The Wolverine Plan

Training Plan of the University of Michigan Women's Rowing Team

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Introduction

Training is distinct from "exercise" or "working out" in that the goal is to maximize performance in a particular sport or activity (as opposed to being active simply to promote good health, maintain acceptable body weight, etc. – admirable goals, but below the expectations of the serious athlete). A **Training Plan,** then, is a systematic and progressive program to allow an athlete to achieve her full potential in her chosen sport. What follows is a description of the Training Plan used by the University of Michigan Women's Rowing Team.

To understand how to get the most out of training, let us first review several core concepts exercise physiologists have identified as the Principles of Training, and consider their application to the sport of rowing. Most important is the *Overload Principle*, which tells us an athlete must challenge herself to stimulate further physiological adaptation. An untrained person can stimulate significant physiological improvement by exercising at a modest intensity for 20-30' at a time 3-4 times per week. But the elite athlete needs to train more frequently, for longer durations, and at greater intensities. A second very important concept is the *Specificity Principle.* This means an athlete must perform the greatest portion of her training doing the actual activity in which she competes – in this case, rowing. While occasional workouts doing cardiovascular activities such as running, biking, swimming, or stair climbing can supplement your basic training or provide a break from the monotony of rowing exclusively, we must recognize the limitations of cross-training. (As a side note, we recognize that *erging* is only an approximation of rowing *on the water,* and can't develop many of the fine technical skills required for success. At the same time, *as a training tool,* in some ways erging is actually superior in that it allows us to much more accurately quantify performance, which is critical to success as will be discussed below.) Another application of the Specificity Principle is that a rower must train to perform during a *2000-meter race.* Therefor the training for an event that lasts a little under seven minutes is different than for a 100m sprint or a marathon. A third Principle of Training is the *Reversibility Principle.* This means that training gains are *not permanent*. The outstanding performances of last year cannot be duplicated or improved without continued effort this year. Athletes who stop training lose fitness, regardless of the reason (poor motivation, injury or illness, lack of time, etc.) How much and how fast varies depending on circumstances, but **any** reduction in training could make the crucial difference between winning and losing for the elite athlete. Finally, another Training Principle might be called the *Individual Differences Principle.* This recognizes that every athlete is genetically different and all athletes are not expected to respond to the same training program in the exact same way. Some athletes won't make the same progress over the course of the year as their teammates, and it won't be for lack of trying. However, the Training Plan will allow every athlete her best chance at reaching her own personal potential.

Your coaches consider the benefits of training so self-evident as to hardly require elaboration, so we'll confine ourselves to just a couple of comments relating training to success. If the team's ultimate goal is to win the National Championship, then we must recognize this goal will not be achieved without cost. A favorite metaphor is to think of the NCAA finals as an auction, where each team and each crew will "bid" for their place. Training represents the funds you have available to make your bid. A crew that has trained poorly will be out-bid early, perhaps starting the race at a fast pace but fading quickly as their limited funds expire. A crew that has invested wisely in their Training Plan and accumulated plenty of funds will be able to bid strongly early in the race, setting a fast pace in the first 600-700m while still having plenty of funds in reserve as the bidding increases in the middle of the race and into the final 200-300m. We want to show up at the line holding a sack of $100 bills in each hand, while our opponents are jingling a few coins in their change purse. But to accumulate that amount of funds requires a substantial amount of training. (Perhaps during a lengthy ergometer workout, you can envision dollar signs where the meters appear, like a slot machine hitting a jackpot.) Still another metaphor is to imagine that when we race we are going to war, and superior training means we show up with bigger guns and more ammo.

Before looking at our Training Plan in detail, please consider a basic and unalterable truth: *training is essential for success.* This is a Law of Nature, like gravity. Your coaches have determined the amount of work necessary to give us a realistic chance to compete for a National Championship. This can't be negotiated. Still, athletes on occasion try. You can recognize how absurd the following conversation would be between a doctor and a very sick patient:

> Doctor: I'm sorry to report you have cancer, which is life-threatening and will require painful and debilitating treatment for a long time.
> Patient: But I have a husband and three young children and a part-time job, and I have so many plans right now!
> Doctor: Oh. In that case, you just have a bad cold.

Yet some athletes apparently expect to have the following exchange with their coach:

> Coach: Here is the Training Plan we need to follow to give us a chance to win NCAAs. It means several hard workouts a week from September to May with little mental or physical rest.
> Athlete: But I have to study and I have a boyfriend and I want to hang out with my friends and I tend to get sick easily!
> Coach: Oh. In that case, just train once in a while when you feel like it.

The point is your coaches are only pointing out some physical truths, not setting policy for the Universe. If the goal is to win, the price can't be negotiated. The only thing that can be negotiated is the goal. We could train less and still beat a lot of crews. The decision you the athlete must make is, how many crews am I satisfied with beating?

General Features of the Plan

Before getting a complete description of the workouts we will do, there are some general features of the Plan you should recognize. The first is, this is no magic formula and there are no clever gimmicks.

Some will be disappointed to learn the secret to success is simply lots of hard work, *which in the first place is no secret and in the second place anyone else can do too!* The Plan will help you organize and focus your efforts more efficiently, but athletes must accept that success or failure ultimately rests on your shoulders. Some find that a blessing and some a curse, but in one sense the Plan is simply a way for you to take ownership of your readiness to race.

Another feature of the Plan is that it doesn't vary much throughout the year. There are different levels of intensity for various workouts which range from short pieces at race pace and cadence to much longer pieces at lower ratings and power outputs. But all workouts will be performed throughout all portions of the year in roughly the same proportions (with the exception of a little less race-pace work in September and October). This is different from some approaches to training, which might label the fall as a time for laying an "aerobic foundation", the winter as a period for "general conditioning", and the spring as a time for "specific race preparation". In fact, effective training should *always* be geared toward specific race preparation. It is not possible to completely isolate and separate different aspects of physiology, training them separately and sequentially, expecting gains in one area to persist when moving on to another area. This would be analogous to expecting an infant to grow by first maturing its skeleton, then its muscles, and then its vital organs. In fact, their growths are interdependent and each must mature in conjunction with the others. (Some tissues do mature at slightly different rates, but there must be a certain proportionality, and the same is true for training.)

This Plan is meant to apply equally to all workouts, whether performed on the ergometer or on the water. Once the basic formats and instructions are understood, each workout may be performed in either environment. This allows a lot of flexibility when water conditions are unrowable. And while it's nice to see athletes perform well on the erg, the ultimate goal is to perform well on the water. Towards this end, it is essential to perform the workouts consistently, with the same intensity for specific workouts when on the water as on the erg. Throughout the year, athletes, coxswains and coaches must learn to oversee or perform workouts in the prescribed manner.

The Plan features a fairly high volume of training, but note there will be no large or sudden increases in volume or intensity. The Plan is to systematically, progressively, and continually build throughout the duration of the season. This will minimize the risk of overtraining and minimize the need to taper before competition. (These topics will be discussed more fully later.) Individual workouts will rarely be perceived as exceptionally difficult or bordering on impossible. It *will* be a challenge to perform day after day, but an *attainable* challenge.

To make optimal progress, it is necessary to *monitor* progress and keep accurate records of all workouts. This will be addressed more fully with examples for specific workouts, but the basic message is clear: learn to keep detailed records of all your workouts. You will be asked to turn in results of your training regularly (on prepared forms that will be provided). Note these records are necessary for your coaches to determine if training is effective and whether the team or any individuals requires special attention. In addition, you are encouraged to keep

personal records of your own. Get a notebook or training log where you can record all scores, as well as other information that may prove useful. This might include notes about your diet, sleep, emotions, etc. This may be entirely private and for your eyes only, or it may be something you would eventually want to review with a coach or trainer for insights into your performance. The training log could be thought of as a bankbook to record the funds you are putting away for your Championship auction.

