

2017 International Paris Air Show

19-25 June 2017

Paris, Le Bourget - Hall 1 G278

The CNIM Group is presenting a comprehensive offering of engineering and manufacturing services for the aeronautics and space industries at the 2017 International Paris Air Show

CNIM and its subsidiary Bertin Technologies will be exhibiting at the 2017 International Paris Air Show, in hall 1, stand G278

From Earth to Space, and from research through to manufacturing.

The CNIM Group's fields of intervention in the aeronautics and space industries cover consulting, engineering and the manufacture of sophisticated or large systems requiring a high degree of precision. Operating at the cutting edge of innovation and technology, the group works either directly for major civil and military clients in the capacity of lead contractor, or as a subcontractor.

The CNIM Group's offering comprises:

- Design and manufacture of ground and on-board equipment
- Build to specification and Build to print
- Upstream expertise and research: consulting in innovation, optimization and simulation, modeling, ergonomics and human factors, risk management

CNIM operates from a top-class manufacturing site near Toulon and is equipped with several clean rooms.

The CNIM Group and its subsidiary Bertin Technologies will be presenting their latest innovations and creations in the space field, on the same stand:

- P120C development nozzle structures for Ariane 6
- Components for Stratobus, the autonomous stratospheric platform project led by Thales Alenia Space
- HADES software platform developed by Bertin Technologies: MDO (Multidisciplinary Design Optimization) dedicated to the space industry
- MGSE Zero Gravity technology developed for Thales Alenia Space, for testing on-board equipment for satellites.

CNIM wins a contract for Ariane VI with Airbus Safran Launchers



Ariane V booster casing. Photo credit: CNIM

In December 2016, CNIM won an initial contract with Airbus Safran Launchers to build the P120C development nozzle structures for the Ariane VI launcher. Delivery of the first booster casing is scheduled for July 2017.

This contract illustrates the ability of CNIM's staff teams to meet demanding technological challenges and the quality of its manufacturing plant at La Seyne-sur-Mer, which is tailored to the production of large, high-added-value components.

Since 2004, CNIM has been demonstrating its know-how by building all of the nozzle structures for the side-boosters of the Ariane V launcher. These nozzles, which are positioned at the base of the propulsion units, are tasked with evacuating and

guiding the propulsion gases during the first flight phase of the launcher. In December 2016, the CNIM's workshops at La Seyne-sur-Mer produced the 150th booster casing for Ariane V.

Production is due to continue until 2020, and will gradually give way to the Ariane VI launcher, which will be equipped with either 2 or 4 nozzles, depending on the configuration.

CNIM is designing all of the mechanical equipment for the Stratobus™ project managed by Thales Alenia Space

Following the signature of the partnership agreement with Thales Alenia Space in April 2016, an initial design milestone was passed in March 2017 and things are looking very encouraging for the next stages of this unprecedented project, involving a solar-powered geostationary and stratospheric balloon. CNIM is responsible for the most important mechanical components of the Stratobus™ structure: its two nacelles and the four structures that support its propulsion engines.



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The CNIM Group is one of the six industrial partners assembled by Thales Alenia Space to work on this multi-mission autonomous drone project. Stationed 20km above its theatre of operations, in the lower reaches of the stratosphere, Stratobus™ will be positioned between aircraft and satellites.

The balloon is designed for localized civil or military observation and surveillance missions, e.g. border surveillance, detection of pirate ships, oil dumping and spills at sea, etc. It will bring the Internet to digital deserts, reinforce GPS in high traffic areas, analyse meteorological and coastal erosion data, and monitor beach cleanliness. It will help the authorities to manage natural disasters and fires. In addition to the more global coverage provided by satellites, its detailed regional coverage will help to monitor threats of all kinds.

A technological challenge met by CNIM

Stratobus™ is as long as a football stadium and as tall as an 11-storey building: it will have to constantly battle against winds blowing at speeds of between 0 and 90 km/h, in order to maintain itself in a stationary position: this poses a serious technological challenge for CNIM, which is responsible for the design and production of the 3 structural units:

- the support structures of the 4 engines,
- the fixed nacelle housing the balloon's energy management components,
- the nacelle that will carry the balloon's communication and/or surveillance payloads. This nacelle will be able to move around the balloon, so that the entire Stratobus™ can be orientated to follow the movements of the sun and thus exploit its rays to the full...

These 3 units will be produced using an ultra-light, very high quality composite material.

Key figures for the Stratobus™ stratospheric drone

- Surveillance and communication
- **20,000 m**: mission altitude (stratosphere)
- **110 m / 35 m**: Length / Diameter
- **60,000 m³**: Volume of carrier gas.
- **6 T / 250 kg**: Total mass / Mass of on-board payload.
- **- 80°**: ambient temperature on stratospheric missions.
- **1 year**: Duration of autonomous mission.
- **5 years**: Total life-span

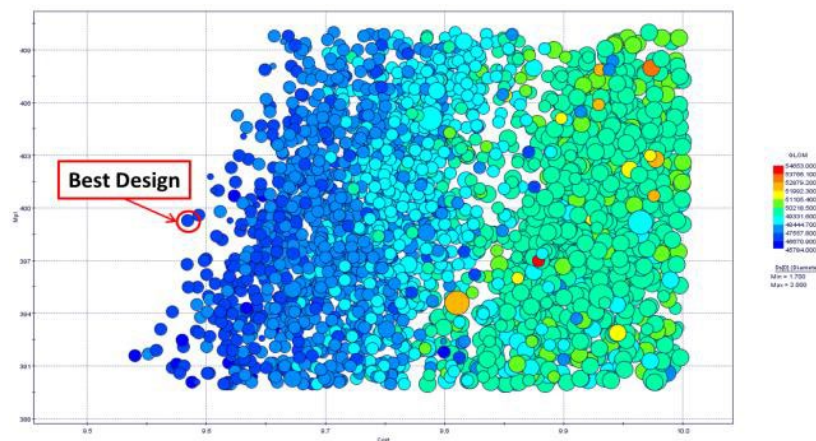
For further information:

