

Defence
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Future Artillery 2013 – 2023



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About the research

This report offers an indicative examination of the future artillery market over the next ten years. The report is based on a survey of senior executives and professionals within the artillery domain. The analysis of the survey data has been supplemented with proprietary interviews and desktop research. The report also analyses data from last year's Future Artillery study. All references to data from the 2012 will be clearly marked – figures ending in “a” are from the 2013 dataset while all those marked “b” are from 2012.

Topics examined include; which capabilities the military will prioritise as it increasingly embarks on urban, complex and dispersed operations, how militaries can achieve greater precision, the changing nature of training scenarios as well as looking into which regions are being targeted as emerging growth markets. India's artillery requirements and capabilities will also be subject of particular focus towards the end of this report.



Survey respondents clearly identified ‘precision of munitions’ as the top priority for militaries as the battlefield landscape continues to shift to increasingly urban environments. With 79% identifying precision to be a high priority, this capability has seen a small boost in prominence compared with the 75% seen in Figure 1b from the 2012 survey data.

The next most important issues were ‘digital targeting’ and ‘forward observer (FO) technological advances’ (75% and 68% respectively). The advancement of digital targeting appears to have dramatically increased over the last 12 months; last year 19% fewer respondents identified it as a high priority capability. The development of these systems is clearly one that must be watched carefully.

Similar to last year’s survey data, the development of ‘futuristic’ weaponry was considered to be the least important factor with almost half of respondents dismissing it as a low priority.

The issue of cost has however become noticeably more important with 95% of respondents admitting that it is either a medium or high priority. That’s an 18% increase on last year. However, of those, only 24% see it as a *high* priority – meaning that people are certainly aware of the economic issues, but don’t believe them to be the most pressing.

Figure 1a
Analysis of key artillery capabilities to prioritise

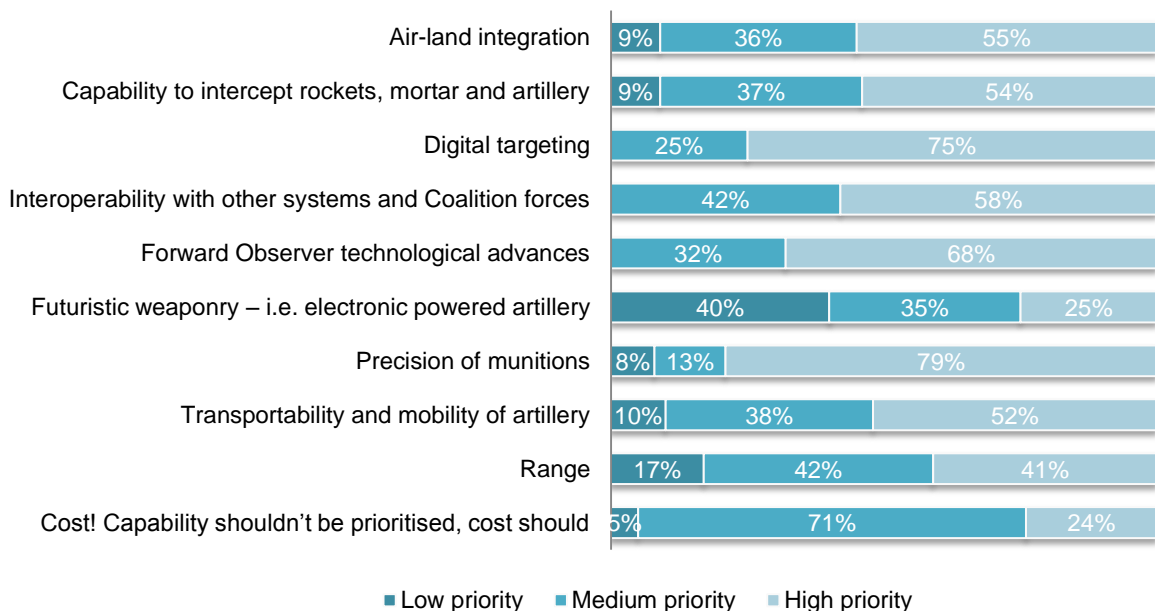
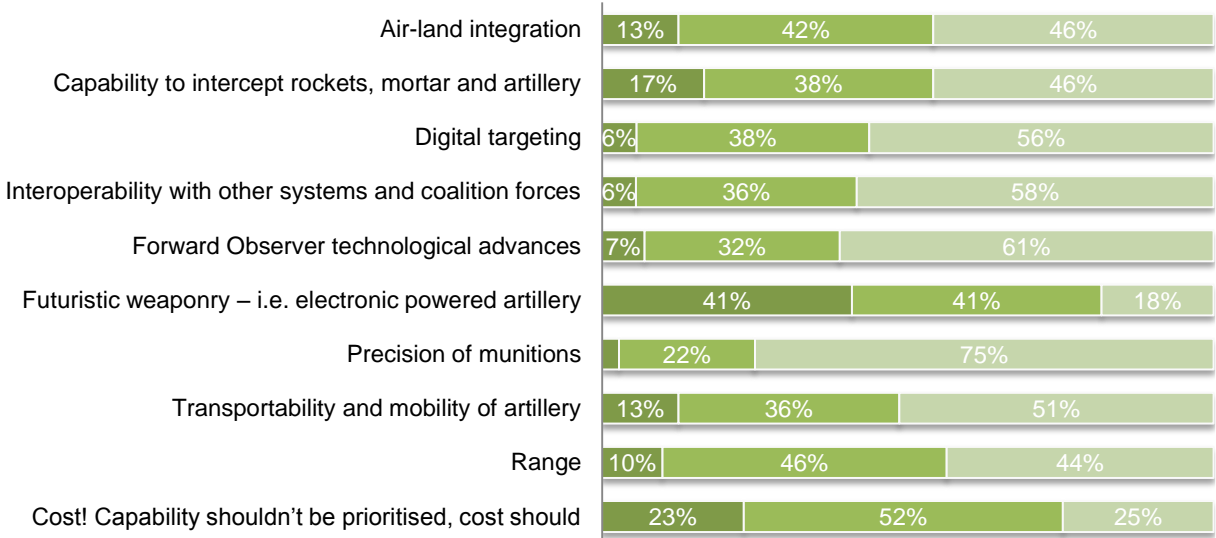


