Realisation of ATC to Lelystad (EHLE) – independent review of project timelines (as of 6th February 2017)

Executive summary

LVNL, the Ministry of Infrastructure and Environment, Lelystad Airport and CLSK have signed a letter of intent, to enable research activities and to make further arrangements about the intention to deliver Air Traffic Control (ATC) services for Lelystad Airport as commercial air transport begin operations to and from the airport. The ATC services will be provided in designated airspace to all users, including the military.

The scope of the change includes the connecting routes over Flight Level 60 (around 6,000ft), airspace re-design and coordination with adjoining ATC centres, and all technical and human factors enablers. Public consultation is planned on the operational changes not already agreed in the Alders process.

This review of the project to introduce ATC services at Lelystad Airport is based on a request to look specifically at the schedule, and determine if the revised planning towards an April 2019 operational date is achievable, realistic and resilient.

The review team is independent of LVNL, and the findings are wholly independent of all stakeholders involved with the project.

The review examined the project from the perspective of functional planning, future risks and dependencies, and the underlying change control processes.

The project schedule (v1.0) appears reasonable as a planning document, setting out a series of goals and targets by which the project can be managed. The process shows a clear critical path by which the project can be focused and managed.

Key dependencies are being identified as they arise, with oversight via specific activities at Steering Committee level. Key risks are also well-discussed, but in a reactive manner.

With the recent proposed delay to the operational date (originally April 2018), the project workflow now includes some significant buffers which provides re-assurance that certain unplanned delays can be managed within the current schedule. In particular, this allows for some delay to the agreement of the operational concept (connecting routes and airspace design), enabling all stakeholders to make an informed and robust decision on these matters.

To this end, **the opinion of the independent review team is that the revised planned April 2019 operational date is *achievable* and *realistic*, following a clear critical path based on key identified dependencies, along with clear goals and targets. However, there are some fundamental points that require addressing to ensure confidence in the *resilience* of the project's revised planned April 2019 operational date**. These can be categorised as:

- **Internal**, where LVNL has direct control of activities, including resolution of issues;
- **External**, where LVNL maintains an advisory and/or coordinator role for required activities involving other stakeholders, but has no direct control or responsibility of those activities. This would include appropriate tracking of activities through formalised dependencies (eg letters of agreement) and inclusion of activity tracking (checklist) in the project transition planning.

Overall, several significant risks with “medium” probability remain in the project planning, and combined result in a higher level of risk to the schedule overall. Given the number, the review team determines that it is likely that one of them will occur in such a manner as to disrupt the critical path. From a review team perspective, taking into account current mitigation activities, the most likely risks remain the following:

- success criteria[1] changing during the project’s lifetime, including not being comprehensive enough to drive valid project requirements (**Internal** and **External** risk);
- an agreement on the operational concept which alters through the project lifecycle; each connecting route is tightly designed and has drawbacks; therefore, all civil and military airspace users, Lelystad and Schiphol Airports, civil and military controllers, Ministry and regulatory stakeholders must agree with the trade-offs in choosing the eventual routes (**Internal** and **External** risk);
- the risk of re-work to the operational concept as a result of public consultation, even recognising the schedule anticipated by LVNL and the Ministry (**External** risk);
- a change to the agreed constraints on the project, for example the requirement for no negative impact on Schiphol traffic changing due to the route design, and the resultant time and coordination to agree the changed constraint (**Internal** and **External** risk);
- the possible delay in recruitment and training of civil TWR controllers, in finding an appropriate controller pool with the skills required for the mix of IFR and VFR traffic, and the potential delay in assigning and training CAPP controllers (military), in both cases ensuring the simulation facilities are ready on-time (**Internal** and **External** risk); and
- the identified risk around the AAA build delivery, AAA being the Flight Data Processing software used by LVNL (**Internal** risk).

The key risk with the delivery of AAA CAPP (Centralised Approach), allowing co-location of civil and military controllers, relates to it being an agreed basic requirement stated by the military controllers. Without successful delivery, the project will not proceed. Implementation relies on development of the solution by the LVNL software team, and acceptance of the design by the military controllers. The review team notes that this risk is understood, possible mitigations have been explored, but that the timescales for the release are still tight and would have immediate impact on other activities.

Several smaller repair builds, dealing with software errors, and a single rectification build, often dealing with changes in underlying requirements, are foreseen. Changes and adaptations will include integration of new routes and re-calibration of tools. Although many of the expected changes are considered to be based on familiar code, in the review team’s experiences of similar environments, changing acceptance requirements in multi-stakeholder projects can often lead to multiple rectification builds, often unplanned.

In addition, a dedicated Lelystad CAPP console and TWR (Tower) system are planned, requiring further revisions to the AAA software. The fall-back solution in case of non-delivery would impact the ability of the controllers to handle the traffic as follows:

- From the TWR perspective, a procedural solution would be required based on voice-based coordination of traffic, requiring the implementation of an Aeronautical Fixed Telecommunications Network (AFTN) terminal rather than the data being integrated within the Flight Data Processor. There would be operational restrictions, due to less automation, more handwork and more verbal communication between TWR and CAPP. Whilst this appears permissible given the traffic levels of Lelystad in the early years, the review team

[1] Lelystad Airport capacity estimates currently being discussed between LVNL and Lelystad Airport.

notes that expectations are being set, and LVNL controller acceptance is also part of the consideration;

- From the Lelystad CAPP perspective, the alternative may require traffic on more than one system with separate tools and display. There may be military controller acceptance considerations if the AAA Lelystad CAPP changes are not implemented prior to operations.

The revised operational date of April 2019 still relies upon a single major release of AAA Lelystad CAPP and TWR software following the civil-military co-location AAA build. Repair builds are foreseen, but any issues with the software requiring a rectification build may possibly impact the critical path and operational date. LVNL should explore adding margin to the project plan to take account of these points, particularly in adding resilience to the current schedule.

Finally, the lack of explicit control of the risks, and history to date of reactive risk management, suggests that the effectiveness of mitigations may not be as planned. The review team did not have full confidence that the mitigations were adequately implemented, resourced and tracked from the material made available. Again, LVNL should address this point to add resilience to the current schedule.

Given the above findings, the review team have provided recommendations for LVNL consideration, the resolution or clarification of which need to be provided to ensure confidence that the project's planned operational date could be met. It is worth noting that the earlier the operational concept and therefore success criteria are finalised, as per recommendation 1, the greater the scope available to address the subsequent recommendations.

Recommendations

Recognising the complexity of a multi-stakeholder project, the review team strongly recommends agreeing the project requirements across all relevant internal and external stakeholders as soon as feasible, and reinforcing the ability of the relevant Steering Committee to control all known risks and interdependencies effectively.

More specifically:

1. At the earliest opportunity, finalise the operational concept based on capacity planning with Lelystad Airport and the key airlines, identifying clear and appropriately detailed success criteria and with assumptions agreed between all stakeholders. This will mitigate the risk that the delivered solution will not fit the business case for the airport and require re-work. (**Internal** and **External** recommendation)

2. In all aspects of AAA development, there is no margin in the planning. For true confidence in the schedule, LVNL could explore adding more margin, potentially planning for a second rectification build of AAA CAPP (co-location) and/or a single rectification build of AAA Lelystad CAPP and TWR. (**Internal** recommendation)

3. Develop risk scenarios to understand the potential impact of individual or combined risks on the operational date. From this process, ensure the externally agreed operational date takes reasonable account of possible future iterations of the project plan. Early identification of risk scenarios and therefore ensuring associated contingency in the project plan mitigates this risk. (**Internal** recommendation)

4. Develop and agree more detailed mitigation plans for key risks. Identify internal (to LVNL) and external owners of these risks and their mitigations, and communicate them to all affected stakeholders. Ensure ownership of the mitigation plans by the appropriate Steering Committee, particularly validating the ability of the Steering Committee to implement the mitigations across various organisations. (**Internal** recommendation)

5. Develop a clear dependency log, assessing all potential interdependencies (input and output) and identifying key tracking metrics to understand the impact of changes in scope or timelines. Highlight any dependency which cannot be controlled from Steering Committee level, and carefully track its development and impact. (**Internal** and **External** recommendation)

6. Identify the assumptions under which the implementation date can be met and communicate these with all stakeholders. (**Internal** and **External** recommendation)

1 Context and scope

This independent review of the project to introduce Air Traffic Control (ATC) services at Lelystad Airport was commissioned by LVNL[2]. It seeks to identify a level of confidence in the project timelines, with reference to the revised target operational date for air traffic services for the airport of 1st April 2019.

