The mile / 1600m presents a unique challenge in determining an ideal training plan for the event. Success in the mile likely requires a variety of physiological components common to both short distances and longer distances – factors such as endurance, strength, speed, a high aerobic capacity, and also a strong anaerobic capability.

Historically, the energy required to race the mile / 1600m has believed to come (approximately) 50% from the aerobic energy system and 50% from the anaerobic energy system. This estimate came primarily from a handful of research studies completed from the 1920s to the 1950s, based on the available measurement techniques of the day.

These numbers appeared for the first time in 1971, and have been widely accepted for years as a basis for training design by coaches and athletes. However, as measurement techniques improved in the 1990s, it became clear that the methods used to determine the original estimates were based on some faulty assumptions. In recent years, several new research studies have examined the contributions of the aerobic and anaerobic energy systems, using newer, more sophisticated techniques. The consensus results appear below:

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>400m</th>
<th>800m</th>
<th>1500m</th>
<th>5000m</th>
<th>10,000m</th>
<th>Marathon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic (%)</td>
<td>18.5</td>
<td>35.0</td>
<td>52.5</td>
<td>80.0</td>
<td>90.0</td>
<td>97.5</td>
</tr>
<tr>
<td>Anaerobic (%)</td>
<td>81.5</td>
<td>65.0</td>
<td>47.5</td>
<td>20.0</td>
<td>10.0</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Table from P.O. Astrand, *Textbook of Work Physiology*, 1971

** These new values indicate that most events, including the mile / 1600m, are much more aerobic based than was previously thought. This finding also matches the applied results that many coaches of elite level milers have also noticed.

**Principles of the “aerobic / strength model” for the mile / 1600m / 1500m**

1) The mile / 1600m / 1500m is primarily an aerobic event.
2) For most athletes, training that focuses on aerobic development (and running economy) will have the largest benefit on mile / 1600m / 1500m performance.
3) Improvements in anaerobic capacity and speed are limited and will affect mile / 1600m / 1500m performance to a smaller extent.

The most common counter argument to this model suggests that athletes need to develop lactic acid tolerance, in order to avoid fatigue / slowing late in the race. However, with the aerobic / strength model, the goal is not to build up a tolerance to lactic acid, but to reduce lactic acid production at race speed by increasing the aerobic energy system contribution.

With the aerobic / strength model, workouts are generally divided into two categories:
1) **Aerobic / Lactate Threshold Development**

Estimating threshold pace from 1600m / 3200m personal bests (from Daniels):

<table>
<thead>
<tr>
<th>1600m PR</th>
<th>3200m PR</th>
<th>Approx. Lactate Threshold Training Pace (per mile)</th>
<th>Difference (1600m PR to Threshold pace)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:20</td>
<td>13:28</td>
<td>7:45</td>
<td>1:25</td>
</tr>
<tr>
<td>6:00</td>
<td>12:52</td>
<td>7:25</td>
<td>1:25</td>
</tr>
<tr>
<td>5:40</td>
<td>12:05</td>
<td>7:00</td>
<td>1:20</td>
</tr>
<tr>
<td>5:20</td>
<td>11:26</td>
<td>6:40</td>
<td>1:20</td>
</tr>
<tr>
<td>5:00</td>
<td>10:43</td>
<td>6:15</td>
<td>1:15</td>
</tr>
<tr>
<td>4:40</td>
<td>10:00</td>
<td>5:55</td>
<td>1:15</td>
</tr>
<tr>
<td>4:30</td>
<td>9:37</td>
<td>5:40</td>
<td>1:10</td>
</tr>
<tr>
<td>4:20</td>
<td>9:18</td>
<td>5:25</td>
<td>1:05</td>
</tr>
<tr>
<td>4:10</td>
<td>9:05</td>
<td>5:10</td>
<td>1:00</td>
</tr>
</tbody>
</table>

