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14. ABSTRACT The Next Generation Software and Survivability Technology areas of TARDEC RDECOM proposed the Dependable Automated Reconfigurable Technology (DART). The DART's "Health & Situation Control" will test the processing elements with Probe/Agent technology for software checking. Algorithms within the Health & Situation Control will assess the health of the processors and recommend element hand-off based on a "Criticality Scoring System" in conjunction with the Statistical Usage Test (SUT) model. The DART technology represents the next generation of software systems for ground combat vehicles. DART will enhance the performance of a weapon system by providing on-the-fly reconfiguration to accommodate the loss or malfunction of processing elements or to optimize onboard computational capability. Off-vehicle probes will be launched to assess the health of companion vehicles within the Operations Unit. The SUT will be used to evaluate software reliability. The SUT combined with a test environment that includes test benches, simulators and automated testing will provide the ability to arrive at a statistically valid					
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SUPERIOR TECHNOLOGY FOR A SUPERIOR ARMY

TARDEC

ARMY AUTOMATION RESEARCH DEVELOPMENT AND ENGINEERING CENTER

IVSS-2005

Prognostics Models of Combat Vehicles Software

Dr. Elena Bankowski
Survivability Engineering Technology Area

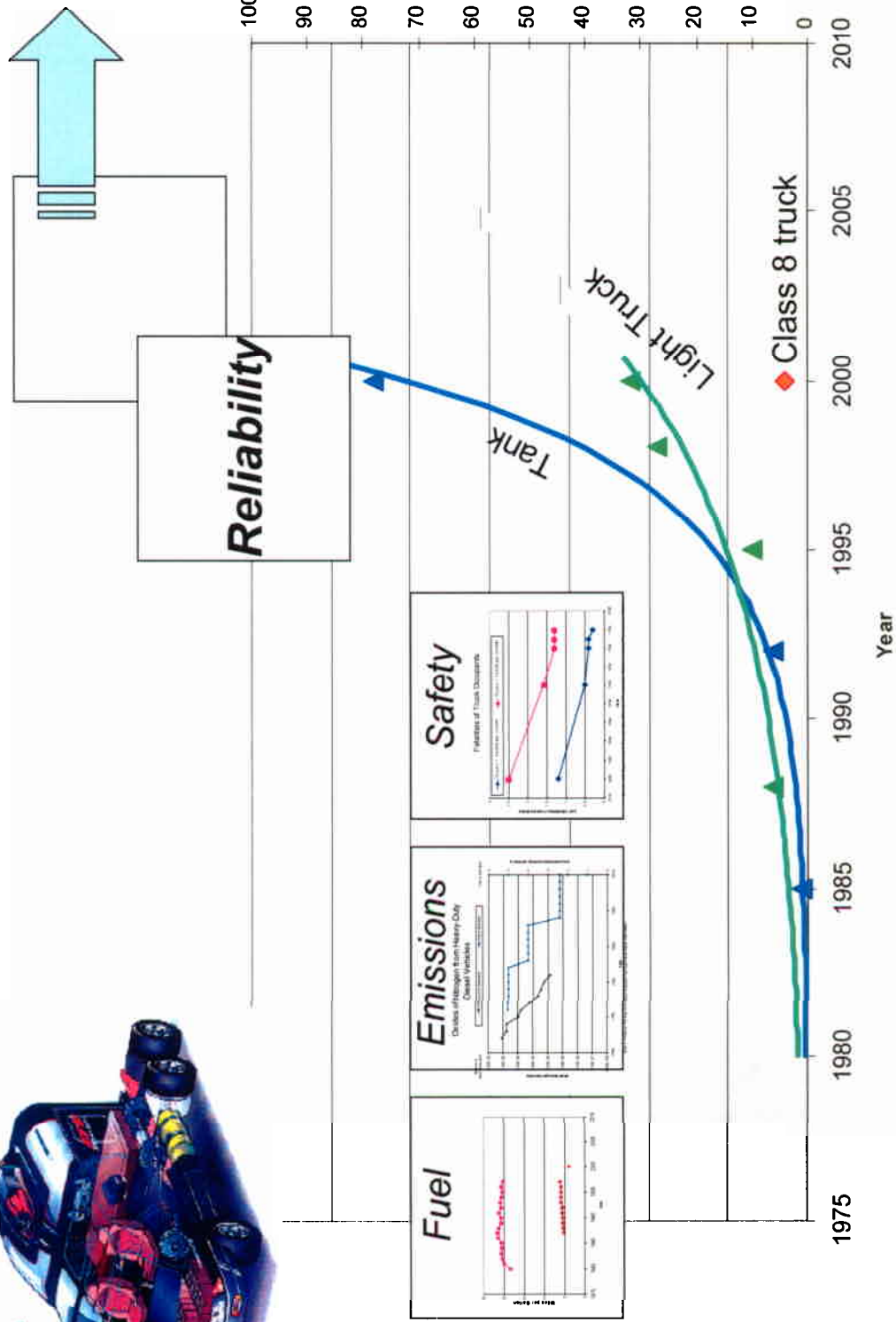
Dr. Abul Masrur
Next Generation Software Engineering Technology Area

