



## TRANSITION TO A NEW ERA OF SPACE EQUIPMENT MANUFACTURING

Markus Jonek – ESCCON 2019 – Noordwijk 13-March-2019

- » New Era of “New Space”
- » Why New Concepts?
- » Production Today
- » Production Challenges
- » Constellation Production
- » Observation and Guidelines
- » Example Conductive Bonding
- » Lessons Learnt EEE-Parts

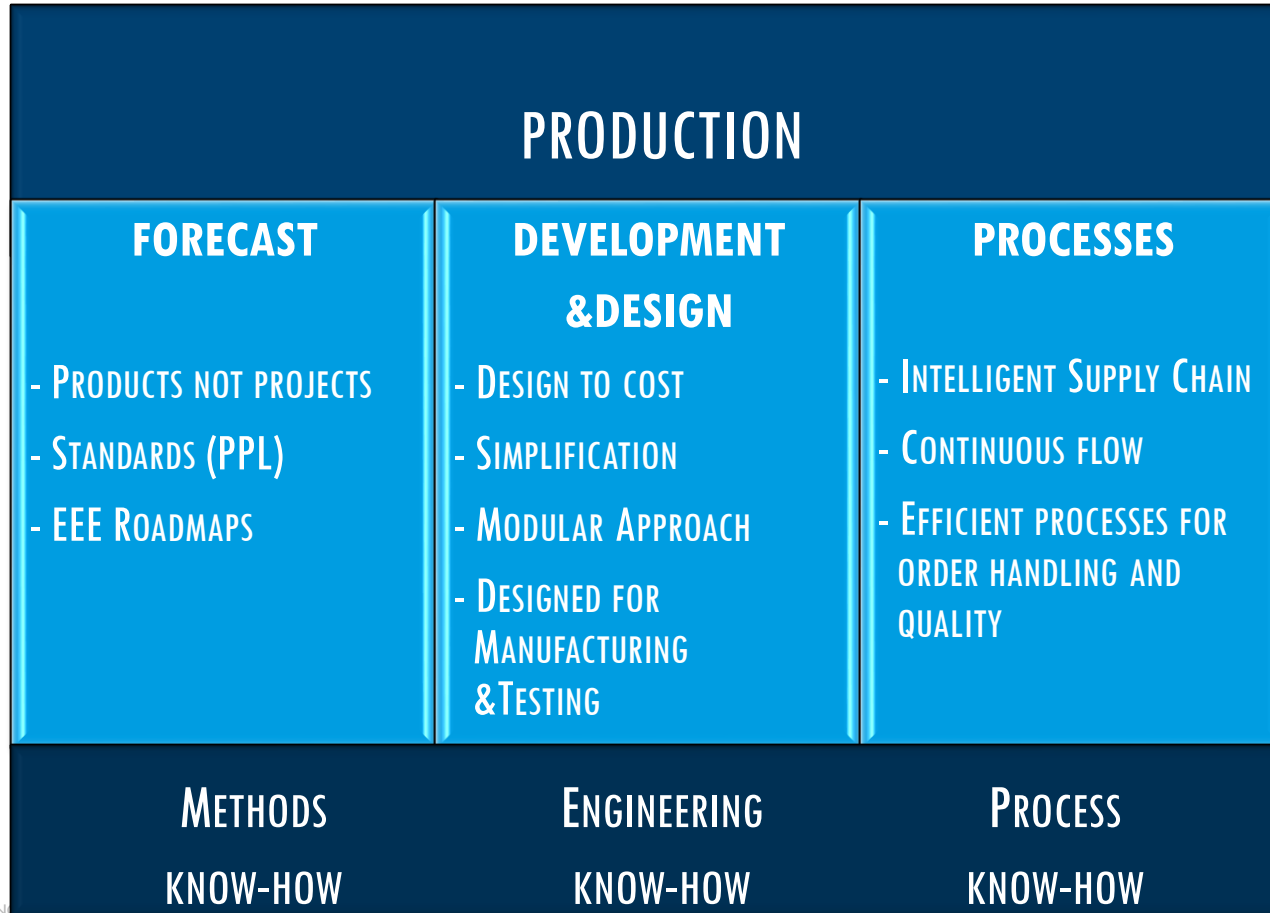
**“New Space” has same physics as Classic Space.  
It is about need for new concepts.**



- » New players, new business models
- » Pressure to reduce costs
  - -30% ... -50% ... and less
- » Time to market → -50%
- » Time to fly → -50%
- » Manufacturing in “Volume” for e.g. constellations → +400% ... ++



AND: Transfer of “New Space” approaches to “Classic Space” market



- » Tesat is set up for serial production for space equipment with space quality standard
- » 12.000m<sup>2</sup> clean room (various classifications)
- » More than 50 thermal-vacuum chambers
- » More than 2.500 devices manufactured each year
- » Test capacity for 1.500 channels p/a
- » Own test system for vibration and EMC
- » 500 highly qualified manufacturing employees



High frequency test systems



>50 thermal vacuum chambers



Test system for amplifier electronics



Test systems for environmental testing

## Today



## New challenges

- » High quantities in short period
- » Low price
- » Shorter lifetime, agility

Changes in the way  
of work

## Tomorrow



Assembly:  
» Paper documentation  
» Individual work stations  
» Complex manual and individual work

