

APPLE



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A. DEEPENING RESEARCH APPROACH

VISION IN PRODUCT

Vision in Design – Paul Hekkert & Matthijs van Dijk

1. “Understand what direction a certain domain is taking” (p. 60)
2. “Take a position in the here and now about what to accomplish relative to that domain” (p.60)
3. “Lastly, the designer has to think of products that fulfil the goal as defined in the statement” (p.60)

NOT design thinking conceives products, functions and features, BUT thinking that sees solutions (changing) world.

- People say what they need based on what they know and have

Steps to take (figure 37):

1. Start: context research
 - a. Ask: what factors will become or are relevant to the domain of the growth of the airbase?
 - i. Starting with 5 important people interviewing
 - ii. Own insights
 - b. Factors: principles, states, developments, trends
 - c. Clusters = mutual quality of factors and is more abstract = common strength
2. What do you want to achieve and why?
3. Domain (time, strategy, specific/open)
 - a. Collect influencing factors on domain
4. Deconstruction of current context
5. New context
 - a. Set timeframe/state timescale
 - b. Define words in domain
 - c. Show relevant factors within timeframe
6. Structure in the context + statement
 - a. Cluster factors into effect they have on people’s life/work environment
 - b. Raison d’être
 - c. What would you offer people

- d. who will be part of your new world?
 - How do you want people to behave in relation to the distilled structure of your context factors?
 - i. “I want to offer people...”
 - ii. “I want to enable people...”
 - iii. “I would like people to see/experience/feel/understand...”
 - e. Statement is not multi-layered, briefest overview of the things that play a role in the domain
7. How should people interact within/from the statement
 - a. Metaphor
 8. Statement + Interaction + Product
Qualities = context vision
 9. Context vision leads to concept development

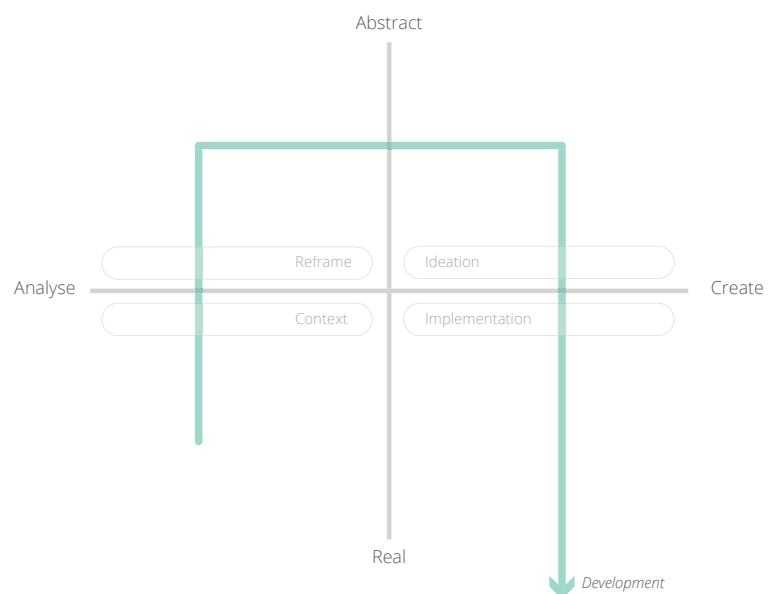


figure 37. Essentials of ViP process

Part of the Vision in Product approach is the internal - and external analysis (figure 38).

INTERNAL ANALYSIS

The internal analysis will be about the company, Royal Netherlands Air Force with the focus on Eindhoven Airbase. First of all the general background of the company needs to be studied. With this study good insights can be found, about the history and the 5th Generation Air Force of the company. Next to that the strategy of Eindhoven Airbase will be clarified via their vision and mission. The last important factors of the internal analysis are the resources and statistics.

EXTERNAL ANALYSIS

The external analysis contains a desktop-, literature- and field research. Starting with the desktop research to find the most influencing partners, stakeholders and competitors. Besides, the market needs to be clarified and a trend analysis needs to be done. The trend analysis consists of five different search areas, namely Demographic, Economic, Political, Ecological, Social and Technological (DEPEST). Secondly a literature analysis is done, which contains reading scientific papers and books. Literature about airport innovation, aviation industry, Vision in Product, Safety and Growth, Lean - and Design thinking will be explored to get helpful and relevant insights.

Thirdly insights from different stakeholders around Eindhoven Airbase will be gained from qualitative research with semi-structured interview.

FORMULATING VISION

Gathering data, from both the internal- and external analysis will lead to useful and relevant context factors. These context factors can be clustered, whence insights can be formulated. Clustering will help to identify interesting topics, such as links, clashes and patterns. These interesting topics will be explored even more to get more depth within the required knowledge. After this third step a vision need to be formulated. This vision will be the start of the ideation phase and is a leading threat towards the end result.

The start will be the vision about the future airport, this vision will be connected to the masterplan 2035 of both Eindhoven Airbase as Eindhoven Airport. The masterplan of Eindhoven Airport is almost complete, but Eindhoven Airbase need to adapt to and agree whit this masterplan which may lead to gaps and restrictions within processes. These gaps and restrictions need to be discovered and may lead to an optimisation tool. This tool needs to facilitate the growth of both companies, which will have impact on the vision of the future airport.

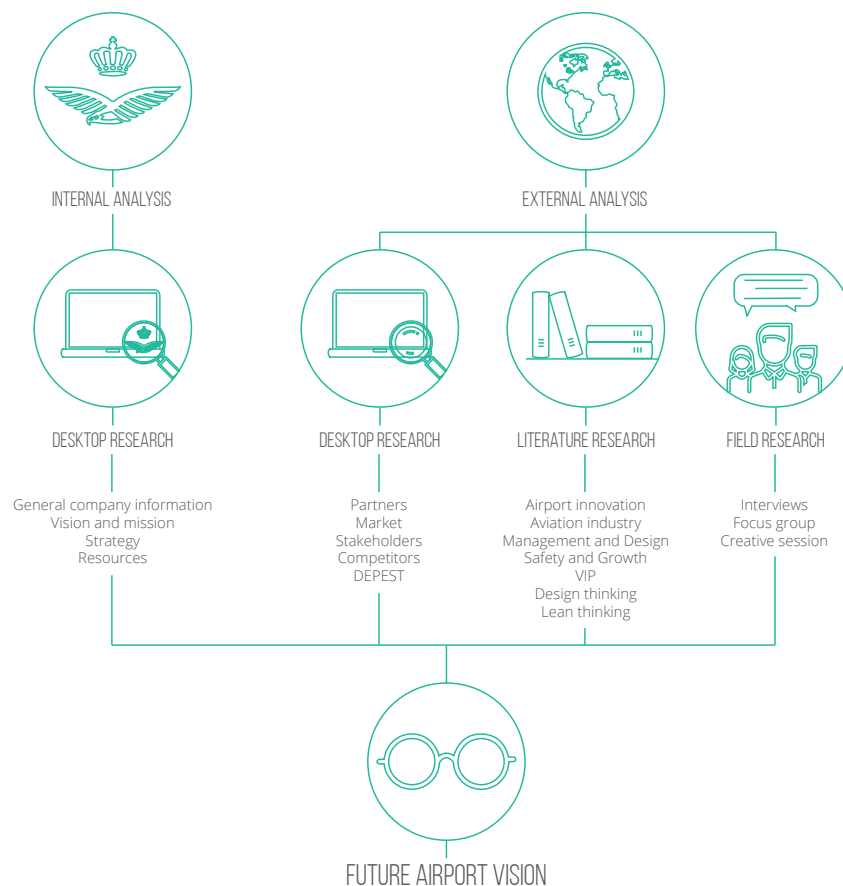


figure 38. Internal- and external analysis

B. CREATIVE SESSIONS AND BRAINSTORMS

Starting point of research with an inspirational session at the event of Aviation meets design.

AVIATION MEETS DESIGN

Aviation meets design was an initiative of the Design Management Network. More than 80 professionals from the aviation industry, creative industry and research/education were gathered to brainstorm about what the impact of design can be for a global industry with huge and complex challenges. These challenges were explored during creative sessions in groups with professionals from KLM, Royal Schiphol Group, variety of Design Agencies and students. The challenges tackled during these sessions were:

- Mobility
- Congestion
- UX/CX
- Safety
- Digitalisation
- (Disruptive) Innovation
- Competition
- Environment

The first brainstorm was about "Why would the aviation industry no longer exist in 2035?". The most important insights from this brainstorm were:

- Hyperloop
- Space X
- Lack of fuel: unaffordable

The second step within this brainstorm was to translate this to opportunities to reject the disappearance of the aviation industry. New ways of traveling and working at the airside were explored, the most important insights were:

- Green travel
- Travel on demand: "Uber airlines"
- No borders
- Robots

In the future, advances in ultralight batteries will allow insect-like UAS to fly without needing to be tethered to a power supply (Villasenor, 2014).

We are rapidly moving toward a future in which a majority of aircraft will be unmanned. "Drones," or more formally, unmanned aircraft systems (UAS), are poised to revolutionize the domestic aviation landscape, raising complex questions regarding privacy, property rights, and airspace safety (Villasenor, 2014). Advances in wireless communication and networking are making it easier than ever before to deliver real-time information from an unmanned aircraft located 50 m or 5000 km away from its operator. Improved airframe design and flight control methods have enabled the construction of smaller, more capable unmanned aircraft, some of which can perform highly complex manoeuvres (Villasenor, 2014). UAS can be used for search and rescue, news reporting, crop spraying, air quality monitoring, after-the-fact crime scene investigation, surveying, disaster response, wildlife tracking, research into the dynamics of violent storms, spotting wildfires, filmmaking, and traffic monitoring. Some applications around Eindhoven Airbase could be:

- Cargo drones
- Fire brigade drones
- Manage environment drones (reduction of bird strikes)
- GPS flight automated
- Meteorology drones

Creative session related to domain:

In two sessions a few students were brainstormed about the following topics:

1. Why would Eindhoven Airbase not exist anymore in 2050?
2. What does the military aviation look like in 2050?
3. What does the civil aviation look like in 2050?
4. What will transporting look like in 2050?
5. What will a combined aviation look like?

Creative session Eindhoven Airport:

A session with Eindhoven Airport needs to give insights in the view of Eindhoven Airport on the

vision. This session is not done yet.