Both at Indiana Univ. and with the professional athletes I coach, we have used workouts that focus on lactate threshold improvement as a primary training component. Examples of threshold workouts:

--6-12 mile continuous efforts at (Daniels) LT pace plus 10-20 sec/mile [HS – 4-8 mile efforts]

--3-4 mile tempo efforts at LT pace to LT minus 10 sec/mile [HS – 2-4 mile efforts]

--2-3 x 3k or 2mi at LT minus 10-20 sec/mile [HS – 1-2 mi reps]

--2-3 x 5-8 x 1k at LT minus 20-30 sec/mile [HS – 5 to 8k total volume of 1k reps]

The argument for threshold work:

--Work at threshold allows for the most stimulus to adapt the aerobic system, with the least amount of stress on the legs.

--This allows for multiple threshold sessions to be completed in a week (or better pace on gentle days)

--Instead of viewing training as aerobic and anaerobic, we view our sessions as either “aerobic development” or “leg prep”

**Neuromuscular “Leg Prep” Workouts**

These workouts are used to  a) develop neuromuscular coordination at race pace (NOT faster paces) and  b) develop lower leg (track specific) strengthening -- as opposed to anaerobic development, lactic acid tolerance, or overspeed development. These workouts:

--Recruit fast twitch fibers

--Reinforce mechanics of being on toes

--Provide stress / stimulus for feet, Achilles and calves
Examples of neuromuscular leg prep workouts:

--80-100m strides in trainers or spikes (on grass or track – indoors, use some around turn)
--200m repetitions at 3k-5k pace – continuous jog
--400m repetitions at 3k pace – full recovery
--Single 1k reps (slightly slower than mile pace)
--Single 1500m reps (slightly slower than 1k/1500 pace)

Specific examples of aerobic / strength model of training – Sean Jefferson and John Jefferson

The workouts below detail a nine week block of training that the Jeffersons completed prior to the 2005 Notre Dame Invitational, where they ran 3:56 and 3:57 for the mile. Their training was based on the aerobic / strength model discussed above. A similar pattern of workouts following this model has also been used by Derek Scott (3:57 ’09), Jordan Fife (3:59 ’08), and Eric Redman (4:03 ’07).

It is important to remember that for all four sub 4 min milers, each had a fall (or winter) block of training that was cross country or extended base / aerobic strength training in focus. One common mistake many milers make is starting with quality work too early, without developing an extensive aerobic base.

2004 Summer -- Standard Pattern

After two weeks off, mileage build from 50 mpw in early July, to 80-90 by Sept.
Sun – long run – 20% of weekly volume
One day per week – 20-45 min at threshold tempo – based on “feel”
One day per week – hilly run

2004 Cross Country
Standard Pattern – two week cycles - week 1
Sun – long run – 20% of weekly volume
Mon – gentle + 20x100m strides – 10 trainers/10 spikes (two runs)
Tue – 8-10mi threshold (5:30 to 5:10)
   (late season) – 6mi threshold (5:15) + 3200m (9:00 – 9:10)
Wed - Hill fartlek – 3-5 x 2mi loop with 600m hill
Thur – gentle
Fri – threshold session (2x6x1k 3:10 / 60s / 3min or 3 x 3k at 5:10-5:15 mi pace)
   (late season) – 3 x [3x1k 2:55 / 60 + 2k hill loop 6:40]
Sat – gentle – two runs

Standard Pattern – two week cycles - week 2
Sun – long run – 8mi cutdown in middle 5:45 to 5:15
Mon – gentle + 10x100m strides (two runs)
Tue – 300m neuromuscular turnover reps - 2 x 6 x 300 54 (early season) / 48 (late season) / 60s
Wed - Hill fartlek – 3-5 x 2mi loop with 600m hill
Thur – gentle
Fri – Pre-race
Sat – Race