The review was requested by the Dutch Ministry of Infrastructure and the Environment. It follows notification by LVNL and CLSK[3] that the initial April 2018 target date would be delayed.

The focus of this review is on the feasibility and robustness of the schedule within the wider context of the overall LVNL programme strategy. A separate review is examining the feasibility of the designed airspace routes from an operational perspective.

The project includes the introduction of Tower services and associated infrastructure. It also includes the design of the routes connecting the Lelystad approaches and departures to the existing en-route traffic flows, and airspace and centre coordination changes.

Outside the direct scope of this review are:

- The route designs from ground level to Flight Level (FL) 60 (around 6000ft), these being the low-level transitions for arriving and departing traffic to/from EHLE. The routes have been agreed upon following previous public consultations, and form a strict requirement for this project;
- Co-location of the military approach (APP) services with LVNL's infrastructure and operations, known as Centralised Approach (CAPP). Impacts and dependencies are within the scope however;
- Technical development of the Flight Data Processing system, known as AAA. This requires upgrading (civil-military co-location project) to allow the military to use it for fully integrated service provision for approach services. Lelystad specific changes to the AAA system are in the project scope, as are impacts and dependencies.

As with any review, the review is reliant on the information provided. The review has been based on meetings and conversations with the Lelystad, Military and AAA project teams and the review team has been happy with the engagement of LVNL and other stakeholders in the review process. The review team has no reason to believe any information was intentionally withheld.

[2] Luchtverkeersleiding Nederland (Air Traffic Control Netherlands) is the Dutch Air Navigation Service Provider, providing ATC for Tower, Approach and En-route services. The project is known internally as *Realisation ATC Lelystad*.

[3] Commando Luchtstrijdkrachten, the Netherlands Air Force Command, provides an air traffic service to airspace users in designated airspace, and operates military aircraft in and around Lelystad.

2 The current plan and its history

2.1 Background

A formal decision[4] was taken by the Netherlands government to develop Lelystad as a commercial air transport airport in March 2015. It is currently used for civilian General Aviation, including training and business aviation. The aim is to grow commercial air transport to 45,000 movements per annum in the longer term, with a phased increase of 2,000 IFR movements per annum (5-6 per day) initially.

A letter of intent[5] was signed between LVNL, the Ministry of Infrastructure and Environment, Lelystad Airport and CLSK, in March 2015 to enable research activities and to make further arrangements about the intention to deliver and introduce ATC services to Lelystad Airport. This stated that the military would be willing to provide approach services, co-located with LVNL's existing approach facility at Schiphol Oost, whilst LVNL would be willing to provide Tower services and overall technical integration, both under the conditions as stipulated in the Letter of Intent. This letter of intent was reached on the basis of the low-level routes and connecting points being agreed. CONOPS variant B+ sets out the routes, with the airport certification based on this understanding with the Alders Platform (community consultation).

The project itself is relatively straight-forward. Introducing a fairly simple ATC service to an existing airport with a few commercial movements a day should not be unduly difficult. However, the review team notes that the complex interfaces with multiple stakeholders, airspace constraints, and dependencies on other projects complicate this task and add risk.

The related technical project (civil-military co-location) on the introduction and technical integration of the military Centralised Approach (CAPP) service and system at Schiphol Oost proceeds as an input to this project. The Lelystad upgrades to the CAPP service and system are part of the Realisation ATC Lelystad project.

Distinct stakeholder groups include LVNL management, Schiphol approach (TMA) controllers, en-route (Area Control Centre) controllers, Lelystad Airport (Director), CLSK command, CLSK controllers, the regulator, the Ministry of Infrastructure and Environment, airlines, General Aviation, existing airport users (including Business Aviation), local communities (Alders Platform) and Schiphol Group, the owner of the airport. The confidence in project delivery must take account of each of these.

2.2 Project governance structures

Figure 1 provides an overview of the project governance structure, including where the Steering Boards are placed.

[4] Luchthavenbesluit Lelystad, besluit van 12 maart 2015, Staatsblad 2015, 130.

[5] Intentieovereenkomst van 25 maart 2015, Staascourant 7 april 2015, nr. 9645.

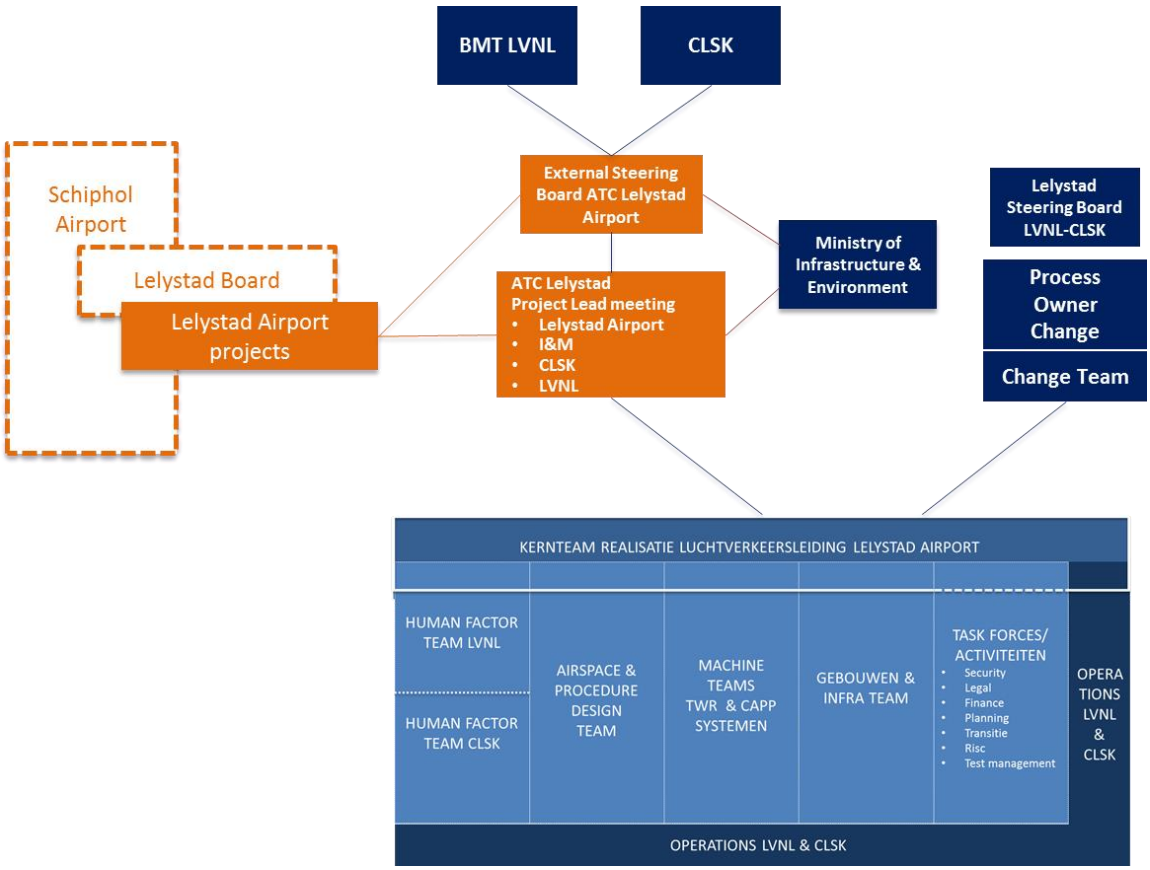


Figure 1: Project governance structure

A level of complexity and risk was recognised by the parties at the outset in the governance and review structures initiated:

- LVNL's internal project control structures, known as the Change Team and including the programme manager and process owner;
- LVNL/CLSK Steering Committee, including General Managers and Director of Operations – meets as required, up to 2-3 times per month;
- LVNL Executive Board and Management Team meeting;
- Lelystad Steering Committee – meets once per month, and includes the Airport Director as well as LVNL, CLSK and the Ministry of Infrastructure and Environment.

