



# Research and Innovation Solutions

From product development to manufacturing

**Empowering Trust™**

# TOTAL SOLUTION PARTNER

UL has over 120 years of experience in safety and performance testing. Our experience is used to help clients streamline their product development process so they can launch safe and effective products on time.

UL can help you make data driven materials choices, and accelerate your time to market. Our experts help clients solve their product development challenges through customized materials research and testing.

## ADVANCED KNOWLEDGE SOLUTIONS

Technology moves at an amazingly fast pace, fueled by constant, dynamic innovation. Quickly designing and producing new and improved products is a must for businesses to thrive.

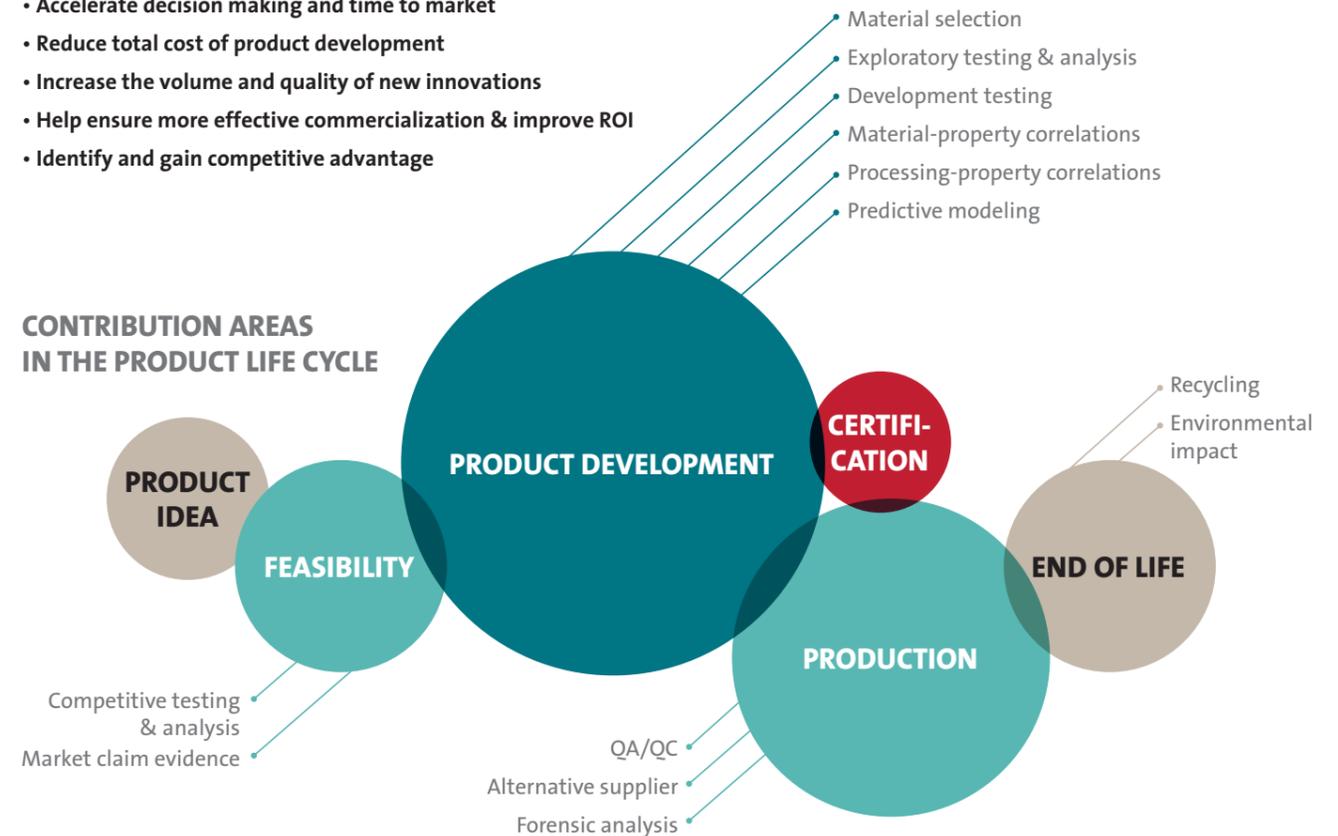
Clients can leverage UL's vast knowledge and research into product safety and performance to enhance the quality, speed and efficiency of the product development process.

