



News Home	GolfVites	Mobile	Golf Specials		
Jeff's Journal Brauer's Book Writer's Corner	On The Lip Book Reviews Tour Updates	Women's Golf Industry Updates Architect's Corner	Golf Photography Golf Lessons Golf Fitness	International Mexico Australasia	National

Golf Courses
 Discover how to get your own
 FREE GolfVite Social Networking
 site

Featured Golf News

Forging the Latest Driver Revolution

By: [Tony Dear](#)

On Tuesday, July 13, 2010, a U.S. federal trademark registration was filed for Forged Composite. Its owner? The Callaway Golf Company which insists its high-tech new material will do for titanium what titanium did for steel in the driver market, and what steel did for wood before that. Which means we're on the verge of a driver revolution. Maybe.

A little over a month ago, George Fellows of Callaway Golf and Automobili Lamborghini's Stephan Winkelmann took to the stage at the Paris Motor Show and, before a gathering of car writers (there's probably a more elegant term), signed a deal making their respective companies strategic partners.

What, you may ask, could an American golf-club manufacturer want with the maker of exotic Italian sports cars? Or, if you're looking at it from the automobile enthusiast's perspective, why on Earth is the firm that makes the sort of cars James Bond dreams about getting into bed with a firm that makes golf clubs for Phil Mickelson and John P. Hacker?

As it happens, the two organizations are at the forefront of a technological development that promises to provide the world with both incredibly light, strong and fast cars, and amazingly light, strong and fast drivers (the golf club, not the person operating the light, strong, fast cars). Actually, it's Callaway that has led the move, working with the Aeronautics and Astronautics Department at the University of Washington in Seattle, and Assistant Professor Dr. Paolo Feraboli specifically, in a quest to find the perfect composite - a material so light, strong and fast, it will render all-titanium drivers obsolete.

"We used some lab facilities at UW and the folks from Lamborghini were interested in using the same lab facilities to do some similar work," Callaway's Senior VP of Research and Development Alan Hocknell told Automobile Magazine in October 2010. "It was at that point that our paths crossed. The guys at Lamborghini realized we had been working in that area for about four years, so we had already gathered knowledge and experience in how the material behaves in different forming-process parameters."

The result of all the research is a carbon-based material called Forged Composite (FC) in which over half a million turbostratic carbon fibers are concentrated on every square inch, making it a third the density of titanium but significantly stronger. That allows for a greater load carrying capacity per unit mass in bending (80% greater than titanium, in fact) which, in terms non-Ph.Ds might understand, means that when the lighter-weight clubhead bends and stretches at the moment of impact, it remains strong and cohesive which, in turn, means more powerful shots.

In turbostratic (not a ghastly made-up marketing word but an actual scientific term) carbon fiber, sheets of hexagonally-arranged carbon atoms are folded over each other randomly, giving this form of carbon higher tensile strength. With graphite, also made up of carbon atoms, the sheets are stacked up alongside each other in a far more regular pattern, making the bonds between the sheets relatively weak. This explains why graphite is brittle and crumbles fairly easily.

"We can now form the crown with composite in all directions," says Luke Williams, Callaway's Director of Product Design. "Because of the nature of Forged Composite and the new forging process we use to make, it takes four minutes to heat the composite. Carbon fibers are suspended in a matrix which moves with the consistency of toothpaste so can therefore be pushed into all parts of the machine tool, ensuring the absence of voids and strength in all parts of the structure. The clubhead is not only stronger but also much more consistent. Using an old laminate carbon tool, we would find the walls of the crown weren't always uniform. With the new process, we can optimize the FC down to one-thousandth of an inch."

While finding a suitable grade of carbon for the job is one thing, knowing what to do with it is quite another, adds Williams. "This is high-tech stuff," he says. "The R&D is very expensive and requires a certain level of expertise. This is not the sort of thing someone tinkering in his garage is going to discover. We've been riding the coattails of the aerospace industry for a while, but we're now right at the forefront of composite technology. It's very exciting."

But as Hocknell stresses, even though this new material has been in development for years it has only recently come to market and is therefore something of an unknown quantity, in the consumers' eyes at least. So far, the Italians have come out with a concept car - Sesto Elemento - whose monocoque (basic frame) is constructed entirely with the new carbon composite, while the Americans have produced a Forged Composite driver - the Diablo Octane, which possesses a titanium sole plate and face but an FC crown that is 10g, or 26%, lighter than a typical titanium crown, a weight reduction that enables Callaway to make the shaft (the Project X, built by Graffaloy) an inch longer than standard.

