

# **18305 — Thermal Isolation For Integrally Suppressed Weapons**

By:

Howard D. Kent, ADG, LLC.

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## Introduction:

In 2012 The Topic Of Integrally Suppressed Weapons Was Suggested By Dr. Barton Halpern For The All Volunteer "**ARDEC JSSAP Commercial Technology Military Potential Survey**" To Help Locate Thermal Management Elements For Integration Into Future Weapons.

Found Were Ultra-Thin Vacuum Barriers, Nano-Composite Rifle Forend Materials, Carbon Fiber Mandrel Winding And Inspiration From The WW-I Lewis Machine Gun. Survey Members Then Contributed Weapons, All Materials, Ammunition, Test Equipment And Their Own Labor To Perform Preliminary Testing For Potential That Could Lead To Actual Improvements In Weapon Handling And Performance.

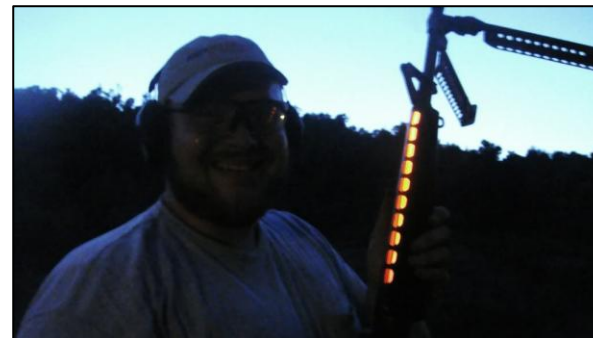
These Are Our Results...We Are Privileged To Serve.

# The Problem Of ISR Forend Heat:

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# Contributing To The Heat Problem:

“Big Magazines & Full Auto Fire”



Above: Bottersshoot Photo C-Mag Gas Tube, DSC M-16A1 Gas Tube Photo, SonsOfGuns M-16A2 C-Mag Gas Tube Photo.

## Contributing To The Heat Problem:

“Big Magazines & Full Auto Fire”



Above: Internet Photos Firearm Blog & AR-15.com Provided By Contributors, Damaged & Destroyed M-4 Type Fixed & Adjustable Gas Tubes.

# Contributing To The Heat Problem:

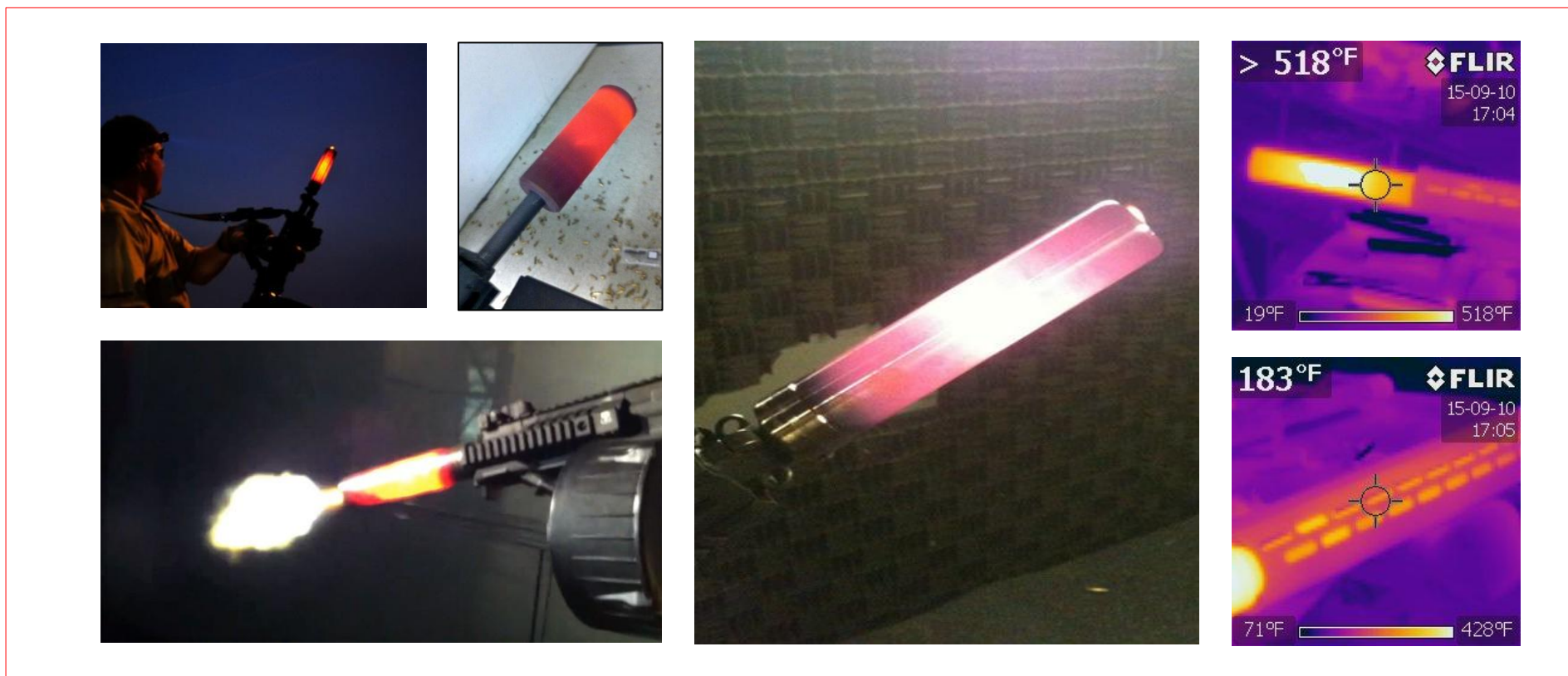
“Big Magazines & Full Auto Fire”



Above: DoD M-4 Barrel Failure With Forend; AR-15.com Four Failed M-4 Barrels In Reduced Diameter Section.

