Carl's Golfland is a 20,000 square foot retail golf shop and 15 acre driving range facility that has been operating since 1958. In 2006 we were named Best of the Best by GolfWorld in their annual Top 100 Best Golf Shops awards. In 2010 we became the only off-course golf shop to be named to GolfWorld's 100 Best Golf Shops every year since the award's inauguration in 1985. For 54 years Carl's Golfland has offered the best quality products and services along with an aggressive pricing strategy to our customers. In late 2011, we decided to pursue one more service by creating an outdoor Performance Fitting Center utilizing TrackMan in a state of the art fitting facility, the Launch Pad.

The development of the Launch Pad was inspired by the fact that outdoor, live ball flight fitting is the most advanced method of fitting golf equipment. This is a service we had not previously offered at Carl's Golfland. As the facility was constructed, we decided that we needed the industry standard for advance club and ball tracking, TrackMan III. Our goal is to provide our customers with the best experience possible while offering them the most accurate information available.

In conjunction with our new fitting options, we also have incorporated TrackMan into our lesson offerings. Our PGA Professionals have had access to advanced video and teaching techniques for a number of years, however, by taking the lesson one step further with the swing data TrackMan offers, all while utilizing full visual ball flight we are able to genuinely enhance our customers abilities and general knowledge of their swing and game. Furthermore, with TrackMan Combine, our customers can precisely focus their practice time while having fun doing it.

We currently have 2 full time outdoor Performance Fitters on staff at Carl's Golfland. Both of whom are TrackMan Certified Operators, passing the Level 1, Level 2, and Operator tests. The backgrounds for both fitters are as follows:

Nicholas Morrow
-Custom Fitting golf equipment for over 5 years
-Using TrackMan since February 2012
-TrackMan Certified Operator since May 2012
-4 year captain of golf team at Kentucky State University
-Performed over 700 TrackMan Fittings since March 2012

Peter Farner
-Specialized in Custom Fit Golf Clubs for over 3 years
-Custom Fitting on TrackMan for over 2 years
-TrackMan Certified Operator since May 2012
-Played collegiate golf at Wayne State University
-Performed nearly 2000 TrackMan Equipment Fittings

Our Fitting Process

Carl's Golfland offers a variety of golf club fitting services for our customers. From the simplest form of a basic fit to an in-depth Performance Fitting on TrackMan, all depending on the customer's preferences and needs. This is why the first thing we do with new clients is qualify them, determine their skill set, what they are looking for, how in-depth they would like their fitting process to be, and overall whether a Performance Fitting or Basic Fitting will benefit them most. Once we've determined their wants and needs we set them up accordingly.

The Basic Fitting process starts by allowing our customers to demo golf equipment on our driving range with an Equipment Specialist. With the help of the equipment specialist, they decide which product works the best based on live ball flight, and use of our indoor launch monitor to simply check Swing Speed, Launch Angle, Spin Rate, lie angle, etc. For a more advanced fitting our customers opt for one of our Performance Fittings.

Performance Fittings utilize TrackMan, where we are further able to fine tune new equipment around our customer's needs. By using the information TrackMan provides in conjunction with knowledge from one of our fitters we are able to offer one of the most comprehensive fittings available.

During our Performance Fittings, we begin by evaluating the customer's current equipment, including length, lie, loft, shaft, shaft flex, grip, etc. We then test their current equipment's performance on TrackMan. By evaluating their equipment using many of the twenty six variables TrackMan offers, we can determine whether they need to alter their current equipment and also which direction to go in regards to examining new product. Once goals are established we then begin to test and evaluate new equipment.

Our process consists of trying specifically selected equipment from various manufacturers, based on the consumer's needs. This allows us to give our customers variety as well as examine many of the different possible options and combinations currently available on today's market. Each one of these new pieces of equipment is evaluated in the same manner that our customer's current equipment was. After testing is complete we are able to then compare all of the information gathered. If complete optimization has not been reached, we will make adjustments to the new equipment. We then continue to test and adjust until we've completely optimize the customer's equipment as far as his or her swing allows. Upon completion we explain to our customers the benefits of their new equipment compared to their current while providing additional feedback and answering any further questions about the results.

One thing we should note, we are dedicated Performance Fitters only. We do not give lessons, even though we believe that TrackMan should be used hand in hand with fitting and teaching. We have several dedicated PGA Professionals on staff. As Club Fitters we are dedicated to the understanding, learning, and teaching of TrackMan and its related theories. Because of this we pride ourselves on being committed to being the best fitters we can possibly be and continually learning and improving each and every fitting.

