ASTRON

Netherlands Institute for Radio Astronomy

AAMID FrontEnd Development

AAMID/MIDPREP workshop 08-03-2016

Mass production towards 2025

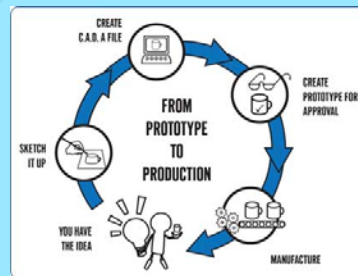Robert van den Horn – horn@astron.nl

Agenda

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New kid on the block	R & D	SKA AAMID Goal – Going life in 2025

New kid on the block

- Background
- Experience

R & D

- Mass production thinking
  - Keep it simple
  - DFMA
- Example on our Vivaldi arrays
  - Sub-assy-Antenna

CREATE C.A.D. A FILE

CREATE PROTOTYPE FOR APPROVAL

FROM PROTOTYPE TO PRODUCTION

SKETCH IT UP

YOU HAVE THE IDEA

MANUFACTURE

SKA AAMID Goal – Going life in 2025

SKA Central Region

Dense Aperture Arrays

SKA
MID-FREQUENCY APERTURE ARRAY

ASTRON

SKA AFRICA
SQUARE KILOMETRE ARRAY

provincie Drenthe

SNN

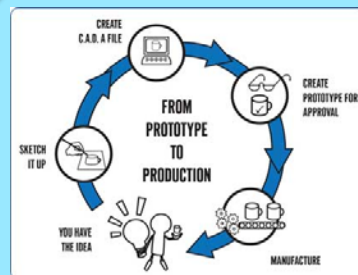# Agenda

ASTRON

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SKA AAMID Goal – Going life in 2025

Using ASTRON

Vivaldi arrays

SKA Central Region

Dense Aperture Arrays

New kid on the block

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Robert van der Horn
Background ME

- CursorControls (UK) Mechanical Design Engineer (2005-2008)
  Max. 10000 pieces per year

- Pezy Product Innovation (NL) (2008-2015)
  - Philips
  - Sony Ericsson
  - Adlens
    - *Max. 10 mil. products per year*

Example:
When eliminating 1 screw of €0,03 you will save
€0,03 x 10.000.000 = €300.000,-
On product life cycle of 5 years = €1.500.000,-
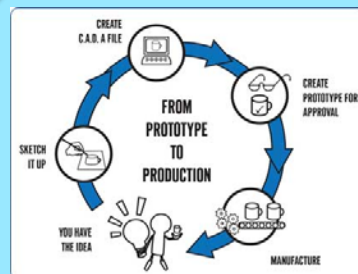
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FROM PROTOTYPE TO PRODUCTION

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SKA Central Region

Dense Aperture Arrays

Complex construction?

Mass production thinking
- Keep it simple

Basics

Mass production thinking
- Keep it simple

"Create the simplest design with fewer component parts" will have:

- Fewer ways in which the product can fail or have a shorter product life span.
- Less maintenance and repair required.
- Lower bill of material costs.
- Lower stock of replacement spare parts needed.
- Reduced assembly costs.
- Higher accuracy may sometimes be achieved by reducing stacked tolerances in the assembly.
- Fewer tooling and fixtures required.
- Reduced waste and environmental impact.

Mass production thinking
- DFMA

Definitions:

DFM (Design for Manufacturing)
DFM is the method of design for ease of manufacturing of the collection of parts that will form the product after assembly.
DFA (Design for Assembly)
DFA is the method of design of the product for ease of assembly.

DFM and DFA are now commonly referred to as a single methodology, **DFMA.**

DFMA seeks to eliminate Parts and Processes!!

WHY????

Mass production thinking
- DFMA

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Eliminated Parts and Processes are NEVER….

