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# Review of the Dutch Airspace Redesign Project Track 2

## Produced for the Dutch Ministry of Infrastructure and Water Management & Ministry of Defence

an egis company

# Document information

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# 1 Introduction

## 1.1 Background

The Netherlands has established a multi-stakeholder Dutch Airspace Redesign Project (DARP) to develop a long-term solution (2035) for the Netherlands airspace. The Ministry of Infrastructure and Water Management (MINIENW) and the Ministry of Defence are working closely together with Air Traffic Control the Netherlands (LVNL), the Air Force Command (CLSK) and the Network Manager (NM) to achieve the overall objective.

In parallel to the long-term solution, several short-term operational requirements are being addressed by DARP. This includes airspace adjustments to create a connected military airspace in the north of the Netherlands, which will increase civil movements to/from Lelystad Airport.

These short-term activities, planned to complete in 2023, have been included in Track 2 of the Airspace Redesign Programme. To date, Track 2 has proposed a Three State Airspace System (as seen in Figure 1) which has yet to be fully agreed or prepared for implementation.

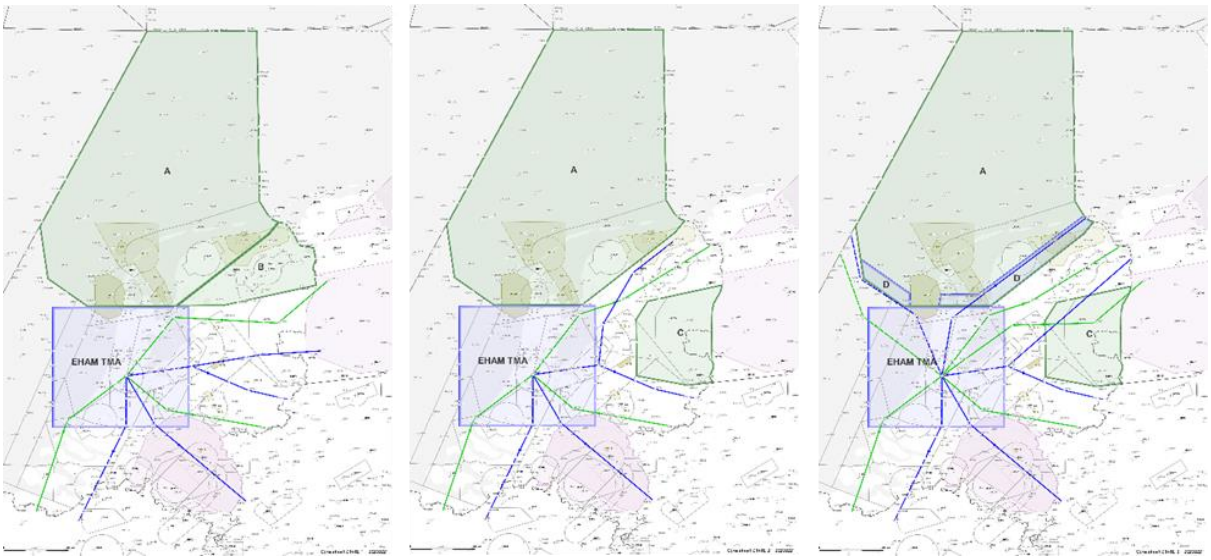



*Figure 1. Depiction of the Three States developed (March 2020)*

## 1.2 Context

MINIENW and the Ministry of Defence has contracted Helios to complete a review of the DARP Track 2 process leading up to the Three State solution currently proposed, addressing the political and administrative context (including time constraints) under which the proposal was reached.

The brief from MINIENW and the Ministry of Defence was as follows:

- Review and provide guidance on the process and activities completed to date, including assessment of information inputs, process traceability, process obstacles, and process integrity.
- Provide guidance on operational considerations for the Three State solution including a high-level review of each State, assessment of the issues to consider, and an evaluation of tools which might assist dynamic State alternation.

- Complete a review of the timeline planning for option assessment, preferred option development, and implementation of the Three State solution, and provide guidance on realistic timescales for each stage of development and implementation.

## 1.3 The Questions

Specifically, MINIENW and the Ministry of Defence have contracted Helios to address the following questions relating to DARP Track 2, based on the Three States defined to date:

**Consider the way ahead based on progress so far**

- Information inputs
  - What information / data / guidance (e.g. requirements, performance objectives, outcome of user sessions) has the design group received for their work?
  - Is this sufficient?
  - If not, what specifically is missing?
  - Which steps should be taken to acquire any missing information?
- Process traceability
  - Is how the programme arrived at the design options sufficiently traceable?
  - If not, what specifically is missing?
- Process obstacles
  - Which bottlenecks can be identified in the process?
  - Are there any recommendations on how identified bottlenecks can be overcome?
  - Is anything hindering the design discussions?
  - What actions should be taken to avoid the process getting stuck?
- Process integrity
  - Does the programme take the necessary steps to ensure the integrity of Track 2 and 3 (with reference to Principle 1 in the Project Plan for Track 2)?

**Operational considerations for Three States**

- Provide some high-level comments on each State, based on the information available.
- Are there additional issues to consider as a result of working with the Three States? For example:
  - Feasibility of changing States during the day (and even during a shift)
  - How this will influence sectorisation
  - Consequences for training and licensing
- In order to work with three airspace States, planning will be essential. Can you recommend any tools to make State changes possible several times a day?

**Review the timeline planning**

- Option assessment
  - Are the proposed steps sufficient to be able to provide an assessment of the feasibility and ‘implementability’ of a Track 2 preferred option?
- Preferred option development
  - Is the proposed timeline realistic to develop a preferred option?
- Three State solution implementation

- What would be a realistic timeline to implement the Three States (subject to feasibility and 'implementability') considering the issues mentioned above?

## 1.4 Approach

In order to fulfil our brief, we approached the project through a number of defined tasks, as indicated in Figure 2. Further details of our methodology are provided in Section 2 of this report.


*Figure 2. Project approach*

# 2 Review Activities

## 2.1 Desktop Study

The aim of this task was to properly understand the DARP Track 2 process and compare it with international best practise, and to identify potential opportunities and challenges by mapping project activities and deliverables against these processes. Findings from the desktop research were used to inform the questions for stakeholder interviews.

As part of our desktop study we reviewed more than 20 detailed project documents, provided by the DARP Programme Team. A list of the source documentation provided by DARP to Helios can be found in Appendix A.

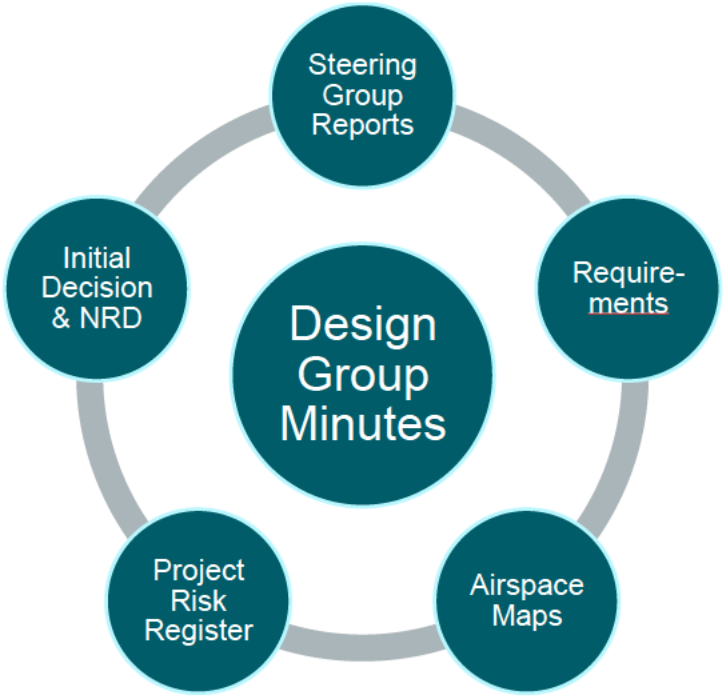



*Figure 3. Overview of documentation types reviewed in the Desktop Study*

The findings of our desktop study are incorporated in Section 3 of this report.

## 2.2 Stakeholder Interviews

The aim of this activity was to conduct structured interviews based on our understanding of the DARP Track 2 process to better understand stakeholders' engagement in the activities to date, as well as the effectiveness of those activities.

Several questions were prepared in advance of the interviews, informed by our initial findings from Task 1. In total we interviewed 15 individual team members from the Design Group and the Programme Team, representing all of the following organisations:

- DARP PT (4 interviewees)
- CLSK (4)
- LVNL (3)

- Maastricht Upper Area Control Centre – MUAC (3)
- The Eurocontrol Network Manager – NM (1)

A detailed stakeholder interview schedule can be found in Appendix B. Our findings from all stakeholder interviews are incorporated in Section 3 of this report.

## 2.3 Information Analysis

Using the output of our desktop study and stakeholder interviews, we focused on drawing out information from our findings and comparing it to a combination of industry best practise, the Dutch national context and our own experts' experience to provide an independent review of the DARP Track 2 process as followed to date, and the sufficiency of current timeline planning to completion.

The conclusions of our review and resulting recommendations are summarised in Section 4 of this report.

### 2.3.1 Comparison with best practise

We reviewed the Definition phase of the DARP Track 2 process (corresponding to the DARP Exploration phase) alongside airspace change management best practise to identify potential opportunities for improvement. Our resulting observations and recommended improvements are detailed throughout Section 3. Our main reference comparators for this study were the FABEC Airspace Policy and UK CAA CAP1616.

Of critical importance in international airspace change management best practise is the high level of scrutiny achieved through the demonstration of transparent, objective assessments of design options. This scrutiny then informs the explanation of impacts (negative, neutral and positive) to all key stakeholder groups.

In reviewing DARP Track 2 progress, we have especially kept under consideration what we consider to be the key initiatives currently present in best practise:

1. **Key benefits driving the change process** – related to a Statement of Need and effective Requirements / Design Principles.
2. **Creation and development of design options** – aiming for "comprehensive coverage" of all potential options.
3. **A clearly defined series of gateways** – for options selection, stakeholder buy-in and regulatory approval of the work conducted.
4. **Transparency of impacts** – of all design options for each stakeholder (quantified and monetised), including the effectiveness of methods used to communicate them.
5. **Stakeholder engagement and consultation throughout the full airspace change process** – including stakeholder identification, engagement methods and effectiveness.
6. **Comprehensive analysis and assessment of design options** – including assessment using defined and consistent metrics to enable 'trade-offs', and a record of all feasible options being considered.

## 2.4 Iterative Review Development

In order to gather, process and analyse the large amounts of information produced during this review in the relatively short timescale available, we implemented an iterative approach to development which included the following key milestones:

- 12-13 March: visit to Amsterdam to conduct stakeholder interviews
- 19 March: complete set of documentation received
- 27 March: briefing to the DARP Guidance Group on review process and key themes
- 6 April: presentation of draft review findings to the DARP Programme Team
- 9 April: presentation of findings and recommendations to the DARP Steering Group
- 9 April: delivery of draft report with recommendations
- 17 April: delivery of final report

This approach, in addition to weekly meetings with the DARP International Review programme coordinator, enabled us to receive regular feedback on both our approach and our findings as the review progressed, while maintaining our essential independence as a reviewer of the DARP Track 2 process.

# 3 Review Findings

Our review is focused mainly on the inputs, activities and outputs of the DARP Track 2 Design Group.

Our review findings are organised into three sections, corresponding to the three categories of key questions asked by the DARP Programme Team:

- Section 3.1 - Review of Track 2 Process and Obstacles
- Section 3.2 – Review of The Three States
- Section 3.3 - Airspace Design Timeline Planning

We have deliberately organised our report in this order to maximise logical flow. For example, our observations on Timeline Planning should naturally be influenced by our understanding of the feasibility and/or potential complexity of the proposed Three State solution.

## 3.1 Review of Track 2 Process and Obstacles

We completed a detailed review of the DARP Track 2 Exploration phase process, along with the activities completed and outputs produced until March 2020.

In doing this, we compared the output of our desktop study and stakeholder interviews with a combination of industry best practise, the Dutch national context and our own experts' experience, and identified findings and recommendations in alignment with the key questions put to Helios for this review.

### 3.1.1 Timeline considerations

Figure 4 illustrates the Design Group progress timeline and summarises some of the key topics that were discussed at monthly Design Group meetings from September 2019 through to March 2020.

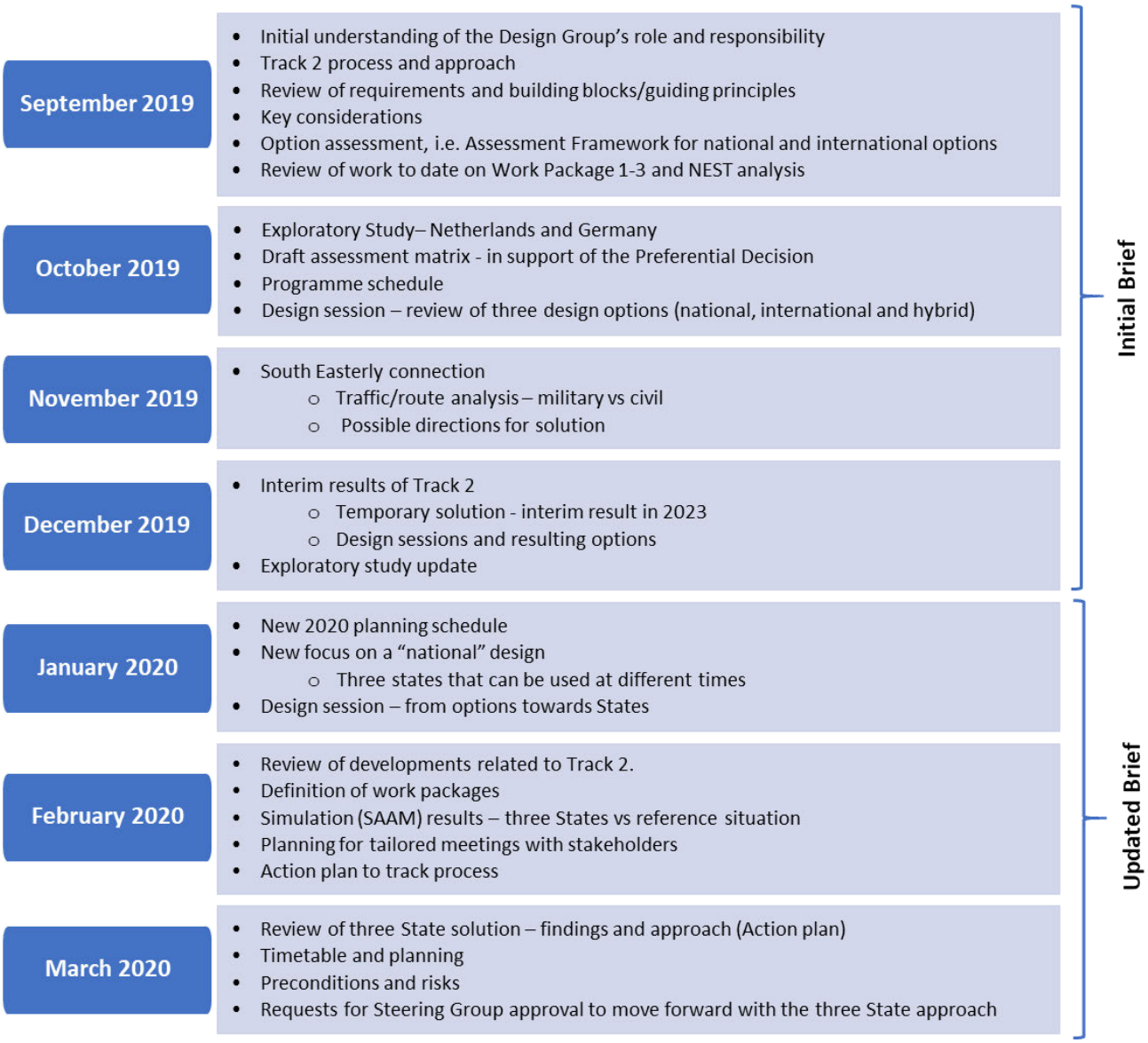



*Figure 4. Main discussions reported by Design Group: Sep 2019 – Mar 2020*

In practice, from September 2019 until the time of writing, the Design Group work can be considered to have operated against two distinct briefs:

- Initial brief: Sep 2019 – Jan 2020
- Updated brief: Jan 2020 – Mar 2020

#### 3.1.1.1 Initial brief

Initially, the Design Group worked to the brief of meeting all stakeholder requirements to the fullest extent possible, and subsequently developed a set of national and international options. These options would be assessed against the Assessment Framework in a trade-off matrix and would be deliberated and assessed by the Steering Group.

#### 3.1.1.2 Updated brief

Since January 2020, the Design Group has reported several obstacles including the likelihood that Germany would be unlikely to meet the design pace required by DARP due to resource

restraints. As a result of this challenge, the Steering Group provided guidance on a new way forward:

> *"No longer asking for 100% of the requirements to be met but instead looking for a National design that brings benefits for all parties. The end state should be a result that can be implemented in 2023 which:*
>
> - *Improves the current situation from both civil and military perspective.*
> - *Can be further improved after implementation of a cross border-area with Germany as soon as possible after 2023.*
> - *Will be measured in 2023 against a reference scenario in which the military area in the south (TRA-12) remains in place."*

#### 3.1.1.3 Structure of this review

For clarity, this Section 3.1 "Review of Track 2 Process and Obstacles" considers the planned and initial inputs, activities, and outputs of the Design Group against the 'initial brief'. In Section 3.3 "Airspace Design Timeline Planning" we have considered questions relating to the way ahead in the context of the 'updated brief' and our understanding of the current situation at the time of our desktop study and stakeholder interviews.