The effectiveness of these decision-making groups is an important factor in the ability of the project to respond to emerging issues and risks, and maintain its plan.

2.3 Project plan at the time of review (v1.0)

The independent review was carried out on version 1.0 of the project schedule plan, shown in section 6 at the end of this report. It includes all functional areas involved: policy/regulatory, procedural, human and technical.

3 Assessment of the current plan

The independent review focuses on determining the level of confidence in the schedule. To achieve this, it takes a comprehensive view of all aspects of the plan and portfolio that could influence this timeline. Figure 2 below therefore sets out the structure of the assessment.

Attention is primarily given to the critical path analysis of the project management schedule (Figure 4, section 6), and the risk management activities currently undertaken by the project.

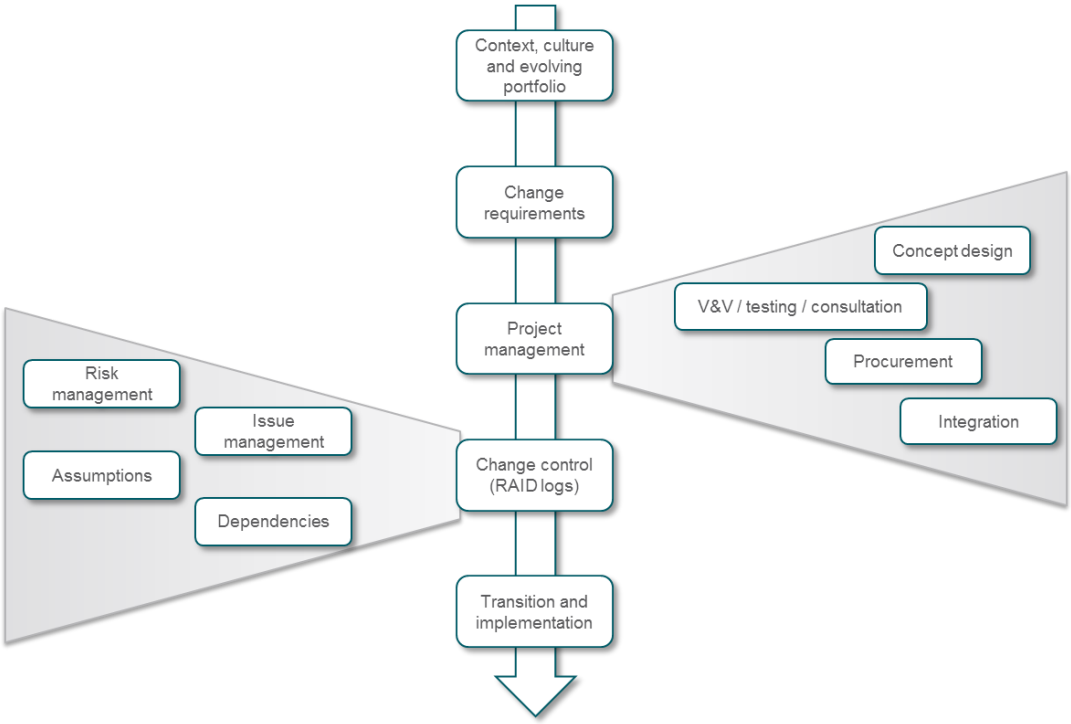


Figure 2: Assessment approach

3.1 Context, culture and evolving portfolio

The leadership and organisational culture of LVNL and other stakeholders is a key factor in the on-time delivery of the project. The review recognises strong involvement of senior management via the Steering Committees, but also highlights the potential de-coupling of strategic objectives and project resourcing with multiple stakeholders involved. Strong leadership aligned to clear resourcing decisions must be maintained at Steering Committee level for the project to reach a successful outcome.

The project's priority, arising partly through political drivers, appears to be well-understood by LVNL management. Appropriate resourcing in the overall strategy is given to the Lelystad related developments. The current and planned portfolio of changes appears reasonable; for example, software work related to the project is prioritised amongst other developments, and does not look to be creating a problem of over-demand on the teams. Some other key developments (eg iTEC – a new ATM system) are now scheduled for post-2020, and thus deconflicted.

LVNL is a mature ANSP with comparably less cost pressures than other ANSPs, due to increased Schiphol traffic overcoming the impact of RP2[6]. Therefore, whilst resources in LVNL will be rightly optimised and empowered, the review team do not believe there are undue financial constraints which prevent management increasing resource on the change projects as required. However, there needs to be effective allocation and involvement of operational staff from the early stages through to full operations.

Although the project is clearly a priority within LVNL's overall programme strategy, the motivation of each staff grouping needs further consideration. LVNL stated there was general acceptance of the change at present, but there is general desire for the project to have zero impact on surrounding sectors and units, eg ACC controllers, Schiphol TMA controllers, military mission effectiveness (MME). The concept of zero impact is clearly not possible when introducing new movements and complexity into the local ATM system. Any change in motivation or enthusiasm could exacerbate the issues with availability and operational acceptance if expectations are not well-managed.

3.2 Change requirements

Strong change management requires valid success criteria to be well understood and agreed at the start of the change. If the outcome being targeted is unknown, it becomes difficult to justify and validate elements of the change.

The political agreement with the Alders Platform for a long-term limit of 45,000 movements, including a stepped increase in movements, gives some bounding of the performance requirements of the new ATC service.

However, the success criteria in the immediate short term are unclear. Clear success criteria agreed with Lelystad Airport could include a requirement for initial levels and scheduling of commercial (IFR) traffic through which a viable business case could be created for the airport. The review team is aware that LVNL are currently addressing this risk through discussion with Lelystad Airport to estimate the capacity requirements.

Without these criteria, given the ambivalence with which the development is treated by adjoining ATC units, there could be a tendency within LVNL to revert to the minimum impact possible; eg begin ATC services assuming a limit of 2,000 IFR movements per annum, limited to 6-7 hours of the day, irrespective of whether that will support a business case for airline investment in the airport.

The review team is very aware that this process can include an element of cyclical decision making; concept validation adds constraints, which are then turned into new feasible success criteria. This is an accepted part of complex developments.

The risk is captured in the project risk log (MC5), but is assumed to be mitigated by agreement at Steering Group level during the first part of 2017, with no potential re-work required by the project. The review team's experience is that a political project with multiple stakeholders is not generally so neatly de-risked in terms of expectations and demands, and that performance requirements may evolve as new constraints and demands come to light. The review team has observed the multi-stakeholder introduction of new concepts and systems in other European countries,

[6] Reference Period 2 is the European Commission's second five-year period of performance targets for ANSPs, most notably in cost effectiveness. Some ANSPs have significant challenges to reduce their operational expenditure to meet the targets.

where projects required re-work post-training as new operational requirements became apparent.

This re-work then impacts other areas of the project – human factors, safety, training schedules and formal dependencies with other projects. Such re-work is particularly apparent where operational staff have not been engaged from an early stage through to full operation. It should be noted, however, that the review team are aware that best practice benchmarks lessons learned have been taken on board by LVNL from other similar projects in Europe.

However, the review team do not believe this risk is captured explicitly enough in the risk management planning for the revised April 2019 operational target. For example, areas of potential re-work could be identified (particularly when uncontrollable by LVNL), and possible fall-back scenarios captured, with early warning metrics identified. Such scenarios should consider the overall change-management impact and links to various dependencies.

3.3 Project management

The core of the change process is overseen by the project management tasks across the lifecycle of the change. The planned schedule is captured in the Gantt chart in Figure 4, section 6, and the planning process and detail can be tested to give confidence that the critical path identified will be followed.

3.3.1 Project management plan (PMP), including critical path

The PMP and critical path analysis is split into the functional areas by which the project is organised, these being:

- Policy and regulatory elements
- Procedural elements
- Human factors
- Technical elements
- General assessment points and the critical path

3.3.1.1 Policy and regulatory elements

Based on feedback from the project, the review team understands that the stakeholder consultation is assumed to bring low risk to the project timelines as the connecting routes are above FL60 (circa 6,000ft). Traditional drivers during public consultation tend to be environmental impact (noise) and airspace user acceptance, particularly General Aviation. With the routes above FL60, these impacts are reduced.

