

Smaller, Cheaper, "Better" – Disruptive Innovation for Chemical Detection. An Essay



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Abstract

A *Disruptive Innovation* is defined as an innovation that creates a new market and value network, and eventually goes on to disrupt an existing market and value network, displacing an earlier technology. A well-known example of a disruptive innovation is flash-memory, an innovation which has transformed the electronics consumer markets through the availability of cheap, robust and very-high-density data storage. There can be little denial that the Chemical Detection (CD) market is in need of a disruptive technology to deliver the capability demanded by users. There is a significant gap between what exists off-the-shelf and what the war-fighter, first responder and/or security professional would really like. The result has been a proliferation of system solutions of varying specifications and CONOPS based (essentially) on a set of core, long established, technologies (MS, IR, IMS, etc.). Performance *verses* cost compromises are often severe. Not surprisingly the, organizations such as DARPA and HSARPA invest at the grass roots, with the mission to deliver disruptive innovation in the CD space. So why are disruptive innovations in the CD space so elusive? To answer that question one must consider a utopic solution that would define an innovation as "disruptive". "Smaller, Cheaper, Better" might well be defined as the metrics by which the "disruptiveness" of the innovation is measured. The metrics "Smaller" and "Cheaper" speak for themselves – ubiquity, *i.e.*, presence of numbers, transforms CONOPS, expands capability, eliminates human factors, etc. "Better" is a crude metric. What defines "better" and when does better constitute "disruptive"?

Threat & Impact scale	V. High impact / low threat	High impact / medium threat	Medium impact / medium threat	Low impact / medium threat
Class	Chemical Warfare Agents (CWAs)	Toxic Industrial Chemicals (Class A)	Toxic Industrial Chemicals (Class B)	Toxic Industrial Chemicals (Class C)
Examples	Nerve, NTA's, Blister	Hydrogen Cyanide, Chlorine, Acidic gases, Phosgene	High toxicity organic solvents	Various toxic chemicals used in manufacturing
Agents in Group	~20?	> 20	> 40	> 40

Threat list of Today – the challenge & it's proliferating; is a utopic solution possible?

Physical Metrics	Performance Metrics
<ul style="list-style-type: none"> → Size → Weight → Power → Cost 	<ul style="list-style-type: none"> → Selectivity / Resolution → Sensitivity → Response time → Broadband (detection)

Smaller, cheaper, lower power !

Where is the compromise

"Better" all round performance

Engineer **Scientist**

Engineering the System for the Job – it can be a frantic "tug-of war"; are you really communicating critical requirements and forward think?

Buyer	Courtesy of DARPA	Developer
<ul style="list-style-type: none"> → Define performance metrics → Get manufacturers specifications → Do a thorough comparison → Which delivers to best suit your application → What trade off's are tolerable and what aren't? 		<ul style="list-style-type: none"> → Define performance metrics → Create specification → Do a thorough comparison with competitive technologies → Can you compete?

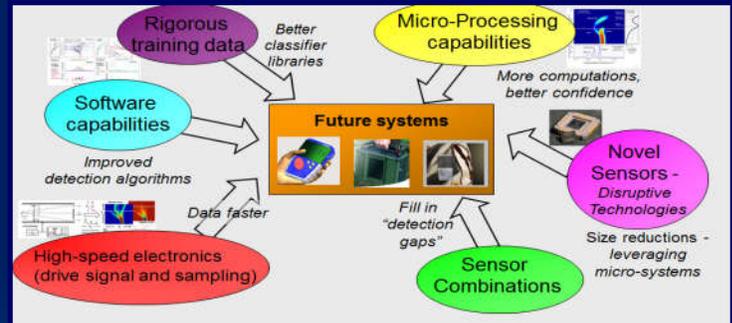
Engineering the System for the Job – it can be a frantic "tug-of war"; are you really communicating critical requirements and forward think?

Performance metrics improve all the time

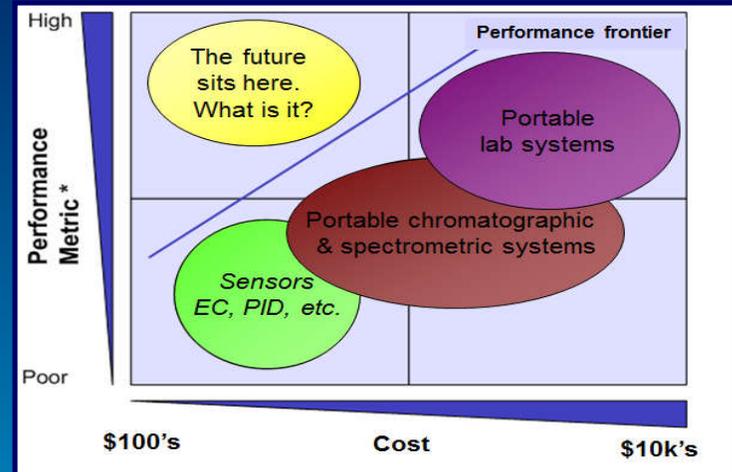
User feedback is critical to realise improvements

Developmental cycles may be important but must be minimized. Ensure adequate overhead for future plug-ins (HW & SW hooks)

Incremental improvement cycles should be minimized; both users & developers for ensuring this. It is not one sided



Future system solutions will be data intensive – the "library" approach can be off-putting – the reality is that any "new" technology can only be as good as the data



Performance metrics include; Size, Selectivity, Sensitivity, Power Consumption, and Response Time

Priority Segments / Established buyers of CBRN technology	Potential new Markets for "disruptive" CBRN technology
Focus Applications	Transportation Networks
Infantry Special Forces Remote Monitoring	Public spaces Financial Institutes Government buildings Stadiums
Fire Brigade HAZMAT Police ER	
Aircraft Security checkpoints	

New market opportunities are the vendor drivers. Are they real? That is an important question