### 3.1.2 Information inputs

#### 3.1.2.1 Key questions:

- *What information / data / guidance (e.g. requirements, performance objectives, outcome of user sessions) has the design group received for their work?*
- *Is this sufficient?*
- *If not, what specifically is missing?*
- *Which steps should be taken to acquire any missing information?*

#### 3.1.2.2 Analysis and Recommendations

To understand the sufficiency of the sets of information, data and guidance provided to the Design Group, it is important to compare what was actually provided in practice with a) the DARP process as defined by the Initial Decision and b) international best practice.

Based on the information assessed during the desktop study and the stakeholder interviews, this information is best represented in a straightforward manner using the table in Figure 5.

| Best Practise (with rationale) | DARP T2 Process equivalent(s) **(see Appendix F)** | Design Input in Sep 2019? **(see Appendix G)** | Observations |
|---|---|---|---|
| **Future Airspace Strategy** Sets change proposal within national strategic context. | National Airspace Vision 2012 | Yes | The National Airspace Vision 2012 sets the justification and rationale into why the change is taking place but is pitched at a strategic level so provides little rationale of the key requirements and objectives for the airspace redesign. The "first steps" defined – to incorporate a new military training area in the north and to redesign airspace over east and south east Netherlands – are in effect the high-level design goals of DARP Track 2. |
| **State Requirements** Defines State-level airspace change parameters and requirements. | Civil Aviation Policy Memorandum 2020-2050 | No | The Civil Aviation Policy Memorandum is not yet available. This document is expected to "answer the question as to how civil aviation can develop while remaining in balance with other public interests" and also to "offer a framework for airspace redesign" (Initial Decision), both of which are theoretically essential to the design process. As such, it should be a key input to the DARP Track 2 Assessment Framework.<br>To align with best practice this document should detail the objectives and assumptions associated with the DARP and set parameters around the boundary for prioritising noise and emissions, as well as setting the key 'design themes' which must be considered and the boundaries by which the variant scenarios are elaborated. |
| **Early Stakeholder Engagement** | Perspectives | Yes | Outputs from stakeholder meetings during the research phase. It is understood that these perspectives informed the "Architecture Principles" that were used to inform the Exploration Phase. |
| **Gateway Entry Review** To conclude the research phase and commence F&O | DARP Initial Decision (following National Airspace Vision 2012) | Yes | The Initial Decision provides substantial information on the activities completed within the DARP Research Phase, "guiding principles" (see below), and the plan for following activities including (in Appendix 5) a "linear approach" process to be used for Track 2. However, the description of the design process flow is spread across several sections and not represented in a flow diagram, so it is difficult to understand and communicate. No clear rationale is given why Track 2 (a complete national airspace redesign) should not follow the same full process as Track 3.<br>High-level DARP stakeholder requirements were descr bed in the Initial Decision, but a set of design principles were not provided. |
| **Airspace Change Regulation** and/or associated guidance material | Memorandum on Scope and Detailing (NRD) | Yes | The NRD outlines three DARP programme objectives (increasing civil and military (MME) capacity; improving sustainability; efficient use and management of airspace) without proposing any breakdown or prioritisation of these objectives. It also proposes at a very high level an assessment framework to be applied to the whole programme (not only Track 2).<br>This document also includes a proposal to consider four mutually-exclusive 'variant scenarios' within Track 3 (2035). In this context, it is important to note that any effective airspace design for Track 2 will be dependent on the T3 scenario chosen, as well as its specific design (TMA boundaries, fixed route coordinates etc). The programme relationship between T2 and T3 should therefore be considered as wholly inter-dependent, and not unidirectional. |
| **Statement of Need** Justifies and rationalises the need and sets direction for the change. | Not clear | No | A clear Statement of Need (SoN) for DARP T2 is important because it facilitates the Design Group's common understanding of the driver for change, and potentially also their scope. In the case of DARP Track 2 this need will trace all the way up to the National interest so it is important to clarify explicitly whether the main benefit driver is political, military or civil; in other words who in the room absolutely needs the change to happen and why. |

| | | | |
|---|---|---|---|
| | | | Design objectives and assumptions for an airspace change should normally be conducted by the change sponsor (in this case DARP) and prioritised as a clear set of Design Principles to be tested with all stakeholders. |
| **Design Principles**<br>Design principles, priorities and limitations | Assessment Framework<br>"Premises"<br>Related Projects | Partial, unclear | A clear set of Design Principles needs to be agreed, based on stakeholder inputs around the intended change, against which design options can be produced and assessed. No such stakeholder-informed principles were discussed withing the first Design Group meeting, although an outline Assessment Framework based on the NRD was presented which might fulfil the same important role if it is traceably informed by confirmed stakeholder requirements.<br>Regarding 'Related Projects' in terms of best practice it should be the responsibility of the Change Sponsor (i.e. MINIENW and MOD, acting through DARP) to ensure "compat bility and consultation". Certain DARP Track 2 project dependencies (FRA at FL245, SW Airspace Redesign, iCAS) were identified in the Initial Decision and others (e.g. UK/German dependencies, TMA redesign) have been discussed in Design Group meetings, but we found no evidence of a consistent and sustained attempt to track all 'external' project dependencies and their interfaces with DARP Track 2 specifically. |
| **Design Constraints** | "Guiding Principles"<br>"Building Blocks"<br>"Design Premises"<br>(terminology sometimes confused) | No | Nowhere is a set of Design Constraints specifically identified, although several clearly exist. For example: current airspace volume, airport locations and the international route network are design constraints if they are not to be changed by the design, although these were labelled "Guiding Principles" in the initial decision. The issue may therefore be one of terminology, but it is nevertheless an important enabler for airspace design to be open and clear about the 'design constraints' being imposed Design Group. For example, even the two high level goals from the Future Airspace Vision 2012 (i.e. incorporate a new military training area in the north and redesign the airspace over east and south east Netherlands) might be considered design constraints, given the fact that alternative solutions to meet key military and civil needs are also likely to be poss ble, even if highly undesirable.<br>The DARP Track 2 Design Group kick-off meeting described a set of "Premises for Design" which covered a combination of design constraints and very high-level design principles, although these were not aligned to the objectives set within the National Airspace Vision and Civil Aviation Policy Memorandum. They were not prioritised, or classified *essential* and *non-essential*, which can lead to problems when principles are later identified as conflicting. In Design Group meetings the following three 'work packages' were defined to provided structure to design activities: Northern Training Area, Access in the Southeast and Development of Schiphol Terminal Manoeuvring Area (TMA) concept. |
| **Options Appraisal Criteria**<br>Facilitate design decisions and quantitative assessment and trading of design principles and requirements | Assessment Framework | No | The high-level DARP Assessment Framework as described in the Initial Decision was used as an input to the Design Group meetings. However, this was little more than a top-level list of design criteria. A more detailed and quantified Assessment Framework needs to be developed for Track 2 and applied to the development and assessment of *all* design options.<br>In addition, **tracing** this Assessment Framework to the DARP (T2) User Requirements set would enable it to meet the best-practise requirement for a set of Design Principles, providing a robust framework for the stakeholder acceptance of any preferred option. |

| | | | |
|---|---|---|---|
| **User Requirements** | User Requirements | Partial | At the time of the Track 2 Design Group kick-off meeting (Sep 2019) it was stated that requirements elicitation from the Airline and international stakeholders remained in progress. Military and Civil ATC requirements had already been captured, and an initial set of DARP "user needs" had been collected from all stakeholders – including public entities, GA and Environmental groups – through a process of questionnaires and meetings in 2018, culminating in an 'integrated user needs' document during the DARP Research phase. Within the Initial Decision document however, there was little evidence (direct or referenced) to justify why certain airlines or communities had been selected to provide stakeholder input.<br><br>This initial requirements -capture process, along with the structuring and consolidation activities which followed it in the exploration phase, was extensive in scope and formed an important stakeholder engagement exercise but in practical terms the output was effectively a very large "wish list" of requirements from a wide range of stakeholders, of limited practical value to the Design Group. limitations of the requirements set for design purposes include:<br>• Too many requirements for designers to consider all at once (even with airspace users prioritised)<br>• Requirements all generic to all DARP; no attempt to identify specific applicability to Track 2<br>• No clear attempt to prioritise requirements (e.g. Moscow method: shall, should etc)<br>• No clear attempt to group or categorise requirements (e.g. capacity, noise, complexity etc)<br>• Inconsistent phraseology used e.g. "must", "it is necessary", "it is the wish", "it is desirable"<br>• No consistent attempt to quantify requirements into performance objectives (i.e. to implement a performance-based approach to requirements elicitation)<br>• Key requirements for feasibility (e.g. ATC complexity) deprioritised if not from airspace users<br>• Important requirements in several areas (e.g. ATC 'trainability', military mission 'flex bility') were thought by some stakeholders to remain 'hidden'<br>• Military and Civil requirements all considered "equal priority" – makes design prioritisation difficult<br>• Relationship between Military airspace user requirements and MME not clear to non-military stakeholders<br><br>These limitations, in combination with other factors and despite the best efforts of Project Management, hampered design progress and sometimes lead to frustration in Design Group meetings. For example, discussions occurred in which the representatives of one stakeholder group would challenge the requirements of another, sometimes leading both parties to then adopt defensive "negotiating positions" over their respective design requirements. |

*Figure 5. Analysis of information, data and guidance inputs received by the Design Group (by September 2019)*

[redacted]

**Recommendation 1**: Clarify and clearly communicate the DARP Vision (The “Why?”) in a way that is relevant to DARP Track 2. This could be expressed as a Statement of Need.

**Recommendation 2**: Communicate and stick to a consistent terminology for all design inputs and outputs. This could be in the form of a DARP Glossary.

**Recommendation 3**: Rationalise and reduce the number of design inputs for the Exploration Phase (and where appropriate also the Plan Elaboration Phase) of Track 2.

**Recommendation 4**: Update and prioritise the DARP Track 2 user requirements. Specifically, this should include:

1. Improve understanding of airspace user requirements: adopt a performance-based approach and increase granularity back to essential user need where possible (e.g. Military MME and flexibility, Schiphol TMA shape).
2. Introduce a clear prioritisation scheme for all requirements, including civil and military airspace users.
3. Implement a ‘hidden requirements’ elicitation session to see if the Design Group and/or other stakeholders think any key user requirements are still missing.
4. Trace all requirements to the Assessment Framework
    a. Standardise level of quantification.
    b. Assess and indicate applicability of each requirement to DARP Track 2.
    c. Ensure all key stakeholder needs are reflected (not only airspace users).
5. Standardise requirements format and language/phraseology.
6. Make it easy to sort and group requirements (e.g. by capacity, noise, complexity etc) to aid designer understanding and design validation.

To expand upon Recommendation 3, the table in Figure 6 summarises a potential set of rationalised inputs for DARP Track 2 based on our analysis.

| DARP Track 2 Document | Purpose | DARP Action |
|---|---|---|
| Civil Aviation Policy Memorandum 2020-2050 | State Requirements; airspace redesign framework | Await availability |
| DARP Statement of Need | Common vision: the "Why?" | Write and communicate |
| Initial Decision and NRD | Process and governance, design objectives | Map and communicate the end-end design process flow |
| Design Constraints | Clearly capture all constraints (existing decisions) being imposed upon the Design Group | Compile from other sources (e.g. Guiding Principles, Building Blocks, Design Premises) and manage at a DARP Track 2 project level |
| Assessment Framework | Key principles to design against, options assessment, stakeholder engagement | Complete Assessment Framework and implement full traceability to user requirements |
| User Requirements | Complete database of user requirements from airspace users and other stakeholders | (See specific Recommendation) |

*Figure 6. Proposed actions to complete and consolidate Design Group input information*

### 3.1.3 Design option traceability

#### 3.1.3.1 Key questions

- *Is how the programme arrived at the design options sufficiently traceable?*
- *If not, what specifically is missing?*

#### 3.1.3.2 Design Group reports

A key source of documentation for understanding the traceability of the design options were the Design Group minutes and reports to the steering group, comprising seven documents in total from September 2019 to March 2020. The documents tell a story of the exploration of various design options including, at different times: national options, international options and occasionally working on ideas for the North or South/South-East of Netherlands airspace separately. The study of these documents provides, subject to each reader's interpretation, an element of traceability in how the current design was produced. However, not all key decisions and design process steps were clearly recorded. For example the key decision taken by the project manager with a small (and representative) subset of the Design Team in January 2020 – to communicate the Three States to the Design Group as the new basis of the DARP Track 2 design work – was only elicited and understood through interviews.

**Recommendation 5:** Track all design progress against the agreed DARP Track 2 design process flow, ensuring that Design Group members know exactly how their current task maps to specific project goals.

More broadly, this somewhat informal method of 'design traceability' through regular minutes and reports carries an inherent risk of losing important design information. Best practise would be to implement instead, a structured and transparent method of traceability from the very beginning of the design process, based around the tracking of all options considered against an agreed set of quantified Assessment Criteria / Design Principles, on an iterative basis.

#### 3.1.3.3 Comprehensive options coverage

A design goal should be to aim for 'comprehensive coverage' – in other words, sufficient information to justify to *any* stakeholder (including the regulator) that "every possible" option was considered and assessed against the agreed criteria. The meaning of "every possible" will always contain a strong subjective element, but if stakeholder and/or regulator confidence in the final design is likely to be important then this principle of good airspace design becomes essential. In the case of the Exploration phase for DARP Track 2, it is not clear whether a "comprehensive" set of possible options were briefly considered and discarded without record, or whether such options were never considered at all. Figure 7 shows an example of best practise for an airspace design Feasibility & Options (equivalent to DARP Exploration phase) process.

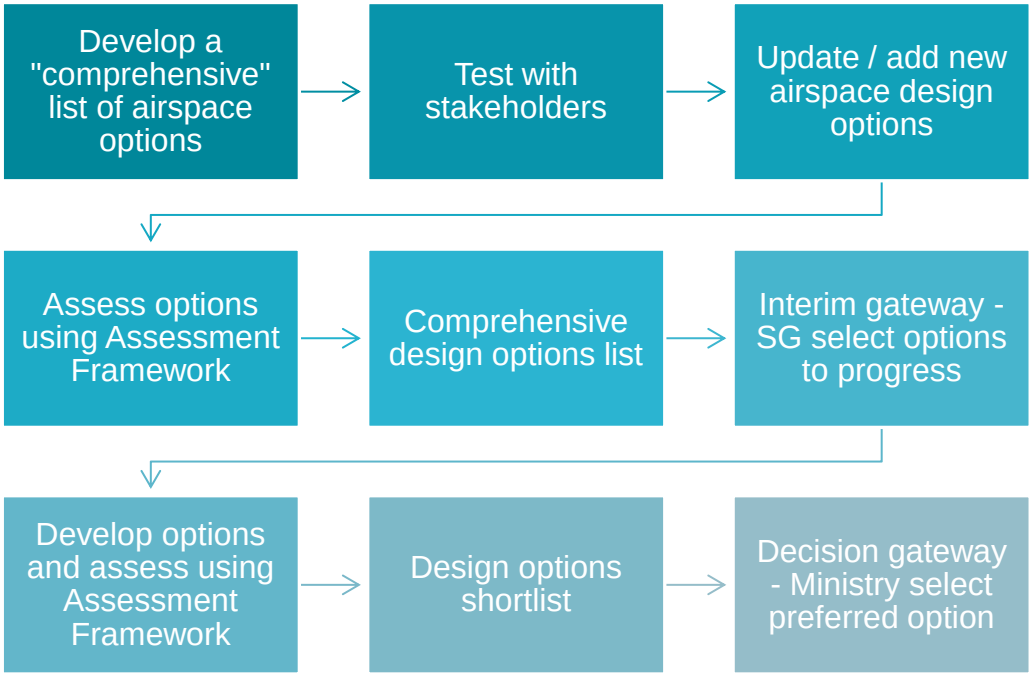



*Figure 7. Example of best practise for an airspace design F&O process*

**Recommendation 6:** Make it a design principle to provide "comprehensive coverage" of airspace design options, including the do-nothing option.

**Recommendation 7:** Track and assess all airspace options considered (however sub-optimal some may appear, and even if one or more stakeholders claims that a 'showstopper' issue exists) until at least the end of the DARP Exploration Phase.

#### 3.1.3.4 Possible alternative options

One conclusion to be made from the analysis of design inputs in Figure 5 above is that there may have been too many restrictions placed on designers at what should still be thought of (despite the approaching 2023 deadline) as an early stage in the project. The Exploration phase is well named – designers should be encouraged to explore and play with "blank sheet" options (subject to a clear set of design principles and constraints) without having to consider from the beginning dozens of potentially conflicting requirements. For example, a valuable exercise might be to try to produce efficient designs simply by considering up to date technological advancements, ensuring compliance with PANSOPs and meeting safety legislation. Free-thought sessions between talented designers using the language of "what if?" and "just imagine" are essential if truly innovative solutions are to emerge.