» Digitalisation  
» Automation  
» Industry 4.0

Fully automated  
production line for  
high volumes

- » Efficient manufacturing to fulfill business approach
- » High volumes ramp-up (factory setup)
- » System needs critical minimum qty in orbit
- » Relatively short life cycle - replacement mode
- » Automation needs volume
- » Balance standardization with flexibility
- » Obsolescence management



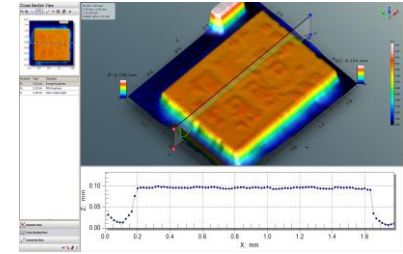
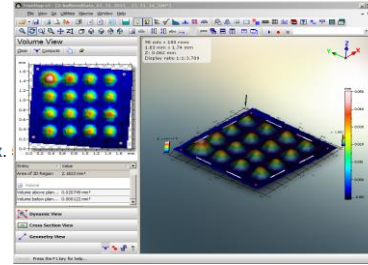
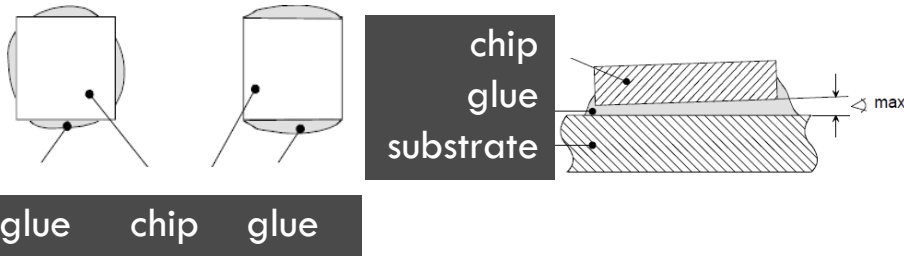
source: networkworld.com



- » Reduce manual involvement and interactions (man-less manufacturing)
- » Reduce tests but assure quality
- » Reduce process diversity especially for manual steps (e.g. hand soldering/gap welding/harness)
- » Encounter parameter trade-offs vs. process trade-offs
- » Use of improved design analysis to limit parameter optimization
- Invest in automation, processes and use of statistical process data review



## New Space vs Classic Manufacturing – Cost Drivers comparison



### Classic Process Flow

Dispense – adjust manual

In-process inspection - visual

Pick & Place – adjust manual

In-process inspection - visual

Temperature curing

Quality inspection - visual

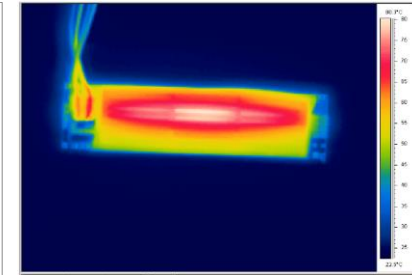
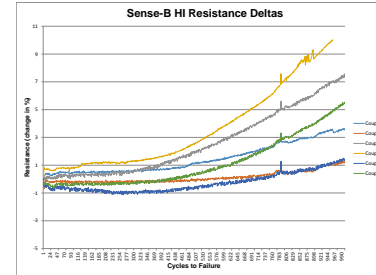
### New Way Process Flow

Height profiling/dispense/volume scan – inline

Pick & Place/height profiling / Curing – inline

Optional Quality inspection “off line” by data/pic.

## New Space vs Classic Manufacturing – Cost Drivers comparison



### Classic Process Flow

PCB manufacturing

electrical test - In-process

microsectioning before & after thermal stress

final visual inspection

data review and release of batch

### New Way Process Flow

PCB manufacturing

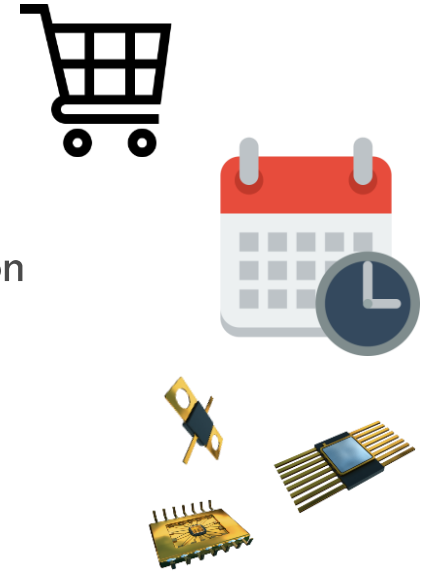
electrical test - In-process

final visual inspection

optional data review/release of batch

IST - SPC

- » EEE-parts to be ordered centrally is mandatory
- » Upfront engineering efforts and part selection
- » Intelligent supply chain to balance just-in-time vs. lot variation
- » Lead-time transparency
- » Reduce/spread cost-drivers e.g. radiation tests
- » Consolidate parts lists (MOQs)
- » Stock approach - as needed - for risk mitigation
- » Smart documentation



It is not about EITHER/OR, its is about AND.



Thank you for your attention  
any ?

