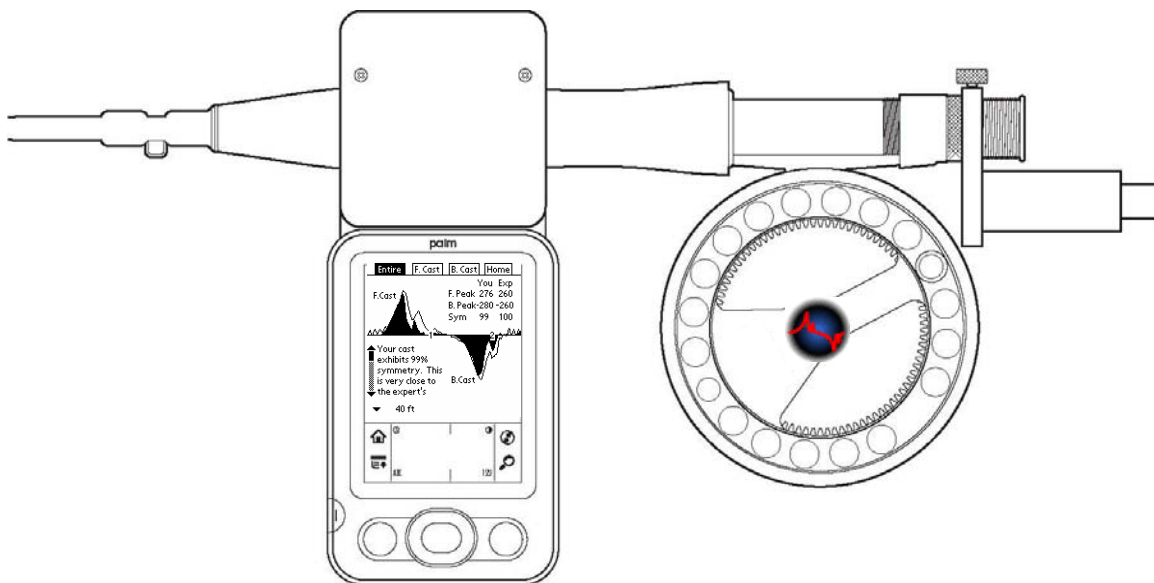


# CASTING ANALYZER

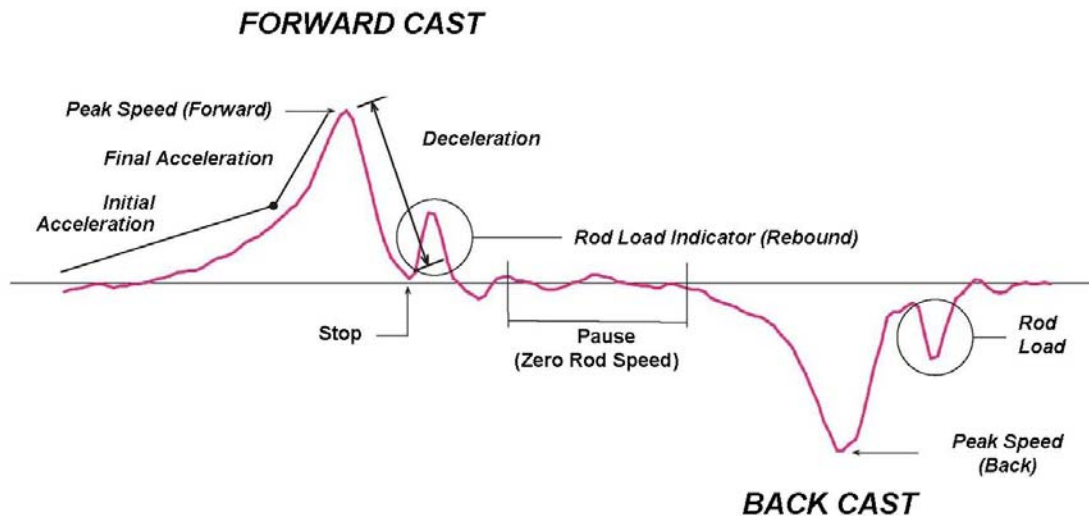
Reference Manual  
V1.1



# The Fly Casting Analyzer

Learning to fly cast well is arguably one of the greatest bottlenecks towards advancing in our sport. In our quest to improve our casting techniques, we are fortunate to have excellent resources including fly casting schools, casting instructors, and guides as well as exceptional books, articles, and videos. Fly casting instruction though remains largely qualitative and rests on the ability of the instructor or the student to critique a cast using visual observations of the motion of the fly rod and the fly line, sometimes with the aid of video capture and playback. However, many of the important motions of the fly rod during casting are either too quick or too subtle to be adequately observed by eye.

The *Fly Casting Analyzer* changes all that by providing completely new capabilities to support the teaching and learning of fly casting. It does so by giving you immediate and quantitative measurements of the casting stroke right at your finger tips. The easy-to-use software breaks your casting stroke into its major parts and provides a quantitative measurement of each. This innovation arises from the marriage of novel sensor hardware, software, and scientific research as summarized herein. The *Fly Casting Analyzer* is specifically designed to be a tool for fly casting schools, instructors, and any avid student of casting.



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# 1. Getting Started

Welcome to the *Fly Casting Analyzer*. Enclosed you will find assembly, operating and training instructions. **Please read this manual thoroughly.** The *Fly Casting Analyzer* is a unique tool that provides a scientific interpretation of the fly cast. Your understanding of the measurements and how to interpret them is the key to using it successfully. If at any time you have questions, please contact Cast Analysis, LLC by messaging

[info@castanalysis.com](mailto:info@castanalysis.com)

## **Step 1 -Section 2**

Check compatibility of your Palm. We recommend a Palm Z22 (Retail \$99).

## **Step 2 -Section 3**

Install the software – instructions on CD provided.

## **Step 3 -Section 4 - 6**

Prepare the tackle and analyzer components.

## **Step 4 -Sections 7 - 8**

Read all training materials.

## **Step 5 -Sections 9**

Read instructions for measuring & analyzing your first cast.

## **Step 6 -Sections 10 - 12**

Further hone your skills with the *Fly Casting Analyzer*.



## 2. Palm Compatibility

If you do not already own a Palm and need to purchase one, we recommend the Palm Z22. If you have an IR capable Palm already, it may work. Most of the Zire and Tungsten series are compatible (see list below). Please follow these steps when preparing your Palm for use with the *Fly Casting Analyzer* program:

1. Install the Palm software on your computer; see directions in your Palm manual.
2. Read your Palm manual so that you understand how to "HotSync".
3. Install the Palm Casting Analyzer software from the disk by "HotSyncing".
4. Attempt to measure your first cast after reading the training materials herein.
5. If your Palm accepts the data, your Palm is compatible.
6. If your Palm does not accept data, check to make sure that your IR connection is "enabled". If the Palm still does not work, you may need to update to another Palm device (e.g., Palm Z22, retail \$99).

List of Palms that we know are compatible

Z22

Tungsten E2

Tungsten T5

Tungsten c

Zire 31

m500

m505

and even some Palm cell phones



## 3. Software Installation

### To install on a Mac:

1. Insert disk and open the file.
2. Drag the Mac folder to your desktop.
3. Open the folder “Fly Casting Analyzer V1.1”
4. Open the folder “Fly Casting Analyzer.”
5. Double click on the “FlyCast” icon.

### Note

If you wish to add the program to your desktop simply hold down the control button on the keyboard and use your mouse to click on “FlyCast.” Select “Make Alias.” Drag the alias program to the desktop.

### To install on a PC:

1. Insert disk and open the file.
2. Double click on the PC folder.
3. Double click on “FlyCast” setup icon.
4. Follow on-screen instructions.

### To install the Palm Software:

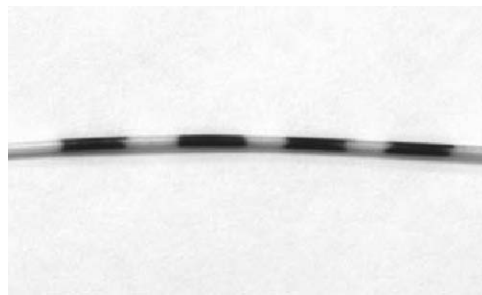
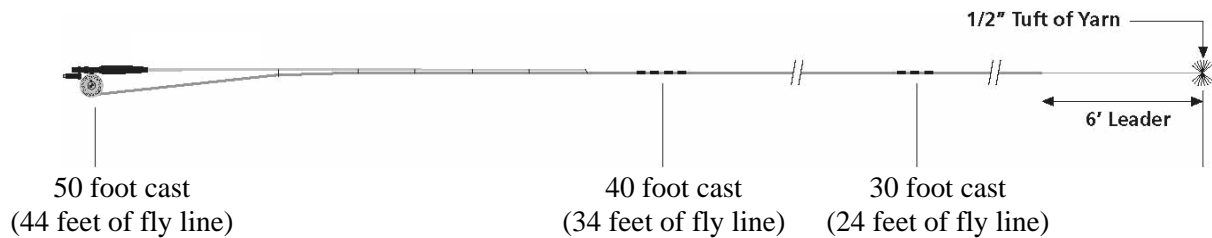
1. Insert disk and open the file.
2. Double click on the Palm folder.
3. Double click the “Install FlyCast” icon.
4. HotSync your Palm.



## 4. Tackle Assembly

It is good practice to measure and mark your fly line for the length of casts you wish to make during instruction or practice. While not required, we recommend that you make three marks on your line that correspond to 30', 40' and 50' casts as shown below. Doing so will allow you to also make a direct comparison with the three "expert casts" at these distances that are provided with your software.

The "expert casts" were recorded with a 6' leader followed by a specific length of fly line. The length of line is measured from the reel to the end of the leader. It is very important to have the same length of line when comparing two casts since the casting profile changes significantly with cast length. We recommend the following marks to enable you to easily keep track of the cast length.



