directly using available listed airport comparators. NERA considers that NERL's closest comparator is ADP, given similar traffic composition and noting that ADP is also subject to a volume risk sharing mechanism, but it would expect NERL to face greater systematic risk than ADP because of NERL's higher operating leverage. Europe Economics considers that UK airports are most relevant to NERL, which are estimated using international airport betas. This informs the upper end of Europe Economics' constraint range, to use with the comparator range from ENAV. Europe Economics continues to consider that NERL's asset beta should be expected to be lower than for UK airports given greater demand diversification and partial protection from demand risks.

E119 NERL considers that Brexit, asymmetric incentives and changes in airport/utility betas suggest that risks faced by NERL have increased and therefore the asset beta should be higher in RP3 than in RP2. Europe Economics' previous and updated analysis uses recent estimates for airport and utility betas and does not decide to include any adjustment for Brexit. We consider that any adjustment is likely to be highly uncertain and NERL has not provided any evidence to suggest what this adjustment should be. On incentives, our final decision includes a reduced set of penalties and rewards compared with our draft proposals and RP2, and less stretching targets than our draft proposals. While this change could reduce rather than increase the beta, we note the impacts on systematic risks and beta will not be straightforward to assess.[54]

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53 NERA, Cost of equity for RP3, April 2019; NERA, Cost of equity for HAL at H7, April 2019

54 For example, a reduction in traffic due to an economic slowdown may make it easier for NERL to achieve capacity targets, meaning the incentive impact partially offsets the risk that NERL faces from the traffic volume sharing mechanism

E120 CEPA, in its report for IAG, proposed a range of 0.43-0.50, so supported our draft proposals.[55] However, CEPA considers that there is evidence consistent with an estimate below 0.46, including the mid-point of the ENAV estimate (0.415) and a slightly lower range for UK utilities (0.38-0.43) that imply that 0.46 is not the low end of the range. We consider these points are addressed in Europe Economics' updates below to the ENAV and UK utilities betas to update its estimates of the comparator and constraint ranges for the asset beta.

E121 Based on the latest market information, Europe Economics has updated the ENAV comparator range for asset betas from its previous report. This has produced a narrower range for the asset beta of 0.36-0.46 (compared with 0.29-0.54 in its previous report), reflecting a reduction in 2-year betas measured against the European index and an increase in 2-year betas measured against the domestic index. The lower end of EE's constraint range based on utility betas has also reduced slightly since draft proposals from 0.46 to 0.44.

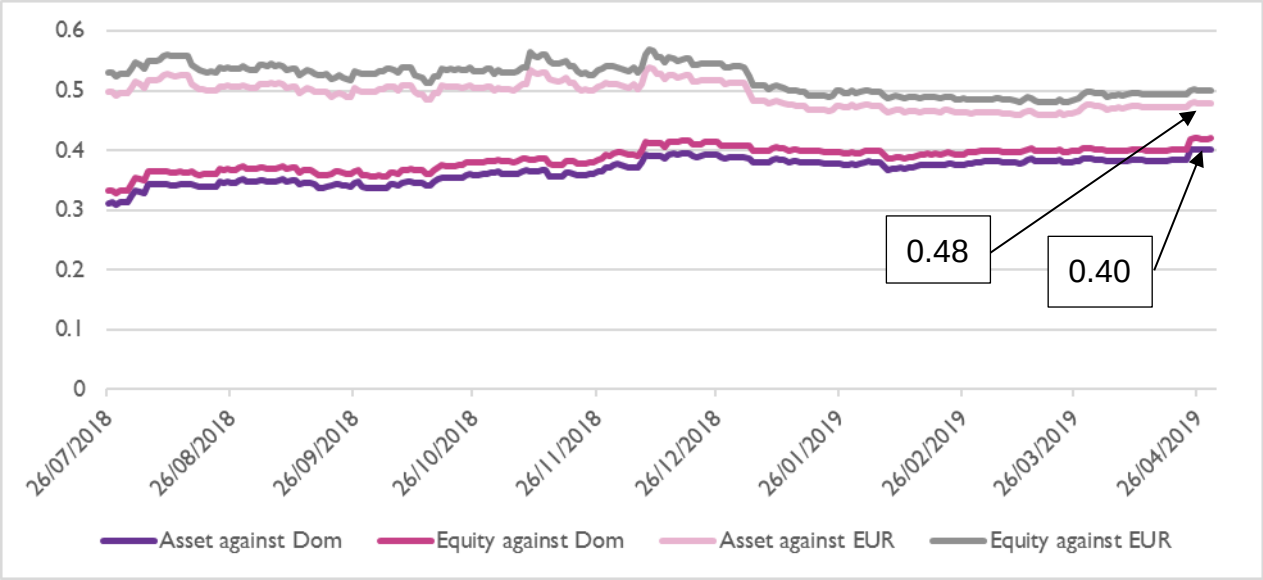
E122 Europe Economics concludes that a value towards the bottom end of the 'constraint range' is supported by its analysis. This is a point estimate of 0.45 (based on the mid-point of the new 0.36-0.46 range, uplifted by 9% for operational gearing adjustment), or 0.44 (based on the mid-point of an alternative range where there are no adjustments for terminal services or operational gearing). This is slightly below the lower end of 0.46 estimated by Europe Economics for our draft proposals.

E123 We note that NERA, in its updated report for NERL, has only used the 2-year beta for ENAV and does not put weight on the 1-year beta. This is a change from its approach in its earlier report for NERL where it put weight on both the 1-year and 2-year ENAV betas. NERL cited one reason for putting weight on the 1-year beta was an expectation than betas could continue to increase in future, though we note that the 1-year beta has instead fallen since our draft proposals. As a cross-check, if we estimated the asset beta using our understanding of NERA's previous approach with the latest market information and applied an uplift for operational leverage, the mid-point is close to 0.46.[56]

[55] CEPA, Response to CAA consultations on RP3 and H7 WACC, April 2019

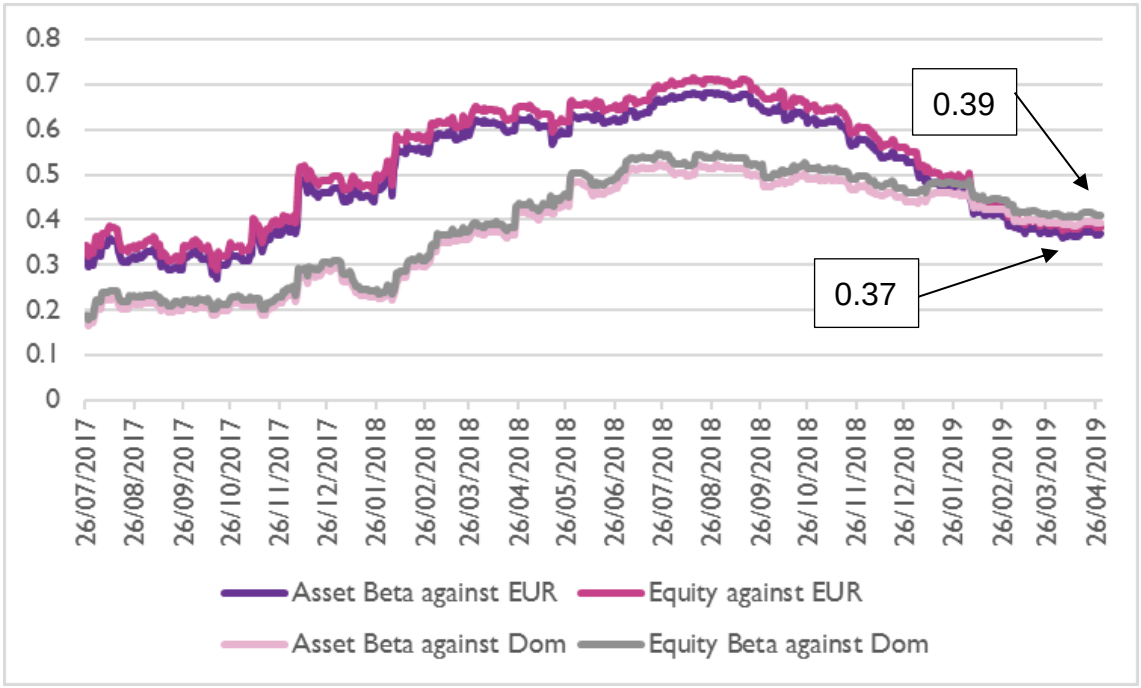
[56] This is based on taking the mid-point (0.425) from the 1-year (0.37) and 2-year (0.48) asset betas estimated against the European index and applying a 9% uplift for NERL's higher operational leverage

Figure E.6: 2-year asset and equity betas for ENAV (vs domestic and European indices)



Source: Europe Economics, Comments on NERA/NERL critiques of Europe Economics' WACC analysis, June 2019

Figure E.7: 1-year asset and equity betas for ENAV (vs domestic and European indices)



Source: Europe Economics, Comments on NERA/NERL critiques of Europe Economics' WACC analysis, June 2019

Debt beta

E124 In its response to our draft proposals, NERL has proposed a debt beta of 0.05 within the plausible range of 0 to 0.10.

E125 NERA considers that the 'indirect' method proposed by Europe Economics for the estimation of debt betas omits a key component of the debt premium – liquidity premium – as considered by the CMA in its calculation of debt betas in

2007. NERA also considers Europe Economics has used incorrect parameters in the decomposition, including: i) the default premium (understated); ii) the debt spread (overstated) and iii) the ERP (understated). Applying its own parameter estimates and using the CMA's liquidity adjustment, NERA calculates lower debt betas of 0.05 to 0.1.

E126 NERA and NERL put weight on direct econometric estimates of debt beta using NERL's bond, HAL's bonds and iBoxx indices. A paper from Professor Zalewska estimates debt beta from a range of econometric models and concludes that the debt beta is significantly smaller than 0.1 and not statistically significantly different from zero. NERL also cites other papers that showed debt betas below 0.1.

E127 NERA also puts weight on wider academic literature on debt betas to support its estimate below 0.1, though it does not set out in detail what this literature is.

E128 We asked Europe Economics to review the points raised in NERL's response and the supporting papers from NERA and Professor Zalewska. In summary:

- Europe Economics finds that the econometric approaches suffer from a range of problems leading to highly volatile and unreliable results. Europe Economics therefore continues to prefer the indirect decomposition approach in its report.
- Europe Economic updates its indirect beta estimates for the risk-free rate and equity risk premium in the CAA's draft proposals. This increases the debt beta from 0.19 in its previous report to 0.22 (with a range of 0.19-0.25).
- When including a 30bps liquidity premium, in response to NERA's comment, Europe Economics finds that the debt beta falls to 0.18 (with a range of 0.15-0.21).
- In Europe Economics' previous report for CAA, it cited precedent from the Competition Commission CAA Q5 review as supporting a debt beta in the range 0.09 to 0.19, as well as other recent UK regulatory precedent, to recommend an overall range of 0.1-0.19.

E129 We also asked PwC to review the econometric analysis in NERL's response on debt betas. In summary:

- PwC finds that debt beta estimates are highly sensitive to data frequency (monthly data leads to higher betas than daily data) and time period used (2-year rolling betas are higher than 5-year rolling betas). PwC finds that debt betas are negative when using daily data and prefers to use monthly data.
- NERL has consistently lower debt beta than HAL for monthly data (by about 0.1). PwC might expect NERL to have a lower debt beta than HAL due to NERL's lower gearing and higher credit rating.

- PwC recommends that CAA take a balanced view across a range of estimation approaches (both empirical and decomposition) and align the time period in estimating a consistent debt and equity beta.

E130 Recent UK regulatory precedent has used debt beta in the range of 0.1-0.15. Ofgem has proposed a range of 0.1-0.15 for RIIO-2, Ofwat has used a debt beta of 0.125 in its PR19 draft determinations and Ofcom has used a debt beta of 0.1 in its statement on business connectivity market review.[57]

E131 In reviewing UK regulatory precedent, we noted that in NERA's 2018 WACC report for Ofcom,[58] NERA concluded that a debt beta of 0.1 was appropriate for BT. In this report, NERA argues against using econometric methods to estimate debt betas and presents recent academic and other evidence with a debt beta range of 0-0.22. This evidence was not presented in its report for NERL.

Overall CAA view on equity beta

E132 Based on our review of NERL and NERA's responses to our draft proposals and the updated report from Europe Economics, we do not consider that NERL has made a strong case for increasing the asset beta from our draft proposals. As set out above, more recent estimates from Europe Economics and a cross-check where we estimate the asset beta using our understanding of NERA's previous approach, support an asset beta that is at or slightly below the asset beta of 0.46 from our draft proposals.

E133 We have used the same **asset beta of 0.46** from the draft proposals to inform our overall WACC estimate in our final decision. We consider this to be a conservative assumption as updates to market information since the draft proposals suggest the asset beta may be slightly lower.

E134 We consider this provides a reasonable estimate of NERL's asset beta by putting weight on the estimated beta for ENAV over a longer timeframe (2-years, rather than 1-year) and considering movements against both the domestic and European indices. We consider it is reasonable to consider beta estimates from using these different approaches. While NERA provides evidence that NERL's beta should be higher than ENAV, CEPA provides evidence to support the opposite. It is therefore not clear that an adjustment to ENAV's beta is needed in addition to the adjustment applied by Europe Economics' for NERL's higher operating leverage. Europe Economics has also put some weight on utility comparators, in addition to airports, as relevant comparators to NERL as a regulated company, while recognising the higher demand risks that NERL faces.

[57] Ofcom, 2019 PIMR and BCMR Statement: Annex 21, June 2019

[58] NERA, Cost of capital: Beta and gearing for 2019 BCMR, October 2018

E135 We have sense-checked this 0.46 asset beta against recent regulatory precedent, noting that this is significantly above the recent estimates from Ofwat (0.36 in Ofwat's PR19 draft determinations) and Ofgem (0.38 in Ofgem's RIIO-2 methodology decision). Moreover, the asset beta is slightly below the mid-point of PwC's estimated range for HAL (0.42-0.52, based on 2-year daily and 5-year monthly asset betas for ADP and Fraport, measured against both local and European indices), so seems to be broadly consistent with Europe Economics' conclusion that NERL's asset beta should be below that of UK airports.

E136 For our final decision, we do not consider that additional adjustments are required to reflect the performance regulation, which shows that NERL will continue to have strong protections against elements of systematic risks from traffic risk-sharing, pension cost pass-through and an additional mechanism for RP3 to protect NERL from unexpected changes in the RPI-CPI inflation wedge.

E137 The new evidence from NERA and Professor Zalewska on debt beta suggests that the plausible range may be lower than our draft proposals and NERL recommends the bottom end of the range of zero. However, following the review of the new evidence by Europe Economics and PwC, we are cautious about placing too much weight on low estimates of debt beta estimated directly from the econometric models, which appear to be highly volatile and, in some cases, produce counter-intuitive results. This finding also appears to be supported by NERA in its previous work for Ofcom.

E138 On balance, we consider that the plausible range of the debt beta has increased to the downside compared with our draft proposals range (0.1-0.19), so we have used a slightly lower **debt beta of 0.1** to inform our overall WACC estimate in our final decision. This estimate is supported by the range of evidence from direct econometric approaches and indirect decompositional approaches. It is also in line with the plausible range from NERL (upper end of the range), recent regulatory precedent and the report from Europe Economics in December 2018 (lower end of the ranges) and the estimate used by CAA at RP2.

E139 We consider there to be some evidence that debt betas are higher than was assumed at RP2 given analysis by Europe Economics and recent changes made to estimates by UK regulators. We will explore this further, including considering future work by UKRN,[59] in considering whether we should adopt a higher debt beta for future price controls.

E140 Taking the asset beta of 0.46 and debt beta of 0.1, we have used an **equity beta of 1.00** to inform our overall WACC estimate in our final decision. This is towards the upper end of the range we set in our draft proposals (0.87-1.11).

[59] UKRN, Annual report and 2019/20 work plan, July 2019

E141 We consider this equity beta to be conservative as:

- NERL will receive strong protection from unforeseen changes in pensions costs, traffic and inflation risks through the regulatory framework, which will reduce its exposure to systematic market risk. It is also a monopoly. It therefore seems implausible that NERL would face a higher risk than the average company in the market with an equity beta of 1.
- We have not sought to reduce the asset beta to reflect new market evidence from Europe Economics (which suggests the asset beta may have reduced to 0.44-0.45), nor the changes since our draft proposals where there has been a reduction in traffic forecasts (which will reduce downside traffic risks), reductions to the potential performance incentive penalties and introduction of a new mechanism to protect NERL against unexpected changes in the RPI-CPI inflation wedge.
- The debt beta of 0.1 appears to be at the lower range of recent regulatory precedent and below indirect estimates by Europe Economics, which may mean that the equity beta is more likely to be overestimated rather than underestimated.
- We have increased the equity beta since our draft proposals, in contrast with recent changes by other UK regulators where the equity beta has reduced. For example, Ofwat reduced the equity beta from 0.77 in its PR19 methodology to 0.71 in its PR19 draft determinations.

Table E.2: Betas for RP3 WACC

	Asset beta	Debt beta	Equity beta
CAA RP2	0.505	0.10	1.11
NERA's report for NERL (Sept-18)	0.56-0.66	0.05	1.33-1.58
NERL's business plan	0.61	0.05	1.45
Europe Economics report for CAA (Dec-18)	0.46-0.54 (recommends 0.46 or higher)	0.10-0.19 (0.1 based on precedent)	0.87-1.20
CEPA report for IAG	0.43-0.50	0	0.96-1.11
CAA's draft proposals	0.46 (Range: 0.46-0.505)	0.13 (Range: 0.10-0.19)	0.96 (Range: 0.87-1.11)
NERA's updated report for NERL (April-19)	0.53-0.58	0.05	1.25-1.38

	Asset beta	Debt beta	Equity beta
NERL's response to CAA's draft proposals	0.57	0.05	1.35
Europe Economics updated report for CAA (June-19)	Recommends 0.44 or higher	0.19-0.25	Not calculated
CAA's final decision	0.46	0.10	1.00

Source: CAA analysis of various sources

Post-tax cost of equity

E142 In its RP3 business plan, NERL proposed a post-tax cost of equity of 9.65% (RPI-deflated), based on the CAPM approach and its estimates for the TMR, RFR and equity beta.[60] This was the mid-point of the range estimated by NERA of 8.97% to 10.32% and is significantly above the allowed cost of equity set at RP2 (6.87%).