1. I will illustrate the context vision of 2050
2. Connect context vision with Masterplan 35 of Eindhoven Airport
3. Do they think their masterplan will lead to sustainably operating in 2050?
4. Visualize what bottlenecks it will give and how will they tackle these bottlenecks

5. considering the context vision.
If they have a blank sheet to start from:

“What will the airside look like for Eindhoven Airport in 2050?”

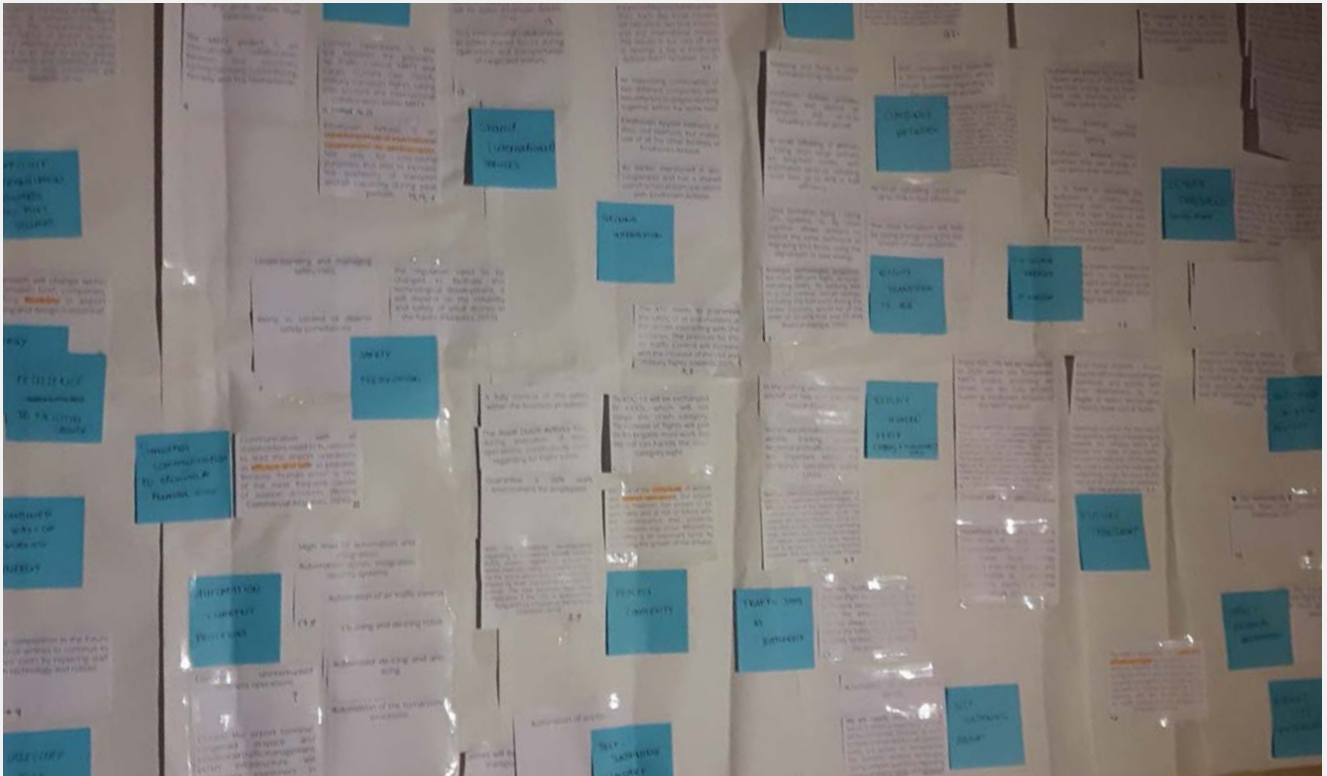


figure 39. Different brainstorm set-ups

C. THE FIFTH GENERATION AIR FORCE

STRATEGY OF THE ROYAL NETHERLANDS AIR FORCE

The Air Force Command has set focus points regarding the different levels of operation, within the multi-annual plan. These focus points are:

1. Restoration of the broad employability
2. Transition towards the 5th Generation Air Force
3. Focus on innovation

Restoration of the broad employability

1. Restore Operational Readiness, which means investment within three operation levels;
 - Restore personal readiness
 - Restore material readiness
 - Restore practical readiness
2. Financial sustainability and investment realisation

Transition towards the 5th Generation Air Force

All actions will be in line with the vision of the Royal Netherlands Air Force. This vision is called the 5th Generation Air Force. It consists of three pillars:

- Achieving information dominance

The 5th Generation Air Force will be capable of gathering, analysing, combining and sharing information better and faster than enemies. Next to the operational information dominance, the business information dominance gives the opportunity to strengthen the process-chains by increasing the ability to predict the performance of the chains.

- Increasing agility

Squadrons connecting operations and support as one and broad employability among the organisation with more responsibility which will result in a more agile Air Force. The Air Force is connected in networks.

- Strengthening the operational level

Strengthening the operational level will lead to an effective readiness of the weapon systems.

Focus on innovation

- Technological innovation (Aerospace cluster)

Social and cultural innovation are connected with and form the base for technological innovation. This innovation will lead to more developments within the Aerospace cluster, which support the restoration of the broad employability and the transition towards the Fifth Generation Air Force.

- Air Force Command Research & Technology Roadmap

This roadmap is driven by technological innovations which can create an advantage within current and future operations and influence the preparation and execution of air operations.

- Incremental and radical innovation

The Royal Netherlands Air Force will only be open-minded towards exponential innovations when they will create significant military advantages. The exponential innovations will lay in the field of Big Data, non-kinetic influences, smart sensors and artificial intelligence. All these innovations need to contribute to restoration of the broad employability, transition towards the 5th Generation Air Force and create possibilities to an information-driven Air Force.

D. DIGITAL REMOTE TOWER

The principles of the Digital Remote Tower are given in figure 40.



High definition cameras provide a panoramic view of the airport



A pan-tilt-zoom camera can magnify any part of the airfield up to 40 times for close inspection



Displays enhanced with augmented reality style maps and aircraft data for increased controller awareness



Laser range finder can measuring distances to any point on the airfield to millimetre accuracy



As well as tracking aircraft, the system can alert the tower to airfield incursions and even drones

figure 40. Principles of the Digital Remote Tower (NATS, 2017)



E. INTERVIEWS

STAKEHOLDER NOTES

TO70 – ADRIAN YOUNG

Different challenges, restrictions and questions came up:

- Starting point is the current lay-out of the field, which will limit the future possibilities of the field.
- Is there enough workable space for platform services?
- How does Eindhoven Airport envision the transition of their masterplan 2035 towards 2050?
- Why does Eindhoven Airport want this amount of aircraft stands? Because there will never be a proportional distribution of aircraft, but there will always be peak loads.
- Furthermore there is no buffer space concerning the peak loads.

Eerste ingeving van Defensie is om Defensie naar andere kant van de baan te verplaatsen.

Kijk naar Gatwick Airport: waarbij de taxitrack ook als landingsbaan kan fungeren in nood, wel kijken hoe je kan uitrollen bij disability.

Venezuela Porlamar Airport heeft hetzelfde, maar ook nog militaire vliegtuigen die landen over taxiënde vliegtuigen.

MRTT = vermarkting van defensie/luchtmacht: Noren in NLse vliegtuigen, NL in Canadese vliegtuigen, Canadese in Noorse vliegtuigen etc.

MP35 EA:

- Geen werkbare luchthaven, want hoe kunnen service diensten hier te werk? Ze kunnen op huidige tekeningen niet langs de vliegtuigen.
- Waarom zoveel VOPs? Je hebt nml nooit evenredige verdeling druk, er is piekbelasting.
- Geen bufferruimte: vol = vol (geen flexibiliteit)

TO70 gebruikt AirTOpSoft om simulatie te maken van eventuele (nieuwe) knelpunten aan airside:

- Input = vops, landingsbanen,

vliegbewegingen, eisen luchtvaart, eisen vliegtuigen etc

- Fast-time simulatie
- Model aanpassen waar nodig, high-speed exits nodig? Kan je in die simulatie toetsen over tijd.

PROVINCIE NOORD-BRABANT - DEON VAN SCHIJNDEL

- Beraad Vlieghinder Moet Minder (BVM2) = BVM2 is een federatie, waarin momenteel 26 organisaties zitten
 - Handelen vanuit duurzame operaties; dit betekent zowel adaptief als circulair (innovatief zoals Defensie voorheen was)
 - Na bezuinigingen heeft Defensie nu 10 – 15 jaar herstel nodig.
 - People, Planet en Profit in Roadmap. Niet zoals alleen EA kijkt naar Profit.
 - Leefbaarheid omgeving = key voor de provincie:
 - Daarbij scheelt de A330/MRTT de helft aan geluid
 - Gezondheid en geluid zijn onderdeel van leefbaarheid
 - / Motor is essentie bij opstijgen
 - / Grondgebonden operaties geluid
 - / Andere aanvliegeroutes - aanvliegeroutes verspreiden met RNP
 - Er zou een beloningsstelsel moeten komen voor stillere kisten, zodat het aantrekkelijk is om de innovatieve vliegtuigen aan te schaffen.
 - En daarnaast dus integraal benaderen, waarbij je geluid gaat verspreiden, zodat niet één individu 24/7 last heeft, maar X aantal dagen.
 - Het is key voor Defensie om nu snel, open en eerlijk te communiceren. Visie bespreekbaar maken en fundament creëren bij omwonenden.
 - Provincie verenigt bepaalde relevante werkgroepen en de communicatie moet dus snel naar deze werkgroep.
- Eindhoven Airport is van groot belang voor de

internationale toppositie die Brabant wil bereiken als toonaangevende kennis- en innovatieregio in Europa. Ondersteunt groei, maar stelt hinder beperkende maatregelen op.

Om de afspraken, waaronder deze groei plaats mag vinden, te realiseren is een uitvoeringsorganisatie gestart: de Uitvoeringstafel Eindhoven Airport. Brabant neemt daarin deel. Neemt verder leefbaarheid waar.

GEMEENTE EINDHOVEN - HANS VERHOEVEN

Gemeente Eindhoven moet kijken naar de houdbaarheid van de stad en zetten een stip op de horizon. Vanuit Vliegbasis Eindhoven moeten we integraal denken met de gemeente "duurzame gezonde gebiedsontwikkeling".

- Er kan geld vrijgemaakt worden vanuit de gemeente als het plan aansluit op hun visie

Klimaatdoelstellingen vanuit de gemeente:

- CO2 neutraal in 2050 (uitfaseren van fossiele brandstoffen)
- "economie ter dienste vd maatschappij"

Voorbeeld van aanpak gemeente tov Philips: Philips wil gezonde werknemers, dus gemeente legt geen parkeervakken aan, maar fiets-, looppaden en OV gelegenheid.

