MORE ADDED VALUE? – AN INVESTIGATION ON THE COMMERCIAL BENEFIT OF DIFFERENT EP TECHNOLOGIES FOR ORBITAL PROPULSION

Cyril DIETZ, Guilherme CLAUDINO E SILVA
IEPC 2019-A883

36th International Electric Propulsion Conference
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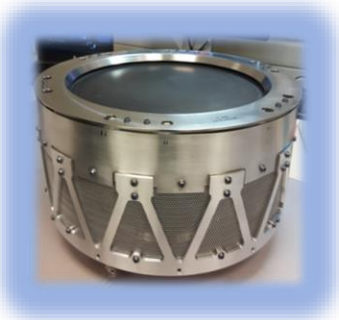
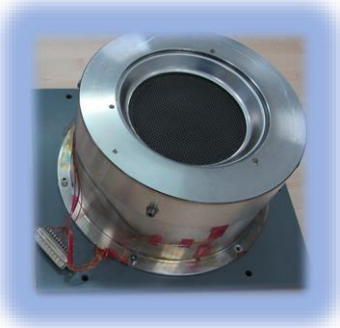
WELCOME TO ARIANE GROUP AT IEPC2019



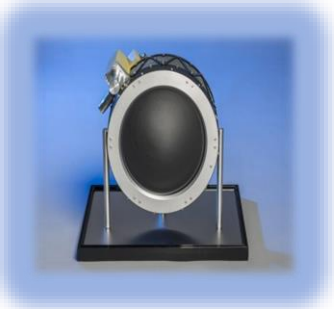
More Added Value? – An Investigation on the Commercial Benefit of Different EP Technologies for Orbital Propulsion
IEPC-2019-883: 16.09. 15:45 - Commercial Propulsion Needs
by Cyril Dietz

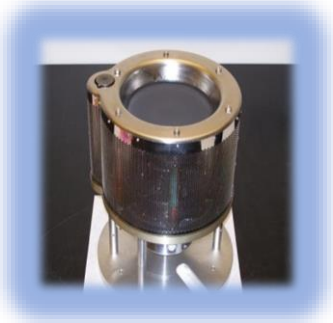


Ariane Group 5A Neutralizer qualification status
IEPC-2019-896: 18.09. 09:30 – Material Technologies Cathodes
by Marcel Berger

The Ariane Group Electric Propulsion Program 2019-2020
IEPC-2019-592: 19.09. 09:15 - Commercial Propulsion Needs
by Hans Leiter

A Nouvelle Neutralization Concept for RIT-µX Miniaturized Radio Frequency Ion Thruster Systems
IEPC-2019-806: 19.09. 17:15 - Ion Thrusters
by Hans Leiter





OUTLINE

01 INTRODUCTION

02 USE CASES

03 RESULTS

04 CONCLUSION AND WAY FORWARD

01
INTRODUCTION

INTRODUCTION

Horizon 2020

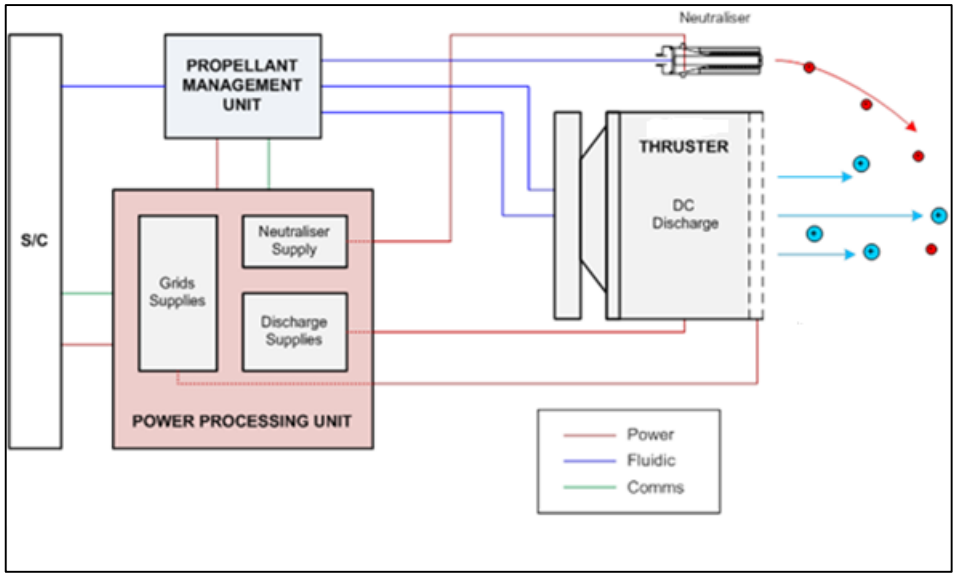
EP Development

- **GIESEPP** – Gridded Ion Engine Standardized Electric Propulsion Platforms
- 3 platforms for LEO/MEO, GEO, Space Exploration…

Our Goal

What Impact on the final result has the selection of an EPS for a S/C?

