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SMALL ARMS PROPELLANT THERMAL STABILITY

Presented by:

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- **BACKGROUND**
  - **Current ammo test protocol only covers temperature range of -65°F to +165°F**
    - **M16 family of weapon systems can reach chamber temperatures of 400°F in extreme use.**
  - **Effects on chamber pressure over +165°F were unknown.**
  - **Rail Interface System (RIS) test at BlackWater in July 05 reported stuck cases and blown primers after 3-4 magazines fired (using MK 262 MOD 1).**

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- SCOPE
  - –Record actual chamber temperature of M4A1 carbine during extreme use.
  - –Transfer the M4A1 carbine chamber temperature results to a chamber pressure test barrel.
  - –Record chamber pressure when cartridge is subjected to extreme chamber temperatures.

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- M4A1 Chamber Temperature
  - Six (6) weapons fitted with thermo couplers. (Installed externally at shoulder of chamber).
    - 3 Wpns for M855, 3 for MK 262
  - Firing Sequence
    - One weapon fired in semi-auto, one double tap, and one 3-5 round bursts. Seven (7) magazine fired through each weapon.
    - The magazines were reloaded and the firing sequence repeated (420 rnds each weapon total).

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- M4A1 Chamber Temperature (cont)
  - Data Recorded
    - Initial chamber temperature
    - Chamber temperature at the end of each magazine
    - Duration (time) required to fire each 30 round magazine

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M4A1 Chamber Temp Results-MK 262

	WEAPON #1 Dbl Tap		WEAPON #2 3-5 Rnd Burst		WEAPON #3 Semi-Auto	
	TEMP	DURATON	TEMP	DURATON	TEMP	DURATON
	(F)	(sec.)	(F)	(sec.)	(F)	(sec.)
INITIAL	83		78		77	
MAG #1	177		171		165	52
MAG #2	240	49	235	45	211	60
MAG #3	278	41	266	35	244	60
MAG #4	304	55	295		272	61
MAG #5	326	45	247		290	64
MAG #6	354	47	275	38	303	60
MAG #7	384	48	302	48	317	63
RELOAD						
INITIAL	167		144		175	
MAG #8	213		193	30	216	55
MAG #9	235	40	246	35	250	55
MAG #10	255	40	285	32	278	58
MAG #11	277	60	313	83	296	57
MAG #12	308	50	269	185	308	60
MAG #13	343	60	258	140	314	59
MAG #14	356	48	281	35	320	63