However, from experience, the review team notes that the combination of airspace access arising from classification changes and acceptability across stakeholder groups has the potential to lead to political pressures which may engender a change of the operational concept. The associated timeline risk has not been factored into the critical path; any changes may lead to repeated Real Time Simulations and further work on operational concept acceptance. Although the Ministry has the formal and overall ownership of the specific 5.11 procedure and the outcome thereof, the procedure itself foresees the consultation of stakeholders by the party initiating the change under consideration. This means LVNL (jointly with CLSK) has the responsibility to consult with stakeholders throughout.

A similar point is valid for the regulatory approval, upon submission of the formal safety case (VEMER 2.0). The review team do not foresee an unusual risk here, but note that the presence of an independent review by the regulator late in the validation process can lead to new views becoming apparent which must be taken into account. The risk is recognised by LVNL, and commitment made to ongoing engagement with the regulator.

3.3.1.2 Procedural elements

Procedural elements include the operational concept design, validation and subsequent implementation of new routes and airspace design, including changes to legislation.

The validation lifecycle and agreement for the introduction of a new operational concept was perhaps assumed to be simpler than is the reality. The review team note that in the Amsterdam region, one of the strongest drivers is environmental impact. With the low-level routes being agreed through consultation (CONOPS B+), it may have seemed a smaller, less complex step to develop connecting routes to the transitions.

The reality is that competing stakeholder interests and constraints have led to a very narrow set of possible options for the connecting routes and airspace design, with the potential that none of them fully meet all the proposed constraints referenced in section 3.4.2.

There has been an additional Real Time Simulation (RTS2) recently added to the schedule with a proposal for another. This back-up RTS would also lie on the critical path. RTS2 is still to be precisely scheduled, but is planned to be prior to October 2017. It may pose issues for availability of operational staff, particularly as the co-location project is also proposing to use simulator time during this period. Schedules are being closely monitored and planned between the Lelystad ATC project manager and military lead.

There is an assumption that workload modelling, RTS1 and military modelling on mission effectiveness will lead to clear decisions. The review team had some confidence with this in relation to the CLSK associated risks, understanding that the modelling assesses MME and the ability of the military controller to manage traffic for the proposed Lelystad routes. Although this assessment is qualitative, it has considered route length, complexity and likely levels of coordination required. This is understood to be based on the expected controller tasks and the worst-case traffic load per hour.

However, the review team did not have full confidence, based on the following reasoning:

- It is not clear what happens if the workload model shows unacceptable outcomes for specific sectors. It is also unclear whether the workload model is representative of a most credible scenario for a particular sector. Finally, the mitigation for the workload model may depend on high level agreement – for example, by limiting traffic for safety reasons to Lelystad during certain busy periods at Schiphol. This would need to be agreed with all stakeholders, and be within the constraints of a credible business case for the airport and potential airline customer.
- The review team understands that similar assessment and outputs as the military modelling is expected of the RTS1, planned for late March, which will allow single aircraft to and from Lelystad to be modelled in the affected sectors,

for example understanding the impact on Schiphol traffic flows and military traffic. This is intended to show the acceptability of the individual routes. However, the limited nature of the RTS may lead to an invalid conclusion, which may only be picked up during the second RTS later in the fall. There is also no apparent opportunity for a re-run of RTS1, for example if the Schiphol controllers do not accept the impact.

Consensus between LVNL and CLSK on the concept design is planned for May 2017, taking account of the LVNL workload modelling, MME modelling, and the RTS1 results. This then allows a range of other steps reliant on the concept design to begin, including formal procedure design, flight validation, stakeholder consultation and training design. This critical connected step is a high concern for the timeline.

For example, a clear risk is that stakeholder consultation is carried out on an ATS route design and airspace concept which has received insufficient validation, and could change in future validation iterations. More likely, stakeholder consultation could be delayed and become a potential critical path issue. This parallel process has been agreed at Steering Committee level, but remains a risk.

A related risk can be seen in the regulatory regime. The review team is aware that possible changes in legislation could emerge further along in the process. The timeline for legislative changes is not affected by changes in the operational design, although the legislative process may start later due to delay as a result of unplanned changes in the operational design. The legislative process is the responsibility of the Ministry.

If major changes are required during the safety case process for the airspace or routes, this would put the schedule at risk. LVNL have stated that the ILT/NSA regulator is being kept informed of the developments with respect to the safety argument and development of the safety case, ensuring the change is carried out according to standard operating procedures.

A potential risk is also identified in agreeing handover procedures, ensuring adjacent en-route centres are satisfied and have factored in their requirements. LVNL have stated that adjacent centres have been contacted and necessary changes fit into current Letters of Agreements. LVNL also stated that, if traffic numbers increase significantly, additional measures with adjacent centres could become necessary and will be implemented.

Nevertheless, the project should continue to ensure adjacent centres, including military, are fully aware of the impact of the airspace changes, so that those centres can determine their own needs to conduct internal simulations and safety assessments to validate and accept the changes. Such confirmation of adjacent centres' readiness should also be formally confirmed through the transition planning checklists, to avoid delay of acceptance of the procedures.

Finally, although there are several route options per sector, the review team noted that each route option is *brittle* and does not allow much flexibility in design. If a route becomes unacceptable, this could lead to new issues and acceptability.

In summary, from experience, the review team recognises that the assumptions that there will be limited requirement for re-work in the validation process may lack credibility. The presence of multiple stakeholders with competing interests (and no solution which meets all constraints) leads to a significant risk that acceptance of the final airspace solution will not be straightforward.

3.3.1.3 Human factors

Human factors considerations include recruitment, licensing, and the training lifecycle including design, development and implementation.

Finalised training development (version 1.0) will depend upon the assessed required competencies specific to Lelystad and finalised procedures being available. There is considerable buffer in the period between training development finalisation and the eventual implementation, particularly given the delay from April 2018 to April 2019. This may be necessary, as recruitment of controllers may be challenging.

For Lelystad tower, the skills required for the mix of IFR and VFR traffic may not suit all, and it is not certain that the recruited controllers will all pass testing for the license. Furthermore, there may be difficulty in convincing enough controllers to transfer. Schiphol is proximate and has the largest controller pool. However, it is also at capacity, requiring more controllers in the coming years, and gives rise to a skillset which may not match the requirements of Lelystad TWR. Other airports have a similar skillset (eg Rotterdam) but have far fewer controllers available.

The same is true for the new approach service staffed by military controllers. Early identification of a controller pool for the new service must be made, and training put in place to enable qualification.

Finally, the training is heavily reliant on stable operational requirements and resultant simulator platform development. Any delay to these would impact the timeliness of the training.

In the opinion of the review, these factors should not unduly reduce confidence in the April 2019 target date, given the buffer which exists. However, the mitigations within the current planning and risk management log will need to be more clearly and explicitly identified and actioned, so quick action can be taken early in case of recruitment and subsequent training.

3.3.1.4 Technical elements

<u>TWR systems procurement and integration</u>

The core project aiming to provide TWR services to Lelystad comprises a number of procurements of known technical systems. These procurements are planned to proceed in parallel, with eleven or twelve separate processes through 2017, dependent upon architectural decisions made. Most of the systems are standard, with accepted specifications already available and used by LVNL.

Nevertheless, the volume of procurements gives rise for concern, specifically LVNL's resourcing to manage them according to best practice and integrate the systems as planned during 2017. This will impact supply chain management as well as the project team.

The LVNL contract department has an overview of all procurement processes necessary for the Lelystad project. One is a European call for tender (OJEU), whilst others are part of already ongoing procurement processes. Existing frameworks enable LVNL to downselect multiple contractors and after receiving their quotation, select the supplier. These have a relatively short duration; the total amount of hours is estimated and is integrated with the planning of the LVNL contract department. Due to the nature of the various procurement processes, the amount of parallel processes are not thought to pose a risk.

Due to the proposed revision in operational date, there is now a significant buffer of three months or more available in case of issues. For this reason, there are few plausible scenarios related to the procurement which would reduce confidence in meeting the target date.

