WHAT’S ON TOMORROW’S PLATE?

LAB MEAT, ALGAE, 3-D PRINTED FOOD
Menus will undergo big changes in the future

A BREAKTHROUGH IN TUNA FARMING
The secret to success is in the feed

BIRDSEYE VIEW OF THE UPPER ATMOSPHERE
Satellite lenses shed new light on luminous events
Bühler solutions for manufacturing high-quality meat alternatives.

Tap into new customer groups with textured plant proteins extracted from soy, oilseed, glutenous grains, pulses, and other plant-based protein sources. Adjust the texture, shape, color, and flavor of the products according to the needs of your target market and process them into high-grade meat alternatives.

Find out more: buhlergroup.com/tvp or nutrition@buhlergroup.com

Innovation with an edge.
Efficient meat alternatives made by extrusion.

Innovations for a better world.
The need today to research the nourishment of the future and make it industrially available is – next to the need to serve consumer demand for food-safe production and traceability – driven by two challenges: scarcity of resources and climate change. We already know that in a few years there will not be sufficient sources of protein available. The existing farmland and the applied methods for food processing are nearly exhausted. But humankind continues to grow, and by the year 2050, the United Nations estimates there will be 9.8 billion people inhabiting the Earth. If we don’t act now, we will be short by about 250 million tons of protein per year. That is the quantity needed to feed about 3 billion people.

Second, the production of foodstuff from field to fork is under pressure from the generally underestimated effects of climate change. According to the Intergovernmental Panel on Climate Change, about 30 percent of all carbon emissions come from agriculture. If you add in processing, transportation, refrigeration, preparation, and disposal of food, about 40 percent of all emissions depend on how we nourish ourselves and run our agriculture. What’s more, about one-third of all food produced ends up as waste. There is an urgent need for action.

No one can manage the task of sustainable food production alone. We need innovation – and we need platforms, where we cooperate with conscientious market participants, the economy, and politicians, to implement and scale these innovations in a purposeful way.

Bühler has made both its goal, and therefore this issue of Diagram magazine is focused on these subjects. They will also be the main topic of our Networking Days in 2019. “We want all people to have access to healthy food.” That is our claim. We can work together to get as close to this goal as possible.

Sincerely,

Stefan Scheiber
CEO Bühler Group
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TECHNOLOGY & SOLUTIONS

Latest innovations

Bühler in space
The French national space research center is sending a satellite into space with optical filters made with Bühler equipment.

Modernizing a malter
Swedish Viking Malt jumped from the '70s into the modern age thanks to a retrofit.

A banknote’s colorful tale
The Swiss 200 franc note was newly released – Bühler machinery was involved.

INNOVATIONS

Our latest digital solutions

MoisturePro
Get the optimal moisture content for food and feed and better yield with this new digital solution.

Bühler Insights
How our IoT solution will help you.

LumoVision
Improved food safety, kernel by kernel.

PastaSense
Pasta joins the digital revolution.

HyperVision
A gateway to a breadth of applications.

Innovation campus
The CUBIC is taking form and will be officially opened in late spring 2019.

Did you know?
• Fun facts about the future of food
• Imprint

Food for thought
Our Chief Technology Officer on Bühler’s innovation journey, new innovation campus, and Networking Days 2019.
WHAT WILL WE BE EATING TOMORROW?

Our eating habits will inevitably change in the coming decades. The ability to provide humankind with sustenance in the future is not guaranteed by any means. One consequence of enormous population growth is that we will have to find new sources in just a few decades if we want to feed all the people in this world. Bühler is taking on a large piece of the responsibility in this development. It is investing in researching new technologies for processing alternative foods, whether proteins sourced alternatively, algae proteins, or insects for animal and aqua feed.

Working together with customers, Bühler tests new processes and gathers feedback until the processing technology reaches market readiness. The implementation of digital technologies developed by Bühler also makes it possible to increase the sustainability of existing production, improve its efficiency, and reduce food waste as well as energy consumption. New digital technologies such as blockchain are the key to complete traceability within the value creation chain. Bühler is working on the leading edge of development here as well. Time is short, with today’s food production heavily burdened by the environment while our planet pushes the limits of its capacity.

Bühler’s goal is to provide all people with access to healthier and safer nutrition. Though it is not possible today to say with complete certainty what will be on our plates 30 years from now, one thing is sure: Bühler and its partners are working intent on entirely new, sustainable solutions for the future.
Today’s view of tomorrow’s foods

Whether alternative protein sources, insect-fed chicken and fish, cultured meat, or algae, many technologies are being tested for the diet of tomorrow. With digital transparency across the value chain, health tracking and traceability are within reach.

TEXT: DANIEL RÖTTELE AND BEATRICE CONDE-PETIT / INFOGRAPHIC: DANIEL RÖTTELE

In the year 2050, there will be around 9.8 billion people on Earth according to the United Nations. Feeding them will require the production of a huge amount of protein each year – 50% more than today. To keep both people and the planet healthy, we will have to change the way we think about consuming and producing foods. Biotechnology and digitalization are among the drivers of the transformation to come.

Algorithms

Pulses

Algae and seaweed

Insect-fed chicken and fish

Many people love meat. With the middle class growing in threshold countries, global consumption is set to rise dramatically. &XUUHQWPHDWSURGXF - WLRQFRVWHijHFWLYHDQGZKDWFRQVXPHUVZLOOWKLQN of meat coming from labs. 1XPHURXVıWQHVVWUDFNHUV and apps already exist today. In the future, health tracking and wearables are expected to grow in importance, for example with sensors that measure the blood sugar level via the skin. Start-ups already offer comprehensive DNA analyses of intestinal bacteria as a health indicator – together with personalized dietary recommendations. But the question arises: How reliable is this information? Does more insight really lead to lasting change in consumer behavior and improved health? And: who does the data belong to? Transparency along the entire production chain is the key to food security, less fraud and efficient utilization of resources. Drones and satellites capture field data, while Big Data analyses warn of any contamination. Online sensors, the Internet of Things and block-chain enable end-to-end, unalterable documentation of all steps in the value chain. As a result, food production can be monitored, allowing consumers to make founded purchase decisions based on information about origin, processing, and sustainability of the food. Today, Bühler already offers a range of digital solutions. The pressure for greater sustainability and food security is the driving force behind cellular agriculture. Biotechnology offers enormous potential for developing food for humans and animals using yeasts, bacteria, algae or animal cells. Gene technology is also becoming more important in reducing the carbon and water footprint of the food chain. For example, a US start-up is developing a cow-less milk that is brewed in a fermenter. In addition, labs across the globe are researching the new genome editing method CRISPR/Cas9 in an attempt to cultivate plants resistant to certain diseases.

Meat straight from the lab

Many people love meat. With the middle class growing in threshold countries, global consumption is set to rise dramatically. Current meat production is already placing excessive strain on the planet: major demand for feed weighs heavily on our carbon footprint, while bacteria resistant to antibiotics used in factory farming are a threat to health. We need alternatives. Numerous smart-ups and researchers are working on new ways to produce meat without breeding and slaughtering animals by growing animal muscle cells in a nutrient solution. The challenges are: keeping meat production cost-effective and what consumers will think of meat coming from labs.

Textured proteins

Meat alternatives are made from a variety of protein-rich, plant-based sources, such as soy, wheat or peas. Bühler offers solutions for texturizing plant-based proteins that can be used for a variety of end products. Algae proteins are also gaining notice in the world of texturates.

Bühler’s modular twin-screw extrusion system enables flexible configuration.
“Providing food for people in the future requires a rethink”

Our planetary resources will not be sufficient to feed the growing world population – with current food production methods. Alexander Mathys, Professor at the Institute of Food, Nutrition and Health of ETH Zürich, is convinced of this. He is carrying out research with his group in the area of sustainable food production, and he proposes interesting alternatives for the future.

INTERVIEW: CARMEN PÜNTENER / PHOTOS: THOMAS EUGSTER
Would you hazard a prediction for the future? What will you be cooking in 30 years when you invite friends around for a meal?

I believe we will be cooking a lot of new products in 30 years, from algae and insects to types of food that we haven’t even considered yet. Above all, we will have more healthy types of food to choose from, and hopefully we will eat much less meat. And we will be personalizing food for the specific needs of the relevant person.

Does that mean you would cook something different for each guest at the table? How will that be possible?

For example with a 3-D printer. I believe technology will be developed to the point where such a device will one day be part of standard kitchen equipment alongside the oven, microwave and a coffee percolator.

My vision is that we will use this equipment with healthy, relevant ingredients that come from environmentally-friendly production. For example, I can imagine algae-based snacks from home-produced cultures grown on the kitchen wall with urban farming concepts, entered directly into the 3-D printer, freshly prepared and served. We could also consider insect-based ingredients and natural classic ingredients such as cereals or pulses. But I am sure we will still really appreciate freshly baked bread in 30 years.

To go a little further with this vision, does that mean that you will no longer be doing any cooking at some point in the future, but just press a few buttons instead?

It depends what you mean by cooking. When I put a saucepan on the hob, that form of cooking is a thermal process, whereas 3-D printing is a thermo-mechanical process. I can already introduce mechanical energy in a simple way when I cook, for example by using a mixer. In the future it will still depend largely on the person in the kitchen. Anyone who has the time and inclination will still put a lot of effort into cooking. I believe the key factor in the future will be taking greater care to make sure that the end product is healthy and that it comes from environmentally-friendly production.

It is said that our planetary resources are finite. And, the United Nations predicts a world population of 9.8 billion by 2050. Therefore, future consumption also depends on which products can be produced sustainably.

There are 14 million square kilometers of cultivated land in the world which we can use. That amounts to 1.4 billion hectares. And this is already fully used. We have already reached the limit in some areas.

We are already in the red zone according to the planetary boundaries concept explained by Johan Rockström and Will Steffen. There is irreversible damage in biodiversity and in the nitrogen and phosphorus cycle.

Providing food for people in the future requires a rethink. One consideration here is to use areas other than farmland for primary production. I am talking about concepts such as urban vertical farms, roof plantations, innovative greenhouses or self-contained life-support systems. My research also relates to this area. We are growing microalgae in photobioreactors which can be installed, for example, on house walls.

Can you tell us more about that?

It’s basically about producing alternative proteins. Our current level of meat consumption is unsustainable. Around two-thirds of all vegetable proteins end up as food in the stomachs of animals kept for slaughter such as pigs, cows or poultry. That doesn’t actually make sense when we think about the growing world population.

Our microalgae can become more sustainable after a few optimization processes, and together with other types of food such as insects or pulses it could help to meet the requirement for protein in the future. In concrete terms, we use a self-contained ecosystem in which the algae filters carbon...
dioxide from the air and produces oxygen to breathe. It grows quickly and is therefore very productive. A microalgae project which we are carrying out together with the Institute of Space Systems at Stuttgart University will take a bioreactor to the International Space Station (ISS) this autumn to test whether the life-support system will work in space. That does not mean we are saying that people should live on Mars in the future. We would like to use these concepts especially here on earth.

So are we moving towards self-sufficiency?

What role will today’s food processors play?

The fact that we are talking about these systems and that they are being tested in many locations around the world does not mean that industrial production will no longer be needed in the future. On the contrary, it will still provide most of the food.

Therefore, food processors are extremely important. This is because they have a special place in the value chain. They work closely with farmers and they have contact with consumers. They could play a key role when it comes to minimizing the environmental impact of primary production and having an influence on society by talking directly to consumers and meeting their needs.

There is much to suggest that we will eat more things in the future without being able to see at a glance what they are made of. Does that really meet consumer needs?

Novel food does not necessarily mean that we know more about what is in it. Traceability must be guaranteed even with these products. But we need to be open to new things. If we cannot see at a glance what our food consists of, that just means that it is a type of processed food. And we are already familiar with thousands of processed foods.

Bread is processed. I harvest cereals, transfer them for intensive mechanical processing and grinding; then I move the raw material on for biotechnological processing, then comes the yeast which allows fermentation, and then I pass the raw materials on for intensive thermal processing – the baking process. And if I show consumers a loaf of bread, they will always say that it is a natural food. I believe that new products can also be accepted by consumers.

You emphasize that food should be healthier in the future. Is this really what people are trying to get in everyday life? What they really care about in the end is whether it tastes good.

That is true, everyone wants a nice meal and pleasant life. And yet fitness apps, for example, are extremely successful. This shows that people really do care about their health. We eat a lot of unhealthy food because we need it quickly. But what if my per-

Prof. Alexander Mathys

Professor Alexander Mathys is a food technologist. He received his Ph.D. in food processing in 2008. He has been Assistant Professor in Sustainable Food Processing at the ETH Zurich since 2015, where he is focusing on more efficiency and sustainability of value chains in food and feed. Mathys is the author of 70 publications and has won several prestigious research awards. He has also served as lecturer, teacher, reviewer, and supervisor at several universities and organizations.

Bühler contributed financially to the ETH foundation in 2015, to establish Professor Mathys’ chair.
A personalized smart watch tells me that this option is not ideal? And if it offers me an alternative which is equally delicious? You can already measure blood sugar levels with a sensor on the skin.

We are not far from developing an individual nutrition app which supports people in their choice of food based on personalized health data.

Even now I always have various options when I want to eat, and quite often I don’t know why I favored something particular in the shop. Perhaps because it was especially well presented? Perhaps a tip from the personalized smart watch would sometimes be enough to prompt me to decide on a healthier and more environmentally-friendly alternative.

Another subject which is often discussed is meat grown in a laboratory. Do you think these products will take off? People love meat even if there is no objective reason why we should eat animals. Meat is environmentally harmful and unhealthy when consumed in excess. And there are enough products which provide the same protein content. Therefore, it is only a matter of enjoyment. Meat grown in laboratories is currently at a very early stage in the innovation cycle. As with all innovations, they are starting here with an inefficient process with no optimization.

They can already demonstrate that it works in the laboratory but not much more than that. Burgers produced in this way do not have an optimized structure and they are expensive. That will certainly change as things develop. Of course, the social element will play a part here. Many people reject meat grown in a laboratory – they even refer to it as a Frankenstein burger. But the economy sees gigantic potential in it. Start-ups in this sector are able to attract a great deal of risk capital.

But, I do not believe this will be the only solution. Products that resemble meat can be made from a vegetable base, for example, texturates made with soy. Such products have already found acceptance on many continents.

In the realm of vegetable-based meat substitutes there are numerous start-ups that work with genetic engineering ...

The most prominent companies in the biotech sphere come from Silicon Valley. Impossible Foods is one of these players. Not only have they managed to replicate the structure of meat – they distinguish their products from those of their competitors in terms of the taste and color. The company produces a special protein which normally occurs in soy roots from genetically modified yeast cells.

One thing is important to me when it comes to genetic engineering – full transparency. And unfortunately we don’t get that everywhere. We must not forget that people who want to avoid meat are
frequently also those who reject genetic engineering, at least in Europe. People in North America are somewhat more open-minded about this.

**Is genetic engineering absolutely essential, or could we manage without it?**

Now, up to 80 percent of cheese in Germany is made with enzymes that come from genetically-modified yeast. But what is the alternative? Should we kill countless calves to win over the laboratory for cheese production? As I have already said, I think transparency is the key issue with these products. We should also do more research concerning the risks associated with genetic engineering.

