FPGA/ASIC supply-chain thematic

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Head of Marketing & Sales

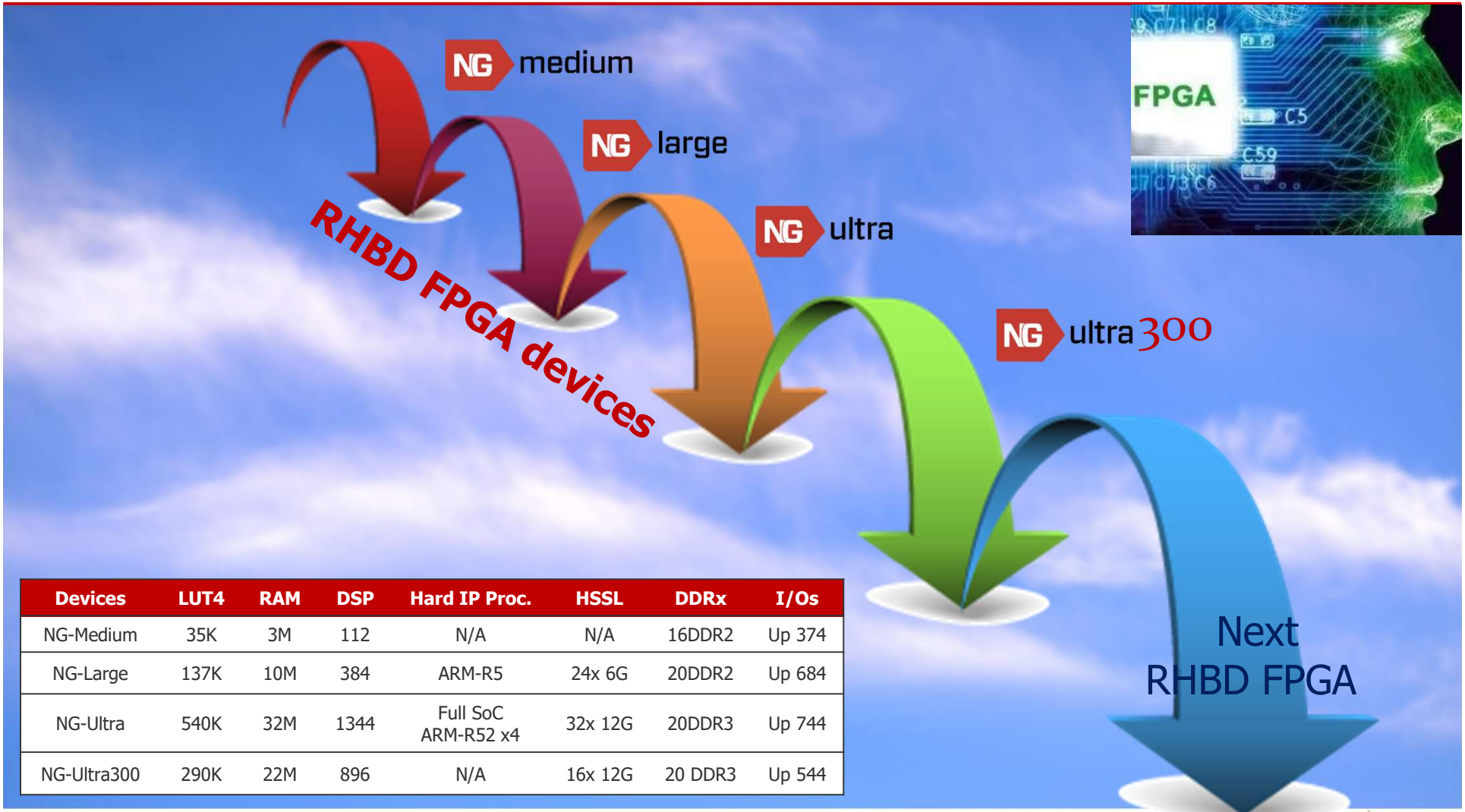
Noordwijk, NL – 10th March 2021

Who is NanoXplore?

ITAR-free PLD vendor

- NanoXplore is the EU solution for Programmable Logic Devices

RHBD FPGA Product roadmap



Devices	LUT4	RAM	DSP	Hard IP Proc.	HSSL	DDRx	I/Os
NG-Medium	35K	3M	112	N/A	N/A	16DDR2	Up 374
NG-Large	137K	10M	384	ARM-R5	24x 6G	20DDR2	Up 684
NG-Ultra	540K	32M	1344	Full SoC ARM-R52 x4	32x 12G	20DDR3	Up 744
NG-Ultra300	290K	22M	896	N/A	16x 12G	20 DDR3	Up 544

Capability Domains

NXmap3
NXcore
NXscope
NXboard
NXPE
NXSDK
Linux
python 3

TOOLS SUITE

LOW COST

QUALITY Standards

ESCC European Space Components Coordination
JEDEC Global Standards for the Microelectronics Industry

