Life Time Extension for passivation

Clean Space Industrial Days 24-26 October 2017 ESTEC

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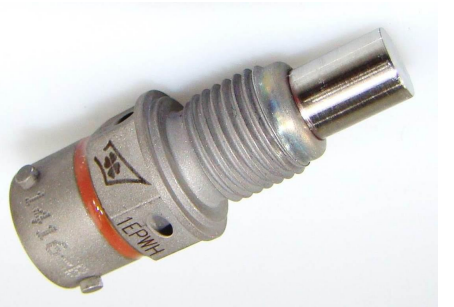
DASSAULT AVIATION

Life Time Issues

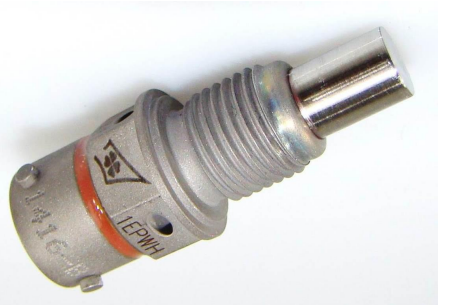
- ✓ Dassault aviation provides a large range of initiators for space application known as ESI
- ✓ Dassault Squibs 1EPWH100 used on satellite application for pyro-valves actuation



- ✓ Two powders are parts of 1EPWH100:
  - MIRA powder,
  - GBSe powder.

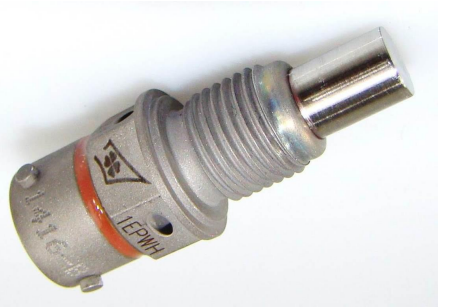
Life Time Issues cont'd

- ✓ MIRA powder :
  - Lifetime : 12 years maximum
  - Subjected to REACH obsolescence (cf. dedicated presentation)
- ✓ GBSe powder :
  - Lifetime : 8 years maximum
  - Subjected to REACH obsolescence (due to Dibutyl Phthalate in REACH appendix XIV)



Objectives

- ✓ Both MIRA and GBSe powder :
  - To identify an alternative
    - compliant with REACH,
    - with lifetime of up to 20 years
    - With temperature range up to 120°C
- ✓ Alternatives selected :
  - ZPP as substitute of MIRA
  - RDX as substitute of GBSe based on preliminary tests (thanks to CNES)



Logic

Determination of the quantities of powders ZPP and RDX

Ageing test

Radiation test

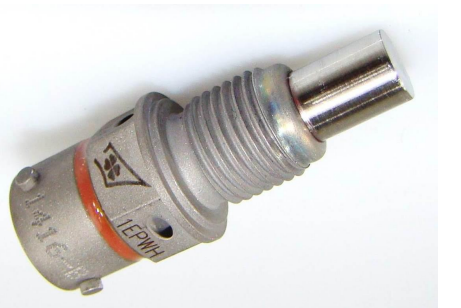
Reliability test

Bomb test

Define the influence of the temperature and initiation current on the operating time

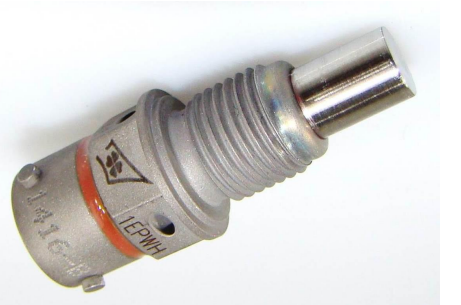
Define the initiation capability with under charged squibs

Qualification for space applications



Drivers

- ✓ Ageing
  - Accelerated ageing method based on Arrhenius law
  - Covers a life of 23 years after manufacturing and a passivation phase of 6 months at temperature of 60°C
- ✓ Radiation
  - 600 kRads on the powders and 2.1 MRads on O-rings
- ✓ Reliability tests
  - Statistic test with firing at -100°C

