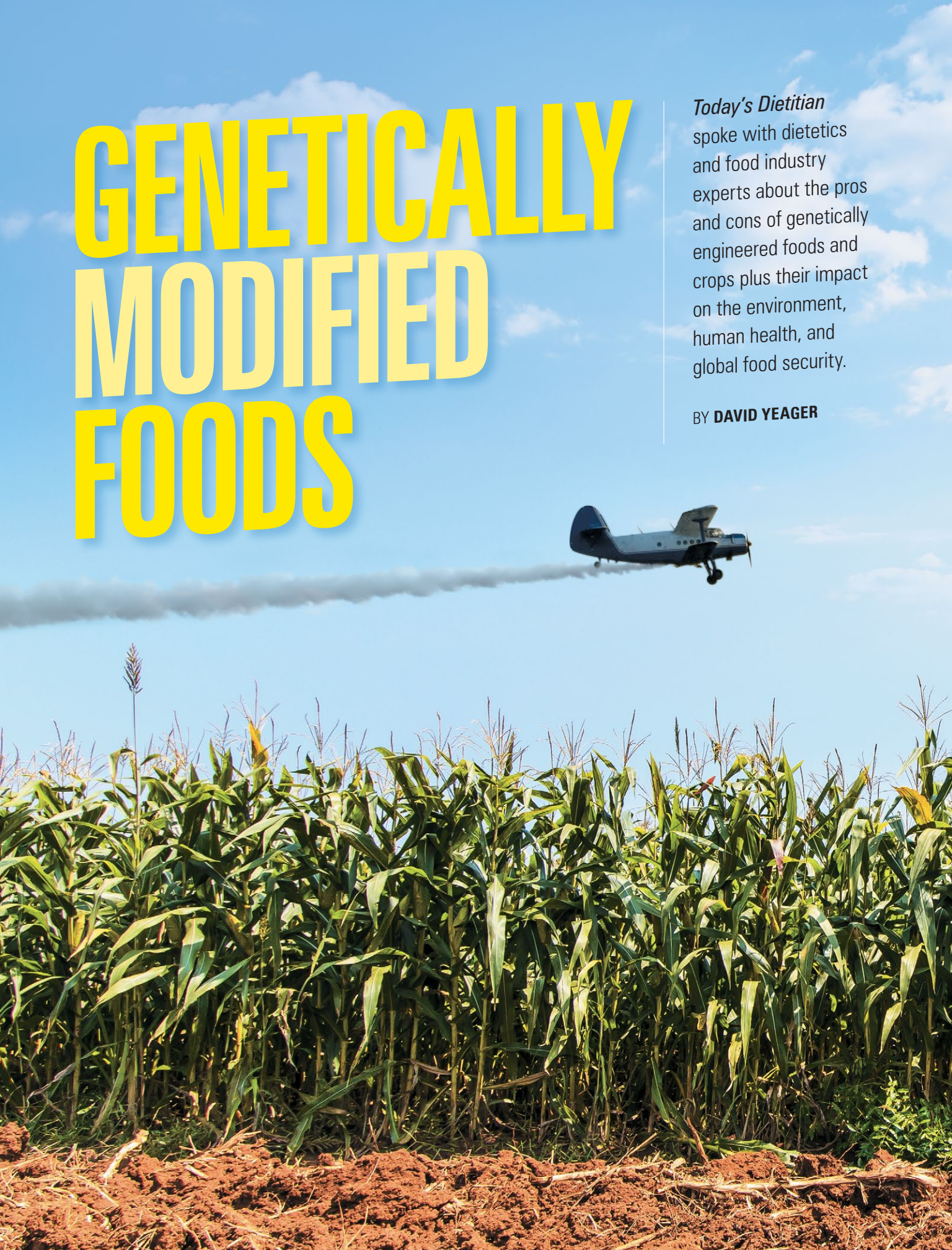
GENETICALLY MODIFIED FOODS

Today's Dietitian spoke with dietetics and food industry experts about the pros and cons of genetically engineered foods and crops plus their impact on the environment, human health, and global food security.

