NAVSEA
WARFARE CENTERS
Indian Head EOD Technology Division

CAD/PAD International Logistics Meeting (ILM)

CAD / PAD Ordnance Assessment (OA)

Capt. Scott H. Kraft, USN
Commanding Officer

Mr. Ashley G. Johnson, SES
Technical Director

- 11 June 2019 -

AGENDA

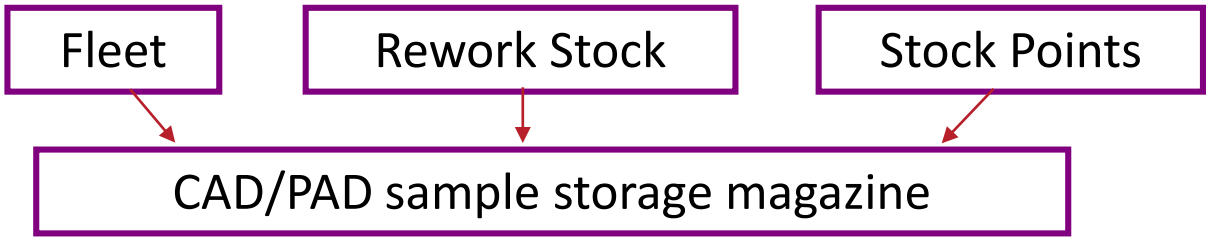
- Purpose, Sponsors and Test Considerations
- Acquiring Samples
- Ordnance Assessment (OA) Process Steps
- Sample Test
- Recent Work
- OAs Findings and Analysis Examples
- Summary
- Questions

OVERVIEW

- The OA programs assess the quality, reliability, and serviceability of all CAD/PADs
- End-User Benefit
  - Identifies and analyzes aging trends to assign appropriate service lives
  - Identifies deficiencies due to environmental conditions and/or maintenance procedures
  - Ensures CAD/PADs are working as intended within requirements of system or end-item application
- Typically conduct 60-70 new OAs annually for various sponsors on three-to-five year cycle
  - USN, USAF, USA, NASA and other sponsors when requested and funded
- Emphasis on items that have been installed into their intended applications, exposed to associated environment
  - Currently tracked in Virtual Fleet Support (VFS) for USN/USMC
- CAD/PAD design or production changes, aircraft configuration changes, material performance/reliability level, logistical needs, obsolete/suspect items, new qualified items, etc., are all taken into consideration when conducting OA tests

Acquiring Samples

- Annual sample requirement to fleet
  - Sample acquisition initiated at least one year in advance
  - Identified by DODIC for upcoming year
  - Administrative Naval Message (U.S. Navy Only*)
  - Fleet Return Module (Currently USMC Only, USN Implementation scheduled for FY19*)
- NSWC Indian Head EOD Technology Division rework stock
- Coordinated with NAVSUP Ammo Logistics Center (NALC) Mechanicsburg (USN and USMC only*)
- A good OA depends on a good sample
  - A good sample is determined by exposure to its fleet representative environment; therefore, it is essential to receive these samples back from the fleet after removal.
  - A quality sample boosts confidence in the test results



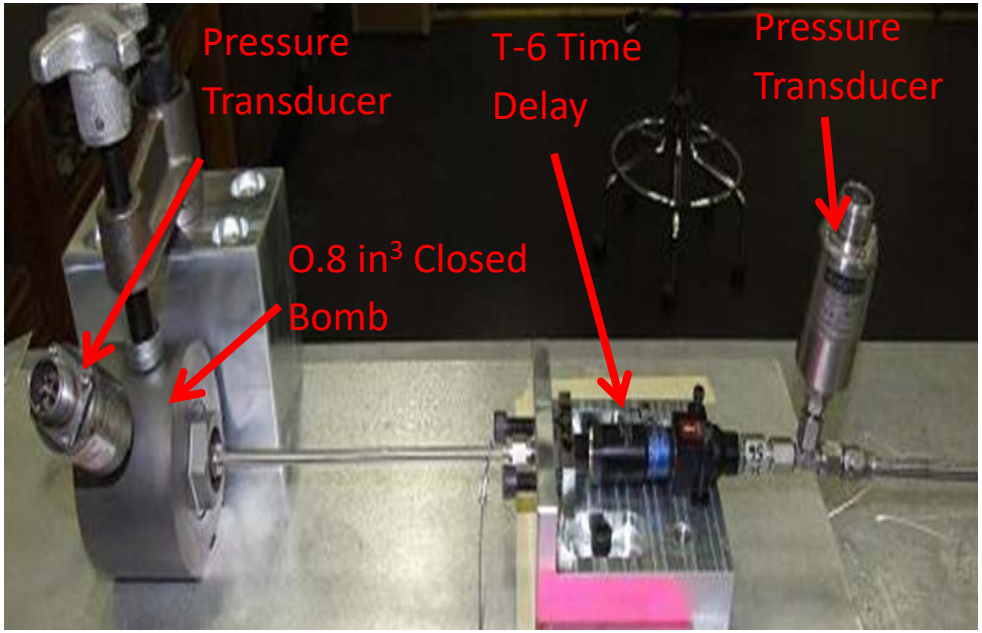
*Other sponsors responsible for their own OA sample collection