Realizing that innovation never stops, UL constantly seeks new techniques, approaches and methodologies to help clients streamline product development from day one.

## UL'S RESEARCH AND INNOVATION SOLUTIONS SUPPORT SUCCESSFUL PRODUCT DEVELOPMENT

As a total solution partner, UL helps you

- Make data driven design decisions
- Improve product safety and performance
- Select optimal materials/formulations
- Access objective third party input
- Extend and enhance capabilities
- Accelerate decision making and time to market
- Reduce total cost of product development
- Increase the volume and quality of new innovations
- Help ensure more effective commercialization & improve ROI
- Identify and gain competitive advantage



## TALK TO US FROM THE START

UL can help you improve product safety and performance through customized material research, analyses and testing to meet your specific product needs.

For more than a century, UL has built up a vast resource of scientific knowledge, engineering skills, as well as testing and standards expertise, which you can harness to:

- **REDUCE RISK OF FAILURE**
- **HELP AVOID RISK OF UNDESIRABLE SURPRISES**
- **EXPAND YOUR CAPABILITIES**

Involving UL from the product conceptualization stage helps your development team understand the intricacies of product requirements so you can achieve compliance early on and make the informed decisions that safeguard launch dates. Benefit from the added value of earlier market access and cost savings, as well as the confidence and comfort that come with a simplified process.

# MODULAR SERVICES TO DELIVER TARGETED RESULTS

*A challenge is always specific.  
A service solution can be, too.  
UL provides modular, mix-and-match services for every step of the product life cycle. You decide when and where you need to boost your knowledge or expand your capabilities. UL supplies the know-how and high-tech tools to assist you.*

## FORENSIC ANALYSIS

Building on extensive experience in materials, components and products, UL can deploy a comprehensive suite of forensic analysis tools and techniques to identify the root causes and understand the mechanisms of various changes or failures in properties and products, and help manufacturers better address safety and performance goals.

## TEST STANDARDIZATION

UL has been developing national, international, and company-specific safety standards for 120 years. They are designed to make products safer and maintain performance level. UL's knowledge can also provide a basis for making data driven product development decisions, such as in the areas of materials.

## TEST DEVELOPMENT

UL has an extensive history of developing specialized tests when conventional testing cannot provide the insight required. Our engineers collaborate with clients to develop new tests or modify existing ones.

## EXPERIMENT DESIGN

Our experts aim to design the best test plan to deliver the necessary data for reaching the project goal. Our solutions cover simple testing as well as complex multi-level Design of Experiments (DOE), and Multi-Variate Analysis (MVA) test plans.

## TESTING

Through its extensive network of global testing laboratories, UL has a broad range of capabilities ranging from material characterization and performance property assessment to product-level performance testing. UL also conducts system-level tests to better understand the influence of a given product on overall system performance.