Technical inter-dependencies with AAA

The more prominent risks are caused by the technical dependencies:

- The civil-military co-location project, developing the infrastructure and integration for CLSK air traffic controllers to provide radar services from LVNL's Schiphol Oost facility. This includes the design and delivery of the AAA CAPP (Centralised Approach) build, dealing with the core Flight Data Processor software development for the co-located military controllers.
- The Lelystad AAA CAPP (Centralised Approach) project, dealing with the Flight Data Processor software development specific to the Lelystad ATC routes and airspace changes for the co-located military controllers. This project was initially thought to be delivered one year after the operational date. However, revisions to the date have meant that the project is planned to be delivered prior to completion, with LVNL believing this to be a low risk addition.
- The Lelystad AAA TWR project, dealing with software development of the Flight Data Processor with respect to Lelystad Tower services. This project was not part of the initial architectural design, but has been included following the decision to delay operations to April 2019. This was on the basis that it is the preferred option to meet operational requirements for the service. It is planned to be released in a common software build with Lelystad AAA CAPP.

The AAA system development, including the build associated with the civil-military co-location project before this project, is on the critical path for the target date for operations at Lelystad (see Figure 3). The Lelystad ATC realisation project can be considered the customer for the AAA developments. Therefore, the risks associated with these projects are considered to be part of the overall system development and included within the project and steering groups. It should be tested whether control and decision making also fully sits with the relevant Steering Committee.

The planning for the AAA build calls for a delivery of Co-location AAA (66.0) by end of 2017, a single rectification build for Co-location AAA (67.0) six months later, and a delivery of Lelystad AAA CAPP and TWR (68.0) by November 2018. There are several smaller repair builds planned within these timelines. This schedule is then on the critical path for the simulator development and subsequent training, as shown in Figure 3.

A further Lelystad AAA CAPP and TWR rectification release is optionally planned early in 2019.

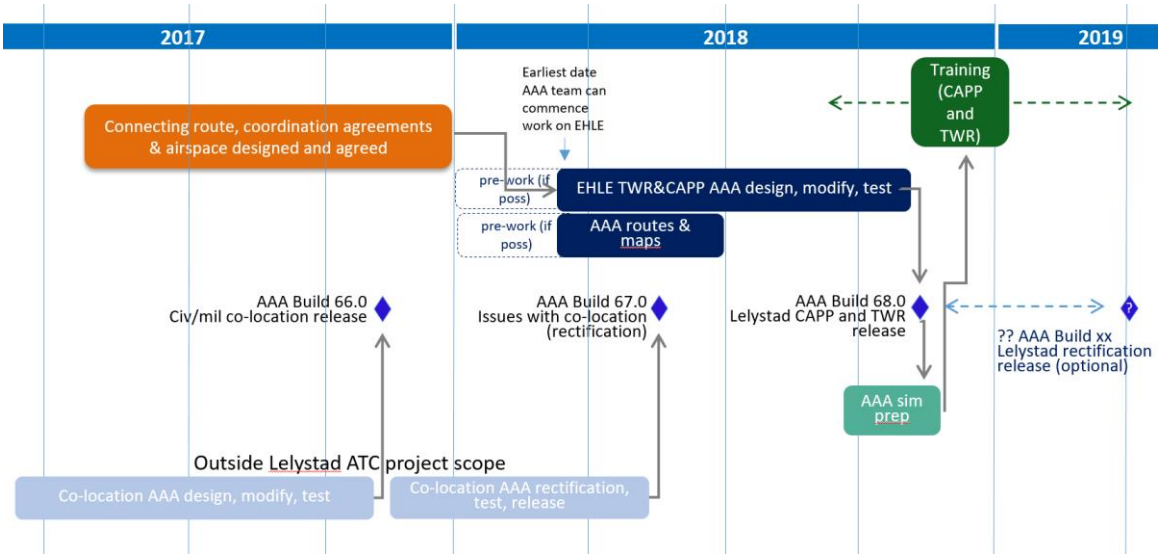


Figure 3: Timelines for technical AAA system development

The risks presented by these dependencies appear well understood by the project team and steering groups. In summary, the key dependencies are:

- procedures, airspace and coordination must be mature; and
- work on co-location AAA release significantly finalised, prior to work commencing on the AAA software for Lelystad.

The civil-military co-location is recognised as a critical and complex project. The military (CLSK) do not want to change their concept of operations as they re-locate. Therefore, the system must be familiar to the controllers, whilst incorporating the functionality available to LVNL civil controllers and appropriate safety levels.

Question 1: is the co-location AAA development a true dependency for Lelystad ATC?

Within the co-location project, the AAA system development is a key aspect. Technically it adds risk and complexity, but is considered by the military to be a core requirement. It enables a view of all traffic on one system with integrated tools and display. The military operational experts consider this to be a safety issue.

The review team is reasonably familiar with the arguments, and generally agrees with this position. The co-location AAA (CAPP) therefore becomes a blocker for operations at Lelystad if it does not proceed. There are no other solutions or alternatives.

Question 2: what is the risk of delay for the co-location AAA release?

The project team informed the review that best practice benchmarks had been taken on board from other similar projects in Europe, and lessons learnt from a previous military system upgrade to interface with Maastricht Upper Area Control Centre (MUAC). This appears to be reflected in the core planning, with reasonable man-hour estimates for system delivery.

The biggest risk internal to the co-location project has been identified as military controller availability and the ability to conduct appropriate validation in Real Time Simulations. In common with the Lelystad project, these are planned for fall 2017.

The project manager for the co-location sits on the steering board of the Lelystad ATC project, ensuring accurate and timely exchange of information.

In spite of this, for Lelystad ATC and LVNL, there are elements to this risk which cause concern for the project, generally activities outside the direct control of LVNL. The review team must assess how much confidence to place in the late 2017 AAA co-location delivery and the rectification release in May 2018 in time for the AAA Lelystad CAPP and TWR project. Critical to this is the ability of the Steering Committee representatives to exercise control over resources to meet the planned schedule.

A further risk lies in the planning for a single rectification release. In the review team's experience, a late change in requirements for controller acceptability can often occur, particularly when dealing with multiple stakeholders. A second rectification release may be required to address these; the scenario and planning for this should be assessed to understand what risk it would pose to the schedule for Lelystad ATC.

Question 3: what are the risks for the Lelystad CAPP and TWR AAA builds?

The review team questioned whether the lack of a rectification build for AAA Lelystad CAPP and TWR is justifiable in terms of experience, recent history and best practice. If a rectification build were required, it would almost certainly push back the operational date. There would be operational restrictions, due to less automation, more handwork and more verbal communication between TWR and CAPP.

The alternative for Lelystad TWR operations in case AAA cannot be delivered is to revert to another technical system. This comprises a procedural solution based on voice-based coordination of traffic, requiring the implementation of an Aeronautical Fixed Telecommunications Network (AFTN) terminal rather than the data being integrated within the Flight Data Processor.

For AAA CAPP changes specifically related to Lelystad routes and airspace, it is unclear to the review team whether suitable alternatives exist.

The review team understands from the military perspective that the alternative requires traffic on more than one system with separate tools and display. The human machine interface issues and related workload has resulted in no alternative to full AAA interface being acceptable to the military controllers. Their safety reasoning - of avoiding differing human machine interfaces through working on two systems - for the co-location AAA requirement may also apply, making it unacceptable and thus redundant.

The AAA software team has almost doubled in size to 45 people, which has operated at this capacity for around two years. The sub-contractors have been trained and are considered fully effective on existing projects; therefore no change to the team is foreseen or deemed necessary by the AAA team. This gives confidence as to available resources and their experience.

However, the review team is aware of there being around 50% sub-contractors, needing 6-12 months training prior to full effectiveness as part of the team. It is the review's understanding that the team is operating at full capacity, with multiple changes on-going. Any change to the team could therefore add a potential delay to the project although this risk is reduced with the AAA team's expectation much of the civil-military co-location code will be re-used for the Lelystad CAPP and TWR AAA builds.

Question 4: what is the overall risk to the operational date?