When asked whether it might be possible to design a "better solution" than the Three States, several members of the Design Group replied in the affirmative - that given a very clear set of constraints, a useful set of design principles (or an updated Assessment Framework) and the freedom to conceive new design against a blank sheet of paper rather than over the existing National airspace structure, better (i.e. more beneficial) designs for the future airspace structure of the Netherlands might be possible. As long as DARP remains in the exploration phase, this possibility is important to explore.

> **Recommendation 8:** Organise at least one 'blank sheet' brainstorming/design session (ideally in small groups of up to 6 people) to investigate the likelihood that other options are possible. This should take as minimum inputs 1) the completed Assessment Framework and 2) a clear and unambiguous set of Design Constraints, informed by the research phase.

In relation to Recommendation 8 it is worth noting that the report 'Netherlands Airspace Review', conducted by Helios for LVNL in November 2017 (reference in Appendix A) studied three separate airspace scenarios for the Netherlands, proposed by LVNL. This report concluded that none of the three scenarios (in the form they were presented) would meet all the needs of all airspace users. However, it did *not* conclude that all possible options had been considered. The report further recommended that stakeholders adopt a more performance-based approach to requirements definition, to enable options to be refined to better balance the needs of the different stakeholders. This recommendation remains valid and is represented through Recommendations 4 and 12 of this report.

### 3.1.4 Process bottlenecks and obstacles

#### 3.1.4.1 Key questions

- *Which bottlenecks can be identified in the process?*
- *Are there any recommendations on how identified bottlenecks can be overcome?*
- *Is anything hindering the design discussions?*
- *What actions should be taken to avoid the process getting stuck?*

#### 3.1.4.2 Understanding the Track 2 process flow

To identify and understand any bottlenecks in the DARP Track 2 Airspace design process it was first necessary to understand the process itself.

The Airspace Change Process (ACP) declared for use in DARP including Track 2 was formally described in the DARP Initial Decision (ID) document, published by the Government of the Netherlands in April 2019.

### MIRT-based DARP Change Process

The formal Change Process for DARP (Tracks 1, 2 and 3 together) was to follow a phased approach as outlined in the Multi-Year Programme for Infrastructure, Spatial Planning and Transport (MIRT) that applies for infrastructure on the ground. This is summarised in Figure 8. This process and its application to DARP was elaborated in writing throughout the Initial Decision.

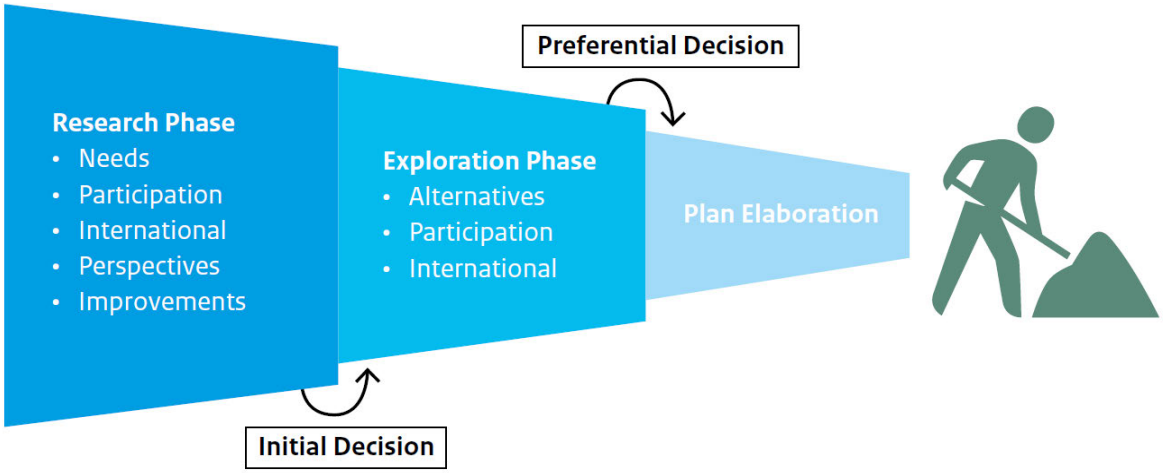



*Figure 8. DARP MIRT-based Change Process from Initial Decision*

### DARP Approach specific to deliveries for 2023 (i.e. T1 and T2)

In addition to the overall DARP ACP process, the Initial Decision defined (in Section 4.3 and Appendix 5 of the Initial Decision) a separate 'linear approach' process for application specifically to "projects with an envisaged outcome for or in 2023", in this case meaning DARP Track 1 and Track 2. The basic process, as described in the Initial Decision (Appendix 5) can be found in Appendix C of this report. Appendix D shows the same process in more detail, including the information from Section 4.3 and key interfaces to Tracks 1 and 3.

Aside from the MIRT-based Change Process diagram, the Initial Decision did not include a DARP process flow diagram. Helios' graphical interpretation of the written ACP for DARP (all tracks) described in the Initial Decision can be viewed in Appendix F.

### Helios Review of the Initial Decision (May 2019)

Shortly after the publication of the Initial Decision, in May 2019 at the request of the Government of Netherlands, Helios completed an International Review of the DARP Initial Decision and provided a set of recommendations. These recommendations focused on best-practise improvements to the overall ACP process and practical measures for its implementation and did not specifically focus on the linear approach proscribed for Tracks 1 and 2. Helios' resulting recommendation for the Overall DARP ACP Process is shown in Appendix H.

Following this review, several recommendations from the International Review of the Initial Decision were adopted and applied to DARP Track 2, while others were not. At this stage no detailed DARP process flow diagram was communicated by the programme to confirm the final process that would be applied to DARP.

#### T2 Change Process, as communicated within the Design Group

On 20 September 2019 the DARP Track 2 Design Group held their first design workshop. Without reference to any other process, the minutes of this meeting clearly described the process which the Design Group would be intending to follow, including their interaction with the Steering Group. Helios' understanding of this description is shown in Appendix G.

The process described from this workshop did have elements in common with the DARP Track 2 process described in the Initial Decision (Appendix E), but differed significantly in that it did not mention any of the following DARP Track 2 activities, which the Initial Decision had defined for completion within the Exploration Phase:

- Development of Track 2 Operational Concept, or CONOPS
- Validation by simulation
- Integration of key project dependencies
    - Free Route Airspace over FL245
    - SW Airspace redesign
    - iCAS

A new set of 'Premises' and 'Considerations' for design were introduced, and the Memorandum on Scope and Detailing (NRD, July 2019) was referred to as providing the 'Reference Framework'. This meeting also introduced a new design framework for noise and emissions, with a boundary of prioritisation at 6000ft. The Network Manager's NEST tool was employed for early analysis of some initial airspace design options.

### 3.1.4.3 Communication of Track 2 process flow

As a general conclusion it seems clear that although the programme did attempt to define and communicate an airspace design process for DARP Track 2, this goal was not successfully achieved nor clearly recorded. In terms of best practise, a single process flow clearly communicated to all stakeholders (including the Design Group) is needed to ensure that all parties clearly understand how each activity fits into the wider process – and by extension into the programme's high-level goals. This process flow should include at least one flow diagram showing the complete end-end process, including the interfaces between separate workstreams (e.g. Tracks 1-3) and wherever possible dependencies on other related projects (e.g. TMA, UAS FRA) and stakeholders (e.g. international). A clearly communicated process flow such as this brings several important benefits, including:

- Facilitates effective activity planning – the 'what next' and the 'why this'.
- Enables activities to be properly tracked and monitored against the agreed process.
- Better tracking of project dependencies, which aids risk management.
- Quicker identification of process deviations or bottlenecks enables rapid reporting and resolution.

> **Recommendation 9:** Define and communicate widely one clear detailed process flow for DARP Track 2, with accompanying flow diagram(s). This should accommodate iterative design development, with regular internal 'gateways' to determine which options to progress for further design work.

#### 3.1.4.4 Process bottlenecks

Within the DARP Track 2 design process, some clear steps were taken. It is now important to formalise the steps taken and to connect all the pieces.

In comparing the work and direction of the DARP Track 2 Design Group against both the process defined in the Initial Decision (see Appendix E) and the process that was outlined within Design Group meetings in September 2019 (Appendix G), in combination with our stakeholder interviews, we identified several key themes.

##### National vs International Options

Common to both of these written processes was the objective of developing and accessing both national and international design options, under the premise that an international option would be preferable if both MUAC and the neighbouring states (especially Germany) were found to be able to accommodate the impact of DARP Track 2 changes within the required T2 timescales. This was summarised in Section 4.2 of the Initial Decision, as follows:

> *With regard to the aforementioned results [for 2023], the outcome may be further enhanced through cooperative agreements with neighbouring countries. That is why responsible government officials are striving to engage inactive cross-border consultation. Where possible, bilateral agreements are being made, as well as multilateral agreements within FABEC.* ***Should it prove unfeasible to arrive at international agreements of this kind before 2023, because neighbouring countries are not yet fully prepared, the focus will then shift to (possibly temporary) national redesign.*** *This alternative will be taken into account in the design process of the projects for this path.*

This aspect of the process introduced some complications and unknowns for Design Group members, including:

- Developing two sets of options in parallel potentially implies double the effort.
- To what extent might a beneficial “national redesign” (without international bilateral or multilateral agreements) actually be possible?

Our conclusion is that in practice the term “national redesign” came to be informally applied within the Design Group to any option which would not incorporate a Military Cross-border Area (CBA) with Germany. By this second definition, a “national” option may still require bilateral and multilateral international agreements (in addition to MUAC, who of course are a DARP programme partner), so the rationale described in the Initial Decision for pursuing it would no longer necessarily apply.

Another conclusion that can be drawn from the T2 Design Group’s output to date is that any realistic solution within the current scope of T2 is likely to have a significant Military and Civil impact on neighbouring states (especially Germany), both in relation to the North of the Netherlands and to the South / South-East. Whatever the end goals for DARP (e.g. Military CBA with Germany), any interim solution should therefore aim to ensure that all ‘interim’ international agreements are clearly justified as positive steps towards the final design.

> **Recommendation 10:** Recognise that a “national redesign” (i.e. without need for bilateral/multilateral international agreements, beyond MUAC) is not a realistic option, and therefore ensure that any interim international agreements are clearly justifiable as positive steps towards the end goal for DARP.

### Design Group – Steering Group Interaction

A process for iterative interaction between the Design Group and the Steering Group was discussed and communicated in early T2 Design Group meetings (Appendix G). This appears to have been well understood and followed, such that between September 2019 and March 2020 a written report was delivered to each of the three Steering Groups (in December, January and March). From these reports it is clear that at specific times (e.g. in January) the Steering Group did provide clear and unambiguous guidance to the Design Group, as and when needed.

On the other hand, several Design Group members expressed a concern that between October and December the Design Group was encountering serious difficulty in finding a solution to meet all user requirements, and as a result was approaching something of a stalemate. These members felt as though they were simply being asked to keep trying, which sometimes resulted in reworking previously studied design problems without finding any new outcomes. What the Design Group really needed from the Steering Group during this period was instruction concerning a material change in the user requirements – for example, the freedom to prioritise specific aspects of Civil/Military requirements over others. Such instruction would almost certainly first require some 'negotiation' of user requirements (for example Civil/Military) at a more senior level than the Design Group.

In the event, the minutes of the Design Group meeting dated 23rd January noted the following:

- *In the design sessions of 2019 we looked for options in light of required time, prioritization and 100% fulfilment of the requirements.*
- *After the Steering Group meeting of 12 December 2019 and LVNL-CLSK meeting on 10 January 2020 new guidelines are given. In 2020 we will move from a 3D approach to a 4D/5D approach. Not 100% of the requirements need to be met. Therefore, we are going to define different States (priority cases) that can be used at different times.*

This means that rather than incompatible user requirements being negotiated at a more senior level than the Design Group, the Design Group was instead asked to continue to accommodate the existing set of (somewhat inflexible) requirements using an advanced – but not fully understood and potentially highly complex – technological development (i.e. Advanced FUA). This strategy certainly offers a possible solution for the Netherland's future airspace design and is worth exploring further. However, refining and negotiating the DARP Track 2 requirements at a senior level remains an essential task, and may yet facilitate design options that are more elegant and less complex, which would therefore carry less cost and timescale implementation risk.

> **Recommendation 11**: Prioritise the refinement and negotiation of Civil/Military requirements at senior level, with the goal of facilitating new airspace design options in addition to the Three States.

### Options assessment

The design process agreed in early T2 Design Group meetings (Appendix G) clearly specified that the Design Group would identify the benefit and impacts of each option it could identify, and then produce a "trade-off matrix" to summarise these pros and cons. These process steps should have helped the Design Group to guide and communicate its own progress, as well as providing an essential record of traceability to the final option, but from the stakeholder interviews and the documentation available there is no evidence that they were followed.

**Recommendation 12:** Prioritise the completion and implementation of the DARP Assessment Framework (KPA/KPIs) to facilitate the development and assessment of new airspace options, covering all DARP Tracks.

#### TMA & Related Projects

The premise that the airspace structure of the Netherlands can be redesigned as the foundation for a new set of TMAs with an accompanying Concept of Operations (e.g. in DARP Track 3) is fundamentally flawed, and appears to have been driven partly by the 2023 deadline to facilitate political acceptance of the opening of Lelystad. Rather, to produce an effective (ideally optimal) and future-proof airspace design it is necessary to consider *as inputs* a holistic set of accompanying decisions about how that airspace will be managed. These decisions should include such elements as TMA designs, fixed/free routing, airport runway configurations, Civil-Military interaction, innovative present/future ATM technologies etc.

As such, designing airspace within the DARP Track 2 project in any sort of isolation from key related projects (whether internal or external) will inevitably lead to suboptimal solutions being progressed, and quite possibly to significant rework and delay. To an extent this appears to have been recognised by the DARP team, such that in March 2020 Track 2 Design Group members had begun to share meetings with the LVNL TMA design team with a view to facilitating alignment of DARP airspace designs and Schiphol TMA designs. This joint working needs to continue in as close a capacity as possible, with the relationship being formalised in an updated programme process flow and managed through tight project control.

**Recommendation 13**: Bring TMA design activity into the DARP design process

The same may also be true of a variety of other dependent projects and initiatives (e.g. iCAS, Schiphol, One ATM…) which are outside the scope of this review but which would appear to have a strong interdependency on effective airspace design and/or its implementation.

**Recommendation 14:** Perform an analysis of all Related Projects to determine which of them should, or are likely to, influence the future airspace infrastructure of the Netherlands. Where dependencies are identified, consider implementing overarching dependency management at Steering Group level or above, to include shared design activities where appropriate.

### 3.1.4.5 Other Design Group obstacles

In terms of how the Design Group went about their task, a large amount of determination, resilience and creativity was evident both in the design group reports and from the stakeholder interviews. Despite limitations in the information and data provided, and uncertainties remaining regarding the work's purpose and process flow, the Design Group sessions themselves appear to have been well-managed and most often productive. Several stakeholders expressed their strong belief in the value of the 5-partner team approach. Even as the sessions started to get more difficult towards the end of 2019 – at which point it was becoming apparent to many of the Design Group that they were highly unlikely to be able to find a solution to meet all the airspace user requirements – creative approaches were conceived and attempted. For example, in one session military and civil experts spontaneously decided to swap roles to view their design problems from an alternative perspective, thereby hoping to identify new possible solutions.

However in this difficult phase, from around November 2019 to January 2020, several of the Design Group also reported feeling a sense of frustration that when no solution was initially

forthcoming they were repeatedly asked to tackle the same problem, without any significant change in the design parameters or requirements. This led to a perception of performing unnecessary rework without any significant change in outcome, which some group members felt was due to a lack of appropriate guidance from above.

What the Design Group really needed to move forward constructively at these times was an updated brief from the Steering Group: ideally significant changes to (or new prioritisations for) the conflicting Military and Civil airspace user requirements which were becoming so difficult to meet within the context of existing design constraints (not least, the limited total airspace volume of the Netherlands). Instead, the Design Group frequently resorted to the behaviour of requirement negotiation within the design activity – challenging and defending each other's requirements in an attempt to unlock new design solutions – which only served to reduce the sense of team spirit and goodwill within the team.

> **Recommendation 15:** Conflicting airspace user requirements to be refined, prioritised and negotiated at senior/political level, outside of Design Group meetings, whenever a viable design solution cannot otherwise be found.

In relation to these difficulties, several Design Group members mentioned the negative legacy carried over from the earlier project "Cross Border Area Central West" (CBA CW) which had involved several members of the DARP Track 2 Design Group and which had ended in failure and a certain amount of acrimony. Whatever the precise historical circumstances, this 'hangover' has apparently never been completely resolved between the various parties of the Design Group and as a result it is now a source of underlying mistrust.

> **Recommendation 16:** Recognise and address underlying team trust issues directly, perhaps through discussion sessions and team-building exercises. This should include (but not necessarily be limited to) addressing the outcome of the CBA CW project.

A further observation is that while most Design Group meetings had around 20 attendees, the Design Group was usually at its most productive when working in small teams of 5-6 designers. This was achieved in various ways, including breaking the room up into 3-4 separate teams, or arranging smaller sub-meetings outside of full Design Group sessions. Smaller teams bring several advantages - not least the opportunity to develop greater trust and a sense of 'solidarity' through closer working relationships.

> **Recommendation 17:** Find a way to formalise performing a significant proportion of the design process in smaller teams of up to 5-6 experts.

For example this could mean appointing a "Core Design Team" of 5-6 designers to progress the design work on an ongoing basis, calling in other experts as required, or it may instead involve implementing a clear hierarchy for the whole team to implement during Design Group meetings.