Telos monitor: people, planet, profit Brabant

- Sociale veerkracht herkennen (werkloos - obese - hoge ziektekosten etc)
- EHV streeft naar knooppunt XL: busbanen weg, moet ondergronds, groene baan naar campus + autoloze binnenstad.
- Plan aanpak Fellenoord = groen + in 1h in Düsseldorf dus in 1h op EU HSL
- Wetten CO2 uitstoot en stikstofbelasting.

Afwegingen om tijdslot Vliegbasis Eindhoven aan te passen, nu van 7h - 24h, in de ochtend of avond tijd bij pakken als dat nodig is?

- Voor Gemeente Eindhoven is nachtrust een afweging van groot belang, want nachtrust = gezondheidsfactor

Energiebehoeften; warmtebehoeften - zonnecollectoren

Ambitiebuurt = CO2 neutraal, als VLBE daarin ondersteunen

De-icing- warmteleidingen in startbaan
Alfredo Verboom: weet over warmteopslag mogelijkheden op VLBE

Ehv begint aan circulaire economy; VLBE zou daarop kunnen aansluiten.

LVNL- DAVID ZWAAF EN LONNEKE SMIT

Collaborative Decision Making (CDM): Niet van gate tot gate, maar en route to en route CDM zorgt voor winst gebruik luchtruim, ipv van -15/+15 minuten naar -5/+5 minuten.

- Gedoseerde werkdruk
- Beter afgestemd op slottijd (feasible) = beter voorspelbaar met CDM

Spelers: LVNL, Luchthaven, KLM, dus Schiphol met Airport-CDM (A-CDM) aan European Network linken

Afhandelaren dan ook kunnen afstraffen:

Airline on demand = kiezen uit de beste, qua hoe ze afspraken nakomen etc - Performance Review Unit (PRU)

CDM EuroControl manual (<http://www.eurocontrol.int/publications/airport-cdm-implementation-manual>): benefits wat heeft het opgeleverd.

Link to Network benefits:

- Optimaal baan gebruik
- Improved punctuality (nu bij toename vluchten, neemt punctualiteit af)
- Reduced ATC delay
- More feasible slots (CTOT)
- Reduced ATFM delay

A-CDM common objectives:

ATC - Airport Operators - Ground Handling - Airport operations - Network operations - ATC

Brainstorm einde van meeting:

MP35 is aardig krap; gepropt op huidige stukje met vliegtuigen van nu; EA kijkt niet buiten huidige gegevens

Defensie moet commercieel opstellen. Hebben geen belang bij groei. Maar ze moeten kijken wat ze eruit kunnen halen?

- Mogelijkheid tot innovaties
- Leer van Schiphol, procesen gingen daar uit elkaar door groei, nu gaan ze weer naar CDM. Bij Eindhoven zit het nu allemaal nog bij elkaar, dat werkt goed, zo voorkom je human errors.

RIJKSVASTGOEDBEDRIJF (RVB) – R. KUIJPERS

Structuur – en inrichtingsplan opvragen:

- Inrichting van het veld
- Daarin staat hoe het nu is en wat ze willen bereiken

Advies van Kuijpers is om het veld als 'blank sheet' te zien;

- 2023 luchtruim herziening
- 2020 flight movements overheid afspraak

Waarom vliegtuigen op VLBE laten staan?

- Strategisch van belang
 - Logistiek
 - EA kan VLBE uitkopen, waardoor VLBE kan verplaatsen, maar drukte luchtruim beter centreren door te blijven.
 - HDB 2015 hebben gezegd dat ze VLBE aanhouden

DOSCO (Defensie Ondersteuningscommando) belangrijke partij Vliegbasis Eindhoven afhankelijk van kabinetsbeslissing (figure 41); moeten groenlicht krijgen even goed kijken naar Lelystad Airport kwestie

Eindhoven Airport of de staat moet geld neerleggen, niet vliegbasis Eindhoven.

Defensie kant is wel oorzaak van geluid, dus geld voor isolatie omwonende wanneer nodig.

Hangaar is te klein voor MRTT - veranderen of niet; zijn al die MRTTs tegelijk aanwezig etc?

Hoe vaak gaat EHV die MRTTs zien? Big Data (nu nog niet bekend)

Wie moeten uiteindelijk deelnemen/goedkeuring geven in plan?"

- Vliegbasis Eindhoven
- Staf CLSK
- HDB, directie plannen
- RVB (Maarten Brandt)

Scenario's:

- Samen (EA + VLBE)
- Overkant (eigen processen behouden, niet laten versplinteren)
- Helemaal weg

Eindhoven in Beweging kernwaarden:

- Logistiek/ops
- MRTT
- Host nation support

NATO geld:

- Capability package = beschrijving NATO behoefte (alleen EHV en Volkel krijgen ondersteuning)
- EHV staat bekend als doorvoer luchthaven
- AAR staat ook in die package; landen moeten dit ondersteunen, dus EHV zou (civiele) vliegtuigen AAR kunnen doen

Criteria NATO opzoeken om geld te halen. Willen ze in toren investeren? NL mag meer beroep op NATO geld doen, DVM (Arold van de Biggelaar) contacten!

Eerst taxitrack aanpassen, dan pas VOPs volgens Kuijpers

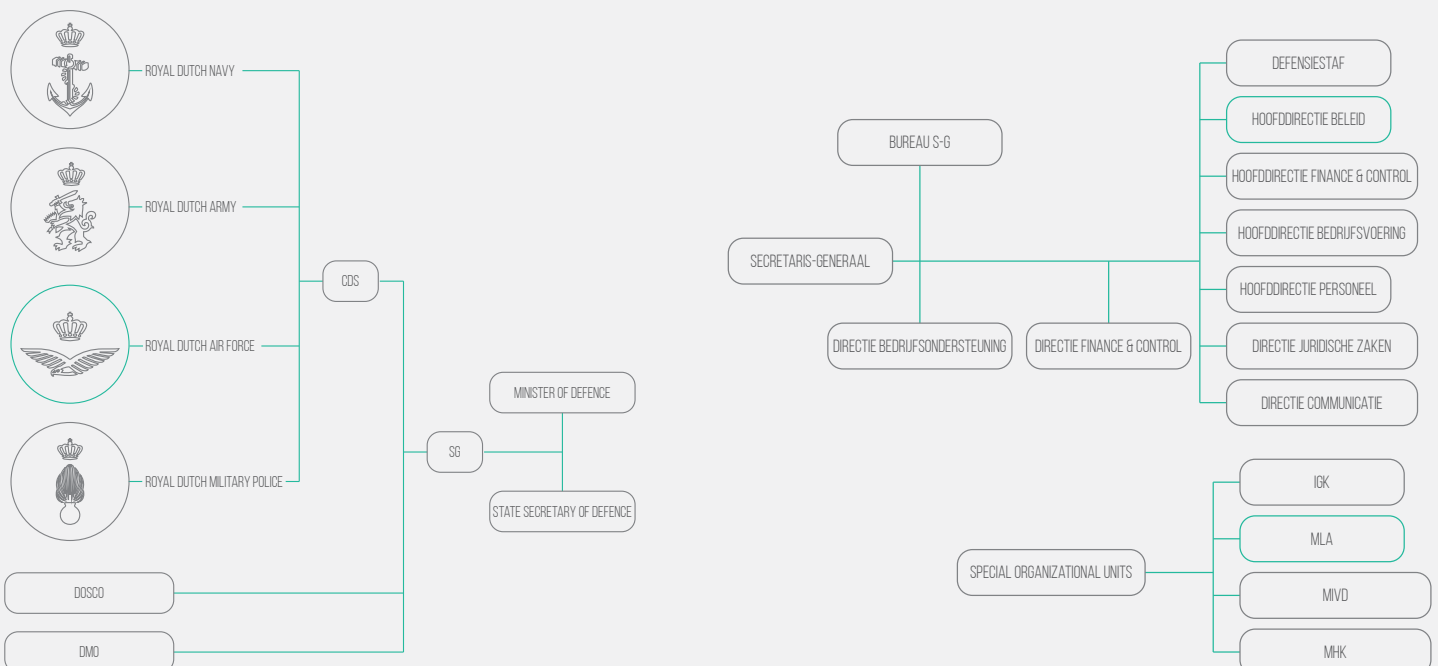


figure 41. Structures Ministry of Defence and Defence staff

Toetsingskader van MVP naar 2050 aanhouden:

- Kwaliteit
- Continuïteit
- Veiligheid
- Geluid

SQUADRON 940 - VAN OTTELE

Logistiek, Handling en CIS

Logistiek

- Bevoorrading
- POL: aftanken vliegtuigen
- Transport

Handling

- Loadcontrol: plannen waar vracht in vliegtuig moet
- PAX: passagiers afhandelen
- Groupage: check cargo bij tussenstop/ eindpunt at VLBE

CIS

- Opengesteld houden informatie
- Beheren de systemen (12 man = betaald door EA vd 39 man die er werken)

Aan de hand van Masterplan EA:

- Handling zou niet kunnen opereren door de civiele vliegtuigen op dat deel van het platform
 - Dit kan dus wel als je de terminal gaat delen en daar ook militaire vliegtuigen kan laten staan
- Logistiek heeft daar geen problemen
- A330: Airbus gaat zelf onderhoud doen, zo staat het in het tweejarig contract
- C-130: Dit vliegtuig blijft, dus de Defensie mensen moeten ook blijven
 - Waarom niet ook gelijk A330 Defensie mensen erop zetten, als ze toch moet blijven voor C-130
- C-130 loopt af in 2030, dus logistiek wordt minder
- Als de operaties naar de overkant van het veld moeten, dan moet alles verplaatst worden (niet pendelen)
 - Onderhoud en logistiek moet dicht bij elkaar opereren
 - En moeten er nieuwe aanrijroutes komen, bv ook nieuwe afslag snelweg
 - Groupage bij het hek, leveranciers hoeven dan niet het veld op.
- CIS levert nu al ondersteuning aan civiele deel, wat gebeurd er met deze

ondersteuning bij groei? En komen er nieuwe systemen? Hoe zal het er voor hun dan uitzien?