EXPORT

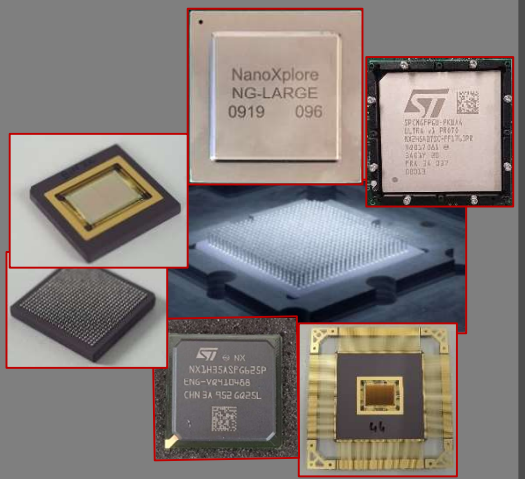
Rad-Hardened
Low-end FPGA
Mid-End FPGA
High-End FPGA
High-End FPGA-SoC

FPGA Devices

PACKAGING

ORGANIC

CERAMIC



FBGA / CQFP / CLGA / CCGA

- NanoXplore is a fabless company

CONCLUSION

NanoXplore brings an answer to ALL SPACE Missions with **Low-Cost**, **Rad-Hard**, **Low Power** devices

- From **GEO satellites** requesting
  - *Long life cycle (20years),*
  - *Ceramic/Hermetic packages,*
  - *Low quantity (~few parts),*
  - *Up to Mil-Prf-38535 Class-V qualified,*
  - *At unit price /2 vs Competition*

- To **Constellation of LEO Satellites** with
  - *Short to Medium life cycle (5 years),*
  - *Organic Packages,*
  - *High quantity: From 100pcs to x1000pcs,*
  - *Military screening & qualification,*
  - *At Unit price **like COTS** (x100€)*

NX FPGA Supply-Chain

Which FPGA for which Spaceborne Appls

NanoXplore

- Space project classification:
  - Traditional Space
  - or New Space?
- What about FPGA function?
  - System-On-Chip?
  - Companion chip?
  - Critical function?
- What about Package type:
  - Ceramic/Hermetic packages?
    ➔ Mean MIL or ESCC standards
  - Organic packages?
    ➔ Mean probably New Space, new standards
- What about FPGA Quantities & budget?
- What about Export Control?
- What about Project planning?