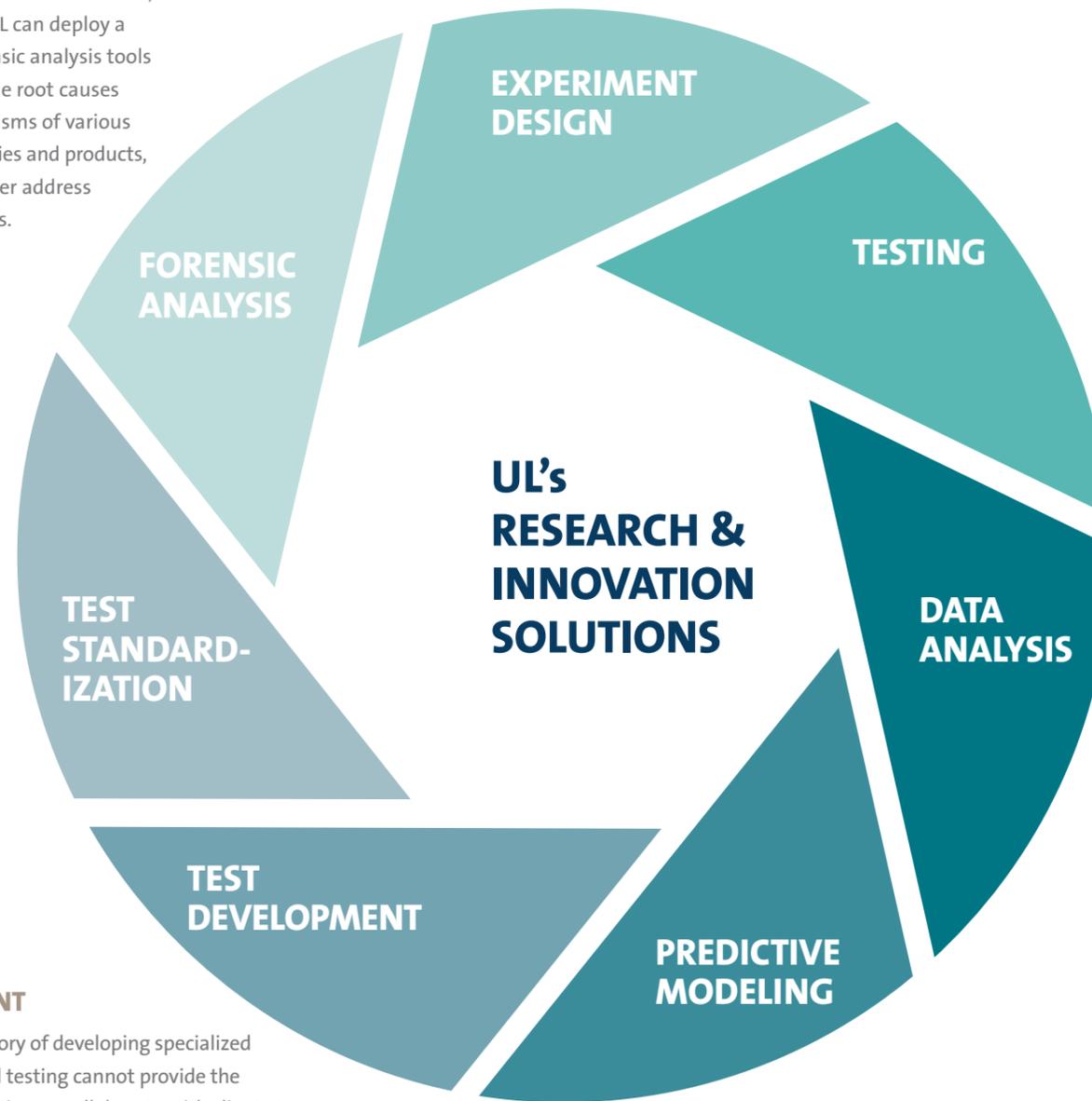
## DATA ANALYSIS

Beyond the interpretation of results, UL can provide complex statistical analyses identifying influential factors and variation sources. Over the years, a vast database of test results has developed into a valuable knowledge resource.

## PREDICTIVE MODELING

## PREDICTIVE MODELING

UL engineers have a unique understanding of how formulations influence component performance, and how those components contribute to end product performance. This knowledge helps create predictive models that accelerate product development and increase confidence in the product development process.



# SELECTING THE RIGHT MATERIALS FROM THE START

*A material might be excellent for one application, but not produce the desired results in another. With the UL iQ™ family of databases and the Prospector® database, UL maintains comprehensive sources of material properties which serve as excellent starting points for selecting the right materials.*

*Our experts can help you choose the right materials early in the design process, based on your performance needs and your target markets' safety requirements.*

## CASE STUDY



### FROM WOOD TO PLASTIC PALLETS

A pallet manufacturer wanted to replace wood with plastic, but did not have in-house plastics expertise or testing capabilities. UL investigated six materials, ranking them for their mechanical, thermal and flammability properties according to their application needs. The client confidently selected a material that later passed certification testing.