Before we continue we'd like to mention that the data in the fittings that we will discuss are Normalized. Normalizing allows us to adjust weather and ball conditions to neutralize the affects weather and ball type may have on our fittings. Because our driving range plays slightly uphill with a headwind, we feel that the Normalized data will be more accurate for our customers. Our particular TrackMan units are set to Normalize to an altitude of 833ft, same as our geographic location, and the temperature is set to 75*F. This is a decent average temperature for most of the golfing months here in Michigan. By doing so this allows us to level the playing field for customers getting fit during the fringe and off seasons. This allows the weather conditions to always be consistent and perfect.

Case Study 1

Scott is a right handed 10 Handicap, he is 5'11", with average build. Scott's current driver specifications are listed below.

Brand: TaylorMade
Model: RBZ
Shaft: Matrix X Con 5 (Stock)
Flex: Regular
Loft: 9.5*
Length: 46" (Standard)
Setting: Neutral (Standard)
Grip: Tour Velvet Standard Size (Stock)

Scott was concerned with the lack of distance he was obtaining off the tee. He said that he would often hit his irons similar distances as his playing partners but they were driving much further than he was off the tee. His typical ball flight with his irons was fairly straight with a slight fade. However, with the driver it was a little more aggressive left to right. The first step to getting Scott longer and straighter off the tee was to examine his current driver performance on TrackMan (See Appendix A-1).

Looking at Scott's initial data we examined many of the different TrackMan data points. Scott's current Ball Speed (See Appendix B) was 127.7mph. We explained to Scott that Ball Speed is the most influential factor on distance. The more Ball Speed we could obtain the further Scott could potentially hit the ball. Ideally with a Ball Speed of 127.7 mph we'd want Scott to launch the ball somewhere upwards of 13 degrees. However, due to a couple factors we'll examine in a moment Scott's average Launch Angle (See Appendix B) of 11.4 degrees was in an acceptable range. Average Spin Rate (See Appendix B) was a little bit of a concern at 2914 rpm. Ideally with Ball Speed in the 125-130 mph range we would aim for Spin Rates closer to the 2200-2700 range (See Appendix A-1). Reducing Spin Rates and increasing Launch Angle would allow Scott's driver to potentially Carry (See Appendix B) further with more efficient roll out, resulting in further Total distance.

One of the most important aspects of a golf shot is making centered contact at impact. In order to examine Scott's efficiency we took a look at his Smash Factor (See Appendix B). Scott's Smash Factor was a little concerning at 1.42. We checked impact by using dry erase marker and he was a impacting little low on the heel. Due to factors such as gear effect, bulge, and roll, shots

struck low on the heel typically tend to launch lower and spin more. This was potentially costing Scott not only distance but also accuracy. Carry distance averaged at 188.7 yards with a total of 218.6 yards. Our average Landing Angle (See Appendix B) was 27.2 deg. Maintaining Landing Angle in the low to mid 30 degree range would validate that we have our launch and spin rates somewhere near optimal. Our goal was to maintain Landing Angle close to the 27.2 degree we started with or increase Landing Angle to the low 30 degree range, this would indicate we are getting a good Carry and Total (See Appendix B) distance combination.

Scott's Launch Direction (See Appendix B) was -1.1 degrees. On average Scott started the golf ball 1.1 degrees left of his target line. Essentially this is fairly straight at the target as we look for values here somewhere between 2 and -2. Looking at Spin Axis (See Appendix B) Scott's average was at 7.8 degrees, moving the ball from left to right in what we'd classify as a moderate fade (See Appendix A-1). We like to classify shots that have a Spin Axis between 2 and -2 degrees as essentially straight. Shots that have single digit Spin Axis (9.9 to -9.9) are shots that we would call playable or repeatable draws or fades. And shots with a Spin Axis of over 10 or -10 we classify as slices or hooks. Our goal here obviously was to limit Spin Axis as close to 0 as we could or into a shot shape that Scott felt comfortable with.

