

Overview Examples

by *Gerrit Muller* USN-SE

e-mail: gaudisite@gmail.com

www.gaudisite.nl

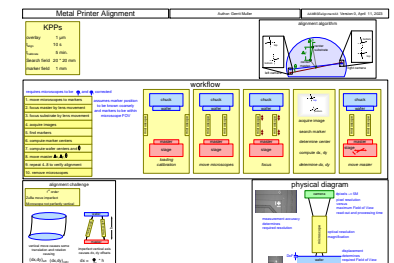
Abstract

This is a collection of examples of architecture, application, business, life cycle, quality, and design overviews.

Distribution

This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

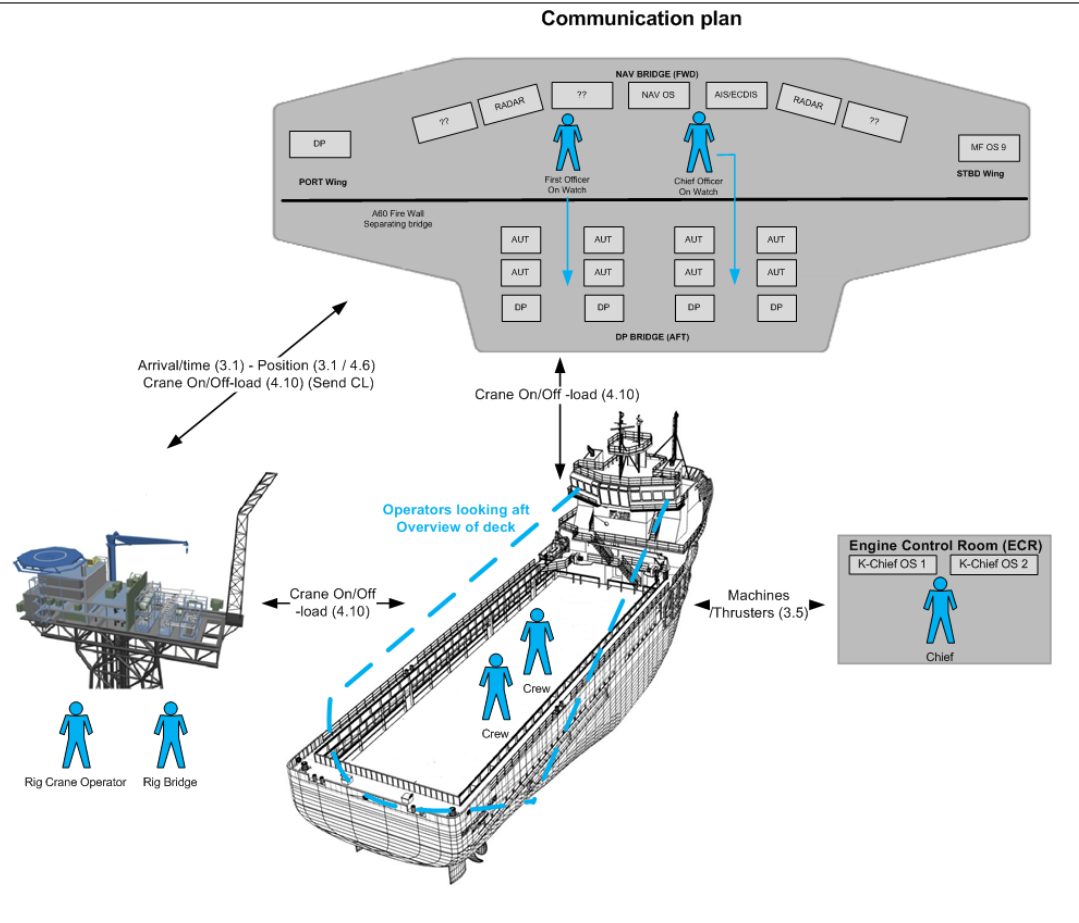
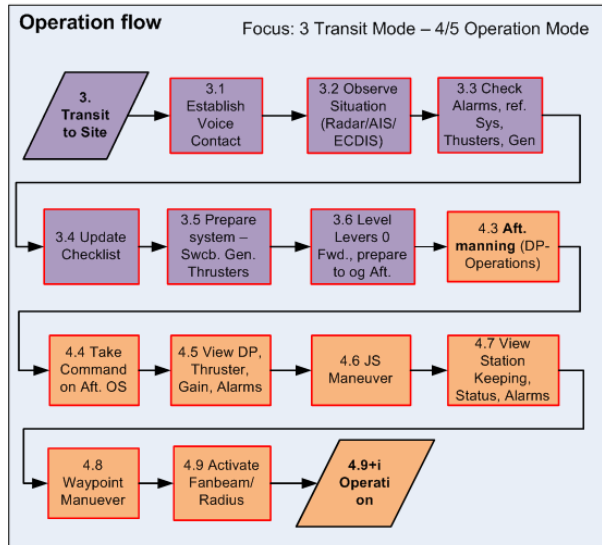
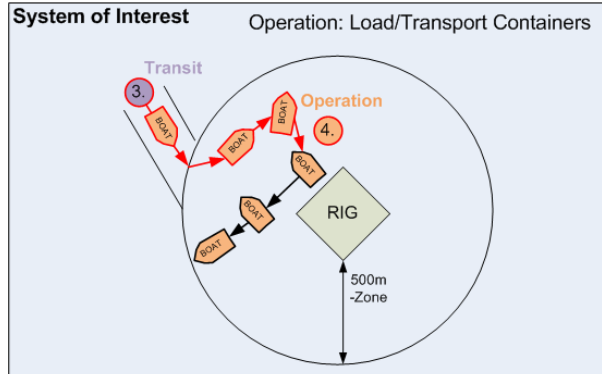
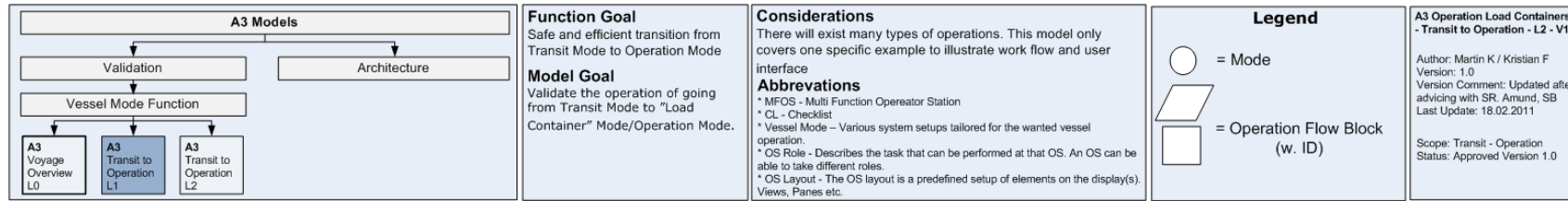
May 31, 2026
status: preliminary
draft
version: 0



