TRANSITION TO A NEW ERA OF SPACE EQUIPMENT MANUFACTURING
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.
Why 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
# Ingredients for Success

## Production

### Forecast
- Products not projects
- Standards (PPL)
- EEE Roadmaps

### Development & Design
- Design to cost
- Simplification
- Modular Approach
- Designed for Manufacturing & Testing

### Processes
- Intelligent Supply Chain
- Continuous flow
- Efficient processes for order handling and quality

## Methods
- Know-how

## Engineering
- Know-how

## Process
- Know-how
Tesat is set up for serial production for space equipment with space quality standard

- 12,000m² 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
Today

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

New challenges

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

Changes in the way of work

» Digitalisation
» Automation
» Industry 4.0

Tomorrow

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
» 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.

Example: Conductive bonding of chips
**Example: Microsectioning vs SPC based IST for PCBs**

**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
» 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?