# Introducing Safe3Step (S3S): A Quality Wins and Power Rating method for selecting at-large teams to the NCAA Division I Men's Lacrosse Championship

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**Abstract**: This document describes a new system for selecting teams for the NCAA Men's Division I Lacrosse championship tournament called "Safe3Step" that was developed in discussions with the NCAA Lacrosse Selection Criteria and Ranking Committee (SCR)[3]. The method employs three steps: (1) evaluate the strength of each team's opponents based on goal differences in all games; (2) award points to each team (quality wins/losses) based on the strength of the opponent and game outcome and (3) employ head-to-head considerations when two teams are adjacent to each other in the order produced by step 2. The objective of this method was to improve on the current Ratings Percentage Index (RPI) method used for selecting teams to the NCAA Divisuon I Lacrosse Championship Tournament.

**Keywords:** At-large selection; men's Division I lacrosse; Power Ratings; goal-differences; quality wins; Ratings Percentage Index; Sagarin; Massey; Colley.

# 1.Introduction

Four years ago, the Lacrosse Selection Criteria and Ranking Committee (abbreviated SCR, herein referred to as the "coaches' committee" or, simply, the "committee") set out to develop a rating system uniquely suited to select teams for the NCAA Men's Division I Lacrosse championship tournament. The committee examined over a dozen potential methods, testing each algorithm against 20 years of data to assess its hypothetical at-large selections. Drawing on years of committee-member experience, the history of sports ranking, and some of the existing academic literature, the committee identified a variety of desirable factors, including:

I. Emphasis on head-to-head and common opponents' records instead of complex analytics.
II. An unbiased, accurate adjustment for teams' strength of schedule.

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[3] The SCR includes the following coaches: Andrew Shay, Yale; William Wilson, Air Force Academy; Ryan Danehy, Mercey; J.L. Reppert, Holy Cross; Matthew Madalon, Princeton; Keegan Wilkinson, Marist; Marc Van Arsdale, Loyola; Chris Wojcik, Notre Dame; Lars Tiffany (Chairman), Virginia; Kevin Conry, Michigan; Doug Murray, Air Force Academy

III. The use of margins of victory.
IV. Minimizing bias and human intervention where possible.
V. Common-sense results.

Safe3Step was one method considered that would replace the existing RPI system for rating teams, which is based on a biased and mathematically flawed Ratings Percentage Index (RPI) and closed-door committees that - despite producing reasonable results leads to a "large amount of speculation, second guessing, and debate each year about [committee] decisions." (Coleman et al. [2010], Colley [2002]) The committee considers a method that integrates a Sagarin-inspired Power Rating[4] (which measures team strength based on goal margins of victory) And quality win/loss evaluation where the points awarded and deducted were based on the strength of the opponent. The stronger the team, the more points awarded from each vctory and likewise, the less points deducted for each loss.

The method aims to be simpler, more objective, and more transparent than the existing selection process, painting a clearer and fairer picture of which teams deserve to participate in the tournament given their performance in the regular season. This method is known as " Safe3Step" or "S3S,"-because it requires 3 steps, (1) the goal margin strength evaluation followed by 2, the awarding or deducting of points based on each opponent's and finally, 3, the head-to-head evaluation for neighboring teams in the strep 2 calculation. This document will describe the Safe3Step method and expand on its merits, chief among them simplicity, transparency, and common-sense results. Another method also considered was called the 'Powerwise' method which describes in detail the potential shortcomings of the current RPI selection process. This method os documented at http://arxiv.org/abs/2508.04919.

# 2. Requirements For New Model

The coaches stated certain requirements for a new model, some beyond the obvious. The common list includes: public acceptance; selections are clearly justified; a new method must cleary be superior to the current method; no surprises with selections; simplicity without compromising accuracy; no gaming the system; results are reproducible such that they are easily verified and can be projected for the remainder of the season; no scheduling advantage; no advantage or disadvantage to playing more or less games; home-away site is considered; and strength of schedule is a strong consideration. Not so obvious is 'head-to-head' is considered; elimination of pods (1-5,6-10, etc.) for quality wins; a team is never punished for defeating a weaker team; games played early in the seasson count the same as games played late in the season; all games, no games deleted; and game scores are considered.

