



DARP CORE AIRSPACE STRUCTURE ASSESSMENT

FINAL REPORT

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1 - INTRODUCTION

1.1 - General

This document has been produced by Egis as part of the project working on behalf of the Dutch Airspace Redesign Programme (DARP), to support an assessment of the design solutions for the DARP Core Airspace Structure.

1.2 - Background and objectives

The DARP concept is to provide *'a comprehensive, future-proof design and management of (Dutch) airspace, based on careful consideration of public interests, in cooperation with (international) partners and in focused dialogue with active stakeholders.'*

DARPs Goals are:

- To increase civil and military capacity and to increase the efficiency of airspace use and management;
- To reduce the impact of aviation on the environment, such as noise and CO₂ and (ultra) particulate matter emissions;
- The key condition is that safety levels are maintained or improved.

Within DARP there are two main projects:

- Core Airspace Structure;
- Transition / Operational Concept.

This study concerns the Core Airspace Structure, which aims to prepare a better and more efficient design of the Dutch airspace to be implemented in the medium term (starting 2025-2027). It consists of the following three main elements:

- Northeast Netherlands including Cross-Border Area (CBA) North, the extended northern national training area & 30x30 NM national over land area. The CBA fulfils the Dutch and German military need for a large (temporary) segregated NL-DE military area for large (international) exercises and national military training areas for daily use (MTAs).
- Southeast Netherlands including interface between the Amsterdam & Langen Flight Information Regions (FIR), which concerns the eastern and south-eastern parts of the Dutch airspace together with the interfaces with the German airspace.
- Schiphol TMA, which concerns a new concept for the Schiphol TMA allowing Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO), and including a fourth entry fix. A corresponding redesign of the Lelystad and Rotterdam TMA's is also part of this main element.

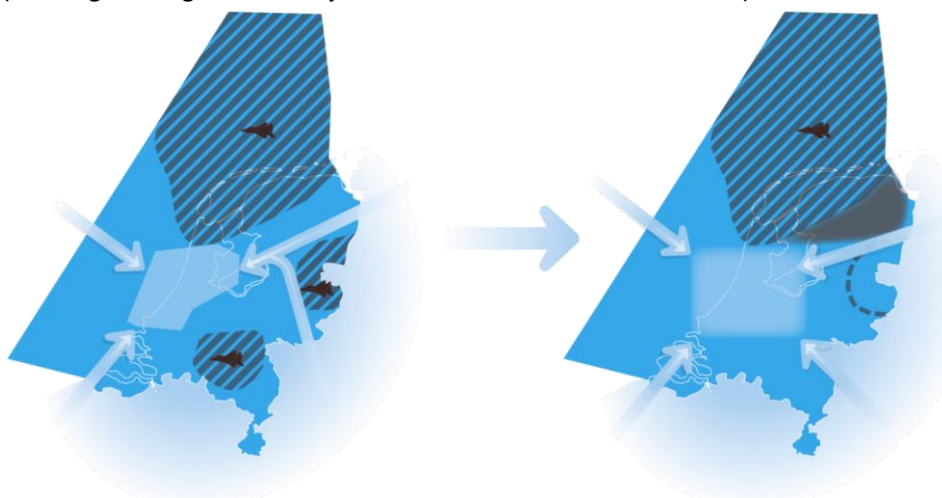


FIGURE 1: THE CORE AIRSPACE STRUCTURE (CONCEPTUAL)

To facilitate the Core Airspace Structure, there is the requirement to redesign the airspace, as shown in **FIGURE 2**, to optimise for civil & military use in line with Flexible Use of Airspace (FUA) concepts.



**FIGURE 2: FUTURE AIRSPACE (CONCEPTUAL)
MILITARY AIRSPACE CHANGES**

There have been several design options proposed by the design team consisting of experts from LVNL, MUAC, RNLAF, DFS and GAF. There are complex issues to be solved with the interactions between, specifically, Schiphol and Lelystad airports and the military training areas to address the operational needs of the F35.

Egis has been requested by DARP to provide a fresh look and propose recommendations to be explored by the design team which will help move the project towards meeting more of the operational requirements. It is accepted that some of the Egis proposals may not meet all of the Key Performance Indicators (KPIs) set by the design team and some compromise may be needed from the DARP stakeholders.

1.3 - Project scope

The project has broken down the services required into four tasks:

- Task 1: Coordination of workshops/interviews;
- Task 2: Paper based research and exploration of potential avenues and opportunities for the two specific design areas that would unlock further design solutions to be explored by the Dutch team;
- Task 3: Assessment of potential avenues and opportunities;
- Task 4: Recommendations.

This report is the outcome from Tasks 1-4 and is based upon the evidence provided by the DARP partners. All criteria and analysis are based on the evidence provided; primary research activities were not a part of the tasking.

In developing the assessment, an approach broadly following the four tasks has been followed. These are described below:

- Task 1: Egis participated in interviews with DARP Designers and other interested parties;
- Task 2: Egis conducted Paper based research and exploration of potential avenues and opportunities;
- Task 3: Egis assessed potential avenues and opportunities;

- Task 4: Egis have proposed a number of recommendations.

Egis' final assessment reviewed potential avenues and opportunities within the Concept of Operations structure setup for the Core Airspace Structure Project and feedback received from the design workgroup. It may be that there is no 'clear winner' from the evaluation; trade-offs will need to be highlighted for each of the suggestions made with some advantages/disadvantages to each.

1.4 - Intended readership

The primary intended readership of this report is the Dutch Government and DARP stakeholders.

1.5 - Document structure

The document is the report designed to meet Tasks 1-4 as outlined above and follows a structure as presented in **FIGURE 3**.