On paper, the numbers each product is achieving look very impressive. The Sesto Elemento (Sixth Element) weighs in

Story Options

- Send to a friend
- Print this Story
- Recommend this story

GolfVite Updates

- [cdubin1](#) signed up. Welcome!
- [Ron Paveloff](#) signed up. Welcome!
- [lcardenas81](#) signed up. Welcome!
- [Jeongha](#) signed up. Welcome!
- [AVaughn](#) signed up. Welcome!

Invite your friends to golf with a GolfVite **It's FREE**
Join Now!
 Send an invitation to your friend to play golf together.

Headlines

- [Catching up with Michelle Wie](#)
- [Montreal Woman Makes History](#)
- [FarmLinks Set to Host 95th Alabama Men's State Amateur Championship](#)
- [Couples Back on Course in the Memorial](#)
- [Masters Champ Back in Action at Memorial](#)

Related News

- [First LPGA Sectional Qualifying Tournament Set to Start](#)
- [GOLF 20/20 Concludes with Historic Alliance](#)
- [Billy Casper Golf Raises Funds](#)
- [Billy Casper Golf Raises Funds](#)
- [Cybergolf's New Broadcast System Helps Golf Courses](#)

at just 2,202lbs - about 600 pounds lighter than your basic Honda Civic - and reaches 62 mph (100km/h) in a mind-boggling, cheek-wobbling (pant-wetting?) two and a half seconds. That's means if it blasted off now, the Lamborghini Sesto Elemento would be traveling at more than 60 mph by now. Actually, it would have reached that speed at about the time you started saying the word "traveling." That's a rate of acceleration similar to a competition motor bike.

"The introduction of the Forged Composite technology allowed Lamborghini to realize the monocoque and the suspension arms of the Sesto Elemento with groundbreaking quality and cost levels," Maurizio Reggiani, Director Research and Development at Lamborghini, said in Paris. "Our next challenge is to make this technology a standard for low-volume productions."

As for the Diablo Octane, Callaway is naturally making rather a big deal of its new find. "8 yards longer than titanium," the company's web site screams. "The most powerful driver ever imagined," "game-changing," "revolution," "maximum power to weight ratio," "the new standard in driver technology," "ultimate distance."

But it doesn't just have the capacity to hit the ball a long way, says Williams. "It's actually quite easy to make a driver lighter and longer," he adds. "The challenge comes in making it lighter, longer *and* forgiving. But because we were able to incorporate new features that were impossible to manufacture before Forged Composite, we can make an exceptionally lightweight head with optimal mass distribution that delivers longer drives and uncompromised forgiveness."

Sounds great, but not everyone's buying it. Tom Wishon, one of the game's most respected club-makers and equipment experts, has a hard time believing Callaway's claims are anything but marketing hype.

"Today, there is no possible way drivers can be made to hit the ball farther," Wishon says bluntly. "And there's one very good reason for that: the USGA rule on a clubhead's spring-face performance. When the USGA went to work in the late 1990s in an effort to halt the ever-escalating distances top players were hitting the ball, it used the Co-efficient of Restitution (COR) as a measurement of a clubhead's spring-face capability and put a limit on it. So, as long as the COR (Characteristic Time CT is now used in place of COR, but it's more or less the same thing - a measure of the efficiency of impact) limit is in place, there is no new material, no new design of a clubhead that can deliver more distance than what clubheads deliver right now."

Wishon adds it is the job of non-technically informed, marketing-oriented mavens in the industry to make golfers believe otherwise but that, among those who really know the physics of clubhead performance related to distance, it is acknowledged there can be no significant distance gains ever again, or at least until the CT limit is changed.

He goes on to say that Forged Composite does not possess the capability to increase distance, no matter how it is used in the design of a clubhead. "Its only real possible benefit to clubhead design," says Wishon, "is in enabling engineers to make the body of the head lighter so the leftover weight can be used to increase the Moment of Inertia (Mol) and, in-turn, improve the club's level of forgiveness. But this too has a USGA limit in two areas. Firstly, a clubhead can not have an Mol higher than 5,900g/cm², and second its volume cannot be greater than 469cc."

No company has yet been able to engineer a driver head of 469cc or smaller, whose swing-weight is acceptable to most golfers and which gets close to the limit of 5,900g/cm². That said, at the beginning of 2008, Nike introduced the SQ Sumo² 5900, whose clubhead, as the name suggests, matched the USGA's limit for Mol.