US Army RDECOM-TARDEC, Warren, MI 48397-5000

Software Intensive Feature Growth



Improved
Lean
Logistics



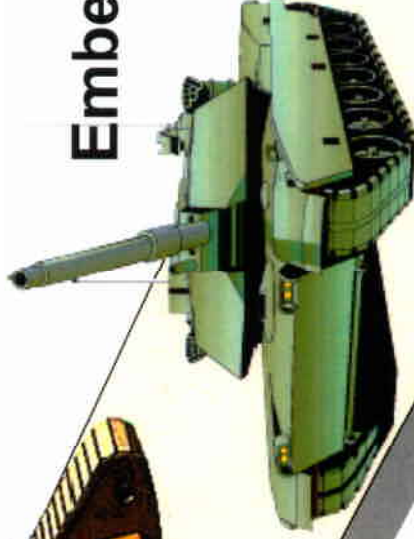
Software Evolution

No Software



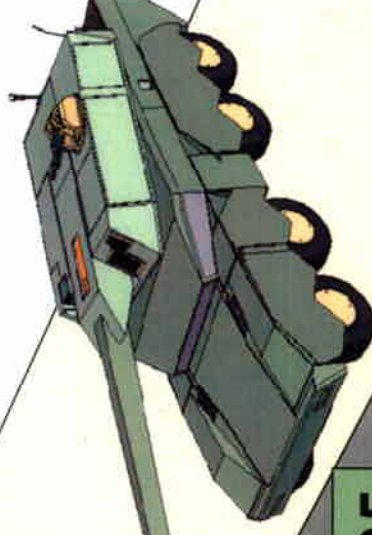
1918

Embedded Software

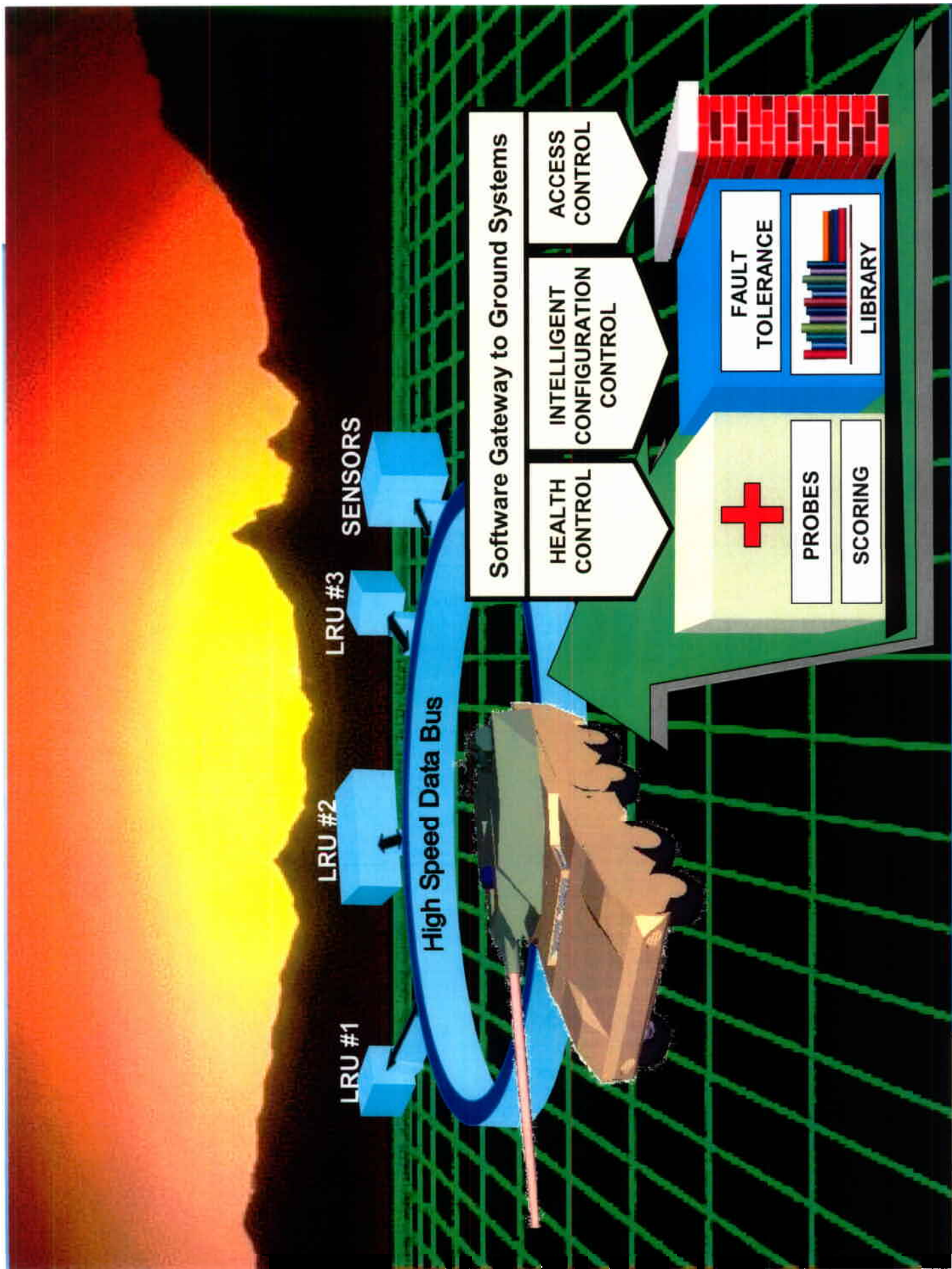


1980

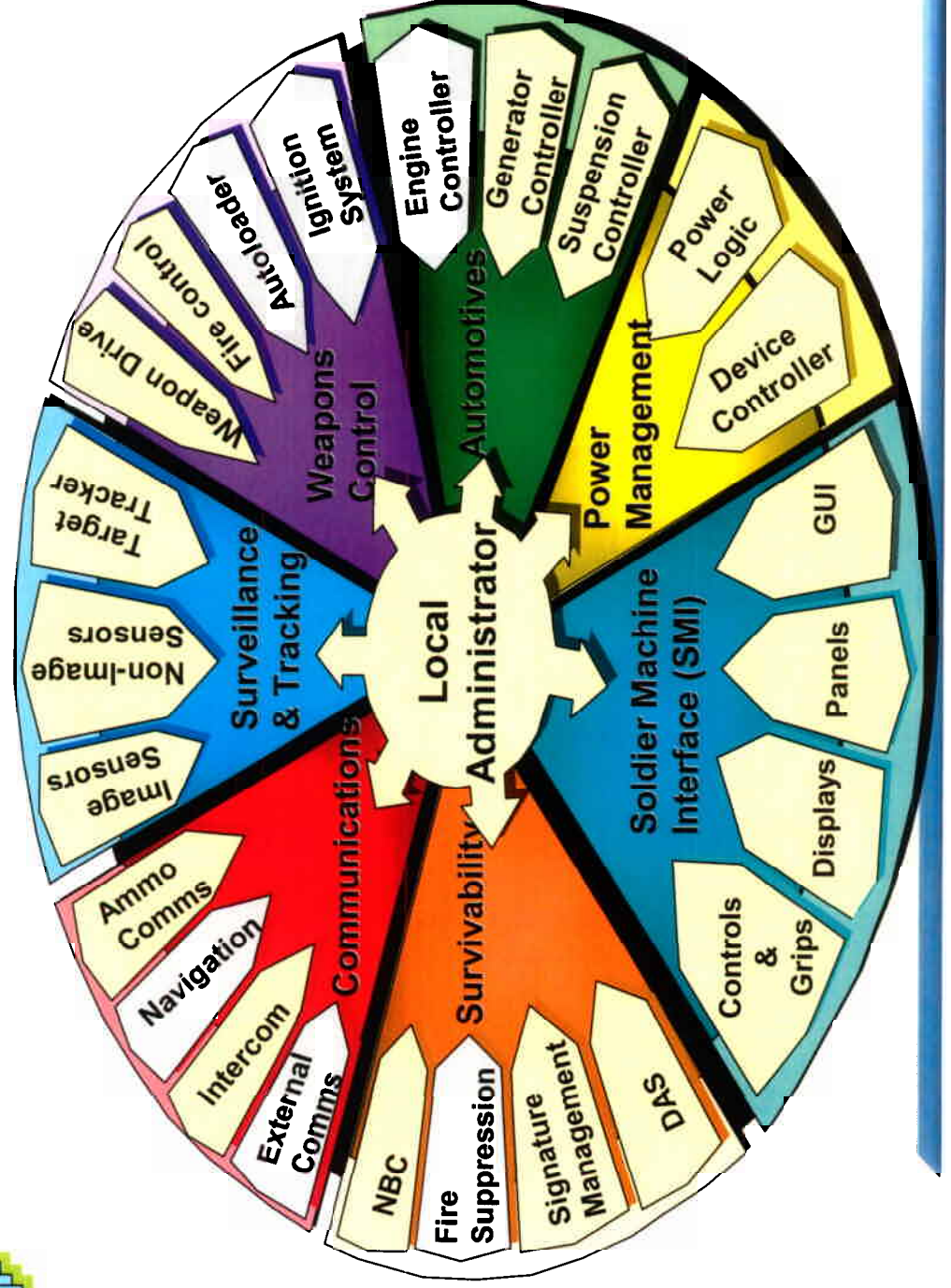
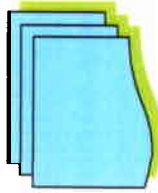
Federated Software



