Abstract

The Systems Engineering Master education in Kongsberg requires from students that they work part-time. This document describes the needs and expectations for the part-time job. The main purpose of the part-time job is that the students build up engineering experience. This experience helps to appreciate Systems Engineering teaching, it facilitates their further personal development in becoming broader engineers.
# Objectives of this Presentation

<table>
<thead>
<tr>
<th>company HR and supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>provide inspiration by examples</td>
</tr>
<tr>
<td>provide background for part-time job</td>
</tr>
<tr>
<td>to benefit the most as company from IM student-employee</td>
</tr>
<tr>
<td>to get the most benefit for the competence development of the IM student</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>student</th>
</tr>
</thead>
<tbody>
<tr>
<td>provide background for part-time job</td>
</tr>
<tr>
<td>provide support by examples</td>
</tr>
<tr>
<td>to provide the most value to the company</td>
</tr>
<tr>
<td>to achieve maximum personal growth</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Buskerud University College</th>
</tr>
</thead>
<tbody>
<tr>
<td>share how to provide students with experience</td>
</tr>
<tr>
<td>to ensure industry involvement</td>
</tr>
<tr>
<td>to ensure industry value</td>
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</tbody>
</table>
Evolution from Engineer to Systems Engineer

Traditionally, systems engineers "grow" in decades. Traditionally, systems engineers "grow" in decades.

- **All-round Engineer**
- **Aspect Systems Engineer**
- **Systems Engineer**

**Legend**:
- **System**
- **Mono-disciplinary**

**Root Knowledge** to be maintained.

**Depth of Knowledge**

**Breadth of Knowledge**
Industry Master time line

**Bachelor** science or engineering

- SE courses
- part-time job

**Master** systems engineering

- electives
- master project

**Work experience**

- mono-disciplinary knowledge (theory)
- multi-disciplinary skills (practice)
- mono-disciplinary skills (practice)
- multi-disciplinary knowledge (theory)

- time

3 years

3 years

3 years

3 years

master project
Intended growth of Industry Master students

- Industry Master; Engineering Work Experience part-time Job
- version: 0.5
- September 9, 2018
- IMWEfromBachelorToSE

**Theory**
- bachelor
- master
- systems engineer
- on the job training

**Practice**
- industry master
- mono-disciplinary
- root knowledge
to be maintained

**Breadth of knowledge**
- depth of knowledge
- time
Intended growth of Part-time student (1)

- **Engineer**
  - Part-time Master
  - Depth of knowledge to be maintained
  - Breadth of knowledge to be maintained

- **Theory**
  - On the job training

- **Systems Engineer**
  - Legend:
    - System
    - Mono-disciplinary

- **Mono-disciplinary root knowledge to be maintained**
Intended growth of Part-time student (2)

- All round engineer
- Systems engineer

Root knowledge to be maintained

Breadth of knowledge

Part-time master

On the job training

Legend:
- System
- Mono-disciplinary

Depth of knowledge

Mono-disciplinary root knowledge to be maintained

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IMWEFromAllRoundToSE
Overload of Impressions for Fresh Bachelors

project
- cost pressure
- time pressure
- BoM
- WBS
- schedules
- sales price
- margin
- cost

finance
- EBITA
- RONA
- ROI
- cost
- margin

business functions
- logistics
- production
- sales
- service
- Quality ass.

human
- politics
- project leader
- managers
- colleagues
- other disciplines
- CEO
- CFO

process/organization
- processes
- procedures
- tools
- organization
- requirements
- engineering
- testing
- documentation
- changes

systems engineering
- components
- technology
- functions
- products
- systems

"hard" technology
- legacy
- installed base
- problems

customer+life cycle
- customers
- users

Industry Master; Engineering Work Experience part-time Job
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IMWEcontextExperience
What is the employer expected to do?

+ Treat industry master as "normal" engineer.
+ Taking part-time into account.
+ Provide limited scope engineering tasks.
+ Allocate capacity and responsibility for work and study related coaching.
+ Provide regular feedback to the student.
+ Appraise according HR system.
+ Involve students in meetings and business processes.

What does the employer get in return?