Figure 1b
Analysis of key artillery capabilities to prioritise (*2012 data)



■ Low priority
 ■ Medium Priority
 ■ High priority



Figure 2a
Summary of key factors for achieving greater artillery precision

Precision is the key capability that OEMs must concentrate on to improve artillery systems so they remain relevant to military operations in the future. But what factors will allow for this uptick in precision performance?

According to survey participants the most important area of research should focus on improving the C4I interoperability of the systems. Figure 2a shows that 55% believe interoperability to be the key issue, up 8% on the 47% indicating so from last year's data in Figure 2b.

What is not important is the resurgence of the 105mm, with just 9% of respondents identifying it as a key precision requirement. There has been much deliberation about the balance between precision, range and transportability since the introduction of the 155mm as the new industry standard in place of the 105mm. While more powerful and with greater range, the more cumbersome 155mm has been criticised by many for being too heavy, reducing the ease by which it can be transported in theatre. Respondents clearly do not conceive the resurgence of the 105mm to be a viable alternative.

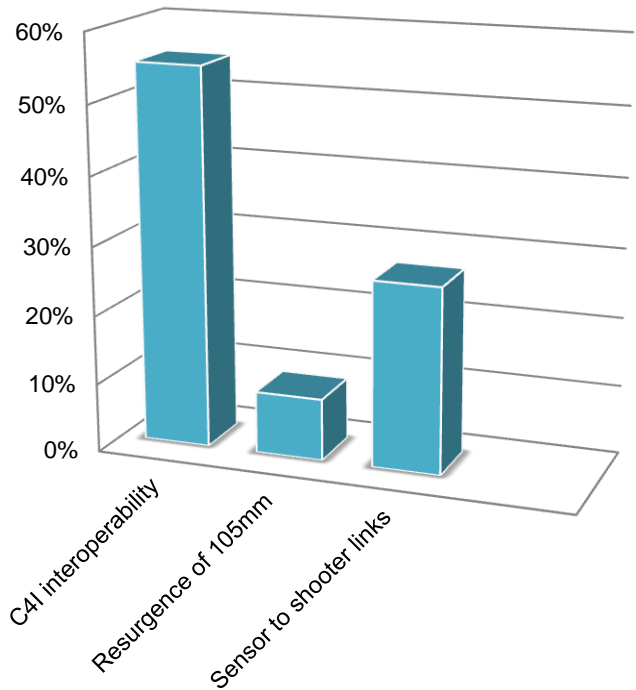
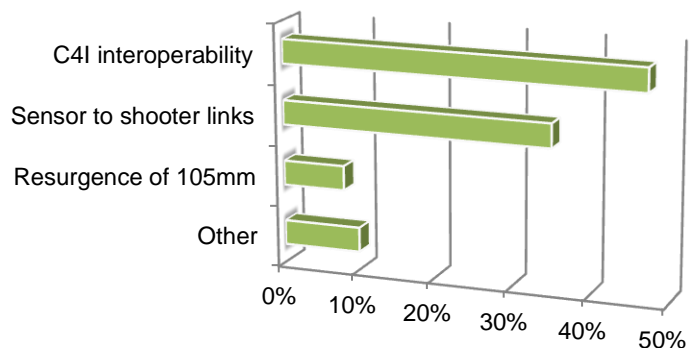


Figure 2b
Summary of key factors for achieving greater artillery precision (*2012 data)



Although Figure 1a shows that cost shouldn't be prioritised over capability, the fact remains that the economic black hole will significantly effect defence equipment procurement over the next decade, inclusive of artillery. In Figure 3a over half of all respondents expect budget restrictions to be the critical factor that may dog artillery advancement in the future.

With just 17%, the change in warfighting strategies is not truly considered to be a threat to future artillery. Although warzones are becoming more urban, respondents indicated that the role of artillery will not significantly change through to 2023 and will still be a vital component of military arsenals.

Interestingly, the perceived threat from cyber attacks on artillery systems (or at least cyber attacks that could ultimately come to affect artillery systems) has decreased over the last 12 months from 10% in 2012 to 8% in 2013.

Figure 3a
Analysis of the most significant threat to future artillery advancement

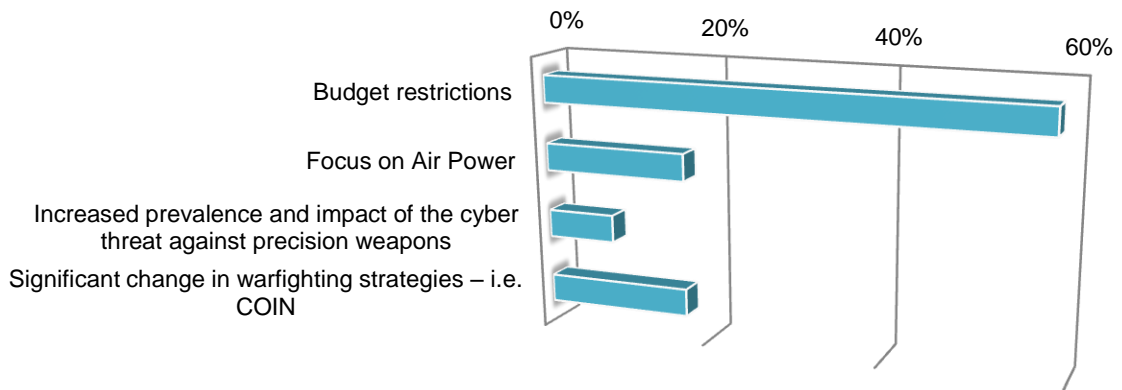
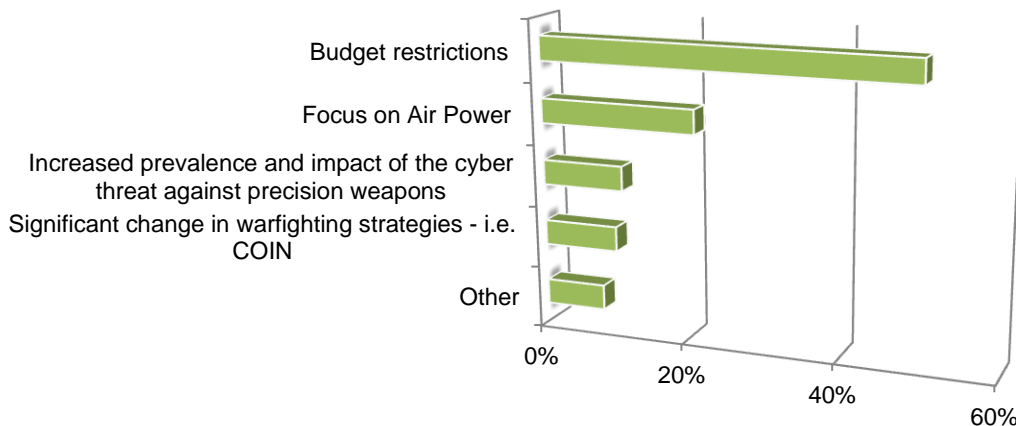