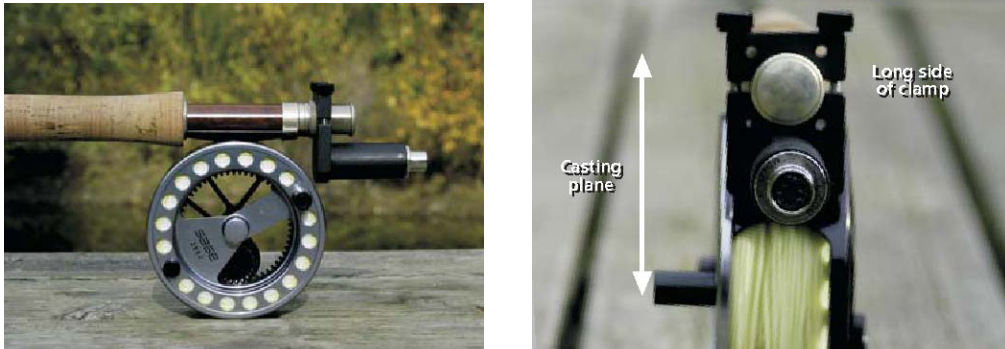
Example of 40 foot marking (4 hash marks)

Reminder: The "expert casts" were created with the total length of line plus leader measured from the reel to the fly. Varying the leader and/or line lengths affect all casting parameters and will result in data that does not correspond with our measured expert casts. However, you may wish to develop your own comparison casts at these and other line lengths and we encourage you to do so.



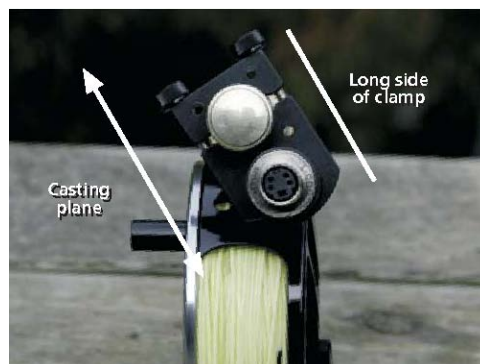
## 5. Orientation of Gyro and Connecting to Palm

The capsule should be oriented so that the long side of the clamp is parallel to the plane of the cast. You can easily make this adjustment by loosening the thumb screws and rotating the capsule until it is properly positioned for the casting plane of a particular fly caster.



Most fly casters grip the rod so that their casting plane is the plane of the fly reel. The proper orientation in this instance is illustrated in the side and end views above.

However, some casters grip the fly rod so that the plane of the cast is no longer in the plane of the reel. In these cases, you will need to re-orient the capsule slightly after you observe the cast and note the orientation of the casting plane. Failing to do this will lead to unrealistically low rod speed readings. Consider the case below where the cast is “off to the side a bit” resulting an approximately 30 degree difference from the plane of the reel.



After attaching the gyro capsule to the rod, you should now connect the black cable (4 pin S-video) to the connector on the capsule and the connector on the top of the circuit box. It is good practice to leave this cable connected to the gyro capsule while in use to prevent dirt and moisture from entering. Please do not set this connector on the ground.



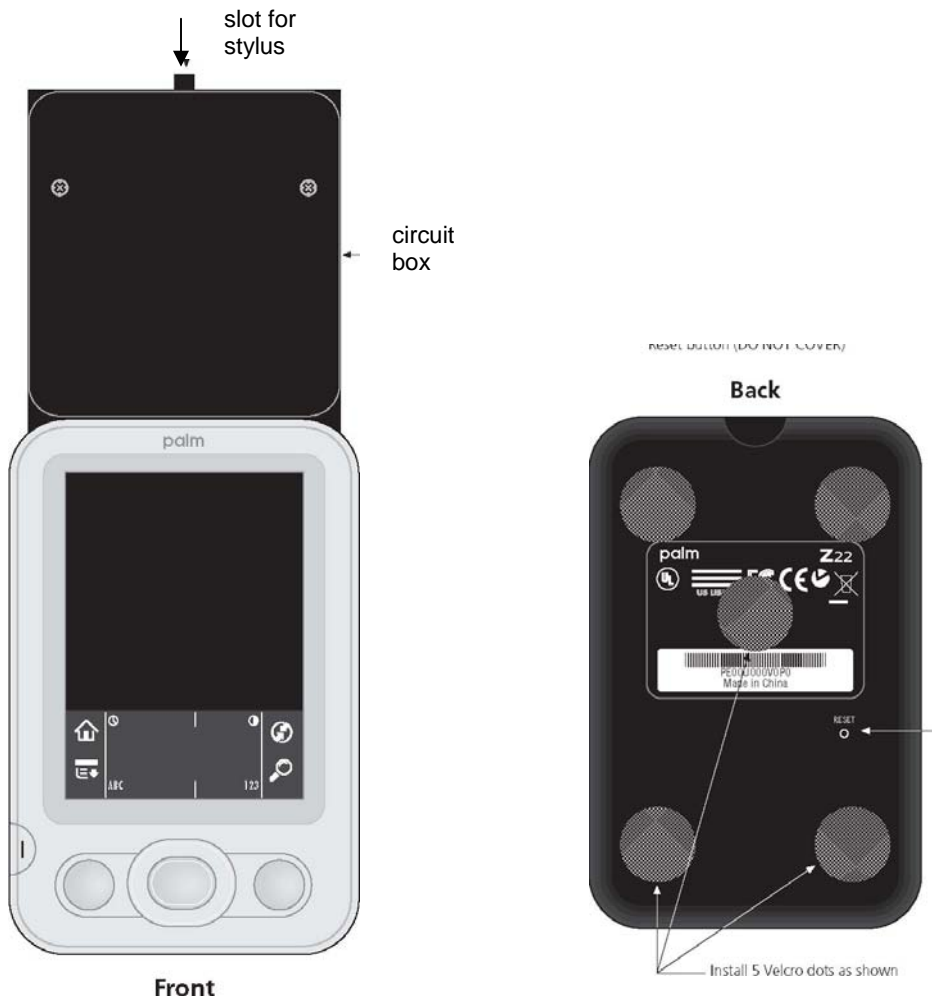
## 6. Palm Zire Z22

### Installing the Velcro

The Velcro dots that are supplied with the analyzer are used to locate and hold the Palm on the plate below the circuit box as shown. We recommend that you place five Velcro dots in the approximate positions shown.

### Placement of the Palm

The Palm is placed just below the circuit box as shown. This placement insures the proper alignment of the infrared transmitter in the circuit box with the infrared receiver on the Palm.



## 7. The Science: How It Works

### The *Fly Casting Analyzer* Hardware

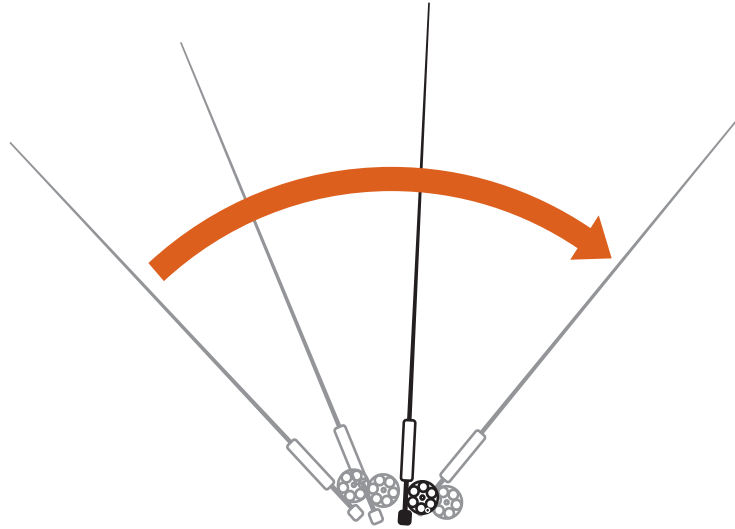
The *Fly Casting Analyzer* hardware consists of a small sensor capsule that readily attaches to the reel seat and that also attaches to the Palm pilot or Palm cell phone via the black cable that runs to the small circuit box.



*Fly Casting Analyzer* hardware: A MEMS angular rate gyro is mounted on the reel seat of a fly rod. During fly casting, the sensor measures the rate of rotation of the fly rod and produces a signal that is collected on a body-worn or hand-held Palm pilot.

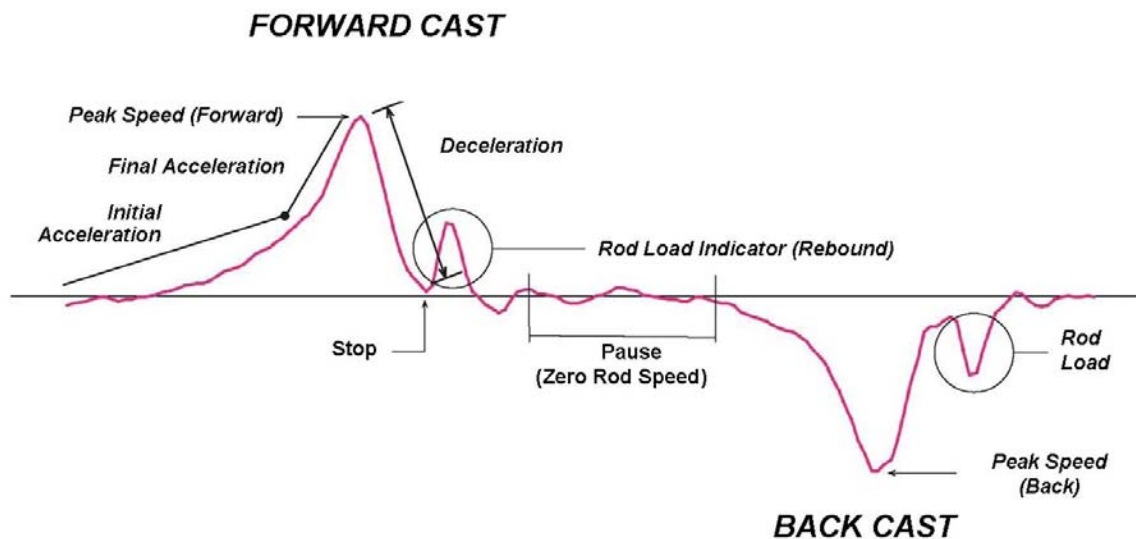
The sensor capsule contains a tiny microelectromechanical (MEMS) sensor known as an “angular rate gyro” which senses the rate at which you rotate your fly rod while casting. This rotation rate, or what we simply call the “rod speed”, represents approximately 90% of the motion you give to the fly rod during normal casting. More specifically, about 90% of the speed developed by the tip of the fly rod results from your rotating this very long (9 foot!) lever. The remainder derives from translating your hand.