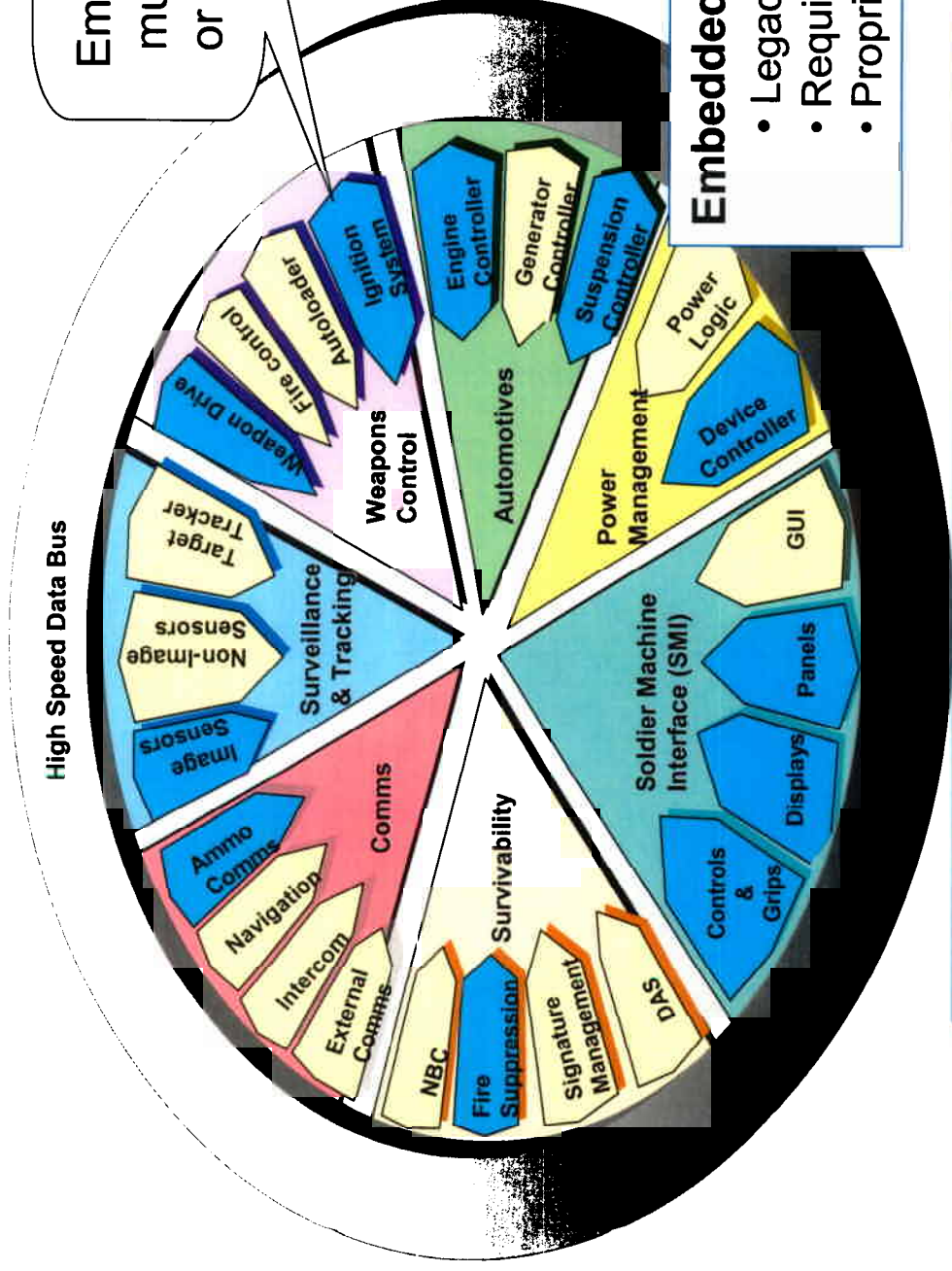
2005



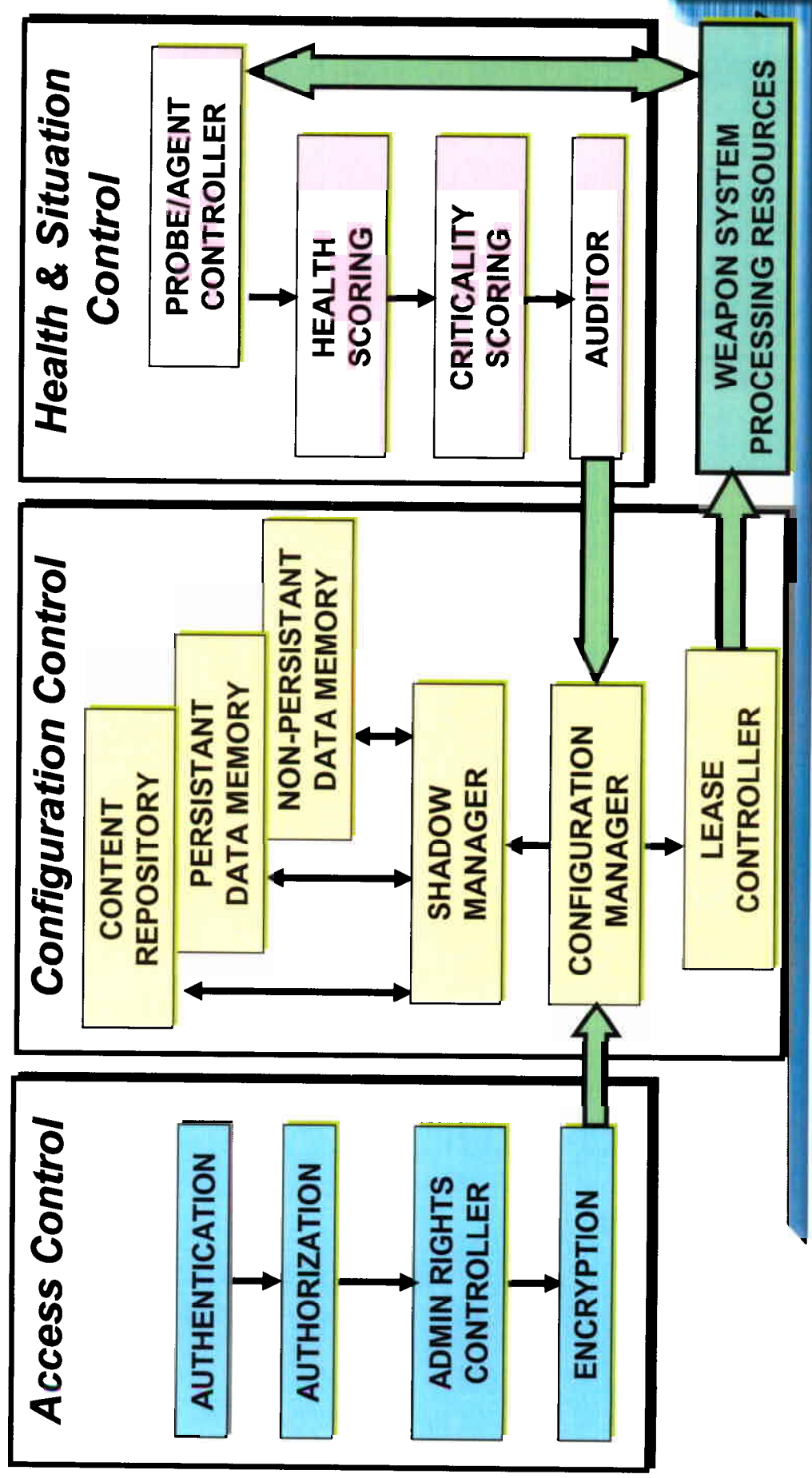
Hub & Spoke Functional Categories of Software



Embedded Systems (shown in blue)



Administrator's Operational Areas



TECHNICAL DISCUSSION

Probes

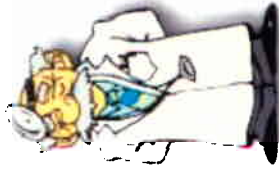
- Probes are able to capture events that occur in the software systems.
- These must span multiple software technologies used in the target software.
- They must be able to be inserted automatically to avoid software rework.
- A variety of probes is necessary in order to capture various kinds of information. The probes must have negligible impact on the behavior of the software.
- They must not interfere with operations by slowing response.
- The act of monitoring should not change the timing behavior, in testing it is misleading, in operational environments it could be catastrophic.
- The solution to this is three fold:
 1. Probes must be engineered to have minimal space and performance impact.
 2. Performance thresholds must be defined and monitored for critical software interactions.
 3. It must be possible to turn off monitoring when these thresholds are in danger of being violated.

