A good multi-fleet regatta has three important goals:

1. Give sailors the preferred courses: usually windward – leeward*
2. Keep fleets separated for safety and competitive reasons
3. Minimize wasted waiting times

*(In planing conditions reaching courses are attractive and somewhat easier for race management.)*

The Challenge:

- The goals are not harmonious.
- Windward-leeward courses tend to bring fleets together, not separate them.
- Congestion among fleets generally forces the RC to finish all fleets before starting any of them for the next race, maximizing waiting times.
Separating fleets at the start

Can rolling starts keep fleets separated?

- Minimum start separation is 3 minutes.
- At start the separation between back of fleet ahead and front of the fleet behind is about a minute less than the difference in start times.
At the finish the separation between fleets depends on quality of the sailors. Slow sailors in the fleet ahead can interfere with the lead sailors in the fleet behind.

- The RC must make a judgement about the likelihood of fleet interference.
- Maximizing the time between start times increases separation (but raises other problems).
- Starting fleets in order of speed increases separation and is usually a requirement.
Separating fleets at the start

How much can we space out starts to keep fleets separated?

- Maximum starting interval is determined by the course.
- Start for last fleet must occur well before first fleet returns to starting area (at least 3 min). This can be a severe limitation.
- For windward-leeward courses across the lake (6 min windward leg) four fleets must use rolling 3 min sequences.

Triangles and trapezoids allow large starting intervals.
Separating fleets on the course

Minimizing when fleets meet

- Fleets cross each other where ever there is two-way traffic.
- Windward-leeward courses maximize fleet crossings.

Example:
- W4 course, four fleets
- Each fleet crosses each other fleet 3 times

<table>
<thead>
<tr>
<th>Fleet 1</th>
<th>Fleet 2</th>
<th>Fleet 3</th>
<th>Fleet 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x2</td>
<td>1x3</td>
<td>1x4</td>
<td>1x2</td>
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<tr>
<td>2x3</td>
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</table>

Total of 18 fleet crossings on this course
Separating fleets on the course

Minimizing when fleets meet

- G and O courses separate upwind and downwind traffic on the first lap so that there are no fleet crossings until the second lap.
- Laps 2 and 3 have the same issues as windward-leeward courses.

Example:
G course, four fleets
Each fleet crosses each other fleet once

1x2 1x3 1x4
2x3 2x4
3x4

Total of 6 fleet crossings
Example:
O course, four fleets
Each fleet crosses each other fleet twice

1x2  1x3  1x4  1x2  1x3  1x4
2x3  2x4
3x4

Total of 12 fleet crossings
Minimizing when fleets meet

- Trapezoid courses have two separate windward-leeward legs which allows separation of fleets.
- Adequate horizontal distance between windward-leeward legs is required for best results.
- Even less than ideal horizontal separation provides benefits over windward-leeward courses

Example:
TO (outer loop) and TI (inner loop) courses, four fleets
Blue and yellow fleets cross each other twice
Red and green fleets cross each other twice
Blue and yellow never cross red or green

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Total of 4 fleet crossings
Box courses create one-way traffic by separating the upwind legs from the downwind legs.

- Start for last fleet must occur well before first fleet returns to starting area (at least 3 min).
- Adequate horizontal distance between windward-leeward legs is required for best results.

Example:
B2 course, four fleets
Clear ahead clear astern issues may occur on across the lake courses

No fleet crossings
## Summary

<table>
<thead>
<tr>
<th>Scoreboard</th>
<th>Start spacing separation</th>
<th>Crossing separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapezoid</td>
<td>★★★★★</td>
<td>★★★★★</td>
</tr>
<tr>
<td>Gold cup</td>
<td>★★★★★</td>
<td>★★★★★</td>
</tr>
<tr>
<td>Box</td>
<td>★★★★★</td>
<td>★★★★★</td>
</tr>
<tr>
<td>Olympic</td>
<td>★★★★</td>
<td>★★★★</td>
</tr>
<tr>
<td>Windward-leeward</td>
<td>★</td>
<td>★</td>
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Waiting Time

Why can’t a race start when the fleet is ready?

- Course is not set
- Starting line needs adjustment
- RC is occupied with finishing another fleet
- Other fleets are in the way

Obviously, the race management team needs to be skilled and agile to set and re-set courses quickly and efficiently.

However, the choice of course and the start-finish line configuration are the most critical determinants in being ready for the next start.
How well does it work when all fleets have to finish before restarting the first fleet?

How long will that take?

Optimal case – 15 min
Typical case – 28 min
Difficulty resetting the course – 45 min

Anecdotal evidence says 25 – 45 minutes.
In order to reduce waiting time we must be able to start the one fleet while others are still racing.

