



# REACH replacement

Clean Space Industrial Days 24-26 October 2017 ESTEC

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# REACH Issues



- ✓ Dassault aviation provides a large range of initiators for space application known as ESI. USE on-board Ariane 5 and satellites
- ✓ Dassault initiator family consist of ignitors, squibs and detonators. They all use MIRA powder as initiating powder. Squibs use GBSe as booster charge
- ✓ MIRA powder is banned (REACH) due to ammonium dichromate
- ✓ GBSe powder is banned (REACH) due to Dibutyl Phthalate



# Objectives



- ✓ In addition to REACH issue,
  - lifetime of MIRA powder is 12 years maximum,
  - lifetime of GBSe powder is 8 years maximum
  
- ✓ To identify an alternative to solve both the REACH and the life time issues



- ✓ Two main customers:
  - Launchers : igniters and detonators
  - Satellites : squibs
- ✓ Powder selection and risk reduction done on Dassault funding (2014 – 2015)
- ✓ Validation within ARTA program and EXPRO
- ✓ Qualification
  - Ariane5 ARTA for igniters and detonators
  - EXPRO CCN for squibs



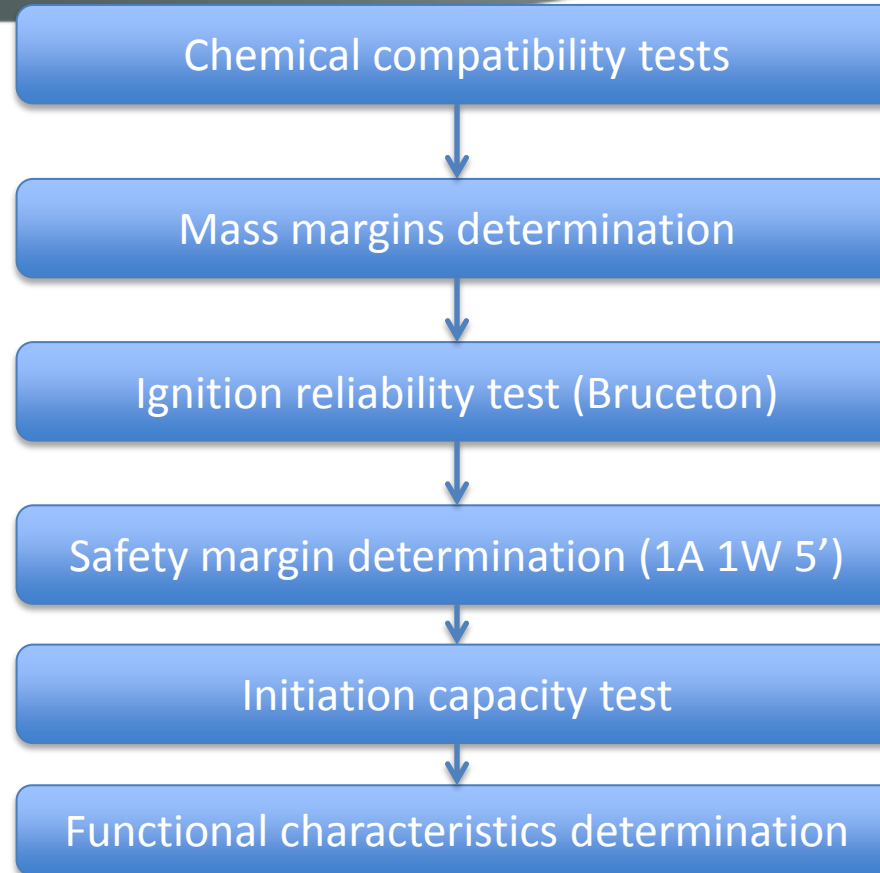
# Powder selection



- ✓ 4 candidates to replacement compared by tests
- ✓ Zirconium Potassium Perchlorate (ZPP) identified as best candidate
- ✓ Set of tests done (following slides) with ZPP to determine mass and performances



# Validation Logic



- ✓ Chemical compatibility
  - Vacuum Stability Test (ESV)
  - Differential Scanning Calorimetry (DSC)
  
- ✓ Mass margins determination
  - Minimum : 1.33 on initiation capability
  
- ✓ Ignition Reliability tests
  - “Bruceton” test with firing at  $-160^{\circ}\text{C}$  (after 1A 1W at  $+100^{\circ}\text{C}$ )