Figure 3b
Analysis of the most significant threat to future artillery advancement (*2012 data)





“What we are currently thinking, what we are exploring, is about how to reduce dispersion. We already have good accuracy, so if we reduce dispersion we can be almost sure that we can avoid collateral damage.”

Lieutenant Colonel Nicolas Bomont, Chief Operations in the French Army's 1st Marines Artillery Regiment

Precision munitions and artillery capabilities rely on a fully functional and efficient forward observer resource to ensure accurate target location and operational mission planning. How can FO management and efficiency be improved over the next decade?

Nearly half of all respondents indicated that advances in network-centric systems will be the most important factor for FO's in the future, followed by geo-location equipment upgrades with 25%. As you can see from Figure 4b, this is a role-reversal on last year's results. The role of the network is undoubtedly becoming a critical component for all military technologies and it appears that the artillery community is really beginning to take this on board. The role of the FO has become an increasingly important one recently and will continue to heighten in significance for military operations as communications and other C4I technologies improve.

However, as these systems become increasingly complex and network-centric, the cyber threat becomes decidedly more apparent too. Training will need to expand its reach in order to combat the cyber threat in future, which is a point a significant number of respondents were adamant upon.

Figure 4a
Summary of most significant factors for Forward Observer improvement

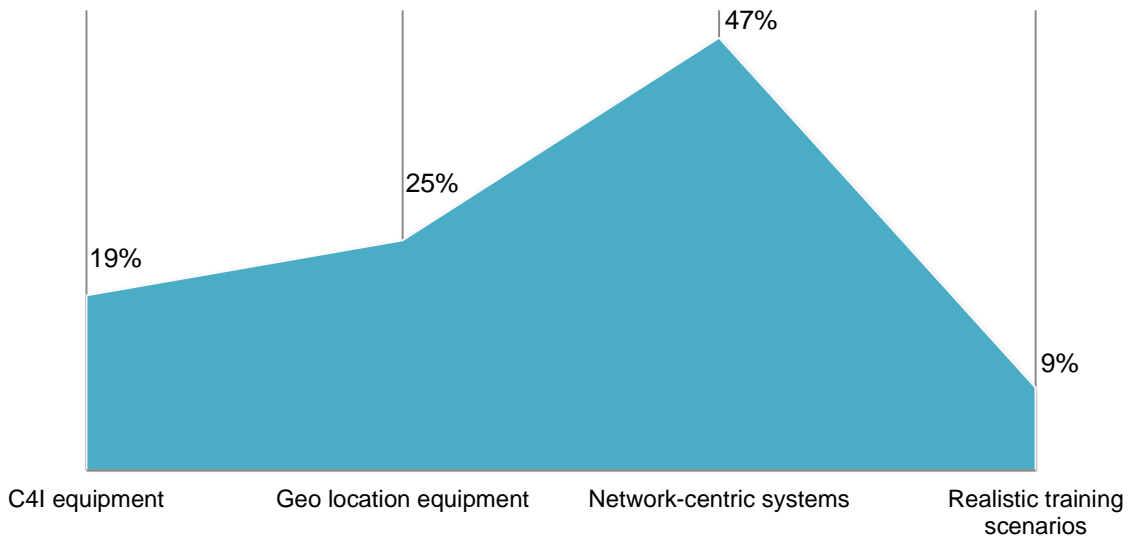
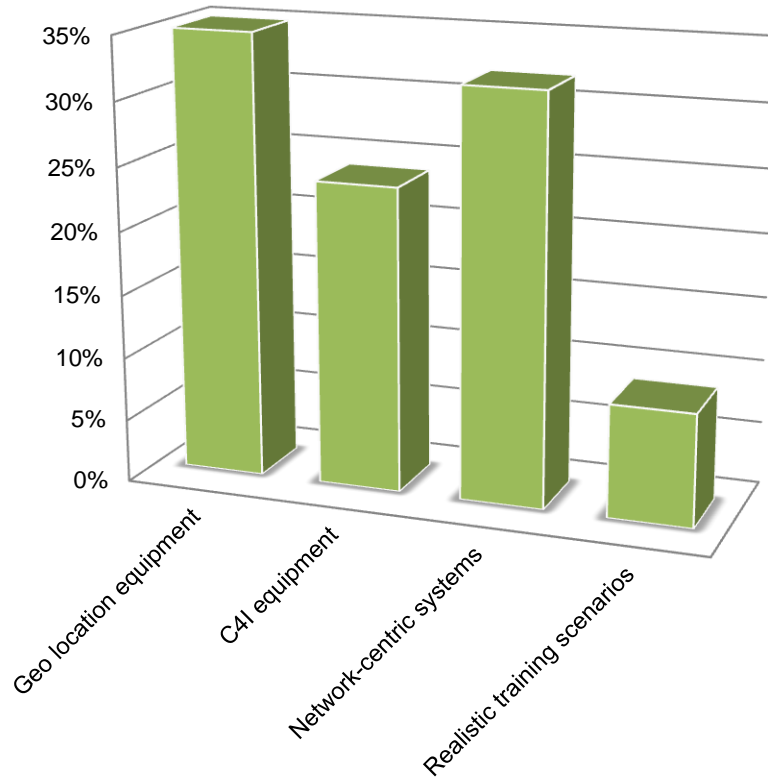