BY **DAVID YEAGER**



The debate over genetically engineered (GE) crops and foods containing genetically modified (GM) ingredients or genetically modified organisms (GMOs) is marked by passionate opinions on both sides. Whether you're pro-GMO, anti-GMO, or unsure, you're most likely familiar with some of the arguments. Opponents cite questions about GMOs' effect on human health and ecosystems, their potential to hasten the evolution of pesticide-resistant insects and herbicide-resistant weeds, and the undue influence of large corporations on agricultural policy as reasons to be wary. Proponents counter that safety concerns are highly exaggerated; GE crops reduce the amounts of pesticides and herbicides that farmers must use; and they're necessary for meeting the food needs of a human population that will continue to grow.

To learn more, ***Today's Dietitian*** (***TD***) asked experts about the potential effects of this biotechnology on our food supply and health. The participants in our Q & A are as follows:

• **Ashley Colpaart, MS, RD**, is the 2013-2014 chair of the Academy of Nutrition and Dietetics' Hunger and Environmental Nutrition Dietetic Practice Group and a doctoral student in interdisciplinary studies of food science and food safety at Colorado State University. She previously worked as the farm to institution coordinator at the Tierra Miguel Foundation.

• **Gregory Jaffe** is the biotechnology project director for the Center for Science in the Public Interest (CSPI). He previously served as a trial attorney for the US Department of Justice's environmental and natural resources division and as senior counsel with the Environmental Protection Agency's air enforcement division. He's an international expert on agricultural biotechnology and biosafety.

• **Lisa D. Katic, RD**, is the president of K Consulting, specializing in food policy, communications, and education. She provides strategic counsel for numerous clients in the food and agriculture industry and is an expert in scientific and regulatory programs in many areas, including nutrition, biotechnology, functional foods, food labeling, and obesity. She was formerly senior director of scientific and nutrition policy at the Grocery Manufacturers of America and, before that, associate director of food safety for the International Food Information Council in Washington, D.C.

• **Christine McCullum-Gómez, PhD, RD, LD**, is a consultant, writer, and speaker whose areas of expertise include community food security, public health nutrition, sustainable food systems, and school and worksite wellness. She serves as a column editor for the ***Journal of Hunger and Environmental Nutrition*** and has received numerous awards, including a National Cancer Institute postdoctoral fellowship.

• **Barbara Ruhs, MS, RD, LDN**, is a consultant, writer, and speaker and the owner of Neighborhood Nutrition, a company that provides counseling and retail food and health marketing communications. She also directs the annual Supermarket Dietitian Symposium in partnership with Oldways Preservation Trust. She was formerly the dietitian for Bashas' Grocery Stores.

***TD*: What are the advantages of GM crops?**

Jaffe: They're not a panacea, but this technology can be applied precisely and safely to address specific agricultural problems. Also, because the technology is contained in the seed, it's scale neutral. Large-scale and small-scale farmers can use it and store it, so it can be used in developed or developing countries. But you have to look at the application on a case-by-case basis. Some GM crops may increase yields; others may reduce pesticide use or reduce impacts on the environment.

Katic: There's a lot of benefit for insect control and weed management. We've seen examples of good disease protection in crops, such as the Hawaiian papaya crop. We've also seen increased yields, and I think they've been beneficial for food safety. But the most exciting development for me, as a dietitian, is that we're now seeing nutritional benefits being realized due to this technology, such as high-oleic soy, which will allow the food industry to eliminate trans fats from the diet and decrease saturated fats at the same time.

Ruhs: Food in the United States is much more affordable, as a percentage of our per capita income, compared with anywhere else in the world. This is partly because we find efficiencies in food production, and biotechnology, such as GE crops, is one tool that helps us do that. Biotechnology also has allowed us to improve nutrition quality while maximizing natural resources to ensure a safe and global food supply.

