

Deception Report

VOLUME 3 • THE STRUGGLE TO STAY UNSEEN IN THE ARCTIC
WHY CAMOUFLAGE DESIGNERS CAN'T IGNORE AI



SAAB

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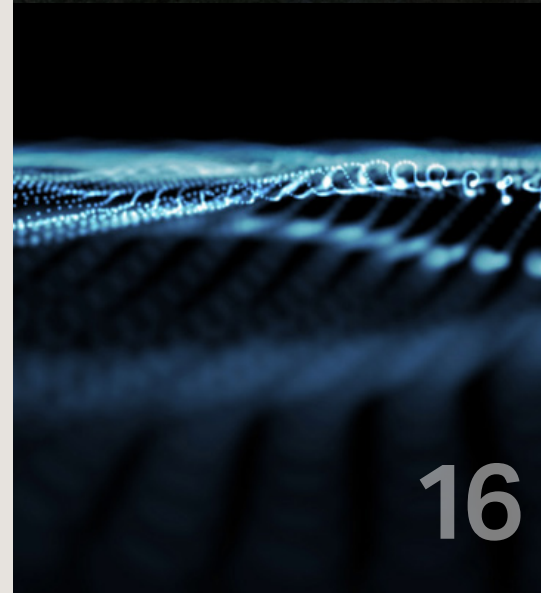
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Letter from the Head of Business Unit Barracuda



We are proud and at the same time humbled to present the Deception Report #3 in the current geopolitical situation.

Across NATO, there is a growing emphasis on national responsibility and the need to reinforce individual defence capabilities. Broader geopolitical developments are also contributing to increased attention on regions of strategic significance, such as the Arctic.

In parallel with the evolving geopolitical landscape, technological development is accelerating rapidly. AI (Artificial intelligence), is proving, both increasingly useful and, at times, unsettling across many aspects of society. The defence industry is particularly affected, where what was considered true just a few years, or even months, ago is quickly being surpassed as AI continues to enhance capabilities.

This Deception Report focuses on:

- **Deception in the Arctic regions**
What differs – and what remains the same – when operating in -30°C , partially snow-covered terrain? The reality is that the Arctic is far more than just snow and ice.
- **Deception against AI-enabled sensors**
It is no longer enough to deceive the sensor itself; each image may be instantly compared against vast datasets, demanding a more advanced approach to deception.



Survivability, i.e. the ability to protect yourself, your soldiers, and their equipment over time, remains critical. The best protection is to avoid being targeted, by denying the enemy visibility and understanding of your movements and intent. Deception, the art of hiding and surprising the enemy, is as old as warfare itself, yet more important than ever today.

We hope the Deception Report #3 provides valuable insights and encourages new thinking to support continued development.

Henning Robach
Head of Business Unit Barracuda



"The environment will kill you before the enemy fires a single shot. You have to be prepared, trained and equipped just to survive."

Major Joakim Östlin

The struggle to stay unseen in the Arctic

As climate change opens access to shipping routes and natural resources, the Arctic is rapidly emerging as a potential global flashpoint. Here, officers Major Johan Karlman and Major Joakim Östlin, from Sweden's Arctic regiments share insights on what's needed to survive in the region and how to use camouflage in a landscape that exposes almost everything.

Deploying armed forces in Arctic environments is a serious business. Winter temperatures in the far north of Sweden can easily drop to -30°C , snow covers every surface, and the sun disappears for weeks on end. In spring and autumn, the terrain is just as treacherous, with partially frozen wetlands and a lack of roads creating a logistical nightmare and a constant danger for troops. It's often said that troops fighting in the Arctic face a greater threat from the environment than from their enemy.



Swedish officer Major Johan Karlman
Boden Artillery Regiment (A8)

Despite these very real challenges, the need for armed forces to patrol the Arctic is growing rapidly. Climate change has eased the brutal winter temperatures, melting pack ice and creating new possibilities for cargo ships to travel from Europe to Asia across the top of the world. At the same time, the Arctic is home to vast and largely unexploited reserves of oil, gas and critical minerals, which are now becoming easier to access. Add to that geopolitical uncertainty, including hostile posturing by



Swedish officer Major Joakim Östlin
Norrbotten Regiment, Subarctic Warfare Center (I19)



Russia, and the region has the potential to become one of the world's most strategically contested theatres.

