CEROS Industry Day

Dr. Deborah Furey
Program Manager, STO
703 248-1510
deborah.furey@darpa.mil

14 September 2009

Dr. Larry Stotts
Dep Dir, STO
571-218-4346
larry.stotts@darpa.mil

Mr. Donald Woodbury
Director, STO
703-5696-2362
Donald.Woodbury@darpa.mil

Dr. Brian Pierce
Dep Dir, STO
703-248-1505
brian.pierce@darpa.mil

CEROS – Industry Day

- DARPA Overview
  - Mission
  - Organization Updates
  - Program Traits & Transition Paths
  - Business Strategy
  - STO Strategic Thrusts
- DARPA Role in CEROS
  - CEROS RFP Statistics
  - Heilmeier Questions
  - Technology Transition Levels
  - Public Release Approval

DARPA Mission

The Defense Advanced Research Projects Agency (DARPA) is the central research and development office for the U.S. Department of Defense (DoD). DARPA's mission is to *maintain the technological superiority* of the U.S. military *and prevent technological surprise* from harming our national security. We also create technological surprise for our adversaries.

DARPA Update

- **DARPA Leadership –**
  - **Director: Dr. Regina Dugan**
  - **Deputy Director: Dr. Ken Gabriel**
- **New Offices**
  - **Transformative Convergence Technology Office**
    - **Fundamental Research**
    - **Office Director: Dr. Peter Lee**
  - **Adaptive Execution Office**
    - **Transition**
    - **Office Director is: Dr. Dick Urban**

DARPA Technical Offices

Director, Dr. Regina Dugan
Deputy Director, Dr. Ken Gabriel

Tactical Technology
David Neyland
Steve Walker

- Air/Space/Land/Sea Platforms
- Unmanned Systems
- Space Operations
- Precision Strike

Strategic Technology
Don Woodbury
Larry Stotts / Brian Pierce

- Energy
- Global ISR
- Cyber Networks
- Medical and Health
- Austere Environments
- Warfare: Conventional & Irregular
- Space and Near Space Sensors and Structures

Defense Sciences
Leo Christodoulou
Ben Mann

- Physical Sciences
- Materials
- Biology
- Mathematics
- Human Effectiveness
- Bio Warfare Defense

Information Processing Techniques
Charles Morefield
Charlie Holland, Mark Luettgen

- Cognitive Systems
- Command & Control Systems
- Computer Language Translation
- High Productivity Computing
- Sensors & Processing

Microsystems Technology
Gregory Kovacs
Dean Collins / Mark Rosker

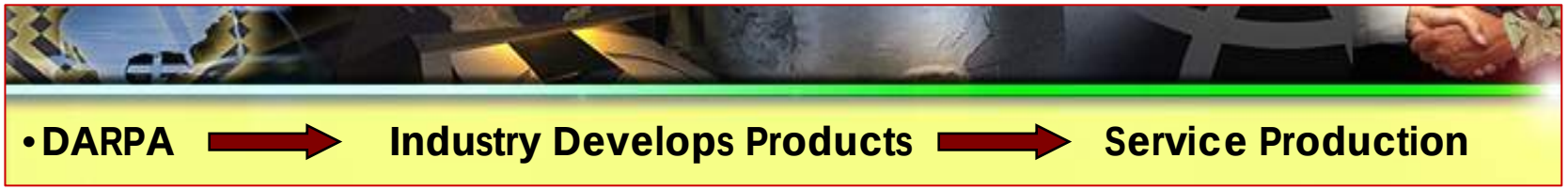
- Electronics
- Photonics
- MEMS
- Algorithms
- Integrated Microsystems

Characteristics of a DARPA Program

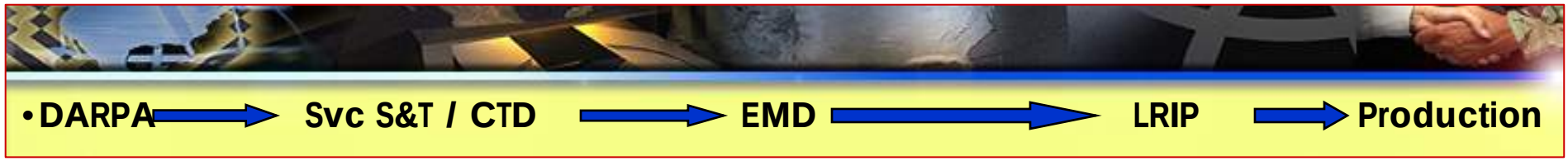
- ***Revolutionary change*** **in defense capability (not extensions or incremental gains)**
- **Empowered by ideas and passion of the *program manager***
- ***Project centric*** **– not investigator centric**
- **Creates opportunities, "encourages" *teams* – evaluated by Government**
- ***Flexible, rapid review*** **and contracting**
- ***Actively managed*** **by the program manager**
- **Driven by *quantitative milestones* leading to a Memorandum of Agreement (MOA) when possible**