3-Day Workshop Results in 20 Flipover Sheets



Example A3 "Transit to Operation"

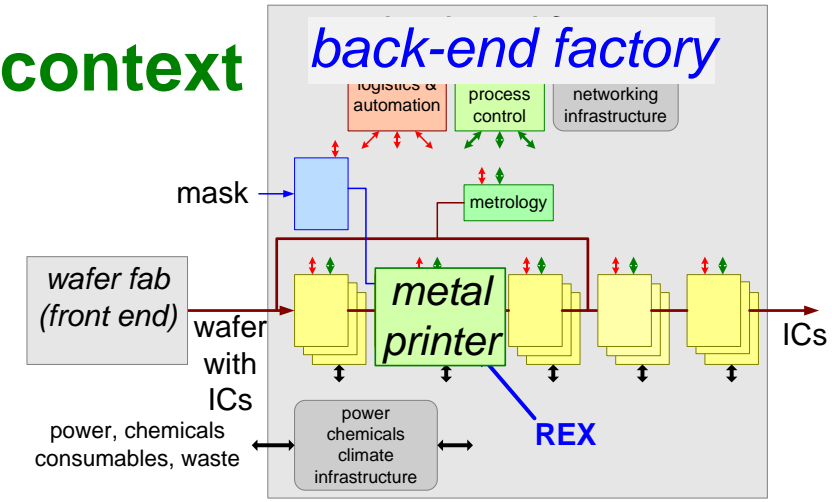


from: Kristian Frøvd, Applying A3 reports for early validation and optimization of stakeholder communication in development projects, INCOSE 2017 in Adelaide, Australia http://gaudisite.nl/INCOSE2017_Frovold_A3.pdf

Example Systems Layers of a Metal Printer

context

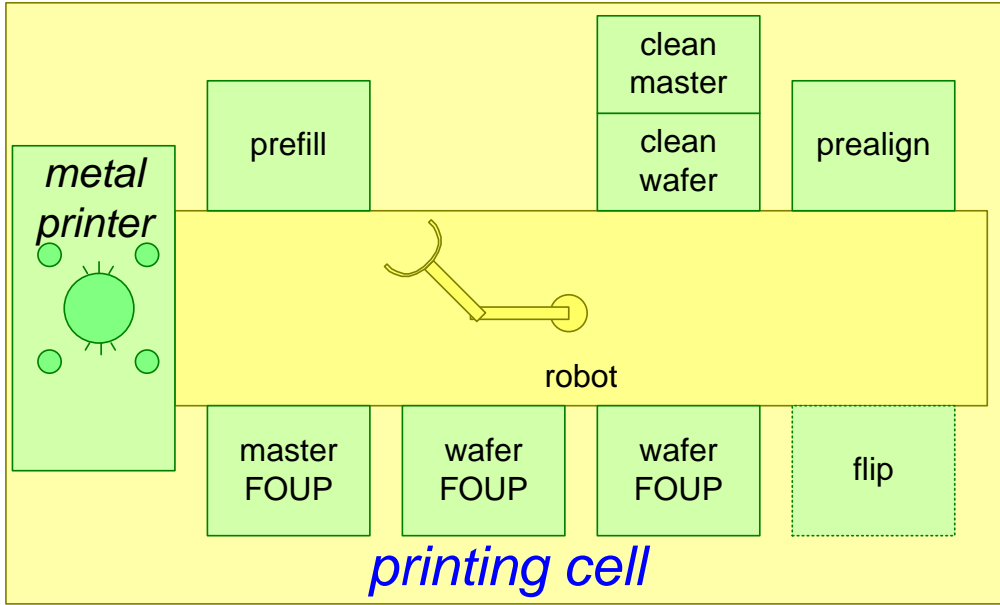
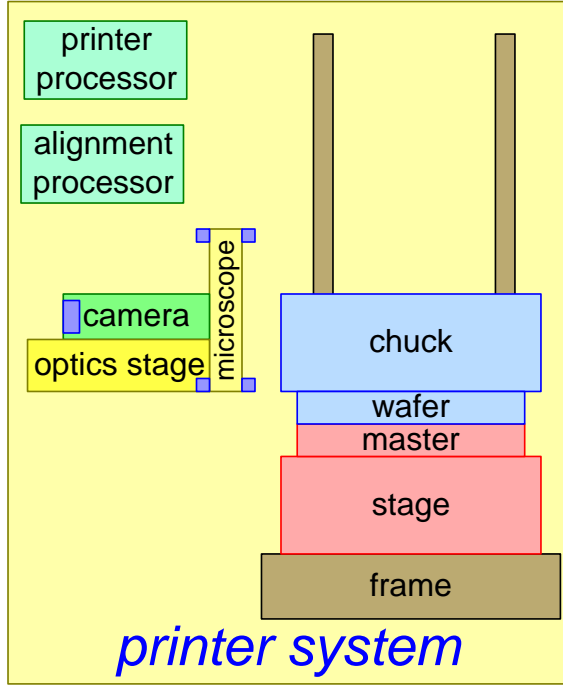
back-end factory



