

Introducing the INCOSE competency framework @ Saab Aeronautics

An experience report

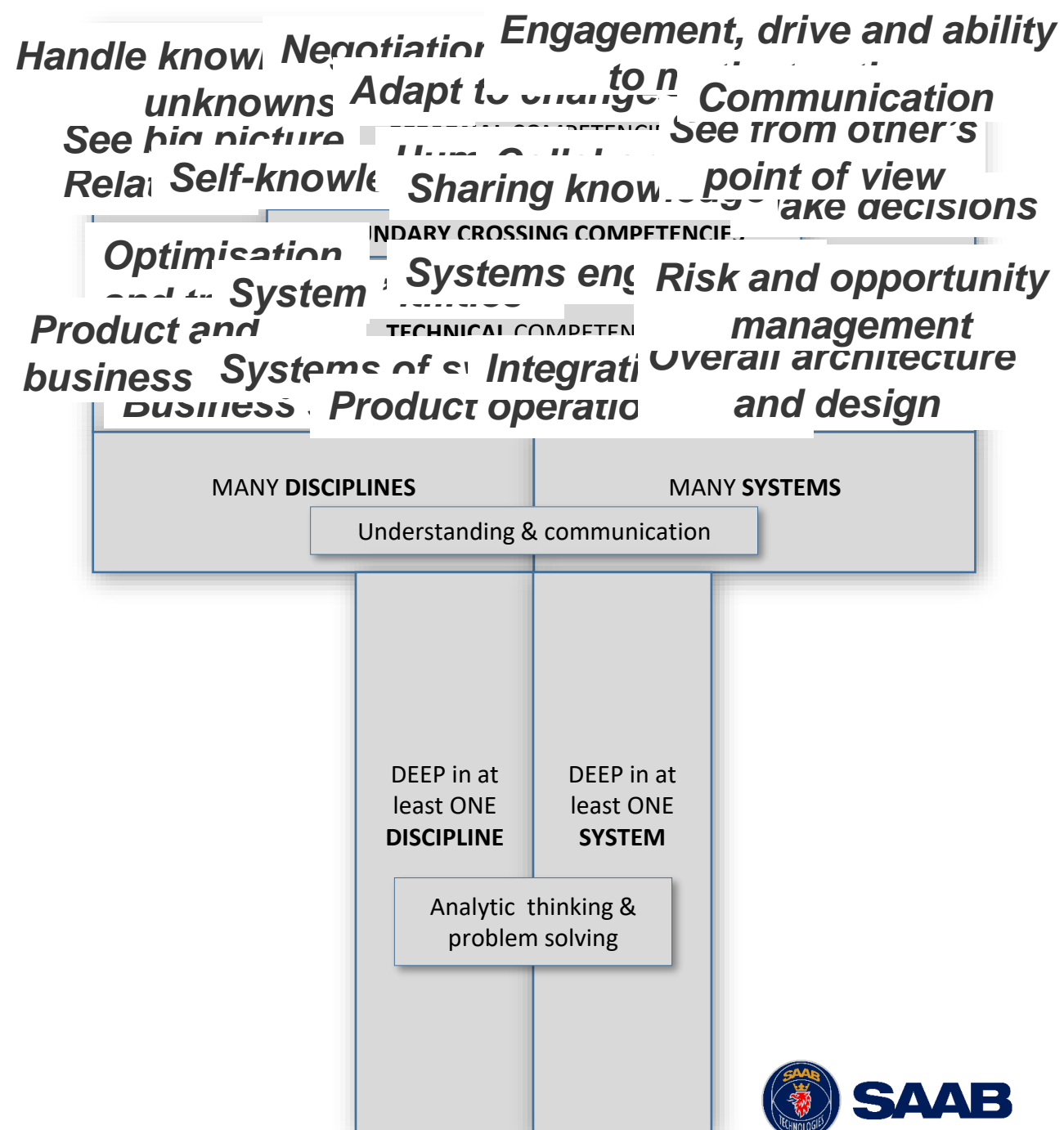
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Background

- Reasoning about desired competence for development of large scale complex systems



Background and goals

Background

- The organisation has been in a **delivery mode** for a long time
 - Many new people
 - High turn-over (both internally and externally)
- Need to **focus** on building **competence for the future**

Goals

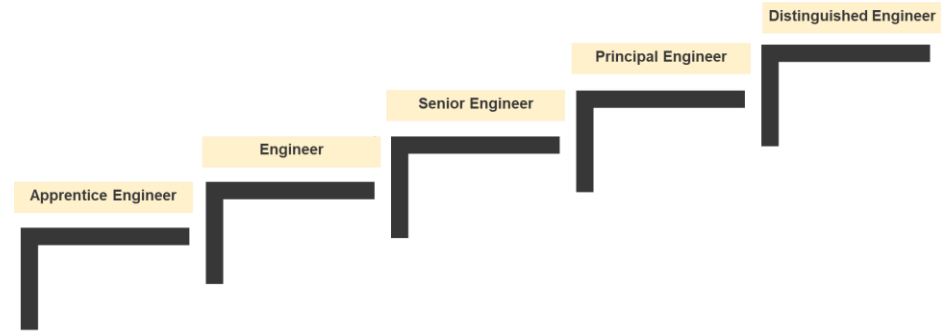
- Make **competence development** a **continuous** and **prioritised activity**
 - For **all engineers** (both new and very experienced)
 - highlight the **breadth of competence needs** within the organisation
- Ensure that the **engineer career ladder** is relevant for **every engineer**
- Highlight the **importance of technical leadership**

Objectives for a new framework

- Capture the **breadth of competencies** required in the organisation
 - Base on existing frameworks
- It is **mandatory** for all engineering employees to have an up to date **competence development** plan
 - Used **throughout a person's career** and not just for authorisation
- Tailored to fit **all engineering disciplines** and products
 - Predefined topics combined with open discipline specific ones
- **Unified framework** applicable in multiple contexts, e.g., for individuals and teams, for establishing current and desired states
- Tool for reasoning about the **ideal competence profile** for **named roles** within the organisation



Two components



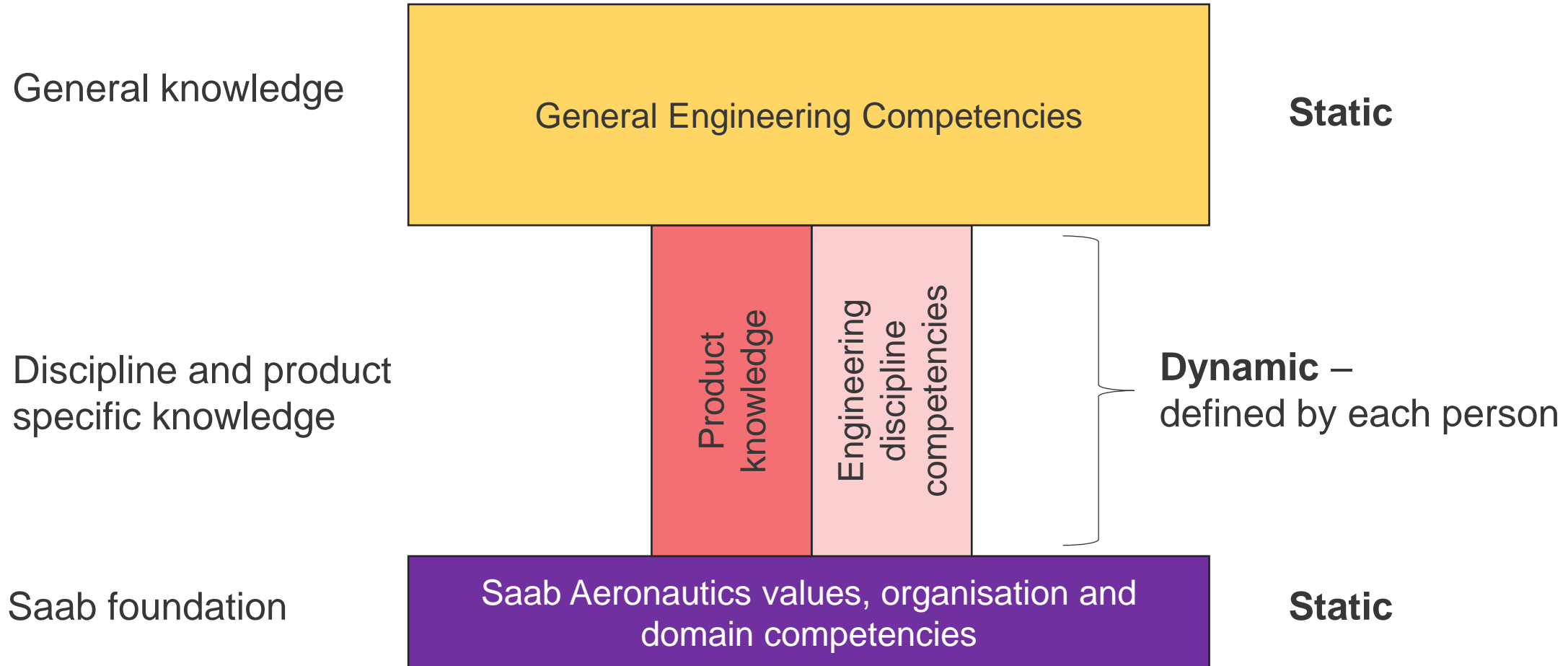
1. Competence assessment and development
 - Structured
 - Continuous
 - Illustrating the wide set of competencies needed in the organisation
 - Captures both "as is" and "desired to be"
2. Authorisation, based on competence and organisational contribution
 - For both
 - Formal role
 - Progression in the "competence ladder"



