Happen

2017

THINK LUXEMBOURG

Business not only in space

LUXEMBOURG
LET'S MAKE IT HAPPEN

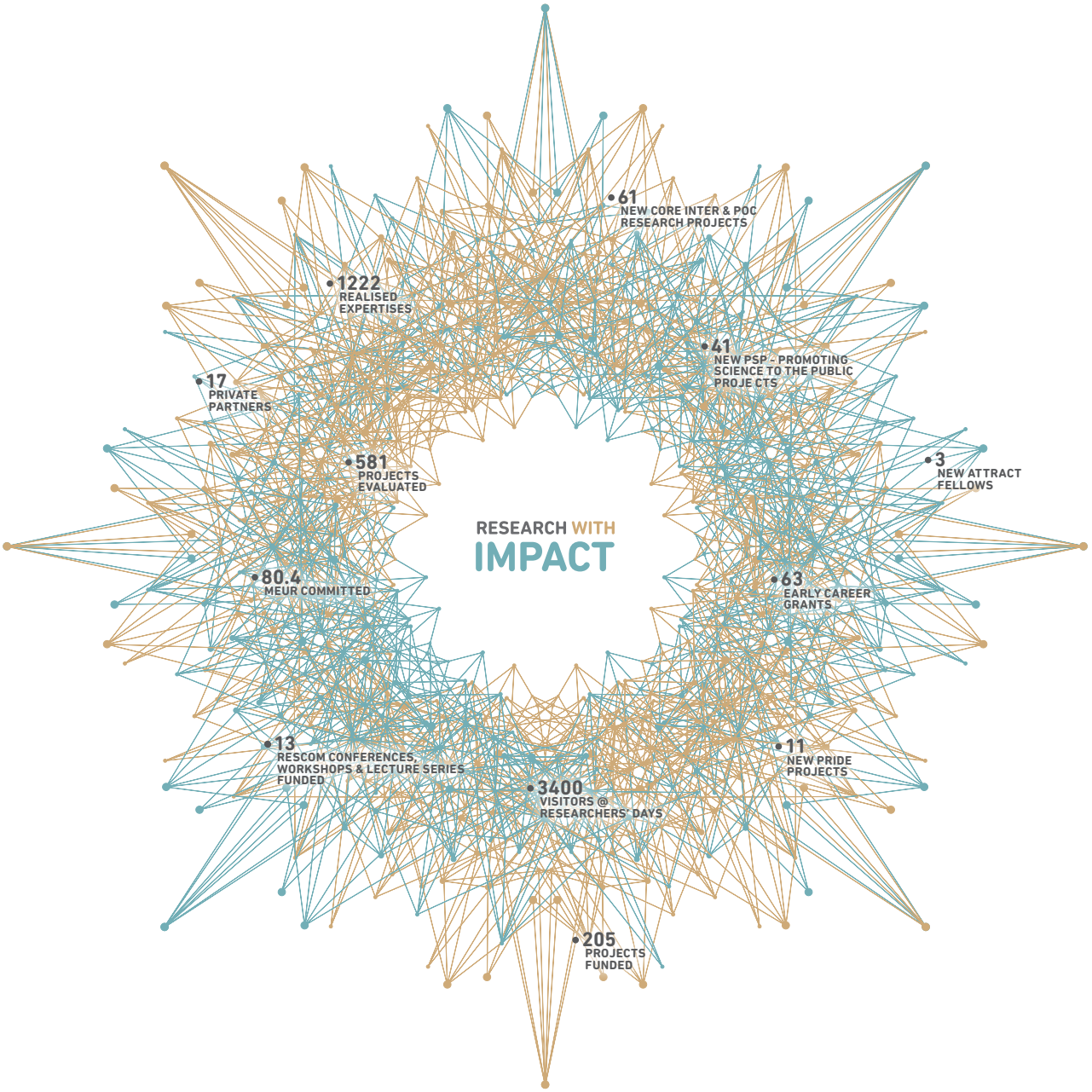
Strategy
Third industrial revolution

Digital Luxembourg
Innovation testbed

Start-ups
An upward trend

FNR.lu

The FNR is the main funder of research activities in Luxembourg. We invest public funds and private donations into research projects in various branches of science and the humanities, with an emphasis on selected core strategic areas. Furthermore, we support and coordinate activities to strengthen the link between science and society and to raise awareness for research. We aim to establish Luxembourg as a leading knowledge-based society through science, research and innovation.



Key figures:
FNR Annual Report 2016

Luxembourg National Research Fund

LUXEMBOURG'S values

Openness, Dynamism, Reliability

Three words and three values that sum up the country and are cherished by the population and stakeholders in Luxembourg.

Openness. Openness to the outside world is a key element of the Luxembourg model of society. Luxembourg has always fought for a united open Europe, one characterised by tolerance and solidarity. Development cooperation is one of the pillars of its foreign policy. As a cosmopolitan crossroads at the centre of Europe, Luxembourg is a real melting-pot of nationalities, cultures and languages. Therein also lies openness to new projects and partnerships.

Dynamism. Luxembourg has reinvented itself a number of times in our history. First a farming country, then an industrial power, now we have managed to develop a service-sector economy. Innovation is taking place at an exciting rate in the areas of research, digital technologies, space industries, and more. This same dynamism can be seen in our creative industries and social initiatives and around the concept of circular economy. Luxembourg is constantly creating new jobs and attracting talent and investment from all over the world.

Reliability. Luxembourg is an economically and politically stable country, offering a serene environment, a place where people enjoy living. We cherish our traditions, cultivate consensus, and favour sustainable solutions. The quality of our country's public infrastructure also reflects this concern. The solid legal framework and the health and social security system are key features of the reliable environment Luxembourg offers.

Your health, wherever you are

myLAB® is more than just a results server. It's a scalable interface allowing medical labs, health professionals and patients to communicate with each other. It allows them to:

- make appointments to have a blood sample taken, for themselves or for a close relative (a child or and elderly person), whether at home, at work or at an address of their choice
- to locate the closest open centres for having a blood sample taken
- to view 24/7 their current and past test results
- to locate a doctor, either by discipline or healthcare institution.

myLAB
a solution developed by BioneXt Lab

Google Play l'App Store

www.bionext.lu

Happen

THINK LUXEMBOURG

Impressum

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WHAT happened in LUXEMBOURG?

Whether it's a start-up disrupting the traditional tourism industry or an artist reinventing a small town into an urban art museum, here's a look at some of Luxembourg's latest innovative developments.

New science centre On 5 October 2017, the Luxembourg Science Center opened its doors in Differdange. The permanent space contains 50+ experimental stations for kids and adults alike, including one of the world's largest Tesla coils of its kind.

START-UP

itravel to Luxembourg

Operating on a purely digital tourism platform, itravel is one of two start-ups **presented €500,000 by the Luxembourg Digital Tech Fund in July 2017**.

It allows users to bypass intermediaries to configure their own travel experiences, with some 5,000 options ranging in everything from shopping to culinary in 64+ destinations.

CEO & Founder Axel Schmiegelow believes it's a radical change which ultimately gives customers more value not just on flights and hotels, but on experiences--the heart of itravel's mission.

Schmiegelow recently made a discovery of his own which led to the company's selection of Luxembourg for itravel's headquarters: "Something we had not initially anticipated was the drive, focus and coherent policy the entire country seems to have, from banks to the government allocating resources, making tech companies feel welcome," he says. "All that represents such a clear commitment to venture and tech start-ups."

itravel plans on **creating 75 jobs within three years in Luxembourg**, and the multilingual workforce will certainly add to the website's content and company's overall mission. "Our claim is for those special moments you carry in your heart. Whether you meet an elephant or see an amazing landscape, you should have a once-in-a-lifetime experience." X

www.itravel.de

Photograph from www.itravel.de

WHO SAID WHAT?

"Luxembourg is progressively transforming into a 'digital-by-default' country."

Xavier Bettel
Luxembourg Prime Minister

"This small Grand Duchy at the heart of Europe is so much larger in space than on Earth."

Étienne Schneider
Luxembourg Deputy Prime Minister & Minister of the Economy

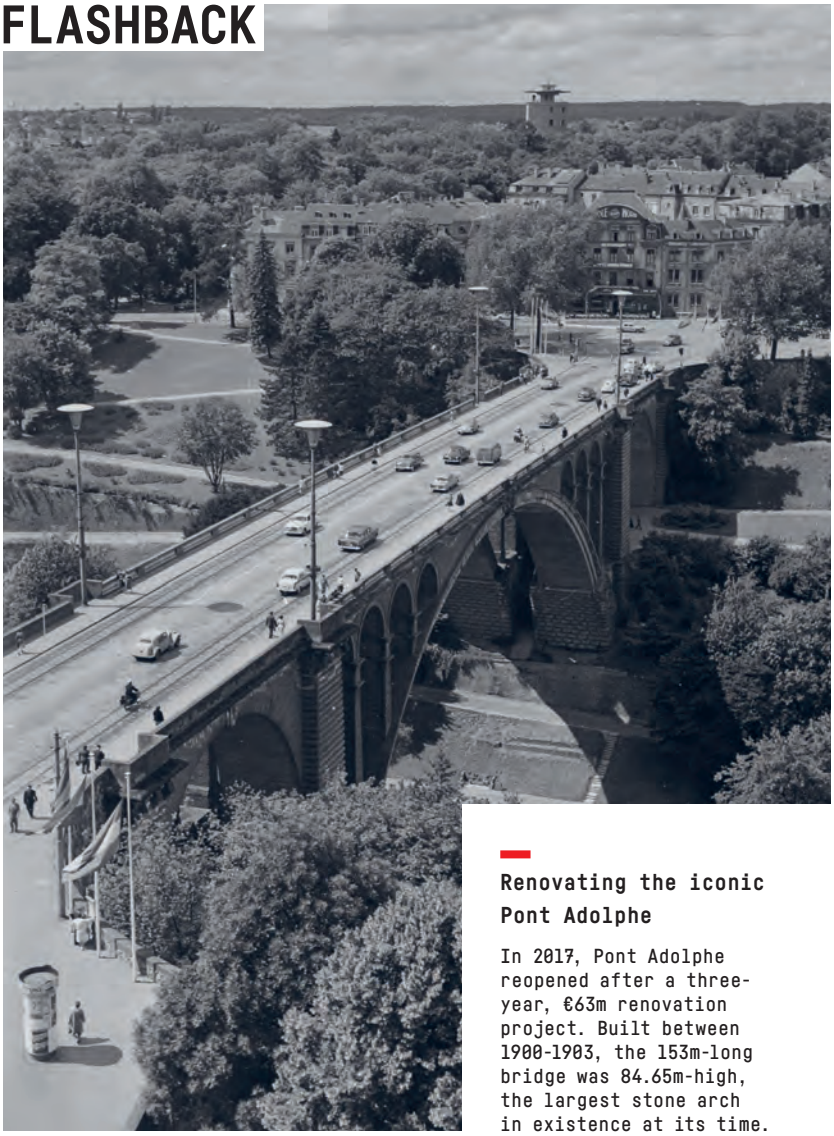
"Luxembourg offers an environment of focused growth, supported by government-led initiatives, in a diverse environment, due to the multitude of cultures and nationalities present in the country."

Carlos Cipollitti
*VP, EMEA Product Development & General Director, GIC*L, Goodyear*

WHO IS SHE?

Nicki Crush has been International School of Luxembourg (ISL) Director since 2015; for 20 years prior, she was Upper School Principal. Over that time, the school has grown from a few hundred to 1,377 students today. ISL is truly international (50+ nationalities) with what Crush calls a "rigorous academic programme". In 2017 the school recorded a 96% pass rate for its international baccalaureate students--far exceeding the world average of 78%. The school focuses on inquiry-based learning, introduced design technology as a programme a few years ago and is also expanding its language offerings.

FLASHBACK

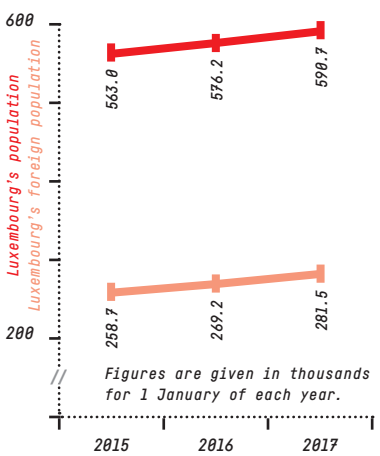


Renovating the iconic Pont Adolphe

In 2017, Pont Adolphe reopened after a three-year, €63m renovation project. Built between 1900-1903, the 153m-long bridge was 84.65m-high, the largest stone arch in existence at its time.

Illustration by Maison Moderne > Photograph by Edouard Kutter

Luxembourg's population reached nearly 600,000 residents at the start of 2017. Growth tends to be driven by the favourable economic climate and migration. The steady increase is evident in the country's foreign population as well, which grew from 45.9% of total population in 2015 to 47.7% in 2017. Eurostat forecasts Luxembourg's total population to reach 1m by 2062.



Source: Statec

CULTURE

Photograph by Mike Zenari

Make Koler Kooler

Kahler (in Luxembourgish "Koler") is a village with some 250 residents in Luxembourg which may have remained forever unknown if not for Alain Welter, illustrator and muralist, who, after finishing his studies in illustration design in Berlin, initiated a project in 2017 to pimp his village.

The project "Make Koler Kooler" is gaining notoriety in this one-horse town and turns it into a unique, vibrant masterpiece--a perfect example of the sort of innovative spark happening in Luxembourg while also serving as a calling card for Welter.

Welter's concept is simple: to bring life and colour to his hometown, turning it into a free, accessible canvas for his art through painted house facades, barns and bridges.

"The town was behind me from the start," he says. "I discussed my project with the Mayor, and he liked the idea. Of the 16 people whom I asked [to] paint their buildings, only two declined." He received support from the commune of Garnich (which includes Kahler), local business Gérard Couleurs (a paint store), and funding from l'Œuvre Nationale de Secours Grande-Duchesse Charlotte.

Welter enlisted his retired father to assist, e.g., with the construction of a Hollywood-style town sign dominating a cow pasture, making this project a true community effort.

Before Welter painted on a wall, he proposed a sketch to the building owner for approval. The art is terrifically suited to the buildings, and the result is a charming mix of old and new, creating quite a buzz. X

"The town was behind me from the start"

www.makekolerkooler.com
www.alainwelter.com

DID YOU KNOW?

3.5 million

The new record number of passengers the Luxembourg airport expects for 2017.

3

The number of international schools set to open in Luxembourg in September 2018, offering students the European baccalaureate, free of charge.

3

The number of Luxembourg productions or co-productions selected for the 2017 Toronto International Film Festival [including Govinda Van Maele's *Gutland*, and co-productions *The Breadwinner* and *Mary Shelley*].

Étienne Schneider

MISTER Space Business

At first they laughed. But not for long. Luxembourg's space business is no joke, already attracting the interest of over 60 companies. Luxembourg's Minister of the Economy has helped to diversify Luxembourg's economy and seeks to play a leading role in the extraterrestrial supply chain.

Text by Mary Carey > Photographs & Illustrations by Maison Moderne

Digest:

On a visit to California in 2012, Luxembourg's Minister of the Economy, Étienne Schneider, met Dr Simon Worden, then Director of NASA's Ames Research Center. They spoke about space resources and space mining. Originally sceptical, Schneider realised the opportunity in space resources and the surrounding business. In March 2015 Schneider organised a conference in Luxembourg which was a success and convinced him to develop space business in Luxembourg. The first challenge was the need for a legal framework. The government developed the SpaceResources.lu initiative. Mining resources and space travel are not Luxembourg's first involvement in space. In 1985, a public-private partnership effort launched Société Européenne des Satellites, today known as global satellite operator SES. Luxembourg's proactive approach has made it home to an increasing number of companies developing products and systems in the space and ground segments, and delivering services and downstream applications. Among them are recently established start-ups from the space mining industry that have set up European operations in Luxembourg with the support of the government. X

WHO IS HE?

Name
Étienne Schneider

Born
January 29, 1971

1997
Project leader with NATO, Brussels

2012
Minister of the Economy and Foreign Trade

2013
Deputy Prime Minister, Minister of the Economy

Étienne Schneider is a Luxembourg politician and economist of the Luxembourg socialist workers' party [LSAP]. In 1997, he worked in Brussels as a project leader with NATO. Schneider was appointed Minister of the Economy and Foreign Trade on February 1, 2012. In this capacity, he also co-chaired the Superior Committee for Research and Innovation. In the government formed following the 2013 Luxembourg general election he is Deputy Prime Minister and Minister of the Economy, Minister of Internal Security, Minister of Defence.

From perceived crazy scheme to 'no one is laughing anymore' smart economic strategy, Luxembourg is positioning itself as the European central hub for space business, in particular space mining. How did this happen so fast?

Étienne Schneider: When I became Minister in 2012, one of my first trade missions outside of Luxembourg was to California. There I met Dr Simon 'Pete' Worden who was then Director of NASA's Ames Research Center and who is now one of my advisors. He was talking to me about space resources and space mining. At that time it sounded like complete science fiction to me, but as I became more and more interested in what he was telling me I realised the potential.

Dr Worden put me in touch with different people who were already active in this business, start-ups, etc., so I participated in several conferences. In March 2015, I organised a conference back in Luxembourg which was a big success. People came from all over the world to discuss space resource initiatives and to talk about all of the opportunities that we have up in space. Seeing this interest, I decided that we should go for it.

Where did you start?

After all the discussions we had, I realised that the most important element for the development of these activities would be the legal framework. Money is important too, but most of the start-ups I saw had no real problems with money but they did have problems (or would eventually have) with the lack of a legal framework. They did not have the assurance that whatever they might find in space could be commercially used. To put it into context, the Outer Space Treaty of 1967 says that celestial bodies are not subject to national appropriation, but the status of the resources you might find there is not clearly described.

At that time I also got into a discussion with an American congressman who discussed with me that they were planning on creating a new space agency. We decided to do that as well but with a focus on space business rather than exploration. >

WHERE TOMORROW BEGINS

Some dream.
Some discover.
Some change the world for the better.

We connect it all.

At LIST, we build the bridges that connect the world of academia with the real change that's happening in the market. It's research and innovation made in Luxembourg. And it's at your service.

LIST.lu

LUXEMBOURG
INSTITUTE OF SCIENCE
AND TECHNOLOGY

LIST

When did you realise that the idea was starting to develop a momentum with vast potential economic benefits?

When we launched our space resources initiative in February 2016, I was thrilled to see the reaction. Even though at the beginning people said "He has gone completely mad," there was a lot of attention. And the very fact that all the American and international newspapers, magazines and TV channels, etc., wanted to have interviews showed me that there was some kind of acceptance.

There was a lot of attention, including a Richard Quest interview on CNN.

Following all the press attention, we then got the reaction of all these companies that started knocking on our door wanting to settle in Luxembourg. Now we have more than 60 companies and international research institutes that want to know more details about what we are doing and also want to do some kind of activities from Luxembourg. This really showed me and others in Luxembourg that the interest is really there, and that this was a serious initiative.

To put it into perspective, when we started to develop the logistics strategy here ten years ago that was easier for people to understand. They said, "Okay, you are located in the heart of Europe, this makes sense", but then it still took six years to get it started with just the buildings, and it took nearly ten to have all of these activities running, and it took €1bn of investment by the government.