E143 Based on our proposed range and point estimates for the TMR, RFR and equity beta and using the same CAPM approach, in our draft proposals we used a range for the post-tax cost of equity of 4.12% to 7.05%, with a point estimate of 5.13% (RPI-deflated) to inform our overall WACC estimate. Our estimate was significantly below the estimate proposed by NERL due to lower estimates for the RFR, TMR and equity beta.

E144 In its response to our draft proposals, NERL proposed a slightly reduced post-tax cost of equity from its RP3 business plan of 8.93%, due to changes in its proposals for TMR, RFR and equity beta. However, this was still significantly above our draft proposals and allowance for RP2.

E145 Based on our proposed point estimates for the TMR, RFR and equity beta and using the same CAPM approach, in our final decision we use a **post-tax cost of equity of 5.40%**[61] (RPI-deflated) to inform our overall WACC estimate in our final decision. This has increased slightly from our draft proposals due to an increase in our estimates for the debt and equity betas.

E146 Our final decision is within the range estimated by CEPA in November 2018 for IAG (4.70% to 6.82%). However, CEPA assumed a debt beta of zero. Introducing a debt beta similar to our proposed range with the same asset betas would significantly reduce its cost of equity range.

60 The post-tax cost of equity is calculated as: RFR + Equity beta * (TMR – RFR)

61 The CAA's post-tax cost of equity of 5.40% (RPI-deflated), is calculated as: RFR (-1.7%) + Equity beta (1.00) * [TMR (5.4%) – RFR (-1.7%)]

E147 Our point estimate is higher than the post-tax cost of equity in recent publications from Ofwat for PR19 (3.46%), Ofgem for RIIO-2 (3.22%) and Ofcom for Openreach (4.71%). We would expect NERL to have a higher cost of equity as NERL faces a portion of demand risk, unlike the regulated water and energy companies.

E148 Ofgem, in its RIIO-2 methodology decision provided a number of cross-checks from investment managers and advisers, bids for offshore electricity transmission assets and infrastructure fund discount rates. Ofgem concludes that these checks support Ofgem's CAPM cost of equity range of 4-5.6% in CPIH-deflated terms, or around 3-4.6% in RPI-deflated terms. We consider that market-based measures can provide useful cross-checks for the efficient cost of equity for NERL, though recognise that the nature of risks faced by NERL, such as its share of traffic risks, are likely to support a higher cost of equity for NERL for RP3.

Table E.3: Post-tax cost of equity for RP3 WACC

	NERL business plan	CAA draft proposal	CAA final decision	Notes
Post-tax cost of equity (RPI-deflated)	9.65%	5.13%	5.40%	CAA has used lower estimates than NERL for risk-free rate, beta and total market return to calculate the cost of equity using CAPM

Source: CAA analysis

Cost and proportion of embedded debt

E149 In its RP3 business plan, NERL proposed a cost of embedded debt of 2.13%, based on the nominal yield at issuance of NERL's existing bond (5.4%), deflated by NERA's inflation forecast of 3.2% (using the Fisher formula). NERL's existing bond has a declining balance and is due to mature in 2026.

E150 PwC reviewed the efficiency of the cost of the existing bond for CAA at RP2. As PwC did not identify any issues, we used this as the basis of the cost of embedded debt at RP2 and in our draft proposals we considered this approach remained appropriate for RP3. No stakeholders raised issues with this approach.

E151 Using the same nominal cost of debt of 5.4%, in our draft proposals we used a cost of embedded debt of 2.3% in RPI-deflated terms to inform our overall

WACC estimate in these draft proposals, using the Fisher formula and our RPI forecast of 3.0% for RP3. This was higher than NERL's estimate given its higher forecast for RPI inflation over RP3 of 3.2%.

E152 In its response, NERL proposed a cost of embedded debt of 2.13%, in line with its RP3 business plan and based on its review of higher RPI inflation forecast from Oxford Economics.

E153 As mentioned above, for our final decision we are using the same RPI inflation forecast of 3.0% p.a. for RP3 as in our draft proposals. Therefore, we have used the same **cost of embedded debt of 2.3%** in RPI-deflated terms to inform our overall WACC estimate in our final decision.

E154 For our final decision, we reviewed the average proportions of embedded and new debt in RP3 from NERL's RP3 business plan and concluded that NERL's assumption of an embedded debt proportion of 30% (70% new debt) appeared reasonable. No stakeholders commented on this approach. We use the same **proportion of embedded debt of 30%** to inform our overall WACC estimate in our final decision.

Table E.4: Cost of embedded debt for RP3 WACC

	NERL business plan	CAA draft proposal	CAA final decision	Notes
Cost of embedded debt (RPI-deflated)	2.13%	2.30%	2.30%	CAA has increased to reflect our updated RPI forecast, which is lower than used by NERL
Proportion of embedded debt	30%	30%	30%	No change to NERL's business plan

Source: CAA analysis

Cost of new debt

E155 In RP2, we set a cost of new debt of 1.75% (RPI-deflated). Since 2014, the costs of debt for regulated UK utilities have fallen significantly, with much lower cost of debt estimates being proposed by other UK regulators in recent publications.

E156 In its RP3 business plan, NERL proposed a cost of new debt of 0.42% (RPI-deflated). This was based on estimates from its advisors NERA, starting from the yield on its existing bond with adjustments for a longer maturity, expected

increases in rates to mid-RP3 and a notice period premium, reflecting that debt-holders will expect a higher cost of holding debt beyond NERL's 10-year rolling notice period.

E157 To support our draft proposals, we commissioned Europe Economics to provide an estimate for NERL's cost of new debt.[62] Europe Economics provided a range for the cost of new debt of 3.03% to 3.46% (in nominal terms) and recommended choosing the mid-point of 3.25% (in nominal terms). The range was based on two approaches:

- a bottom-up approach starting from the yield of NERL's existing bond, similar to NERA's work for NERL, but then with smaller adjustments than NERA for expected increases in forward rates, longer maturity for new debt, and a downward adjustment for liquidity. This produced a nominal cost of new debt of 3.03%, compared with 3.64% from NERA; and
- a top-down approach using iBoxx data to estimate the yield for an A-and-above Utilities bond. Europe Economics adjusted this estimate for forward rate, liquidity risk and maturity to obtain an overall estimate of 3.46%.

E158 For our draft proposals, we considered that the two approaches from Europe Economics' analysis provided an appropriate starting point but we made two adjustments where we considered we did not have sufficient compelling evidence:

- we removed an upward adjustment for the potential impact of a rolling notice period on the cost of debt, which looked overstated; and
- we removed a downward adjustment for liquidity and inflation risk term of 0.1%, which appeared highly uncertain and was not used by other UK regulators.

E159 Bearing the above in mind, the Europe Economics' range with our adjustments lead to a range for the cost of new debt of 2.63% to 3.56%, with a mid-point of 3.10% (in nominal terms). In our draft proposals, we used a real cost of new debt of 0.1% to inform our overall WACC estimate, based on the mid-point of 3.10% in nominal terms, deflated by our RPI forecast of 3.0% p.a.

E160 In its response, NERL considered that CAA's draft proposals were broadly appropriate except for two points:

- Europe Economics was incorrect in assuming a 10-year maturity for new debt. The likely maturity is 15 years, in line with average asset lives for calculating depreciation, which would increase the cost of new debt by 0.3%; and

[62] Europe Economics, Components of the cost of capital for NERL (December 2018)

- The CAA has provided no evidence for a change in transaction cost from 0.15% in RP2.

E161 CEPA, in its report for IAG, considered Europe Economics and NERA have overestimated the adjustments to NERL's existing debt to increase the maturity to 15 years and to forecast the current yields to mid-RP3. CEPA considered that we should put weight on the cost of new debt based on existing costs, with benchmarks used only as a cross-check. CEPA also considered that the CAA should use a benchmark based on the A-rated iBoxx index (rather than the Utilities index) and supported Europe Economics' estimate of 7bps for transaction costs.[63]

E162 To support our final decision, we asked Europe Economics to update its analysis for costs of new debt for more recent market information and consider the impact of using a 15-year maturity on the cost of new debt.[64] The updated analysis from Europe Economics shows reductions since our draft proposals in the yield of NERL's existing bond, forward rates to mid-RP3 and the iBoxx benchmark. Excluding transaction costs, this analysis provides an updated range for the nominal cost of debt of 2.90% to 3.32% with a mid-point of 3.11% (compared with 3.25% in draft proposals), if assume a 10-year maturity for new debt. Europe Economics estimates that an increase in maturity to 15 years results in an increase in the nominal cost of debt range to 3.08% to 3.38%, with a mid-point of 3.23%, similar to our draft proposals.

E163 For our final decision, we propose to make the same types of adjustments to the range from Europe Economics as we made in our draft proposals. These were not challenged by stakeholders. We also propose to accept NERL's suggestion to base the cost of new debt on an assumption of a 15-year maturity for new debt, which appears to be plausible given the assumption for average asset lives and the long-term nature of the RAB-based regulatory regime. This leads to a range for nominal cost of new debt of 2.7% to 3.5%, with a mid-point of 3.1%, when rounded, as shown in Table E.5 below.

63 CEPA, Response to CAA consultations on RP3 and H7 WACC, April 2019

64 Europe Economics, Comments on NERA/NERL critiques of Europe Economics' WACC analysis, June 2019

Table E.5: Calculation of cost of new debt for RP3, excluding transaction costs (in nominal terms)

	NERA (Sept-18)	Europe Economics for 15-yr debt (June-19)	CAA based on Europe Economics (June-19)	Notes
Yield on existing bond	1.73%	1.62%	1.62%	Used latest spot rate from Europe Economics
Adjustment for forward rates to reflect expected increases in rates to mid-RP3	0.63%	0.40%	0.40%	NERA and Europe Economics use UK gilt forward rates. Europe Economics uses more recent market information
Adjustment for liquidity and inflation risk term to reflect future uncertainty in longer-term bonds	-	-0.10%	-	Europe Economics proposes an adjustment based on academic studies, which we have removed due to uncertainty
Adjustment to reflect difference in maturity between existing bond and new debt (15-year)	0.78%	0.66%	0.66%	NERA and Europe Economics assume a 15-year maturity for new debt and compare UK gilts with 5 and 15-year maturities. Europe Economics uses more recent market information
Notice period premium to reflect cost of holding debt beyond rolling 10-year licence period	0.50%	0.50%	-	Both NERA and Europe Economics propose the adjustment, based on a report from Europe Economics

	NERA (Sept-18)	Europe Economics for 15-yr debt (June-19)	CAA based on Europe Economics (June-19)	Notes
				for CAA in 2015.[65] We have removed this due to lack of evidence.
Cost of new debt – bottom-up approach	**3.64%**	**3.08%**	**2.68%**	CAA estimate is below Europe Economics' estimate due to adjustments
iBoxx utilities benchmark – rated A and above	-	3.08%	3.08%	Europe Economics estimates the iBoxx index for A-and-above Utilities
Adjustment for forward rates to reflect expected increases in rates to mid-RP3	-	0.40%	0.40%	See comment above for the same adjustment
Adjustment for liquidity and inflation risk term to reflect future uncertainty in longer-term bonds	-	-0.10%	-	See comment above for the same adjustment
Cost of new debt – top-down approach	**-**	**3.38%**	**3.48%**	CAA estimate is below Europe Economics' estimate due to adjustments
Cost of new debt – average of two approaches	**-**	**3.23%**	**3.08%**	

Source: CAA analysis of NERL's RP3 business plan and Europe Economics' report, May 2019

65 Europe Economics, Implications for debt – raising and the cost of debt of changing the minimum termination notice period for NERL's licence (September 2015)

E164 CEPA, in its updated report for IAG, has provided its own estimates for adjustments required under the bottom-up approach to extend the maturity of debt from 5 to 15 years (adding 0.32 to 0.62% based on ILGs and nominal gilt yields respectively) and to forecast spot rates to mid-RP3 (adding 0.15% to 0.33% based on ILGs and nominal gilt yields respectively). These are below the updated estimates from Europe Economics, which we understand mainly reflects Europe Economics putting most weight on the adjustments calculated using nominal gilt yields (the upper end of the CEPA ranges) and using more recent market information. We consider that Europe Economics' approach appears reasonable as it is estimating a nominal cost of debt for NERL.

E165 CEPA has also raised concerns that the top-down approach should only provide a cross-check on the bottom-up approach, to avoid over-compensating NERL. We consider that we should put weight on all relevant available evidence to inform the cost of new debt for RP3. This includes the top-down approach, with an appropriate benchmark for the notionally financed company, in addition to the bottom-up approach based on the current yield on NERL's bond. This reduces the risk associated with placing more weight on a single approach, which could significantly over or understate NERL's forecast cost of new debt. This also avoids placing undue weight on NERL's existing cost of debt at its current low level of gearing.

E166 For our final decision, we use a real **cost of new debt of 0.1%** to inform our overall WACC estimate in our final decision. This is based on the 3.10% cost of new debt in nominal terms, deflated by our RPI forecast of 3.0% p.a. This is similar to our draft proposals and reflects reductions since our draft proposals in expected debt costs, offset by the impact of from assuming a longer 15-year maturity for new debt.

E167 We have cross-checked that the cost of new debt of 3.10% is close to NERA's estimate for the cost of new debt if you also remove the notice period premium of 0.5% for consistency (which reduces its estimate from 3.64% to 3.14%).

E168 NERL proposes an additional transaction cost of 0.15% for new debt based on the allowed cost at RP2, though did not provide any new evidence in response to our draft proposals to support its estimate. CEPA considers that the CAA should put weight on evidence from Europe Economics. Europe Economics estimated a lower transaction cost of 0.07% for NERL based on its analysis of issuance and liquidity costs for utility companies.

E169 As discussed in our draft proposals, from a review of recent regulatory precedent, in general an allowance of 0.10% is included for the cost of new debt (e.g. this is adopted by Ofwat in its draft determinations for PR19, Ofcom in its statement on the business connectivity market review and in PwC's advice to CAA on the next price control for HAL.

E170 For our final decision, we continue to include a **transaction cost of 0.1%** to inform our overall WACC estimate in our final decision, which is between the estimates from NERA and Europe Economics.

Table E.6: Cost of new debt for RP3 WACC

	NERL business plan	CAA draft proposal	CAA final decision	Notes
Cost of new debt (RPI-deflated)	0.42%	0.10%	0.10%	Reflected updated evidence from Europe Economics and removed notice period premium
Transaction cost	0.15%	0.10%	0.10%	Reduced to reflect evidence from Europe Economics and regulatory precedent

Source: CAA analysis

Cost of debt

E171 In its RP3 business plan, NERL proposed an overall cost of debt of 1.08% (in RPI-deflated terms), consistent with the estimate by NERA.

E172 In our draft proposals, we used an overall cost of debt of 0.86% to inform our overall WACC estimate. This was lower than estimated by NERA as it reflected the lower cost of new debt, partially offset by a higher cost of embedded debt (reflecting a lower RPI forecast).

E173 In its response, NERL estimated an overall cost of new debt of 1.07%, slightly below its RP3 business plan. This reflected its slight reduction in the cost of new debt, as set out above.

E174 We use an **overall cost of debt of 0.86% (in RPI-deflated terms)**, in line with our draft proposals, to inform our overall WACC estimate in our final decision. The cost of debt of 0.86% is calculated as the weighted average of the cost of new debt (0.1% cost * 70% proportion) and cost of embedded debt (2.3% * 30% proportion), plus an allowance for transaction costs of new debt (0.1%). This is lower than estimated by NERL as it reflects the lower cost of new debt, partially offset by a higher cost of embedded debt (reflecting a lower RPI forecast).

E175 CEPA, in its November 2018 report for IAG,[66] estimated a cost of debt of 0.08% to 0.39%. However, in our draft proposals we considered this was likely to underestimate the efficient cost of new debt for NERL and excludes any allowance for transaction costs.

Tax uplift

E176 In its RP3 business plan, NERL proposed to continue the RP2 approach of applying a pre-tax WACC, with the tax uplift applied to the cost of equity based on the effective tax rate actually paid, rather than a notional corporation tax rate. In our draft proposal, we considered this approach to be reasonable as it protects users by ensuring that they share in gains from NERL minimising its tax costs. No other stakeholders commented on this approach.

E177 In its RP3 business plan, NERL included a tax uplift of 12.7% in the pre-tax WACC. This is based on the current headline corporation tax rate of 19% but also takes account of research and development tax credits and allowances for airspace design capital expenditure in reducing NERL's tax cost.

E178 As part of its RP3 business plan, NERL provided a model to estimate the necessary tax uplift to meet NERL's estimated tax cost. We used this tax model, as applied to our draft proposals, to estimate a lower tax uplift of 11.7% to inform our overall WACC estimate in our draft proposals. We have updated this tax model, as applied to our final decision, to estimate a slightly lower **tax uplift of 9.9%** to inform our overall WACC estimate in our final decision.

E179 For our draft proposals, we asked our advisers Grant Thornton, to review the tax calculation. Grant Thornton raised some questions around the assumptions used in the tax calculation, which we have raised with NERL and have now been resolved.

Overall cost of capital

E180 We use the components above to estimate an **overall vanilla WACC of 2.68% (in RPI-deflated terms)** and a **pre-tax WACC of 2.91% (RPI-deflated)** for this final decision. This is marginally above the pre-tax WACC in our draft proposals (2.84%) but significantly below NERL's RP3 business plan pre-tax WACC of 5.07%, particularly reflecting differences in the cost of equity. The details are shown in Table E.7 below.

E181 We have compared the vanilla WACC with the recent regulatory precedent and PwC's report for CAA on Heathrow Airport's next price control, in Table E.8. This shows that our draft proposed WACC appears to be broadly in line with recent UK regulatory precedent and so appears reasonable overall. While our final

[66] CEPA, Cost of capital for NATS (En-Route) plc, November 2018

decision generally includes a higher cost of equity reflecting higher betas (due to NERL facing demand risk, for example), this is partially offset by a lower estimate for the cost of debt (particularly reflecting the relatively high proportion of low-cost new debt that NERL expects to raise during RP3).

E182 G181 Our final decision on vanilla WACC for RP3 is around 1.6% lower (in RPI-deflated terms) than allowed at RP2. By comparison, this is around the mid-point of the change between the allowed WACC at Q6 and PwC's advice to the CAA on H7 (-2.2% to -1.3%) and is similar to the range of the change in Ofwat's vanilla WACC from PR14 to PR19 draft determinations (-1.5%). It is less of a reduction than Ofgem's vanilla WACC from RIIO-T1/GD1 to its RIIO-2 methodology decision (-2.0% to -2.6%), though Ofgem's RIIO-2 decision reflects a 49bps reduction in cost of equity for expected outperformance.