So, what does it take for modern armed forces to survive and thrive in such conditions? And what strategies are needed to avoid detection across the different seasons and landscapes?

Decades of Arctic experience

Swedish officers Major Joakim Östlin from the Norrbotten Regiment (I19) and Major Johan Karlman from the Boden Artillery Regiment (A8) agreed to speak with Saab to talk us through the challenges of operating in the Arctic and the important role that camouflage plays. Since Sweden joined NATO in 2024, the I19 has been tasked with defending the country's far north and supporting NATO operations in neighbouring Finland. The A8, meanwhile, is responsible for delivering long-range fire support and defending NATO's northern flank, particularly towards Finland and the Baltic region.

Both Major Östlin and Major Karlman have decades of experience of living and working in the Arctic and both agree that no military unit can operate in the region without extensive preparation and the right equipment.

"The environment will kill you before the enemy fires a single shot," warns Major Östlin. "No mistakes are acceptable – you have to be prepared, trained and equipped just to survive." The majors point out that in winter freezing conditions make simply moving extremely difficult, with every task from digging trenches to setting up position taking twice as long as it does in warmer climates. Then there's the impact on machinery, like the trucks onto which the A8's Archer Artillery Systems are mounted. "You have to be very conscious of oil, fuels and other fluids in vehicles," says Major Karlman. "You may have to have the engine going at all the time because if they stop and get cold, you may not be able to start the vehicles again."

While the cold eases in spring and autumn, the perils remain. Partially frozen ground turns movement into a constant risk, with marshlands and lakes that can give way under the weight of a vehicle or body of troops. "Just passing a river or marshland is difficult," says Major Östlin, pointing to the challenge of judging whether terrain or ice can support troops and vehicles. For Karlman, the danger is persistent. "All year round, it's not just your enemy that's dangerous – it's the environment you're operating in," he says.



Where the environment becomes the enemy

As in any potential field of conflict, evading detection by the enemy is crucial in the Arctic. And, again, the extreme and changeable climate presents major challenges.

In the icy winters, the landscape is consistently frozen meaning that any uncamouflaged source of heat is instantly obvious to thermal sensors. This creates major problems when moving from one position to another or firing weapons, both of which generate easily identified signatures. Travelling through undisturbed snow also leaves tracks with distinct visual and heat signatures, which may be visible long after soldiers and vehicles have passed by. The distinct shift from an all-white environment to a mottled one with white and black/green patches in spring and autumn is another challenge. All-white camouflage can stand-out badly at such times, and blended green-and-white uniforms are essential.

Both Majors Östlin and Karlman agree good camouflage strategies take into account all these factors as well as the types of sensors

used by the enemy. "You need to understand what kind of sensors you are facing," says Major Östlin. "Then you adapt your camouflage to that threat. You use what nature can provide – you dig in, you use the terrain, the trees, the snow." For Major Karlman, effective camouflage is closely tied to how units operate. "The tactic is hiding, going into a firing position, firing and then moving to another hiding position," he says. Remaining static for too long increases risk, but movement must be carefully timed to avoid detection.

Layered camouflage and deception in practice

Both units rely on Saab's Barracuda camouflage. For the I19, this primarily takes the form of multispectral camouflage nets used on vehicles, equipment and static positions, helping to reduce detection across the electromagnetic spectrum. The regiment also integrates these systems with natural concealment, using terrain, vegetation and snow to further disrupt detection. At the A8, Barracuda systems are applied directly to platforms such as the Archer artillery system, with Barracuda's Mobile Camouflage System (MCS) fitted to the vehicles

to reduce thermal and visual signatures during operations. Static nets are also used to disguise firing positions, command posts and support elements, particularly when units remain in place for longer periods. In the case of the Archer system, MCS is applied across the entire vehicle, helping to suppress heat emitted by the engine and reduce overall thermal signature. "When you have fired the Archer, the barrel gets very hot, and with infrared you can see it," Major Karlman explains, pointing to one of the system's key vulnerabilities. To counter this, the Archer's barrel can be lowered into a compartment, making it far more difficult to detect. When combined with full-vehicle MCS it can be "quite hard to see the thermal signature... if they stand still and don't fire."