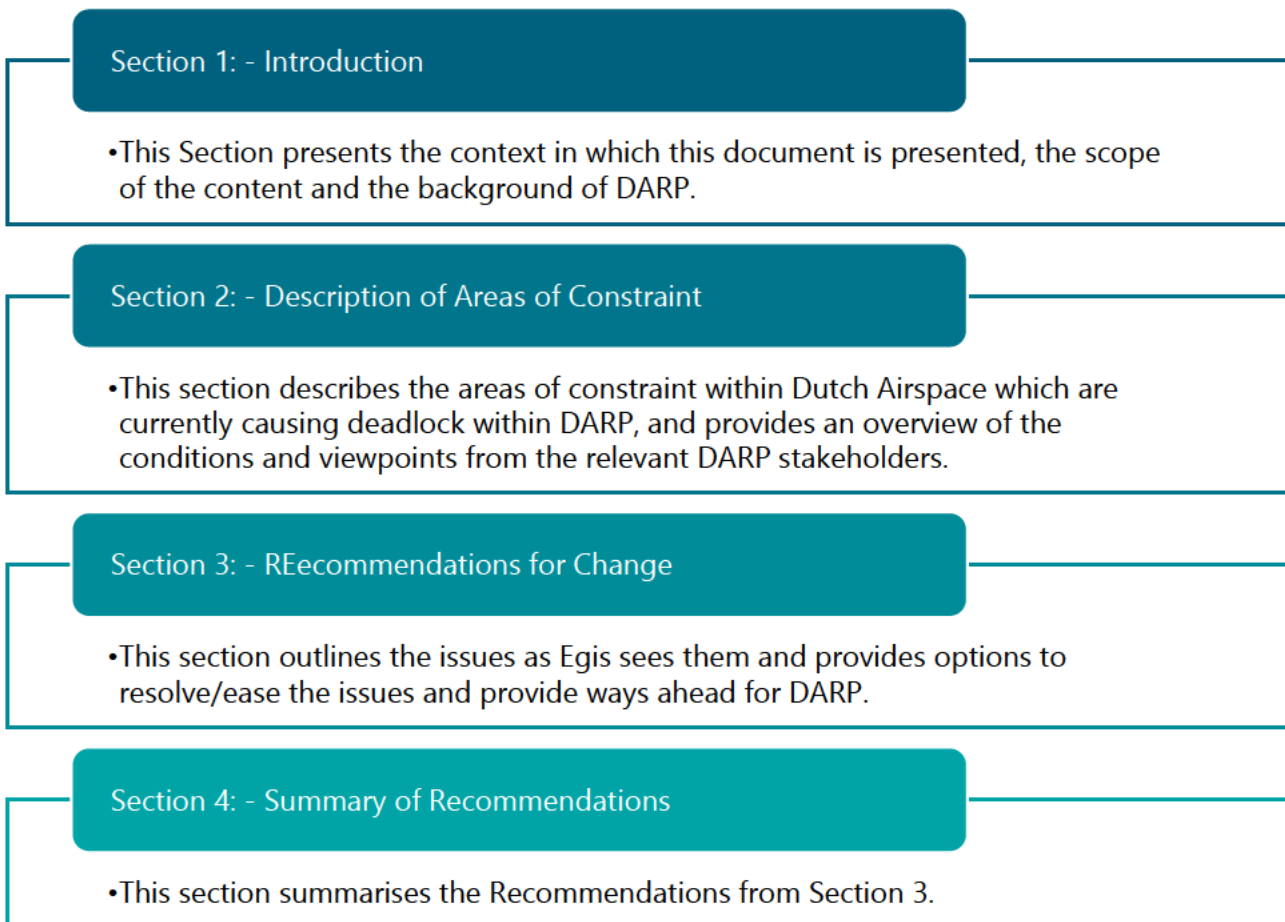


FIGURE 3: DOCUMENT STRUCTURE

1.6 - Diagrams within this Report

All diagrams within this report are conceptual and do not represent design solutions.

2 - DESCRIPTION OF AREAS OF CONSTRAINT

2.1 - General

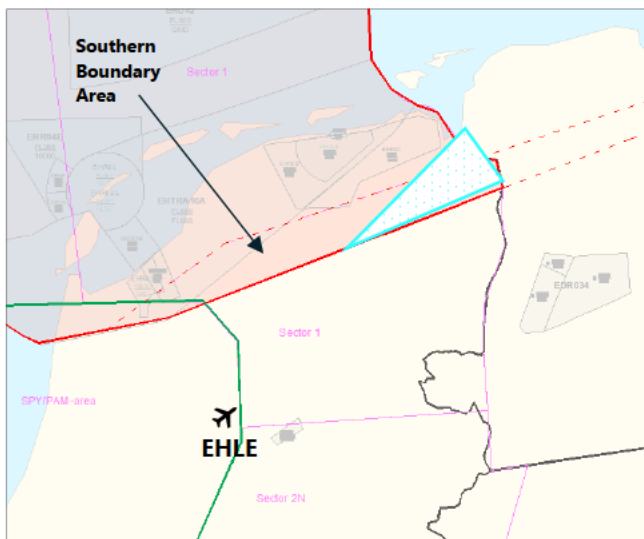
This section describes the Egis view on the areas of constraint within Dutch Airspace which are currently causing challenges within DARP, and provides an overview of the conditions and viewpoints from the relevant DARP stakeholders.

2.2 - Northern Military Training Area, Southern Boundary

2.2.1 - Description

CLSK requires an extension (South Eastwards) of the current Danger Area Complex in the North of the Dutch Airspace in order to accommodate F35 operations, provide sufficient overland area for effective training and form part of the larger Cross Border Area shared with Germany.

A number of options have been tabled for the size of the Northern Military Training Area (NMTA) and position of the southern boundary. CLSK have analysed the options using their Military Mission Effectiveness (MME) Tool and Subject Matter Experts, and have declared that operating within the whole block of the NMTA with the Southern Boundary Option (see **FIGURE 4**) as the only option which supports an acceptable level of MME. CLSK have offered the use of the South Eastern Corner of the NMTA for civil use if required.



- **Conceptual Diagram only**
- Southern Boundary Option shown in solid red line.
- Northern Southern Boundary Option shown in red dashed line.
- The Southern Boundary Area lies between the Northern & Southern Boundary Options
- Approximate position of Lelystad shown for reference.
- SE NMTA corner proposed for civil use shown in blue.

FIGURE 4: NMTA SOUTHERN BOUNDARY

Enabling effective F35 operations is the primary goal within DARP for CLSK. The Southern Boundary is required for a significant number (but not all) of the exercises planned within the NMTA. If they are unable to achieve an acceptable level of operational effectiveness, then they have stated that their ability to support the DARP may be limited.

2.2.2 - Issue

The most Southerly Boundary option of the NMTA presents a major constraint to LVNL, particularly with regards to support both Schiphol North Easterly routings through Sector 1 and Lelystad operations.

Working with NLR, LVNL have designed and safely separated (within the current DARP constraints) North Easterly inbound and outbound routes for Schiphol and routes for Lelystad (see **FIGURE 5**), which requires the movement of the ARTIP TMA entry point north of its current location. Currently the ARTIP and EHLE protection surfaces would overlap, hence the requirement for ARTIP to move. **FIGURE 5** shows ARTIP moved North by 25.5 NM to create a 5 NM separation between the ARTIP hold protection area and the EHLE departure track protection areas.