## UL iQ™ DATABASES

The UL iQ™ family of free databases is a suite of relational databases that allow users to search for UL Certified Components and review relevant safety certification and material performance data. UL iQ™ is used by thousands of designers, engineers, and suppliers every day. [iq.ul.com](http://iq.ul.com)

## PROSPECTOR® DATABASE

UL's Prospector® is the premier database for manufacturers to quickly find the precise materials they need. Bringing together thousands of suppliers, Prospector offers an online service to sort and search materials by properties, applications, safety data, performance characteristics and more. [ULProspector.com](http://ULProspector.com)

# MATERIAL FORMULATION FOR TARGETED MARKET ENTRY AND FUTURE OPPORTUNITIES

*Small formulation changes can drastically influence performance characteristics and material properties. UL can carry out testing on different formulations and analyze the results to generate fact-based predictive capabilities. The findings help manufacturers choose formulations that take both performance and safety certification into account.*

## CASE STUDY



### RESIN PROPERTY PREDICTION

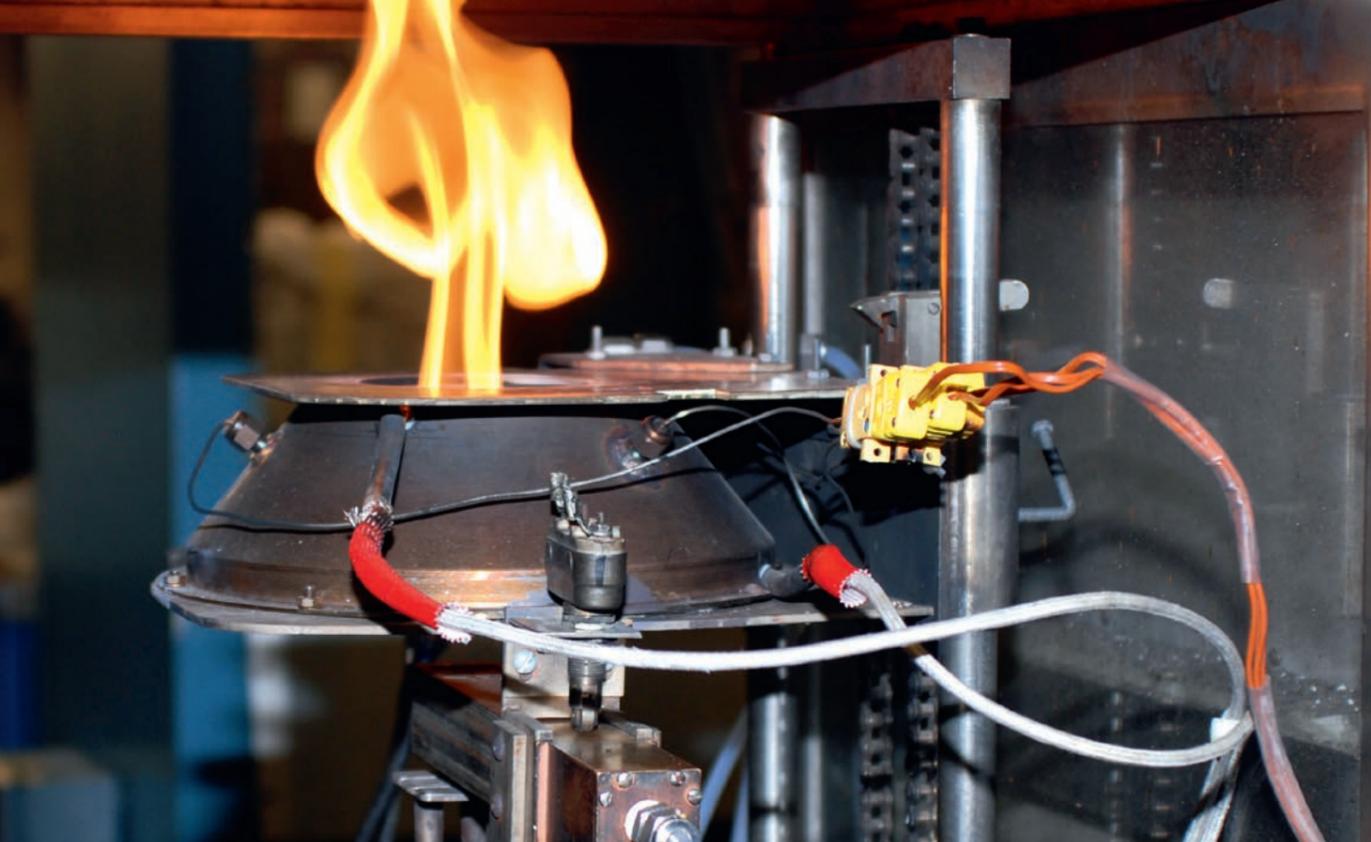
A resin manufacturer wanted to develop predictive capabilities to quickly tailor formulations in response to new market opportunities, and thus secure future growth. UL helped the manufacturer design a multi-variate analysis program for investigating the influence of key formula ingredients on mechanical, electrical, flammability and aging properties.