The role of decoys

Both Majors Östlin and Karlman also believe decoys have a critical role to play in Arctic warfare. "If you want a decoy to work, it has to be as good as the real unit," says Major Karlman. "You can't just have a wooden decoy – with UAVs and good cameras, they will see that it's

not real." To be effective, decoys must replicate more than just appearance. "You need some kind of transmission... and a thermal heat source," he explains, noting that modern sensors can quickly expose anything that doesn't behave like a real system. Even the surrounding detail matters. "You have to have tracks leading to the decoy," he adds, otherwise it will stand out in the landscape. Used properly, decoys can shift the balance. "The enemy has to spend time looking at several different parts of the operation," Major Karlman says. In an environment where detection is increasingly unavoidable, that confusion can be decisive.

In the end, the Arctic offers no easy advantages. It strips warfare back to fundamentals – survival, movement and the ability to remain unseen just long enough to act. For the soldiers operating there, success is not defined by disappearing entirely, but by understanding when they can be seen – and how to stay one step ahead.

The surprising power of camouflage

Effective camouflage doesn't necessarily mean becoming completely invisible to sensors. A new Swedish military study has shown even a relatively small reduction in detectability can have a big effect on mission success. Major Richard Öster shares key insights from the study.

Imagine two identical main battle tanks preparing to enter a warzone. Each has a similarly trained crew and exactly the same equipment, but one is equipped with camouflage that reduces its chances of detection by 30 percent. How much more likely is it that the camouflaged tank will survive an engagement with the enemy? If you thought 30 percent, think again. The correct –

and perhaps surprising – answer, as determined by a recent Swedish military study, is that the camouflaged tank has a 50 percent better chance of survival.

"With camouflage, it's not all or nothing," says Major Richard Öster from the Swedish Armed Forces' Engineer Regiment, a contributor to the research. "You don't need to be completely invisible to benefit. For the study, we set the probability for a tank being hit, being killed, being detected and being classified by the enemy all at one. That 30 percent reduction in the probability of being detected also influences the probability of being classified, lowering the chances of being hit or killed."

Major Öster explains this emerged from a two-year study involving participants from the Swedish Army, Navy, and Air Force, the Swedish Defence Research Agency, and the Swedish Defence Material Administration. The research was aimed at determining how effective the Swedish Armed Force's current camouflage approaches are while looking ahead to what will be needed over the coming ten years. A key driver for the research was recent advances in sensor technologies, including an explosion in cheap, affordable drones and commercial satellite imagery.



In conversation with Major Richard Öster,
Swedish Armed Forces' Engineer Regiment

Winning time through deception

The study reconfirmed the long-held doctrine that camouflage, decoys and deception can have an extremely significant impact on the outcome of a conflict. "It's not necessarily about completely disappearing," says Major Öster. "When you reduce your signature, it's much harder for your opponent to understand the information they are gathering, and that slows down their decision-making process. And this wins you time." Deceiving the enemy through the use of assets such as decoys, movement and electronic chatter is also an extremely powerful tactic. "Today, you can't hide an entire brigade due to all the electronic signatures, but you can still hide your intention," says Major Öster. "You use camouflage so your enemy can't clearly see the brigade. Then, you might have a small unit in another location using decoys, moving a lot and making a lot of noise so that they also

look to the enemy like an active brigade. They are sending out fake messages and signals, and your opponent then needs to spend resources to work out where the real threat is."

Focus on the threat from above

Another key finding of the study was that today's armed forces need to increase the attention they pay to avoiding detection from above. "Twenty years ago, the horizontal threat was our main focus", says Major Öster. "Camouflage was used to make it hard for the enemy to detect you from a horizontal viewpoint and it was focused on the optical and thermal spectrums. Today, the biggest threat is from the sky, and you need to consider radar, optical and thermal sensors. Drones are flying just above the ground and the amount of satellite data has exploded. Anybody with a credit card can buy this information."



**"With camouflage,
it's not all or nothing"**

Major Richard Öster

The need for units to measure their own signatures

The study also pointed to the importance of armed forces measuring their own electromagnetic signals prior to and during deployment. This task is critically important given the increased use of commercial electronic products in military applications. "If you use a modern passenger car in your unit, you need to be aware that it will be sending information about its location and the road conditions back to the manufacturer because they collect this kind of information," says Major Öster. "Or you might have a soldier with a cellular phone hidden in his rucksack who is making calls. Or you could have a commercial off-the-shelf drone, like they are using in Ukraine now, that is sending signals even though you might have it turned off. If you are responsible for the unit, you need to ensure all these signals are switched off. Otherwise, you are creating gaps in your camouflage." Major Öster believes the study shows that Sweden has made appropriate investments in camouflage and that its multispectral solutions are a good match for the sensor technology that will be used over the next ten years. However, the increased emergence of hyperspectral sensors, capable of layering multiple spectrums in a single view, will require new camouflage solutions in the years to come.