# Contributing To The Heat Problem:

## “Big Magazines & Full Auto Fire”

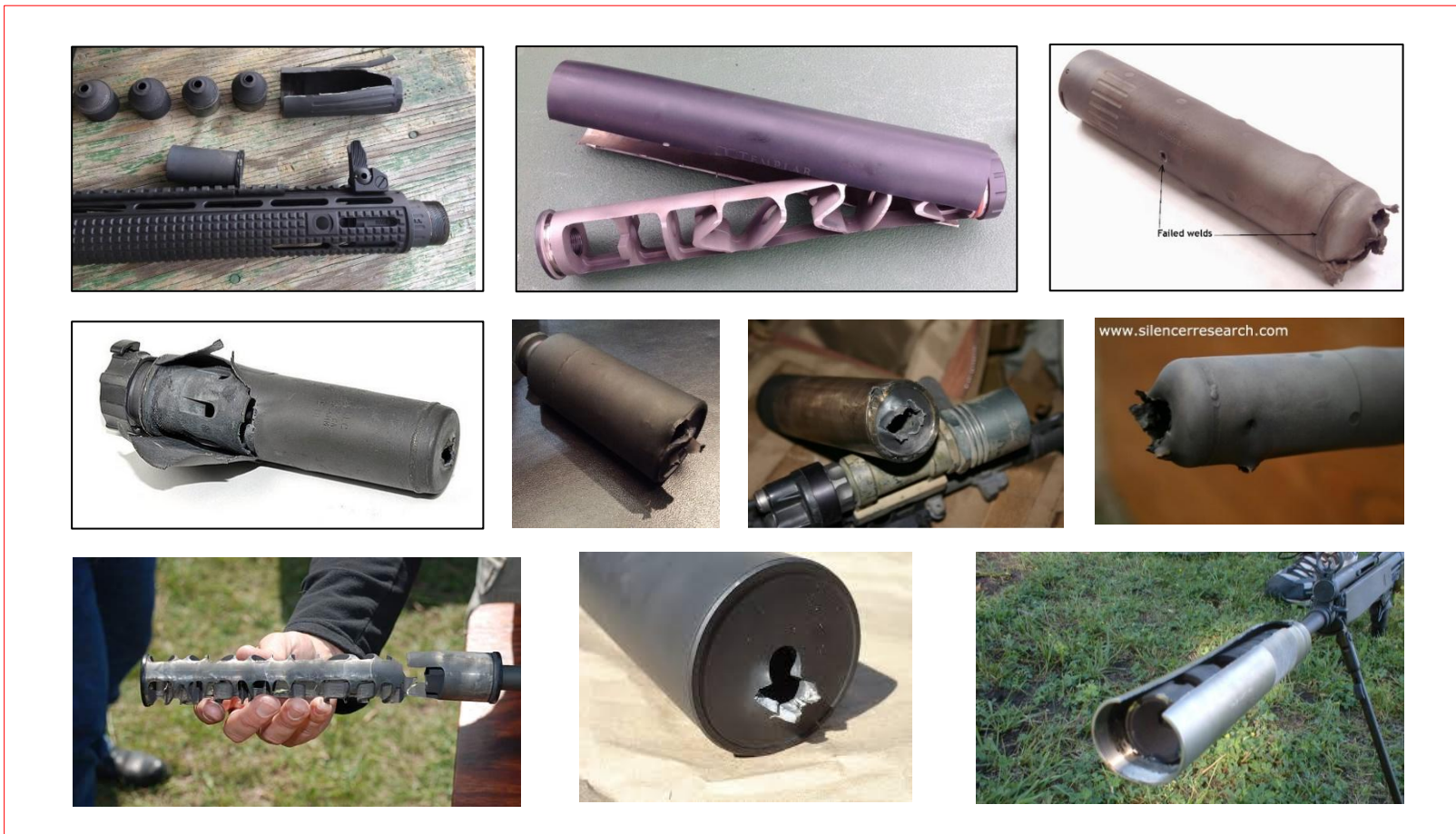


Above Left To Right: AAC LMG Photo; YouTube Armatac Drum; SilencerTalk Photo; SureFire Hot Suppressor; H. Kent FLIR Photos.



# Contributing To The Heat Problem:

## “Big Magazines & Full Auto Fire”



Above: All Suppressors Can Fail: Silencerco, AAC, SureFire, AWC, Liberty, Gemtech & Unidentified.

# Contributing To The Heat Problem:

## “Big Magazines & Full Auto Fire”



Clockwise From Upper Left: XProducts 50 Round Drum, Armatac Double Drum; SureFire 90; Chinese 5.56mm; Magpul 60; C-Mag Photo.

# The New Heat Problem:

“SOCOM SURG P-Spec High-Performance Standard”



*“S6A - Cool To 140F – Repeat” 15,000 Rounds @ +1 MOA/LAT, Minimum Velocity 2,500 fps M-855A1*

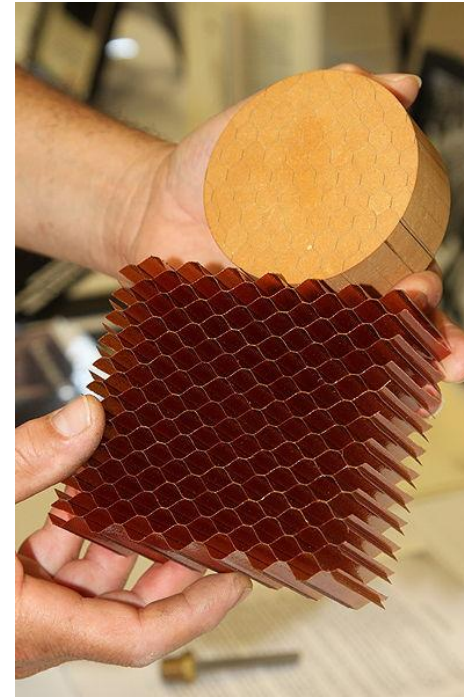
Above: Magpul P-Mag 30 Modified.

## Proposed Thermal Management Solutions:

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# Proposed Thermal Management Solutions:

“It Is Possible To Withstand Extreme Heat”



Above: NASA Photos Of Apollo 11 Heat Shield, Orion Crew Return Module Ablative Heat Shield.

# Proposed Thermal Management Solutions:

“Using Conduction, Convection & Radiation”

## Types Of “Heat Shielding” Explored In 2015 SURG Research:

1. Reflective – Barriers which reflect heat due to flat or specular surfaces, redirecting or scattering IR radiation.
2. Refractory – Ceramic or composites which absorb IR by radiation or conduction, then diffuse and radiate it again.
3. Vacuum – Barriers which both reflect and diffuse heat, reduce heat transfer across the barrier by absence of atmosphere and only allow end area conduction.

# Proposed Thermal Management Solutions:

## “Reflective Barriers Or Heat Shields”



Clockwise From Upper Left: M-4 Heat Shields; Zircoflex Photo; Heat Shield Photo; Aluminized Mylar; Armor Exhaust Photo; Flowmaster Photo; AutoPerformance.com Photo; Heatmaster Photo.

# Proposed Thermal Management Solutions: "Exploiting Passive And Active Cooling Options"

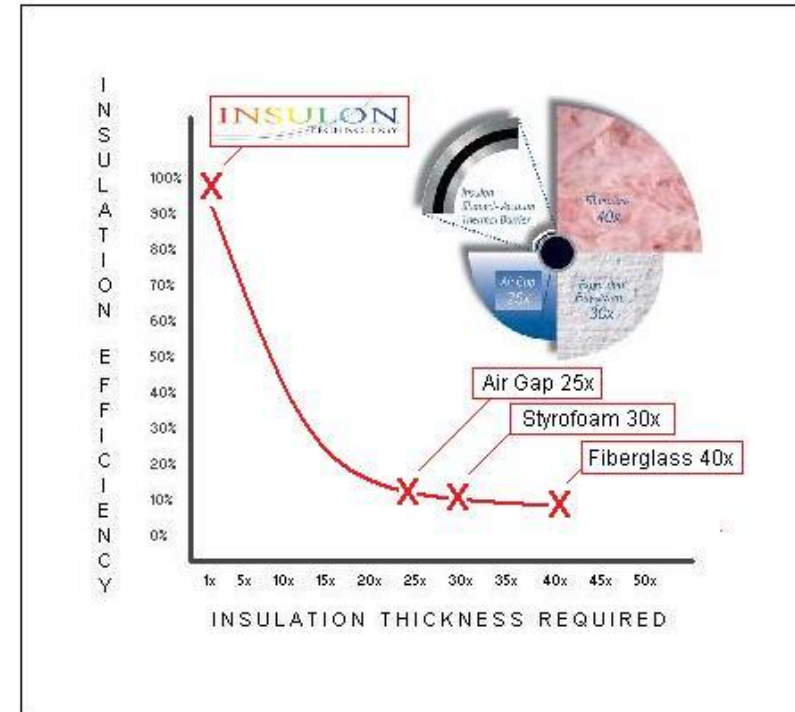
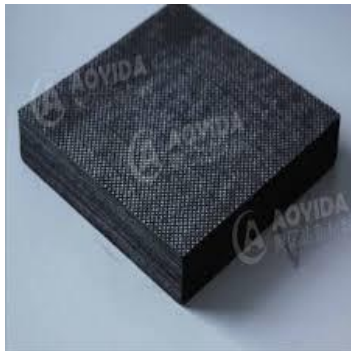
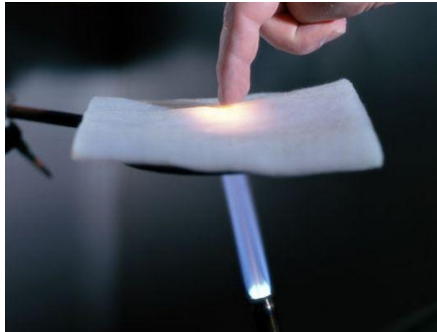


Above: POF Photo, JP Rifles Photo; NIDEC Stirling Photo; Thermacore PC Photo, ACT Graphic; Spike's Tactical Photo; POF Photo, Internet Lewis MG.



# Proposed Thermal Management Solutions:

“Insulation Retains Heat And Resists Conduction”



Above: Thermoblok Photo; Exhaust Armor Photo; Aoyida Carbon Fiber Insulation; Texas DOE Foam; Owens Fiberglass Photo, H. Kent Graphic.