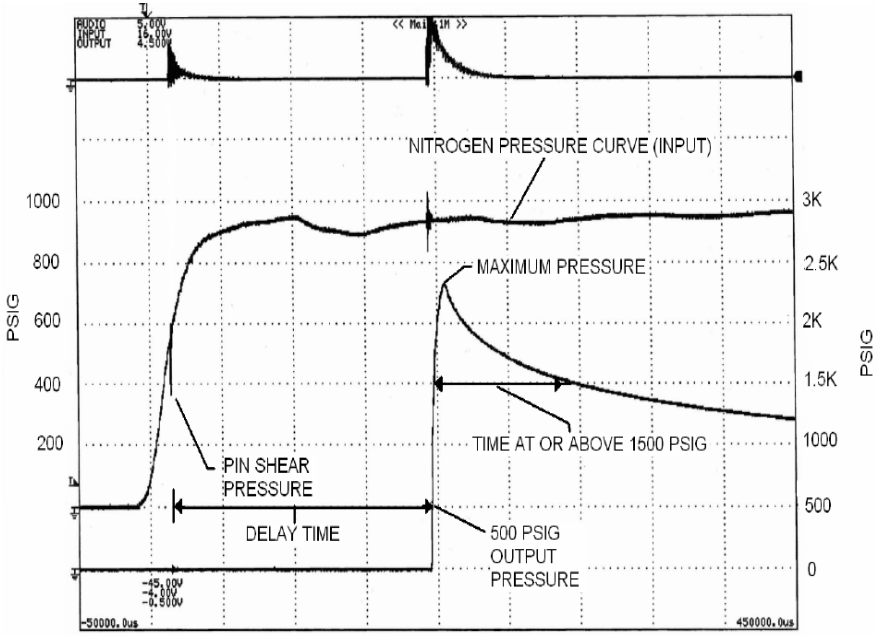
OA Process Steps

- Research Install History (Tracked in VFS – TRACE/LogBook)
- Non-Destructive Testing
  - Visual, Electrical Resistance, X-ray, Helium Leak, etc.
- Ballistic/Destructive Testing
  - Same as original Lot Acceptance Tests (LAT) in order to maintain commonality
  - Fixtures designed to simulate end item use or configuration
  - Typically temperature conditioned at extreme temperatures (Cold/Hot) and ambient condition to ensure life cycle sustainment
- Propellant Stability Testing
  - Ensures CAD/PAD is safe to handle and store by analyzing stabilizer levels
- Statistical Analysis
  - Generated aata compared to original LAT and prior OA data
  - Plotted as a function of total age and installed time
  - Reliability Statistics
    - Functional Reliability: item performing within specification
    - Catastrophic Reliability: Ability of item to complete the firing cycle when initiated

Sample Ballistic Test

- DODICs JL56/57 (T-6 Time Delays) and DODICs JN10-12 (T-38 Time Delays)
  - Delay Time (ms)
  - Maximum Pressure (psig)
  - Time at or above 1500 psig (ms)





Engineering Decisions

- Does item have relevant system/environmental exposure?
  - Install data (VFS – TRACE/Logbook)
- Does data represent the current fleet population?
  - Sample Quality
- Safe to store and handle at current lives?
  - Propellant Stability
- Reliable? Performance within required limits?
  - Statistical Analysis
- Effects of fleet environment?
  - NDT and Ballistic Testing