E183 G182 Since our draft proposals, ADP has published its 2019 business plan with a nominal vanilla WACC of 5.6%,[67] which is towards the lower end of the range proposed by PwC for HAL and is similar and slightly below the vanilla WACC of 2.7% that we have set for NERL in our final decision, if we remove 3% for RPI inflation.

Table E.7: CAA's final decision for NERL's RP3 WACC (RPI-deflated)

	CAA – RP2 allowance	NERL – RP3 business plan	CAA – RP3 draft proposals	NERL – RP3 response to draft proposals	CAA – RP3 final decision
Gearing	60%	60%	60%	60%	60%
Cost of new debt	1.75%	0.42%	0.10%	0.40%	0.10%
Cost of embedded debt	2.50%	2.13%	2.30%	2.13%	2.30%
Proportion of new debt	20%	70%	70%	70%	70%
Issuance costs	0.15%	0.15%	0.10%	0.15%	0.10%
Pre-tax cost of debt	**2.50%**	**1.08%**	**0.86%**	**1.07%**	**0.86%**
Total market return	6.25%	6.80%	5.40%	6.25%	5.40%
Risk-free rate	0.75%	0.46%	-1.40%	-1.40%	-1.70%

[67] Groupe ADP, Public consultation document: Economic regulation agreement 2021 – 2025, April 2019

	CAA – RP2 allowance	NERL – RP3 business plan	CAA – RP3 draft proposals	NERL – RP3 response to draft proposals	CAA – RP3 final decision
Asset beta	0.505	0.61	0.46	0.57	0.46
Equity beta	1.11	1.45	0.96	1.35	1.00
Debt beta	0.10	0.05	0.13	0.05	0.10
Post-tax cost of equity	**6.87%**	**9.65%**	**5.13%**	**8.93%**	**5.40%**
Vanilla WACC	**4.25%**	**4.51%**	**2.57%**	**4.21%**	**2.68%**
Tax uplift	37%	12.7%	11.7%		9.9%
Pre-tax WACC	**5.86%**	**5.07%**	**2.84%**		**2.91%**

Source: CAA analysis

Table E.8: Comparisons of vanilla WACC by other UK regulators (RPI-deflated)

Regulator	Recent estimate	Comments
CAA – RP3 final decision	2.68% (4.25% at RP2)	Reduction of c.1.6% from RP2 to RP3
CAA – PwC's estimate for H7 'as is' (Jan-19)	2.5 – 3.4% (4.66% at Q6)	Reduction of c.1.3-2.2% since Q6 CAA's draft proposals for RP3 include a cost of equity within PwC's range but a slightly lower cost of debt, mainly reflecting a higher proportion of low cost new debt
Ofwat – PR19 draft determinations compared with PR14 (July 2019)	2.19% (3.74% at PR14)	Reduction of c.1.5% since PR14 CAA's draft proposals for RP3 include a higher cost of equity than Ofwat, mainly due to higher betas reflecting demand risks, though partly offset by a lower cost of debt for CAA

Regulator	Recent estimate	Comments
Ofgem – RIIO-2 methodology decision (May 2019)	1.81% (3.8-4.4% at RIIO-T1/GD1)	Reduction of c.2.0 to 2.6% since RIIO-T1/GD1 CAA's draft proposals include a higher cost of equity, mainly due to higher betas reflecting demand risks and a similar cost of debt
Ofcom – Business connectivity statement – Openreach (June 2019)	3.25% (3.98% in Apr-16)	Reduction of c.0.7% since April-16 CAA's draft proposals include a higher cost of equity, mainly due to higher betas, and a similar cost of debt, though this is given a lower weight using Ofcom's lower gearing

Source: CAA analysis of UKRN, Cost of Capital – Annual Update Report, June 2018; PwC, Estimating the cost of capital for H7 – Response to stakeholder views, January 2019; Ofwat PR19 draft determinations, July 2019; Ofgem, RIIO-2 Sector Specific Methodology Decision – Finance, May 2019; and Ofcom, 2019 PIMR and BCMR Statement, Annex 21, June 2019.

APPENDIX F

Met Office costs – additional information

F1 The costs of meteorological services provided by the UK Met Office to aviation are recovered from airspace users through UK Determined Costs and the unit rate. Met Office costs comprise National Capability costs and Service Development and Delivery costs. This appendix sets out the basis for Met Office Determined Costs in RP3.

National Capability costs

F2 National Capability costs reflect the en route share of the basic infrastructure needed to operate a weather forecasting service. This infrastructure includes a surface and upper air observing network (as specified by the World Meteorological Organisation), the operation of a supercomputer, numerical weather prediction and a contribution to European weather satellite programmes (operated by the European Organisation for the Exploitation of Meteorological Satellites).

F3 The Met Office expects the introduction of the next generation of European meteorological satellites in the last two years of RP3, which will collect frequent imagery and data to support the improvements in accuracy and short-range forecasting. The National Capability costs in 2023 and 2024 reflect the increased investment (and so higher depreciation charges) in these satellites.

F4 The contribution of en route services to National Capability costs is calculated in accordance with the guidelines contained within ICAO Document 9161, Manual of Air Navigation Service Economics. In the UK, National Capability costs are divided between civil aviation, UK Government Departments, the Maritime and Coastguard Agency and a contribution from the sale of numerical weather prediction data and other products to third parties, including commercial weather service providers. The contribution of civil aviation to the National Capability has fallen from its original level of around 20% to approximately 15%, reflecting changes in the National Capability cost base and use. This ratio remains consistent with the fraction of funding from aviation services relative to total direct service revenue.

Service Development and Delivery costs

F5 Service Development and Delivery costs are associated with providing the specific products and services required as part of the UK's obligations under ICAO requirements. This includes the provision of services in support of:

- UK low level aviation;
- the World Area Forecast System (WAFS) and the Volcanic Ash Advisory Centre (VAAC); and
- the utilisation of human resources (for example, aeronautical meteorologists) and IT production systems (for example, post processing systems that can turn numerical weather prediction data into specific aeronautical information).

F6 The provision of an airborne volcanic ash monitoring platform will continue and will complement the ground-based and space-based monitoring capabilities. The current airborne platform is a Cessna 421 twin-engine aircraft that is becoming increasingly difficult and expensive to maintain. This is expected to be replaced early in RP3, with both manned and unmanned vehicles being considered as replacements.

F7 An onsite team of meteorologists will continue to be located in NERL's Swanwick Area Control Centre to provide weather resilience for ATM in the UK. The Met Office team at Swanwick primarily advise on Area and Terminal weather-related disruption and help improve weather-related resilience, including airspace capacity optimisation in both planning and tactical timeframes. This improves ATM decision making, in particular around the timely application of flow restriction to maintain safe separations. For example, thunderstorm information is able to be provided 24 hours in advance, which is then refined to tactical information on the day of operations to enable decisions to be made around the likely impact on airspace and the availability of specific routes.

F8 At the September 2018 Met Office consultation event[68] there was a request to further integrate Met Office advice into NERL services as part of weather resilience activities. Airspace users also requested an increase to the Met Office team at Swanwick. The Met Office and NATS expect that efficiency savings will increase as the onsite Met Office team integrate and further develop processes to increase weather resilience within the NATS Swanwick operation, while also extending the service to cover the Prestwick area.

F9 There was also a request at the September 2018 consultation meeting to develop performance metrics linked to the main aspects of Met Office activity. Metrics are currently being developed to measure the tangible and ongoing impact of the Met Office team working directly with NATS, including a measure to assess the impact on reduced airborne holding.

F10 During RP3 Met Office advice will be developed to fully encompass the Prestwick operations to reduce European weather-related disruption impacting

[68] https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/services/transport/aviation/met-office-rp3-briefing-note-update-jan-2019.pdf

on UK air traffic. A Met Office web tool is being developed to enable consistent weather information to be made available to aviation stakeholders (including ANSPs, airlines and aerodromes), with the first operational version of the web tool expected by the end of 2019. The web tool aims to enable a common situational awareness of current and forecast weather, allow wide access to the latest forecast information (that is currently provided by email) in relation to thunderstorms and low visibility and provide an opportunity to visualise the aviation meteorological information available from the Met Office. The benefits of the tool will include improved situational awareness for all aviation stakeholders and a consistent view of the latest disruptive weather, which will enable increased ability for network-wide decision making.

F11 Specific aviation meteorological research and development will be undertaken through RP3, focussing on developments in capability for phenomena identified with users. Specific areas of research include global en route hazards (convection, turbulence, in-flight icing, high altitude ice crystals) and improved understanding and forecasting within UK airspace (such as convection and disruptive conditions at UK airports including low visibility).

F12 A significant amount of work is also planned as part of the UK's contribution to the development of the ICAO WAFS. This encompasses both the provision of significantly higher resolution forecast information on a global scale, and the transformation of access to the data. The planned approach will enable the provision of high resolution data on the implementation timescales required by IATA – mostly by November 2022 – to support the Global Air Navigation Plan, by implementing Web Services and Application Programming Interface (API) access to the data. The planned developments also enable the replacement of legacy technologies and take advantage of wider IT infrastructure changes taking place within the Met Office. This represents a significant change to the technologies used to enable access to the relevant, detailed and specific meteorological information for the trajectory of an individual flight. It also represents a significant upgrade in the global provision of wind, temperature and weather-hazard information, used extensively in the flight planning process and developed to enable increased fuel efficiency and hazard avoidance.

F13 It is anticipated that the benefits of this work will include increased efficiencies through reduced manual resource requirements for the global significant weather forecast process during 2023 and 2024.

F14 The changes will also provide benefits by access to new data. A draft of the Met Office-commissioned study regarding the anticipated global benefits of implementing the planned WAFS changes indicates a cumulative benefit to the global aviation industry of approximately £9.9 million over ten years. The increase in spatial and horizontal resolution and accuracy of key meteorological parameters such as wind, turbulence, temperature and icing lead to benefits to

the aviation industry through a reduction in additional fuel carriage, reducing insurance costs, staff absence and personal injury claim processing, improved operations' planning and strategic re-routing and overall passenger comfort. Once the final report is available, it will be made available to interested stakeholders.

F15 The new approach to accessing data via Web Services and APIs will require third party users of the information, such as flight planning companies, to also develop their systems. This will in turn enable airlines to access the data within the flight planning process so as to be able to realise the benefits of the new systems. In response to a request at the September 2018 consultation meeting the Met Office has undertaken a wide range of consultation activities, including with 15 flight planning providers, to ensure they are aware of and prepared for the rapidly increasing range and amount of data that the Met Office is proposing to make available during RP3, and to further understand stakeholder requirements and to inform of likely system requirements. This engagement will continue through the development phase of the activity.

APPENDIX G

Financeability

Introduction

G1 The CAA has a statutory duty under the Transport Act 2000 to ensure that NERL will not find it unduly difficult to finance its licensed activities. NERL's licence also includes a requirement for NERL to use all reasonable endeavours to ensure that it maintains at all times an investment grade issuer credit rating.

G2 In addition, NERL's licence includes a gearing cap of 65%. That is, if gearing (debt as a percentage of its RAB) exceeds 65% it would be prohibited from paying dividends or making any cash payments to affiliates except if these payments satisfy specific criteria.

G3 Our business plan guidance asked NERL to provide evidence that its business plan (including both in respect core and wider requirements) is financeable using a broad interpretation of financeability that looks beyond simple credit metrics and acknowledges the wider context of agencies' rating assessments. In particular, rating agency methods draw on a broad assessment of the operating and risk environment that a company faces as well as the assessment of credit metrics.

G4 NERL and its existing bonds are rated by Moody's and Standard & Poor's (S&P) credit rating agencies. In their latest credit reports, both Moody's and S&P assigned NERL a relatively strong investment grade rating of A2 and A+ respectively.[69] In March 2019, following publication of our draft proposals, Moody's published a Credit Opinion where NERL's long-term rating was unchanged at A2, but the outlook was changed to negative.

G5 The credit ratings reflect NERL's strong financial performance due to its strong and stable cash generation, relatively low level of gearing and regulatory arrangements for risk sharing that limit downsides in its revenue. It also includes one notch uplift due to the rating agencies' assessment of the likelihood of government support if NERL were to face extraordinary adverse circumstances. We understand that the negative outlook from Moody's reflects potential pressure on the company's liquidity position around the beginning of RP3 due to the CAA's proposed reduction in allowed returns, repayments by NERL of revenues under the traffic-risk sharing mechanism for outperformance in RP2,

[69] Moody's, Credit opinion, NATS (En Route) plc, March 2019; and S&P Global Ratings, NATS (En Route) plc (December 2017).

potential downside traffic scenarios due to economic uncertainty (including from Brexit), a growing capital expenditure programme and challenging efficiency targets on operating expenditure.

NERL's RP3 business plan

G6 In its RP3 business plan, NERL set a target credit rating in the range of A2/A to A3/A-. This is a strong investment grade credit rating that is consistent with NERL's current rating from Moody's and is one notch below NERL's current credit rating from S&P. NERL considers that a higher target credit rating would not be in the interest of customers (given the potential costs involved which it would seek to recover from its customers) and that a lower credit rating would be inconsistent with the gearing "target"[70] and cap in NERL's licence.

G7 Based on its interpretation of published guidance from Moody's and S&P NERL has suggested that for:

- Moody's: an adjusted net debt / RAB ratio above 70% would indicate a possible downgrade and a ratio below 60% would indicate a possible upgrade; and
- S&P: a ratio of funds from operations (FFO) to S&P adjusted net debt of below 18% would indicate a possible downgrade.

G8 NERL also:

- reviewed its RP3 business plan against other credit metrics (adjusted interest cover and FFO to net interest payable), its own financial covenants and return on regulatory equity (RORE); and
- modelled upside and downside scenarios against a number of traffic, cost, incentive and macroeconomic factors using Monte Carlo simulations, and considered qualitative factors such as NERL's licence, Brexit and NERL's regulatory framework.

G9 On the basis of the above assessment, NERL said that its business plan would be financeable.

CAA's approach to assessing financeability

G10 We have assessed the financeability of this final decision in line with our duties and NERL's licence requirements. Our financeability assessment takes account of our proposals for changes to the forecasts in NERL's RP3 business plan for operating costs, traffic, non-regulatory income and allowed return.

[70] We note, however, that it does not set a particular target level of gearing for NERL to meet and that its financial structure is a matter for NERL's management.

G11 We consider that NERL's high-level approach to assessing financeability is broadly appropriate, using a combination of quantitative and qualitative factors. We have assessed financeability of our final decision for the same credit metrics and financial covenants as NERL and have focused on the core Moody's and S&P metrics for downside stress testing. We have also considered relevant qualitative factors around NERL's operating and risk environment.

G12 In testing financeability, we have assessed our final decision against NERL's target credit rating based on the notionally financed company (with a 60% gearing), consistent with our views of reasonably efficient financing arrangements, the constraints in NERL's licence and an efficient cost of capital. It is NERL's management's responsibility to ensure that it maintains an investment grade credit rating. NERL also has an important role in being efficient and responding effectively to downside scenarios. Our stress tests are before any significant mitigating actions by NERL's management. This could involve strengthening its cash position by reducing dividends and/or taking other actions so that its long-term business prospects would remain strong.

G13 To assess the financeability of the notional company, we made the following adjustments to the financing and inflation assumptions in NERL's business plan:

- to model the notional financing structure with a gearing around 60% during RP3 and RP4, we assumed a special one-off dividend in 2019, used current levels of NERL's dividends for RP3 and a lower level of dividends in RP4 based on our assumption for the cost of equity (5.4%). Given NERL's current gearing below 30%, and forecast increases in capital expenditure and RAB from the end of RP2, our approach described above with the special dividend in 2019 means that gearing increases steadily until it gets to around 60% in 2021;
- we set the costs of new debt during RP3 to be consistent with the cost of new debt in our proposed WACC (0.1% in RPI-deflated terms, 3.1% in nominal terms); and
- we updated the forecasts for CPI and RPI inflation during RP3 to reflect more recent forecasts published by the International Monetary Fund (IMF), having cross-checked these with forecasts published by HM Treasury, Bank of England and Office for Budget Responsibility.

Approach to stress tests

G14 We have adopted a more focused approach to stress-testing rather than repeating NERL's Monte Carlo analysis.

G15 We identified two key business risk drivers: traffic and operating costs (excluding pension costs). These reflect that the key demand driver for NERL is air traffic and operating costs are the largest price control building block making up more

than 60% of determined costs. In addition, the regulatory framework provides strong protection against other key external risk factors, with a pension cost pass-through and arrangements that allow efficiently incurred capital expenditure to be recovered through NERL's RAB.

G16 We have modelled two stress tests for traffic and costs, based on a range of historical and forecast information available from NERL and STATFOR. These are summarised below, with further details on how these have been selected in chapter 7 of the main document. We consider these represent plausible but relatively unlikely downside scenarios, particularly given we assume they are sustained over the whole of RP3.

- Stress test 1: 10% reduction in actual traffic compared to our central assumption in all years of RP3.
- Stress test 2: 5% reduction in actual traffic and 2.5% increase in actual staff and non-staff operating costs compared to our central assumption in all years of RP3.

G17 For each of these stress tests, we reduced NERL's forecasts of dividends in RP3 to be consistent with our assumptions for the cost of equity in the WACC (5.13% in post-tax RPI-deflated terms). In practice we would expect NERL to be able to take stronger mitigating actions, if necessary suspending dividends and making offsetting efficiency gains.

G18 For our final decision, we have also modelled a stress test for capital expenditure, to assess the impact if NERL incurred higher capital expenditure in line with its RP3 business plan.

