

The Future of the European ARIANE Launcher

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Natters, 15.05.2014

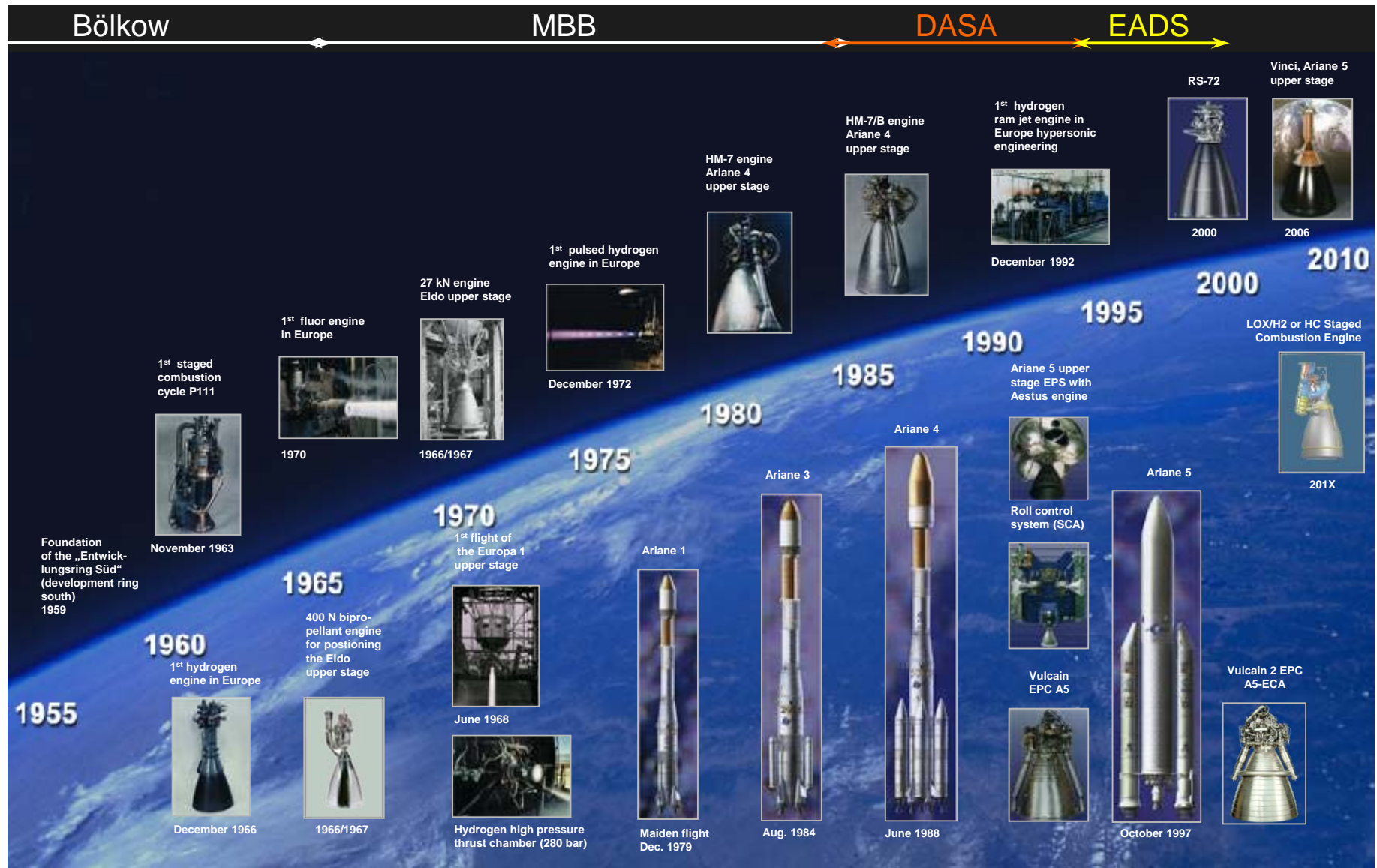
Table of Content

- Ariane History
- Present Situation
- Present Issues
- The Future

History of the ARIANE Launcher from ARIANE 1 to ARIANE 5

- ARIANE (1) was developed after ELDO nonsuccess in the seventies
- Maiden flight of this Launcher on 24.12.1979 !!
- Launcher was progressively further developed to ARIANE 2, 3 and finally ARIANE 4
- First flight of ARIANE 4 in 1988
- Decision for ARIANE 5 was taken mid 80ties in a threefold context
 - Development of the Columbus Module for the ISS
 - Development of the HERMES shuttle to enable independent access to space also for manned flight
 - Development of the ARIANE 5 as the launcher for HERMES
- After the death of HERMES, ARIANE 5 was considered to serve for satellite launching solely, thus leading to the dual launch strategy
- First successful flight on 30.10.1997
- Launcher now since more than 16 years in operational service
- ARIANE 4 ceased in 2003