# 3. S3S Three Steps

There are three distinctive steps. They are:

[4] Consult Appendix A for historical context on the development of Powerwise.

(1) Evaluate the strength of each teams using power ratings based on goal margins of victory (game scores). The power rating states that if two teams played each other on a neutral field, the outcome would be equal in goals to the difference in power ratingsa of the two teams.
(2) Teams accumulate or subtract points based on wins and losses but only to the degree of the strength of the opponent. A victory over a strong opponent counts more than a victory over a weak opponent and a loss to a strong opponent subtracts less points than a loss to a weak opponent.
(3) When teams are rated adjacent to each other, head-to-head comes into play where two adjacent teams reverse in their standing if the less team defeats the team rated one step above.

# 4. Calculating S3S Points

Cal;culating power ratings involves solving a large system of linear equations based strictly on game scores and an adjustment for the home-field advantage, iterating until the average difference between two teams' Power Ratings is equal to the expected (or real) difference in scores were those two teams to play, adjusting for the home-field advantage.[5]

Power Ratings implicitly account for strength of schedule thanks to the inclusion of goal differentials. To enable the use of goal differentials, power ratings employ an adjustment (cut-off or goal margin limit) to measured score data intended to disincentivize "running up the score." This merits further discussion.

$$\sum_{i=1}^{n}\sum_{j=1}^{m}(PR_i - PR_j) = \sum_{i=1}^{n}\sum_{j=1}^{m}(score_i - score_j) \mp hfa$$

| **Power Rating Components** |
|---|
| n = number of teams (75) |
| m = number of games |
| PR = Power Rating (0. – 100.) |
| i = team i |
| j = game j |
| Score(i) game score for team i |
| hfa = home field advantage in goals (~1.5) |
| {PR(i)-PR(j)} = difference in power ratings between team(i) and team(j) |

**Table 1**. Power Rating Components

[5] Two ways to account for the home-field advantage include a constant adjustment across all teams in a division (determined by historical data or by some other means) or a team-by-team measure that accounts for the fact that different fields (say, Denver's mile-high stadium) perform differently. We opt for the simpler division-bydivision average to simplify this analysis, but the preferred method is up for debate.

Once the power ratings are computed, we next normalizee them to create a goal offset allocation table in which to determine how many points a team should be awarded or deducted to produce the S3S total score. Table 2 takes the power rating and subtracts it from 99.9 and table 3 then adds 25[6]. In the case of table A2, if Notre Dame played Syracuse, Notre Dame is predicted to beat Syracuse by (99.90 - 95.47) or 4.43 goals.

| Rank | Team | Power Rating | Team Record |
|---|---|---|---|
| 1 | Notre Dame | 99.90 | 10-2 |
| 2 | Virginia | 99.73 | 11-3 |
| 3 | Duke | 97.89 | 13-2 |
| 4 | Penn State | 97.16 | 9-4 |
| 5 | Maryland | 97.12 | 10-5 |
| 6 | Cornell | 96.81 | 11-3 |
| 7 | Georgetown | 96.68 | 12-3 |
| 8 | Michigan | 96.61 | 9-6 |
| 9 | Yale | 96.43 | 9-5 |
| 10 | Princeton | 96.24 | 8-6 |
| 11 | Johns Hopkins | 96.18 | 11-5 |
| 12 | North Carolina | 95.84 | 7-7 |
| 13 | Denver | 95.75 | 10-5 |
| 14 | Army | 95.62 | 12-3 |
| 15 | Pennsylvania | 95.56 | 7-6 |
| 16 | Syracuse | 95.47 | 8-7 |
| 17 | Rutgers | 95.35 | 8-6 |
| 18 | Boston University | 95.09 | 10-4 |
| 19 | Villanova | 94.73 | 10-5 |
| 20 | Richmond | 94.72 | 11-4 |

Normalization involves translating the high rated team to 0.0 and the (99/9-PR) indicates how much the other remaining teams are underdogs to the best team and b y how many goals see table (2).