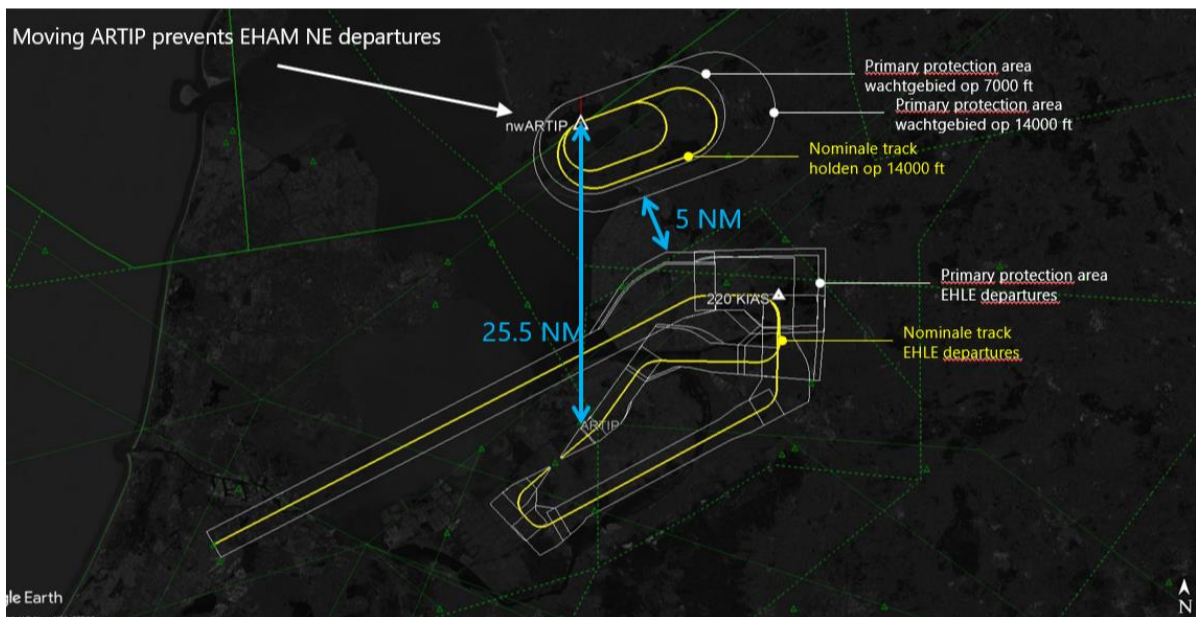


FIGURE 5: EHLE AND EHAM ROUTE DECONFLICTION EXAMPLE

The major issue is that the proposed EHAM & EHLE route designs meet the constraints imposed upon them but are currently incompatible with the Southern NMTA boundary.

If the Southern boundary of the NMTA is in operation there is insufficient physical airspace for a NE outbound route for EHAM. This impacts Asia and Scandinavian traffic, with alternative routing being to the North West around the NMTA or, more likely, East (south of the EDR202/EDR302 complex). The easterly route will add at least 120kms (65nm) to a route to the North East, which represents an approximate additional 400kg of fuel / 1260 kg of CO₂ emissions for a typical single-aisle aircraft. There would be an impact on traffic flows and loading in Sector 2 and MUAC Sectors, and may also be an impact on capacity, both in the air and on stand, at EHAM.

2.3 - Lelystad

2.3.1 - Description

The Core Airspace Structure within DARP is required to provide a solution for routes to and from Lelystad Airport. This solution, must make it possible for airport growth to accommodate 25,000 flight movements by 2035, rising to 45,000 flight movements by 2043, whilst considering the commitments made and environmental agreements (such as the fact that CCOs are required, preferably to higher than FL60 and expected to above FL90) and remaining within the current airspace structure.

2.3.2 - Issues

The position of Lelystad and the limited airspace available, combined with other constraints such as the requirement for non-interference with EHAM routes, CDO/CCOs, and inability to overfly population centres, severely hampers route options. Current LVNL designs for Lelystad are incompatible with the use of the southern boundary of the NMTA and a NE outbound route from Schiphol. There is no other airspace available within the current structure for alternative routings.

2.4 - 30 x 30

2.4.1 - Description

Contained within the Core Airspace Proposal is the requirement for an alternative military training area to the NMTA, currently proposed to be TRA15 redesigned as a '30x30 area' (see **FIGURE 6**). This area is required for combined Air Force and Ground Forces exercises, basic and advanced aircraft handling and UAV operations. It

is estimated by CLSK to be required for 30-35 days per year, and will be particularly used when environmental conditions are unsuitable in the NMTA.

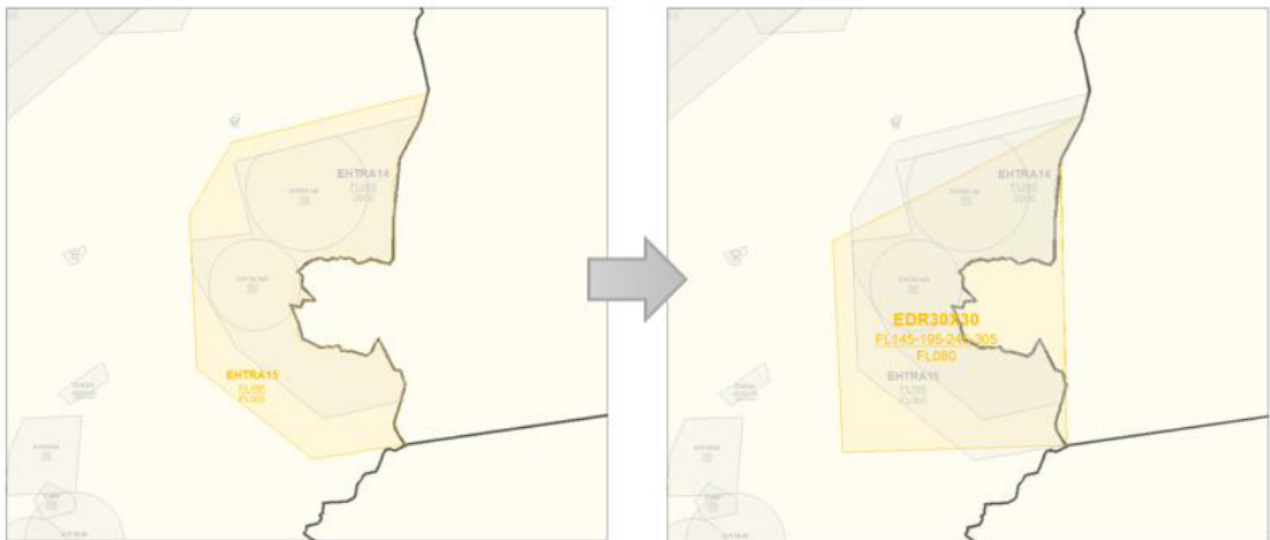


FIGURE 6: PROPOSED REDESIGN OF TRA15 TO THE 30X30

2.4.2 - Issues

The proposed position of the 30x30 restricts route options for EHAM and Lelystad. It effectively funnels traffic between itself and the NMTA in the NE, restricts available space for vectoring by the ACC and does not allow space for EHAM NE inbound and outbound routes. Its existence also inhibits EHLE route options.