- LVNL zal waarschijnlijk de systemen onderhouden in de toekomst

- Kan i.c.m. civiel en militair geen modulair gebouw ingericht worden, waarbij er flexibel omgegaan kan worden met gezamenlijke krachten?
- Defensie toekomst = luchthaven runnen; in tijden van spanning moet defensie het veld open kunnen houden
- Er moet soort flexibele schil ontstaan, waarbij adaptief ingezet kan worden

Het gebouw van Handling is al niet meer goed bruikbaar, want het volledige proces past niet in één gebouw:

- Gebouwd voor 30 man, er zijn nu 84 man

Eisen vanuit CLSK zijn:

- 4 vliegtuigen per dag aankunnen, waarvan 2 vliegtuigen tegelijk aankunnen; als het gaat om widebody (?) = vastgeveugeld (KDC-10; C17; A330)

Shared services met EA is viable

- In militair vliegtuig is er wel nog een extra safety procedure
- Vrucht maakt uit, LUTRA heeft alleen Defensie, dus dit militaire component geeft hun bestaansrecht
- Passagiers inchecken maakt niet uit of dat militair of civiel is
- Platformmanagement kan ook gecombineerd worden
- POL: Brandstof JFSI (?)

Nu is er 1 punt, komt een 2e laadpunt bij, het kan ook gecombineerd worden; zit alleen iets bij qua geld (commercieel/overheid); en ander soort brandstof, maar dat zou gelijk getrokken kunnen worden

Dit is een knelpunt, maar AAR door militair aan civiel zou een optie kunnen zijn in de toekomst

Aftanken van militaire vliegtuigen kan gedaan worden in een civiel veld bij een civiele partij; echter expeditionair moeten militairen dat doen (FARP; soort pop-up vliegveld in onbegaanbare gebieden = bewapening en aftanken)

Dus beste optie is om POL militair te houden en EA te ondersteunen

Brainstorm van Ottele:

- Sluisidee; deel landside aan de poort en met sluisidee naar airside + platform langer maken
- Werklast handling voor KDC-10 staat niet 1 op 1 met werklast A330
- A330 = primair AAR en kan voornamelijk passagiers vervoeren; minder goed in vracht vervoeren
- Verwachting is dat A330 passagiers in andere landen oppikken en niet dat ze naar Eindhoven komen met bussen
- Handling heeft nu vooral pieken en dalen
- Samenwerking EA is dan relevant; terminal 5 kan adaptief civiel/militair
- Dus logistiek apart van civiele operaties, maar PAX en handling samen?

TEUGE – AND TWENTE AIRBASE - MEILTJE DE GROOT

In Nederland zijn er drie partijen mbt luchtverkeersleiding:

- LVNL
- Luchtmacht
- EuroControl

In Scandinavië + London City hebben ze 1 punt met 1 toezichthouder = efficiënt en goedkoper

- Niet meer fysiek aanwezig bij digital(/) remote TWR
- LVNL ligt hierbij dwars, zien hun banen natuurlijk gaan
- CLSK wil alleen met LVNL in zee, zien dus ook R-TWR niet zitten, volgens MLA onzin dat het niet zou kunnen, kan mbt regelgeving en veiligheid gewoon

Twente heeft budget voor capaciteit problemen, krijgen namelijk veel uitwijk vliegtuigen.

Belangrijke partijen voor R-TWR: LVNL, SAAB, Defensie, NLR

Remote TWR: multi airport control (Twente wilt/krijgt dit); oa Eelde doet me

- Bereikbaarheid kleine luchthavens was insteek en finance omlaag want ATC is met R-TWR goedkoper.

Eigen glasvezel netwerk is essentieel voor veiligheid van Remote TWR

NLR vliegt al met drones op Twente (drone radar, bird radar = robin radar system)

Remote TWR: 2018 moet het onderzoek klaar zijn. Tegelijk fysieke aspecten testen. Het is

een opdracht vanuit Twente. Transitie LVL gaat waarschijnlijk makkelijk als het goed voorbereid is voor R-TWR.

- Het is alleen implementeren, want andere airports hebben het al, het wiel is al uitgevonden.

Andere optie is:

- Remote OPS

Potentieel NATO geld naar R-TWR:

- Niet toren VLBE renoveren
- Aanvraag indienen
 - Op welke termijn: INM moet meedoen, weg bij LVNL, durven ze niet.
- 8 ton voor kabels + 3D beeld // London city 10 – 30 miljoen
- Pilot is op Twente, daarna doorzetten naar Eindhoven
- Veiligheid omhoog + kosten gaan omlaag bij gebruik R-TWR
- VLBE is jaren 60 veld in Brainport
- Veld gelijk vol leggen met sensoren+verlichting (relevant voor groeipotentieel)

F. SUSTAINABLE AVIATION

Below a list of 25 new technologies and operational improvements for green aviation is given, which were published by the Royal Aeronautical Society of U.K. They have identified 25 new technologies, initiatives and operational improvements that may make air travel one of the greenest industries by 2050 (Agarwal, 2012):

1. *Biofuels* – These are already showing promise; the third generation biofuels may exploit fast growing algae to provide a drop-in fuel substitute.

2. *Advanced composites* – The future composites will be lighter and stronger than the present composites which the airplane manufacturers are just learning to work with and use. www.intechopen.com 434 Recent Advances in Aircraft Technology

3. *Fuel cells* - Hydrogen fuel cells will eventually take over from jet turbine Auxiliary Power Units (APU) and allow electrics such as in-flight entertainment (IFE) systems, galleys etc. to run on green power.

4. *Wireless cabins* – The use of Wi-Fi for IFE systems will save weight by cutting wiring - leading to lighter aircraft.

5. *Recycling* - Initiatives are now underway to recycle up to 85% of an aircraft's components, including composites - rather than the current 60%. By 2050 this could be at 95%.

6. *Geared Turbofans (GTF)* - Already under testing, GTF could prove to be even more efficient than predicted, with an advanced GTF providing 20% improvement in fuel efficiency over today's engines.

7. *Blended wing body aircraft* - These flying wing designs would produce aircraft with increased internal volume and superb flying efficiency, with a 20-30% improvement over current aircraft.

8. *Microwave dissipation of contrails* – Using heating condensation behind the aircraft could prevent or reduce contrails formation which leads to cirrus clouds.

9. *Hydrogen-powered aircraft* - By 2050 early versions of hydrogen powered aircraft may be in service - and if the hydrogen is produced by clean power, it could be the ultimate green fuel.

10. *Laminar flow wings* – It has been the goal of aerodynamicists for many decades to design laminar flow wings; new advances in materials or suction technology will allow new aircraft to exploit this highly efficient concept.

11. *Advanced air navigation* - Future ATC/ATM systems based on Galileo or advanced GPS, along with international co-operation on airspace, will allow more aircraft to share the same sky, reducing delays and saving fuel.

12. *Metal composites* - New metal composites could result in lighter and stronger components for key areas.

13. *Close formation flying* - Using GPS systems to fly close together allows airliners to exploit the same technique as migrating bird flocks, using the slip-stream to save energy.

14. *Quiet aircraft* - Research by Cambridge University and MIT has shown that an airliner with imperceptible noise profile is possible - opening up airport development and growth.

15. *Open-rotor engines* - The development of the open-rotor engines could promise 30%+ breakthrough in fuel efficiency compared to current designs. By 2050, coupled with new airplane configurations, this could result in a total saving of 50%.

16. *Electric-powered aircraft* - Electric battery-powered aircraft such as UAVs are already in service. As battery power improves one can

expect to see battery-powered light aircraft and small helicopters as well.

17. *Outboard horizontal stabilizers (OHS) configurations* – OHS designs, by placing the horizontal stabilizers on rear-facing booms from the wingtips, increase lift and reduce drag.

18. *Solar-powered aircraft* - After UAV applications and the Solar Impulse round the world attempt, solar-powered aircraft could be practical for light sport, motor gliders, or dayVFR aircraft. Additionally, solar panels built into the upper surfaces of a Blended-WingBody (BWB) could provide additional power for systems.

19. *Air-to-air refueling of airliners* - Using short range airliners on long-haul routes, with automated air-to-air refueling could save up to 45% in fuel efficiency. www.intechopen.com Review of Technologies to Achieve Sustainable (Green) Aviation 435

20. *Morphing aircraft* - Already being researched for UAVs, morphing aircraft that adapt to every phase of flight could promise greater efficiency.

21. *Electric/hybrid ground vehicles* – Use of electric, hybrid or hydrogen powered ground support vehicles at airports will reduce the carbon footprint and improve local air quality.

22. *Multi-modal airports* - Future airports will connect passengers seamlessly and quickly with other destinations, by rail, Maglev or water, encouraging them to leave cars at home.

23. *Sustainable power for airports* - Green airports of 2050 could draw their energy needs from wave, tidal, thermal, wind or solar power sources.

24. *Greener helicopters* - Research into diesel powered helicopters could cut fuel consumption by 40%, while advances in blade design will cut the noise.

25. *The return of the airship* - Taking the slow route in a solar-powered airship could be an ultra 'green' way of travel and carve out a new travel niche in 'aerial cruises', without harming the planet."

Some of the ideas listed above as electric, solar and hydrogen powered aircraft are currently feasible but are unlikely to become viable for mass air transportation by 2050 (Agarwal, 2012).

G. CONTEXT FACTORS

Factors can be divided in four distinctive categories: **Principles** that determine stable patterns in the world; **States** which define relatively constant circumstances; **Developments** which reflect the changes over time, and **Trends** that determine people's behaviours as a consequence to these changes. All context factors are given below.