Luxembourg devotes **0.03% of its GDP to the European Space Agency (ESA)**, and ranks fourth among European countries in terms of space investment.

Your critics will complain about your space spending, will they not?

With our space initiatives up until now we have spent less than €15m, including but not limited to the public capital investment in one major US company. So, even without spending huge amounts of money, the interest is enormous as evidenced by all of these companies who are coming to us and all of these research institutes who want to collaborate with our institutions, such as the University of Luxembourg and the SnT [Interdisciplinary Centre for Security, Reliability and Trust] and the Luxembourg Institute of Science and Technology [LIST]. >

“With our space initiatives up until now we have only spent about €15m”

It was quite a bold move, especially as people were sceptical at first. It could have been political hara-kiri.

Politically, this is quite a risky thing I am doing. When I launched this I thought that it would take ages in order to have a positive effect or to show results. But in actual fact, it only took a couple of months. Because all of these companies are there. Some have settled down already, and others are in the loop, ready to come and install themselves here, which is obviously good for our economy in terms of revenue but also diversification and technological progress.

I am really interested in all of this, and in the end it is a logical move for humanity. Humankind has always tried to find new frontiers and to grow past them. In this day and age we know every single square metre of our world on Earth. Why should humanity decide to stay on this one planet, especially when we have the opportunity to go somewhere else?

What is behind the SpaceResources.lu initiative?

Of course, the long-term view of this initiative, as with any economic development, is to earn money with it and to ensure that our economy will be successful in the future as well.

We are all aware of the eventual scarcity of certain resources on Earth. The SpaceResources.lu initiative provides the legal, regulatory and business environment that will allow private investors and companies to explore and utilise the resources in space.

At the same time, Luxembourg was looking for ways to diversify its economy and explore new sectoral avenues. So space resources is a good fit for Luxembourg, a country that has had to reinvent itself over and over again for most of its existence. For example, when the steel industry collapsed in the 1970s, that was when you first saw the real rise of the finance industry here. We had to invent something new. At that time, we had only a small number of banks, and few people believed that we would become a financial centre. Then in 1990, we started to really succeed in the fund industry, and look where we are now. Luxembourg is the second largest investment fund centre >

WHO ARE THEY?

KLEOS SPACE

Founded
2017 (100% owned by UK-based Magna Parva Limited)

Director
Andrew Bowyer, Co-founder/Director at Magna Parva + Kleos Space

Website
www.kleos.space

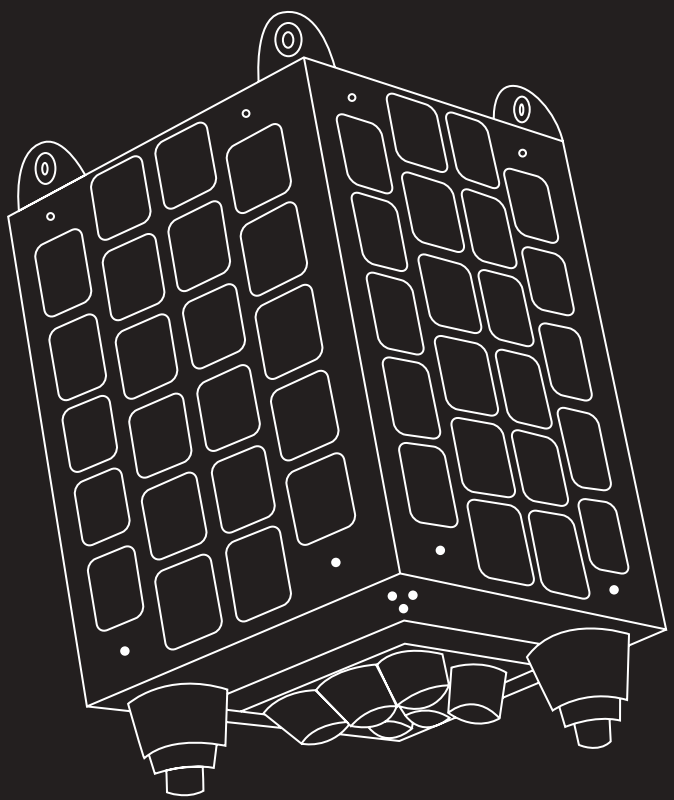
Headquarters
Technoport, Esch-sur-Alzette, Luxembourg

Kleos Space started with five employees. By 2022, the company intends to employ up to 60 people in Luxembourg. Director Andy Bowyer says: “We are extremely proud to be located in Luxembourg. The country has a rich heritage in satellite operations and data sales, alongside a space resources initiative showing true thought leadership with a global impact.” The government and Kleos Space have signed an MoU setting out their cooperation for space technology development within the *SpaceResources.lu* initiative. The company’s mission is to launch a single LEO (Low Earth Orbit) small satellite to collect global signals intelligence (SIGINT), geolocating target RF (Radio Frequency) transmissions to within ≈100m daily, to sell these data as a service (DaaS) to government and commercial intelligence users and to expand their offer to near real-time SIGINT collection by launching further satellites into a constellation formation.

WHAT'S THEIR ROLE?

Kleos data will be provided to users for whom information, intelligence, surveillance and reconnaissance (ISR) superiority is absolutely essential for success in dealing with increasingly complex threats and emergencies, driving the need for quality geospatial intelligence and signals intelligence. This is not a nice-to-have, but a must-have capability. The mission is enabled by patented, proprietary In-Space Manufacturing technology, a miniature machine that manufactures enormous composite booms used to deploy antennas. The phase difference over multiple antennas separated by these large fixed distances enables them to accurately locate the source of the radio signal.

WHAT DO THEY MAKE?



Within the framework of the signed MoU, and in collaboration with EmTroniX, a Luxembourg-based company specialised in electronics development, and the Luxembourg Institute of Science and Technology (LIST), Kleos Space will deliver a mission and data potential ground demonstration in Q2 2018. Following the ground demonstration, Kleos Space will move into flight hardware & launch procurement, with the first satellite becoming operational by Q4 2019.

in the world after the US and the premier private banking centre in the Eurozone. It was the same when we launched our SES initiative.

Can you give us some background?

In 1985, a public-private partnership effort launched the Société Européenne des Satellites, today known as global satellite operator SES. SES operates a network of satellites that delivers TV and radio, internet connections, data and voice to homes and workplaces around the world.

I was recently reading the discussions from the 1980s when we first launched that initiative. At that time, we had to go to parliament in order to give a guarantee because no insurance company would underwrite this strategy, meaning that the government had to do it to the tune of 5% of their total budget. Now that was a huge risk. The plan was for SES to launch the Astra satellite network. At that time people were asking, "Why do we need satellite TV? We have TV. We have our antennas on the roof." Some people even said that the plan was dangerous because the satellites would fall down from space, damaging Earth and putting people at risk.

And the result?

The government launched it with enormous success. Today SES is the biggest satellite operator in the world. Right now space business counts for 1.8% of GDP. This is the biggest percentage of space business to GDP for any country in the EU. Perhaps it sounds like nothing but actually this is huge. That is €1bn every year. >

SES

For more than 30 years, Luxembourg has been at the forefront of commercial and cooperative developments to promote the use of space in practical and progressive ways. SES (Société Européenne des Satellites) is the world-leading satellite operator, operating a network of satellites in geostationary and medium Earth orbits that deliver a staggering 7,538 digital TV channels to over 325 million homes as well as internet connections, data and voice to homes and workplaces around the world. They are the first to deliver a differentiated and scalable GEO-MEO offering worldwide, with more than 50 satellites in Geostationary Earth Orbit (GEO) and 12 in Medium Earth Orbit (MEO).

"I want Luxembourg to become a hub for space-related research and business"

What is the ultimate goal for Luxembourg?

The long-term [goal], of course, is to earn money, to assure that people will have good jobs, and to develop research activity. I want Luxembourg to become a hub for space-related research and business. This is why we call it space 'resources', because it is everything that you can do with space.

Isn't space business a huge upfront investment with a long waiting period for return?

There are different business models and this is important. Short, medium and long-term.

There is what is already happening right now, such as with Earth observation. We have companies like Telespazio, a Franco-Italian joint venture in satellite solutions and services that is selling services to farmers. They can advise them where to put their fertiliser, or they sell satellite images to wineries and tell them whether the grapes can be harvested or not. Another short-term business model is in disaster relief, so important in recent years. These are services that already exist. Then you also have satellite GPS [Global Positioning System] and telecommunications. These are commercial activities where Luxembourg already plays a big role.

See illustration on page 030

We then also look at the medium term. What can we improve now? One example is the challenge of how to improve certain elements of space resources such as the life span of a satellite or the time that you can use it. Currently, you can send up a satellite into space with, let's say, fuel to survive for five to ten years. The average lifespan of the satellites is actually decreasing year to year because of the build-up of space debris. The satellites end up needing more fuel because they have to reposition themselves to avoid collision with debris. This means they move more and burn more fuel. And the more space debris, the bigger the problem. If there is no fuel left you have to give up that satellite and get a new one. So what can a satellite company do to improve this?

Are we talking about gas stations in space? Or charging stations?

Yes *[laughs]*. Even if they suffer from a lack of maturity, the technologies already exists to >

WHO ARE THEY?

EmTroniX

Founded
2001

CEO
Cédric Lorant

Website
www.emtronix.lu

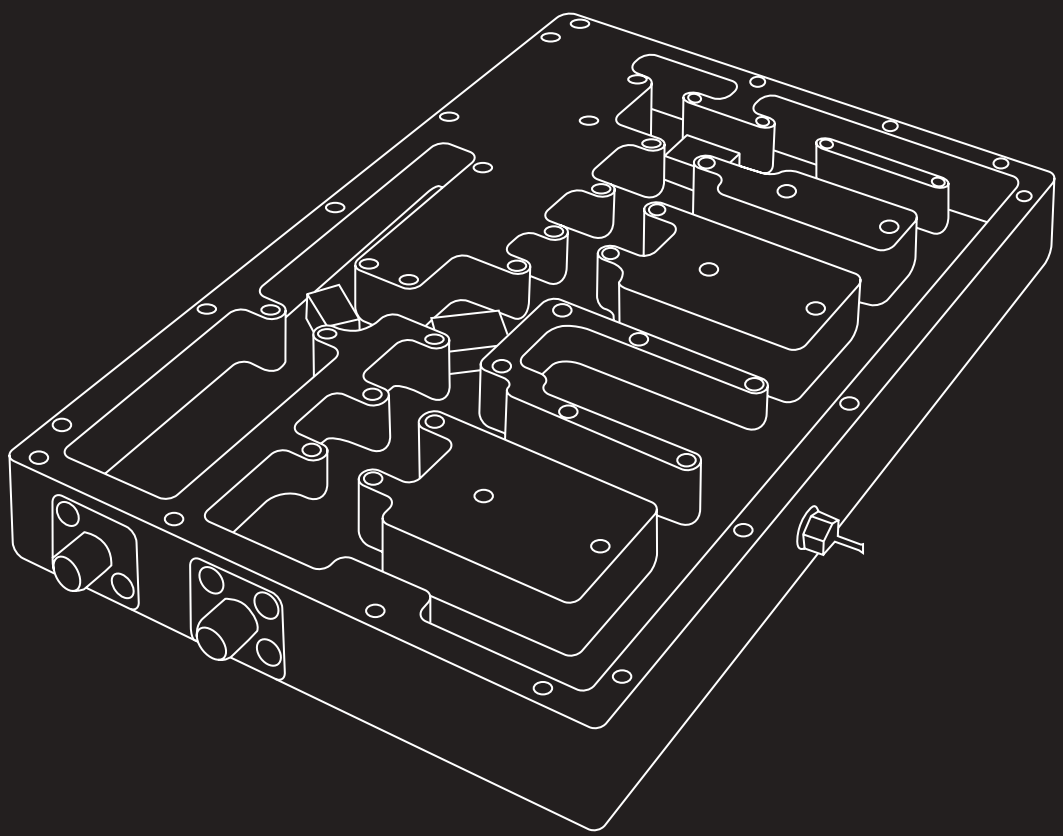
Headquarters
Sanem, Luxembourg

EmTroniX was created in 2001 by engineers with a passion for electronics and software. In the first years the company mainly worked on automotive electronics, moving rapidly into the military, aeronautics and space industry after Luxembourg became a member of the European Space Agency in 2005. EmTroniX is now an engineering partner of many major companies and institutions involved in spatial electronics developments. EmTroniX offers the significant advantage of having all the skills in-house, tools and experience required to handle all different technical aspects of engineering development projects. Having successfully worked on many space projects has enabled EmTroniX to develop technologies that also give it a strong advantage on ground applications, especially in the RF communication sector and Internet of Things (IoT).

WHAT'S THEIR ROLE?

Luxembourg has created a strong environment for space activities development. A recent example of this is a signed MoU between Kleos and the government, in which EmTroniX will be a major partner. Thanks to this and the attraction that the Luxembourg 'space hub' creates, EmTroniX will develop in an exponential way and engage new partnerships with world-leading companies. The very near future of EmTroniX consists in building a high-reliability electronic production line and a modern laboratory with a clean room in order to design, produce and assemble satellite subsystems and payloads, as well as high-reliability electronics for aeronautics, military and instrumentation. "If what we do works in space, it will work ten times better on the ground," says Cédric Lorant.

WHAT DO THEY MAKE?



EmTroniX has been selected as a major technical partner for the innovative challenge related to the project for In-Space Manufacturing of composite beams equipped with antennas. Their task is to design the arm deployment controller and the digital receiver for the geo-localisation.

16,000

Near-Earth asteroids rich in resources.

2 trillion

Tonnes of water available for life support and fuel in space.

95%

Reduction in space exploration cost using asteroid resources.

Source: www.planetaryresources.com

“Space tourism (…) is expensive now, but the price will come down”

transform ice found on asteroids or on the moon into rocket fuel to refuel the satellite, thus increasing its life expectancy. So, whether you are considering space gas stations or rocket fuel or even batteries, you are talking about big business. That is one example, but there is also tourism. Look at what Richard Branson is doing.

Space travel: it sounds like science fiction.

Currently, to travel to space costs $250,000, but the price is already going down. When people are cynical about space travel I always say, look, when I was a child I had two brothers and we could never go on holiday by plane. It was too expensive back then. We had to drive five of us in a car, and 1,000km was the maximum distance. Now everyone travels by plane all the time. Space tourism is the same. It is expensive now, but the price will come down.

Can you give us an example of medium-term business?

Made In Space is a start-up that has a very interesting business model. They invented the Zero-G printer, which is the first 3D printer designed to operate in zero gravity. I went to visit them in California, and an astronaut on the ISS [International Space Station] lost his plyers and needed a new pair. A person in California sent a programme to the 3D space printer so the astronaut could print the missing tool in space. Now, if you had to transport items like plyers or even larger [ones] to space, it would cost millions of dollars.

That is a very disruptive idea.

See illustration on page 030

There are even other possible benefits with printing rather than transporting; for example, why not use recycled space debris? A long-term idea is to transfer some of the activities that are more harmful for the Earth to space. Why not? We could grind space debris and have all the material you need to produce and construct your equipment in space without harming the environment on Earth. In this sense, space debris is both a problem and opportunity. Luxembourg is actively pushing this discussion at the UN level. We want to have a regulation and a clear understanding about all the people who are responsible for space debris and how it can be recycled. This raises the possibility of another business model, being a debris (or garbage) collector in space. >

DATES

February 2016

Government announces series of measures to position Luxembourg as a European hub in the exploration and use of space resources within the SpaceResources.lu initiative.

April 2017

OHB Venture Capital GmbH and LuxSpace establish Luxembourg company Blue Horizon to pursue vision of creating necessary conditions for sustainable life in space.

June 2017

ESA announces Europe's first innovation competition on space exploration, the "Space Exploration Masters". The Ministry of the Economy and *SpaceResources.lu* feature a prize in this competition.

July 2017

Luxembourg parliament adopts draft law on exploration and use of space resources, making it the first European country to offer a legal framework.

August 2017

Law comes into force providing that space resources can be owned. The country's law also establishes the procedures for authorising and supervising space exploration missions.

Where does space mining fit in?

That is a really long-term business model which could have a huge influence on lowering prices for raw materials--and therefore the products manufactured with them--on Earth. You bring one asteroid down, and raw materials prices will immediately fall *[laughs]*.

Seriously, all of the tech devices we use require rare earth elements, and 90% of these are in China. And since they are rare they are expensive. Everyone in the world wants or needs a computer. Why don't we harvest rare earths in space? It would bring down the cost of all our IT technology dramatically, and therefore make it more accessible. This is exactly what we mean when we talk about advances in space being beneficial for humankind. Making technology available to everyone is a good thing.

We are living in a period of accelerated rates of invention.

Invention is how the world progresses. Look at history. Sometimes when I give speeches, I quote Charles Holland Duell, former Commissioner of the US patent office. He said, "Everything that can be invented has been invented." This was in 1898!

My point is, to people who don't believe any of this will happen or think it is crazy science fiction, just look back at history. It is happening, and it is all driven by innovation. A few decades back we couldn't have imagined emails and smartphones, but now we use them every day. And more and more, disruptive ideas are pushing that invention acceleration rate. Innovation in space helps to drive invention on Earth. That is good for mankind.

What can Luxembourg offer that another country cannot?

The commitment of the government, I think that is the most important thing. When I am speaking with various players, entrepreneurs and engineers, etc., sometimes it is not instantly obvious that they have such a thrilling idea. But what they need is someone who listens and believes in them and in their initiatives, and that is exactly what they get in Luxembourg: someone who listens and offers a clear commitment. That is why so many companies are looking at us, and not just from the US, but from many other countries as well. >

WHO ARE THEY?