The Plan recognizes that different athletes start the year at different levels of fitness, and progress at different rates. Furthermore, sports psychologists recognize that athletes perform better with specific and individualized goals (as opposed to general comments like "work hard" or "do your best"). You will be taught how to calculate specific performance goals (splits, meters, etc.) for various workouts. For some workouts, your goal will be simply to perform better (by any small amount) than your previous similar workout. You simply need to recognize that any progress is a step forward, and the progressive nature of the Plan recognizes that over the course of the year, a lot of little steps add up to huge gains. (While we don't specifically plan to take any backward steps, we recognize they do occasionally happen, and if they are not too frequent and not too large, we recognize that eventually the desired forward progress will be made.)

Finally, a few words about the *names* of the workouts. A distinct lack of imagination will be quickly noticed. The overall program is referred to simply as "The Training Plan", and different workouts are grouped into categories ranging from Level 1 (most intense) to Level 4 (long duration, low cadence). This is preferable to using terms such as "steady state", "anaerobic threshold", "lactate tolerance", etc. which are generally misleading or just plain wrong. Names that simply describe the workout rather than misidentifying physiological energy systems would be preferable, but as it turns out, "Short Intervals of 250-1000 Meters Duration Totaling Approximately 4000 Cumulative Meters At An Intensity At Or Below Race Pace" can be pretty awkward, so let's just stick with "Level 1".

Details of the Plan

A typical week's training will consist of nine water and/or erg workouts of various types (supplemented by two lifting sessions). The entire Plan can be thought of as a pyramid, with the apex consisting of Level 1 workouts and the base made up of Level 4 workouts. The intermediate strata are composed of Level 2 & Level 3. The entire purpose of the Level 4 and other underlying levels is to support the apex, or Level 1. We will begin there and work our way down.

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Level 1

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As prescribed by the Overload Principle (the fundamental Principle of Training), we must continually challenge ourselves to stimulate further improvement. Furthermore, according to the Specificity Principle, our training must be performed while doing the activity at which we compete, and periodically we should train *at the specific intensity* at which we compete. Therefor Level 1 workouts are the backbone of the Training Plan. These workouts are critical to develop true racing speed, and are performed at intensities of 95-105% of competitive 2K pace (expressed as m/s). But as effective as they are, they are very demanding and require significant recovery to realize their full benefits. As a result, we will only perform Level 1 workouts once a week (every other week in September and October). These workouts will only make up approximately 3-4 % of the total meters we row. The basic format is to row intervals as short as 250m to as long as 1000m (and rarely,

slightly longer). The total number of meters in one workout should add up to about 4000. (This figure is determined simply by doubling the competitive distance of 2000 meters and seems to give the best overall results, but smaller distances totaling as little as 1500m can still be very effective if circumstances require a shorter workout.)

For reference, a typical Level 1 workout is **8 x 500m.** Other common variations include **4 x 1K** and a **4K Pyramid** (250m/500m/750m/1K/750m/500m/250m). The most important factor is to maintain the proper *high intensity* over the duration of the workout. The *minimum* (i.e., slowest) acceptable intensity for this workout at the beginning of the (fall) season is the average 500m pace from your personal best 2K test. In other words, if your best 2K to date is 7:15.0, your average 500m split is 1:48.8, and that would be the *slowest* pace at which you would complete the 8 x 500m (or other Level 1) workout. Go faster if possible, but don't attempt to force the pace too much. Let it develop naturally over the winter, and you will be encouraged to push the envelope more as spring approaches. The suggested goal pace refers to your *average* pace for the entire workout. There will be some fluctuation of pace from piece to piece, but fluctuations should not be too large. We will discuss pacing strategy for all workouts in more detail a little later, but the basic idea is to be consistent, and be smart, so you are able to finish strong.

Since all Level 1 workouts are performed using the Interval format (after all, how could you do a Continuous 4000 meters at 2K intensity?), it is also necessary to consider the *recovery* intervals that follow the work intervals. The distance and intensity of recovery intervals will be prescribed for each workout, just as the work intervals are. A key term to understand is the process of *active recovery* (distinct from *passive* recovery, which is simply becoming totally inactive). The idea is to finish a work interval, say 500m, and after a few seconds of catching your breath and recording your score, to immediately reset the monitor for the recovery distance (for Level 1 workouts, generally the same distance as the previous work interval). At a low rating (16-18spm), row at the designated minimum recovery intensity. (Consult the Level 4 Pace Chart to find your warm-up/recovery intensity based on your 2K PR.) Active recovery after high-intensity work promotes faster and more complete recovery and minimizes fatigue by increasing circulation and promoting the removal of metabolic waste products. This is critical when attempting to maintain high performance during high-intensity training. It is important to feel fairly recovered as each piece starts (though you may quickly lose that feeling as each piece progresses). Therefore, it would be better to recover a few seconds too many than too few when performing Level 1. However, it is important to be consistent from workout to workout so as to avoid artificially improving your times by extending your recovery periods. In general, you should expect to finish your last work interval about 40' after beginning your first interval when performing Level 1 workouts.

Level 2

Level 2 workouts are similar to Level 1 in that they are fairly high intensity (~ 90-95% 2K intensity). The duration of each piece is a little longer (generally 1500m-3K) and the total meters for the workout almost twice that of Level 1 (usually 7.5K, give or take 500m). This would be ~ 6-8% of the training distance for one week. Typical workouts include **5 x 1500m; 4 x 2K;** and a pyramid of **3K/2.5K/2K**. We will do Level 2 workouts once per week (once every other week in the fall, alternating with Level 1). The minimum or slowest pace for Level 2 when beginning the season is roughly 2K PR pace * 1.08. For example, if your 2K PR is 7:11.0, your 500m split is 1:47.8. Convert this # to seconds and multiply by 1.08:

107.8 * 1.08 = 116.4, or 1:56.4/500m. You should be able to average this pace over the entire workout. As your fitness improves, simply note your performance on past workouts and attempt to improve during the season. Active recovery intervals will be prescribed for each workout, the recovery intervals generally being a little shorter than the work intervals (for example, 2000m work → 1500m recovery).

Level 2 workouts are perhaps the most psychologically demanding in the Training Plan. Anybody can punch it out for 500m, but to keep up the intensity for 2 or 2.5K takes guts. These workouts are crucial for training your mind as well as your body.

Level 3

Level 3 workouts are generally continuous in nature (though occasionally the interval format is used), performed at a consistent pace for a total duration of ~ 12K. The intensity is ~ 85-90% of 2K velocity. The focus is on endurance more than speed, though a shorter Level 3 workout can approach Level 2 intensity. Level 3 workouts are typically performed 2-3 times/week, accounting for ~ 22-25% of total training meters. Sample workouts include **Continuous 12K** (beginning at shorter distances in the fall and progressing to even longer distances by spring); **2 x 6K** (with 7-8' recovery between pieces); and **15 x 3'** (with 1' recovery between pieces).

Level 4

For someone just being introduced to the Training Plan, Level 4 workouts will require the most explanation. These workouts make up the greatest proportion of total meters rowed, accounting for ~ 65-70% of training volume. Intensity is generally ~ 80-90% of 2K. Level 4 workouts are unique and contain a few features the other Levels do not. In the first place, stroke rating is always strictly prescribed, whereas rating for Levels 1-3 vary somewhat from person to person. The ratings are fairly low, beginning at 16spm and occasionally reaching 24 or even 26spm, but most ratings will be in the 18-22 range. On the water or on the erg, these workouts can be used to develop timing & rhythm as well as conditioning, since all rowers must follow the same cadence. But the primary physiological benefit is to develop not only endurance, but also strength and *power per stroke.* Another important benefit is to develop a very accurate sense of pacing. Still another potential benefit that encompasses psychological as well physiological and neurological adaptation, is that by learning to produce a given power output at lower ratings, it should be possible to eventually produce the same power output using a higher rating, creating a decreased perception of effort. In plain English, that means that even though you are performing the same amount of work on the oar, it feels easier and you are more likely to hold the pace longer.