1. Close formation flying - Using GPS systems to fly close together allows airliners to exploit the same technique as migrating bird flocks, using the slip-stream to save energy.
2. Quiet aircraft - Research by Cambridge University and MIT has shown that an airliner with imperceptible noise profile is possible - opening up airport development and growth.
3. Open-rotor engines - The development of the open-rotor engines could promise 30%+ breakthrough in fuel efficiency compared to current designs. By 2050, coupled with new airplane configurations, this could result in a total saving of 50%.
4. Electric-powered aircraft - Electric battery-powered aircraft such as UAVs are already in service. As battery power improves one can expect to see battery-powered light aircraft and small helicopters as well.
5. Air-to-air refueling of airliners - Using short range airliners on long-haul routes, with automated air-to-air refueling could save up to 45% in fuel efficiency.
6. Electric/hybrid ground vehicles - Use of electric, hybrid or hydrogen powered ground support vehicles at airports will reduce the carbon footprint and improve local air quality.
7. Multi-modal airports - Future airports will connect passengers seamlessly and quickly with other destinations, by rail, Maglev or water, encouraging them to leave cars at home.
8. Sustainable power for airports - Green airports of 2050 could draw their energy needs from wave, tidal, thermal, wind or solar power sources.
9. Being the base of military strategic and tactical transport, the airbase is the second civil airport of the Netherlands due to Eindhoven Airport.
10. An interesting combination of two different companies, with two different strategies working together within the same field.
11. Eindhoven Airport will grow significantly towards 2025, the amount of flight movements and passengers will increase
12. Eindhoven Airbase is also growing, because of a recently formed international collaboration. This collaboration will result in more flight movements at the side of Eindhoven Airbase.
13. Because of the complexity of aircraft and related operations, the airport surface, however, has proven to be vulnerable and at risk of failure with the consequence that accidents and incidents may occur. Wherefore the safety is an important factor by facilitating the growth of the airbase.
14. Eindhoven Airport interacts at their civil platform, but makes use of all the other facilities of Eindhoven Airbase.
15. In the current situation both parties are situated at the westside of the field.
16. Within the current lay-out of the field both Eindhoven Airport as Eindhoven Airbase cannot grow.
17. Shared services is determined as 'parts within (future) processes which can be done by one company for both companies', which lead to a more efficient way of working and creates the opportunity to facilitate growth.
18. Outside the airport terminal, congested airspace and obsolete air traffic management (ATM) infrastructure will necessitate investment in next-generation equipment and information management systems (Frost & Sullivan 2016).
19. The Royal Netherlands Air Force is a globally active, modern and technology-driven service branch of Ministry of Defence.

20. The Royal Netherlands Air Force provides support to combating international tension and bringing relief to (natural) disaster-stricken regions.

21. In The Netherlands it provides security from the airspace (Defensie, 2017).

22. "To successfully fight and win within the future, from both air and space, the Air Force Command will transform towards an information-driven and agile Air Force. Beside they have the ambition to bring Airpower, on both tactical – as well as operational level (Koninklijke Luchtmacht, 2017).

23. Eindhoven Airbase provides strategic and tactical air transport and air-to-air refuelling to other aircraft.

24. Air transport is an indispensable capability, because it takes place in hostile and high-treat environments and areas difficult to reach (Factsheet Koninklijke Luchtmacht, 2016).

25. Eindhoven Airbase is an established hub of international cooperation in (air)transport. Not only for cost-saving purposes, but also to increase the availability of transport aircraft capability during peak periods.

26. Eindhoven Airport is a base for some low budget airlines. Low-cost carriers (LCCs) are footloose and can easily move from one airport to another.

27. Airports compete with each other because the owners, often government, recognize their airports value in promoting economic growth in the region (Assaf, 2014) (Brainport Development NV, 2017).

28. Civil air transport business is a rather complex macro-industry.

29. Within the industry, a mass of activities are being undertaken by a complementary and combined network of actors: passenger and cargo airlines, integrators, airport authorities, handling agents, in-flight catering firms, General Sales Agents, car rentals, air brokers, hardware providers like aircraft manufacturers and air terminal building firms, tour operators and travel agents, all of them striving to satisfy, at least partly, end demand needs (De Neufville, 2016)(Jarach, 2001).

30. Eindhoven Airport wants to grow from 6 million passengers in 2019 towards 9 million passengers in 2025.

31. They believe in connection and collaboration with the internal – and external environment. With a strong connection and good collaboration the support of the environment regarding their ambition towards this the growth will be stable

(Eindhoven Airport, 2016).

32. Eindhoven Airport connects the transport companies within the direct environment, becoming an important stakeholder within Brainport Eindhoven.

33. Airbase operations will not make any profit within their operations

34. Both companies are open for a strong collaboration, which should be essential regarding the prospective growth.

35. Eindhoven Airport outsources the rest of its airport operations.

36. As earlier mentioned it also cooperates and has a shared use of certain airport operations with Eindhoven Airbase.

37. Opportunities in the future could be a closer cooperation regarding shared services. Depending on the infrastructural change both companies can combine some airport operations, like logistics, cargo, refuelling and airport operations management.

38. Air transport is a key driver for social and economic development and its demand has increased steadily over the years.

39. Since the mid-1980s, passenger numbers have more than doubled and freight traffic has increased almost three-fold (ATAG, 2005). This trend is expected to continue over the next 20 years, with world passenger traffic (by revenue passenger-kilometers) expected to grow 5% annually and air cargo (by revenue tonne-kilometers) 5.2% per year (Boeing, 2012).

40. As (civil) aviation expands, environmental aspects and fuel savings are becoming increasingly important. Amongst technologies proposed for more efficient flight, air-to-air refuelling (AAR), 'hopping' and flying in close formation (drag reduction), all have significant possibilities. In military use, AAR is virtually indispensable. Its benefits are real and largely proven in hostile and demanding scenarios. By applying AAR in a civil context overall savings, including the fuel used during the tanker missions, would be of the order of 30-40% fuel and 35-40% financial (Nangia, 2006).

41. In 2010 the Dutch government decided that Eindhoven Airport can incrementally grow towards 43.000 civil flight movements in 2020.

42. These KDC-10s will be replaced in 2020 within the European MRTT project, according to Jeroen van der Lely

project leader at Eindhoven Airbase of the MRTT project.

43. The MRTT project is an international collaboration between four countries, namely Germany, Luxembourg, Norway and The Netherlands.

44. This international collaboration provides shared forces during operations and transportation of cargo and military personnel.

45. The Netherlands will be the lead-nation within this MRTT project, where the flight movements will increase (Personal interview Jeroen van der Lely, 2017).

46. The aircraft will be introduced in the period May 2020 till November 2022. Each day, three missions will take place, two local missions and one international mission. This results in five take-off and/or landings a day at Eindhoven Airbase (MRTT factsheet, 2017).

47. In the future there will be more flight movements, which will have an impact on the environment.

48. The new aircraft are more quiet than the old one, but there is not a clear picture of the noise for the local communities yet.

49. To become the lead-nation a minimal change of infrastructure was required by the NATO.

50. The growth will change within and between both companies, therefore flexibility in airport planning and design is essential.

51. Changes in the types of traffic and modes of operation constantly modify the requirements and performance of airport facilities. To be effective, airport managers need to be able to easily adjust the capacity and capability of their facilities to new conditions (De Neufville, 2016).

52. One key performance indicator (KPI) of such operations is safety, which can be defined as 'the state in which the possibility of harm to persons or the property damage is reduced to, and maintained at or below, an acceptable level through a continuous process of hazard identification and safety risk management' (ICAO, International Civil Aviation Organization, 2009). Because of the complexity of aircraft and related operations, the airport surface, however, has proven to be vulnerable and at risk of failure with the consequence that accidents and incidents may occur (Wilke, S. 2014).

53. The Royal Netherlands Air Force has, during execution of their operations, continuously risks regarding to:

- Flight safety
- Guarantee a safe work environment for employees
- Continue uninterrupted business operations
- Protect nature and environment

54. Safety Management System needs to result in:

- A full control of the safety within the business processes
- Understanding and managing safety risks
- Being in control of diverse safety compliances

55. The ATC needs to guarantee the safety of all stakeholders at the airside interacting with the airplanes. The pressure for the Air Traffic Control will increase with the increase of the civil and military flights towards 2025.

56. With the increase of flights the communication with all stakeholders need to be smooth to lead the airport operations as efficient and safe as possible. Because "human error" is one of the most frequent causes of aviation accidents (Boeing Commercial Airplanes, 2006). It is defined as an incorrect execution of a particular task, which then triggers a series of subsequent reactions in the execution of other tasks, resulting in a serious aircraft accident (Netjasov, 2008).

57. The fire brigade is the only unit 24/7 available at the airbase.

58. The KDC-10 will be exchanged for A330s, which will not change the crash category. The increase of flights will give the fire brigade more work, but they can still handle the crash category eight.

59. The prospective growth will have impact on the bird control way of working, because of the increase of flights, the chance to drive on the runway will decrease. Which means that dislodging birds at the runway cannot be done frequently anymore. Next to that, the pressure will increase, because when a clash between birds and airplanes happens, they have less time to clean the runway (Personal interview SNEB, 2017).

60. The AOM is responsible for a safe and efficient way of getting passengers from entrance of the airport to the airplanes. Next to that the AOM is also responsible for smoothly running the processes at the civil platform. During the day the AOM interacts with the airside security, Air Traffic Control and fire brigade of Eindhoven Airbase.

61. Current Operations is the link between the planners, Air Traffic Control, MRTT and Cargo. Current Ops classify military transport flights, taking into account the international collaboration within MRTT.

62. When Current Ops can only fill half a flight, they will see if they can cooperate with international partners to transport more goods with one flight. Current Ops get points every time they fly more efficient by preventing “empty” flights. Next time Current Ops can arrange that a partner will transport the cargo, so there will be a balance in points. This will save money, time, employees for the flight crew, fuel and emission.

63. The Safety Manager needs to adapt to the prospective growth, taking into account the increase of flights and change of infrastructure inside and outside the airbase. The change of infrastructure may lead to different emergency routes for the fire brigade, police and ambulance inside and outside the airbase.

64. The way leading towards the airbase (flight forum) is already a bottleneck. Because of the traffic jams the emergency routes are not always easily available. Hence the Safety Manager is key in safely facilitating the growth of the airbase (Personal interview Safety Manager, 2017).

65. With the technology developments regarding Unmanned Aircraft Systems (UAS), aviation regulations around the world need also being updated to prepare for the era in which skies are increasingly shared by both manned and unmanned aircraft. The task becomes even more complicated if the UAS is autonomous, i.e., flying without a human at the controls. (Villasenor, 2014).

66. Hyperloop is the concept of a fifth mode of transportation that is faster than commercial air travel, more energy efficient than train travel, and as accessible as a personal automobile touched a nerve (Musk, 2013).

67. Hyperloop could be the new way of transporting cargo and passengers towards the airbase, which will reduce the noise of cars, traffic jams and air pollution. On the other side it could also be the new way of transporting cargo, because of the noise and air pollution of airplanes for the environment.

68. The great potential of passenger space travel for ‘space commercialisation’ has also been acknowledged in reports published by NASA (O’Neil, 1998); the American Institute of Aeronautics and Astronautics (AIAA) which concluded: “In light of its great potential, public space travel should be viewed as the next large, new area of commercial space activity” (Gerard, 1998)(Collins, 2002).

69. It is hard to estimate the pollution of rockets, when becoming more commercial in the near future. It will not be as sustainable as the hyperloop, but it will save travel time compared to traditional air transport.