CAA's assessment of financeability

Quantitative factors

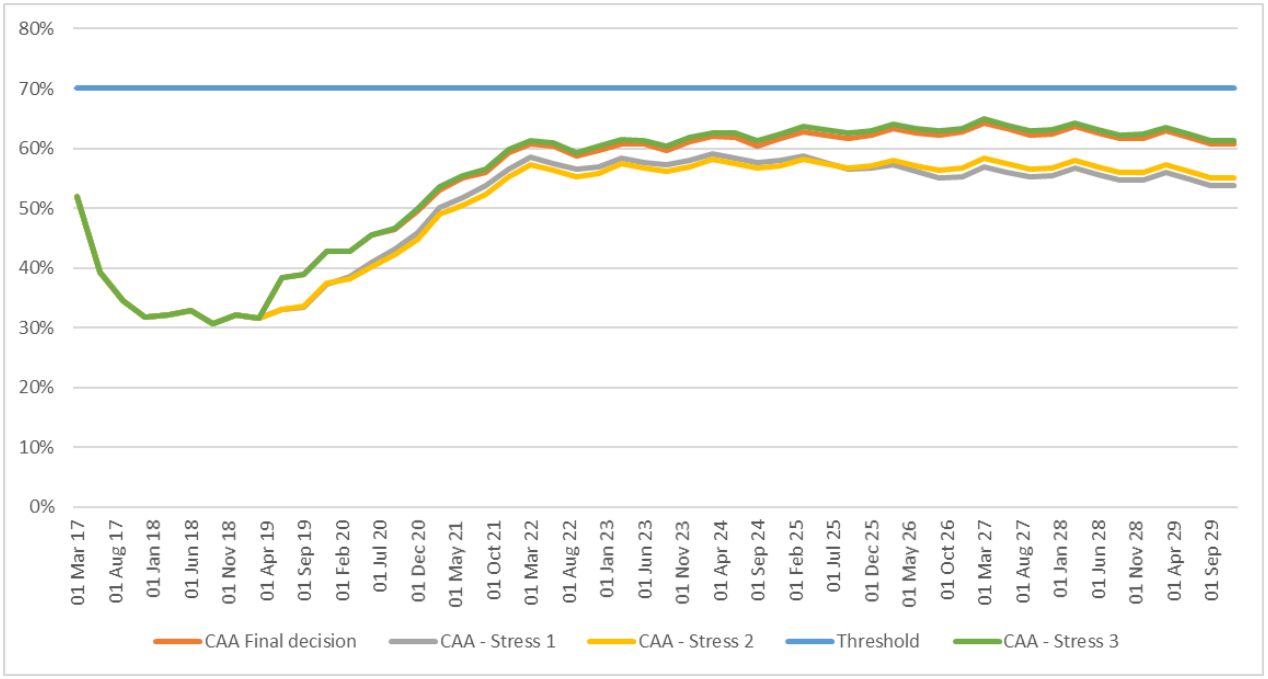
G19 In its credit analysis on NERL in November 2017, Moody's stated that: "*downward pressure on the rating could develop if NERL's financial profile were to materially deteriorate, such that Moody's adjusted Net Debt/RAB was to increase above 70%*".[71]

G20 Figure G.1 below shows that adjusted Net Debt/RAB is expected to increase substantially in RP3, particularly reflecting our assumption that NERL will be raising a significant amount of debt during RP3. However, there remains substantial headroom to the 70% threshold for a downgrade under our draft proposals and stress tests, based on our dividend assumptions. Under the stress tests, we have reduced NERL's dividends based on the allowed cost of equity,

[71] Moody's, NATS (En Route) plc Credit Opinion (November 2017)

though in practice we might expect further significant management action in response to worsening traffic, cost levels and/or other factors.

Figure G.1 – Assessment of adjusted net debt to RAB



Source: CAA analysis

G21 In its credit analysis for NERL in December 2017, S&P set out that it could lower NERL's rating if funds from operations (FFO) to debt falls below 18%.[72] This ratio has been estimated from our assumptions about NERL's EBITDA relative to its net debt, adjusted for pension deficits and lease costs.

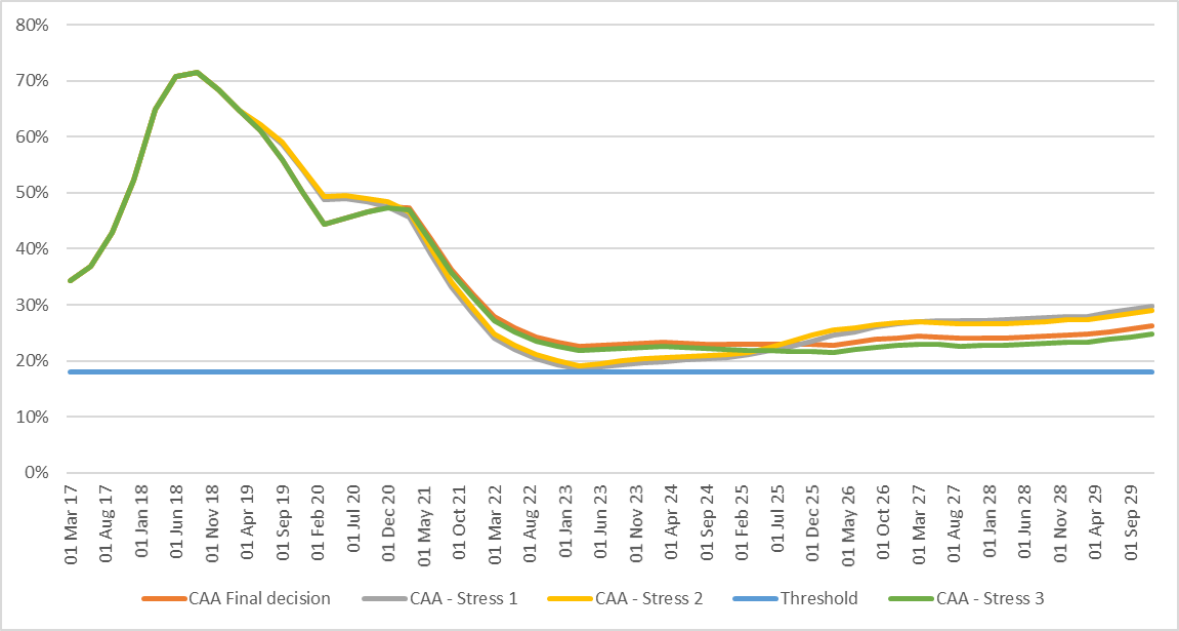
G22 Figure G.2 indicates that FFO to adjusted net debt is expected to decline in RP3, due to increases in debt and reductions in expected revenues, including from our assumptions for a lower cost of capital and pension deficit payments. While there is a decline in this ratio in our final decision and in the stress test comes relatively close to the threshold in 2023, we note that there remains reasonable headroom above the 18% threshold on average over RP3. Our stress tests, with significantly lower outturn traffic and higher outturn costs than forecast during RP3, remain at or above this threshold during RP3 and RP4, with headroom increasing after 2023. Therefore, the longer-term trend, even under the stress tests, is for FFO to net debt to remain above 18%.

G23 As noted above in our downside stress tests, we have not modelled the further mitigations available to NERL. We consider that these downside stress tests would prompt significant management action to avoid the risk of a downgrade,

72 S&P Global Ratings, NATS (En Route) plc (December 2017)

such as reducing dividends. We therefore consider it is unlikely that the FFO to net debt would fall below 18% during RP3 for a sustained period.

Figure G.2 – Assessment of FFO to adjusted net debt



Source: CAA analysis

G24 Table G.1 below shows the results under our final decision for the core metrics above, as well as two other credit metrics presented in NERL's RP3 business plan based on previous Moody's guidance (adjusted interest cover ratio and FFO to net interest payable), as well as NERL's financial covenants.

G25 On FFO to Net Interest Payable and Adjusted Interest Cover, NERL mentions that Moody's no longer publishes guidance on these thresholds, but that in previous guidance these were, respectively, 5.5x and 2.2x for A2, and 4.5x and 1.8x for A3.[73] These are similar ratios and it is unclear what weight, if any investors and credit rating agencies will place on these ratios, particularly given the headroom to Moody's and S&P's core ratios and the other qualitative factors discussed below. Our financial modelling does show an issue with a declining trend in Adjusted Interest Cover. This has improved slightly compared with our draft proposals and remains significantly above one. We also did not receive any representations from stakeholders about this ratio in response to our draft proposals. Taking all of the above into account, and given the positive results for the two core ratios and FFO to Net Interest, we consider in the round that the credit metrics appear to be consistent with NERL maintaining a strong investment grade credit rating.

[73] These ratios both measure the ability of NERL to repay its debt costs. The Adjusted Interest Cover is significantly lower than FFO to Net interest payable as the FFO in the Adjusted Interest Cover is reduced for regulatory depreciation and depreciation of lease costs

G26 For NERL's financial covenants, our final decision remains above the 'trigger levels' during RP3. In the stress test where traffic is 10% lower than the baseline, we note there is pressure towards the beginning of RP3. The cash position then recovers as mechanisms such as traffic risk-sharing mitigate this risk with a 2-year time lag. The overall trend appears reasonable, but there may be pressures on operating cash flows early in RP3 if traffic is very significantly lower than forecast in these years. We would expect NERL to be able to mitigate these risks, at least to some extent, by taking significant management action, such as reducing dividends, identifying cost reductions, and managing debt costs and liquidity reserves. Given this is not a sustained issue during RP3 and the potential mitigations available, we consider it unlikely that NERL would breach the financial covenant trigger levels under the downside scenarios.

G27 Furthermore, we have made a number of changes in our final decision that improve the financeability metrics compared with our draft proposals and will further strengthen NERL's financeability, particularly in the early part of RP3 where Moody's has highlighted risks if there is a severe economic downturn. In particular, we have:

- reduced the efficiency challenges to NERL's allowed operating costs in the first three years of RP3 to 2022, where we have allowed NERL's forecast cost increases;
- increased the allowed cost of capital to reflect our judgements on new evidence provided by stakeholders on debt beta;
- reduced the traffic forecast reflecting more recent forecasts from STATFOR, which further reduces downside risks relative to our final decision;
- reduced the efficiency challenge to NERL's allowed pension costs and in particular allowed NERL's forecast Defined Benefit pension deficit cost in 2022;
- proposed a mechanism to correct the allowed depreciation and allowed return in the calculation of the En-route and Oceanic RABs for any unexpected changes in the wedge between RPI and CPI inflation; and
- reduced potential service penalties for capacity and environment service level targets, compared with our draft proposals and RP2.

Table G.1 – Assessment of credit metrics under CAA's Final decision

		Unit	Threshold / Trigger	2020	2021	2022	2023	2024
Credit metrics	Adj. Net Debt to RAB	%	<70%	46%	56%	60%	61%	61%
	Adj. FFO to Net Debt	%	>18%	46%	39%	25%	23%	23%

		Unit	Threshold / Trigger	2020	2021	2022	2023	2024
	Adj. FFO to Net interest	Ratio	Not in guidance	10.2x	10.0x	7.4x	6.9x	6.8x
	Adj. Interest Cover	Ratio	Not in guidance	1.8x	2.8x	1.9x	1.6x	1.3x

Source: CAA analysis. Note: Annual values are an average of quarterly results

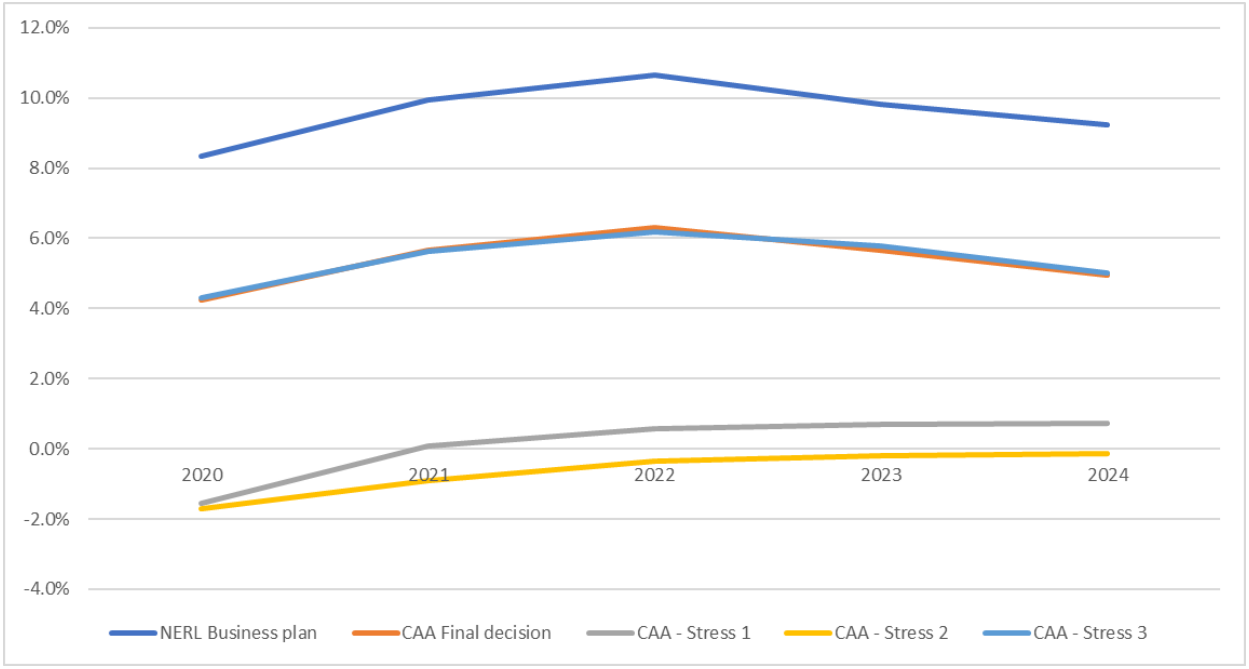
G28 Figure H.3 below shows the return on regulatory equity (RORE) under our final decision and stress tests. The RORE is a measure of the expected return on the portion of the RAB financed by equity and gives an indication of financeability from an equity perspective.

G29 In our final decision, RORE is in line with our allowed cost of equity of 5.40% over RP3, with some variation between years. In our stress tests, RORE reduces to close to zero or negative. This reflects the relatively high sensitivity of RORE to the changes in regulatory returns from lower traffic and higher costs, given the relatively small size of NERL's RAB (and hence notional portion financed by equity) to operating expenditure, compared with other regulated companies. It is also consistent with a company making lower returns in more challenging times, as returns in line with the cost of capital should be earned rather than guaranteed. Given the focus on stress-testing for credit metrics, we have not shown equivalent upside scenarios, though these could lead to RORE that is significantly higher and potentially above 10% in real-RPI-deflated terms. We also note that returns to equity holders are within management control and could be improved through effective management of costs and performance against financial incentives.

G30 An important factor in determining that equity is financeable is setting an allowed weighted average cost of capital and cost of equity that provides appropriate compensation for the risks faced by equity investors. The calculation of the allowed cost of equity is discussed in Appendix E. We have considered a broad range of evidence to estimate the appropriate cost of equity for RP3 from our advisors, information submitted by NERL to support its business plan and in response to our draft proposals, and from a review of recent regulatory precedent and other cross-checks.

G31 Based on all of the above, we consider that our final decision provides for reasonable equity returns.

Figure G.3 – Return on regulatory equity (RORE)



Source: CAA analysis

Qualitative factors

G32 In addition to the quantitative factors from credit metrics and financial covenants, we also considered a range of different qualitative risk factors that could affect NERL's financeability. We note that both Moody's and S&P places significant weight on qualitative factors, in addition to credit metrics, in assessing NERL's financeability. Both S&P and Moody's assess NERL as having a strong position underpinned by its monopoly position resulting in stable cash flow generation, with a well-established and transparent regulatory regime. Both rating agencies mention the uncertainty regarding the SES performance scheme framework under Brexit.

G33 One of the key areas is the nature and stability of NERL's regulatory framework which is closely interlinked with SES performance framework. In its RP3 business plan, NERL considered that substantial changes to the regulatory mechanisms such as pensions pass-through, could put pressure on its existing credit rating.

G34 The majority of the risks highlighted by NERL have been addressed in our final decision and/or are dealt with SES performance scheme. These mitigations should enable NERL to maintain its current strong position on business risks that supports its investment grade credit rating. In particular:

- the pensions cost pass-through mechanism will remain in RP3 under the performance regulation. We also propose to introduce a regulatory policy statement to provide longer-term certainty around cost sharing of defined benefit pension costs and remuneration of efficient pension costs;
- we have proposed that the traffic sharing mechanism will remain the same as it was in RP2, consistent with the default mechanism under the performance regulation. This mechanism provides significant downside protection to revenue in the event of lower than expected traffic. We note that any significant reduction in traffic arising from a hard Brexit may fall at the end of RP2, when NERL has an even stronger financial position than forecast in RP3. This is supported by recent findings from S&P that NERL would likely maintain strong liquidity under all no-deal Brexit stress tests;[74] and
- the performance framework also provides strong protections against unexpected changes in requirements requiring more efficient capital expenditure, as well as other factors such as unexpected changes in inflation, financing costs, taxation or other legal changes. Our approach and proposals are based on the SES performance framework applying to the UK on the 1 January 2020. If no future EU-UK arrangements are put in place before the end of 2019, the economic regulation of NERL will default to the Transport Act. Under both the EU and domestic regulatory frameworks the substantive requirements are similar – and we expect to produce a price control and service quality targets based on these final decisions (that go towards achieving the strategic outcomes established in CAP 1511),[75] irrespective of whether EU or UK framework has primacy by 1 January 2020.

Overall assessment

G35 Based on our assessment of quantitative and qualitative factors above, we consider in the round that our Final decision is consistent with NERL maintaining a solid investment grade credit rating and does not cause undue financeability concerns even under our downside stress test scenarios.

G36 Although there may be a risk in some downside circumstances that NERL does not maintain its current strong rating, we note that NERL should be able to maintain an investment grade credit rating. In such adverse circumstances we would expect significant management action by NERL to both deliver on its commitments to users and to drive forward airspace modernisation, but also to seek to maintain a strong financeable position for debt and equity holders. We

74 S&P Global Ratings, Countdown to Brexit: Just 100 days left to find a firm foundation for the transportation infrastructure sector (December 2018)

75 CAP 1511 - Strategic outcomes for the economic regulation of NERL 2020-2024: discussion document (April 2017)

would expect that like any prudent business, NERL would consider potential challenges it could face, and have plans about the interventions it could make to respond to such challenges.

APPENDIX H

Draft licence modifications

Introduction

H1 This appendix sets out initial draft licence modifications in support of our RP3 decisions. The licence conditions that will require modification are:

- Condition 10: Business plans, service and investment plans and periodic reports;
- Condition 21: Control of Eurocontrol service charges
- Control 21a: Control of London Approach charges
- Condition 22: Oceanic charges.

H2 Additionally, a new condition will be required, Condition 10a airspace modernisation. A short description of the modifications to each condition is below, followed by each of the proposed modified, or new, conditions.