- ✓ Safety margin determination
  - 1A 1W 5' hardened test at 100°C stabilized
  
- ✓ Initiation capacity test
  - Hardened tests for
    - Powder → Detonator cap
    - Powder → booster charge
    - Long time delay interface
  
- ✓ Functional characteristics determination
  - Functioning time vs Initiation current level at various temperatures
  - Functioning time versus temperature at nominal load





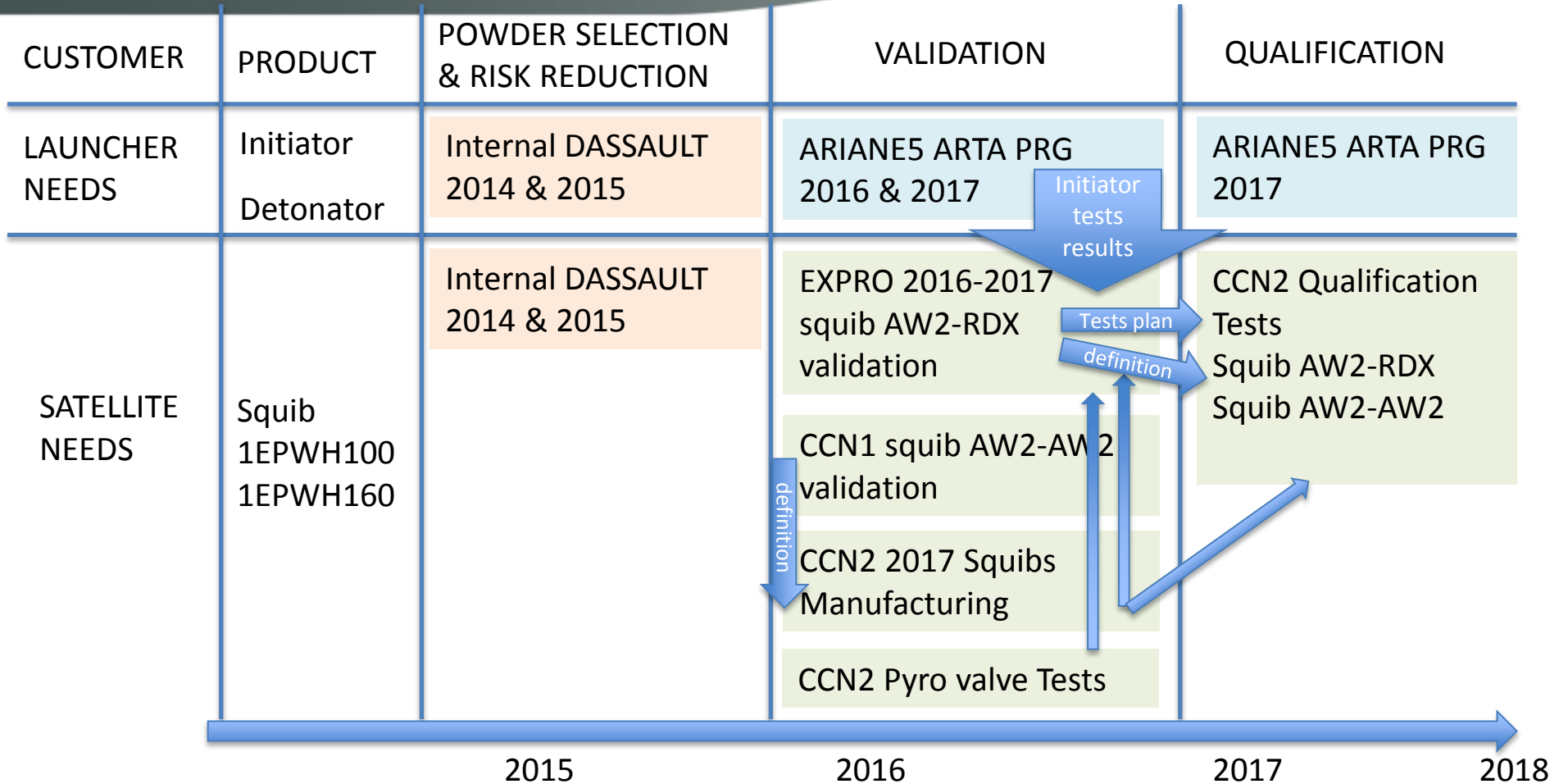
# Results



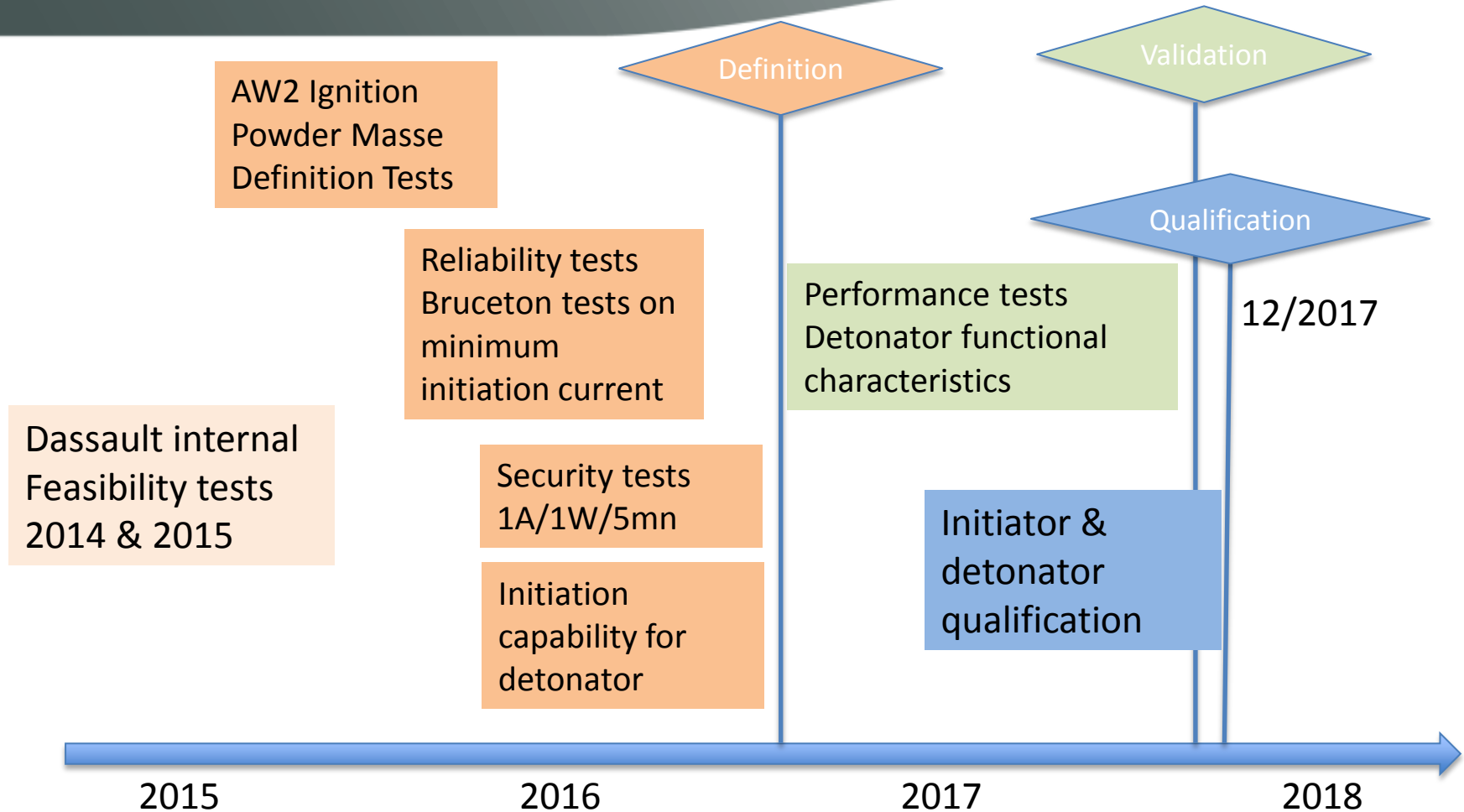
- ✓ Nominal charge = 35 mg of ZPP (previous = 40 mg of MIRA)
  - Margin of 1.5 (mass) on initiation
  