DARPA Transition Paths

- Components, tech base



- Components, small systems

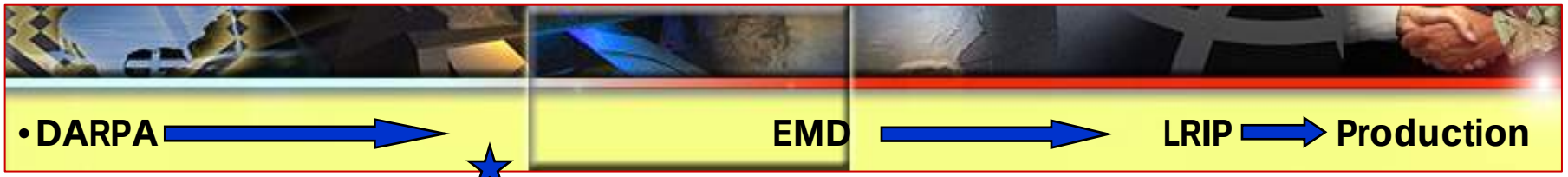


- Concept and Technology Development
- (MS A)

- Engineering and Manufacturing Development (MS B)

- Low Rate of Initial Production
- (MS C)

- Prototypes



- POM submit

Strategic Areas of Investment

Strategic Thrusts

ENERGY

Areas of Interest

- **Deployable Energy Network**
- **Storage**
  - Harvesting/conversion
  - Control
- **Smart Systems**
- **Distribution**
  - Wireless
  - Superconducting

Strategic Thrusts

SPACE & NEAR-SPACE SENSORS & STRUCTURES

Areas of Interest

- **Continuous, reliable, stand-off tracking of air and ground moving targets, day or night**
- **Seek and engage tracked targets**
- **Battle Damage Assessment**

Strategic Thrusts

BIOLOGICAL AND HEALTH APPLICATIONS

Areas of Interest

- **Stand Off Triage**
- **Stand Off Soldier Health Monitoring**
- **Stand Off Soldier Care**
- **Survival Pack**
  - 24 hour
  - Extended
- **In-field Medic Test Diagnostics**
- **Broad Spectrum Hazard Indicators**

Strategic Thrusts

SUSTAINMENT IN AUSTERE ENVIRONMENTS

Areas of Interest

- **Infrastructure in a Box**
- **Feels Like Sea Level**
  - maintain physiology as though you were at sea-level maintain effective oxygen volume
- **Operational Supremacy in Extreme Environments**
- **Dense Nutrition Supplements**
- **Water Harvesting (Potable/Scale)**
- **Anti-Icing**
- **Deep Sea**

Strategic Thrusts

CYBER NETWORKS

Areas of Interest

- **Reliable, robust, continuous connectivity**
- **Fast transport**
  - Surface and subsurface
- **Information superiority**
  - The network as a weapon
- **Defend the network**
  - Guarantee connectivity and survivability

Strategic Thrusts

GLOBAL ISR AND NATIONAL DEFENSE

Areas of Interest

Standoff detection of weapons, explosives, chem/bio/nuclear

Technical Challenges

- Identification of observable characteristics
- Highly cluttered environment
- Historical correlations to create an acceptable false alarm rate
- Signal attenuation and dispersion (physics limitations)

Strategic Thrusts

WARFARE: CONVENTIONAL AND IRREGULAR

Areas of Interest

- Portable Manufacturing
- Tamper Resistant Expendable Technology
- Develop a universal, symbol-based command and control system
- Revolutionary Force Projection

BioFuels Program

Strategic Technology Office

Objective: Produce a bio-derived JP-8 to reduce DoD dependence on petroleum-based fuels

March 2007 - October 2008

Highly-efficient conversion process to JP-8 from long and target chain oils

"Build-down" process:
- •cracking/isomerization of C12-C16 to JP-8
- •no crack process targeting C8-C16

Approach:

- Identify a broad variety of feedstock crops for oil extraction and processing to JP-8
- Develop multiple oil-to-JP-8 conversion pathways that are not specific to the origin or structural properties of the oil
- Submit a final bio-derived JP-8 sample for government testing and evaluation
- Diversify portfolio of agricultural / aquacultural source feedstock to avoid competition with current food crops

Proof of Concept: September 2007 – January 09
Demonstration: February 2009 – February 2011