Condition 10

- 3(a) date service and investment plan required changed from December to January in each year;
- 3(b) date interim service and investment plan required changed from June to July in each year;
- 3(c) additional requirement for quarterly updates on service investment plan in April and October of each year;
- current paragraph 4 on implementation of major air traffic management programmes in UK FAS deployment plan deleted;
- current paragraphs 5, 6, 7, 8 and 9 requiring detailed and outline technology programmes, detailed airspace programme and outline of options for implementing lower level airspace changes in London terminal and related airspace redesign area deleted;
- new paragraph 6 on financial delivery incentive added;

- 7 increased roles for Independent Reviewer to review timeliness of NERL's reporting, assess NERL's explanation and justification for capital programme, track and assess NERL's investment delivery and associated benefits, and report on NERL's cost efficiency of capital expenditure.

Condition 10a

- paragraph 1 NERL to establish, maintain and manage Airspace Change Organising Group (ACOG);
- paragraph 2 NERL to create and maintain UK airspace change masterplan;
- paragraph 3 setting out criteria for masterplan.
- paragraph 4 masterplan to be assessed and accepted by CAA in consultation with DfT.
- paragraph 5 NERL to make changes to masterplan as proposed by CAA;
- paragraph 6 NERL to update masterplan as requested by CAA;
- paragraph 7 NERL to prepare and submit to CAA airspace change proposals related to the airspace for which it provides en-route air traffic control services;
- paragraph 8 NERL to prepare and submit to CAA any proposal to change airspace design when instructed by the CAA;
- paragraph 9 NERL to support airspace change proposals proposed by other bodies with agreement of the CAA;
- paragraph 10 NERL to assist sponsors with preparation and submission of airspace changes in the masterplan. NERL to keep CAA and DfT informed on progress of preparation and submission of airspace change proposals in the masterplan;
- paragraph 11 NERL to report to CAA progress against the masterplan by 1 November in each year and on request; and
- paragraph 12 NERL to be responsible for other activities under the masterplan it is required to undertake under other legislation.

Condition 21

- Eurocontrol services charge control updated to take account of RP3 performance plan;
- paragraph 1 addition of terms to return Innovation and Networks Executive Agency (INEA) funding and any unspent portion of FAS Facilitation Fund to users;
- paragraph 15 updated list of exemptions from C3 and C4 capacity incentives;
- paragraph 16 addition of reference to updated flight efficiency metric calculation and annual review protocol.

Condition 21a

- London Approach charge control updated to take account of RP3 performance plan.

Condition 22

- Oceanic charge control updated to take account of RP3 decision;
- paragraph 1 addition of charges for Atlantic and Tango flights including terms for charges for use of ADS-B service. ADS-B charge for Tango flights to be subject to traffic risk sharing;
- paragraph 2 definition of Tango flight;
- paragraph 3 definition of Atlantic flight;
- paragraph 4 NERL to certify that is operating a fully ADS-B based service to 99% of flights in Oceanic area; and
- paragraph 5 NERL to commission independent review of whether benefits of providing ADS-B service outweigh the costs of providing the service no later than two years and six months after certifying it is providing a full ADS-B service.

Condition 10: Business Plans, Service and Investment Plans and Periodic Reports

1. The Licensee shall deliver to the CAA a full five year Business Plan fulfilling the requirements of Paragraph 4 of this Condition. The Business Plan shall be consistent with any overall business plan of the Licensee but, provided that it fulfils the requirements of paragraph 4 need not include the entirety of any such overall business plan. The Licensee's RP3 Revised Business Plan (2020-2024) delivered on 26 October 2018 and published on the CAA's website as amended subsequently for the purpose of producing the UK's RP3 Performance Plan and any further changes made and published by the European Commission following its own assessment process shall be deemed to meet this requirement for the period 2020-2024.

2. Each Business Plan shall be submitted to the CAA not less than twelve months before each Plan Renewal Date and shall relate to the five year period beginning on that Plan Renewal Date (or the period until expiry of the Licence whichever is the shorter period). Each Business Plans shall be deemed to replace any previous Business Plan in respect of a period which is covered by both. Each Business Plan shall also comply with the relevant requirements for a business plan in Annex 1 of Commission Implementing Regulation No 1035/2011 (or in any subsequent relevant legislation which lay down common requirements for the provision of air navigation services).

3. Each year the Licensee shall submit:

   (a) not later than 31 January a service and investment plan fulfilling the requirements of Paragraph 5 of this Condition;

   (b) not later than 31 July an updated mid-year interim service and investment plan fulfilling the requirements of Paragraph 5 of this Condition;

   (c) not later than 30 April and 31 October, a quarterly update on its service and investment plan which shall include additional material on any material changes or decisions that are required to be made before the next service and investment plan (or interim service and investment plan as the case may be); and

   (d) not later than 31 July a Business Plan report relating to the previous regulatory year fulfilling the requirements of Paragraph 8 of this Condition.

4. The purpose of each Business Plan shall be to describe in detail the Licensee's plans and expectations for each of the En route Businesses including its capital investment and operational plans, together with measures which it proposes to take to improve the efficiency and effectiveness of its operation in providing the services required by this Licence. Each Business Plan shall include such information as is reasonably necessary to achieve this including, but not limited to, details concerning the following:

(a) the demands, in terms of the volumes of flights, which the Licensee forecasts that it will be required to serve in meeting its general obligation under Condition 2 together with the principal factors which it expects to determine those demands;

(b) the standards of service that the Licensee plans to meet in serving the demands in sub-paragraph 4(a), including the expected levels of and variations in delays to the flights in respect of which services are provided, and other appropriate measures;

(c) the capacities which the Licensee plans to provide in order to meet the demands in sub-paragraph 4(a) at the standards of service in sub-paragraph 4(b);

(d) any underlying assumptions regarding airspace;

(e) the likely level of and developments in any constraints on the volume of services which the Licensee may provide in each of the Licensed Areas and any proposed changes thereto;

(f) the Licensee's capital investment plans and how these will contribute to the provision of the planned outputs;

(g) the Licensee's plans with respect to operating and human resources and practices, operating expenditure and how these will contribute to the provision of the planned outputs.

5. Each service and investment plan (and interim service and investment plan) shall provide an update on:

(a) the Licensee's investment plans, with reference to the most recent Business Plan and including information on projects at the initiation or optioneering stage;

(b) the Licensee's delivery against the programme milestones provided

(c) material changes in the Licensee's expectations as to the level and quality of the services it will provide, the means by which the services will be provided, and the likely implications for charges to Users beyond the expiry of the period for which charges are for the time being set pursuant to the Charge Control Conditions. Service and investment plans shall include such information as is reasonably necessary to achieve this including, but not limited to, material changes in the Licensee's expectations as to its operating practices and resources.

6 (a) The CAA will set a financial incentive on the Licensee's delivery of its capital expenditure programme set out in the Business Plan. On the basis of the CAA's assessment, a penalty of up to £36 million (in 2017 CPI prices) may be applied in the next reference period. The incentive shall be based on both:

i) A general assessment by the CAA of the Licensee's delivery of its programme during a calendar year; and

ii) Delivery of specific milestones in its programme;

(b) During RP3 the specific milestones that will be considered under the financial incentive shall be:

i) The deployment point (en-route) and deployment point (lower) technology changes which together will provide a common platform for the Swanwick and Prestwick centres allowing for legacy escape and mutual contingency; both completed by [XX] 2022;

ii) The delivery of the required documentation for step 5A of the CAA's airspace

iii) e change process for the AD6 airspace change for Essex airspace which would increase capacity into Stansted and Luton airports by [XX]; and

iv) LAMP (phase 1) and LAMP (phase 2) airspace changes to modernise airspace in the South-East of England completed by [XX] 2024.

[Note: We expect to confirm the dates above marked “XX” before the start of RP3.]

(c) The specific milestones may be modified if the Licensee and users have agreed appropriate changes to the Licensee’s capital investment programme through the service and investment plan process.

7. The CAA shall appoint a person (the Independent Reviewer) to report on the Licensee’s progress on delivering its capital investment programme. The report shall:

(a) review the timeliness and accuracy of the Licensee’s reporting in its service and investment plan;
(b) assess whether the Licensee has sufficiently explained or justified its capital programme in its service and investment plan;
(c) track and assess the Licensee’s progress on delivering its investment plan and achieving the associated benefits; and
(d) report on the cost efficiency of the Licensee’s capital expenditure plan.

The CAA will publish the conclusions reached by the Independent Reviewer. Unless the CAA directs otherwise, the Independent Reviewer will be paid for by the Licensee.

8. Each business plan report shall provide a summary of progress achieved in relation to the business plan and the latest service and investment plan, reconciling actual performance against these plans. Each business plan report shall also include information on the performance of the Licensee against its obligations in Condition 2(1)(a) of this Licence.

9. The form, scope and level of detail of the plans referred to in this Condition shall be approved by the CAA (acting reasonably) and shall take into account the views of Users consulted in accordance with Condition 16.

10. The Licensee shall make available a copy of the latest business plan, business plan report and service and investment plan to any person who requests a copy of such plan or report.

11. The Licensee may with the prior consent of the CAA (provided that such consent is not unreasonably withheld or delayed) omit from any document made available under paragraph 11 any details as to the terms of any agreement between the Licensee and any User, or other information disclosure of which the Licensee satisfies the CAA, or the CAA otherwise considers, would seriously and prejudicially affect the commercial interests of the Licensee or any third party.

12. The Licensee may make a charge for any copy document given or sent pursuant to paragraph 10 of an amount reflecting the Licensee's reasonable costs of providing such copy document.

13. In this Condition:

"Plan Renewal Date"	means 1 January 2015 and every fifth anniversary thereof.
"Business Plan"	means a business plan delivered by the Licensee to the CAA pursuant to paragraph 1 above.

Condition 10a – Airspace modernisation

1. The licensee must establish, maintain and manage an Airspace Change Organising Group (ACOG). ACOG shall be a unit within the licensee, separate from the licensee's other functional units set up for the purpose of carrying out the functions set out in paragraphs 3, 5 ,6 and 10 below. ACOG will work co-operatively with a Steering Committee,
2. The licensee must create and maintain a single coordinated implementation plan for airspace changes in the UK ("airspace change masterplan" or "the masterplan") for the period to 2040. The first phase, focussing on airspace changes in southern England, must be submitted to the CAA by June 2020 or such later date agreed by the CAA in writing (in consultation with the Secretary of State).
3. The masterplan must:
    a. be consistent with the delivery of airspace modernisation as described in the Airspace Modernisation Strategy (CAP 1711) published by the CAA in accordance with Direction 3(e) of the Civil Aviation Authority (Air Navigation) Directions 2017 (the "Airspace Modernisation Strategy");
    b. meet the criteria set out in paragraph 6 of the Department for Transport ("DfT") and CAA's joint letter to the licensee of 2 November 2018 (see Annex B);
    c. comply with any requirements or guidance provided by the Secretary of State or CAA as co-sponsors of the Airspace Modernisation Strategy, including on the content or the methods by which the masterplan is to be produced;
    d. take into consideration the information provided by and expertise of the airport operators and other ANSPs in the relevant part of the managed area; and
    e. take into consideration the views of the entities listed as representatives of a stakeholder group, or as a conduit to them, identified in the Airspace Modernisation governance annex to the Airspace Modernisation Strategy.

4. The masterplan shall be subject to assessment and acceptance by the CAA who shall consult with the Secretary of State in making such assessment.

5. The licensee shall make any changes to the masterplan as are reasonably proposed by the CAA in order to comply with and meet the objectives of the Airspace Modernisation Strategy.

6. The licensee shall periodically update the masterplan as reasonably requested by the CAA.

7. The licensee shall prepare and submit, to the CAA, the airspace change proposals related to the airspace in which the licensee provides UK en-route air traffic control services. Such requirement will be identified in the masterplan.

8. The licensee shall prepare and submit to the CAA any proposal to change airspace design when instructed by the CAA to do so, if in the opinion of the CAA that airspace change is in the interests of delivering the masterplan.

9. Subject to coordination with relevant stakeholders and the agreement of the CAA, the licensee may provide support to airspace change proposals proposed by other bodies where other bodies are designated as responsible for such airspace change proposals in the masterplan.

10. The licensee shall, where appropriate, assist sponsors with the preparation and submission of the airspace changes identified in the masterplan and encourage such sponsors to follow the co-ordinated programme plan in the masterplan. The licensee shall keep CAA and DfT informed on the progress of the preparation and submission of airspace change identified in the masterplan.

11. The licensee shall provide a report to the CAA on progress against the masterplan and related activities on 1 November each year and at any time it is requested to do so by the CAA.

12. The licensee shall be responsible for other activities identified in the Airspace Modernisation Strategy which the licensee is required to undertake pursuant to legislation.

Condition 21: Control of Eurocontrol Service Charges

1. Without prejudice to Condition 25 (Suspension and Modification of Charge Control Conditions), for each Eurocontrol Relevant Year beginning on 1 January 2020, 2021, 2022, 2023 and 2024, the maximum Permitted Average Charge Per Service Unit shall be calculated as follows:

$$Maximum\ Charge_t = \frac{DC_t + INF_t + ReS_t + TRS_t + CSM_t + FI_t + MOD_t + Tvar_t - VFR_t - INEA_t - FAS_t}{ForecastTSU_t} - DISCOUNT_t$$

Where:

Maximum Charge$_t$	means the Maximum Permitted Average Charge Per Service Unit in Eurocontrol Relevant Year t.	
DC$_t$	means the determined costs, expressed in nominal terms for relevant year t.	
	Year t	(£)
	2018	589,585,024
	2019	579,006,611
	2020	678,457,133
	2021	661,997,446
	2022	675,862,804
	2023	643,690,078
	2024	646,694,954
INF$_t$	means the adjustment of the difference between forecasted and actual inflation in relevant year t calculated in accordance with Paragraph 3 of this condition.	
INEA$_t$	means any assistance provided by the Innovation and Networks Executive Agency (INEA) in relevant year t, where funding is to be returned to users via a specific unit rate reduction as calculated and agreed with the CAA.	
FAS$_t$	means any unspent portion of the FAS Facilitation Fund in relevant year t, where funding is to be returned to users via a specific unit rate reduction as calculated and agreed with the CAA.	

<table>
<tr><td>ReS_t</td><td colspan="2">means the restructuring costs in relevant year t authorised in accordance with Article 2(18) of Commission Implementing Regulation (EU) No 2019/317.
For all years t = 2020, 2021, 2022, 2023, and 2024,
$ReS_t = 0$</td></tr>
<tr><td>TRS_t</td><td colspan="2">means the Traffic Risk Sharing element from previous years calculated in accordance with Paragraph 4 of this condition.</td></tr>
<tr><td>CSM_t</td><td colspan="2">means the carry-overs from the previous reference period resulting from the implementation of the cost sharing mechanism referred to in Article 14 of Commission Implementing Regulation (EU) No 391/2013;</td></tr>
<tr><td></td><td>Year t</td><td>(£)</td></tr>
<tr><td></td><td>2020</td><td>1,590,664</td></tr>
<tr><td></td><td>2021</td><td>7,943,638</td></tr>
<tr><td></td><td>2022</td><td>8,029,814</td></tr>
<tr><td></td><td>2023</td><td>8,106,474</td></tr>
<tr><td></td><td>2024</td><td>8,180,708</td></tr>
<tr><td>FI_t</td><td></td><td>means the Financial Incentives relating to performance as calculated in accordance with Paragraphs 7-18 of this condition.</td></tr>
<tr><td>MOD_t</td><td></td><td>means the over-or under-recoveries that may result from the modulation of air navigation charges in application of Article 32 of Commission Implementing Regulation (EU) No 2019/317.</td></tr>
<tr><td>$Tvar_t$</td><td colspan="2">means the over-or under-recoveries resulting from traffic variations as defined in Paragraph 5 of this condition.</td></tr>
<tr><td>VFR_t</td><td colspan="2">means the expected cost of services to traffic operating under Visual Flight Rules in relevant year t.
For all years t = 2020, 2021, 2022, 2023, and 2024,
$VFR_t = 0$</td></tr>
<tr><td>$DISCOUNT_t$</td><td colspan="2">means an adjustment to the maximum charge per Total Service Unit in relevant year t where the Licensee at its own discretion decides to recover less than it would otherwise be allowed to recover and has declared to the CAA that it will not pursue this as under-recovery in subsequent years.</td></tr>
<tr><td>$ForecastTSU_t$</td><td colspan="2">means the forecast of Total Service Units for relevant year t</td></tr>
</table>

	established at the beginning of the reference period as follows:	
	Year t	TSU
	2018	10,758,000
	2019	10,940,000
	2020	12,647,945
	2021	12,891,000
	2022	13,183,000
	2023	13,406,000
	2024	13,615,000
Total Service Units (TSUs)	means the route service units calculated in accordance with Article 25 and Annex VIII of Commission Implementing Regulation (EC) 2019/317 as amended from time to time *including* the service units relating to military exempt flights.	

Inflation Assumptions

2. The forecast values of the inflation index referenced in paragraph 3 shall be as follows:

$FHICP_t$	means the reference values of the HICP (all items) index in respect of the UK for Eurocontrol Relevant Year t established prior to the control period, consistent with the projections in nominal prices (the index base is 2012=100 up to 2019 and 2017=100 thereafter), which shall be:		
	Year t	Index (base 2012=100)	Index (base 2017=100)
	2018	110.28	
	2019	112.31	
	2020		106.44
	2021		108.57
	2022		110.74
	2023		112.96
	2024		115.22

Inflation Adjustment

3. The adjustment of the difference between forecasted and actual inflation shall be calculated as follows:

For t = 2020, 2021, 2022, 2023 and 2024

$$INF_t = DC_{t-2}\left(\frac{HICP_{t-2}}{FHICP_{t-2}} - 1\right)$$

Where $HICP_{t-2}$ is calculated as follows:

Year t-2	Calculation
2018	110.28
2019	$HICP_{2019} = 110.28 \times (1 + Inflation_{2019})$
2020	$HICP_{2020} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020})$
2021	$HICP_{2021} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020}) \times (1 + Inflation_{2021})$
2022	$HICP_{2022} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020}) \times (1 + Inflation_{2021}) \times (1 + Inflation_{2022})$
Where:	
$Inflation_t$	means the annual Inflation rate produced by Eurostat in the Harmonised Index of Consumer Prices in respect of calendar year t as published by Eurostat in April of year t+1 (the published rate of inflation is rounded to one significant place of decimals).