+ Normal engineering tasks are being done.
+ Inquisitive employee.
+ Broader and productive engineers tailored to own needs and domain.
+ Long term more systems engineers.
**What is the employee expected to do?**

- to perform normal engineering tasks
- to be inquisitive, curious, wondering
- to be cooperative
- to work hard (it is more difficult to deliver part-time)
- to reflect on theory and practice of Systems Engineering
- to apply as much exercises and home work on local situation

**What does the employee get in return?**

- building up engineering experience
- appreciation for Systems Engineering methods and techniques
- a rich frame of reference
- personal development
be modest in view of domain knowledge
but don't underrate SE knowledge
### Roles

<table>
<thead>
<tr>
<th><strong>company supervisor</strong></th>
<th><strong>student</strong></th>
<th><strong>Buskerud University College</strong></th>
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</thead>
<tbody>
<tr>
<td>keep in contact with BUC</td>
<td>work</td>
<td>provide education</td>
</tr>
<tr>
<td>work related</td>
<td>study</td>
<td>provide workshops:</td>
</tr>
<tr>
<td>what tasks, duties</td>
<td>try-out SE techniques and methods in job (low-key)</td>
<td>monitor growth</td>
</tr>
<tr>
<td>when, how much time</td>
<td>apply exercises and home work on local situation</td>
<td>monitor SE relevance</td>
</tr>
<tr>
<td>how</td>
<td>reflect</td>
<td>keep in contact with HR, supervisor, and students</td>
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<tr>
<td>feedback on results</td>
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<tr>
<td>embedding in organization</td>
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<tr>
<td>study related</td>
<td></td>
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<tr>
<td>support to find right:</td>
<td></td>
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<tr>
<td>means, people, documentation</td>
<td></td>
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<tr>
<td>stimulates reflection</td>
<td></td>
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<tr>
<td>monitors growth</td>
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*Industry Master; Engineering Work Experience part-time Job*

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IMWEroles
What is Competence?

<table>
<thead>
<tr>
<th><strong>Attitude</strong> (perseverance, faith, critical, constructive, etc.)</th>
</tr>
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<tbody>
<tr>
<td><em>train</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Ability</strong> (know when to use what skill and knowledge)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>apply/use often, experience</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Skills</strong> (calculate missing angle, calculate hypothenusa)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>exercise</em></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Knowledge</strong> (triangle has 3 corners, sum of angles is 180 degrees, Pythagoras $c^2 = a^2 + b^2$)</th>
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<tbody>
<tr>
<td><em>learn</em></td>
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</table>

**Competence = Knowledge + Skills + Ability + Attitude**
Competence Program Partitioning

what

Knowledge
Skills
Ability
Attitude

how

lecturing
eexercises
assignments
practice
coaching
reflection

who

teacher/coach
participant
Examples of Respective Tasks for Students

**typical engineering tasks**

1. make minor change(s) to component or function
2. make sizable change(s) to component or function
3. add feature(s) or function(s) to component
4. execute tests at subsystem level
5. participate in requirement review at component level
tasks evolve, similar to other new engineers

- single: well defined
  - engineer
  - technology
  - discipline
  - aspect
  - stakeholder

- few: less defined
  - engineers
  - technologies
  - disciplines
  - aspects
  - stakeholders

(time)
RP: Stimulate Students to Relate Theory and Practice

Reflective Practice

School
(Theory)
SE courses

Work
(Practice)
work in company

Master Project

workshops during first years of study

last half year of study
Non-disclosure of Confidential Information

All information exchanged between USN staff and students is to be treated as confidential.

Academic supervisors are not allowed to make any confidential information public without permission of the company.

Exception is information that was already known to the supervisor or is already public.

See publication procedure http://www.gaudisite.nl/BuskerudSEpublicationProcedureSlides.pdf
Example questions for Mentors

What change/feature/... is asked for?
What are the requirements for this change/feature/...?
Who is asking for it?
Why is that stakeholder asking for it?
What are the needs and concerns of this stakeholder?
When is the deadline for this task?
How will the task be realized?
What tools, methods, techniques have to be applied?
What company processes apply?