ISPACE

Founded
2000

Director
Takeshi Hakamada, Founder & CEO

Website
ispace-inc.com

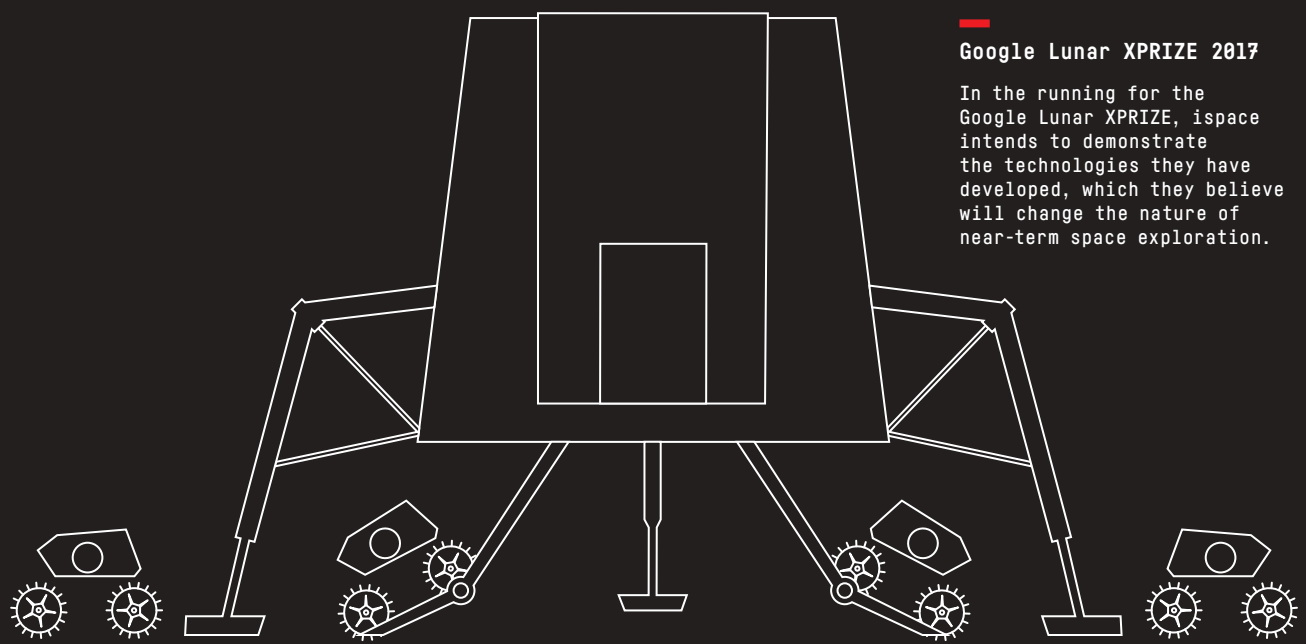
Headquarters
Japan [Paul Wurth InCub, Luxembourg]

ispace is a private lunar exploration company with a vision to extend human presence into outer space. In order for mankind to live in space, we would need a sustainable ecosystem. The first step is to utilise space resources and establish an economy in space--starting from the moon. Since the company's inception, ispace has grown steadily, starting from a small office space to a global company with over 20 employees in total, with offices in Tokyo, NASA's Ames Research Center in California and Luxembourg. ispace currently operates Team Hakuto, Japan's sole entry team for the $30m Google Lunar XPRIZE. In 2015, the team was awarded the Mobility Milestone Prize. In early 2017, Hakuto was selected as one of the five finalists to proceed to the final stage of the Google Lunar XPRIZE.

WHAT'S THEIR ROLE?

The Luxembourg government and ispace, inc. announced in May 2017 that they signed an MoU in the context of the SpaceResources.lu initiative with focus on developing miniaturised technology to discover, map, and utilise resources on the moon. Within this framework, ispace intends to focus, through its European office based in Luxembourg, on business development, R&D and several key technical services, including payload development, engineering and integration. For its part, Luxembourg contributes by providing funding through national R&D grants or programmes of the European Space Agency (ESA) to co-fund relevant research and development activities such as the ispace "roving spectrometer".

WHAT DO THEY MAKE?



Google Lunar XPRIZE 2017

In the running for the Google Lunar XPRIZE, ispace intends to demonstrate the technologies they have developed, which they believe will change the nature of near-term space exploration.

ispace is developing microrobotic technology to provide low-cost frequent transportation service to and on the moon, conduct lunar surface exploration to map, process and deliver resources to customers in cislunar space. The project with Luxembourg aims to bring an innovative mass spectrometer developed by the Luxembourg Institute of Science and Technology (LIST) to the surface of the moon to explore elemental compositions of lunar ice and regolith.

When I compare the SPACE [Spurring Private Aerospace Competitiveness and Entrepreneurship] Act of 2015 to our Space Resources Law of July 2017, which was voted in this summer, there is one huge difference. In the US, in order to be covered by the SPACE Act, the capital of your company has to be more than 50% American money. Many space-related start-ups are working with $10, 15, 50m, and it is relatively easy for them to find this first money. But once they launch their first initiatives on the market they will need huge amounts of money, and if they don't find American money they might not be able to continue. We don't have this kind of limitation for companies who want their headquarters in Europe.

The other advantage is that being in Europe they can work for and/or with the European Space Agency [ESA]. They are not limited to NASA. What makes us really interesting is our LuxIMPULSE programme, which can provide funding to help companies bring innovative ideas to market. Every euro we spend on ESA has to be reinvested into Luxembourg projects. Our problem is that we often do not have enough projects to put the money back, so there is relatively easy access to this funding.

Luxembourg is an active member of the European Space Agency [ESA] and in particular of ARTES, the ESA programme to develop innovative satellite communications systems and services. The country contributes significantly to Europe's 40% share of the global satellite business, supporting thousands of highly skilled jobs and keeping billions of people connected.

What other advantages can Luxembourg offer?

Of course, there is the legal framework and the fact that the government invests directly in companies. For this investment, we decide by two criteria. First is the idea in itself: do we think that this is an idea that can really fly? Secondly, who are the other shareholders? Is it of interest for us to be at the same table with them? This is exactly what we did with Planetary Resources, an asteroid mining company. This direct investment is good for us and good for the companies. When companies are looking for new money they can say that the Luxembourg government is a shareholder. That gives them credibility. Then, of course, there is our research budget because we are in the Horizon 2020 programme from the European Commission. We committed ourselves to spending 2.3-2.6% of our GDP on R&D, so we need to increase that spending.

As the Luxembourg National Contact Point for Horizon 2020 and related EU Research and Innovation funding programmes, Luxinnovation can inform, advise and guide applicants on European funding for their research and innovation projects.

For more information, contact Benjamin Questier, *Head of European Funding, Luxinnovation,* on (+352) 43 62 63 - 667, or by email: *benjamin.questier@luxinnovation.lu*

Can you tell us more about the national space agency project?

This is another advantage. Maybe our most important idea is to launch a space agency in Luxembourg >

with a public-private partnership where the government and private investors alike can take a share. This PPP fund will decide which companies we will invest in and which we will not. We are in early discussions with the investment fund industry, and there is already a great deal of interest. This will be a unique space agency in that it will not focus on space exploration but on space business, and when you focus on business, investors are interested.

When people see some of the companies you are attracting like ispace, the Japanese company developing microrobotic technology for space, they will still ask: when is Luxembourg's first space prospecting mission?

See illustration on pages 024-025

As a country we will not do space exploration. What is true is that we want to attract some of the companies that are involved in these activities. These companies bring other benefits to Luxembourg beyond revenue such as R&D. ispace is a good example, as they are working together with LIST on several key technical services, including payload development, engineering and integration. This project aims to bring an innovative mass spectrometer developed by LIST to the surface of the moon. Weight is an issue in space, so they are trying to reduce the weight. Right now this mass spectrometer weighs similar to two washing machines, and they need to reduce it to the weight of a shoebox.

What sort of long-term ROI is Luxembourg forecasting?

Like space, there is seemingly no limit, with very little involvement of the taxpayer.

What are the benefits for other sectors?

We are trying to put all of the different bricks together. I discussed the HPC [high-performance computing] within the framework of developing space activities. What we saw when we visited California was their quantum computer which you need to calculate where you are going and to land your rover on the moon. There is a large amount of commercial activity in space that will require huge calculation power and HPC. >

WHO ARE THEY?

DEEP SPACE INDUSTRIES PROSPECTOR-X™

Founded
2013

Director
Bill Miller, CEO

Website
www.deepspaceindustries.com

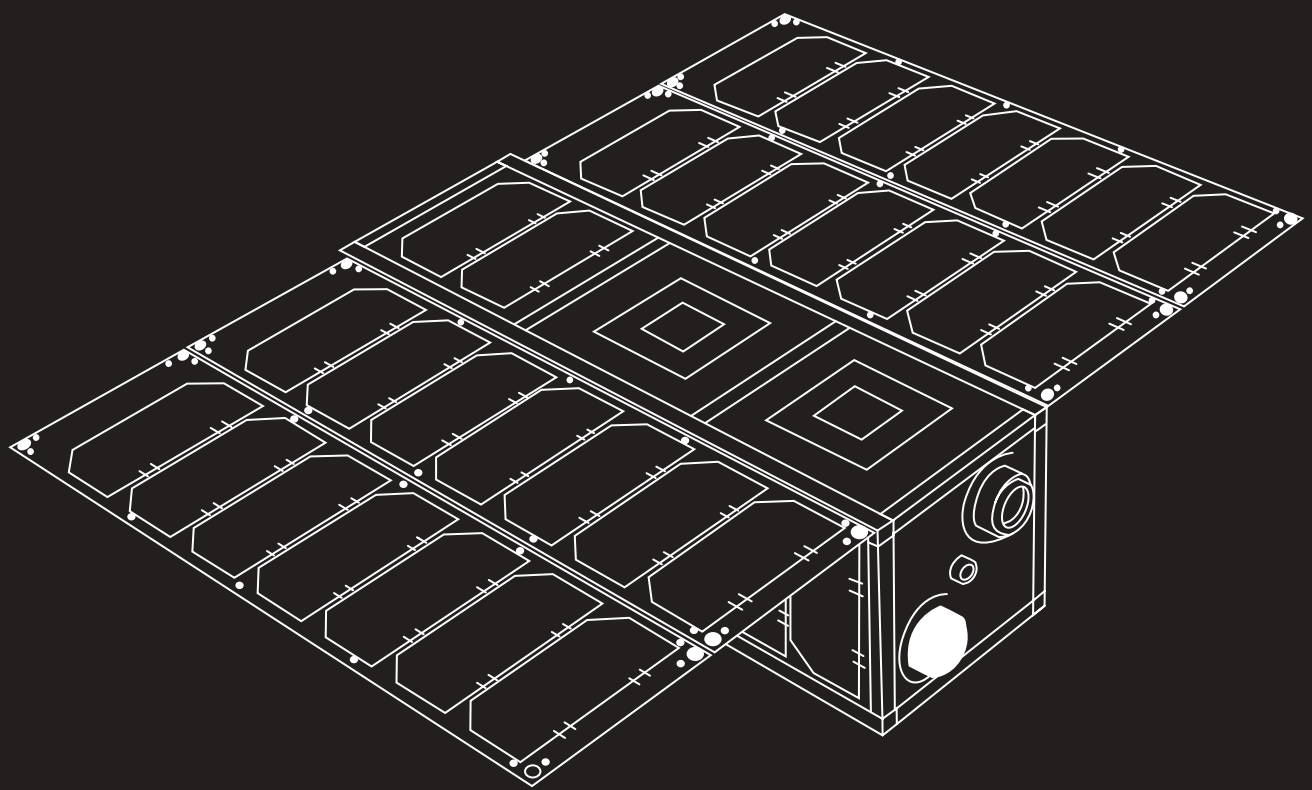
Headquarters
Japan [Paul Wurth InCub in Luxembourg]

Deep Space Industries [DSI] is an asteroid mining company, seeking to change the economics of the space industry by providing the technical resources, capabilities and system integration required to prospect for, harvest, process, manufacture and market in-space resources. These resources, found on easily accessible near-Earth asteroids, will provide unlimited energy and supplies for a growing space economy. The company aims to produce water, propellant, and building materials to serve growing space markets. From extending the profitability of commercial satellites to providing life support and power to new private-sector orbiting research stations, Deep Space Industries is industrialising the space frontier.

WHAT'S THEIR ROLE?

Prospector-X™ is the inaugural mission of the partnership between Deep Space Industries and the Luxembourg government, as they work together to develop the technology needed to mine asteroids and build a supply chain of valuable resources in space. The first stage in the harvest of space resources is prospecting. In the near future, Deep Space Industries intends to launch a small spacecraft to a near-Earth asteroid for the purpose of assessing the target's geotechnical properties and suitability for mining. This commercial deep space mission will require new technologies which are currently being developed by Deep Space Industries: small satellite subsystems that are robust, agile, highly performant, and increasingly smaller in size.

WHAT DO THEY MAKE?



When planning for any complex deep space mission, it is crucial to perform risk-reduction technology demonstrations in the familiar environment of low-Earth orbit. Prospector-X™, an experimental small nano-spacecraft, will be used to test several key enabling technologies in advance of the first Deep Space Industries asteroid rendezvous mission. The experimental mission will be built in, and operated from, DSI's European office in Luxembourg.

Space debris is a serious problem. The solutions create new business models.

Space debris is the collection of defunct man-made objects in space--old satellites, spent rocket stages, and fragments from disintegration, erosion, and collisions--including those caused by debris itself. The 'Kessler effect' is the collisional cascading of space debris.

Problems:

> Collisions between satellites or debris itself. As of December 2016, five satellite collisions resulted in space waste.
> Fuel wastage as satellites try to avoid collisions. On average there is a high risk alert of a potential collision every week, and every ESA satellite has to be manoeuvred to avoid a collision once or twice a year.
> Risk of human lives: the International Space Station has had to be manoeuvred out of harm's way in the past.
> Orbit into a literal mine field, essentially closing off access to space.

Solutions:

> Catching dead satellites with robotics arms, 'harpoons' and 'nets'.
> Space collectors that 'eat' space debris for fuel.
> Recycling old satellite parts into news ones.
> Grinding space debris to use the materials.

To purchase one of these supercomputers, we took the lead on a centralised solution, which industry leaders backed, by asking the European Commission to help finance the project. We were joined by France, Italy, Spain, Germany, Portugal and the Netherlands. The computer will reside in Luxembourg by 2018 and will have the power of one petaflop per second, or one thousand trillion calculations per second. This calculating power will be accessible to all companies, not just space.

Can you give us another example?

Artificial intelligence is already being used and will be further developed to make all of these initiatives in space possible, particularly in the first stage. This is true for space mining, which will not be done with people. We are in discussions all the time with big mining companies because they are very interested in what we are doing. For example, the difference between deep-sea mining and space is not that big. For many of the space-related start-ups, part of their strategy is to have short-, medium- and long-term plans so they can make money right away to fund the longer-term part of their business plan.

What sparked your interest in space?

I hate to disappoint you, but I was never particularly interested in space. I never wanted to become an astronaut *[laughs]*. It was just that when, in my capacity as the Minister of the Economy, I analysed space business activities, I saw the huge opportunity and realised it is not a question of whether all of these activities will happen in space, but when.

I really want to do something for my country. I want us to be in the forefront, an early adopter. Luxembourg has a track record of being successful when it takes risks. This is true when we invested in the SES initiative. This is true when we took on our Maritime Pavilion [flag registry which establishes Luxembourg's maritime business governed by the Act of 9 November 1990] in a landlocked country *[laughs]*. You need to take on risks to be successful. X

INFO

Asteroid Day

Luxembourg hosted its first International Asteroid Day in 2017 and is now the headquarters of the event. Asteroid Day is an annual global event that aims to raise awareness about asteroids and what can be done to protect the Earth, its families, communities, and future generations. Where does Asteroid Day fit into Luxembourg's space business scheme? The event is really to attract more visibility to the subject of asteroids and the science around them but also to Luxembourg and what the country is doing. It is a subject that fascinates people, so it draws a large audience. It makes people aware of the danger asteroids present to Earth, but as we raise awareness we combine the danger with the economic opportunity that asteroids also present.

Did you know?

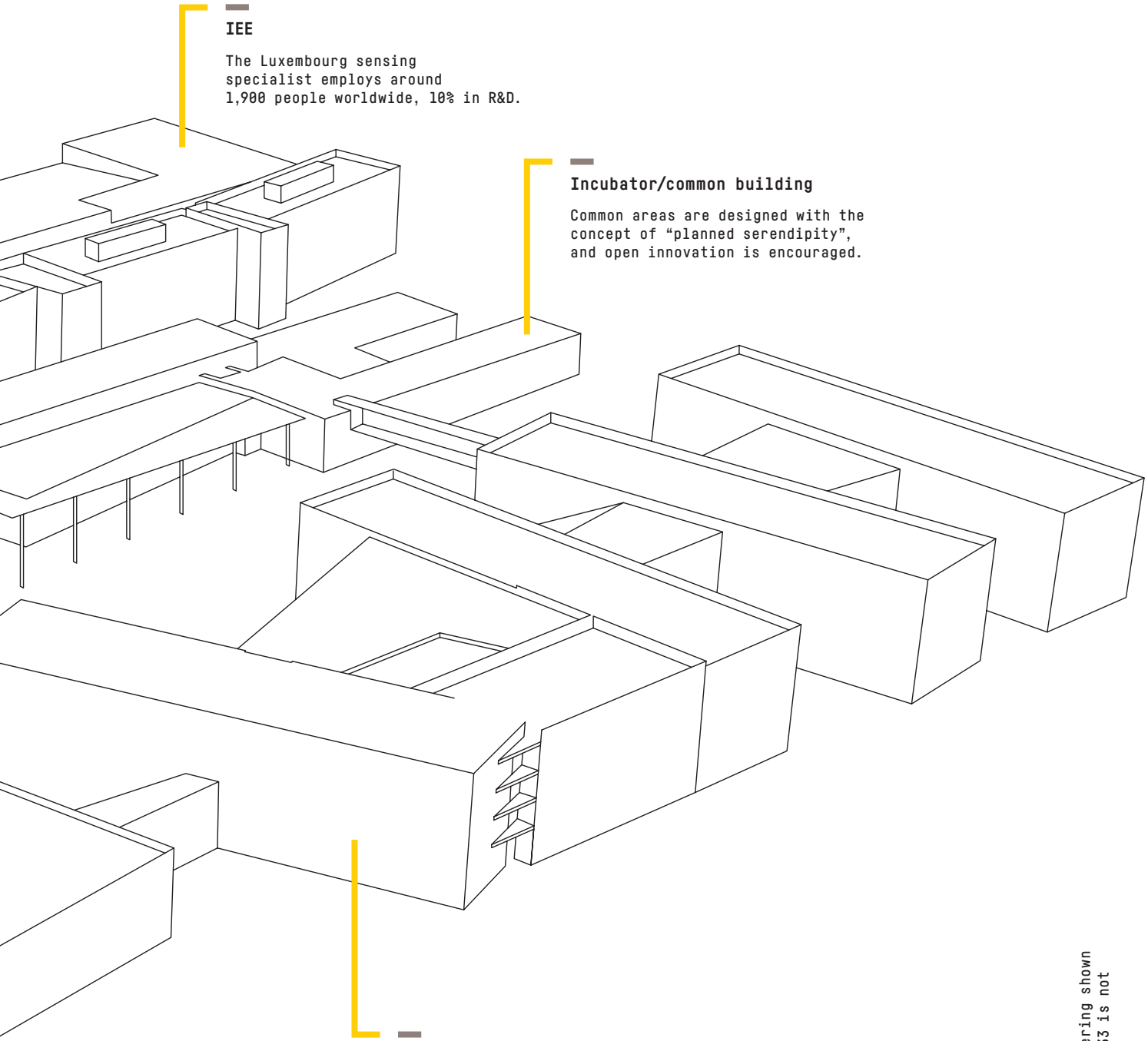
According to Planetary Resources, it currently costs $20,000 to send a litre of water from Earth to deep space. One 500m tonne water-rich asteroid could produce enough fuel for every rocket launched in history.

"Did you know?" source: Planetary Resources

Where research & development will make history

A unique R&D centre is being built in Roost, just a 20-minute drive from Luxembourg city. The Luxembourg Automotive Campus will provide state-of-the-art facilities to companies--corporations and start-ups alike--dedicated to innovation in automobility. But that's only one piece of the puzzle…

Text by Natalie Gerhardstein > Photographs by Maison Moderne



IEE

The Luxembourg sensing specialist employs around 1,900 people worldwide, 10% in R&D.