- **Latest Stratobus™ video**: <https://www.youtube.com/watch?v=Vj1JnN98FRI>
- **Thales Alenia Space press release dated 17 March 2017**:
<https://www.thalesgroup.com/fr/monde/espace/news/quoi-de-neuf-pour-stratobus>
- **Thales Alenia Space launch press release dated 26 April 2016**:
<https://www.thalesgroup.com/fr/monde/espace/press-release/stratobus-decolle>

Bertin Technologies enhances its ‘HADES’ CAD tool for designing space vehicles

As well as participating in several space launch vehicle projects, Bertin Technologies, a CNIM subsidiary, has been lead contractor since 2005 for the HADES software platform. This allows preliminary designs to be produced for new-generation space transport systems, making use of innovative multidisciplinary optimization techniques.

HADES: design based on multidisciplinary optimization tailored to the space industry



The HADES platform developed by Bertin Technologies is a methodology-based CAD tool for space vehicles, which uses MDO (Multidisciplinary Design Optimization). By taking all disciplines and their interactions into account, the platform optimizes the design processes and provides the client with a highly detailed dataset, which it can use to make the best possible decisions. For the past 10 years, the CNIM Group subsidiary has been using this platform to participate in the modelling of space launch vehicles.

New functionalities to broaden the scope of applications

Thanks to the integration of **new modules** and **new methods**, such as **computation of aerodynamic properties, trajectory, engine design and costs**, Bertin Technologies can now expand its expertise to encompass airborne launcher projects. These technological changes are opening up possibilities for new industrial and civil applications in a variety of fields, such as renewable energy, the car industry, the oil industry, etc.

Roxane, a project in orbit

Miniaturization is revolutionizing the commercial satellite and launch vehicle industry. The Roxane miniature launch vehicle project has been led by Bertin Technologies, supported by the HADES tool, in partnership with the CNES (Centre national d'études spatiales). The CNIM subsidiary has designed a **micro-launcher capable of carrying a 250 kg payload to an altitude of 600 km, at an estimated cost of under 10 million US\$ per launch.**

Project Roxane includes on-the-ground operations at the Kourou space center in French Guiana, preparation of the satellite and associated sales services. Since 2016, Bertin Technologies has been carrying out complementary design studies with a view to commencing sales in 2023-2025.



Roxane photomontage,
Photo credit: Bertin Technologies

Bertin Technologies manipulates weightlessness for the benefit of Thales Alenia Space

Reproducing a weightless environment on the ground, so that optical instruments carried on board satellites can be set and tested prior to use



Bertin Technologies MGSE Zero Gravity equipment,
Photo credit: Bertin Technologies

Bertin Technologies has developed “MGSE Zero Gravity” technology, which can reproduce the weightless conditions experienced by a satellite. MGSE ZG is used during on-the-ground campaigns to set and test optical instruments that will be carried on board observation satellites. Following the successful development of an initial piece of equipment designed in 2014, the company delivered a second unit for Thales Alenia Space in record time, as part of another programme.

These days, the optical instruments carried on board observation satellites have to comply with extremely rigorous demands in terms of precision. To guarantee this level of performance, it is necessary to master the positioning of the optics that comprise it, to within the nearest micron. However, when they are integrated and tested on the ground, these components suffer deformations associated with gravity, which may result in them being incorrectly set. MGSE Zero-G technology places the telescope under the real-life microgravity conditions experienced by the satellite when it is in its orbit.

MGSE Zero-G forms part of the instrument's overall integration and testing configuration. It operates in a vacuum and applies controlled stresses at different points of the instrument's structure, so as to cancel out the deformations created by the earth's gravity. Fitted with servo actuators to manage positions and stresses, this test bed enables the user to fine-tune the stresses to be applied to the instrument's structure.

This operation takes place while the instruments are being assembled, integrated and tested before they are fitted to the satellite. The "MGSE Zero Gravity" technology developed by Bertin is aimed at major lead contractors, such as Thales, Airbus and OHB. Philippe Maquet, project manager at Bertin Technologies comments: "it meets the need for enhanced optical performance on future observation satellites. And it certainly looks set to be used on different applications in future, on other programmes".

ABOUT US

The CNIM Group designs, develops and manufactures turnkey industrial solutions with high technological content and provides expertise, services and operating capability in the areas of the Environment, Energy, Defense and High Technology. CNIM manages projects and sells equipment throughout the world. CNIM is backed by a stable family shareholder base that underpins its future development. The Group employs 2,500 staff and had revenues of €539.9 million in 2016, 54.6% of which was from exports. CNIM is listed on the Euronext Paris stock exchange.

www.cnim.com

BERTIN TECHNOLOGIES, a subsidiary of CNIM Group, relies on its long history of innovation to develop, produce and market innovative systems and equipment worldwide. With close to €96 million in turnover and 700 employees in 2016, 2/3 of whom are engineers and high-level managers, the group works in four major fields: systems and instrumentation, consulting and engineering, information technology, pharmaceuticals and biotech. Based in Paris region, the group is highly active worldwide.

www.bertin-technologies.com

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