Over the last several years, the Naval Research Laboratory has developed a new global numerical weather prediction system, based on a three-dimensional spectral element numerical discretization. The system, known as NEPTUNE, is constructed to be computationally scalable and numerically flexible, in terms of grid design and order-of-accuracy. One capability that is planned for the system is the option for both $h$- and $p$-refinement in the horizontal and vertical directions. In this talk, we will explore the impact of independently increasing the polynomial degree and the number elements for full physics numerical weather prediction forecast skill. Initial results show that for numerical configurations with nearly the same number of degrees of freedom, simulations with a higher-degree (5th-degree) polynomial and fewer elements are more skillful in the mid- and high-latitudes than simulations with lower-degree (3rd-degree) polynomials and more elements. In contrast, the opposite is true in the tropics. We will explore the reason behind this difference. The computational consequence of using high-degree polynomials relative to lower-degree polynomials on different computational architectures (CPU vs. GPU) will also be explored.