The motion of a fly rod is largely planar and the speed of the rod tip is largely determined by how fast you rotate the fly rod. The MEMS angular rate gyro measures this rotation rate, which is what we call simply the “rod speed”.

So think of the sensor as a speedometer. However, rather than measuring linear speed in the units of miles (or kilometers) per hour, this sensor measures angular speed and in the units of degrees per second, what we again call simply the “rod speed”. By measuring and then storing your rod speed during casting, we produce your unique “casting signature” which forms the basis for analyzing your casting stroke. An example casting signature is shown below for one forward cast followed by one back cast. The figure also introduces the major parts of the fly cast that are automatically analyzed by the software; see **Terminology and Example Casts** to learn more.



An example “casting signature” showing a measured forward cast and back cast. The major parts of the casting stroke, which are automatically evaluated by the software, are illustrated.



The sensor data required to create your casting signature is transmitted from the sensor to the Palm pilot by the small circuit box shown in the photo below. The circuit box converts the sensor signal into a digital form that can be transmitted to the Palm pilot using an infra-red transmitter and the Palm's own infra-red port. Upon transmission, the data is stored in a user-named file, and it is immediately ready for viewing and analysis within seconds. The same file can also be later uploaded to a host computer using the standard HotSync function for a Palm device. There is a separate program for using the *Fly Casting Analyzer* on a personal computer (Windows or Mac) which has several advantages including large format display, printing reports, and group instruction.



The entire *Fly Casting Analyzer* system: a sensor capsule, a small cable that connects the capsule to the (black) circuit box, the circuit box, and an attached Palm pilot. A casting signature can be immediately analyzed using the *Fly Casting Analyzer* software installed on the Palm.



## 8. Terminology and Example Casts

The *Fly Casting Analyzer* provides a scientific interpretation of the fly cast. It is important to understand what the analyzer measures and how to interpret the measurements. Think of the rate gyro as a speedometer that measures the speed at which you cast. Rather than measuring speed in say, miles-per-hour, however, the gyro measures the speed you rotate the fly rod. Thus, the 'speed' we measure is a rotation rate and that is reported in the units of degrees-per-second. There is a simple reason for this. About 90% of the speed developed at the tip of the fly rod comes from rotating the fly rod (a very long lever!); for a recap refer to **The Science – How It Works**. We refer to this rotation rate simply as the rod speed. We measure the rod speed and use the following terms to understand all the parts of your casting stroke

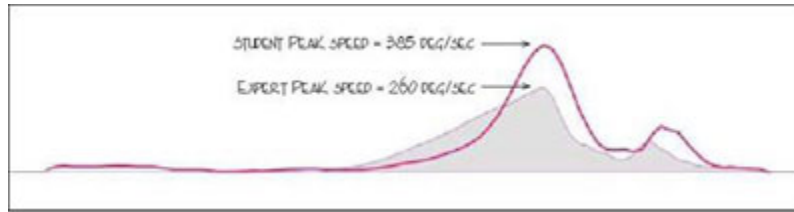
### Symmetry, Peak Speed, and Casting Energy

The best casters usually have remarkable symmetry between their forward (or front) casts and their back casts. The symmetry is reported as a number that compares the peak speeds of the forward and back casts. A value of 100 means 100% symmetry (i.e. the back cast peak speed is the same as the forward cast peak speed). However, it is very common to see higher peak speeds on an angler's forward casts. The back cast is sometimes thrown with inadequate power and, equally often, the forward cast is thrown with excessive power. If you see symmetry readings less than 80% it is likely that your back cast needs additional power or that your forward cast has too much power. The example shown below compares the symmetry of an expert's cast (100%) to that of student's cast (69%). The next figure shows that the student's peak speed (385 deg/sec) in the forward cast is substantially greater than the expert's (260 deg/sec) and this overpowered forward stroke is the root source of the asymmetrical student cast in this example.



An example of symmetry.





An example of peak speed. The peak speed details also reported on the 'Front Cast' and 'Back Cast' pages.

Very often, we cast with far more energy than required and doing so is both fatiguing and potentially injurious. The casting analyzer allows you to compare your casting energy with that of an expert caster or any other caster. To do so, simply select your comparison cast and then proceed to the forward cast page or to the back cast page and click on the "energy" button. The result you will see may look like the example below which compares a student cast to an expert cast. The energy bar graph in this example shows that the student uses 126% more energy to cast the same length of line as the expert. The casting energy function compares the kinetic energy of the rod for the two casts and reports the energy difference as a percentage. It is important to realize that the kinetic energy increases as the square of the rod speed. So if a student cast has a peak speed that is twice that of the expert cast, then it will also have four times the kinetic energy and we would report a 400% increase in kinetic energy as the result. It is not uncommon to see casts with well over 100% more casting energy when you compare to an expert cast.



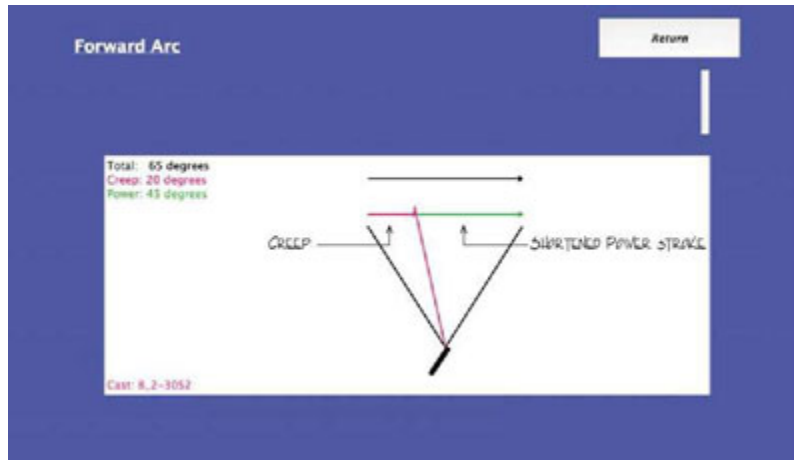
An example of casting energy.

### Cast Arc, Creep and Drift

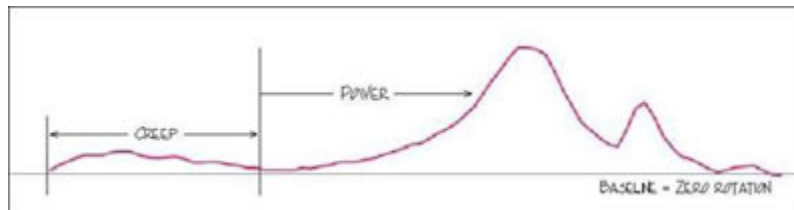
The casting arc (or rod arc) is the total angle through which you rotate the fly rod in a stroke, measured in degrees. We report the casting arc for the forward cast as well as the casting arc for the back cast. Casting arc is relative; the longer the cast, the larger the casting arc should be. Casting arcs that are larger than they need to be often result in large or 'wide' loops. Casting arcs that are too small may result in tailing loops. Like symmetry, matching just the forward cast arc and the back cast arc to those of an expert does not guarantee a 'perfect' cast. Other attributes including acceleration, stop, and rebound must also be considered as detailed further below.



The casting arc graphic also shows "creep" and "drift," if they are present. Creep is a major cause of tailing loops and it is detected on the rod speed curve as early, slow and sustained rod speed in the same direction as the upcoming stroke; refer to figures below. Creep reduces the portion of the casting arc where you can apply power. As a result, power must be applied rather abruptly in the smaller (remaining) portion of the casting arc this often results in a tailing loop. Thus, creep will also often lead to a high "smoothness ratio" as defined later. In the example illustrated below, there is 20 degrees of creep in a forward casting arc of 65 degrees. Thus, power is applied rather abruptly over a short 45 degree portion of the forward arc.



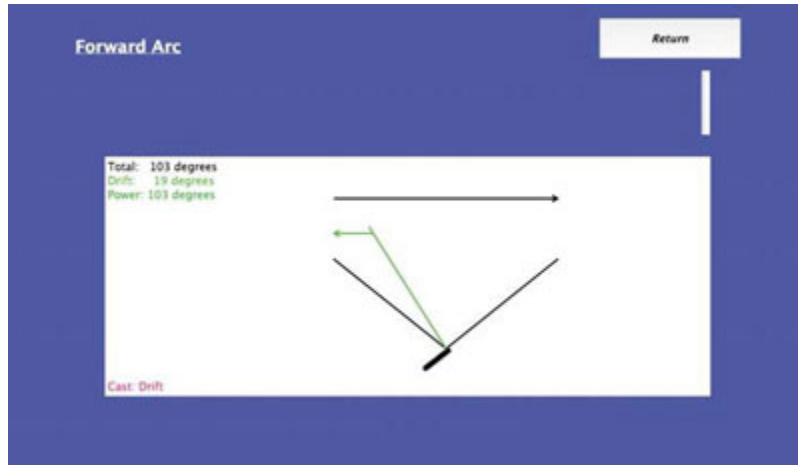
A visual example of creep in the casting arc.