TECHNICAL DISCUSSION (Continued)

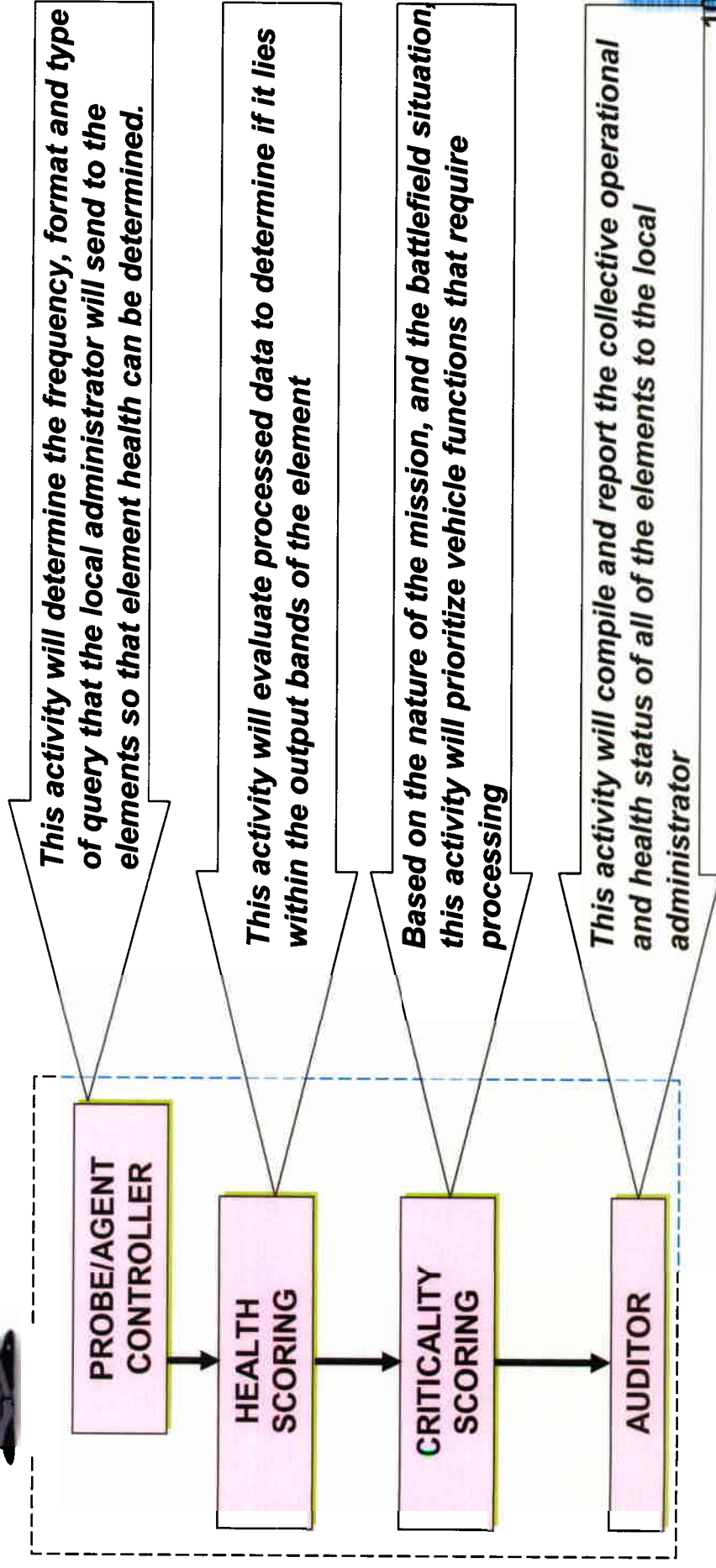
Gauges

Gauges analyze probed event streams and report summaries/conclusions in a more usable fashion. Gauges output can be used in four distinct ways:

- Gauges can feed back to previous software activities.
- Gauges can be used to affect previous software lifecycle steps.
- Gauges can control the operation of the target software, possibly by triggering a reallocation of resources, shutting down nonessential functionality, and even compensating for errors.
- Gauges can control the data collection activities by activating and deactivating probes to avoid impacting performance or to focus collection activities on suspect or critical areas.