# Proposed Thermal Management Solutions:

“Vacuum Insulation: The World’s Best Insulator Is Not On Earth”



One Atmosphere = 760 Torr “Pressure”

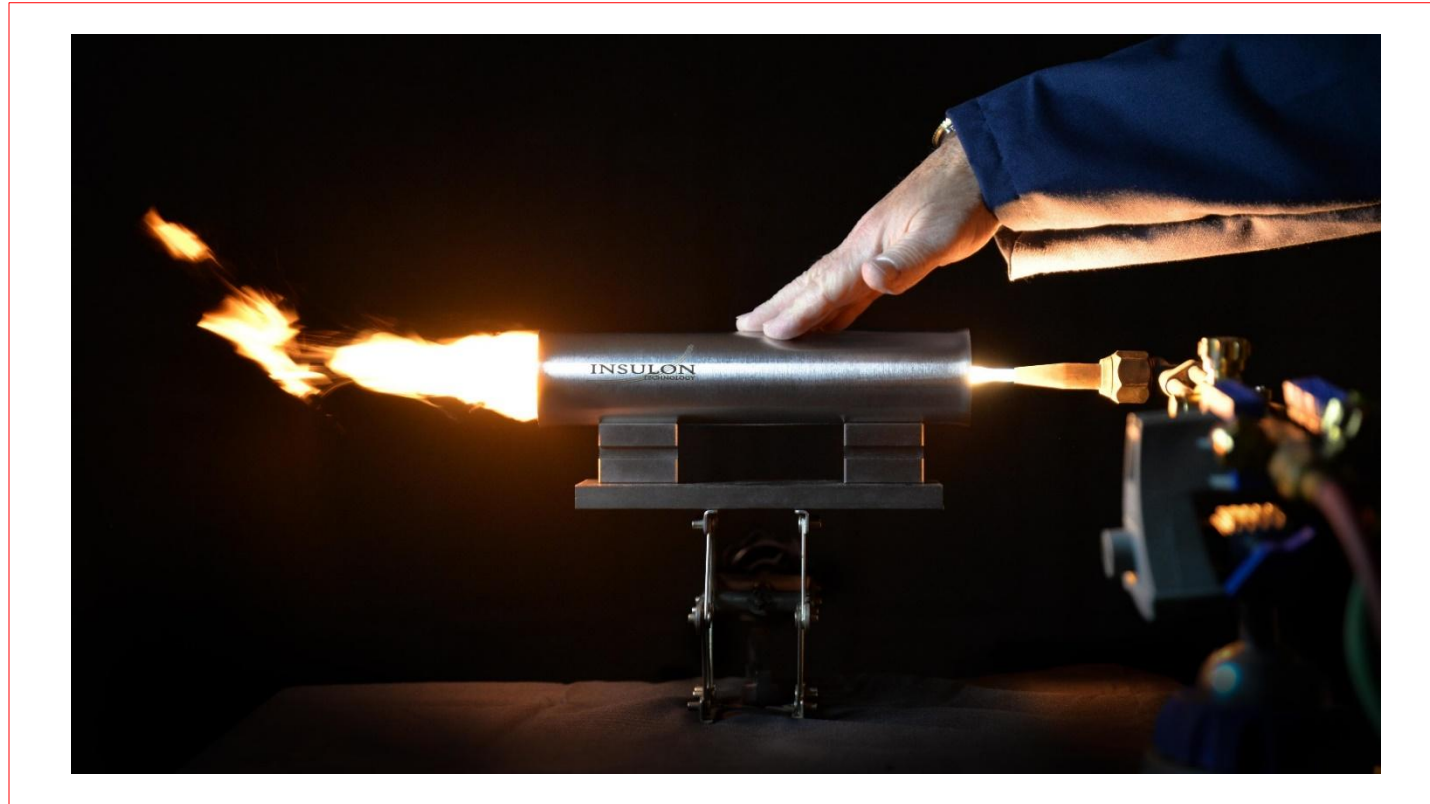
INSULON ( $10^{-9}$  ATM) = 0.0000076 Torr

Perfect Vacuum = 0 Torr “Pressure”

Above Left: NASA Sunrise Photo; Chart-Torricelli Scale Of Pressure Based On The Perfect Vacuum At 0 “Torr”, INSULON @  $1 \times 10^{-9}$  ATM Effective.

## Proposed Thermal Management Solutions:

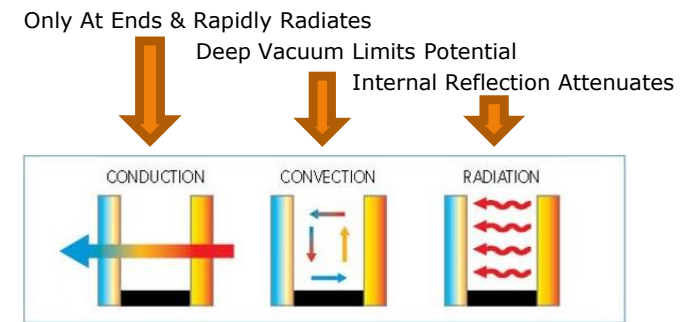
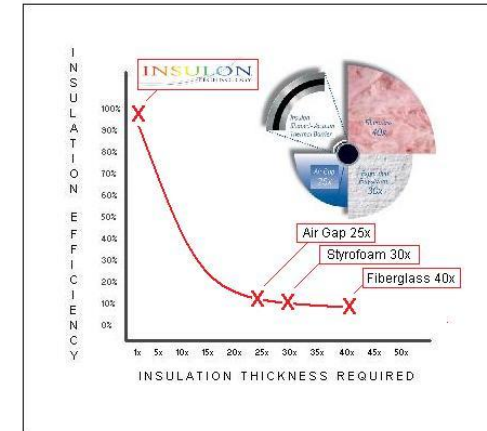
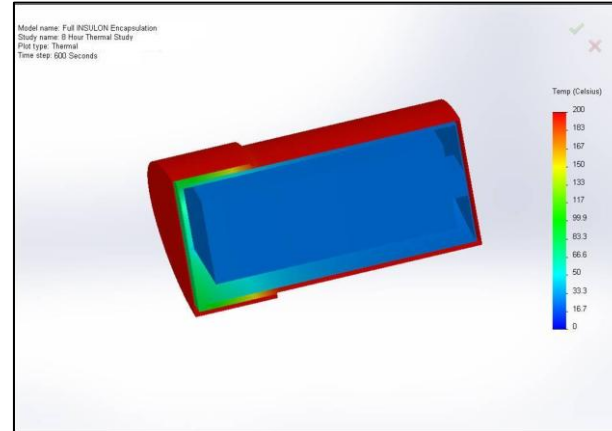
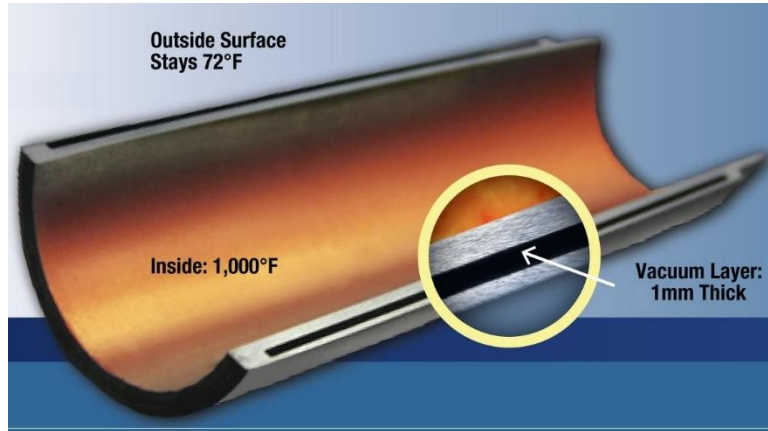
“Vacuum Insulation: The World’s Best Insulator Is Not On Earth”



[www.conceptgroupinc.com](http://www.conceptgroupinc.com)

