

ALPhANOV

Optics & Lasers Technology Center



OPTICAL SOLUTION DEVELOPMENT
FOR OPTO-PYROTECHNICS

METHODOLOGY AND QUALITY

Drawing from its rich heritage in opto-pyrotechnics, ALPhANOV is dedicated to harnessing its diverse technical expertise for your project's benefit. Our capabilities span optical engineering, opto-mechanics, opto-electronics, software development, and HMI, all at your service.



Driven by a skilled and devoted workforce, overseen by a project manager well-versed in opto-pyrotechnic intricacies, our teams collaborate seamlessly to craft, assemble, test, and seamlessly integrate your solution, all in alignment with your program's prescribed timeline.



Training

We are aware that the use of lasers can represent a **technological leap** for your organization. That's why on-site **training** on the developed systems, and more generally on laser safety through our qualified training center PYLA, can be organized to fully support you.

Quality in our DNA

Recognizing the paramount significance of quality and meticulous documentation requisites, ALPhANOV extends bespoke assistance fortified by dedicated project and quality assets.

At your behest, this comprehensive support can encompass a Project Management Plan and a meticulously tailored Quality Management Plan, intricately synchronized with your technical prerequisites and stipulated framework.

From delineating the Justification Dossier to culminating in the ultimate acceptance document, encompassing all pivotal evaluations mandated by your timeline, ALPhANOV steadfastly ensures unwavering, coherent, astute, and rigorous supervision.

Preserved confidentiality assured

In a dynamically shifting geopolitical landscape, we apprehend the imperative necessity of preserving heightened exchange confidentiality and safeguarding your vested interests. Moreover, embracing an unwavering commitment to continuous enhancement, ALPhANOV diligently enhances its level of information system protection.

Our high standards, adaptability, and technological prowess are all poised as formidable assets dedicated to advancing your aspirations.

OUR TEAM



CROSS-DISCIPLINARY EXPERTISE

For your most exacting applications, ALPhANOV's versatile team expedites the increase in your project's Technology Readiness Level (TRL), leveraging the diverse skills imperative for the seamless progression of your endeavor in the realms of lasers, photonics, opto-mechanics, opto-electronics, firmware, and associated software development.



Optical

- Optical design by ray tracing using Zemax®
- Design of free-form optics on dedicated software
- Interfacing and connectorization of optical fibers



Opto-electronics

- Hardware design with fast signal generation
- Signal processing and conditioning, digitization and communication
- Implementation of FPGAs and microcontrollers



HMI/Software

- Embedded VHDL and C/serial communication protocols
- Customized control HMI and monitoring of embedded systems



Lasers

- Control of power laser diodes
- Management at several wavelengths, in various systems
- Integration into the design of safety standards



Opto-mechanics

- Opto-mechanical design using Solidworks
- Automation
- Rapid prototyping, complex integrations and assemblies in a controlled environment



Qualification

- TRL requirement integration from the design phase
- Prequalification through operational testing in climatic chamber and vibration testing
- Reliability analysis
- CE compliance

OPTO-PYROTECHNICS SOLUTIONS

Discover our opto-pyrotechnic solutions, a technology that brings weight savings, compactness and electromagnetic insensitivity to pyrotechnic initiation chains.

Firing devices:

Systems for the safe ignition of one or more opto-pyrotechnic components.

Optical Barriers:

Optical switches (barrier and multi-channel addressing) can be integrated into pyrotechnic firing systems and are compatible with harsh environment applications.

Optical reflectors and power meters:

Portable, lightweight, robust and autonomous peripheral devices for optical line control in laboratory and production environments.

Qualification of power diodes:

Environmental test campaigns for the qualification and testing of opto-electronic and opto-mechanical components dedicated to opto-pyrotechnics (thermal, humidity, vibration).

Development of OGSEs (Optical ground Support Equipment):

Multi-channel equipment, essential for ground validation of laser functions on firing units.



- Laser ignition using a device with an optical switch



FIRING DEVICES

ALPhANOV excels in the design and production of optical ignition systems. This specialized equipment, developed and manufactured at our technology center, is tailored to safely activate opto-pyrotechnic components using multiple cutoff mechanisms.

One such example is the enclosed unit below, a versatile equipment piece capable of transmitting eight distinct firing commands. These commands can be synchronized with external electrical signals, accommodating optional delays, while offering adjustable durations and amplitudes tailored to specific application requirements.