Keys to starting a fleet while others are racing:

• Start line can’t be used as a finish line

• Configuration of the start – finish lines needs to minimize fleet interference

• Course configuration needs to minimize fleet interference
Waiting Time Effect of Start – Finish Configurations

W3,5,7 Courses

Start and finish on opposite sides of the boat

Signal boat mid-course

- Starting boats interfere with boats going upwind, downwind and finishing
- Almost impossible to start a race without interfering with two way traffic.
- Success less likely with increase in number of fleets (more than 2), more boats, and shorter courses.

In all cases where the finish line is different than the start line, extra personnel may be required to take finishes during starts.
On going race

New start

Start and finish on opposite sides of boat

Much better in terms of fleet interferences

- Finishing boats interfere with boats rounding leeward mark.
- Difficult to start and avoid oncoming traffic.
- Success less likely with increase in number of fleets, more boats, and shorter courses. (Very difficult to do with 4 fleets and east west course.)

In all cases where the finish line is different than the start line, extra personnel may be required to take finishes during starts.
**Waiting Time Effect of Start – Finish Configurations**

**W2,4,6 and G Courses**

Signal boat to leeward and right of leeward mark

Start and finish on opposite sides of boat

- Easier to avoid oncoming traffic, but does not eliminate the issue
- Success less likely with increase in number of fleets, more boats, and shorter courses. (Very difficult to do with 4 fleets and east west course.)

Further reduces start / finish interference

On going race

New start

In all cases where the finish line is different than the start line, extra personnel may be required to take finishes during starts.

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Waiting Time Effect of Start – Finish Configurations

W3,5,7 and O Courses

Finish at windward end

Signal boat to leeward and right of leeward mark

Further reduces start / finish interference

• Even easier to avoid oncoming traffic, but still a minor issue
• Requiring finishers to sail the length of the course to leeward undermines many of the benefits of separating start and finish
• Extra boat and personnel needed for finish line.

In all cases where the finish line is different than the start line, extra personnel may be required to take finishes during starts.
Separate start and finish boats and lines

**Excellent solution to fleet interference issue**

- Inner loop(s) fleets are usually clear of leeward mark by the time first fleet is ready to re-start.
- Extra boat and personnel needed for finish line.
- Finishers are well clear of starters below the line.
- Success very likely with up to 4 fleets.
- Large number of boats not a problem.
Signal boat mid-course
Start and finish on opposite sides of the boat

• Starting boats interfere with boats going upwind and finishing
• Difficult to start a race without interfering with the fleet behind or the fleet ahead
• Success less likely with increase in number of fleets (more than 2), more boats, and shorter courses.

In all cases where the finish line is different than the start line, extra personnel may be required to take finishes during starts.
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Mitigating concerns:

- When separation of legs is restricted, the value of trapezoid and box courses is reduced.
- When the full length of the lake is usable, windward-leeward, gold cup and Olympic courses become better than otherwise.
Practical Applications

South (North) wind
Trapezoid course

- Less than ideal width
- Separate mark roundings for inner and outer loops
- Separate finish line allows new starts while others racing

Box course possible
- Go around the rocks
- South wind but not north
South wind
Trapezoid course

• Outer loop is shorter course
South wind
Gold cup or Olympic course

• Length of course allows separation of starts, which enhances possibility of new starts while other are racing.
• 90 degree triangle good for spinnakers, but sharper angle better for planing
Southwest (northeast) wind
Trapezoid course

- Either side of rocks is possible
Practical Applications

Southwest (northeast) wind
Trapezoid course

- Going around the rocks provides ideal separation.

Box course possible with same geometry.
Practical Applications

West (east) wind
Trapezoid course

- Either side of rocks is possible
Practical Applications

West (east) wind
Trapezoid course

- Going around the rocks provides ideal separation.
- In east wind reach leg needs to be as far from Massapoag Ave as possible (just over rock marks)

Box course possible with same geometry.
Practical Applications

Northwest (southeast) wind
Trapezoid course

- Less than ideal width
- Separate mark roundings for inner and outer loops
- Separate finish line allows new starts while others racing

1/7/2016
Southeast wind
Gold cup or Olympic course

- Length of course allows separation of starts, which enhances possibility of new starts while other are racing.
The race management team should get more training and practice before the regatta.

The starting line should not be used as a finish line.

When possible the finish line should be separate from the starting line with a separate boat.

Default course should be a trapezoid with some fleets sailing the inner loop while others sail the outer loop.

Olympic (O) and gold cup (G) courses can be used to provide variety when:
- Only two fleets are racing at the time
- Or the wind is from the south and the reach legs go around the rocks so that the entire lake can be used.
- Or a trapezoid course would have to be so narrow that it no longer successfully separates fleets

Windward-leeward courses can be used when:
- Only two fleets are sharing the course at the time