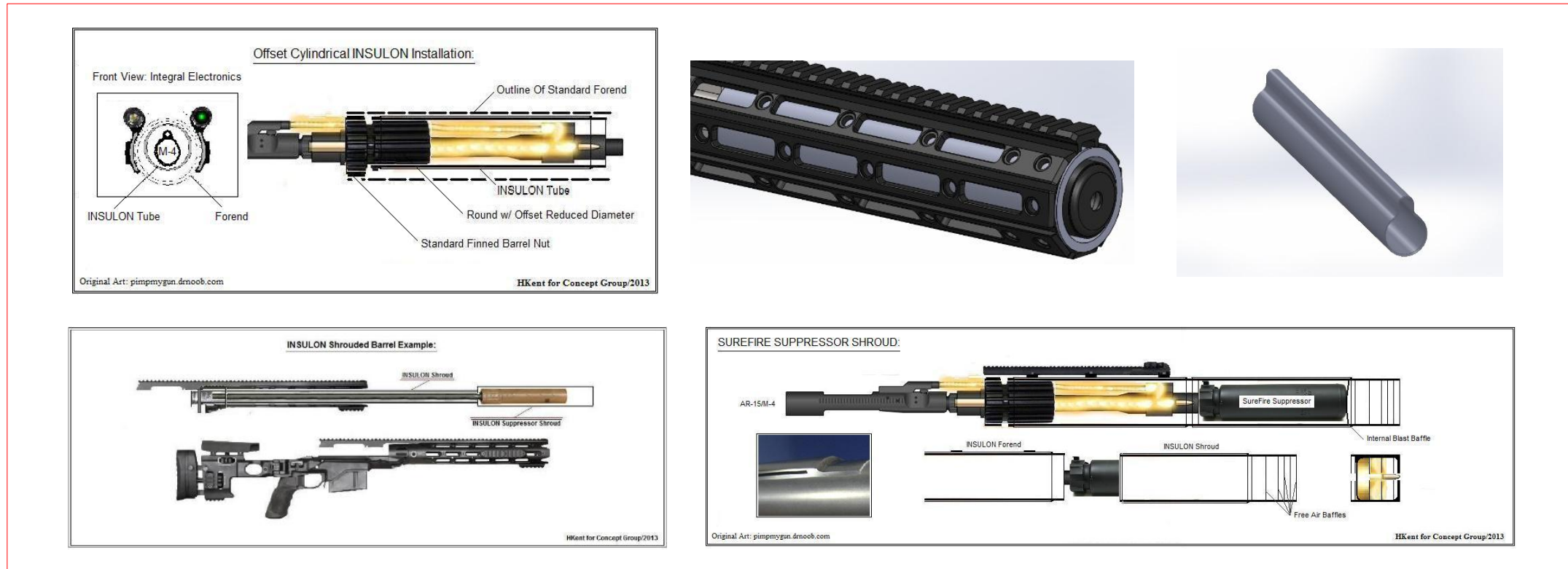
# Proposed Thermal Management Solutions:

“Vacuum Insulation: The World’s Best Insulator Is Not On Earth”



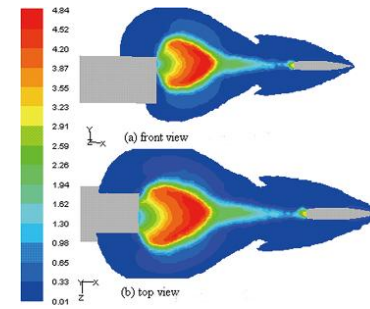
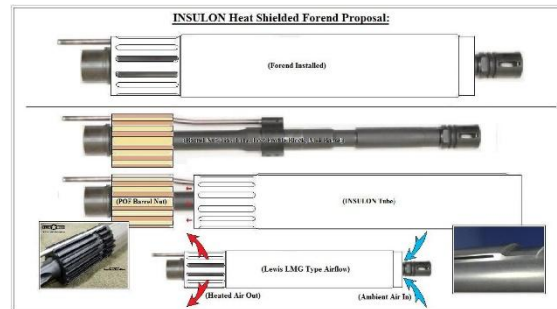
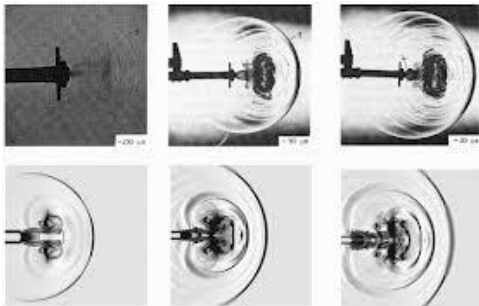
[www.conceptgroupinc.com](http://www.conceptgroupinc.com)

# Proposed Thermal Management Solutions: "Integrating Vacuum Thermal Barriers Into Firearms"



Clockwise From Above Left: H. Kent Graphic; Solidworks ISR Graphic; Solidworks Keyhole Graphic, H. Kent Graphic; H. Kent Graphic.

# Proposed Thermal Management Solutions: "Under Forearm Airflow Powered By Muzzle Blast"



Above Left To Right: Helmholtz Decomposition; Lewis MG Photo; H. Kent-POF Graphic; Color Muzzle Blast Model; Gun & Ammo Photo; Tactical Solutions Rimfire "SURG" Photo; H. Kent/Daniel Defense SURG Graphic.

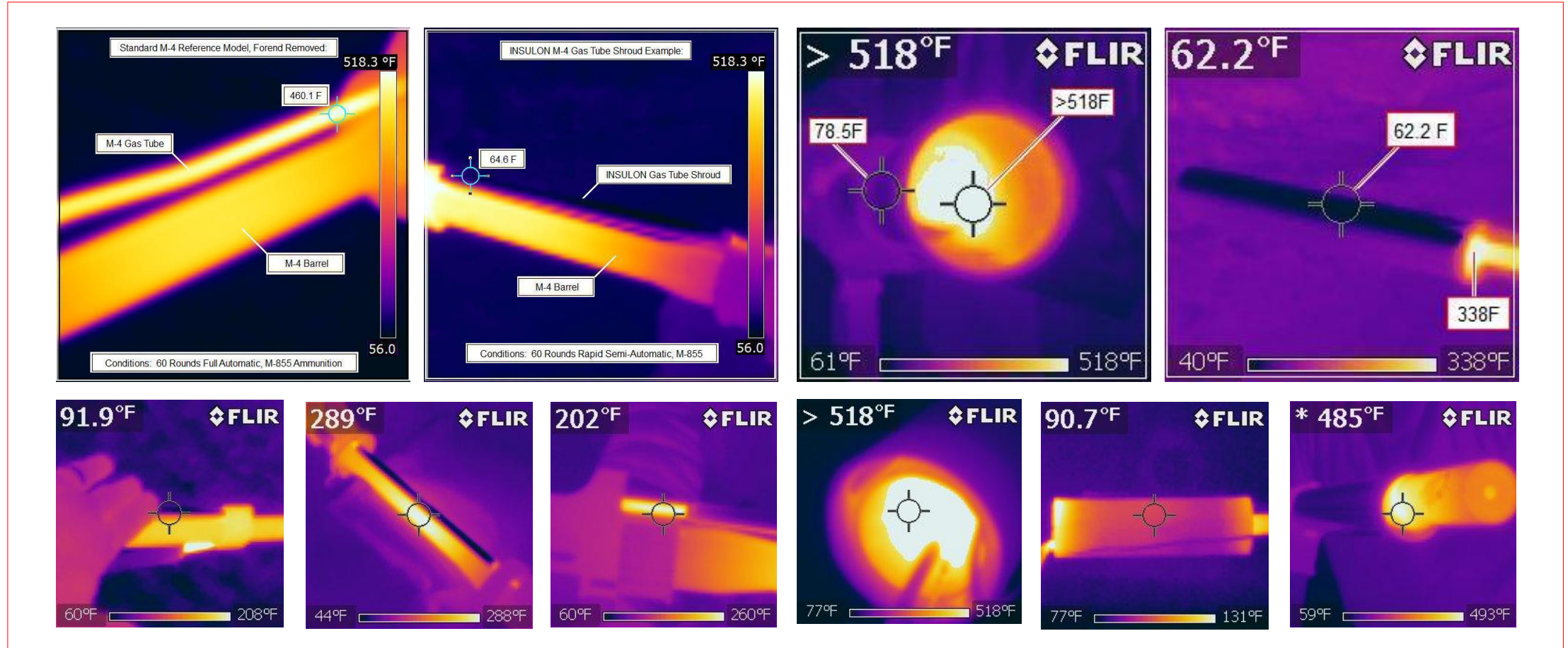
# Proposed Thermal Management Solutions: "Vacuum Jacketing High Thermal Impulse Components"



Above: H. Kent Documentation Photos, INSULON Gas Tube Shroud & Vacuum Jackets For M-4 Forends.