Figure 4b
Summary of most significant factors for Forward Observer improvement (*2012 data)



“While the rat race in development of higher calibre 155mm guns seems to have almost ended, the direction of future development is not clear. More than the gun itself, the need of the hour is to work on accuracy, range and lethality of munitions.”

**Major General Anukul Chandra,
Adviser & Consultant**



Over half of all respondents (51%) said that immersive training and simulation would be the most effective form of training over the next decade, pushing joint exercises into second place (with 26%) and live exercises into third (21%). The significant change from the data in Figure 5b is the elevation of joint exercises – clearly with the budget cuts and belt-tightening beginning to hit home, the military and government is waking up to the fact that joint training may have to become a reality.

While training is often a balance between the classroom, simulation and live exercises, Major Tom Ellis, the training development advisor for the Royal Artillery, told Defence IQ that “nothing is ever going to take away the requirement of live training.”

Ellis agrees with the 51% of respondents in that simulation is a very effective training tool because it is available any time. Ellis also affirmed that “you must have a sound underpinning knowledge” of the equipment; you cannot learn everything in a simulator.

Figure 5a
Summary of the most effective factor to improve artillery training programmes

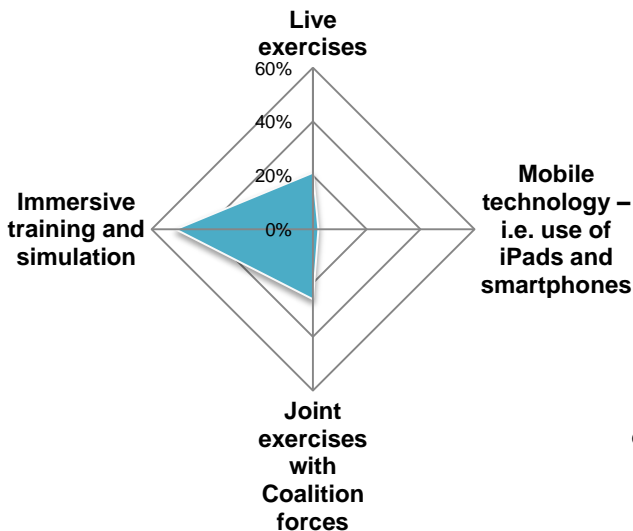
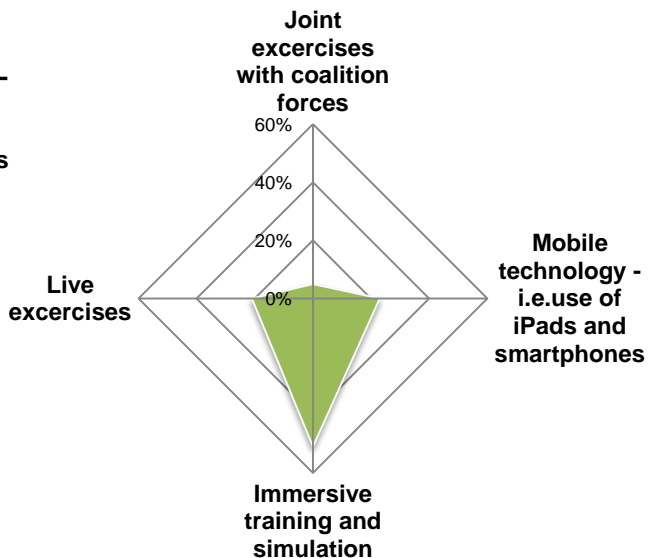


Figure 5b
Summary of the most effective factor to improve artillery training programmes (*2012 data)



The market with the most growth potential over the next ten years is India according to 72% of respondents. Together with China it stands out as a key target market for the future, but with China closely following with 69% it's apparent that the Asia-Pacific region will see a great deal of traction in the artillery market over the next decade.