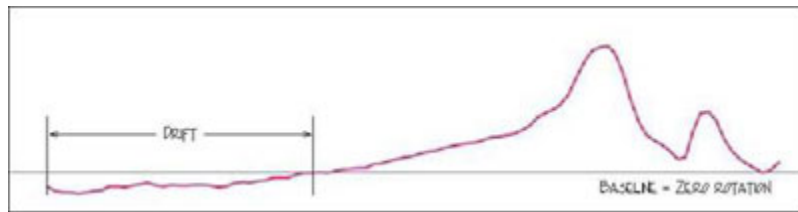
For creep, the casting signature shows slow rod speed in the same direction of the next cast. This slow, sustained and premature rod speed produces the "creep" shown in the forward casting arc above.

Drift is the opposite of creep. Drift occurs when the rod is "drifted" slowly back in the direction of the stroke just made (after that stroke's stop and rebound). Thus, with drift, the rod is moving slowly in the opposite direction of the upcoming stroke. Drift effectively lengthens the next casting arc rather than decreasing it as with creep. This is a desirable motion in nearly all casts because you can then apply power more smoothly over the resulting larger casting arc.





A visual example of drift in the casting arc.



For drift, the rod speed begins moving slowly in the opposite direction of the upcoming stroke. Thus, this forward cast begins with slow rotation in the direction of the previous back cast after the stop and rebound of that back cast. This slow sustained backward rotation produces the "drift" shown in the forward casting arc above.

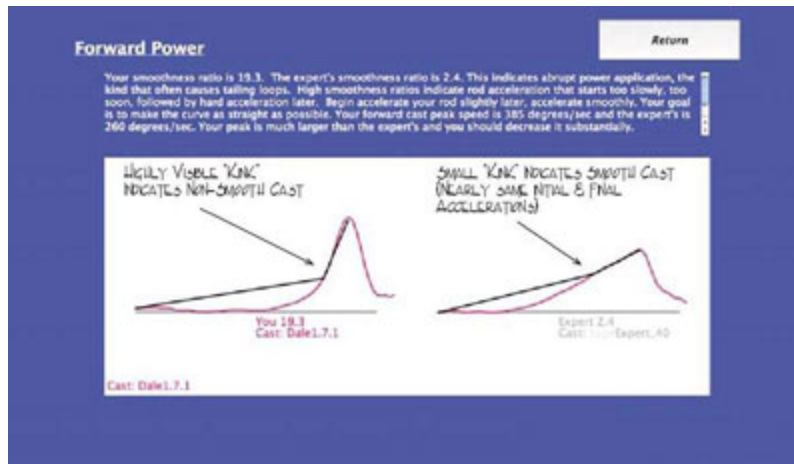
### Smoothness Ratio

The smoothness ratio is a measure of how power is applied to the rod during the casting stroke. To make a good cast it is very important to accelerate the rod smoothly. Smooth acceleration leads to smooth bending of the fly rod and this enables the tip of the rod to track in a straight line. Keeping the rod tip on a straight path is the key to developing an expert casting stroke.

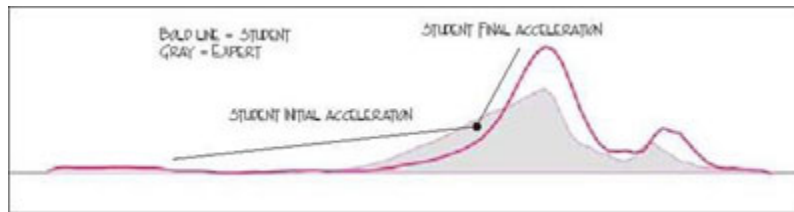
Smooth acceleration appears as a near-constant slope on the rod speed curve in the portion of the curve where power is being applied. This portion of the curve is illustrated in the two example forward casts below. The first slope drawn on each rod speed curve represents the (average) initial rod acceleration. The second slope represents the final rod acceleration at the end of the stroke. If these slopes are nearly the same, as in the case of the expert cast to the right below, then the power application is smooth. By contrast, if these slopes are very different, as seen by the obvious 'kink' in the student cast to the left below, then the power application is not smooth. The smoothness ratio is computed as the final acceleration divided by the initial acceleration. The smaller this ratio, the smoother the application of power. Experience has shown that expert casters achieve smoothness ratios of 8 or less. If your smoothness ratio is higher, you may be starting your stroke too early and slowly and then compensating by accelerating too quickly at the end of the stroke. A good example of this problem is illustrated in the student cast below where the smoothness ratio is 19.3. You may also simply be



'snapping' the rod with your wrist at the end of your stroke, thereby over-accelerating just at the very end.



These rod speed curves illustrate the application of power for a student cast (left) and an expert cast (right). In each cast, the slope of the first line is the average acceleration at the beginning of the stroke. The slope of the second line is the acceleration at the end of the stroke. The ratio of these two slopes is called the "smoothness ratio". When this ratio is small (8 or less), then the two slopes are similar and there is little visible 'kink', as in the expert cast.



The student cast above shows a very small initial acceleration (small initial slope) followed by a very large final acceleration (large final slope). The visible 'kink' where these two slopes intersect is testimony to a non-smooth application of power (large smoothness ratio of 19.3) in this student cast.

## Deceleration and Stop

How the rod decelerates, commonly called the "stop," is critical to loop formation. The transition from acceleration (as power is last applied) to deceleration (when the stop begins) must be rapid and will result in the sharp "peak" on the rod speed curve previously described in "Symmetry Peak Speed and Casting Energy." Following this peak, the rod decelerates significantly. This deceleration reduces the rod speed to a minimum rod speed which we refer to as the "stop speed" or simply the "stop". Most often, this stop is not complete in the sense that the rod stops moving completely. In general, the rod actually continues to rotate, though at a very slow speed. Thus, the term "stop" is more accurately described by the phrase a "dramatic slow down."

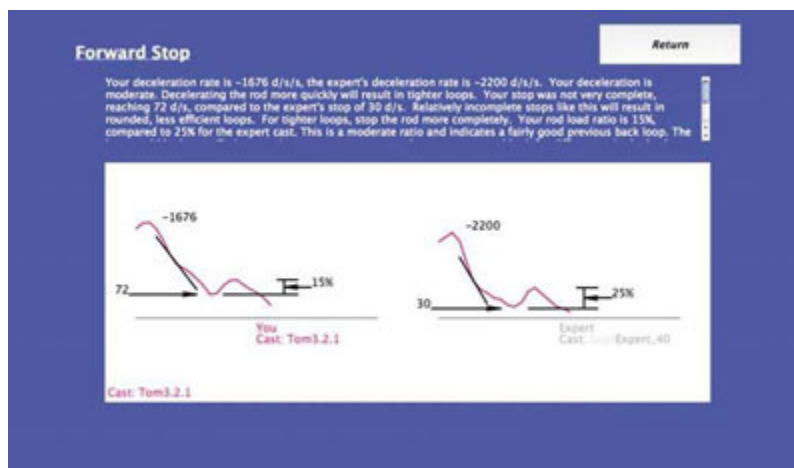
This distinction aside, it is important to understand that this stop has considerable influence on the size of your loop. In general, the smaller the stop speed, the smaller your loop will be. Small loops have less air drag and therefore they can propagate



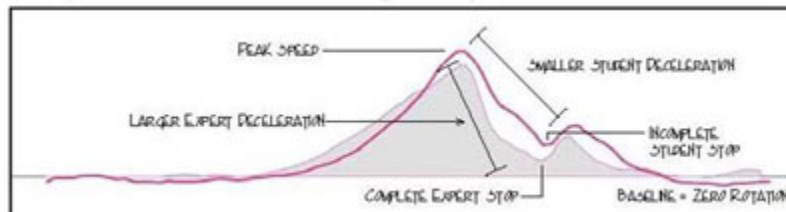
farther than large loops that have greater air drag. However, small loops are not necessarily a goal in fishing situations. For example, close range delicate presentations may demand larger loops, while long range casts and casts into a headwind may demand very small loops. Knowing how to control the size of your loop is another key to expert casting and the casting analyzer can help you practice this skill. Below we review two example student casts that illustrate how we measure the rod deceleration and stop, starting with a cast that will lead to a large loop.

### ***Small Deceleration, Incomplete Stops, and Large Loops***

The stopping phases of a student cast (left) and an expert cast (right) are illustrated below. In each case, we report the deceleration during this phase which is the (negative) slope of the line on the rod speed curve. (Deceleration is reported in the units of degrees per second per second.) The student's deceleration of  $-1676 \text{ deg/sec/sec}$  is substantially smaller in magnitude than the expert's deceleration of  $-2200 \text{ deg/sec/sec}$ . As a result, the student develops an incomplete stop of  $72 \text{ deg/sec}$ , while the expert develops a more complete stop of  $30 \text{ deg/sec}$ . A fully complete stop would result in  $0 \text{ deg/sec}$  at the minimum (rod butt section would be truly stopped) and thus extremely small loops (see next example).



An example of an incomplete stop

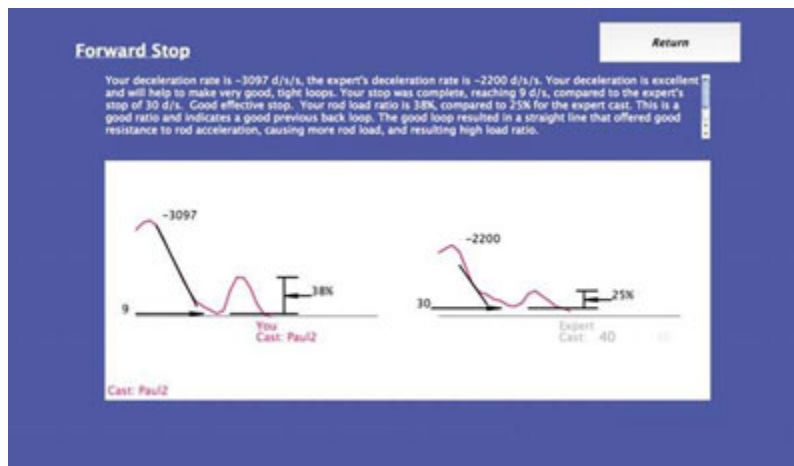


In the above casting signature, the rod deceleration is the slope of the steep line from the peak speed towards the stop. The stop is the minimum speed at the end of this deceleration phase. Here, the student's smaller deceleration and incomplete stop produces a large loop. By contrast, the expert's larger deceleration and more complete stop lead to a significantly smaller loop. (See grey curve in background).

