ECI – Status, Way Forward and Lessons Learnt

March 2016

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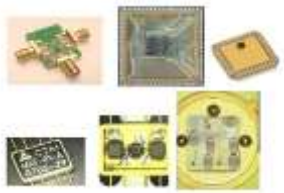
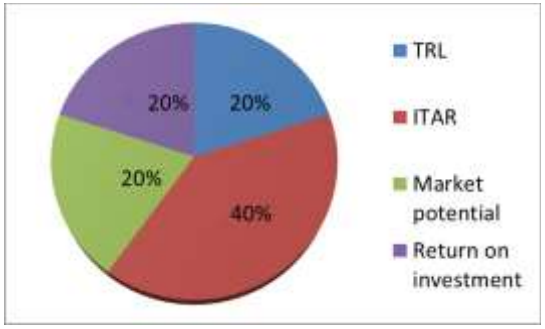
Some ECI Facts and Figures

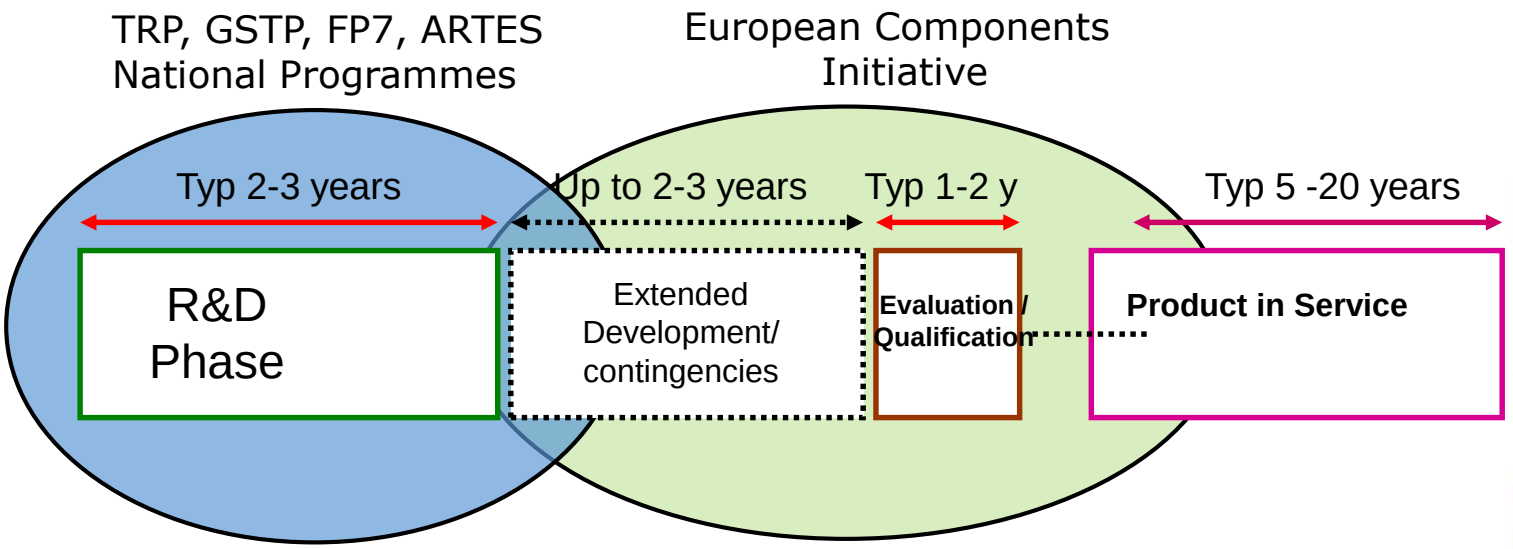
ECI started in 2004 primarily to address the growing ITAR concerns and to reverse the trend of a declining supply chain in Europe for EEE components .

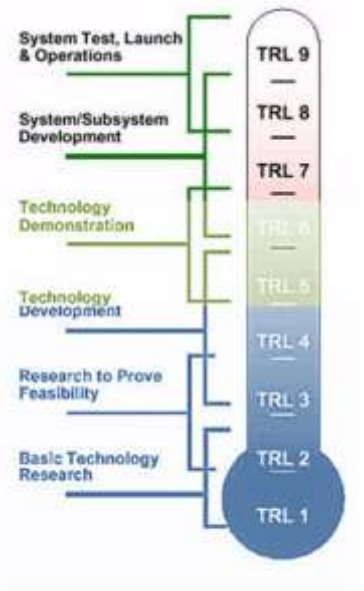


- Based on ESCC endorsed roadmaps, 94 activities have been launched since 2004 under ESA funding
  - 15 countries, 44 different prime contractors.
  - All EEE-technology domains have been addressed.
  - Activities funded and coordinated with CNES and DLR.
- Baseline document for the selection of components for ECI funding:
  - ESCC Technology Roadmaps, prepared by the ESCC Components Technology Board (CTB), approved by the SCSB.
  - Selection evaluation matrix is used to identify and screen the best potential candidates for ESA -ECI
    - ITAR/Single Source ,
    - Long Term Market Potential,
    - Technology Readiness,
    - Product Life Duration/ Value for Money.