Incubator/common building

Common areas are designed with the concept of “planned serendipity”, and open innovation is encouraged.

Goodyear

Around 1,100 employees will be housed in the building spanning 16,000m².

NB: The rendering shown on pages 32-33 is not a final one.

Digest:

Luxembourg is developing rapidly in automobility: the sector already boasts an annual turnover of €1.5 billion and employs around 10,000 people. In March 2016, the government announced plans to create a 14-hectare Luxembourg Automotive Campus just 20 minutes from the capital. In its first phase (by mid-2019), the site will be ready for 1,600 employees from Goodyear and IEE, which specialises in sensing systems. The open campus will be able to accommodate up to 4,000 in the future, with plans to include an incubator and common areas to help spark innovation and exchange among start-ups, large companies, researchers, etc. The site is a manifestation of developments in areas such as e-mobility and car connectivity currently taking place in the Grand Duchy. Due to its size, network and agility to meet company's demands, Luxembourg is also a prime testbed. On 14 September 2017, the Luxembourg government signed a joint agreement with German and French governments to establish and cooperate on an experimental cross-border testbed for automated and connected driving, putting Luxembourg once again at the intersection of mobility and digitisation. X

Ministry of the Economy

Luxembourg has high potential when it comes to automated and connected mobility. The country has a long industrial history, and the automotive sector is no exception: Luxembourg's automotive components sector boasts an annual turnover of €1.5 billion and employs some 10,000 people. Around 50 companies in Luxembourg are working in the sector. The Luxembourg Automobility Cluster also maintains strong relationships with other European automotive clusters as well as with the national clusters for ICT, space and more.

The multilingual and multicultural environment that defines Luxembourg also extends to the automotive sector, which is powered by German, French and Italian engineering experts. Luxinnovation estimates there are about 2,500 multilingual and multicultural professionals in R&D.

www.luxinnovation.lu

Recently, in steps to further diversify its economy, Luxembourg has truly developed an innovative, high-tech industry. In addition to the country covering all major key competencies--from vehicle dynamics, connectivity and mobility services to automated driving and more--the country is well positioned not just in its business-friendly environment, but also by the fact that it is small and based in the heart of the EU, offering the perfect location for cross-border testing.

The Luxembourg Automotive Campus will serve as a manifestation of innovation in automobility--what Christian Tock, Director of Sustainable Technologies at the

"Locating leading automotive organisations in the same area will naturally lead to synergies and benefits for everyone involved…"

Michel Witte, IEE

Ministry of the Economy, refers to as “only one piece of the puzzle”. While the campus will focus on R&D and innovation in the automotive supplier sector, it will also develop Luxembourg as a true centre of excellence and innovation.

Preparations for summer 2019

The idea for an innovation hub had been brewing since 2013, and by March 2016 the Luxembourg government announced plans to create the campus on the 14-hectare site in Roost, 20 minutes from the Luxembourg capital.

In the first phase American multinational tyre manufacturer Goodyear and IEE, a Luxembourg-based sensing specialist, will set up on the campus. By summer 2019, facilities should be ready for the site to welcome 1,600 employees from the two companies, although the entire site should accommodate up to 4,000 in the future.

At the launch event, Deputy Prime Minister and Minister of the Economy, Étienne Schneider, commented on the campus: “By centralising these R&D activities, the Luxembourg Automotive Campus will provide professional automotive equipment and service providers with new tools and infrastructure, enabling them to remain dynamic--and thus also innovative and competitive--in a market in constant evolution.” >

www.luxembourg.public.lu

Question to

Christian Tock
Director Sustainable Technologies, Ministry of the Economy

How is Luxembourg well positioned to welcome companies?

Over the last few years, we have brought together road authorities and ministries to build the Inter-Ministerial Committee for Smart Mobility to help us react fast to demands from companies that want to test here. We want to further develop Luxembourg as a testbed for mobility. Mobility is performing, but it is complicated: it’s not enough anymore to build a car, you need smart infrastructure on the road, connectivity, and charging infrastructure for electric cars, so you need public support. We really would like to support companies in their endeavours as a long-term partner. X

Info

By the year 2020, Luxembourg is expected to have 800 public charging stations for electric and hybrid vehicles.
www.chargy.lu

Capital of Greater Region automotive R&D

The Greater Region (a geopolitical region with Luxembourg at the centre and adjacent regions of Belgium, Germany and France) is hosting five manufacturing plants of global OEMs and more than 500 suppliers, according to Luxinnovation. In total, about 150,000 jobs are generated in production, product and process development and fundamental research.

Question to

Joost Ortjens
Head of Sector Development – Automotive, Luxinnovation

What is the potential of automobility in Luxembourg?

Luxembourg is developing its industry by looking at new business opportunities created by major technology trends in the mobility industry in conjunction with the added value potentially generated by our ecosystems. Two specific business fields are in focus: electromobility and car connectivity [see main article]. We're identifying business opportunities in smart and shared mobility, comfort and convenience: from vehicle-embedded apps for multimodal transport, to car and ride sharing, high-speed internet access for onboard video streaming, real-time traffic information and smart navigation. It will all happen in the future connected car, and it will all happen in Luxembourg--at least a part of it! X

www.news.goodyear.eu

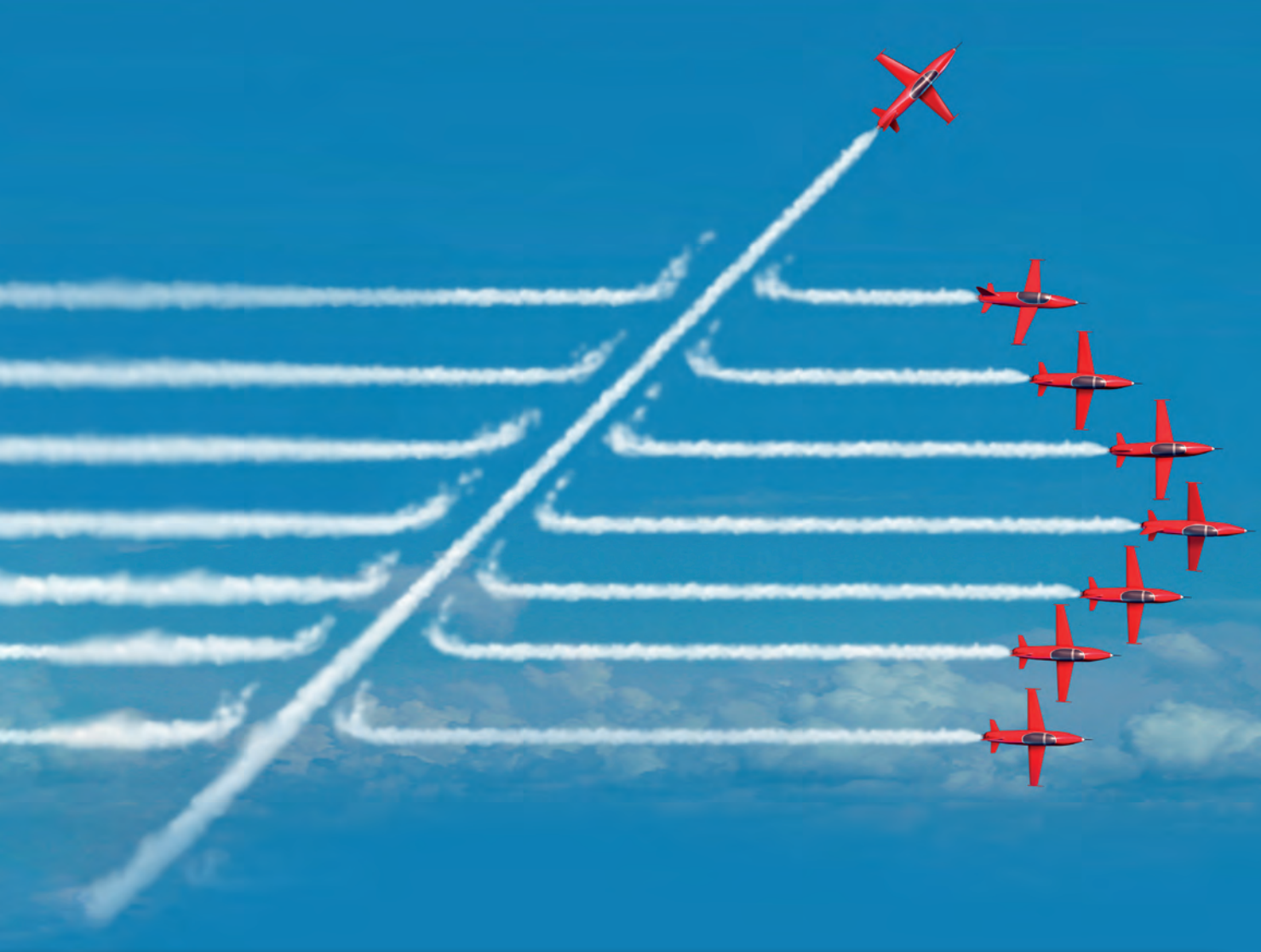
Goodyear employs around 66,000 people and manufactures in 22 countries around the world and has two innovation centres in Akron, Ohio (US), and Luxembourg. The company indeed has a long history with Luxembourg: it grew from one tyre plant to three over its 70 years in the country. The new Goodyear facility on the Luxembourg Automotive Campus will house many engineers, scientists and technicians--around 1,100 employees in total, in a building spanning 16,000m^2.

When plans were announced, Jean-Claude Kihn, President of Goodyear Europe, Middle-East and Africa, stated Goodyear was "look[ing] forward to collaborating with other progressive companies on the design, testing and incubation of new concepts" and highlighted that the company's "philosophy of open innovation around the globe" would be further expanded by joining the campus.

www.iee.lu

IEE is also moving its headquarters to the site. IEE was founded in 1989 and employs around 1,900 people worldwide, 10% of which engage in R&D. It is considered a world leader in specialised sensing systems, for occupant detection and classification.

When the campus was announced, Michel Witte, IEE's President & CEO, similarly shared his excitement about the benefits: >



Paul Wurth - the capacity to continuously innovate

The development of new products and the optimisation of our existing portfolio have always been a high priority for Paul Wurth. For a technological company such as ours, innovation is crucial as it means that we are able to continuously take a technological lead and thereby meet our customers' expectations. Thanks to the know-how and innovation skills of our highly-qualified employees, we offer most advanced solutions in our different fields of activities:

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PAUL WURTH
SMS group

"Locating leading automotive organisations in the same area will naturally lead to synergies and benefits for everyone involved-- both in terms of shared resources and enhanced innovation," adding: "It will also help us to attract high-calibre talent to the region."

A vision of open innovation

There is also the potential for some of the University of Luxembourg and research organisations to be present, but at the time of writing it had not been defined to what degree. Nevertheless, it is feasible that students and faculty would work with companies, a selling point for all involved. As Witte says, "We could facilitate the preparation of students and post-doctoral candidates so that their skills could fit the requirements of the campus members. A win-win situation for everyone."

The campus, which will include an incubator and other common areas, is being thoughtfully designed using circular economy principles as well as a philosophy of "planned serendipity", with both indoor and outdoor shared areas to encourage "chance" encounters among the various employees and researchers at the campus, also through events organised on site.

"The campus itself should also be very innovative," says Patrick Nickels, Director General for Industry, Logistics and Infrastructure. "We are working on a concept for a smart campus which would allow you to experience how new technologies can help manage and support the campus in an intelligent way but could also be a useful way to test mobility solutions on the campus." He adds that if the infrastructure is smart, it could also be an ideal opportunity for testing how vehicle to infrastructure and infrastructure to vehicle communication could work.

Focus on electromobility and car connectivity

The future of automobility in Luxembourg is an exciting one, and Joost Ortjens, Head of Sector - Automotive at Luxinnovation, looks forward to the value generated by the ecosystems.

For him there are two specific business fields in focus: electro-mobility and car connectivity. He notes that while some see this as a potential threat for traditional automotive business, such as those developing components and combustion engine systems, others are emphasising challenges in R&D and new business opportunities.

"We all know Tesla, but more of these players will enter the European market. Among them the Chinese BYD and Silicon Valley start-ups Faraday Future and NIO (NextEV)," he adds. "The Chinese automotive giant SAIC already decided on Luxembourg for establishing their European sales and marketing HQ. Who's next?" Part of the task at hand, then, is identifying new opportunities, Ortjens says, "not only for battery-cell and battery-pack suppliers, but also for suppliers providing various energy-saving measures, new materials (composites), energy-efficient thermal solutions, etc."

Another strategic avenue is car connectivity, or how cars meet smart infrastructures, but Luxembourg is supporting automated mobility for next-generation tools, like 5G to G5 wifi communication and satellite technology. As Ortjens notes, "Uninterrupted connectivity is key to automated driving and related functions like e-horizon. However, smooth and uninterrupted transition between visited networks becomes a huge challenge when crossing a national border."

"Electrification of mobility is a reality. We don't know how fast, but it will come soon"

And this is where Luxembourg becomes all the more interesting. A Greater Region day trip could include up to seven border crossings --not just with Luxembourg's direct neighbours (France, Belgium and Germany), but also with the Netherlands--covering a distance of around 700km which includes several tunnels, a toll section and several highly dense sections posing congestion risk.

"We believe in our capabilities to develop the necessary solutions with our partners in the Greater Region, and we believe in the excellent opportunities to test these cross-border solutions in Luxembourg, provided by the geographical constraints of our region," Ortjens says.

Cross-border testbed

Luxembourg has already been a successful testbed for the Volvo Bus Corporation, to take one example. Volvo wanted to charge its electric buses, and it needed a charging infrastructure to do so. >

The Vehicular Simulation Lab consists of a driving simulator equipped with a cockpit and movement platform, traditional screens and virtual reality headsets. The lab can be used for projects relating to energy consumption, safety, autonomous driving and traffic flow.

The E-Bus Competence Center (EBCC) was therefore established and an e-mobility testbed created in 2016 by the company in partnership with the Luxembourg Ministry of the Economy and Ministry of Sustainable Development and Infrastructure. “This was a nice example in how we could react fast to demands and make sure all the important actors were gathered around the table,” says Tock.

More recently, on 14 September 2017, another exciting development took place: Deputy Prime Minister and Minister of the Economy Étienne Schneider and Minister for Sustainable Development and Infrastructure François Bausch signed a joint statement with the German, French and Luxembourg governments to establish a common digital, experimental site for automated and connected driving as part of their visit to the International Motor Show in Frankfurt, Germany.

The cross-border testbed covers the road network of the central and southern regions of Luxembourg, the Metz region of France, and Saarland in Germany. By the first half of 2018, experimentation of automated and connected driving technologies will be possible. What’s more, innovative technologies can be tested on all road categories--from highways to urban roads--and the countries will share their legal and technical experiences across borders as well. >

Question to

Patrick Roulling
Facilities & Campus Affairs, IEE

What are some exciting developments in automobility from your perspective?

We know the automotive sector will change a lot in the coming years. There will be autonomous driving, connected services, new mobility offerings, an increase in the electrification of vehicles. This will generate enormous change in automobility, meaning we have to attract talented people to be fast and adapt. We need a kind of melting pot where public research, industrial companies and start-ups can come together in a natural way. You can organise meetings, but it’s not the same: we want that spontaneous way of meeting each other. Infrastructure and animation are necessary for that. X

Headquartered in Luxembourg, IEE has 1,900 people across seven countries and is supported by its alliance partner, All Circuits, which has some 1,600 employees.

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Question to

Thomas Engel
Head of NetLab, SnT, University of Luxembourg

What are some exciting developments in automobility from your perspective?

These are exciting times for the automotive sector. At the University, rapid advances are being made by multimobility groups in robotics and autonomous driving, electromobility, electrical engines for vehicles, sensor fusion for optical and radar sensors, resilience and robustness of communication in and between cars, software testing. Our researchers break new ground in privacy-friendly and secure intelligent transport systems, focusing on new algorithms, machine learning, deep learning and data analytics in general. With particular expertise in M2M (machine-to-machine), and working alongside Luxembourg's major players like SES, we develop new architectures and communication paradigms for the IoT and ad hoc networks. X

INFO

The University of Luxembourg runs the Interdisciplinary Centre for Security, Reliability and Trust (SnT), which has 34 partners and 180+ researchers, focusing mainly on applied security and software transfer of resources.

The agreement reaffirms the common will of the three countries to promote the development and testing of automated and connected driving technologies, in close connection with intelligent transport systems, while taking into account e-mobility and multimodality through this real, cross-border vision.

Developments on the horizon

Many other exciting developments are also taking place in R&D through places like the NetLab Research Group (NetLab), headed by Thomas Engel, at the University of Luxembourg's SnT (Interdisciplinary Centre for Security, Reliability and Trust). NetLab focuses on networking, privacy and security--key components in automobility--and is developing new architecture and communication paradigms for IoT and networks, including studying and designing secure, intelligent transport systems which are simultaneously privacy-friendly.

One example is the "Securing Smart Entry Systems" project, in collaboration with Honda, which aims to develop cryptographic protocols using transmission time and device fingerprinting to determine whether a signal is being relayed from a distance. Such security is necessary to prevent attacks, given that new key systems are allowing owners to unlock vehicles without their own interaction, therefore potentially allowing car thieves to gain access

to off-the-shelf products that help amplify signals, meaning that if they get close to car owners, they can relay signals to accomplices near the vehicle. NetLab's research involves a system that recognises tampering, automatically locking the vehicle, to analyse time and distance of the signal.

This is one of a number of R&D projects being carried out. Other examples include algorithms to model how individuals drive and sense, for example, when a driver is tired or distracted. Or "Accordion", a National Research Fund (FNR)-Singapore INTER project backed by IEE, which explores up-and-coming avenues like sparse/compressive sensing.

And there are several other labs working in fields which could yield high impact on automobility as well, from the Software Verification and Validation Lab (SVV), ensuring that software systems are reliable and secure and working on advanced driving assistance systems, to an Automation and Robotics Research Group, which is conducting research in distributed and networked control systems, mobile robotics (including the control of unmanned aerial vehicles and autonomous robots, which could have high implications in Luxembourg's role as a space pioneer--see our cover story).

It remains to be seen how much these projects could be tested in Luxembourg or pay off in the short- and long-term, but one thing is clear: the Luxembourg Automotive Campus will help "drive" a vision for the future. X

DATES

2013

Luxembourg Ministry of the Economy first has the idea to create an innovation hub which would later become the campus.

2016

Plans unveiled for the 14-hectare industrial site specialising in automotive component research and development in Roost.

2019

By summer 2019, facilities should be ready for the campus to welcome 1,600 employees from Goodyear and IEE. The site will eventually be able to accommodate around 4,000 people.

FACTS

85%

The percentage of executives who agreed that the digital ecosystem would generate revenues higher than car hardware.

1/3

More than every third consumer agrees, either absolutely or partly, that by 2025, half of today's current car owners will no longer want to own a car.

83%

The percentage of executives who agreed, either absolutely or partly, that OEMs will make money with data.

Facts source: KPMG Global Automotive Executive Survey 2017

For more information, contact Joost Ortjens, Head of Sector Development - Automotive, Luxinnovation, on (+352) 43 62 63 - 653 or by email: *joost.ortjens@luxinnovation.lu*

Peter Stadler
Managing Director
of Kronospan Luxembourg

third industrial

“What about the revolution?”