### 3.1.5 Process integrity

#### 3.1.5.1 Key question

- *Does the programme take the necessary steps to ensure the integrity of Track 2 and 3?*

#### 3.1.5.2 Relationship between Tracks 2 & 3

Within both the Initial Decision and the NRD, DARP Track 2 is several times referred to by no other name than a "Project with results in 2023". It is therefore easy to conclude that DARP Track

2 has so far been defined more by this delivery date than by its intended output of a new main airspace structure for the Netherlands.

From both a design and a cost/benefit perspective it could actually be more sensible to design and implement a new main airspace structure for the Netherlands in progressive and incremental tranches between now and 2035. Furthermore, it may not be necessary to change the entire airspace in a single design. One workstream might focus on the South/South-East while another looks at the North, for example, and individual modifications to Military airspace might be made one-by-one over time, with Advanced FUA concepts introduced slowly as part of a gradual process. It is not clear from the material we studied why such sensible possibilities appear to have been excluded from the DARP programme.

Section 3.1.4 outlines our analysis of the DARP process flow, as described and referred to in the Initial Decision and the Memorandum of Scope and Understanding (NRD). Appendix E shows Helios' interpretation of this process in the form of a flow diagram. Regarding the relationship between DARP Track 2 and DARP Track 3, the following points are apparent:

- Track 2 has its own process distinct from Track 3 and even its own process phases (Definition, Design, Realisation), although these do largely correspond to equivalent phases in Track 3 (Exploration, Plan Elaboration, Implementation)
- Track 2 is intended to produce the "Airspace Results" for 2023, which should then become a "Guiding Principle" for Track 3, feeding into the "Variant Scenarios" being developed and assessed (along with other Guiding Principles and innovation-related "Building Blocks" from the Research Phase e.g. Inter-airport planning coordination, Advanced FUA, CDAs…)
- The selection of the final "Airspace Results for 2023" is intended to form the airspace structure for Track 3 through to 2035, and therefore for the future of the Netherlands.
- It is intended for an airspace design to exit the Track 2 Definition phase after being validated by simulation, but *not* after being subjected to any sort of "Variant Scenarios" (i.e. options analysis) process, such as will be applied in Track 3.

This process as written is inadequate, for at least the following reasons:

- The scope of Track 2 is to design an airspace structure for the future of the Netherlands, through to 2035 and beyond. This is an enormous task, well worthy of being a programme all on its own. To consider it a short-term input to another (more rigorous and longer term) process, appears to underestimate its complexity and importance.
- As mentioned previously (section 3.1.4.4), designing an effective and future-proof airspace requires considering as inputs a holistic set of accompanying decisions about how that airspace will be managed. For Track 2 this should include all the Guiding Principles (e.g. future Lelystad movements, international route networks, One ATM) and innovation-related Building Blocks (e.g. Inter-airport planning coordination, Advanced FUA, CDAs) that are described in the DARP process as being inputs *only* to Track 3.
- Both Track 2 and Track 3 describe separately the development of CONOPS. Although they may have many different aspects within them, these cannot be two separate activities. The Concept of Operations for Track 2 and Track 3 is necessarily one and the same.
- Guided by SESAR, including through the implementation of iCAS in the Netherlands, the future of airspace design in Europe will increasingly incorporate 4D trajectory management – a significant evolution from today's methods of managing air traffic to fixed (adaptation-defined) airspace routes. Attempting to define a long-term 'airspace structure' in advance of

developing a new Concept of Operations for the Netherlands, based on developing technologies, may therefore be putting these two activites in the wrong order.

On this basis, the apparent attempt to define DARP Track 2 as both the "project with results in 2023" **and** at the same time "a new airspace structure for the Netherlands" is extremely optimistic, and likely to lead to sub-optimal outputs involving large amounts of rework and unnecessary expense. *Either* the project should be defined by its deadline - in which case its key task should be to identify the most beneficial "quick-wins" for National ATM (not necessarily a national airspace redesign) in alignment with the national strategy – *or* it should be defined by the goal of delivering an optimal, future proof, sustainable, robust and adaptive airspace design for the Netherlands – in which case DARP Track 2 should be the main and central project of DARP.

**Recommendation 18:** Clarify what defines DARP Track 2: the deadline or the task?

**Recommendation 19:** Make a redesigned airspace structure with accompanying CONOPS the central deliverable of the DARP programme.

**Recommendation 20:** Plan a new series of DARP 'benefit drops' through to 2035.

As the Exploration Phase has progressed, the DARP programme has clearly recognised the importance of keeping Tracks 2 and 3 aligned and has introduced the concept of defining and monitoring the 'interfaces' between the two tracks. Given the existing programme structure, this is an understandable and sensible measure to implement, and in the short term it is likely to help the two Tracks stay aligned. However, as the design complexity naturally increases it is also likely to be a frustratingly complex and time-consuming activity, and almost certainly insufficient on its own to enable DARP to deliver the "future-proof airspace design" that the Netherlands needs.

More generally, at the time of this review DARP project control was being performed centrally, with only certain risks and issues being noted as relevant to DARP Track 2. Without its own dedicated risk register, the airspace design process is more vulnerable to hidden risks and dependencies than it might otherwise be. It was also noted that all risks were being assessed against time impacts only, based on a programme-level decision that time would be the essential programme success factor (with cost being less important). However despite elevating time to this level of importance, no attempt has yet been made to quantify the impacts of all identified risks on the project schedule.

**Recommendation 21:** Implement Qualitative Schedule Risk Analysis (QSRA) against the DARP programme schedule (including DARP Track 2).

## 3.2 Review of The Three States

### 3.2.1 High-level Observations

#### 3.2.1.1 Key question:

- *Provide some high-level comments on each State, based on the information available.*

#### 3.2.1.2 Introduction

As part of our desktop study we undertook a high-level review of the operational considerations for dynamic use of all three proposed states. The three states developed for assessment against the Reference scenario (current airspace) are depicted below in Figure 9.

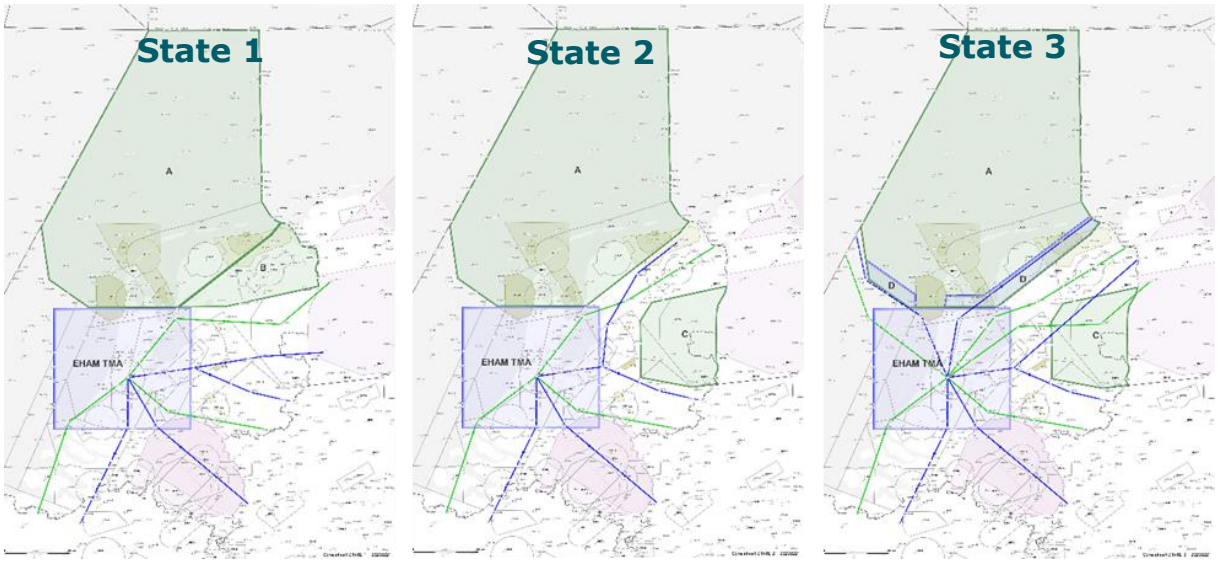



*Figure 9. Depiction of the Three States developed (March 2020)*

#### 3.2.1.3 State 1

In State 1, EHTRA 10 is expanded with an additional fillet of airspace to the South-Eastern boundary (labelled B) and the southern boundary is subject to a small revision northward to allow the northward expansion of the Schiphol TMA. A detailed depiction of State 1 is shown in Figure 10.

The resulting expanded volume contained within EHTRA 10 appears sufficient to accommodate the MME airspace requirements required by all national fleets including F-35 and other 5th generation fighter aircraft. The airspace volume provided appears sufficiently large to accommodate separations of circa 120nm x 80nm, and the area is predominantly offshore allowing supersonic and sub-sonic sortie profiles. The expansion also includes an enlarged onshore airspace volume that appears sufficient to accommodate a variety of overland sortie profiles including close air support. It is assumed that the basing policy for F-35 and other fleets allows acceptable transit times and aircraft have unhindered access to and from EHTRA 10 at operationally efficient altitudes.

The impact (gains and losses) in terms of track mileage flown varies within State 1 depending on whether the military are operating in EHTRA 10. When EHTRA 10 is active certain ATS routes will not be available for civil traffic resulting in increased track miles for traffic routed around the area.

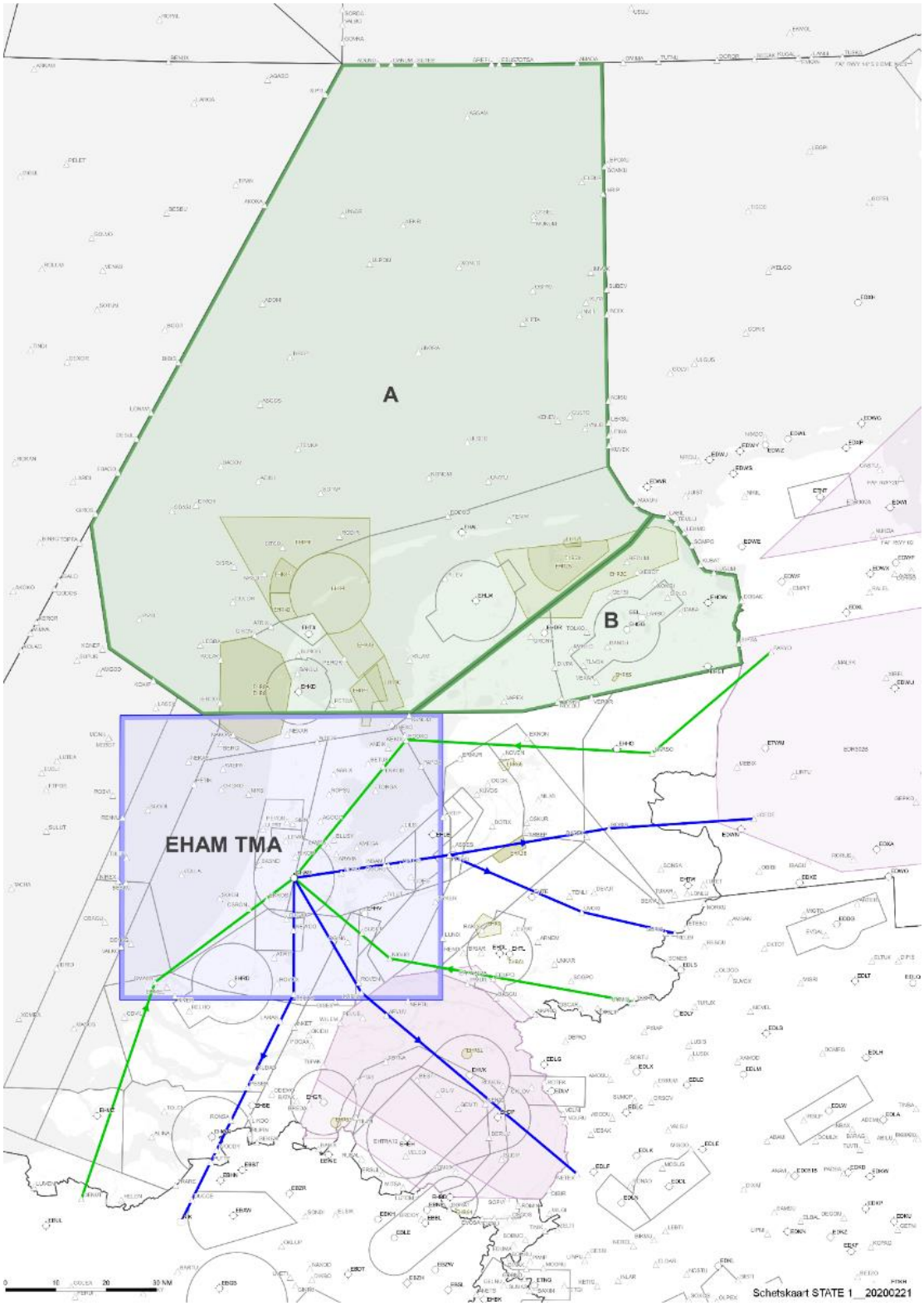



*Figure 10. Depiction of State 1*

Amsterdam (EHAM) traffic departing to and arriving from the East/North-East will be impacted by the change. Traffic departing and arriving Rotterdam (EHRD) and Eindhoven (EHEH) are likely to be similarly affected. Extended arrival routings to EHAM from the South-West may result, adversely affecting certain city-pairs e.g. EHAM/EGLL and EHAM/EGKK. However, these increases in track miles flown may be offset by benefits (reductions in miles flown) on

other new routes. Dusseldorf and Cologne may benefit from the introduction of new arrival and departure routes made possible by changes to EHTRA 12.

It is not possible at this level of analysis to accurately assess any net gain or loss (in terms of track miles flown) in relation to the reference scenario, or the sum cumulative analysis when the combined operating hours of EHTRA 10 are considered over the longer term. Nevertheless, many other critical factors should be considered when trying to determine any net benefit.

**Recommendation 22:** The scope of analysis of all Three States should be extended to include a quantitative assessment (Fast Time Simulation) of other critical factors including capacity, complexity and workload (cockpit and ATCO).

#### 3.2.1.4 State 2

In State 2, the southern boundary of EHTRA10 is subject to a slight adjustment (small reduction) and the expansion overland seen in State 1 is removed. An additional overland area of airspace is established along the eastern FIR boundary, known as 'Area C', extending vertically from surface up to FL295. A detailed depiction of State 2 is shown in Figure 11.

The airspace volume contained within EHTRA 10 appears sufficient to accommodate the MME airspace requirements required by all national fleets including F-35 and other 5th generation fighter aircraft. The airspace volume provided appears sufficiently large to accommodate separations of circa 120nm x 80nm, and the area is predominantly off-shore allowing supersonic and sub-sonic sortie profiles. It is assumed that the newly established 'Area C' is of sufficient volume alone to accommodate the required overland sortie profiles without access to any larger volume of cross-border airspace. It is assumed, but not clear, whether the national fleet basing policy allows aircraft unhindered access to and from 'Area C' at operationally efficient altitudes.

As with State 1, the impact (gains and losses in terms of track mileage flown) varies within State 2 depending on whether the military are operating in EHTRA 10. It appears that the State 2 arrangement would meet MME requirements. However, when EHTRA 10 is active certain ATS routes will not be available for civil traffic, resulting in increased track miles for traffic routed around the area. Amsterdam (EHAM) traffic departing to and arriving from the East/North-East will be impacted by the change (reference DARP_13_Feb_20, Appendix A). When EHTRA 10 is active, certain routings that cross the areas will not be available e.g. routings via UCEDE, PARYD, AGISU. During STATE 2, traffic departing EHAM Eastbound or North-Eastbound will only be allowed in FLEVO_GRONY or FLEVO_DOBAK; traffic arriving to EHAM from the East or North-East will only be allowed to route via DOBAK_EEL or LUGUM_EEL, and routings via PARYD will not be possible. Traffic departing and arriving Rotterdam (EHRD) and Eindhoven (EHEH) are likely to be similarly affected as they will share the same routings as EHAM. Moreover, it appears that within State 2 traffic routing between EHAM and Scandinavia will experience increased track miles due to unavailability of access to Scottish FIR. Certain city-pairs would experience significant increased track miles e.g. EHAM/ENBR and EHAM/ENZV. However, it is not clear whether these increases in track miles flown may be fully offset by benefits (reductions in miles flown) on other new routes.

High-level analysis of track miles during State 2 activation suggests a slight reduction will result compared to the Reference Scenario. However, the use of FTS is recommended to accurately assess any net gain or loss (in terms of track miles flown) compared to the reference scenario, or the sum cumulative analysis when the combined operating hours of EHTRA 10 are considered over the longer term.

