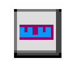
LAB 4: ANALYZING RECTILINEAR MOTION WITH VIDEOPOINT

INTRODUCTION: The objective of this laboratory to analyze the rectilinear motion of rocket launches using VideoPoint, a video analysis software package. The coordinates of a single point are identified visually in each frame and digitized manually within VideoPoint. A time code is read automatically by VideoPoint. The digitized coordinates are output to a table within VideoPoint and can be exported, e.g., to Excel, for subsequent analysis. VideoPoint can be used to conduct some analysis including curve fitting.

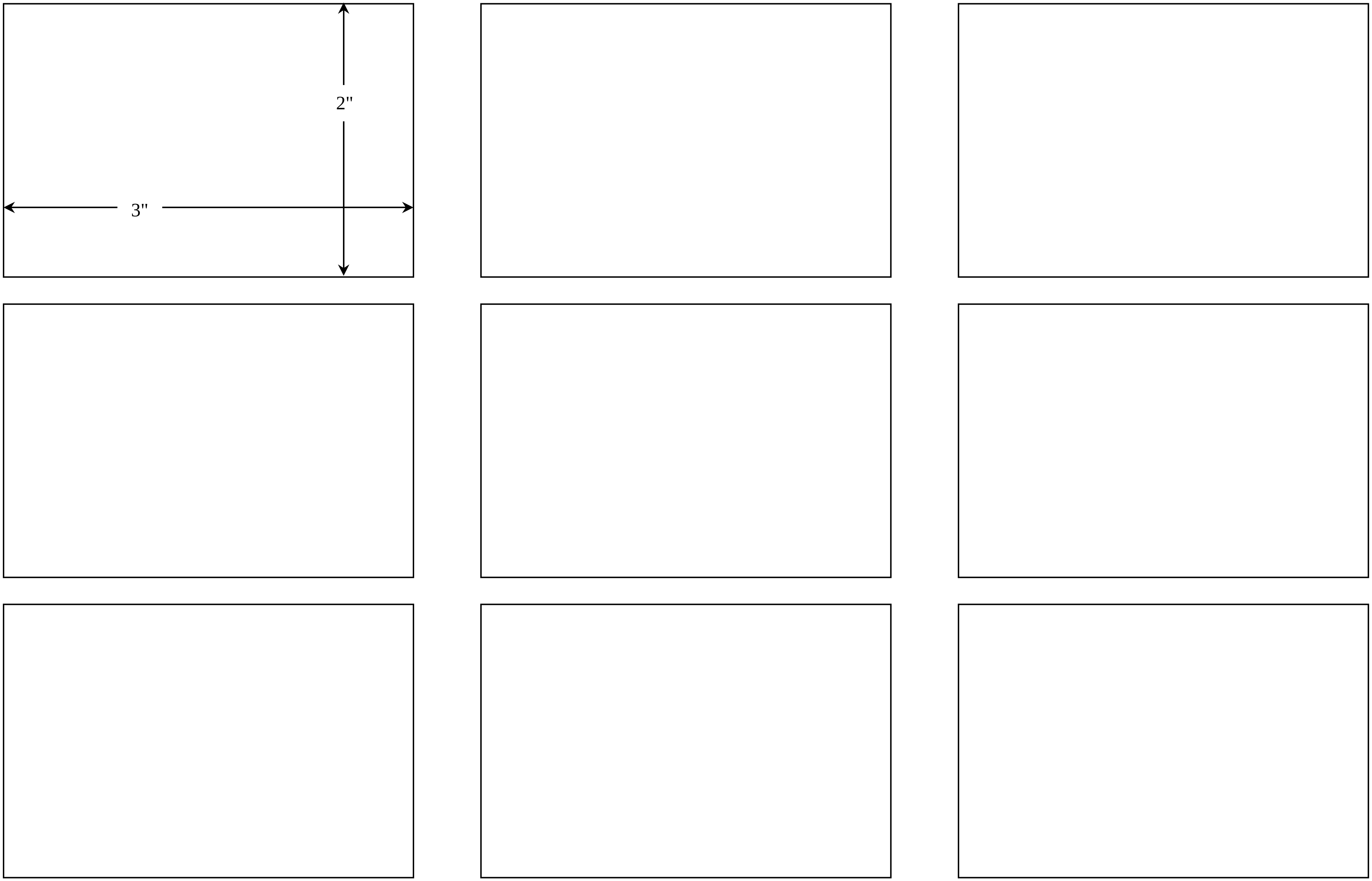
PROCEDURE

- Download the three rocket launch movies from the course web site onto the desktop.
- Launch VideoPoint.
- Open the Mercury Redstone movie in VideoPoint.
- Calibrate the movie using the rocket length in the first frame and the scale button: 
- Identify a tracking point on the rocket that remains in view throughout the movie.
- Digitize the position of the tracking point in each frame.
- Export the data to Excel.
- Eliminate any pre-launch points, i.e., those indicating the rocket is still clamped to the tower, and ensure that the "new" time and position begin at zero.
- Numerically differentiate the position data to determine the speed then the speed for the acceleration. Note the noise, especially in the acceleration.
- Fit a quadratic polynomial with zero intercept to the position data then determine the speed and acceleration from it.
- Prepare individual plots of position, speed and acceleration versus time. On each plot, indicate the digitized data with markers and the fits with curves.

Repeat for the Space Shuttle and V2 movies. The camera pans in the V2 movie, therefore, a fixed point and a point on the rocket must be tracked in each frame (or a translating coordinate system must be constructed and a single rocket point tracked) so that the displacement of the rocket point can be determined.

REPORTING REQUIREMENTS: Prepare a landscape oriented page with a 0.75" top margin and 0.5" margins elsewhere on which the motion plots appear for each rocket (see template on following page). Text font must be 10 point Times New Roman; text on the plots must be 8 point Times New Roman. The plots must have a caption and may "share" axis titles to allow maximum sizing of each plot. Carefully prepare each plot, e.g., markers, curves, axis labels and axis scales including making all axes of same range.

Idea: Bucinell; Write Up Modification: Rapoff



Left to right: Mercury Redstone, Space Shuttle, V2. Top to bottom: position, speed, acceleration. Markers = digitized data; curves = from position curve fit.