# Proposed Thermal Management Solutions:

“Thermal Image Testing Of High Heat Impulse Components”

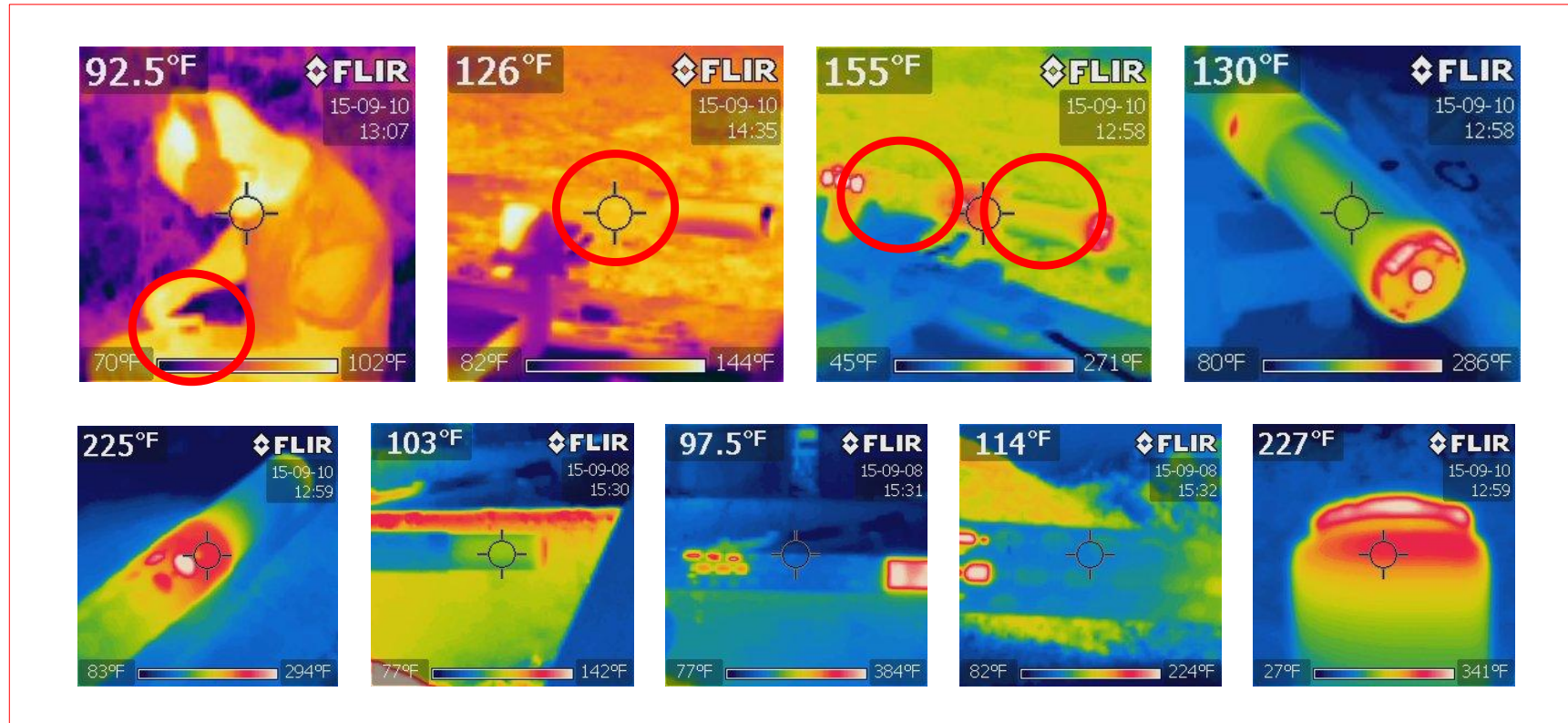


Above: H. Kent, Arne Reid Documentation FLIR Photos; INSULON Gas Tube Shroud & Vacuum Jacket For M-4 Forends.



# Examples Of Thermal Blending Of Weapon With Background:

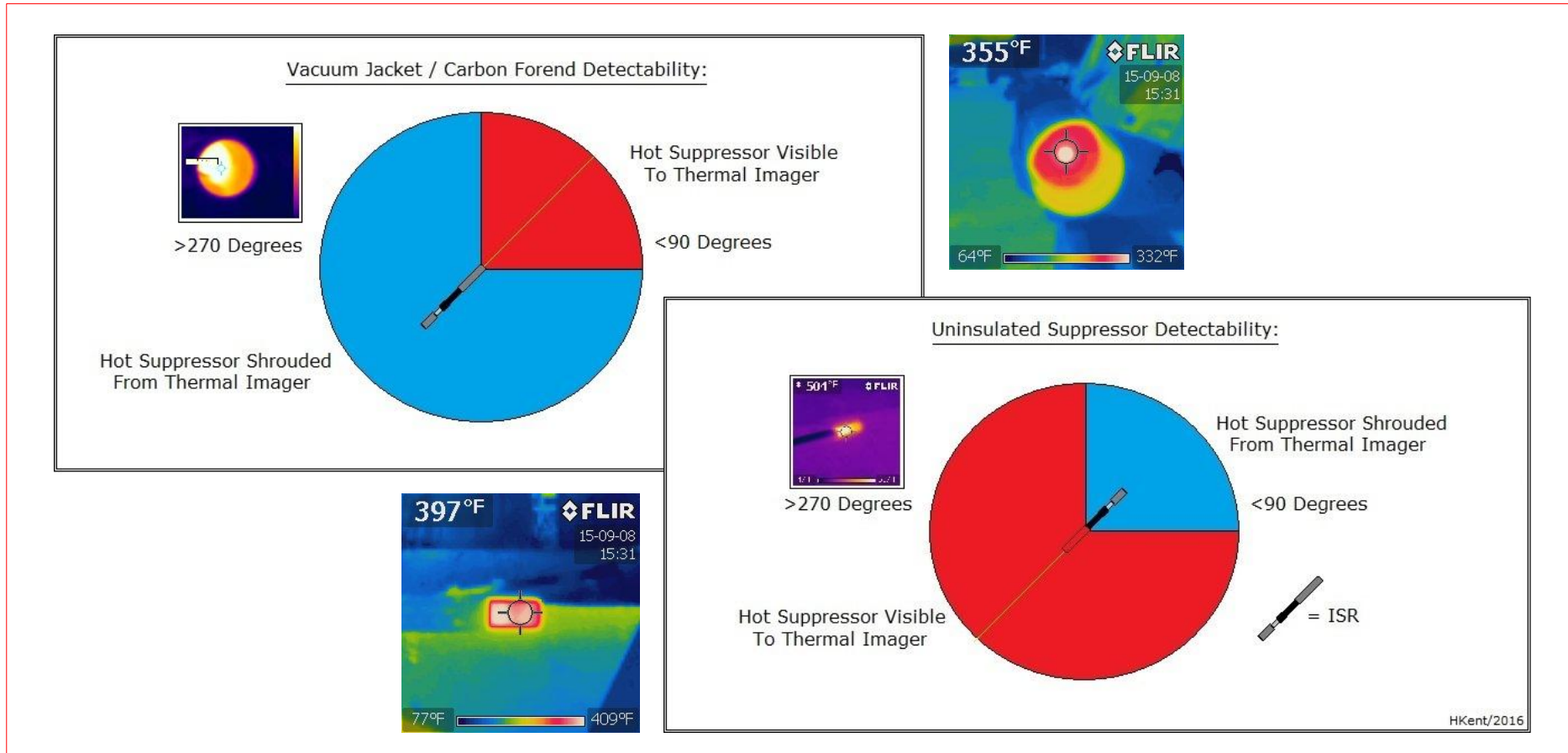
“Wherever The Vacuum Barrier Was Stayed Cool”



Above: H. Kent Documentation FLIR Photos, INSULON Vacuum Jacket Examples.