8-channel opto-pyrotechnic firing equipment @940 nm (10 W / channel)



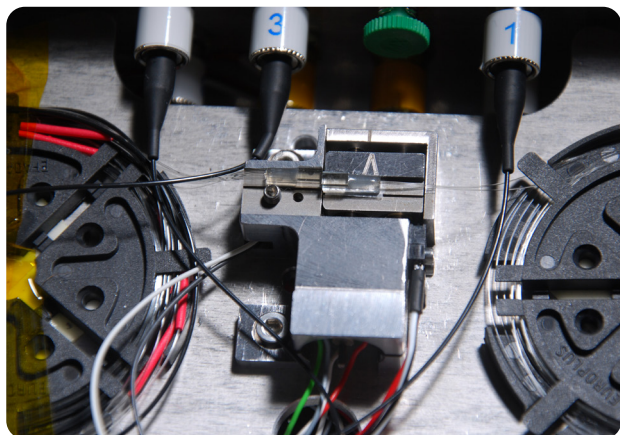
- Independent optical outputs
- Adaptable wavelengths
- Management of very high power (Laser class 4) with consideration of Maximum Permitted Emission (EMP)
- Impulse firing modes
- Reduced optical rise time
- Adjustable delay between electric and laser emission
- Consideration of laser safety (calculation of DNDO – Nominal Ocular Danger Distance)
- Integrated light and electrical barriers

OPTICAL BARRIERS

Tailored to diverse applications and desired maturity levels, ALPhANOV has the capability to engineer optical switches – both barrier and multi-way addressing – catered to your opto-pyrotechnic needs. These switches adhere to the stringent security standard of STANAG 4368.

Featuring a deformable component housing V-grooves for optical fiber arrays, the switch's fiber support facilitates seamless switching, even in in-flight scenarios.

Our optical switches seamlessly integrate into pyrotechnic firing systems, with select systems showcasing successful demonstrations at a noteworthy TRL 7 level.



Optical switch

- **Optical switch** for addressing eight channels from two laser diodes



Secure opto-pyrotechnic firing device

- **Secure opto-pyrotechnic firing device**, integrating an optical barrier, two laser diodes and a control circuit by reflectometry. The electronics are remote.



OPTICAL REFLECTOMETERS AND POWERMETERS

ALPhANOV extends its expertise to assist you in conceiving and fabricating laboratory and production-grade optical line control apparatus. This encompasses optical reflectometers and power meters tailored for your opto-pyrotechnical subsystem.

Our dedicated power meters, designed for your firing mechanism, facilitate connection verification through initiator simulation at the line's terminus. The optical reflectometers provide insight into reflection rates, enabling assessment of the optical cable's initiator condition. These control wavelengths can be customized, and our designs seamlessly adapt to your operational environment.

Deliberately engineered to be lightweight, portable, and robust, these devices offer autonomous operation spanning numerous hours.



Optical power controller

- Validate connectivity
- Accurately ascertain ignition power



Safety Optical Reflectometers

- Indicate the reflection rate of a pyrotechnic component (line integrity)



OGSE DEVELOPMENT

An OGSE (Optical Ground Support Equipment) is a rack-based apparatus crucial for thorough ground validation of laser functionalities within firing units.