To examine why Scott was creating these low launching, high spinning fades we needed to take a look at a couple more factors, his club data. Scott's average Attack Angle (See Appendix B) was -3.1 degrees. This meant that Scott was hitting his drives with a descending blow. Typically players that have tendencies to hit down on their drivers create low launch angles coupled with higher spin rates, while players who hit up on the golf ball generally launch the ball higher with lower spin. Therefore, we'd ideally want players to have a positive Attack Angle with their driver when looking to maximize their efficiency. Scott's Club Path (See Appendix B) was averaging -2.5 degrees. Ideal numbers would fall between -1 to1. For most handicaps we like to see somewhere in the mid to low single digit range, which Scott was well within. Scott said he always felt like he might swing a little over the top and because this really only influences about 20% of our Launch Direction we were fairly happy with his current -2.5 degree Club Path. Face angle averaged -0.9 degrees, meaning his face at impact pointed an average of 0.9 degrees left of his target line. Face Angle (See Appendix B) is important in the sense that it influences our Spin Axis and around 80% of our Launch Direction. The difference between the two, Face to Path (See Appendix B), was 1.7 deg. This meant that on average Scott left his face 1.7 degrees open at impact, relative to his Club Path. Examining the data it now made sense to Scott why he was losing distance with the driver and hitting his "weak fade".

To fix these issues our first step was to try new equipment we felt would help address his current issues and examine the results. After testing selected low spinning driver heads to optimize his Spin Rate, and light/moderate weight shafts to keep feel similar to his current driver, we found that the Titleist 913 D3 outperformed the rest.

The specifications are listed below.

Brand: Titleist
Model: 913 D3
Shaft: Aldila RIP Phenom 50
Flex: Stiff
Loft: 9.5
Length: 45”

Setting: C3 (10.25*, 0.5* closed, .75* upright)
Grip: Tour Velvet Standard

Our largest concern was Scott's struggle to hit the center of the face. In order to help address this we gave Scott a shorter shaft. When you shorten the shaft on a golf club typically it will move a player's impact more towards to toe, with the opposite being true on longer clubs. Fortunately for Scott the length adjustment gave him more centered contact with his misses now being slightly on the toe. With misses now being slightly towards the toe instead of the heel we explained to Scott that he should see more straight and draw misses. As an added bonus to the shorter length Scott actually picked up Club Speed (See Appendix B). He said that he felt more in control and therefore was able to maintain better swing mechanics and actually create more speed. We actually see this every so often in driver fitting where the length to club head speed relationship works along a bell curve. If a shaft is too long or short, a player's Club Speed can actually slow down.

Scott preferred the look of the slightly smaller head so the D3 was a great choice for him. We are firm believers that the head of a golf club is really the "engine". What we mean by this is that the key factors in fitting such as Ball Speed, Launch Angle, and Spin Rate, are all influenced the greatest by head design and set up. By using a driver head design that typically spins fairly low we were able to increase the effective loft of Scott's driver to 10.25 degrees and still obtain a lower Spin Rate. This allowed us to also maintain our initial Launch Angle of 11.4 degrees.

Another contributing factor was in our new, shorter shaft we went to a stiff flex. The aftermarket Aldila RIP Phenom 50 maintained similar weight to what Scott was used to but in a stiffer flex. The firmer flex contributed to lower Spin Rates while at the same time helping Scott tighten up his dispersion. With the added Club Speed, Ball Speed, and decreased Spin Rate we saw Scott's Carry and Total distance increase up to 202.0 and 234.7 yards. This was an increase of about 13 yards of Carry and 16 yards of Total distance (See Appendix A-1). Because we maintained good Launch Angle and Spin Rates his Landing Angle remained largely unchanged at 26.7 degrees. Ideally we would have loved to see this go up but Scott's negative Attack Angle made it hard for us to produce high launching low spinning drives. We also tried an even higher lofted 913 driver which you can see listed as the purple colored "913D3 10.5". Scott actually started losing distance due to his increase in Spin Rate and decreased Ball Speed, partly influenced by the increase in loft.

The additional distance Scott was looking for was also aided by his improved Spin Axis. We were able to take Scott's Spin Axis down to -0.2 degrees. Instead of expelling energy into shot curvature we were now directing it down the fairway. Scott was able to hit very straight and consistent drives while minimizing that slight right miss he wasn't so fond of. Even though Scott was still slightly struggling to maintain consistent center impact, the upright setting of the 913 driver allowed us to slightly offset his open face at impact and utilize gear effect to help him create straighter drives. You can see this by looking at his Face to Path relationship at 1.5 degrees with the new 913 D3. Even though Scott still struggled to get a perfectly square Club Path, and his Face to Path was still slightly open, he was swinging more neutrally with a club he felt much more comfortable with. Overall Scott was able to add some length and direction back to his drives and now had a driver that he could feel much more confident with on the golf course.

Case Study 2

Deanna is a 12 handicap, she is 5'11", who came in to replace her current irons, the specs of those irons are listed below.