- Designed
- Detailed
- Prototyped
- Produced
- Scrapped
- Tested
- Re-engineered
- Purchased
- Progressed

- Received
- Inspected
- Rejected
- Stocked
- Outdated
- Written-off
- Unreliable
- Recycled

Mass production thinking
- DFMA

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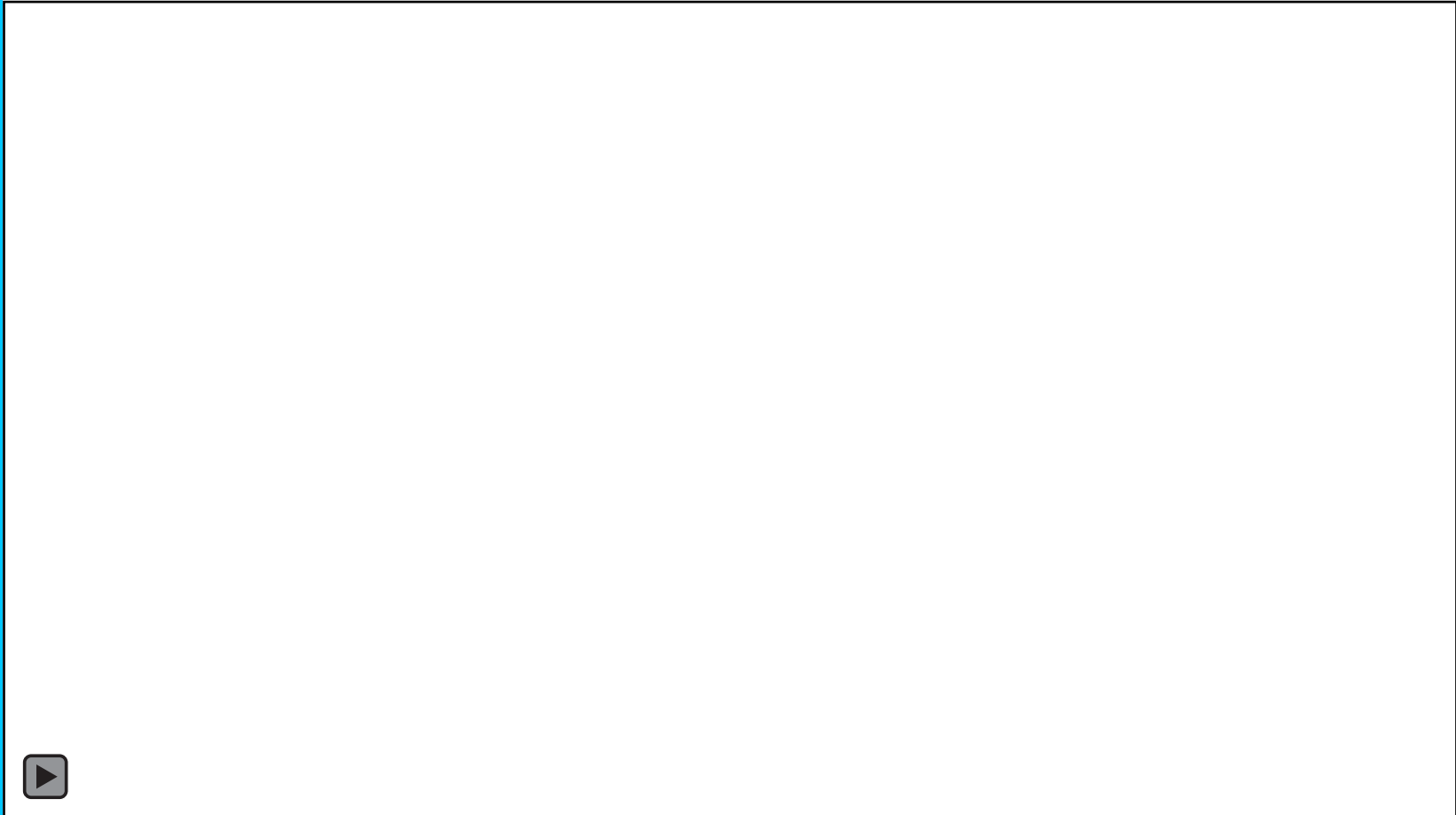Eliminated Parts and Processes are NEVER….