Based on previous experience on ATC system developments, and noting that precise estimates for re-work appear to vary, the review team are concerned that:

- the different stakeholders and organisational cultures involved will almost certainly lead to varying drivers, priorities, and expectations; the review team's experience is that this increases the risk of additional re-work;
- there may be unforeseen re-work arising from new requirements on the co-location AAA build; although one re-work build is planned, similar projects in other countries by experience have required two rectification builds for issue resolution; at least it should be a scenario which is considered;
- the software team is at full capacity, and is reliant upon a resource which is not easily replaceable – in other words, if a contractor drops out, their replacement would only be effective after 6-12 months;
- the planned start on Lelystad CAPP and TWR (~Mar 2018) is at significant risk from the co-location rectification build (due for release May 2018) and other projects across LVNL using software team resource; the plan appears vulnerable at this point;
- the lack of a rectification build for Lelystad AAA CAPP and TWR in the core planning is a concern; the review team recognises that the next step on the critical path (simulator and training exercise development and implementation) could proceed with the initial build, but also notes that any changes could require re-work and re-training;
- the alternative solution to AAA CAPP has already been assessed as not acceptable to the military controllers due to considerations of human machine interface and safety; this view may also apply to the Lelystad specific changes to AAA CAPP.

In summary, the technical development projects are planned according to best practice and experience of similar projects. The planned separation of the co-location and Lelystad builds reduces the risk and demand on resource, also allowing similar personnel to be involved on all builds for continuity.

However, in the review team's view, the LVNL programmes are taking an optimistic assessment of the likelihood of re-work arising from varying stakeholders and the complexity of the upgrade. Given the software team's loading, any change to requirements during the process would almost certainly alter the build delivery dates and thus the critical path. LVNL should explore adding margin to the project plan to take account of these points, particularly in adding resilience to the current schedule.

3.3.1.5 General assessment points and the critical path

The project plan contains some well-thought through analysis. Many of the risks raised above are known by the project team, but not necessarily acted upon decisively. This point is further developed in the risk management section 3.4.1.

As the review team conducted the assessment, there were a number of changes to the plan being made. Many of these reflected the notified change in schedule, and are understood to be one-offs in their scope and effect.

However, some elements have been added towards the end of 2016 which may suggest a more generalised planning issue. As earlier discussed, the complexity of the project requires a high degree of forward planning for the procedure design,

AAA build and subsequent simulation and training steps. There is a project plan for the definition phase (signed in October 2015). The realisation phase plan completion was postponed due to the conclusion that the initial Lelystad project operational date (1 April 2018) could not be met. This has resulted in some elements added towards the end of 2016 (eg new simulations).

The identification of a 10-week buffer in the critical dependency between finalisation of procedures and commencement of technical work on AAA is a welcome step. It is based upon the capacity of the AAA project team to start work on the Lelystad AAA CAPP and TMA, and so is a necessity rather than a true mitigation. However, LVNL have stated that many AAA activities can already be underway, independent of finalisation of the procedures, for example including operations unit functionality and inclusion of the CAPP workstation. Where procedural elements become delayed for a short time, it therefore means no impact on the planned critical path.

Finally, there is extensive contracting-out included in the plan. Whilst this allows for flexibility in resourcing, based on the review team's experience, it can also lead to unplanned shortages and possibly experience issues given the 6-12 month ramp-up in competence for new staff. This is being tracked at a functional level – for example, the known reliance on Navigation experts and possible shortage of supply – but the overall impact on the project is difficult to estimate.

3.4 Change control: Risks, assumptions, issues and dependencies (RAID)

Successful projects use strong change control processes. These include risk and issue logs, but also awareness and tracking of assumptions and dependencies.

The RAID analysis aims to identify areas which could impact the project plan, and mitigation, control or plan for them as required. These may be elements outside the control of the project team or LVNL.

This section focuses on the process of change control rather than the functional project elements, but gives specific examples where necessary.

3.4.1 Risk management

Risk: A specific event that may occur to impact the achievability of the project plan.

A risk log has been produced by the project. It contains high level risks, an assessment of their impact, and some high-level mitigations.

The review team has significant concerns with the risk management process.

By November 2016, the project had 12-13 red risks when looking at an April 2018 operational date. Red risks are defined by LVNL's own risk management process as *impermissible*.

Once the decision to delay the project was taken, many of these schedule-related risks reduced in impact. However, there were a still a number seen as red. The mitigations applied are seen by the review team as having little impact on the underlying risk, thus the risk scoring should not change.

- Example 1: the AAA CAPP modification risk is correctly stated to endanger timelines, is accepted as a risk by the Lelystad project, but is then moved from a medium likelihood to a low likelihood (red to orange). Usually, acceptance of risks means they cannot be controlled directly and thus mitigations won't have impact. It is unclear how the stated mitigation "start with preparatory activities at an early stage – part of project planning" will have any discernible impact.

- Example 2: the risk of not being able to recruit enough CAPP and TWR controllers has an effect of endangering timelines. The risk is considered as impermissible without further mitigation. Mitigations are applied, stating that deadlines will be set, extra controllers will be trained, and outside sources will be examined if this doesn't work. It is unclear whether these mitigations will impact the specific risk. They may lead to controllers being found and trained, but it is not apparent whether the schedule will be kept.

For a project of this complexity and political importance, the review team would expect to see a detailed risk management register, with clear and agreed controls, persons responsible and impact analysis.

Best practice would suggest each key mitigation should have its own plan, with key metrics to help track its effectiveness and give early warning if the mitigation is not implemented. Each mitigation becomes an element in the project plan, with resourcing, responsibilities and dependencies of its own. These plans are then communicated to all affected parties, giving a common view of the situation.

Without these, there is a concern over the true control of the risk, and the explicit understanding of what needs to be done to maintain control.

Even with the re-scheduling and after other mitigations are applied, there are still eight severe risks identified to the project going operational on-time.

It is unclear how the overall risk profile of the project is being treated. Having eight independent risks impacting the schedule, each with a certain likelihood, will mean that the overall likelihood of delay is higher than each of the individual values.

The specific reaction to a risk profile such as the one presented by the project will depend upon the individual organisation. Each organisation will have a way of presenting risks and making the subjective decisions on likelihood. The colour coding is intended to help with this, assisting management of where to allocate resources. However, even this may be organisation dependent, with one organisation tolerating several risks in the red zone whilst another would take extensive action if even one controllable risk moved into that zone.

If the review team were to take the wording of the risk matrix at face value, the continued presence of eight severe risks and the lack of confidence in some mitigations leads to a conclusion that the project retains a severe risk of further delay.

3.4.2 Key assumptions

Assumption: Statements considered as true throughout the project lifetime to enable the planning and realisation.

Several assumptions were made at the start of the programme:

- There should be no negative impact on traffic flows to and from Schiphol, giving rise to a constraint that route designs should not enter the Schiphol TMA. The overarching business case for the Lelystad Airport is aimed to release certain traffic from Schiphol, ensuring the Mainport (hub-and-spoke, transfer traffic) model can be developed. To ensure the case, the development of Lelystad should not penalise Schiphol flows.
- Mission Military Effectiveness must not be compromised.

- The agreed CONOPS B+ is assumed and should not be re-visited. This covers the low level routes up to FL60.

Given the constraints of the route design and airspace solution, these may represent preferred constraints rather than core assumptions.

For this reason, assumptions must also be considered as risks, and tracked in a similar manner. If the assumption becomes invalid, it will cause *ripple* impacts to various parts of the project. The project should aim to understand these impacts, and whether they could lead to further scheduling risks.

An example of this would be the initial assumption that *there will be no change to Schiphol TMA design*. If the only feasible means of route design is through the existing TMA airspace, the validity of the assumption is questioned. The impact may be a concern amongst Schiphol controllers, potential performance impacts, and negative airline views. Thus careful communication and management would be required to gain agreement, balancing the factors to achieve an acceptable conclusion.

3.4.3 Issue management

Issue: something which arises during the project which requires resolution.

Whilst risks look at potential events in the future, issues management considers those events which have already occurred.

Issues are currently presented to the steering groups each month, with discussions around the most critical areas.

The review team have not seen an issue management log. This would assist the organised and explicit communication of issues as they occur, and would ensure all stakeholders become aware of the impacts.

3.4.4 Dependencies

Dependency: an output from a specific piece of work is required for this project to proceed according to plan.

The specific dependencies have been discussed above, where identified. Focus appears to be placed on the major identified dependencies, with discussion occurring in the steering groups.