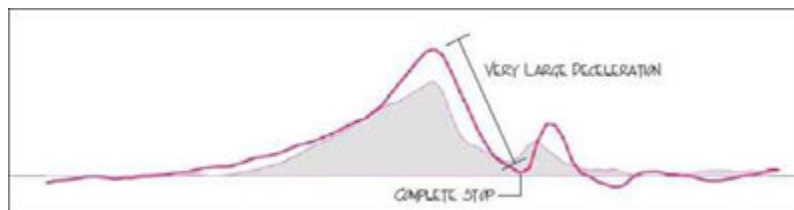


### Large Deceleration, Complete Stops and Small Loops

The next example illustrates a much more complete stop for the student cast. (The expert cast is repeated for comparison). The deceleration is now  $-3097$  deg/sec/sec (nearly twice the prior student deceleration) and the stop is  $9$  deg/sec. Thus, at the end of the stop, the fly rod butt section is still rotating forward, but at a mere  $9$  deg/sec which is essentially still! A complete stop like this will surely lead to much smaller loops. (In fact, it is also possible for the rod speed to go negative at the conclusion of a stop in the forward cast. Doing so leads to the smallest possible loops of the type one may desire only during practice or for tournament casting games.) We emphasize again that your goal is to learn how to control the size of your loops for the various fishing situations you encounter. Knowing how to control complete and incomplete stops is the key to this skill.



An example of a complete stop



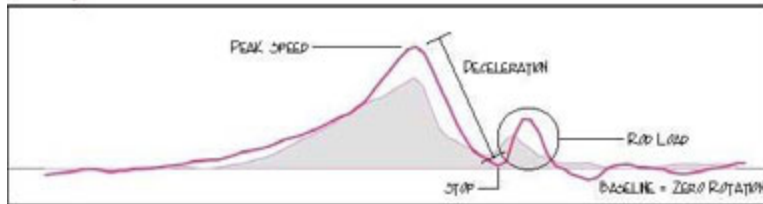
In this example, the student exhibits large deceleration and a complete stop. This type of stop is needed to form the smallest possible loops.

### Rod Load

Rod load is an indicator of how much the rod bends when applying power. This number compares the peak speed (the maximum speed before the stop begins) to the smaller peak after the stop. The rod load is reported as a percentage of the smaller peak to the larger peak. The smaller peak measures how the caster rotates the rod in response to the rebound of the fly rod. Rebounds or rod load of  $30\%$  or more indicates significant rod loading which is desirable. The rod bends or "loads" in response to tension developed in the fly line. If the line is slack from a poor previous loop, there is little tension in the fly line. The result is a rod without much bend, hence little rod load would be measured.



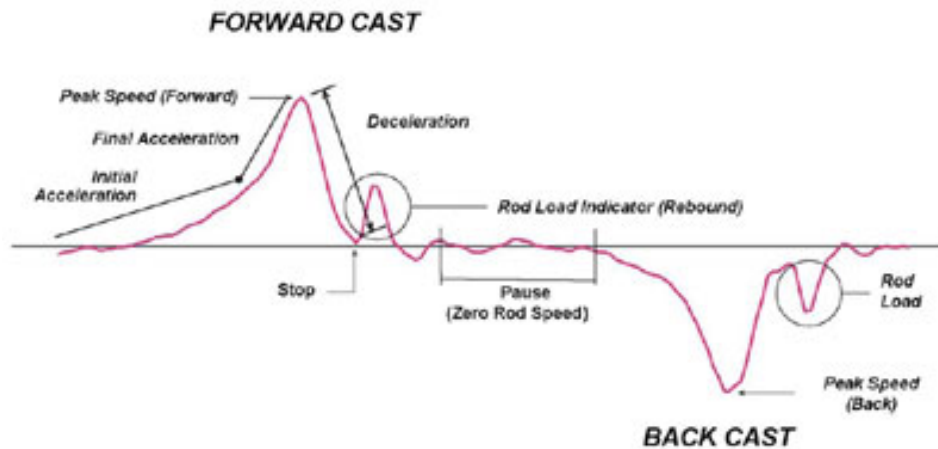
It is very possible to have acceleration, peak speed and stops that look good, but if the measured rod load is low it means the rod did not bend much and the resulting loop will not be good. This typically happens if the previous loop was big and the line never straightened. One good cast leads to another and rod load is the best indicator of that. If the rod load percentage is low (less than 25%) analyze the previous cast to determine why the previous loop was not good.



An example of rod load.

### The Entire Fly Casting Signature: A Summary of the Terminology

Now that you have reviewed the terms that we use to describe all the parts of a cast, it is time to put them all together. Below is a handy graphic that shows an example fly casting signature and the most commonly used terms.



The entire casting signature.



## 9. Operating the Program on a Palm and Your First Cast

Please read your Palm Manual to learn more about operating your Palm Pilot. The manual provides all basic instructions including how to perform a HotSync.

The *Fly Casting Analyzer* software is stored on the home page section of the Palm. To find it, tap the home icon (typically on the bottom left corner of the Palm screen). You should see the cast icon and the words "Fly Cast" beneath it. If you don't see this, check the top right corner of the Palm screen (see small black triangle) and make sure that All is selected. If All is not selected, tap the small triangle in the top right corner and select All. Now scroll through the icons shown on the Palm screen to locate "Fly Cast." If you still don't see it, then it has not been installed; refer to **Software Installation**.



Palm main screen showing *Fly Casting Analyzer* icon. On the right, the home page of *Fly Casting Analyzer* software.

### To record a cast

Tap with the stylus next to Name Cast until you see a cursor appear in the field immediately to the right. Enter a new cast name via the graffiti window or tap ABC in the bottom left corner of the text entry screen to use the keyboard function. When done, tap OK (this action checks that the name you entered does not already exist and also confirms that circuit box is ready to transfer data to the Palm). Lay out the desired length of line length and the rod in front of you (refer to **Tackle Assembly**). Holding the rod very still, press and quickly release the green button on top of the circuit box and keep the rod very still until you hear a first beep. Immediately start casting beginning with a back cast, make several (often 5 to 6) false casts without stopping, and continue casting until you hear a second beep. You're now ready to display the results!



*Tips:*

- This is a fixed line cast with no hauling, *and you must start with a back cast, so lay the line and the rod out in front of you first.*
- Make your first cast immediately after the first beep and continue casting while keeping the line in the air and without stopping (i.e., continuous false casting).
- We suggest naming the cast by name and by date. Example, Paul8.1.1 (Name.Month.Day.Number Cast). Do not use backslashes (/) to separate the name and date, use periods.

**To display and analyze the results**

Tap Pick Cast File (small triangle). Scroll to the desired cast and tap the cast name. Then tap Results, wait for it to process, and you're ready to navigating the results.

**Navigating the results**

When you access the results, the first page to open will be the entire cast profile. This is a snapshot of the third cast made in the series of false casts. To overlay a comparison cast, tap the Comparison triangle in the bottom left corner. Tap the corresponding length of cast to compare with one of the Expert casts, or scroll through Other Comparisons to select any other cast as your comparison cast. Please note, choosing the Expert will provide substantial dialog and useful casting tips. When you select Other Comparisons, you will still be able to draw useful conclusions (including overlaying the casts), but only the factual data will be displayed. Comparing a student's cast before and then after specific instruction is often a very effective way to show progress. Similarly, you could use your own casts as the basis for comparison if you were to teach a student to make a specific adjustment that you've identified; refer to **Tips for Casting Instructors**.



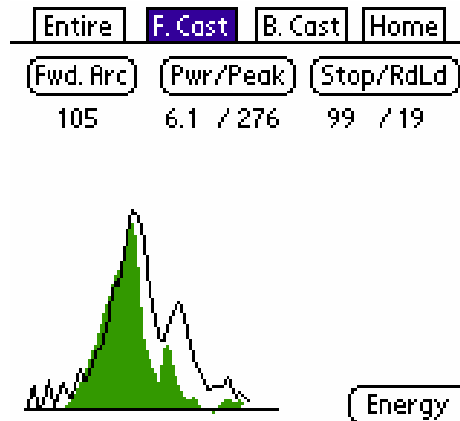
Example of the entire cast page which shows one complete forward cast followed by a back cast. In this example a comparison cast was also selected which happens to be the 40 foot Expert cast.

After selecting a comparison (which is not required) use the tabs at the top of the page to navigate between front and back cast results. Use the Home tab to return to the main



page to obtain a new cast or the Entire tab to return to the entire cast profile to choose another comparison cast.

For both the front cast page and the back cast page you will then have the opportunity to proceed to detailed analyses of these strokes. For example, you may wish to evaluate the casting arc, the smooth application of power, the peak speed, the deceleration and stop, and the rod load indicator. You may also wish to compare the casting energy of two casts. As you start to do this, we recommend that you make frequent reference to the section **Terminology and Example Casts** so that you can interpret these results. As an aid, we have added significant comments in dialog windows on each page when you select an Expert cast as your comparison cast.



Example Forward Cast page with a comparison cast overlaid. From this page you can proceed to evaluate the Forward Arc, the Power and Peak and the Stop and Rod Load Indicator. You may also compare the energy required for these two casts. Refer to **Terminology and Example Casts** for a complete description of these terms.