Which FPGA for which Spaceborne Appls

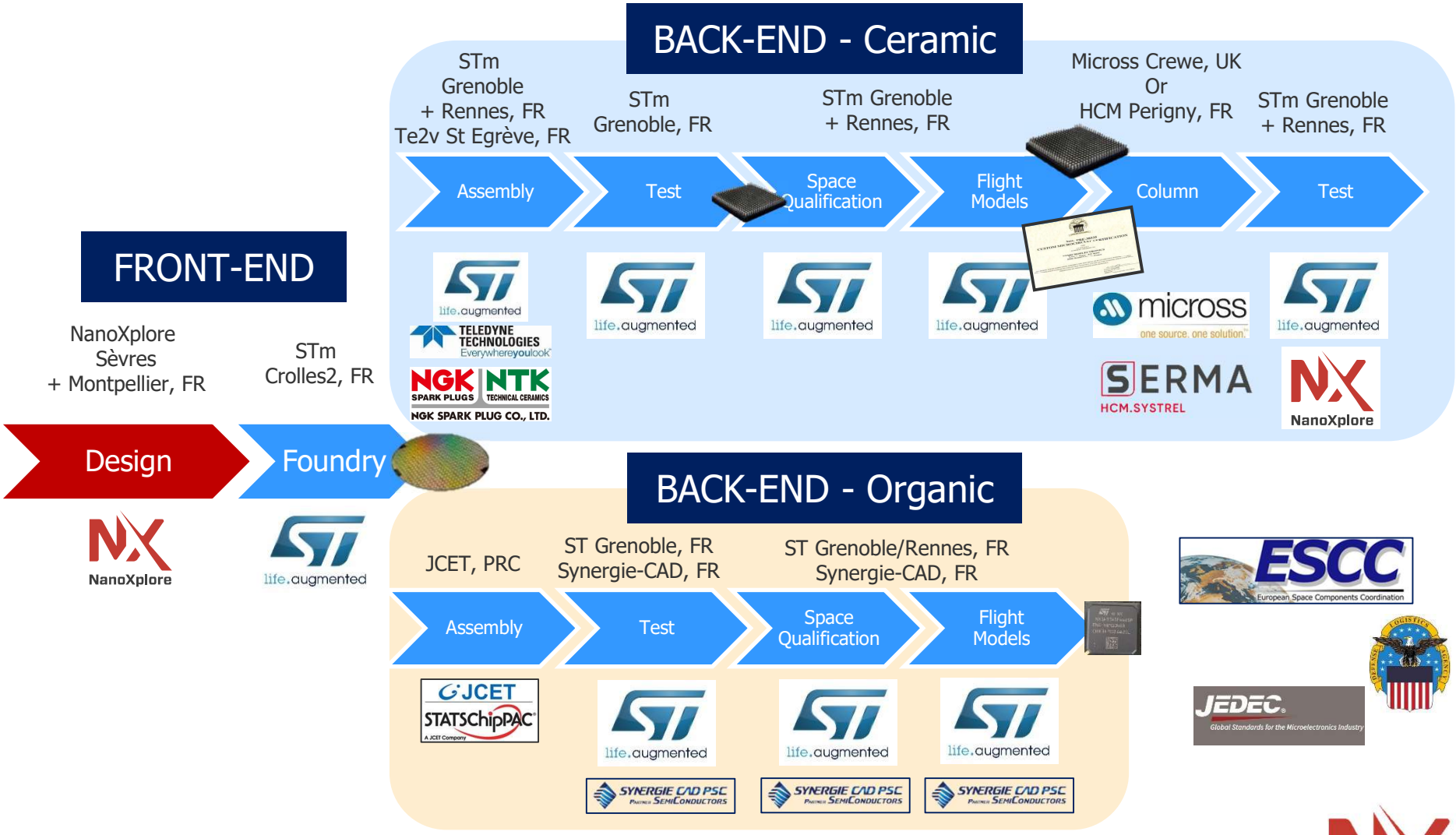
Traditional SPACE

- Just 1 to 3-5 satellites,
- Lifecycle: 18 years GEO mission profile,
- Qty of ICs: From 2-3units, up x10pcs,
- **Ceramic/Hermetic** Packages,
- QA: ECSS Class-1 or 2,
- Qualification: At Component level.

NEW SPACE

From 100 to x10.000 satellites,
Lifecycle: 5-8years LEO mission profile,
Qty of ICs: From 100 to x10Kunits,
Plastic/Organic Packages (like COTS),
QA: Automotive grade (AEC-Q100),
Qualification: At System level.

Space Supply-Chain

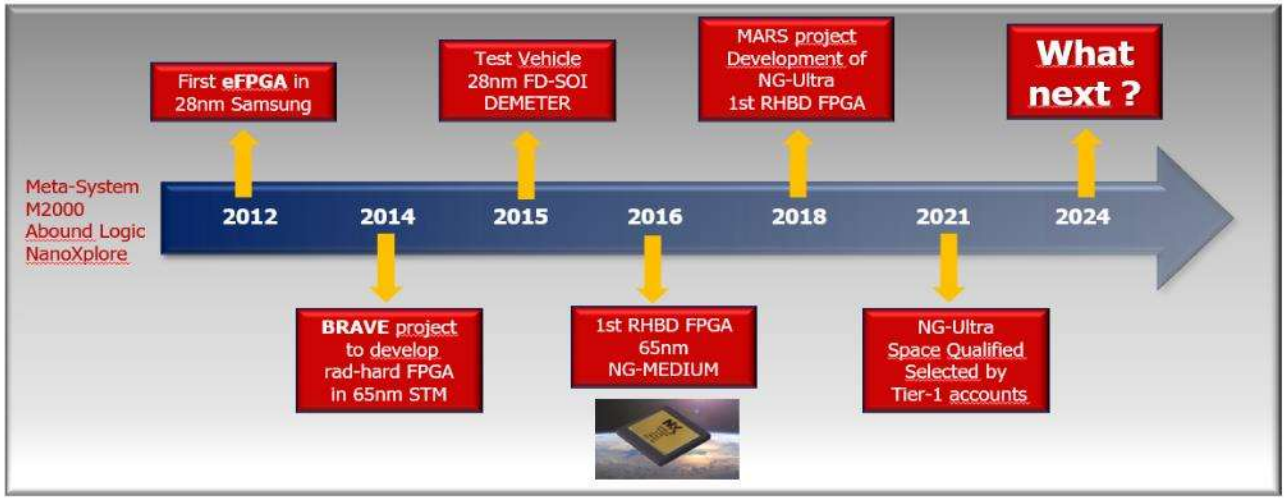


DESIGN – From Low-end to High-End FPGA-SoC

- NX design based on STRONG technology heritage

Already space qualified 65nm FPGA

+20 FPGA patents



30+ years experience engineers

Patented FPGA Architecture

More than 200 end-users

FOUNDRY – The Complexity is at the interconnect

- ST foundry – Partnered through the former IBM SemiConductor Development Alliance

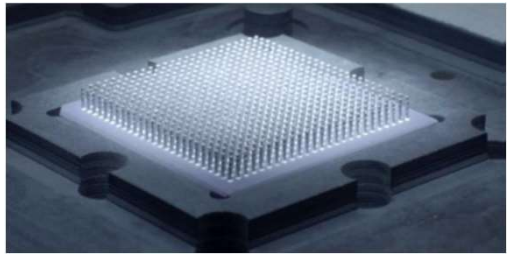
28nm FD-SOI Cross Section – STMicroelectronics 2012

CERAMIC BACK-END

- From Rad-Hardened silicon foundry to High-Reliability Ceramic FPGAs.