# Examples Of Reduced SURG Visibility To Thermal Imagers:

“270+ Degrees Invisible vs. 270+ Degrees Visible”

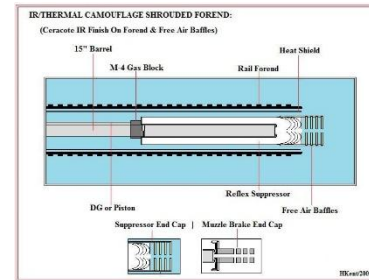
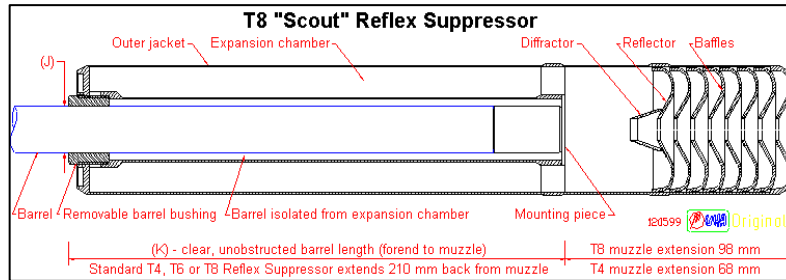
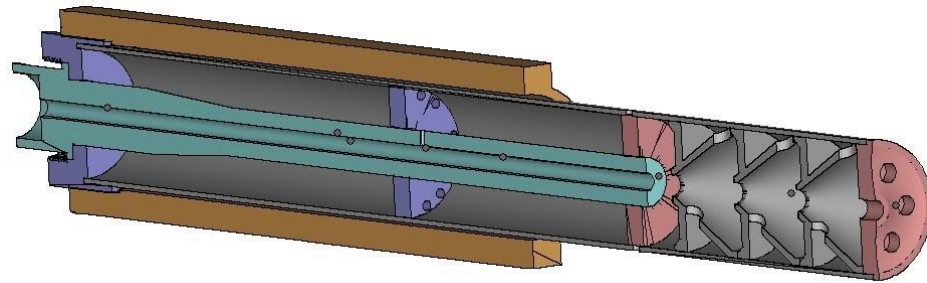
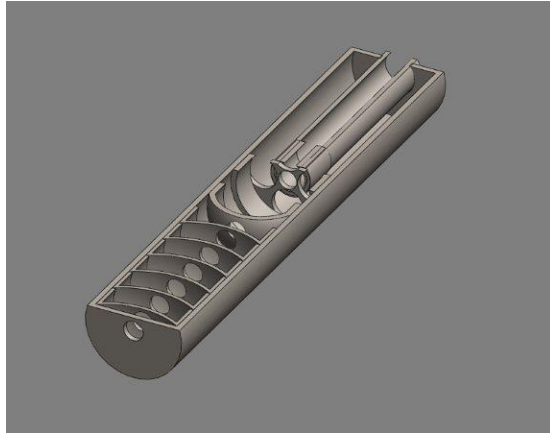


Above: H. Kent Documentation FLIR Photos & Graphics.

# SURG P-Spec Elements In Commercial Offerings:

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# Reflex Suppressors:



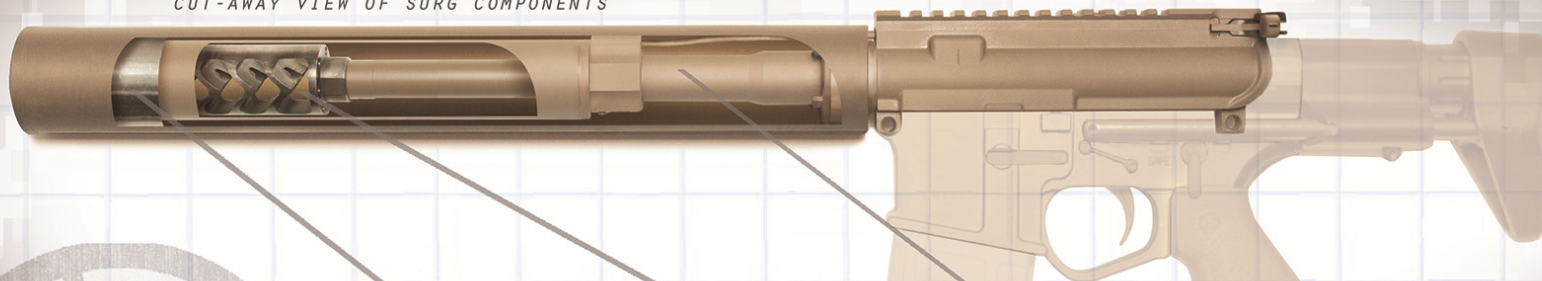
# SEG SUPPRESSOR UPPER RECEIVER GROUP

(SURG) SOLICITATION # H92222-16-R-0010



2" 4" 6" 8" 10" 12" 14" 15.7"

CUT-AWAY VIEW OF SURG COMPONENTS



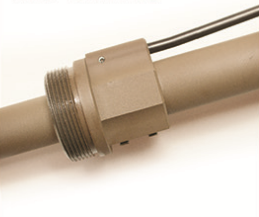
SEG INSULON  
LINED HANDGUARD



SEG SYMETRICAL  
BAFFLE



SEG GAS BLOCK  
AND BARREL



CONTACT  
**Rob Morrison**  
CEO SEG Suppressors  
Rob@StealthEngineering.US



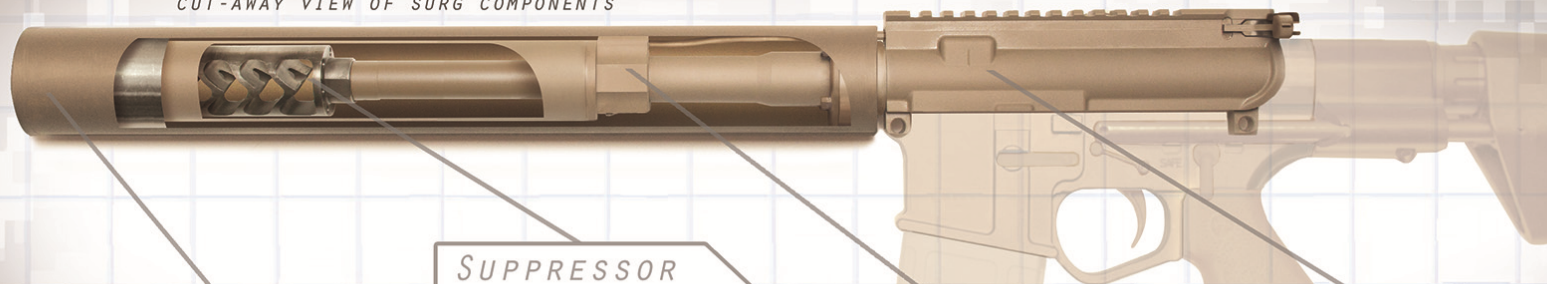
POC: Rob Morrison, CEO, Phone: 770-841-3619, e-Mail: [vpmorrison@gmail.com](mailto:vpmorrison@gmail.com)

# SEG SUPPRESSOR UPPER RECEIVER GROUP

(SURG) SOLICITATION # H92222-16-R-0010



CUT-AWAY VIEW OF SURG COMPONENTS



## HANDGUARD

- Superior Insulation with genuine Insulon™
- Safe handling Temperature
- Reduced Thermal Detection
- Ergonomic Shape and Sizing

## SUPPRESSOR

- Superior Suppression
- Reduced Blow Back
- Unsurpassed Accuracy
- Improved Heat Distribution
- Full Auto Durability
- Minimal Bullet Shift
- 2-Point Combat Durability
- Serviceable
- Integral Design is Quieter than End of Barrel Configuration