supersystem

supersuper system

system



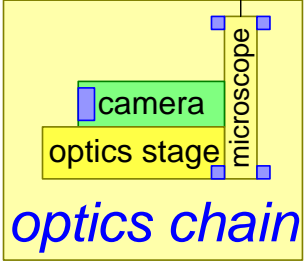
alignment subsystem

printer system

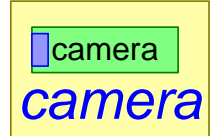
printing cell

subsub system

sub system



sensor component

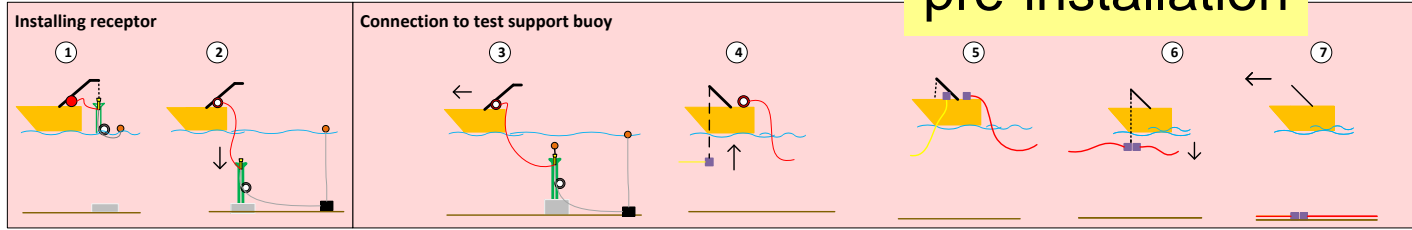


1.3.1.(1) Installation single vessel

V.1.1
2015.12.11

Introduction

The purpose of this A3 is to show how the first time installation process is purposed to be done functionality wise. It is a work in progress and is being worked on by several stakeholders with offshore installation experience.



pre-installation

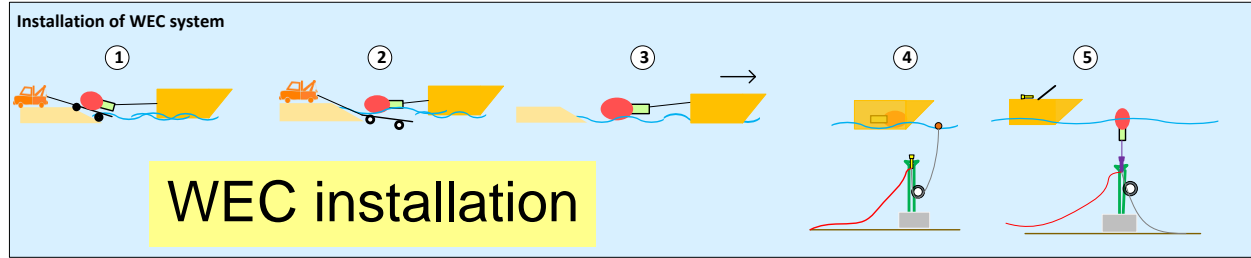
Concerns

- Step 1: Can the receptor be lifted by the dummy plug?
- Step 2: How does the crane get connected to electrical connection point without an ROV and will the electrical connection point have lifting ears?
- Step 5: How are the two cables connected: manually, tool?
- Step 6: How is the electrical connection points attached to the seabed?
- Step 7: What if cable is not working?

concerns pre-installation

Workflow

- Cable lowers the receptor into the water.
- Receptor is lowered by cable down to existing GBA and attached to existing lifting ears.
- Export cable (red) is rolled out on the