There are too few long-term studies about the effects. In the case of soy plants, for example, weeds have already developed resistance. Is the product then still as efficient as we imagined?

I also believe we should invest above all in the development of completely new products and processing technologies.

**For example?**

I have already mentioned two examples, our microalgae in the photobioreactor or insects. And there will certainly be many other possibilities that we simply haven’t thought of yet. There must have been a time when the first loaf of bread was baked and the first beer brewed. These are now traditional products even though they are heavily processed.

We should invest in research to develop new processing methods for safer and more healthy food. This is where industrial production has a key role again. Raw ingredients must be presented in an attractive form to meet consumers’ taste.

This can be done by means of various processes. I see great potential, for example, in extrusion where people now make pasta or texturulates. New structures can be created with the technology. An important factor with all possible processes is efficiency, for example, it must be possible to produce large quantities with low use of resources.

**Where do you think the most innovative solutions will come from? Research by universities, start-ups or big technology companies?**

Solutions will probably come from all stakeholders. Companies like Bühler will play a central role in the sphere of technologies. Basic research will definitely continue in universities, and start-ups often have innovative thinkers. I think it is important, especially in the food sector, that the authorities come on board at an early stage. After all, new types of food required their approval. And we must not forget the consumers because they decide what to accept on their plates.

**What does Bühler need to do from your point of view to stay at the forefront?**

Bühler is already very well set up. The company works closely with all players in the value chain, agriculture, food processors, consumers, universities, and applied research centers. It has a hub function and it operates proactively.

Bühler invests approximately 5 percent of its turnover in research and development, an impressive figure in comparison to many other companies. Moreover, it has an outstanding position in markets such as Asia and Africa where, according to statistics, the biggest growth will take place in the coming decades.

If all players engage in synergistic cooperation, we will succeed in creating a sustainable nutritional base for the future.

“We must not forget the consumers because they decide what to accept on their plates.”
Hiltl burger developed by Hiltl, the oldest vegetarian restaurant in the world, according to Guinness World Records.
Textured thinking for tasty meat alternatives

With today’s consumers increasingly choosy about what they put in their shopping baskets, the market for texturedates has never looked healthier.

TEXT: DAVID GILLIVER / PHOTOS: THOMAS EUGSTER
The food market is undergoing significant changes, with younger generations far more likely to take issues such as health, sustainability, and animal welfare into account when making their purchasing decisions. “Meat-free weeks” and “vegan months” are increasingly common features in magazines, newspaper supplements and food-related websites, and meat-free eating also has cachet on social media. But it’s not just younger people – older generations are starting to realize that their diet over the last decades may not have been the healthiest, and are looking to make amends.

While textrudates have long existed as an alternative to meat, the ever-growing popularity of both vegetarian and vegan dishes among health-conscious “flexitarian” consumers looking to reduce their animal protein intake means there is a rapidly expanding market for versatile and affordable texturized products outside of their once quite limited consumer base.

Texturized products are obtained from vegetable raw materials using the cooking extrusion process. Many can be almost indistinguishable from meat in terms of their texture, taste, and color. These texturized products – or textrudates – come in traditional dry and increasingly popular wet form, and while the dry textrudates currently have a longer shelf life, the wet products can be even more realistically meat-like than anything commercially available before.

What’s more, the high moisture content – around 60 percent – of wet textrudates means they need to undergo further processing in the same way as fresh meat, which makes them ideal for any company producing meat that’s looking to expand its product portfolio and that already has the necessary logistics in place.

Bühler is at the forefront of developing technology to produce textrudates, and is the leading provider of production solutions for creating both dry and wet textrudates at very high output rates. While soy has traditionally been the main raw material – thanks to its low cost, high protein content, and wide availability – Bühler has been actively looking to develop new textrudate ranges from materials other than soy, such as pulses and oilseeds, along with a range of gluten-free products. “We want to develop new styles, rich in fiber and protein, with different microstructures and based on customer expectations in regard to texture, fiber length, and strength – a new generation of textrudates, you could say,” says Christoph Näf, Head of Nutrition at Bühler. “We are convinced that there is a huge market for new, vegetarian products.”

Bühler’s aim is to expand its range of wet texturized, plant-based products beyond the market for meat analogues, and at high capacities of 500 kg/h or more.

A key part in the development of new textrudates is being played by Bühler’s application centers in Uzwil, Switzerland, Minneapolis, US, and Wuxi, China, where most of Bühler’s extrusion process innovations are realized by highly experienced R&D teams. “We are currently renovating our application center in Uzwil – very soon our customers will be able to develop and test their textrudate product ideas in the most modern extrusion application center in the world,” Näf continues.

A partnership to create new textrudates
Another cornerstone of Bühler’s innovation strategy is a close partnership with ETH Zurich (the Swiss Federal Institute of Technology). Together with the ETH, Bühler also has a key role in EIT (European Institute of Innovation and Technology) food projects, in which innovative extrusion programs are developed with leading food companies. “The advantage for the university is that these are really interesting projects for both the students and the PhD candidates to work on,” explains Näf. The initiative sees professors and PhD students carrying out extensive research into potential new textrudates on equipment supplied by Bühler. “The ETH is equipped with the latest Bühler extrusion technology in its labo-

“We are here to help our customers to create meat alternatives consumers will enjoy.”

Christoph Näf, Head of Nutrition at Bühler
A tasty curry dish made with textrudates prepared by a chef at Zurich’s famous Hiltl vegetarian restaurant.

ratories, which makes it very flexible for many types of product testing on a smaller scale,” says Näf. “The partnership, in a first step, allows us to do basic research on fiber development and on the influence of different raw materials. It also enables us to test new and innovative food products on Bühler equipment at the ETH.

And if any of these ideas work out, they are followed by trials on industrial-sized equipment at Bühler's extrusion application centers, where these promising test products are further developed for commercial success for textrudate producers.”

**Taking development to new levels**

Studies will also be carried out into people’s attitudes to, and relationships with, meat and meat alternatives, in order to determine exactly what consumers are looking for. This will cover issues such as health consciousness, general dietary behavior, the importance of “naturalness,” and also people’s “attachment” to meat, to help identify the key drivers and barriers.

One recent study at the ETH saw a range of different vegetable raw materials analyzed and compared to soy in terms of their taste, mouth feel, color, and protein content, with textrudates based on bean isolate, sunflower seeds, and wheat gluten producing particularly promising results. The ETH partnership is central to taking the development of new textrudates to the next level, and tapping into this large and ever-expanding market.

“Our customers can develop new recipes or improve existing textrudates in our lab facilities in Switzerland, China, or in the US,” Näf explains. “We are here to help them create meat alternatives that consumers will enjoy. We think we can help our customers make even better, healthier products, and this gives us much more of an opportunity to innovate.”

**Video**

Meet Rolf Hiltl, owner of Zurich-based Hiltl AG, at his academy and learn about consumer preferences when it comes to textrudates. Watch the video to discover more about Bühler’s solutions and Haus Hiltl – the world’s oldest vegetarian restaurant.
“What we did at every generation is to combine our great traditions with a lot of innovation.”

Rolf Hiltl, Owner of Hiltl restaurants
A history of healthy indulgence

It’s been 20 years since Rolf Hiltl took over operations of his family’s Zurich-based vegetarian restaurant. Haus Hiltl was 100 years old then. The fourth-generation owner has built up a brand around the “healthy indulgence” motto established by his forefathers. Today, there are seven Hiltl restaurants, three clubs, a vegetarian butchery, and a cooking academy. Rolf Hiltl’s vision does not stop there.

INTERVIEW: MICHÈLE BODMER / PHOTOS: THOMAS EUGSTER

How does it feel to be the fourth generation to be running Hiltl?
It feels good. I’m very thankful to be able to run this business with our great team. I think it is not very common that a family business exists for over four generations. We celebrate 120 years of Hiltl this year. My great grandfather, Ambrosius Hiltl, the founder, would be very proud to know that we have kept the business in the family, and that it’s so successful. He would have never thought that a vegetarian diet would be as mainstream as it is today.

Did you always know that you would be part of the family business?
It seems so. My parents told me that when I was about five years old, we were in my father’s office and they asked me what I wanted to do when I grow up. I pointed to his “boss chair”, so I guess I knew.

What are some of the highlights of the success of Hiltl?
It has grown pretty dramatically. When I began working there 30 years ago it was one restaurant, the Haus Hiltl. Today there are seven Hiltl restaurants in the greater Zurich area, three clubs, a vegetarian butchery, and the Hiltl Academy.

How has the Hiltl brand developed over its history?
The brand has evolved a lot. At the beginning, people referred to the restaurant as “the root bunker” and guests were called “grass eaters”. At that time, guests didn’t want others to see where they were going to eat, so they snuck in through the back door. Today it’s a very hip place with a very wide clientele. Young people, trendy people, families, older people, party people. They all come to Hiltl for the experience. Eighty percent of our guests are flexitarians.

What parts of Hiltl’s roots have you continued and what have you changed?
What certainly continued is that we are still vegetarian, today with a huge choice of vegan options. We don’t serve meat, and we don’t serve fish – and we never will. We have a strong, value-based mission statement that we live by. I think this is important. And most importantly, people are always at the center of everything we do – this tradition is well preserved. My father and my grandmother were always very close to the customers. Our food is about healthy indulgence. It’s about the joy of life.

What we did at every generation is to combine our great traditions with a lot of innovation. We have always searched for continual improvement – we do this day by day, and I think this is the reason we are still here and are successful.

I am very proud that we are over 120 years old, but that alone is not enough to grow and be successful. We want to be the oldest and the freshest! We always wanted to please customers with great food and atmosphere, and good service. This is what brings them to Hiltl and later, maybe they realize it’s a vegetarian restaurant, maybe not.

Are you a vegetarian?
I’m a part-time vegetarian, who is becoming more and more vegetarian over time. I don’t like meat too much anymore. I used to eat more meat and sometimes I do make an exception.

What are your views on people having a flexitarian diet, especially considering the issue of a growing global population?
I would say that 100 years ago it was okay to eat meat the way they did. It was the Sunday roast after the church. Meat was a treat eaten once a week, and I think that is still okay. But today, if I
go out with friends, everybody orders the beef filet. We just can’t continue to eat the quantity of meat that we do now. This is why it’s good to have more flexitarians. I don’t think that we will ever live in a vegetarian world, but I think that we should all become flexitarian. It’s a great movement. In time people will see the benefit of eating less meat and fish because they care about the next generation.

Let’s talk about meat alternatives. Have they changed over the years?

It has changed a lot. When we look back over 30 years ago, people didn’t know tofu in Europe. In Switzerland, Germany, and Austria, we are traditional meat, cheese, and milk countries, and therefore we are used to it. Zurich, for example, is known for “Geschnetzeltes with Rösti” (a ragout of veal in mushroom and cream sauce served with a potato dish). When people come to Zurich they want to eat this traditional meal. We serve this dish with meat alternatives and many people who have eaten it are surprised that it was vegan.

Have textrudate meat alternatives also changed?

They have really evolved. Years ago they weren’t good at all. In fact, I have to say that there are still a lot of products out there that still aren’t good, and this is bad for the industry as it tears down the whole image of good vegetarian products. However, in some products I have seen a big improvement and I think we are on a good way. Today, we are seeing many good meat alternatives, and I am sure that in 10 years we will see many really great ones because there are so many people investing in this area. At the Hiltl Academy we are creating great, homemade meat alternatives like burgers and tartare, and we sell those products in our vegetarian butchery. What is most important in this development is to create products with clean ingredients. This is something that our customers expect and it is a trend that will only grow stronger. People want to know what they are eating is clean and healthy.

What are the chances of Hiltl being run in the future by the fifth generation?

It could happen. We have three kids, they are 21, 18, and 15. They are free to make their own choices. They are very interested in what we are doing.

What do you see as the future for Hiltl? What is the next big thing?

Continual improvement is very important. It is one thing to open more stores and get bigger and bigger, but this is not really our style. We want to grow naturally and with great quality. In the next two or three years, our concentration will be on the details, doing things right and doing them well.

There is one vision I would like to see develop. I love New York and Los Angeles. I am thinking about opening a Hiltl flagship like the one in Zurich, with an à la carte restaurant, a takeaway, an academy with a cooking school and event location, seminar rooms, and a nightclub. Perhaps we will do this one day, or maybe our kids will do it.
Hiltl burger recipe

Meat alternative burger with coleslaw

1 hour 20 minutes | 4 burgers

Patties:

4 tbsp olive oil
1 shallot
200 g soy mince
80 g okara
70 g breadcrumbs
15 g fried onions
1/2 bunch parsley
30 g butter
3 g beetroot powder
2 pinches smoked salt
1 egg
1 egg yolk
Salt, freshly ground pepper

Coleslaw:

65 g vegan rice mayonnaise
1 tbsp apple cider vinegar
1 tsp unrefined sugar
70 g carrots
100 g white cabbage
5 g fresh horseradish
Salt, freshly ground pepper

4 burger buns
4 tbsp cocktail sauce
4 large lettuce leaves (e.g. frisée lettuce)
4 tomato slices
2 gherkins, sliced

Tip: If you want to make the veggie burger patties ahead of time, they freeze very well.

To make the patties, heat 1 tablespoon of oil in a frying pan. Peel the shallot, finely chop, and fry in the hot oil until golden brown. Then mix together with the soy mince, okara, breadcrumbs, and fried onions. Wash the parsley, shake dry, finely chop and stir into the burger mixture.

Over a low heat, melt the butter in a frying pan, then add to a large mixing bowl, along with the beetroot powder, smoked salt, egg and egg yolk, then blend the whole mixture with a hand blender. Add this to the soy mince, then combine the mixture with your hands. Season generously with salt and pepper and leave the mixture to cool in the fridge for about 30 minutes.

Meanwhile, make the coleslaw. In a bowl, mix together the rice mayonnaise with the apple cider vinegar and sugar. Peel the carrots and grate directly into the sauce. Using a mandolin, also shred the cabbage directly into the sauce, or thinly slice if using a knife. Peel the horseradish and again grate directly into the sauce using the finest side of the grater. Mix everything together well, season with salt and pepper and let it rest for about 15 minutes.

With wet hands, form the chilled burger mixture into 4 equal-sized patties. Heat the remaining 3 tablespoons of oil in a griddle and fry the burgers for a few minutes on both sides until golden brown.

Briefly toast the burger buns under the grill or on the griddle then spread a thin layer of cocktail sauce over them. On each lower half, place a lettuce leaf, a tomato slice and 2 gherkin slices. Place the patties on top and then divide the coleslaw over all 4. Place the other half of the burger buns on top and serve immediately. Goes well with country fries.

This recipe has been provided courtesy of Hiltl.
A circular economy — with insects

Providing a growing global population with protein requires new and innovative approaches. Insects offer a unique opportunity to address the challenge.

TEXT: ANDREAS BAUMANN / INFOGRAPHIC: DANIEL RÖTTELE

Today’s challenges:
The increasing demand for meat puts pressure on our current animal feed protein sources such as soy and fish meal. The limited availability of fertile land means that increased meat production will have considerable impacts on the environment. A huge amount of food doesn’t even reach our tables.

