How to Build a Better ~~Mousetrap~~ Mass Spectrometer: IARPA's MAEGLIN Program as a Case Study

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Development of mass spectrometers for various non-laboratory environments that most efficiently and completely respond to the needs of that environment should be motivated by a first-principles evaluation of the needs of the mission at hand. An approach commonly taken is to start with an existing system, apply design changes to fit into the critical limiting parameters dictated by the mission (i.e. size, weight, power, ruggedness), and accept the performance degradation these design changes cause (i.e. resolving power, sensitivity, library size). However, a more robust approach is to look at the entire parameter space and identify areas where unconventional approaches may yield solutions that can both meet the critical limiting parameters, and still preserve performance in areas most important to the mission. This general design approach will be demonstrated for the case of the Intelligence Advanced Research Project Activity's (IARPA's) Molecular Analyzer for Efficient Gas-phase Low-power INterrogation (MAEGLIN) program. IARPA's mission is to invest in high-risk/high-payoff research to provide the U.S. with an overwhelming intelligence advantage. The MAEGLIN program is developing in integrated chemical collection and identification system that can provide 2-year unattended operation with daily samples analysis in a 1.5 liter package (including power).