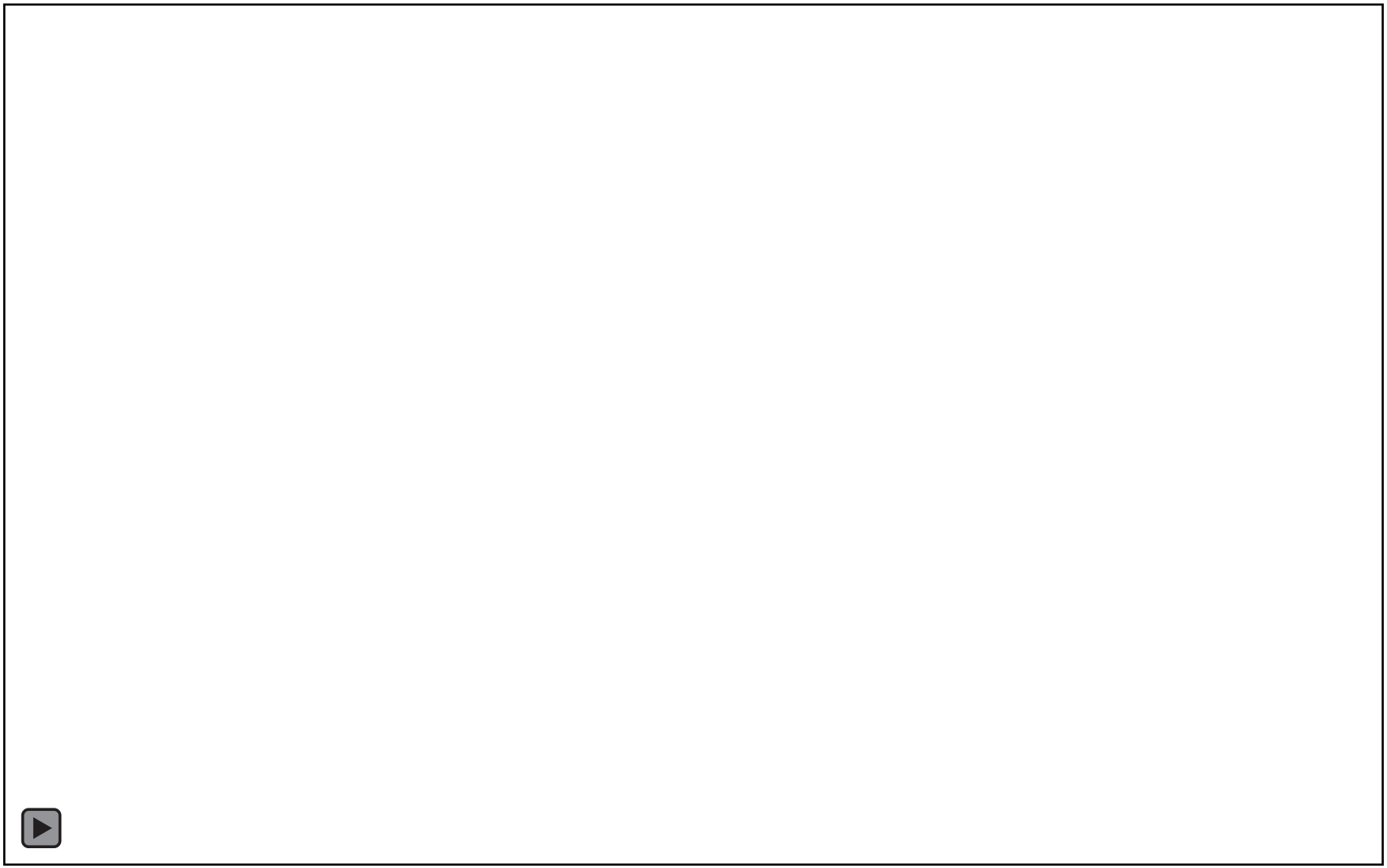
Video - T&E supports readiness ...



U.S. ARMY TEST AND EVALUATION COMMAND

Test … it’s not a four letter word.