Brand: TaylorMade
Model: 2009 Burner
Shaft: Dynamic Gold R-300
Flex: Regular
Length: Standard (Mens)
Lie: Standard
Grip: Standard (Mens)

After a brief discussion with Deanna about her natural tendencies and what she was looking for in an iron set, we discovered that her natural ball flight was right-to-left and on a bad swing her shots went well left. She also wanted to add some distance. We used TrackMan to get baseline data on her current 6 iron and discovered a few areas where she could improve upon. Deanna launched and spun the ball very low, in this case a 13.2* Launch Angle with a Spin Rate of 4233 RPMs, creating a Landing Angle of 30.9* (See Appendix A-2). To give a reference point on the Landing Angle, this would be very good for a driver, meaning the ball will stay in the air an acceptable amount of time, but the player will see a lot of roll. This is great for a driver, not for a 6 iron. We needed to find a higher launching and spinning club head and shaft combination. On top of that, she also had a problem controlling her natural draw, Spin Axis of -9.9* in this case needs to be reduced. Because her Smash Factor (See Appendix B) was so high, and she was comfortable with the current length of the irons, we kept the length the same.

To add some height and spin, we demoed irons with wider soles and a lower center of gravity. On top of that we tried lightweight graphite shafts to increase Launch Angle and Spin Rate even more. The head designs did improve our launch conditions, and the lightweight graphite helped achieve more optimum Launch Angle and Spin Rate. As you can see below, the Launch Angle and Spin Rate both increased, 1.7* and 1300RPMs respectively. This particular demo was a 7 iron head vs. her current 6 iron head. Typically we see that Launch Angle going from 6 to 7 iron in the same model of club will increase 1-2* and the Spin Rate increases about 800-1000 RPMs, so effectively she only added .7* of Launch Angle and about 300 RPMs of Spin, at the most. Slower swing speeds struggle with Launch Angle gapping between mid and long irons, so it is not uncommon for her 6 and 7 iron to only have 1* of Launch Angle variance. But more notably, the Landing Angle increased almost 9*, from 30.9* to 39.3*, which is closer to the optimum Landing Angle of 45-50* (See Appendix A-2).

The reason the Landing Angle increased so much with Launch Angle and Spin Rate only changing marginally, is because her Ball Speed picked up dramatically from the increase of Club Speed with the lighter golf club. She increased her Club Speed 2.7 MPH, from a 6 iron to a 7 iron, which is a dramatic improvement, and this higher speed kept the ball in the air longer and allowed for more stopping power with the Landing Angle increasing by almost 9*. The only other adjustment we made with the new irons was to weaken the lofts 1*, this will add a little more launch and spin and help her stop the ball faster, without sacrificing any distance. She was hitting the new 7 iron 11.5 yards longer than her current 6 iron in the air, a significant

improvement (See Appendix A-2). On TrackMan, the Total (yds.) is a calculation based on a Tour caliber fairway, since we will typically hit irons into a green, we would not expect to see nearly this amount of roll, so Carry distance is much more important with the irons when fitting.

Deanna was now stopping the ball faster with significant distance. The next step was to reduce the amount of right to left movement she had with her shots. Her current irons had a Spin Axis of -9.9*, this would result in an aggressive right to left movement. To hit the ball with less movement in the air the Spin Axis needs to get closer to 0*, with 0* being a perfectly straight golf shot. With the new iron set, we made the lie angle 2* flat, this helped create a spin axis of -0.2*. This means on average her ball was moving 9.7* less to the left than her current irons. You may notice that her dispersion did not improve in relation to the target, this was because she has been used to aiming to the right of the target and working the ball back to the left (See Appendix A-2). With the new equipment and lie angle her ball is not moving as far left, so she will have to adjust her target line and game accordingly.

Deanna came into her custom fitting session on TrackMan with two major goals, to hit the ball straighter and further. By using the data that TrackMan offers, we found that she was losing distance because her launch conditions were not optimum. By increasing Ball Speed, Launch Angle and Spin Rate, and in turn Landing Angle, she not only had better green stopping power, she was carrying the new 7 iron 11.5 yards further than her old 6 iron. On top of that, her miss to the left, Spin Axis of -9.9*, has shrunk to -0.2*, meaning she is hitting the ball much straighter with the new irons than her old equipment (See Appendix A-2).

The specifications of Deanna's new irons set are listed below.

Brand: Nike
Model: VRs
Shaft: Fubuki 75
Flex: Regular
Length: Standard Mens
Lie: 2* Flat
Loft: 1* Weak
Composition: 5-PW,AW
Grip: Golf Pride Multi-compound red/black Standard

Case Study 3

The Performance Fittings on TrackMan are not only beneficial to better players when fine tuning their equipment, but can be useful in helping higher handicaps get everything out of their game, as is the case with this example. This driver fitting is for Derek, he struggles to break 100, he is 6'4", and the specifications of his current driver are listed below.