Highly-efficient conversion process to JP-8 from short chain biomass waste

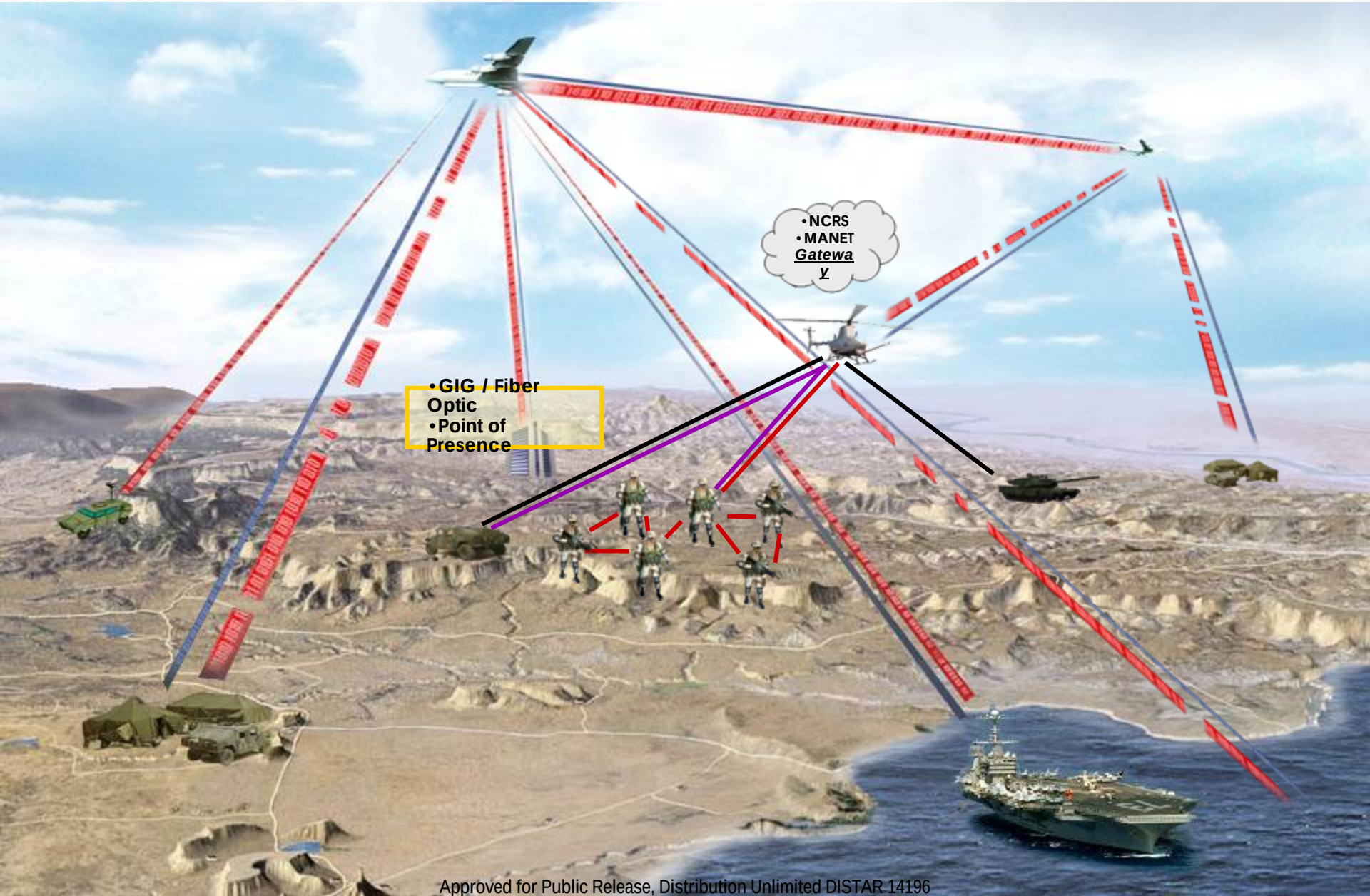
"Build-up" process:
- •oligomerization of C2-C6 to JP-8

Algal Oil: December 2008 – June 2010
Celluose: March 2009 (est) – September 2010

Highly-efficient system for cellulosic feedstocks and low-cost algal oil production and conversion to JP-8

Optimize cellulosic process and algae selection to process oils to JP-8

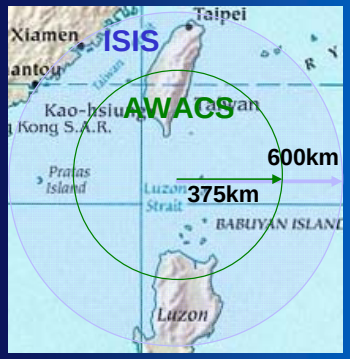
Optical RF Communications Adjunct (ORCA)

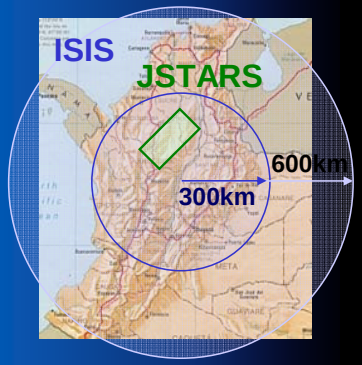


Integrated Sensor Is Structure (ISIS)

Strategic Technology Office

All-weather "High-Definition" Picture of All Moving Targets





Afghanistan required "persistent ISR 24 hours a day, seven days a week, 365 days a year, good weather or bad weather."