Good camouflage starts before a conflict

According to Major Öster, future sensor threats are likely to be more sophisticated and harder to beat. "In the future, the numbers of sensors will increase, they will be more autonomous, and they will be in swarms." He says it is critical that Western armies think seriously about their approach to camouflage today before they are actively engaged in a conflict. This includes ensuring that potential enemies don't have an opportunity to capture and catalogue the electronic signatures of key assets. "We can't give our opponents the opportunity to train their sensors and to collect information about our platforms so that they can establish some kind of picture of how we look." According to Major Öster, the findings of this two-year study will be used to create a new camouflage handbook for the Swedish Armed Forces.

" It's the constant battle between the sword and the shield. As the sensors develop, the countermeasures also have to develop. If more technology is being put into the sensors, you also have to put more technology into signature management to handle this threat."

Major Richard Öster

Why camouflage designers can't ignore AI

Gone are the days when good camouflage systems only needed to fool sensors operated by humans beings. Leading camouflage researcher Dr Alexander Schwegmann says artificial intelligence is rapidly rewriting the target-detection rule book, with AI now able to fuse vast amounts of data and enable much faster target and object identification.

Modern camouflage nets are designed to disappear into their surroundings, but they're also designed for mass production. Rather than the patterns on them being entirely randomised, they repeat every so often in accordance with the printing template being used. This ensures consistency and quality – but it could also make them easier to discover as artificial intelligence



Dr Alexander Schwegmann
Germany's Fraunhofer Institute of Optronics

begins to play an increasing role in target recognition.

Leading camouflage researcher Dr Alexander Schwegmann has warned that AI's advanced ability to spot patterns in sensor data is swinging the camouflage-sensor arms race back in favour of detection systems. He has urged camouflage designers to factor in the impact of AI when designing camouflage and to use AI assistance when creating new solutions.

"AI learns recurring features, and camouflage solutions [that are] too uniform tend to make classification easier," he says. "This means that while camouflage systems still need to hide things from humans, they now need to take a dual approach and also deceive AI."

Multiple AI applications

Dr Schwegmann, who works at Germany's Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (IOSB), has published extensively on camouflage assessment and multi-spectral signature management. He explains that the same AI surge that has reshaped fields from medicine to agriculture is now rapidly transforming asset detection in the battlefield.

Discriminative AI, which recognises and classifies patterns, can significantly enhance the sorting and analysis of data gathered from sensors in a range of ways. It is being used, for example, in data fusion, where AI combines inputs from multiple sensors – such as visual, thermal and radar – into a coherent picture. It also supports pattern recognition, identifying features associated with potential targets and flagging objects of interest within vast data streams. These outputs can then be fed into decision-support systems, helping analysts to prioritise what to investigate and accelerating the conversion of raw data into actionable information. Finally, AI enables ongoing tracking, continuously monitoring identified objects across time and sensor feeds to maintain situational awareness.

"AI is most powerful wherever very large volumes of sensor data have to be fused, pre-processed, and prioritized quickly," explains Dr Schwegmann. "In practice, that means automatic target recognition in images and video streams, faster pattern recognition, and a significant reduction of the human workload in screening large [intelligence, surveillance and reconnaissance] data volumes. The main gain is

not simply more enhanced detection, but faster conversion of raw sensor data into information that we can actually use or that can actually support assessment in decision making."

Strengths and weaknesses of AI

Dr Schwegmann explains light, affordable sensors fitted on platforms such as rotary wing drones have led to an explosion in battlefield data in recent years. While in the past, the sheer volume of such information could never have been analysed in a time-effective ways by humans, data from multiple sensors types and locations can now be fused into a single coherent picture. At the same time, discriminative AI models are being trained with countless images, as well as infrared signatures, radar returns and other multi-spectral sensor data. This enables them to rapidly identify deployed assets, like tanks, supply facilities or artillery battalions, for targeting and destruction. Human beings in the target recognition loop can then review and validate AI-generated outputs before decisions are made.