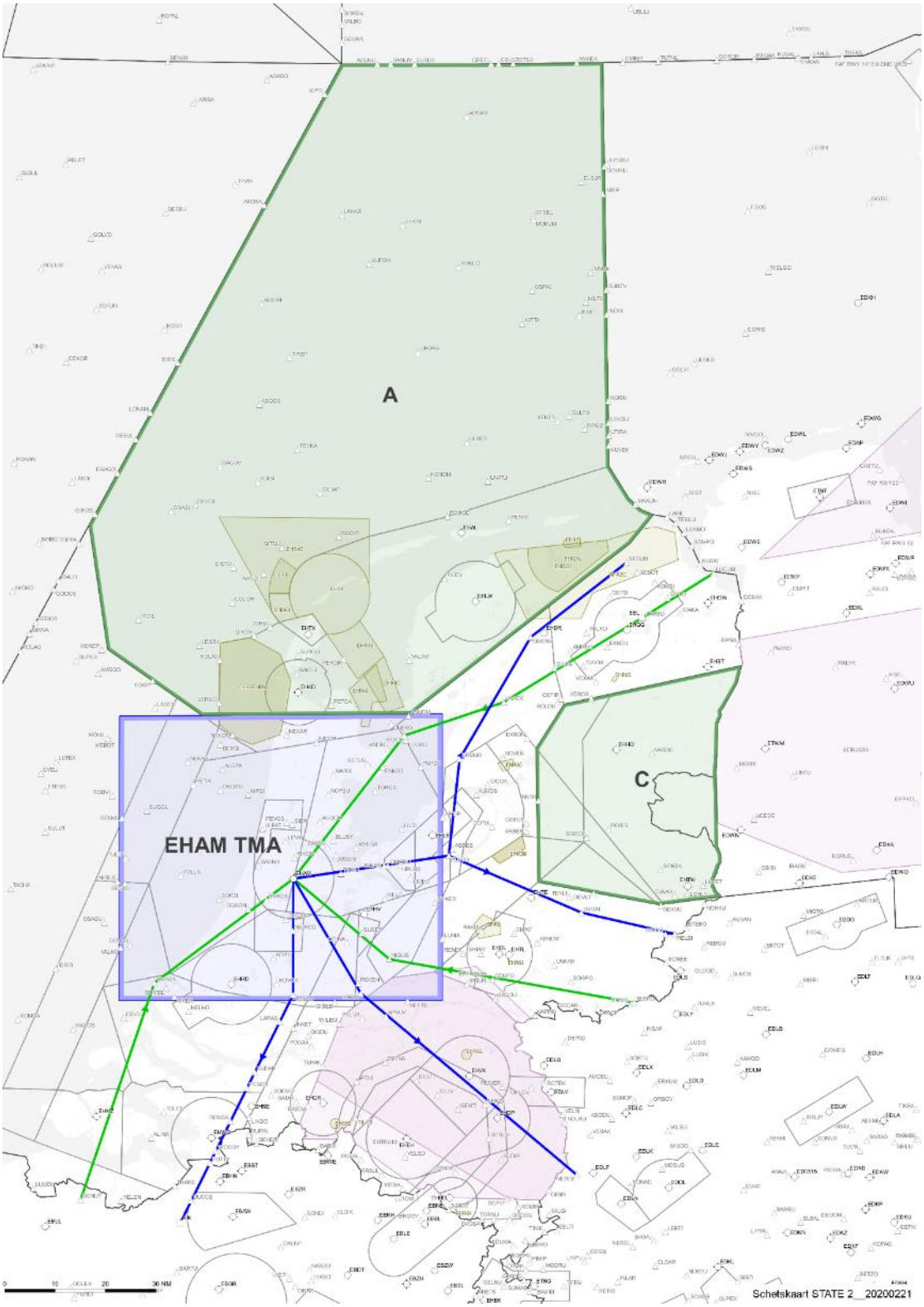



*Figure 11. Depiction of State 2*

#### 3.2.1.5 State 3

In State 3, the lateral boundaries of EHTRA10 are slightly reduced along the Southern and Eastern borders. The lateral boundaries of Area 'C' are reduced compared to State 2, and the upper limit in State 3 extends from surface up to FL195. A detailed depiction of State 3 is shown below in Figure 12.

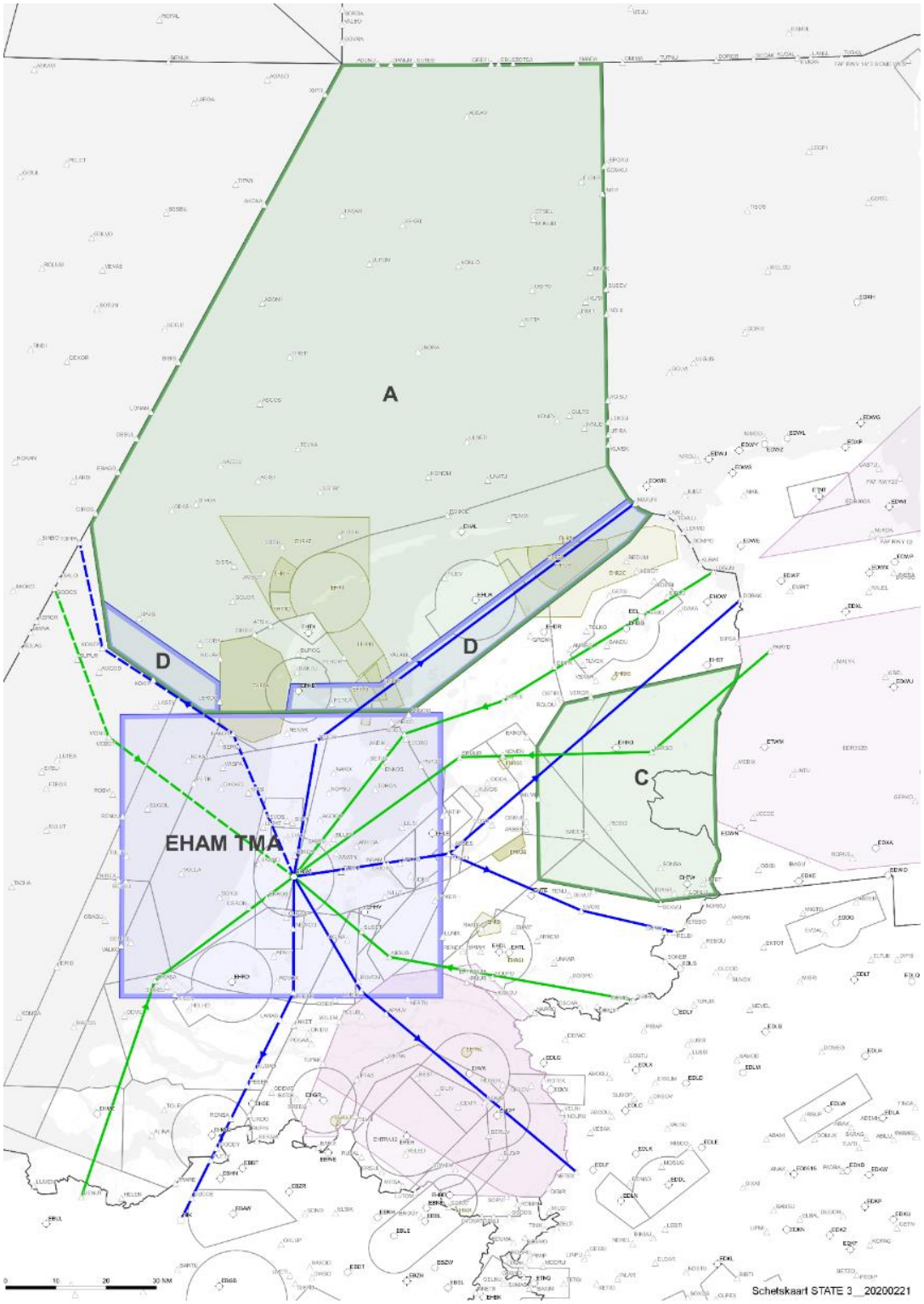



*Figure 12. Depiction of State 3*

The airspace volume contained within EHTRA 10 appears sufficient to accommodate the MME airspace requirements required by all national fleets including F-35 and other 5th generation fighter aircraft. The airspace volume provided appears sufficiently large to accommodate separations of circa 120nm x 80nm, and the area is predominantly offshore, allowing supersonic and sub-sonic sortie profiles. It is not clear whether the reduced airspace volume within Area 'C' is of sufficient volume alone to accommodate the required overland sortie profiles; it may be that the efficacy of this area is contingent on access to larger volume of cross-border airspace.

It is assumed, but not clear, that the basing policy allows aircraft unhindered access to and from Area 'C' at operationally efficient altitudes.

Within State 3 the departure and arrival routes to and from the East remain the same as States 1 and 2. However, an adjustment is made to routes to and from the West, where arrivals come via GODOS while outbound traffic routes via TOPPA. It is not clear whether this arrangement would be beneficial in practise and it may be preferred to retain the same inbound and outbound routings in each of the Three States. It is recommended that this is assessed via the use of Fast Time Simulation so that the preferred scenario is properly informed.

Within State 3, route lengths for traffic inbound to EHAM from Scandinavia, accessing via the Scottish FIR, is broadly neutral compared to the reference scenario (current airspace design), although some routes are slightly longer e.g. EHAM/EGNM. A similar result arises with arrivals from the South West e.g. EGLL/EHAM and EGCL/EHAM and this appears to be in common with States 1 and 2. However, these slight increases in route lengths are offset by decreases in arrival routes.

Again, the net gains and losses appear finely balanced and it is recommended that analysis be extended to include quantitative results via Fast Time Simulation.

**Recommendation 23:** Use Fast Time Simulation to assess route options for each of the Three States so that the preferred solution is properly informed.

### 3.2.2 Switching Between States

#### 3.2.2.1 Key question

- *Are there additional issues to consider as a result of working with Three States? For example:*
  - *Feasibility of changing States during the day (and even during a shift)*
  - *How this will influence sectorisation*
  - *Consequences for training and licensing*

#### 3.2.2.2 Problem Analysis

The concept of Advanced Flexible Use Airspace (FUA) requires the seamless adaption of airspace structures and volumes in response to fluctuations in demand across airspace user groups. Therefore, the need to transition between States is recognised in response to the need to accommodate increased demand particularly between military and civil users.

In this case, the switching between the Three States may affect the MUAC airspace arrangement above the Netherlands, specifically existing sectorisation arrangements within MUAC airspace. In addition, optimum airspace design often involves a high degree of alignment between ATS routes in Upper and Medium level airspace domains. It is not clear whether some of the new routes or directional flows proposed within each State may not be possible if any associated routes within MUAC airspace are not possible or allowed.

Furthermore, switching between States is likely to produce a significant effect within neighbouring FIRs, including Germany. Each of the Three States independently would already be likely to have a significant impact on existing airspace agreements with neighbouring states due to their respective differences from the current design. To implement all 3 States and the ability switch between them would therefore further increase this impact, especially concerning the demand/capacity balance within adjacent sectors bordering the Netherland FIR boundary.

Consequently it is recommended that detailed analysis be undertaken to quantify the impact of the Three States on and within neighbouring sectors, including the relevant portions of MUAC airspace.

> **Recommendation 24:** Undertake analysis to quantify any impact within neighbouring sectors, including relevant portions of MUAC airspace.

The switching between States will require the effective implementation of Advanced FUA principles in order to be effective. Any Airspace Management (ASM) tools used should provide the following key enabling functions:

- Very high levels of interoperability between Civil and Military ATM systems allowing the seamless exchange of data or, preferably, use of a single combined ATM system by all airspace users.
- Communications, navigation and surveillance (CNS) systems, and advanced information management technology, with the capability to functionally combine the ground-based and airborne system elements into a fully integrated, interoperable ATM system open to all users.
- The development and application of efficient national ASM processes, allied to a centralised ASM facility (e.g. Civil and Military ATC staff collocated within combined facilities).
- Continuous monitoring and re-assessment of the national airspace usage requirements of various stakeholders.

There may be a need for considerable training associated with the procedures that will be employed to achieve the seamless switching between States, both for Netherlands and MUAC ATCOs, in addition to further ATCO training/familiarisation driven by the creation of all additional routes.

It is not clear whether any additional licensing requirements will arise for Netherlands civil ATCOs. Licenses are endorsed with specific validations for each control position; the potential exists for new validations if new sectors or control positions are created. Additional licensing requirements may be necessary for military ATCOs however this is not clear and should be explored further by DARP.

### 3.2.3 Recommended Tools

#### 3.2.3.1 Key question

- *In order to work with three airspace States, planning will be essential. Can you recommend any tools to make State changes possible several times a day?*

#### 3.2.3.2 Problem analysis

In the future more tools will be required to automate Airspace Management (ASM) processes. Managing frequent and often short notice changes in the airspace arrangement will result in a high degree of complexity and an increased potential for human error. The employment of automation could assist in the maintenance of the necessary safety standards, by:

- Reducing or removing the potential for human error.
- Storing data on future airspace requirements (e.g. major sporting or political events, major military exercises).

- Making more efficient use of resources, by reducing the amount of human input required to process airspace requests and deconflict them, and to issue airspace utilisation or allocation messages.

The deployment of a single nation-wide ASM platform is perhaps the key tool required for the effective implementation of FUA. The effective implementation of advanced FUA concepts will require the employment of dedicated ASM tools to perform the following functions:

- Automate and speed-up the data flows in near real-time. For example, is information available in sufficient time for an airline operator to be able to react to it and load the right fuel load to use the route?
- Enable Enhanced Airspace Management (EAM) decisions to be made on an informed basis by the centralised airspace management centre – an important aspect of SESAR.
- Facilitate promulgation of EAM decisions to all airspace users. It is no good making a decision to switch if the message cannot be passed efficiently to all those who need to know the information and then use it. In some cases, this could mean General Aviation users, so the delivery mechanism must be robust - otherwise it may be necessary to default to the lowest common denominator.
- Enable re-allocation of airspace where pre-planned activities are cancelled. Response times are essential here – how quickly can ATC or the airspace users react if an activity is cancelled or stopped sooner than originally planned?
- Facilitate full connectivity with ATC displays and flight planning systems by making sure that the right information is made available to the right people in as close to real-time as possible.

#### 3.2.3.3 Eurocontrol tools

EUROCONTROL has developed a set of toolboxes to raise awareness of the benefits and promote the implementation of FUA. These tools include support systems such as a local and sub-regional airspace management support system (LARA), civil-military air traffic management coordination tool (CIMACT) and pan-European repository of information supporting civil-military key performance indications (PRISMIL).

- LARA was developed to improve airspace management processes by providing mutual visibility on civil and military requirements, by increasing mutual understanding and by enabling a more efficient collaborative decision-making process. The LARA system is built around a performant server and database offering multiple client's seamless access to a variety of sophisticated ASM functions. LARA's functionality encompasses all phases of airspace management – reaching from long-term event planning to airspace management at level 2 and 3 – including real-time coordination of airspace activations. The capability to connect a national LARA system to neighbouring LARA systems allows seamless coordination between different States and facilitates efficient cross-border operation.
- The CIMACT tool supports the improvement of civil-military coordination and security during the execution phase of FUA. CIMACT is developed as a common co-ordination system to exchange information between civil and military users. It contains a set of ATC functionalities, filters and collaboration facilities to enable silent coordination between connected systems. CIMACT offers an automated interface with the LARA system.
- PRISMIL allows data relevant for civil-military performance measurement to be collected, integrated and stored, thereby supporting the implementation of civil-military performance measurements at both national and pan-European level. PRISMIL supports a collaborative

civil-military data-driven decision-making. The tool provides data-centric customized dashboards facilitating the civil/military cooperation at national and regional level, reporting measures and KPIs on military demand and utilization of airspaces, impact on civil traffic, mission effectiveness.

It should be noted that, although each of these tools is recommended to help facilitate the coordination of switching between airspace states, their use alone cannot guarantee that any particular airspaces combination(s) can be successfully implemented.

**Recommendation 25:** The EUROCONTROL toolboxes LARA, CIMACT and PRISMIL are all recommended to help facilitate coordination of switching.

## 3.3 Airspace Design Timeline Planning

In this section we assess the project planning and timeline. We have examined the steps proposed by the project and assessed against a review of the available documentation, evidence from interviews and our own experience to determine whether the timelines are credible.

Specifically, we have assessed the timeline and process for:

- the options assessment
- preferred option development, and
- implementation of the Three State solution.

These are expanded in the following sections.

### 3.3.1 Options assessment

#### 3.3.1.1 Key question

- *Are the proposed steps sufficient to be able to provide an assessment of the feasibility and 'implementability' of a Track 2 preferred option?*

#### 3.3.1.2 Analysis

We have interpreted the 'proposed steps' to be those presented in the project schedule and expanded as a number of parallel work packages (Figure 13) as defined in the DARP Memorandum dated 28 February. In general, these proposed steps are consistent with the methodologies defined in the Initial Decision; although as discussed in Section 3.1.4 the DARP process is described in words across a number of documents, rather than captured in a dedicated process flow diagram.