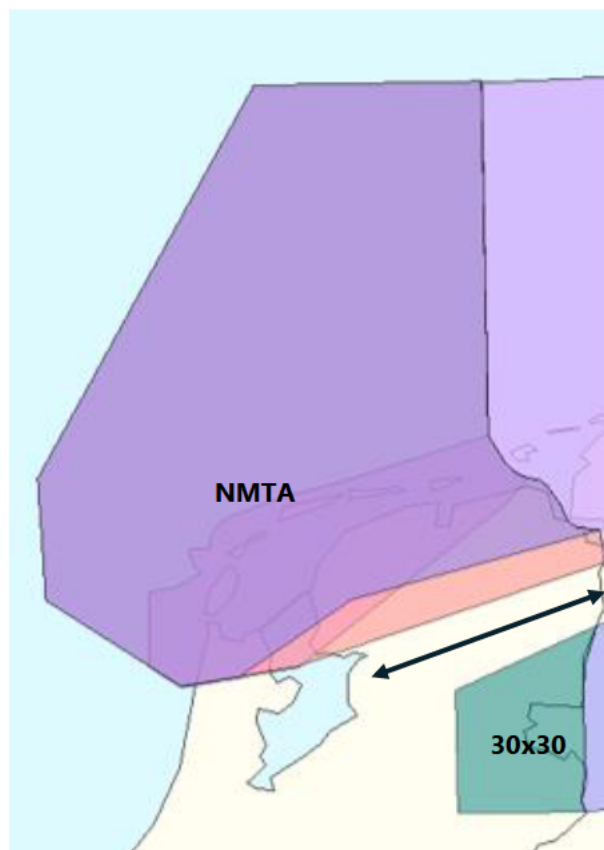


FIGURE 7: POSITION OF 30X30 IN RELATION TO NMTA

2.5 - The Schiphol Terminal Manoeuvring Area (TMA)

2.5.1 - Description

One of the primary operational requirements within DARP has been to enable flying as much as possible on fixed routes with continuous climb and descent profiles that maximise horizontal and vertical flight efficiency (minimising greenhouse gas emission) and reduce noise pollution to a minimum.

LVNL have duly followed these requirements by designing a number of Fixed Route profiles to accommodate the most frequently used Schiphol runway configurations, an example of which is shown in **FIGURE 8**.

The LVNL Fixed Route designs are intended to allow CDO from the TMA entry points (at FL100). To achieve this, vectoring within the TMA has been eliminated for the main runway configurations. Arrival routes are relatively direct from the entry points to the route merge points with relatively long final approach tracks (final plus intermediate segment of the approaches) above 10 NM in (nearly) all RWY configurations. As a result, the ILS glidepath is intercepted relatively high.

The departures are designed to allow CCO up to at least 6000ft.

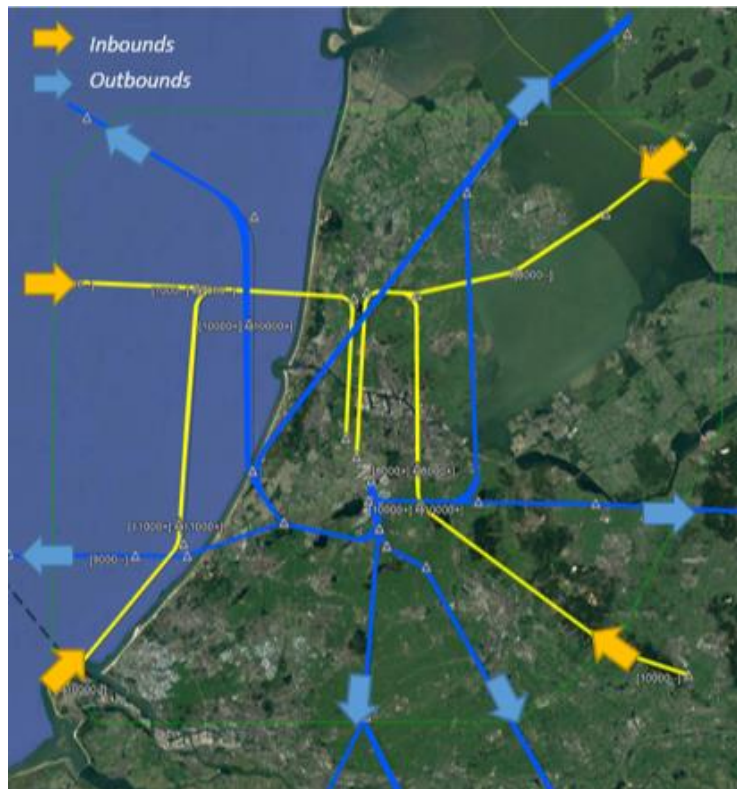


FIGURE 8: EXAMPLE OF FIXED ROUTES WITHIN THE TMA

2.5.2 - Issues

The very limited available airspace and for the high Schiphol traffic levels (500k pa) the proposed Fixed Route structure is highly ambitious and aspirational. Schiphol appears to be the only major airport currently attempting such a route structure

With a complex set of runway configurations which are subject to noise abatement rules for runway preferential use, Schiphol operations require a large number of runway changes per day. Globally, other large-scale airspace re-design programmes (such as the UK's London TMA), with comparable traffic levels but more available airspace and less demanding runway configurations (and hence maybe considered less complex), have considered but decided against widescale Fixed Route solutions. This is mainly due to issues encountered in designing fixed track approach routes that can maintain capacity in high-density TMAs.

The current Fixed Route Proposal introduces risk to DARP because:

- The required ATM Toolset is under development and currently is not available to support it. Awaiting introduction of suitable ATM Toolsets may significantly slow DARP progress.
- The design relies on routes through airspace that is not currently planned to be available to civil traffic, i.e. within the NMTA, regardless of the southern border option.
- The design requires traffic to be sequenced with a very exacting level of delivery accuracy (+/- 30secs) at the TMA boundary. MUAC are currently unable to deliver inbound aircraft within this tolerance, therefore leaving the burden of positioning and sequencing to the ACC, who are operating themselves within a very restricted area of airspace. This creates a significant risk of ATC overload within the ACC.
- There is no fall back other than to move away from fixed routes and initiate planned ATC vectoring within the TMA.

2.6 - Egis Conclusions

- CLSK require the Southern NMTA boundary for effective F35 operations.
- LVNL are currently unable to design EHAM NE inbound/Outbound routes and EHLE CDO/CCO routes with the Southern NMTA boundary in place.
- The proposed Fixed Route Structure within the Schiphol TMA is very ambitious in the short term and represents a high level of risk to the current DARP objectives.

3 - RECOMMENDATIONS FOR CHANGE

3.1 - Approach

Egis has approached the delivery of this study, with the aim of suggesting areas of change that may allow progress within DARP. The following recommendations are designed to offer a package of wide-ranging options and enable changes that range across design, usage, environmental constraints etc, with the DARP being free to choose which to accept, and to what level. It should be noted that many of the recommendations are linked or have dependencies upon acceptance of other recommendations; selectively “Cherry picking” recommendations to implement may have a detrimental impact on the dependant recommendations or risk not achieving the overall objective.