James G. Roche, Fmr. Secretary of the Air Force, Spending for Defense (A Special Report) Wall Street Journal, 28 March 2002.

SEA ⟷ LAND ⟷ AIR

Pulse-to-Pulse aperture reconfiguration enables all missions simultaneously

Unprecedented Moving Target Knowledge of the Battlefield

- Precision knowledge of all moving targets to include foliage obscured
- Engagement quality target tracks on all vehicles – air and ground
- Fire-control enabling long-range command-guidance intercept

The National Cyber Range

A Dedicated Cyber Testbed To Enhance the Nation's Ability to Defend Against Cyber Attacks

The National Cyber Range will

- Provide a dedicated "test bed" to produce qualitative and quantitative assessments of the security of cyber technologies and scenarios.
- Provide a revolutionary, safe, instrumented environment for our national cyber security research organizations to test the security of information systems.
- Revolutionize the state of the art of cyber security testing.

Revolutionary test capabilities	
Automated configuration, sanitization, reconfiguration	*- Automation*
-Virtualization technology	*- Scale*
-Simulate human activity	*- Realism*
Time dilation & contraction	*- Efficiency*
All systems: wired, MANET, control systems, phone, etc.	*- Completeness*

Facilitates consistent, realistic, verifiable testing

CEROS – Industry Day

- DARPA Overview
  - Mission
  - Organization Updates
  - Program Traits & Transition Paths
  - Business Strategy
  - STO Strategic Thrusts
- **DARPA Role in CEROS**
  - **CEROS RFP Statistics**
  - **Heilmeier Questions**
  - **Technology Transition Levels**
  - **Public Release Approval**

DARPA's Role in CEROS

- **Provide Recommendations To Improve:**
  - Technical quality, and
  - Management of the program

- **Review Projects For:**
  - Technical quality,
  - Within scope of the DARPA/CEROS mission, and
  - Duplication of research previously performed.

- **Grant Public Release Approval**

- **Provide Funding**

CEROS RFP STATISTICS

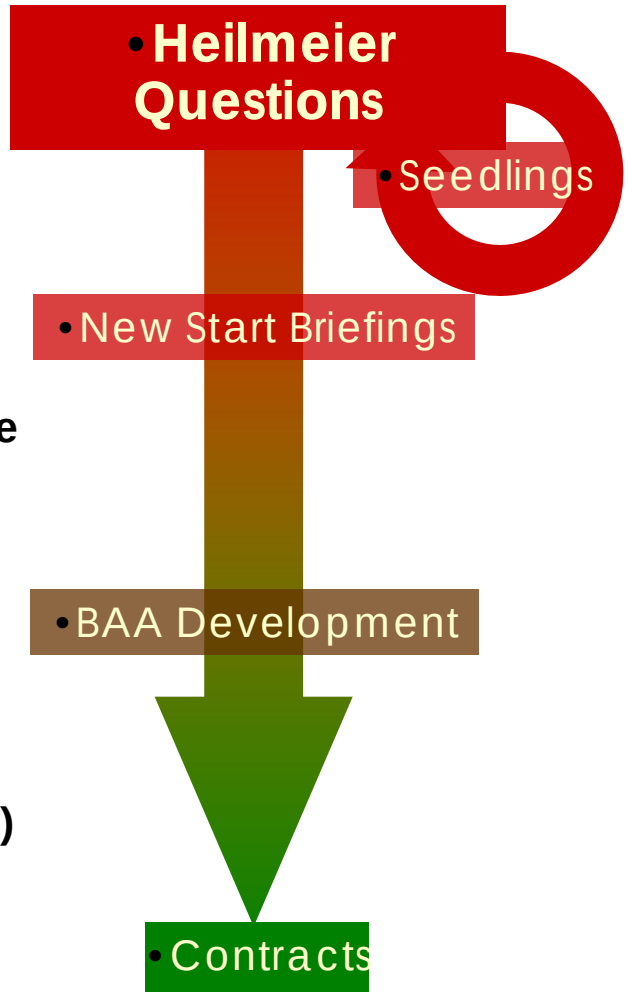
	RFP	ABSTRACTS	PROPOSALS	FUNDED
93 CORE	MAY 93	0	79	12
94 CORE	MAR 94	160	28	16
95 CORE	DEC 94	114	32	11
96 CORE	DEC 95	95	31	12
97 CORE	DEC 96	103	31	16
98 CORE	OCT 97	66	28	19
99 CORE	OCT 98	99	27	15
00 CORE	OCT 99	96	25	15
01 CORE	OCT 00	69	17	14
02 CORE	OCT 01	66	17	10
03 CORE	OCT 02	100	21	15
04 CORE	OCT 03	82	21	19
05 CORE	0CT 04	68	24	15
06 CORE	OCT 05/FEB 06	60 + 19	16 + 8	17
07 CORE	NOV 06	71	29	13
08 CORE	JAN 08	102	32	19
09 CORE	NOV 08	68	28	19
TOTALS		1438	494	257

