Re-visualizing a comparison of US launch systems

1. **In 2017, NASA published a presentation[1] comparing US launch systems.**
   I saw opportunity to clarify it.

2. **I re-graphed their data, highlighting the much lower costs of SpaceX.**
   The main implications of the data are now clearer.

3. **The visualization principles I employed are broadly applicable.**

[1]Slide 16 in "The State of Play: US Space Systems Competitiveness", October 11, 2017
https://ntrs.nasa.gov/api/citations/20170009967/downloads/20170009967.pdf

From correspondence with the primary author, I've learned no updated versions of this presentation are publicly available. Though the "state of play" has changed since 2017, the strategies applied to clarify the presentation remain valid.

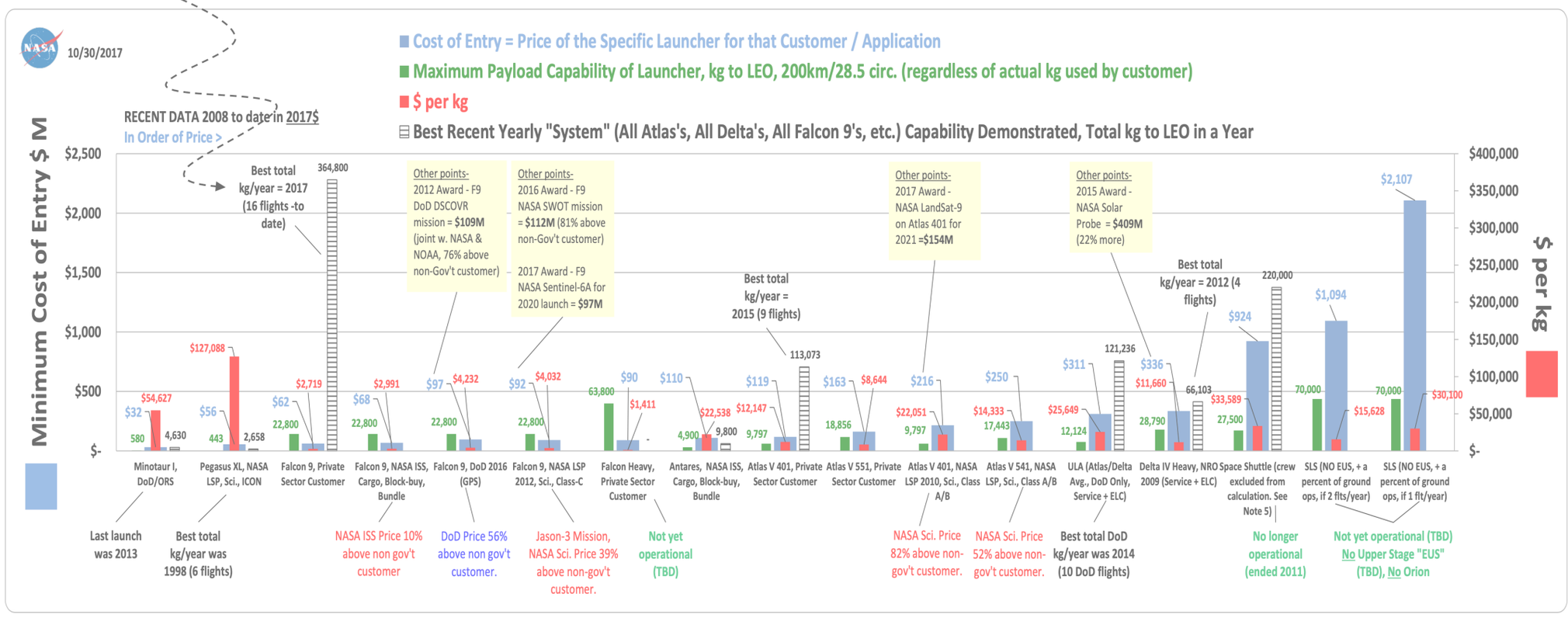
Graphs: NASA original and my revision