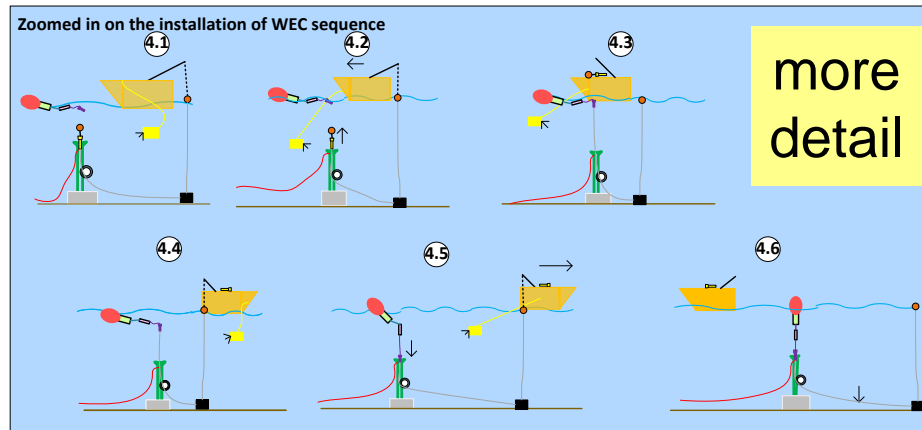


WEC installation

pre-installation workflow

- Joined cable are lowered by vessel cable to seabed.
- Umbilical cable is tested before vessel is leaving.
- Transport WEC to dock on trailer. Connect mooring line to vessel

- Deploy monitoring device. Attach crane cable on vessel to messenger line.
- Move messenger line mooring closer to WEC mooring until the seal connector surfaces.
- Put down the messenger line mooring. Lift up seal connector. Switch seal connector with mooring connector.
- Reconnect to the messenger line and let the WEC float freely
- Move the messenger line mooring away and the mooring connector follows due to the tension.
- Vessel lets go of messenger line. WEC uprights and is energized and pulls down to equilibrium level.



more detail

WEC installation workflow

- WEC is brought along side of service vessel and ready for installation.
- Installation of WEC completed and service vessels return to the harbor

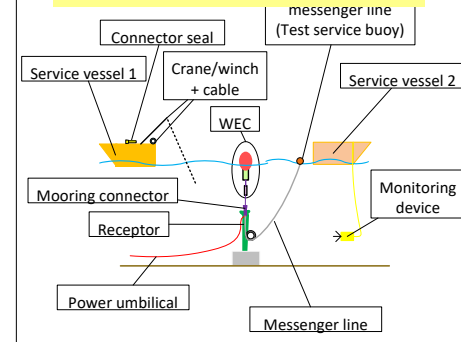
Timelines
There will be a timeline model illustrating the time consumption of the different processes in the installation sequence. One overview of the process and one zoomed in on the actual sequence illustrated in 4.1 to 4.6

timelines (not available yet)

Under installation and equal the tidal system pre-tension system is fully extended.

from: A reflection on the use of A3 architecture overview in designing Wave Energy Converters
E.F. Aune, H. Lind, and G. Muller, SoSE 2016 https://gaudisite.nl/SoSE2016_Aune_eAtI_SEMA.pdf

physical view



concerns WEC installation

- Step 4: Collision with vessel can crack buoy shell (caused by waves, etc.)?
- Step 4.1: what happens if messenger line is stuck (some mechanism to prevent damage)?
- Step 4.2: How is seal connector released?
- Step 4.3: Switching messenger line between connectors done manually?
- Step 4.4: How is the connector guided into the receptor?
- Step 4.5: Is there a risk that the mooring connector is not placed correctly in the receptor, and if so will there be a risk that the WEC uprights before the mooring connector is correctly placed in the receptor. Length of mooring line is crucial for getting at equilibrium level at the right tide, etc.
- Step 5: How is it tested that the WEC is correctly installed.

key learning points

Here it is installed

Project Overview Metal Printer

Project overview Metal Printer R2

version 2.0. January 22, 2023
author: Gerrit Muller

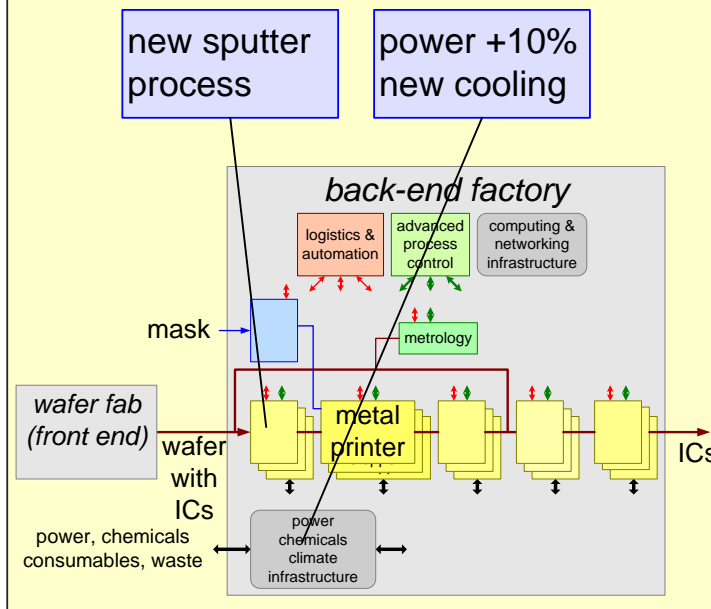
Project Goals

support production of node 1C
process development Q2 2022
volume production Q2 2023
productivity 30,000 W/m
yield 95%