Another feature of Level 4 is that goals for 500m splits and distances covered in a given time period are very explicit and individualized. First, let's look at some sample workout formats and how an individual workout is structured. Level 4 workouts range from **40-70'** of continuous effort. Other variations include **2 x 40'** (with 6-7' recovery between pieces) and **4 x 10'** at a proportionately greater intensity (with recovery intervals of 3' 20"). Each piece will be subdivided into segments of either 10' or 6' length, so a 40' workout may be thought of as 4 consecutive 10' pieces with no recovery. Consult the chart labeled "Level 4 Sequence Formats" to see descriptions of various 10' & 6' segments. For example, two common sequences in the fall are referred to simply as "176" and "180". The numbers refer to the total strokes in the sequence and are a way of quantifying the overall intensity of the piece. The higher the number, the more difficult the sequence. The

Sequence Format chart also explains the stroke rate changes during the piece. For example, "180" involves 4' @ 16spm, followed by a shift for 3' @ 18, then 2' @ 20, and finally 1' @ 22. In the fall, a 40' Level 4 workout may be described as "176, 180, 176, 180" and you would begin by completing a 176 sequence and segue immediately into a 180, then a 176, and finally another 180. The total # of strokes for this piece would be 712, and the average spm = 17.8. As the season develops and fitness improves, a 40' piece will become more difficult as sequences with more strokes are used (for example, "188, 200, 196, 200" = 784 total strokes, an average of 19.6 per minute). A typical rate of progression is to add 4-8 strokes to a given time frame per workout, so 40' might go from 720 → 724, and 60' from 1092 → 1100.

So, each Level 4 workout is formatted by its ratings structure and quantified by total number of strokes. Another way of quantifying intensity that is specific to each athlete is pace (500m split) *per stroke rate.* This means that while everybody will be doing the same workout in terms of number of strokes, each person will be expected to cover a different distance for that given stroke total. The expected distance will be a function of each athlete's personal best for a 2K test. The first thing to do is calculate your 2K PR 500m pace, rounded to the nearest whole number. (Example: 2K PR = 7:11.3 → 500m pace = 1:47.8 → round off to 1:48.) Next, consult the chart labeled "Level 4 Pace Chart". Locate your 2K PR pace in the left-hand column, and read across to find your prescribed pace at various ratings. For example, if your 2K PR pace is 1:48, your 500m split when rowing at 16spm should be 2:15; at 18spm, 2:10; at 20, 2:06; at 22, 2:01; and so on. (Also note the minimum *warm-up/recovery pace* is designated at 2:32.) This does not mean that *every* single stroke you take at 16spm will show "2:15" on the monitor. For that matter, your stroke rating will occasionally vary slightly around an *average* of 16 (or whatever) during a particular segment of a particular piece. But it is important to become familiar with your paces as soon as possible, and develop as much accuracy and consistency as you can. The distance (total meters) you should cover during a given sequence, if you hit your goal paces exactly, can be determined by looking at the chart called "Level 4 Distance Chart". (There are separate charts for 10' and 6' sequences.) For example, if your 2K pace is 1:48, according to the Distance Chart you will cover 2288 meters during a 176 sequence and 2305 meters during a 180. You will be provided with a Record Sheet to record both your *goal* and *actual* meters for each segment of each workout. This will enable you and the coaches to chart your progress and see how consistent you are during specific sequences.

Since your 2K PR pace as well as your Level 4 goal paces and distances are all calculated with a certain amount of rounding off, your numbers may vary slightly from what is expected. But with a little practice you should be able to come very close to hitting the numbers you want. The most important thing is to develop consistency within the framework of your own workouts. As with all the workouts in the Plan, it's okay to exceed your goals if it comes naturally, but don't feel obligated to force the pace beyond the goal. Baby steps, baby steps. If this is your first year on varsity and you are following the Plan for the first time, your rate of improvement will probably be greater than that of a senior. If you reach a point where your totals are exceeding the goal of the *next* 2K pace on the Pace Chart, you will be reassigned a new 2K pace for reference. Otherwise, you will probably keep the same 2K reference pace you use at the start of the season, even if your actual 2K PR improves (as it will!) during winter testing. But this will depend on the circumstances of the individual.

A couple other comments about Level 4:

Workouts are designed to be continuous, but 70' can be a long time and sometimes a workout will be interrupted. Of course, on the water it is unlikely you will be able to row 70' continuously without having to turn the boat. From a *physiological* standpoint, a brief interruption will not

lessen the benefits of the workout. Just try to complete the sequence in progress, then turn without wasting time and resume rowing as quickly as possible. On the ergometer, it is *strongly* urged you row each piece continuously unless absolutely unavoidable (nature does sometimes call at an inopportune moment). If your workout should need to be interrupted, simply record the meters for each of the sequences already completed, take care of business, and then reset your monitor for the time remaining. Again, this is for *emergencies* only.

Nothing good will come of stopping a workout every time your butt itches or you want to change the CD in the boom box. We want to be mentally tough and able to focus for an entire workout, and every time you interrupt a workout before it's completed makes it that much easier to stop the next time.

Another point regarding Level 4 workouts is to reiterate the importance of developing consistency on the erg, and then applying that consistency to workouts performed on the water. On the water there is much less feedback regarding actual performance vs. your perception of effort. You want to be able to apply the same pressure to the oar at a given stroke rate, whether during the 1st minute or the 70th minute of a piece.

Other Training Factors

More About Stroke Rate: Ratings during Level 4 are designated as part of the workout**,** but for Levels

1-3 athletes should select ratings most comfortable for them and allow ratings to develop naturally, without too much conscious thought. In general, ratings for Level 3 will probably be in the range of 24-28; Level 2, 26-32; and Level 1, 30-36. These numbers may be even higher at the end of the year as maximum fitness is reached. A general rule of thumb is if an athlete can reach her goal at a lower rather than a higher rating, good. That leaves more room to improve. If an athlete must row excessively high to reach her goal early in the season, there will be problems later. (Lack of strength is probably a factor and could be addressed specifically during other conditioning portions of the overall training season.) On the other hand, if an athlete's paces are stagnating during different workouts, she may need to consciously work on bringing the rating up. Finally, note that ratings on the ergometer don't translate exactly to ratings on the water (it should be easier to achieve higher ratings in a shell since the hull runs out under the crew during the recovery). But ratings on the ergometer should be in the general ballpark of ratings on the water for a given workout. An athlete who can do 8 x 500 on the erg at a 1:44 pace while rowing at a 22 is pretty impressive, but if she can't produce that power at a 36 while in an eight, she won't be helping anybody win races.

About *Drag Factor* (Resistance): The resistance encountered while using the Concept II ergometer varies as a function of the flow of air through the flywheel during the stroke (more air means a "thicker" fluid and more resistance). The airflow can be controlled by adjusting the damper to the right of the flywheel, and a setting of 3-4 is generally appropriate for female athletes. The optimal setting varies from person to person as a function of strength and overall fitness. A given flywheel damper setting does not always correspond to a given resistance, however, due to variations in individual ergs (dust in the fan, etc.) and variations in the environment (such as barometric pressure or wind). The erg monitor can numerically quantify the resistance by calculating the *drag factor*. (Simultaneously press "OK" and "Rest" and the drag factor will appear in the lower right corner of the monitor. Adjust the damper setting to get the desired resistance. For greatest accuracy,

calibrate while pulling approximately a *2:15* split.) Generally, a number around *120* is appropriate for female athletes, but the ideal # would vary for any individual. Now, there is some concern that athletes may select a drag factor that is inappropriately high (creating an increased risk of injury) in an effort to maximize performance. Concern is especially great for Level 3 & 4 workouts, where low ratings and long duration create proportionally greater stress to tissues susceptible to injury. As a matter of policy, always adjust drag factor to ~ 115 for Level 4 and ~ 120 for Level 3. Levels 1 & 2 may be set at your discretion to maximize your performance, but use good judgment.

Warm-Up and Cool Down: To achieve optimal performance during a workout, it is important to prepare by warming up thoroughly before starting the workout. On the ergometer, this would mean a *minimum* of

8-10 minutes for a Level 4 workout, and 15-20' for Level 1. The shorter and more intense the workout, the longer the period of preparation. Include several minutes of low-intensity low-cadence rowing at your designated warm-up intensity, interspersed with an occasional power 10 or 20. After completing the warm-up, before starting the actual workout, you should be sweaty and breathing harder than at rest. Warm-up is necessary to give your circulatory system time to open up capillaries in the active muscle, to allow your heart rate and stroke volume to expand, to begin the sweating (cooling) process, to mobilize your energy stores and activate the necessary metabolic pathways, etc. Next to poor pacing strategy, probably the most common reason athletes under-perform during workouts or while racing is failure to properly warm up. Let's not sacrifice the benefits of so much hard work by ignoring so simple a process.