- Extend the pure engineering-centric view
- Consider full S/C life cycle
- Link one end of „the chain“ (operators) with the other end (EPS suppliers)
- Establish a fundamental comparison in EPS



02

USE CASES

INTRODUCTION

4 representative Use Cases

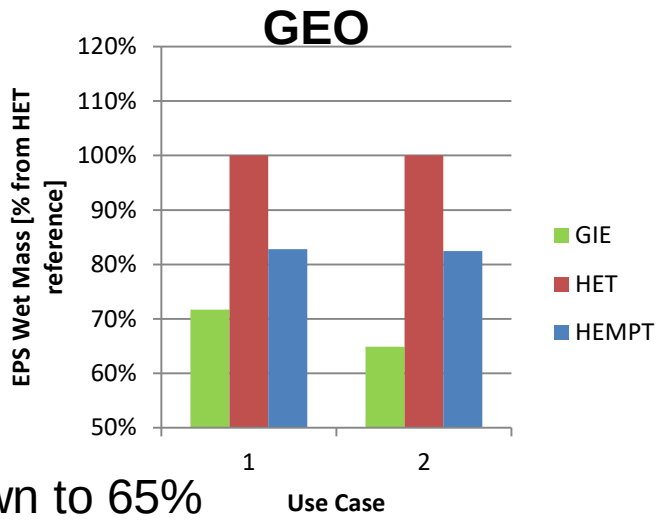
- Commercial Telecommunications
- Assumptions and Conventions
- Continuous Iterations

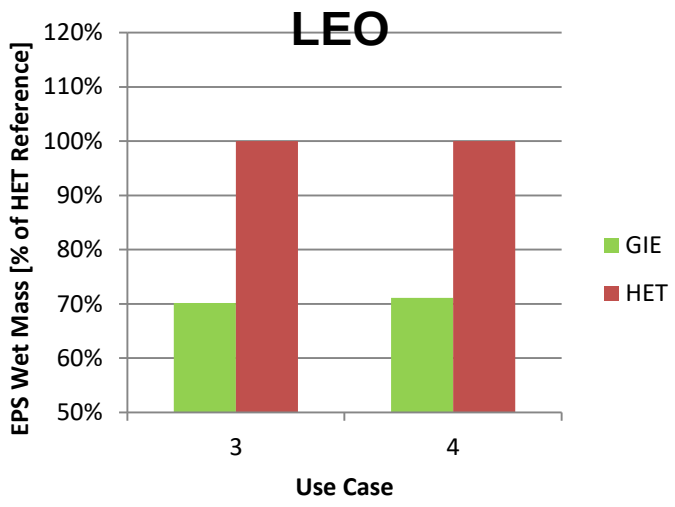
Use Case	Mission Name	Final Orbit	Satellite Dry Mass [kg]	Qty of Thrusters	Payload Capacity Equivalent	Ejecti on Orbit	Total electric Power [kW]	Comments
1	Heavy GEO	GEO	4700	4	100 Gbps	GTO	25	Direct injection to be considered.
2	Small GEO	GEO	3000	3	50 transponders	GTO	10	Direct injection to be considered
3	LEO Constellation, small sat	LEO	140	1	8 Gbps	LEO	2	Orbit supposed at 1000 km; no OR; 700 sats / constellation
4	LEO Constellation, medium sat	LEO	280	2	20 Gbps	LEO	4	orbit supposed at 500 km; no OR; 1200 sats / constellation