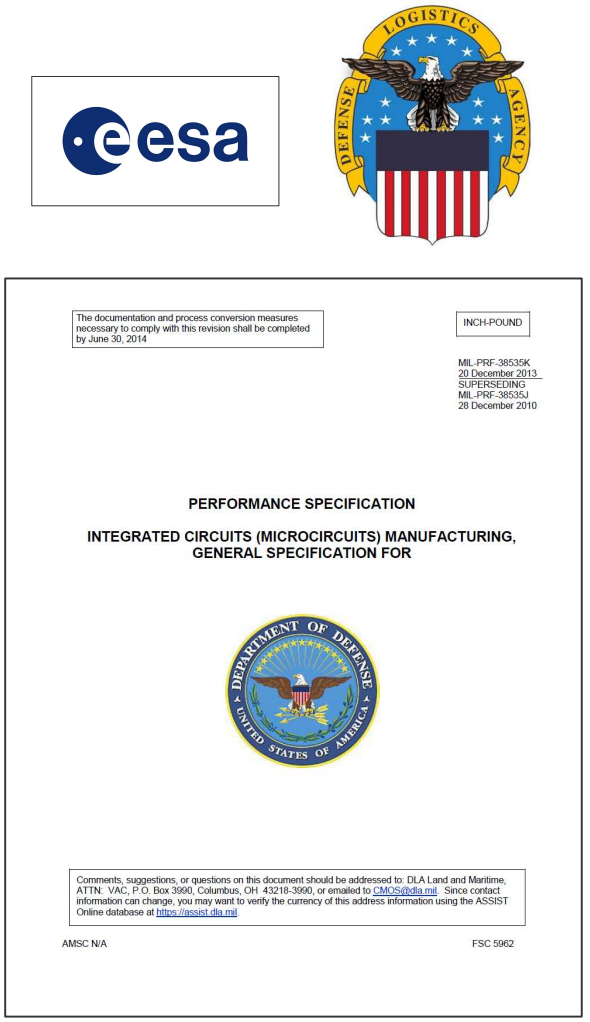
- Class-1 EU Assembly lines,
- Single-Lot Date Code,
- Full traceability,
- Ceramic/Hermetic pkgs,
- High-pin count,
- IVI capabilities,
- PRECAP inspection,
- Data Package,
- QML / ESCC brand,
- MOQ – 1piece.

NGK SPARK PLUGS | NTK TECHNICAL CERAMICS
NGK SPARK PLUG CO., LTD.



Ceramic/Hermetic Quality Flows

Ceramic	PR	M	Q	V
WLAT	✗	✗	✓	✓
TID / Report	✗	✗	✓ Yes	✓ Yes
SLDC	✗	✗	✓	✓
T/C	✗	✗	✓ 10cy	✓ 10cy
IVI	STM policy	2010B SPL	2010B 100%	2010A 100%
Pind-Test	✗	✗	On Request	✓
Serialization	✗	✗	✗	✓
Burn-In	✗	✗	✓ 160h	✓ 240h
PDA	✗	✗	5%	5%
Electrical Test	25°C	-55°C & +125°C	25°C then -55°C & +125°C	25°C then -55°C, +125°C R&R
QCI	✗	✗	✓	✓
EVI	✗	SPL	✓ 100%	✓ 100%
CoC	No Warranty	✗	✓	✓



The documentation and process conversion measures necessary to comply with this revision shall be completed by June 30, 2014

INCH-POUND

MIL-PRF-38535K
20 December 2013
SUPERSEDING
MIL-PRF-38535J
28 December 2010

PERFORMANCE SPECIFICATION

INTEGRATED CIRCUITS (MICROCIRCUITS) MANUFACTURING, GENERAL SPECIFICATION FOR

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to CMOS@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

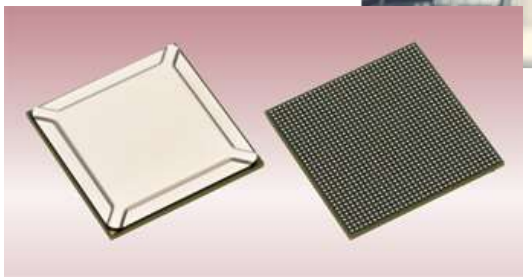
AMSC N/A FSC 5962

ORGANIC BACK-END

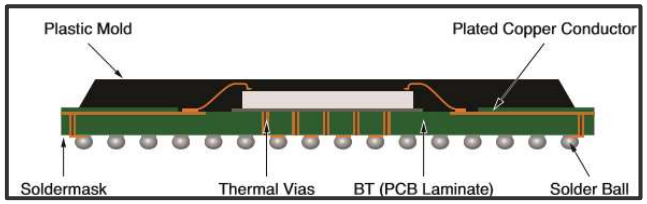
- From Rad-Hardened silicon foundry to High-Volume Low-Cost FPGAs

  - Lowest Cost:
    - OSAT,
  - SnPb / RoHS,
  - Highest Reliability:
    - JEDEC,
    - ESCC9000P,
  - Automatic Handlers,
  - Lowest MOQ.