***TD*: What are the disadvantages?**

Colpaart: I think the biggest disadvantages are decreased biodiversity, the effect on soil microbes, and a lack of funding in agriculture for agroecological systems. Specifically, we continue to perpetuate a reliance on fossil fuels in agriculture, and we need to move away from chemical dependence in agriculture and carefully consider the toxicity that happens downstream to humans and wildlife.

McCullum-Gómez: Herbicide-tolerant GE crops have made weed management easier for farmers, but overuse of the technology has resulted in an acceleration of weeds resistant to glyphosate, the world's most popular herbicide. In response to the rise in glyphosate resistance, farmers have turned to using other herbicides, often needing to apply several herbicides in a single growing season, to protect their crops.

Seed and agrichemical companies are developing crops that are genetically engineered to have combined resistance to glyphosate and other synthetic herbicides such as 2,4-D and dicamba. Some scientists, however, see this as a short-term fix that will further encourage a "genetic engineering treadmill," similar to the "pesticide treadmill" experienced during the mid-20th century.

***TD*: Given that the first GM foods came to market in 1996, is 18 years' worth of scientific evidence enough to declare them safe?**

Colpaart: I don't think the current evidence shows that we should have concern for our safety in eating GE foods, but lack of evidence doesn't prove safety. Personally, I wish that concerns about antibiotic resistance, mercury, BPA (bisphenol A), organophosphates, and phthalates, which are all compounds that have been shown to have a significant negative effect on human health, would evoke the same protestation.

However, it took many years for us to realize the dangers of hydrogenated oils. Trans fat was a game changer for the food industry, much like GM crops have been for agriculture. To assert that we understand the whole body of knowledge around GM foods and human health is shortsighted. Long-term epidemiologic studies are difficult to conduct. My gut feeling, though, is that GM foods, on their own, are safe to consume; it's their coupling with pesticides that we should be concerned about.

Jaffe: The short answer is yes for currently grown crops, but we can't say anything about future crops. You have to look at each crop on a case-by-case basis. For example, humans have been eating corn for a long time, and corn contains many proteins. Genetically engineered Bt (*Bacillus thuringiensis*) corn has one new protein that isn't found in many food products that contain corn, but Bt started out as an organic spray that was used by bio-organic farmers. People have been eating crops with Bt spray on them for 60 or 70 years. In the case of corn oil, oil from GE corn is biologically identical to oil from non-GE corn because all of the proteins have been removed.

Another example is papaya from Hawaii. It's engineered to be virus resistant, but before we had virus-resistant papaya, we were eating papaya that had been infected with the virus. We eat fruits infected with plant viruses all the time. So eating the virus-resistant papaya, which has a part of the virus engineered into it, is really not exposing us to something that's new.

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— Ashley Colpaart, MS, RD

Ruhs: The tomato we ate 75 years ago or 100 years ago vs. the tomato we eat today is a different tomato. Should we use only the plants or seeds that we had 100 years ago? Technology and plant breeding have improved the quality of tomatoes. We have applied our knowledge to processes that give us more food and better quality.

There are many beneficial technologies that we weren't using 100 years ago—for example, synthetic insulin and cancer medications—which are made using genetic

engineering and biotechnology. Why would biotechnology applied to the food supply be any different than its use in modern medicine?

***TD*: Do you have any concerns about GE crops causing unintended consequences in ecosystems, such as creating pesticide-resistant insects or hastening the evolution of herbicide-resistant weeds?**

Katic: What we've learned is that there's no more of an environmental issue of concern for biotech crops than there would be for conventional crops. I've talked to farmers, researchers, and developers of this technology who all have said that pesticide and herbicide resistance happen in conventional crops.

McCullum-Gómez: Overreliance on herbicide-tolerant GE crops has resulted in an acceleration of glyphosate-resistant weeds. Weeds resistant to glyphosate are now present in the majority of soybean, corn, and cotton farms in some US states. Herbicide-resistant weeds are symptomatic of a bigger problem, which is a system of farming that relies on planting huge acreages of the same crop year after year—a system referred to as monoculture. Such a system has provided an especially good habitat for weeds and pests.