Make: Callaway
Model: Octane
Length: 46.5”
Shaft: Project X 6.0
Flex: Stiff

Loft: 9.5*
Grip: Standard (Men's)

After testing his current driver on TrackMan we discovered a few key issues that needed to be addressed in regards to: Smash Factor, Spin Axis, Launch Angle, and Spin Rate. First and foremost was Derek's Smash Factor, which came in at 1.38. We aim for values in the 1.42-1.48 range depending on player ability. By applying dry erase marker to the club face, we discovered Derek consistently hit shots near the heel of the golf club. With his driver having been extended, all the newer drivers that we tested were shorter than Derek's which should have helped him contact the center of the face easier, and increase his Smash Factor. But the Smash Factor did not increase until the drivers were shortened another 1/2-1" from standard, which in this case was the Adams Speedline Fast 12 Draw driver at 45". Smash Factor increased from 1.38 to 1.42 with this driver. As a result Ball Speed increased over 4 MPH! (See Appendix A-3)

With Smash Factor having been increased, the other issues needed to be addressed. The Spin Axis was caused by Derek's heel impact, -5.4 Club Path, 6.8* Face Angle, and 12.2* Face to Path. This type of golf swing will result in a ball flight starting right of the target and moving further to the right, in this case his ball moved 24.8* to the right, signified by his Spin Axis. So we decided to try some adjustable drivers, with no improvement, and then used an offset driver, which helped decrease the spin of the ball to the right. You can see Spin Axis decrease from 24.8 to 17.6, this means the ball is spinning 7.2* less to the right with the offset driver compared to his current driver. Also, the dispersion chart clearly shows the improvement between Derek's current driver and the offset driver he tested. Looking at Appendix A-3, you can clearly see Derek's ball shift to the left, back toward the target line.

Now that Derek is making better contact, and keeping the ball more on line, the last issues, Launch Angle and Spin Rate, can be addressed. The optimum Spin Rate for a player with this speed is in the 2200-2700 RPMs range, depending on their exact Ball Speed this number can fluctuate a few hundred RPMs. Optimum Spin Rate can also vary slightly depending on the Launch Angle, which we generally want between 11-16* depending on the speed and Spin Rate the player produces. With lower Ball Speeds needing the higher Launch Angle to maximize distance. In this case, Derek's current driver's Launch Angle is 11.6* and Spin Rate is 4958 RPMs. The Launch Angle at 11.6* is on the low end for a player of this speed and the Spin Rate is extremely high. These launch conditions will result in shorter Carry distance and hardly any roll. So we kept the loft at 9.5*, would have tried 8.5* to try to bring down spin, but it was not available in the golf club. Derek's Launch Angle increased to 14.8* and his Spin Rate dropped to 4206 RPMs (See Appendix A-3). This is a near optimum Launch Angle with the current ball speed, and the Spin Rate decreased over 700 RPMs. So even with the same lofted driver, Derek's Launch Angle increased due to contact and club head design.

Derek did not achieve a completely optimum spin rate, but by altering length and a new driver head design, the client found vast improvement in control and he increased carry distance by over 20 yards and total distance just under 20 yards(See Appendix A-3).

Derek's new driver specifications are listed below.

Brand: Adams
Model: Fast 12 Draw
Shaft: Graffaloy Prolaunch Blue 55

Flex: Stiff
Loft: 9.5*
Length: 45"
Grip: Tour Wrap 2G Standard

As you can see from the above pages there are many different potential outcomes and improvements that can be found in custom fitting. Just like each individuals swing, their fittings and results typically differ from player to player. Regardless of handicap or ability level golfers of all ages can benefit from TrackMan to help with their own specific requirements or goals. If you want to be 100% confident on your next equipment purchase, there is no better way than to get fit by a Certified TrackMan Operator utilizing TrackMan.