Traffic Risk Sharing

4. Article 27 of Commission Implementing Regulation (EU) 2019/317 sets out the basis of traffic risk sharing.

Traffic Risk Sharing (TRS_t) shall be calculated as follows:

For t = 2020, 2021, 2022, 2023 and 2024

$$TRS_t = RSF_{t-2} \times DC_{t-2}$$

Where:

	DC_{t-2}	has the meaning in Paragraph 1 of this condition.
And	RSF_{t-2}	means the risk sharing factor relating to Eurocontrol Relevant Year t-2 based on the actual number of Total Service Units which shall be calculated as follows:
	Where:	$0.98 \leq \frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} \leq 1.02$ $RSF_{t-2} = 0$

	Where:	$1.02 \leq \frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} \leq 1.10$ $RSF_{t-2} = -0.7 \left[\frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} - 1.02\right]$
	Where:	$0.90 \leq \frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} \leq 0.98$ $RSF_{t-2} = -0.7 \left[\frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} - 0.98\right]$
	Where:	$\frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} < 0.90$ $RSF_{t-2} = -\left[\frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} - 0.90\right] + 0.056$
	Where:	$\frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} > 1.10$ $RSF_{t-2} = -\left[\frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}} - 1.10\right] - 0.056$
Where:	$ActualTSU_{t-2}$	means the actual level of Total Service Units for relevant year t-2 published by Eurocontrol.

Correction of INF and TRS Adjustments for Subsequent Traffic Variations (TVar)

5. The TVar component shall be calculated as follows:

$TVar_t$	is an adjustment to allow for variations between actual and forecast TSUs in the year that a correction originally takes place. For t = 2022, 2023 and 2024 $TVar_t = INF_{t-2} + TRS_{t-2} + CSM_{t-2} + FI_{t-2} + TVar_{t-2}\left(1 - \frac{ActualTSU_{t-2}}{ForecastTSU_{t-2}}\right)$ For t = 2020 and 2021 $TVar_t = 0$.

Calculation of Capacity Target (C1)

6. The C1 (UK capacity target) shall be calculated as follows:

$C1_t$		means the average minutes of en route air traffic flow management (ATFM) delay in relevant year t. Where: $C1_t = \frac{EnRouteDelay_t}{Flights_t}$
$EnRouteDelay_t$		means the en route ATFM flight delay from all causes which has been attributed by Eurocontrol to the UK in relevant year t.
$Flights_t$		means the Network Manager (STATFOR) determined count of all IFR flights for the UK for year t. For the avoidance of doubt these include flights which depart or arrive at airports in the UK or which overfly the area UK
$C1Target_t$		means the target set in the performance plan which have the following values:
	Year t	$C1Target_t$
	2020	0.26
	2021	0.32
	2022	0.32
	2023	0.30
	2024	0.32

Calculation of financial incentives (FI)

7. Financial incentives for capacity and environment performance shall be calculated as follows:

For FI_{2020} and FI_{2021}		$FI_{2020}$and FI_{2021} shall have meanings set out in Paragraph 18 of this condition with reference to Condition 21 of the Air Traffic Services Licence for NATS En Route plc which was in effect on 1 January 2019.
For FI_{2022}, FI_{2023} and FI_{2024}		$FI_t = FC2_{t-2} + FC3_{t-2} + FC4_{t-2} + F3DI_{t-2}$
Where:	$FC2_{t-2}$	means the financial incentive for the C2 measure of NERL's contribution to UK performance for relevant year t-2 as defined at Paragraph 8 of this condition.
	$FC3_{t-2}$	means the financial incentive from the C3 Impact Score for relevant year t-2 as defined at Paragraph 9 of this condition.

	$FC4_{t-2}$	means the financial incentive from the C4 Daily Excess Delay Score for relevant year t-2 as defined at Paragraph 12 of this condition.
	$F3DI_{t-2}$	means the element of financial incentives relating to measure 3DI for relevant year t-2 as calculated in Paragraph 16 of this condition .
In respect of all the elements of the Financial Incentives:		
Licensee Attributable En Route ATFM Delay		means En Route ATFM Delay attributed by Eurocontrol which meet the regulation cause and regulation location in the following tables:

Regulation Cause	NM Code	Regulation Location
ATC Capacity	C	En route
ATC Routings	R	En route
ATC Staffing	S	En route
ATC Equipment	T	En route
Military	M	En route
Special Event	P	En route

En Route ATFM Delay		means en route ATFM delay calculated by the Network Manager of ATFM as defined in Commission Regulation (EC) No 255/2010 on ATFM and expressed as the difference between the take-off time requested by the aircraft operator in the last submitted flight plan and the calculated take-off time allocated by the Network Manager.
	FLT_{t-2}	means the Network Manager (STATFOR) determined count of all IFR flights for the UK for year t-2.

Calculation of FC2

8. For the purpose of Paragraph 7, the term $FC2_{t-2}$ shall be calculated in accordance with the following formulae where Eurocontrol relevant years t-2 are 2020, 2021 and 2022 (relating to penalties or bonuses in 2022, 2023 and 2024 respectively).

$FC2_{t-2}$	If $C1_{t-2} > C1\ Target_{t-2}$ and $C2_{t-2} > 1.1 \times C2ParValue_{t-2}$ (where $C1_t$ and $C1Target_t$ have the meaning in Paragraph 6 of this condition; and $1.1 \times C2ParValue_{t-2}$ is rounded to 2 significant figures.) $FC_{t-2} = -MIN\left[\left(\frac{C2_{t-2} / C2Target_{t-2} - 1.1}{0.4}\right) \times (0.0025 \times$

	$REV_{t-2}), (0.0025 \times REV_{t-2})\Big]$
	If $C1_{t-2}$ < $C1Target_{t-2}$ and $C2_{t-2}$ < 0.8 x $C2ParValue_{t-2}$ (where $C1_t$ and $C1Target_t$ have the meaning in Paragraph 6 of this condition; and 0.8 x $C2ParValue_{t-2}$ is rounded to 2 significant figures.) $FC_{t-2} = +MIN\left[\left(\frac{0.8 - C2_{t-2} / C2Target_{t-2}}{0.4}\right) \times (0.0005 \times REV_{t-2}), (0.0005 \times REV_{t-2})\right]$
	Otherwise $FC2_{t-2} = 0$
$C2_{t-2}$	means the average minutes of en route ATFM delay in relevant year t. $C2_{t-2} = \frac{Licensee\ Attributable\ En\ Route\ ATFM\ Delay_{t-2}}{FLT_{t-2}}$ Where: Licensee Attributable En Route ATFM $Delay_{t-2}$ has the meaning in Paragraph 7 of this condition; and FLT_{t-2} has the meaning in Paragraph 7 of this condition.
$C2ParValue_{t-2}$	means the par values for C2 set in the UK performance plan which have the following values in the relevant years: t-2 = 2020 $C2ParValue_{t-2}$ = 0.20 t-2 = 2021 and 2022 $C2ParValue^{t-2} = 0.25$ t-2= 2023 $C2ParValue^{t-2} = 0.23$ t-2= 2024 $C2ParValue^{t-2} = 0.25$
REV_{t-2}	means the revenues from that part of the charges paid to Eurocontrol by users which is reimbursed to the United Kingdom and relates to services provided by the Licensee in year t-2. Where: REV_{t-2} = Maximum $Charge_{t-2}$ x $ActualTSU_{t-2}$ Where Maximum $Charge_{t-2}$ and $ActualTSU_{t-2}$ have the meanings in Paragraphs 1 and 4 respectively of this condition.

Calculation of FC3

9. FC3 is the financial incentive relating to C3 (an Impact Score placing greater weight on long delays and departures in the morning and the evening peaks).

For the purpose of Paragraph 7, the term $FC3_{t-2}$ shall be calculated in accordance with the following formulae where Eurocontrol relevant years t-2 are 2020, 2021 and 2022 (relating to penalties or bonuses in 2022, 2023 and 2024 respectively).

$FC3_{t-2}$	If $C1_{t-2} > C1Target_{t-2}$ and $C3_{t-2} > C3Upper_{t-2}$ $FC3_{t-2} = -MIN\ [(C3PenRate_{t-2}\ (C3_{t-2} - C3Upper_{t-2})\ FLT_{t-2}), 0.0075 \times REV_{t-2}]$
	If $C1_{t-2} < C1Target_{t-2}$ and $C3_{t-2} < C3Lower_{t-2}$ $FC3_{t-2} = +MIN\ [(C3BonusRate_{t-2}\ (C3Lower_{t-2} - C3_{t-2})\ FLT_{t-2}), 0.0025 \times REV_{t-2}]$
Where:	
$C3_{t-2}$	is defined in Paragraph 10.
$C3PenRate_{t-2}$	means the penalty rate for the reduction of revenues relating to the C3 score in Eurocontrol relevant year t-2 (to take effect in relevant year t) calculated as follows: $C3PenRate_{t-2} = £0.075 \times \frac{HICP_{t-2}}{100}$
$C3BonusRate_{t-2}$	means the bonus rate for the reduction of revenues relating to the C3 score in Eurocontrol relevant year t-2 (to take effect in relevant year t) $C3BonusRate_{t-2} = £0.038 \times \frac{HICP_{t-2}}{100}$
$C3Upper_{t-2}$	is the value of the C3 score in Eurocontrol relevant year t-2 above which a penalty becomes payable calculated in Paragraph 11.
$C3Lower_{t-2}$	is the value of the C3 score in Eurocontrol relevant year t-2 below which a bonus becomes payable calculated in Paragraph 11.

The Calculation of $C3_{t-2}$

10. $C3_{t-2}$ shall be calculated as follows:

$C3_{t-2}$	$C3_{t-2} = \frac{\sum w_{p,b} d_{p,b}}{FLT_{t-2}}$ For all flights in year t-2	
Where:	Where p denotes that each flight in relevant year t-2 shall be considered as falling into one of three periods:	
	Morning Peak (p=1)	means flights in relevant year t-2 with an off-block estimated time ≥ 0400 and < 0800 UTC in Summer (April –October inclusive) and between ≥0500 and < 0900 UTC in Winter (January -March inclusive and November-December inclusive).
	Evening Peak (p=2)	means flights in relevant year t-2 with an off-block estimated time ≥ 1500 and < 1900 UTC in Summer (April –October inclusive) and ≥ 1600 and < 2000 UTC in Winter (January-March inclusive and November-December inclusive).
	Other (p=3)	means flights in relevant year t-2 with an off-block estimated block time not in the morning peak and not in the evening peak.
And	b denotes bands of delay for each flight where:	
	$b = d_{p,1}$	means the Licensee Attributable En Route ATFM Delay for each flight in seconds up to and including 15 minutes per flight in relevant year t-2 of flights which fall into relevant period p as defined above.
	$b = d_{p,2}$	means the Licensee Attributable En Route ATFM Delay in seconds over 15 minutes but less than or equal to 30 minutes per flight in relevant year t-2 of flights which fall into relevant period p as defined above.
	$b = d_{p,3}$	means the Licensee Attributable En Route ATFM Delay in seconds over 30 minutes but less than or equal to 60 minutes per flight in relevant year t-2 of flights which fall into relevant period p as defined above.
	$b = d_{p,4}$	means the Licensee Attributable En Route ATFM Delay in seconds over 60 minutes per flight in relevant year t-2 of flights which fall into relevant period p as defined above.
	$w_{p,b}$	means the weighting to be applied to bands of delay b for each flight subject to the period of the flight p where the weightings applied shall be:

	p=1	p=2	p=3

			Morning Peak Period	Evening Peak Period	Other Times
		b=1 (Delay > 0 and <=15 minutes)	3	2	1
		b =2 (Delay >15 and <= 30 minutes)	6	3	2
		b =3 (Delay >30 and <= 60 minutes)	9	6	3
		b =4 (Delay >60 minutes)	18	9	6

Definition of Thresholds at which Bonuses or Penalties for $C3_{t-2}$ become payable

11. The thresholds for bonuses or penalties shall be calculated as follows:

Where	$LFT_{t-2} \le FLT_{t-2} \le UFT_{t-2}$	
		$C3Upper_{t-2} = 24$ $C3Lower_{t-2} = 16$
where	$LFT_{t-2} > FLT_{t-2}$	
		$C3Upper_{t-2} = 24\left(1+\frac{5(FLT_{t-2}-LFT_{t-2})}{LFT_{t-2}}\right)$
		$C3Lower_{t-2} = 16\left(1+\frac{5(FLT_{t-2}-LFT_{t-2})}{LFT_{t-2}}\right)$
where	$FLT_{t-2} > UFT_{t-2}$	
		$C3Upper_{t-2} = 24\left(1+\frac{5(FLT_{t-2}-UFT_{t-2})}{UFT_{t-2}}\right)$
		$C3Lower_{t-2} = 16\left(1+\frac{5(FLT_{t-2}-UFT_{t-2})}{UFT_{t-2}}\right)$
Where:		
FLT_{t-2}		has the meaning in Paragraph 7.
LFT_{t-2}		$LFT_{t-2} = 0.96 \times FFlight_{t-2}$
UFT_{t-2}		$UFT_{t-2} = 1.04 \times FFlight_{t-2}$
$FFlight_{t-2}$		means the forecast of flights for relevant year t established at

		the beginning of the reference period as set out as follows:

t-2	$FFlight_{t-2}$
2020	2,649,000
2021	2,686,000
2022	2,737,000
2023	2,771,000
2024	2,802,000

Calculation of FC4

12. FC4 is the financial incentive relating to C4 (a daily excess delay score based on weighted delays exceeding pre-determined thresholds on a daily basis).

For the purpose of Paragraph 7, $FC4_{t-2}$ shall be calculated in accordance with the following formulae:

Where:	$C4t-2 \geq 1800$	
		$FC4_{t-2} = -MIN[C4PenRate_{t-2} \times (C4_{t-2} - 1800) \times FLT_{t-2}, 0.0025 \times REV_{t-2}]$
Where:	$C4_{t-2} < 1800$	
		$FC4_{t-2} = 0$
Where:	$C4_{t-2}$	means the annual sum of the weighted daily excess delay score calculated as set out in Paragraph 13.
	$C4PenRate_{t-2}$	means the penalty rate for the reduction of revenues relating to the C4 score in Eurocontrol relevant year t-2 (to take effect in relevant year t) calculated as follows:
		$C4PenRate_{t-2} = 0.00167094 \times \frac{HICP_{t-2}}{100}$

Calculation of C4

13. $C4_{t-2}$ shall be calculated as follows subject to the exemption in Paragraph 15:

$C4_{t-2}$	$= C4DailyScore_d$ for all days in year t-2 except where an exemption applies as defined in Paragraph 15.	
Where:	d is a day in the months January to March inclusive or November to December inclusive:	
	Where:	$\frac{DT1_d}{DailyFlights_d} \leq 40$
	then	$C4DailyScore_d = 0$
	Where:	$40 < \frac{DT1_d}{DailyFlights_d} \leq 80$
	then	$C4DailyScore_d = \frac{DT1_d}{DailyFlights_d} - 40$
	Where:	$\frac{DT1_d}{DailyFlights_d} \succ 80$
		$C4DailyScore_d = 40 + 2\left(\frac{DT1_d}{DailyFlights_d} - 80\right)$
Where:	d is a day in the months April to October inclusive.	
	Where	$\frac{DT1_d}{DailyFlights_d} \leq 60$
	then	$C4DailyScore_d = 0$
	Where	$60 < \frac{DT1_d}{DailyFlights_d} \leq 110$
	then	$C4DailyScore_d = \frac{DT1_d}{DailyFlights_d} - 60$
	Where	$110 < \frac{DT1_d}{DailyFlights_d}$
	then	$C4DailyScore_d = 50 + 2\left(\frac{DT1_d}{DailyFlights_d} - 110\right)$
Where:	$DT1_d$	means total Licensee Attributable En Route ATFM Delay in seconds on day d.
	$DailyFlights_d$	means the actual aggregate number of flights on day d to be calculated by reliance on figures of chargeable flights reported to the CAA by the

		Network Manager (STATFOR).

Mitigation of $C3_{t-2}$ or $C4_{t-2}$ scores for equipment failure

14. On days where both the following two conditions apply:

- the scores relate to a day for which the relevant $C4DailyScore_d$ as calculated in Paragraph 13 is greater than zero; and
- there is a C3 score relating to Licensee Attributable to En Route ATFM recorded as equipment failure greater than zero.

The following mitigation should apply:

If:	$\lvert C3PenRate_{t-2}\rvert(C3_d)DailyFlights_d > \lvert C4PenRate_{t-2}\rvert(C4DailyScore_d)FLT_{t-2}$	
then:	for day d, the C3 numerator for all NERL attributable cause codes shall be included in the annual FC3 penalty or bonus term, the C4 score shall be excluded from the calculation of the annual $FC4_t$ penalty or bonus.	
If:	$\lvert C3PenRate_{t-2}\rvert(C3_d)DailyFlights_d \leq \lvert C4PenRate_{t-2}\rvert(C4DailyScore_d)FLT_{t-2}$	
then:	for day d the C3 numerator for all NERL attributable technical cause codes shall be excluded from the annual FC3 penalty or bonus term; the C4 score shall be included in the annual $FC4_t$ penalty or bonus term.	
Where:	$C3PenRate_{t-2}$	has the meaning in Paragraph 9.
	$DailyFlights_d$	has the meaning in Paragraph 13.
	$C4PenRate_{t-2}$	has the meaning in Paragraph 12.
	$C4DailyScore_d$	has the meaning in Paragraph 13.
	FLT_{t-2}	has the meaning in Paragraph 7.
	$C3_d$	has the following meaning: $C3_d = \frac{\sum w_{p,b}d_{p,b}}{DailyFlights_d}$ for all flights in day d Where: $\sum w_{p,b}d_{p,b}$ has the meaning in Paragraph 10.

For the avoidance of doubt the C3 and C4 measures are based on different units and the estimation of the penalty for each in the tests above requires the different parameters as specified.

Exemptions for $C3_{t-2}$ and $C4_{t-2}$ in respect of Major Changes in Operations

15. C3 weighted delays and C4 Daily scores for the relevant day shall not be counted for the purposes of calculating $C3_{t-2}$ or $C4_{t-2}$ where all the following conditions apply:

- The day falls into a period designated by the Licensee in advance as a period when major new systems or airspace changes are being implemented and transitioned into the operation;
- Users have been notified and consulted in advance over the timing of such exemptions under currently existing consultation mechanisms (e.g. the Service and Investment Plan (SIP)) or targeted consultation;
- The total number of days falling into such periods designated by the Licensee shall not exceed 100 in aggregate for the period of the five Eurocontrol relevant years 2020 to 2024 inclusive, considered as a whole;
- The length of any given transition period should be limited to three weeks (unless otherwise agreed with users) and will be agreed in advance as well as the amount of days from the overall cap that NERL wishes to use towards this transition;
- The number of days agreed during the consultation will be fixed (unless subsequently revised with the agreement of users) but the particular exempt days within the agreed transition period would not need to be specified as part of the consultation;
- NERL will carry out the transition by means of the detailed steps and timing that are most operationally practical. NERL will nominate the exempt days ex-post (up to the pre-agreed maximum) for the transitional period;
- If at the end of the transition period NERL does not use the pre-agreed amount of exempt days, these will still count against the overall 100 day cap (i.e. NERL cannot roll over unused exclusions).