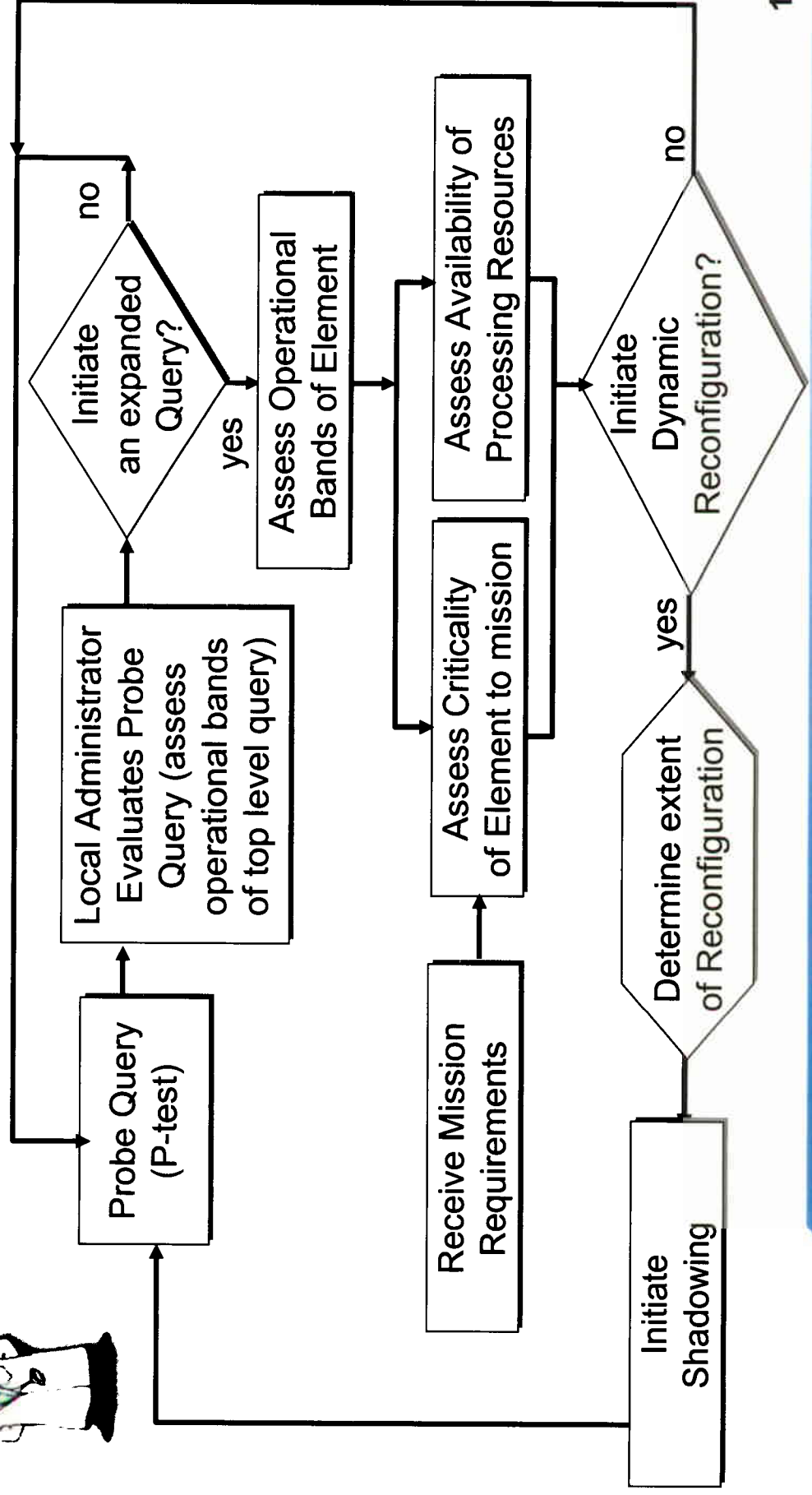


Health and Situation Control

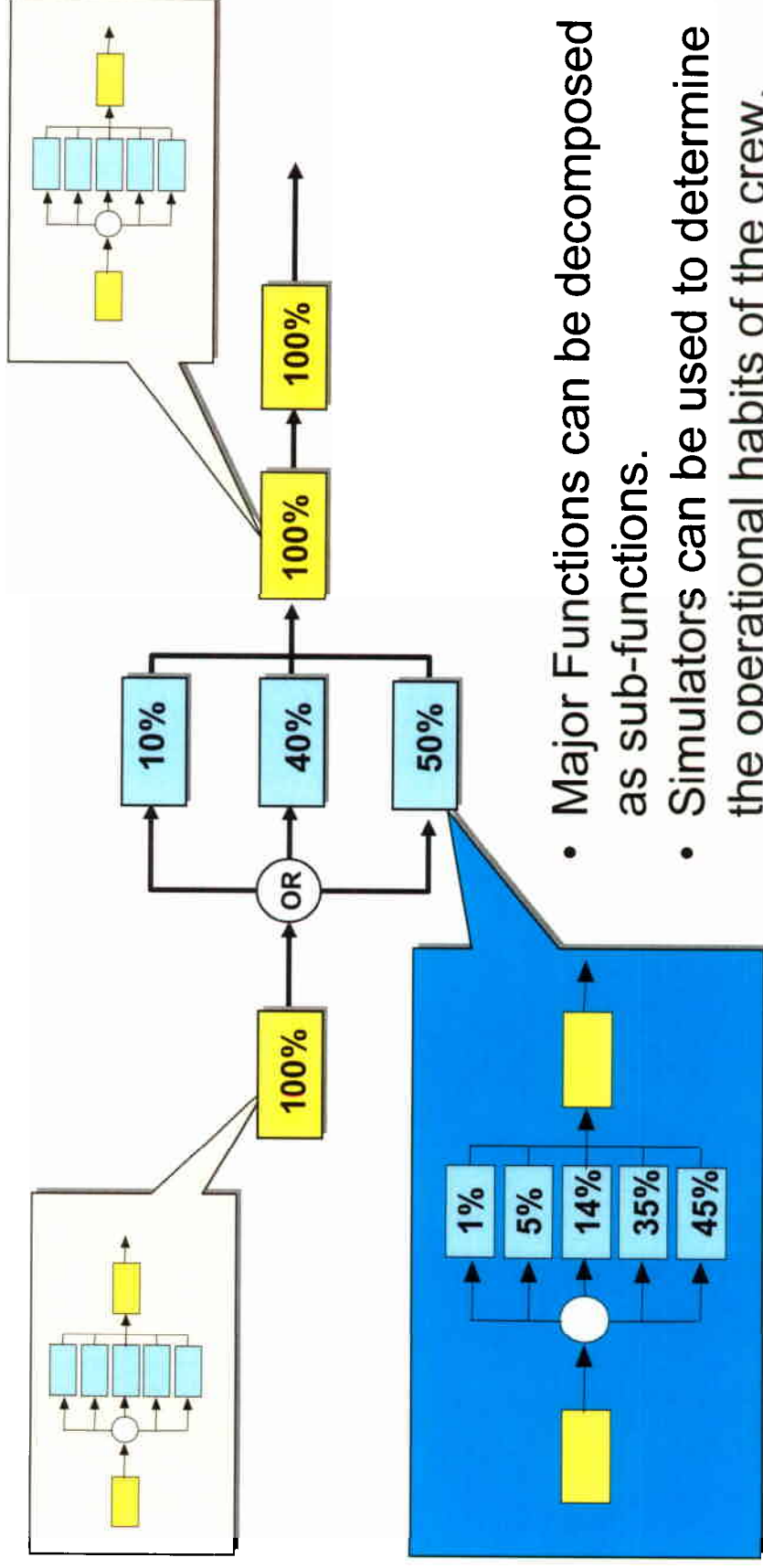