NDIA Brief

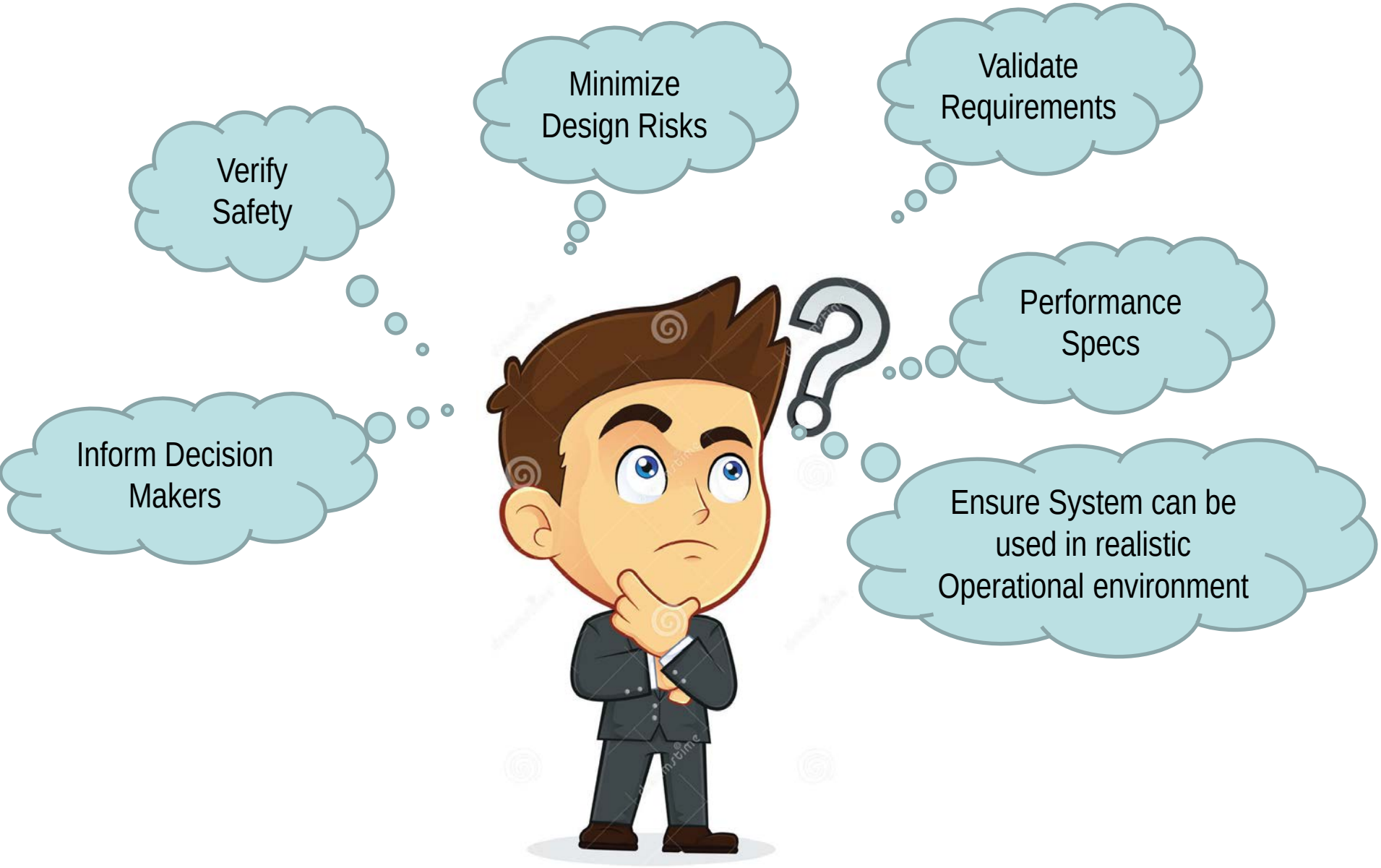
Presented by Mr. Robert Miele

1 March 2017

AGENDA

- Why Do We Test?
- TRL vs. Test
- How Consumer Reports Tests Vehicles
- Army Capability Gaps
- Questions We Answer
- Design of Experiments
- COTs/NDI = No Test
- Test Examples
- Where Do We Test
- Summary

Why Do We Test?



Technology Readiness Levels and T&E

TRL	TRL Description	Decision	Phase	DT	OT	ATEC Products
9	Actual system proven through successful mission operations.		O&S	PVT/ FAT/ LAT Surveillance	FOT	OFER*, SC*, Position Memo*
8	Actual system completed and qualified through test and demonstration.	FRP/ FD	P&D	PQT/ SQT LFT	IOT	OER, SC, Position Memo
7	System prototype demonstration in an operational environment.	MS C				OMAR, SC*
6	System/ subsystem model or prototype demonstration in a relevant environment.	MS B	EMD	EDT/ SDT	LUT	OMAR, SC*
5	Component and/or breadboard validation in relevant environment.		TMRR	TFT Comp. Proto.	EUT	
4	Component and/or breadboard validation in laboratory environment.	MS A				
3	Analytical and experimental critical function and/or characteristic proof of concept.		MSA	Market Research TFT		
2	Technology concept and/or application formulated.					
1	Basic principles observed and reported.					

DT verifies functional requirements. OT validates operational need.