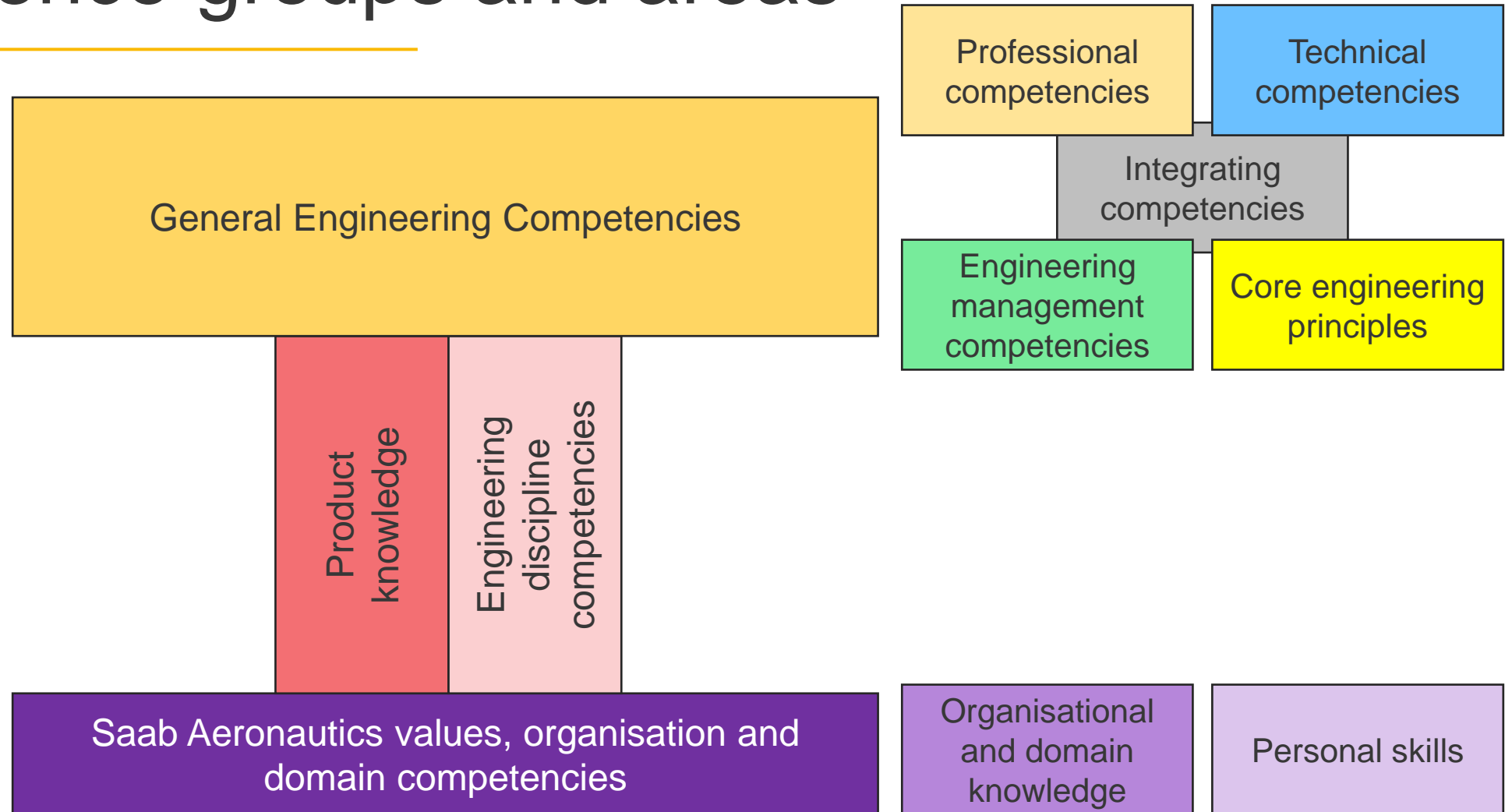
Competence assessment

INF-1980

Competence profile structure



Competence groups and areas



Framework for competence areas

(from INCOSE competency framework)

Professional Competencies	<i>This competence group covers behavioural competencies which are all well-established within the HR domain. It is important that the definition of these competencies would be taken from well-established, internationally-recognised definitions rather than</i>	Communications Ethics and Professionalism Technical Leadership Negotiation Team Dynamics Facilitation Emotional Intelligence Mentoring	Integrating Competencies	<i>This competence group recognises the fact that Systems Engineering is an integrating discipline, joining activities and thinking from specialists in engineering or other disciplines in order to create a coherent whole. It covers the systems engineering competencies required to understand and integrate the viewpoints and perspectives of others into the overall picture</i>	Project Management Finance Logistics Quality	Technical Competencies <i>This competence group relates to the ability to perform a series of tasks associated with the Technical Processes identified in INCOSE SE Handbook at Version 4. As a result, there needs to be a clear relationship (does not need to be 1-1 however) against the handbook / ISO 15288.</i>	Requirements Definition System Architecting Design for... Integration Interfaces Verification Validation Transition Operation and Support
SE Management Competencies	<i>This competence group relates to the ability to perform tasks associated with controlling and managing Systems Engineering work. Once again it is desirable for these to be a clear relationship to Management processes identified in INCOSE SE Handbook at Version 4. However, this does not need to be 1-1 as these tasks also could be utilised for other activities.</i>	Planning Monitoring and Control Decision Management Concurrent Engineering Business & Enterprise Integration Acquisition and Supply Information Management Configuration Management Risk and Opportunity Management					
				Core SE Principles	<i>This competence group covers core principles which underpin engineering as well as systems engineering.</i>	Systems Thinking Lifecycles Capability Engineering General Engineering Critical thinking Systems Modelling and Analysis	

Competence levels

Grade	Label	Simplified interpretation	Description
0	Unaware	I don't know this subject	The person has only very limited knowledge about the competence area.
1	Awareness	I know what the competence area is theoretically, but I have no, or only very limited, working experience	The person displays knowledge of key ideas associated with the competency area and understands key issues and their implications. The person asks relevant and constructive questions on the subject. This level characterises engineers new to the competency area. The level is also applicable for non-engineers interacting within engineers – i.e., not working actively in the competency area, but is aware enough for participating in informed professional discussions in the area.
2	Supervised Practitioner	I can work independently, but need help on a regular basis	The person displays an understanding of the competency area and has some experience. The person requires regular guidance and supervision during the daily work. This level typically defines those engineers who are “in-training”, are inexperienced, has not practised in the area for a long time, or has the specific competency as a complementary side area.
3	Practitioner	I work independently on a daily/weekly basis, but need occasional help with infrequent activities	The person has sufficient knowledge and practical experience to work independently on most day to day tasks. The person is capable to provide advice and guidance to supervised practitioners. Being a practitioner means that the person, although being able to work independently, will need help with some more complex or infrequent topics, e.g., the definition of planning documentation based on existing processes.
4	Senior Practitioner	I work independently and provide support to supervised practitioners	The person displays both knowledge and practical experience of the competency area and can work without any supervision. The person is also capable of providing guidance and advice to less experienced practitioners. The person is well versed in tailoring activities and other infrequent task. Being a senior practitioner within a competency area implies that a person is well versed in and up to date with best practice. This competency level is the final result for the vast majority of the employees within an organisation during a successful working life.
FOR ENGINEERS WITH EXCEPTIONAL KNOWLEDGE (VERY FEW)			
5	Lead Practitioner	I am the person within the organisation that the practitioners turn to for advice	The person displays extensive and substantial practical knowledge and experience of the competency area and provides guidance to others, including practitioners encountering unusual situations. Typically, this level is associated with an individual who is the “go-to” person for advice. Moreover, the person contributes to and improves best practice within the competency area within an organisation or business unit. The number of lead practitioners in an organisation is rather small.
6	Expert	I am an authority on national or international level in the subject	In addition to extensive and substantial practical experience and applied knowledge of the competency area, this individual contributes to and is recognised beyond the organisational or business boundary. Typically, this level is associated with contribution to and definition of national or international best practices within the competency area. Experts are rare, for many competency areas there are no experts – even in a large organisation.