Dependencies were available and maintained for LVNL's Board and Management Team (BMT), but only for the Definition Phase of the project. However, in terms of a project planning process, no dependency log was available to the review team to show all possible dependencies, their impacts, specific expectations and potential mitigations. Again, this would help with clear and explicit communication of impacts. At present, the process appears relatively reactive. Emerging dependencies are only superficially understood and reacted to. A more proactive analysis may assist in communication and risk planning.

3.5 Transition and implementation

The final part of a project process is the transition and implementation steps. These are described at quite high level in the project plan, being at the end of the timeline.

Nevertheless, the review team would expect to see a transition plan produced, outlining the steps necessary to commence ATC services at Lelystad. All assumptions on input material could be clarified and checked off as they become available. Ideally, this should be available in advance of operational teams becoming involved in the transition.

4 Conclusion and recommendations

Conclusion

The independent review team examined the project from the perspective of functional planning, future risks and dependencies, and the underlying change control processes. The core question is whether the revised planning towards an April 2019 operational date is achievable, realistic and resilient.

The project schedule (v1.0) appears reasonable as a planning document, setting out a series of goals and targets by which the project can be managed. The process is reasonably linear, and shows a clear critical path by which the project can be focused and managed.

Key dependencies are being identified as they arise, with oversight via specific activities at Steering Committee level. Key risks are also well-discussed, but in a reactive manner.

With the recent proposed delay to the operational date (originally April 2018), the project workflow now includes some significant buffers which provides re-assurance that certain unplanned delays can be managed within the current schedule. In particular, this allows for some delay to the agreement of the operational concept (connecting routes and airspace design), enabling all stakeholders to make an informed and robust decision on these matters.

To this end, the opinion of the independent review team is that the revised planned April 2019 operational date is *achievable* and *realistic*, following a clear critical path based on key identified dependencies, along with clear goals and targets. However, there are some fundamental points that require addressing to increase confidence in the *resilience* of the project's revised planned April 2019 operational date. These can be categorised as:

- **Internal**, where LVNL has direct control of activities, including resolution of issues;
- **External**, where LVNL maintains an advisory and/or coordinator role for required activities involving other stakeholders, but has no direct control or responsibility of those activities. This would include appropriate tracking of activities through formalised dependencies (eg letters of agreement) and inclusion of activity tracking (checklist) in the project transition planning.

Overall, several significant risks with “medium” probability remain in the project planning, and combined result in a higher level of risk to the schedule overall. Given the number, the review team determines that it is likely that one of them will occur in such a manner as to disrupt the critical path. From a review team perspective, taking into account current mitigation activities, the most likely risks remain the following:

- success criteria[7] changing during the project’s lifetime, including not being comprehensive enough to drive valid project requirements (**Internal** and **External** risk);
- an agreement on the operational concept which alters through the project lifecycle; each connecting route is tightly designed and has drawbacks; therefore, all civil and military airspace users, Lelystad and Schiphol Airports, civil and military controllers, Ministry and regulatory stakeholders must agree with the trade-offs in choosing the eventual routes (**Internal** and **External** risk);
- the risk of re-work to the operational concept as a result of public consultation, even recognising the schedule anticipated by LVNL and the Ministry (**External** risk);
- a change to the agreed constraints on the project, for example the requirement for no negative impact on Schiphol traffic, changing due to the route design, and the resultant time and coordination to agree the changed constraint (**Internal** and **External** risk);
- the possible delay in recruitment and training of civil TWR controllers, in finding an appropriate controller pool with the skills required for the mix of IFR and VFR traffic, and the potential delay in assigning and training CAPP controllers (military), in both cases ensuring the simulation facilities are ready on-time (**Internal** and **External** risk); and
- the identified risk around the AAA build delivery, AAA being the Flight Data Processing software used by LVNL (**Internal** risk).

This key risk with the delivery of AAA CAPP (Centralised Approach), allowing co-location of civil and military controllers, relates to it being an agreed basic requirement stated by the military controllers. Without successful delivery, the project will not proceed. Implementation relies on development of the solution by the LVNL software team, and acceptance of the design by the military controllers. The review team notes that this risk is understood, possible mitigations have been explored, but that the timescales for the release are still tight and would have immediate impact on other activities.

In addition, a dedicated Lelystad CAPP console and TWR (Tower) system are planned, requiring further revisions to the AAA software. The fall-back solution in case of non-delivery would impact the ability of the controllers to handle the traffic as follows:

- From the TWR perspective, a procedural solution would be required based on voice-based coordination of traffic, requiring the implementation of an Aeronautical Fixed Telecommunications Network (AFTN) terminal rather than the data being integrated within the Flight Data Processor. There would be operational restrictions, due to less automation, more handwork and more verbal

[7] Lelystad Airport capacity estimates currently being discussed between LVNL and Lelystad Airport.

communication between TWR and CAPP. Whilst this appears permissible given the traffic levels of Lelystad in the early years, the review team notes that expectations are being set, and LVNL controller acceptance is also part of the consideration;

- From the Lelystad CAPP perspective, the alternative may require traffic on more than one system with separate tools and display. There may be military controller acceptance considerations if the AAA Lelystad CAPP changes are not implemented prior to operations.

The revised operational date of April 2019 still relies upon a single major release of AAA Lelystad CAPP and TWR software following the civil-military co-location AAA build. Repair builds are foreseen, but any issues with the software requiring a rectification build may possibly impact the critical path and operational date.

Finally, the lack of explicit control of the risks, and history to date of reactive risk management, suggests that the effectiveness of mitigations may not be as planned. The review team did not have full confidence that the mitigations were adequately implemented, resourced and tracked from the material made available.

Given the above findings, the review team have provided recommendations for LVNL consideration, the resolution or clarification of which need to be provided to increase confidence that the project's planned operational date could be met.

Recommendations

Recognising the complexity of a multi-stakeholder project, the review team strongly recommends agreeing the project requirements across all relevant internal and external stakeholders as soon as feasible, and reinforcing the ability of the relevant Steering Committee to control all known risks and interdependencies effectively.

More specifically:

1. At the earliest opportunity, finalise the operational concept based on capacity planning with Lelystad Airport and the key airlines, identifying clear and appropriately detailed success criteria and with assumptions agreed between all stakeholders. This will mitigate the risk that the delivered solution will not fit the business case for the airport and require re-work. (**Internal** and **External** recommendation)

2. In all aspects of AAA development, there is no margin in the planning. For true confidence in the schedule, LVNL could explore adding more margin, potentially planning for a second rectification build of AAA CAPP (co-location) and/or a single rectification build of AAA Lelystad CAPP and TWR. (**Internal** recommendation)

3. Develop risk scenarios to understand the potential impact of individual or combined risks on the operational date. From this process, ensure the externally agreed operational date takes reasonable account of possible future iterations of the project plan. Early identification of risk scenarios and therefore ensuring associated contingency in the project plan mitigates this risk. (**Internal** recommendation)

4. Develop and agree more detailed mitigation plans for key risks. Identify internal (to LVNL) and external owners of these risks and their mitigations, and communicate them to all affected stakeholders. Ensure ownership of the mitigation plans by the appropriate Steering Committee, particularly validating

the ability of the Steering Committee to implement the mitigations across various organisations. (**Internal** recommendation)