Increased profits, improved quality of life, healthier environment, more vibrant economy and saving the world’s population from extinction: these are just some of the promising benefits of the third industrial revolution in Luxembourg.

Text by Lisa Francis-Jennings > Photographs by Maison Moderne

Digest:

Just like its predecessors, the third industrial revolution (TIR) is characterised by a convergence of evolution and advances in transportation, communication and energy production that are changing how businesses operate and how people live. According to Jeremy Rifkin, a strong proponent of TIR, this will save the world's population from extinction. It will also level the playing field, distributing wealth into more hands due to the change in the way economic activity moves across the value chain--invigorating the way people interact with each other, with business and, more broadly, with the planet. Luxembourg is at the forefront of this movement, facilitating discussions and setting its sights on becoming Europe's flagship for a smart, green, digital society. The ultimate goal: to make the economic paradigm shift to a profitable--and ecologically-friendly--society. With hundreds of initiatives planned, Luxembourg is working closely with business to support dramatically improved aggregate efficiencies and reduce environmental footprints across industries. Here it's evident that Luxembourg is aiming to be the first fully-integrated TIR nation. X

After years of effort to diversify its economy, Luxembourg's successes include a host of employers, who produce everything from injection moulding equipment, high-tech windshields, nanotechnology to high density, wood-based products. Recently, the government took another innovative step to showcase its unique ability to provide a thriving business environment: the step was to walk to the beat of the third industrial revolution (TIR).

www.troisiemerevolutionindustrielle.lu

The elements and players of the third industrial revolution (TIR) are complex, which is why Luxembourg gathered 300 of its most engaged stakeholders to discuss, consider and devise a winning TIR strategy. The project is built on the principle that strong and profitable business, and a vibrantly diverse economy, can enhance the ability to maintain a clean and safe environment--and a clean, safe environment is good for business.

Luxembourg's approach is refreshing. Taking on the role of facilitator, the government engaged those stakeholders to work collaboratively to plan a TIR strategy which combines social, cultural and environmental narratives with economic theory and business practices.

Becoming the first smart, green nation-state requires reconceiving and redesigning Luxembourg's progress within a "quality of life" framework that also fosters global interconnectivity. So using the Biosphere Valley model, Luxembourg now takes responsibility for

Greenhouse gas emissions

Reliance on "old" energy forms creates a crisis. Reductions in energy consumption and increased energy efficiency will combat climate change and increase profits.

Source: wikipedia.org/wiki/Ease_of_doing_business_index

its land-based environment and the 19km above it.

Leveraging circular economy principles

The TIR strategy elements span how we produce and use energy and manage production, consumption and waste. It envisions the technical infrastructure needed to support business and development. It also includes buildings, mobility, transportation, economy and finances. To ensure the study is used, actors have been appointed, and partnerships among businesses and the community are directing resources into sustainable projects.

A central element of TIR and Luxembourg's focus on diversification is the circular economy. Businesses in Luxembourg are turning away from the current "take, make and discard" model, towards a cradle-to-cradle and/or circular economy model, in which design and production focus on waste minimisation and reclaim-ability. The Luxembourg subsidiary of Kronospan, an Austrian company specialised in compressed, wood-based panels, has been using this approach for decades.

"Cradle-to-cradle historically was the economic base. A key to strong industry. There's no future for industry that does not respect this logic," says Peter Stadler, Managing Director of Kronospan Luxembourg. "TIR writing confirms what I've learned in 32+ years at Kronospan: the circular economy is in our DNA. For over 100 years, it's been a big part of our success."

The cradle-to-cradle model envisions products that are designed and produced specifically to be recycled and reused safely. Intrinsic to the model is that the design and manufacture of an item ought to make it more expensive to use new materials than recycled or reclaimed materials. Eliminating waste, optimising the value chain, using clean and renewable energy, promoting safety and diversity for a healthy ecosystem are all fundamental principles for ensuring a product's useful lifecycle.

Kronospan, in Luxembourg since 1994, is investing over €300m in its facility in Sanem, in southwest Luxembourg. Using their ideas and research, they've developed an investment plan based on enlarging the effect of the circular economy to meet >

www.kronospan-luxembourg.com

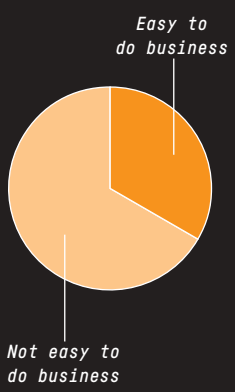
"I read some of Rifkin's books. I recognised and was happy to see that we're following TIR principles"

FACTS

Ambitious goals are a hallmark of Luxembourg's TIR initiative.

- ↑ Increase renewable energy sources to 20%
- ↑ Increase renewable transportation fuel to 10%
- ↑ Increase energy efficiency by 20%
- ↓ Decrease greenhouse Gas emissions by 80 to 95%

Rated as 59th of 190 in the *World Bank Doing Business 2017 Report*, Luxembourg consistently falls into the top 1/3 of countries where it is considered easy to do business. The report is based upon 10 categories, which include analysis of ease of starting a business, support for entrepreneurship, dealing with permits, transparency of regulation, trade, contract law, permitting and credit.



future demands. With a €10+m contribution from Luxembourg, Kronospan feels well supported. The two-stage project will add robotics, double OSB-production capacity to bring the product closer to the customer, and ultimately provide co-generation facilities that fit into Luxembourg's power generation plan. According to Stadler, proactive and positive support from local government convinces investors to take risks for big, long-term investments in new technology. "We are spending €37m for our co-generation plant to produce about 105MW of electricity and reduce CO_2 emissions by 60,000 tonnes per year. The underlying concept is connected cascading: recycling, raw material and energy use. It will be a case study in profitability for our industry."

"The key factor"

Integral to TIR economic success are good partnerships. OCSiAL is an example of the collaborative, transparent approach used here. Originating in Russia and now headquartered in Differdange in south Luxembourg, its single-walled carbon nanotubes are one of the most promising materials in the world. This lightweight, complex and transparent additive can be used to increase conductivity, reduce product weight and improve fuel efficiency. OCSiAL's break-through has made an affordable product for thousands of applications.

Today, the undisputed leader in the field knows that could change. Their strategy: stay at the cutting edge in this exciting industry to continuously develop new products and applications. The positive relationship with the Luxembourg government and authorities is indisputable. "Speaking of markets, which we, in part, are forming, ours is growing fast! And with it, our company," says Konstantin Notman, CEO at OCSiAL Europe.

"We started, many years ago, by simply registering our company here because of the favourable IP regime. Gradually we understood that this is an excellent business location. There are clear and stable rules and regulations, accessible and active authorities that do not interfere but help, and available quality labour which, in the world of high-performance nano-augmented materials, is critical."

OCSiAL was familiar with Luxembourg's investment climate and efforts to attract innovative businesses. But when it came >

Ten sustainable development goals

The government has committed to a clean and sustainable environment. As well as working with business, it is also supporting community efforts that increase health and well-being and help the environment such as car and bike sharing programmes.

1 Good health and well-being

2 Quality education

3 Affordable and clean energy

4 Decent work and economic growth

5 Industry, innovation and infrastructure

6 Reduced inequalities

7 Sustainable cities and communities

8 Responsible consumption and production

9 Climate action

10 Partnerships for the goals

TIPS

Foster innovative practices

Fostering innovation for the third industrial revolution takes motivation, education and collaboration. The People's Vote Projects is one way that organisations showcase their sustainability initiatives and inspire others.

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PRICE OF A LOCAL CALL

> “The authorities never broke their word or terms of providing any information or support”

Konstantin Notman

to creating over 200 jobs and investing in 250 tonnes of nanotube production annually, they wanted a trusted partner. “We chose the simplest and most banal way to get started. We just visited the Ministry of the Economy and told them about our project and ourselves [and that] we were selecting a Western European location for a large-scale production facility. And now, the main thing: during the year of joint preliminary work, the authorities never broke their word or terms of providing any information or support. We received answers to all our questions and requests. This is what I call transparent and understandable rules of the game. This is the key factor.”

It’s the people

Another hallmark of TIR is local development for the local market. Owned by a Japanese glass manufacturer, Carlex produces windshields for high-end car manufacturers, and with locations throughout the world, they know about being close to the customer.

www.carlex.com

Their €25m production line upgrade is as much about the people, as increasing efficiency or responding to customer needs. With 500+ employees, the digitalisation of machinery creates its own challenges. Their focus: reskilling, or upskilling, their existing workforce, while ensuring that their changing requirements for personnel are met. “The automotive industry is changing, and with it the nature of our work. It is no longer enough to know how to drive a forklift, which is already a complex job. Our line

workers must be comfortable with computers and other digital-age elements," Olivier Laufer, Managing Director for the Grevenmacher plant, explains, adding: "We rely on the government to promote Luxembourg as a great place to live and work, to ensure that we have a good supply of highly skilled workers."

The government is aware of TIR impacts on traditional labour and works collaboratively and proactively to include stakeholders in discussions and projects to decisively and positively tackle this challenge to the best benefit of this small, cohesive society.

But with challenge comes reward. Working closely with Luxembourg Institute of Science and Technology (LIST) to develop smart windshield coatings has its advantages.

"We are the flagship within the group for this project, which reduces ecological impacts of heating/cooling systems, and fuel consumption to meet future EU emissions regulations. It will also increase the range of electric vehicles. We could have developed this technology in Japan, but the proximity, professionalism and experience LIST offers triggered our decision to partner here," says Olivier Farreyrol, Manager of the Advanced Development group in Europe. "That is a big win for us and helps put Luxembourg on the map as a preferred location for business and employment."

Talent-focused

Canadian company Husky Injection Molding Systems understands the value of R&D.

Luxembourg's renewable energy transformation

A press conference held on 14 September 2017 by Secretary of State for Economy Francine Closener revealed the "Solar, our commitment to clean energy" campaign. Here are a few takeaways.

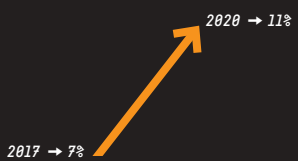
6,500
The number of photovoltaic installations in the country

1/5
Photovoltaic installations account for just over 20% of renewable energy generated by the Grand Duchy

€10m
The amount of related subsidies given by the state in 2014-2017

Total electricity from renewable sources

At the time of writing, total electricity used in Luxembourg included 7% coming from renewable energy. By 2020, the plan is for that figure to rise to 11%, of which 2% should be generated elsewhere within the EU and 4% from within the country.



For more information on how to install photovoltaic panels for your household or workplace, visit www.cleversolar.lu

www.husky.co

In 2016, its 950-strong Dudelange manufacturing facilities won the Process Innovation Prize (FedIL) for developing a fully automated manifold manufacturing cell. Stefano Mirti, President Hot Runners and Controllers, is proud of Husky's innovation and appreciates Luxembourg's stable social/political environment: "Available talent has sustained innovation and our continuous growth over the last 32 years. Access to a welcoming and flexible government is integral to our success story."

The company has a long and strong history of corporate social and environmental responsibility. Since 2013, Husky's extensive study and implemented projects have led to a yearly reduction of more than 2m kWh in energy consumption, and -17% CO_2 emissions. Their TargetZero™ programme seeks to achieve carbon neutrality and zero lost time by 2025. Their team is also encouraged to volunteer for charitable cause: education, health, environmental projects.

High ROI

"SHE (safety, health and environment) is also a core value for DuPont de Nemours (Luxembourg) Sàrl, along with respect for people, environmental stewardship and highest ethical behaviour," says Paul Meyers, Managing Director of the Contern facility. "Environmental stewardship means that we continually strive to reduce our footprint, minimise energy and water consumption, and drive emissions towards zero."

All units (Tyvek®, Typar®, Hytrel®, Mylar® and Power Station) >

of this E.I. DuPont de Nemours and Co. subsidiary have reduced their footprint steadily over the last few years using environmental projects which yield profitable returns and/or pay for themselves. The construction of a new Tyvek® manufacturing line exemplifies the open, collaborative relationships with authorities; the government's can-do attitude helps overcome hurdles and supports business success. Funding provided for R&D and projects that reduce environmental footprint--coupled with Luxembourg's stable, predictable and future-oriented legal framework--enable sustainable manufacturing and innovation. Short communication channels and flexibility are key for this multinational company which has felt welcomed by Luxembourg for 55 years.

One plus many

A much lauded outcome of TIR is the democratisation and humanisation of the marketplace. Peer-to-peer-based sharing, collaborative consumption and open-source communities are just a few of the changes enabled by the evolution of the online world. At its best, the heart of the sharing economy pulses with individuals' aspiration to make a better world. But businesses and the Luxembourg government are also determined to make a difference.

The TIR strategy in Luxembourg introduces new milestones in economic diversity and governance. It sets standards that can be used by other nations to change their thinking about their economy, the environment, and personal prosperity. It allows growing organisations in Luxembourg to understand the potential for profit while protecting and healing the environment, and encourages individuals to better realise their potential through a diverse and vibrant business and economic landscape. TIR will allow all citizens to truly become "quality of life" advocates for themselves, their community and the planet. X

FACTS

19th century

First industrial revolution: Cheap coal. Low-cost transportation. Telegraph. Automated printing press. Inexpensive communication and education.

20th century

Second: Oil. Electricity. Mechanisation. Telegraph. Telephone. Faster communication. Innovation in steel. Rail travel. Stock market.

21st century

TIR: Clean, renewable energy sources, IoT & cloud. Managed transportation. New financial system: people-driven.

"We rely on the government to… ensure that we have a good supply of highly skilled workers"

Olivier Laufer

TIR updates

Keep up to date on the third industrial revolution in Luxembourg. Visit the site to find the short and long reports, projects, strategies and awards. *www.troisiemerevolutionindustrielle.lu*

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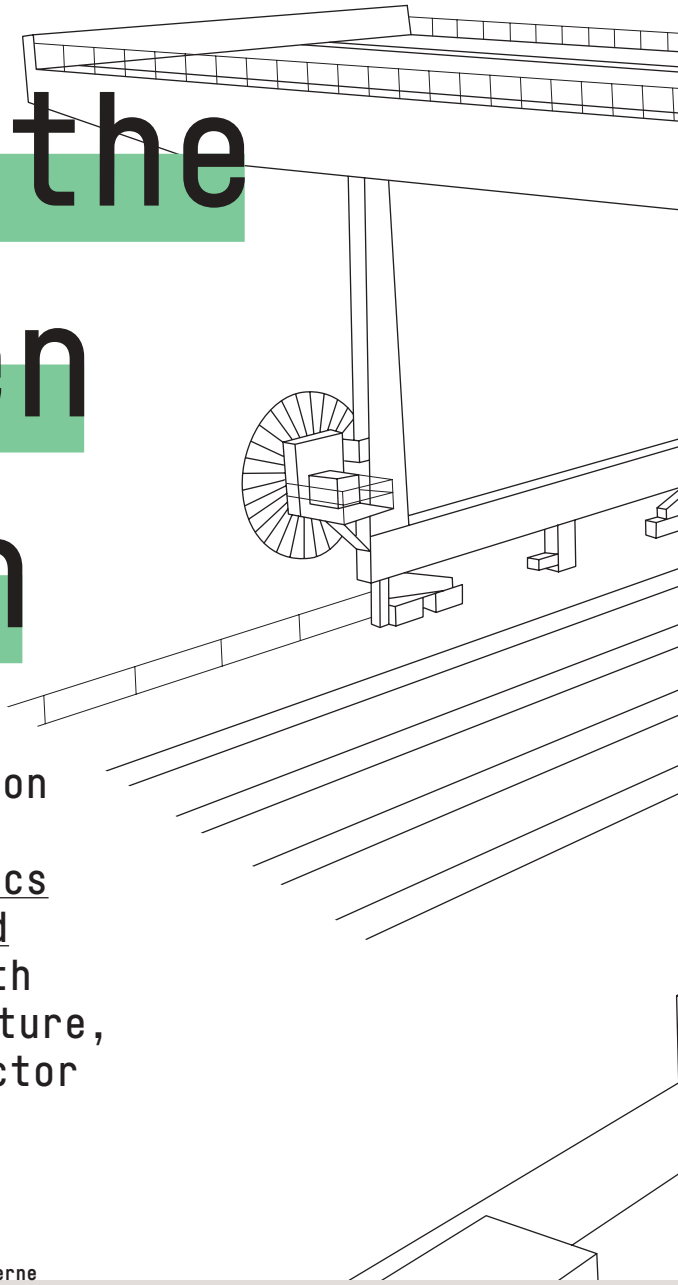
Luxembourg logistics: embracing the data-driven revolution



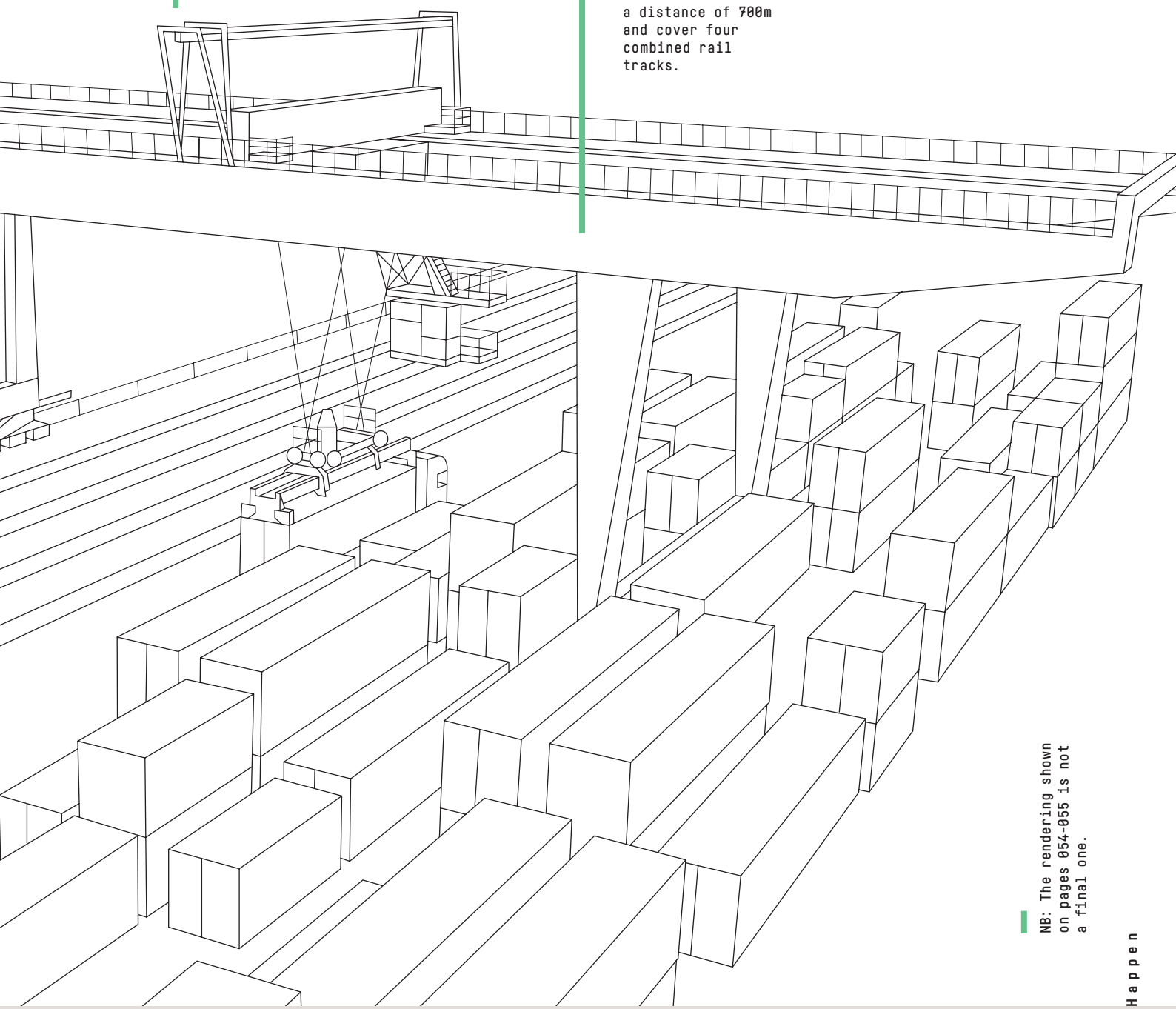
As global production and consumption rises and the habits of consumers become more demanding, the logistics industry must respond to increased global challenges. Luxembourg, with its excellent logistics infrastructure, continuing investment into the sector and forward-looking gaze, is well primed to meet those challenges.