CEROS has funded 257 projects since April 93

Before You Propose: *Ask Yourself These Questions*

Is it *really* a good idea?

- **We constantly ask our Technical Directors/Program Managers the Heilmeier Questions:**
  - **What are you trying to accomplish?**
  - **How is it done now, and with what limitations?**
  - **What is truly new in your approach which will remove current limitations and improve performance? By how much?**
  - **If successful, what difference will it make?**
  - **What are the quantifiable technical metrics required to prove your hypothesis? When will they be done? (Go/No-Go Criteria)**
  - **What is the DARPA "exit strategy"? (Transition Plan)**
  - **How much will it cost?**



PLAN YOUR TRANSITION NOW

- **Identify Your Transition Partner**
  - **Acquisition Programs (ACAT I – IV) (Preferred)**
    - **PMS 403 (Unmanned Undersea Vehicles)**
    - **PMW 264 (Air ASW Systems)**
    - **PEO Integrated Warfare Systems**
    - **PEO C4I**
  - **Fleet Support and Operational Commands**
    - **Naval Air Force, U.S. Pacific Fleet (NAVAIRPAC)**
    - **Marine Forces, Pacific (MARFORPAC)**
    - **Navy Explosive Ordnance Disposal**
    - **COMSUBPAC**
    - **CTF-34**
    - **Shipyards**
  - **DARPA or Office of Naval Research**

- **Close the Deal, Discuss Follow-on Funding, Get the Commitment Now**
  - **Identify your future funding source (POM wedge)**
    - **R&D: 6.2 – 6.6**
    - **Operations and Maintenance, Navy (O&M,N)**
  - **Get Agreement On What Must Be Demonstrated**
    - **Document in Memorandum of Agreement (MOA) between CEROS and the Transition Partner**

- **Identify Contracting Strategy for Follow-on Work**
  - **Direct with Transition Partner**
  - **Subcontractor Under Prime**
  - **DARPA STO BAA**

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
1	Basic Principles observed and reported	**Basic research** – Invention of Gas Laser
2	Technology concept and/or application formulated.	**Basic research** – Invention of Ring Laser. Theoretical description of Ring Laser Gyro
3	Analytical and experimental critical function and/or characteristic proof of concept.	**Applied research** – Demonstration of Ring Laser as a rate sensor
4	Component and/or breadboard validation in laboratory environment.	**Applied research** – Demonstration of Ring Laser Gyro (RLG)-based Inertial Measurement Unit (IMU) operation under temperature, shock, vibration, and g-loading
5	Component and/or breadboard validation in relevant environment.	**Advanced Technology Demonstration** – Demonstration of HG1700-based guidance set components (IMU, GPS receiver, control system, flight computer) in a high-fidelity hardware-in-the-loop facility
6	System/subsystem model or prototype demonstrated in a relevant environment.	**Advanced Technology Demonstration** – Demonstration of actual flight-ready HG1700-based guidance set in a high-fidelity hardware-in-the-loop facility and under expected levels of shock, vibration, altitude and temperature
7	System prototype demonstrated in an operational environment.	**System Design and Development** – Demonstration of actual Guided MLRS missile in a flight test sequence from an operational launcher. Successful operation in multiple flight demonstrations
8	Actual system completed and "flight qualified" through test and demonstration.	**Low Rate Initial Production** – Developmental Test and Evaluation of GMLRS in its final form under mission conditions.
9	Actual system "flight proven" through successful mission operations.	**Production** – Operational Test and Evaluation of GMLRS by the soldier, airman, or seaman.

