THE GIFT THAT KEEPS ON GIVING: LRO AFTER 11 YEARS IN LUNAR ORBIT. N. E. Petro[1], [1]NASA Goddard Space Flight Center, Greenbelt, MD 20771 (Noah.E.Petro@nasa.gov).

Introduction: The Lunar Reconnaissance Orbiter (LRO) in now in its second decade of observing the lunar surface and its environment. Launched in 2009 as a robotic precursor for future human and robotic exploration, LRO has contributed to a decade of improved understanding of the Moon, deep space, and the near-Earth environment.

With a new era of lunar exploration on the horizon, in the form of robotic missions to the surface and orbit via the Commercial Lunar Payload Services (CLPS) office and the Artemis program, LRO is poised to support a myriad of future missions.

We will discuss the datasets that continue to be generated by the LRO science teams as well as lessons for future missions in operating at and around the Moon for an extended period of time. LRO has shown that simple, focused missions can survive in lunar orbit for 5x (or more) as long as their design life.

LRO data encompasses a broad range of datatypes, from visible images revealing intriguing morphologies and young volcanics [1], to radiation data critical for planning extended operations in deep space [2]. In that sense, LRO data is not only telling us where to go on the Moon, but how to survive there.

LRO will support the identification and characterization of landing sites for commercial enterprises and use these landings as opportunities for science observations [e.g., 3, 4]. This new era of lunar exploration is fundamentally enabled by LRO's data, creating a period of lunar exploration on the shoulders of LRO, GRAIL, Kaguya, and the other recent missions [5].

Landing Site Characterization for Commercial Landers: The new era of cooperation with private missions to the lunar surface allows LRO to 1) support the characterization of landing sites and 2) coordinate on potential observations of lunar landings and their effects on the lunar regolith. LRO has, by definition, been supporting lunar landing site characterization since its inception, however now there is a coordinated effort from NASA HQ to work directly with the companies to work at all levels of identification of landing sites (from the initial identification to detailed characterization).

This new era of lunar surface exploration also enables a new age of coordinated lunar science between an orbital asset and surface assets. During Apollo, coordinated measurements of surface magnetic fields and the deep space environment by Explorer 35 [6], during this period of exploration we may offer similar coincident measurements that benefit both LRO and the surface asset.

LRO science in its 4th Extended Science Mission (ESM4), from Sept. 15, 2019 to Sept. 14 2022, will focus on volatiles, interior processes such as volcanism, tectonism, and regolith evolution including impacts. The mission will use the long baseline of measurements to monitor changes occurring on the Moon over the course of the mission.

References: [1] Braden, S. E., et al., (2014) *Nature Geosci*, 7, 787-791. [2] Schwadron, N. A., et al., (2014) *Space Weather*, 12, 622-632. [3] Retherford, K. D., et al., (2013) LRO-Lyman Alpha Mapping Project (LAMP) Observations of the GRAIL Impact Plumes, [4] Clegg-Watkins, R. N., et al., (2016) *Icarus*, 273, 84-95. [5] Keller, J. W., et al., (2016) *Icarus*, 273, 2-24. [6] LSI, (1972) *Post-Apollo Lunar Science*, 104 p.