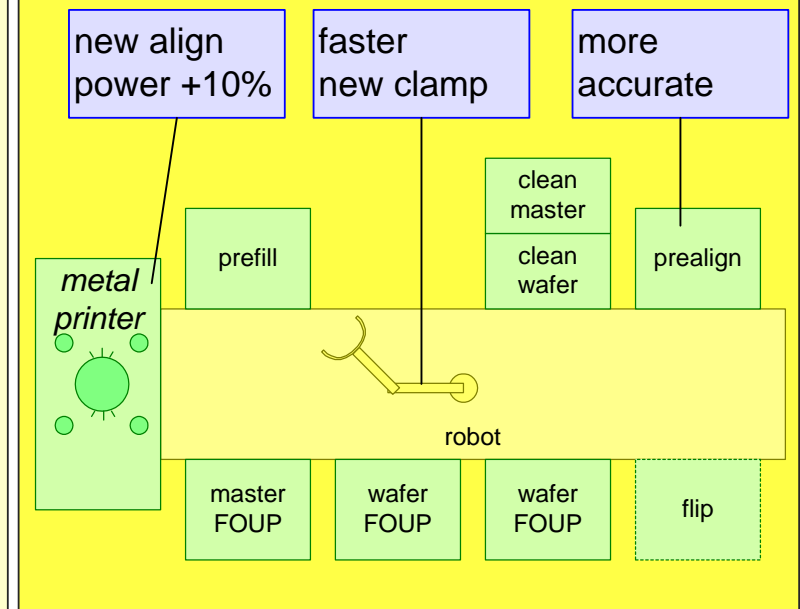
Key Performance Parameters

min. line width 100 nm
overlay 30 nm
throughput 100 WPH
MTBF 2000 hr
wafer size 300 mm
power 5 kW
clean room class C
floor vibration class D

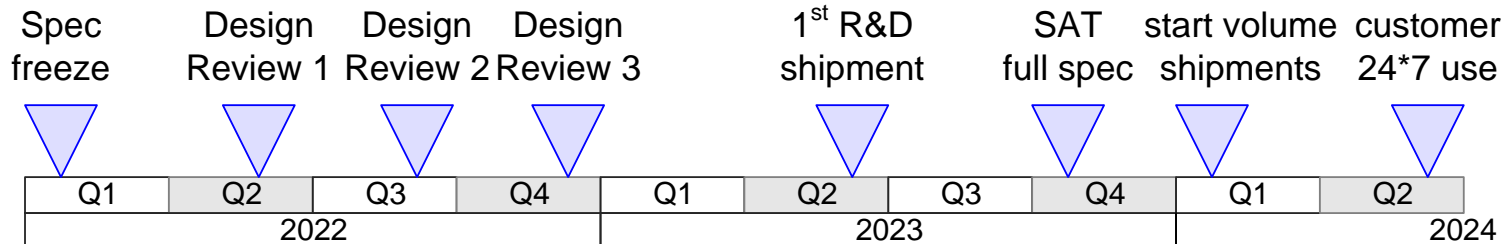
system context



system of interest



project master plan

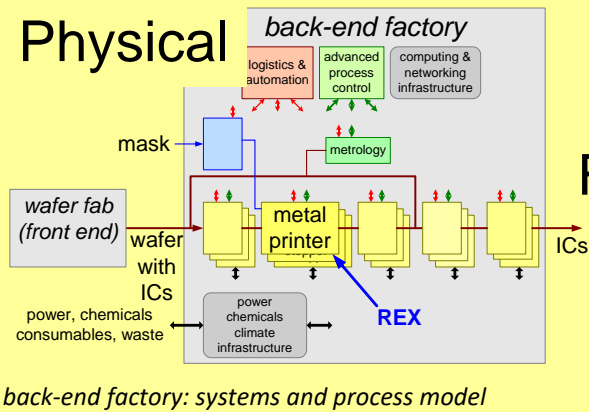


changing enabling systems

conditioned transport
calibration wafers
calibration metrology

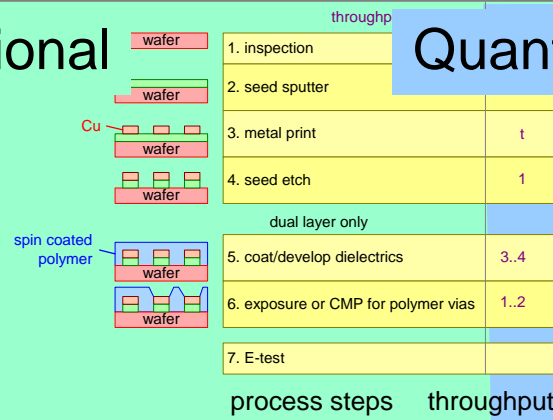
Metal Printer: 3 Levels of Systems on 1 A3 (all numbers have been removed for competitive sensitivity) CTEAMetalPrinterA3