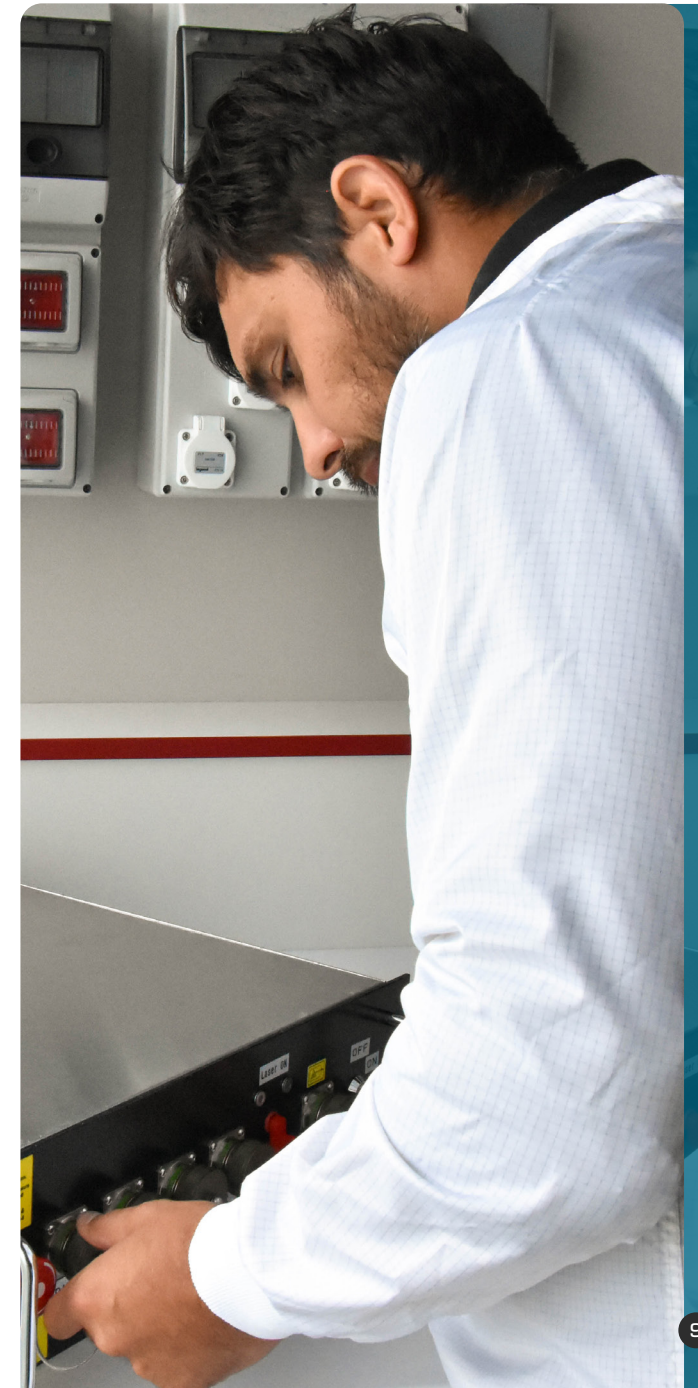
ALPhANOV possesses the capability to engineer multi-channel OGSEs according to specified requirements. These OGSEs serve to analyze signals emitted by laser diodes, measure optical powers or energies, validate proper multi-channel firing fiber-to-fiber operation, and ensure the absence of inadvertent firing.

**32 channels OGSE with
crosstalk >37dB**



Alexandre LOULIER
Sales Engineer

«The design, connectivity, interfaces, along with testing, verification, and calibration procedures, will be tailored to seamlessly integrate with your work environment and optical firing infrastructure.»



POWER DIODES QUALIFICATION

ALPhANOV boasts specialized resources for environmental and mechanical characterization, qualification, and testing of opto-electronic and opto-mechanical components. Notably, our capabilities encompass a vibrating pot and a climatic chamber.

Our engineers frequently conduct environmental test campaigns for the aerospace sector, with a particular focus on laser diodes and control electronics. These facilities facilitate efficient prototyping and proof-of-concept development. Additionally, for projects necessitating expanded environmental resources, ALPhANOV collaborates with French suppliers.

Qualification campaigns

Tailored tests can be set up to meet your project requirements.

We will cite for example:

- X-ray inspections
- High temperature electro-optical measurements (spectrum, optical power vs current curve, voltage-current curve)
- Thermal cycling and endurance in high power operation
- Mechanical vibrations and shocks during high power operation
- Calculation of drift parameters



RELEASEABLE PUBLICATIONS AND REFERENCES



ALPhANOV: An Ariane 6 Project Partner

In 2017, ALPhANOV joined forces as a partner in the prestigious Ariane 6 project, collaborating closely with Airbus CRISA. Our mandate includes co-developing firing units and pioneering the development of innovative OGSEs.

ITP Partnership Program Recognition for ALPhANOV and THALES UK

ALPhANOV and Thales UK were honored through the Franco-British Innovation and Technology Partnership (ITP) program. Their collaborative endeavor, titled «Solid Plastic Optics for Future Low Cost Proximity Fuzing,» was awarded the «Best Collaboration» trophy.



Scientific papers:

- S. Ermeneux, B. Chassagne, G. Pedroza, E. Chalumeau, "Laser initiation: laser sources for initiation", Proc. ITP Conf.
- E. Chalumeau, S. Ermeneux, B. Chassagne, G. Pedroza, R. Clutterbuck, "Laser initiation: optical switch for safety ", Proc. ITP Conf.
- G. Pedroza, E. Chalumeau, S. Ermeneux, J. Dean, H. Lebreton, D. Cazajous, "Opto-Pyrotechnic Detonics – Evaluation Of Laser Diode Reliability Risks Associated With Optical Feedback Within An Optopyro Ignition Line", Proc. ITP Conf.
- G. Pedroza, E. Chalumeau, S. Ermeneux, J. Dean, H. Lebreton, D. Cazajous, "Evaluation of laser diode reliability risks associated with optical feedback within an optopyro ignition line" Proc. Europyro
- G. Pedroza, E. Chalumeau, S. Ermeneux, "Optical feedback effects on laser diodes for optopyro applications", Proc. ISROS



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