Timeline From R&D to Commercialization





Typically 10 years !

Initial Investment ***Return on Investment***

TRL 2- TRL3/4 (Technology developed) → TRL 4- TRL6 (Technology evaluated and qualified) → TRL 8 (System test, launch and operation)

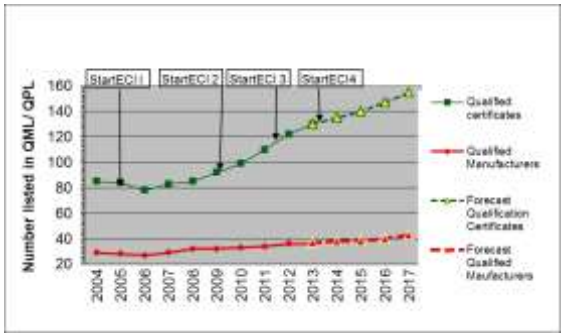
European Space Agency

Examples of qualified products in service:
AVX Type 1 capacitors since 1983, Infineon CFY66/67 GaAs HEMT since 1994….

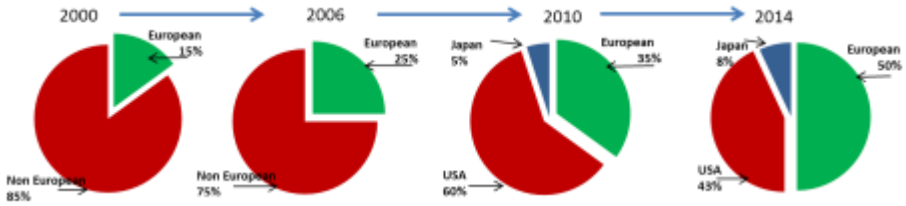
European Components Initiative: Objectives

The European Components Initiative (ECI)….

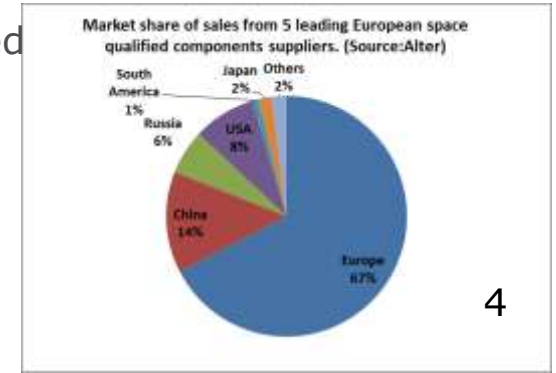
1. aims at maintaining and enhancing a European industrial base for critical technologies needed by Europe's space missions;
2. increases the availability of European EEE-components used in European space missions by developing capabilities to manufacture and qualify critical technologies within Europe;



3. exists to reduce the dependence of Europe's space sector on non-European component suppliers, by focusing on one of the fundamental building blocks of space missions - EEE components;



4. increases European export sales of space qualified components to emerging space powers where substantial growth is expected during the next 10 years.



ECI Industrial Contracts (2004…2015)

MPB

AME

Cobham Gaisler, IVF, Ruag (SE)

ETCA, Verhaert, IMEC, On-Semi

VTT, Picosun

IQE, Peregrine, Rakon, Thermocore, Gooch & Housego

AXON Kabel, IDA, UMS, IHP, Rood Technology, Infineon, Fraunhofer, TESAT

Tyndall

REL, ATMEL, OMMIC. Cobham (CTM), UMS HCM, TAS, Airbus ADS, Eurofarad, TRAD, Rakon, E2V, STm, Siteal, Syrlink

Eggo

Seibersdorf

Constalex

Arquimea, TuV Alter

Ruag (CH), IST, Schurter, CEA, Diamond, CSEM

Digimmic, Optoi, FBK, TAS(IT), STm

How Important is Non-dependence ?