Change details and reasoning on next slide

NASA original

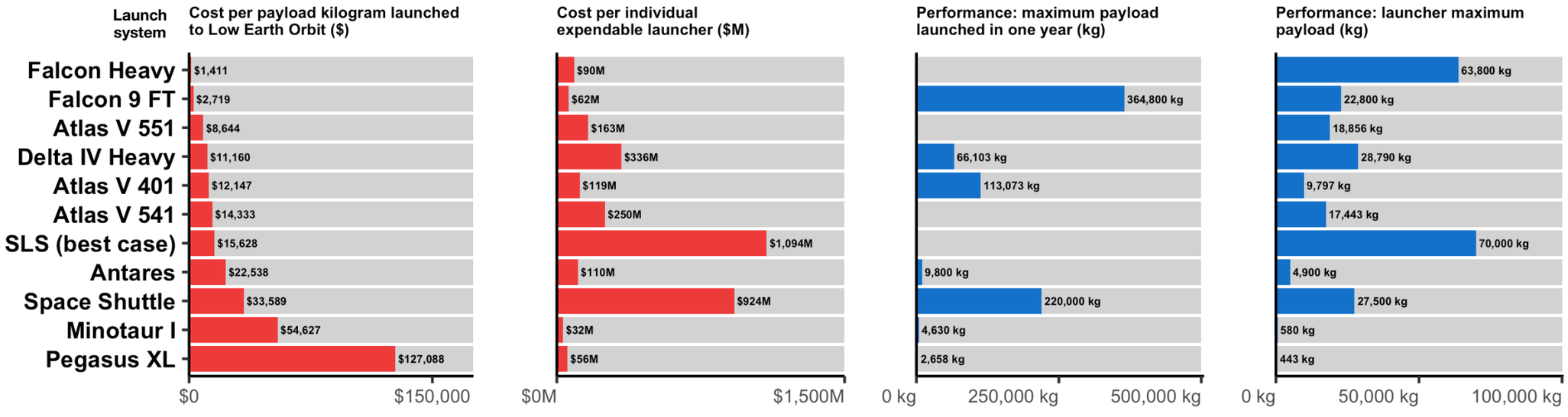
Note!

Launch Systems – Multiple Measures – Especially *kg per Year*



My revision

SpaceX is the cheapest by far, with leading performance (2017)



Revision details and reasoning

NASA original

Analysis structure challenges

Units of analysis vary

- Some launch systems are split by customer and cargo.
  4 records for Falcon 9
- Some launch systems are *merged* by provider.
  Averaging of Delta + Atlas ULA launches
- Performance for a system is aggregated.
  "All Atlas capability demonstrated"

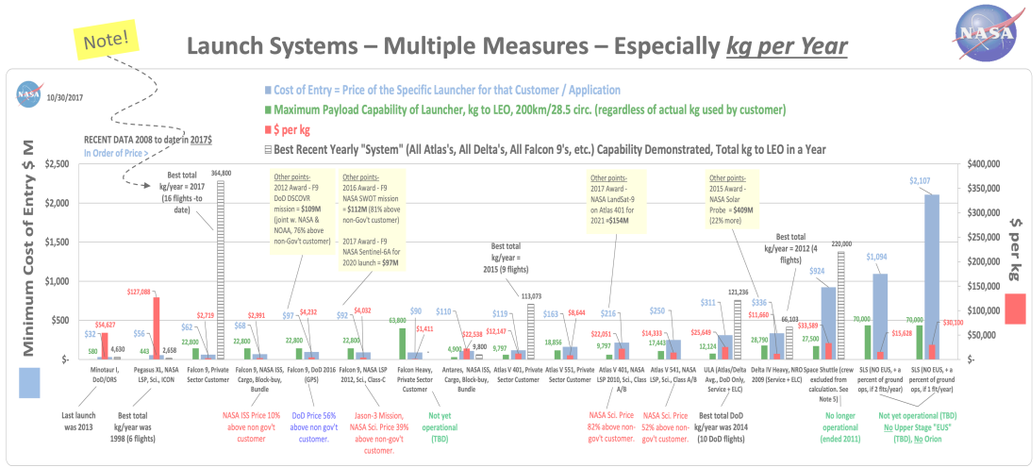
Graph clarity challenges

Plotting four variables together makes it hard to compare any one

- Is a "high bar" good or bad? It depends – but it's hard to interpret when everything is plotted together.