Calculation of the Flight Efficiency Incentive (F3DI)

16. For the purpose of Paragraph 7, the term $F3DI_{t-2}$ shall be calculated in accordance with the following formulae where relevant years t-2 are 2020, 2021 and 2022 (relating to penalties or bonuses in 2022 and 2023 and 2024 respectively):

$3DI_{t-2}$	means the average 3Di score for all flights for year t-2 as calculated by NERL in accordance with the flight efficiency metric calculation and annual review protocol.[76]	
Where:	$3DI_{t-2} > 3DIUpper_{t-2}$	
	Then	$F3DI_{t-2} = -MIN\ [3DIPenRate_{t-2}\ (3DI_{t-2} - 3DIUpper_{t-2}), REV_{t-2} \times 0.005]$
Where:	$3DI_{t-2} < 3DILower_{t-2}$	
	Then	$F3DI_{t-2} = MIN\ [3DIBonusRate_{t-2}\ (3DILower_{t-2} - 3DI_{t-2}), REV_{t-2} \times 0.005]$
Where:	$3DIUpper_{t-2}$	is the upper deadband limit on the flight efficiency metric in year t-2; and
	$3DILower_{t-2}$	is the lower deadband limit on the flight efficiency metric in year t-2: which shall be calculated in accordance with:

t-2	$3DILower_{t-2}$	$3DIUpper_{t-2}$
2020	26.4	29.2
2021	26.2	28.9
2022	25.9	28.6
2023	25.6	28.3
2024	25.4	28.1

	$3DIPenRate_{t-2}$	Is the penalty rate in year t-2 $= 3DIBonusRate_{t-2}$
	$3DIBonusRate_{t-2}$	Is the bonus rate in year t-2 which is calculated as follows:

t-2	$3DIBonusRate_{t-2}$

[76] CAA (January 2015) "Flight efficiency metric calculation and annual review protocol" available online. Note that the protocol will be updated for RP3 – a draft version of the updated protocol is published on the CAA website.

		2020	$(0.005 \times REV_{2020}) / 5.6$
		2021	$(0.005 \times REV_{2020}) / 5.5$
		2022	$(0.005 \times REV_{2020}) / 5.5$
		2023	$(0.005 \times REV_{2020}) / 5.4$
		2024	$(0.005 \times REV_{2020}) / 5.3$

17. For the avoidance of doubt, the treatment of C2, C3, C4 and 3DI occurring in 2018 and 2019 will be subject to review before the end of Relevant Year 2019 under the provisions of Commission Implementing Regulation (EU) No 390/2013 and the provisions of sections 11 to 19 of the Transport Act 2000. (Subject to those provisions, the CAA would expect to take the performance in 2018 and 2019 into account in the charges for subsequent years as if this condition applied to charges in 2020 and 2021

18. Financial Incentives Carried Forward From RP2

In respect of charges in year 2020		
$FI_{2020} = FC2_{2018} + FC3_{2018} + FC4_{2018} + F3DI_{2018}$		
In respect of charges in year 2021		
$FI_{2021} = FC2_{2019} + FC3_{2019} + FC4_{2019} + F3DI_{2019}$		
Where:		
$FC2_{2018}$	$FC2_{2019}$	have the meanings defined in Condition 21 of the Air Traffic Services Licence for NATS (En Route) plc which was in effect on 1 January 2019.
$FC3_{2018}$	$FC3_{2019}$	
$FC4_{2018}$	$FC4_{2019}$	
$F3DI_{2018}$	$F3DI_{2019}$	

Condition 21a: Control of London Approach Charges

1. Without prejudice to Condition 25 (Suspension and Modification of Charge Control Conditions), for each London Approach Relevant Year beginning on 1 January 2020, 2021, 2022,2023 and 2024, the maximum Permitted Average Charge Per London Approach Service Unit shall be calculated as follows:

$$MaximumCharge_t = \frac{LDC_t + LINF_t + LReS_t + LTRS_t + LCSM_t + LFI_t + LMOD_t + LTvar_t - LVFR_t}{ForecastLTSU_t} - LDISCOUNT_t$$

Where:

Maximum Charge$_t$	means the Maximum Permitted Average Charge Per London Approach Service Unit in Relevant Year t.	
LDC$_t$	Means the determined costs, expressed in nominal terms for relevant year t.	
	Year t	(£)
	2020	13,355,046
	2021	13,249,924
	2022	14,174,118
	2023	13,528,112
	2024	14,317,370
LINF$_t$	means the adjustment of the difference between forecasted and actual inflation calculated in accordance with Paragraph 3 of this condition.	
LReS$_t$	means the restructuring costs authorised in accordance with Article 2(18) of Commission Implementing Regulation (EU) No 2019/317. For all years t =2020, 2021, 2022, 2023, 2024, ReS$_t = 0$	
LTRS$_t$	means the Traffic Risk Sharing element from previous years calculated in accordance with Paragraph 4 of this condition.	
LCSM$_t$	means the carry-overs from the previous reference period resulting from the implementation of the cost sharing mechanism referred to in Article 14 of Commission Implementing Regulation (EU) No391/2013; For all years t =2020, 2021, 2022, 2023, 2024 LCSM$_t = 0$	

LFI_t	means the Financial Incentives relating to performance. For all years t =2020, 2021, 2022, 2023, 2024 $LFI_t = 0$	
$LMOD_t$	means the over-or under-recoveries that may result from the modulation of air navigation charges in accordance with Article 32 of Commission Implementing Regulation (EU) No 2019/317. For all years t= 2020,2021,2022,2023,2024 $LMOD_t = 0$	
$LTvar_t$	means the over-or under-recoveries resulting from traffic variations as defined in Paragraph 5.	
$LVFR_t$	means the expected cost of services to traffic operating under Visual Flight Rules. For all years t =2020, 2021, 2022, 2023, 2024. $LVFR_t = 0$	
$LDISCOUNT_t$	means an adjustment to the maximum charge per LTSU in year t where the Licensee at its own discretion decides to recover less than it would otherwise be allowed to recover and has declared to the CAA that it will not pursue this as under-recovery in subsequent years.	
$ForecastLTSU_t$	means the forecast of Total London Approach Service Units for relevant year t established at the beginning of the reference period as set out as follows:	
	Year t	LTSU
	2018	940,093
	2019	958,830
	2020	1,005,900
	2021	1,015,600
	2022	1,041,800
	2023	1,054,300
	2024	1,061,000
Total London Approach Service Units	means the terminal service units calculated in accordance with Article 25 and Annex VIII of Commission Implementing Regulation (EU) 2019/317 as amended from time to time *including* any service units relating to military exempt flights for the aggregate of Heathrow, Gatwick, Stansted, Luton, and London City airports.	

Inflation Assumptions

2. The forecast values of the inflation index referenced in paragraph 3 shall be as follows:

$FHICP_t$	means the reference values of the HICP (all items) index in respect of the UK for Eurocontrol Relevant Year t established prior to the control period, consistent with the projections in nominal prices (the index base is 2012=100 up to 2019 and 2017=100 thereafter), which shall be:		
	Year t	Index (base 2012 = 100)	Index (base 2017 = 100)
	2018	110.28	
	2019	112.31	
	2020		106.44
	2021		108.57
	2022		110.74
	2023		112.96
	2024		115.22

Inflation Adjustment

3. The adjustment of the difference between forecasted and actual inflation shall be calculated as follows:

	For t = 2020, 2021, 2022, 2023 and 2024 $INF_t = LDC_{t-2}\left(\frac{HICP_{t-2}}{FHICP_{t-2}} - 1\right)$ Where $HICP_{t-2}$ is calculated as follows:	
	Year t-2	Calculation
	2018	110.28
	2019	$HICP_{2019} = 110.28 \times (1 + Inflation_{2019})$
	2020	$HICP_{2020} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020})$
	2021	$HICP_{2021} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020}) \times (1 + Inflation_{2021})$
	2022	$HICP_{2022} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020}) \times (1 + Inflation_{2021}) \times (1 + Inflation_{2022})$
	Where:	

	$Inflation_t$	means the annual Inflation rate produced by Eurostat in the Harmonised Index of Consumer Prices in respect of calendar year t as published by Eurostat in April of year t+1 (the published rate of inflation is rounded to one significant place of decimals).

Traffic Risk Sharing

4. The Traffic Risk Sharing ($LTRS_t$) term shall be calculated as follows:

For t = 2020, 2021, 2022, 2023 and 2024 $LTRS_t = (LDC_{t-2} \times LRSF_{t-2})$		
Where:	LDC_{t-2}	has the meaning in Paragraph 1 of this condition.
And	$LRSF_{t-2}$	means the risk sharing factor relating to Relevant year t-2 based on the actual number of Total London Approach Service Units which shall be calculated as follows:
	Where:	$0.98 \leq \frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} \leq 1.02$ $LRSF_{t-2} = 0$
	Where:	$1.02 \leq \frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} \leq 1.10$ $LRSF_{t-2} = -0.7 \left[\frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} - 1.02\right]$
	Where:	$0.90 \leq \frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} \leq 0.98$ $LRSF_{t-2} = -0.7 \left[\frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} - 0.98\right]$
	Where:	$\frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} < 0.90$ $LRSF_{t-2} = -\left[\frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} - 0.90\right] + 0.056$
	Where	$\frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} > 1.10$ $LRSF_{t-2} = -\left[\frac{ActualLTSU_{t-2}}{ForecastLTSU_{t-2}} - 1.10\right] - 0.056$
Where:	$ActualLTSU_{t-2}$	means the actual level of Total London Approach Service Units for relevant year t-2 published by Eurocontrol for the aggregate of Heathrow, Gatwick,

		Stansted, Luton, and London City airports.

Correction of LINF and LTRS Adjustments for Subsequent Traffic Variations (LTVar)

5. The LTVar component shall be calculated as follows:

$LTVar_t$	is an adjustment to allow for variations between actual and forecast LTSUs in the year that a correction originally takes place. $LTVar_t = LINF_{t-2} + LTRS_{t-2} + LTVar_{t-2} \times \left(1 - \frac{Actual\ LTSU_{t-2}}{Forecast\ LTSU_{t-2}}\right)$

Condition 22: Oceanic Charges

1. Without prejudice to Condition 25 (Suspension and Modification of Charge Control Conditions) the Licensee shall use its best endeavours to ensure that in each Oceanic Relevant Year beginning on 1 January 2020, 2021, 2022, 2023 and 2024:

$$O_t = A_t + T_t + L_t$$

Where O_t means the the Maximum Permitted Average Charge Per Oceanic Flight in Oceanic Relevant Year t

and

the Average Charge Per Atlantic Flight shall not exceed the Maximum Permitted Average Charge Per Atlantic Flight calculated in accordance with the following formula:

$A_t = U_t + ADA_t + AINF_t$

the Average Charge Per Tango Flight shall not exceed the Maximum Permitted Average Charge Per Tango Flight calculated in accordance with the following formula

$T_t = U_t + ADT_t + TINF_t$

where:

A_t	means the Maximum Permitted Average Charge Per Atlantic Flight in Oceanic Relevant Year t.	
T_t	means the Maximum Permitted Average Charge Per Tango Flight in Oceanic Relevant Year t.	
U_t	is a base charge per Oceanic Flight in Oceanic Relevant Year t, expressed in nominal terms:	
	Relevant Year t	U_t
	2020	56.04
	2021	54.74
	2022	54.80
	2023	51.30
	2024	49.88

<table>
<tr><td>ADA_t</td><td>means the price charged per Atlantic Flight for the use of the ADS-B service, expressed in nominal prices.

When the ADS-B service is not fully available for Atlantic flights ADA_t=0

When the ADS-B service is fully available:

<table><tr><td>Relevant Year t</td><td>ADA_t</td></tr><tr><td>2020</td><td>31.64</td></tr><tr><td>2021</td><td>32.27</td></tr><tr><td>2022</td><td>32.92</td></tr><tr><td>2023</td><td>33.57</td></tr><tr><td>2024</td><td>34.24</td></tr></table></td></tr>
<tr><td>$AINF_t$</td><td>means the adjustment to the ADS-B North Atlantic charges to account for the difference between forecast and actual inflation in relevant year t calculated in accordance with Paragraph 3 of this condition.</td></tr>
<tr><td>$TINF_t$</td><td>means the adjustment to the ADS-B Tango charges to account for the difference between forecast and actual inflation in relevant year t calculated in accordance with Paragraph 3 of this condition.</td></tr>
<tr><td>ADT_t</td><td>means the price charged per Tango Flight for the use of the ADS-B service, expressed in nominal prices.

When the ADS-B service is not fully available for Tango flights ADT_t=0

When the ADS-B service is fully available:

<table><tr><td>Year t</td><td>ADT_t</td></tr><tr><td>2020</td><td>4.90</td></tr><tr><td>2021</td><td>4.83</td></tr><tr><td>2022</td><td>4.76</td></tr><tr><td>2023</td><td>4.56</td></tr><tr><td>2024</td><td>4.51</td></tr></table></td></tr>
</table>

$TVar_t$	is an adjustment to allow for variations between actual and forecast Tango flights on a t minus 2 basis. For 2020 and 2021 $TVar_t = 0$ For 2022, 2023 and 2024 $TVar_t = Z_{t-2} \times \left(1 - \frac{Actual\ Tango\ Flights_{t-2}}{Forecast\ Tango\ Flights_{t-2}}\right)$	
Forecast Tango $Flights_t$	means the forecast of Tango Flights for relevant year t established at the beginning of the reference period as follows:	
	2020	31,000
	2021	32,000
	2022	33,000
	2023	35,000
	2024	36,000
L_t	means the correction factor (whether of a positive or negative value) which is calculated in accordance with the following formula: where: $L_{2020} = L_{2021} = 0$ Otherwise: $L_t = \frac{(QA_{t-2}\ OA_{t-2}) + (QT_{t-2}\ OT_{t-2}) - TO_{t-2}}{QA_{t-2} + QT_{t-2}}$ This recovery mechanism will generally be zero because the maximum allowed can be determined based on known information before the charge is set for the relevant year.	

	QA_{t-2}	means the quantity of Atlantic Flights in Oceanic Relevant Year t-2 attracting an Atlantic Charge.
	QT_{t-2}	means the quantity of Tango Flights in Oceanic Relevant Year t-2 attracting a Tango Charge.
	OA_{t-2}	means the Maximum Permitted Average Charge Per Atlantic Flight in Oceanic Relevant Year t-2.
	OT_{t-2}	means the Maximum Permitted Average Charge Per Tango Flight in Oceanic Relevant Year t-2.
	TO_{t-2}	means the total Oceanic Revenue in Oceanic Relevant Year t-2.

Inflation assumptions

2. The Oceanic base charge (U_t) and ADS-B North Atlantic (ADA_t) and Tango (ADT_t) charges are set above in *nominal* prices, and therefore include the CAA's assumed forecast of CPI inflation.

$FHICP_t$	means the reference values of the HICP (all items) index in respect of the UK for Eurocontrol Relevant Year t established prior to the control period, consistent with the projections in nominal prices (the index base is 2017=100), which shall be:	
	Year t	Index
	2018	102.48
	2019	104.36
	2020	106.44
	2021	108.57
	2022	110.74
	2023	112.96
	2024	115.22

Inflation Adjustment

3. The adjustment for the difference between forecast and actual inflation shall be calculated as follows:

For t = 2020, 2021, 2022, 2023 and 2024: $AINF_t = (U_{t-2} + ADA_{t-2}) \times \left(\frac{HICP_{t-2}}{FHICP_{t-2}} - 1\right)$ and $TINF_t = (U_{t-2} + ADT_{t-2}) \times \left(\frac{HICP_{t-2}}{FHICP_{t-2}} - 1\right)$ Where $HICP_{t-2}$ is calculated as follows:	
Year t-2	Calculation
2018	102.48
2019	$HICP_{2019} = 102.48 \times (1 + Inflation_{2019})$
2020	$HICP_{2020} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020})$
2021	$HICP_{2021} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020}) \times (1 + Inflation_{2021})$
2022	$HICP_{2022} = 102.48 \times (1 + Inflation_{2019}) \times (1 + Inflation_{2020}) \times (1 + Inflation_{2021}) \times (1 + Inflation_{2022})$
Where:	
$Inflation_t$	means the annual Inflation rate produced by Eurostat in the Harmonised Index of Consumer Prices in respect of calendar year t as published by Eurostat in April of year t+1 (the published rate of

	inflation is rounded to one significant place of decimals).

Other licence conditions

4. Tango flight means a flight operating along the length of ATS routes T9 and T290, as defined and promulgated within the UK AIP, within a defined volume of airspace bounded by coordinates 4500N01000W - 4500N00845W - 4834N00845W - 4841N01000W – 4500N01000W

5. Atlantic flight means any flight in the En route (Oceanic) Area that is not a Tango flight.

6. The ADS-B service is fully available when NERL's Board has certified that it is operating a fully ADS-B based service in the En route (Oceanic) Area and 99% of flights crossing the En route (Oceanic) Area are being provided with an ADS-B enabled service for the whole time it is within the En route (Oceanic) Area. At all other times the ADS-B service is unavailable. The certificate may say that the ADS-B service is fully available for both Atlantic flights and Tango flights; or is fully available for Atlantic flights but not for Tango flights; or the ADS-B service is fully available for Tango flights but not for Atlantic flights.

7. By no later than two years and six months after NERL has certified it is operating a fully ADS-B based service in the En route (Oceanic) Area, NERL shall commission an independent review of whether the benefits of providing a fully ADS-B based service outweigh the costs of providing the service.

APPENDIX I

Draft capital expenditure and funds governance policy and processes

Introduction

I1 In chapter 5[77] we set out NERL's RP3 Determined Costs, including the requirement for enhanced governance of NERL's capital programme. This appendix expands on the requirements set out in chapter 5 in respect of capex incentives, the role of the Independent Reviewer and sets out our draft policy and processes for capital expenditure (capex) and AMS funds governance during RP3. It is divided into two parts:

- Part A refers to governance policy and processes for NERL capex and the Opex Flexibility Fund (OFF).
- Part B refers to governance policy and processes for the CAA AMS Support Fund (ASF).