- ✓ Squibs : nominal charge = 85mg of RDX



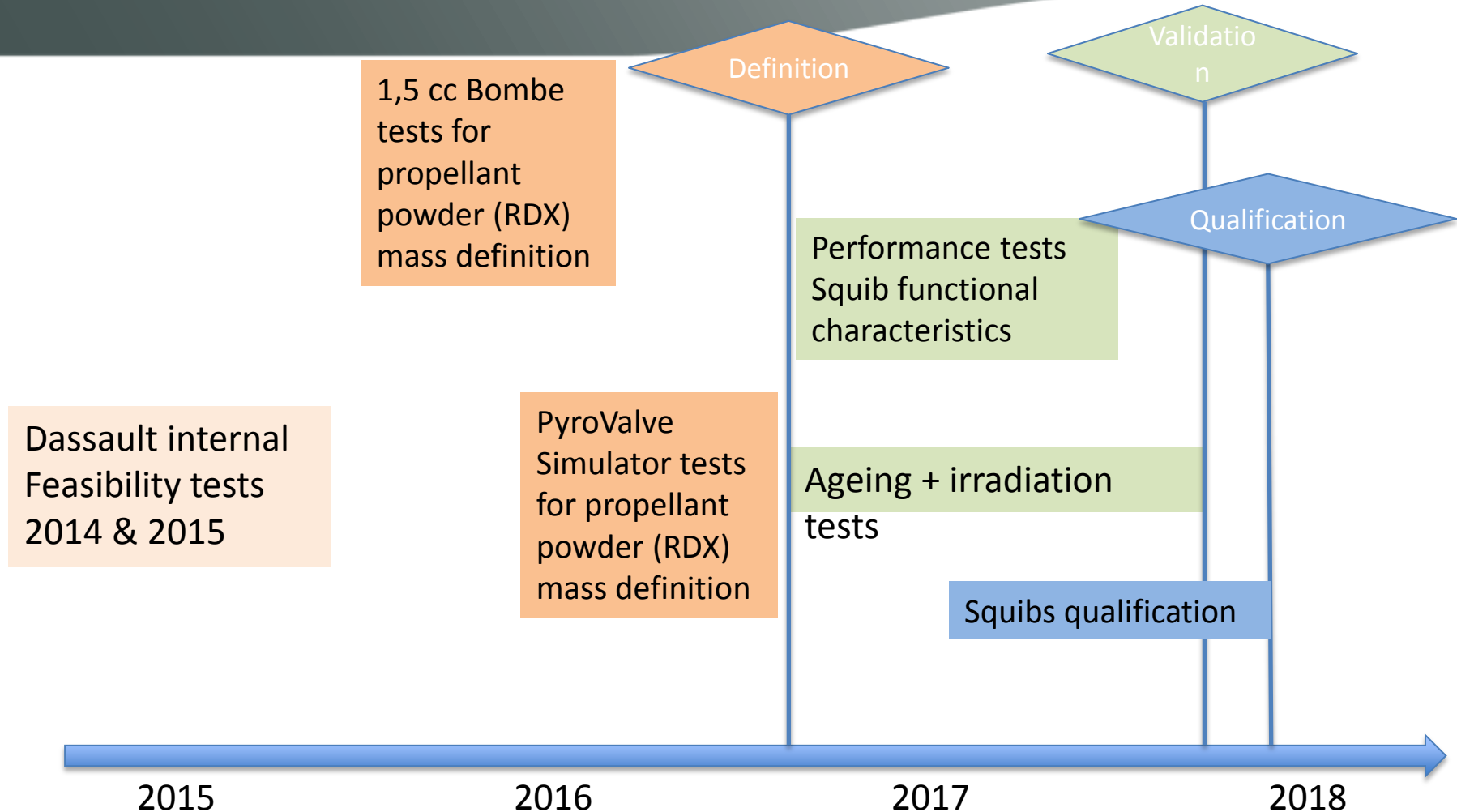
# Road Map



# Qualification for launchers environment



# Qualification for satellites environment



# Acknowledgements



## ✓ Special thanks to

- CNES (Denis DILHAN) for preliminary work
- ESA/ESTEC (Massimo PALLADINO) for his support

## ✓ And many thanks for your attention

- Any question ?