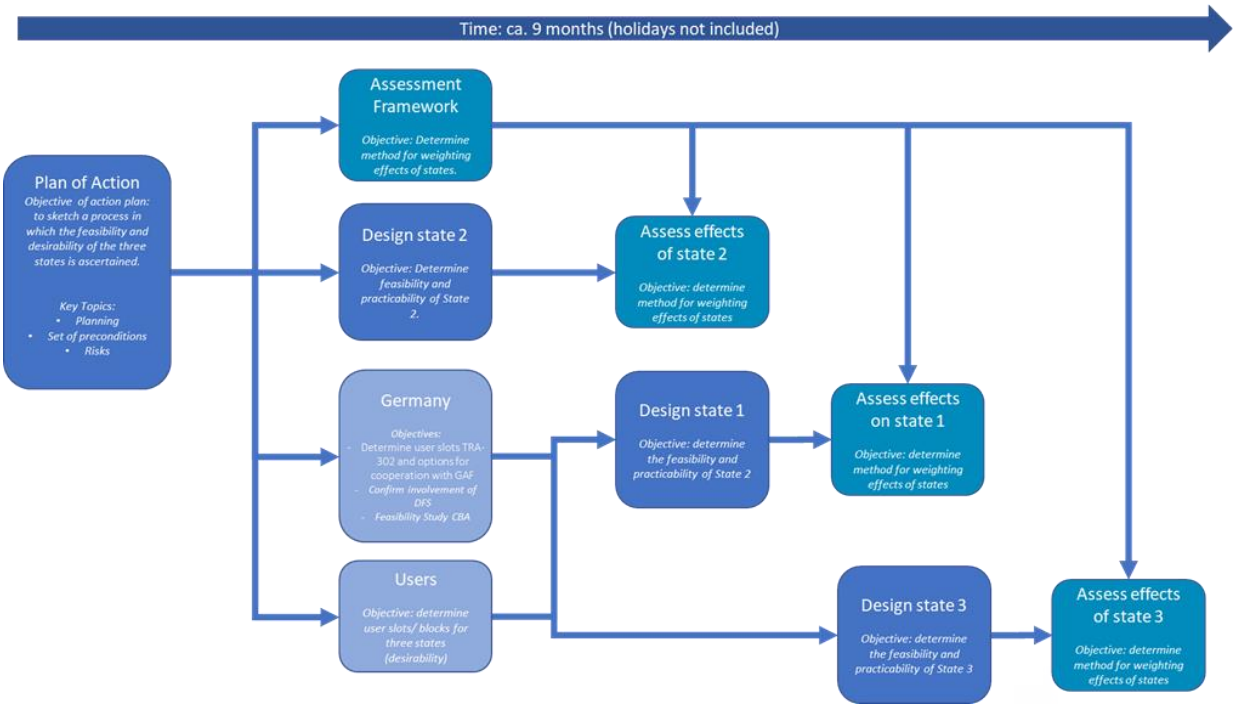



*Figure 13. Track 2 'proposed steps' for DARP Exploration Phase (28 Feb 2020)*

We have further analysed these proposed process steps to determine whether they are sufficient to provide a credible assessment of the feasibility and 'implementability' of a preferred option for Track 2 (table in Figure 14). To avoid duplication , this section assesses the *specific* steps themselves, whilst Section 3.3.2 assesses the steps in the context of the timeline.

| Step Description | Observations |
|---|---|
| **Design**<br><br>Detailing of a (3D) design for each State, to assess the feas bility and practicability of each solution. A rough design will be created for, among other things, the military training area, Schiphol TMA, north-eastern and south-eastern access and the required adjustment of MUAC sectors. In addition, we must show that the transition between States is practicable (4D/5D).<br><br>Activities to support the development of Global Design States 1 and 2 as defined in the Project Schedule. | • The level of detail required is not defined and it is not clear how the feasibility and practicability can be assessed.<br>• The concept designs developed to date lack sufficient detail to enable an assessment to determine 'implementability'.<br>• The concept design cannot be assessed without a CONOPS that describes how the Three States will be managed (specifically the transition between States 4D/5D). We note that a CONOPS is planned for delivery in March 2021, but this will be too late to prove the concept design.<br>• The current scope of DARP Track 2 excludes some national elements that might directly impact the design, such as the Schiphol TMA. If they remain outside the project, then careful management will be required.<br>• There is no evidence that simulation activities (FTS/RTS) to assess the feasibility of the design have been started.<br>• The current level of detail is insufficient to support FTS (too conceptual).<br>• It is also not clear what can be achieved in the proposed RTS, unless it is proposed to focus only on specific activities.<br>• We consider that the inherent complexity of the design and the associated airspace management requirements are under-estimated and are immature for the stage of development. |
| **Users**<br><br>Consultation with users is currently being planned to gain insight into user needs during specific times (4D). This information is needed to decide on the availability of States over the course of a day, week or month (desirability).<br><br>Activities as defined in the Project Schedule. | • It is common practice to define the user needs or requirements before developing the solutions, this should involve appropriate stakeholder/user engagement.<br>• The user requirements are partially defined in Track 3 and are documented in the requirements database; however, there is little evidence to suggest that these have been applied to Track 2 (see Section 3.1.2.2).<br>• The Assessment Framework (see below) could form the basis of this assessment. Going back to the users now without a clearly-controlled framework introduces the risk of requirements scope creep. |
| **Germany**<br><br>Within the framework of Track 2, consultations should be held with the German Air Force, to gain insight into the utilisation of TRA-302 and the options for coordinating planning of this area. The talks with DFS (German Air Traffic Control, both in Langen and Bremen) are intended to ensure that DFS swiftly joins the design sessions.<br><br>Activities as defined in the Project Schedule. | • The engagement with Germany appears to be the most advanced, but there are also other partners to consider.<br>• There are several stakeholders in Germany, it is not clear what has been progressed and agreed to date.<br>• The level of detail in the design and CONOPS might prevent meaningful discussions with Germany and other international stakeholders.<br>• In addition to agreement with DFS and the German Air Force, there will also need to be political agreement to ensure access to German territory in Area C. The current agreement is for ATC delegation only. There could be legal implications which will inevitably cause delay. If agreement cannot be reached, changes will have to be made to the design potentially bringing Area C closer to Lelystad resulting in additional problems.<br>• It is probably still possible to reach agreement with Germany, but it is a significant timescale risk and will need real focus and cooperation. |

| | |
|---|---|
| **Simulation**<br>RTS/FTS activities as defined in the Project Schedule | • A number of FTS/RTS activities are scheduled, but the scope, approach and objectives of these are not yet defined. |
| **Assessment Framework**<br>An assessment framework will be devised and used to assess the effects of the States on feasibility and desirability. Specific areas of attention include assessment of impact on civilian capacity (both at Schiphol and MUAC) and the impact on Military Mission Effectiveness (MME). | • In general, it is not clear how the benefits of the project will be assessed as the users' need or the performance of the current design are not clearly defined.<br>• The Assessment Framework is potentially a good tool, but it is incomplete and not yet approved by stakeholders.<br>• In particular, some assessment criteria and weightings are not defined.<br>• Significant modelling will be required to quantify and balance some requirements.<br>• The assessment approach relies heavily on 'expert judgement', there is a risk that this cannot be agreed or accepted by all parties.<br>• From our interviews, there does not seem to be a common understanding of the requirements or assessment criteria amongst key stakeholders.<br>• The development of an assessment tool for MME is ongoing, we have not had the opportunity to examine the tool. However, the tool risks introducing new requirements or expectations that could impact the design and ultimately its acceptability to the military. |

*Figure 14. Analysis of Process Steps/Work Packages*

#### 3.3.1.3 Key findings:

- There is a need to further refine the design to support the feasibility and practicability assessment.
- An interim CONOPS should be developed to define how the airspace will be managed to support the design process, modelling and assessment.
- There is a need to expedite FTS activities.
- International cooperation should be prioritised, especially with Germany.
- Review the Assessment Framework against previously agreed design principles, prioritised user requirements and performance objectives.
  - Review the means of assessing performance to reduce the amount of 'expert judgement' where possible.
  - Agree the Assessment Framework with key stakeholders before employing it.
- Use FTS to model the performance of the Netherlands' existing airspace and CONOPS to define a performance baseline. In addition to facilitating the quantitative validations of designs, this will help to demonstrate benefits over the current airspace design even when some requirements may be unclear.

**Recommendation 26:** It is essential that the concept is proven before progressing further. Do not underestimate the complexity of the design and the work required to prove the concept.

**Recommendation 27:** Develop an interim CONOPS to inform the design and how airspace will be managed – they are intrinsically linked.

**Recommendation 28:** Finalise and use the Assessment Framework to ensure that benefits can be measured and balanced – you need to determine whether the concept is worth pursuing.

### 3.3.2 Options development

#### 3.3.2.1 Key question

- *Is the proposed timeline realistic to develop a preferred option?*

#### 3.3.2.2 Analysis

For the purposes of this review were not provided with a single documented DARP Track 2 Project Management Plan. Instead we have based our assessment on various inputs from Steering Group meeting notes, interviews and the proposed project schedule (Figure 15).

Ideally, project information would be consolidated in a single Project Management Plan which should clearly define *at least* the following planned elements of the project's delivery:

- A summary of key stakeholder needs / project vision
- SMART project objectives
- Clear deliverables and deadlines
- A detailed project schedule
- Project roles and responsibilities
- Project cost projections
- A stakeholder communications plan
- Project systems and processes

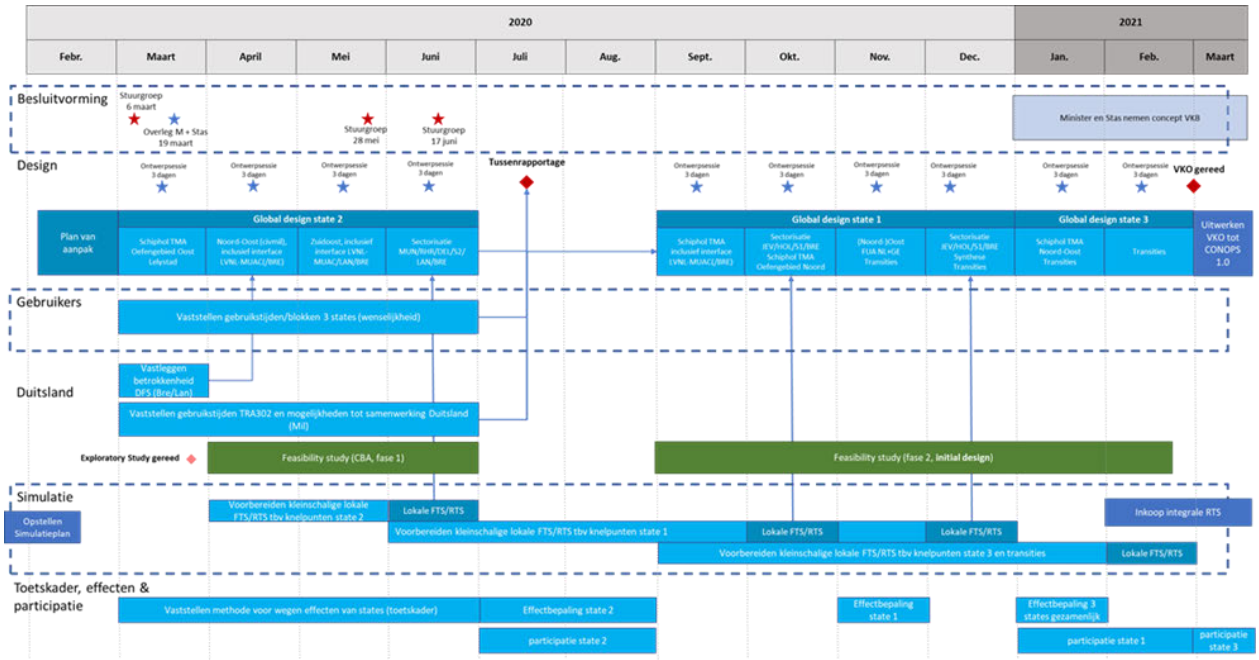



*Figure 15. Track 2 Proposed Timeline*

According to the project schedule (Figure 15) the preferred option must be prepared in early 2021. We also understand that the 'Preferred Decision' gateway relates to the DARP programme as a whole and not only to Track 2. For the purposes of this section, we have considered only the contribution of Track 2.

#### 3.3.2.3 Observations

In relation to the project schedule, we can make the following observations:

- There are still numerous activities to complete. In particular, to further develop what is currently a conceptual design and complete modelling to prove the concept in time for the Preferred Decision.
- The development of a CONOPS is planned for March 2021. However as a minimum it will be necessary to agree an interim CONOPS or agreed methods of working to describe 'how' the airspace will be managed. In the context of the Dutch airspace this is as important as the airspace design itself.
  - This was identified as a requirement in the Track 2 process as described in the Initial Decision (Appendix E), but it does not appear to have adopted.
- Whilst DARP recognised the inter-relationship between the tracks, as discussed in Section 3.1.5, there is no clear relationship between Track 2 and the other tracks in the project schedule. It is not clear from the schedule whether there are any applicable dependencies or risks that could impact the Preferential Decision. The separation of the programme into separate tracks with different processes has added complexity and risk.
- The project schedule does not appear to consider all external dependencies, for example:
  - There is also no clear relationship to other programmes such as One ATM. From evidence received, we understand that that this is an operational dependency.
  - There is a disconnect between the airspace design and the required technical solutions. For example, it is not clear whether AAA or iCAS (depending on which system will be available at the time of implementation) is capable of performing the required dynamic sectorisation that would be required as part of the Three States solution.
- With the exception of the planned summer break, the project plan does not have any other slack. If something does not go to plan then there is no opportunity for rework. The decision to develop only one scenario (the Three States) could also add delay if that scenario has to be further developed and tested in order to gain acceptance.
- There are multiple international dependencies, particularly with Germany and MUAC. We understand that there are multiple channels (from political to operational) to manage international cooperation, but there doesn't appear to be a defined approach to assess the impact and ensure effective international cooperation specifically for the Three States. In DARP's ongoing cooperation with Germany – on both the development of a CBA and the improved civil flow in south easterly direction – the international network effects and (joint or individual) international activities are a topic designated to be explored jointly.
- It is not clear whether sufficient information can be captured to provide input to the proposed Interim Report that is scheduled for July 2020. This is a key deliverable and could impact the direction of the project and the ability to achieve the Preferential Decision in time.
- The required level of evidence for the Preferential Decision is not clear. How will the programme make a recommendation, and what will be the minimum information required for ministers to make a decision? It is not clear whether the activities defined in the project schedule are sufficient to support such a decision.

#### 3.3.2.4 Key findings

- Significant further work would be required to prove the Three State concept.
- The timeline is challenging, with no 'slack' and numerous activities to complete.
- Track 2 risks and dependencies do not appear to be actively managed.

- There is significant risk to achieving the Preferential Decision milestone by January 2021, some of which is unmitigated or outside the control of the project.
- The required content of the Interim Report and Preferential Decision are not clear, which could hinder progress.

In addition, in our analysis of the approach and progress of DARP Track 2 in Section 3.1 of this report, our general conclusion was that to facilitate good progress going forward significant changes first need to be made to the various design inputs, the design process and the Design Group's way of working.

All of these findings lead us to the conclusion that the Preferential Decision of a clearly validated, feasible option is unlikely to be achieved by March 2021, which in turn would delay the start of the Design (i.e. Plan Elaboration) and Realisation phases.

**Recommendation 29:** Reconsider the timeline - in particular the complexity of developing the design and CONOPS and the steps necessary to prove the concept.

**Recommendation 30:** There is a need to more actively manage and consider risks; the revised timeline should also reflect an up to date assessment of known risks and dependencies.

**Recommendation 31:** Define the content of the Interim Report well in advance of its due date and use this to define and drive activities. It is a key deliverable.

**Recommendation 32:** Confirm the level of evidence required for the Preferential Decision and reflect this in the project schedule.

### 3.3.3 Options implementation (The Three States)

#### 3.3.3.1 Key question

- *What would be a realistic timeline to implement the Three States (subject to feasibility and 'implementability') considering the issues mentioned above?*

#### 3.3.3.2 Analysis

We have assessed what might be a realistic timeline to implement the Three State solution by considering both:

a) The progress of DARP Track 2 to date, and the further steps required in both the Design and Realisation Phases.

b) The impact of known risks and dependencies, including other ongoing projects.

**a) Design and Realisation phase steps**

Without a detailed ongoing planning review accompanied by further risk management analysis, it is difficult as part of this review to estimate DARP implementation timescales to a high degree of confidence. Even with those elements, there would still be many significant project risks and dependencies that would introduce further uncertainty.

Based on our current understanding of the project, the stakeholder interviews and our own airspace change expert input, our 'best estimate' for a realistic best-case implementation of a DARP Track 2 solution*, assuming an on-time Preferential Decision in Q2 2021*, might be as follows:

- Start Design phase: 2021 Q2

  - Develop CONOPS, Flight procedures, Advanced FUA, supporting technology (1 year)
  - Validate all design elements (1 year)
  - Design phase total estimate: minimum 2 years
- Start Realisation Phase: 2023 Q2
  - Impacted sectors: Netherlands, Maastricht, Germany, Denmark, UK, Belgium
  - ATC training (e.g. 8 Maastricht sectors alone => 220 ATCOs, 2 days each)
  - ATM systems updates, including FUA readiness
  - Safety Case, Legal
  - ATIS, AIRAC (2 cycles)
  - Realisation Phase total estimate: minimum 1 year 6 months
- Best-case implementation date: Q4 2024

Of course, this is a very high-level thought experiment which we consider appropriate to our review-based understanding of DARP Track 2, the proposed Three State solution and its potential impacts. The final implementation plan for DARP Track 2 would need to go into much more detail on expected timeline activities, deliverables, risks and dependencies to determine a realistic timeline with a higher degree of confidence.

Nevertheless, even this simple high-level analysis does highlight some of the complications of implementing the Three State solution and leads us to conclude that any implementation date in 2023 is highly unlikely to be achievable.