**Table 2**. Power Rating (PR) Results. Men's Division 1 Lacrosse 2025.

| Rank | Team | 99.9 - PR | Team Record |
|---|---|---|---|
| 1 | Notre Dame | 0.00 | 10-2 |
| 2 | Virginia | 0.17 | 11-3 |
| 3 | Duke | 2.01 | 13-2 |
| 4 | Penn State | 2.74 | 9-4 |
| 5 | Maryland | 2.78 | 10-5 |
| 6 | Cornell | 3.09 | 11-3 |

[6] 25 is aprroximate;y the difference in goal margin between the highest and lowest power ratings

| | | | |
|---|---|---|---|
| 7 | Georgetown | 3.22 | 12-3 |
| 8 | Michigan | 3.29 | 9-6 |
| 9 | Yale | 3.47 | 9-5 |
| 10 | Princeton | 3.65 | 8-6 |
| 11 | Johns Hopkins | 3.72 | 11-5 |
| 12 | North Carolina | 4.06 | 7-7 |
| 13 | Denver | 4.15 | 10-5 |
| 14 | Army | 4.28 | 12-3 |
| 15 | Pennsylvania | 4.34 | 7-6 |
| 16 | Syracuse | 4.43 | 8-7 |
| 17 | Rutgers | 4.55 | 8-6 |
| 18 | Boston University | 4.81 | 10-4 |
| 19 | Villanova | 5.17 | 10-5 |
| 20 | Richmond | 5.18 | 11-4 |

Table 2 illustrates that losing to number 1 Notre Dame will cause a 0 reduction (no penalty) for losing but losing to Denver would cause a teams to loses 4.15 goals. Table 3, below re veals a team that defeats Duke would eatn 22.99 goals but defeating Richmond would only earn 19.92 goals.

**Table 3**. Power Rating Offsets. Men's Division 1 Lacrosse 2025.

| Rank | Team | 99.90 -PR + 25. | Team Record |
|---|---|---|---|
| 1 | Notre Dame | 25.0 | 10-2 |
| 2 | Virginia | 24.83 | 11-3 |
| 3 | Duke | 22.99 | 13-2 |
| 4 | Penn State | 22.26 | 9-4 |
| 5 | Maryland | 22.22 | 10-5 |
| 6 | Cornell | 21.91 | 11-3 |
| 7 | Georgetown | 21.73 | 12-3 |
| 8 | Michigan | 21.71 | 9-6 |
| 9 | Yale | 21.53 | 9-5 |
| 10 | Princeton | 21.34 | 8-6 |
| 11 | Johns Hopkins | 21.28 | 11-5 |
| 12 | North Carolina | 20.94 | 7-7 |
| 13 | Denver | 20.85 | 10-5 |
| 14 | Army | 20.72 | 12-3 |
| 15 | Pennsylvania | 20.66 | 7-6 |
| 16 | Syracuse | 20.57 | 8-7 |
| 17 | Rutgers | 20.45 | 8-6 |
| 18 | Boston University | 20.19 | 10-4 |
| 19 | Villanova | 19.83 | 10-5 |
| 20 | Richmond | 19.92 | 11-4 |

**Table 4**. Translate Power Ratings to Goal Offsets. Goal Offset Allocation Table.

In summary, table 3 established thes points warded for defeating an opponent and table 2 determines the points reduced by a team for losing to each opponent