APPENDIX A-1


HOME LIVE ANALYZE
Select player...
Select club...
Hard
Shot List
VIDEO TRAJECTORY SHOT LIST
BALL SPEED [mph] | LAUNCH ANG [deg] | SPIN RATE [rpm] | SMASH FAC. [] | CARRY [yds] | TOTAL [yds] | LAND. ANG. [deg] | HANG TIME [s] | LAUNCH DIR. [deg] | SPIN AXIS [deg] | ATTACK ANG. [deg] | CLUB PATH [deg] | FACE ANG. [deg] | FACE TO PATH [deg] | CLUB SPEED [mph] | HEIGHT [ft] | SIDE [ft] | DYN. LOFT [deg] | SPIN LOFT [deg] | SWING PL. [deg]
Scott Driver,
Location: N 42° 36.54 W 083° 18.207 alt. 955 ft
127.7 11.4 2914 1.42 188.7 218.6 27.2 4.88 -1.1 7.8 -3.1 -2.5 -0.9 1.7 90.0 50.2 14.2R 13.7 16.9 46.9
Scott Driver 913 D3 10.5,
Location: N 42° 36.54 W 083° 18.204 alt. 933 ft
130.8 11.5 3086 1.42 198.7 225.6 29.8 5.24 0.2 2.2 -2.2 -2.6 0.8 3.4 92.2 57.1 10.7R 13.8 16.4 45.8
Scott Driver 913 D3,
Location: N 42° 36.54 W 083° 18.204 alt. 933 ft
133.6 11.4 2560 1.44 202.0 234.7 26.7 4.98 -0.1 -0.2 -2.9 -1.4 0.1 1.5 93.1 52.8 1.5L 13.3 16.3 46.6
Dispersion
Total
240
220
Driver
Driver 913 D3 10.5
Driver 913 D3
Total yds