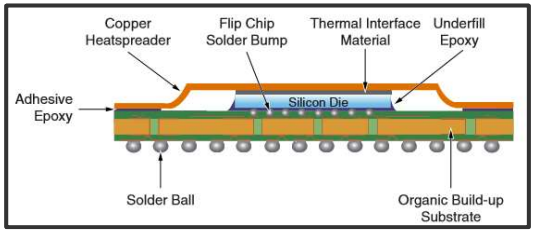
JCET STATSChipPAC



NG medium



Amkor Technology®



NG large
NG ultra
NG ultra

Organic Space Quality Flows

Organic	PR	M	MP	MPS	E
WLAT	✗	✗	✗	Option	✓
TID / Report	✗	✗	✗	Option	✓
SLDC	✗	✗	✗	✓	✓
T/C	✗	✗	10cy	10cy	10cy
IVI	STM policy	2010B SPL	2010B SPL	2010B SPL	2010A 100%
CSAM	✗	✗	✗	✓	✓
Serialization	✗	✗	✗	✗	✓
Burn-In	✗	✗	48h	48h	240h
PDA	✗	✗	✗	✗	5%
Electrical Test	25°C	-55°C & +125°C	+25°C then -55°C & +125°C	+25°C then -55°C & +125°C	25°C then -55°C & +125°C R&R
LAT	✗	✗	✗	✗	✓
EVI	✗	SPL	100%	100%	100%
CoC	No Warranty	✗	✗	✓	✓

NanoXplore proposes various QA flows from

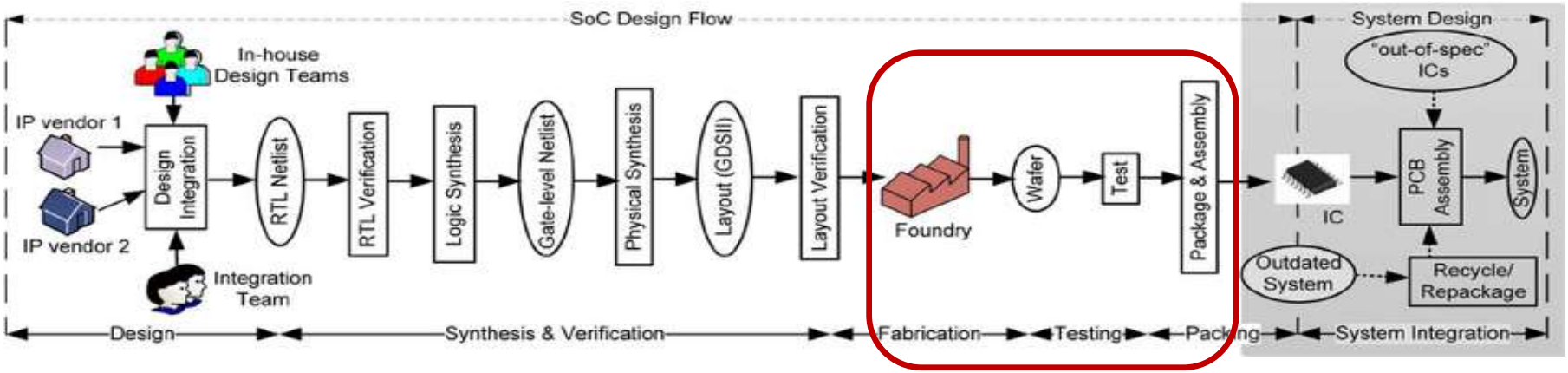
- M-grade for Lowest Cost,
- MP-grade where T/C and Burn-In added,
- MPS-grade where SLDC and CSAM added,