In contrast, organic farming, which relies on crop rotation and diversity, could limit the spread of diseases and pests without farmers having to resort to synthetic pesticides. Recent studies demonstrate that herbicide use could be reduced by more than 90%, while maintaining or increasing yields and net farmer profits by using practices based on the principles of ecological science, such as crop rotation, using cover crops and mulches, and taking advantage of weed-suppressive chemicals produced by some crops and crop varieties, which decrease weed numbers and growth.

***TD*: Do we need GE crops to feed expanding populations?**

Jaffe: I think we shouldn't eliminate any technologies. Obviously, the world's population is growing, and we need to produce more food in a more sustainable way. I do think GE crops can be used in a sustainable manner, at least more sustainable than some current methods of agriculture. I'm not sure that they're essential, but I also wouldn't dismiss them.

McCullum-Gómez: Harmful economic systems, conflict, and climate change are the primary causes of global hunger. To address the effects of climate change, we need to do more research on the types of food people eat in developing countries and reduce food waste. Some researchers estimate that one-third of food is wasted, and that eliminating food waste could feed an additional 2 billion people.

Increased research and investment into minor crops, produced mainly in the developing world using local agrobiodiversity, such as (but not limited to) sorghum, millet, sweet potato, yautia, quinoa, and amaranth, will be particularly important in the developing world. Crops such as millet require less water than corn to grow, which will become increasingly important as climate change leads to more intense droughts in some regions.

In the October 2013 issue of *Agronomy for Sustainable Development*, Jacobsen and coauthors concluded that "the available evidence supports a focus on agrobiodiversity as a more appropriate technology to secure food production in a sufficiently high quantity and quality in the years to come than GM technology."

_TD_: Are sustainable farming practices practical for use on a large scale?

Colpaart: Absolutely. Even now in the Midwest, farmers who are growing massive fields of soy and corn are using integrated pest management methods, such as rotating soy and corn every other year. Integrated pest management and agroecology are ways to work within the system to ensure the entire system is in balance, and that starts with the soil and water.

We need to promote on-farm resilience to climate change, too. Biotech companies are working on climate change–resistant seed, but how long are we going to have to wait for these technologies to go through their research and development phase? We could be building on-farm resilience to climate change right now.

I also think the dichotomy between GM crops and "other" types of agriculture illogically paints the issue in black and white. We really should be talking about crop diversity and production methods. The lion's share of GE food is coming from two crops: soy and corn. Those crops largely are going to animal feed and biofuels and to create processed food products. We need to think seriously about diversifying our cropping systems and our diets as well as reducing our meat consumption.

McCullum-Gómez: I think they are. Often, what's lacking are adequate public policies, funding, infrastructure, and/or institutional support to enable the implementation of sustainable farming practices on a large scale. For example, agroecology, or applying ecological science to the design of agricultural systems, has the potential to address numerous agricultural and ecological problems, but it isn't backed by strong public policies, so it's rarely used beyond the experimental stage.

Ruhs: To promote sustainability, I think the Farm Bill needs to be completely overhauled. We have a lot of problems with our agriculture systems that are related to the way the Farm Bill is written and how it's funded. For example, there isn't enough funding for specialty crops, such as fruits and vegetables. Introducing GMOs into the food supply isn't what started the monocultural mindset; it was the Farm Bill subsidies, which haven't been updated in decades.

_TD_: What's the difference between genetic mutations that occur as a result of cross-pollination or crossbreeding practices vs. inserting specific genes into a plant's DNA?

Jaffe: It depends on the crop. Most of the GE crops available today are transgenic, meaning they have DNA from a different species. Often, DNA from bacteria or another microorganism is used. Although, in nature, there's some evidence that there can be DNA transfer from single-celled organisms to plants, it's unlikely that a Bt protein, for example, would have been transferred to a corn plant without human intervention.