The protein gap
Primary protein production needs to increase by 50% until 2050.

Meat production and consumption
Meat consumption will increase by 50% until 2050, most of which in Asia, Africa, and Latin America.

Four plant-based proteins are needed on average to make one animal-based protein.

Current feed proteins pose challenges. The example of soy:
• 80% of production occurs in only three countries
• high price volatility in some regions of the world
• expansion of soy production is contributing to deforestation

Food waste and losses
One-third of the food produced in the world for human consumption is lost or wasted every year, 95% of food waste ends up in landfills.

Source: Food and Agriculture Organization of the United Nations
Today’s solutions:
Insects are able to recover nutrients from organic residues and bring them back into the food value chain, thereby contributing to a circular economy. Since no fertile land is needed for their production, they are a promising and sustainable new source compared to today’s main alternatives. Some species, such as the black soldier fly, are well-suited for growth on large scale.

Benefits of insects for feed and fish food

- Insects can recover up to 70% of proteins from local organic waste.
- Insects are the natural diet of many animals, including fish and chicken.
- Insect proteins can be produced domestically and do not require fertile land.
- It is not necessary to ship vast quantities of proteins around the world.
- Insects can be produced with little environmental impact.

<table>
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<th>Land use (m²)</th>
<th>Water use (m³)</th>
<th>CO₂-eq (kg)</th>
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<tr>
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<td>34</td>
<td>33</td>
<td>80</td>
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Impact on the environment per kilogram of protein

The unique features of black soldier fly larvae

- Flexible feed → They can grow on a large variety of wet and dry feedstock.
- Fast growth cycle → This makes efficient production possible.
- Naturally live in high densities → They are suitable for mass rearing.
- High nutrient accumulation → They are rich in proteins, lipids, and minerals.

Flexible feed for mass rearing. High nutrient accumulation.
Revolutionizing tuna farming

To meet global demand for bluefin tuna while protecting the species, many seafood processors rely on fish farms. The major challenge in successfully rearing tuna lies in the fish feed. Together with the Japanese company Nissui, Bühler has developed a tuna feed that will enable sustainable, economic farming.

TEXT AND PHOTOS: MARTIN HOFFMANN
Tsuyoshi Goto is on board a fishing boat owned by Kaneko Sangyo, a group company of Nissui Cooperation, one of the largest Japanese seafood processors. It’s 9 a.m., and the ship is near Kabashima Island in the Sea of Japan, about 90 kilometers from the mainland. It’s feeding time.

The bluefin tuna are excited, swimming circles around the aqua farm. They know what is about to happen. They are fed three times a week in the spring. Goto-san (Japanese for Mr. Goto) bends down, reaches into the sack behind him, and takes out a handful of oblong pellets. They look like a mix of chocolate and energy bar, but they definitely smell fishy.

“This is the future of tuna farming,” he says, tossing the pellets into the 40-by-40-meter floating cage. This is the signal that feeding time is about to start. The handful of pellets is followed by a canon shot that blows one ton of feed into the cage. The tunas come. Nearly 1.2 meters long, the creatures stir the water, having at the energy bars.

Tsuyoshi Goto is Plant and Quality Manager at Farm Choice, a subsidiary of Nissui. Farm Choice produces feed for fish farming. Together with Bühler, his team developed these extruded pellets, the key to sustainable, economical tuna farming.

Bluefin tuna are endangered
Since the end of the 1990s, the population of bluefin tuna maturing in the wild has decreased by 80 percent – an alarming trend. Yet, fish consumption has continued to grow for years. In 2016, 151 million tons of fish were consumed worldwide, corresponding to over 20 kilograms per capita.

Among the Japanese, fish takes the number one spot when it comes to most popular foods. On average, each Japanese citizen eats 66 kilograms a year, with this tendency growing. At the top of the menu – tuna. Of course, this is also related to the increasing popularity of sushi across the globe.

Demand for high-quality tuna has skyrocketed in recent years. The catch quotas set by the government are nowhere near enough to satisfy the hunger for sushi, resulting in illegal fishing. Many are unable to resist the appeal of earning a quick buck.

At Japanese fish markets, a fully grown 200-kilogram tuna can easily bring in tens of thousands of dollars, with the record price for a single fish coming in at 1.3 million dollars. In 2013, a sushi restaurant purchased this high-cost bluefin tuna at the prestigious New Year auction at the Tsukiji fish market in Tokyo. Naturally, this exorbitant price gained the media’s attention. One thing this development makes clear is that tuna has become a multi-billion dollar business. But the consequences are as obvious as they are alarming. Bluefin tuna has become an endangered species.
"Bühler is the expert technology provider when it comes to fish feed production."

Tsuyoshi Goto, Plant and Quality Manager, Farm Choice

The huge sack filled with compound feed has done its job here and the crew makes their way to the next cage. In total, there are around 1,600 of them spread around the Japanese islands.

Kaneko, another subsidiary of the Nissui Cooperation and the link between Farm Choice as the feed producer and the Nissui brand, operates several farms in the Goto Island archipelago, no more than 20 kilometers from the harbor. In the morning, Okuura is always the first stop – it’s where the large tunas can be found. At four-years-old and weighing in at 80 to 100 kilograms, they are “ready for harvesting,” as it is officially called. Kaneko manages the farms, is responsible for butchering the fish, and processes the tuna in several plants. The company sells cut-to-size pieces to sushi restaurants as well as end consumers around the world.

The concept of tuna farming is nothing new. Research in the area began as early as the 1970s, when it was first discovered that the population of bluefin tuna was declining while demand was growing. The research is now led by Japanese Kinki University. But Nissui also identified the trend in the ’90s, testing various methods and resulting in the establishment of Kaneko and Farm Choice.

The right feed
The main problem in tuna farming is the survival rate. Less than 1 percent of fish eggs hatch into little tunas. By comparison, the survival rate of other farmed fish, for example salmon, is between 20 and 40 percent. And more important, of course, is that the few hatchlings quickly grow in terms of size and weight without major losses.

The issue: tuna are predators. If they aren’t fed enough or at all, or are given the wrong feed, they are no stranger to cannibalism and end up depleting their own kind. On top of that, the bluefin tunas are very picky eaters and prefer to prey on herring and mackerels.

Past experiments with artificial feed failed miserably. Consistency, the mixing ratio, and shape were all too complex to produce and the tuna simply did not accept them. The only remaining option was to eat fresh fish.

Consider this example: around 2,000 tuna are bred in a single cage. Each week, they need 40 tons of mackerels and herring. In total, the fish spend four years in a floating cage. Over time, this equates to 8,320 tons of fresh fish that are fed per unit and cycle. 8,320 tons! And there are over 1,600 cages like this in the Sea of Japan alone. This is not very efficient. However, it shows that the key issue lies in their feed.

Tuna farming may earn money despite the high costs associated with purchasing feed, but this is mainly due to the extremely high retail price of the fish. This approach to production is far from sus-
tainable. In parts of Japanese waters, even mackerels and herring are considered endangered species. There has to be another solution.

Collaboration with Bühler
“In 2010, we decided to collaborate with Bühler. Bühler is the expert technology provider when it comes to fish feed production. For us, it was clear that we could come a long way with their expertise in extrusion,” says Goto-san.

It is now evening. Goto-san has joined his colleagues for dinner, including Urs Wüst, Key Account Manager and fish-feed expert at Bühler. Having lived in Japan for 11 years, he is familiar with the culture and customs, and now provides Nissui with support on behalf of Bühler.

What else is on the table other than sushi – a fitting meal after a day at sea. Of course, bluefin tuna is also a must, sliced as sashimi or formed into a nigiri with wasabi and rice. What’s special about all this? The tuna served comes from one of the Kaneko fish farms. Fed exclusively with compound feed, produced on Bühler extruders.

Shortly after establishing contact in 2010, Goto-san and his team traveled to Switzerland to work with Bühler on the tuna feed production process. The main difficulties lie in the shape, composition, and different consistencies required for the feed. The shell of the pellets has to be both solid and soft, yet pliable, while the inside has to be soft, but not liquid. This recipe calls for the Swiss experts.

The lower the portion of fishmeal, the more sustainable and cost-effective the feed. “It contains all the ingredients that tuna need to grow: fishmeal, fish oil, vitamins, and minerals. Our feed enables healthy farming of tuna, without using antibiotics,” says Goto-san. After two years of intense collaboration, the pilot phase can begin. In 2012, Bühler installed three extruder lines in the Farm Choice production hall farm in Karatsu.

Developing the feed
In addition to the standard feed with mackerel and herring, several units are also fed with the extruded compound feed. Thanks to the higher nutritional value compared to fresh fish, a much lower amount is required. Instead of the standard 40 tons per week across five feeding days in spring, now only three feedings of 4.5 tons are necessary a week, a total of 13 tons. This saves time, personnel, and above all, costs for boats and fuel. And the pellets are also easier to store.

Unused feed can be put back and used at a later point in time. Yet another advantage over fresh fish, which has to be caught, portioned, frozen, transported, and finally thawed before the tuna can chow down. During the test phase, the feed is optimized in close collaboration with Bühler.
“Our feed enables healthy farming of tuna, without using antibiotics.”

Tsuyoshi Goto, Plant and Quality Manager, Farm Choice

The three Bühler extruder lines in Karatsu have been working since 2012.

The aqua feed from Farm Choice was developed together with Bühler.

These pellets appeal to bluefin tuna, which are known to be very picky eaters.
With underwater cameras in aquafarms, Goto-san studies the behavior of the fish during feeding. His team observes that the tuna hesitate before eating the pellets. Compared with real fish, the feed doesn’t have a “front.” Predators always eat their prey head first, as this makes them easier to swallow due to the direction of their scales and fins. As for the pellet, the tuna is unable to detect a head, which is cause for confusion. “So we changed the shape of the feed yet again. It was important to develop a kind of a point, sort of like a nose, to signalize to the tuna that this is the front,” explains Goto-san.

Minor adjustment, major success. The fish accept the feed. This recipe forms the basis for further experiments, with the objective of continuing to reduce the fishmeal content by 50 percent. The lower this portion, the cheaper and above all more sustainable production becomes.

A toast to success
Tsuyoshi Goto, his team, and Urs Wüst have just reached the sake. This rice wine goes perfectly with sushi. “I am confident that we will meet our goal. Tuna farming will turn into a huge business. Of course, it’s a risk, but I am certain that we will continue on our course for success,” says Wüst. But first, another toast to their success.

Before the bluefin tuna are sold at auction, an employee at the market assesses the quality.

On average, each Japanese citizen eats 66 kilograms of fish a year. At the top of the menu is tuna, which is enjoyed as sushi and sashimi.
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The algae market is blooming

In the light of the emerging protein gap, the use of algae as food or dietary supplement is getting increasing attention. In the Asian diet, but also on the European Atlantic coasts, algae consumption can be traced back to prehistoric times and is still very present in today’s cuisine. Beyond seaweed, new opportunities are now also driving industrial production of microalgae – single-cell organisms, which provide valuable proteins and unsaturated fatty acids.

TEXT: CARMEN PÜNTENER / PHOTOS: GETTY IMAGES AND ANDRÉ GUTZWILLER
A seaweed farm in Bali, Indonesia.
Seaweed or macroalgae have been grown commercially for a long time. Some of these have been part of the daily diet in many regions of the world since prehistorical times. Red and brown algae, for example, are part of the daily diet in China, Korea, and Japan. The dried nori leaves are indispensable in sushi preparation. Macroalgae are rich in proteins and vitamins, and a few also contain the valuable vitamin B12 that is otherwise found only in animal products.

“Microalgae could make a significant contribution to closing the upcoming protein gap,” says Erika Georget, Project Leader Biotechnology at Bühler. She is currently evaluating ways to capture the potential of this crop for human and animal nutrition through the Bühler solutions.

As microalgae grow rapidly and do not require arable land, they offer an interesting alternative to conventional crops bound to agricultural land. Current production mostly stems from photobioreactors, consisting mainly of large glass tubes or open ponds. However, large-scale biomass production is also now intensified through the use of industrial scale fermenters.
Bühler Aeroglide systems are already successfully drying seaweed (semi-refined carrageenan) for several customers in South Asia. Dried seaweed is also processed on Bühler roller mills in China. The processed products are used in various applications such as the production of gelling and thickening agents, with the potential to replace equivalents of animal origin, but also used as food, fertilizer, and in cosmetic formulations.

Microalgae are a growing market
While the industrial processing of seaweed is already established, the cultivation and processing of microalgae is still in its infancy. Nevertheless, experts around the globe see tremendous potential in finding more efficient cultivation and processing methods, to be able to extract high-quality ingredients from single cells.

One of the important process stages in extracting high-added-value compounds from microalgae is cell disruption. Bühler technology also comes in this step with the bead milling process. Bühler established its Cenomic bead mill for microalgae cell disruption as part of a consortium led by the Netherlands Organization for Applied Sciences (TNO) focusing on improving the efficiency of microalgae processing. Bühler’s bead mill is characterized by a high flow rate and low energy consumption. With this solution, the process of cell disruption could be greatly optimized. “We have the technology and we are leveraging our extensive academic partnerships and start-up ecosystem to move the integration of this new crop in the food chain forward,” says Georget.

Microalgae are a growing market. According to the European Algae Biomass Association, there are over 2,000 companies worldwide that are active in the production or processing of microalgae. The use of fermentation is also boosting biomass availability for novel applications.

A key to successful market uptake of microalgae is finding ways to integrate these ingredients into attractive food products which can become a part of our daily diet. Bühler and the Swiss startup Alver have partnered to develop the use of microalgae as an ingredient in pasta production.

In a first test at the Pasta Application Center in Uzwil, Bühler and Alver used golden chlorella microalgae to produce long and short pasta samples. The biomass comes as an orange powder and has a protein content of 63 percent. Thanks to Bühler pasta processing technology and the expertise of the team, the microalgae biomass was integrated into a tasty and nutritious finished product.
Total traceability thanks to blockchain

In this digital age where food incidents can quickly become food safety scandals, traceability, transparency, and data intelligence are the truest allies of the food industry and consumers. Digital technologies, including blockchain, will unlock a new degree of food safety assurance.

TEXT: STUART BASHFORD / INFOGRAPHIC: MICHAEL STÜNZI

What is blockchain?

A transaction is recorded
The network verifies the transaction
Each block of information is linked to the next

Blockchain is, like any ledger, a record of transactions. What distinguishes it from other ledgers is that it is virtually impossible to tamper with. This is because the information is stored digitally in a network of computers around the world. There is no central location holding all of the records. If a new transaction is added or a change made, it has to be verified by each of the computers before it is recorded. Each “block” of information is linked to the previous block to create an unchangeable record of events.

The benefits:

Security
Every event is recorded in time-stamped blocks and stored in multiple locations.

Shared
Multiple stakeholders along the supply chain are able to exchange data.

Transparency
Data is accurate, distributed across a network of computers, and always accessible.

Accounting (ledger)
There is an unchangeable, verified record of every transaction.

