We have developed several concepts for an Astrobiology Field Laboratory (AFL) mission that fit within project planning budget and mass constraints that are projected for both the 2016 and 2018 Mars mission launch opportunities. The AFL mission architecture we will discuss assumes maximum heritage from the 2009 Mars Science Laboratory (MSL), in particular the cruise, entry, descent and landing system methodology, as well as the fundamental design of the rover system. The AFL candidate platform and payload elements for this concept were identified from a set of recommendations put forth by the Mars Exploration Program Analysis Group, or MEPAG, Astrobiology Field Laboratory Science Steering Group (SSG) in 2004, for the express purpose of identifying overall mobility, mass and power requirements for such a mission. While the actual platform/payload for an eventual AFL mission would be defined and selected through a typical NASA-initiated competitive Announcement of Opportunity (AO) process, a rover architecture for this concept has been put forth and is for planning and discussion purposes only. The fundamental goals of AFL are to make a major advance in astrobiology, to search for evidence of past or present life, and to test for habitation.

Other than the different payload elements, identifying the best possible sample for analytic laboratory analysis is the key feature that differentiates AFL from MSL. Characterization and sub-sampling of acquired material requires the next generation sample processing system. The Precision Sample Handling System (PSHS) would replace the rock crusher (or other MSL sample processing system), and would be the main sample handling system of the AFL rover. This system will be able to perform a detailed sample characterization of cores up to 30 cm that have been obtained from a surface and bedrock sample acquisition system (e.g. scoop and coring system). Individual sub-regions of the 30cm core will be processed with a precision of ~4 mm and the generated fines analyzed by the analytical suite of instruments.