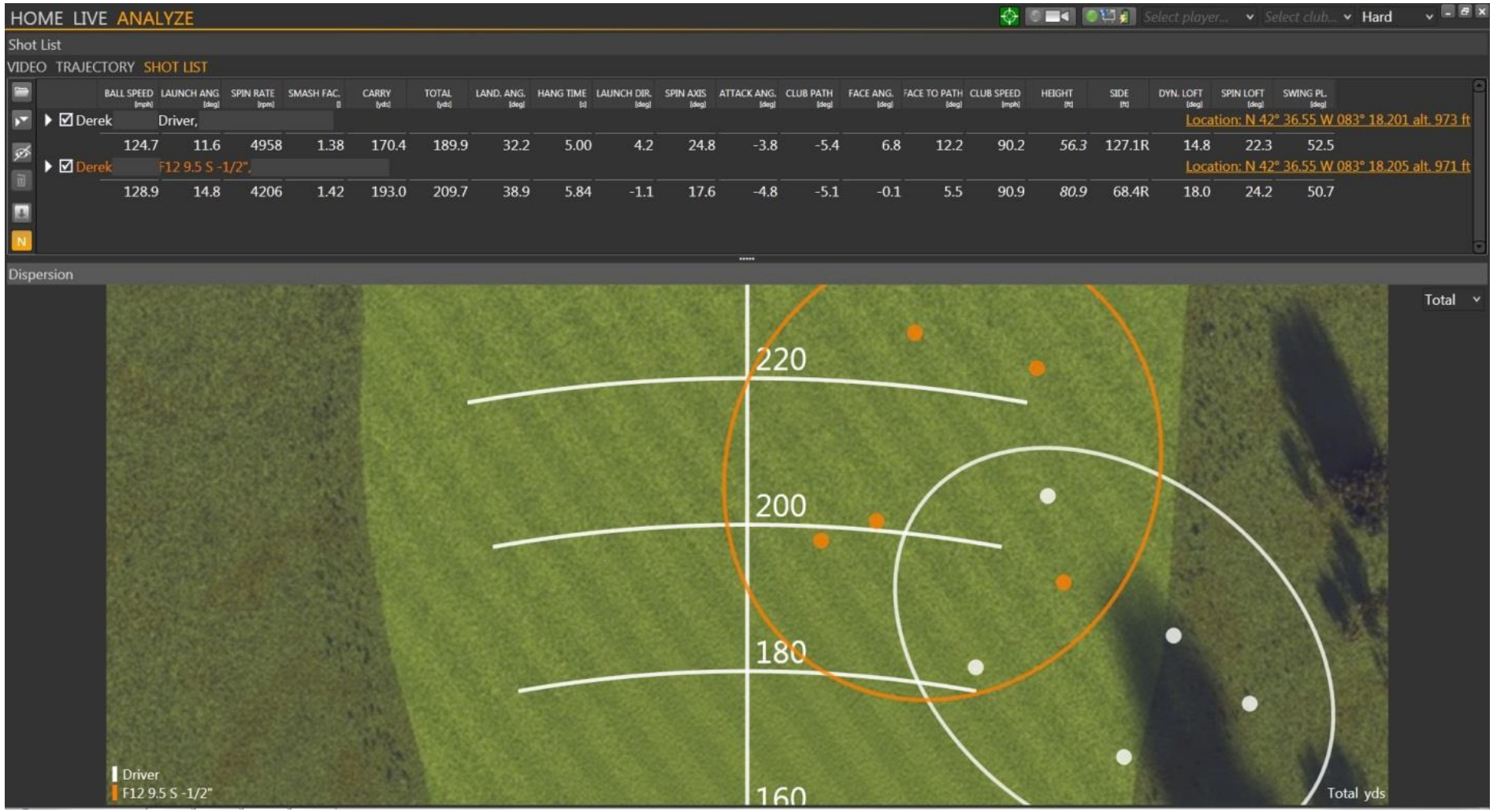
APPENDIX A-2


SELECTED: 6 9
R
VIEW
MENU
NORMALIZED
BALL LAUNCH AND LANDING
BALL SPEED [mph]
VERT LAUNCH [deg]
LAUNCH SPIN [rpm]
SMASH FACT. [ ]
CARRY [yds]
TOTAL [yds]
LAND ANGLE [deg]
6 D.. 6i 106.9 13.2 4233 1.43 143.9 165.8 30.9
9 D.. vrs 7 -2 112.2 14.9 5532 1.44 155.4 168.9 39.3
SELECTED: 6 9
R
VIEW
MENU
NORMALIZED
CLUB DELIVERY
CLUB SPEED [mph]
ATTACK ANGLE [deg]
CLUB PATH [deg]
V SW PLANE [deg]
H SW PLANE [deg]
DYN. LOFT [deg]
FACE ANGLE [deg]
6 D.. 6i 75.0 -3.9 2.2 65.6 0.4 17.2 -0.1
9 D.. vrs 7 -2 77.7 -4.2 5.7 63.1 3.6 19.9 5.9
SELECTED: 6 9
R
VIEW
MENU
NORMALIZED
BALL FLIGHT DETAILS
HORZ. LAUNCH [deg]
SPIN AXIS [deg]
MAX HEIGHT [yds]
SIDE [yds]
SIDE TOTAL [yds]
TIME FLAT [s]
LAST DATA [yds]
6 D.. 6i 0.4 -9.9 15.3 -7.4 -10.0 4.52 138.8
9 D.. vrs 7 -2 5.8 -0.2 21.9 15.6 16.8 5.25 132.0

APPENDIX A-2


SELECTED: 6 9
R
VIEW
MENU
NORMALIZED, TOTAL
20
40
60
80
100
120
140
160
180
200

APPENDIX A-3


HOME LIVE ANALYZE
Select player...
Select club...
Hard
Shot List
VIDEO TRAJECTORY SHOT LIST
BALL SPEED [mph] | LAUNCH ANG [deg] | SPIN RATE [rpm] | SMASH FAC. [] | CARRY [yds] | TOTAL [yds] | LAND. ANG. [deg] | HANG TIME [s] | LAUNCH DIR. [deg] | SPIN AXIS [deg] | ATTACK ANG. [deg] | CLUB PATH [deg] | FACE ANG. [deg] | FACE TO PATH [deg] | CLUB SPEED [mph] | HEIGHT [ft] | SIDE [ft] | DYN. LOFT [deg] | SPIN LOFT [deg] | SWING PL. [deg]
Derek Driver,
Location: N 42° 36.55 W 083° 18.201 alt. 973 ft
124.7 11.6 4958 1.38 170.4 189.9 32.2 5.00 4.2 24.8 -3.8 -5.4 6.8 12.2 90.2 56.3 127.1R 14.8 22.3 52.5
Derek F12 9.5 S -1/2",
Location: N 42° 36.55 W 083° 18.205 alt. 971 ft
128.9 14.8 4206 1.42 193.0 209.7 38.9 5.84 -1.1 17.6 -4.8 -5.1 -0.1 5.5 90.9 80.9 68.4R 18.0 24.2 50.7
Dispersion
Total
220
200
180
160
Driver
F12 9.5 S -1/2"
Total yds

APPENDIX B

TrackMan Data Descriptions

Listed below are the major data points we use during a Performance Fitting on TrackMan. We've also included 3 previous fittings in order to give you an idea on how custom fitting with TrackMan may be able to improve you golf game and your enjoyment on the course.