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
1	Basic Principles observed and reported	**Basic research** – Invention of Gas Laser
2	Technology concept and/or application formulated.	**Basic research** – Invention of Ring Laser. Theoretical description of Ring Laser Gyro

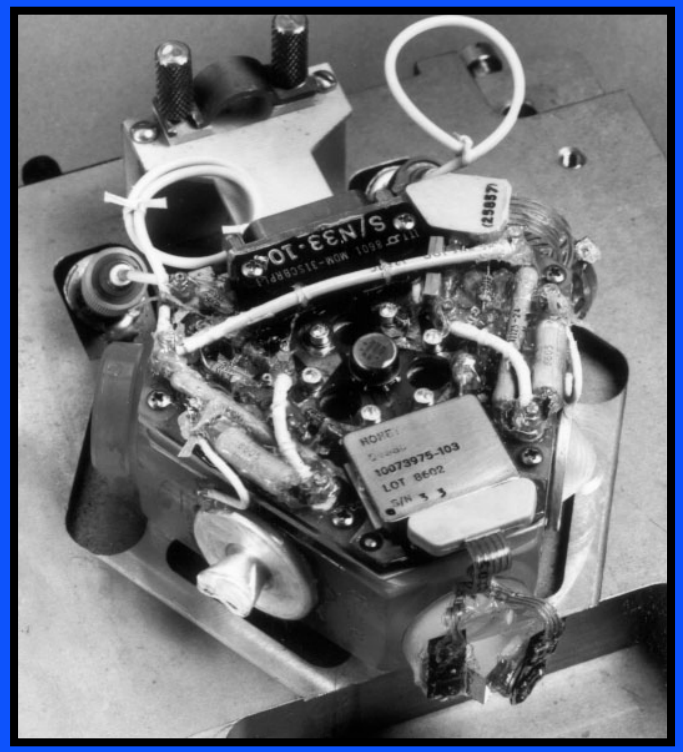
- **Laser**
- **Research**
- **Facility**

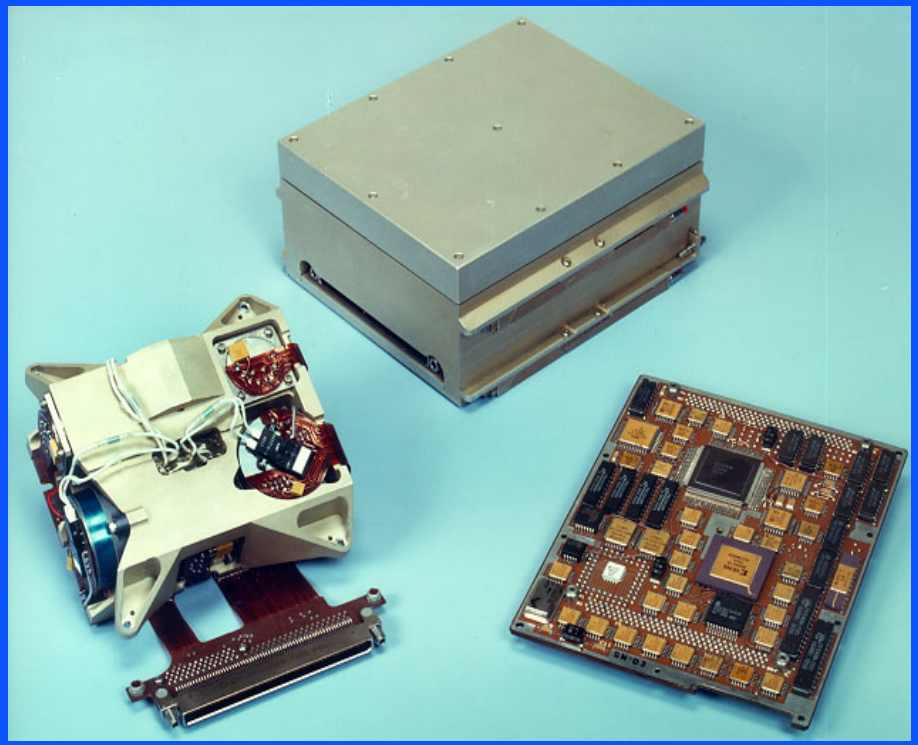
- **circa 1960**

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
3	Analytical and experimental critical function and/or characteristic proof of concept.	**Applied research** – Demonstration of Ring Laser as a rate sensor

- **Ring Laser Gyro circa 1975**





- **HG1108 Inertial Measurement Unit circa 1990**

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
4	Component and/or breadboard validation in laboratory environment.	**Applied research** – Demonstration of Ring Laser Gyro (RLG)-based Inertial Measurement Unit (IMU) operation under temperature, shock, vibration, and g-loading