Blockchain is transforming big industries

A range of industries are using blockchain to drive greater transparency, including banking, health care, charity organizations, the luxury goods sector, and food. Bühler and Microsoft are working together on the development of a blockchain solution that will increase food safety and transparency across the food value chain. Here are some examples of how blockchain will help the food industry and consumers.

Track product along entire journey

The need for traceability is regulated, but the systems used to be compliant are not. Many players still rely on manual records, which are vulnerable to human error. In the event of a food safety incident, manual systems limit the speed of response. With blockchain, each event is verified and the flow of a product can be traced backward or forward to quickly pinpoint the source of the incident and mitigate risks.

Verify authenticity / anti-tamper

Food fraud costs the global food industry USD 30-40 million a year, according to Price-waterhouseCoopers. Food fraud includes mislabelling, adulterating, and counterfeiting food products. For example, olive oil can be diluted with lower quality oils; wood pulp is added to Parmesan cheese; and seafood is often wrongly declared. With blockchain, product authenticity is verified at each step of the production process.

Empowerment for farmers and consumers

Trust and ethics are important to today’s consumers, and blockchain allows them to get the transparency they are looking for when it comes to the foods they buy. For example, consumers can trust that a fair-trade label really means that the farmer was treated ethically and was paid a fair price for his products. The consumer can even track a product back to the source and learn more about the farmer.

A third of food is lost or wasted

One-third of the food we produce is lost or wasted along the value chain, according to the Food and Agricultural Organization of the United Nations. Digital technologies, such as blockchain, and the Bühler Insights digital platform will significantly help to curb loss in production.

Where food loss and waste occurs:

| Source: Food and Agricultural Organization of the United Nations, PwC, Bühler Group |
Every “block” in the food chain is tracked

With blockchain, every stage of a physical product’s journey from farm to fork is recorded and verified. This is an example of how blockchain can be used in the food industry.

* This food supply chain has been simplified for illustrative purposes

**Farmer:** A farmer produces wheat under specified conditions to earn organic and fair-trade certifications.

**Transport:** Authenticity is verified and the wheat is transported under high-quality assurance regulations.

**Processor:** The containers of wheat are again verified and the wheat is processed in the mill.

**Distributor:** The finished product is now moved by a distributor under high-quality assurance regulations.

**Retailer:** The product reaches the retailer having been accounted for and verified at each step of the journey.

**Consumer:** The consumer purchases the organic and fair-trade certified flour that has been quality assured.

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25 tons of wheat are ready to ship.

The wheat is verified as organic and fair-trade by a certification body.

The first block of data is recorded and distributed across the network that verifies its authenticity before it is added to the chain.

Date and time stamp: 25 tons of wheat have been shipped.

Sensors digitally record the status and condition of the shipment (temperature, humidity, and many more parameters).

More blocks of data are added to the ledger as the raw material is transported.

Date and time stamp: 25 tons of wheat are received.

Sensors can collect processing data along every step in the Bühler production line.

All data can be added to the blockchain.

The wheat arrives at the processor and more blocks are added to the ledger.

Date and time stamp: The packaged, certified organic, fair-trade flour is picked up.

A distributor picks up the flour. This event is again verified and recorded in the digital ledger.

Date and time stamp: The packaged, organic, fair-trade flour is received by the retailer.

The final block is added when the product reaches the retailer.

Guaranteed fresh
Certified organic
Certified fair trade

The consumer can access the complete history of a product.
Sputtering Components Inc. (SCI) became a member of the Bühler Group in September 2018. SCI is a US provider of components and subassemblies for large-area vacuum coating systems with about 40 employees. In the future, SCI will operate as an autonomous unit of Leybold Optics. Antonio Requena, Managing Director of Bühler Leybold Optics, is pleased about the successful acquisition: “We have worked intensively with SCI for many years. Together, we have gained a leading market position, especially with systems for coating of architectural glass. Therefore, we are proud to know that the SCI team will in the future be part of Bühler, with all its capabilities, its reputation in the marketplace, and its enthusiasm for high-quality products.” SCI will retain its existing location in Owatonna (Minnesota).

Major project for Bogasari and Bühler

Bogasari, one of the biggest milling companies in the world, signed a contract on two new milling lines, each with a capacity of 750 tons per day. In June, the Bogasari Flour Mills division and Bühler held the signing ceremony in Jakarta.

The new project will be realized at their Cibitung location. The ceremony was attended by Franciscus Welirang, CEO of Bogasari; Calvin Grieder, Chairman of Bühler Group; and Dieter Voegtl, Global Head of Operations Bühler Group.

Atta process wins award

The Atta process with PesaMill from Bühler has received major recognition. As part of the GRAPAS conference for the milling industry, which took place in Bangkok this spring, Bühler was recognized with the 2018 GRAPAS Innovation Award for its unique process for manufacturing Atta flour.

The jury was composed of industry experts and expert audience members. The experts attested to the excellent degree of innovation in the Atta process, the high level of practical benefits, and excellent properties with regard to efficiency, safety, hygiene, and cost reduction. The GRAPAS award is presented every two years by the specialist magazine Milling and Grain.
New service factory opens in Enschede

In June, a new service factory opened in Enschede in the Netherlands for manufacturing press forms and roller cage assemblies for feed pellet presses. More than 80 guests from the feed and biomass industry were on hand at the opening ceremony. The system achieves 20 percent more output than its predecessor at the previous location in Oldenzaal. “The relocation of the fabrication facilities means that we now have a first-class system with which we can supply our customers with products of the best quality,” says Marcel Natterer, Head of Business Area Value Nutrition. With 31 employees, the new factory processes about 1,300 tons of steel into components for feed pellet presses.

New leader for the rice business

With a contribution of approximately 30 percent to the global paddy processing market, Bühler is the number one supplier in the rice processing industry. Centers of competence located in major rice-producing markets house the world’s best rice technology and nutrition experts, who are well placed to develop regional rice processing and added-value technology solutions that meet distinct local requirements.

Morten Riisager, Bühler’s new global head of rice business, started work this summer. “With dedicated local services and solutions, built on thorough regional knowledge, we are able to meet the exact needs of customers across the world. That is the great strength of Bühler,” says Riisager. He brings more than 20 years of experience as a food industry executive in Europe and Asia.

New cocoa training center in Abidjan

With the opening of a cocoa training center in Ivory Coast, Bühler supports the country’s goal to raise the local processing capacity of cocoa beans. University graduates, together with local employees from cocoa customers, will be the future students of the Centre de Formation et d’Innovation pour l’Agroalimentaire (C.F.I.A.) in Abidjan. Bühler opened the C.F.I.A. this spring.

Western Africa is the largest producer of cocoa worldwide, yet only 25 percent of the beans are processed in the region. The Ivorian government wants to raise this number to 50 percent. The first theoretical course at C.F.I.A. started in autumn 2018. In spring 2019, when the application lab will be ready, more practical courses will follow.

For more information, watch the video
About a year ago, Bühler announced it would take over the Haas Group and integrate it into the company. Together Bühler and Haas offer systems along the entire value chain in the areas of chocolate and baked goods. Diagram spoke with Haas CEO Germar Wacker about the progress of the merger.

TEXT: BURKHARD BÖNDEL / PHOTO: HAAS

Haas has been part of Bühler since the start of the year. How has the market responded?
Agreeably and positively. One customer wrote to us, “Haas and Bühler are a perfect fit. This provides room for new innovations.” Another customer said: “We see it as very positive that Haas joined Bühler, because we expect that doing business with one company is easier than doing business with two.” The companies do, in fact, complement each other excellently.

The perfect combination. What is the foundation for this?
The product range is key here, in that there are no overlaps. Haas is the leader in machinery for wafer and cookie production, and for mixing and aerating creams; while Bühler dominates in milling and baking, and the processing of chocolate and nuts. When we put these puzzle pieces together, we get a picture of a continuous value creation chain. This logic, and the great potential that this step offers, was immediately obvious.

How are Bühler and Haas handling the integration thus far?
The focus is clearly on our customers – we want to make the collaboration simple and support our customers quickly, competently and locally with the combined know-how of Bühler and Haas as partners for wonderful end product worlds. We are working on the necessary internal integration.
diagram #178

INTERVIEW / Germar Wacker

Will the blue Haas triangle still be used in the medium term?
On the corporate level, in the next year Haas will become Bühler, meaning the Haas logo will be replaced with the Bühler logo. On the product level, we will continue the established brands of Franz Haas, Haas-Meincke, and Haas-Mondomix.

Isn’t that a difficult step for the employees and customers of Haas?
Of course it represents a big change, and I can understand that it might not be easy for everyone, both customers and employees. However, it is important to understand that one clear identity offers many advantages. And it also makes it clear that Bühler takes this seriously.

What matters here is that we adjust the internal organization in order to further establish not only the Grains & Food and Advanced Materials business areas, but also Consumer Foods. We have combined the areas of wafers, biscuits, mixes, baked goods, chocolate, nuts, and much more into the Consumer Foods business. This step shows that we are consistently focused on the market and that we have adjusted our structure accordingly.

How do things look for the Haas brand?
Bühler has been pursuing a one brand strategy at the corporate level for decades. As a result, the company has preserved its uniformity despite a few takeovers, and developed into one strong brand with a high level of reach and appeal. It will be the same for Haas.

“Everything is being run with the mind-set of being able to offer added value to our customers.”
Germar Wacker, CEO of Haas

steps, such as IT systems and other organizational adjustments. These are running in the background as silently as possible.

What are the specific advantages that customers can expect?
The consistent support along the integrated process chain from grains, nuts, and cocoa beans to wafers with chocolate coating and nut filling. From exchange through innovative end-product ideas, product and recipe development to the industrialization of the manufacturing process and the sustainable optimization of the systems in operation, our customers worldwide can rely on us as partners.

It’s an inspiration to see our food technologists conjure up creations from the shared portfolio.

Step by step, we will coordinate and optimize our machine and system technology. Bühler’s global service network is also available to all customers of Haas, which enables us to be on site even faster if necessary. This will have a continuous positive influence on the availability of the systems from Haas. Finally, there are the topics of digitalization and innovation, which we are now working on together.

Are there already specific, demonstrable results of the merger?
Many – I’ll give you just a few examples. One long-time Turkish customer who invested in a chocolate coating machine for their new flat wafer production line decided to go with Bühler because we can now offer extensive support from one source.

In the area of digitalization, the smart glasses solution from Haas for service work really impressed an important customer of Bühler in Belgium. Meanwhile, the Bühler team in Indonesia is supporting Haas in importing replacement parts for a large custom, and in Angola, the good business connections of Bühler gave us the opportunity to meet with local producers.

Our customers benefit from the merger as much as we do. We are activating the service centers for Haas as quickly as we can. To do so, we have to train the technicians, establish regional spare parts warehouses, and notify customers. In the long term, it is critical to jointly develop new, integrated solutions. Long-term does not mean that we are only going to start on this in a year or two – we are doing so right away. But it takes a bit of time to bring new, joint applications to market maturity.

This step must be fairly easy, given that both corporate cultures are very similar.
Yes, that’s true. That is also one of the reasons why the employees of Haas and Bühler who are in direct contact with each other were quickly able to develop good relationships. Those who are following our appearance at this year’s Iba baking trade show in Munich could sense that the merger is in full swing.

Both companies have a proud history going back more than 100 years. Both companies are, or in the case of Haas were, family operations in which there is a respectful interaction and where long-term opportunities are developed and realized.

Both companies are leaders in their markets with a solid reputation, and both are committed to quality. I sometimes say, simply put, that nothing has actually changed for the customers of Haas and our employees other than horizons are now opened, new opportunities are created, and in the future we are no longer in the Haas blue, but instead in the Bühler green.
Expanding with combined forces

Alimentos S.A. is a key corn processor in Central America. Together with Bühler, the food manufacturer from Guatemala has found a recipe for success, helping the company to achieve maximum profit despite limited space. Using a 3-D scan, experts transformed the production hall into an extraordinary game of Tetris.

TEXT: CARMEN PÜNTENER / PHOTOS: JENS KILIAN AND CARMEN PÜNTENER
Jorge Guzman, Area Sales Manager, Bühler Mexico, Francisco Pivaral, General Manager, Alimentos S.A., and Walter Bollinger, Area Sales Manager Nutrition, Bühler, in the Alimentos production hall in Guatemala City.
“On todo” – with everything – says the 9-year-old boy, hopping around impatiently waiting for the brightly dressed woman to give him his skewer. He glows as she hands it to him. For Central America, elotes locos are the sausage stands of Germany or pho stands of Vietnam. Skewered corncobs are offered on every street corner, including in Antigua, a tourist magnet around 40 kilometers outside of Guatemala City. The less healthy variant is coated with various sauces, a colorful combination of mayonnaise, green chili sauce, cheese, and ketchup. The lower-calorie version is boiled and sprinkled with salt.

“A good deal of people in Guatemala are indigenous or have indigenous roots,” explains Francisco Pivaral, General Manager of Alimentos S.A., one of the largest food producers in the country. “And for the Mayas, corn was a staple. Nothing has changed over the last few hundred years. Today, we still eat tortillas at nearly every meal. In fact, it’s essentially the common denominator of the many different people here.”

**Tortillas or cereal**

It begins with breakfast: tortillas and black beans are the traditional meal taken in by Guatemalans. Those pressed for time drink atole, a thick, hot drink traditionally prepared from corn. Or cereal, inspired and adopted from the American breakfast culture decades ago, which is now also produced in the country.

“At Alimentos S.A., we installed the first extrusion line
for cereal in 1994,” says Walter Bollinger, Area Sales Manager from Bühler. “It was obvious, after all Alimentos has cooperated with Bühler in the area of milling since the ’60s.”

Back then, the Castillo family, which owned the largest brewery operation in the country, Cervecería Centro Americana, received an unusual assignment from the Institute of Nutrition of Central America and Panama (INCAP).

“INCAP approached us, as we were known for supporting social projects,” says Eduardo Castillo, Vice President of Alimentos S.A. “We were commissioned with bringing a nutritious, plant-based product to the market for low-income families rich in carbohydrates and protein, supplemented with all essential vitamins and minerals. And it wasn’t supposed to contain milk, as many indigenous people in Guatemala are lactose-intolerant.” This marked the birth of Incaparina, a porridge based on corn and soy, sold as cereal powder or a drink.

Preventing malnourishment
After a successful market launch, the former brewery suffered a stroke of fate: the Incaparina production site burned to the ground. The Castillo brothers decided to establish a new subcontractor and build a production facility outside the city, including a company-owned corn mill to be able to process the raw material into flour. And so, Alimentos S.A. was born.

As mill partner, collaboration with Bühler was the obvious choice: “My ancestors sought a company that shared the values and philosophy of the Castillo family, and we found Bühler. Both are family-owned companies that committed to social projects and sustainability early on,” says Castillo. “Besides, Bühler had the most experience in milling.” In 1968, the new production facility was opened, including the corn mill built by Bühler.

Incaparina became a bestseller, suited the taste of Guatemalans, and was also affordable. “The product has helped reduce malnourishment here many times over,” states Castillo confidently. It has found its way into nearly every kitchen in the country: “Today, you will find the product in one out of every two homes.”