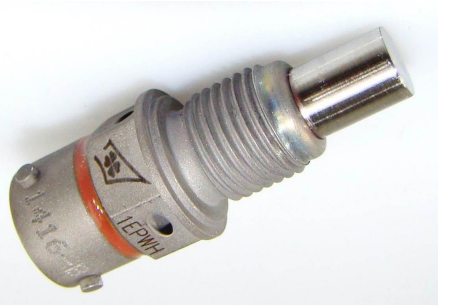


Drivers

- ✓ Bomb tests
  - Firing in closed volume at ambient temperature
- ✓ Influence of temperature
  - Existing squib acceptance test at specific temperatures (-100°C, +120°C)
- ✓ Influence of initiation current
  - Existing squib acceptance test at specific temperatures (-100°C, +120°C) and for 2 initiation currents (3.5A, 4.1A)

Status and Schedule

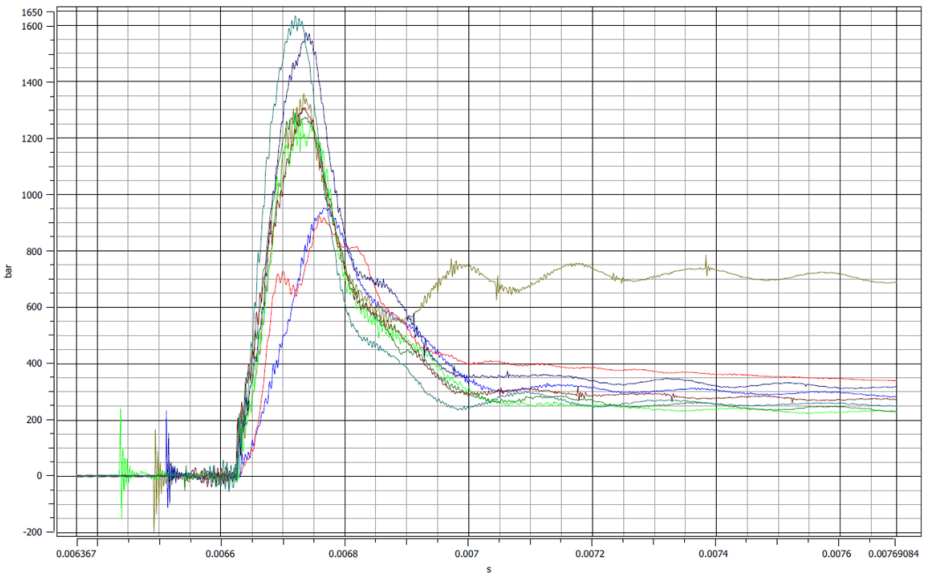
- ✓ Mass of powders determined by tests
  - Using valve representative volume

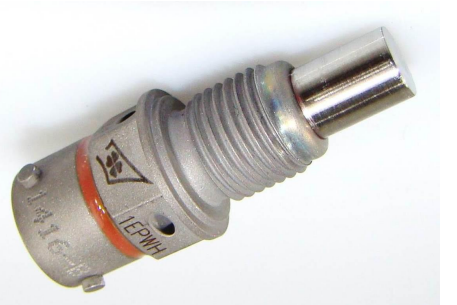


Status and Schedule

✓ Mass of powders determined by tests

- to evaluate the required quantity of powder to reach the same motorization margins than GBSE