Life Determination

Install History + Quality Sample + Test Performance +
Safe Handling + Statistical Analysis

Recent Work – Ballistic Firings

DODIC	Nomenclature	Test Date	Current Li
M182	Fire Extinguisher Cartridge	1/18/18	216/72
MF69	Initiator	1/31/18	108/36
JM36	Cutter	2/20/18	132/108
JM33, JM34, JM41	EEDs, Canopy Thruster Rocket	2/20/18	120/96
MD87	Harness Release Cart	2/28/18	96/96
JN28, JN29	Secondary Impulse Ctg (T-6 and T-38)	3/9/18	60/48, 72/48
SR67/68	B-1B LCAs	3/15/18	156/75
WB55	Initiator	3/23/18	48/24
MC50	0.3-Second Delay Initiator	3/23/18	60/24
WB54	Delay Initiator	4/16/18	84/48
MU84, MU87	F15 - 2.0 and 1.5 SEC DELAY INIT	4/17/18	72/36
MT57, MT58, MT65	.33, .40, & 1.0 sec Delay Initiators	4/17/18	108/96
MT89	NACES Impulse Cartridge	4/23/18	192/96
JN08	Canopy Jettison Booster Cart	5/3/18	72/48
MT88	NACES Impulse Cartridge	5/14/18	180/108
MT98	NACES Impulse Cartridge	5/14/18	144/84
SU58	Mild Det Cord (MDC) Set	5/17/18	120/72
MT13	NACES Impulse Cartridge	5/24/18	168/96
MT16	NACES Initiator	5/28/18	168/108
MD66	Impulse Cartridge (Bomb Ejection)	6/5/18	192/24
BY81	FLU-9 Inflation Device	6/13/18	108/108
FW98	Inflation Device FLU-8 B/PA	6/20/18	168/-
MW19	Parachute Release Imp. Ctg.	6/26/18	150/85
MT23	Fire Extinguisher Cartridge	6/28/18	132/60
MT91, XW50	Impulse Cartridge	7/3/18	182/108
MT95	CCU-107/B Impulse Cartridge	7/6/18	156/12
M948	Aerial Refueling Cartridge	7/10/18	72/36
MU15-19, MU79/80, MJ93	B-1B Time Delays	7/17/18	156/75
MU97, MU98, MU99	AND Gates Type 1	7/17/18	108/36
SR74	Manual Pull Initiator	7/17/18	144/120
MU90, MU89 MU29,	Time Delay Cartridge	7/17/18	72/48
JL64, JN06	Impulse Cartridge	7/18/18	96/60

Recent Work – Ballistic Firings

DODIC	Nomenclature	Test Date	Current Life
MT64, SQ34	SMDC to Gas Initiator	8/21/18	120/84
SP82, SP83	ARM-FIRE INIT, EXTERNAL	8/21/18	60/36
JL57	.17 Second Delay Cartridge	8/28/18	60/24
XW78	Initiator	9/14/18	180/114
XW52	Initiator	9/14/18	192/102
XW70	S &A Detonator	9/14/18	120/60
MJ98, MH61	Initiator	9/17/18	216/148,
JL42-44	Fire Extinguisher Cartridge	9/17/18	198/108
M690	M3A2 Initiator	9/27/18	246/192
MT97	NACES Impulse Cartridge	10/8/18	144/96
WB06	Det Cord (Gas Gen to HE)	10/11/18	60/24
JN13, JN14	Front & AFT USRMs	10/15/18	various
XW51	Impulse Cartridge	10/19/18	204/1/26
JL65	CCU-157/A Impulse Cartridge	10/19/18	84/60
MD68, MD69	Mk 100/101 Mod 0 Rocket Motor	10/25/18	216/-
JL63, JN16	Parachute Impulse Cartridge	10/30/18	120/72
JM60	CKU-5 Rocket Catapult	11/5/18	108/-
MT06	JAU-59/A Initiator	11/7/18	156/72
JL54	ADU Cartridge	11/7/18	132/60
JL55	Drogue Gun Imp. Ctg.	11/20/18	84/72
A965, MD73, MG62	M839/M796/BBU-35/B Impulse Cartridge	11/28/18	Various
JL62	PIRD Cartridge	11/29/18	108/60
MT86	Canopy Remover Cart	12/5/18	144/144
WB34-39	Canopy Severance Assemblies	12/5/18	84/60
JM39	F-22 Thermal Battery	12/5/18	72/36
JM56	Time Delay Initiator	12/8/18	72/36
JM55	Aneroid Cartridge	12/8/18	60/36
JM57	Time Delay Initiator	12/8/18	96/72
WB51	Fire Extinguisher Cartridge	1/3/19	204/126
JM58	Initiator	1/29/19	84/72
ZY56	Drogue Severance Assy	2/1/19	120/120