Text by Mary Carey > Photographs by Sven Becker, Mike Zenari, Maison Moderne

They weigh 380t, with a height of 20m, and are able to lift up to 45t.

The two new gantry cranes move over a distance of 700m and cover four combined rail tracks.

In the future, most of the handlings on the combined terminal will be done by the cranes.



NB: The rendering shown on pages 054-055 is not a final one.

Digest:

Rising global production and consumption and changing consumer habits are forcing the logistics industry to respond. With its position as a central European hub and forward gaze, Luxembourg is well equipped to meet the challenges. Luxembourg's airport is one of the leading freight airports in Europe and home base of Cargolux, Europe's leading all-cargo carrier. One of the country's newer facilities is Le Freeport Luxembourg, located in a prime location at the Luxembourg airport next to the air cargo terminal. Andrea Scammacca, Head of European Supply Chain, FANUC, offers insight into why Luxembourg is an excellent choice as a logistics hub. Richard Forson, President and CEO of Cargolux Airlines, sees external forces such as disruptive technologies as catalysts for business model change. One such disrupter is Nektria, a Luxembourg-based start-up offering a new logistics and delivery solution model. Arnaud Lambert, CEO, CHAMP Cargosystems, explains why digitalisation will be the key to success in this environment. Professor Benny Mantin explains why the new Luxembourg Master in Supply Chain Management will help individuals and companies stay current. X

The simple definition of "logistics" is the management of the flow of things between point A (often the producer) and point B (the consumer). Yet logistics is anything but simple in our complex world.

There is a wind of change being whipped up by e-commerce. Logistics companies have to respond to consumers who want timely, low-cost deliveries, and to retailers demanding low-cost fulfilment and delivery operations. This demand for efficient, time- and cost-effective supply chain management has become a major factor of success for companies operating cross-border. With its position as a central European hub, Luxembourg provides global companies with many strategic advantages for conducting their business successfully in, from and to Europe, continuously improving its positioning as an intercontinental value-added logistics hub in particular for contract, air and rail freight-based logistics activities.

Luxembourg's key logistics players

According to the World Bank's *Logistics Performance Index 2016*, Luxembourg ranks as the second best-performing country globally. An important number of key players (carriers, handling agents, forwarding agents and logistics service providers) provide top quality service, allowing just-in-time access to the EU consumer market.

lpi.worldbank.org/international/global

"Cross-border e-commerce is growing"

Richard Forson

Who is he? Living in Luxembourg since 2012, Richard Forson is President and Chief Executive Officer at Cargolux Airlines International. He spoke to us about how the cargo business has to replicate the smooth and efficient B2C experience found in e-commerce.

> “Our role is to help develop another pillar in the foundation of our economy”
>
> Benny Mantin

Who is he? Professor Benny Mantin is Director of the Luxembourg Centre for Logistics and Supply Chain Management (LCL), founded in December 2015 to establish Luxembourg as a world-class research and teaching hub in the field.

www.clusterforlogistics.lu

This list includes such players as Cargolux, China Airlines, Cobelfret, DB Schenker, DHL, Kuehne + Nagel, Morrison Express, Nippon Express, Panalpina, Qatar Cargo, TNT, HNA Yangtze River Express, and Yusen Air & Sea, to name but a few. As a result, numerous international companies are shipping their products through Luxembourg to gain entry into the European market.

Luxembourg’s international airport is one of the leading freight airports in Europe and home base of Cargolux, Europe’s leading all-cargo carrier. The global network of Cargolux and other airfreight carriers offers multiple destinations to all continents making Luxembourg an excellent platform for worldwide distribution. Adding to its attractiveness are LuxairCargo’s modern and well-equipped air freight handling facilities which offer secure, efficient and speedy ground handling as well as a state-of-the-art constant temperature Healthcare & Pharmaceuticals facility dedicated to the storage and transportation of sanitary products and pharmaceuticals. >

FACTS

E-commerce grows double-digit, but...

According to research done by Nektria, *Disruptive on Demand Mobility & Smart Transportation Solutions*, when developing their product Responsive E-commerce Shipping (RECShipping), by allowing the end consumer to choose where and when to receive his/her online purchase at a variable price, online stores can offer premium delivery. The carrier can use this valuable information to improve planning, and ultimately the impact over cities is minimised: less traffic, lower carbon trace, less noise.

This was partly based on R&D that showed:

21%-60%
Cart abandonment

20%-35%
Failed deliveries

↑↑%
E-commerce logistics costs

CFL Cargo (conventional rail freight) and CFL Multimodal (combined transport and multimodal logistics services) are able to offer reliable rail connections to major continental hubs all across the EU and Turkey, as well as to ports of the North Sea and the Baltic Sea, thus making Luxembourg an extended gateway of the main European ports of Zeebrugge, Amsterdam, Rotterdam and Hamburg. With its rail motorway connection, Lorry-Rail provides innovative solutions for multimodal transportation modes.

Rail freight

The new CFL Intermodal Terminal Bettembourg-Dudelange was officially inaugurated in July 2017, greatly increasing Luxembourg's logistics capability. With 40% of European GDP within a 500km radius and 80% of European industrial centres within a one-day reach, the new terminal has a surface of 33ha, four combined rail tracks and two rail motorway platforms, each 700m long. With its ideal geographic and its efficient combined train network, the new hub will enable the consolidation of multimodal transport flows within Europe and beyond.

Inland waterway shipping is another form of reliable and safe transport. Luxembourg has a river port, which can be used for the shipment of raw materials and agricultural products, iron and steel, and petroleum products to

> "Multiculturalism represents one of the main characteristics of the Luxembourgish working environment. At FANUC, we embrace this cultural diversity"
>
> Andrea Scammacca

Who is he? Andrea Scammacca, *Head of European Supply Chain of FANUC Supply Chain and Logistics activities in Luxembourg.*

other domestic destinations or to the North Sea.

Luxembourg Freeport

One of the jewels in Luxembourg's logistics crown is "Le Freeport Luxembourg" which has been open since September 2014. CEO Philippe Dauvergne is justifiably proud of this surprisingly beautiful and spotless facility which allows for the management and storage of valuable goods under a regime of suspension of VAT and customs duties. This freeport, located at Luxembourg's international airport, is a safe and highly secure area of 22,000m², spread over four floors. Under the control of the services of the Administration of Customs and Excise, it stores works of art, jewellery, vintage cars, wines, important documents and other treasures in an ultra-sophisticated, ultra-safe platform.

A big advantage, mentioned by both Dauvergne and Laurent Jossart, Executive Vice President LuxairCargo, is the smaller size of Luxembourg's airport and its closer proximity to cargo handlers and storage. Whereas elsewhere, delicate, perishable, live or high-value goods could potentially be damaged when being removed from a plane and then driven to a cargo facility some distance away, here the cargo can mostly be delivered direct from a plane to the storage or handling facility.

The satisfied customer – FANUC case study

Andrea Scammacca is the Head of European Supply Chain at the FANUC Europe Corporation, one of the worldwide leaders in factory automation for CNC (computer numerical control) systems, robots and production machinery. Since 1956, FANUC has been the pioneer in the development of numerically controlled machines in the automation industry and now has over 259 subsidiaries worldwide with more than 6,000 employees engaged in sales, technical support, research & development, logistics and customer service activities.

Prior to selecting Luxembourg, FANUC undertook considerable studies to determine the best location for centralising their European product customisation. "The analyses using the centre of gravity method showed that Luxembourg was the optimal solution due to its central European location and the ideal balance between factors such as customer locations, volume of goods shipped, transportation, labour and warehouse costs," Scammacca says.

He further explains, "The logistics business of FANUC is supported by three different aspects: the product customisations according to the European customer needs, the direct connection to the Japanese headquarters, which has allowed us to form >

www.lefreeport.lu

Freeport

Le Freeport Luxembourg, located at Luxembourg airport next to the Air Cargo Terminal, is a high-end facility for storage, handling and trading of valuable goods that will change the landscape of the Luxembourg airport for the better.

Arnaud Lambert is CEO of CHAMP Cargosystems, a company seeking to connect the cargo community with innovative IT solutions.

a strong bridge between them and European customers and, finally, the strategic partnerships that support our complex logistics activities. For the European stock management (contract logistics) as well as the distribution of more than 10,000 robots and robo-machines per annum, steady and reliable partners are a must. Every week, our products are shipped here from Japan by sea in more than 40 containers. They are then delivered by train and by truck to the ECDC by Yusen Logistics. Kuehne + Nagel then manage the stock and outbound shipments.

Finally, the customisation activities are 100% handled by FANUC, with a dedicated multinational team." Multiculturalism represents one of the main characteristics of the local working environment, in Scammacca's view a key advantage to doing business in Luxembourg.

Winds of change

No matter how strong the Luxembourg logistics industry has to be prepared for the winds of change. Richard Forson, President and Chief Executive Officer of Cargolux Airlines, calls his industry, "A 24/7/365 business at the end of the day", normally spending weekends at the office. But it is not just because of the traditional demands. He adds, "Our industry will be forced to change the way they do business. There are many external forces changing the original business model. You have disrupters such as artificial intelligence, ICT and competing or complementary players that have new business models like *Expedia.com* (third-party booking).

It's easy to see what Forson means and not just for cargo, but for the entire global supply chain. When Amazon purchased Whole Foods, the upscale supermarket chain, it upturned the apple cart because it means that you can order your food and have it delivered straight to your home, eliminating the need for the store, and probably more cheaply and efficiently. It sent shockwaves of fear throughout the wholesale and

retail world but also a clear message to the supply chain and logistics world: innovate or be left behind.

One company also singing this tune is CHAMP Cargosystems which provides software solutions for the air cargo industry. CEO Arnaud Lambert says that digitalisation is the number one opportunity and challenge: "The key to success will be a willingness to digitalise. This will involve collaboration amongst parties. In our industry, everyone is part of a chain, or like dominos if things don't go well."

CHAMP's client base represents the broader airfreight community for whom they provide cargo management systems, messaging, online booking, handling, accounting, border management, customs and security and/or quality matters. They also have an astonishing 83% penetration of the worldwide IT solutions for cargo freight and a coverage of 83% of the data of the freight.

Lambert believes that, "What companies need to do now is optimise the cross-processes to keep the customer of your >

Luxembourg Cargocenter

Luxembourg Cargocenter is the 6th largest airfreight platform in Europe and the 25th largest in the world.

> “What digitalisation does is offer the classic players a chance to change their game to the level of the new players who are bringing a better experience to the end customer”
>
> Arnaud Lambert

Who is he? Arnaud Lambert, *CEO of CHAMP Cargosystems*

customer happy. We are all looking for better availability, integrity and security of information. As soon as you go digital, these also become challenges. That is why we are happy to have our headquarters in Luxembourg which is readily adapting General Data Protection Regulation (GDPR) standards and which stands on the frontline of the digital revolution.”

Another way in which Luxembourg is preparing itself for the future is through the University of Luxembourg’s Centre for Logistics and Supply Chain Management (LCL). Professor Benny Mantin, Director of LCL, explains that, “Our role is to help develop another pillar in the foundation of the economy and our core element is a ten-month Master in Logistics and Supply Chain Management (LSCM), taught in English. This programme has been created in cooperation with the Massachusetts Institute of Technology – Center for Transportation and Logistics (MIT CTL).”

The disruptors in Luxembourg

Meet Nektria, a company that offers a logistics and delivery solution model and whose product, Responsive E-commerce Shipping (RECShipping), seeks to revolutionise the last mile for e-commerce. Nektria was one of the two first companies (along with itravel) to receive €500,000 by the Luxembourg Digital Tech Fund, a seed fund launched by the government in 2016 for ICT start-ups.
Why did they choose Luxembourg? “The country and government are heavily betting on turning into a logistics and e-commerce hub. This is very important for us,” says Javier Juncadella, CEO of Nektria.

With their RECS solution, they make it possible for the digital shoppers to decide when and where they want to receive their order, a major problem for e-commerce businesses, who see that a lot of consumers abandon their shopping carts when they are unable to decide when the delivery should take place.

About their service, Juncadella explains, "In the midst of the 20th century you are at the expense of the carrier. With our model, customers can choose when and how much to pay." And while Juncadella cites, "… ultra-broadband connections and very short latency between Luxembourg and the primary internet access centres in Europe" as part of their decision to move here, Luxembourg in turn is clearly banking on this company that found out of a logistical challenge opportunity to strengthen the local ecosystem.

"Disruption leads to innovation," Lambert says, "Innovation is the way forward. Companies like Amazon have disrupted the logistics industry, but this can bring value to everyone through digitalisation. We have launched a whole new set of innovations inside our company because we are interested in how our processes and ideas can translate into new businesses. This is how Luxembourg is also innovating. We cannot say Luxembourg is the Silicon Valley of the EU, but the country has a very good set of brains sitting around the table that has pushed us forward, and we should continue in this direction." x

FACTS

80% of the European Union GDP can be serviced from Luxembourg in one day.

European air-cargo hub linked to all continents.

Extended gateway for major European seaports.

Info

For more information, Daniel Liebermann, Director Logistics, Ministry of the Economy, on [+352] 24 78 43-41 or by email: *daniel.liebermann@eco.etat.lu*

INFO

Luxembourg is ranked second globally for logistics capabilities with a score of 4.22 by the World Bank's *Logistics Performance Index* for 2016, published as part of the fifth edition of its biannual *Connecting to Compete study*.

Luxembourg is located in the heart of Europe with air links to all continents. It is a gateway to major European ports and is connected to EU consumers. With the country's advanced ICT environment, the country is ready to embrace the e-commerce and data-driven revolution.

In 2016, Luxembourg was ranked fifth in the *FM Global Supply Chain Resilience Index*. A total of 130 countries were analysed, on the state of their economies, overall risk levels and supply chain robustness.

Anne-Catherine Ries
Digital Policy Advisor

Making our way towards a digital nation

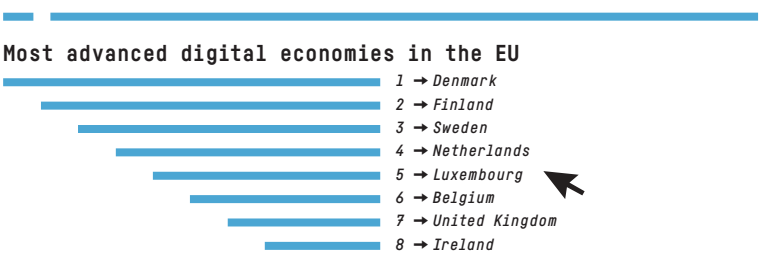
Search

In 2014, Digital Luxembourg launched: the government is working closely with public and private institutions to implement a digital nation. Luxembourg has an excellent infrastructure for established companies and start-ups alike, but it's the size and ease of access to key stakeholders which make it an agile ecosystem and perfect testbed.

Text by Natalie Gerhardstein > Photographs by Maison Moderne

Digest:

At the turn of the millennium the Luxembourg government decided to take a hard look at which key priority areas it would develop in an effort to diversify the economy, including ICT. In order to take digital to the next level, the Digital Luxembourg initiative was launched in 2014 as an umbrella for public-private projects and ventures. Anne-Catherine Ries, its Digital Policy Advisor, reflects on milestones in Luxembourg, showcasing RTL and SES and e-commerce giants such as Amazon and PayPal, among others. Although Luxembourg today boasts the highest density of Tier IV data centres anywhere in the EU, Ries acknowledges infrastructure is not enough, emphasising the need for digital skills, an entrepreneurial spirit and creative minds within an innovative framework, all of which Digital Luxembourg is actively promoting. David Foy of Luxinnovation agrees infrastructure isn't enough: the real game changer is the fact there are successful case studies across a broad range of industries. He believes Luxembourg's size makes it an ideal testbed for new concepts--and if there are further challenges, ease of access to key stakeholders keeps the entire ecosystem agile. X



The ICT venture has moved through several stages, culminating in the launch in 2014 of the Digital Luxembourg initiative. A public-private initiative bringing together ministries, institutions, individuals, start-ups, corporations and academia, Digital Luxembourg helps them create innovative solutions to meet current and future needs. "We act as an enabler to those who facilitate the digital transformation of our country," says its Digital Policy Advisor Anne-Catherine Ries.

For start-ups and companies looking to set up in Luxembourg, the country offers more than just a list of USPs: its size and ease of access to key stakeholders make it an ideal living laboratory and testbed.

Commitment to digitalisation

Luxembourg has a long history of taking the lead in innovative communication technologies, with the likes of RTL and SES showcasing the country's talent for creating success stories on the international stage. But Ries says it was a major milestone when, in 2004, international e-commerce giants started heading to Luxembourg. These included Amazon and PayPal, among others.

"We learned, by talking to these innovative companies, that we needed to invest in technological infrastructure and international connectivity," says Ries. LuxConnect was created in 2006 under the initiative of the Luxembourg government, with the objectives of improving the dark fibre network, as well as building and operating state-of-the-art data centres.

Source: Digital Economy and Society Index (DESI) 2017, European Commission

It triggered tremendous investment, which in just a few years turned Luxembourg into one of the best-connected countries in the world: today Luxembourg has the highest density of Tier IV data centres anywhere in the EU.

However, Ries recognises that infrastructure and attracting major players is not enough. "We need innovative start-ups and entrepreneurial spirit; we need broad skills and creative brains to come up with the next big thing." She adds: "We therefore need to invest in R&D, in our university and our research centres. We also need future-proof and innovation-friendly, yet privacy protecting legal frameworks to accompany these societal changes. Lastly, we have to foster creativity, collaborative mindsets and digital skills in our children."

The launch of Digital Luxembourg is the result of the government's acknowledgement that it takes strong joint political commitment to address the challenges of a digital society in every portfolio and key policy area, and that this needs to be done in close collaboration with the private sector.