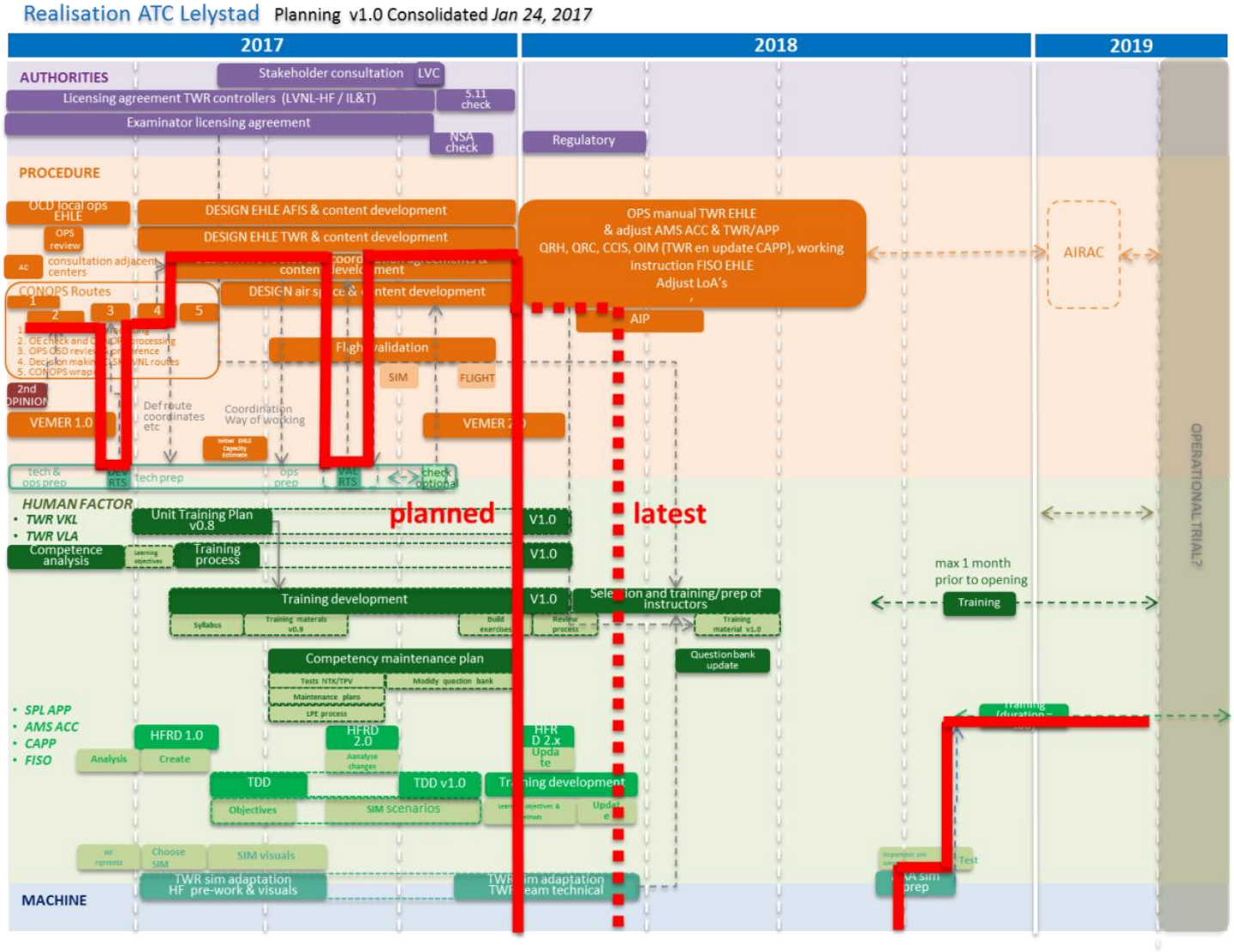
5. Develop a clear dependency log, assessing all potential inter-dependencies (input and output) and identifying key tracking metrics to understand the impact of changes in scope or timelines. Highlight any dependency which cannot be controlled from Steering Committee level, and carefully track its development and impact. (**Internal** and **External** recommendation)
6. Identify the assumptions under which the implementation date can be met and communicate these with all stakeholders. (**Internal** and **External** recommendation)

5 Acronyms

ACC	Area Control Centre
AFTN	Aeronautical Fixed Telecommunications Network
ANSP	Air Navigation Service Provider
APP	Approach (an ATC service)
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Service
BMT	Executive Board and Management Team (LVNL)
CAPP	Centralised Approach
CLSK	Commando Luchtstrijdkrachten, the Netherlands Air Force Command
CONOPS	Concept of Operations
FDP	Flight Data Processing
FL	Flight Level
IFR	Instrument Flight Rules
ILT	Inspectie Leefomgeving en Transport
iTEC	interoperability Through European Collaboration (an ATM system development project)
LVNL	Luchtverkeersleiding Nederland (Air Traffic Control Netherlands)
MME	Military Mission Effectiveness
NSA	National Supervisory Authority
OJEU	Official Journal of the European Union

PMP	Project Management Plan
RAID	Risks, Assumptions, Issues and Dependencies
RTS	Real Time Simulation
TMA	Terminal Control Area
TWR	Tower (an ATC service)
VCS	Voice Communication System
VFR	Visual Flight Rules

6 Gantt chart provided by LVNL (version 1.0)



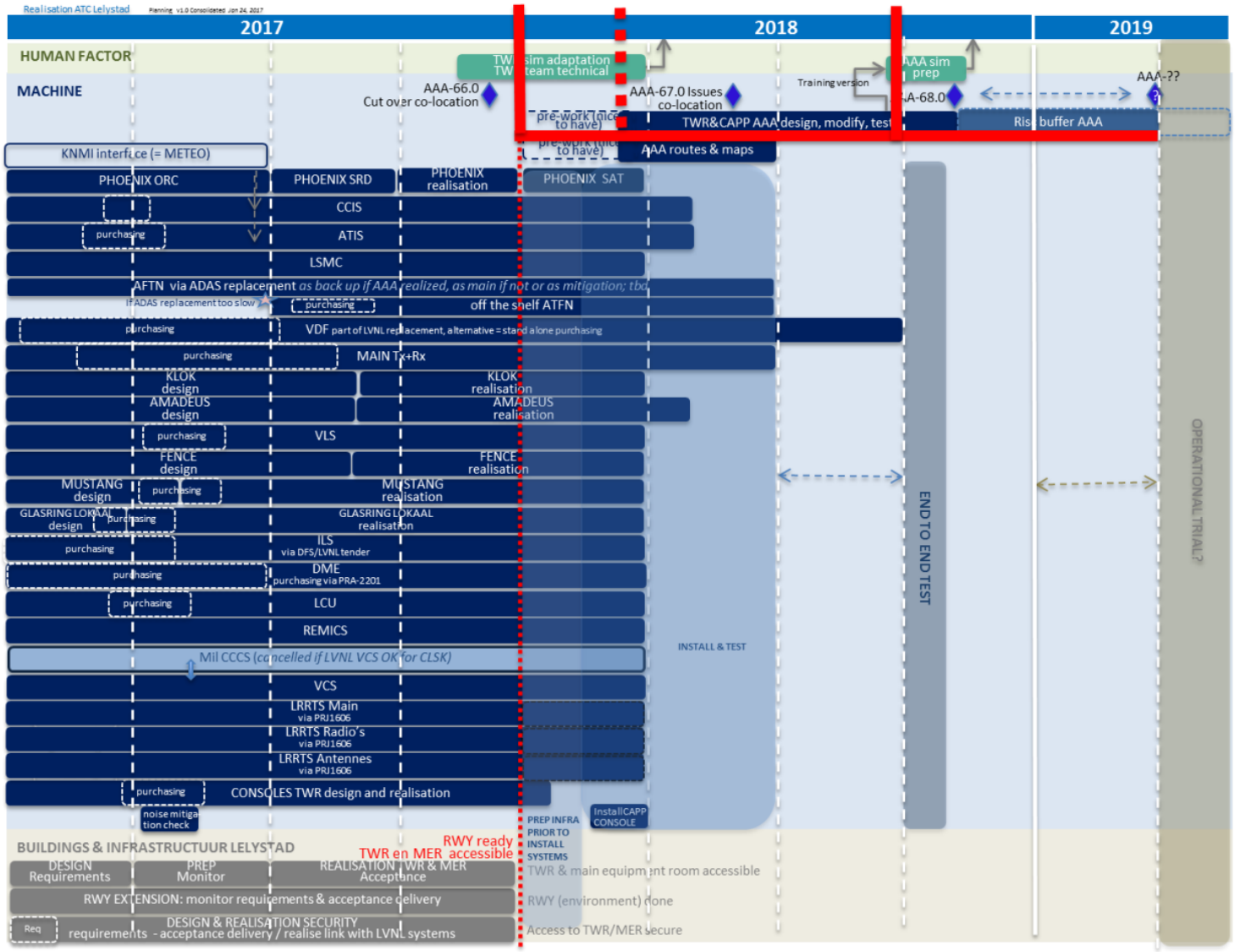


Figure 4: Project timelines and critical path (version 1: LVNL)