Recent Work – Life Evaluations

NALC/ DODIC	Nomenclature	Final Publicatior	Old Life	Life Determinatio
WB55	Initiator	8/7/2018	84/48	48/24
MT85	CCU-109/A Impulse Cartridge	8/7/2018	240/90	240/90
XW36	Catapult Ctg. Mk 205 Mod 1/2	8/7/2018	96/-	108/-
WB55	Initiator	8/7/2018	48/24	48/24
MD68, MD69	Mk 100/101 Mod 0 Rocket Motor	8/7/2018	216/---	216/-
MT89	NACES Impulse Cartridge	8/7/2018	192/96	204/108
XW78	Initiator	8/7/2018	180/114	192/126
M690	M3A2 initiator	8/7/2018	246/198	246/198
MW19	Parachute Release Imp. Ctg.	8/7/2018	150/85	150/85, 162/85
JL71	CCU-148/B Impulse Cartridge	8/7/2018	96/24	96/24
M264	M55 Electric Ignition Element	8/7/2018	96/12	96/12
XW57	Impulse Cartridge	8/7/2018	159/96	159/96, 183/108
M365	Impulse Cartridge MK 1 MOD 3	8/7/2018	144/18	144/18
XW49	Shoulder Harness Reel Imp Ctg	8/7/2018	158/96	158/96
FW98	Inflation Device FLU-8 B/PA	8/7/2018	168/-	180/-
MT16	NACES Initiator	8/7/2018	168/108	168/108
M689	M53 Initiator	8/7/2018	AF: 248/216, N: 248/ 132	264/148
MT69	Fire Extinguisher Cartridge	8/7/2018	156/84	168/96
M012	Impulse Cartridge Mk 19 Mod 0	8/7/2018	204/42	204/42
M783	Multi-Use Impulse Cartridge	8/7/2018	264/126, 288/144	300/144
M703	M31 Initiator	8/7/2018	168/168, 180/168	192/168
MJ15, MJ92	Fire Extinguisher Cartridge	8/7/2018	various	180/108

Recent Work – Life Evaluations

NALC/ DODIC	Nomenclature	Final Publication	Old Life	Life Determination
MF72	JAU-27 /A Initiator	8/7/2018	192/120	204/132
MU84, MU87	F15 -Time delay Initiators	8/7/2018	72/48	72/48
JM81	EED, Catapult	8/7/2018	108/108	132/108
UY01, UY02, UY03	Bottom Bailout Handle, Type 4	8/7/2018	144/120	144/120
MG08, MU10	Antenna Cutter	8/7/2018	132/120	144/120
MD33, MD34, MD36, MS67, SS45, SS46	WCA	8/31/2018	216/96	216/96
M720	Cartridge Actuated Initiator	8/31/2018	various	various
A965, MD73, MG62	Impulse Cartridges	9/28/2018	228/12, 228/12, 132/12	228/12, 228/12, 132/12
MS81-MS88	AH-64 A/D SMDC	9/28/2018	240/144	240/150
JM52	U-2 ROCAT	9/28/2018	84/60	84/60
MG59	Impulse Cartridge	9/28/2018	186/90	190/90
MF21	Mk 79 Mod 1/2 Rocket Motor	9/28/2018	156/-	168/--
SP93, SP97, JM50	Rotary Actuators	9/28/2018	120/96	144/96
DWEA	MARK 273 MOD 0	9/28/2018	108/36	96/36
XW72	Initiator	11/28/2018	192/96	216/120
MD65	Impulse Cartridge	11/28/2018	various	various
M596	Initiator	11/28/2018	90/24	90/24
M492, MG01	Cartridge Actuated Cutters	11/28/2018	M492: 108/36, MG01: 96/36	M492: 108/36, MG01: 96/36
CWDR	MXU-792A/A Thermal Battery	11/28/2018	120/96	144/120
M647	Impulse Cartridge	11/28/2018	252/111	252/126
SS08	B-2 Butterfly Valve	11/28/2018	60/36	84/36
MU12	TOW SEVERANCE REL ASSY	11/28/2018	84/60	96/60