From a recent survey of leading European space equipment providers:

When asked "*In your design/ projects, value the criteria for selection of EEE parts*":

The top five most important criteria were identified as:

✓	**Performance**	*it has to meet the requirement of the equipment/mission*
✓	**Availability**	*it must be available when required*
✓	**Cost**	*it must be competitively priced, (also minimum order quantities)*
✓	**Free of export restrictions**	*is particularly important for equipment sales to emerging markets outside of Europe (Russia/ China).*
✓	**Flight heritage/used in similar equipment**	*lowers the design risks (IOD)*

(*2013-2014 Alter Survey* commissioned by ECI)

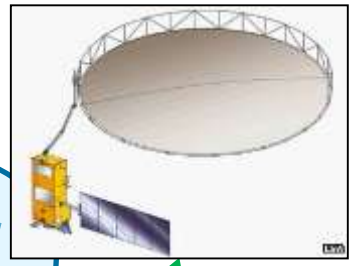
Non-dependence is not the only argument, if all of the above are not taken into account, the probability for a successful ECI end-product is reduced.

In-Orbit Demonstration of RF GaN

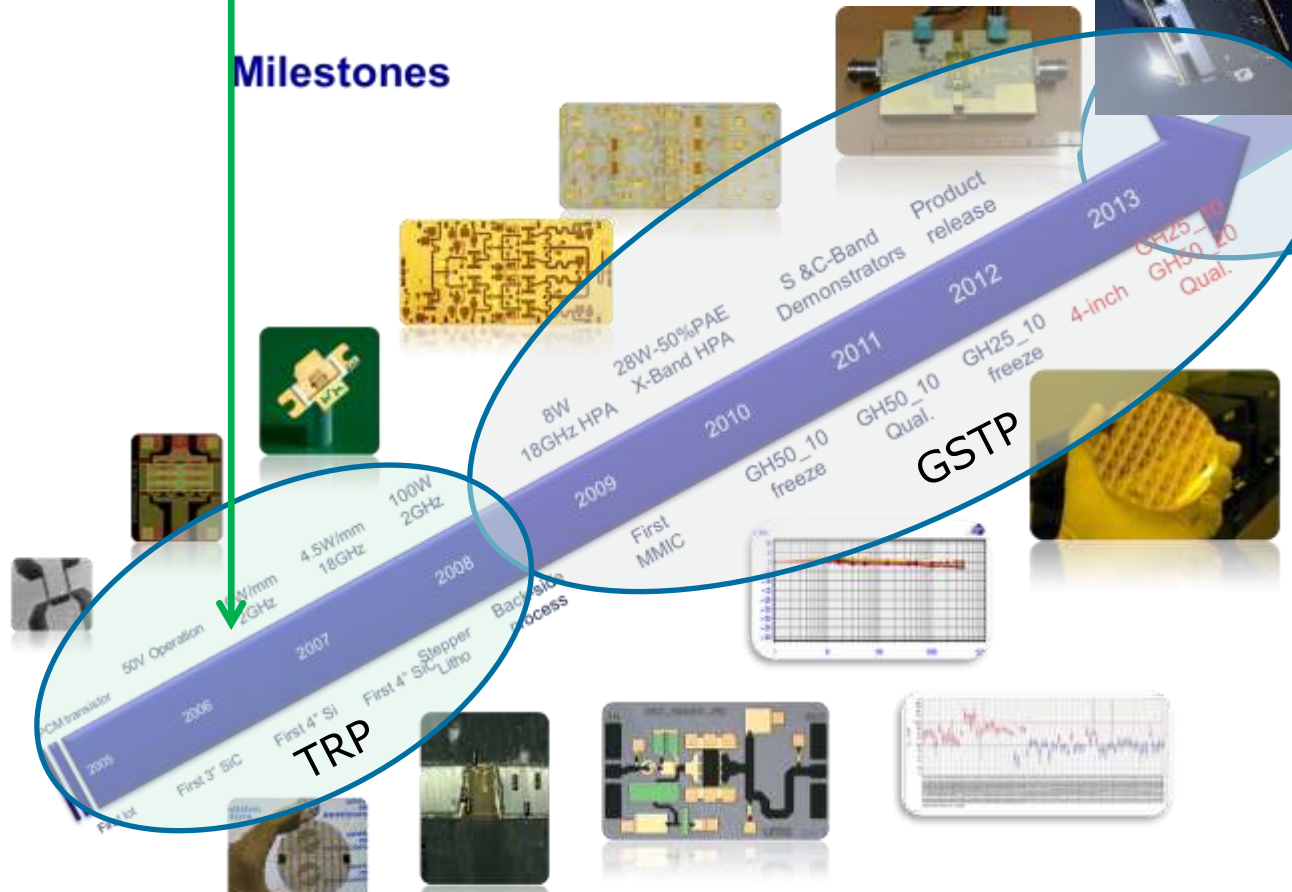
IPC Strategy paper on GaN, with the objective to bridge the technology gap of US/JP suppliers

Solid end-to-end strategy definition is a key to success

2013 First in-orbit demonstration of European GaN – PROBA V



Milestones



GaN technology insertion into **Biomass** space mission for realization of 240W SSPA at P band (435 MHz)

•Space qualification planned for GaN power bars: 15W (driver stage), 80W (output stage).