When the workout is completed, you should allow your body the opportunity to adjust gradually to the change in conditions. As discussed under *active recovery*, maintaining a modest intensity for several minutes after the workout will help minimize the fatiguing effects of the workout. The amount of time required is somewhat inversely proportional to the length of the workout. After a long Level 4 workout, 5' may be enough, but 15-20' may be required after a Level 1. This might include a low-number Level 4 sequence. Allow your heart rate and respiration rate to return to nearly resting levels before proceeding to stretching.

Pacing: This topic will be addressed in many ways at many times throughout the year, since it will have enormous impact on the overall success of the Plan and the outcomes of races. We should consider the proper pace for a single piece, all pieces within a workout, all workouts within a week, all weeks within the year, etc. And most important, the proper pace to achieve maximum results for a 2000-meter race! In a nutshell, the most efficient and effective way to expend a finite amount of metabolic energy is to do so at a consistent output. For example, if you were truly capable of performing a 2K erg test in 7:00, the best strategy would be to settle *immediately* into a 1:45 pace and hold it until the test is completed. Setting off at an unrealistically fast pace results in the situation commonly referred to as "fly & die": the athlete pays for the rash act by being forced to endure a disproportionately greater accumulation of metabolically fatiguing byproducts, and the pace gradually fades (and fades and fades…) This is as painful for a coach to watch as it is for an athlete to experience. The opposite strategy would be to row conservatively in the beginning, gradually picking up the pace throughout the test. This allows the athlete to put the hammer down at the end, and would probably result in a faster time than the Fly & Die strategy. But it's not optimal because there is too big a deficit to overcome due to the slow start.

The ideal compromise, therefor, is to race at some consistent "optimal" pace. The trick is discovering *what* that pace is. That is a big part of what we will accomplish this year, both for individuals on the erg, and entire crews on the water. As the year progresses, we will move closer and closer to that ideal race pace and work on holding it consistently from beginning to end. Early in the season, as you begin performing workouts on the erg and recording scores, it's perfectly acceptable (in fact, encouraged) to be a little conservative. Give an honest effort on your first piece of the day, but it should never be your fastest.

For example, an athlete's first 8x 500m workout may look like this:

1:47.2, 1:47.0, 1:47.0, 1:46.9, 1:46.8, 1:46.5, 1:46.3, 1:45.1 (average = 1:46.6)

Next time, she would begin with the first pieces closer to the previous average, and attempt to bring the overall average down 2-3 tenths. The above performance is in contrast to an undisciplined athlete who might do something like: 1:44.5, 1:46.0, 1:46.6, 1:46.4, 1:46.9, 1:47.9, 1:52.4, 1:49.5

The more fit & experienced you become, the smaller the variation between pieces. We also want to minimize variation *within* pieces. Each 500m piece should begin with a couple rapid hard strokes to get the wheel spinning, then settle right into a consistent pace. It is not effective training to begin each piece at 1:39 and finish at 1:50, even if on paper you achieve your goal of 1:45. The concept of minimal variation between and within pieces also applies to Level 2 (e.g., 5 x 1500m), as well as sub-intervals within continuous pieces. You may be asked to record the 2K splits within a 12K piece, and the overall progression should be fairly even, with a slight trend toward getting faster, rather than a gradual decline or a bell-shaped curve. When doing a Level 4 workout, the distances for a given sequence (e.g., 180) should show the same pattern.

Poor pacing strategy during an erg test or race will result in serious under-performance. It is a sign either of inexperience or mental weakness (and you will have plenty of experience by the time the testing and racing portions of the season arrive). An athlete who is afraid of performing poorly on a test will often go out much too hard as a way of sabotaging her own test. The results will fall short of expectations, but at least she can say "Hey, I went for it!" This attitude is unacceptable. Going for it means going for *your* pace, not someone else's or some unrealistic and ultimately unattainable pace. True mental toughness means having the discipline to not be overcome by adrenaline at the start, and holding back just enough to settle into a pace that, if held, will end up challenging your will to live by the end.

To emphasize one of the points made earlier: our goal when racing is to set a fast pace at the start, hold it in the middle, and still finish strong at the end. In a true dogfight of a race, the victory will most likely go not to the crew who sprints the most, but who fades the least. By training effectively, we expect to have a lot of fight in the dog and to not be the crew that fades.

Calculating Paces: In most cases, you will not need to calculate any information pertaining to your workouts. An erg or a coach will do it for you. However, it's nice to be able to if necessary (for instance, you lose information from your monitor before recording it). Two helpful calculations are to determine the average 500m pace for a given distance or time, and to project time or distance from a given 500m pace.

To determine 500m pace from any workout, divide the total number of seconds by the total number of meters, then multiply by 500. Example: row 12K in 48:33.6. What's the average pace?

1. Total # of seconds = (48 * 60) + 33.6 = 2913.6
2. Total # of meters = 12, 000
3. 2913.6 ÷ 12,000 = .2428 → .2428 * 500 = 121.4, or **2:04.1**

Second example: row for 60', cover 13,098 meters. Average pace?

1. Total # of seconds = 60 * 60 = 3,600
2. Total # of meters = 13,098
3. 3600 ÷ 13,098 = .2749 → .2749 * 500 = 137.4, or **2:17.4**

To project *time* from pace, multiply *seconds per meter* by *total meters.* Example: I rowed 12K @ 2:04.1, but I lost the total time. How long did I row?

1. 2:04.1 = 124.1s/500m = .2482
2. .2482s/m * 12,000m = 2913.6s, or **48:33.6**

To project distance from pace, multiply *meters per second* by *total seconds.* Example: I rowed @ 2:17.4 for 60'. How far is that?

1. 2:17.4 = 500m/137.4s = 3.639m/s
2. 3.639m/s * 3600s ~ **13,100m** [some accuracy lost b/c rounding]

Record Keeping: As mentioned, accurate record keeping is essential to the Plan. It is necessary to be able to look at scores and chart individual and team progress. You will be provided with a Record Sheet prior to the start of each week of practice. (A sample is provided.) Be sure to record the specific information required: **time, distance,** or **pace.** For Level 4 workouts, you are asked to record your *goal* as well as your *actual* meters. Please be sure to properly set your erg monitors to record the designated *sub*-interval when necessary. The default intervals are 2:00 (time) and 500m (distance). If you are going to do 60' Level 4 with 10' sequences, begin by setting the monitor for 60' as normal. Then simultaneously hold down "OK" and "Time"; a flashing "2:00" will appear. Use the "Set Digits" keys to customize the sub-intervals to 10'. When this is accomplished, press "OK" a second time. The monitor should now show the total 60' time, and you are ready to begin. The same method is used to customize for distance. If you are rowing 12K and are asked to record paces for 2K sub-intervals, begin by setting "Meters" at 12K as usual. Then simultaneously hold "OK" and "Meters" till the flashing "500" appears, adjusting until the desired distance is set. Finish by pressing "OK" again. To recover the sub-interval information after completing the workout, press the "M" (for Memory) key until all information is recorded (use the "Display" key as usual to change the screen to "total", "pace", etc.) The last sub-interval appears first and information is presented in reverse order. You can scroll through as often as necessary. Even if you accidentally

shut off the monitor or it shuts off on its own, you should be able to turn it back on and retrieve the information, as long as another workout has not been performed on that erg. You can recover partial information from an incomplete piece using the "M" key. If you must leave the erg in the middle of a long Level 4, for example, and want to record the sequences you have completed, begin by pushing "Off" to clear the screen, then "On" (all zeroes will be visible). Next push "M", and information for the last *complete* sub-interval will appear. Scroll back to record information for all completed sub-intervals. Please be sure to make a note on your Record Sheet that your workout was interrupted (we don't need to know the details), indicating where the break occurred.