Recent Work – Life Evaluations

NALC/ DODIC	Nomenclature	Final Publication	Old Life	Life Determination
MH59	Inertia Reel Gas Generator	11/28/2018	156/96	180/96
JM51	U-2 Foot Retractor	11/28/2018	72/36	96/36
M934	Mark 17 Mod 0 Ignition Element	1/24/2019	84/12	84/12
MT89	NACES Impulse Cartridge	1/24/2019	204/108	204/108
MH66, MH63	SMDC to Gas Initiator	1/24/2019	108/84	108/84
MU05	Cartridge Actuated Cutters	1/24/2019	132/108	144/108
MJ21	CCU-92/A Impulse Cartridge	1/29/2019	various	various
MC60	INITIATOR, DELAY 0.4 SEC	1/29/2019	120/96	120/84
BY81	FLU-9 Inflation Device	1/29/2019	132/132	132/132
EY28	Battery Supply	1/29/2019	132/120	132/120
M758	JAU-8/A Initiator	1/30/2019	132/132	144/132
XW58	Impulse Cartridge	1/30/2019	204/96	204/96
JL47, JL48, DWFF	Det Cord Assembly	1/30/2019	96/48	96/48
JL56, JL57	Initiator JAU-78/A and 79/A	1/30/2019	84/60, 84/48	60/36
MT29	PDRM	1/30/2019	180/24, 180/48	180/24, 180/48
MT91, XW50	MOR Cartridge	1/30/2019	182/108	194/120
JL58, JL59	MARK 137/138 USRMs	1/30/2019	96/-	108/-
JN10, JN11, JN12	.40, 1.3, and .85 sec Delay Initiators	1/30/2019	84/48	84/48
SP02, SP03	AH-64 TLX	1/30/2019	240/108	240/108
MT57, MT58, MT65	F-16 Dual Delay Initiators	1/30/2019	MT57: 96/72, 72/60 MT58: 96/72, 72/60 MT65: 96/96, 72/60	MT57: 96/72, 72/60 MT58: 96/72, 72/60 MT65: 96/96, 72/60
MD53	Drogue Fun	1/30/2019	AF: 96/84, N: 84/72	AF: 108/84, N: 108/72
MD90, MD91	Reefing line Cutter	2/6/19	156/132	168/132