## BARREL

- SEG Developed Rifling
- SEG Gas Location
- Length 11.5" - 15.5"

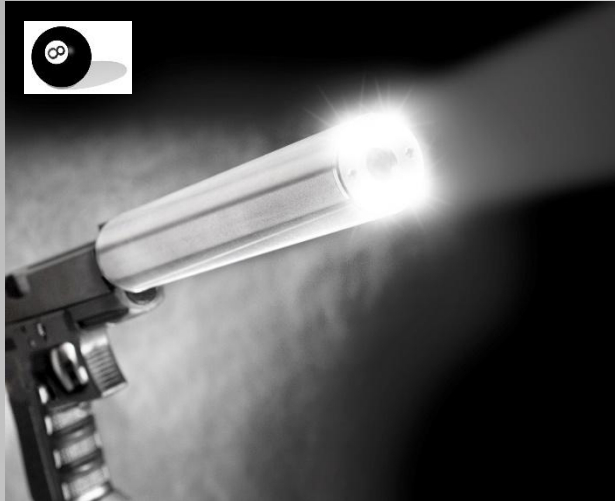
## GENERAL

- Color Coyote 498 (20150)
- Overall Length 21" - 26.7"
- Weight 4.5 - 5.5lbs.
- Combat Durability



STEALTH ENGINEERING GROUP

POC: Rob Morrison, CEO, Phone: 770-841-3619, e-Mail: [vpmorrison@gmail.com](mailto:vpmorrison@gmail.com)



Eliminates Handgun Suppressor Shadow  
Withstands Pistol Caliber Temperatures

**SEG** **SEG PATENTS**

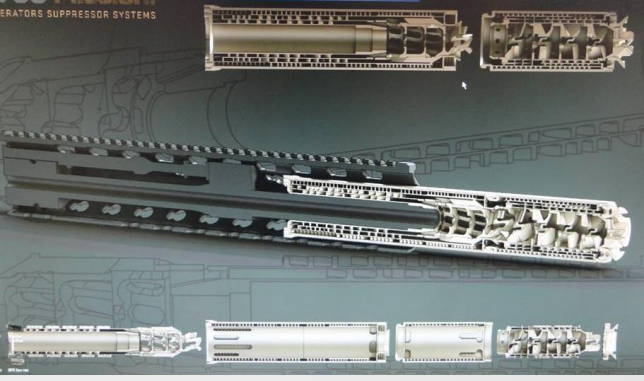
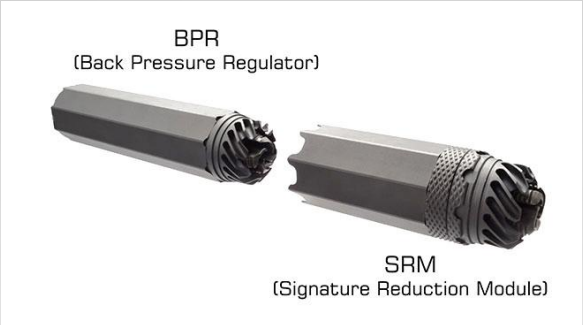
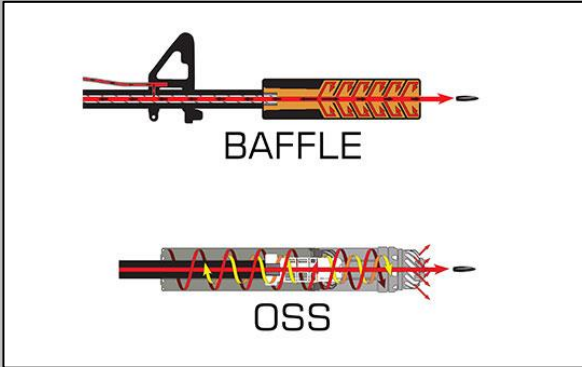
- Light Enhanced Suppressor  
Patent: US 9091502B1
- Sheetmetal Baffle  
Patent: US 9038770B1
- Coil Enhanced Suppressor  
Patent: US 9115949B1
- Hinge Suppressor Mount  
Patent: US 9222747B1

**STEALTH**



POC: Rob Morrison, CEO, Phone: 770-841-3619, e-Mail: [vpmorrison@gmail.com](mailto:vpmorrison@gmail.com)

From Left Above: "No 8-Ball" High Temp LED Illuminator In Suppressor; SEG Patents; Folding Suppressor Mount Closed & Open Reduced OAL.



POC: Chris Estadt, Phone: (385) 722-9060, e-Mail: [cestadt@ossuppressors.com](mailto:cestadt@ossuppressors.com)





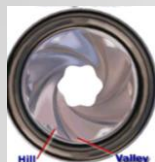
From Left Above: Gemtech ISR 10.5" 131dB 5.56mm; Gemtech "The One"; Above (2) "The One"; Below; Gemtech Monocore Handgun Model.



Modernized Roller-Locking Weapons With Advanced Features:  
Enhanced Velocity Supersonic, Heavier Subsonic, Load Insensitive, Integral Rails



5.56mm ISR "MAD-33SD"



7.62mm SBR



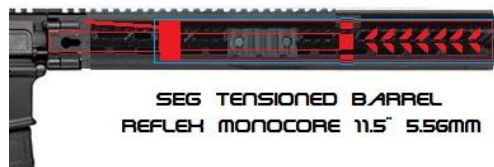
POC: Gary Jessup, MAD; Phone: 913-499-8391; e-Mail: [GaryMADArms@gmail.com](mailto:GaryMADArms@gmail.com)

Clockwise From Upper Left: M-4 Magwell Adapted 5.56/300 BLK ISR; 5.56mm "MP-33K" 8.9" FS; Size Comparisons To MP5; G-3K; M-4 Mag; Polygon Rifling.

# LANCER SYSTEMS



LANCER "C" HYBRID DDM LITE FOREND  
INSULON VACUUM JACKET



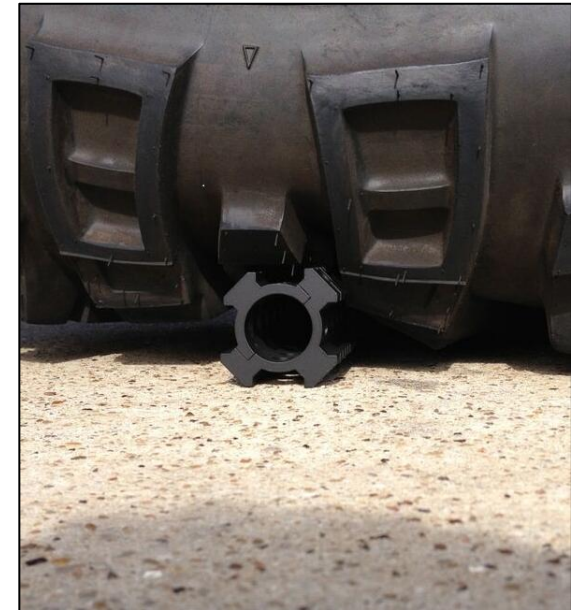
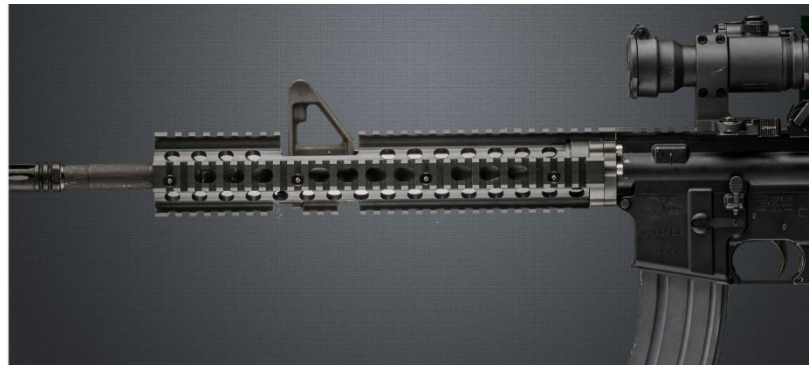
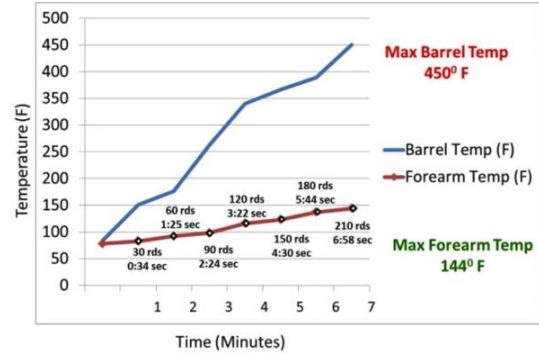
SEG TENSIONED BARREL  
REFLEX MONOCORE 11.5" 5.56MM



Clockwise From Upper Left: LANCER M-Lok Return To Zero Rail Forends; Octagon Shaped Mandrel Wound Forend; LANCER Forend Adapter To Be Vented As In Lewis Machine Gun; Above Assembled; Lancer Barrel Nut & Forend Adapter With Gas Tube; Proposed LANCER Forend On Daniel Defense DDM-4.