But the GE apple that's being considered by the USDA for commercialization contains only apple DNA. The Simplot GE potato uses only potato DNA. So even though those varieties are genetically modified, theoretically they could have occurred by natural means. As the technology becomes more advanced, scientists are able to use more traits from within the species genome.

Katic: General crossbreeding can cause unintended traits to appear, and it takes a long time to figure out what those traits may be. Biotechnology allows us to identify the trait we want or, more specifically, the exact protein we want to use and where it's going to go. It's actually safer than conventional crossbreeding because it's much more precise.

McCullum-Gómez: Researchers have raised questions about the hypothetical hazards of whole GM foods related to the random or inaccurate integration of transgenes into recipient plants, specifically as it relates to the direct or indirect effects of transgene polypeptide products on the gastrointestinal tracts of mammals. There's also concern about problems that could arise from the purposeful production of potential hazards, such as allergens or powerful pharmaceutical products.

_TD_: Do you think GM foods or ingredients should be labeled? Why or why not?

Colpaart: Economics 101 says that in order for markets to work, consumers need access to information. The agribusiness and food industry shouldn't get to decide. If consumers are demanding labeling, industry should stand by their products and let the consumers decide. Their efforts to stifle public discourse on this issue only make them seem suspicious.

Jaffe: Mandatory labels should be used only for the most important information about food safety, such as the presence of allergens, and nutritional information, such as trans fat content. There's nothing harmful about eating an ingredient that's genetically engineered. I do believe that consumers who want to know whether there are ingredients that came from GE crops should have that information available to them.

The CSPI's No. 1 legislative priority in the GMO area is a mandatory FDA approval process for GE crops. In our view, there's a real weakness there, in that the FDA doesn't have a mandatory premarket approval process for GE crops; they have a voluntary consultation process. We'd rather see a process that ensures that the foods made from these crops are safe before they get to the market.

Ruhs: GMOs easily can be avoided in the food supply by choosing USDA Organic products. I'm opposed to labeling because it raises undue concern about GMOs and, in my opinion, is a waste of a lot of money that can be focused on more important issues, such as funding the SNAP program or

child nutrition programs. The USDA, FDA, CDC, and several national medical and health organizations have deemed GMOs identical to their non-GMO counterparts and safe for human consumption. Furthermore, there are a limited number of GMO crops in the food supply—less than a dozen—that are mostly found in highly processed foods. Save money on costly GMO labeling projects and invest in educating Americans about eating more whole grains, fruits, vegetables, low-fat dairy, and lean animal proteins—none of which naturally contain any GMO ingredients.

***TD*: A common criticism of GE crops is that large corporations have an undue influence in their creation and distribution. Is it possible to increase access to food and decrease world hunger without allowing corporate interests to monopolize the process?**

Colpaart: I think campaign finance reform would take back the ability of politicians to make decisions that favor the public interest over those of big agribusiness. Living wages for people are important, too. Also, antitrust enforcement would limit the ability of large companies to dominate markets and policy. Globally, four chemical companies dominate the market, creating unprecedented ownership and control of plant genetic resources, decreases in seed options, and price increases. We need to reinvigorate public plant breeding programs.

Katic: I'm not against regulation, but too much regulation makes the technology more expensive, making it harder for small, independent companies to produce it and small farmers to gain access to it.

Another important consideration is that a lot of research is done at the university level. Looking at the example of Hawaiian papaya, that research wasn't driven by any company or any corporate interest. This technology isn't necessarily owned by just one company or a handful of companies; this research is being done at universities all across the world.

Companies also have funded small operations around the world or provided microloans to operations that try to get tools in the hands of needy farmers or farmers in developing countries. People often don't hear about those efforts; what they usually hear about is the corporate takeover of our agriculture system, and that's just not an accurate depiction.

— David Yeager is a freelance writer and editor based in Royersford, Pennsylvania.

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