### Notes on the Expert Casts used for comparison casts

For comparison purposes, we have included a series of casting profiles which we consider to reflect "ideal" casts. These functional fishing casts are of average speed with functionally perfect loops. The loops are tight, but not unreasonably tight. They are of ideal shape, rounded with a smaller radius on top. The casts were made with a specific length of line, measured from the reel to the fly. The casts were all made with a Sage 590 Z-Axis, 2550 reel, and Performance Taper-II line with no hauling. The casts were medium speed casts, not unduly slow or fast, but average fishing speed casts. If you use these comparison casts, make sure you have are casting the same length to insure that the comparisons are valid. As a reminder the Expert 40 cast is made with 40 feet of line measured from the reel to the fly; refer to **Tackle Assembly**.

### Casting variables

If you cast using a very slow action rod you can expect that your rod arc will be slightly wider than the expert casts, hence your rod load percentage will also be larger. Using a very fast action rod, your rod arc and rod load percentage will be less. Using rods lighter or heavier will yield slightly different results. If your goal is to cast with minimum energy,



then you may indeed cast slower than the expert casts and you will probably have a smaller casting arc as well. So bear this in mind when you read the comments since it may actually be your goal to cast with far less energy.

### **Making/using your own comparison casts**

You can easily record your own "ideal" casts for your own rod and line and at distances you chose and this flexibility makes for an outstanding tool for casting instructors. You will need to enlist the services of a caster who casts the way you want to. Record his/her signature of the specific casts you want to make and use those for your comparison casts.

You can also compare your cast to any previously cast stored. Simply analyze one cast, and then select the other cast as your comparison cast. This is a great way to track your student's progress during a casting lesson by comparing a cast made before instruction with one made after instruction.

For more information, see **Tips for Fly Casting Instructors**.



## 10. Operating the Program on a PC

### Installing and setting up the software on your PC

Run the PC installer that came with the CD and follow the installation instructions; refer to **Software Installation**. You can then run the program *Fly Casting Analyzer* from the shortcut created on your desktop. The first time you run the software, select Set Up in the lower right corner. Use the Owner box to input your personal contact information that you would like to appear on all printed casting reports for your students. This information will appear in the top right corner of all printed reports.

Next, import the casting files from your Palm pilot for use in the PC version of the software by performing a standard Palm HotSync operation as described in your Palm owner's manual. If this should fail, you might be able to resolve the problem by referring to the quick tip What do I do if my Palm will not HotSync?; see **General Care and Trouble Shooting**. Next, you will have to tell the PC version of the software where to find the casting files you have just uploaded upon completing a HotSync. You need only to this once since the program will remember this path. To set that path,

1. Click the Set Up box on the main page.
2. Select Pick Folder

A Select Folder window will now appear on the left side. Use this window to browse to the folder where your Palm pilots backs up all data files. This is typically on your hard drive. Start by finding the folder called "Palm" (or "PalmOne") which is often within your "Program Files" folder. Then look for the folder with the same user name that you gave your Palm. Within that folder open the "Backup" folder. Finally, click "Set Folder" at the bottom, and you've now set the path. You are now ready to analyze any/all the casts you have uploaded. If you don't see these files under Pick Cast File, then you need to properly set the path to the Backup folder as described above.

### Navigating the PC *Fly Casting Analyzer* software

Navigate with the tabs at the top of the page exactly the same way you do with the Palm version of the software. To select a cast to analyze, open the Pick Cast File box, select the desired cast, and click Results. The entire cast profile will appear. You navigate through the PC version of the software the very same way you navigate through the Palm version. Follow these steps.

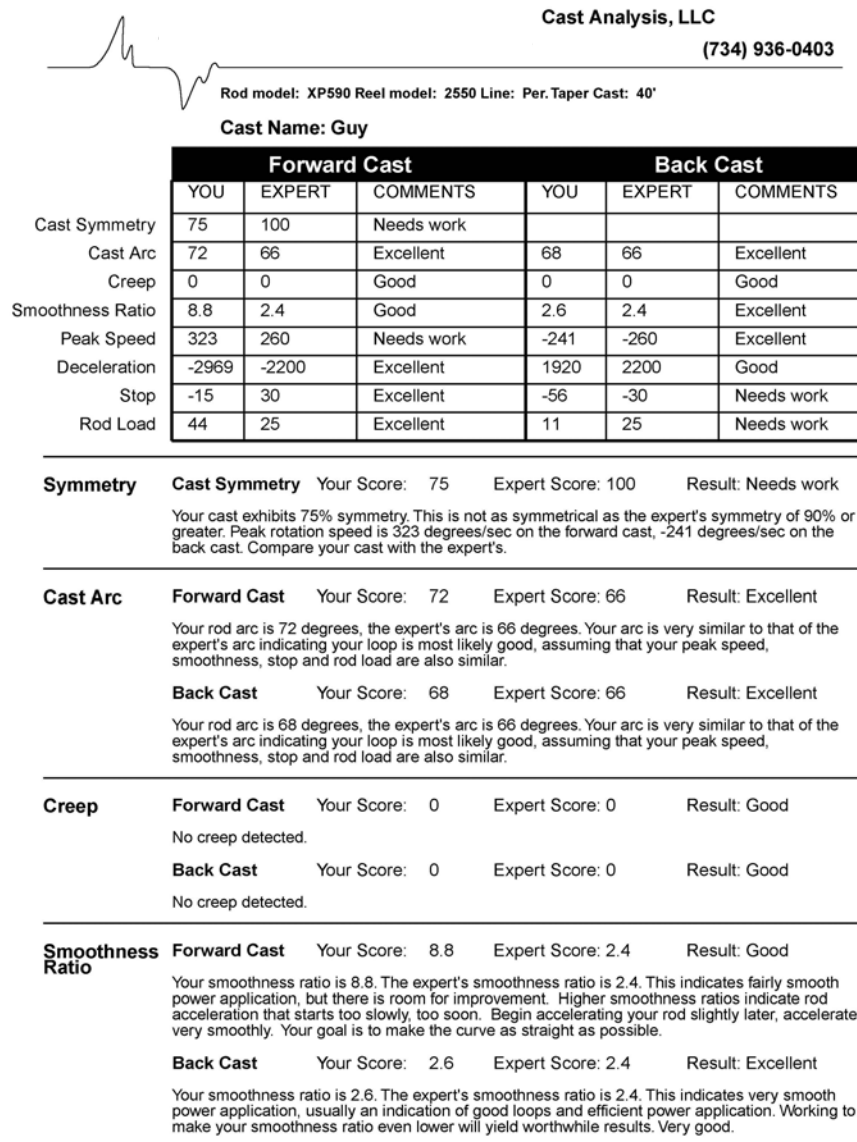
Select a comparison if you desire. For instance, you can select an appropriate length Expert cast or click Other Casts to compare to any other casts you have. The Expert cast will provide substantial feedback and dialog in the report; selecting other casts will provide the data only.

To produce a report, click the Report box. This generates a report in PDF format which you can now print or simply view. If you would also like to email this report as an attachment, you can find it in the very same Backup folder where your casting files are stored by your Palm.



# 11. The Printed Casting Report

The PC version of the *Fly Casting Analyzer* software provides you with an automatic way to create a printed report (in PDF format) which you can view/print for a student or send by email attachment. You may print a report in one of three modes: 1) without any comparison, 2) with a comparison to one of your own casts, or 3) with a comparison to one our Expert Casts. When you make a comparison with one of the Expert Casts, the report will include comments as well as the numerical data. In the other two modes, the report will include the numerical data for comparison only. The examples below illustrate the report format when using an Expert Cast for the comparison cast.



First page of report.





<b>Peak speed</b>	<b>Forward Cast</b>	Your Score: 323	Expert Score: 260	Result: Needs work
	Your forward cast peak speed is 323 degrees/sec and the expert's is 260 degrees/sec. Your peak is much larger than the expert's and you should decrease it substantially.			
	<b>Back Cast</b>	Your Score: -241	Expert Score: -260	Result: Excellent
	Your back cast peak speed is -241 degrees/sec. Well done! Peak speeds in this range are usually an indicator of good, efficient casting at moderate speed.			
<b>Deceleration</b>	<b>Forward Cast</b>	Your Score: -2969	Expert Score: -2200	Result: Excellent
	Your deceleration rate is -2969 d/s/s, the expert's deceleration rate is -2200 d/s/s. Your deceleration is excellent and will help to make very good, tight loops.			
	<b>Back Cast</b>	Your Score: 1920	Expert Score: 2200	Result: Good
	Your deceleration rate is 1920 d/s/s, the expert's deceleration rate is 2200 d/s/s. Your deceleration is moderate. Decelerating the rod more quickly will result in tighter loops.			
<b>Stop</b>	<b>Forward Cast</b>	Your Score: -15	Expert Score: 30	Result: Excellent
	Your stop was complete, reaching -15 d/s, compared to the expert's stop of 30 d/s. Good effective stop.			
	<b>Back Cast</b>	Your Score: -56	Expert Score: -30	Result: Needs work
	Your stop was not very complete, reaching -56 d/s, compared to the expert's stop of -30 d/s. Relatively incomplete stops like this will result in rounded, less efficient loops. For tighter loops, stop the rod more completely.			
<b>Rod Load</b>	<b>Forward Cast</b>	Your Score: 44	Expert Score: 25	Result: Excellent
	Your rod load ratio is 44%, compared to 25% for the expert cast. This is a good ratio and indicates a good previous back loop. The good loop resulted in a straight line that offered good resistance to rod acceleration, causing more rod load, and resulting high load ratio.			
	<b>Back Cast</b>	Your Score: 11	Expert Score: 25	Result: Needs work
	Your rod load ratio is 11%, compared to 25% for the expert cast. This is a low ratio and indicates a poor previous forward loop. Usually the reason for the poor loop can be found by comparing the forward cast rod arc, peak speed, smoothness ratio and stop data to the expert cast.			

