

**Ariane 5 ME – Midlife Evolution:**  
Backed by Germany

# Next-generation heavy-lift rockets

Europe faces a critical decision over its next-generation Ariane launch vehicle which will be in direct competition with SpaceX's Falcon 9 Heavy. Competing ideas to cut operating costs include a midlife upgrade of Ariane 5, or new cryogenic-liquid or solid-fuelled versions of Ariane 6

**Falcon 9 Heavy**  
SpaceX, United States



**Payload:** 11 tonnes to geostationary transfer orbit (GTO). 20-metre-long satellite bay

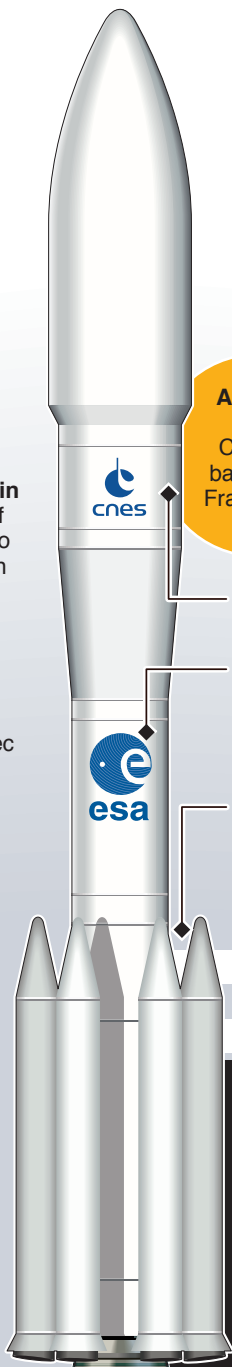
**Vinci cryogenic upper stage:** New restartable engine to deliver two satellites to GTO at 33,660km/h. Orbital insertion about 29 minutes from launch



**Vulcain 2 cryogenic main stage:** Ratio of liquid oxygen to liquid hydrogen raised to give 20% extra take-off thrust to increase payload. Engine burns for 8 min 59 sec

**Solid-fuel boosters:** Each burns more than 100 tonnes of propellant in first 134 seconds of flight

**Current cost per launch:** \$220 million  
**Subsidy from EU taxpayer:** \$150m  
**Ariane 5 ME to enter service 2017**



**Ariane 6 P1B:** Concept backed by France and Italy

**Vinci upper stage (as Ariane 5ME)**

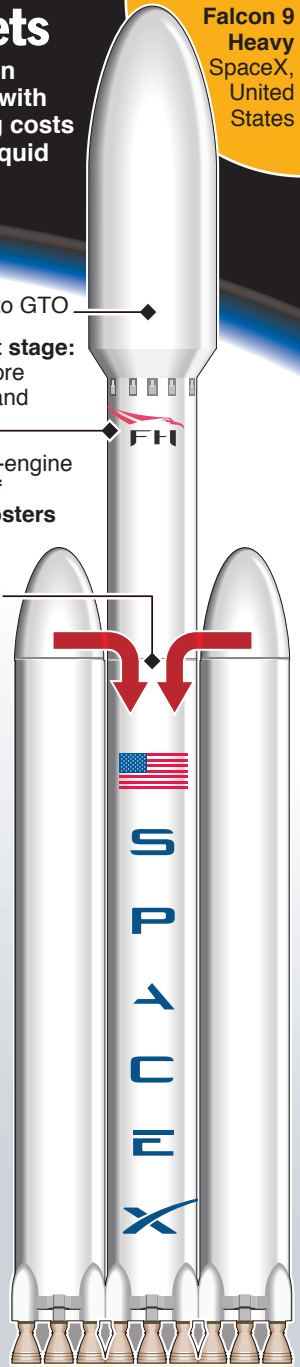
**Vega P135 solid-fuel engines:** Newly designed two-stage core rocket

**Strap-on P39 boosters:** Variable number of boosters increase payload range

Payload	Boosters
5 tonnes	2
6.5 tonnes	4
8.1 tonnes	6

**Cost per launch:** From \$80 million  
**Any subsidy financed by builder-nations**

**To enter service 2020**



**Payload:** 19 tonnes to GTO

**Falcon Heavy's first stage:** Merlin nine-engine core fuelled by kerosene and liquid oxygen

**Boosters:** Twin nine-engine cores. **Cross-feed of propellant from boosters leaves centre core almost full on booster separation**

Payload	Boosters
5 tonnes	2
6.5 tonnes	4
8.1 tonnes	6

**Cost per launch:**  
**Up to 6.4 tonnes to GTO – \$83 million**  
**Above 6.4 tonnes – \$128 million**  
**Enters service 2013-14**

Sources: Aviation Week & Space Technology, FAA, SpaceX © GRAPHIC NEWS