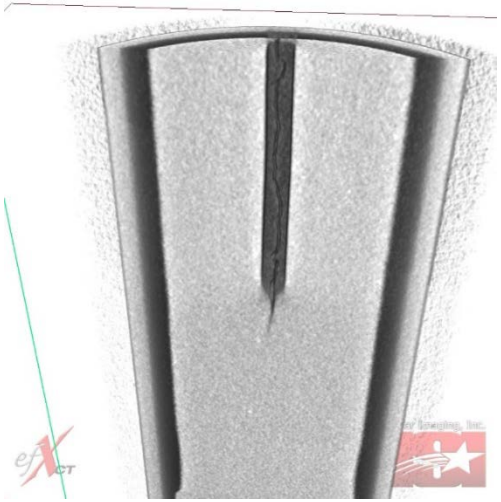
Planned OAs in 2019

#	DODIC	Nomenclature
1	1W18	Explosive separator
2	DWEY	CCU-158/A Laser-Initiated Detonator
3	DWEX	Seat Movement Detection Laser
4	DWEZ	T-6 Canopy Fracture Lasers
5	JL09	FLU-12 Inflation Device
6	JL53, DWFI, DWFH	Acceptor Initiator & Donor Assemblies
7	JN10, JN11, JN12	Time Delay Initiators
8	M161	Impulse Cartridge MK23 MOD 0
9	M284	Delay Cartridge MK 5 MOD 2
10	M363	MK124 Mod 0 Impulse Cartridge
11	M397	Impulse Cartridge Set
12	M571	Impulse Cartridge
13	M596	JAU-13/A Initiator
14	M688	M99 Initiator
15	M689	M53 Initiator
16	SU44/45	FCDC
17	MD65	Impulse Cartridge (Bomb Ejection)
18	MT05	Initiator
19	MT29	Mk 122 Mod 0 Rocket Motor
20	MT69	Fire Extinguisher Cartridge
21	SS34 & 35	UWARS
22	XW49	Shoulder Harness Reel Imp Ctg
23	SS89-93	Gas Fire Ext Generator
24	WB56	Cartridge Actuate Initiator
25	WB62	MLU-62/P25P Ctg. Act. Cutter
26	XW48	Impulse Cartridge

#	DODIC	Nomenclature
27	XW57	Impulse Cartridge
28	XW77	Initiator
29	M679, MU78	.75 Sec Time Delay Initiator
30	M251	M4 Canopy Remover
31	JL96	CKU-7 Rocket Catapult
32	MD88	ACES II - MORTAR CTG
33	TY60	Fire Ext Cart
34	MT20	CCU-125/A Fire Ext Cart
35	MT93	Pin Puller
36	ME34	Initiator
37	ME80, ME81, JM43, JM44	Canopy Jettison Rocket Motor
38	VY07	Gas Cylinder
39	MH59	Inertia Reel Gas Generator
40	MG47	Delay Initiator
41	MG48	Delay Initiator
42	EY28	ACES II Power Module
43	ME52-55, ZY46, ZY47	Emergency Canopy Release Lines
44	UY01-03	Bottom Bailout Handle, Type 4
45	SR73	Hatch Jettison Rocket Motor
46	WB40, WB41, WB44, WB46	C-17 FEDS Panels
47	JM46	Cable Actuated Drogue Gun
48	JM81	EED, Catapult
49	MT92, MT10	Thruster & Output Cartridge
50	SP93, SP97	Rotary Actuator
51	MU96	Kit Deployment Actuator
52	MH66, 63	SMDC to Gas Initiator
53	MT75, MT19, MU88, MU22	Aft/Hatch Remover Cart