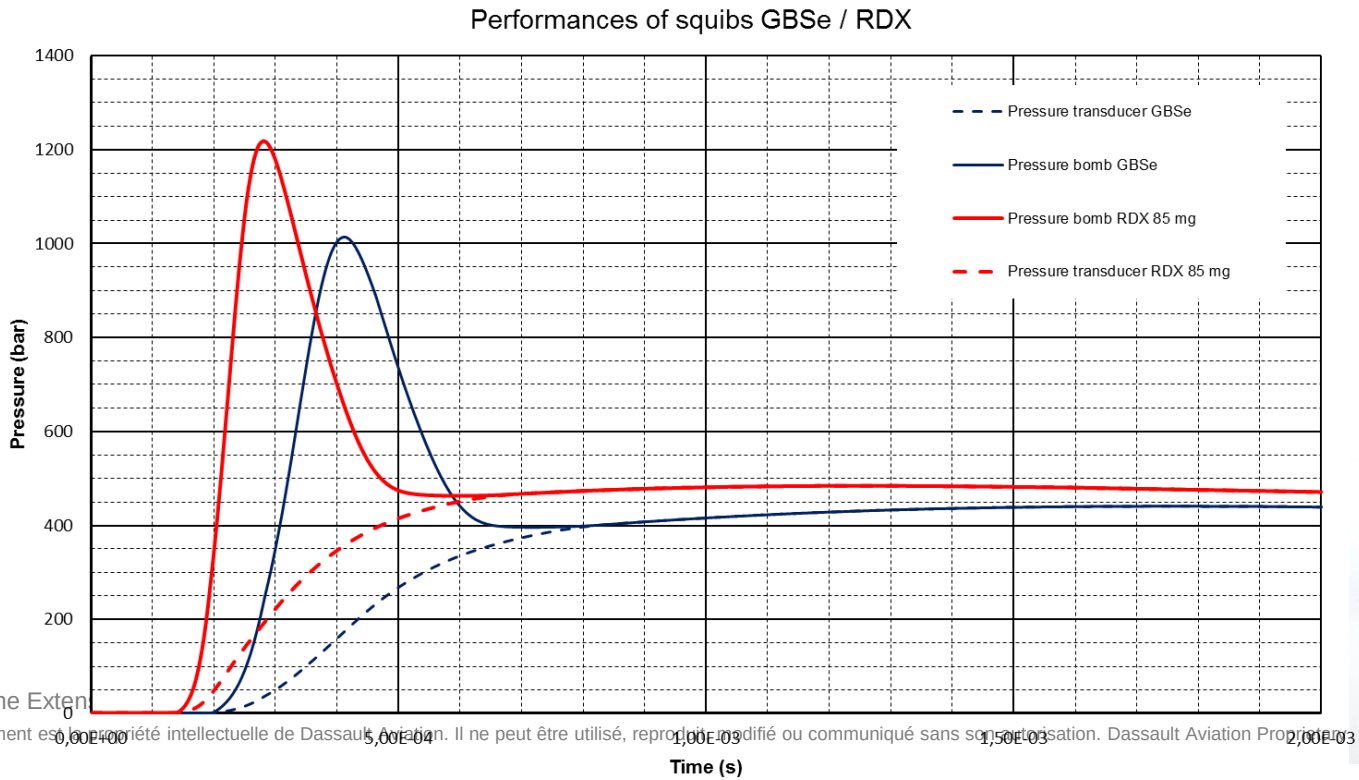


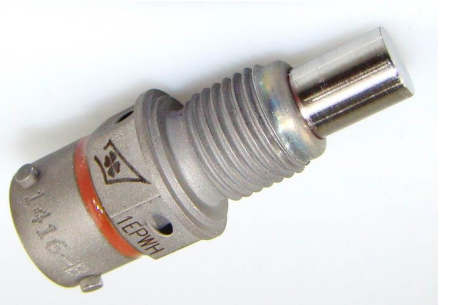


Status and Schedule

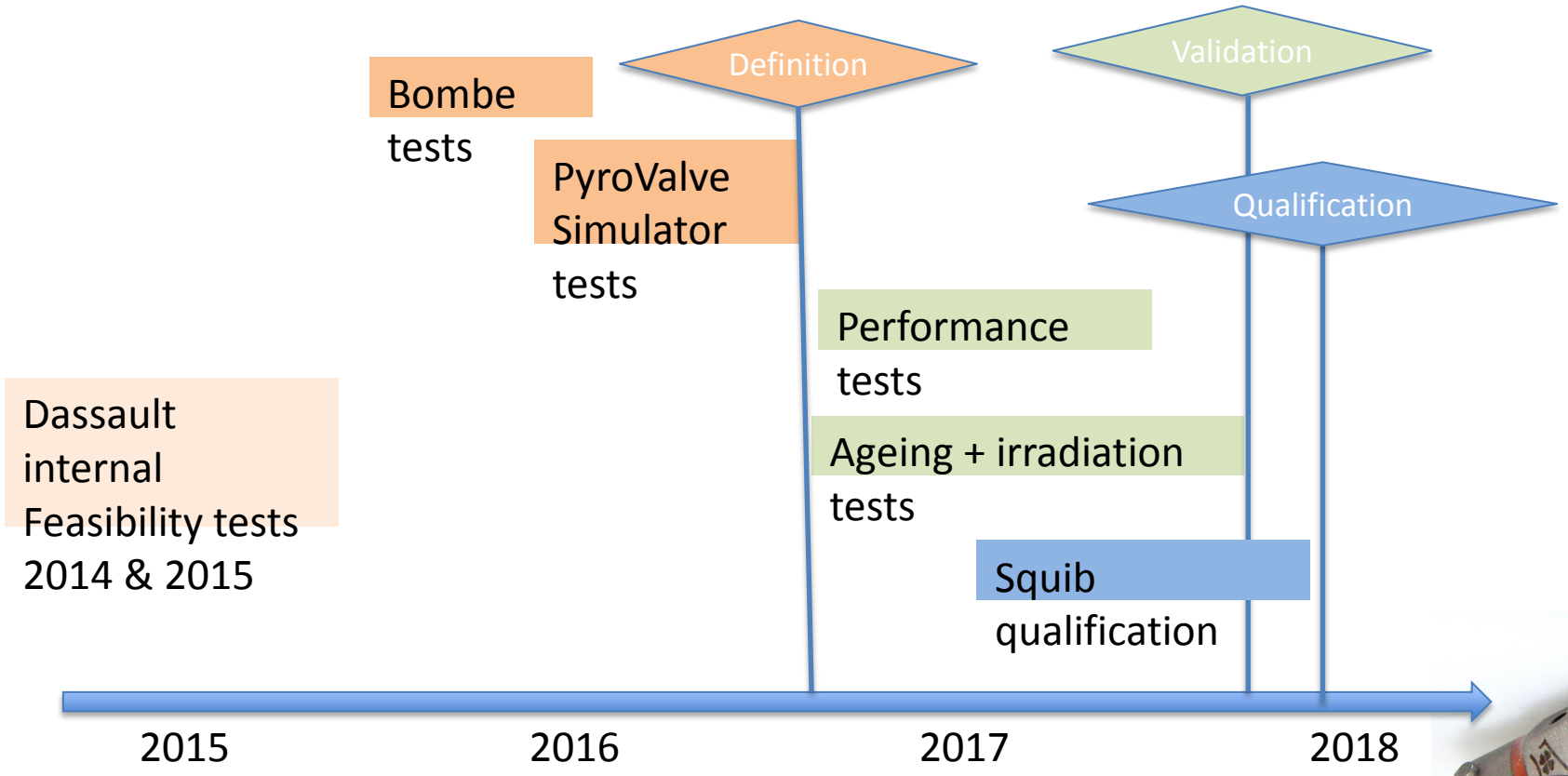
✓ Mass of powders determined by tests

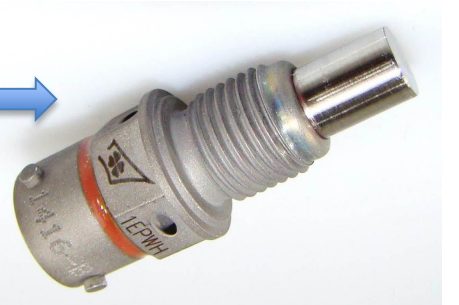
- By comparison with calculated curves
  - 40 mg of MIRA => 35 mg of ZPP (ARTA Ariane5 program)
  - 100 mg of GBSE => 85 mg of RDX





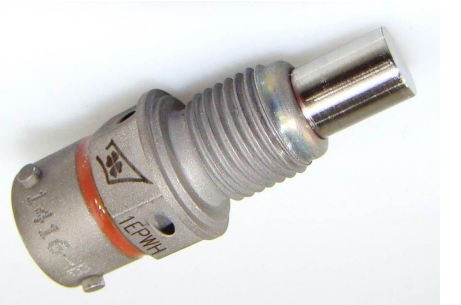
Status and Schedule





Perspectives

- ✓ Qualification mid 2018
- ✓ At this date, Dassault will supply space applications with
  - fully qualified up to 20 years lifetime squibs
  - REACH compliant
  - Interchangeable on pyro-valves
- ✓ Application to use those squibs : Juice program



Acknowledgements

- ✓ Special thanks to
  - Massimo PALLADINO (ESA/ESTEC) for his support
  - Denis DILHAN (CNES) for preliminary work
  - Arianegroup GmbH for support in valve tests

- ✓ And many thanks for your attention

- Any question ?