A typical comment written on Record Sheets in the past has been, "The monitor wouldn't give me that information." It will if you set it and ask it correctly! Once you have completed a training week, you will transfer all of your workout data from your personal sheet to the official team training log kept in the erg room. Please record your information *neatly, legibly,* and *promptly!*

It is assumed your recorded scores will be true and accurate representations of your workouts. The intent is to give you as much flexibility in performing workouts as is practical, and your coaches aren't interested in spending valuable time validating your scores. Nobody will question the scores you submit (unless an actual recording error is suspected). The Plan could not be implemented without trusting athletes to keep honest records of their training. It is likely that in the past an athlete or two has abused this trust and submitted a score for a workout that wasn't completed or altered the score of a completed workout. Ultimately that can only harm and not help the athlete. We do not plan to say any more on this subject.

Overtraining & Taper: O*vertraining* is a simple concept. While it is clear that physiological improvement cannot occur without a significant training stimulus, or *overload*, it is equally clear that too much overload can impair rather than improve the athlete. This is most likely to happen when training volume and/or intensity increase in large increments, allowing insufficient time for adaptation. Athletes who are inactive for extended periods of time and jump into a full-scale training program by attempting to do the same workouts they did when in a properly conditioned state are inviting injury and symptoms of overtraining. Two solutions are to 1) not get too far out of shape (maintain some conditioning during the off-season), and 2) progress training volume & intensity at a reasonable rate. Our Training Plan is designed around the cornerstone philosophy of constant but gradual increases in workload, and you have been given fairly explicit guidelines about the minimal level of fitness necessary to begin training in the fall. Furthermore, while it is easy to recognize symptoms of overtraining such as lethargy, irritability, sickness, weakness, etc. it is important to recognize these symptoms sometimes have other causes. Symptoms that are attributed to overtraining may in fact be due to such factors as *under-recovering* or *poor nutrition*. Failing to get adequate sleep or to eat the right foods at the right times can have a serious negative impact on an otherwise well-designed training program.

One ongoing measure the coaches will use to assess the likelihood of overtraining is to monitor progress during training. If one athlete is struggling, that athlete can be counseled to help her deal with whatever difficulties she may be having. If the *entire team* is consistently having trouble reaching its expected goals, it will be time to look at the overall Plan. This reinforces the need for complete, accurate, and prompt record keeping during training.

Tapering is the practice of reducing training volume & intensity prior to competition to ensure peak performance. While it is a common perception among athletes that a taper is necessary to allow maximal performance, this is not clearly supported by scientific research. The benefits of tapering are most evident in situations where athletes were clearly overtraining in the first place. In other words, the benefit is not so much the taper *per se*, but removing the negative effects of overtraining. In situations where training volume and intensity are properly controlled, the effects of tapering are less substantial. Now, this is not to say we won't taper before important tests and competitions. We will. Rest assured that we have your best interests at heart. But some athletes expect a vacation and are disappointed when all they get is a modest reduction in a pretty demanding schedule. The fact is the only noticeable reduction in training will occur during the week prior to NCAAs. And the benefits are probably far more psychological than physical.

Strength & Flexibility: A detailed discussion of these topics is beyond the scope of this document, and you will have access to other specialists and instructors on these matters. But it is worth emphasizing that these are important qualities for rowers, for allowing proper technique and maximal performance, as well as minimizing the risk of injury. Beyond a certain level or threshold, additional strength or flexibility will probably not increase performance, and proportionally we will devote much less time to their development. But lack of strength and/or flexibility may certainly limit performance, and athletes must give the same commitment to optimizing these qualities as to the rest of the Training Plan.

Nutrition & Hydration: It is also beyond the limits of this document to treat these subjects with the thoroughness they deserve, but a brief treatment will be made. A simple and easily comprehended model for proper eating is the *Food Guide Pyramid*, presented by the U.S.D.A. as a guide to daily food choices. This plan emphasizes the need for complex carbohydrates in the form of breads, cereals, rice, and pasta, as well as servings of vegetables and fruits. Also important but in lesser amounts are foods in the dairy and meat/poultry/fish categories. Foods to be limited (not necessarily avoided entirely) are those high in fats, oils, and simple sugars. This model is appropriate for general health (avoiding heart disease, obesity, diabetes, etc.) as well as providing optimal fuel for the elite athlete.

If an athlete is training seriously, performing several strenuous workouts per week, it is unlikely she will need to be too concerned about how much she eats. This is especially true if she makes the right food choices. But do recognize that training is not a license to eat anything, any time. At the other extreme, some athletes compromise their performance by not eating enough, perhaps believing that eating too much will cancel out the benefits of hard work. Remember that food is fuel, and athletes need plenty of high-quality fuel. For anyone concerned about weight management, the proper way to think of food is as an investment in your ability to expend energy. By taking in the appropriate foods in the right quantities at the right time, you provide your body with the means of expending significant amounts of energy during a workout. Starving yourself, or limiting your body's access to fuel, seriously undermines your ability to expend energy during exercise. You become unable to meet your training goals and your metabolic rate is reduced.

One problem faced by serious athletes is figuring out *when* to eat. Timing of meals is a factor that has a significant impact on performance. The busy student-athlete trying to fit morning practice and afternoon workouts around classes, study time, work, etc. does not always prioritize meals, and this may compromise training. An important term to understand regarding nutrition and exercise performance is *glycogen*. This is a complex carbohydrate stored in muscle and is your body's primary source of fuel while training. A well-trained athlete

burns plenty of fat as well, but *nobody* can perform without adequate amounts of glycogen in the muscle. This is why the bulk of your diet should be composed of carbohydrates: your body disassembles the cereals, breads, vegetables, etc. you eat and reassembles the glucose molecules into muscle glycogen. After 60-80' minutes of rowing, your muscle glycogen supply is nearly depleted. It is helpful to eat a high-carbohydrate snack as soon after a workout as possible, since your muscles are most efficient at restoring glycogen at this time. Sometimes athletes will not perform well because they are literally "out of gas", having failed to restock their muscle glycogen after the previous workout. It may also be helpful to have a small snack shortly before a workout, but there is a lot of individual variation regarding effects and tolerance. One thing to avoid is a snack of sugary, quickly digested foods in the 60' or so just before working out. If the meal is broken down too quickly, large amounts of glucose appear in the blood, triggering a large surge of the hormone *insulin,* which removes sugar from the blood. This results in what has been described as a "sugar crash", leaving you in a low energy state which is not conducive to a productive workout. Once exercise begins, the release of insulin is suppressed, so ingesting simple sugars 5-10' before exercise, or during exercise, is not likely to be a problem. Items like a banana, orange, commercial sports food, etc. may be helpful in supplementing your muscle glycogen stores during a long workout. (Be warned that sugary foods or drinks ingested during exercise may promote diarrhea.) The ability to tolerate foods before or during exercise without symptoms such as cramping or gastrointestinal distress is highly variable, so use caution when experimenting with your personal limits. A primary message here is you need to *plan* to eat right so that meals complement your training as advantageously as possible. This may mean preparing meals in advance to eat when possible, while riding the bus, while studying, during lecture (if appropriate), and so forth. Sometimes a week's worth of meals may be prepared on a Sunday afternoon to be available during the busy week. This is an overlooked but important example of *doing what it takes.*

Hydration, of course, means sustaining an intake of water adequate for maintaining blood volume and sweat capacity during intense training, despite sometimes hot and humid conditions. Most athletes are well educated regarding the dangers of poor hydration during strenuous workouts, and coaches are educated about the need to allow athletes access to water during practice. One aspect of hydration that is not stressed as much as it should be, is the need to be fully hydrated *before* practice. A well-trained athlete can easily sweat at 2-3 times the rate at which water can be absorbed, which means that a poorly hydrated athlete will run into trouble pretty quickly no matter how much water or sports drink is ingested. Make a conscious effort to drink water regularly, especially the 2-3 hours before a workout. Frequent trips to the bathroom are a small price to pay for health & performance.

Qualities of a Champion

Pause now to reflect on what it will take to become a Champion. Training is a huge component regarding success in athletics and particularly rowing. If you remember the movie *Rocky,* a wonderful story that allows us to cheer for the underdog and imagine it is possible to accomplish anything, you must also remember it is essentially a fairy tale. Rocky Balboa is a second-rate out-of-shape club fighter who in the span of a couple of weeks, through sheer force of will, transforms himself into a championship contender. We will be championship contenders, but we can't just wish it to happen, or simply *want* it more than our opponents. It will come with months of solid preparation.