"The political objective and strategic vision are clear: to use digitalisation as a lever for transformation, to prepare Luxembourg for the future and to harness the huge potential that new technologies can offer. The aim of Digital Luxembourg is not only to respond quickly and with agility to this profound ongoing transformation, but also to shape it proactively by making Luxembourg an ultra-connected, innovative and dynamic country--a world-leading smart nation."

Unique competitive advantage

For David Foy, Head of Sector Development for the Digital Economy at Luxinnovation, developing an economy rather than a bottom line is much more fascinating--and the digital economy in Luxembourg is a cause he absolutely champions. Foy recognises how broad ICT is, and he should know: for over 25 years, his career has developed in a variety of roles in the field, ranging from infrastructure, operational to international strategy.

"When you can speak to a potential foreign investor about Luxembourg without having to put a self-interest 'sales' twist on what you say, it allows you to go out and say this is the economy, this is what's happening and this is the roadmap for the future," he says. "That's quite an exciting thing to do."

For him, the roadmap can be visualised as an inverted pyramid: industries across the top (the pyramid's base), ICT at the bottom (its apex), and the entire framework comprised of "bricks". Digital strategy is generally very broad, and Foy is the first to admit that Luxembourg isn't unique in many of those "bricks" which help form the broader strategy.

The real game changer

"Five or six years ago, there were obvious tax implications for the gaming industry, streaming, media-related activities," Foy says. "But as far as USPs go, it's very complicated to find one these days." >

DATES

2014

Digital Luxembourg initiative launches in autumn.

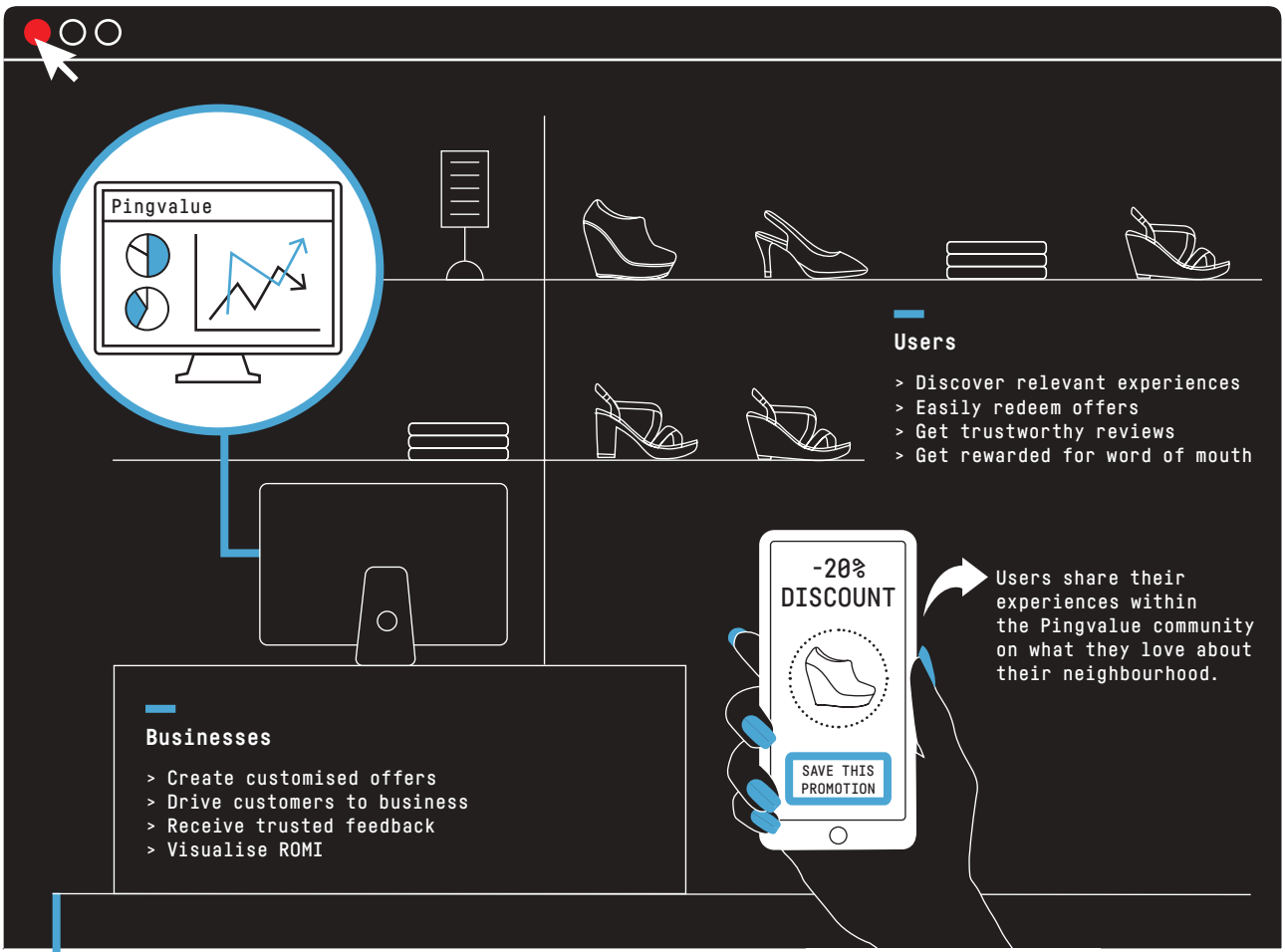
2017

The Luxembourg House of Financial Technology opens on 24 April to serve as hub for interaction among tech start-ups and financial institutions.

FACT

1st

Luxembourg will host the world's first data embassy for Estonia, set to be operational by 2018. The agreement was signed in 2017 by Luxembourg PM Xavier Bettel and Estonia PM Jüri Ratas.



How Pingvalue works

Pingvalue is a user-centric platform using Luxembourg as a living laboratory. The company began in 2014 at the Lux Future Lab incubator and works with Cisco to provide hotspots. Through the co-creation of "smart-hoods", users interact with their surroundings, and businesses then access data through a dashboard, helping them target consumers through customised promotions.

Take connectivity, for example: Amsterdam and London are strong competitors. Great infrastructure? Again, Amsterdam and London both rank high, as does Dublin. Multilingual workforce? Other international cities, especially those with universities, are contenders. Security, both on a personal level as well as a cyber level? Luxembourg has it, but is this a game changer? Even data centres are commodities these days.

So how, then, does Luxembourg compete on the international level when it comes to digital? Foy thinks that each brick--alone--is useless. "But we can tell the story from the industry point of view--be it fintech, logistics, automotive--and show some success stories of people who have come to Luxembourg and the whole value chain we can provide," he says, adding: "We say we are good at approaching your industry, and we have everything supporting that to be able to deliver on it."

Instead of an approach focused on one or more USP, Foy prefers an approach from the industry perspective, highlighting specific case studies with best practices in that given industry, and he notices that more is happening transversally as well. >

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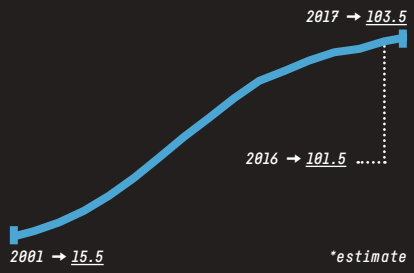
“One of the most exciting things we can offer as a country is our size and agility”

David Foy, *Head of Sector Development for the Digital Economy at Luxinnovation*

Global ICT developments

The rise of mobile-cellular telephone subscriptions, 2001-2017*, per 100 inhabitants



*estimate

Source: ITU Statistics

Such a network and approach help keep the entire framework agile. "One of the most exciting things we can offer as a country is our size and agility," Foy says. This translates not only to the ease of access to politicians, key decision makers and peer CEOs, but also the sheer ease of using Luxembourg, or subsets of it, as a living laboratory.

It's part of a "soft-landing initiative": people are looked after from a business perspective as they arrive and set up in the Grand Duchy. If companies are setting up elsewhere, they might not find out whether a country's sales tactics were just propaganda until they have already arrived and set up and by then it's too late. But in Luxembourg, "You can test it, find out whether it works," Foy says. "And if you don't like it, that's fine--we'll either adapt the system, or it wasn't a fit at all."

Testbed case study: Pingvalue

Pingvalue is one example of a company using Luxembourg as a living laboratory. A user-centric platform, the start-up began in the Grand Duchy in 2014 at the Lux Future Lab incubator. By July 2017, it had received the EU seal of excellence as a high-quality project for innovation in retail under Horizon 2020, an EU Framework Programme for Research and Innovation (the largest of its kind ever, with €80 billion in funding made available between 2014-2020).

Working with Cisco to provide hotspots, Pingvalue facilitates the co-creation of so-called "smart-hoods", whereby users interact with their surroundings, sharing content through the app about products or services they like. Companies can then access certain data, based on user agreement, through a dashboard to garner more information, helping them effectively target consumers through customised promotions.

CEO Luciano Scatorchia wants users to "experience physical content with emotion, and encourage people to get back to physical locations."

At the time of writing, Scatorchia was anticipating the launch of the platform on the Belval campus in Esch-sur-Alzette, in southern Luxembourg, by end 2017. A former steelworks site, Belval is one of the most impressive recent European urban renewal projects, spanning 120ha, housing the University of Luxembourg businesses in R&D, retail and more. The expectation is that 7,000 students will eventually be on site at this hub, plus some 3,000 employees at the university alone.

www.uni.lu

"The site offers a complete and secured environment," Scatorchia says. "If we succeed in Luxembourg, we can succeed in any country we enter."

Marco Mentucci, Marketing Coordinator, also cites a number of factors that make Belval ideal: good IT networks and environment, students and businesses, and the fact that it's a growing area. "We started in Luxembourg because they're investing a lot in IT start-ups at the moment," he says. "We have partnerships with companies and the university here, and it was easier than having to establish our own network. Working with the local government is also much easier." X

DATE

2016

The Digital Tech Fund is set up by the Ministry of the Economy with private investors in a bid to support innovation in technology.

FACT

€500,000

The amount awarded to each of the first Digital Tech Fund recipients, itravel and Nektria, in July 2017.

Info

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Jean-Michel Ludwig
Director for Start-up Support and SME Performance at Luxinnovation

FIT 4 START PROGRAMME

Since	2015
Head of programme	Jean-Michel Ludwig
Located	Esch-Belval Campus, Luxembourg
# start-up applications	451 (no call on pilot project)
# start-ups accepted	23 (incl. fall 2017 edition)
# start-ups graduated	14 (excl. fall 2017 edition)

As GDP saw a similar development in the same time period, the study suggests that there could be a possible link between economic growth and entrepreneurial activity.

Start-ups in Luxembourg – an upward trend

Source: Statec

Thanks to a thriving ecosystem, Luxembourg is an emerging hub for entrepreneurs with great ideas who want to launch or accelerate their start-ups.

Text by Mary Carey > Photographs by Mike Zenari

Digest:

Fit 4 Start with its excellent coaching and grant of €50,000 at Luxinnovation has gained quick notoriety. Jean-Michel Ludwig, Director for Start-up Support and SME Performance, says Luxinnovation offers other services such as to SMEs, backed by a support structure of sector development specialists, funding experts and specialists in market analytics. New players such as Luxembourg City Incubator and Vodafone's Tomorrow Street are evidence of the start-up ecosystem's health. Closer cooperation between players brings more success for entrepreneurs and the national economy. X

Looking for an overall picture of the Luxembourg ecosystem, we ask Jean-Michel Ludwig, Director for Start-up Support and SME Performance at Luxinnovation, about the Fit 4 Start programme.

Jean-Michel Ludwig: We offer services not only to start-ups but also to small- and medium-sized enterprises. These are our two priorities. My role is to coordinate the teams dedicated to these two target groups so we can offer them optimum support. Towards this we have developed a series of programmes which includes Fit 4 Start. This programme is based on the most relevant methodologies and techniques for strengthening start-ups' value proposition and business model.

What does the programme entail?

It is a 16-week programme of coaching and weekly follow-up by 'Lean Start-up' experts that includes free access to the co-working space at Technoport and a grant of €50,000 from the Ministry of the Economy. They offer an additional €100,000 to start-ups that have both successfully graduated from Fit 4 Start and managed to raise at least €50,000 of private equity.

What makes Fit 4 Start a success?

It's not for us to speak about success. That is for the companies to say. But combining excellent and experienced coaching with a grant and adding the tough and honest advice of recognised jury members who have had success (and often failures) is a winning formula. We want our participants to succeed, but only they can make it happen.

What other services does Luxinnovation offer?

Let me stress that the Fit 4 Start programme only supports ten companies per year. However, 700 people come to us with start-up ideas. Half of them can be considered as innovative and can access the guidance of our five dedicated start-up advisors. But behind the start-up team is a larger support structure, including dedicated and experienced sector development specialists, funding experts and specialists in market analytics. Business planning and road mapping, access to finance (public grants, banks and private equity) and market validation can be considered as high added-value services for entrepreneurs.

Where does Luxinnovation fit into the ecosystem?

We are the national innovation agency and therefore play a unique role. As an arm of the Ministry of the Economy, we work with everyone in Luxembourg. Since we do not play the same role as an incubator or shared working space, our positioning allows us to connect the people who come to us to the ecosystem. This is an important role, as we know the roadmap of the various partners, and if we see a match we facilitate it.

What measures are being taken towards this?

A good example is how we have opened our Fit 4 Start programme so that the 20 projects competing for >

Jean-Michel Ludwig

"Luxembourg's advantage is close proximity to the players, the political decision makers, the government, and private industry"

The Fit 4 Start programme includes free access to the co-working space at Technoport, Luxembourg's technology-oriented business incubator.

DATE

2015

Still a young programme. Nevertheless, the programme clearly contributes to putting Luxembourg on the start-up scene.

FACTS

Fit 4 Start is a young programme that has seen some very promising start-ups, such as Aiva Technologies, an artificial intelligence platform that composes soundtrack music.

Nomoko is a former Fit 4 Start graduate. They are the developers of the world's first compact gigapixel camera system and 3D reconstruction software.

Luxinnovation
Linking the start-up ecosystem

Private accelerator

> PwC's Accelerator
> EAEC
> EYnovation
> InnoHub
> The Khube
> Deloitte

Non-profit incubator

> Technoport
> nyuko
> House of Entrepreneurship

Corporate incubator/accelerator

> Paul Wurth InCub
> Tomorrow Street
> Lux Future Lab

Sectoral

> Neobuild
> 1535°
> 6zero1
> The Lhoft

"In terms of the start-up ecosystem, we want to do more because it will benefit everyone, most of all our country. We want to ensure complementarity between what we do and what the others do. Even if sometimes there are overlaps, we want to avoid duplication because the system works better if everyone concentrates on their role. We have signed an agreement with most members of the ecosystem to share services with one end goal in mind--to make the start-ups successful."

Jean-Michel Ludwig

places in the 2017 autumn edition will be presented to the entire start-up ecosystem to find matches between good ideas and those who can help these start-ups thrive in Luxembourg--including ones not admitted to Fit 4 Start. This also increases our visibility.

How do you rank Luxembourg's start-up ecosystem?

We are emerging in a dynamic environment and the number of players is increasing drastically across the entire ecosystem. More important than figures is the uptick in private involvement, more and more corporate players exploring the opportunity of investing in start-ups, and more incubators that involve private actors.

One example is the development of the Luxembourg City Incubator which will become part of the future House of Start-ups, a project initiated by the Chamber of Commerce. Opening its doors in 2018 in the heart of the capital, it aims to house between 150 and 200 innovative start-ups from multiple sectors, both national and international, in a 4,200m^2 facility.

Another example is the recent grand opening of Tomorrow Street, Vodafone's innovation centre and acceleration programme for start-ups. This public-private partnership with the Ministry of the Economy and Technoport, an incubator, will make Luxembourg visible all over the world.

What types of start-ups does Luxembourg focus on?

In general, start-ups that are a good local fit and can therefore benefit most, so naturally there is an emphasis on fintech. Luxembourg is more than just fintech, however. In a bid to build a diversified, innovative economy, Luxembourg has developed a strategy based on key sectoral priorities in such areas as ICT, space, life sciences, materials and production technologies, automotive and smart mobility, cleantech and logistics. As this sectoral diversity flourishes the economy becomes healthier and more sustainable.

Our current ecosystem is not as good for early stage start-ups as we are for start-ups that already have a viable prototype and proof of concept.

Where do start-ups come from?

The majority come from abroad. We do see more successful start-ups than before developing from the ground up, but the majority are not Luxembourgish. Right now that is a fact in part because we are starting to have some very good spinoffs from our research institutions and from talented people coming from all over the world who are working for companies like PayPal and Amazon who start their own businesses. Luxembourg also has a large number of commuters meaning that we attract start-ups from the Greater Region. Add to this the fact that we are a small country yet one with extremely international visibility, and Luxembourg becomes an obvious place to nurture a new venture and springboard it to internationalisation.

How strong a role does research play?

The role of research cannot be underestimated. Luxembourg has invested heavily in the areas of cybersecurity, high performance computing (HPC), big data, and blockchain, amongst other areas, and Luxembourg is typically more interested in start-ups in these areas.

And funding?

Within Luxembourg we have a powerful instrument--Aid for Young Innovative Enterprises--for companies already in their expansion phase which have achieved traction and are seeking to accelerate and internationalise their businesses with the support of public investment up to €1.2m.

What could be improved?

The number of private investors. Here a large majority of private investment goes into real estate, despite extremely welcoming instruments such as the Lux Future Fund and the Digital Tech Fund. Another improvement would be earlier investment. In some countries the governments allocate more money for the really early-stage start-ups to decrease the risk that is taken by the entrepreneur. This early generosity can really pay off.

What is an essential ingredient for a start-up to achieve success?

It comes down to the entrepreneurs' ability to listen. If they are able to listen and take advice from all the people that they meet from the top to the bottom then we know they will pay attention and listen to their market. They will take the appropriate measure to match their product or services to the needs of the market even (or perhaps especially) if that need does not match their own objectives. This is exactly what we stress and coach in our Fit 4 Start programme. X

WORDS

Alexandros Trepeklis
CEO, Yollty

"What did we like about Fit 4 Start? The insights from coaches and enriching brainstorming with the other teams. The lean methodology that forces you to validate your assumptions in the real world. And the €50,000."

Charles Antoine Beyney & Antoine Boniface, *Co-founders, Etix Everywhere*

"Based in Luxembourg, a company benefits from a central location in Europe, an engaging start-up environment, strong and continued support for R&D."

Genna Elvin
Co-founder, Tadaweb

"In a country that is primarily focused on finance, the emergence of a tech ecosystem is exciting for many, as a result there are many stakeholders pushing technology forward."