| Date | H/A | Opponent | Offset | 25.- Offset | HFA | Score | S3S Points |
|---|---|---|---|---|---|---|---|
| 211 | H | Michigan | 3.29 | 21.71 | -0.73 | 17-13 | 20.98 |
| 218 | H | Harvard | 5.96 | 19.04 | -0.73 | 25-21 | 18.31 |
| 225 | H | OSU | 5.41 | 19.59 | -0.73 | 17-6 | 18.85 |
| 304 | H | Richmond | 5.18 | 19.82 | -0.73 | 25-8 | 19.09 |
| 307 | A | JHU | 3.72 | 21.28 | +0.73 | 18-13 | 22.01 |
| 311 | H | Towson | 7.08 | 17.92 | -0.73 | 19-12 | 17.18 |
| 318 | H | Maryland | 2.78 | 22.22 | -0.73 | 13-14 | -3.51 |
| 325 | A | ND | 0.00 | 25.00 | +0.73 | 15-10 | 25.73 |
| 331 | H | Duke | 2.01 | 22.99 | -0.73 | 14-16 | -2.75 |
| 407 | A | UNC | 4.06 | 20.94 | +0.73 | 19-12 | 21.68 |
| 415 | A | Duke | 2.01 | 22.99 | +0.73 | 14-15 | -1.28 |
| 422 | H | Syracuse | 4.43 | 20.57 | -0.73 | 19-12 | 19.83 |
| 425 | A | Lafayette | 8.43 | 16.57 | +0.73 | 20-11 | 17.31 |
| 430 | H | Notre Dame | 0.0 | 25.00 | -0.73 | 12-8 | 24.27 |
| Corr. | 16/14 | 217.69 | | | | | 248.79 |

Finally, table 4 illustrates Virginia's entire schedule and their total S3S index is 217.69 but all teams are normalkized to 16 games and since Virginia only played 14 games, their total is 217.69 * (16/14) or 248.79 -goals.

**Table 5**. An Example of One Team's Summation.

| Rank | Team | Total S3S Points | Team Record |
|---|---|---|---|
| 1 | Notre Dame | 272.27 | 10-2 |
| 2 | Duke | 269.68 | 13-2 |
| 3 | Virginia | 248.79 | 11-3 |
| 4 | Cornell | 229.13 | 11-3 |
| 5 | Georgetown | 228.08 | 12-3 |
| 6 | Maryland | 204.04 | 10-5 |
| 7 | Johns Hopkins | 203.40 | 11-5 |
| 8 | Penn State | 199.32 | 9-4 |
| 9 | Army | 195.51 | 12-3 |
| 10 | Denver | 178.97 | 10-5 |
| 11 | Yale | 178.81 | 9-5 |
| 12 | Richmond | 176.04 | 11-4 |

| | | | |
|---|---|---|---|
| 13 | Boston University | 175.51 | 10-4 |
| 14 | Utah | 170.68 | 12-4 |
| 15 | Villanova | 168.80 | 1-5 |
| 16 | Michigan | 165.21 | 9-6 |
| 17 | Bryant | 161.54 | 12-4 |
| 18 | Delaware | 160.75 | 12-4 |
| 19 | Jacksonville | 152.04 | 12-4 |
| 20 | Lehigh | 151.39 | 10-5 |

**Table 6**. Summing Up All Allocated Points for Wins and Losses. (2023)

# 5. Issues with S3S

The issues with S3S includes the uses a power ratings algorithm based on goal margins which create the possibility of running-up-the score. The most salient feature of S3S is that it safely guards against that becuae of step 2. If a team beats up on its opponent, it reduces the value of defeating that team and thus is not awarded as many points for the win. So, while running up the score increases one's strength evaluation, it does not increase one's s3s index and consequentially its final standing. If however, modifying 3s3 to partially include the power ratings as an option in the final tally, then running-up the score must be somewhat mitigated by provideing a cut-off goall margin of victory. The current method does not consider the power rating in its final assement of points awarded, but it can optionally, be added in which case running-up the score is an issue. Another issue is that power ratings produce a 'point spread' which could encourage gambling. A common problem with all goal margins of vistory algorithms. In addition, any and all mathematical models generally do not include such factors as personnel injuries, weather, team morale and other matters influencing game outcomes .

# 6. Conclusions

(1) The RPI Method is flawed because it is strongly influenced by the strength of a team's schedule and not necessarily the results of a team's performance on the playing field.
(2) The SAFE method provides sportsmanship because it does not allow 'gamesmanship' through scheduling or running up the score.
(3) The SAFE method is a 'risk-reward' system such that the greater the risk, the greater the reward and vice-versa. A team controls its own destiny by winning and not by the outcome of the performance of other teams.
(4) The main difference between RPI and SAFE is that all wins/losses are not equal and SAFE considers the degree of difficulty of the opponent and the site of the game.
(5) SAFE allows forecasting the end results by easily playing 'what if? for the remaining games. There are no surprises on 'Selection Sunday.'