But Incaparina is not the end of the Alimentos success story. In the decades to come, the company expanded profitably, and today produces snacks, cereals, and oat products as well as meat alternatives made from plant-based proteins. Alimentos has transformed into one of the largest food producers in Central America, with plants in Guatemala, Nicaragua, and El Salvador. “Our production facility in Guatemala City is the most modern in the entire country,” says Pivaral. “In the area of cereals, we cover 20 to 50 percent of the domestic market, depending on the product. For snacks, we have a
market share of 14 percent.” For visitors driving along the main street from Guatemala City to the production facility, it’s hard to believe that the area used to be outside of town. Guatemala City has grown significantly and now encompasses an urban center with a population of 2.5 million.

Stop-and-go traffic is an everyday thing; colored buses honk their way through traffic searching for the best route. Every now and then, small, lush little groves appear at the edge of the road, reminding passersby that Guatemala is located right in the middle of the Central American jungle.

**Linea Bühler saves space and energy**

The new snack extruder, the “Linea Bühler,” is on show in the huge snack production hall. It is currently producing Bolitas, a puffed corn ball snack with a cheese flavor. After extrusion, the product goes through a barrel, where the colors and flavoring are mixed. The orange crispies are then transported straight to the packaging machine on a conveyor belt.

Pablo Kummerfeldt, Senior Advisor to the Engineering Teams at Alimentos is satisfied with the snack line, which has run steadily with a capacity of 550 kilograms per hour since 2016. It replaced three existing lines, saving not only space but also electricity. “But, compared with our cereal lines, it’s just a toy,” says Kummerfeldt. The cereal extruders in the adjacent hall are his pride and joy, one reason being that it was a major challenge installing them.

“We already had one line from the 1990s,” states Kummerfeldt. “But we had built it in the middle of the hall, meaning space for a second and third line was tight.” The experts from Bühler accepted this challenge, and soon had an unusual idea: to build the second line in the shape of an L. No sooner said than done, and it ran superbly! Business was going so well for Alimentos that a third line was planned just two years later. Once again, space was an issue.

**An intricate puzzle for Bühler experts**

“Both the width and height presented us with challenges in this project. The roof of the hall is lower at the outside than at the center,” explains Bollinger, who has looked after the company for over 15 years. The engineers decided to commission a 3-D scan of the hall. “We would have had to take at least two or three people to survey the entire hall. This would have cost us two to three weeks of work at the minimum,” states Bruno Rölli, project manager at Bühler. “We commissioned Ocuplan, which used special cameras to take the 3-D scan for us. The result was brilliant and basically enabled us to precisely plan the third line right on the drawing board.”

Those entering the production hall today are met with a big surprise: the three lines are interlocked like blocks in a game of Tetris. The cornmeal is transported over 100 meters from the mill to a silo by pneumatic systems. From here, conveyor systems bring it to the extruders. The girders for these conveyor systems are 18 meters deep, necessary due to the fact that the country is regularly hit by category seven earthquakes and higher.

The production hall smells heavenly, like freshly roasted grains, but also of chocolate, a must in Guatemala, one of the countries of origin of cocoa. A mixer stirs the coating before the dosing tank is conveyed to the Bühler Aeroglide dryer.

The third cereal line was again built in the shape of an L. Each hour, 4,600 kilograms leave the plant either as expanded product, pellets, or flakes. Of this amount, 20 percent are exported to customers throughout Central America and the United States. Alimentos sells the rest under its own brand name Gran Día.

**Support in many areas**

“For us, it was important for the machines to run trouble free, without requiring much maintenance,” explains Pivaral. This is another reason the company decided to have Bühler install remote access in all of the new lines. “This allows us to quickly and effectively solve automation issues.”

Bühler also provided Alimentos support in another area – food safety. “Guatemala is strongly geared to US specifications on food safety,” explains Bollinger. “And it is a well-known fact that they are the strictest in the world. Thanks to our global presence, we are experts in this area and more than able to assist Alimentos.” The company’s rules on food safety in production were revised, enabling Alimentos to keep pace with any American food standards.

“We are more than satisfied with the service and quality of Bühler products.”

Eduardo Castillo, Vice President of Alimentos S.A.
producer. Export business is going so well that the company is thinking about a fourth line. But this time, Bühler has already done some groundwork. Thanks to the space-saving construction, this line could also be installed in the same hall.

“We are more than satisfied with the service and quality of Bühler products,” says Vice President Castillo. “And we have plans to expand across Central America and the Caribbean. We will keep on collaborating with Bühler, not least because we have total confidence in our contacts.” Pivaral agrees: “Bühler will continue to play an important role for us, as Bühler offers innovative solutions, and has the technology we need as well as teams passionate about their work.”

Alimentos S.A.

Alimentos S.A. belongs to the Corporación Castillo Hermanos S.A. holding, an umbrella joining around 90 subsidiaries in the areas of food and beverage production, shopping centers, and real estate in Guatemala, El Salvador, Honduras, and Nicaragua. The conglomerate, which to date is a family-run business, stems from the brewery Cervecería Centro Americana, founded in 1886 by the Castillo Córdova brothers and now in the 5th and 6th generations of management.

The beer brand Gallo is very popular across Central America and Mexico, and is even considered an icon in Guatemala. The original brewery is a pioneer in the area of corporate social responsibility, supporting numerous projects in the areas of education, nutrition, and environmental protection with the Castillo Córdova Foundation.
In Turkey, one of the most competitive milling markets in the world, Bühler has entered into two new partnerships with well-known companies. They produce special and industrial flour, durum wheat semolina, and flour for Turkish specialties. The significant actors in the Turkish market have one thing in common: they want to be equipped for the future and meet the country’s growing appetite for baked goods.

TEXT: CARMEN PÜNTENER / PHOTOS: GETTY IMAGES AND CARMEN PÜNTENER

The new Özmen Mill stands somewhat alone on open fields, surrounded by fallow land. The industrial region outside of Gaziantep in southern Anatolia is a sign of the numerous expansions by companies in food production, the mill above all.

“Our new location is our answer to the needs of the emerging markets in the Near East, in Asia, and in Africa. The old mills in the city could no longer meet our demands.” Oğuz Özmen, General Manager of the Özmen Mill, is proud of the new production facility. Its production capacity of 450 tons per day makes it one of the largest mills in the region.

About 900 kilometers farther west in Izmir is another such bastion, the freshly renovated Tezcan Flour Mills. With 380 tons per day it has the largest capacity in the Turkish region of Ağâis and primarily produces for the industrial market. Dozens of trucks leave the mill every day, heading toward ports where the flour is loaded into containers. Both milling operations have been in the respective families for many generations and have a long tradition.

Turkey has always played an important role in the milling industry. The first archaeological findings of stone hand mills date back to 10,000 years B.C. Even today, the hunger for baked goods persists. The Turkish people consume 199 kilograms of baked goods annually per capita – this is the world record and seven times more than the global average.

Rich variety of specialties
From simit, the well-known ring bread with sesame, to sandwiches on flatbread like pita, to rolled vegetables or meat in börek, products made of wheat flour are part of every meal.

With dessert, the love of dough continues: baklava, chopped pistachios rolled into a wafer-thin yufka dough, or revani, a sweet cake made of buckwheat grit, are such popular desserts that they have long since been added to international menus. “Baked goods for us are not just something to eat, but a lifestyle. Our city Gaziantep, for example, is famous for its baklava. We eat it for every occasion. For this reason, baklava flour is one of our most
important products,” explains Oğuz Özmen. The numerous traditional dishes alone explain the immense appetite the Turks have for products made of flour, but not entirely: “In the past, people made dough, then they baked bread to quiet their hunger. Today we are all gourmets; we want to try different and new things,” says Haluk Tezcan, owner and President of Tezcan Flour Mills. “For this reason, the demand has increased for quality, special flours.”

**Biggest player in the export market**

The industry is booming. According to an article in the Financial Times, 65 percent of the companies operating the food industry in Turkey are in the area of baked goods. Per World Grain magazine, the country has 707 active mills with a total capacity of 300 million tons per year. Turkey is one of the most important exporters of flour.

In 2017, 3.6 million tons was exported with a value of USD 1.1 billion. This is confirmed by Erhan Özmen, owner and President of Özmen Mill and father of Oğuz: “Turkey is responsible for one-third of the global trade.” Erhan Özmen is the head of the Southeast Flour Industrialists Association. One advantage for his country is its geographic position between the large wheat producers Russia, Kazakhstan, and Bulgaria, and the consumers in the Near East, Asia, and Africa, says Erhan Özmen.

Tezcan Flour Mills also relies on this beneficial starting position. An additional benefit for the family is that their location is only 25 kilometers from İzmir’s international container port. “We export to about 30 different countries, including Madagascar, Venezuela, Benin, and Angola, and of course to all possible regions in Northern Africa and the Near East. About 50 percent of our production goes abroad,” says Haluk Tezcan.

The largest importers are Iraq, Syria, and Sudan. Forty-three African countries import Turkish flour. It is no surprise that almost all large milling companies are relying more and more on exports. “Even though the domestic market is still the most important market for us, we export 20 percent of our

“The moment we stop changing is the moment we stop doing business.”

Haluk Tezcan, President of Tezcan Flour Mills
yield,” says Erhan Özmen. Exports have experienced strong growth in recent years, so many milling companies have expanded production and made large investments in new equipment. Here is where Bühler comes in.

When Özmen Mill was ready to expand, father and son spent a great deal of time researching possible partners, as Erhan explains: “Oğuz and I visited about 10 newly built mills in Turkey. We also took a look at mills in Germany, Belgium, and Switzerland, and the most prominent brand that we saw in these mills was Bühler. Both were especially impressed with Bühler’s pursuit of innovation.

“Bühler is very committed to continuous improvement, and to new and innovative solutions. You can sense this commitment in what the company does,” says Erhan Özmen. They have yet to regret their decision: “We have benefited a great deal from Bühler’s expertise in the engineering area. We have also learned something on the topic of workplace safety from Bühler. Our new production area is unbelievably efficient and easy to maintain.”

New approaches for the future
At Tezcan Flour Mills as well, Bühler has come through ahead of the competition. “We have a very ambitious goal. We want to become a global brand. For this reason, we looked for a partner who has already proven themselves on a global level, so we found Bühler,” says Yüksel Tezcan, son of Haluk and General Manager of the mill. This was not the only reason for the partnership. Tezcan Flour Mills wanted to invest in the future in order to be equipped for all the coming changes.

“The way which we used to make flour will soon be history,” says Yüksel Tezcan. “We talk about Industry 4.0, about self-driving cars. We cannot afford for the mill to stay behind. We have to change.” Digitalization is another reason Tezcan Flour Mills decided on Bühler, a leader in this field. His father Haluk seconds that thought, saying: “The moment we stop changing is the moment when we stop doing business.”
SWAKT-ECO automatic wafer baking oven

This new generation of premium wafer baking ovens with a revolutionary heating concept is used for the fully automatic, large-scale industrial production of flat and hollow wafers. The SWAKT-ECO produces up to 60 wafer sheets per minute, that is 1,100 kilograms of wafer blocks. No mechanical adjustment of the burners is required, allowing heat distribution to be adjusted via PLC without any cool-down periods. Thanks to the optimized wall and door insulation and the controlled air and heat circulation, gas consumption and emissions are reduced significantly.

- Less cleaning, less downtime
- Parameters easily adjusted via PLC
- Significantly reduced gas consumption

SPIDER equipment monitoring system

SPIDER offers perfect assistance for optimizing your productivity and keeping your operations running smoothly, providing information from and about your production equipment to IT systems such as ERP and MES. Collect the data from a whole production line and gather the status and performance of all machines at a single glance – on the factory floor, in your office, or on mobile devices. Quickly make the best decisions to achieve manufacturing excellence while saving valuable resources. Getting started with Industry 4.0 has never been easier!

- Compatible with all Haas machines
- Easily monitor the efficiency of your equipment
- Quickly pinpoint sources of errors
- Access data via standard industrial interfaces (SQL, OPC-UA)
ContiMix MRMC continuous dough extruder

Bühler is extending its system line for industrial bakeries with the ContiMix dough extruder, combining the mixing and the kneading process with a pressure or vacuum treatment. The continuously operating extruder is ideal for the production of consistent dough for laminated products like puff pastry sheets, as well as for flat or shaped products. Various configuration options allow a rapid, recipe-based adjustment to the desired dough specifications. Bakery products produced with the ContiMix have an improved volume and crumb structure and a more intensive taste. Furthermore, the continuous process makes it possible to eliminate any additional resting time for the dough and thus to leverage time and cost savings.

- Increased product quality
- Increased food safety
- Time and cost savings vs. batch production

Greater dough yield by up to 9%

FF-AWDM free-shape wafer block cutter

Don’t be square: with the free-shape cutter FF-AWDM, cutting wafers into complex shapes is a piece of cake! Make your wafer dreams come true and cut flat wafers into any form or shape you desire. Economically produce seasonal varieties of your products, from content for Advent calendars to individualized shapes like letters for weddings and birthdays. Even oversized wafer blocks can be cut with the freely moving wires, their high speed ensuring clean edges. Easily switch between patterns via the HMI and choose between embedding the forms in square blocks or cutting them as completely interleaving figures, thus reducing waste. Get in shape for more playful snacking!

- Fully automatic operation
- Easy cleaning due to hygienic design
- Variable output for individual and mass production

Up to 10 cutting cycles/min

Visconomic+ bead mill

Visconomic+ is the innovative solution for the efficient grinding and dispersing of high viscous and temperature-sensitive pastes. Target applications are UV-curing inks, sheet-fed offset inks, PCB (printed circuit board) inks and cosmetic products such as lipsticks and foundations.

The advanced process chamber design guarantees best performance and particle size reduction to the sub-micron range. Thanks to new chamber materials with excellent heat transfer properties the Visconomic+ offers an effective product temperature control particularly important for temperature sensitive products.

- Highest flow-rates even with very high viscous products
- Effective cooling for temperature-sensitive products
- User-friendly design

Up to double productivity of traditional bead mills

diagram #178
Tracking a mystery

It is still not clear what influence storms in the upper atmosphere have on our planet. In order to gather new insights, the French national space research center CNES is sending a satellite into space at the end of 2019. This satellite is equipped with an innovative optical filter that was developed by Institut Fresnel in Marseille with the help of Bühler technology.

TEXT: BIANCA RICHLE / PHOTOS: GEMINI OBSERVATORY AND BENJAMIN BÉCHET

Transient luminous events (TLEs) are gigantic light incidents that can arise above storm clouds in the higher atmosphere. This one was recorded by the Cloud-cam of the Gemini Observatory in Hawaii. Gemini Observatory / AURA / NSF
About 20 years ago, researchers discovered the existence of gigantic light events in the upper atmosphere. These so-called TLEs (transient luminous events) take place about 20 to 100 kilometers above large thunderstorms, for example, over tropical storms. The discharges reach heights of 30 to 90 kilometers and are visible from space as yellow, red, and blue light explosions. Science is working hard to examine this phenomenon more closely.

Until now, there has been no clear knowledge of what influence this light show and its energetic discharges have on Earth, and what relationship they have with terrestrial gamma ray flashes (TGFs) that occur in upper thunderclouds. Because the phenomena take place over clouds that are visible from Earth, it is not possible to research them from Earth in detail. Currently, the French national space research center CNES (Centre National d’Études Spatiales) is working on the first satellites for researching TLEs and TGFs. In 2019, the mission Taranis is expected to start. The satellite will fly over thousands of such light events and systematically record them.