EDT = Engineering Development Test
EMD = Engineering & Manufacturing Development
EUT = Early User Test
FAT = First Article Test
FD = Full Deployment
FOT = Follow-on Operational Test
FRP = Full rate Production
IOT = Initial Operational Test
LAT = Lot Acceptance Test
LFT = Live Fire Test
LUT = Limited User Test
MS = Milestone
MSA = Materiel Solutions Analysis
OER = OTA Evaluation Report
OFER = OTA Follow-On Evaluation Report
OMAR = OTA Milestone Assessment Report
O&S = Operations and Support
OTA = Operational Test Agency
P&D = Production and Deployment
PQT = Production Qualification Test
PVT = Production Verification Test
SC = Safety Confirmation
SDT = Software Development Test
SQT = Software Qualification Test
TFT = Technical Feasibility Test
TMRR = Technology Maturation and Risk Reduction
TRL = Technology Readiness Level

* If needed

How Consumer Reports Test Vehicles*

Consumer Reports Vehicle Test Facility

- 327 Acres + local roads
  - 4,400' main straight
  - 3500' handling course
  - Accident Avoidance Course
  - 33 degree rock hill
  - Brake Test facility (wet & dry)
- Staff Includes:
  - Engineers
  - Editors
  - Statisticians
  - Technicians
  - Photographers/videographers
  - Support staff
- $2.1M buying vehicles