These recommendations are not complete solutions; to enable progress they will require further collaborative work and negotiation between the DARP stakeholder, and Egis appreciate that there may be elements of concession and further compromise required of all stakeholders.

3.2 - General

3.2.1 - Baseline Agreement

It became apparent during the various stakeholder discussions that there were many fundamental elements within DARP that were either not agreed, not accepted or not fully understood by all stakeholders within the programme. As examples, the actual position of the proposed TMA boundary used by LVNL in their designs, does not yet appear to be accepted by CLSK, and the NMTA Southern boundary option with the SE corner cut off does not appear to be a recognised option yet.

- **Recommendation 1** – The DARP stakeholders conduct a baselining activity to agree the fundamental elements of the programme and to identify and rectify any deltas within the understanding of the stakeholder group.

STRENGTHS	WEAKNESSES
Baselining across the programme enabling agreed facts and common understanding.	Nil

3.2.2 - Environmental Requirements

Egis supports the overall programme requirements regarding environmental impact, namely:

- The design of the airspace must minimise the impact of noise on all stakeholders.
- The airspace design must minimise the impact of air pollution on all stakeholders.
- Emission preferential design to minimise the impact on climate:
 - Above 6000 ft, emission-preferred designs are given a larger weighting than noise-preferred designs in a design consideration.
 - Below 6000 ft, noise-preferred designs are given a larger weighting than emission-preferred designs in a design consideration.

However, Egis’ opinion is that it is necessary to review these environmental constraints at the initial phases of transition since these may be greatly limiting to the early stage design options. It may be necessary to start at a lower level of environmental ambition in the early stages to enable programme progress towards an optimum long-term end-state.

Ultimately, whilst the longer-term environmental ambitions of DARP are supported, it may also be necessary for them to be reduced to a level that is more achievable in order to enable the programme. This would only occur if the other recommendations in this report had not achieved the desired result.

- **Recommendation 2** – Review the environmental constraints and reduce the environmental ambition in the initial stages of transition, e.g. initially concentrate on meeting noise environmental requirements, but plan to meet emission objectives later. It may also be necessary to review the environmental ambition of the end state of the project if, despite the other recommendations in this report, an operational design cannot be found.

STRENGTHS	WEAKNESSES
Maintains some short-term environmental commitments.	Programme will be slower to achieve all environmental commitments.
Will enable greater route design flexibility and options during transition phases.	

3.3 - NE Airspace

The North Eastern Airspace refers to the airspace in LVNL’s Sector 1 and to the south of the NMTA, shown in **FIGURE 4**.

3.3.1 - Airspace Order of Design

Egis’ opinion is that one of the major factors causing issues in the North Eastern area is the lack of prioritisation given to the usage of this airspace. Equal priority given to the conflicting requirements of EHAM and EHLE routings, to the CLSK requirements to have F35 operations in the NMTA and a proposed 30x30 area have led to the inability to reach agreement within the stakeholders on airspace designs (and hence usage) for the area.

Egis have therefore prioritised each of the 4 elements on what we feel are the most important for the programme to achieve, and which offer the greatest level of flexibility to enable new options that progress the programme. Factors influencing the prioritisation include:

- CLSK within the current airspace construct have a MME of 64%¹. They are unlikely to proceed with any changes relating to DARP that result in a degraded level of MME and or that could adversely affect training within the €14.6 billion F35 programme.
- Schiphol was the world's third busiest airport by international passenger traffic in 2021. With almost 72 million passengers in 2019, it is the third-busiest airport in Europe in terms of passenger volume and the busiest in Europe in terms of aircraft movements. It accounts for 2 to 5 percent of the gross national product, provides between 120,000 and 360,000 jobs and therefore is hugely important nationally. Any proposed changes that adversely impact Schiphol operations are unlikely to be acceptable.
- There are a large number of overflights which will be constrained by airspace restrictions and any additional airspace available to them will be of benefit to MUAC and the wider ATM network.
- Any proposed expansion of operations and routes etc. thereto connected to Lelystad should be subsidiary to Schiphol operations and should have limited impact upon the latter.
- The requested 30x30 area is a secondary area to the NMTA, with proposed limited use during the year, both in terms of activity and time.

- **Recommendation 3** – The order of design work within the North Eastern Airspace should be as follows:

1. Enabling F35 Operations within the NMTA;
2. Enabling EHAM & EHRD routings, and overflights;
3. Enabling EHLE routings;
4. Enabling the 30 x 30 airspace block.

¹ From data provided in interview with CLSK

STRENGTHS	WEAKNESSES
Provides CLSK options to maximise MME	Will increase difficulty of route design and will require review and updated of constraining factors for EHLE.
Enables airspace for LVNL to consider EHAM NE Inbound & Outbound Options	30x30 may not be possible once higher priority usage has been agreed and established.
Opens up airspace which may enable LVNL to consider airspace tools to ease controller burden within the ACC	
May open additional airspace that could be beneficial for routing of overflights	

IMPORTANT NOTE: EHLE and 30x30 designs should be secondary to NMTA Southern Boundary Designs and North-Easterly EHAM route requirements. However, if a slightly less optimum design for EHAM routes can provide significant improvement to EHLE designs this should clearly be considered.

3.3.2 - NMTA Boundary Options

CLSK have requirements for sufficient airspace to be available on a daily basis to conduct air-to-air and air-to-ground (including live firing) exercises, basic & advanced aircraft handling and missile evasive manoeuvring. To utilise its full capabilities, the new F-35 aircraft requires significantly more airspace to achieve this than previous aircraft types.

Based upon the evidence presented, Egis recognise that CLSK believe the Southern Boundary option for the NMTA represents the best solution of those presented (with regards to MME) for F35 Operations. Against a baseline of current operations and airspace of MME, the proposed Southern Boundary delivers comparable MME, while the Northern Boundary represents significantly less. Therefore, if MME results are to be achieved it will be necessary to create a working concept for a daily situation incorporating a NMTA with a southern boundary.

Egis recognises that the preferred usage pattern of the NMTA by CLSK necessitates a single 'block' of time during which civil use is impractical (both from a civil and military viewpoint). Due to the buffer periods required either side of the time block, and the impact on the military operational cycle, Egis recognise that there is no advantage to be gained for either the military or the civil airspace users in breaking down the time block into a number of smaller blocks.

The exact times to activate the NMTA will be the result of a Booking Principles and Priority Rules (BPPR) discussion/negotiation between the two ministries (I&W and Defence). This should also include agreement on the activation periods of the 30x30 and the larger CBA. Both are required to achieve the desired balance between MME and track miles for the entire airspace, noting the changes in the south of the AMS FIR.