# Appendix A: The Current RPI System.

http://arxiv.org/abs/2508.04919 discusses the major flaws on the Rating Percentage Index. We provide for the sake of completeness a brief discussion of the current Men's Division I Lacrosse Criteria. There are three components to this system:

1. The Ratings Percentage Index (**RPI**)
2. The Strength of Schedule (**SOS**) based on RPI rankings
3. Quality Win/Losses Factor (**QWF**) based on RPI rankings.

The actual full list of Men's Division I Criteria  wich the Selection Committee is governed b y is listed in Table A1. The RPI influence most items listed below.

| | |
|---|---|
| [1] | Strength of Schedule  (SOS) only Top 10 based on RPI |
| [2] | Results of rating Percentage Index (RPI) |
| [3] | Record against teams ranked 1-5, 6-10, 11-20, and 21+ |
| [4] | Average RPI win (average RPI of all wins) |
| [5] | Average RPI loss (average RPI of all losses) |
| [-] | Head-to-head competition |
| [-] | Results against common opponents |
| [-] | Significan wins (defeating higher RPI ranked teams) |
| [-] | Significant losses (defeated by lower RPI ranked teams) |
| [-] | Contest location (home or away( |

**Table A1.** Primary Criteria For Selecting At-Large Teams

The RPI has three components:

**(1) RPI = ¼ * team's record + ½ * opponent's record + 1/3 * opponent's opponent's record**

The first is a team's W-L percentage and the 2nd and 3rd terms reresent the team's strength of schedule. Table A.2 and A.3 illustrate these components.

The problem with both components is that a team's performance measured by a team's winning percentage says nothing about how strong or weak the opponent was and by what degree of difficulty the team had in defeating its opponent and the strength of schedule -of a team is based on a team's opponent and it's opponents which a team has absolutly no control over!

| | | | |
|---|---|---|---|
| Team A | 5 | 3 | 0.625 |
| Team B | 4 | 3 | 0.571 |
| Team C | 2 | 5 | 0.286 |
| Team D | 3 | 4 | 0.428 |
| Team E | 7 | 1 | 0.875 |
| Team F | 2 | 5 | 0.286 |
| Team G | 2 | 5 | 0.286 |
| Team H | 9 | 0 | 1.000 |
| | 34 | 26 | 0.545 |

**Table A2.** W-L Component

**SOS ~~= ¼ * team's record~~ + ½ * opponent's record + 1/3 * opponent's opponent's record**

| Team | SOS | Opponent | Opp-Opp |
|---|---|---|---|
| Air Force | 0.6169 | 0.6637 | 0.5232 |
| Albany | 0.6061 | 0.6238 | 0.5528 |
| Army | 0.5964 | 0.6287 | 0.5316 |
| Bellarmine | 0.5684 | 0.5974 | 0.5103 |
| Binghamton | 0.5416 | 0.5635 | 0.4977 |
| Boston Univ. | 0.5911 | 0.6205 | 0.5322 |
| Brown | 0.5876 | 0.6010 | 0.5608 |
| Bryant | 0.5738 | 0.6132 | 0.4949 |
| Bucknell | 0.5355 | 0.528 | 0.5009 |
| Canisius | 0.4936 | 0.5142 | 0.4524 |