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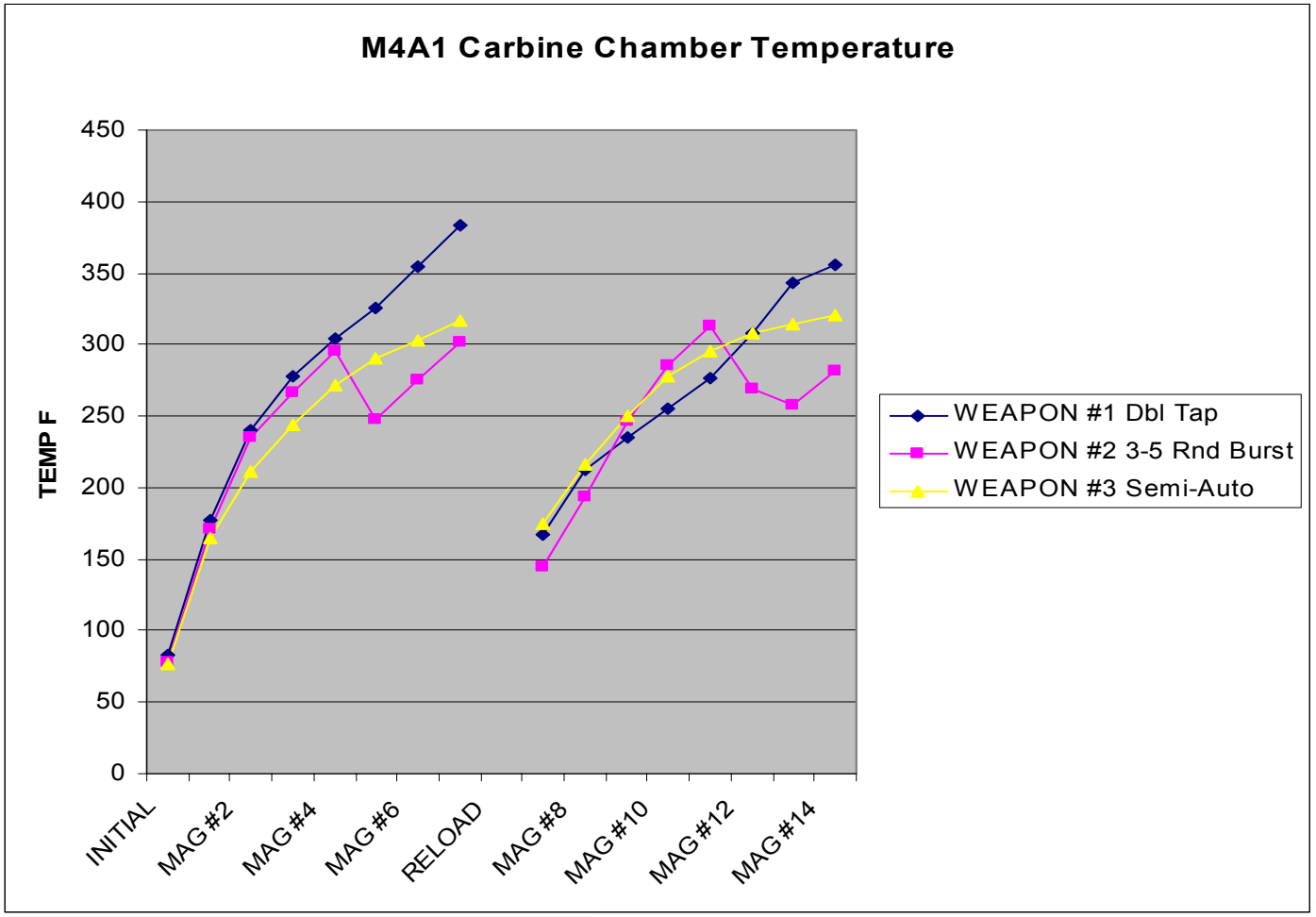
M4A1 Chamber Temp Results-MK 262



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CHAMBER PRESSURE RESULTS

TEMP/TIME	BLH03M032-001		BLH04B038-001		LC-05G380-491		BLH05L096-001	
	AVG.	MAX.	AVG.	MAX.	AVG.	MAX.	AVG.	MAX.
330F/15 sec	70,261	73,657	71,772	75,984	56,015	56,939	52,771	55,880
330F/30 sec	82,769	89,052	80,469	82,857	52,572	54,544	59,707	66,022
330F/60 sec	85,662	87,612					61,602	64,945
300F/15 sec	74,525	77,354	71,080	72,337	54,847	54,847	52,300	55,787
300F/30 sec	82,777	82,777					53,830	56,685
300F/60 sec							65,997	69,515
250F/15 sec	66,599	68,537	65,519	66,234				
250F/30 sec	74,523	77,134	70,855	73,954			53,510	59,482
250F/60 sec							63,511	65,420
200F/15 sec	65,172	67,502	63,813	65,267				
200F/30 sec	67,989	73,472	71,175	72,247				
200F/60 sec							57,313	59,920

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CONTROLLER, HEATER & ADAPTER

CONTROLLER

5.56MM CHAMBER ADAPTER

.250 INCH HEATER

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- CONCLUSION
  - Current small arms ammunition test standards do not address operational chamber temperatures recorded in the M4A1 carbine. (Impacts all M16 weapon systems family).
  - AA53, MK 262 MOD 1 propellant was modified to increase high temperature stability.

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- CONCLUSION (cont)
  - AA53 specification was revised to include high temperature propellant stability test.
  - All NSWC Crane non standard ammo projects designed for use in the M16 family of weapons will be subjected to the high temperature stability test.
  - Impacts future NSWC Crane ammo items designed for use in a magazine fed, semi-auto weapon system.