70. Nowadays, these renewables are limited by viability,

scalability, suitability and low returns on investment as compared to fossil fuels (IBM, 2011).

71. Eindhoven Airbase needs to adapt to this ‘bridging’ period, to easily change their operations according to the new policies and eventually change their way of transporting cargo and military personnel.

72. Eindhoven Airbase could generate their own energy to use within their operations.

73. Aviation offers many possibilities when it comes to autonomous technologies. In different areas of the airport operations autonomous technologies could be applied, like drones (Floreano, 2015), GPS controlled aircraft, refuelling and loading cargo. All these autonomous technologies will reduce conventional jobs, because there is no need for human interaction anymore.

74. According to McKinsey automation will result in new adaptive jobs. In the future, adaptability is key, and people are more adaptable. So when they set up the machine line and it’s all machines, there is a huge amount of retooling to shift from line one to line two, whereas the people are much more easy to shift (McKinsey, 2014).

75. We are rapidly moving toward a future in which a majority of aircraft will be unmanned. “Drones,” or more formally, Unmanned Aircraft Systems (UAS), are poised to revolutionise the domestic aviation landscape, raising complex questions regarding privacy, property rights, and airspace safety.

76. In the coming years, unmanned aircraft will help save lives after natural disasters.

77. In the case of Eindhoven Airbase wildlife tracking, disaster response and traffic monitoring are important within the company’s operations (using UASs).

78. The regulation need to be changed to facilitate this technological development, it will depend on the reliability and safety of small drones in the future (Floreano, 2015).

79. The close formation will help by saving energy using the slip-stream of other airplanes.

80. Air-to-air refuelling could save up to 45% in fuel efficiency.

81. The increase of flight movements will put some pressure on the airbase environment. The technological development of more quiet aircraft will reduce some pressure,

because research by Cambridge University and MIT has shown that an airliner with an imperceptible noise profile is possible, this will open up airport development and growth (Agarwal, 2012).

82. Use of electric, hybrid or hydrogen powered ground support vehicles at airports will reduce the carbon footprint and improve local air quality.

83. Green airports of 2050 could draw their energy needs from wave, tidal, thermal, wind or solar power sources.

84. As battery power improves one can expect to see battery-powered light aircraft and small helicopters as well within 2050 (Agarwal, 2012).

85. Due to the affordable flight tickets, it became easy for people to work in a different country than where they live. The threshold has become low to go by plane, for some it feels the same as getting on a train, where sometimes a flight ticket is cheaper than a train ticket (Keuchenius, 2017).

86. Airport cities will arise in the future, because of the development where traveling by plane becomes common.

87. On demand is a huge trend at the moment.

88. People are one with their devices

89. Hyperloop will be the way of transporting people/ cargo on demand

90. Hyperloop will be faster than traveling by airplane

91. Drones will be the new way of transporting cargo

92. Transport companies will use drones instead of airplanes

93. Drones will become one with the airbase

94. Drones will fulfil different new tasks (vogelmannen, brandweer)

95. Automation of maintenance airside

96. Automation of airplanes

97. Automation of air traffic control

98. Automated de-icing and anti-icing

99. Cleaning and de-icing robot

100. Automation of the turnaround processes

101. Dual threshold and split runways

102. High level of automation and integration;

103. Automation apron, integration security systems

104. Airplanes less dependent on ground facilities

105. Integrated Air-Ground Digital Data Exchange

106. Synthetic Vision; reduced use of runway/taxiway lighting

107. Active buildings; heat recuperation, LED/FIPEL lighting

108. Circular airport

109. Globalisation

110. Due to globalisation people will work in a different country as where they live

111. People will work more at home

112. People will work more part-time

113. The individual is central

114. "Because of the complexity of aircraft and related operations, the airport surface, however, has proven to be vulnerable and at risk of failure with the consequence that accidents and incidents may occur." (Wilke, S. 2014)

115. Traffic jams will get worse

116. Lack of focus, because of high information streams which is caused by technological development

117. Climate change will give Eindhoven Airbase more work to give help after natural disasters

118. Urbanisation

119. Arising airport cities, due to lower threshold taking a flight

120. Green roofs at the airbase

121. Self-energising airport

122. Electric engine accelerators for take-off

123. Disappearing of continental boundaries
124. MRTT will be an international collaboration
125. "But while few citizens on the European continent are eager to see their own country depart the EU, many want the chance to have their voice heard through their own referendum on EU membership."
126. A median of 57% across the 11 NATO member countries surveyed voiced favourable views of the coalition, with only about a quarter (median of 27%) expressing negative opinions.
127. Despite growing security threats to member countries, most NATO members appear reluctant to boost their own countries' military spending. About a third (median of 32%) across the NATO nations surveyed say their country should increase its national defense spending, while nearly half (median of 47%) want to keep spending the same and 14% favor decreasing defense spending.
128. Travel on demand (uber)
129. Internationalisation
130. Eindhoven Airport will have international flights in the future
131. SpaceX will provide traveling to Mars, which creates new markets within the airline sectors
132. Elon Musk: Using that same interplanetary rocket system for long-distance travel on Earth. Musk showed a demonstration of the idea onstage, claiming that it will allow passengers to take "most long-distance trips" in just 30 minutes, and go "anywhere on Earth in under an hour" for around the same price as an economy airline ticket.
133. Vertical growth; verticaal bouwen; High-pier turnaround
134. Dwindling resources
135. More expensive fossil fuels
136. Stricter environmental expectations
137. Strong competition in the future may force airlines to continue to cut their costs by replacing staff with technology and robots.
138. Automation: This trend will continue in the future as airports seek to provide all the services and amenities that

citizens living in heavily urbanised areas expect. It will also mean that airports will depend less on federal governments and airlines for their economic growth and investment, and instead develop a more diversified revenue model.

139. Build airport on top of the city
140. De wereld evolueert sneller dan ooit en de economie zal verder globaliseren en groeien. Daarbij zullen Azië (+4,1% groei) en Afrika (+3,7% groei)¹ de toon zetten. Algemeen groeit de wereldeconomie, maar in Europa is deze groei trager (+1,8%) dan in de rest van de wereld (+2,9%).
141. Increase of pressure of the Air Traffic Control
142. Connectivity
143. Change in MRTT
144. International collaborations
145. Shared use and shared operations at the airside

H. CLUSTERING INSIGHTS

Different topics were gained from clustering. The topics are listed below:

- Insecure due dependence of airlines
- Combined way of working: synergy
- Resilience to facilitate growth/ resilience of system
- Difficult transition towards new fuel sources
- Fast changing environment
- Adaptation via Big Data
- Automation current processes
- Safety preservation
- Shared international services
- Internationalisation
- Ground interaction
- Process complexity
- Self-sustaining transport
- Replace human error (safety + automate)
- Self-sustaining airport
- Traffic jams as bottleneck
- Activity transition to air
- Increase of pressure bird control
- Future transport
- Circular energy at airside
- Combined network
- Lower threshold of taking a plane
- No emission at airside during operations
- Anticipate on new policies
- Impact external environment
- Air purification
- Automate logistic system
- Smoothen communication to eliminate human error
- Airport city
- International sustainable synergy
- The why: motives of growth
- 24/7

Clustering these topics gave new insights:

Adapt in a circular way

- Self-sustaining airport
- Fast changing environment
- Circular energy at airside

International sustainable synergy

- Combined way of working

- Shared international services
- International sustainable synergy

Safely react on fast changes

- Resilience of system
- Fast changing environment
- Safety preservation

Eindhoven Airbase and Airport as one

- Process complexity
- Combined network
- Smoothen communication to eliminate human error

Infrastructure towards Airport City

- Traffic jams as bottleneck
- Future transport
- Impact external environment

Data-driven transport

- Self-sustaining transport
- 24/7
- Adaptation via Big Data

Sustainable system

- Anticipate on new policies
- Resilience of system
- Difficult transition towards new fuel sources

Becoming a Transport City

- Future transport
- International sustainable synergy
- Activity transition towards air

Reduce time – and human pressure

- Automate current processes
- 24/7
- Safety preservation

Connect logistic transport system

- Future transport
- Combined network
- Automate logistic system
- Self-sustaining transport

Automate circular energy

- Circular energy airport
- Future transport
- Self-sustaining airport

Information-driven human interaction

- Ground interaction
- Smoothen communication to eliminate human error
- Adaptation via Big Data

These interesting topics were plotted in an axial system (chapter Vision).

I. ANALOGIES

EXPLANATION ANALOGIES IN AXIAL SYSTEM

The interesting topics were gathered and plotted in different axial systems. Different combinations were evaluated of synergy-automation; connection-circular; connectivity-automation along the axial system. Chapter "Vision" gives the overview of the chosen combination.

Connectivity-automation gave the analogies of four quadrants (figure 42):

- A. Mutual flow
- B. Virtual interaction
- C. Parasitism
- D. Fragmented operations

The 4 quadrants are illustrated in figure 43.

The explanation of the chosen analogy is given in chapter "Vision".