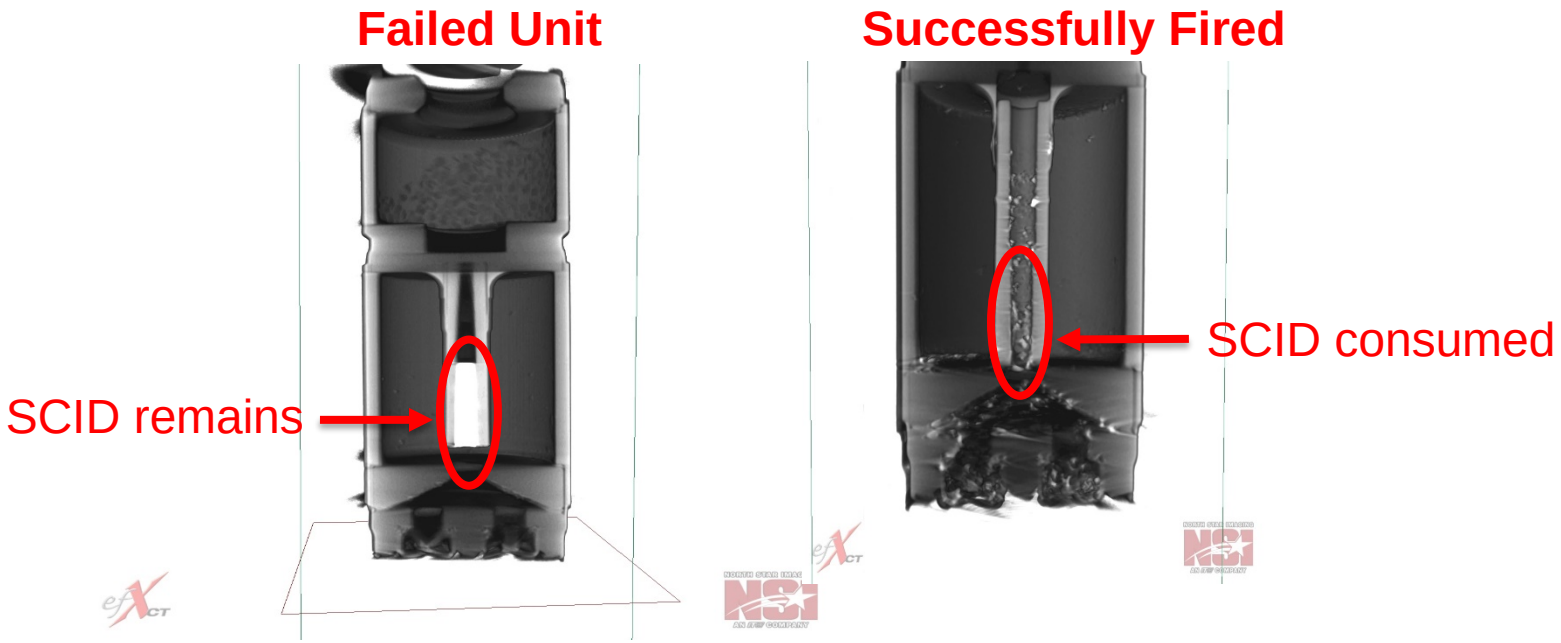
OA Findings and Analysis Examples

- DODIC JM51 (U-2 ROCAT - Dec 2017)
  - Computed tomography (CT) scans revealed cracks were developing in the finocyl and liner regions of the grain at exposure to temperature conditions below 40°F (4°C).
  - Risk analysis was completed and determined there was a 12% increase in pressure in the worst case sample, but occurred early in the burn process prior to achieving peak operating pressures.
  - Risk analysis determined the worst case scenario would be if cracks propagated down the entire length of the rocket catapult grain, resulting in a pressure increase between 9,000-12,000 psi and cause case rupture.
  - Scenario was deemed as low probability and ballistic testing was completed successfully.



OA Findings and Analysis Examples

- DODICs JL56/57 (T-6 Time Delays - Current):
  - Small Column Insulated Delay (SCID) failures (2012 to current)
  - Catastrophic failures and increasing delay times lead to service life reductions.
  - In March 2018, another catastrophic failure occurred.
  - Post-fire CT scans revealed the primers successfully functioned with the SCID never actuating.
  - Failure led to additional four lots being removed from service in 2018.

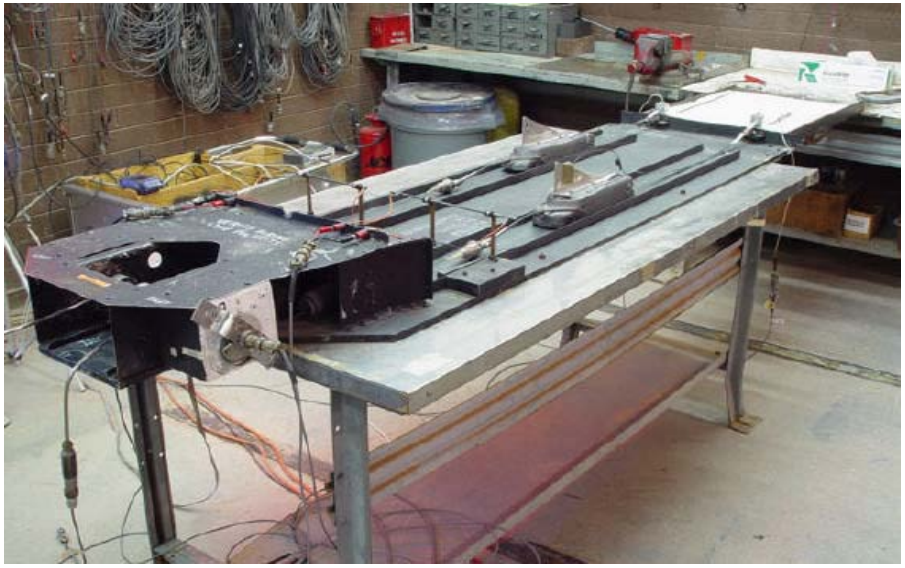


OA Findings and Analysis Examples

- DODICs MT30/31, MT13 (NACES USRMs and Impulse Cartridge – Nov 2017):
  - Conventional Ordnance Discrepancy Reports (CODR) issued due to over-application of MIL-PRF-32033 / VV-L-800 general purpose lubricant at the 84-day inspections of O-rings and preventive maintenance of moving sub-system parts.
  - Engineering investigation (EI) was conducted and subsequent emergency OA test plan was established to ensure system/end-items had not been compromised.
  - All test scenarios concluded minimal impact to system and maintenance procedures were updated as preventative actions for the future.