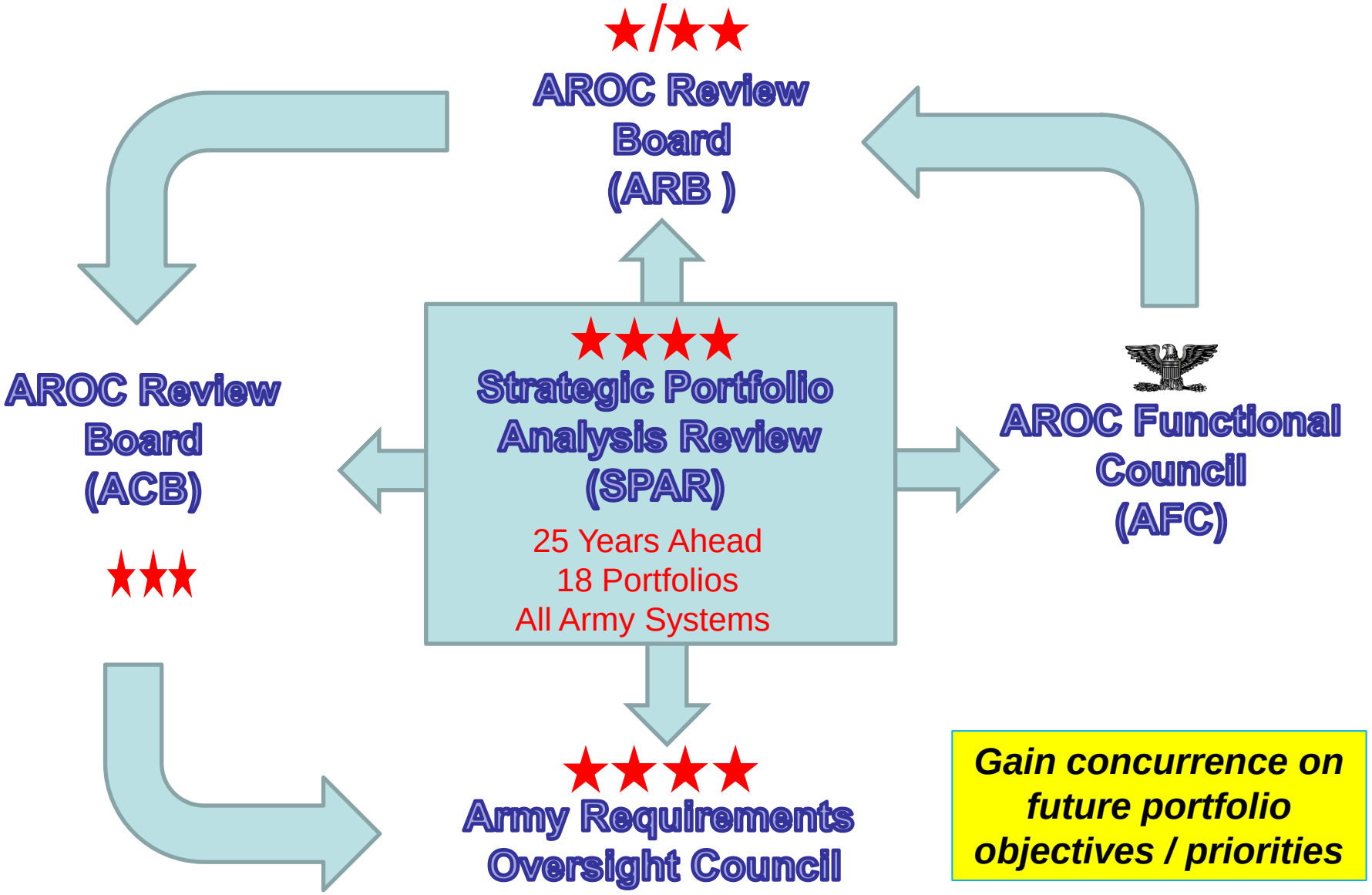
Vehicle Testing

- ~60 vehicles/year
- ~900K miles
- 2K break-in miles over several weeks
- 50 instrumented tests including:
  - Acceleration
  - Transmission
  - Routine/Emergency Braking
  - Routine/Emergency Handling
  - Fuel Economy
  - Headlights
  - Safety
  - Off-Road Capability
  - Tire Testing

TRL 9 Items tested by unbiased organization to provide consumer information on units intended environment

* http://www.consumerreports.org/cars-how-consumer-reports-tests-cars/

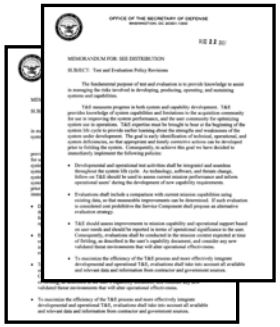
Army Capability Gaps - Requirements

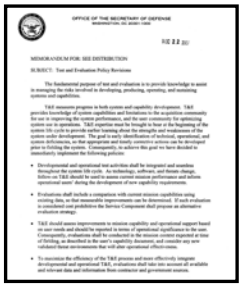


Major Questions We Answer

Capability Requirements

Critical Operational Issues and Criteria (COIC)





Army Capability Gaps lead to Requirements

Does it do what is needed . . .

Can Soldiers safely Operate and Train with the system and use it in the intended environment . . .

Is it survivable against the known threats that it is meant to defeat or deter . . .

IS IT EFFECTIVE

IS IT SUITABLE & SAFE for use

IS IT SURVIVABLE

How Requirements Drive Test

Requirements
- Autonomous: Mountainous Terrain
- Reliability: 10K MTBF
- Temperature Range: -25 to 120^{O}F

COA 1

COA 2

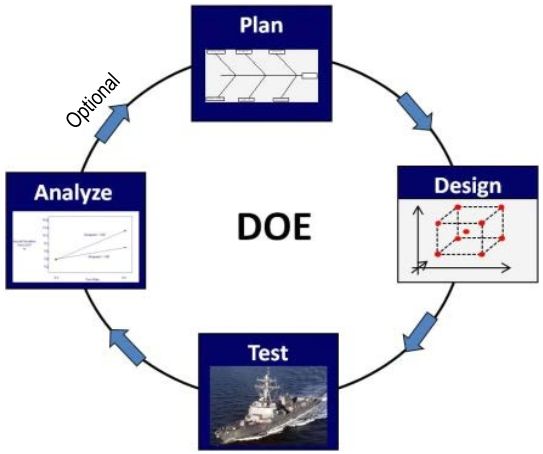
COA 3

Test Design

- 10K miles on flat paved roads
- 10K miles on Mountainous roads
- Temperate, desert & Cold Natural environments
- 3 test vehicles
- Demonstrate reliability at 85% confidence level

Best

DOE provides:
- the most powerful allocation of test resources for a given number of tests
- a scientific, structured, objective way to plan tests
- an approach to integrated test
- a structured, mathematical analysis for summarizing test results
- enables defensible conclusions about system performance



COTS/ NDI ≠ No Testing

Pickup was designed for on & off-road operation …

Radio kit was designed for operation …

Both were independently tested …

Radio kit Installed …

What is your level of confidence with …

- Off-road radio operation?
- Off-road radio kit durability?
- Operator safety?

COTS/ NDI may not be designed for intended Military environments and operations.

Testing will reduce program risk and increase confidence in operational effectiveness, operational suitability, survivability, and user safety.

Brake Test Example

Family of Medium Tactical Vehicles

Hidden Failure Modes!

- Testing based on perceived worst case scenario (combat load and OMS/MP)
- *Missed catastrophic failure mode that occurs when empty at highway speeds*

Testing needs to be optimized to establish the systems performance envelope

Summary

- Strong Systems Engineering (SE) and analysis processes can improve system performance.
  - Requirements analysis
  - System design and development
  - Environment, Safety, & Occupational Health

- Utilize ATEC expertise to support and inform SE processes.
  - Requirements refinement
  - Testability
  - Corrective action assessments

- Utilize ATEC capabilities and resources
  - Early Soldier involvement during Field tests in realistic environments

"Testing the right system, the first time, saves ***time*** and ***money***."