**New insights thanks to innovative filter**

In order to make the individual components of the light spectacle visible and to determine the material composition, the equipment used includes measuring equipment as well as a telescope with a spectral filter. The principle of the technology is already used for satellites that capture images of the earth’s surface: filters that only let through the color green make it possible to take pictures that show how many forest areas there are on Earth.

By using filters that only let the color blue pass through, pictures are created that show the water areas on Earth. Very complex filters that make nitrogen visible, for example, are used for the Taranis project. The Marseille-based Institut Fresnel has developed and produced this filter. “Thanks to the excellent technology from Bühler, it was possible for us to manufacture such innovative filters for space research,” says Julien Lumeau, Head of the Optical Thin Film Research Team.

**Every layer is unique**

Upon entering the lab for the Institut Fresnel, everything is bright and spotlessly clean. “Cleanliness is one of our top priorities,” Lumeau explains. “If only one dust particle ends up in the filter, this could cover a light event and thereby distort the scientific work.” Access to the lab is only permitted with a full body safety suit. A total of five optical coating devices are in the lab. The three more
“Thanks to the excellent technology from Bühler, it was possible for us to manufacture such innovative filters for space research.”

Julien Lumeau, Head of the Optical Thin Film Research Group, Institut Fresnel
recent are from Bühler. The oldest equipment is 35 years old. In 2012, a Helios coating system from Bühler was added. In 2015, a SYRUSpro 710 was added. Followed by a second SYRUSpro 710 in 2018. “The high performance and quality of the machines and the good relationship pushes us to invest in additional equipment from Bühler,” says Lumeau.

The Institut Fresnel has the privilege of being able to choose from various technologies to find those best suited to the respective project. In so doing, Lumeau works very closely with the experts from Bühler. “We propose new concepts, and then we develop a proof-of-concept with Bühler,” says Lumeau. The filter for the Taranis project was produced on the Bühler Helios coating machine.

The machine works under vacuum. The coating material is sputtered when bombarded with ions, and the knocked-out atoms condense on the glass substrate. Layer by layer, the different materials are applied. About 150 layers are required for a Taranis filter. Compared with antireflection coatings that are applied on prescription lenses, for which filters are made of only a few layers, this is quite a lot. The total coating time is therefore significantly longer, too. While this takes a few minutes for lense coating, for the Taranis filter it took more than 10 hours to fabricate. “For the light to be filtered at the exact wavelength, it is essential that

Institut Fresnel

The Institut Fresnel is a research laboratory associated with the CNRS (National Center for Scientific Research), Aix Marseille University, and the École Centrale de Marseille. Almost 200 people (13 different teams) are working in the field of optics and photonics on the development of new imaging systems and components. Among these teams, the Optical Thin-Film Research Team works on the development of innovative and advanced filters.

Their developments include mirrors or bandpass filters (for example, for space applications, lasers, or telecomms), antireflection coatings (eyewear or camera lenses), or colored filters (art, cosmetics). They often innovate in collaboration with industry. For example, the Taranis filters were developed in collaboration with GILAS. Institut Fresnel has been working on the development of optical thin-film filters for over 35 years. It has been a pioneering institute in the domain and continues to be very active in the scientific community.

Website

Learn more about the Taranis project here:
every layer be applied at exactly the right thickness,” explains Lumeau. “This means in the nano range. The individual layers are much thinner than 1 micrometer. They are typically less than one-thousandth of the diameter of a strand of hair.”

**Merging research and industry**

With such dimensions in the nano range, it is no surprise that measurability is an important issue. “The technology has developed rapidly in the last few years. Today, coatings that looked impossible 15 years ago are now commonly fabricated,” says Lumeau. “The challenge is to further improve the precision of the layer thickness and reach atomic precision for each layer.” For this reason, the Institut Fresnel and Bühler are planning to work together on improving optical measuring systems (OMS). The goal is to create new methods for OMS that automatically perform the evaluations and are therefore much more precise than today’s systems.

The new OMS technique is not the only project that could be of interest to the optical industry. Institut Fresnel and Bühler are also working on developing a variable filter. This should allow several color values to be visible at the same time. “People no longer want to be able to capture only one spectral value with one filter, but instead several at the same time,” says Lumeau.

To make this possible, it is necessary for the individual layers of a filter to be of various thicknesses in different spots. “Bühler offers us the best technology on the market for manufacturing homogeneous complex filters,” Lumeau says. “Using this as the basis, we are developing a prototype process for variable filters.” Institut Fresnel, in turn, is making the results of its research available to Bühler. “We are developing a standard process from this and will offer it to our customers,” says Yvonne Bonnin-Degner, Area Sales and Service Manager for Bühler.

“This is the perfect merging of research and industry,” adds Lumeau.

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**Julien Lumeau**

Julien Lumeau obtained a degree in physics from the École Centrale de Marseille in 2001. He also obtained a masters in optics in 2001 and a PhD in optics in 2004. From 2005 to 2012, he worked as a scientist at CREOL University of Central Florida and OptiGrafe in Orlando, Florida, on the study of photosensitive glasses and their use in the manufacturing of new optical elements. In 2013, he joined the Institut Fresnel as a CNRS research scientist. He is currently Head of the Optical Thin-Film Research Team and is working on the development of innovative optical thin-film elements. He is the author of more than 200 scientific communications.

Julien Lumeau and his team work on the development of state-of-the-art thin-film components.
Viking Malt lays the foundation for IoT

The malting company Viking Malt had been struggling with a control system from the seventies and needed an update. Its plant operator was certain: “If we are going to modernize, then we should do it the right way.” He commissioned Bühler to automate and optimize the process. The Bühler automation team rose to the challenge.
he strange programming device, which was previously used to adjust the existing system, reveals the age of the control system. The mobile case looks like an oversized Game Boy with a keyboard and a screen barely bigger than a smart phone display. From today’s point of view, it was prehistoric technology. When the first malting tower of Viking Malt was completed in Halmstad harbor in 1997, it was decided to operate it with the Siemens S5 automation system.

The established control system, launched in 1979, was a safe bet. “What we program on laptops today used to involve difficult coding work on this kind of programming device,” says Kilian Kessler, Head of Automation at Bühler. “But that’s what makes retrofits so exciting.” The automation expert is responsible for modernization in silo and malting plants around the world and has to start at a different point with every customer.

At Viking Malt, retrofitting was primarily a life-support measure. About three years ago, the company caught up with technological developments: At the end of 2015, Siemens officially ceased support and supply of spare parts for the S5. In addition, the outdated control system offered little leeway for optimizing the process or flexibility in the recipes. That’s why Viking Malt and its long-term partner Bühler started the retrofit project for the older malting tower. “We deliberately commissioned Bühler with the modernization as a total solution provider, because we not only wanted to renew the old system, but also to optimize the processes,” says Mattias Arturson, project manager of modernization at Viking Malt. “With Bühler’s malting and automation experience, we were confident that the complex project would be carried out cleanly and with minimal downtime.”

**Efficiency is the key**

Even before the turn of the millennium, Siemens S5 was no longer the latest system on the market, but it did not stand in the way of the malting plant’s success. In 2002, Svenska Malt AB became Viking Malt AB, the largest of today’s six malting sites of the Finnish food producer Polttimo.

In 2004, the second malting tower went into operation, increasing its capacity to 205,000 metric tons of barley malt a year. The domestic market of breweries and whiskey distilleries is too small for Viking Malt: Around 75 percent of Swedish malt is exported, mainly to other countries in Europe, Latin America and Africa. Being located directly on the harbor of Halmstad allows the malt house to load not only trucks but also large ocean vessels, coasters and containers.

To ensure efficient production, the two towers run simultaneously and around the clock. Every 19 hours, a batch of around 270 metric tons of barley begins the process. Two hundred twenty metric tons of barley malt are produced from this amount of barley. The utilization of the production plant is closely linked to the control system, every standstill and every additional minute of cycle time urgently needs.

The art of malting

The big brewery companies have very exact ideas about the characteristics of the barley malt they order. Desired moisture content, color and taste are already precisely defined before the first barley grain from a batch touches the water during what is known as steeping.

Anders Johansson, process expert at Viking Malt, is a maltster with over 20 years of experience, and already knows from the smell when entering the germination box whether everything is going well with the green malt. The circular space has a moisture content of almost 100 percent and has a very specific smell – cucumbers.

If Johansson wants to test whether the germination is sufficiently advanced, he also uses his sense of taste. For that he climbs onto the jetty that towers over the grain and walks to the center of the room. Using special food-safe boots, he can walk on the product just like walking on sand, pouring a sample of the millions of barley grains into his cup.

Once the green malt has passed the taste test by the maltster, the germ box can be emptied and the product released for the next process step. Having many years of experience helps – for example, malt for whiskey has to taste different than malt used for pilsner beer.

Optimum delivery to customers requires not only experienced maltsters, but also finely adjustable systems. “We have to be in control of the process at all times. That’s the most important thing in our business,” says Johansson. Every step, from steeping and germination to the kilning has an influence on the final product and must be precisely adjusted.
The project managers of the retrofit, Killian Kessler and Mattias Arturson, were a good team.

in the control room. The automation retrofit with Bühler should therefore help Viking Malt to produce exactly as required through greater flexibility in the process. A second goal of the company was to reduce the cycle time. The filling and emptying stages during the kilning process were forming a bottleneck. “In addition, each plant operator had his personal wish list with optimizations for the system,” says Arturson. “Compiling the requirements was an elaborate job.”

Take the shortcut
In order to meet all the requirements, Viking Malt opted for a change of direction in the software, going from Siemens’ Braumat to WinCos, Bühler’s process control system in all food sectors. When it came to hardware, they did not want the successor to the S5, but the very latest generation of controller from Siemens, the S7-1500. This was so new to Bühler that the company’s software engineers first had to be trained. Intensive project discussions followed in Halmstad, where it quickly became clear what the biggest sticking point of the project was.

Viking Malt’s order books were full, so by keeping installation time short, they hoped to miss as few batches as possible to keep the sales losses low. Open heart surgery to the control system, so to speak. “I knew I had to put together a top team,” says Bühler project manager Kessler. Among them was Martin Müller, an experienced Bühler engineer. “When I learned about requirements in terms of availability and downtime, I had the idea of working with adapters,” says Müller. “I had already seen this kind of adapter in a similar system.” The challenge: The control boxes in Viking Malt’s older malting tower have as many as 4,000 digital and analogue inputs and outputs. Rebuilding and testing them all individually would have required a long downtime. With adapters, the project team was able to eliminate the rewiring and testing of all inputs and outputs without replacing them.

The project was not completely risk-free. As no suitable adapters were available on the market, the Bühler project team quickly developed a suitable prototype and produced around 500 copies. In the meantime, Viking Malt was tasked with preparing the control boxes in such a way that the adapters only had to be connected during commissioning. Bühler traveled to Halmstad with tools and a strict schedule and set to work.

At the first test, the team found that the adapters caused a twisted connection, that is, a drift in the signals. “I put the entire project team together to look for a quick solution,” recalls Project Manager Kessler. He was concerned there might be a delay in commissioning. After 20 hectic minutes and a touch of improvisation everyone was able to breathe a sigh of relief: The automation experts could correct the drift easily at software level. “You have to reckon with something unforeseen with every commissioning,” says Kessler. “It’s important to be able to respond quickly – especially in time-critical retrofits.”

Expert knowledge required
The plan with the adapters proved successful: After this first test, the conversion went even faster than planned. But just before the end, another challenge presented itself. With each control cabinet that the project team switched to the new system, the old S5 system mysteriously slowed down until it was barely operable. This is where Helena Torin came into play, a former consultant of Viking Malt, who had dealt with the S5 in more detail.

Working hard on the strange programming device, Torin and Kessler together managed to make the old system faster again by disabling the suspended units until it was no longer needed. “It was only thanks to the intensive teamwork of everyone involved that we were able to stick to the plan and that the project succeeded in the end,” says Kessler. Thanks to the innovative solution with the
adapters, the team could even reduce the expected downtime to a record low. “We were able to reduce the production loss from 15 to 5 batches, which was really good,” says Viking Malt Project Manager Arturson. Because when it comes to modernization, malting is a big challenge. “Many think it’s easier because the process is so slow,” says Kessler. “But that’s exactly what makes it difficult. It makes any progress sluggish and dependent on the process.”

**More options for the operators**

To make the smooth transition to the approximately 30-year-newer system as smooth as possible, the Viking Malt plant operators were given extensive training. Months before commissioning, Bühler sent a laptop with a test system installed. This meant the employees could play through the entire process and get to grips with it at an early stage. “It’s not easy to get employees to adapt to a new automation philosophy quickly,” says Johansson. “No matter how good the product is.”

The fact that they have more options with the new operating system was nonetheless a great help during the changeover. For example, recipes can be changed in much greater detail, and operators can design each process step independently of the others. This enables Viking Malt to react effectively and, in some instances, completely automatically to any initial situation, such as quality fluctuations in the raw material or weather-related storage challenges. “That makes the quality more consistent. We can meet customer specifications more reliably,” says Johansson. Improvements in the cycle time are also visible: By switching to Bühler’s WinCos process control system, the malting company was able to achieve the significant time optimization during emptying and filling in the drying kiln.

After optimizing the process with the retrofit, Viking Malt wants to continue investing in the future. The next project begins immediately under the name Benchmalts.

With Bühler, Viking Malt is leading the way in the field of IoT. The data collected from WinCos, its own laboratory system, and additional sensors make it possible to draw conclusions about the optimal process and to optimize quality. The process control learns which recipes are optimal for which types of barley malt and can support the plant operator in daily work. The system will then have the same level of experience as process experts at Viking Malt.

Will that not mean Johansson’s job is no longer required? “No, it’s a good thing. I can go on vacation again then,” says Johansson. Experts will always be needed – but with investments in automation modernization and in Benchmalt, Viking Malt is taking its automation to the next level. “With the retrofit, we have laid the foundation for IoT,” says Arturson. “That’s the future.”
Almost all new banknote inks around the world are mixed on the mixing and fine dispersing machines from Bühler. In August, the newest Swiss banknote was introduced: the 200 franc note.

TEXT: MARKUS REBER / PHOTOS: SWISS NATIONAL BANK AND ANDRÉ GUTZWILLER
A soft hum. There’s not much else coming from the three-roll mill – unimpressed, diligent. It’s a suitable background noise, because the production of banknote ink is a somber, closely controlled process. The new 200 franc notes are created for the Swiss National Bank, or SNB, with the earth brown ink that is evenly distributed by the ink manufacturer over the turning rollers.

The three-roll mill from Bühler only hums until the color has reached the right consistency and brightness. “The roller technology that we use in our machines produces a consistent high-quality ink. Reproducibility is one of the most important criteria for our customers,” explains Norbert Kern, Director Global Product Management & Technology at Bühler Grinding & Dispersing. The department produces solutions for color ink manufacture, and with its technology for banknote ink manufacturing it enjoys the highest confidence of national banks and banknote presses around the world – its colors have to match. The quantity for the new 200 franc notes must be enough to print 55 million new bills – all exactly the same. For this, the manufacturer relies on Bühler’s decades of expertise.