I2 The draft policy and processes set out in Parts A and B have been developed following consultation on our draft proposals, in addition to further engagement on a working note and draft policy note on governance shared with stakeholders in in April and July 2019 respectively and published on our website.

Part A: NERL capex and the OFF

I3 Our final decisions on NERL's RP3 cost allowances and flexibility mechanisms are based on the expectation that NERL will deliver in full the capital investment programme in its RP3 business plan. To further the interests of users with respect to these matters, we have decided to introduce a new financial incentive on NERL's delivery, in the form of a financial penalty of up to £36 million, which would be applied in RP4. We recognise that changes in circumstances and user requirements may make changes to the plan desirable during RP3. We expect NERL to take ownership of its programme and to be pro-active in seeking user agreement for any changes during RP3. We will be open to changes that NERL proposes for which they can show support from an appropriate base of users.

I4 During RP3 the level of our involvement in NERL's capex governance will depend on the extent to which it can engage with users on an open and

[77] Additionally, in chapter 9 we make reference to the capex contingency fund, OFF and ASF as means of addressing uncertainty in RP3.

transparent basis gaining their trust and support. This will require NERL to take a more positive, transparent and pro-active approach than previously.

I5 We have allowed two contingency and support funds for NERL to deal with the uncertainty around requirements, in particular those around the delivery of airspace modernisation in RP3:

- Capex contingency fund – to enable NERL to address new investment requirements, including changes in scope in existing projects; and
- Opex Flexibility Fund (OFF) – to enable NERL to address new requirements for operational expenditure. This fund will primarily be for requirements relating to airspace modernisation.

I6 More detail on these funds is in paragraphs I21 to I25 and I38 to I40.

Capex incentives on NERL

I7 There are three capex incentives that will apply to NERL:

- a delivery incentive designed to encourage timely and effective delivery of NERL's capex programme;
- an ex-post efficiency review, which will consider NERL's RP2 (and in due course RP3) capex; and
- an information incentive designed to ensure NERL provides stakeholders an appropriate level of detail as part of its engagement on its capex.

Delivery incentive

I8 We will introduce a financial incentive on NERL's delivery of its capex programme. This will involve a general assessment of NERL's capex delivery, supplemented by a focus on the delivery of specific milestones for programmes or projects that lead to important outcomes that benefit users. The specific milestones that we sought feedback on and are included in our draft licence modification are:

- the DP (en route) and DP (lower) technology changes which together will provide a common platform for the Swanwick and Prestwick centres allowing for legacy escape and mutual contingency, and will provide the capacity necessary for airspace modernisation;
- the AD6 airspace change for Essex airspace which would increase capacity into Stansted and Luton airports; and
- LAMP airspace changes to modernise airspace in the South East of England to take account of the performance capabilities of modern aircraft.

I9 The Independent Reviewer will produce an annual report on NERL's progress on delivering its capex investment programme. The report is likely to include a judgement on NERL's overall delivery performance. The report will take account

of comments from NERL and other stakeholders (including airlines, airports and the AMS co-sponsors).

I10 We will publish the report which will be used to inform our views on NERL's actual delivery of programmes and outcomes.

I11 Delivery in full of NERL's RP3 business plan capital programme will be the baseline assumption, and we will focus on whether NERL has done everything it could do to deliver the programme. The process will be dynamic to take account of appropriate changes to NERL's capital programme over RP3, that have been agreed with users through the enhanced capital governance process.

I12 The financial incentive will take the form of a reduction in NERL's RP4 revenue or starting RAB, based on both the general assessment of NERL's delivery and the delivery of the specific programme or project milestones above (as amended with the agreement of users and us). The amount of the incentive shall be capped at £36 million (2017 CPI prices) and is linked to NERL's return on equity on its capex in RP3. The assessment shall be complementary to the ex post efficiency review of NERL's RP3 capital programme.

Ex-post efficiency review

I13 Before RP4, we will commission an independent review, or reviews, of the cost efficiency of NERL's RP2 and early RP3 capex. If the review(s) identifies any expenditure as inefficient, we may decide to disallow some or all of the inefficient spend. This will be achieved through a downwards adjustment to NERL's starting RAB for RP4.

Information incentive

I14 To encourage the provision of high quality information as part of capex engagement under the enhanced capital governance process (see below), we are intending to apply a financial incentive on NERL, such that if there are significant weaknesses in NERL's ongoing provision of information on its capital spending, then any overspend during RP3 would only be remunerated at its cost of new debt finance (rather than the full WACC), even if it subsequently passes an efficiency test.

I15 The incentive will apply when there has been a serious failure in the provision of information to justify an overspend either at the project or programme level, or on its overall capex. We consider a significant failure would be where NERL has offered no reason for an overspend or provided information at too aggregated a level to show why the overspend has occurred. If NERL provided information showing why an overspend had occurred, but we and users do not agree with NERL's reasoning, this would not be considered as a weakness in information provision, but might still be subject to the ex post efficiency review. The incentive will take effect through a one-off reduction in RP4 revenue or starting RAB. The

assessment shall be complementary to the ex post efficiency review of NERL's RP3 capital programme and the delivery incentive.

Role of the Independent Reviewer

I16 During RP2, we implemented the Independent Reviewer (IR) function to "review the accuracy of the Licensee's reporting". In practice, the IR has taken a more active role in assessing the quality of NERL's reporting more generally, and this has led to positive developments, for example on reporting risk management. NERL's RP3 business plan supported an enhanced role for the IR, and our draft proposals also included expanding the IR's role to include assessing how well NERL has explained and justified its capital programme in its Service and Investment Plan (SIP) document, as well as reviewing its reporting.

I17 In the context of capex governance at Heathrow airport, the appointment of an Independent Funds Surveyor (IFS) has had a positive reception. The IFS has played an important role in giving airlines more confidence in the capex governance process, and allowed more transparency and clarity in the process.[78] An enhanced role for the IR could provide a similar role for NERL's capital programme – noting the need to adopt a proportionate approach, the IR's scope would likely be less broad compared to the IFS. Even if the IR was not ultimately put in a position to reach views on the efficacy of expenditure, regular reports by the IR would likely be a key input into our ex-post efficiency review. Therefore, stakeholders would be able to take IR reports as a signal on whether, for example, certain capital spending is likely to be allowed as part of the RAB.

I18 The IR will:

- consider NERL's process for user engagement in its capital governance arrangements;
- assess how well NERL has explained and justified its capital programme in its SIP;
- review the accuracy and timeliness of NERL's reporting in its SIP;
- track and assess NERL's progress in delivering its investment plan and achieving the associated benefits; and
- report on the cost efficiency of NERL's capex.

[78] The IFS is jointly appointed by the airlines and Heathrow Airport to provide support in the capex governance process. It reviews and reports on the reasonableness of key investment decisions. This was modelled on the role of a monitoring surveyor in commercial property and aimed at providing assurance that capex is invested efficiently. More detail can be found in CAP1563e - Review of Heathrow Airport's Q6 Capex Governance, CEPA (June 2017)

I19 The IR will report to both us and airspace users, and these reports will (among other evidence) inform our assessment of NERL's capex delivery and our ex-post reviews its capital efficiency. The IR will produce:

- regular reports on each SIP and interim SIP. The report on the annual SIP (provided by NERL in January each year) shall include a report on NERL's capex delivery during the year (see above). This will contain both a general view on NERL's capex delivery on its whole capital programme, and a report on particular projects or programmes that are a particular focus of the RP3 delivery incentive; and
- ad hoc reports on various aspects of NERL's capital programme and performance, for example the efficiency of NERL's spend on a particular programme, or its approach to securing that its capex delivers benefits in line with business cases.

I20 Airspace users have noted that it can be challenging for them to effectively assess the efficiency of NERL capex. NERL spending on, for example, IT infrastructure can differ significantly from that typical for airlines, and is often made of bespoke projects, making it difficult to benchmark. The IR's reports should help support stakeholder understanding of NERL's capital programme.

Capex contingency allowance

I21 We have included a capex contingency allowance of £31 million in our final RP3 decisions. Use of the allowance will be subject to the enhanced governance process (see below), with the final decision on spend taken by NERL. The capex contingency allowance is intended to be used for unforeseen expenditure. NERL is still expected to deliver its plan in full for the capex we have allowed, including the efficiency challenge.

Opex Flexibility Fund

I22 In December 2018, we published the UK AMS,[79] setting out the detailed initiatives that industry must deliver to achieve the objectives envisaged in current government policy. NERL will have a key role in supporting the development and implementation of airspace modernisation. It is important to ensure that NERL's governance procedures are properly linked to the wider AMS governance framework.

I23 The OFF will hold £42 million (2017 CPI prices) over RP3 and be similar in nature to the existing RP2 FAS Facilitation (NERL) Fund but broader in scope. The OFF is intended to be the main vehicle to support uncertain costs arising from the implementation of the AMS. Although this will not necessarily be its only use, it will be its primary use. The main differences between the OFF and the capex contingency allowance is that the OFF applies to operational rather than

[79] CAP 1711 - Airspace Modernisation Strategy (December 2018)

capital expenditure and that the final say on releasing money under the OFF will be taken by the CAA.

I24 There are a number of risks associated with the operation of the OFF. Three key risks are:

- the timing of spending – such that the money is not released at the appropriate time;
- unintended transfer of accountability – the involvement of other parties in the governance process reduces the incentive on NERL to take responsibility and accountability for expenditure, decision-making and delivery; and
- classification of costs – NERL is incentivised to categorise spending as relating to airspace modernisation, to encourage support for its use.

I25 NERL and stakeholders (including us) will need to work together to develop mitigations to these and associated risks. Our draft policy note explored these risks and potential mitigations further.

The enhanced capital governance arrangements

I26 We have been clear in chapter 5 that NERL needs to improve its capital governance process in RP3. The objective of its governance process should be an effective and meaningful engagement between NERL and its customers, to enable customers (and other stakeholders) to express their views and influence NERL's thinking so that it can make and be accountable for its informed expenditure decisions.

Governance process

I27 It is important that NERL owns its capital programme change governance process and develops it with airspace users and other stakeholders over RP3. However, we expect that a good governance process should require NERL to:

- engage with its customers and other stakeholders in a meaningful, effective and timely manner;
- provide clear information of sufficient detail and quality;
- set out its analysis and options for delivering capital projects;
- set out its forecast and actual costs in a way that customers and stakeholders can understand;
- set out performance outcomes and benefits in an open and transparent way for each programme; and

- clearly demonstrate how it has consulted stakeholders and taken account of their comments when reaching its decisions.

I28 It is particularly important for NERL to engage with users when it is intending to make significant changes to the operational outcomes in its baseline RP3 programme or is intending to commit significant resources to new projects, programmes or activities.

I29 We expect NERL to provide users and other stakeholders with business cases for material new investments (of over £10 million) while they are still at the initiation or optioneering stage. This would enable users to comment on them before NERL has decided whether or how to proceed. It could frame its user engagement around the project lifecycle, with greater detail and user engagement as each project nears the decision and implementation milestones. This could be as shown below.

Stage	**Update provided from NERL**	**Stakeholder engagement**
1. Initiation	Issues identified and potential solutions expected	Stakeholders agree that issue is worth further consideration.
2. Optioneering	Describe options identified and explored, setting out minded-to delivery routes	Information; offer further potential options; feedback on preferred solutions
3. Decision	Describe chosen option, including delivery plan and milestones	Discussion on chosen option and milestones, with decision or escalation to senior stakeholders
4. Implementation	Progress report on project delivery, highlighting emerging and potential risks to timescales or costs	Primarily information only, unless there are Medium or Large changes (as noted below)
5. Close out	Summarise completed projects including evaluation and lessons learned	Information; provide feedback on project and feed into lessons learned. [Stakeholders may comment on whether they consider not all the spend was efficiently incurred and/or the project was

		delivered late without good reason.

I30 We consider NERL's proposal to use the following principles to engage with users if there are changes to projects to be a sensible way forward:

- Safety: Advise users and CAA if immediate change required;
- Small: changes to implementation plan that do not affect 'key' milestones, NERL will provide an update in the next SIP document and associated consultation meeting;
- Medium: changes to key milestones incorporating either a 10% change in costs, 10% changes in benefits (scale or timescale), or three months change to a key milestone. In such cases NERL, would update through an ad hoc meeting with users.
- Large: if there are material or fundamental changes to the key milestones, scopes, benefits, or delivery of a project, NERL would call a formal options review with users in a face to face ad hoc meeting where possible.

I31 For both Medium and Large changes, we would expect NERL to get stakeholder agreement.

I32 NERL proposed that the enhanced governance arrangements should include an escalation process to senior stakeholders in NERL, airspace users and the CAA in the event there is a disagreement between stakeholders and NERL regarding milestones or regarding new projects. We consider this to be a sensible approach. Where matters are escalated to us, our focus will be on the quality of information that NERL has provided and its process for engagement and decision-making. If the disagreement is in relation to an AMS-related project, or in relation to whether a project is AMS-related or not, it should also be escalated to the AMS co-sponsors.

Governance reporting

I33 NERL's reporting on its governance process is an important part of its overall governance arrangements, but is distinct from the process itself. Under its licence, NERL is required to produce a SIP document. The SIP is the means by which NERL reports its progress on capital investment delivery and performance outcomes against the baseline. It should also be used to report on, at a summary level, the key points and outcomes of its change governance engagement activities and provide links to material used in engagement and decision-making.

However, the SIP is not a substitute for a good change governance process that meets our expectations set out above.

I34 NERL provides two SIP documents a year – an annual and an interim SIP. Currently NERL has to produce these in December and June. However, NERL has proposed changing these dates to January and July which will allow it more time to provide meaningful figures on yearly and half-yearly spends and progress. We consider that these proposed date changes would be useful.

I35 Each SIP document should :

- provide an update on investment plans against the RP3 baseline (i.e. the full RP3 business plan including the cost allowances in our decision);
- an update on NERL's delivery against milestones;
- summarise any changes made, the governance process followed, how decisions were made, the level of stakeholder agreement, and the justification for decisions;
- include links to associated material (such as business cases); and
- any proposed changes to milestones.

I36 Between the annual and interim SIPs, NERL will provide quarterly dashboard updates, which will provide an update on the investment plan with additional material on any material changes.

I37 The IR will report to us and users on each annual and interim SIP. As mentioned in paragraph I19, its reports will include an assessment of how well NERL has explained and justified its capital programme, review the accuracy and timeliness of NERL's reporting, assess NERL's progress in delivering its investment plan and associated benefits, and, where necessary, report on NERL's cost efficiency.

OFF process

I38 The OFF will primarily be used for expenditure related to airspace modernisation and is not a substitute for NERL meeting the opex efficiency challenge. We expect the process for the use of the OFF to follow the same principles as for capital programme change governance. Additionally, in order for an activity to be eligible for funding through the OFF, NERL would have to adequately demonstrate, as a minimum, that:

- the activity is supported by its users and, where appropriate, wider AMS governance bodies;

- any additional expenditure is based on unforeseen additional scope rather than cost overruns and is a necessary requirement to deliver benefits to airspace users; and
- the activity has a strong business case, demonstrating that the project is well costed and would benefit users, with a clear and established evidence base to support both cost and benefit forecasts.

I39 Where NERL and airspace users agree that an activity should be funded from the OFF, the CAA will approve the use of the fund unless there are compelling reasons for not doing so.

I40 Where airspace users do not agree with a NERL proposal to use the OFF for an activity, NERL can still present its case to the CAA. However, in such cases the onus will be on NERL to justify the use of the OFF, despite user objections.

Part B: CAA AMS Support Fund (ASF)

I41 In addition to the OFF, which is financed from the NERL component of UK Determined Costs, our final RP3 decisions included the creation of an AMS Support Fund (ASF) to be financed from the CAA's component of UK Determined Costs. Like the OFF, the ASF is intended to deal with uncertain requirements in support of the delivery of airspace modernisation during RP3. The ASF will provide the opportunity for entities, other than NERL, to seek financial support to address airspace modernisation requirements that cannot be funded by other means.

I42 The ASF will be £10 million for RP3 and will be similar in nature to the existing RP2 FAS Facilitation (Small Gaps) Fund, but broader in scope. The ASF is intended to be used for projects that are important to the success of the AMS and where there are no other appropriate mechanisms for the recovery of these costs. This fund will be available to non-NERL third parties only.

ASF process

I43 Anyone requesting funding from the ASF will need to prepare investment proposals which will be presented to the ASF Advisory Board ("Advisory Board") and ASF Decision Board ("Decision Board"). Both Boards shall include CAA and industry representatives.

I44 The Advisory Board will check the quality of proposals, assess them for any regulatory issues, and ensure they meet the ASF eligibility criteria. Once the Advisory Board confirms that an investment proposal is of sufficient quality and meets the eligibility criteria, it will be sent to the Decision Board. The Decision Board shall provide an objective review of potential investment proposals to the ASF and determine whether to fund an activity.

I45 The Advisory Board shall assess whether:

- the financial commitment requested, falls within the ASF budget capability;
- the objectives of the proposal align with the strategic aims of AMS and the research or implementation that supports AMS deployment;
- the proposal directly or indirectly aids the delivery of initiatives listed in the AMS;
- other financial support options been considered and exhausted, e.g. European or Government funding, economic regulatory settlements;
- there is sufficient information in the proposal to demonstrate the above criteria has been met; and
- there any policy, strategy or technical guidance or regulation required to enable this proposal to be successful.

I46 In its deliberations, Decision Board will consider the following questions:

- Does the proposal have cross industry support and meet any AMS strategic guidance criteria?
- Is the proposal a necessary requirement to deliver the substantive and timely benefits of airspace modernisation?
- Does the scope seem achievable given resources, timings and budget described?
- Are the benefits described identifiable and measurable?
- Does the proposal deliver a positive value from the point of view of users paying the charges?

I47 Where the Decision Board is unable to reach a decision, the matter will be escalated to the AMS co-sponsors. A matter will also be escalated to the co-sponsors if the Decision Board reached a consensus view which does not agree with a strongly held view of the Advisory Board chair that the proposal should either be awarded or not awarded funding from the ASF. Such an approach has the advantage of avoiding a combative environment and supporting projects that have broad support.

I48 When a decision is escalated to the co-sponsors, they will have an opportunity to review the Advisory Board chair view and the Advisory Board and Decision Board recommendations and make a final determination on whether to fund a particular activity.