**Essentially no or very little mileage taper at the end of the season
<table>
<thead>
<tr>
<th>Jefferson</th>
<th>SUN</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THUR</th>
<th>FRI</th>
<th>SAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 5 – Dec 11</td>
<td>LR 14</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>2x5x1k 3:15/60 /3min 10</td>
<td>10</td>
<td>8 (70)</td>
</tr>
<tr>
<td>Dec 12 – Dec 18</td>
<td>LR 16-17</td>
<td>3+7 or 10</td>
<td>2x5x200 32-34 / 400j 12</td>
<td>12</td>
<td>12</td>
<td>2x5x1k 3:15/60 /3min 10</td>
<td>4+8 or 12 (85)</td>
</tr>
<tr>
<td>Dec 19 – Dec 25</td>
<td>LR 16-17</td>
<td>3+7 or 10</td>
<td>2x10x60/60 12</td>
<td>10</td>
<td>3x10min 5:05-15 / 8 min 12</td>
<td>10</td>
<td>4+8 or 12 (85)</td>
</tr>
<tr>
<td>Dec 26 – Jan 1</td>
<td>LT 10@ 5:30 16-17</td>
<td>3+7 or 10</td>
<td>2x5x200 32-34 / 400j 12</td>
<td>10</td>
<td>10</td>
<td>6x1k 3:10 / 60 / 4min + 6x400 62 / 60 12</td>
<td>4+8 or 12 (85)</td>
</tr>
<tr>
<td>Jan 2 – Jan 8</td>
<td>LR 16-17</td>
<td>Strides – trainers 3+7 or 10</td>
<td>2x10x60/60 12</td>
<td>12</td>
<td>3x10min 5:05-15 / 8 min 12</td>
<td>10</td>
<td>4+8 or 12 (85)</td>
</tr>
<tr>
<td>Jan 9 – Jan 15</td>
<td>LT 10@ 5:30 16-17</td>
<td>Strides – Trainers 3+7 or 10</td>
<td>2x5x200 30-32 / 400j 10</td>
<td>12</td>
<td>10 x 100m strides 10</td>
<td>3mi T 5:00-10 + 1k 2:33-35 12</td>
<td>4+8 (80)</td>
</tr>
<tr>
<td>Jan 16 – Jan 22</td>
<td>LR 16</td>
<td>Strides – spikes 3+7 or 10</td>
<td>3x5x400 64 / 60 to 30 / 4min 12</td>
<td>10-12</td>
<td>10 x 100m strides 10</td>
<td>12</td>
<td>6mi @ 5:20 + 3k (8:12 / 8:30) 10 +4 (82)</td>
</tr>
<tr>
<td>Jan 23 – Jan 29</td>
<td>LR 16</td>
<td>Strides – spikes 3+7 or 10</td>
<td>5 x 800m 2:04 / 3-5min 12</td>
<td>3+7</td>
<td>10-12</td>
<td>(SJ) 3mi 14:35 + 8 x 200 28 10</td>
<td>4+8 or 12 (75)</td>
</tr>
<tr>
<td>Jan 30 – Feb 5</td>
<td>LR 14</td>
<td>Strides – spikes 3+7 or 10</td>
<td>12</td>
<td>2x1k 2:50 / 90s + 3 x 400 60 / 400j 10</td>
<td>10</td>
<td>6</td>
<td>Mile (3:56 and 3:57)</td>
</tr>
</tbody>
</table>

Race splits:
Sean Jefferson ('05) 61.3 / 59.8 / 58.4 / 56.9 (3:56.44)
John Jefferson ('05) 61.5 / 60.4 / 60.0 / 57.0 (3:57.86)
Jordan Fife ('08) 61.9 / 60.5 / 60.1 / 56.2 (3:59.75)
Derek Scott ('09) (approx) 61.x / 60.x / 60.x / 56.x (3:57.80)
Eric Redman ('07) 61.8 / 61.5 / 60.5 / 60.0 (4:03.78)