Physical



Functional

Fab

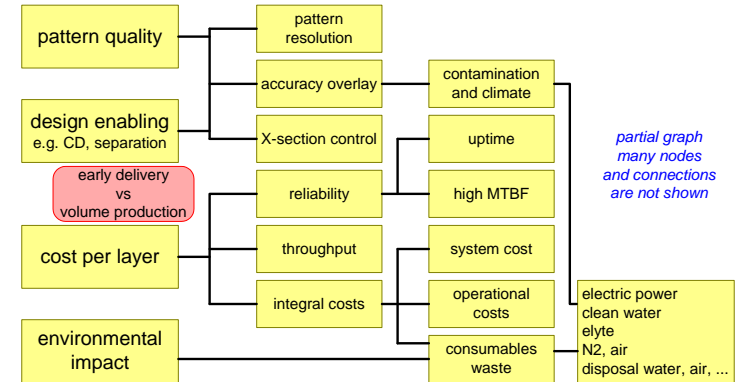


Quantified

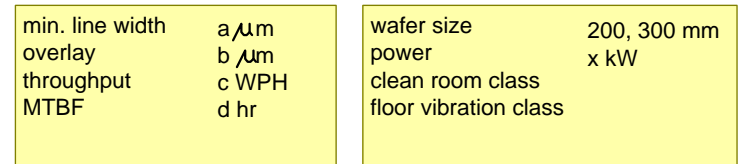
Gerrit Muller
0.1
August 3, 2010

scope system and supersystem
status preliminary draft

Document meta-information

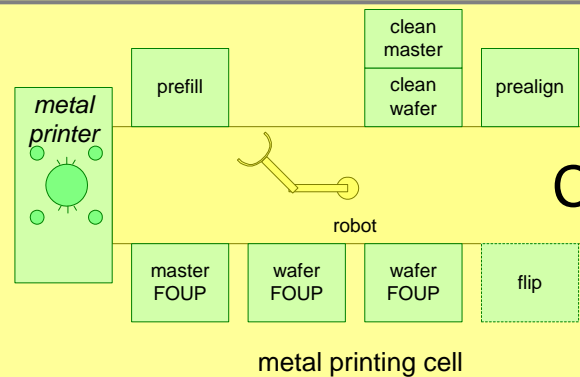


customer key drivers

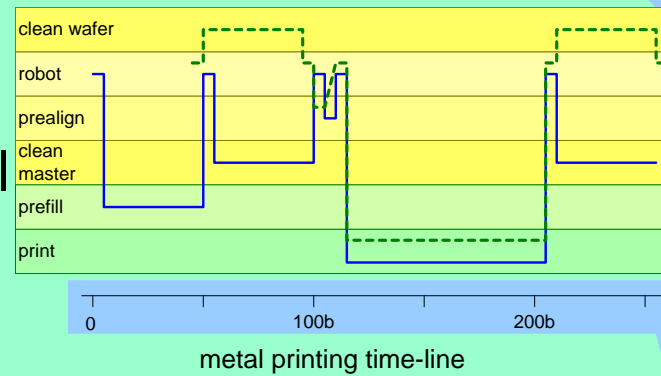


key performance parameters

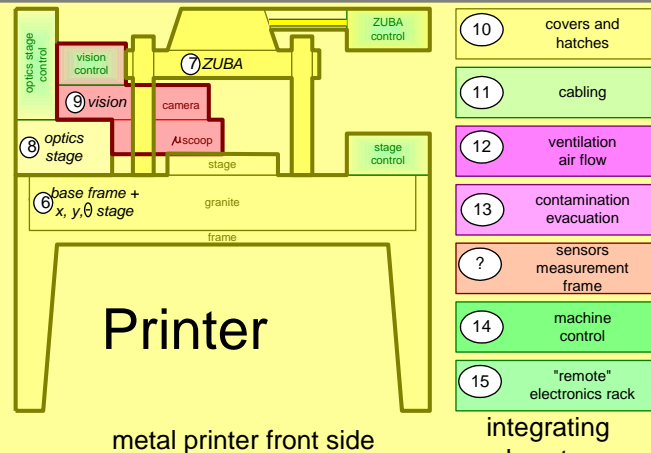
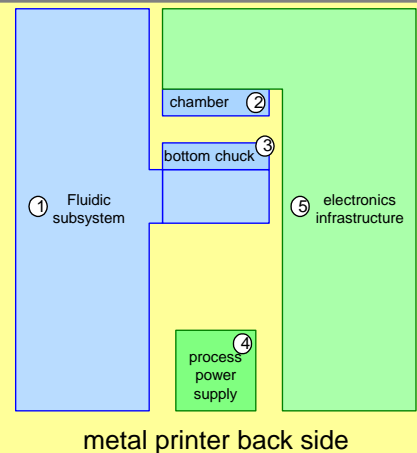
Customer key-drivers and Key Performance Parameters