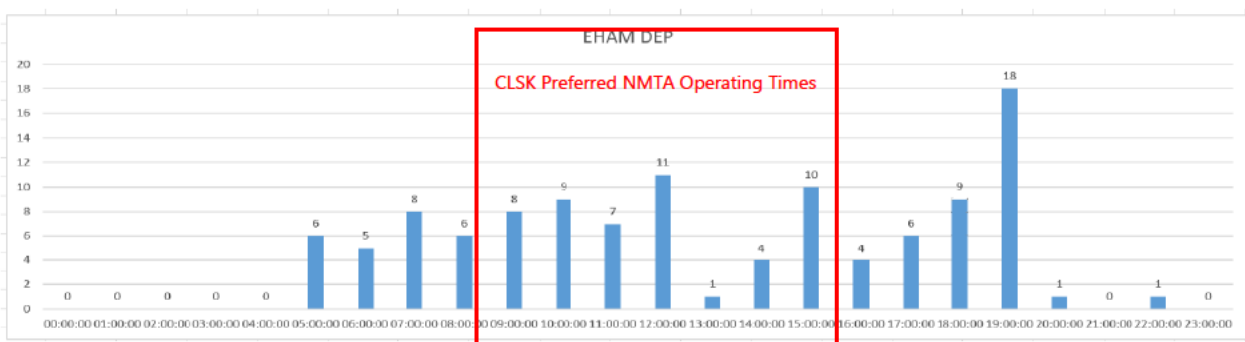


FIGURE 9: EHAM NE DEPARTURES (TRAFFIC DATA FOR WED 17TH APRIL 2019. UTC)

If CLSK operated to the Southern Boundary Option for their preferred 0930-1630 time block, and LVNL were unable to operate a NE outbound route, this would affect approximately 46% of the daily NE bound traffic. Outbounds from Schiphol to the NE operate continuously during the day (See **FIGURE 9**). Schiphol's large volume of traffic and average of 10-11 peak movement periods throughout the day², means there is no particular time period for the military operational block that significantly lessens impact to EHAM routes over any other.

Egis recognises that CLSK are willing to give up as part of DARP, airspace in the south of the country (TRA12/A) to the civil users to enhance civil operations and EHAM routes from the South East.

Egis also recognises that as stated in Recommendation 3, and depending upon the available airspace following Recommendations 5 & 6 (below), there may or may not be a 30x30 airspace block available to CLSK at their required times.

■ **Recommendation 4a** – The NMTA and the civil structure be designed utilising the Southern Boundary option (as shown in **FIGURE 4**), with the following proviso:

1. The South-Eastern Corner of the NMTA (as per **FIGURE 10**) be made available for civil traffic flows if required.
2. The exact times to activate the NMTA will be the result of a BPPR discussion/negotiation between the two ministries (I&W and Defence), and should also include agreement on the activation periods of the 30x30 and the larger Cross Border Area
3. Use of the Southern Border Area by CLSK is planned to be kept to a minimum and released back for civil use when appropriate in line with FUA and agreed BPPR.

STRENGTHS	WEAKNESSES
From the options available, this enables maximum MME for F35 ops to a level that is acceptable to CLSK, enabling them to continue to participate in DARP.	Requires redesign of proposed EHAM routes both inside and outside of the TMA in the NE region, & in turn will require EHLE route redesign.
	May prohibit the activation of 30x30 MTA in certain periods of time.
	If LVNL are unable to operate an EHAM NE outbound during CLSK's required operating hours (Mon-Fri 0930-1630), this will impact approx. 53 aircraft per day. The resulting re-routing will represent an additional 120km (65nm) (approx.) track distance, an extra 400kg fuel use and an extra 1260 kg CO2 emission per aircraft (an approximate extra 3400nm, 21t fuel, 67t CO2 total per day).

■ **Recommendation 4b** – That usage of **all** areas of the NMTA including the Southern Boundary Area will be notified via LARA to stakeholders by at least midday D-1 to allow greater planning and use of CDR1s. Tactical release of the areas should continue as at present.

STRENGTHS	WEAKNESSES
Follows Flexible Use Airspace principles and may enable additional civil traffic to plan use of CDR1s when available.	May require changes to current CLSK operating procedures.

² For 2-8 May 2022, [Schiphol Website](#) records the peak movement periods as: Take-off: 07:00 - 07:40, 09:20 - 11:00, 11:40 - 13:00, 13:40 - 15:00, 16:00 - 17:40 and 20:40 - 22:00 Landing: 07:40 - 09:20, 11:00 - 11:40, 13:00 - 13:40, 15:00 - 16:00 and 18:20-20:00.

3.3.3 - EHAM NE Routing Structure

As per Recommendation 3, EHAM routing design should have priority over EHLE and 30x30 considerations. To that end, all of the airspace to the North-East of the TMA and to the south of the southern boundary option of the NMTA should be considered available for EHAM route structures (see **FIGURE 10**). EHLE and 30x30 designs should be secondary to North-Easterly EHAM route requirements, however, if a slightly less optimum design for EHAM can provide significant improvement to EHLE designs this should be considered.



FIGURE 10: AREA AVAILABLE FOR EHAM NE ROUTES, OVERFLIGHTS AND EHLE ROUTES BELOW

- **Recommendation 5** – EHAM inbound and outbound routes to the North East should be redesigned in relation to the Southern Boundary of the NMTA, utilising the area conceptually shown in **FIGURE 10**. To facilitate this the following actions should be considered:
 1. Utilisation of the airspace within the South Eastern corner of the NMTA, as shown in **FIGURE 10**.
 2. Requesting from the German Airforce use of the airspace in the North West Corner of the future EDR202.
 3. Utilise airspace previously unavailable due to EHLE routes and 30x30 considerations.
 4. Investigating the potential of introducing traffic sequencing tools such as Point Merge or SARA etc within the airspace now available to ease the pressure on the ACC controllers and to give a structured methodology for the separation and sequencing of traffic received from MUAC.
 5. If a hold is required at ARTIP, the height of the base level may be required to facilitate potential EHLE requirements under it, suggesting a potential move from FL70 to FL100 to allow EHLE CCO at higher altitudes than today .
 6. If the route design is still impossible without an outbound route entering Southern Boundary Area of the NMTA, the I&W Ministry should coordinate with the Defence Ministry to agree fixed timings when it would be available, and plan to offer alternative routings when it is not.

It is recognised that the proposed Fixed Route Structures within the East and North East of the TMA will be required to be re-set to meet the new route structure. This links with Recommendation 9.

NOTE. It may be advantageous to LVNL to consider designing an alternative route structure for the routine scheduled periods when the Southern Boundary Area is not being used.