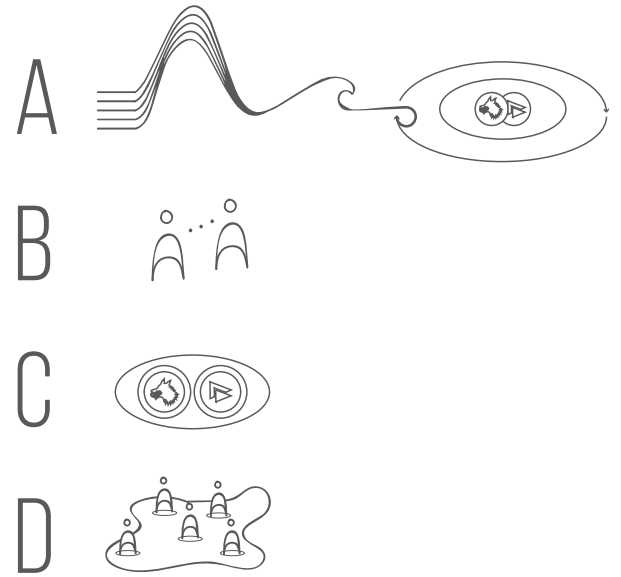


figure 43. Visuals of analogies

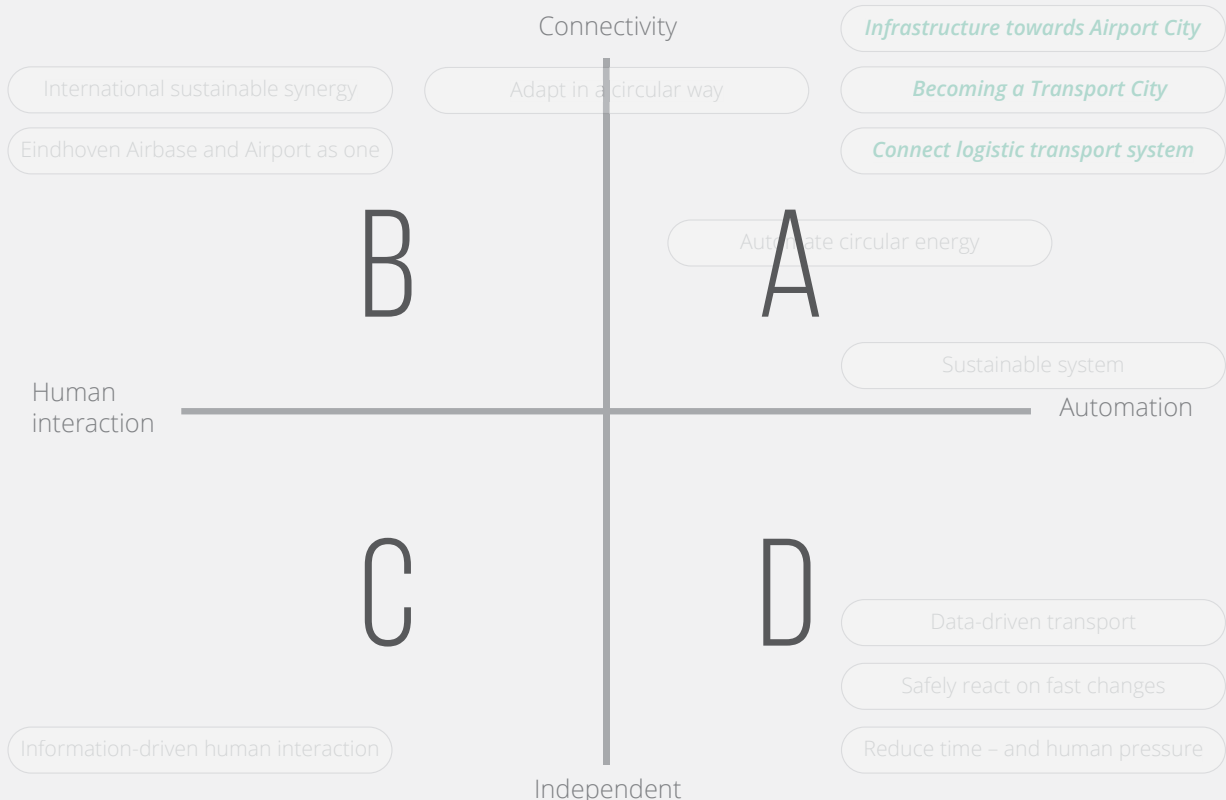


figure 42. Quadrants of axial system

J. CONCEPT FUNDAMENTALS

ENGLISH

Mutually operating

Mutually operating can be divided in two segments, namely coordination and operations. Both can be centralised, thus the core processes of Eindhoven Airbase and Eindhoven Airport can be connected. This will improve and optimise the core processes, guarantee safety by reducing human error and will facilitate the resilient transport system.

Adaptive hub

In times of peak loads the airbase must be able to resiliently adapt and adjust. The airbase must ensure that it constantly is one step ahead with regard to disruptive innovations, by means of an adaptive way of working. This can be made possible by a shared innovation team between Eindhoven Airbase and – Airport. In addition, relevant companies must be attracted towards the environment around the airbase. This will enrich the airbase with the right knowledge, leading to the establishment of disruptive innovation. Thence the airbase can work adaptively and resiliently by being able to test and execute immediately. Furthermore, the airbase can be a hub for international collaborations and other branches of the armed forces to enable performing relevant operations.

Circular operations

In the future all operations should be circular in the way of running on (a)biotic materials instead of raw materials, like electric energy instead of fuel. The operations need to be flexible, so they can react to external factors and adapt to growth when needed. Over time the operations within the field of Eindhoven Airbase will be automated, electrified and data-driven. The energy source, such as solar and wind energy, will be found in the field itself. Next to that different heat sources (i.e. runway) can be used, more precisely this heat can be stored and used when necessary.

In summary the energy will be produced, used and stored in the field. Storage is required for use during peak loads. In addition, co-developers will

be added to the airbase so that (parts of) aircraft can be disassembled, repaired and/or recycled on site, consequently a circular economy can develop around the airbase.

Seamless and resilient transport

Reducing the impact on the external environment of the airbase by transporting in a seamless and efficient way around the airbase can lead to becoming an international hub. Both the internal and external connection must seamlessly connect, where automation of operations is central, but also the infrastructure towards the airbase needs to run smoothly concerning the external environment. For example, the airbase together with the city of Eindhoven can become an important junction in terms of knowledge, sustainability and transport. Additionally both will be nationally and internationally oriented.

NEDERLANDS

Wederzijds opereren

Alle gedeelde operaties zullen samen genomen worden en vanuit één centraal punt aangestuurd worden. Door het aansturen vanuit één centraal punt zal de communicatie direct zijn en zullen er minder menselijke fouten gemaakt worden, waardoor de veiligheid gegarandeerd blijft ook bij de potentiële groei. Waarbij een gedeeld innovatieteam nieuwe ideeën levert voor de operaties, deze direct vanuit het centrale punt getest en doorgevoerd kunnen worden, waardoor het systeem altijd up-to-date zal zijn en adaptief handelen mogelijk maakt.

Adaptieve hub

In tijden van dal- en piekbelastingen moet de vliegbasis zich veerkrachtig kunnen opstellen en aanpassen. Door een adaptieve werkstijl moet er gezorgd worden dat de vliegbasis elke keer een stap voorloopt met betrekking tot disruptieve innovaties. Dit kan mogelijk gemaakt worden door een gedeeld innovatieteam in samenwerking met Eindhoven Airport. Daarnaast moeten relevante bedrijven vanuit de omgeving, en naar de omgeving toe, aangetrokken worden. Dit om de

vliegbasis met de juiste kennis te verrijken, zodat de disruptieve innovaties tot stand kunnen komen en de vliegbasis zo adaptief en veerkrachtig te werk kan gaan door direct te kunnen testen en/of uit te voeren. Verder kan de vliegbasis een onderkomen zijn voor internationale samenwerkingen en andere krijgsmachtdelen voor het uitvoeren van relevante operaties.

Circulaire operaties

Binnen het veld van vliegbasis Eindhoven zullen de operaties in de loop der tijd geautomatiseerd, geëlektrificeerd en data gedreven worden. Waarbij de energiebron, zoals zonne- en windenergie, onder andere in het veld zelf te vinden zal zijn. Maar ook verschillende warmtebronnen (d.w.z. landingsbaan) kunnen gebruikt worden, zodat de warmte opgeslagen en wanneer nodig gebruikt kan worden. De energie wordt dus in het veld geproduceerd, gebruikt en opgeslagen. Het opslaan is nodig voor gebruik tijdens piekbelastingen. Daarnaast zullen co-developers aan de vliegbasis toegevoegd worden, zodat (onderdelen van) vliegtuigen gedemonteerd, gerepareerd en/of gerecycled kunnen worden, waardoor er een circulaire economie rondom de vliegbasis kan ontstaan. Daarnaast kunnen deze co-developers ook gebruikt worden om kennis up-to-date te houden.

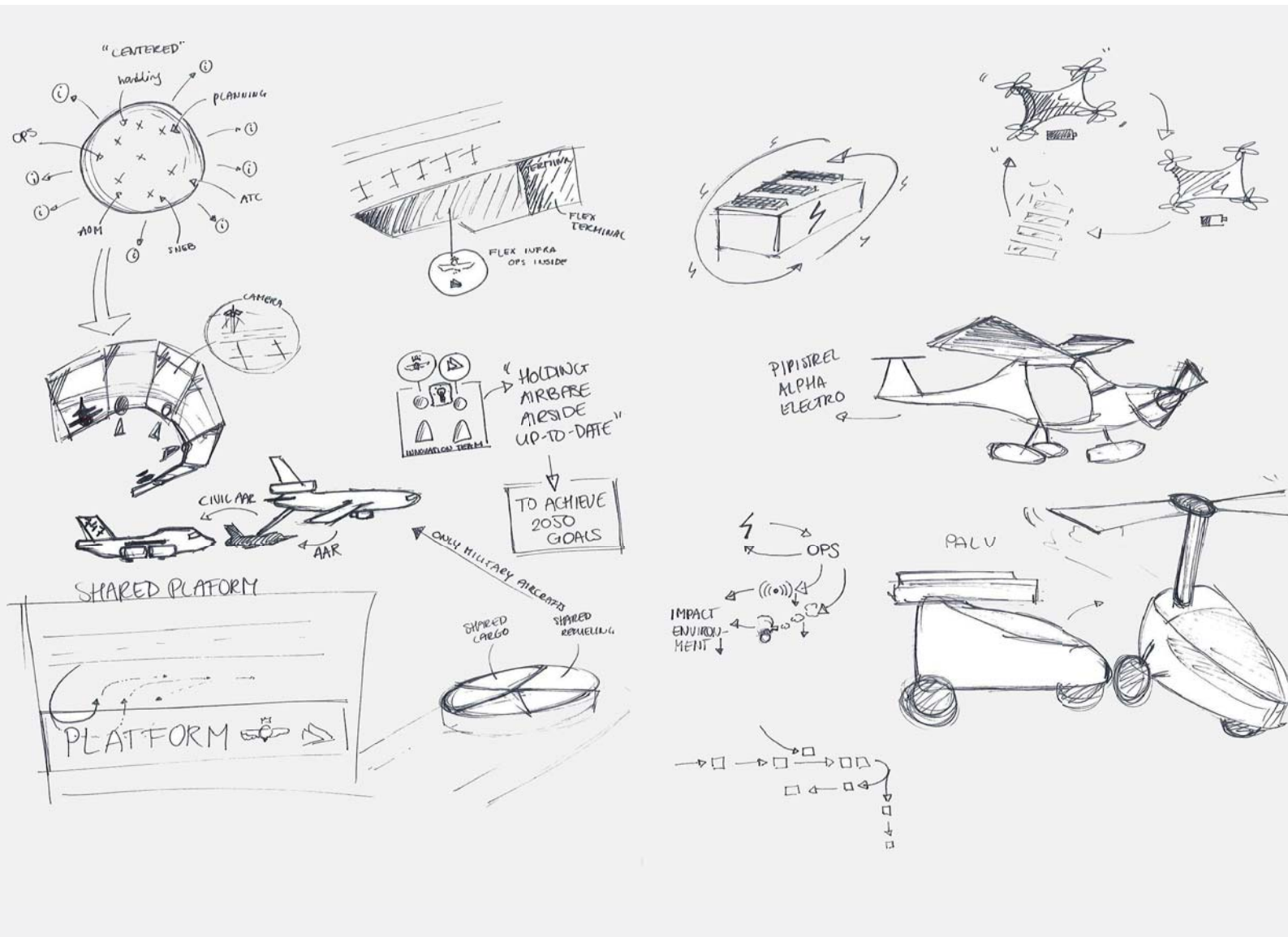
Veerkrachtig en vloeiend transport

Zowel de interne – als de externe connectie moet naadloos in elkaar overlopen. Waarbij automatisering van operaties centraal staat, maar ook de infrastructuur naar buiten toe. Zo kan de vliegbasis samen met de stad Eindhoven een belangrijk duurzaam knooppunt worden wat betreft kennis, duurzaamheid en transport. Waarbij beide zowel nationaal als internationaal georiënteerd zullen zijn.