While the development should be alarming for any nation deploying armed forces, Dr Schwegmann says for the moment there are still limitations on AI's abilities. "AI systems struggle

with heavily concealed, partially occluded objects that are low contrast, or where the context is not the right one,” he says. “They also tend to struggle when viewing conditions differ too much from the data that were trained on. So, AI is strongest on what it has seen often – and when reality differs from this, camouflage, clutter and real-world variability still matter.”

Dr Schwegmann says while AI is swinging the balance toward target detection, there is plenty

camouflage manufacturers can do to fight back. The key is designing systems that take into account not just conventional sensors operated by humans, but AI-enhanced systems.

One approach may be to look at increased variation in camouflage patterns and scale. The less uniformity and consistency present in camouflage solutions, the lower the chance that AI will spot a pattern and deduce that an asset is being hidden. Camouflage must now also be

designed and tested across multiple spectral bands simultaneously, as a solution that appears effective visually may still stand out to AI-enhanced sensors operating in thermal or radar domains.

Growing importance of ‘adversarial camouflage’

Another important avenue to explore is adversarial camouflage. This involves embedding camouflage netting and other

products with patterns that are mathematically designed to mislead AI systems by mimicking the features they associate with entirely different objects. Through the use of a printed design, an AI-supported sensor might see a camouflage covered tank as a tree, despite the object looking nothing like a tree to the human eye. In effect, the camouflage does not just hide an asset, but actively feeds false information to machine vision, causing it to misclassify what it is seeing.

Most work on adversarial patterns has so far focused on the visual domain, but there is also potential to develop systems that AI-supported sensors working in other spectrums.

“I expect adversarial camouflage to become more important... but not replace classical camouflage, rather an addition to it,” says Dr Schwegmann. “At present, adversarial effects are sometimes quite fragile in the real world... as they depend on geometry, sensor type, distance and other factors.”

Advances in AI-supported target detection also have implications for decoys. Poorly designed decoys are likely to become less effective, as AI systems quickly learn to identify the inconsistencies that distinguish them from real assets. However, more sophisticated, data-driven decoys could become even more valuable, particularly if they are designed to replicate the specific features AI systems are trained to detect.

Dr Schwegmann says it is now critical for camouflage manufacturers to incorporate AI into both design and testing processes. Using AI allows developers to evaluate how patterns and materials perform against real sensor pipelines and detection algorithms, exposing weaknesses that may not be visible to the human eye. It also enables faster, data-driven optimisation across multiple spectral bands and conditions, ensuring solutions are effective against both human observers and machine vision systems.





Camouflage for the win

As drones have increased in number and sophistication in the Ukraine conflict, so too has the need for effective camouflage. Swedish officer and academic Major Daniel Smith argues that good signature management solutions including Barracuda camouflage are crucial to maintain combat effectiveness.

"When we have Barracuda's products, we're invisible in the night. The thermal optics will not see us."

Ukrainian soldier interviewed by Major Daniel Smith

Major Daniel Smith's PhD research took him from the halls of Swedish academia right to the frontline of the Ukraine conflict. A captain with the Swedish Armed Forces, Major Smith was intrigued by why some combat units hold together and fight effectively under intense pressure, while others fall apart. To try to find out and complete his doctorate at Swedish Defence University, he spent 55 days at the conflict's frontline, interviewing more than 50 active warfighters serving with the Ukrainian forces about their experiences.

In September 2025, he publicly defended his thesis *Focalizing Warfighters: Combat Cohesion from Below*. While Major Smith's work primarily focused on the motivation of soldiers, his interviews also shone a light on how the war has progressed from a tactical and technological perspective and the important role played by

camouflage. Speaking to a panel, he recently explained why camouflage is now needed further behind the frontline than ever before and how smart decoys are playing strategic role.