History of the ARIANE Launcher



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Present Situation

ARIANE Family today



- Original ARIANE 5 EPS featuring:
 - VULCAIN engine
 - EPS upper stage with AESTUS engine
 - Central main stage with initial stage mixture ratio
 - Payload capacity (dual launch) of 6 tons
- ARIANE 5 EPS was evolved to ARIANE 5 ECA featuring:
 - VULCAIN 2 engine
 - New ESCA upper stage with HM7 engine
 - Central main stage with increased stage mixture ratio
 - Upgrade of solid boosters
 - Payload capacity 9,5 tons
- ARIANE 5 ES is the combination of:
 - Central Main stage in ECA configuration
 - Upper stage EPS , requalified for reignition



Present Situation

Entire European Launcher Family today



**Ariane 5
ES**



**Ariane 5
ECA**



Soyuz



Vega

Pictures courtesy of ARIANESPACE

GTO performance (dual launch)

6 t

9.5 t

3 t

LEO performance

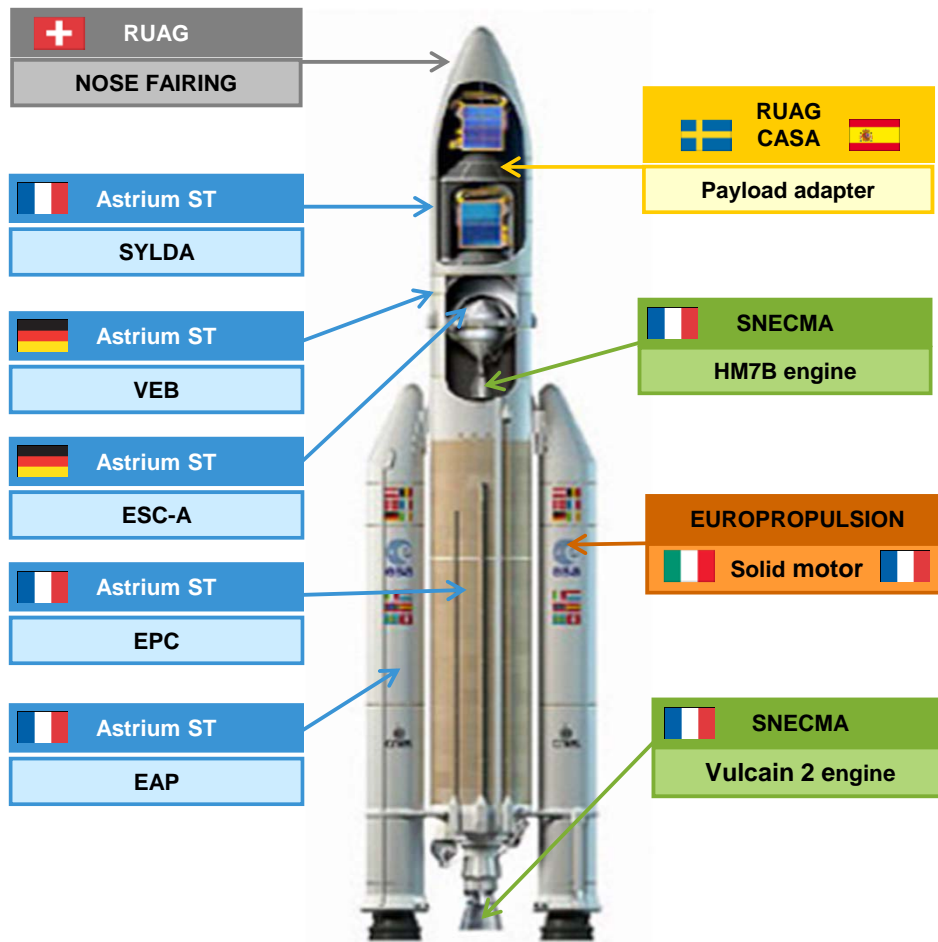
> 20 t
300 km – 51.6°

2.5 t / 5 t
1,400 km

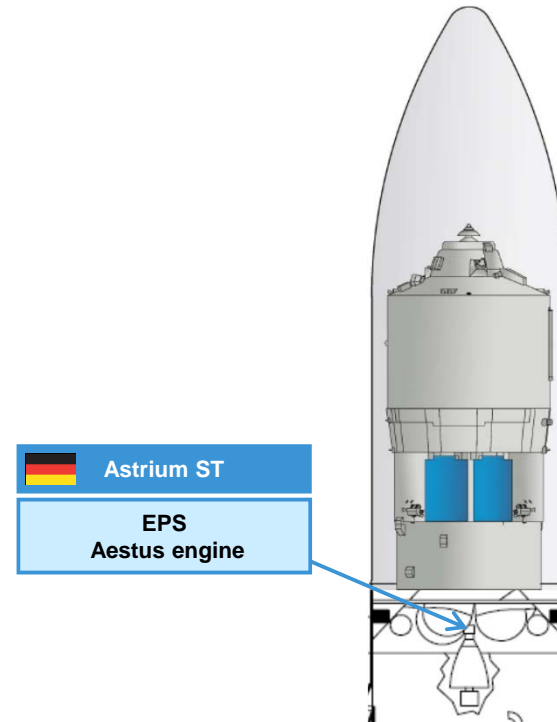
1.5 t
700 km

Present Situation

Main contractors today



Ariane 5 ES
Special missions
(ATV, Galileo...)



Present Situation

Ottobrunn Contribution today

AIRBUS DS
(Ottobrunn) is in
charge of Key
Components in
the Propulsion
System of the
Ariane 5 ECA /
ES

Aestus engine upper
stage EPS



HM7B Thrust Chamber
Upper stage ESC-A

Attitude control system- SCA



Cryogenic Valves – Central
Stage



Vulcain Thrust Chambers – Central
Stage



Present Situation

Economical figures and challenges

- ARIANESPACE order book is filled with (status 02/2014)
 - Total 20 A5 launches (18 ECA and 2 ES)
 - Total 9 Soyuz launches
 - Total 6 VEGA launches
- Figure represents more than 3 years of business
- However the following challenges exist (ARIANE 5)
 - Increasing price pressure especially in the small satellite market
 - Increasing difficulty to match two satellites
 - Still increasing satellites masses
- Necessity to counteract in time to stay competitive

Preparing the Future

Threefold rational for the Future

- The following scenario counteracts the upcoming challenges
- Short term:
 - Increase ARIANE 5 ECA competitiveness now
- Mid Term:
 - Make ARIANE 5 ME available
- Long Term:
 - Develop ARIANE 6 as quick as possible

Preparing the Future

Short Term Competitiveness Increase

ARIANESPACE Statements: *)