Excerpt of competence matrix

Competence groups	Short description	Core competence areas	Self-assessment	Self-assessment	Self-assessment	Rationale
			Demonstrated competence	Estimated competence	Desired competence Future competence target	
Personal Skills and Organisational Knowledge						
Personal Skills	<i>This competency group skills associated with the interpersonal behaviour and the social context.</i>	Cultural Awareness				
		Language Skills: English				
		Language Skills: additional language(s)				
		Drive				
Organisation and Domain Knowledge	<i>This competency group recognises general knowledge related to Saab's organisation and products, and its business context.</i>	Business Awareness				
		Knowledge of the Company				
		Product Knowledge				
		General Aeronautics				
Rules, Regulations and Standards						
Engineering Discipline Competencies						
Discipline Competencies	<i>This competency group recognises different disciplines needed for systems/product/technology research and development. Add any applicable area(s) applying to you, for example mechatronics, mechanical design, stress analysis, system safety / security / availability / maintainability etc.</i>	Area 1				
		Area 2				
		Area 3				
		Area 4 etc				
Product Knowledge						
System/Product Competencies	<i>This competency group recognises different product and system related competencies. Add any applicable area(s) applying to you, for example landing gear system, brake system, hydraulics integration, mechanical design system etc.</i>	Area 1				
		Area 2				
		Area 3				
		Area 4 etc				
General Engineering Competencies						
Core Engineering Principles	<i>Core engineering competencies.</i>	Systems Thinking				
		Lifecycles				
		Capability Engineering				
		Critical Thinking				

How to use the framework

Name	Description	Discussion and examples	Example indicators for Senior Practitioner
Language Skills	Language skills are of importance in an international arena, to enable an efficient communication with each other. English skills are necessary in almost every international context, but also other local languages to be able to have successful social communication, information sharing and social interaction.	<p>Language skills (English): Since English is the concern language, a good knowledge of English is necessary for the internal activities within the company. For example, the ability to speak and write good technical English helps when assimilating information within the discipline and to communicate efficiently.</p> <p>Language skills (additional languages): With an increasing amount of international customers and partners, other languages than English are also of increasingly importance for conducting successful businesses and being close to the customers.</p> <p>A word of caution: It is easy to overestimate the language skills. It is a feat to reach the Senior Practitioner level for a non-native speaker.</p>	<ul style="list-style-type: none"> • Can speak and write (fluently) good technical English • Can speak and write in customer specific languages, or other languages of importance for partner/supplier relationships • Language certification is an indicative measure for foreign languages, for example Cambridge Certificate in Advanced English.

Name of the specific competence area

A general description, to put it in an overall context

*A few examples of specific competency indicators, indicating the **Senior Practitioner** level. For other levels, follow the general line of thought.*

More specific Saab context, possibly with examples and ways of working

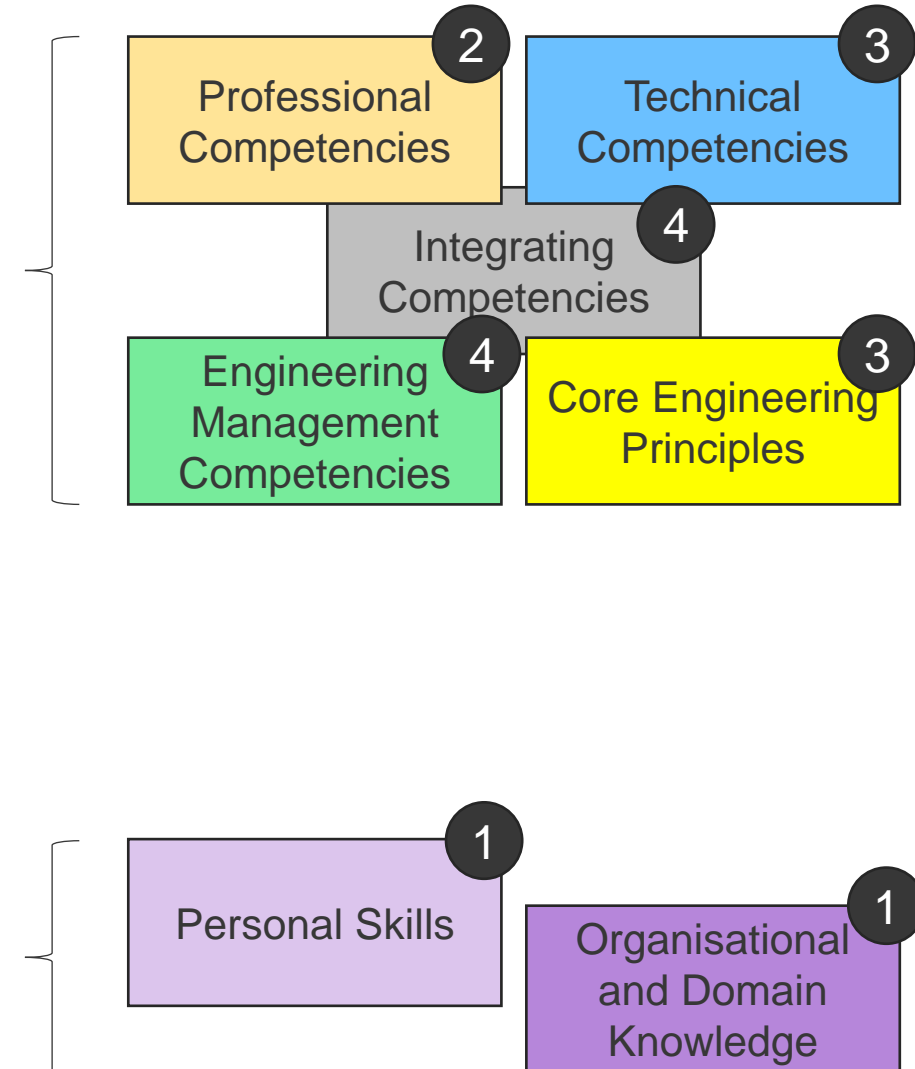
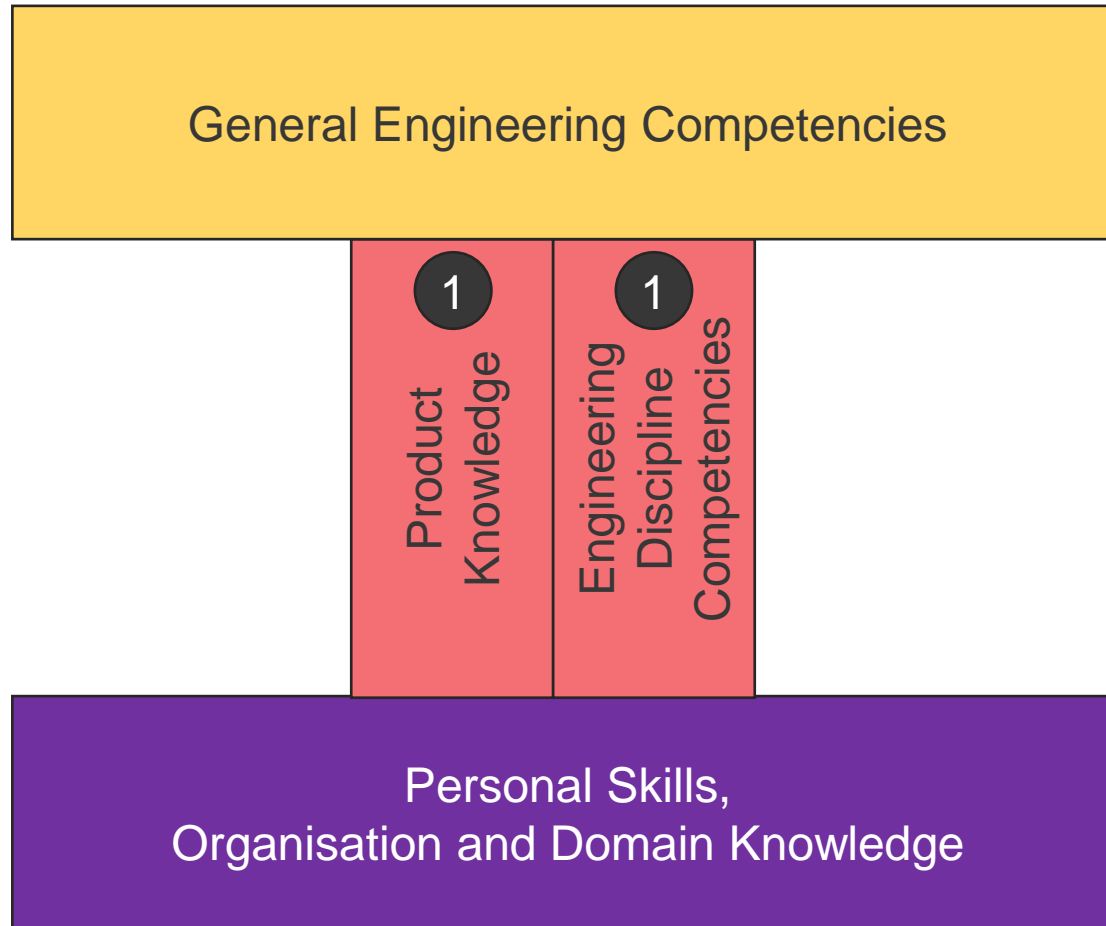
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4	Senior Practitioner	I work independently and provide support to supervised practitioners