**Table A3.** Strength Of Schedule Component

| Team | RPI | W-L | Opponent | Opp-Opp |
|---|---|---|---|---|
| Air Force | 0.5428 | 0.6471 | 0.5183 | 0.4875 |
| Albany | 0.5041 | 0.3750 | 05634 | 0.5148 |
| Army | 0.5379 | 0.8000 | 0.4963 | 0.5029 |
| Bellarmine | 0.5044 | 0.6471 | 0.4485 | 0.4735 |
| Binghamton | 0.4980 | 0.6249 | 0.4258 | 0.4973 |
| Boston Univ. | 0.5613 | 0.7143 | 05095 | 0.5121 |
| Brown | 0.5271 | 0.4286 | 0.5747 | 0.5306 |
| Bryant | 0.5642 | 0.7500 | 0.5122 | 0.4825 |
| Bucknell | 0.4187 | 0.2308 | 0.4773 | 0.4894 |
| Canisius | 0.3534 | 0.1333 | 0.4216 | 0.4372 |

The SOS appears not only in the RPI but also independently as a standalone component in the election Committee Criteria. Not only is it considered a poorly conceived measure of a team's strength of schedule but it dominates the criteria for selecting at large teams. Finally table A5 and A6 are examples of how the Quality wins and Losses are computed.

**Table A4.** RPI Summation

| | | | |
|---|---|---|---|
| Defeating a | 1-5 | yields | 25 points |
| Defeating a | 6-10 | yields | 15 points |
| Defeating a | 11-20 | yields | 10 points |
| Defeating a | ➢ 20 | yields | 5 points |
| | | | |
| Losing to a | 1-5 | yields | -5 points |
| Losing to a | 6-10 | yields | -10 points |
| Losing to a | 11-20 | yields | -20 points |
| Losing to a | 20 | yields | -25 points |

**Table A5.** Quality Win/Loss Awards/Deductions

| | | | **1-5** | **1-5** | **6-10** | **6-10** | **11-20** | **11-20** | **21-end** | **21-end** |
|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Team** | **Points** | **W** | **L** | **W** | **L** | **W** | **L** | **W** | **L** |
| 1 | Syracuse | 195 | 4 | 1 | 1 | 1 | 4 | 0 | 7 | 0 |
| 2 | Virginia | 175 | 4 | 3 | 1 | 0 | 2 | 0 | 8 | 0 |
| 3 | Duke | 160 | 2 | 2 | 4 | 0 | 4 | 1 | 5 | 1 |
| 4 | Cornell | 115 | 2 | 3 | 3 | 0 | 0 | 1 | 8 | 0 |
| 5 | ND | 115 | 0 | 0 | 2 | 0 | 3 | 1 | 10 | 0 |
| 6 | Princeton | 110 | 2 | 2 | 0 | 1 | 3 | 0 | 8 | 0 |
| 7 | UNC | 89 | 1 | 4 | 1 | 1 | 4 | 1 | 6 | 0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | JHU | 75 | 0 | 3 | 2 | 2 | 4 | 0 | 4 | 0 |
| 9 | Hofstra | 55 | 0 | 2 | 1 | 1 | 3 | 1 | 7 | 0 |
| 10 | Brown | 30 | 1 | 1 | 0 | 2 | 1 | 0 | 10 | 1 |
| 11 | Navy | 30 | 0 | 2 | 0 | 1 | 4 | 2 | 7 | 0 |
| 12 | UMBC | 20 | 0 | 1 | 0 | 2 | 2 | 0 | 10 | 0 |
| 13 | Loyola | 15 | 0 | 3 | 0 | 1 | 2 | 1 | 7 | 0 |
| 14 | Maryland | 10 | 1 | 3 | 2 | 1 | 0 | 3 | 7 | 0 |
| 15 | Harvard | -20 | 1 | 1 | 0 | 1 | 0 | 3 | 7 | 0 |
| 16 | PSU | -25 | 0 | 0 | 0 | 2 | 3 | 1 | 6 | 2 |
| 17 | Colgate | -30 | 0 | 2 | 0 | 1 | 1 | 3 | 8 | 0 |
| 18 | UMass | -30 | 0 | 1 | 1 | 2 | 1 | 2 | 7 | 1 |
| 19 | Bryant | -35 | 0 | 1 | 0 | 1 | 0 | 2 | 10 | 1 |
| 20 | Villanova | -35 | 0 | 1 | 1 | 2 | 0 | 1 | 10 | 2 |

**Table A5.** Quality Win Summations