- Increased competition in GTO leave no other option than to decrease Ariane 5 launch prices on the small satellites market segment to maintain the launch rate
(6 per year in average)
 - Ariane 5 record quality, reliability and availability are considerable assets to be maintained and valued but not sufficient to avoid adaptation to competition
- A price reduction is only possible if a cost reduction is achieved from launch vehicle production to operation costs

*) at the occasion of the DLR propulsion day in LAMPOLDSHAUSEN, 02/2014

Preparing the Future

Mid Term Evolution Program (ME)

- ARIANE 5 ME is presently under development featuring:
 - A new cryogenic upper stage with 28 tons propellant loading
 - A new upper stage engine (VINCI) of the expander cycle type
 - Multiple boost phases interrupted by ballistic coast phases of up to six hours
 - Unchanged central stage and boosters
 - Payload increase to 11 tons net
 - Considered satellites masses of 4,5 tons (in lower position) and 6,5 tons (in upper position)
- Unchanged recurring price in comparison to ARIANE 5 ECA required
- Availability of Launcher required for 2018
- Main challenges are
 - Budget consolidation
 - Compliance to schedule
 - Transition with A5 ECA by keeping launch rate to 6 (launch facilities adaption, stage testing in Europe)



Preparing the Future

Long Term Solution ARIANE 6

- ARIANE 5 ME has been decided on the ministerial conference 2012. Its configuration is described as follows:
 - So called PPH launcher comprising
 - Two stages of solid propellants
 - Two strap on boosters (solid as well)
 - Liquid third stage (utmost communality with ME stage)
 - The concept allows to answer to the entire GTO market in a flexible way (using dual launch for small satellites)
 - Re-ignitable upper stage
 - Payload increase up to 8 tons
- Recurring price for entire launch stipulated to 70 M€
- Availability of Launcher required for 2021/2022



Preparing the Future

Long Term Solution ARIANE 6

- Main Challenges:
 - Very tough price target
 - Its achievement will probably necessitate radical adaptation in the European Liquid Launcher Propulsion Industry
 - Introduction of a complete new launcher aside Soyuz and/or VEGA while still operating ARIANE 5 ECA (scheduled to cease business in 2024)
 - Transition of production locations vis-à-vis production of ME
 - Transition Cost



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What else ???

Reflection in the German
Carnival's Procession 2014