Temperature Chamber

Centrifuge

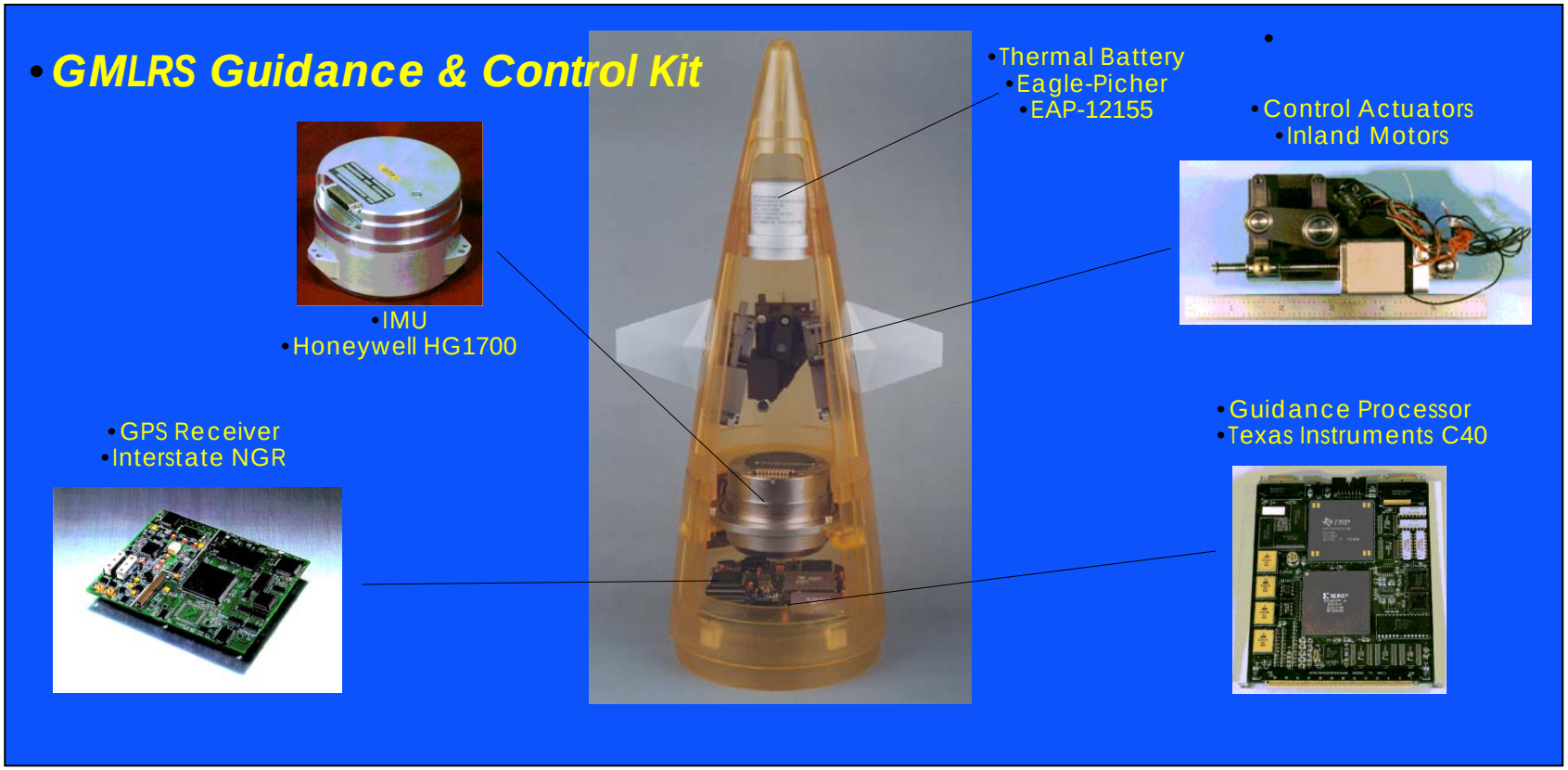
Indexing Table

Vibration Table

Rate Table

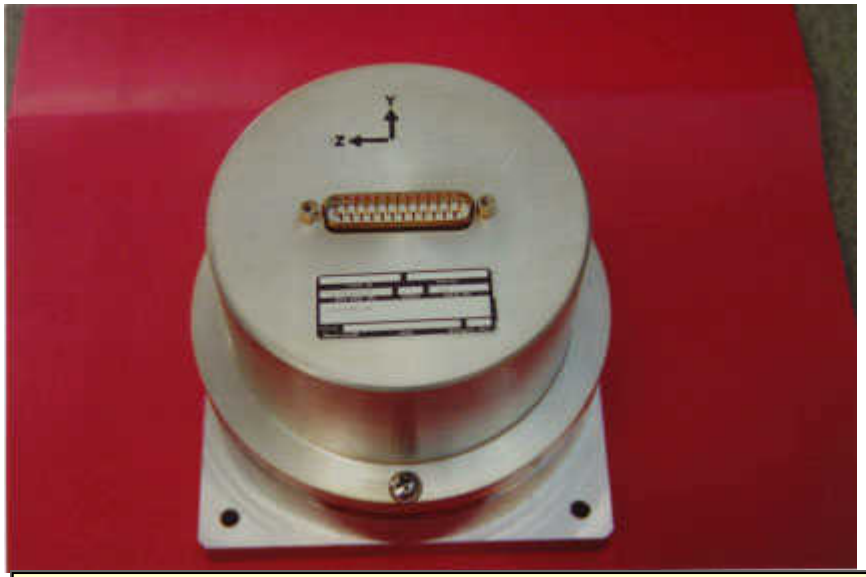
Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
5	Component and/or breadboard validation in relevant environment.	**Advanced Technology Demonstration** – Demonstration of HG1700-based guidance set components (IMU, GPS receiver, control system, flight computer) in a high-fidelity hardware-in-the-loop facility



Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
6	System/subsystem model or prototype demonstrated in a relevant environment.	**Advanced Technology Demonstration** – Demonstration of actual flight-ready HG1700-based guidance set in a high-fidelity hardware-in-the-loop facility and under expected levels of shock, vibration, altitude and temperature



- ***HG1700 Inertial Measurement Unit***

Technology Readiness Example

Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
7	System prototype demonstrated in an operational environment.	**System Design and Demonstration** – Demonstration of actual Guided MLRS missile in a flight test sequence from an operational launcher. Successful operation in multiple flight demonstrations

- ***Guided Multiple Launch Rocket System***

Technology Readiness Example

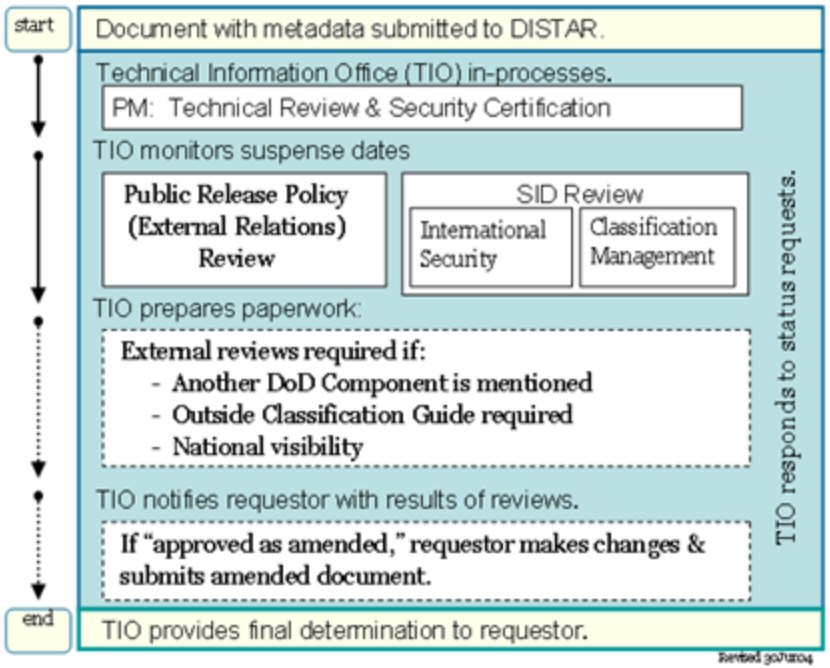
Level	Technology Readiness	Example – HG1700 Inertial Measurement Unit Guided Multiple Launch Rocket System (GMLRS)
8	Actual system completed and "flight qualified" through test and demonstration.	**Low Rate Initial Production** – Developmental Test and Evaluation of GMLRS in its final form under mission conditions.
9	Actual system "flight proven" through successful mission operations.	**Production** – Operational Test and Evaluation of GMLRS by the soldier, airman, or seaman.

- ***Six Guided Multiple Launch Rocket System (GMLRSTM)***
- ***rockets fired at the Cold Region Test Center in Alaska***

PUBLIC RELEASE APPROVAL

- **All information developed under CEROS funding must be approved by the Technical Information Office Before Release to the Public**

- ***Public Release Process***



- ***Email to: TIO@darpa.mil***

- **Document Information**
- **Document Title:**
- **Document Author:**
- **Description:**
- **Number of Pages/Minutes of video:**
- **Document Type: (Briefing, report, abstract, article or paper)**
- **Event Information**
- **Event Type: (Conference, PI meeting, Press Release, Article or Paper)**
- **Event Date:**
- **Desired Date for DARPA's Approval:**
- **DARPA Sponsor**
- **DARPA Program Manager:**
- **DARPA Program Office:**
- **Contract Number:**
- **Point of Contact Information**
- **Name:**
- **Email:**
- **Phone:**