As well as,

- E-grade ~Class1 Organic

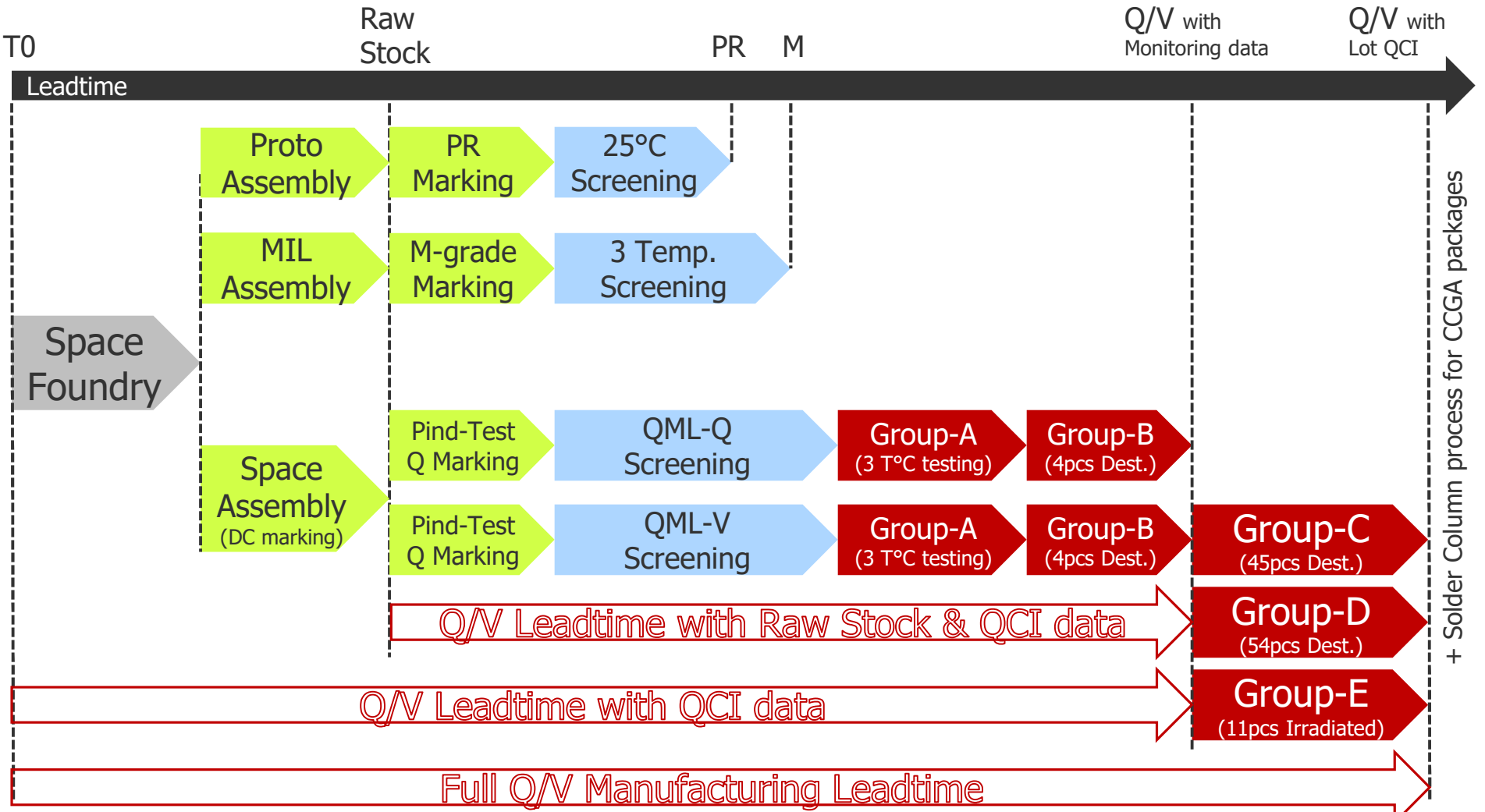
NX Leadtimes

- Leadtimes



- NX product leadtimes are subjected to
  1. Product status:
     - *Design validation?*
     - *Device/Package industrialization?*
     - *Military Qualification?*
     - *Space Qualification (ESCC or QML)?*
  2. Customer forecast?
  3. Raw material stock:
     - *Virgin wafers,*
     - *Package piece parts,*
     - *Test board(s),*
     - *Burn-In Board(s),*
  4. Front-end capacity,
  5. Back-end capacity.

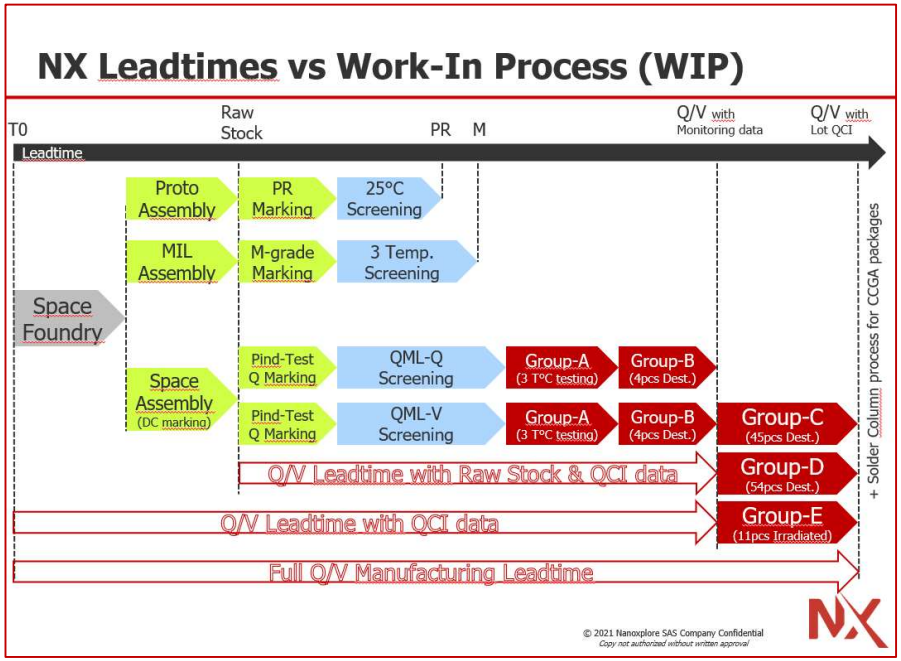
- Leadtimes vs Work-In Process (WIP)



