**Practical Software and Systems Measurement Continuous Iterative Development**

**Measurement Framework**

**Part 2: Measurement Specifications: Team Velocity**

Version 2.1

April 15, 2021

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| **Developed and Published by Members of:** |
| Practical Software & Systems Measurement | National Defense Industrial Association | International Council on Systems Engineering |
|  | NDIA 100 Year logo |  |
| Product No.PSM-2021-03-001 |  | Product No.INCOSE-TP-2020-001-06 |

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PSM Product Number: PSM-2020-06-001

INCOSE Product Number: INCOSE-TP-2020-001-06

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Contents

[8. Measurement Specifications 1](#_Toc70234099)

[8.10 Team Velocity (Team Measure) 1](#_Toc70234100)

List of Figures

[Figure 1: Team Velocity 2](#_Toc70234101)

List of Tables

[Table 1: Sample Acceleration 2](#_Toc70234102)

# Measurement Specifications

## Team Velocity (Team Measure)

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| **Measure Introduction** |
| **Description** | Velocity is a measure of team performance and the amount of work that is completed in an iteration, typically a count of completed story points or equivalent. Velocity calculations can be used to estimate the amount of work that can be accomplished by the team in future iterations and when planned deliveries will be completed. |
| **Relevant Terminology** |

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| Velocity | The average amount of work a team completes in an iteration or release. Used for planning and measuring team performance. |
| Acceleration | Change in velocity across iterations. |

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| **Information Need and Measure Description** |
| **Information Need** | Is the team performing as expected? Does the team consistently meet the anticipated velocity? How much work can be accomplished by the team in a future iteration? |
| **Base Measure 1** | Story Points Completed (integer scale) |
| **Base Measure 2** | Iterations Completed (integer scale) |
| **Derived Measure 1** | Average Velocity = Story Points Completed / Iterations Completed |
| **Derived Measure 2** | Team Acceleration = (Current iteration Velocity – Reference Comparison iteration Velocity) / Reference Comparison iteration VelocityNote: the Reference Comparison iteration Velocity may be calculated as the Average Velocity across all teams, or by setting a goal for all teams to meet. |
| **Derived Measure 3** | Average Acceleration = Sum (Team Acceleration 1 …Team Acceleration N) / N |

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| **Indicator Specification** |
| **Indicator Description and Sample** | In Figure 1, Story Points Completed is graphed for each iteration [dark blue bars]. Average Velocity is then graphed as of each iteration [red line] based on last 4 iterations (4-iteration rolling average).Figure 1: Team Velocity

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| Table 1: Sample Acceleration |

Iteration 4 had a significant drop in velocity, followed by a large increase in iteration 5. This was due to several stories in iteration 4 that had defects. These defects were resolved in iteration 5, along with the completion of the iteration 5 assigned stories. Velocity improved and became more consistent after iteration 5, as the team became more experienced. This team established a consistent velocity after iteration 6.Changes in velocity across iterations can be analyzed in more detail using acceleration measures. For instance, in Table 1, Teams 1, 2 and 5 show significant positive acceleration, which is typical for early iterations. Team 3 shows a dramatic drop, which should be analyzed to determine if there is a problem. Team 4 shows no variation, which may suggest a reporting anomaly. |
| **Analysis** **Model** | Do we have a consistent velocity? Why is the velocity changing over time? Based on past performance, is the average team velocity adequate to complete defined features allocated to this team? Variations may occur due to vacations, sick leave, changes to team size/composition, or implementation difficulties. |
| **Decision Criteria** | Velocity of +/- 10% should result in analysis at iteration review.  |

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| **Additional Information** |
| **Additional Analysis Guidance** | Use this with the Committed Backlog and story point-to-feature ratio to ensure project will release identified features as scheduled (e.g., will velocity for remaining iterations be sufficient to complete committed features)?Will current average velocity be adequate to complete committed features by end of project? This assumes an ability to estimate average number of story points per feature (and then capability), based on performance. This measure can be used with Reference Comparison iteration Velocity for normalization.Acceleration can be tracked over time to develop predictive trends in performance. For example, performance tends to increase slowly in the first few iterations, then increase sharply, then plateau. Knowledge of long-term acceleration trends can enhance planning accuracy. Comparing individual team acceleration trends can highlight teams that have problems or that should serve as exemplars. Tracking program level acceleration trends is useful for bidding future work. |
| **Implementation Considerations** | In general, velocity is specific to a team and cannot be aggregated across teams to the project level. If velocity is normalized it can be used at the product or enterprise level.Usually, velocity should become more accurate and reliable over time as the team becomes more experienced, processes are established, data is regularly produced and reviewed, and the team gets better at estimating. Since story points may vary across teams, variations in velocity can be compared in percentage terms (positive or negative acceleration relative to prior reference iterations). This gives the program a way of determining which teams are struggling without having to normalize velocities. |

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| **Additional Specification Information** |
| **Information Category** | Process Performance |
| **Measurable Concept** | Process Efficiency - Speed |
| **Relevant Entities** | Features |
| **Attributes**  | Stories, Story Points (estimated size) |
| **Data Collection Procedure** | Data is collected at the end of each iteration by the team lead from the team tracking tool. Story Points must be tested and satisfy the completion criteria, with no open defects to be counted as completed. |
| **Data Analysis Procedure** | Data is analyzed at the end of each iteration by the team during the iteration review and considered during the planning session for the follow-on iteration. |