03
RESULTS

RESULTS

EPS Wet Mass

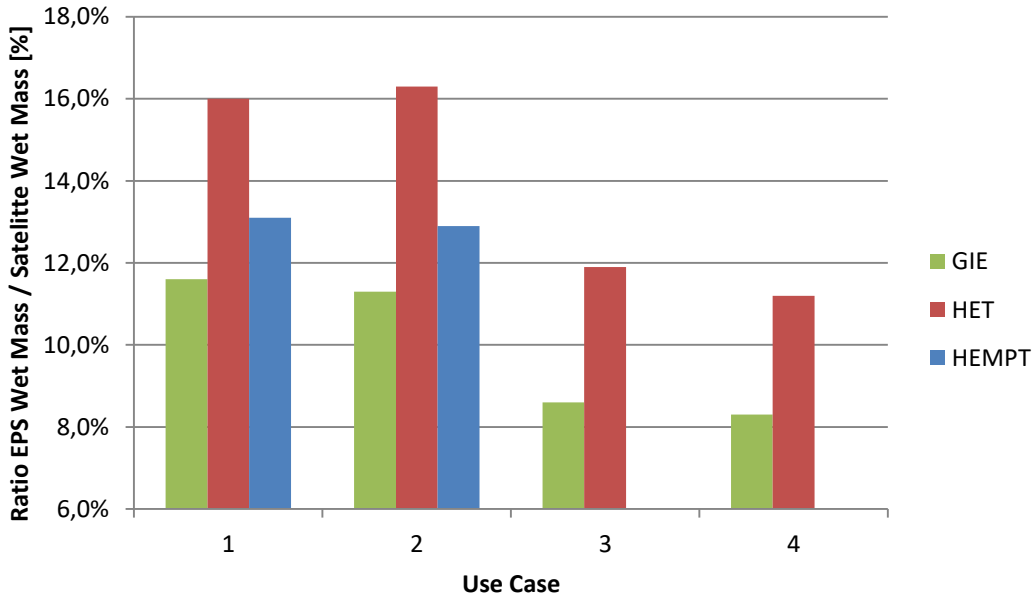




- For GEO reduced down to 65%
- For LEO reduced down to 70%

EPS Wet Mass / Satellite Wet Mass

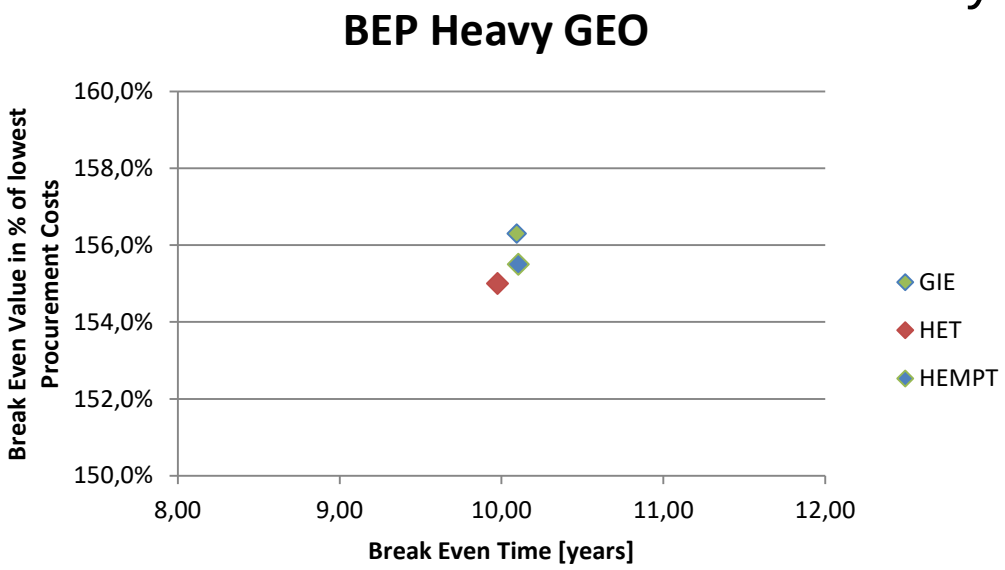
- For GEO reduced down to 11.6%
- For LEO reduced down to 8.3%