Cell



metal printing cell: systems and performance model

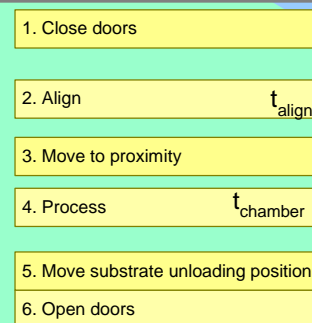


Printer

metal printer subsystems

integrating subsystems

metal printer subsystems, functions, and cycle time model



note: original diagram was annotated with actual performance figures for confidentiality reasons these numbers have been removed

$$t_{print} = t_{p,prepare} + t_{p,align} + t_{chamber}(thickness) + t_{p,finalize}$$

$$t_{prepare} = t_{close doors} + t_{move to proximity}$$

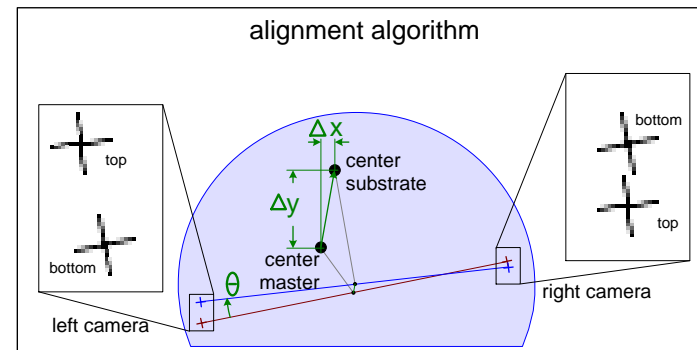
$$t_{finalize} = t_{move to unload} + t_{open doors}$$

$$t_{print} = t_{p,overhead} + C_{transfer} * thickness$$

formula print cycle time

KPPs

overlay	1 μm
t_{align}	10 s
$t_{\text{calibrate}}$	5 min.
Search field	20 * 20 mm
marker field	1 mm

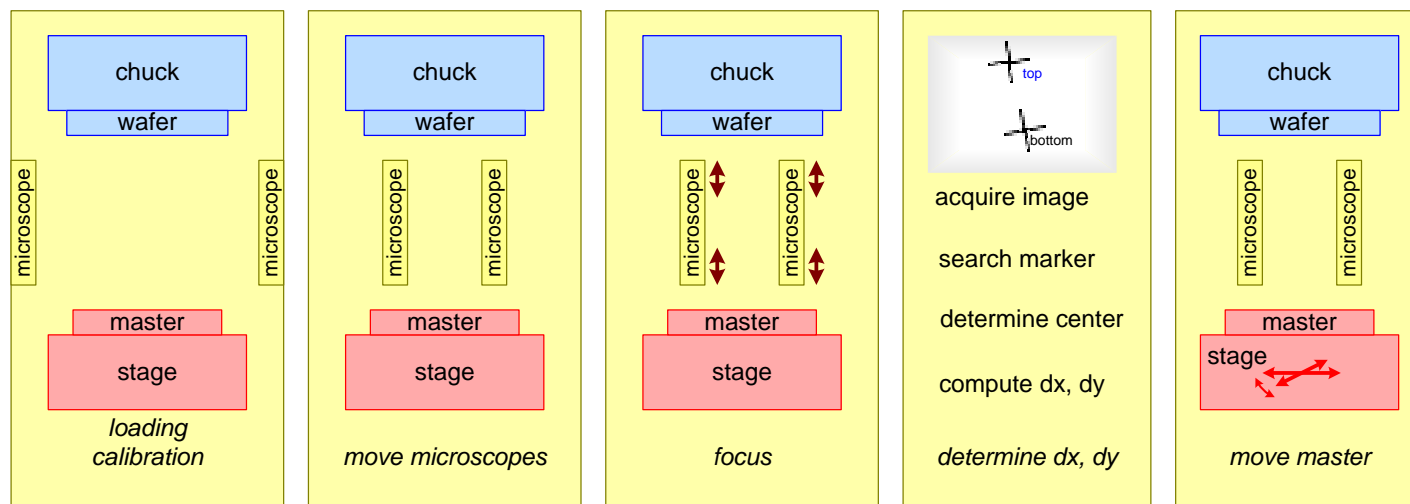


requires microscopes to be φ_x and φ_y corrected

1. move microscopes to markers
2. focus master by lens movement
3. focus substrate by lens movement
4. acquire images
5. find markers
6. compute marker centers
7. compute wafer centers and θ
8. move master $\Delta x, \Delta y, \theta$
9. repeat 4..8 to verify alignment
10. remove microscopes

assumes marker position to be known coarsely and markers to be within microscope FOV

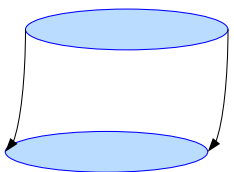
workflow



alignment challenge

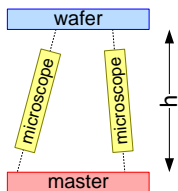
1st order

ZuBa move imperfect
Microscope not perfectly vertical



vertical move causes some translation and rotation causing

$$(dx, dy)_{\text{left}} \quad (dx, dy)_{\text{right}}$$



imperfect vertical axis causes dx, dy offsets

$$dx = \varphi_x * h$$

physical diagram



camera

#pixels \approx 5M
pixel resolution versus maximum Field of View read-out and processing time

measurement accuracy determines required resolution

optical resolution magnification

microscope



DoF \updownarrow

wafer

displacement determines required Field of View

context

- 80 houses, old, large, barely insulated
 - country side
- envisioned future:
- large storage tank
 - heated during summer
 - used during winter
 - low temperature heat network to houses
 - solar panels for electricity and heating