FOR ENGINEERS WITH EXCEPTIONAL KNOWLEDGE (VERY FEW)

5	Lead Practitioner	I am the person within the organisation that the practitioners turn to for advice
6	Expert	I am an authority on national or international level in the subject



Where to start?

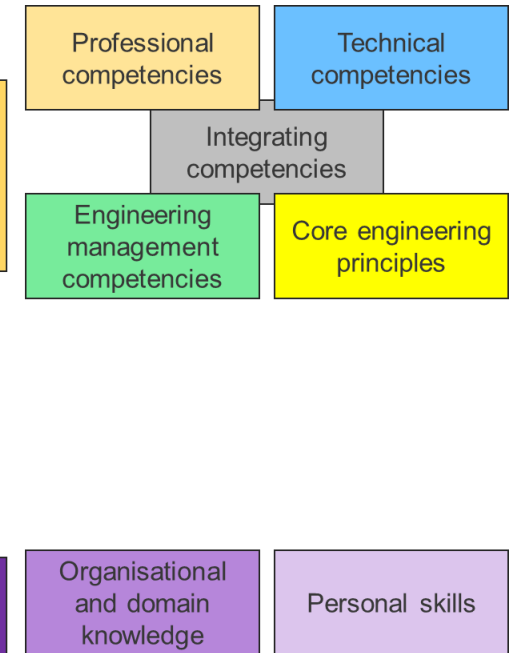
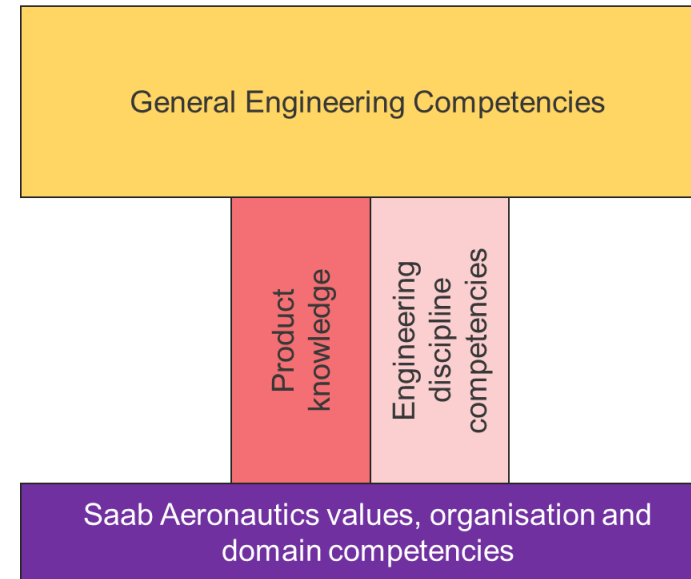




Self-assessment – how to do

How to do the assessment?

- For each group of competencies:
 - Discussion Employee – Manager
- General advice: Make quick assessments!
 - Look at the indicators for guidance
 - Spend more time on the areas where you are most familiar
 - Don't be ashamed if not being aware
 - Look at white spots as opportunities!



Grade	Label	Simplified interpretation
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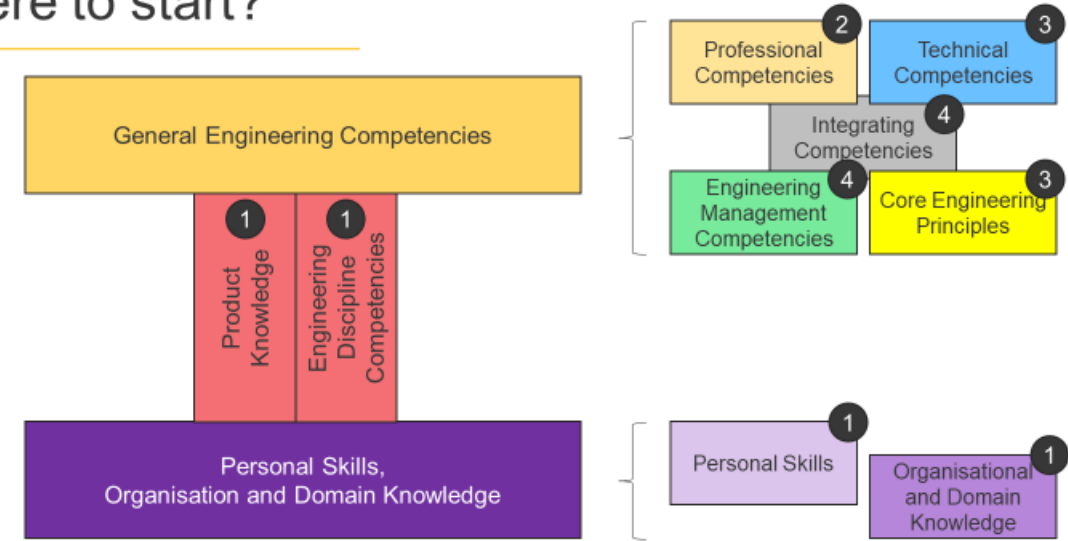
5	Lead Practitioner	I am the person within the organisation that the practitioners turn to for advice
6	Expert	I am an authority on national or international level in the subject

Remember – if you are at Senior Practitioner level, you are really good 😊

Practical guidance

1. Good idea: perform the assessment with your manager, team or your colleagues, to be able to **discuss interpretations and the assessment outcomes**.
2. Identify your **systems of interest** when doing the assessment (aircraft or aircraft subsystem, ground support equipment, PLM system, training system etc).
3. **Tailor** the general competence descriptions to your specific product or system. Ask yourself how each specific competence is manifested in your working environment.

Where to start?



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Erik Herzog & Johanna Axehill | Issue 1



4. Begin with the groups where you feel **most familiar**, an example is illustrated in the figure below serving as an indication of assessment order. There is no need to fill out all groups for a newly hired engineer – build up the matrix over time.
5. Indicators for each specific competence area are only provided **as examples to guide you**.
6. Please note that being a **Senior Practitioner within a competence area implies that you are well versed and up to date with best practice. Attaining higher competence levels is an indication of outstanding skill in a specific area.** Normally, there are only a few people on the Lead Practitioner level and above within each competence area even within a large organisation.
7. It can be helpful to identify colleagues that you believe are at a certain level, to **calibrate your own assessment**, for instance identify who is the senior practitioner in each competence area.
8. Nobody is expected to have a high competence level in all competence areas. **Be honest when assessing your competence and capture your competence profile, and see the whole picture** – be it specialised or bridge-builder.