Too many distracting pixels between any two points to be compared

- As many contextualizing notes as there are observations, and their pixels compete with the heights of the bars.
- Varied placement of notes and labels also deters direct comparison.



My revision

Revisions I made

Consistently grouped by launcher family

- Reported minimum costs and maximum performance because market is maturing; 2010 costs are not 2017 "state of play". *Even with these optimistic views, it's still obvious that SpaceX dominated its competitors in 2017.*

Plotted variables separately

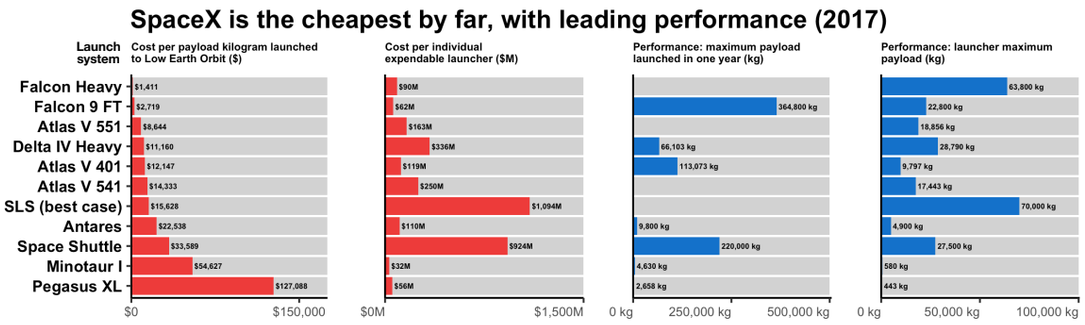
- Facilitates "apples to apple" comparisons of single variables.

Moved extra information off graph

- Restores focus to comparable data.

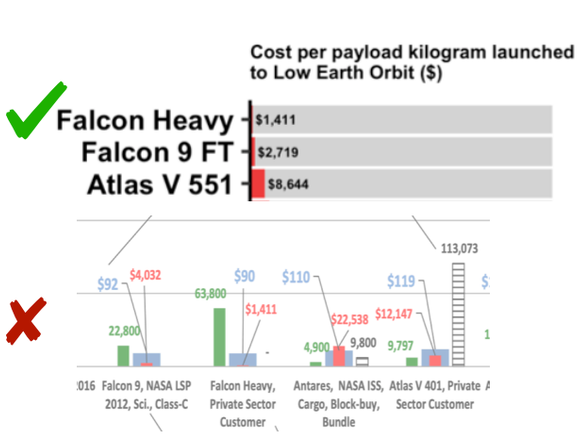
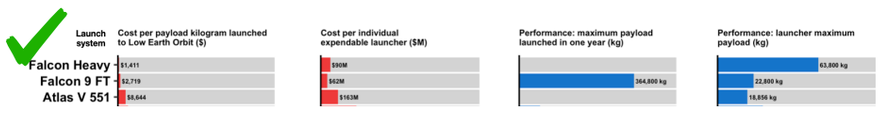
Directly labeled data

- Keeps attention on comparison, not graph parsing.



Principles that apply broadly

Ways I've approached my work and coached others

Principle	Details	Examples
Tell them what to think	**Type out important conclusions, exactly as you want your audience to remember them.**	✓ **SpaceX is the cheapest by far, with leading performance (2017)** ✗ Launch Systems – Multiple Measures – Especially *kg per Year*
Show them where to look	**Make visual impact proportional to significance.** **Every pixel spent on a grid, label, or footnote competes for attention with pixels spent on your conclusion-supporting data.**	✓  ✗
Present information in a logical order	**Sequence information so similar data are together.** **A scannable graph makes conclusions easy to draw.**	✓  ✗