STRENGTHS	WEAKNESSES
Maximises airspace available to LVNL for NE inbound/Outbound routings when Southern Boundary NMTA in place.	Will require redesign of proposed EHAM routes both inside the TMA in the NE region to meet new route structure.
May enable traffic sequencing tools such as Point Merge or SARA etc. within the airspace now available, making traffic flow more predictable and reducing ACC controller workload, thereby increasing the level of safety.	Will require EHLE route redesign and may make such designs more complicated unless constraining factors changed.
	May prohibit the activation of 30x30 MTA in certain periods of time.

3.3.4 - Lelystad

Egis recognises the programme requirement to provide a solution for routes to and from Lelystad Airport. Egis' opinion is that the routes to and from Lelystad should only be considered once the Southern Boundary of the NMTA and the Schiphol NE Inbound/Out Route (including EHRD) structure has been agreed. The issue is that existing Lelystad routes may effectively be preventing the Southern NMTA border and EHAM NE outbounds from co-existing.

The programme states an aspiration for 45,000 movements per annum. Egis recommends that, post-covid, it may be appropriate to re-confirm these expectations since this airport has a major impact on surrounding traffic.

To maximise usage of the available airspace east of Lelystad (see **FIGURE 10**) in Sector 1, and potentially allow design and usage by CLSK of a 30x30 area which will share this airspace, it is necessary for Lelystad and the 30x30 usage to be co-ordinated; the proposed operating hours of Lelystad and the 30x30 should be reviewed to see if they can operate at different time periods.

Lelystad Operating hours could be minimised such that they only cover the periods of "peak" traffic levels (traffic levels to be agreed), for example H24 Saturday & Sunday, defined periods morning and afternoon Mon-Fri. Outside of the agreed times the 30x30 could be made available for CLSKs requirement of 2-4 hours per day for 30-35 days per year. There may also be merit in changing the hours seasonally, for example, Lelystad operations may peak in summer/winter when CLSK's requirement for a 30x30 is less, and conversely EHLE may require fewer open hours in spring/autumn when weather conditions may increase CLSK's requirement for a 30x30. This may also bring efficiencies in operating costs at Lelystad.

Given its physical location and the high population density of the Netherlands, Egis feels that the constraint on EHLE routings not to overfly population centres makes EHLE operations for commercial air transport highly impracticable and will need to be relaxed to find a solution.

- **Recommendation 6** – Lelystad routes be re-designed once the Southern Boundary of the NMTA and the EHAM (inc. EHRD) NE Inbound/Out route structure has been agreed. To ease Lelystad route construction, Egis recommends the following (**Recommendations 6a - 6d**) in order of priority:
 - **Recommendation 6a** – Lelystad routes have priority over the potential 30x30 within the airspace to the east of the airfield out to the national airspace boundary with Germany.
 - **Recommendation 6b** – Lelystad expected traffic levels and operating times be re-analysed, agreed and deconflicted to allow regular meaningful periods when a 30x30 area may be available for use by CLSK.
 - **Recommendation 6c** – Lelystad routes should include CDO/CCOs to minimise noise environmental impact to 6000ft.

At or above 6000ft, priority should be given to designing routes that make the system work. Therefore, it may not be possible to provide CDO/CCOs and may not result in the most carbon efficient routes.

This facilitates wider route design options by allowing the potential for level flight segments at or above 6000ft. Nevertheless, all environmental factors should be taken account where possible outside of these constraints.

- **Recommendation 6d** – Lelystad routes be allowed to include population overflight above 6000ft.

STRENGTHS	WEAKNESSES
Enables CLSK operations in NMTA and EHAM routes to the NE.	Recommendation 6c may be environmentally sensitive.
Focusses EHLE operations to time periods of maximum usage, thereby potentially enabling airspace sharing with 30x30 out with those times.	Recommendation 6d may be politically sensitive.
Use of airspace currently proposed for 30x30 combined with Recommendations 6c & 6d allows wider route design options.	Overall success of establishing acceptable EHLE routes relies upon acceptance of Recommendations 6c & 6d.
	May prohibit establishment of 30x30 MTA entirely or severely restrict its availability.

3.3.5 - 30x30

Egis recognises the programme requirement to provide a 30x30 area for CLSK. However, it is felt that the 30x30 should only be considered once the Southern Boundary of the NMTA, Schiphol NE Inbound/Out Route structure and EHLE routes/operating hours have been agreed. Once these have all been agreed, this will establish the operating environment in terms of airspace and time periods available to design a 30x30 area to CLSKs requirements.

Other positions or options could be considered for the 30x30, including potentially sharing use of MTAs with GAF etc.

- **Recommendation 7** – The physical 30x30 area and operational timings available, be established once the Southern Boundary of the NMTA, EHAM (inc. EHRD) NE inbound/outbound route structure and EHLE routes/operating hours have been agreed. Usage of the 30x30 needs to be pre-planned according to an agreed advance schedule.

STRENGTHS	WEAKNESSES
Enables Southern Boundary of the NMTA, Schiphol NE Inbound/Out Route structure and agreed EHLE routes & operating hours.	Availability of 30x30 may not be to CLSKs requirements.
Enables potential establishment of 30x30 for use by CLSK.	Requirement for pre-planned 30x30 use according to an agreed advance schedule rather than as a bad weather alternative to the NMTA may reduce its value to CLSK.
	30x30 may not be feasible.

3.4 - Schiphol TMA

3.4.1 - Fixed Routes within TMA

As described in Section 2.5 - , routes within the Schiphol TMA are being redesigned to enable, as much as possible, fixed routes with continuous climb and descent profiles whilst maximising horizontal and vertical flight efficiency (minimising greenhouse gas emission) and reducing noise pollution to a minimum.

For the traffic levels concerned (500k movements per annum) and within the very limited airspace available, Egis considers the current proposed Fixed Route Structure to be highly ambitious and represents a risk to DARP. This includes, for example, the reliance upon many factors outside of the control of LVNL, such as the need for a level of aircraft delivery performance from MUAC – which cannot currently be provided – or use of airspace that conflicts with the new design.

The proposed route structure represents the end-state solution. Recognising that work is still on-going, Egis recommends definition of intermediate stages to allow a low-risk transition to the end state. This may allow other parts of the programme to progress in the meantime (e.g. use of southern NMTA border).

Egis recognises that LVNL currently implements CDO/CCO operations during low traffic (night) hours. Intermediate stages with developing route structures (including vectoring options within the TMA) could be implemented to allow expansion of the CDO/CCO operations in increasing traffic level steps. Once airspace, procedures, toolset & system are established or become available, steps to move towards full Fixed Routes within the TMA could be taken.

Re-emphasising Recommendation 2, Egis feel that it is necessary to review the environmental constraints for routes within the TMA since these are greatly limiting design options. It may be necessary to start at a lower level of ambition in the early stages of transition.