Let us stress once more that the Training Plan is only a guide to help you effectively channel your energies. It is nothing more than a piece of paper and is of no value if you the athletes are not willing to actually do the work. If you were willing to work hard, you would do pretty well

even without this Training Plan. The coaches don't think of the Plan as a "secret weapon" and are not worried about sharing this information with others. We are confident in the ability of the athletes at the University of Michigan to implement the Plan and the values it represents more effectively than other teams we will face.

Let us think about what we mean when we say we are willing to "Do What It Takes". It takes relatively few all-out near-death experiences, with the exception of the season's final erg tests and the grand finals of Championship regattas. It DOES take a consistently strong effort day in and day out, all year long, despite holidays and exam periods and personal difficulties. It DOES take effort to not only accomplish your goals during workouts, but to create a lifestyle outside of practice to allow you to get maximum benefits from training. This means making the sacrifices required to get adequate rest, to eat right, and to avoid negative influences such as alcohol and other illegal or potentially harmful substances. This may mean attending fewer social gatherings, and will definitely mean establishing effective study habits. (Academic success parallels athletic success: continual preparation throughout the semester, not just the nights before big exams or papers are due.)

Hopefully the main point here is obvious. To be able to succeed while making the Supreme Effort during the Championship Final requires countless small efforts throughout the season. These are the little-appreciated but essential requirements of becoming a Champion.

ROW BLUE!

Table 1: Level 4 Sequence Formats

	10' Sequences			6' Sequences			
Strokes	# Minutes	@	Stroke Rate	Strokes (AVG)	# Minutes	@	Stroke Rate
168	2'/2'/2'/2'/2'	@	16/18/16/18/16	100 (16.7)	2'/2'/2'	@	16/18/16
172	2'/2'/2'/2'/2'	@	18/16/18/16/18	104 (17.3)	3'/2'/1'	@	16/18/20
176	2'/2'/2'/2'/2'	@	16/18/20/18/16	112 (18.7)	2'/2'/2'	@	18/20/18
180	4'/3'/2'/1'	@	16/18/20/22	112^ (18.7)	1'/2'/3'	@	16/18/20
184	3'/3'/3'/1'	@	16/18/20/22	116 (19.3)	3'/2'/1'	@	18/20/22
188	2'/2'/2'/2'/2'	@	18/20/18/20/18	124 (20.7)	2'/2'/2'	@	20/22/20
192	2'/2'/2'/2'/2'	@	20/18/20/18/20	124^ (20.7)	1'/2'/3'	@	18/20/22
196	2'/2'/2'/2'/2'	@	18/20/22/20/18	128 (21.3)	3'/2'/1'	@	20/22/24
200^	1'/2'/3'/4'	@	16/18/20/22	136 (22.7)	2'/2'/2'	@	22/24/22
200	4'/3'/2'/1'	@	18/20/22/24	136^ (22.7)	1'/2'/3'	@	20/22/24

204	3'/3'/3'/1'	@	18/20/22/24	140 (23.3)	3'/2'/1'	@	22/24/26
208	2'/2'/2'/2'/2'	@	20/22/20/22/20	148 (24.7)	2'/2'/2'	@	24/26/24
212	2'/2'/2'/2'/2'	@	22/20/22/20/22	148^ (24.7)	1'/2'/3'	@	22/24/26
216	2'/2'/2'/2'/2'	@	20/22/24/22/20				
220^	1'/2'/3'/4'	@	18/20/22/24				
220	4'/3'/2'/1'	@	20/22/24/26				

Table 2: Level 4 Pace Chart

2K pace	Pace per Stroke Rate						2K pace	Pace per Stroke Rate					
	Warmup/ Recovery	16	18	20	22	24	26		Warmup/ Recovery	16	18	20	22	24	26
01:27	02:03	01:49	01:45	01:42	01:38	01:34	01:31	**02:01**	02:51	02:31	02:26	02:21	02:16	02:11	02:06
01:28	02:04	01:50	01:46	01:42	01:39	01:35	01:31	**02:02**	02:52	02:32	02:27	02:22	02:17	02:12	02:07
01:29	02:05	01:51	01:48	01:44	01:40	01:36	01:33	**02:03**	02:53	02:34	02:29	02:24	02:18	02:13	02:08
01:30	02:07	01:52	01:49	01:45	01:41	01:37	01:34	**02:04**	02:55	02:35	02:30	02:25	02:20	02:14	02:09
01:31	02:08	01:54	01:50	01:46	01:42	01:39	01:35	**02:05**	02:56	02:36	02:31	02:26	02:21	02:15	02:10
01:32	02:10	01:55	01:51	01:47	01:43	01:40	01:36	**02:06**	02:58	02:38	02:32	02:27	02:22	02:16	02:11
01:33	02:11	01:56	01:52	01:49	01:45	01:41	01:37	**02:07**	02:59	02:39	02:33	02:28	02:23	02:18	02:12
01:34	02:13	01:57	01:54	01:50	01:46	01:42	01:38	**02:08**	03:00	02:40	02:35	02:29	02:24	02:19	02:13
01:35	02:14	01:59	01:55	01:51	01:47	01:43	01:39	**02:09**	03:02	02:41	02:36	02:31	02:25	02:20	02:14
01:36	02:15	02:00	01:56	01:52	01:48	01:44	01:40	**02:10**	03:03	02:42	02:37	02:32	02:26	02:21	02:15
01:37	02:17	02:01	01:57	01:53	01:49	01:45	01:41	**02:11**	03:05	02:44	02:38	02:33	02:27	02:22	02:17
01:38	02:18	02:02	01:58	01:54	01:50	01:46	01:42	**02:12**	03:06	02:45	02:39	02:34	02:29	02:23	02:18
01:39	02:20	02:04	02:00	01:56	01:51	01:47	01:43	**02:13**	03:08	02:46	02:41	02:35	02:30	02:24	02:19
01:40	02:21	02:05	02:01	01:57	01:52	01:48	01:44	**02:14**	03:09	02:48	02:42	02:36	02:31	02:25	02:20
01:41	02:22	02:06	02:02	01:58	01:54	01:49	01:45	**02:15**	03:10	02:49	02:43	02:38	02:32	02:26	02:21
01:42	02:24	02:07	02:03	01:59	01:55	01:50	01:46	**02:16**	03:12	02:50	02:44	02:39	02:33	02:27	02:22
01:43	02:25	02:09	02:04	02:00	01:56	01:52	01:47	**02:17**	03:13	02:51	02:45	02:40	02:34	02:28	02:23
01:44	02:27	02:10	02:06	02:01	01:57	01:53	01:48	**02:18**	03:15	02:53	02:47	02:41	02:35	02:29	02:24

01:45	02:28	02:11	02:07	02:03	01:58	01:54	01:49
01:46	02:29	02:13	02:08	02:04	01:59	01:55	01:50
01:47	02:31	02:14	02:09	02:05	02:00	01:56	01:51
01:48	02:32	02:15	02:10	02:06	02:01	01:57	01:53
01:49	02:34	02:16	02:12	02:07	02:03	01:58	01:54
01:50	02:35	02:18	02:13	02:08	02:04	01:59	01:55
01:51	02:37	02:19	02:14	02:10	02:05	02:00	01:56
01:52	02:38	02:20	02:15	02:11	02:06	02:01	01:57
01:53	02:39	02:21	02:17	02:12	02:07	02:02	01:58
01:54	02:41	02:22	02:18	02:13	02:08	02:03	01:59
01:55	02:42	02:24	02:19	02:14	02:09	02:05	02:00
01:56	02:44	02:25	02:20	02:15	02:10	02:06	02:01
01:57	02:45	02:26	02:21	02:17	02:12	02:07	02:02
01:58	02:46	02:28	02:23	02:18	02:13	02:08	02:03
01:59	02:48	02:29	02:24	02:19	02:14	02:09	02:04
02:00	02:49	02:30	02:25	02:20	02:15	02:10	02:05