Orders with national prestige
The SNB replaces their banknote series about every 20 years. In August 2018, the new 200 franc note replaced its predecessor. The ink for the new banknotes was mixed with technology from Bühler. Both the old and the new 200 franc notes contain earth brown tones. The motif on the new one shows the hand of a teacher and the globe, which are found on every bill,” wrote the SNB in the presentation for the new note. For orders of national significance, perfection is required: “With our technologies and machines, we meet our customers’ highest requirements in the production of banknotes for security, quality, and reliability,” Cornél Mendler, Managing Director of Grinding & Dispersing Technologies explains. The machines from Uzwil dominate the market for fine dispersing of banknote ink. In the last three years, Bühler has won every tender in which it has participated.

Currently Bühler is performing commissioning activities in India and on the American continent. This means the machines will be put to the test at the production site. Bühler won both orders in a public bidding process. Thanks to the international presence of the company, Bühler guarantees quick support with the global service network.

Customers are primarily national banks or manufacturers of security printing inks. With more than 75 percent of the market share, Bühler dominates in supplying these kinds of production machines. For orders of national prestige, national institutions rely on the quality of Bühler. “For more than 40 years, Bühler has been supplying the industry with technology for producing banknote inks. For orders of such significance, our customers do not want to add any risk. Our good references are the convincing sales argument,” says Mendler.

Consistent high quality
The old Swiss 200 franc notes have been replaced piece by piece with the flawlessly processed new bills since roll out in August 2018. High quality can be achieved in such quantities of banknote ink only with precision. “We are able to do this thanks to
Ink for banknotes

Kern says. VIVA rollers have no crown bow, meaning the middle of the roller is not thicker than the ends, like ordinary rollers. As a result, VIVA rollers produce the same high color quality across their entire length.

Counterfeit protection and complete traceability are among the most important issues in the production of banknotes. “Our machines can be completely emptied. The production employees can trace exactly how much produced ink has left the machine and how much is still remaining in the machine,” says Kern. Thus it can transparently be ensured that no ink remnants disappear during the process. This is used for counterfeit protection because the ink remnants could be used to copy the ink formula. Could Bühler somehow be a gateway for counterfeiters? “No, and this is for one simple reason,” says Kern. Inks always consist of a liquid binder and a powder. “We don’t know exactly what this composition looks like; only the ink manufacturer knows. And that remains their secret. For every ink.”

The most beautiful in the world

The last banknotes in the new series, the 1000 franc note and the 100 franc note, will receive their violet and blue colors thanks to the machines from Bühler.

The Swiss National Bank not only has high demands for quality and security – it also has high expectations for the esthetics. The Swiss banknotes are among the most beautiful in the world: in 2017 the golden yellow 10 franc note won first prize from the International Bank Note Society, beating out 169 competitors. Just a year earlier, the brilliant green 50 franc note took home first place. The 200 franc note will enter the competition in 2019.

Bühler Grinding & Dispersing borrowed the technology for manufacturing printing inks from the food industry. Roller mills were originally developed for refining chocolate mixtures or coarse grains. “Roller mill technology is part of Bühler’s DNA,” says Mendler.

Bühler has been developing and improving the three-roll technology for more than 100 years. Products like metal pastes for the electronics industry, lubricants, offset ink, artist’s paint, and even banknote ink are manufactured today on three-roll mills from Bühler.

Security features are also from Bühler

In addition to inks that can be traced back to before the mixing process, Bühler also produces solutions for manufacturing security features. Bühler Leybold Optics contributes with holograms for counterfeit protection on euro banknotes. The Leybold Optics vacuum coating equipment applies a razor-thin layer of zinc sulfide and aluminum to make the hologram on the euro note more visible. Security features like holograms, glittering security threads, or elevations on the paper make banknotes unique.

Money is never just money: every design is different. But, most of the banknotes around the world have one thing in common: their coloring is accompanied by a soft hum.
et food and aqua feed producers work to tight margins. Small percentage gains in production processes can make a significant difference to the bottom line. Maintaining optimum moisture content in the product, for example, can increase profitability, cut waste, reduce production costs, and improve sustainability.

Achieving and maintaining optimum moisture content is challenging. If feed is not dried sufficiently, it risks becoming contaminated with mold. Erring on the side of caution leads to overdrying, which wastes energy and adds to the environmental footprint of the product. Somewhere between under- and overdrying is the optimum moisture content. With decades of experience in thermal processing, Bühler knows that this is a challenge many food and feed producers face. Traditionally, processors monitor and make adjustments manually. While moisture sensors and automation have brought improvements to the process, now with the latest cloud and connectivity technologies, Bühler can help its customers reach the next level.

MoisturePro is a digital service that optimizes thermal processing. Part of the new Bühler Insights digital platform, it is one of a suite of digital services backed by the Microsoft Azure cloud computing service.

With access to continuous real-time data, Bühler is supporting customers in critical decision-making to maintain the right drying parameters. In so doing, MoisturePro plays an important role in achieving Bühler’s goal of cutting waste and energy usage by 30 percent for customers by 2020.

In the food and feed industries, drying is used to reduce moisture in the product, ensure it is shelf-stable, and eliminate pathogens.

The challenge faced by food and feed processors is how to consistently achieve the precise level of moisture control required. Drying requirements for different products and recipes vary, and the drying process can be very slow. It can take many hours before the effect of adjustments is revealed. The traditional way of monitoring moisture content involves taking samples at different stages. However, this manual approach to monitoring leads to inconsistencies.

**Precise moisture control**

“Ideally there should be an expert standing by the machine all the time, checking the moisture levels and making adjustments,” exp Paul McKeithan, Head of Digital Services at Bühler. “But this is not realistic. Tougher market conditions have forced many factories to become leaner. The remaining operations staff have less time to monitor and make the right drying adjustments.” With too little information and too much time between adjustments, overdrying has become a common problem.

MoisturePro is a new approach to achieving a tighter moisture specification that relies on intelligent data, real-time monitoring, and continuous feedback. Developed in partnership with one of Bühler’s pet food customers, it leverages the power of the latest digital technologies and connectivity to enable expert decision-making throughout the drying process.
How IoT increases profitability and sustainability at the dryer

MoisturePro is an intelligent drying solution for food and feed processors that offer real-time, continuous moisture management by harnessing the power of cloud connectivity and IoT.

A network of smart sensors collects customer production data and transmits it to the cloud via a highly secure gateway.

Bühler collaborates closely with customers to deliver process improvements that reduce costs, improve quality, and maximize productivity.

Data is analyzed in real-time by powerful Bühler Digital Services tools, examining process indicators, KPIs, and tolerance levels.

Bühler’s extensive processing knowledge, coupled with oversight into customer operations, produces actionable insights.

Using the IoT and cloud-based storage architecture from Microsoft Azure, Bühler has produced an intelligent drying solution with real-time, continuous moisture management.

A digital partnership
As the continuous stream of product passes through the discharge chute, moisture and temperature are analyzed, providing valuable real-time data. This data is relayed to the dryer control software that enables automatic adjustments. Algorithms immediately and continuously adjust production parameters, so that the optimum moisture content is achieved, eliminating potential time gaps associated with typical manual sampling, testing, and manual dryer adjustment.

The fully automated method significantly increases the frequency of sampling and moves more of the product closer to the target moisture content. The control algorithms, developed with the benefit of Bühler’s extensive process knowledge, reduce moisture deviation, improve dryer yield, and reduce dryer energy consumption.

Moisture content targets can be input by the operator or by recipe control. The dryer automatically establishes and maintains the optimal drying environment for the remaining production run.

Comprehensive production data also supports decision-making. The data can be viewed in real time on a computer, phone, tablet, or other web-connected device thanks to cloud-based architecture, providing processors with actionable insights.
Tangible gains

Intelligent moisture control can quickly show returns on infrastructure investments, increasing profitability and decreasing energy and material costs. For a typical feed dryer operation, Moisture-Pro will deliver a net increase of 1 percent in moisture gain in final product water content, which results in an increase in return on investment of USD 300,000 annually. This translates to an annual energy saving of USD 20,000.

Furthermore, seamless monitoring of end-to-end processing ensures consistency in product, efficient energy use, and safe food production. It also gives decision makers access to data for tracking and measuring operational success. With IoT, a secure web-based solution puts real-time dryer production data reports at the processor’s fingertips. Dynamic reporting shows meaningful correlations, giving the processor the ability to act and react with confidence.

It’s smart, efficient, and intelligent. But more than that, it means Bühler’s expertise is on hand at all times – a true business partner.

“The use of digital technologies has revolutionized food and feed processing. An industry that began with craftsmanship and kitchens now relies more and more on computers and automation. These changes have driven huge improvements in quality and efficiency,” says McKeithan. “Now, the latest digital technologies and connectivity will drive the next revolution. It means our expertise is not just available when a field engineering consul-
tant visits the factory floor, but on an ongoing, real-time basis, proactively helping to make decisions and drive improvements in processes. It’s truly a partnership – a complete platform and service.”

With the double pressures of growing global population and climate change, if we are to continue to meet people’s needs without depleting global resources, all actors in the food value chain need to improve the sustainability of their operations to ensure a secure and safe supply of food in future. Part of this involves improving efficiency and minimizing waste.

Driving sustainability

Bühler’s digital services, including MoisturePro, provide the food processing industry a means of driving its own sustainability while also driving business success.

Machine and plant-based management systems with real-time data collection not only help manufacturers achieve more transparency, but can also ensure sustainable operations by enabling responsible environmental production practices that minimize waste.

Sustainable operations also include efficiency, cost savings, and new profitability. Process control systems can enable efficiency gains that have been unattainable with operator-only led adjustments. Pairing intelligent autonomous machine control with robust producer recipe management, producers can also generate more on-specification products using less energy.

“At Bühler, we know the power of data analytics. With Bühler Insights, our process knowledge is on hand to our customers, so that they can improve efficiency and meet sustainability goals,” explains McKeithan. “That’s good for them, good for us and good for the environment. It’s a win-win-win.”
Bühler Insights: Get the best out of every process – 24/7

The Internet of Things (IoT) helps manufacturers reach new levels of productivity. With the Bühler Insights platform, every machine in your plant can run as if your best operator is on the job around the clock.

TEXT: STUART BASHFORD / INFOGRAPHIC: MICHAEL STÜNZI

Maximizing efficiency with IoT

IoT technology enables clients to remotely access critical production data practically in real time, and to make crucial decisions about machine performance, tolerance levels, and more. That key data provides information to optimize production. It also enables users to diagnose and solve system malfunctions remotely, thereby dramatically cutting wasteful downtime.

An example is the Smart Chocolate Factory – a self-optimizing digital service for dosing, mixing, refining, and conching lines. It’s a digital factory that communicates with sensors to increase performance, reduce operational costs, and keep quality on target.

Bühler Insights explained in four steps:

1. **Monitor and gather**
   Sensors monitor the production process and gather valuable data. Smart sensors enable the quality of the process to be measured. Measuring the quality of a process is essential to maximizing potential.

2. **Send data for analysis**
   The sensors send data to Bühler Insights for analysis and visualization. Bühler draws on its 150 years of process know-how to derive real value from the collected data, ensuring optimal efficiency.

3. **Optimize processes**
   Depending on the digital service required, Bühler can optimize production processes in real time – it is like having your best, most experienced operator at your production line at all times.

4. **Customized information**
   The complete analysis is displayed on a dashboard. It can be viewed in the control room of a factory, on a computer or tablet. Users can customize the information they need based on their specific requirements.

Optimized production reduces energy consumption and waste

The food sector accounts for over 30% of global consumer energy demand and produces over 20% of global greenhouse gas emissions, according to the Food and Agricultural Organization. On top of that, one-third of the food we produce – and the energy embedded in it – is lost or wasted. Bühler’s digital solutions will help customers reduce waste and energy, and optimize efficiency and quality.

Bühler’s 2020 goal is to help its customers reduce energy consumption and waste by 30%. Bühler Insights is a key enabler for achieving these targets. With real-time monitoring and control, even the most modest benefits can accumulate into substantial gains over the course of a year. We are currently developing over 50 digital services – and this is just the beginning.
Connecting to the cloud to boost food safety

Corn, a staple food for millions, can be contaminated with a dangerous carcinogen known as aflatoxin. Making it safe for consumption means catching every contaminated grain. This has been a major challenge until now. Leveraging the latest digital technologies, LumoVision sorts the bad grain from the good with unprecedented accuracy.

TEXT: JANET ANDERSON

With today's digital technology we are able to connect machines so that they communicate and interact with each other. Add to that the potential of cloud computing, and problems become solvable that have previously proved challenging.

One such challenge is aflatoxin. Corn (maize) is one of the most important food and feed crops grown worldwide and a staple in the diets of a third of the world's population. But if it is not handled correctly, it can become contaminated by a fungal mold that produces the carcinogen known as aflatoxin. Acute exposure to high doses of aflatoxin causes death, but more common is long-term chronic exposure to non-lethal but harmful doses. It is estimated to cause 155,000 cases of liver cancer a year and contribute to irreversible stunting in millions of children.

Detecting aflatoxin and removing it from corn is a major challenge as it is impossible to see with the naked eye. Just two highly contaminated kernels in 10,000 are sufficient to render an entire batch of corn unfit for human consumption. With no treatment that destroys it, the risk can only be minimized through management systems involving the whole value chain. However, where these management systems are lacking, high levels of contamination can go unnoticed and endanger the health of millions. Even where state-of-the-art sorting processes are in place, these are imprecise, resulting in many tons of good grain being wasted. The only absolutely sure way to detect aflatoxin is to send a sample to a lab for analysis. But as aflatoxin contamination occurs in hot spots, it can easily be missed, and as sampling takes time, results arrive too late to reliably support real-time decision-making.

Deciding in milliseconds
LumoVision is an answer to these challenges. It is a revolutionary data-driven optical sorting system for corn that improves significantly on current practices and has the potential to make a major contribution to addressing the aflatoxin challenge.

The solution uses the fact that corn contaminated with aflatoxin glows a bright green color under ultraviolet light, whereas healthy corn glows blue. With a specially developed lighting system, a highly sensitive camera and data analytics, Bühler's expert team has developed a sorter that accurately detects individual aflatoxin-contaminated grains in real time as they are processed. When contaminated grains are detected, air nozzles deploy within milliseconds to blow them out of the product flow.

Connecting LumoVision to the cloud via Microsoft’s Azure adds a predictive level that improves the system's efficiency even further. Data from the cameras is fed to the cloud as the batch is processed, where a local risk analysis is carried out. If the risk is minimal, sorting is halted while monitoring continues. If the risk rises, sorting automatically restarts. The risk of aflatoxin occurring is heavily correlated to how the grain is stored, which in turn is heavily correlated to the quality of the storage device, weather conditions, and regional information about previous outbreaks. “By compar-
ing data stored in the cloud with the data collected by the machine, it is possible to assess the risk of aflatoxin occurring in each batch and optimize sorting,” says Stuart Bashford, Digital Officer at Bühler. “For example, if we know that the grain was harvested from a field in a region where the weather was very dry, we know the plants were more susceptible to contamination. On the other hand, if we know that the grain was stored in a Bühler silo under appropriate conditions, we know the mold is unlikely to have grown on it.”