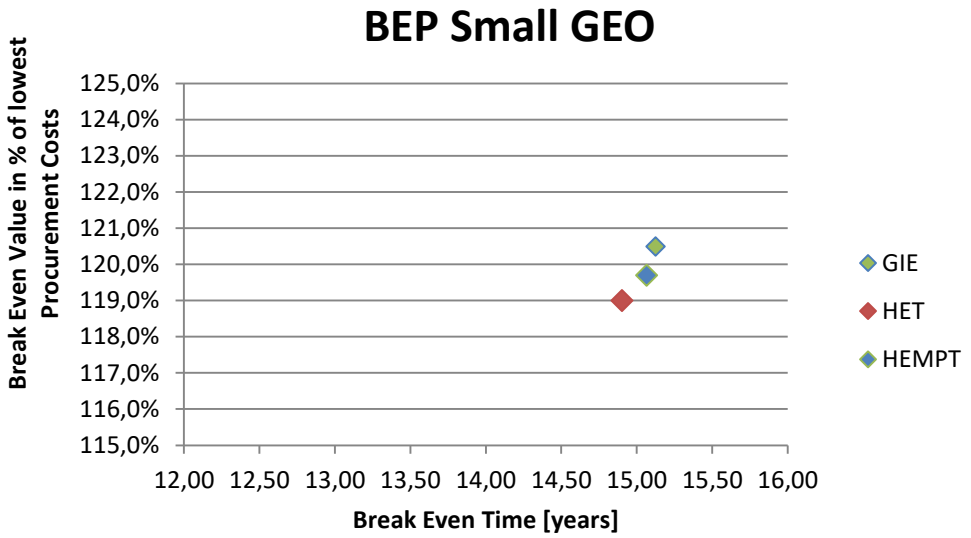


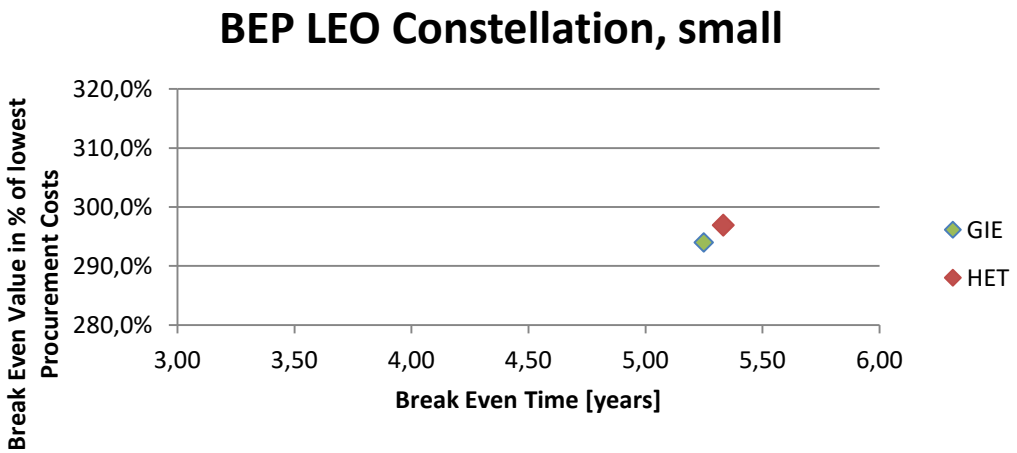
RESULTS

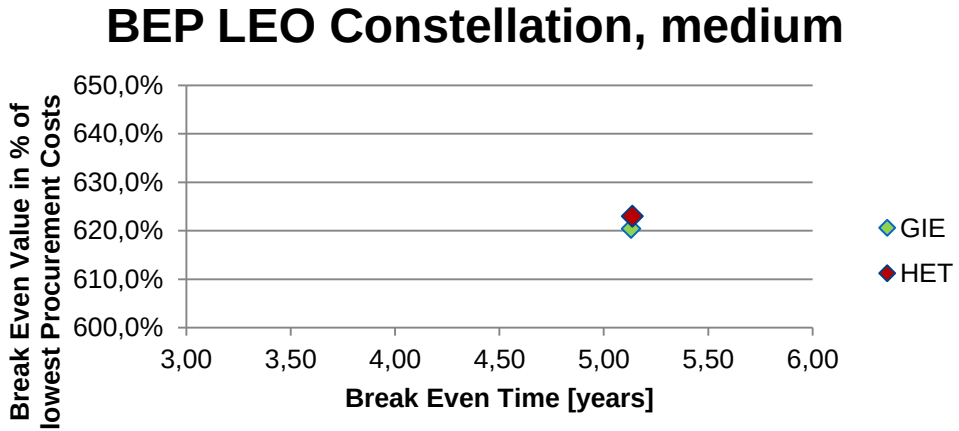
BREAK-EVEN POINT

➢ Widely no impact by EPS



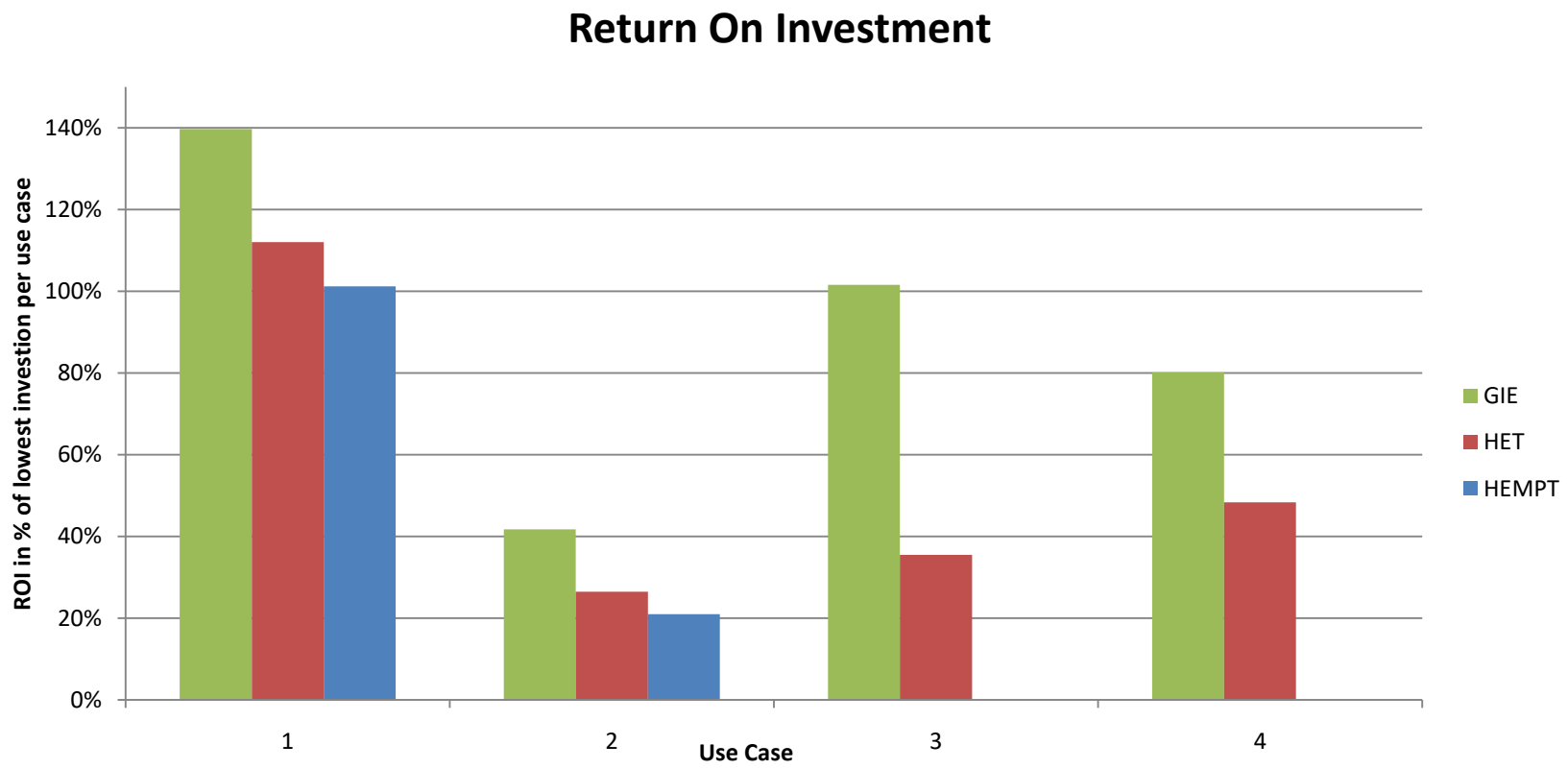






RESULTS

Return On Investment



- Maximum life extension on GEO ➔ ROI Δ up to (39%) 100%
- Maximum launch mass on LEO ➔ ROI Δ up to 127% (36%)

04

CONCLUSION AND WAY FORWARD

CONCLUSION

EPS Selection

- **Strong Influence on S/C Mass**
  - Savings up to 35% of EPS Mass with GIE
  - 5% Satellite Wet Mass savings
- Launch Mass savings **increase flexibility**:
  - Higher transfer orbit → reduce OR time difference to a minimum
  - More Launchers and Launch Configuration on hand…
- **No particular impact on Break-Even Point**
- Extended Potential
  - Considerable **Life-extension** with GIE would increas ROI significantly
  - **Direct injection** as feasable option using GIE

Way Forward

- Extend model with customer input and feedback
- Further use cases and variables
- Assess life extension ot other S/C subsystems

Thank you!

Funded by the Horizon 2020 Framework Programme of the European Union

https://ec.europa.eu/programmes/horizon2020

See your

ArianeGroup electric propulsion team at exhibition

Susana Cortes – Cyril Dietz – Hans Leiter – Marcel Berger