## CASE STUDY



### WOOD-PLASTIC COMPOSITE FORMULATION

A WPC board manufacturer wanted to enter a new market (California), and didn't have the testing capabilities to determine a formulation that would meet the requirements while retaining critical performance properties. UL developed a multi-level, multi-variate analysis approach to identify key ingredients, investigate fire retardant strategies and develop correlations to guide formulation. The client now successfully sells in the California market.



## REDUCING DEVELOPMENT COSTS

*Starting a development project on the basis of robust data and solid research helps take the guesswork out of materials selection. UL has a wealth of collected knowledge on how materials and formulations affect component and end-product performance. UL can, therefore, offer predictive modeling services – powerful forecasts that help avoid costly delays which often mean a return to stage one.*

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### CASE STUDY

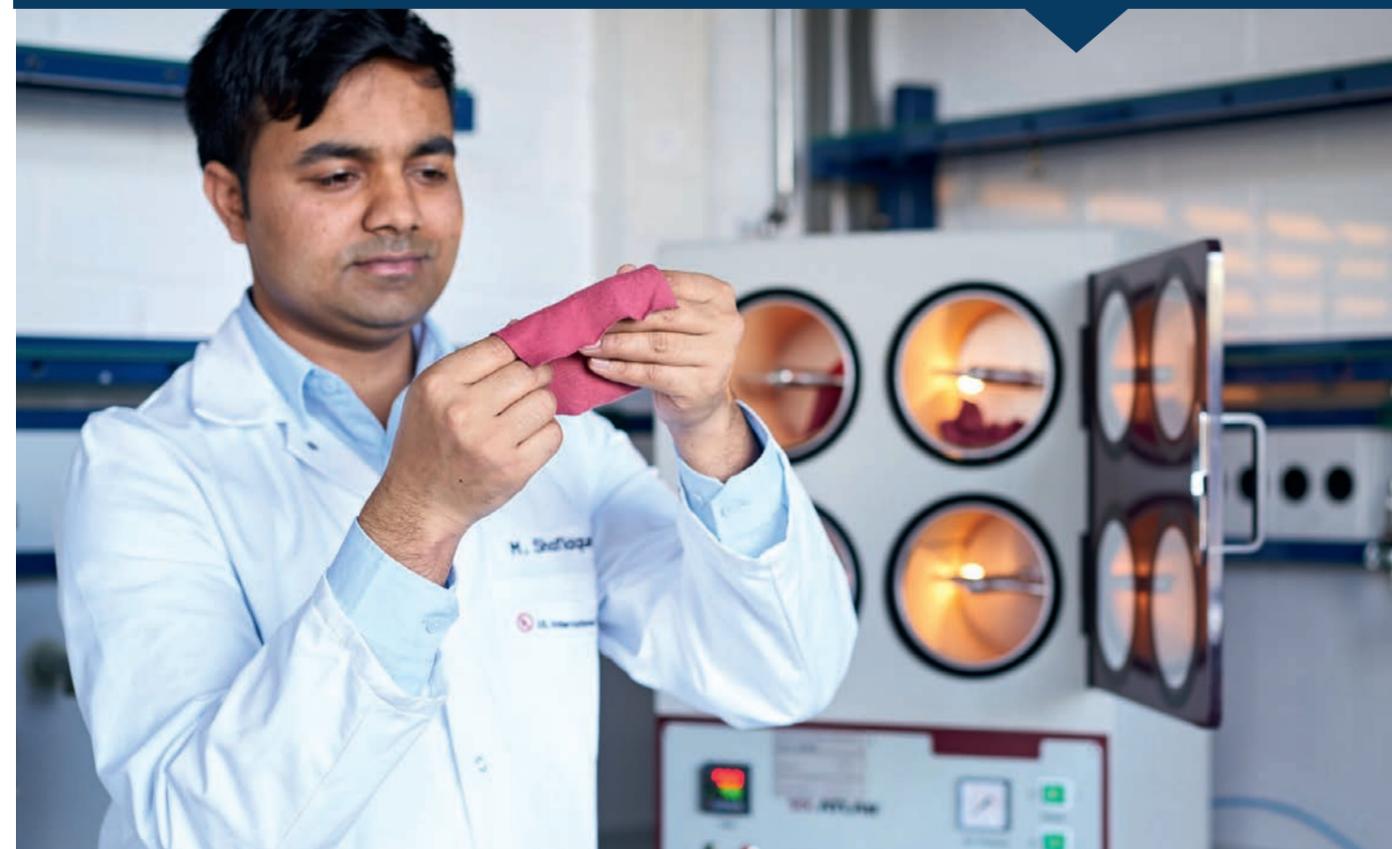
#### CUSTOMIZED FIRE TESTS

A cable manufacturer needed to develop a plenum cable jacket compound that would meet strict fire codes, but the costs of manufacturing cables for full-scale product development tests were too high. UL helped the client create a bench-scale test to predict the likelihood of passing a full-scale fire test. The client continues to use the bench test to successfully develop new compounds.

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## ACCELERATING TIME TO MARKET

*In addition to knowing how materials affect performance, time can be saved by having the right tests in place. Perfecting your internal testing means less repetition of trials and greater predictive power when forecasting actual product performance. In short, accuracy in testing means fewer trials, better predictions and the reduction of product failures and re-development.*



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### CASE STUDY