- Leadtimes vs Customer Forecast

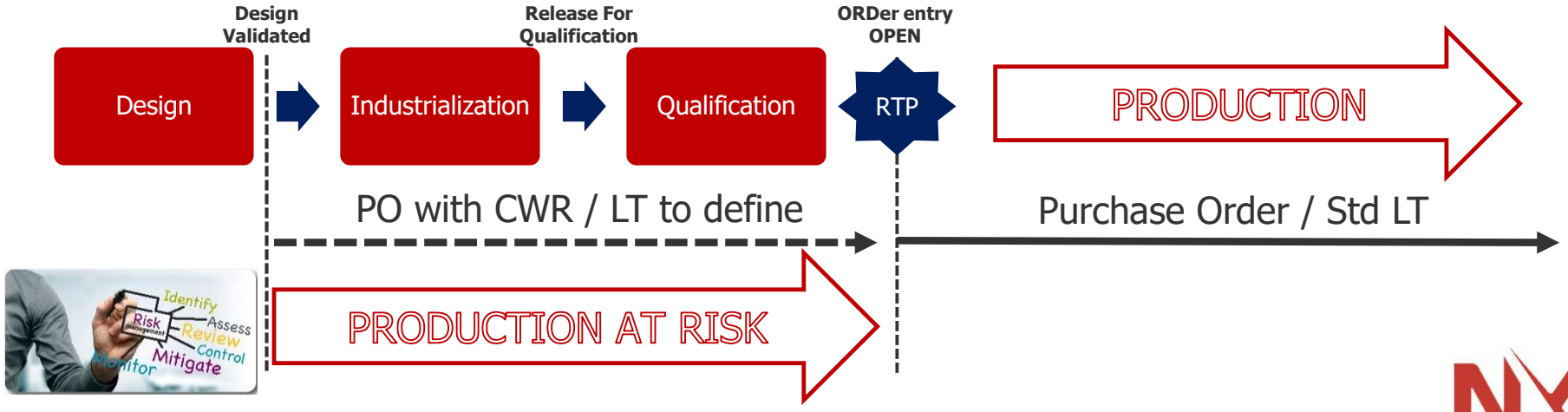
- The Customer / Project forecast for EM/EQM/FM parts will allow NX and its supply-chain
  - To launch silicon batche(s),
  - To procure Package piece parts
  - To reserve
    - Assembly capacity
    - Burn-in capacity
    - Test screening capacity

  accordingly,
  then to secure and minimize Manufacturing leadtimes.