"But to do it, Nike made the swingweight way higher than any company had before," says Wishon. "In essence, this was a trick that did indeed increase the Mol but it came at the expense of playability. The head was so heavy virtually no golfer could use it effectively. With the current limitations, the highest a driver head's Mol can be is in the area of 5,400g/cm². So with respect to Callaway's new material, because it can be no larger than 469cc and because Callaway is smart enough to know they can't make the head any heavier than normal, its use is really just another marketing claim designed to fool casual golfers into buying it out of pure wishful thinking."

Wishon does concede that Forged Composite is probably the only material that could be used to build a 550cc head that would not be too heavy, not sound "like a tin can being hit" and achieve the golden figure of 5,900g/cm², but says it can't do it with the volume restrictions in place. "Really, there is only one technology left that could genuinely enable around 75% of all golfers to buy clubs that could improve their performance in one way or another - longer, straighter, more consistent - overnight," says Wishon.

"But this is a technology that the major manufacturers cannot offer to golfers because it is in direct opposition to their standard business model. To use it would prevent them from ever being able to sustain their mid- to high nine-figure annual revenues."

Wishon is talking about full-specification custom club-fitting - taking into account a golfer's size, strength, athletic ability and swing characteristics to customize every one of the 13 key specifications of a golf club.

The vast majority of golfers have never had the benefit of an expert fitting analysis because only a small number of highly-trained and highly experienced independent custom clubmakers offer such a service. "And because these independent clubmakers have no marketing budget to speak of, the public will never know about them and will not be able to experience what really good fitting can do to help them play to the best of their ability," says Wishon.

Though careful to recognize Wishon's many achievements and acknowledge his standing within the industry, the R&D folks at Callaway refute more or less everything he says about Forged Composite. "In referring to the CT test as an ultimate limit of performance, Tom appears only to be considering a clubhead's performance from the center of the face," says Hocknell, the Senior VP of R&D. "Of course, we are concerned with center hits but, very importantly, we also focus on a club's performance on off-center hits. We try to make those shots behave as they would if the ball had been hit better. The figure we used on the web site - "8 yards longer than titanium" - was the average increase a large number of human testers achieved, not a robot. So there were many off-center hits recorded in the measurement of

this distance advantage."

Hocknell also suggests Wishon is ignoring the effect additional clubhead speed will have on overall distance. "Because of its characteristics, the Octane arrives at the ball moving faster than our previous drivers," he says. "The clubhead is lighter and the shaft longer so, within reasonable bounds, physics tells you the ball will come off the face faster and that you will hit the ball farther without having to create any extra energy."

The USGA does not directly limit ball speed. The COR/CT test applies only to the efficiency of impact under certain test conditions. So if Alvaro Quiros or Bubba Watson step up and exceed that limit, there's nothing the rules-makers can do about it, and it's obviously perfectly legal. "I liken it to Formula 1 Racing," says Hocknell. "I could get into a car identical to that which Jenson Button uses, but there's no way I can drive it as fast as him. People *will* swing this club faster. And because of the Forged Composite's strength, impact will be powerful from all parts of the clubface."

The Diablo Octane hits the shelves on November 12th. In Callaway's labs, it has exceeded expectations and certainly given the marketing department something to work with. It remains to be seen, however, whether or not Forged Composite will resonate with the consumer and if the claims Callaway is making about its new material have any substance.

Tony Dear is an Englishman living in Bellingham, Wash. In the early 1990s he was a member of the Liverpool University golf team which played its home matches at Royal Liverpool GC. Easy access to Hoylelake made it increasingly difficult for him to focus on Politics (his chosen major) and, after dropping out, he ended up teaching golf at a club just south of London where he also made a futile attempt at becoming a "player." He moved into writing when it became abundantly clear he had no business playing the game for a living. A one-time golf correspondent of the New York Sun, Tony is a member of the Golf Writers Association of America, the Pacific Northwest Golf Media Association and the Golf Travel Writers Association. He is a multi-award winning journalist, and edits his own web site at www.bellinghamgolfer.com.

A set of social sharing buttons. On the left is a yellow button with the number '0' and the Digg logo. To its right is a grey button with the number '7' and the word 'tweets'. Further right is a blue button with a plus sign and the text 'reddit this!'. Below these is a green button with the word 'retweet'.

All rights reserved. The content within Cybergolf.com is copyright-protected by its publisher, Orbit Enterprises, Inc. No part of Cybergolf.com may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system, without written permission from Orbit Enterprises. Contents copyright ©2010 Orbit Enterprises, Inc.

[Contact Info](#) | [Privacy Policy](#) | [Site Map](#) | [Photo Credits](#)