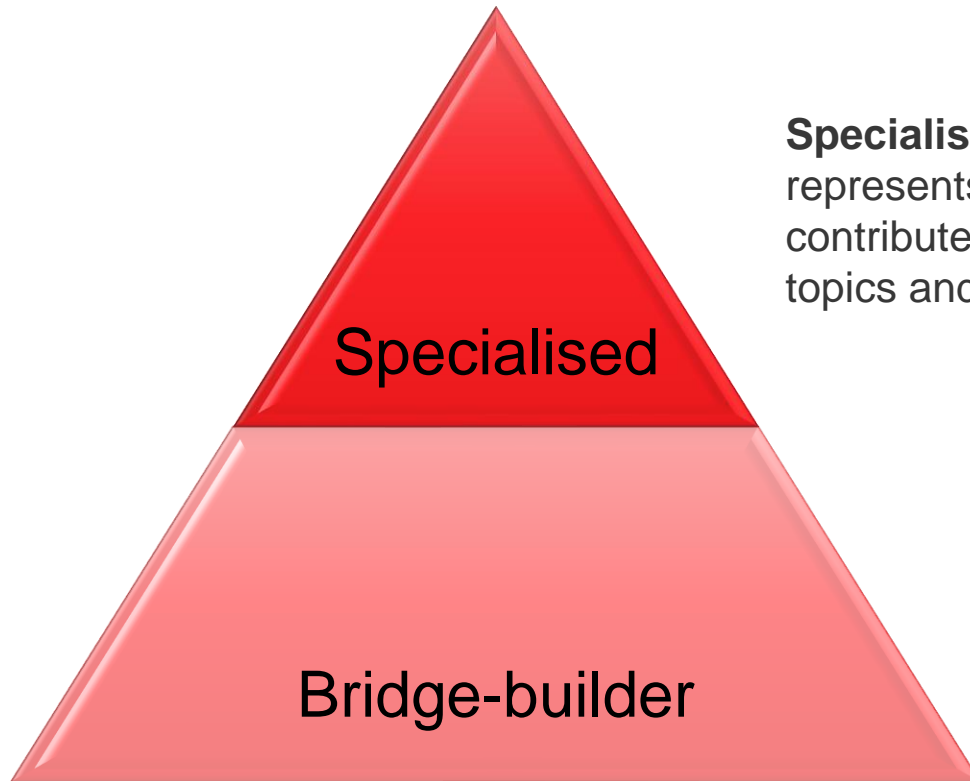


*Authorisation –
competence stair*

New competence stair, but the same!

	Apprentice Engineer		Engineer	Senior Engineer	Principal Engineer	Distinguished Engineer
Level	0	1	2	3	4	
Criterion	Recently graduated	Effective team contributor	Considerable and consistent contribution within team or between teams	Considerable and consistent impact on technology, product or projects	Considerable and consistent organisationwide impact	
Example roles	Systems Engineer	Systems Engineer Test Engineer Equipment Engineer	Systems Engineer Airworthiness Engineer First Test Engineer	Systems Engineer ATA, MGM, CVE Senior Test Engineer SQAM	Systems engineer Chief Engineer Chief Test Engineer Technical Fellow HoA, HoD	
Initiated and authorized by		Line manager	Line manager together with area manager	Line manager together with area manager Authorized by authorization board	Line manager together with area manager Authorized by authorization board	

Evaluating competence as a whole



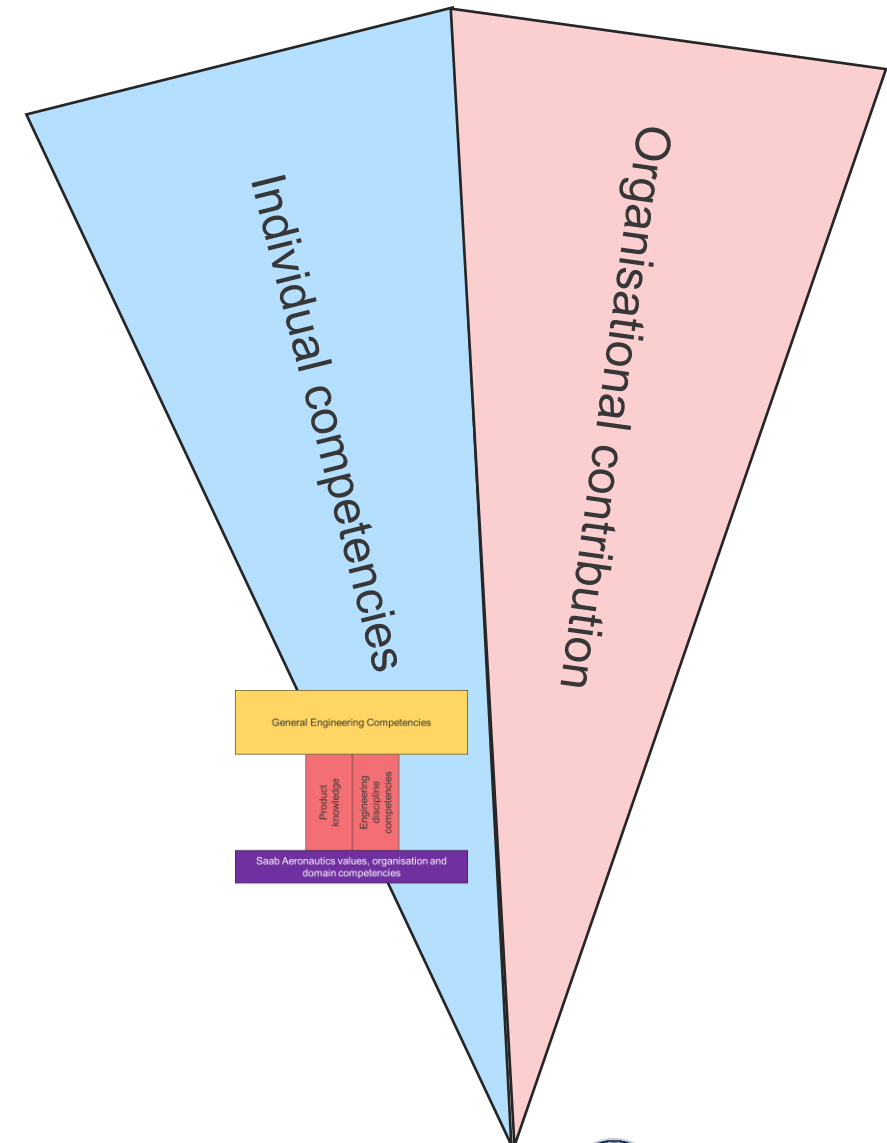
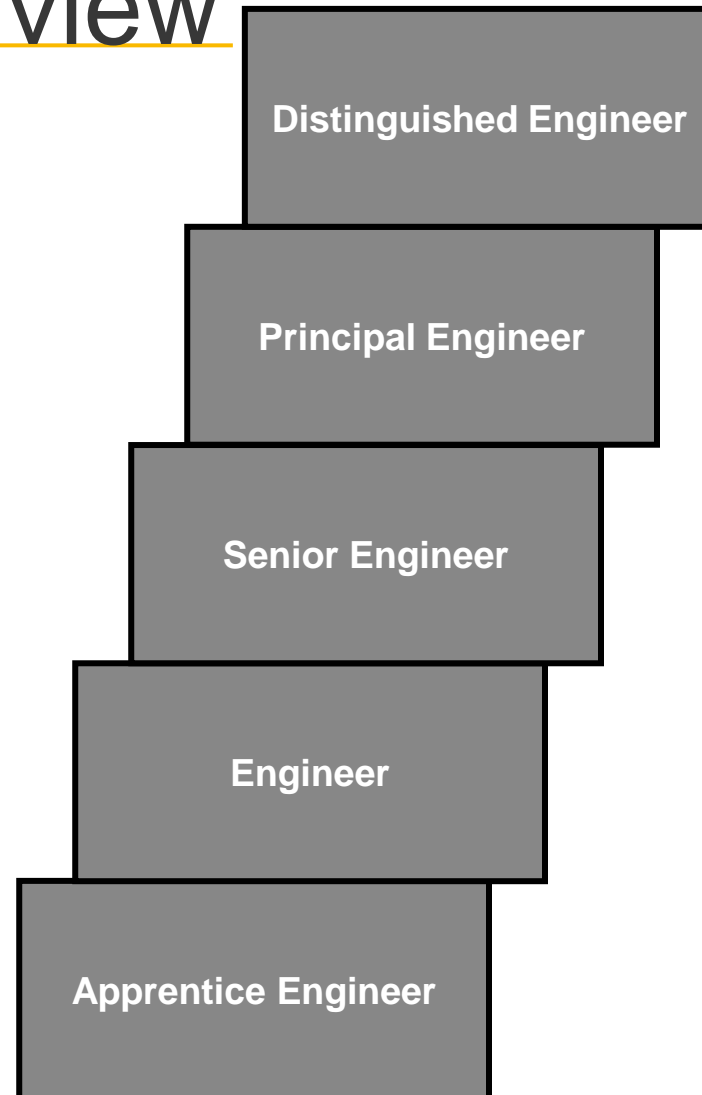
Specialised expertise represents the ability to contribute in deep and narrow topics and discussions

