2. Rationale and need

Each of the missions to be flown to the Moon in the next few years has its own rationale, requirements, scientific focus, and exploration goals. Consequently, each has its own complement of sophisticated instruments and mission constraints. An overview of these missions is summarized in Table 1. Discussion of the missions and the specific instruments continues as they are implemented. Recent overviews of the missions and instruments were presented by Chin et al. (2006), Föing et al. (2006), Goswami et al. (2006), Hao and Zhou (2006), and Takizawa et al. (2006).

The surface of the Moon encompasses 38 million square kilometers and each of the polar orbiting missions in Table 1 has global access to enormously diverse lunar terrain. The processes involved to produce a calibrated global data set that is useful for comparisons with data from other instruments are both lengthy and labor intensive for each instrument. There is nevertheless great benefit to be gained from coordinating measurements between instruments of these contemporaneous orbital missions and from exchanging data early during the calibration process when possible. Although the specific calibration steps are unique to each instrument, there is much commonality across data products of different missions. A common, but limited, set of calibration targets will allow cross validation of instruments with independent information. Validation checks for similar instruments should be straightforward since the lunar surface does not change over the time scale of orbital measurements. Optical data can be compared with optical data, gamma-ray data with gamma-ray data, laser altimeter data with other topographic data, etc. It should be noted that data comparisons across different types of instruments are also highly valuable as well. For example, compositional data obtained with optical instruments should be consistent with compositional data obtained with gamma-ray and X-ray instruments, and so forth.

The eight L-ISCT targets recommended below were selected to meet several criteria. All are approximately 200×200 km in dimension to allow instruments with different spatial footprints to be cross-compared within a common region. A few targets are relatively homogeneous, while others exhibit (and test) diversity of coordinated measurements (topography, morphology, composition, etc.). Since the field of view varies greatly between instruments, we recommend that instruments with a small footprint target as close to the central portion as is feasible. The general locations of the eight L-ISCT areas are shown on a Clementine global albedo image of the Moon in Fig. 1 and their center coordinates are provided in Table 2.

Of equal importance to their calibration function, these areas were selected so that new or young investigators studying the Moon will learn much about the principal scientific issues concerning the Moon by calibrating and analyzing multiple data sets from these specific targets regions. As a whole, the small group of targets provides a good introduction to lunar science. The process of understanding the character of these few areas is intended to educate and spark a desire to explore further with the more extensive data produced by the various missions. These few targets provide a common starting point for much discussion and comparison among the science community and for the public to become reintroduced to the mysteries and excitement of lunar exploration. These L-ISCT areas should not be considered to be the most important science targets on the Moon; many other areas could have been selected just as easily. Instead, these targets were selected to be representative of the important science issues that orbital data can and will address. One target, Tycho crater, was explicitly chosen because of its additional outreach potential since it can be easily recognized by anyone in the world with a pair of binoculars (or exceptional eyes) and is an excellent example of a fundamental process (impact cratering) whose effect can be observed everywhere on the Moon.

Each of the L-ISCT are identified and briefly described below. In preparation for a successful international venture with coordinated data, the first step over the next year is compilation of current data for these L-ISCT sites. The most productive steps will occur over the next several years

Table 1
International Lunar Missions (details presented by Föing et al., 2006; Takizawa et al., 2006, Hao and Zhou, 2006, Goswami et al., 2006, and Chin et al., 2006)

	SMART-1 [ESA]	SELENE [JAXA]	Chang'E [CNSA]	Chandrayaan-1 [ISRO]	LRO [NASA]
Launch	2003	2007	2007/8	2008	2008
Orbit	400×4000 km polar	100 km polar circular	200 km polar circular	100 km polar circular	50 km polar circular
Objectives	Technology demonstration; instrument tests, September 2006 impact ending	Lunar origin and evolution; develop technology for future lunar exploration	Surface structure, topography, composition; particle environment	Integrated composition and terrain mapping science; demonstrate impact probe	Improve geodetic net; evaluate polar areas; study radiation environment
Payload (general)	AMIE, CIXS, SIR, plasma experiments	TC, MI, SP, relay satellites, X-ray, gamma-ray; altimeter; radar sounder, magnetometer, plasma imager	4-band micro-wave, IIM, X-ray, gamma-ray, energetic ions, stereo, altimeter	TMC, HySI, LLRI, HEX, Impact probe + C1XS, SARA, SIR2, miniSAR, M3, RADOM	LOLA, LROC, LAMP, LEND, CRaTER, Radiometer, LCROSS