•0.5 µm GaN technology is now available through GREAT^2 and ECI qualification.

ECI Key Lessons Learnt

- On average its taking 3 years from the selection/ approval of a typical ECI activity to the listing of the component in the EPPL.
  - It is important to separate the R&D and the ESCC evaluation phases
  - In some cases the TRL has not been mature enough to start the activity under ECI, leading to delays in the planned start of the evaluation/qualification. *Perhaps a dedicated TRL review is needed in the future ECI-activities?*

- Draft Declared Component List (DCL) is expected at Preliminary Design Review (PDR) and consolidated evaluation / qualification plan by the Critical Design Review (CDR).
  - 1 year delay in the component availability leads on average to 5 lost opportunities to incorporate the components in ESA system designs.

  - 6 ESA System PDRs took place in 2015 (plus many more subsystem PDRs) and could have been targeted with ECI components if they had been available as planned
    - ***Maybe Component manufacturers are not realizing how much potential revenue is being lost by the delays ?***

ECI Key Lessons Learnt

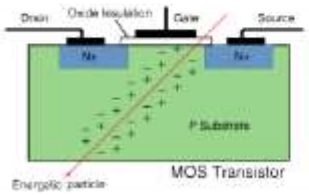
- To ensure access to the technology, it is necessary to stay ahead of the non-European competition, or at least keep up. Playing catchup is not impossible, but it makes it more difficult.
- Need to anticipate the technology requirements 5 -7 years ahead and invest in them early (CTB roadmaps)
  and to succeed it is:
  - essential to have an "end-to-end" strategy for each technology
  - sound business case,
    - (full market survey at the start of each activity with regular updates)
  - commitment support from the potential end users/ delegations
  - IOD opportunity, if possible.
- Constant surveillance is required of new terrestrial technologies, ideas and commercial EEE trends.
- Anticipate commercial pressure to discontinue space product lines and plan accordingly.

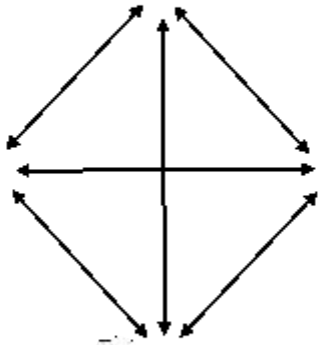
CTB technology roadmap update activity is on-going to identify the future needs and capabilities in the European EEE-domain

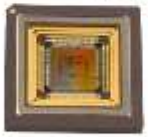
The Need for Balanced Investment

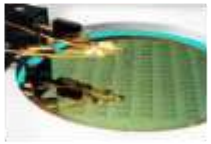
Commercialization,
Quality control

IC Design
expertise +
space reqs



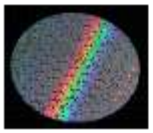






Assembly,
Packaging,
test

IC
Manufacturing
fabs



Can not just concentrate on any one area of the space supply chain

Next Steps

- ECI phase 4 procurement is closed in 2015. The awarded activities will run until 2017.
- Preparation of the next phase of ECI-type programme is on-going; ESCC/CTB technology roadmap update is on-going to identify the key target technologies.
- Need to continue on EEE-related non-dependence programme is identified by all stake holders, independent European access to state-of-art technologies is of vital importance also in the future.
- Decision on the ESA activities in the context of EEE non-dependence will take place in December 2016.

Conclusions

ESA- ECI has been running for more than 10 years:

- This has boosted the number of components available to end user for space applications (EPPL).
- The ratio of European / non European components in a typical commercial satellite has improved to around 50% , and a further improvement is achievable and necessary.
- Time to market is critical, there is need to speed up the design, evaluation and listing of components into the EPPL to target market opportunities.
- Non-dependence is not the only argument for a successful product, price, performance, availability must all be taken into account.
- Preparation towards the next stages of ECI is on-going, ESCC/CTB roadmap being the key technical document for the programmatics.

ECI Presentation Day 2016

- **ECI Presentation day - Tuesday 24 May 2016**
- 09:00- 17:00
  - ESA- ESTEC Noordwijk , The Netherlands
  - Open to all , no registration fee
  - Presentations from key technology providers
  - Hardware demos
  - Posters