By accessing historical data records about aflatoxin outbreaks in a particular area, it is possible to assess the likelihood of another outbreak. If there has never been an outbreak in an area, the likelihood of one occurring is low, as opposed to an area where there is an outbreak every summer. “Via the cloud, LumoVision draws on a huge amount of information, knowledge, and expertise in order to make decisions about each grain in real time,” says Bashford. This means that LumoVision can eliminate 85 to 90 percent of contaminated grain with a yield loss of just 5 percent – a substantial improvement on conventional systems.

**Future potential**

“Microsoft Azure is a very scalable solution that can work across thousands of devices, across all regions of the world,” says Bashford. In developing Azure for LumoVision, the software developers at Bühler have been working closely with Microsoft. The result is that Bühler has built its own Internet of Things platform, Bühler Insights, which will be used for all future machine connectivity requirements. “Bühler Insights will enable us to connect Bühler machines to the Internet and allow customers to visualize data,” says Bashford. “This is a big step as visualizing data unearths information that was hidden and makes more obvious what is needed to reach maximum efficiency.”

For example, the data provided by LumoVision could highlight that storage techniques need improving. “We can offer other digital services, such as PreMa, which monitors the conditions inside silos and alerts if there is an insect infestation or mold growing,” says Bashford. “If there is contamination, the sooner you know, the sooner you can get rid of it. If you don’t know about it, the problem just gets worse.” In terms of connecting machines, the story is just at the beginning. By storing collected data in the cloud and running analytics, the potential is there to make systems that are smarter and more insightful.

“This is an exciting time,” Bashford explains. “We are harnessing the power of digitalization to improve food security and safety and help our customers reduce waste, increase efficiency, and maximize yield.”

**ADDED VALUE**

+ Detect aflatoxin contamination with unprecedented accuracy at industrial throughputs
+ Reduce risk of contamination and improve food safety
+ Optimize sorting processes and reduce waste

**Would you like more information?**

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**Pasta joins the digital revolution**

This year’s launch of PastaSense has caused palpable excitement among pasta manufacturers. This industry that has relied on traditional processes for generations is moving into the digital age and reaping the benefits of the Internet of Things.

TEXT: STUART SPEAR

Global pasta consumption is on the rise with some of the most dynamic growth occurring across Asia and Africa. Its growing popularity is no surprise. Pasta is good value, versatile, and nutritious, while being easy to transport, store, and cook.

But anyone who has tried to make homemade pasta may start to appreciate that behind this apparently simple and ubiquitous food lies a complex manufacturing science. Variables like protein, ash, and water content, along with color and drying parameters, all impact on quality, wastage, and ultimately on cost. The whole production process has to be tightly controlled to continuously guarantee the high-quality product we all expect.

Traditional quality controls involve samples being taken to a laboratory every few hours throughout the production process. It is labor intensive and time consuming, resulting in potentially costly lags between a sample taken and the discovery of a production failing.

**A gigantic step forward**

This year that all changed. In May, Bühler launched PastaSense at the Ipack-Ima trade show in Milan, and according to Marco Loschi, Bühler Product Manager, the enthusiastic response from the industry surpassed even his expectations. He describes a palpable feeling that the launch of PastaSense has finally thrust pasta production into the 21st century.
“I believe this to be a gigantic step forward,” explains Loschi. “I have worked in research and development, so I tend to have a slightly futuristic perspective on things. Before the launch I was unsure if my view would be shared, but in Milan the feedback from the industry was more enthusiastic than I could ever have imagined.”

This excitement was not just due to PastaSense being able to provide real-time quality controls. Delegates at the trade show learned of its ability to address an industry skills shortage, improve traceability and transparency, control composition, increase profitability, and in the future to generate a mass of invaluable digital data to inform future pasta-making processes.

PastaSense technology involves sensors doing the work of the quality control technician. Situated strategically throughout the process, sensors analyze and record the characteristics of the raw material being used, monitor water content at the drying, pre-drying and stabilizing stages, while also monitoring the color of both the product and the raw material. Sensors can be fitted where existing manual sampling already takes place, enabling the automated system to align with existing quality controls. Sensors can be retrofitted to a client’s existing production process or will be provided with future Bühler solutions.

Perfect protein
Quality control of the raw material and its protein content is a key feature of PastaSense. Whether you produce your own flour and semolina, buy it in, or blend it to stabilize your final protein content, manual sampling can never guarantee exactly the right composition until you see the final product. With PastaSense you can be assured, in real time, that the blend is right from the start to ensure achieving your desired end product. PastaSense enables a producer to label a premium product line with a guaranteed measure of protein content.

Controlling your raw material is just the start of the story. PastaSense next helps reduce potential variables throughout production. Strictly controlling the rate of drying to achieve optimum moisture content is a key challenge in pasta production. With PastaSense samples no longer need to be taken from hot dryers. Instead, you are automatically alerted as soon as there is any deviation from the drying curve liable to cause structural defects. As the sensors analyze so PastaSense collects more and more digital data. With this data come all the advantages associated with the Internet of Things.

As data is fed into the secure cloud, it can be analyzed and then displayed on a customized dashboard in the most efficient way for the producer. An overview of the production status can be further mined to bring up specific details on any part of the manufacturing process.

Transparent production
Customers are demanding ever greater traceability and production transparency. With production parameters being monitored and recorded throughout the manufacturing process, the data is there to be able to link the packet of pasta in a consumer’s hand with the quality control parameters at the moment of production.

“This trend in transparency has been going on for a number of years, and any pasta producer who wants this level of second-by-second traceability will in the future be able to use PastaSense to achieve it,” points out Loschi.

As pasta production spreads globally across Asia, the Middle East, and Africa, the skills to exercise and analyze manual quality controls will start to be in ever-shorter supply. Once the production parameters are set in PastaSense, the need for highly skilled operators lessens.

But this is only the beginning for PastaSense. Loschi says that the most common question put to him at the Milan trade show was whether this Bühler solution could go one step further and not just recognize the need to change parameters, but actually change them automatically.

“At the moment this is a step too far,” explains Loschi. “But the exciting thing is that it provides a window into the future. We have not even started exploring full automation, but who knows where we will be in two to three years?”

Video
Watch this video to learn more about PastaSense.

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ADDED VALUE
+ Cost savings as waste is minimized and quality optimized
+ The next generation in traceability and transparency
+ Consistent control of product quality
Sorting technology has evolved to distinguish the ever-subtler surface characteristic of products. But what if it was possible to sort by a food’s nutritional properties or a plastic’s chemical makeup? Bühler believes its new Sortex F HyperVision will be a gateway to a new generation of products.

TEXT: STUART SPEAR

The use of the adjective “revolutionary” when describing new technologies often risks the sin of hyperbole. However, on rare occasions, it can be a fair description. When a new technology has the potential to change production methods, create new commercial opportunities, and open a gateway to a new generation of products, it is safe to call it “revolutionary”.

Bühler is currently talking to pilot clients about Sortex F HyperVision, a revolution in sorting technology capable of distinguishing characteristics such as a food’s nutritional content or the presence of food contaminants as well as more traditional sorting criteria like foreign material.

Bühler clients at this year’s Ipack-Ima trade show in Italy were the first to hear how the new technology can analyze protein in grain, the level of hydrogen cyanide in a nut, or piece of fruit as well as fat content in pulses.

And it’s not just the food sector that is showing interest in this new technology. Bühler is also talking to its clients in the recycling sector about Sortex F HyperVision’s ability to distinguish grades of shredded polymer, to ensure more refined and cost-effective plastic reuse.

**Technological advances**
Sorting technology has evolved unrecognizably over the past 70 years. In its early days machine vision could only detect extreme variances in color. With the arrival of digital imaging, it became possible to recognize blemishes and subtle color differences, while yet further advances meant the ability to sort broken or misshapen produce or infrared detection of foreign objects. Each technical development led to the ever-more refined analysis of a product’s external characteristics. That is, until the development of hyper-spectral imaging.
“The level of data that is flowing through and being analyzed by this machine is truly astonishing.”
Matthew Kelly, Managing Director of Digital Technologies

Developed for use in astronomy and microbiology, hyper-spectral imaging enables Bühler HyperVision to analyze between 200 and 300 different infrared colors from a single pulse or wheat kernel at industrial throughput speeds to provide a whole new palette of information about a product’s nutritional makeup.

“The level of data that is flowing through and being analyzed by this machine is truly astonishing,” explains Matthew Kelly, Managing Director Bühler Digital Technologies. “If you imagine there are thousands of kernels of grain passing through the machine every second as the technology analyzes hundreds of different infrared responses, then things get very busy, very quickly.”

Rethinking sorting
Sorting technology has traditionally provided quality controls at the end of a production line through cleaning applications or color grading. The development of Sortex F HyperVision provides a whole new way of looking at the sorting process. Deciding where in the production process to deploy the technology could generate quite different commercial opportunities.

Wheat processing is a good example. Depending on its protein content, wheat can be used in very different ways. Wheat with a high protein content, for example, may be used for pasta, while lower protein flour might be used in cookies. At the moment producers rely on wet-testing samples in laboratories to try to estimate the protein content of their overall consignment. With Sortex F HyperVision every kernel can be analyzed after leaving the grain silos and then diverted into a different, higher-value, product stream.

Producers of meat substitutes will be able to use Sortex F HyperVision to analyze their protein source earlier in the production process to create a more powerful protein concentrate.

The potential diversity of applications is illustrated by the interest the recycling industry is showing in Sortex F HyperVision. Recycling food grade plastics has long been a challenge for the recycling industry. PET (polyethylene terephthalate) is used for food grade packaging while PVC (polyvinyl chloride) is not. PVC also has a lower melt temperature, resulting in black spots and even holes when melted with PET. Sorting PVC from PET requires a very low tolerance of contamination (10 to 50 parts per million).

Call-out to clients
Bühler believes that the ability to sort by the nutritional content of foods, polymers, or other as yet untested characteristics will prove to be a game changer. But it is producers who are best placed to recognize how this new technology might be applied, which is why Bühler is keen to talk to clients.

Collecting production-scale data on nutrition could also open up opportunities around the Internet of Things by producing invaluable historical databanks on the characteristics of raw materials for food producers.

“We are currently talking to our clients about potential applications, and we are inviting as many people as possible to approach us with their ideas,” explains Kelly. “One of the exciting things about this product is the breadth of applications it opens up for our customers. We are, of course, very interested in exploring this.”

ADDED VALUE
+ The ability to detect nutritional content in foods
+ Product opportunities unachievable with conventional technology
+ Enables plastic recyclers to strip out high-value polymers

Would you like more information?
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The evolution of the CUBIC

Construction work on our new innovation campus in Uzwil, Switzerland has been progressing at a steady pace since the official groundbreaking in September, 2017. The frame of the building is standing, and glass façade is in place.

Work on the interior is currently running at full steam. And, the totally revamped application centers for pasta, value nutrition, die casting, and bakery have already reopened. Those for chocolate and grinding and dispersing will soon follow.

The Cool Urs Bühlér Innovation Campus – CUBIC – will offer an open working atmosphere that inspires cooperation. Not only Bühlér project teams, but also customers, suppliers, start-ups, and research partners will exchange ideas and work on new innovative solutions for the future in this collaborative environment. The opening of the CUBIC will take place in early spring 2019.
September 2017: the old pasta center is demolished

October 2017: space is made for the foundation

November 2017: the new concrete slab for the future pasta hall is poured

May 2018: the exposed steel structure is sprayed with fire-resistant paint

June 2018: the façade frames are moved to their proper location

August 2018: the glass wall façade is set

October 2018: the scaffolding is removed
...that around 27,000 new products with pulses were launched on the market worldwide between 2013 and 2017? Europe topped that list: 39% of products came to market in this part of the world. The greatest growth rates were seen in meat alternatives, pasta, and snacks.

...that the world’s arable land area from the year 2002 would be enough to feed about 10 billion people – provided they were all vegetarians? American biologist Edward O. Wilson cites this figure in his book The Future of Life.

...that one-third of all foods produced worldwide are lost or land in the garbage? Bühler is working on solutions to recycle or reduce food waste (for example, with insects or intelligent sorting technology for processing).

...that there are around 50,000 edible plant species on Earth? Approximately 7,000 of these are grown or gathered. The three most important ones are the grains wheat, corn, and rice.

...that there are over 15 startups worldwide working on developing cultured meat? Companies from the Netherlands, California, and Israel aim to bring pertinent products to market by 2021. The first products will likely consist of a mixture of what’s known as “clean meat” and plant-based proteins.

...that the majority of vegetarians live in India? A total of 38 percent of its population does not eat meat, putting the country at the top of the list worldwide. In 2014, McDonald’s in India even opened a vegetarian-only restaurant.

...that meat-eaters* emit almost twice as much greenhouse gas as vegetarians and nearly 2.5 times as much as vegans based on their diet?


* Consumers of ≥ 100 g of meat per day

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Let’s innovate together

Our innovation journey is an exciting one. The digital transformation of our industry is ongoing, and at Bühler, we are ready to enable that transformation. With our digital platform, Bühler Insights, and our range of digital services, we are testing, understanding, and deploying new technologies to enable our customers to operate more efficiently across their value chains.

Our partnership with Microsoft has enabled us to move fast and profit from their experience and that of their ecosystem of partners and customers. We are convinced that our ecosystem approach is the way to move faster, not only in innovation, but also in building businesses.

We look towards 2019 with great excitement. We will continue our innovation journey with a strong pipeline of new technologies and services, reinforcing and broadening our technology portfolio, and in addition, we will open our new innovation campus – the CUBIC.

The CUBIC will embody our innovation spirit and culture. Our application labs are coming back on line, renovated with new technology and better facilities for trials and development activities. These labs are now linked directly to our new innovation center, where we will bring together the diverse skills, capabilities, functions, experience, and people who can spark an acceleration of innovation output. In fact, we aim to create an innovation factory that produces new business, be it in services or technologies. The center will house apprentices, researchers, engineers, marketing specialists, students and businesses; along with our digital businesses and business development. In short, everyone is welcome. It is open to customers, suppliers, start-ups, and academic partners. If we can grow together, then we can be together in the CUBIC. It will be home to events, training and education programs, and it will embrace all those things beloved of the digital age, such as hackathons, rapid prototyping, maker spaces, and collaboration sessions.

We will go live in March and our innovation production line will be running at full speed by the time the Networking Days 2019 take place in August. After the extraordinary experience of 2016, we will bring together not only customers and eco-systems from across the food value chain, but also those from the mobility ecosystem as well. With experts and industry leaders we will inspire, discuss, understand, and derive actions that will support us as an industry to create more sustainable value chains, while contributing to addressing the burning environmental and societal challenges of our time.

We look forward to welcoming all of you, to exchanging ideas with you, to innovating with you, and to enjoying the spirit of collaboration that will surely make us all stronger and more responsible companies going forward.

“We will continue our innovation journey with a strong pipeline of new technologies and services.”

Ian Roberts, CTO Bühler Group