- Ball Speed – The speed of the ball measured in MPH immediately after impact. Club head speed is the primary influence on ball speed. However, factors such as impact location and club delivery also play a prominent role in producing ball speed. Ball speed is one of the largest influences on obtaining distance along with Launch Angle and Spin Rate.
- Launch Angle – The angle measurement of how many degrees the ball launches relative to the horizon. For example hitting a ball straight up into the air would result in a 90* launch angle. Primary influences here are club delivery and impact location. For each Ball Speed and type of club there are different ideal Launch Angles needed to obtain optimal results and consistency.
- Spin Rate – The launch spin of the ball measured just after impact in RPMs. Simply put this is what most people refer to as "backspin". As in Launch Angle there are different ideals here in relation to Ball Speed, Launch Angle, etc.
- Smash Factor – This is an efficiency rating that allows us to examine how efficiently a player transfers swing energy into ball energy. It is the simple equation of ball speed divided by club head speed. A very good Smash Factor is 1.49, this is Tour Average, but it is possible to achieve a higher Smash Factor than this based on swing dynamics, golf ball design, and custom club fitting possibilities. As lofts increase and club type switches from woods to irons it becomes more and more difficult to transfer energy and as a result smash factors will decrease.
- Carry – This is the carry distance, in yards, of the shot measured at zero elevation (carry flat). I would be careful using the term zero elevation. Some may misunderstand this or confuse it with sea level. You could explain it as zero elevation relative to where the ball was launched. There are several places below where you use the term zero elevation as well that may need adjustment. Simply put TrackMan gives you the distance you'd have hit on a perfectly flat fairway relative to the horizon.
- Total – This is the total distance, in yards, of the shot measured at zero elevation on a perfect fairway. Including Carry plus calculated bounce and roll out.
- Landing Angle – The ball angle measurement relative to vertical as it descends into the ground. Like Carry and Total this is relative to zero elevation. For example a ball falling straight out of the sky would have a Landing Angle of 90*, while one skipping along the ground would be nearly 0*.
- Hang Time – This is the time in seconds the ball spends in the air from club impact until ground impact at Carry distance.

- Launch Direction – This is the measurement in degrees of how far right or left the ball starts in relation to our target line. Positive numbers are always right and negative numbers are always left. This is measured immediately after impact.
- Spin Axis – This is a degree measurement of the axis around which the ball is spinning relative to horizontal. The tilt of the axis dictates whether or not the ball will draw or fade. This is commonly referred to as "sidespin". However in looking at Spin Rate and Spin Axis you can see that the ball is only rotating around a single axis. When this axis tilts left or right the ball will curve in the same direction. Just like Launch Direction a ball with a negative value will go left while a ball with a positive value will go right.
- Attack Angle- The angle measurement at which the golfer's club head is approaching the ball. This is measured relative to the ground. If you have a negative Attack Angle you are hitting down on the golf ball, while a positive Attack Angle means you are hitting upwards. This is very important for fitting purposes as it is very hard to achieve ideal Launch Angle and Spin Rate numbers without a proper Attack Angle.
- Club Path – This is a degree measurement of how much the club is traveling horizontally at impact relative to the target line. These measurements are commonly referred to as "over the top" or "from the inside". Negative values indicated the club traveling left at impact while positive values indicated the club is traveling right at impact.
- Face Angle – This is a degree measurement of orientation of the club face at impact in relation to the target line. Positive values are right of target line while negatives values are left. This is calculated at the time of impact, at the point of impact on the clubface.
- Face to Path – This is a degree measurement of the difference between Club Path and Face Angle at impact. This can be calculated by the equation Face Angle – Club Path. Assuming center impact on the face a Face to Path that is negative will cause a ball to curve left and a Fact to Path that is positive will cause a ball to curve right.
- Club Speed – This is the speed of the club head measured in MPH just before impact. Because this is measured at center face you may see irregularities in other variables such as Smash Factor and Ball Speed in relation to Club Speed
- Height – This is the height in feet at the apex of the shot relative to the horizon. In a properly fit bag a better ball striker will see very similar Height across all clubs, driver through wedge.
- Side – This is the distance measured in feet the ball lands left or right of the target line at Carry distance.
- Side Total – This is the calculated total side distance measured in feet the ball carries, bounces, and rolls left or right of the target line.
- Dynamic Loft – This is the effective loft, in degrees, of the club head at time of impact on the point of impact on the club face. Simply put it's the measured loft of the club at impact on the point of impact on the face measured from vertical. There are five major influences on Dynamic Loft including: loft of the club, bending of the club shaft, roll of the club face (impact location), shaft lean, and attack angle.
- Spin Loft – Angle difference between Dynamic Loft and Attack Angle. This has the largest single influence on Spin Rate. The higher the spin loft the higher Spin Rate you'll be able to obtain.