Info

For more information, contact Jean-Michel Ludwig, Director Start-up Support & SME Performance, Luxinnovation, on (+352) 43 62 63-873 or by email: *jean-michel.ludwig@luxinnovation.lu*

Nine FACTS about Luxembourg

Text by Natalie Gerhardstein > Illustrations by Maison Moderne

19

137

Ranked 19 (of 137) in the *Global Competitiveness Report 2017–2018*, which assesses drivers of an economy's productivity & prosperity. **X**

Luxembourg had **the highest education spending in the EU** in 2015, with an average of €4,635 per inhabitant compared to the EU average of €1,405. **X**

Ranked **8th in innovation** on the European Innovation Scoreboard 2017, topping the "attractive research systems" & "intellectual assets" categories. **X**

Sources: World Economic Forum > Eurostat > European Commission > The *Legatum Prosperity Index 2016*, Legatum Institute > US News & World Report "Best Countries" 2017 > IMD World Competitiveness Yearbook, May 2015 > Luxembourg for Finance > World Economic Forum's *2015 Human Capital Report* > *Global Financial Centres Index*, September 2015

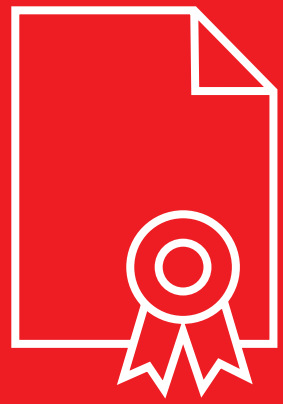
With an average life expectancy of 82, **Luxembourg is top for health** out of 149 countries, measured by infrastructure, preventative care and basic physical/mental health. **X**

Ranked second (of 80) countries as most open for business. ✖

Luxembourg was ranked the **most competitive country in the EU**, and 6th worldwide. **X**

Of worldwide assets under management, **over half of microfinance funds** are domiciled in the Grand Duchy. **X**

Luxembourg ranked first of 124 countries in the world for highest proportion of highly qualified people in its workforce. ✖



Luxembourg is among **the top 3 leading EU financial centres. X**

Happen 2017

Life in LUXEMBOURG

Luxembourg has been rated second of the eighty most business-friendly countries in the world, but it has many other charms. We invited four foreign CEOs and one Luxembourgish CEO to tell us about their experiences and favourite places in the Grand Duchy.

Text by Mary Carey > Photographs by Mike Zenari & Maison Moderne

Nigel Ramsden

Originally from	United Kingdom
Profession	Technical Manager, Robot Division and Dirigeant, FANUC Europe
Company's main business	Automation and robotics
Living in Luxembourg since	Over 20 years

Arriving here with little connection to Luxembourg--he was not entirely sure where it was--Nigel Ramsden is now a Luxembourgish citizen. Married with three children who were all born and educated in the local school system, he has seen huge improvements in the country "mostly in ease of living, transport, etc.", adding: "I had already worked with FANUC on various projects around the world. I had just finished a successful project to install a robot production line in Sweden, and as a result FANUC asked me to come to Echternach to support their automotive business. Later my role expanded to cover all technical issues, not just automotive." FANUC has invested heavily in Luxembourg which is its European centre, recently moving its main logistics/warehousing function from Rotterdam to a large, purpose-built facility in Contern. Luxembourg was partly chosen because of the central location in Europe for logistics. Ramsden unsurprisingly loves robots and is pictured in the new Luxembourg Science Center, where FANUC builds and exhibits, and a few of its robots are housed. X

Carlos Cipollitti

Originally from	Born in US, grew up in Venezuela
Profession	Vice President EMEA Product Development and General Director GIC*L (Goodyear Innovation Center in Luxembourg)
Company's main business	Tyres
Living in Luxembourg since	2007-2009, and then from 2015

Married with three children, Carlos Cipollitti is leading Goodyear's Innovation Center in Luxembourg, where he is VP for Product Development in EMEA (Europe, Middle East and Africa). He first travelled to Luxembourg in 1986, when he started coming to Goodyear's Technical Center for training on product development and industrialisation. He then moved to Luxembourg in 2007 and later to China in 2009 and continued the continuous interactions with the Innovation Center which required frequent trips back to the country. "Luxembourg is currently my country of permanent residence," he says. "We continue to visit our relatives in Venezuela and the US, where my three children live. My two daughters are working, and my son just started his engineering studies in Michigan. For work, Luxembourg offers an environment of focused growth, supported by government-led initiatives in a diverse environment, due to the multitude of cultures and nationalities present in the country. I love walking, running and biking around the various trails and towns in Luxembourg. The richness of the landscape, historical buildings and nature makes it very invigorating and relaxing." X

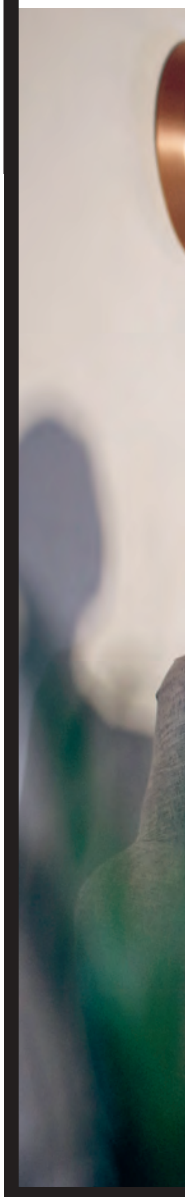
Toshihiko Otsuka

Originally from	Tokyo, Japan
Profession	CEO of Rakuten Europe Bank, Rakuten Europe, Luxembourg
Company's main business	E-commerce and commercial banking
Living in Luxembourg since	October 2014

Toshihiko Otsuka came to Luxembourg as an expatriate of Rakuten Inc. in order to build up the banking business and further strengthen their ecosystem in Europe. Otsuka says, "The business environment in Luxembourg is excellent in terms of talent sourcing, expertise and diversity. The infrastructure and close communication with the government and authorities is another factor which I truly appreciate. The diversification and creativity are very inspiring and unique. In our office, we have 19 different nationalities out of around 50 employees." He lives in Luxembourg but travels a lot to other European countries and Japan for business. "I feel like [Luxembourg] is my second home and I am proud to bring back lots of memories when I return to Tokyo... I love spring and autumn here. I also appreciate the easy travelling by car or train to neighbouring countries with very different cultures and people. This is different from Japan since it is an island and you always need to take a flight or ship to go abroad. There is no karaoke in town, which is a pity. Close to the office is Oberweis, my favourite place as it offers all kinds of food, cake, chocolates, cookies, and wines." X

Richard Forson

Originally from	South Africa
Profession	President and CEO, Cargolux
Company's main business	Europe's biggest all-cargo airline
Living in Luxembourg since	2012



Richard Forson hails from South Africa but prefers the weather in Luxembourg. "I am not one for hot days and sunshine. I like moderate temperatures." This might be why Forson works in what he calls "a 24/7/365 business at the end of the day". In fact, he normally spends Saturdays and Sundays at the office, when it is quiet, to catch up. "Anyone who wants to work at Cargolux needs to have that type of passion for aviation and commitment." He also says his industry is undergoing massive change. "There are external forces that are changing the original business model. Disrupters such as AI, other [cargo] players, [websites like] Expedia and digitalisation. Cargo companies will be forced to make changes to their business." He decided to move here permanently with his wife, although his son is at University in Edinburgh and his daughter is in Leeds. Eating well is also "a passion for my whole family and Luxembourg has many good restaurants. We also travel farther into Belgium if it's a nice location." Good to know he occasionally takes a break from the office!

Christiane Wickler is an entrepreneur and mother of four. 35 years ago, she took over a small gas station in Oberpallen out of which grew the Pall Center, consisting of an out-of-the-ordinary department store and numerous grocery stores throughout Luxembourg, amongst other businesses. President of the Federation of Women Entrepreneurs, she was selected in July 2017 for a seminar at Stanford University, with 40 other women leaders from around the world. All of her children went to school or studied abroad. Today, her two daughters both still live outside of Luxembourg: the eldest lives in Hamburg, Germany, and the youngest studies in Louvain-la-Neuve, Belgium. Often seeing herself in an ambassador role, Wickler feels Luxembourg's image and visibility are on the rise: "People associate stability, safety, diversity, and green with our little nation." Wickler applauds Luxembourgish pragmatism, but feels a Luxembourgish mind-set of risk avoidance still sometimes exists. Although she says that the greatest culinary experience for any visitor would be her mother's potato salad, she concedes that the steak at "Beim Hunn in Vianden is a close second". X

Christiane Wickler

Originally from	Diekirch, Luxembourg
Profession	Managing Director, Pall Center
Company's main business	"Naturally Different" department store
Living in Luxembourg since	1960 (date of birth)


INOWAI
INOWAI
INOWAI
tango

the unexpected LUXEMBOURG

Innovation extends to Luxembourg's cultural offerings. Whether you want to visit a museum by night, sip a glass of crémant in wine country or attend a concert at one of several state-of-the-art venues, the country offers a wide range of activities for individuals and families alike.

Text by Natalie Gerhardstein > Photographs by Anna Katina & Mike Zenari

The last days of summer

In summer, residents enjoy open-air concerts and fêtes, like Luxembourg's national day [D]. Even as summer fades, residents are eager to soak up those last rays at places like Boos Beach Club [B], where they can also enjoy seasonal dining [A]. The Nuit des Lampions festival [C] is another favourite, when Wiltz lights up for a magical evening.

On a chilly evening a couple of years ago, I left a Luxembourg City café during a comedy show intermission to chat with my husband outdoors. As we were speaking, his eyes suddenly grew large and he looked away from me. I turned to follow his gaze, and saw the cause of his reaction: walking along the cobblestone street was none other than Christoph Waltz.

Seeing the Austrian-German actor in Luxembourg momentarily surprised us--it was unexpected--but it shouldn't have. We knew he was in town directing a production at Luxembourg's Grand Théâtre.

I've called Luxembourg home for 10 years, my husband more than 20--but this country keeps us on our toes. We're often faced with the "problem" of trying to select from a range of events on evenings or weekends. And even if we've been to a venue a dozen times before, we find ourselves excited about a new exhibition, or a local music act.

Many of our Luxembourg and expat friends and colleagues say the same. In the last several years, many new venues have popped up, like the Rotondes, housed in a former locomotive shed. There are frequent surprise visitors at film festivals. Winter light displays on facades in the city centre. Local chefs testing new truffle or Kobe beef recipes. And that's just in the city…

Beyond the city, beyond, there is the picturesque north, with the Victor Hugo house and the stunning castle of Vianden. Or the east, with the Moselle river and its vineyards, where you can sip a crémant while watching the sunset. The industrial south is also developing rapidly, from the R&D hub in Belval (where Luxinnovation is also based) to a new science centre and more.

It isn't easy to keep up with the country's developments, but the photos on the following pages capture a few of those unexpected moments. X

A

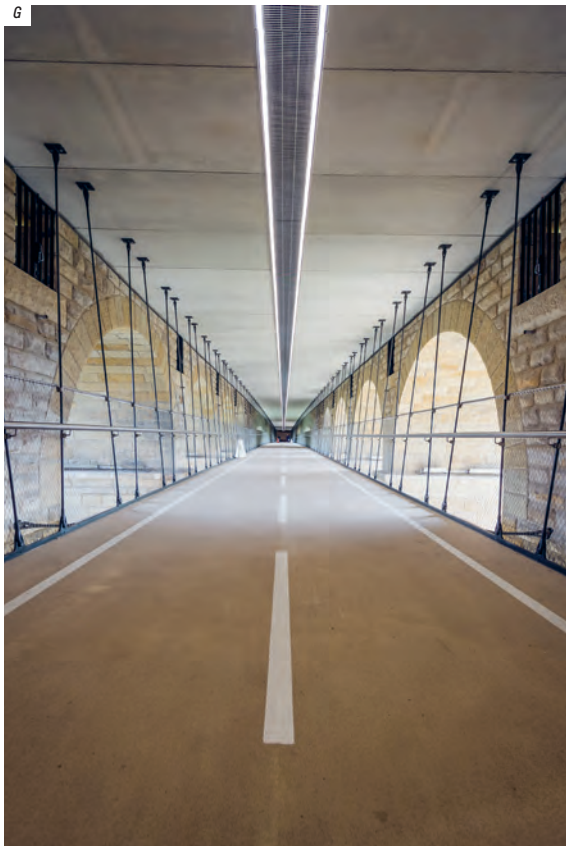
B

C

D

E

F



G

Run, skate and other fun

When it comes to lifestyle in Luxembourg, there's something for all ages and tastes. Favourites for children and families include the Pétrusse skatepark [H,I] for BMX, skating and scooter fans, as well as the Pirate Ship Playground [J]. It's easy to stay in shape with annual races, like the ING Night Marathon which takes place each May [E,F], and the new Pont Adolphe suspended footbridge [G] makes it easy for cyclists to navigate Luxembourg City's unique geography.

H

I

J


HITCH

K


DSP-KY-52
BOURBON WHISKEY
DOUBLE OAKED

L


ORIGINAL
CIDER CO
MEDIUM DRY

M


CIRCUS

N

O


P


Q

Into the late hours

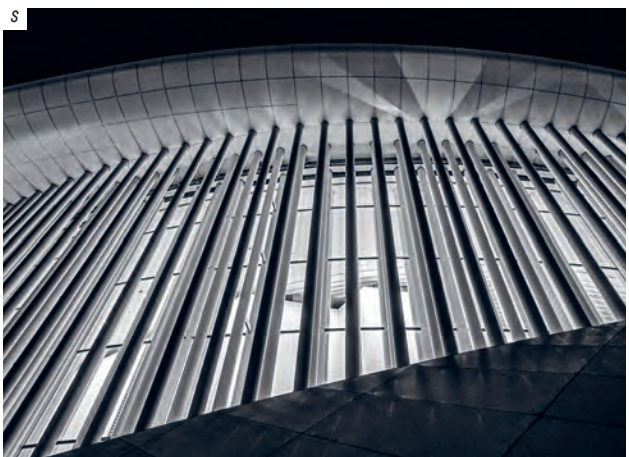
There is a plethora of bars [K] and clubs for a night out, in addition to plenty of festivals like the Schueberfouer [N,O], an annual funfair dating back to 1340. While Luxembourg wines are well-loved in the region, a new cider culture is also emerging, and the Ramborn Cider Haff [centre] in Born in the east celebrates local apples and cider making [L,M]. Avid concert-goers won't be disappointed with the range of music performances at venues such as Den Atelier [P,Q] in Luxembourg City or the Rockhal in Esch-sur-Alzette.

Keeping it classy

On the ever-developing Kirchberg plateau are several architectural marvels, including the Philharmonie [S], host to around 400 performances per year, and Mudam [R], designed by renowned architect I.M. Pei. On the Night of the Museums, visitors can see exhibitions at museums like the contemporary Casino Luxembourg [T] until the wee hours of morning.

T

R



S

To keep up to date with what's on in Luxembourg:
www.visitluxembourg.com

For what's happening in Luxembourg City:
www.lcto.lu & www.vdl.lu

Source: Nuit des Musées, Casino Luxembourg - Forum d'art contemporain

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WHAT will happen in LUXEMBOURG?

From a UNESCO-listed hopping procession to space-related conferences, here are a few event highlights taking place in the Grand Duchy in the year ahead.

2017

November

> **Tue.14**
The Future of Materials

> **Tue.14 – Wed.15**
Luxembourg Internet Days

> **Thu.16**
Newspace Europe

> **Fri.24 – Sun.26**
Startup Weekend Luxembourg

> **Thu.30**
Luxembourg Art Fair

January

2018

> **Fri.12 – Sun.14**
Tourism "Vakanz" Fair

> **Fri.26 – Sun.28**
Luxembourg Euro Meet

February

> **Thu.22 – Sun.4 March**
Luxembourg City Film Festival

> Printemps Musical festival

March

> **Fri.23 – Sun.25**
Springbreak Luxembourg (spring trends fair)

May

> **Sat.12**
ING Night Marathon

> **Tue.15 – Wed.16**
ICT Spring Europe
Pitch Your Startup

> **Fri.18 – Mon.21**
Wine, Taste, Enjoy: open wine cellars weekend

> **Tue.22**
Echternach dancing procession (UNESCO-listed)

June

> OMNI Festival

> **Fri.15 – Thu.21**
Fête de la Musique

> **Sat.16 – Tue.11 September**
Summer in the City

> **Sat.23**
Luxembourg National Day

> **Sat.30**
International Asteroid Day

> **Sat.30 – Sat.7 July**
GayMat Festival (pride celebration)

July

> Blast furnace festival

> Nuit des Merveilles

> Rock um Knuedler (capital rock festival)

> Blues'n Jazz Rallye

August

> e-Lake Festival

> Streeta[rt]nimation

> Bacchus Festival

> **Thu.23 – Tue.11 September**
Schueberfouer (Luxembourg City funfair)

Business events

Cultural highlights

For additional event listings, visit:
www.luxinnovation.lu
www.visitluxembourg.com

It happened 1st in Luxembourg

Luxembourg might be small, but it is constantly pushing the envelope. In 2017 alone, three exciting new firsts happened in the Grand Duchy.

Text by Natalie Gerhardstein > Illustrations by Maison Moderne

June 2017

Circular economy hotspot

In June 2017, Luxembourg became the first country to follow up and exhibit progress it had made over the prior two years to become a circular economy hotspot. Over three days, 200+ delegates from Europe and beyond met and networked to share opportunities for sustainable growth. X

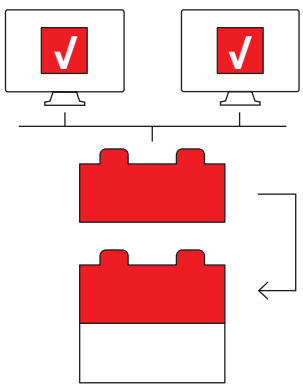
circularhotspot2017.lu

First global blockchain fund transaction

Luxembourg has a successful history in the global investment funds industry, and 2017 was no exception: Natixis Asset Management announced earlier in the year that investors had purchased shares through FundsDLT, marking the first blockchain transaction of its kind. X

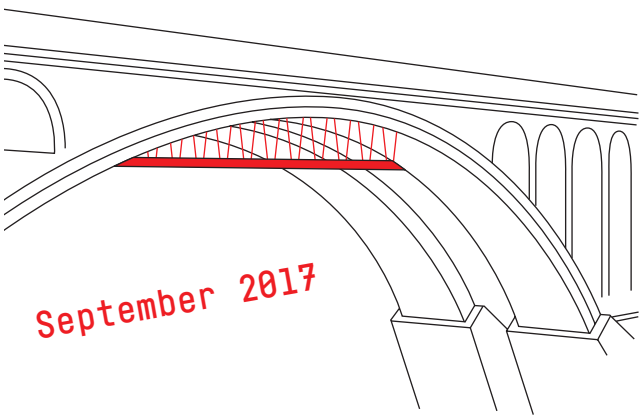
www.luxembourgforfinance.com

July 2017



Suspended footbridge opens

The Pont Adolphe is not only an architectural marvel--it's also a Luxembourg icon (see page 8). In September 2017, a 154-m footbridge suspended below the Pont Adolphe opened. Pedestrians and cyclists can now avoid the traffic above while taking in breathtaking views of the Pétrusse valley below. The opening of the footbridge took place during the Luxembourg edition of Mobility Week, an EU initiative launched in the early 2000s. In total, Luxembourg city has around 156km of cycle paths and 956 parking spaces for bicycles. For those who don't own bicycles, there are 717 vel'oh! bicycles available to rent at over 70 stations. X



September 2017

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