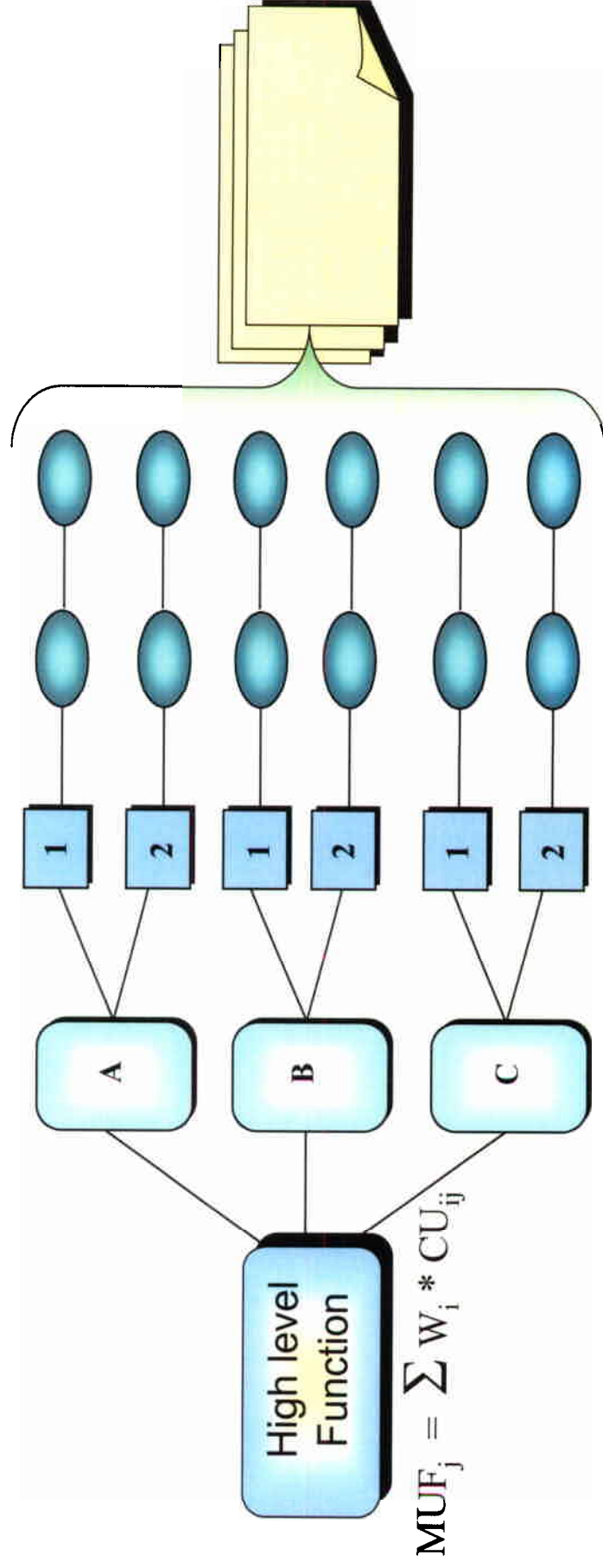
System Health Check Process



Functional Flow Block Diagram (for evaluation of usage)