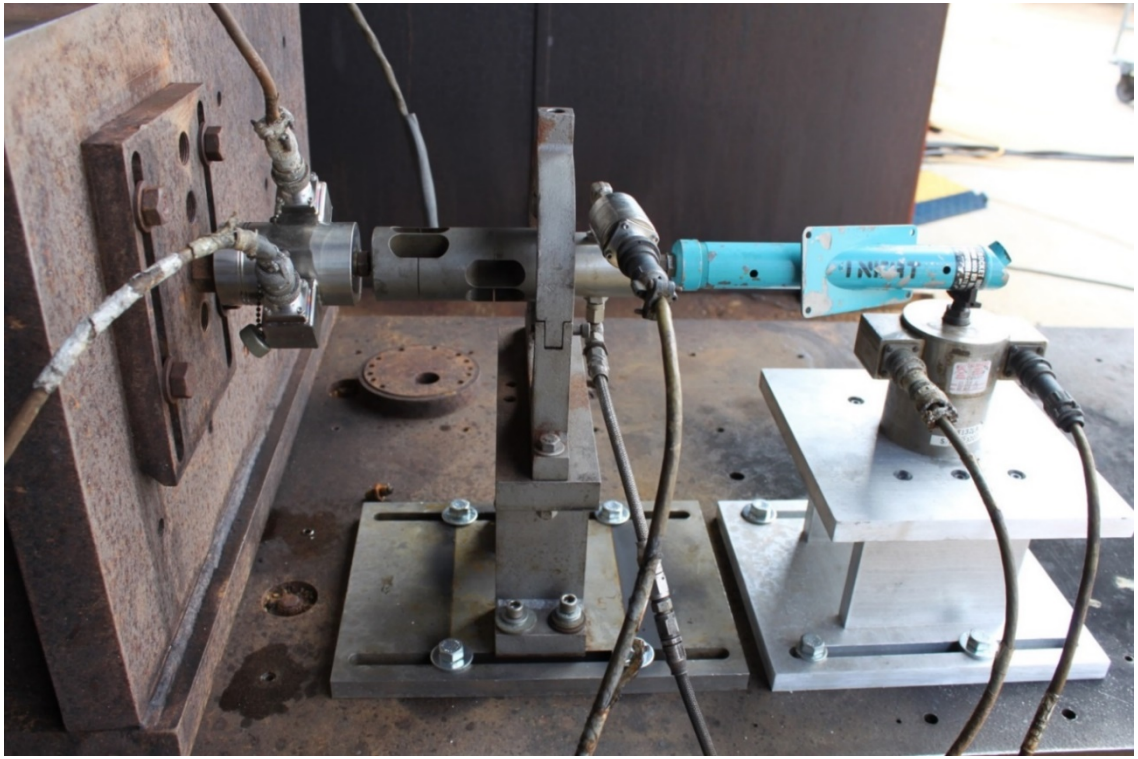
OA Findings and Analysis Examples

- DODIC JM51 (U-2 Foot Retractor - March 2018):
  - Combined test stand validation due to recent refurbishment of fixture and OA at increased ages due to late delivery of assets
  - Test stand validation was essential in follow-up propellant replacement program due to current propellant obsolescence
  - Validation was completed and fixture was accepted as-is though several recommendations for improvement were noted for future use
  - OA testing was completed and life determination was recommended for an increase



OA Findings and Analysis Examples

- DODICs MU75/76 (MK90/82 Man/Seat Separation Rocket Motor - March 2018):
  - OA testing was completed in order to validate performance at increased ages in order to allow temporary service life extensions (SLE) to mitigate late delivery of alternative designs



Summary

- OA ensures the safety, quality and reliability of CADs and PADs
- Quality of test depends on the quality of the samples
- Sample install history (VFS) is essential analyzing degradation of assets
- Usable FMS tests samples are needed in order to ensure similar aging characteristics to U.S. installs

Ordnance Assessment
ensures the safety of our Warfighters!