Second page of the report.

## The Expert Casts and the ranges for each part of the cast

The ability to compare a cast with a standard Expert Cast is a powerful feature when starting to use the *Fly Casting Analyzer*. When you do this, every part of the cast is measured and the numerical values obtained are then benchmarked with the Expert Cast you have selected. It is natural that the example cast and Expert Cast have different values and we then look at how far these values deviate from those of the Expert Cast. To this end, we have established the ranges in the table below which correspond to the qualitative categories: "Excellent", "Good", and "Needs Work". It is quite a challenge to obtain Excellent in all categories simultaneously and this may not even be a goal. For example, if you are intentionally casting with minimum energy, then you may be rated as "Good" or "Needs Work" in Peak Speed or Arc, when in fact you meant to achieve smaller values in these categories by casting with minimum energy.



<b>30' CAST</b>	<b>Expert</b>	<b>CAT 1 Excellent</b>	<b>CAT 2 Good</b>	<b>CAT 3 Needs Work</b>	<b>CAT 2A Good</b>	<b>CAT 2B Good</b>	<b>CAT 3A Needs Work</b>	<b>CAT 3B Needs Work</b>
Symmetry	100%	>90%	80-90%	<80%				
Peak Speed	230	180-240			160-180	240-260	<160	>260
Arc	55	50-60 deg			45-50 deg	60-65 deg	<45 deg	>65 deg
Smoothness Ratio	5.0	1 to 8	8 to 12	>12				
Deceleration	1900	>1600	1200-1600	<1200				
Stop	30	<40	40-50	>50				
Rod Load	30%	>20%	15-20%	<15%				

<b>40' CAST</b>	<b>Expert</b>	<b>CAT 1 Excellent</b>	<b>CAT 2 Good</b>	<b>CAT 3 Needs Work</b>	<b>CAT 2A Good</b>	<b>CAT 2B Good</b>	<b>CAT 3A Needs Work</b>	<b>CAT 3B Needs Work</b>
Symmetry	100%	>90%	80-90%	<80%				
Peak Speed	260	240-280			220-240	280-300	<220	>300
Arc	66	65-80 deg			60-65 deg	80-85 deg	<60 deg	>85 deg
Smoothness Ratio	2.4	1 to 8	8 to 12	>12				
Deceleration	2200	>2200	1400-2200	<1400				
Stop	30	<30	30-40	>40				
Rod Load	25%	>25%	15-25%	<15%				

<b>50' CAST</b>	<b>Expert</b>	<b>CAT 1 Excellent</b>	<b>CAT 2 Good</b>	<b>CAT 3 Needs Work</b>	<b>CAT 2A Good</b>	<b>CAT 2B Good</b>	<b>CAT 3A Needs Work</b>	<b>CAT 3B Needs Work</b>
Symmetry	100%	>90%	80-90%	<80%				
Peak Speed	330	325-375			300-325	375-400	<300	>400
Arc	78	70-85 deg			65-70 deg	85-90 deg	<65 deg	>90 deg
Smoothness Ratio	5.0	1 to 8	8 to 12	>12				
Deceleration	3000	>3000	2800-3000	<2800				
Stop	2	<20	20-30	>30				
Rod Load	30%	>25%	20-25%	<20%				

This is the table of the Expert Casts and ranges for each category.



## 12. Tips for Fly Casting Instructors

Good casting instructors can look at a caster's technique and loops and know generally what the caster is doing wrong and right. As explained earlier, how the fly rod rotates is the most critical motion in fly casting and most casting flaws can be traced to something not quite right in the way the rod was accelerated or decelerated. Sometimes these problems are subtle and very difficult or impossible to see, but they can be very accurately measured with the *Fly Casting Analyzer*. Here are some tips for instructors to use the *Fly Casting Analyzer* most effectively to find these subtle problems.

### Set up a Custom Comparison Cast

Although the *Fly Casting Analyzer* has "canned" expert casts included, you may want to record your own using your student's rod and at the distance s/he finds most comfortable. This can add credibility to the process as the student sees you make the cast to which his/hers is being compared. Of course, if you find that you cannot make a cast that demonstrates the numbers you want your student to emulate, its time to use your *Fly Casting Analyzer* to improve your own casting!

### Work on One Thing at a Time

When you first look at a student's casting signature you may see several things you don't like. Trying to work on all of the flaws at once is often counterproductive. Pick the one thing that is causing the most trouble, such as bad creep, or a wide casting arc, or too much power, and concentrate on fixing that problem. When you see improvement there and that is no longer the biggest problem, switch to what is now the biggest problem.

### Use the *Fly Casting Analyzer* to Reinforce Your Instruction

Although I'm sure most of our students believe what we tell them about their casting, sometimes their response makes me wonder. Challenging your student to match a single number on your comparison cast can be a strong reinforcement to the "work on one thing at a time" tip above. For example, if your student is throwing much too hard, have them work on reducing "peak speed" until it matches yours. Or, if s/he is throwing tailing loops due to creep, have them work on eliminating early, slow rotation until it matches yours on the *Fly Casting Analyzer*, and the tails will be gone.

### Work on the Basics

If your student wants to work on distance, but can't throw 50 ft. "cleanly" with good loops, you have to fix that first. Trying to add more rod arc and power to an already flawed cast will usually not result in more distance. Better to fix the 50 ft. cast first, then start adding distance. In most cases, the main problem going from medium distances to longer is the presence of slow, early rod rotation. This shortens the rod arc and forces an abrupt shot of power later with yields a very high "smoothness ratio". Working on delaying rotation on the shorter casts will make it much easier to incorporate that good technique into longer casts.

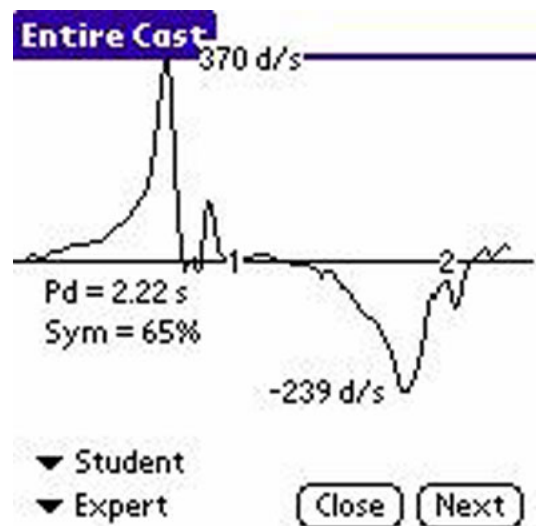


## The *Fly Casting Analyzer* Isn't the Right Tool for All Students

Rank beginners usually have pretty obvious, major things to work on. Yes, the *Fly Casting Analyzer* will clearly show them, but if it is clear to you what is wrong, you can save some time working on those issues without electronically analyzing these casts. Also, beginners won't have enough understanding of what the charts mean to understand them. Once these students gain some understanding and their loops start to improve, the *Fly Casting Analyzer* will become very effective.

### Work on Smoothness Ratio

If your own smoothness ratio is not routinely below 4, work on it; this skill will make you a more credible instructor (and your loops will improve). The forward cast below has a smoothness ratio of 12, much too high. The back cast is much better, a ratio of 3. The forward cast smoothness ratio is 12 due to the slow, early rotation at the beginning of the cast.



A graph of smoothness ratio on the Palm Program

In most cases, the main difference between casters throwing good loops, and those throwing great loops can be found in the smoothness ratios. Good casters have smoothness ratios from 4-8, great casters have ratios below 4. As an instructor, you should be throwing great loops.

### Don't Analyze Every Cast

The *Fly Casting Analyzer* is a great tool and very interesting to use, but it can be overdone. What we've found to work very well is to analyze a student's cast at the beginning of a session and then work from that analysis, and your own observation, for an hour or so. You should be seeing significant improvement in the students cast and these improvements will show clearly in a follow-up analysis. Students need time to



assimilate and practice what they learn; electronically analyzing every cast does not allow this. Using the comparison function for the 'before' and 'after' casts provides very compelling evidence of progress.

### **Video Tape and Analyze**

Some students learn best visually and seeing a video of their cast along with the *Fly Casting Analyzer* charts can be very effective. We sometimes project the *Fly Casting Analyzer* chart next to the casters video and point out exactly how they compare. This can be very effective for many casters and is especially useful for pointing out subtle creep and other flaws that are difficult to see.



## 13. Frequently Asked Questions

### **What type of casts will the Sage Casting Analyzer measure?**

The *Fly Casting Analyzer* is designed to measure standard overhead casting without hauling. It is used during false casting and typically with 30', 40' or 50' of line measured from the reel to the fly. One can indeed use it while hauling and for different length casts, however it does not directly measure the influence of the hauls. It should be noted that the sensor is directional and only measures rotation in one plane. If a caster rotates the sensor out of the plane of the cast, the resulting casting signature will not be accurate. The sensor must remain in plane with the cast to work properly.

### **What kinds of rods can I use?**

The *Fly Casting Analyzer* can be used on any rod for overhead casting in a single plane. Since most spey casts rotate the rod in more than one plane, the *Fly Casting Analyzer* cannot be effectively used to analyze spey casts. You can create your own library of comparison casts for any rod and any length of line. However, if you wish to compare a casting stroke with any of the stored Expert casts, then it would be best to use a fast action rod as that is what the Expert casts were made with. If you want to have an "expert" casting signature of your own, have an expert friend record some casts to compare to. Most good casters would be very willing to record a cast for you if you ask them.

### **Whose casts are the “Expert Casts”?**

We have measured the casting signatures of hundreds of experts in the field. Despite different styles of casting, the signatures are remarkably similar. The Expert casts we offer reflect the characteristics shared by all expert casters. We encourage you to develop your own “expert” casts to support your own teaching objectives.