A **bridge-builder** has a wide, and somewhat shallow competence profile. With it comes the ability to evaluate a bigger picture and mediate between specialists

The competence ladder shall be applicable for all engineers at Saab Aeronautics – regardless of their competence profile

Individual vs organisational view

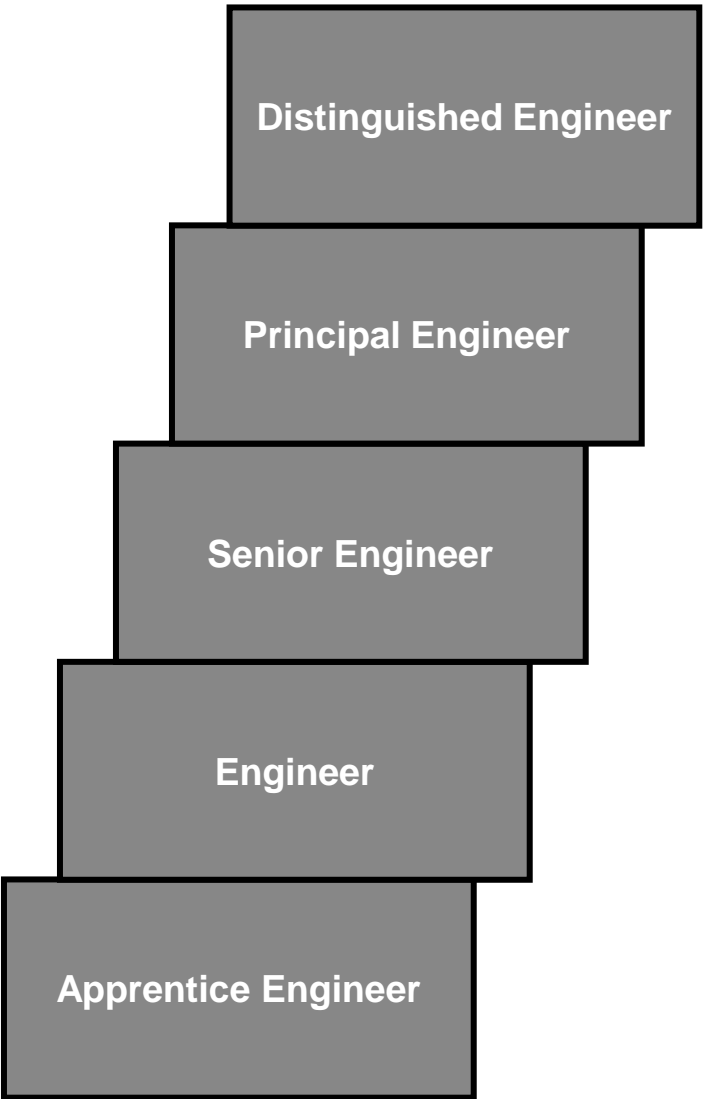
- Individual – level of personal competencies, gained through education and experiences
- Organisational – level of contribution within the organisation