K. IDEATION

CREATIVE SESSION ON CONCEPT FUNDAMENTALS

1. Progressive abstraction on each fundamental
 - Go upwards in problem abstraction by asking "why"
 - Discuss problem and identify players, aspects etc.
2. Collect H2's from progressive abstraction
3. Elaborate H2's by shedding the known
4. Matec: starting is keyword in H2; gives a 5x5 matrix
 - Select two words: find the common quality
 - Common quality is solution start
5. Start of the ideation phase



DESIGN DIRECTIONS

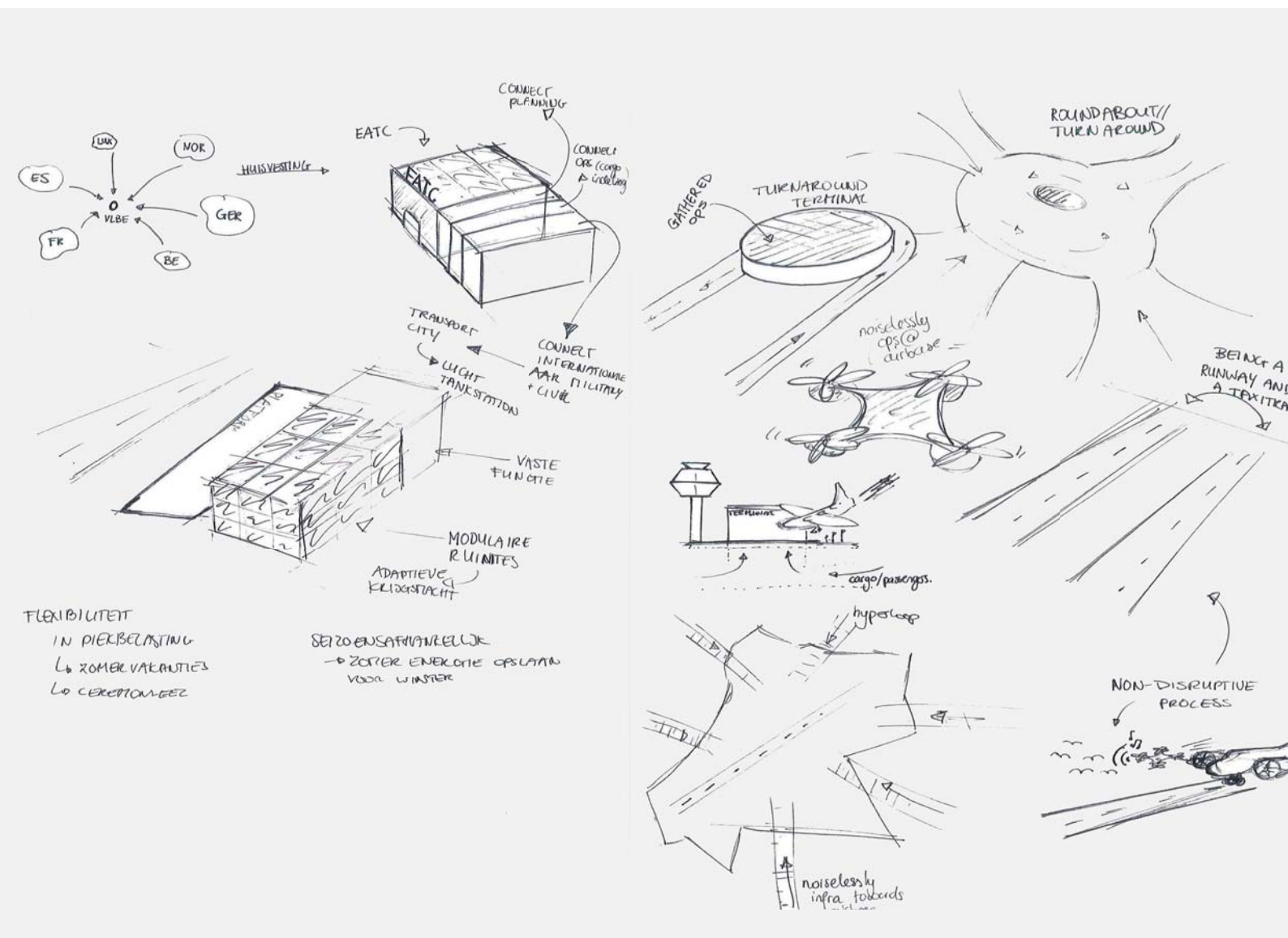
A list of relevant the (idea) design directions:

- Modular buildings
- Self-sustaining cells
- "growing" cells
- Hub for on demand air traffic
- Self-sustaining transport system
- Turnaround terminal
- Circular economy
- European electric network
- Provide hydrogen (research)
- Centred coordination
- Centred operations
- Joint building
- Think tank (Brainport)
- Joint innovation team
- Underground public transport
- European junction
- Second runway is taxi track
- Automated operations

SELECTION IDEATION

The connection of some design directions were evaluated. The most relevant and most connected directions were selected and translated to a concept system, the directions are:

- Circular economy
- European electric network
- Centred coordination
- Centred operations



L. EVALUATION OF THE CONCEPT

EINDHOVEN IN BEWEGING SESSION

Vraag n.a.v. presentatie visie:

“Hoe ziet jouw ideale wereld eruit in 2050?”

“Wanneer je deze ideale wereld schetst, waar zitten dan de obstakels?”

“Hoe overbrug je deze obstakels?”

- EHV moet in connectie staan met alle regionale vliegvelden
- Oirschot civiel maken, EHV volledig militair
- In de lucht zit de ruimte, dus dat is meer relevant dan de beperkte ruimte op de grond
- Kleinere on demand vluchten
- Circular runway i.c.m. ondergrondse autobanen
 - Brengt minder geluidsoverlast, door lagere ligging en conische vorm.
 - Vliegtuig elektrisch opgang brengen
 - Hoe daar te komen is lastig als je 'de winkel' open wilt houden, dus blijven vliegen terwijl je zo'n baan aanlegt.
- EUMITS (Europees militair transport): BENELUX koppelen met vliegbasis
- Scheiden van VLBE (doet dan cargo) en EA (doe dan PAX)
 - Vliegtuig staat centraal ipv objecten eromheen/erin
- Vliegtuig indelen in wat je hebt, niet losse onderdelen (dus niet crew per type vliegtuig)
- Behoud militair belang, boven commercieel in tijden van nood
 - Ook in de zin van adaptiviteit waar je militair bent wanneer nodig, anders kunnen civiel en militair ook samen.
 - Alles civiel ... tenzij ...
 - Civiel/militair vervoer is geen punt = gewoon afspraken maken
- Sociale hub: ontmoetingsplaats voor omgeving EHV; kennis uit wisselen
- Aankomen op vliegbasis via elke weg mogelijk, lucht, land, water...
- Nooit meer leeg vliegen door adaptief vliegtuig (modulair vliegtuig)
- Alles wat beweegt levert energie op: turnaround terminal
- Financiële afspraken m.b.t. commercieel en defensie
- Regelgeving i.c.m. financiën is een obstakel
 - Er is niet één overzichtspunt waaruit geregeld wordt.
 - Resulteert in gebrek aan adaptiviteit, organisatie is niet ingericht op adaptiviteit.
 - Nu investeren, is besparen in de toekomst (+beloning voor slim werk)
 - MLA grote beperkende factor door regelgeving...
- Bekendheid en relevantie VLBE operaties laten zien naar boven toe, bovenin weten ze niet wat er in veld gebeurt en mandaat geven aan commandant vliegbasis, dan gaat de adaptiviteit groeien.
 - Creëer gezamenlijk belang, ook met Eindhoven Airport, op het juiste niveau in de organisatie.
 - Daarnaast zijn de visies beperkt, door een te korte horizon en asynchrone operaties
 - / Politiek termijn 4 jaar
 - / Militair termijn 3 jaar
 - / Maatschappij X jaar
 - Conservatief vs. reactief/innovatief
 - / Niet ondernemend
 - / Generatiekloof
 - / Defensie is "lui", omdat het altijd een bestaansrecht zal houden
- D.m.v. circulaire processen, energie opslaan in tijden van nood.

- Vergroot connectie met partners in de buurt, sluit samenwerkingen:
 - Suppliers die oude vliegtuigen demonteren, onderdelen weer in de loop brengen en/of onderdelen 3D printen en kennis uitwisselen.

Tijdens de Eindhoven in Beweging sessie creëerden 16 verschillende leidinggevenden van de vliegbasis in groepen van 4 hun ideale wereld aan de hand van de visie. Dit resulteerde in verschillende werelden, waarin ze obstakels/knelpunten moesten opzoeken. Hierbij kwam adaptiviteit naar voren, dit blijkt nog een lastig punt in de organisatie. De leidinggevenden kunnen adaptief te werk, staan open voor veranderingen, maar krijgen hun ideeën vanuit het veld niet doorgevoerd, omdat ze allerlei lagen door moeten voordat ze bij degene zijn die het officieel moet goedkeuren. Hier kan een vertaalslag in mijn concept gemaakt worden.

- Relevantie van Vliegbasis Eindhoven communiceren
- Adaptiviteit: regelgeving en financiën; horizon vergroten (nu tot 3 jaar door functielengte)
- Samenwerking met Eindhoven Airport geen probleem, kwestie van afspraken maken
- Sociale hub