### b) Known risks and dependencies

We have also reviewed the known risks and dependencies. Even if the project were to be progressing on track, there are several significant risks and dependencies against the proposed 2023 implementation date:

- International dependencies introduce multiple risks to the timeline, especially for the Three States solution with its potential for rapid switching between states at short notice. Our stakeholder interviews indicated that, in the worst case, up to 28 sectors (internal and external) could be directly impacted by the implementation of the Three States even before switching is considered. The full extent of the impacts cannot be known until the design is developed further but the implementation will inevitably need to align with all required changes and associated training in neighbouring ANSPs, which is highly likely to create additional complexity and delay.
- The iCAS project is currently targeting an implementation date in 2023. There will inevitably be a ‘standstill’ period either side of the system implementation. If iCAS is a technical enabler for DARP implementation (for example to provide Advanced-FUA), then the earliest DARP Track 2 might be delivered would be after the iCAS standstill period.
- OneATM is another dependency which is also targeting implementation in 2023. We understand that this will align methods of operation and ways of working between military and civil controllers – potentially providing a basis for any change to the CONOPS to support the implementation of DARP Track 2. If the stakeholder resources to implement DARP and OneATM at the same time are not available, then it is most likely DARP that will have to be delayed.

- Other national airspace projects will also potentially impact the timeline. We have already identified the TMA redesign and the reconfiguration of the Schiphol runway utilisation as examples, but there could be others that are not yet known to us or that will be initiated in the next 2 years. These projects will either have to be included in the DARP Track 2 scope or very carefully managed in parallel. All of this adds complexity and impacts resource availability, as well as introducing other risks that might further impact the overall timeline.
- The planned national election for in March 2021 might impact the timing and even the ability of the government to make the Preferential Decision. This could delay the start of Plan Elaboration phase activities. The proposed 2-year timeline is already challenging, and any delay would inevitably result in the implementation date being missed.

#### 3.3.3.3 Conclusions

**It is extremely unlikely that the implementation of the proposed Three States airspace solution can be realised within the proposed timescale.** Given the rate of progress to date, the likelihood of the start of the implementation phase being delayed, the overall complexity of both the design and the implementation process, and the likely impact of several dependent projects, we would consider Q4 2024 to be the very earliest date considered. However, this suggestion requires significant work to be validated further.

There is a need to re-plan the DARP programme based on a clear Statement of Need, a revised scope and a realistic assessment of the complexities, dependencies, risks and level of consultation that is likely to be required. This re-planning might also provide an opportunity to re-assess the relationship between Tracks 2 and 3, and to address many or all of our other recommendations made within this report.

# 4 Conclusions

## 4.1 Key considerations on the Way Forward

### 4.1.1 Track 2 process

DARP chose a generic MIRT-based programme approach for Track 2 and has so far largely adhered to it. Defining Track 2 as a project to deliver something in 2023 – and for that something to be a completely new airspace structure for the future of the Netherlands – has always been an enormously ambitious plan, carrying a high level of risk that a solution delivered by 2023 might be sub-optimal in the longer term.

### 4.1.2 The Three States

The Three States solution is a complex and high-risk solution, conceived in part to unlock a design process which had almost stalled. It might ultimately work, although it is highly unlikely to be implemented by 2023 and the cost of its complexity may outweigh the benefits. The proposal's high dependency on new international agreements may not align well with any future Cross Border Area solution. If the Three States solution is to be progressed in any form, there is an urgent need to first invest time and resources into 'proving the concept' by developing a CONOPS and performing additional modelling.

### 4.1.3 Next steps

The various inputs and key design process steps for DARP Track 2 need to be combined and formalised in order to complete the airspace design, with some inputs needing further refinement. This notably includes the airspace user requirements, which need to be negotiated and prioritised at senior or political level. Our complete set of recommendations resulting from this review is derived and explained in Section 3 of this report.

### 4.1.4 Possible outcomes

Our recommended next steps could potentially lead to a less complex overall airspace design, or even a series of smaller design changes to be delivered over a period of time as "benefit drops" to meet specific user requirements. This approach might be easier to implement – and less vulnerable to the numerous risks and international dependencies identified in this report – than the proposed 'Three States' solution. It could also provide more clearly defined 'stepping-stones' to the end results being targeted by DARP for 2035 and beyond.

Currently, the only well-defined alternative to the Three States proposal is the "do nothing" option. For the DARP programme that option might mean ceasing to pursue the interim airspace redesign that Track 2 has so far been set up to deliver.

## 4.2 Summary of Recommendations

A list of all our recommendations can be found in Appendix I at the end of this report.

The diagram in Figure 16 represents a “high-level action plan” within which the key requirements from this report might be grouped, understood and further considered for implementation.

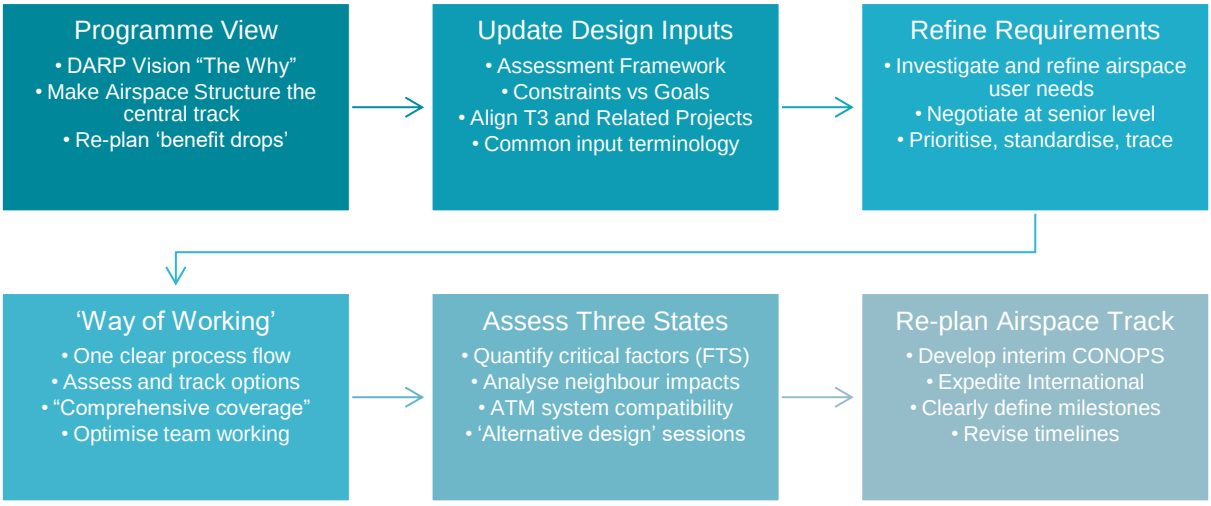



*Figure 16. High-level Action Plan for Recommendations*

# Appendix A. Documentation Reference List

The following list of documentation was provided to us by the DARP Programme Team and has been used to inform our review.

| Document Name | Document Category |
|---|---|
| Summary Scope of SEA - Dutch airspace redesign_final | Steering Group |
| Principles Track 2 for SG 9-7-2019 | Steering Group |
| Initial Decision Dutch Airspace Redesign Programme | Steering Group |
| DARP report design session track 2 2020-02-13 | Design Group |
| DARP Status Update Track 2 - Steering Board 6th March 2020 / Memorandum (28-02-2020) | Design Group |
| DARP track 2 Report DARP Design session 23 January 2020 - 1.0 | Design Group |
| Memo state of play track 2, SG December 2019 | Design Group |
| DARP track 2 2019-11-12 LRH Design session 3 - South easterly connection WG | Design Group |
| DARP report design session track 2 2019-10-29 | Design Group |
| DARP report design session track 2 20-09-2019 | Design Group |
| DARP review document on (Air Transport + Mil) user requirements v 1.0 | Requirements |
| DARP Measurability Military Mission Effectiveness concise document | Requirements |
| 20200306 Requirements Process | Requirements |
| DARP_13_Feb_20 | Maps |
| DARP track 2 Schetskaart STATE 3__20200221 | Maps |
| DARP track 2 Schetskaart STATE 2__20200221 | Maps |
| DARP track 2 Schetskaart STATE 1__20200221 | Maps |
| DARP track 2 OVERZICHT__20200221 | Maps |
| Risk file DARP as sent to Steering Group 6th March | Risk Overview |
| 20200225_Risicodossier LRH | Risk Overview |
| FABEC Airspace Policy 2016 | Best Practise |
| UK Civil Aviation Authority CAP 1616, Airspace Change | Best Practise |
| UK Airports National Policy Statement | Best Practise |
| UK Civil Aviation Authority CAP 1711, Airspace Modernisation Strategy | Best Practise |
| Second Opinion on the Design Products for the Dutch Airspace Redesign, Review of Initial Decision, Helios Report, May 2019 | International Reviews |
| Netherlands Airspace Review, Report for LVNL, Helios, November 2017 | International Reviews |

# Appendix B. Stakeholder Interview Schedule

The following interviews were undertaken with members of the Design Group and the Programme Team, to better understand stakeholders' engagement in the activities to date, and the effectiveness of those activities.

| Interview | Date | Time | Location | Organisation | Group |
|---|---|---|---|---|---|
| 1 | 12-Mar | 09:00 | Teleconference | MUAC | Programme Team |
| 2 | 12-Mar | 10:30 | LVNL Zulu | DARP PT | Design Group |
| 3 | 12-Mar | 12:00 | Teleconference | CLSK | Design Group |
| 4 | 12-Mar | 15:00 | Teleconference | MUAC | Design Group |
| 5 | 12-Mar | 15:00 | Teleconference | MUAC | Design Group |
| 6 | 12-Mar | 16:30 | LVNL Zulu | DARP PT | Design Group |
| 7 | 13-Mar | 08:00 | LVNL India | LVNL | Programme Team |
| 8 | 13-Mar | 09:30 | LVNL India | DARP PT | Design Group |
| 9 | 13-Mar | 11:30 | Teleconference | NM | Programme Team |
| 10 | 13-Mar | 13:00 | Teleconference | CLSK | Programme Team |
| 11 | 13-Mar | 14:00 | LVNL India | LVNL | Design Group |
| 12 | 19-Mar | 11:45 | Teleconference | LVNL | Design Group |
| 13 | 26-Mar | 16:00 | Teleconference | CLSK | Design Group |
| 14 | 02-Apr | 16:00 | Teleconference | DARP PT | Design Group |
| 15 | 03-Apr | 11:00 | Teleconference | CLSK | Design Group |

# Appendix C. Linear Process for DARP Tracks 1 & 2 (Initial Decision Appendix 5)

**Approach to airspace projects**

Projects with an envisaged outcome for or in 2023 follow a linear approach as outlined below:

**Definition Phase (also: Exploration Phase)**

- Develop operational concept of Man – Machine – Procedure
  - Handling method
  - General classification into airspace, routes, sectors
  - Agreements regarding flexible use of airspace (FUA), air traffic planning, transfer
  - Necessary technical support
- Stakeholder consultation
- Validation by means of simulation
- Legal assessment (particularly feasibility within applicable legislation and regulations, international impact)
- Assess safety, efficiency and environmental impact based on safety, efficiency and environmental assessment

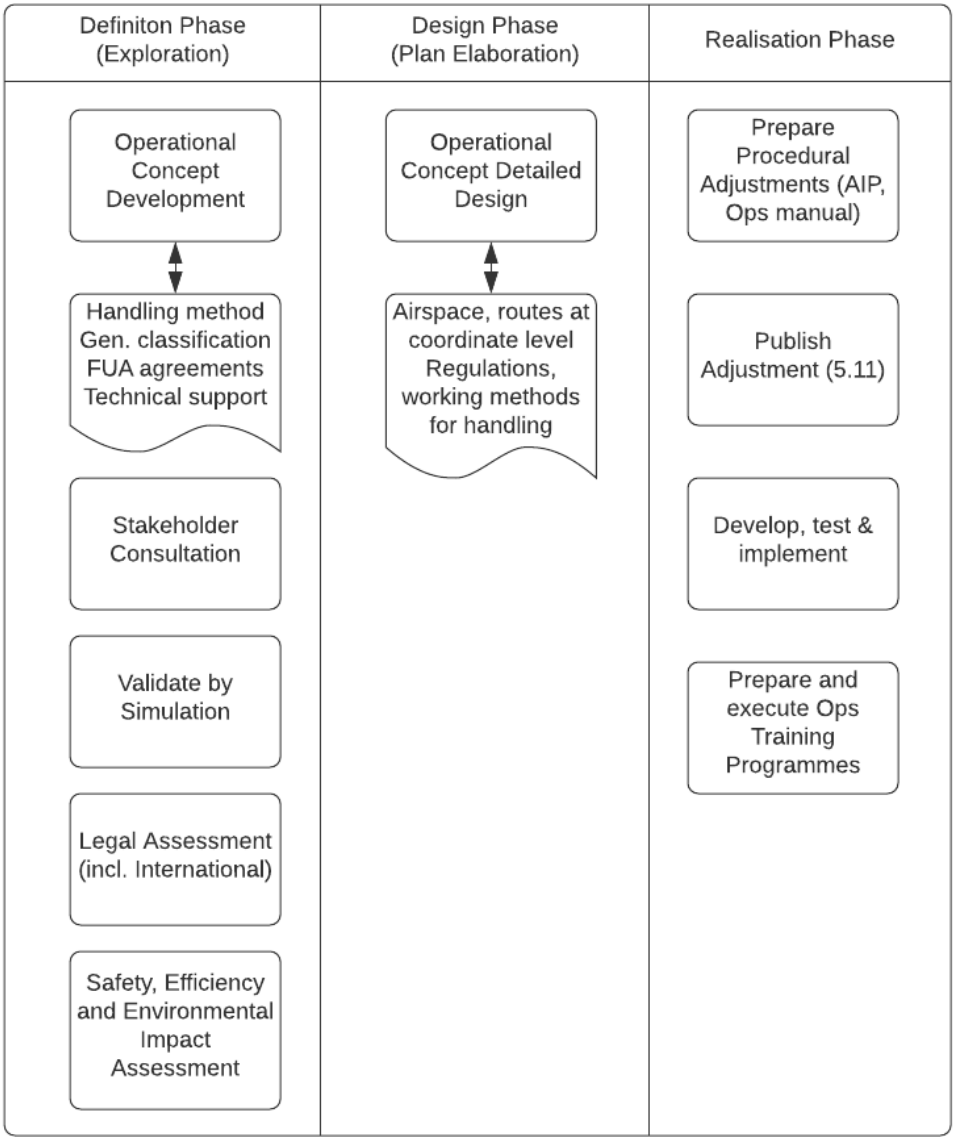
**Design Phase (also: Plan Elaboration Phase)**

- Detailed design of the operational concept
  - Airspace and routes at coordinate level
  - Regulations and working methods for handling
- Design training products to train operational staff
- Detailed design of necessary system functionality
- Stakeholder consultation
- Safety assessment for testing by NSA

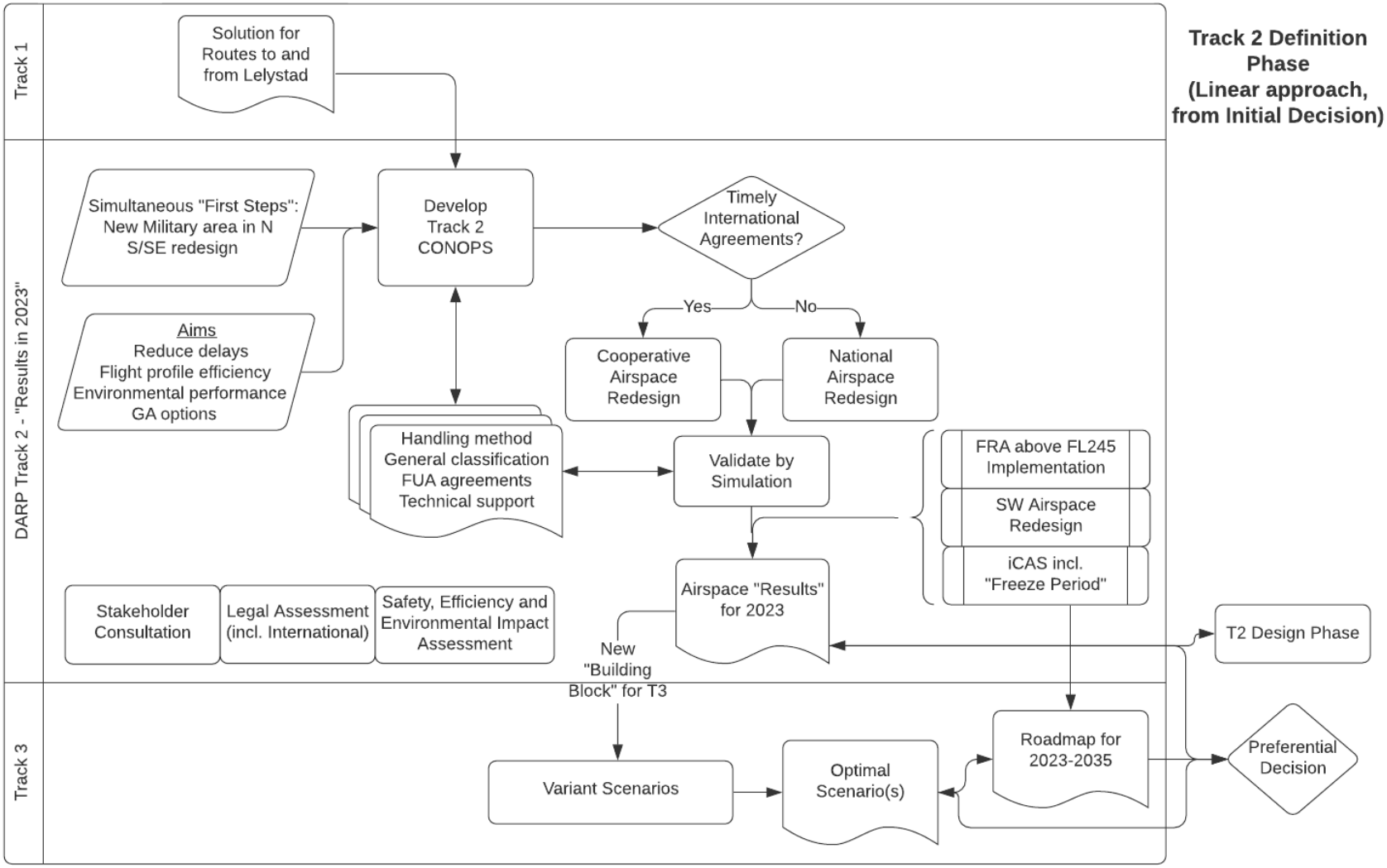
**Realisation Phase**

- Prepare procedural adjustments (AIP, Operations Manual);
- Follow formal steps for publishing the adjustment (the 5.11 Procedure);
- Develop, test and implement system adjustments;
- Prepare and execute training programmes for operational staff.