Individual competencies

Specialised expertise

Bridge-builder



Expert in at least one area
More than 5 relevant publications

Lead practitioner in 4-5 areas

Senior practitioner in 12-15 areas

Practitioner in more than 25 areas

Supervised practitioner in more than 40 areas

Lead practitioner in at least one area
At least one relevant publication

Senior practitioner in 4-5 areas

Practitioner in 12-15 areas

Supervised practitioner in more than 25 areas

Senior practitioner in at least one area

Practitioner in 4-5 areas

Supervised practitioner in more than 12-15 areas

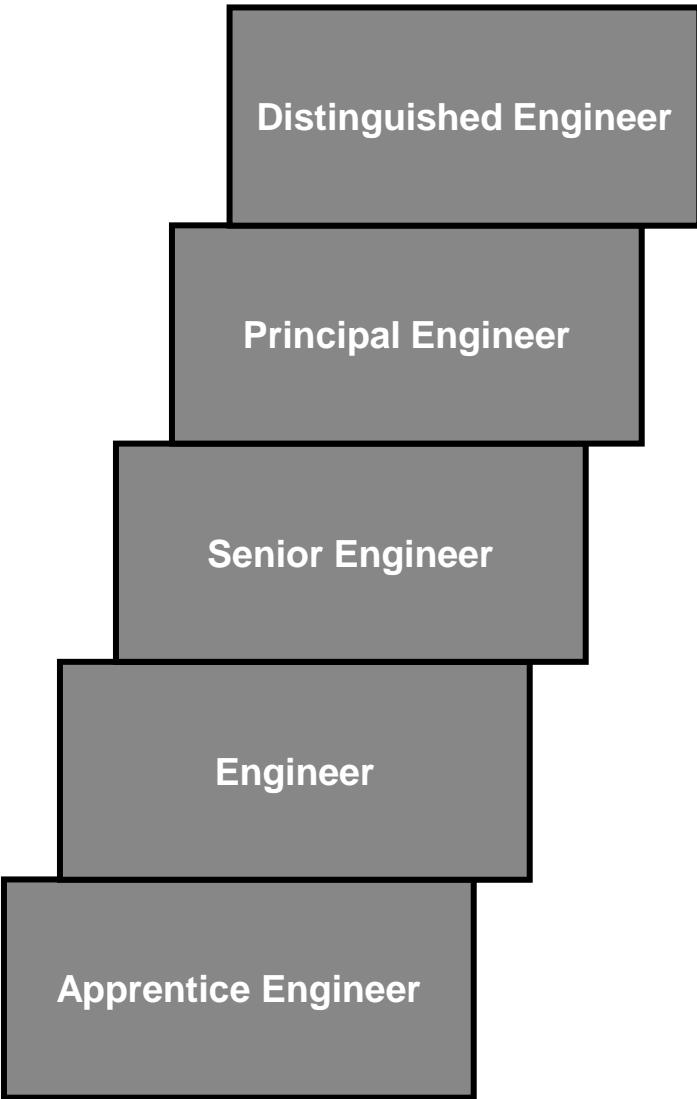
Practitioner in at least one area

Supervised practitioner in more than 4-5 areas

Individual competencies

Specialised expertise

Bridge-builder



Expert in at least one area
More than 5 relevant publications

Lead practitioner in 4-5 areas

Senior practitioner in 12-15 areas

Practitioner in more than 25 areas

Supervised practitioner in more than 40 areas

Lead practitioner in at least one area
At least one relevant publication

Senior practitioner in 4-5 areas

Practitioner in 12-15 areas

Supervised practitioner in more than 25 areas

Senior practitioner in at least one area

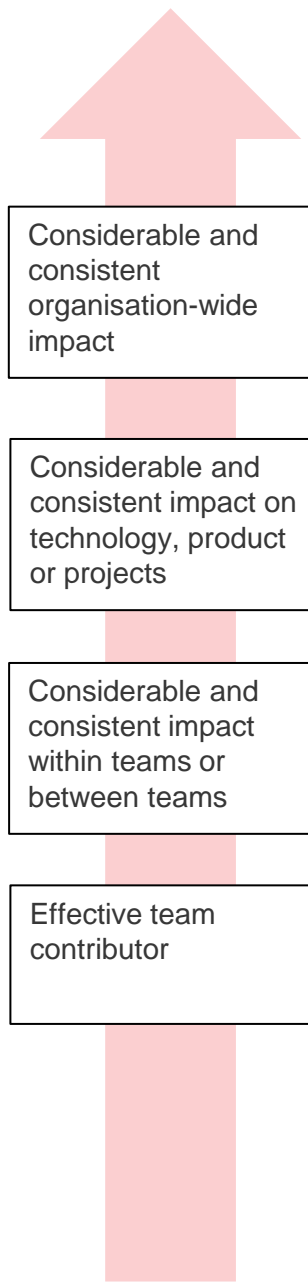
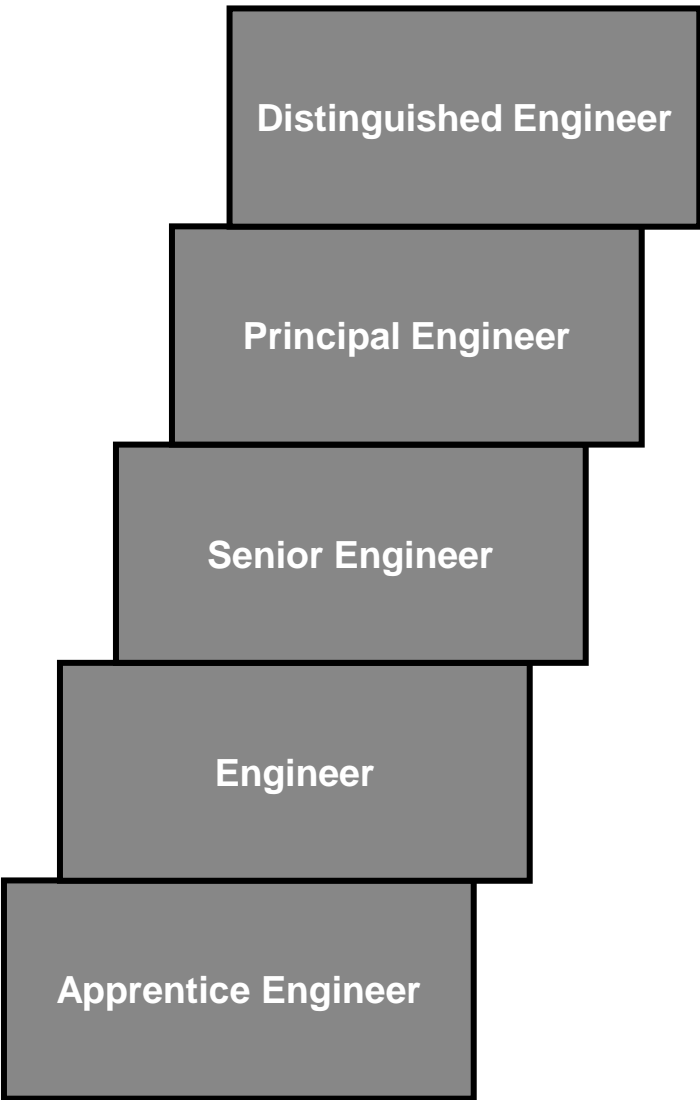
Practitioner in 4-5 areas

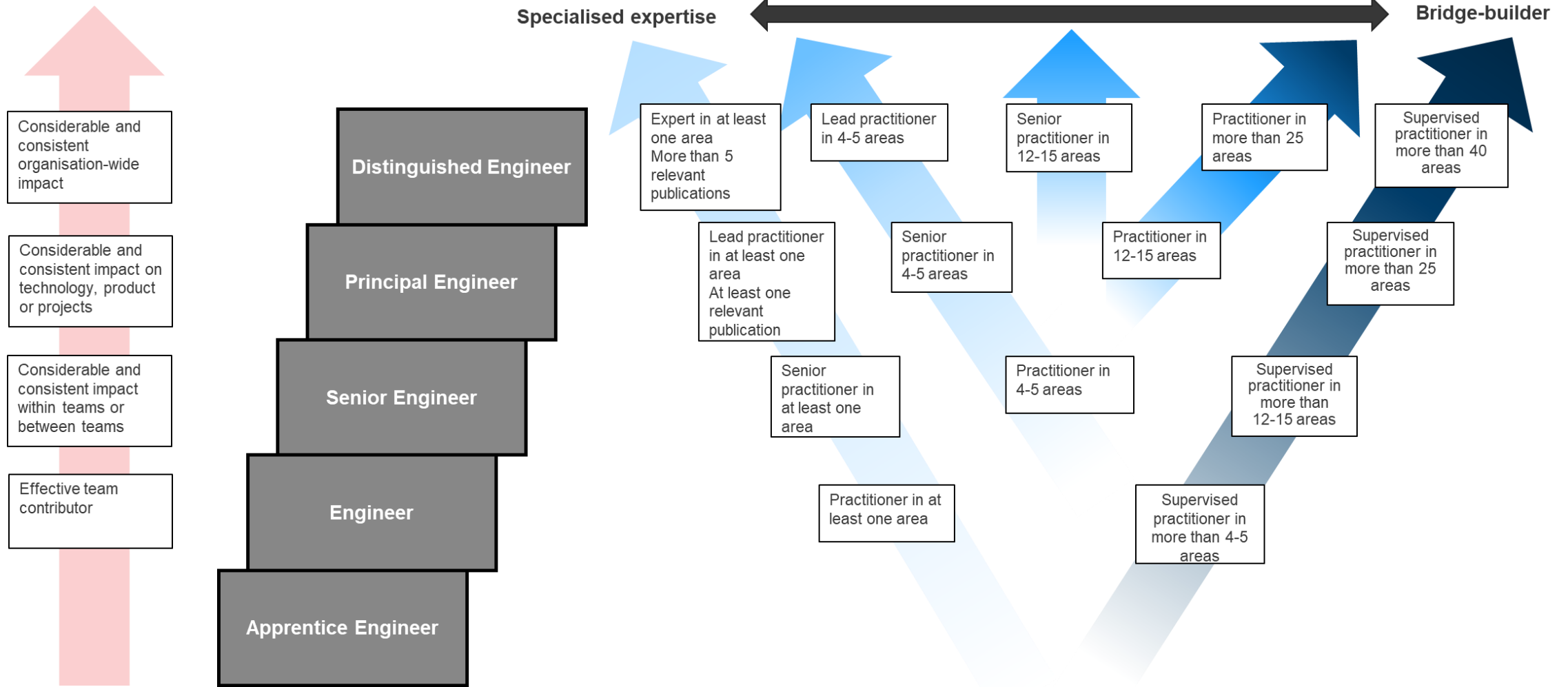
Supervised practitioner in more than 12-15 areas

Practitioner in at least one area

Supervised practitioner in more than 4-5 areas

Organisational contribution





	Apprentice engineer		Engineer	Senior engineer	Principal engineer	Distinguished engineer
Level	0	1	2	3	4	
Criterion	Recently graduated	Effective team contributor	Considerable and consistent contribution within team or between teams	Considerable and consistent impact on technology, product or projects	Considerable and consistent organisationwide impact	
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Initiated and authorised by		Line manager	Line manager together with area manager and relevant technical discipline manager	Line manager together with area manager and relevant technical discipline manager. Authorised by authorisation board	Line manager together with area manager and relevant technical discipline manager. Authorised by authorisation board	
Career span (years)	0-2	Min 2	Min 4	Min 6	Min 10	