02:19	03:16	02:54	02:48	02:42	02:36	02:31	02:25
02:20	03:17	02:55	02:49	02:43	02:38	02:32	02:26
02:21	03:19	02:56	02:50	02:45	02:39	02:33	02:27
02:22	03:20	02:58	02:52	02:46	02:40	02:34	02:28
02:23	03:22	02:59	02:53	02:47	02:41	02:35	02:29
02:24	03:23	03:00	02:54	02:48	02:42	02:36	02:30
02:25	03:24	03:01	02:55	02:49	02:43	02:37	02:31
02:26	03:26	03:03	02:56	02:50	02:44	02:38	02:32
02:27	03:27	03:04	02:58	02:52	02:45	02:39	02:33
02:28	03:29	03:05	02:59	02:53	02:46	02:40	02:34
02:29	03:30	03:06	03:00	02:54	02:48	02:41	02:35
02:30	03:31	03:08	03:01	02:55	02:49	02:42	02:36

Table 3: Level 4 Distance Chart (10' Sequences)

10 Minute Intervals: Total Strokes, Total Meters

2K pace	168	172	176	180	184	188	192	196	200^	200	204	208	212	216	220^	220
01:27	2794	2815	2832	2852	2871	2891	2908	2932	2954	2957	2977	2989	3013	3039	3069	3063
01:28	2768	2789	2811	2831	2853	2875	2897	2915	2933	2936	2956	2977	2995	3020	3044	3047
01:29	2733	2748	2769	2791	2810	2821	2842	2865	2891	2889	2911	2931	2954	2979	3005	3001
01:30	2708	2723	2744	2766	2783	2794	2815	2838	2864	2861	2883	2902	2925	2950	2975	2972
01:31	2670	2689	2710	2731	2751	2768	2789	2811	2834	2831	2853	2875	2897	2915	2933	2936
01:32	2646	2665	2685	2706	2726	2743	2763	2785	2808	2805	2826	2847	2869	2887	2905	2908
01:33	2623	2642	2656	2674	2691	2708	2723	2744	2763	2766	2783	2794	2815	2838	2864	2861
01:34	2591	2605	2624	2644	2660	2670	2689	2710	2733	2731	2751	2768	2789	2811	2834	2834
01:35	2556	2574	2592	2612	2630	2646	2665	2685	2706	2706	2726	2743	2763	2785	2808	2808

01:36	2534	2552	2570	2589	2607	2623	2642	2661	2682	2682	2701	2718	2738	2759	2782	2782
01:37	2513	2530	2548	2567	2585	2600	2619	2638	2658	2658	2677	2694	2713	2734	2756	2756
01:38	2492	2509	2527	2545	2563	2578	2596	2615	2635	2635	2653	2670	2689	2710	2731	2731
01:39	2452	2468	2485	2505	2522	2534	2552	2575	2599	2597	2617	2633	2656	2676	2700	2697
01:40	2432	2448	2465	2484	2501	2513	2530	2553	2577	2574	2594	2610	2633	2653	2675	2673
01:41	2412	2428	2444	2462	2478	2492	2509	2527	2545	2548	2565	2578	2596	2620	2645	2643
01:42	2393	2408	2425	2442	2458	2472	2488	2506	2524	2526	2543	2556	2574	2597	2622	2619
01:43	2363	2382	2398	2415	2432	2452	2468	2485	2501	2503	2520	2534	2552	2570	2589	2592
01:44	2337	2352	2371	2390	2407	2420	2440	2457	2476	2474	2493	2513	2530	2548	2565	2570
01:45	2319	2333	2349	2367	2382	2393	2408	2429	2450	2448	2466	2480	2501	2519	2539	2540
01:46	2291	2309	2324	2341	2358	2374	2389	2409	2429	2428	2446	2460	2480	2498	2518	2519
01:47	2274	2291	2306	2323	2339	2355	2370	2390	2409	2409	2426	2440	2460	2477	2497	2498
01:48	2256	2274	2288	2305	2321	2337	2352	2371	2390	2390	2407	2420	2440	2457	2476	2474
01:49	2233	2246	2264	2281	2296	2309	2326	2342	2359	2360	2376	2393	2408	2429	2448	2448
01:50	2207	2223	2241	2257	2274	2291	2309	2324	2339	2341	2358	2374	2389	2409	2429	2428
01:51	2190	2207	2220	2236	2251	2266	2280	2299	2316	2318	2334	2345	2363	2383	2405	2402
01:52	2175	2190	2204	2220	2235	2249	2263	2281	2298	2300	2316	2326	2345	2364	2386	2383
01:53	2153	2165	2182	2199	2213	2223	2240	2257	2277	2276	2293	2309	2326	2346	2366	2364
01:54	2137	2149	2166	2183	2197	2207	2223	2241	2260	2259	2276	2291	2309	2328	2347	2345
01:55	2113	2128	2144	2161	2177	2190	2207	2224	2242	2240	2257	2274	2291	2306	2321	2323
01:56	2099	2113	2129	2146	2161	2175	2190	2208	2225	2223	2240	2256	2274	2288	2303	2305
01:57	2084	2099	2111	2125	2139	2153	2165	2182	2197	2199	2213	2223	2240	2257	2277	2276
01:58	2055	2070	2085	2101	2115	2128	2144	2160	2177	2177	2193	2207	2223	2241	2259	2259
01:59	2041	2055	2070	2086	2100	2113	2128	2144	2161	2161	2177	2190	2207	2224	2242	2242
02:00	2028	2041	2056	2071	2086	2099	2113	2129	2146	2146	2161	2175	2190	2208	2225	2225
02:01	2014	2028	2042	2057	2071	2084	2099	2114	2130	2130	2146	2159	2175	2191	2209	2209
02:02	2001	2014	2028	2043	2057	2070	2084	2099	2115	2115	2130	2144	2159	2176	2193	2193
02:03	1974	1987	2001	2017	2031	2041	2055	2073	2092	2091	2107	2120	2138	2154	2172	2171
02:04	1961	1974	1988	2002	2016	2028	2041	2056	2071	2073	2087	2099	2113	2132	2152	2151
02:05	1949	1961	1975	1989	2002	2014	2028	2042	2057	2059	2073	2084	2099	2117	2137	2135

02:06	1929	1944	1957	1971	1985	2001	2014	2028	2042	2045	2059	2070	2084	2103	2122	2120
02:07	1916	1931	1944	1958	1972	1987	2001	2015	2028	2029	2043	2055	2070	2085	2100	2102
02:08	1899	1911	1927	1942	1956	1967	1982	1996	2012	2011	2025	2041	2055	2070	2085	2088
02:09	1887	1899	1912	1927	1939	1949	1961	1978	1995	1993	2008	2020	2036	2051	2067	2068
02:10	1875	1887	1900	1914	1926	1936	1949	1965	1981	1980	1995	2006	2022	2037	2053	2054
02:11	1857	1871	1883	1898	1911	1924	1936	1952	1967	1967	1981	1993	2009	2023	2039	2038
02:12	1846	1859	1872	1884	1897	1911	1924	1937	1949	1952	1964	1974	1987	2004	2021	2020
02:13	1830	1841	1855	1869	1882	1892	1907	1920	1934	1934	1948	1961	1974	1991	2007	2007
02:14	1812	1825	1840	1853	1867	1880	1895	1907	1921	1922	1935	1949	1961	1978	1993	1993
02:15	1801	1814	1826	1839	1852	1864	1875	1890	1905	1906	1919	1929	1944	1960	1978	1975
02:16	1791	1803	1815	1828	1840	1852	1864	1879	1893	1894	1907	1916	1931	1947	1965	1962
02:17	1780	1793	1804	1817	1829	1841	1852	1867	1881	1882	1895	1904	1919	1935	1952	1950
02:18	1759	1771	1785	1799	1812	1823	1837	1851	1866	1866	1880	1892	1907	1922	1938	1937
02:19	1749	1761	1774	1788	1801	1812	1825	1840	1854	1853	1867	1880	1895	1907	1921	1922
02:20	1739	1751	1764	1776	1789	1801	1814	1826	1838	1839	1852	1864	1875	1890	1905	1906
02:21	1729	1741	1751	1764	1775	1786	1797	1811	1824	1825	1837	1846	1859	1874	1890	1890
02:22	1709	1721	1733	1746	1759	1769	1782	1796	1810	1810	1823	1834	1848	1863	1878	1878
02:23	1699	1711	1723	1736	1748	1759	1771	1785	1799	1799	1812	1823	1837	1851	1866	1866
02:24	1690	1701	1713	1726	1738	1749	1761	1774	1788	1788	1801	1812	1825	1840	1854	1854
02:25	1680	1692	1704	1716	1728	1739	1751	1764	1777	1777	1790	1801	1814	1828	1843	1843
02:26	1665	1678	1690	1703	1716	1729	1741	1754	1766	1767	1779	1791	1803	1817	1832	1832
02:27	1652	1663	1675	1688	1700	1709	1721	1735	1751	1750	1763	1774	1789	1802	1818	1817
02:28	1643	1654	1666	1679	1690	1699	1711	1725	1740	1740	1753	1763	1778	1792	1807	1806
02:29	1634	1645	1657	1669	1680	1690	1701	1713	1726	1727	1739	1749	1761	1777	1793	1792
02:30	1620	1633	1644	1656	1668	1680	1692	1704	1715	1717	1729	1739	1751	1766	1782	1781