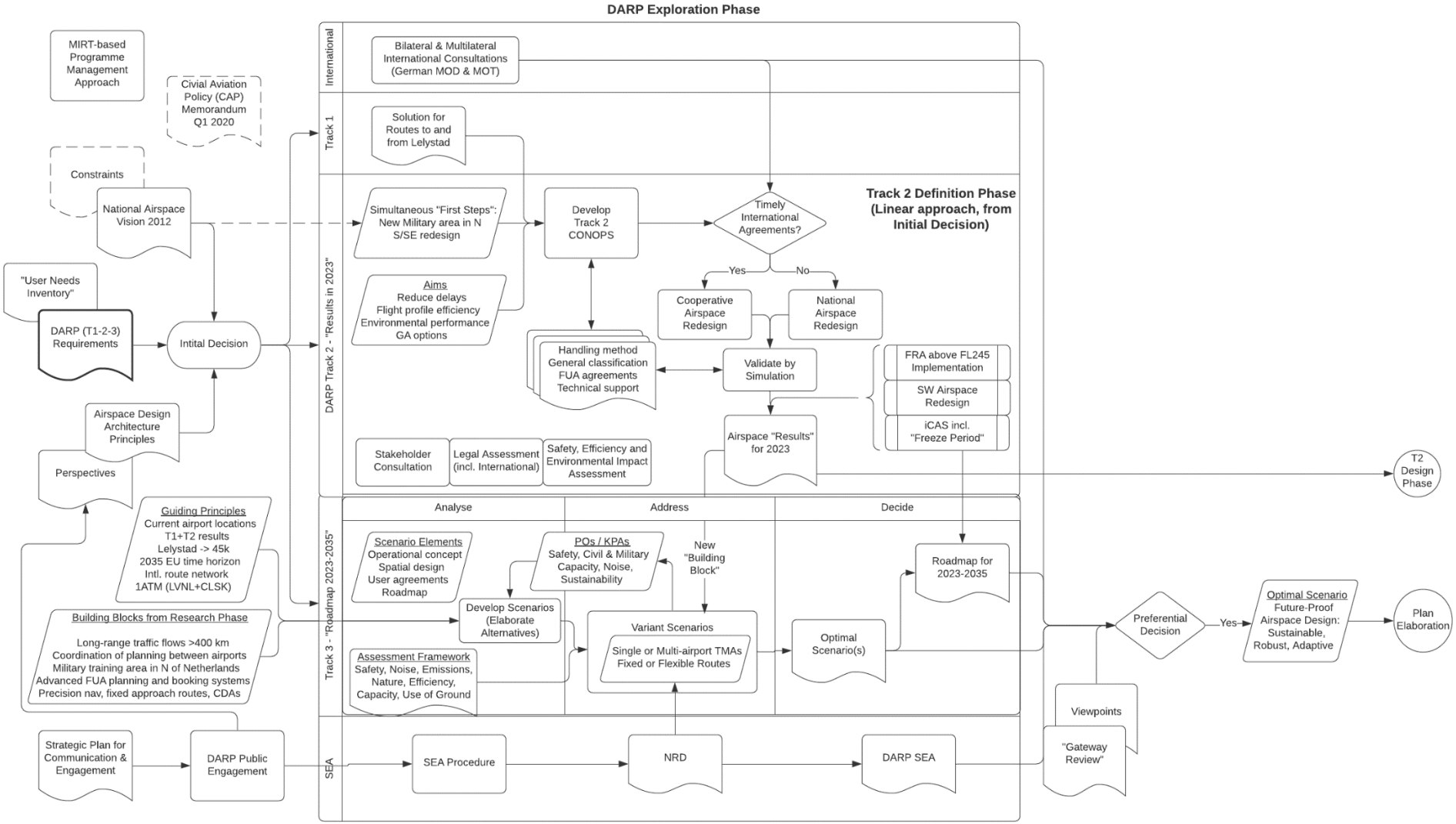
# Appendix D. Linear Process for DARP Tracks 1 & 2 (Helios' Understanding of Initial Decision)



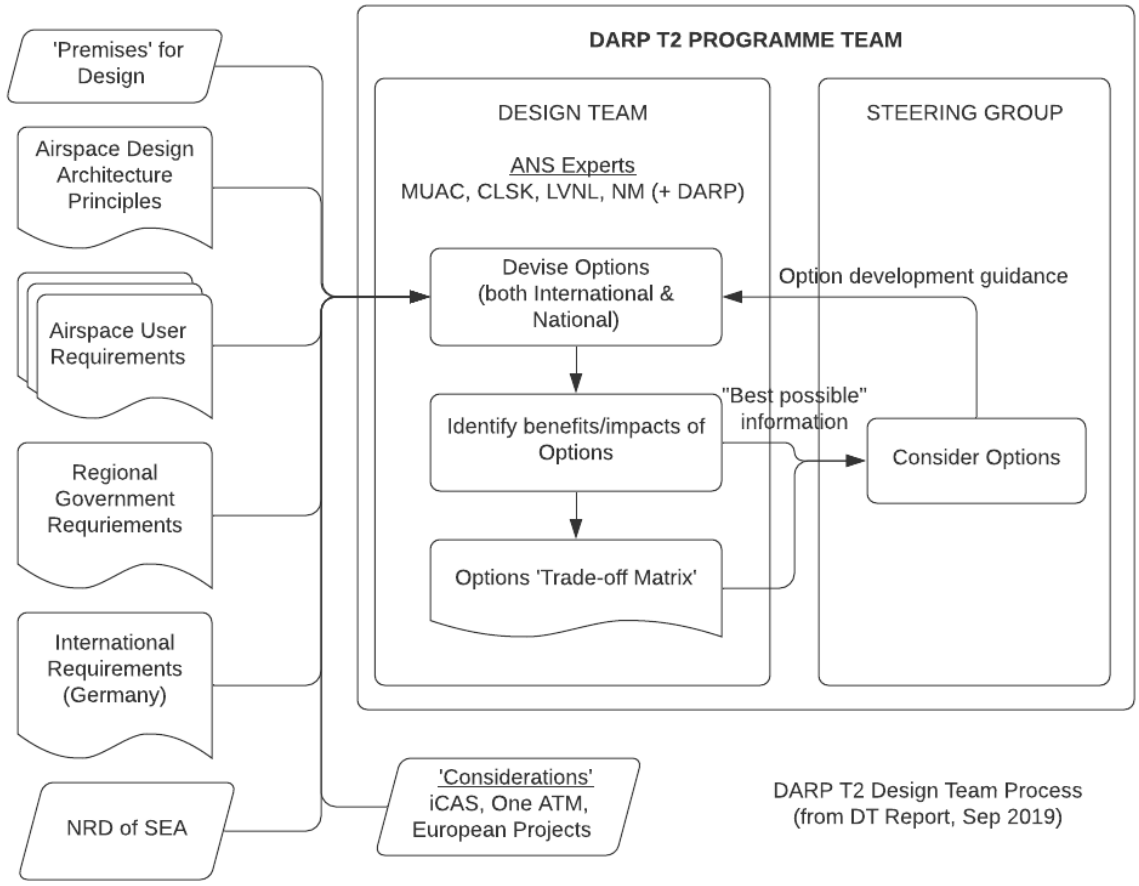
# Appendix E. Track 2 Process: Exploration Phase (Helios' Understanding of Initial Decision)



# Appendix F. Overall DARP Process (Helios' Understanding of Initial Decision)

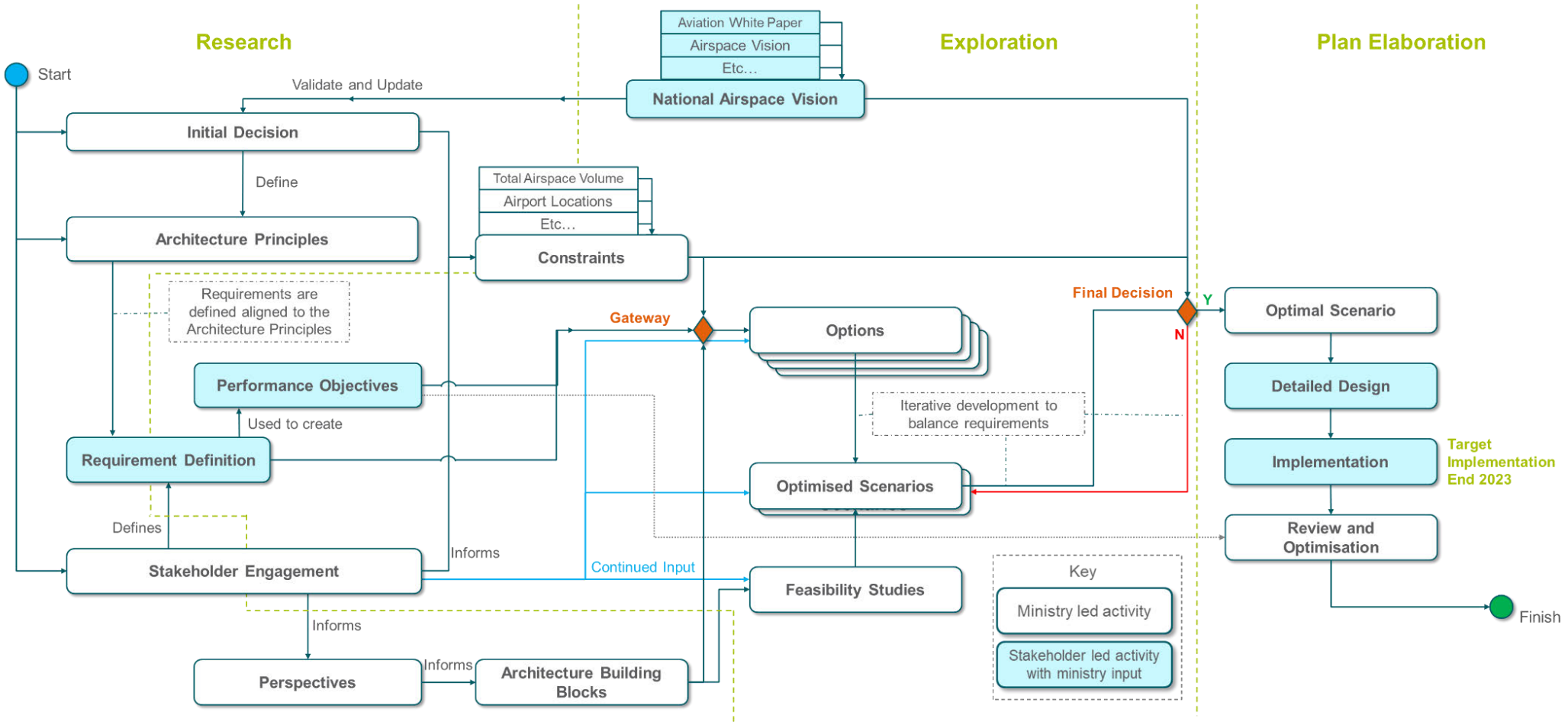


# Appendix G. DARP Design Group Track 2 Process (Workshop #1 Sep 2019)




DARP T2 Design Team Process
(from DT Report, Sep 2019)

# Appendix H. Overall DARP Process (Helios' Recommendation, May 2019)



# Appendix I. Summary of Recommendations

| No. | Recommendation |
|---|---|
| 1 | Clarify and clearly communicate the DARP Vision (The "Why?") in a way that is relevant to Track 2. This could be expressed as a Statement of Need. |
| 2 | Communicate and stick to a consistent terminology for all design inputs and outputs. This could be in the form of a DARP Glossary. |
| 3 | Rationalise and reduce the number of design inputs for the Exploration Phase (and where appropriate also the Plan Elaboration Phase). |
| 4 | Update and prioritise the Track 2 user requirements. Specifically, this should include:<br>• Improve understanding of airspace user requirements: adopt a performance-based approach and increase granularity back to essential user need where possible (e.g. Military MME and flexibility, Schiphol TMA shape)<br>• Introduce a clear prioritisation scheme for all requirements, including Civil and Military airspace users<br>• Implement a 'hidden requirements' elicitation session to see if the Design Group and/or other stakeholders think any key user requirements are still missing<br>• Trace all requirements to the Assessment Framework<br>▪ Standardise level of quantification<br>▪ Assess and indicate applicability of each requirement to DARP Track 2<br>▪ Ensure all key stakeholder needs are reflected (not only airspace users)<br>• Standardise requirements format and language/phraseology<br>• Make it easy to sort and group requirements (e.g. by capacity, noise, complexity etc) to aid designer understanding and design validation |
| 5 | Track all design progress against the agreed DARP Track 2 design process flow, ensuring that Design Group members know exactly how their current task maps to specific project goals |
| 6 | Make it a design principle to provide "comprehensive coverage" of airspace design options, including the do-nothing option. |

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| **7** | Track and assess all options considered (however sub-optimal some may appear, and even if one or more stakeholders claims that a 'showstopper' issue exists) until at least the end of the Exploration Phase. |
| **8** | Organise at least one 'blank sheet' brainstorming/design session (ideally in small groups of up to 6 people) to investigate the likelihood that other options are possible. This should take as minimum inputs 1) the completed Assessment Framework and 2) a clear and unambiguous set of Design Constraints, informed by the research phase. |
| **9** | Define and communicate widely one clear detailed process flow for DARP Track 2, with accompanying flow diagram(s). This should accommodate iterative design development, with regular internal 'gateways' to determine which options to progress for further design work. |
| **10** | Recognise that a "national redesign" (i.e. without need for bilateral/multilateral international agreements, beyond MUAC) is not a realistic option, and therefore ensure that any interim international agreements are clearly justifiable as positive steps towards the end goal for DARP. |
| **11** | Prioritise the refinement and negotiation of Civil/Military requirements at senior level, with the goal of facilitating new airspace design options in addition to the Three States. |
| **12** | Prioritise the completion and implementation of the DARP Assessment Framework (KPA/KPIs) to facilitate the development and assessment of new airspace options, covering all DARP Tracks. |
| **13** | Bring TMA design activity into the DARP design process |
| **14** | Perform an analysis of all Related Projects to determine which of them should, or are likely to, influence the future airspace infrastructure of the Netherlands. Where dependencies are identified, consider implementing overarching dependency management at Steering Group level or above, to include shared design activities where appropriate. |
| **15** | Conflicting airspace user requirements to be refined, prioritised and negotiated at senior/political level, outside of Design Group meetings, whenever a viable design solution cannot otherwise be found. |
| **16** | Recognise and address underlying team trust issues directly, perhaps through discussion sessions and team-building exercises. This should include (but not necessarily be limited to) addressing the disappointing ending of the CBA CW project. |
| **17** | Find a way to formalise performing a significant proportion of the design process in smaller teams of up to 5-6 experts |
| **18** | Clarify what defines DARP Track 2: the deadline or the task? |
| **19** | Make a redesigned airspace structure with accompanying CONOPS the central deliverable of the DARP programme. |
| **20** | Plan a new series of DARP 'benefit drops' through to 2035. |

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| **21** | Implement Qualitative Schedule Risk Analysis (QSRA) against the DARP programme schedule (including DARP Track 2). |
| **22** | The scope of analysis of all Three States should be extended to include a quantitative assessment (Fast Time Simulation) of other critical factors including capacity, complexity and workload (cockpit and ATCO). |
| **23** | Use Fast Time Simulation to assess route options for each of the three States so that the preferred solution is properly informed. |
| **24** | Undertake analysis to quantify any impact within neighbouring sectors, including relevant portions of MUAC airspace. |
| **25** | The EUROCONTROL toolboxes LARA, CIMACT and PRISMIL are all recommended to help facilitate coordination of switching |
| **26** | It is essential that the concept is proven before progressing further. Do not underestimate the complexity of the design and the work required to prove the concept |
| **27** | Develop an interim CONOPS to inform the design and how airspace will be managed – they are intrinsically linked |
| **28** | Finalise and use the assessment framework to ensure benefits can be measured and balanced – you need to determine whether the concept is worth pursuing |
| **29** | Reconsider the timeline - in particular the complexity of developing the design and CONOPS and the steps necessary to prove the concept. |
| **30** | There is a need to more actively manage and consider risks; the revised timeline should also reflect an up to date assessment of known risks and dependencies. |
| **31** | Define the content of the Interim Report well in advance of its due date and use this to define and drive activities. It is a key deliverable. |
| **32** | Confirm the level of evidence required for the Preferential Decision and reflect this in the project schedule. |