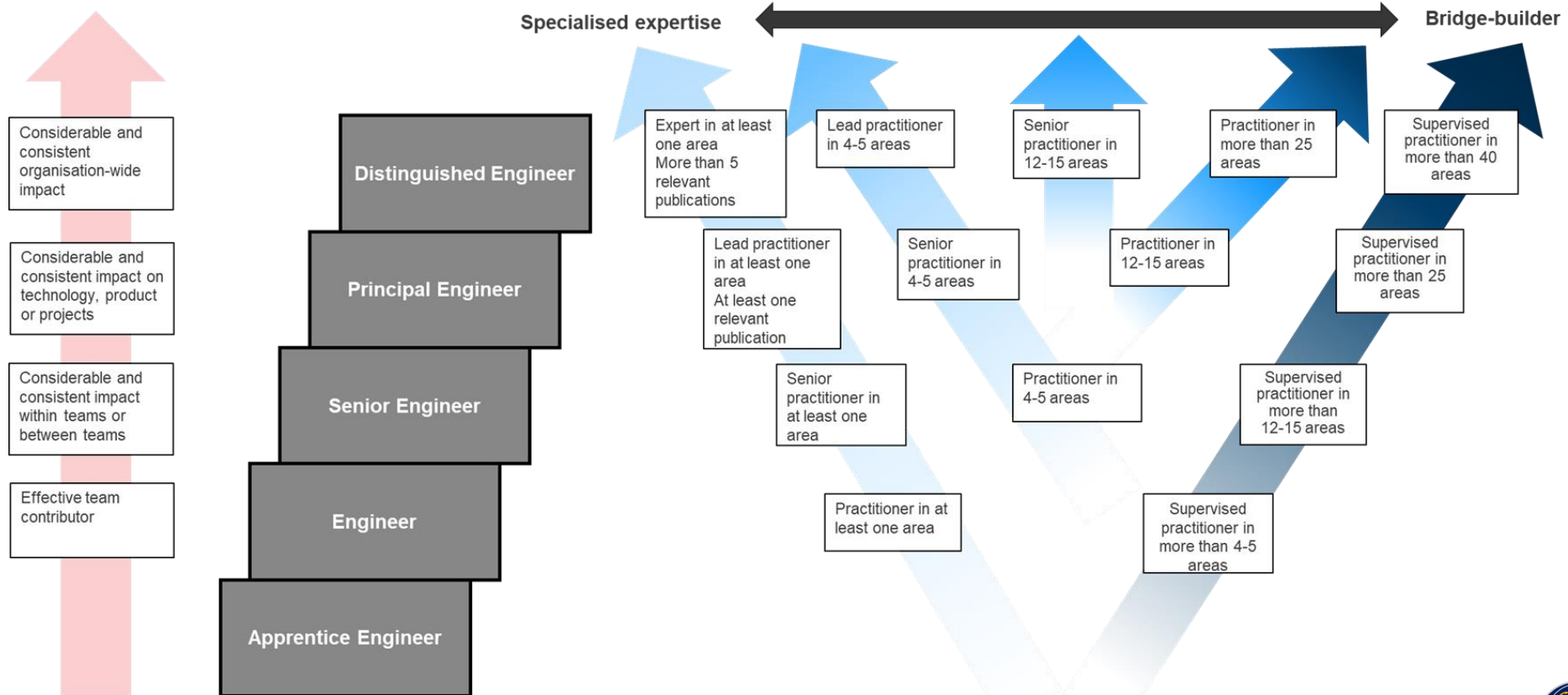
Summary



Authorisation according to the "competence stair"

Organisational contribution

Individual competencies



Authorisation forms

The following information shall be provided for authorization (in accordance with [MAN-01299](#)):

- Application form ([5000349-479](#))
- Up-to-date CV, please turn to Section 8 of this document for required CV information
- Competence matrix ([5000363-533](#)) – ensure that levels and rationales are provided for each competency area



Applicant (name, department, phone)		Application date	Reg. No
Employment No	Date of birth	Classification Company Confidentiality COMPANY CONFIDENTIAL	Application issue

Application

Request for authorization	Present authorization	
Engineer Level <input type="checkbox"/> Apprentice Engineer <input type="checkbox"/> Engineer <input type="checkbox"/> Senior Engineer <input type="checkbox"/> Principal Engineer <input type="checkbox"/> Distinguished Engineer	Engineer Level <input type="checkbox"/> Apprentice Engineer <input type="checkbox"/> Engineer <input checked="" type="checkbox"/> Senior Engineer <input type="checkbox"/> Principal Engineer <input type="checkbox"/> Distinguished Engineer	Date of present authorization
New <u>File</u> "Level" "Main engineering role (specialization within the role)"	Title (for present level of authorization)	

Competence assessment summary from nearest Line Manager

Overall evaluation of the person's individual competencies

Organisational contribution assessment from nearest Line Manager

Overall evaluation of the person's contribution to the organisation

Agreed by

Name (department, name)	signature	cost centre
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Approved by

Name (department, name)	signature	date
Name (department, name)	signature	date

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Experience and Current improvements

Competence assessment

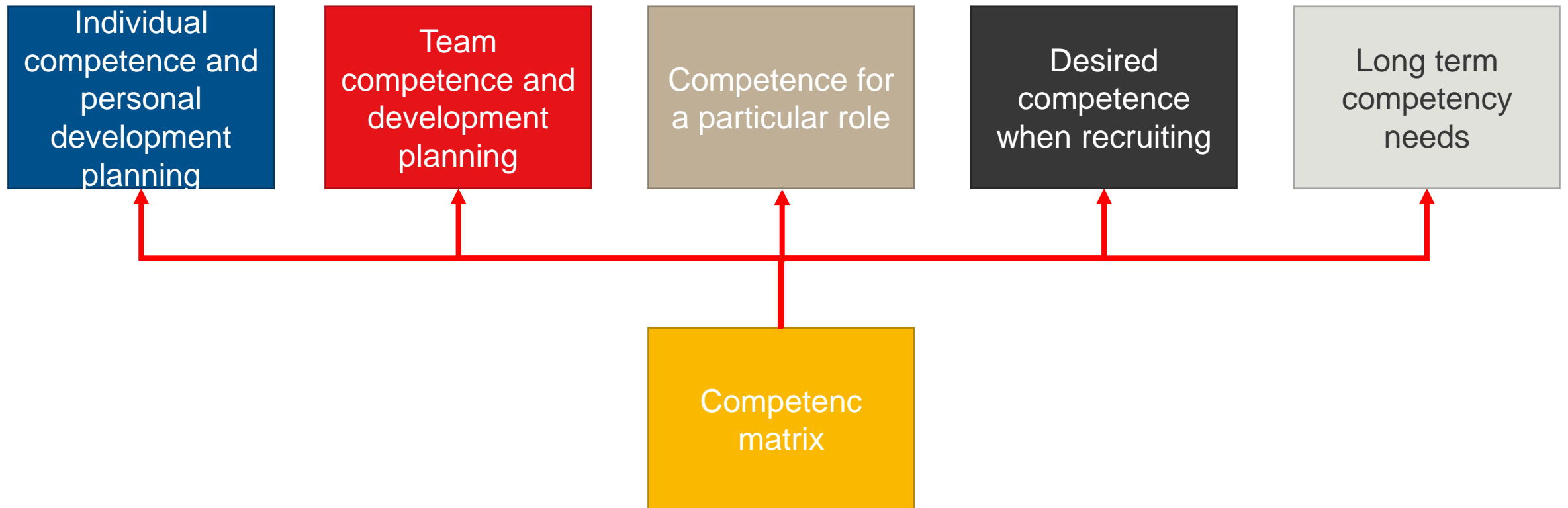
- We believe that, in our organisational environment, assessment must be light weight and easy to perform
 - There is no direct impact on salary
 - Primarily a tool for gauging personal competence and identifying learning opportunities
- It is difficult to assess just about right – the self image will introduce biases
- Competence discussions in groups works surprisingly well for calibrating assessments – for most people
 - But some are clearly uneasy with the concept

Authorisation

- Our understanding is that the authorisation is now open to a wider set of employees
- Keep in mind: authorisation is not based on competency only
- The organisational contribution part will be clarified in upcoming versions of MAN-01299
 - With a little help from Boeing
- Steps in the ladder are not of equal height
 - The step to Principal engineer and Distinguished engineer are higher
 - Will adjust competency expectations
- When authorising employees, do not move them to Distinguished engineer as the first step

	Apprentice engineer		Engineer	Senior engineer	Principal engineer	Distinguished engineer
Level	0	1	2	3	4	
Criterion	Recently graduated	Effective team contributor	Considerable and consistent contribution within team or between teams	Considerable and consistent impact on technology, product or projects	Considerable and consistent organisationwide impact	
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Career span (years)	0-2	Min 2	Min 4	Min 6	Min 10	

Competence matrix as an enabler for scaling



Current improvement activities

- Decrease investments for doing a competence assessment
 - Guidance information included in the assessment matrix
- Removal of competence areas with poor definitions
 - **Drive** – this is really part of the organisational contribution
 - **Ethics and Professionalism** – an area where we can't define the levels properly
- Increase the bar for competence levels Lead Practitioner and Expert
- Increase the expectations for Principal and Distinguished engineers
 - Only our really good employees will progress beyond Senior Engineer

References

- [From Brownfield to Greenfield Development–Understanding and Managing the Transition](#)JW Axehill, E Herzog, J Tingström, M Bengtsson, INCOSE International Symposium 31 (1), 832-847
- [Experience from a Program for Accelerating the Creation of T-shaped Technical Leaders](#)L Cederberg, JW Axehill, E Herzog, INCOSE International Symposium 29 (1), 707-722