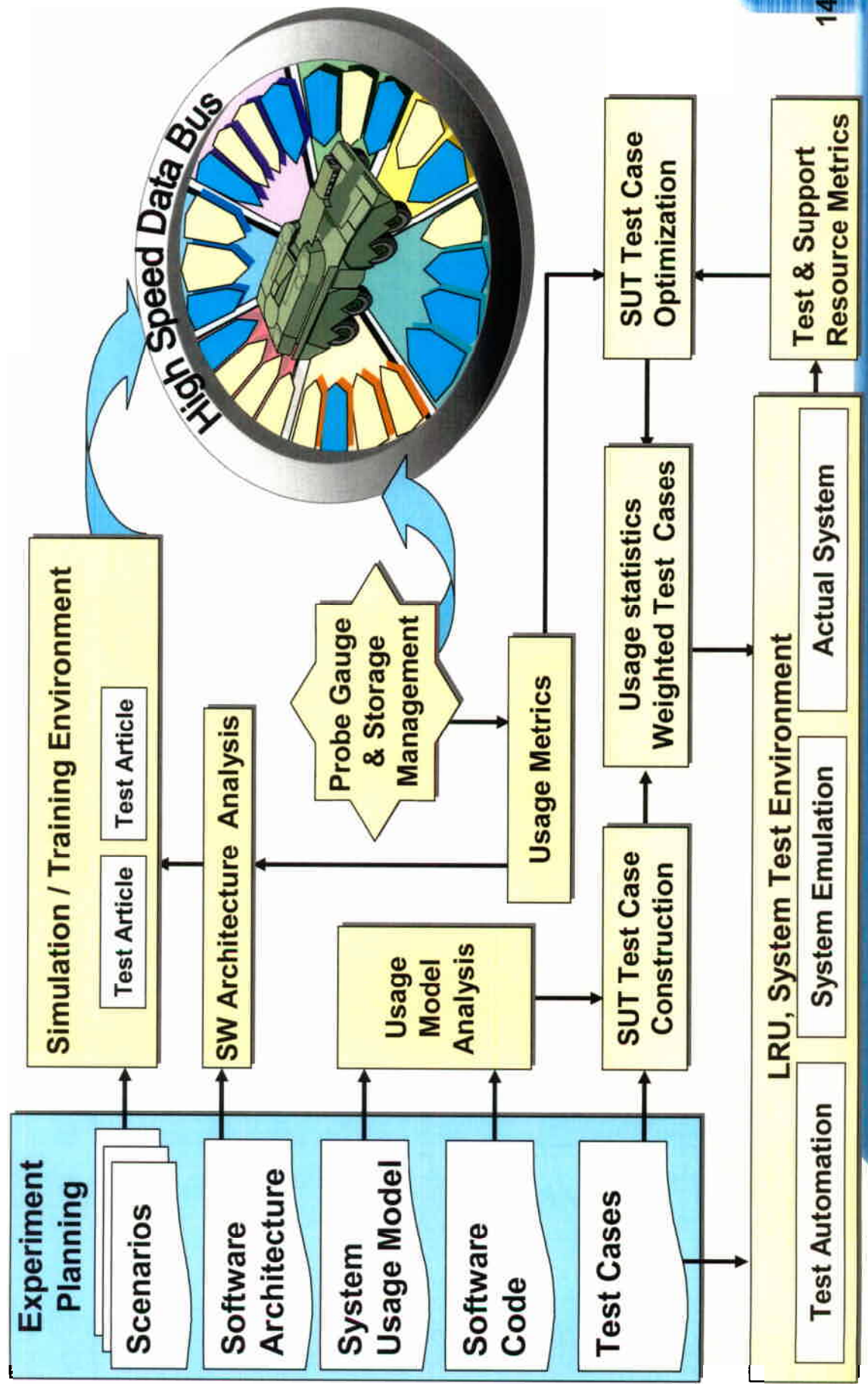
Criticality Evaluation of Element



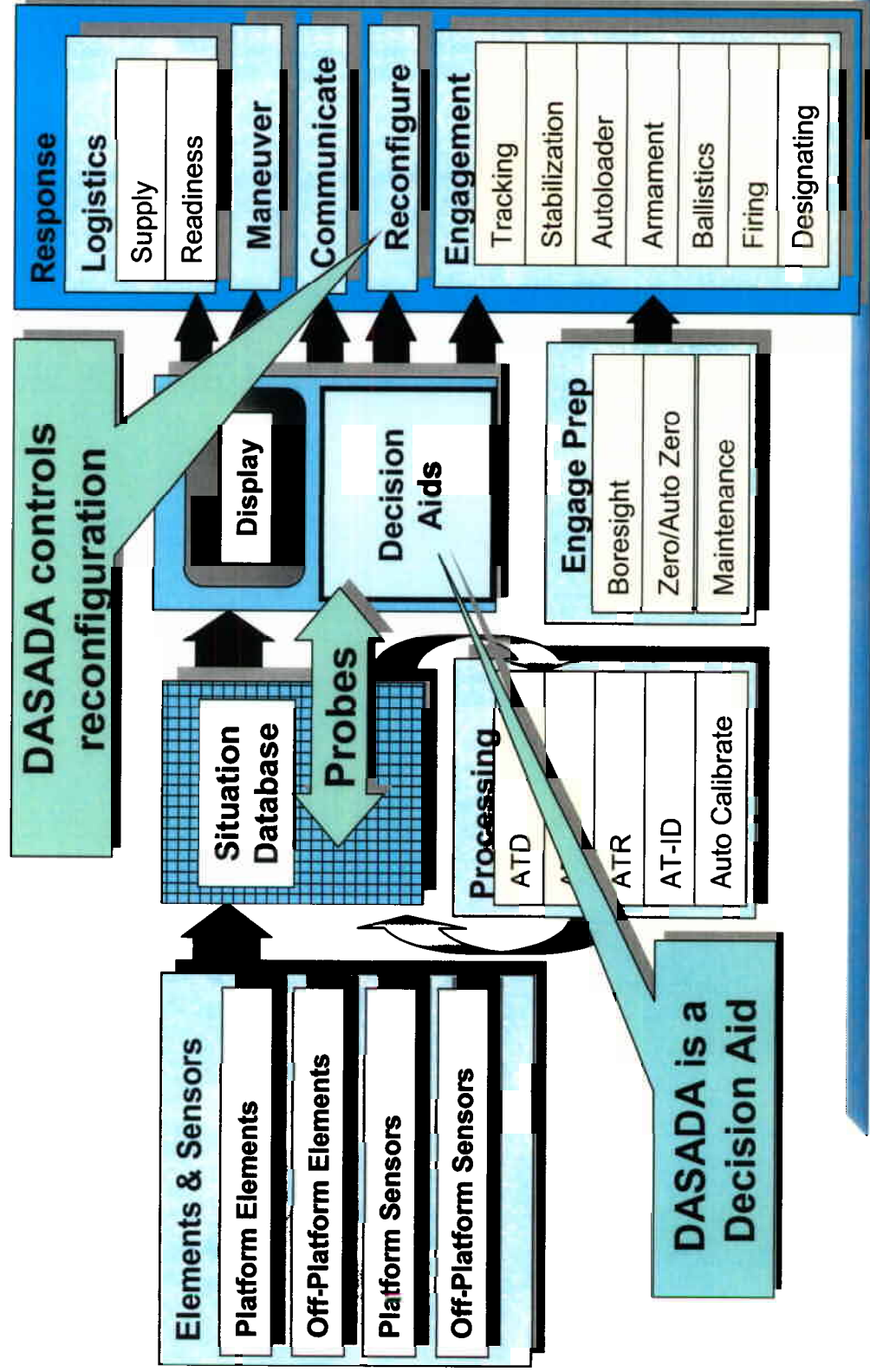
Fundamental Functions Specific Sub-functions Common Units Criticality Levels

W_i

$CU_{ij} = SUF_i(ML_{ij})$



DASADA and the FCS Architecture



Proposed Prognostic Screen

PERPETUAL TEST W00 C00 131340:57A ES 0000 0000 HDG: 000			
ESTIMATED MISSION DURATION		HOURS	
		120.0	
LRU	USE HOURS	EST TIME TO FAILURE	MISSION COMPLETION
DID	00083	00018.6	000 %
NBC	00201	00056.1	050 %
TIS ELEC UNIT	00233	00079.6	064 %
DECU	00121	00127.5	075 %
FCEU	00133	00179.6	092 %
ENGINE	00033	00277.5	100 %
ENGINE	00041	00206.9	100 %
UPDATE			RETURN

The DART Process