Table 4: Level 4 Distance Chart (6' Sequences)

2K pace — **6 Minute Intervals: Total Strokes, Total Meters**

2K pace	100	104	112	112^	116	124	124^	128	136	136^	140	148	148^
01:27	1672	1691	1731	1729	1752	1789	1792	1814	1863	1864	1886	1936	1933
01:28	1657	1678	1720	1721	1740	1783	1780	1804	1844	1848	1870	1922	1924
01:29	1637	1655	1688	1691	1710	1754	1755	1778	1825	1826	1848	1895	1893
01:30	1622	1640	1672	1675	1694	1737	1738	1760	1807	1808	1829	1875	1873
01:31	1598	1618	1657	1658	1678	1720	1721	1740	1783	1780	1804	1844	1848
01:32	1584	1604	1642	1643	1663	1704	1705	1724	1765	1763	1786	1825	1829
01:33	1570	1587	1622	1620	1640	1672	1675	1694	1737	1738	1760	1807	1808
01:34	1552	1568	1598	1601	1618	1657	1658	1678	1720	1721	1743	1789	1790
01:35	1530	1548	1584	1585	1604	1642	1643	1663	1704	1705	1727	1771	1772
01:36	1517	1535	1570	1571	1589	1627	1628	1648	1688	1689	1710	1754	1755
01:37	1505	1522	1557	1557	1575	1612	1613	1633	1672	1673	1694	1737	1738
01:38	1492	1509	1543	1544	1562	1598	1599	1618	1657	1658	1678	1720	1721
01:39	1468	1484	1517	1518	1538	1575	1578	1597	1642	1640	1663	1704	1705
01:40	1456	1472	1505	1505	1524	1561	1564	1583	1627	1625	1648	1688	1689
01:41	1444	1460	1492	1493	1509	1543	1544	1564	1603	1606	1626	1672	1671
01:42	1433	1449	1480	1480	1497	1530	1531	1551	1589	1592	1611	1657	1655
01:43	1414	1432	1468	1466	1484	1517	1518	1535	1570	1571	1592	1632	1635
01:44	1399	1416	1448	1451	1467	1505	1503	1522	1557	1557	1578	1618	1621
01:45	1388	1403	1433	1433	1451	1484	1487	1503	1543	1542	1564	1603	1606
01:46	1371	1387	1421	1420	1439	1472	1475	1491	1530	1529	1551	1589	1592
01:47	1361	1377	1410	1409	1428	1460	1463	1479	1517	1516	1538	1575	1578
01:48	1350	1366	1399	1398	1416	1448	1451	1467	1505	1503	1522	1557	1557
01:49	1337	1353	1382	1384	1398	1433	1431	1451	1484	1487	1503	1543	1542
01:50	1321	1338	1371	1372	1387	1421	1420	1439	1472	1475	1491	1530	1529
01:51	1311	1326	1357	1356	1373	1403	1405	1422	1460	1461	1479	1517	1516
01:52	1302	1316	1347	1346	1363	1392	1395	1411	1448	1449	1467	1505	1503

01:53	1289	1304	1330	1333	1348	1382	1382	1400	1437	1437	1455	1492	1491
01:54	1280	1294	1321	1323	1338	1371	1372	1389	1425	1426	1443	1480	1478
01:55	1265	1281	1311	1312	1328	1361	1361	1377	1410	1409	1428	1460	1463
01:56	1256	1271	1302	1302	1318	1350	1351	1366	1399	1398	1416	1448	1451
01:57	1247	1261	1289	1288	1304	1330	1333	1348	1382	1382	1400	1437	1437
01:58	1230	1245	1274	1274	1290	1321	1321	1338	1371	1372	1389	1425	1426
01:59	1222	1237	1265	1265	1281	1311	1312	1328	1361	1361	1379	1414	1415
02:00	1214	1228	1256	1257	1271	1302	1302	1318	1350	1351	1368	1403	1404
02:01	1206	1220	1247	1248	1263	1292	1293	1308	1340	1341	1358	1392	1393
02:02	1198	1212	1239	1239	1254	1283	1284	1299	1330	1331	1348	1382	1382
02:03	1182	1195	1222	1222	1238	1268	1270	1285	1321	1320	1338	1371	1372
02:04	1174	1188	1214	1214	1228	1256	1257	1273	1305	1307	1323	1361	1360
02:05	1167	1180	1206	1206	1220	1247	1248	1264	1296	1298	1314	1350	1350
02:06	1154	1168	1198	1197	1212	1239	1239	1255	1286	1288	1304	1340	1339
02:07	1147	1161	1190	1189	1203	1230	1231	1245	1274	1274	1291	1324	1326
02:08	1137	1151	1177	1179	1192	1222	1221	1237	1265	1265	1282	1314	1317
02:09	1130	1142	1167	1167	1181	1208	1210	1224	1256	1255	1273	1305	1307
02:10	1123	1135	1159	1159	1173	1200	1202	1216	1247	1247	1264	1296	1298
02:11	1111	1125	1152	1151	1166	1192	1194	1208	1239	1238	1254	1283	1284
02:12	1105	1118	1144	1144	1157	1182	1182	1197	1225	1227	1241	1274	1273
02:13	1096	1108	1132	1134	1146	1174	1173	1189	1217	1219	1232	1265	1264
02:14	1085	1098	1125	1126	1139	1167	1166	1181	1208	1210	1224	1256	1255
02:15	1078	1091	1116	1115	1129	1154	1156	1170	1200	1201	1216	1247	1247
02:16	1072	1084	1109	1108	1122	1147	1149	1162	1192	1193	1208	1239	1238
02:17	1065	1077	1102	1102	1115	1140	1141	1155	1185	1185	1200	1230	1230
02:18	1053	1066	1091	1092	1105	1132	1133	1147	1177	1177	1192	1222	1221
02:19	1047	1060	1085	1085	1098	1125	1126	1139	1167	1166	1181	1208	1210
02:20	1041	1053	1078	1079	1091	1116	1115	1129	1154	1156	1170	1200	1201
02:21	1035	1046	1070	1069	1082	1105	1106	1119	1147	1147	1162	1192	1193
02:22	1023	1035	1059	1060	1072	1098	1098	1112	1140	1140	1155	1185	1185

02:23	1017	1029	1053	1053	1066	1091	1092	1105	1132	1133	1147	1177	1177
02:24	1011	1023	1047	1047	1060	1085	1085	1098	1125	1126	1140	1169	1170
02:25	1006	1018	1041	1041	1053	1078	1079	1092	1118	1119	1133	1162	1162
02:26	997	1009	1035	1034	1047	1072	1072	1085	1111	1112	1126	1154	1155
02:27	989	1001	1023	1023	1036	1061	1063	1076	1105	1104	1119	1147	1147
02:28	984	995	1017	1018	1030	1055	1057	1069	1098	1097	1112	1140	1140
02:29	978	990	1011	1012	1023	1047	1047	1061	1087	1089	1102	1132	1132
02:30	970	982	1006	1005	1018	1041	1041	1055	1080	1082	1095	1125	1125