N-Therm Handguards



POC: Maj. Joe Garst, USA-Ret., Phone: 813-362-9779, e-Mail: [jgarst@ascendaceintl.com](mailto:jgarst@ascendaceintl.com)

## Conclusions:

- A Thermally Isolated Forend Over An ISR; Increases Thermal Stealth, Reduces Temperature Related Damage To Electronics And Prevents Burns.
- Composite Forends Displayed Far Less Thermal Conductivity Than Aluminum, Particularly Dramatic In The Barrel Nut Area Of The M-4 Upper Receiver.
- The Vacuum Jacket Barrier Decreased Temperature Rise Dramatically, And To A Greater Extent When Used In Combination With Composite Forends.
- Reflex Suppressor Designs Allowed The Longest Barrels And Produced Higher Velocities For Wounding Than Muzzle Suppressors Of Equivalent Overall Length, As Well As Fitting Entirely Under The Vacuum Jacket Forend.

## Recommendations:

- Use Stainless (?) Or Kontis' GKH 33 CRMOV 12-10 (!), Hot Bath Nitrided Barrels In Order To Reach Endurance Goals Without Loss Of Accuracy.
- Use A Composite Forend With Vacuum Jacket Internally In "Muzzle Blast Forced Air Cooling" Over A Heat Sink Type Barrel Nut For Airflow.
- Do Not Allow The Suppressor Body Contact With Any Forend Element To Prevent Differential Heating And Cooling From Causing Metal Fatigue.
- Use A Reflex Suppressor Design That Incorporates High Pressure Areas To Eliminate Unburned Powder Caused Detonation...And Let's Test For That.
- Use Faster Twist Barrels For Stability And Keep Velocity Up To 2,500 fps With 62gr. Anticipating Longer, Heavier Bullets Optimized For Suppressor Use.

## Credits:



POC: Howard D. Kent, CEO, Phone: 818-314-8636, e-Mail: HDKent@socal.rr.com

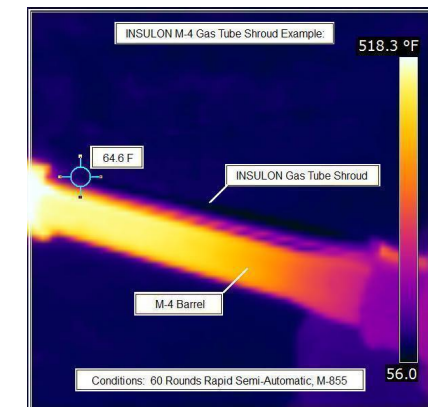
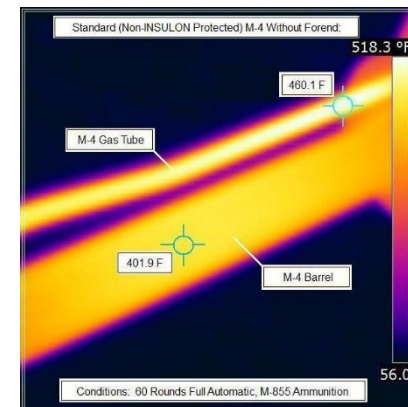
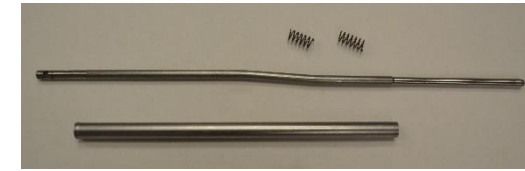
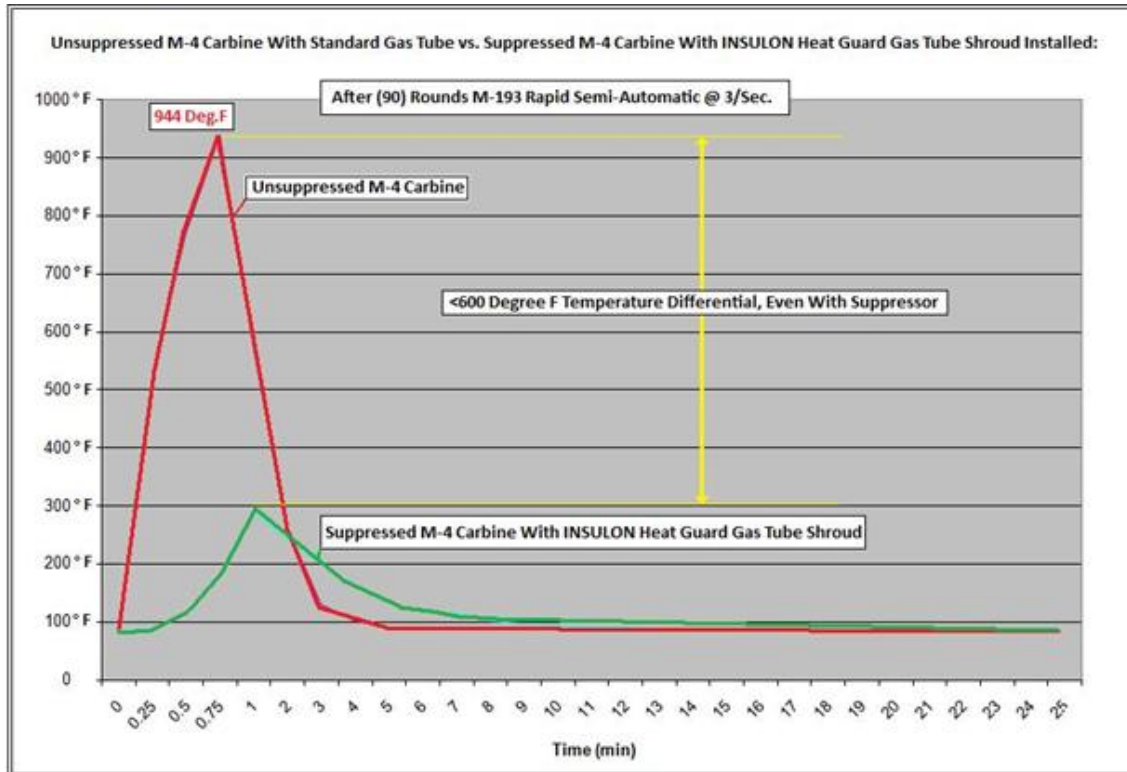
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With Special Thanks To:



# NOTES:

## The INSULON M-4 Gas Tube Shroud Test Series 2013:



Above: H. Kent Documentation FLIR Photos, Photos & Graphics.



POC: George Kontis, PE

Gun IQ International, LLC.

Phone: 321-607-2965

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## Proprietary GKH 33 CRMOV 12-10 Steel Alloy

(Barrel Manufactured By X-Caliber Barrels)



GKH is used to produce Nitrided parts which need to be extremely stable after hardening and tempering. It is particularly suitable for producing parts that undergo special Nitriding:

- Gears, spindles, machine-tool fittings, crankshafts, precision parts, aircraft parts.
- Thrust rings, bearing races working up to 400 °C.