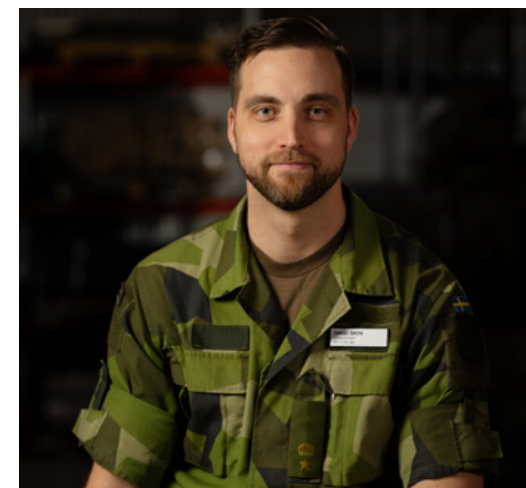
The growing danger zone

Major Smith says in Ukraine, as in prior conflicts, camouflage is playing a key role in ensuring troops survive to carry out their missions. While it doesn't make for exciting viral videos in the way that an exploding munition does, it's highly effective in saving lives. "Camouflage, deception and signature management are probably the best ways of stopping a kill chain entirely, because the chain never gets the chance to start," he says.

"But the experience of successful camouflage isn't really an emotional one. It's a rational, intellectual experience for warfighters who understand they can't be seen, and so gain that confidence." Major Smith says that as technology has evolved throughout the Ukraine conflict, so too have camouflage needs. For example, a huge surge in the number of drones in use by both sides has extended the danger zone on each side of the frontline. "There's a proliferation of cheap drones and loitering munitions like Shahed and that means you simply cannot afford to stop worrying about signature management," he says. "For soldiers, the distance from the frontline that you need to travel to feel safe has increased from a few kilometres just a few decades ago to something between 30 and 40 kilometres today." While travelling in this grey zone, soldiers need to ensure they minimise their visibility to the enemy in order to stay alive.

Thermal sensors now standard

Another major change is the proliferation thermal sensors. While at the start of the war most drones only had optical sensors, today thermal



In conversation with Major Daniel Smith, PhD in War studies



“ Camouflage, deception and signature management are probably the best ways of stopping a kill chain entirely, because the chain never gets the chance to start.”

Major Daniel Smith

sensors are more or less standard equipment, making unprotected soldiers stand out a mile. While Barracuda systems for personal and vehicles gives a multispectral protection for the warfighters offer thermal protection and are in use in Ukraine, many soldiers have only optical camouflage systems. “In terms of signature management, a lot of Ukrainian warfighters expressed the need for something to protect them against thermal imagers,” Major Smith says. “They also wanted something to help them to remain undetected in their headquarters, so better signature management overall.”

Another learning from Major Smith’s interviews is the important role that deception is playing in the conflict. Increasingly sophisticated decoys are being used to waste enemy resources and divert attention from troops’ true intentions and motivations. “The use of decoys is increasing with

the regrettable difficulty in staffing the Ukrainian armed forces,” says Major Smith. “You have to sometimes leave certain sections of the defensive line unprotected – and it’s the same on the Russian side.” Unlike the simple decoys used in WW2, the decoys used in Ukraine replicate the noise, activity and heat signature of true military assets.

“These things emit the same kind of signatures as proper forces,” Major Smith says. “They are visible from a distance to be discovered, and then when an attack drone is dispatched, they might discover that this is not real. They will destroy it anyway.”

Deceive to win

Major Smith says the explosion in sensors in the battlefield in Ukraine means that camouflage and deception will play an important role in any attempt to break the current stalemate. “If

you even want to have a chance of conducting a breakthrough operation in this kind of environment, you need to first be able to mass the necessary forces,” Major Smith says. “And to do that you need to camouflage everything: the preparations, all the depots, logistics bases, hubs, roads, even forming-up points and training areas. You need to remain reasonably undetected without the enemy asking why are there so many more forces and so much ammunition and food trucks and fuel trucks going to a particular area.”

The challenge with avoiding detection on such a scale is that if one individual or unit is lax about signature management, it can draw the attention of the enemy, “Camouflage can definitely be successful on a large scale,” says Major Smith. “But it’s harder because we’re all people, and people make mistakes. We are imperfect.”

Major Smith says the key to increasing mission success in such circumstances is ensuring every warfighter knows what is expected of them in terms of signature management. “It’s not difficult, but it requires discipline. And discipline comes from, among other things, training to do things right. If you achieve that it’s absolutely possible to camouflage the entire system.”

Major Smith says his work in Ukraine has confirmed the belief that having effective camouflage boosts the confidence of soldiers. “I met some warfighters who talked about their Barracuda products,” he says. “They said, ‘When we have this, we’re invisible in the night. The thermal optics will not see us.’, and that gives them a whole lot of confidence. Now, they can actually dare to go to the front line, they can do their job properly without being overly concerned about their own safety.”

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