- **Recommendation 8** – Plan intermediate stages incorporating revised Fixed Route Structures (see Recommendation 9); stages should progress through increasingly busy and complex traffic levels, towards eventual full operations.

STRENGTHS	WEAKNESSES
Staged approach enables some benefits to be gained ahead of full implementation.	Requires significant effort to plan and implement intermediate stages.
	Phased implementation will require significant risk management.

- **Recommendation 9** – Review the environmental constraints and in the near term, revise the proposed Fixed Route Structure to:
 - Meet the revised NE Inbound/Outbound Structure in Sector 1 (from Recommendation 5).
 - Initially concentrate on meeting only the noise environmental requirements, but plan to improve this during the transition. Routes should initially include CDO/CCOs to minimise noise environmental impact to 6000ft.
 - At or above 6000ft, routes should continue to be as direct as possible but priority be given to designs that make the system work. Therefore, it may not be possible to provide continuous climbs/descents and may not result in the most carbon efficient tracks. This facilitates wider route design options by allowing the potential for level flight segments at or above 6000ft, and allows flexibility within the TMA and the ATM network beyond. Indirect NE inbound route designs etc. may enable dedicated vectoring airspace, or sequencing tools such as Point Merge or SARA etc.

STRENGTHS	WEAKNESSES
Enables quicker implementation of some DARP objectives	May not meet all environmental requirements immediately
Gains some environmental benefits immediately	Will require transition phase route designs
Gives TMA controllers options for planned vectoring and sequencing	
May ease TMA entry time requirements and reduce pressure on the ACC by reducing vectoring and workload in the ACC sectors.	
Allows designs to react to airspace changes outside of the TMA	

4 - SUMMARY OF RECOMMENDATIONS

4.1 - Recommendations

- **Recommendation 1** – The DARP stakeholders conduct a baselining activity to agree the fundamental elements of the programme and to identify and rectify any deltas within the understanding of the stakeholder group.
- **Recommendation 2** – Review the environmental constraints and reduce the environmental ambition in the initial stages of transition, e.g. initially concentrate on meeting noise environmental requirements, but plan to meet emission objectives later. It may also be necessary to review the environmental ambition of the end state of the project if, despite the other recommendations in this report, an operational design cannot be found.
- **Recommendation 3** – The order of design work within the North Eastern Airspace should be as follows:
 1. Enabling F35 Operations within the NMTA;
 2. Enabling EHAM & EHRD routings, and overflights;
 3. Enabling EHLE routings;
 4. Enabling the 30 x 30 airspace block.
- **Recommendation 4a** – The NMTA and the civil structure be designed utilising the Southern Boundary option (as shown in **FIGURE 4**), with the following proviso:
 1. The South-Eastern Corner of the NMTA (as per **FIGURE 10**) be made available for civil traffic flows if required.
 2. The exact times to activate the NMTA will be the result of a BPPR discussion/negotiation between the two ministries (I&W and Defence), and should also include agreement on the activation periods of the 30x30 and the larger Cross Border Area
 3. Use of the Southern Border Area by CLSK is planned to be kept to a minimum and released back for civil use when appropriate in line with FUA and agreed BPPR.
- **Recommendation 4b** – That usage of **all** areas of the NMTA including the Southern Boundary Area will be notified via LARA to stakeholders by at least midday D-1 to allow greater planning and use of CDR1s. Tactical release of the areas should continue as at present.
- **Recommendation 5** – EHAM inbound and outbound routes to the North East should be redesigned in relation to the Southern Boundary of the NMTA, utilising the area conceptually shown in **FIGURE 10**. To facilitate this the following actions should be considered:
 1. Utilisation of the airspace within the South Eastern corner of the NMTA, as shown in **FIGURE 10**.
 2. Requesting from the German Airforce use of the airspace in the North West Corner of the future EDR202.
 3. Utilise airspace previously unavailable due to EHLE routes and 30x30 considerations.
 4. Investigating the potential of introducing traffic sequencing tools such as Point Merge or SARA etc within the airspace now available to ease the pressure on the ACC controllers and to give a structured methodology for the separation and sequencing of traffic received from MUAC.
 5. If a hold is required at ARTIP, the height of the base level may be required to facilitate potential EHLE requirements under it, suggesting a potential move from FL70 to FL100 to allow EHLE CCO at higher altitudes than today.
 6. If the route design is still impossible without an outbound route entering Southern Boundary Area of the NMTA, the I&W Ministry should coordinate with the Defence Ministry to agree fixed timings when it would be available, and plan to offer alternative routings when it is not.
- It is recognised that the proposed Fixed Route Structures within the East and North East of the TMA will be required to be re-set to meet the new route structure. This links with Recommendation 9.

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 - **Recommendation 6d** – Lelystad routes be allowed to include population overflight above 6000ft.
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- **Recommendation 8** – Plan intermediate stages incorporating revised Fixed Route Structures (see Recommendation 9); stages should progress through increasingly busy and complex traffic levels, towards eventual full operations.
- **Recommendation 9** – Review the environmental constraints and in the near term, revise the proposed Fixed Route Structure to:
 - Meet the revised NE Inbound/Outbound Structure in Sector 1 (from Recommendation 5).
 - Initially concentrate on meeting only the noise environmental requirements, but plan to improve this during the transition. Routes should initially include CDO/CCOs to minimise noise environmental impact to 6000ft.
- At or above 6000ft, routes should continue to be as direct as possible but priority be given to designs that make the system work. Therefore, it may not be possible to provide continuous climbs/descents and may not result in the most carbon efficient tracks. This facilitates wider route design options by allowing the potential for level flight segments at or above 6000ft, and allows flexibility within the TMA and the ATM network beyond. Indirect NE inbound route designs etc. may enable dedicated vectoring airspace, or sequencing tools such as Point Merge or SARA etc.

5 - APPENDIX A: ACRONYM LIST

TERM	DEFINITION
ACC	Area Control Centre
ATM	Air Traffic Management
BPPR	Booking Principles and Priority Rules
CBA	Cross Border Area
CCO	Continuous Climb Out Operations
CDO	Continuous Descent Operations
CDR	Conditional Route
CLSK	Commando Luchtstrijdkrachten
DARP	Dutch Airspace Redesign Programme
EHAM	Schiphol Airport
EHLE	Lelystad Airport
EHRD	Rotterdam Airport
FIR	Flight Information Region
FL	Flight Level
ILS	Instrument Landing System
LARA	Local and sub-regional airspace management support system
LVNL	Luchtverkeersleiding Nederland
MME	Military Mission Effectiveness
MUAC	Maastricht Upper Area Control Centre
NE	North East
NLR	Royal Netherlands Aerospace Centre
NM	Nautical Mile
NMTA	Northern Military Training Area
SARA	Speed And Route Advisory Tool
TMA	Terminal Manoeuvring Area

TABLE 1: ACRONYM LIST

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