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- Unreliable
- Recycled
- **Late from the supplier!**

Mass production thinking
- DFMA

Examples on our Vivaldi arrays
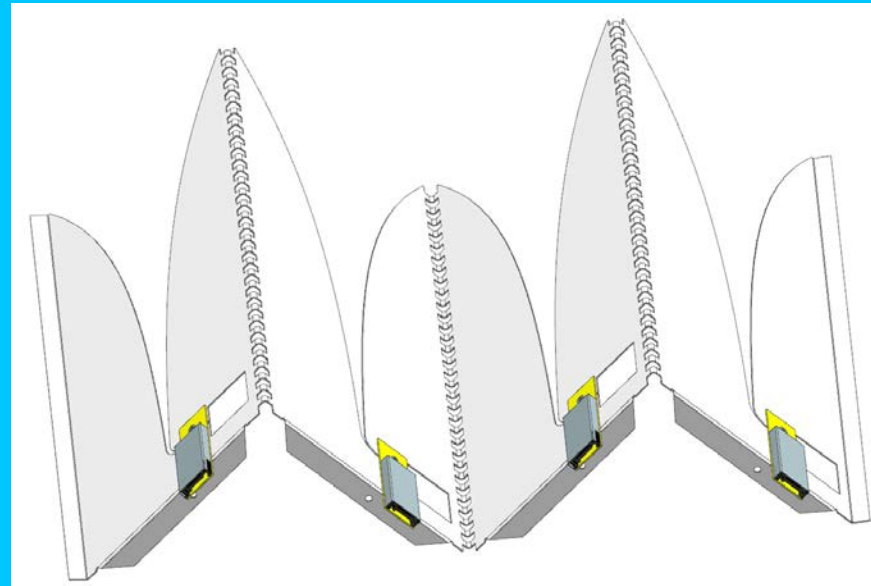## - Sub-assy-Antenna

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Numbers:

Sub-assy-Antenna:
- 1 Sheet metal antenna (4x Vivaldi)
- 4 LNA
- 8 Fasteners

SKA:
- 175 stations * 1000 tiles * 256 antennae

= Approx. 45mil Yes, this is Mass-Production

Examples on our Vivaldi arrays
- Sub-assy-Antenna

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Blue:
- 1 Sheet metal antenna (4x Vivaldi)
- 8 Fasteners
- 10 process steps

Yellow:
- 1 Sheet metal antenna (4x Vivaldi)
- 8 Fasteners
- 10 process steps

Green:
- 1 Sheet metal antenna (4x Vivaldi)
- **NO Fasteners**
- **5 process steps**

Looking at only the fasteners:
When eliminating 8 fasteners of e.g. €0,03 pp
you will save 8 x €0,03 x 45.000.000 =
€10.800.000,-

This is without calculating the eliminated 5 process steps.

Options / Process & Assembly	1	2	3	4	5
Create Vivaldi antenna					
Input	Sheets	Roll			
Cut Antenna shape	Laser cut	Water cut	Wire cut	Automatic punch	
Bend Antenna shape	Bending-machine				Stamping-Die (eg car parts)
Store/mount	Pallet-box	Special storing tray for x amount of antennae	No in between storing, go straight for assembling Sub-assy-LNA		
Output					
Mount Sub-Assy-LNA			When using different companies		
Input					
Position antenna	Mount antenna onto an assembly jig				Mount antenna onto an assembly jig
Pick & Place Sub-Assy-LNA	By hand	Robot			
Position Sub-Assy-LNA	By Eye	Dowelpins on JIG	Vision positioning system		Pick and place unit? With click and or scrape connection.
Fix Sub-Assy-LNA	Semi-auto-Rivet	Self tapping screw	Glue	Reflow solder	
Output					
Pack Sub-Assy-Antenna	Pallet-box	Special storing tray for x amount of antennae	No in between storing, go straight for main assembling		

Questions