## 14. General Care and Trouble Shooting

### How do I take care of my *Fly Casting Analyzer*?

The *Fly Casting Analyzer* contains sensitive electronics and care should be taken to protect it from moisture, contamination, and excessive shock loading (e.g. dropping). When the capsule is attached to the rod butt without the cable, the bare connector is exposed. Setting the butt end of the rod on the grass/ground may allow moisture and contaminants to enter the bare connector. It is good practice to keep the cable attached to the capsule at all times.

### How do I replace the battery following a low battery warning?

When the battery runs down, the *Fly Casting Analyzer* will respond with a message suggesting that you replace the battery. To replace the battery, remove the two screws on the outside of the black box as noted below and carefully lift the top half of the box. Gently remove and replace the battery making sure that the positive pole points opposite to the green button. If you happen to reverse the battery, you will not do any damage. Instead, the *Fly Casting Analyzer* will detect this and suggest that you check the battery polarity. Keep in mind that the battery powering the Palm will also need recharging. For visual instructions, see below.



Replacing the battery with positive pole downwards (i.e., pointing away from green button).



## Replacement batteries

The battery shipped with the *Fly Casting Analyzer* is a 6V alkaline battery found in digital cameras: Gold Peak 476A. A very common replacement for this is the Duracell 28A (alkaline) or the Duracell 28L (lithium). In addition, all of the following batteries can also be used: Eveready L544, A544, Panasonic 4LR44, Kodak K28A, K28L, Varta V34PX, V28PXL, Rayovac 2CR1/3N, Maxell 4LR44P, Toshiba 4LR44, Neda 1414A, 1406LC, IEC 4LR44, 2CR11108.

## What do I do if my Palm will not HotSync?

Double-check the USB or Serial connection to your computer.

On your PC, navigate/search for the Palm or PalmOne folder. Double-click the HotSync Manager. Under HotSync Controls make sure that HotSync is enabled.

If you use a Palm cradle or cable with a button, press the HotSync button on the cradle or cable. If you HotSync using the Palm Main Page, click the HotSync icon. In the center of the page, a small triangle should read Cradle/Cable. If it doesn't, tap the triangle, scroll to the Cradle/Cable line and select it.

If the Palm still will not HotSync, you may want need to study further the Palm manual that came with your device.

## What do I do if my Palm Pilot is frozen/locked up?

On the back of the Palm Pilot there is a small Reset button. If you do not see the Reset button, then you may have covered it up with a Velcro dot. Consult your Palm's owner's manual for instructions on resetting your Palm.

## Want do I do if the cast file has an error message?

This may happen when the connection between the sensor capsule and Palm is lost, when the battery is low, or for a small number of other reasons that are listed in the error message. Try re-plugging the connection between the cable and capsule as well as the cable and the circuit box. The cable may have been just slightly loose.

## What do I do when the cast plot shows abnormal results?

Check the gyro orientation. In addition, watch the angler's casting style. You may need to adjust the gyro to align with that angler's casting plane. Refer to **Orientation of Gyro and Connecting to Palm**.

## The cast file cannot be analyzed and I can't obtain results. Why?

While this does not happen often, occasionally a measured cast will be so far from what we expect that we cannot properly analyze the results. In this case, we recommend that you work with the angler to improve whatever shortcomings you immediately observe and then re-measure.



**How do I obtain a replacement cable?**

You can purchase a replacement cable from Cast Analysis, LLC. You may also be able to purchase a standard S-video cable (4 pin) as an acceptable replacement at a local electronics store.



## 15. History of the *Fly Casting Analyzer*

### Who is *Cast Analysis, LLC*?

Cast Analysis, LLC is a small business owned and operated by Bruce Richards and Noel Perkins. We are the developers of the *Fly Casting Analyzer* and we manufacture them in Ann Arbor Michigan with the help of Noel's son Ryan Perkins. Many others have helped us develop this product and we'd like to particularly acknowledge the help of Chris Joseph and Francis Deck. We'd also like to acknowledge the Sage Rod Company for the earlier introduction of the Sage Casting Analyzer Kiosk to Sage specialty fly shops worldwide.

### Where did this all begin?



### Bruce's History with the *Fly Casting Analyzer*

Several years ago, although it seems like yesterday, I got a phone call, out of the blue, from a guy named Noel Perkins. He said he was a professor at the University of Michigan and was working with a grad student on simulating fly casting. They were having some trouble with the calculations and another professor who saw what they were doing, and knew of me, suggested that Noel call. They certainly didn't need my help with the math, but their assumptions about rod tip path during the cast were erroneous and that was preventing them from getting the simulation quite right. While helping to solve that problem Noel showed me a small device they were using to measure the motion of the fly rod, and that really caused my eyes to widen!



Although a fly rod moves in several possible ways during a cast, there is really only one that is critically important, and that is how it rotates. The little device I saw measured angular rotation and I realized that was the key to seeing the fine points of any cast. Very fine motions at the hand have a huge impact at the rod tip due to the length of the lever we use. The hand motions are often too subtle to see clearly, and the tip moves too fast, so casters and instructors have always been hindered by a lack of hard information about what the rod is doing. The first computer graphs Noel showed me of what the rate gyro was measuring started me thinking about casting in a different way, I now had all the detailed information I could want and could clearly see motions that had been invisible previously.

Since those early days the hardware and software has dramatically improved, as has our understanding of what the charts show us. It still amazes me how long it took us to figure out exactly what we were looking at and how to analyze the charts so that every part of each chart related directly to a part of a cast. Comparing "ideal" casts to average casts helped us to understand just what the experts do differently from the rest to get such a good result with so little effort. Time and time again we see expert casters using half the energy of average casters to get the same, or better, result. And now we know precisely why.

I have been using the analyzer during practice and instruction for about three years now and have had remarkable success with many students. Many students have come back for "follow-up" charts to help them track their progress. Ray Schmidt and I use the analyzer in conjunction with video analysis in our advanced casting schools and our students have told us more than once, "you guys don't charge nearly enough for this". We've been listening! Not every student cares about the fine details of a fly cast, with them I use the charts to help me better understand their cast so I can give the best instruction without boring them with graphs and numbers. Other more analytical types are completely enthralled by the information they see on the Analyzer screen, and especially by the comparisons with an expert cast. Noel is a fine testament to what the device can do. With little instruction from me, but a lot of work with the analyzer, Noel has transformed himself from a creeping, high powered, wind knotter, into a fine caster! (Sorry for the exposé, Noel!)

For a casting geek like me, meeting Noel and being able to help develop, and now market this device has been wonderful. To be on the cutting edge of the technology of a sport I am passionate about is a dream come true, and to have partnered early on with a company like Sage, for whom I have the utmost respect, was a great start.



## Noel's History with the *Fly Casting Analyzer*



It is probably true that learning to fly cast well is the greatest bottleneck towards advancing in our sport. Many of us try to learn to fly cast by reading books, watching videos, taking lessons and by (a lot of!) plain old trial-and-error. Starting in 1998 when I began fly fishing in earnest, I tried all of these methods but my advancement was very limited. I was however fortunate to watch an inspirational fly caster/friend by the name of Kim Eagle who helped me realize just how much one could achieve with superb casting technique. Watching Kim effortless cast from my canoe to the far bank of our local Huron River in Ann Arbor Michigan really lit a fire in me to understand fly casting and to finally improve!

As a researcher in engineering, I first sought to understand fly casting by employing the methods I use in my day job at the University of Michigan, namely by creating computer simulations of fly casting. With the aid of a very talented graduate student, Dr. Caroline Gatti-Bono, this attempt both missed and hit the bull's eye. Through Caroline's heroic efforts, we quickly realized that we needed to understand what motion the fly caster gives to the fly rod as input to our model. The answer to that need ultimately grew to the *Fly Casting Analyzer* we use today due to the timely advice of Bruce Richards.

I gave a cold call to Bruce Richards at Scientific Anglers in nearby Midland Michigan. Bruce is, of course, a world-renown fly casting instructor but just as important he's known locally as a great speaker at our TU chapter. Bruce was very patient with me as I described in overly excruciating detail our work in computer simulation of fly casting and then he paid me a visit. I distinctly recall him looking with interest at our computer monitor and watching simulations of fly line forming loops and interacting with the fly rod and air drag in our model. He then asked how we knew how to move the fly rod. I replied that's simple, we use this "angular rate gyro" to measure rod rotation while actually casting. He took one look at that little instrument and at our measured results and quickly summed things up for us. I think it went something like this... "You know this computer simulation stuff is OK and might even find some use someday, but this thing you have here is truly remarkable. This is what the industry has needed for a long time to understand the casting stroke." That one comment sent us in a totally new and better



direction. Bruce and I started to work on measuring the fly casting stroke immediately, often with the aid of many fine students at the University of Michigan. Over the years, the technique evolved from one that only we could use with clunky and expensive laptop-based computer equipment to the sleek and simple form it now has that employs a Palm pilot and custom software. During this time, we were fortunate to measure/record the casting strokes of hundreds of fly fishers of all skill levels. Those measurements, often made with participants at fly fishing clubs/meetings across the nation, helped us further understand and to quantify the casting stroke. We were also helped by a number of other fine students from the University of Michigan and notably Mr. Chris Joseph who helped with our software.

In 2005, Bruce and I decided it was finally time to formulate a plan to ready the *Fly Casting Analyzer* for the market place. We formed Cast Analysis, LLC and immediately formed a partnership with Sage. Our choice to partner with Sage was a natural one given their own R&D efforts to measure the fly casting stroke and their leadership position in the industry. Sage first introduced a special 'kiosk version' of this product for their specialty fly shops. Following that, we now offer our own version for casting enthusiasts.

More important though, through these efforts my own fly casting stroke has changed radically (and largely for the better)! Suffice it to say that I can also now reach the far bank of our river and, even though the fish don't always accommodate me, my casting usually does.



## 16. Contact Information

Cast Analysis, LLC

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Palm INC. - PalmOne

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**Thank you**