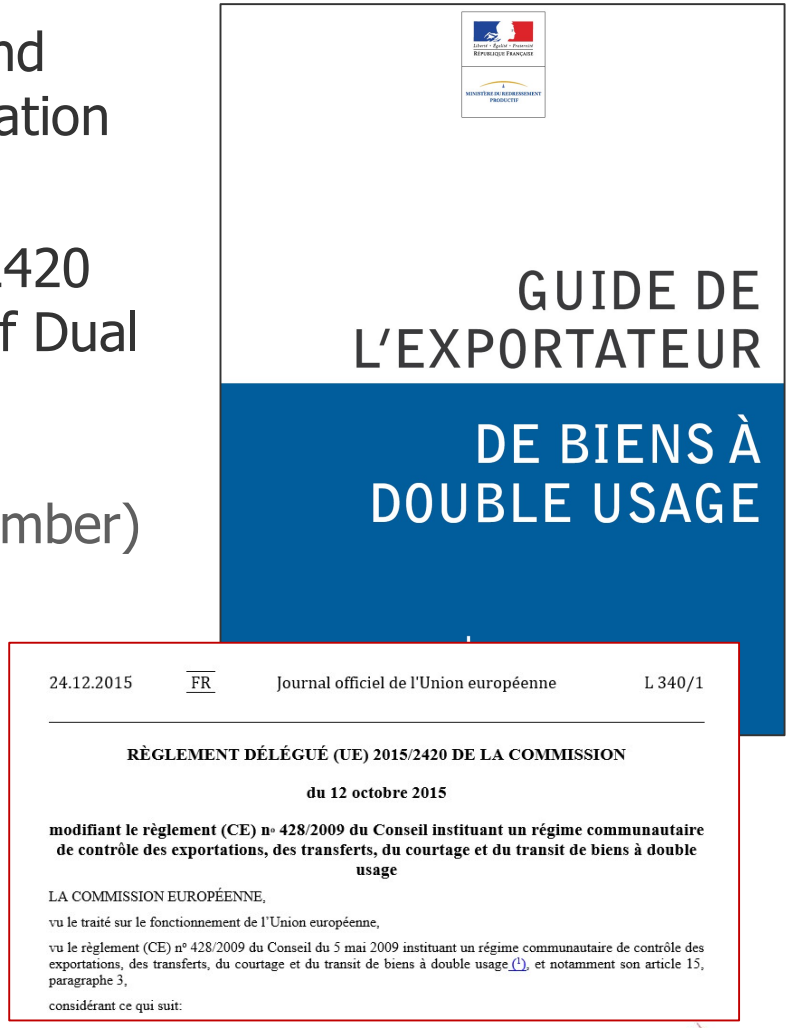
- Leadtimes vs Space Qualification

- NX Production Leadtimes (M to E and V-grades) are valid from T1.
- T1 is 'ORDer entry Date'.
- T1 becomes valid when the Release To Production (RTP) is pronounced, I mean when the product is industrialized and qualified.
- In case a Customer/Project would like to procure a Product before the RTP status, it can be approved by the MFR with a Customer waiver Request (CWR) duly signed by the user. It means, the manufacturing of Goods will be done in parallel with the industrialization-qualification. It will be AT RISK for the Customer.
- In case the qualification fails, it will require to launch a new batch. The LT will be double.



EU Export Regulation

- NX products are no subjected to ITAR and EAR because all HW, SW and Documentation have zero links to USA.
- Nevertheless, we must follow EU 2015/2420 rules about the control of exportations of Dual Use products.
  - ➔ ECCN
    (= Export Control Classification Number)
- ECCNs for Tools and Prototypes
  - NXmap: NOCLASS
  - EKs: NOCLASS
  - Prototypes: NOCLASS
- ECCNs for Mil&Space Parts: 3A001


GUIDE DE L'EXPORTATEUR

DE BIENS À DOUBLE USAGE

24.12.2015 FR Journal officiel de l'Union européenne L 340/1

RÈGLEMENT DÉLÉGUÉ (UE) 2015/2420 DE LA COMMISSION

du 12 octobre 2015

modifiant le règlement (CE) nº 428/2009 du Conseil instituant un régime communautaire de contrôle des exportations, des transferts, du courtage et du transit de biens à double usage

LA COMMISSION EUROPÉENNE,

vu le traité sur le fonctionnement de l'Union européenne,

vu le règlement (CE) nº 428/2009 du Conseil du 5 mai 2009 instituant un régime communautaire de contrôle des exportations, des transferts, du courtage et du transit de biens à double usage (1), et notamment son article 15, paragraphe 3,

considérant ce qui suit:

CONCLUSION

NanoXplore brings an answer to ALL SPACE Missions with **Low-Cost**, **Rad-Hard**, **Low Power** devices

- From **GEO satellites** requesting
  - *Long life cycle (20years),*
  - *Ceramic/Hermetic packages,*
  - *Low quantity (~few parts),*
  - *Up to Mil-Prf-38535 Class-V qualified,*
  - *At unit price /2 vs Competition*

- To **Constellation of LEO Satellites** with
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  - *Military screening & qualification,*
  - *At Unit price **like COTS** (x100€)*


www.NanoXplore.com

ESCCON-2021 - Abstract

- After a short introduction of NX FPGA solutions in term of
  - Devices complexity,
  - Package technology,
  - Quality standards,
  - Export regulation,
- We will identify NX supply-chain versus
  - Requested package type, I mean Ceramic or Organic,
  - Volume,
  - Project planning
  - and Unit Prices

  for either Traditional or New Space projects.
- The NX supply-chain is based in Europe, being not subjected to export constraints. This is not the case for Low-Cost solutions where Volume organic devices need to be assembled in OSATs mainly based in Asia.

Joël LE MAUFF biography

1981	•1981: Memory Product Engineering
1982	•1982: Memory Product Engineering
1986	•1986: Memory Product Marketing •1989: A&D Product Marketing
1997	•1998: Customer/Tactical Marketing Mgr
2000	•2000: Business Development Mgr – EMEA •2004: Sr A&D Marketing Mgr – EMEA-APAC
2009	•2009: A&D market surveys
2009	•2009: Marketing & Business Development Manager •2013: Sr BDM & Regional Sales Manager
• 2016: Head of Marketing & Sales	