historic data

yearly energy consumption per large old house

$$E_{\text{electricity past}} = 3550 \text{ kWh}$$

$$V_{\text{gas heating}} = 3636 \text{ m}^3$$

$$V_{\text{gas hot water}} = 288 \text{ m}^3$$

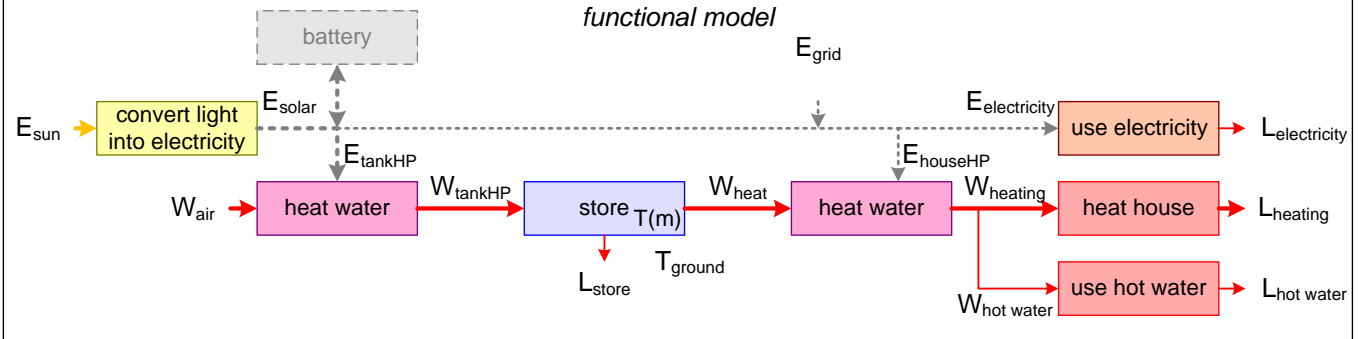
$$C_{\text{gas}} = 9 \text{ kWh/m}^3$$

$$C_{\text{solar}} = 0,913 \text{ kWh/W}_{\text{peak}}$$

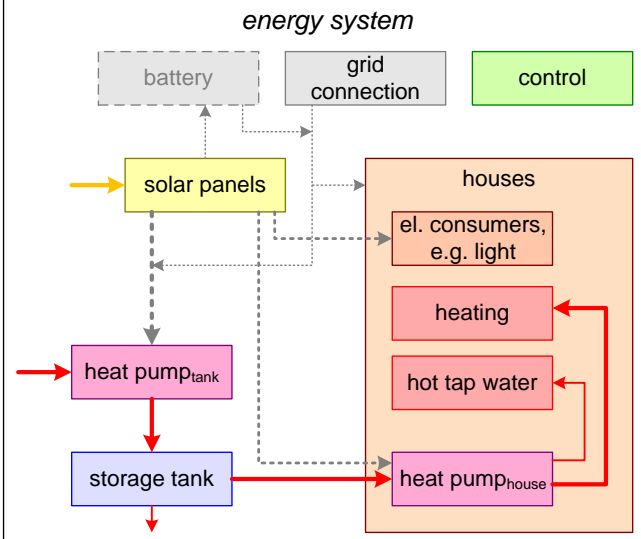
capacity factor = 11%

<https://www.linkedin.com/pulse/waarom-wemoeiten-en-kunnen-stoppen-met-het-van-hans-schneider/>

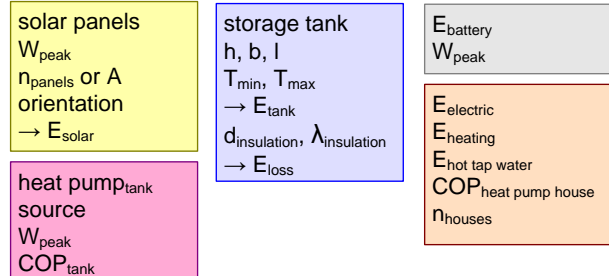
functional model



energy system



design parameters



in formulas

$$E_{\text{electricity}} = E_{\text{electricity past}}$$

$$W_{\text{heating}} = V_{\text{gas heating}} * C_{\text{gas}}$$

$$W_{\text{hot water}} = V_{\text{gas hot water}} * C_{\text{gas}}$$

$$E_{\text{solar}} = W_{\text{peak}} * C_{\text{solar}}$$

$$W_{\text{heat}} = (W_{\text{heating}} + W_{\text{hot water}}) - E_{\text{houseHP}}$$

$$E_{\text{houseHP}} = (W_{\text{heating}} + W_{\text{hot water}}) / \text{COP}_{\text{houseHP}}$$

$$E_{\text{tankHP}} = E_{\text{solar}} + E_{\text{grid}} - E_{\text{electricity}} - E_{\text{houseHP}}$$

$$E_{\text{grid}} = \text{energy in winter when solar is too low}$$

$$W_{\text{tankHP}} = E_{\text{tankHP}} * \text{COP}_{\text{tankHP}}$$

$$L_{\text{store}} = \sum_{\text{jan...dec}} A * h_{\text{month}} * \Delta T / R$$

$$R = d / \lambda \approx d / 0.03 ; h_{\text{month}} = 720 \text{ hrs}$$

$$\Delta T = T(\text{month}) - T_{\text{ground}}$$

$$L_{\text{electricity}} = E_{\text{electricity}}, L_{\text{heating}} = W_{\text{heating}}$$

$$L_{\text{hot water}} = W_{\text{hot water}}$$

base case scenario