#### TEST DEVELOPMENT AND STANDARDIZATION

The product performance test results obtained by a textile manufacturer's lab were repeatedly contradicted by the more reliable results it obtained through field testing. UL used its 100+ years of test-method and standards development to help this customer create original bench-scale testing that more accurately predicted field-test results and end performance. In addition, the new tests were used to streamline product development, as well as to demonstrate competitive advantage.

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# MITIGATING SUPPLY CHAIN DISRUPTIONS TO KEEP YOUR PRODUCTION RUNNING

*UL can help you develop and execute a mitigation plan to address supply chain disruptions and identify reliable, approved suppliers – or take measures to certify a new supplier. Furthermore, our experts can help you find alternative formulations that utilize different materials or relative quantities while still adhering to performance targets. It's an effective approach that compensates for supply chain fluctuations and thereby minimizes production delays.*

## CASE STUDY



### RESIN FORMULATION FLEXIBILITY AND MULTIPLE SUPPLIERS

While helping a resin manufacturer investigate formulas, it became clear that formula flexibility and multiple suppliers needed to be built into the production scheme. UL's knowledge of how specific ingredients affect performance coupled with an extensive network of reliable suppliers aided the manufacturer in generating formulation practices capable of mitigating disruptions within the supply chain. The client now enjoys steady production with increased sourcing options.

# FORENSIC ANALYSIS

*Building on extensive experience in system-level testing, UL's comprehensive suite of forensic analysis tools and techniques help to better identify and understand the root causes of product and prototype failures, enabling manufacturers, integrators and end users to address the issues, improve safety and reduce the chance of future events.*



## CASE STUDY

### INVESTIGATING BATTERY FAILURES

A government agency was investigating a battery fire in a safety critical application. UL provided extensive Li-ion battery knowledge, testing, forensics and standards certification expertise. Our experts identified the root causes of the failures resulting in 23 safety recommendations. The agency successfully concluded their field failure investigation.



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