Figure 6a
Summary of key global growth markets
2013 – 2023

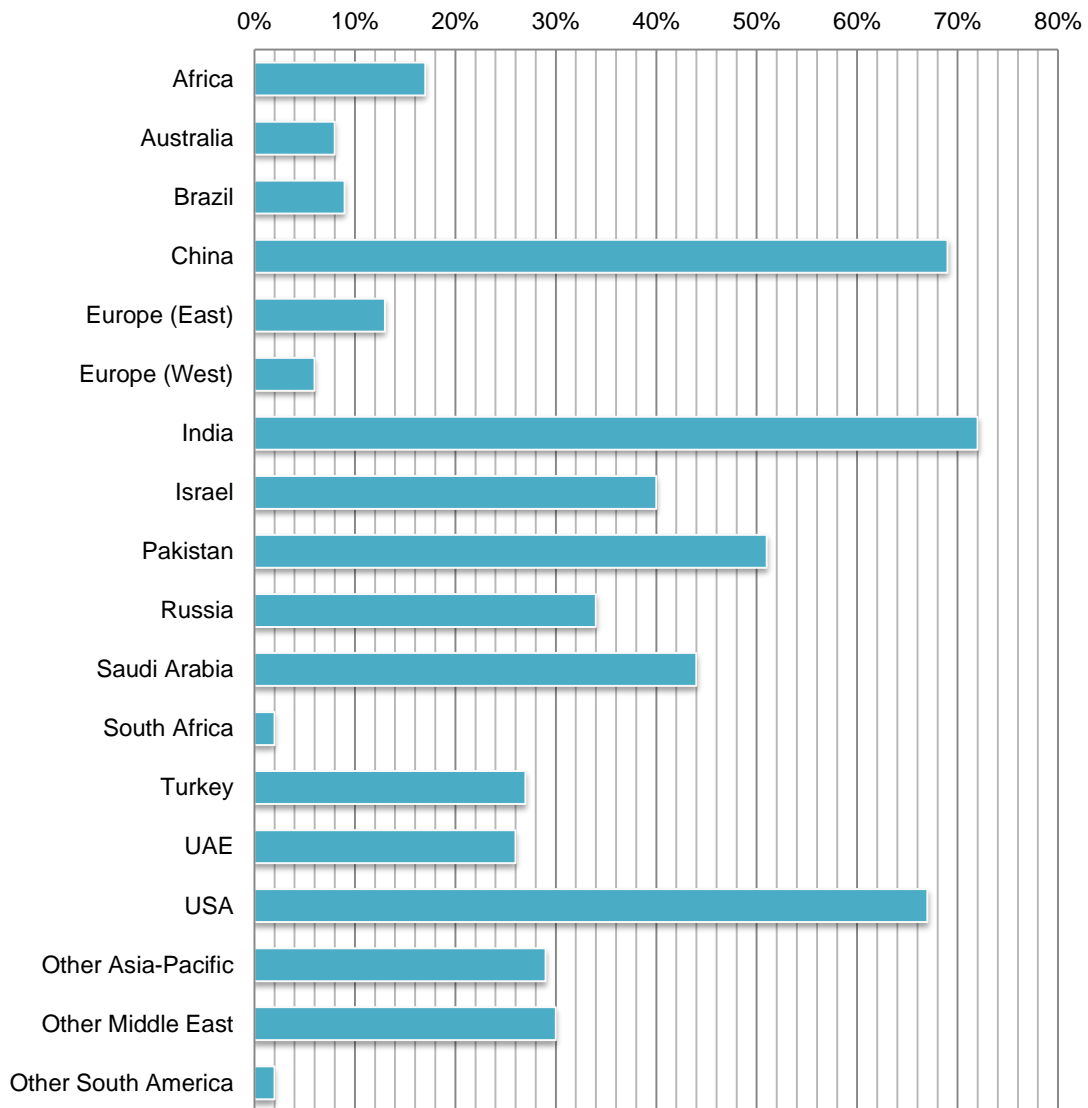
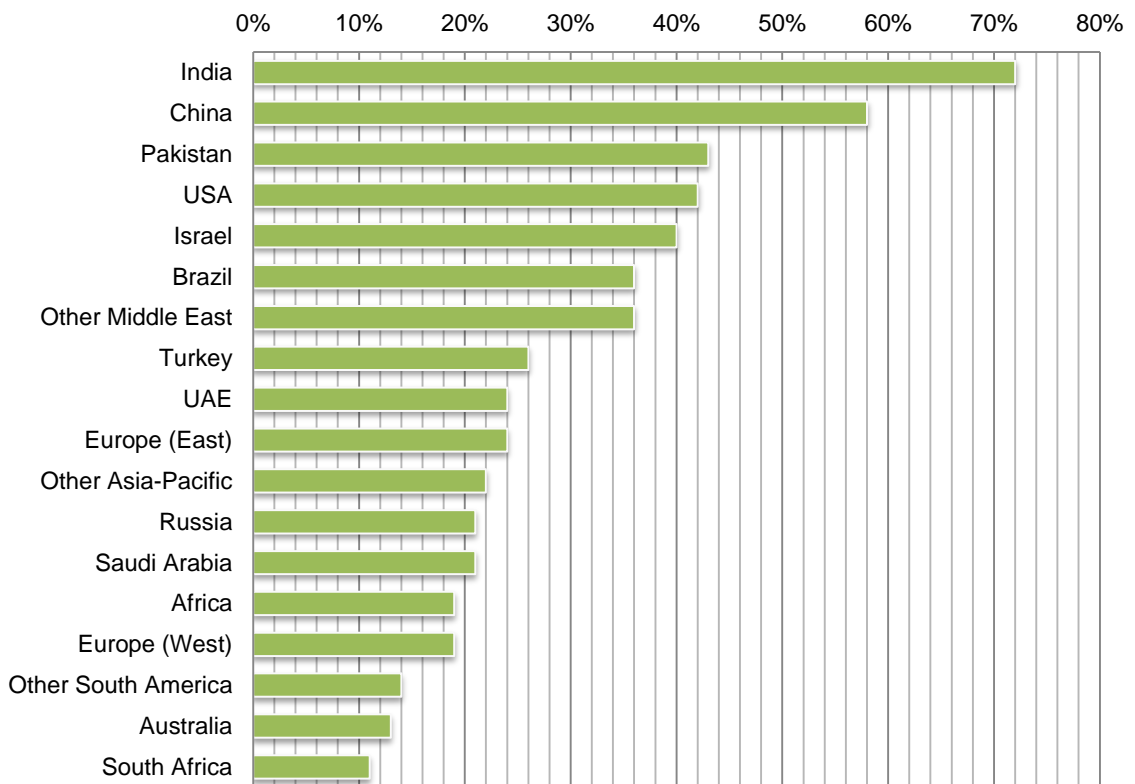


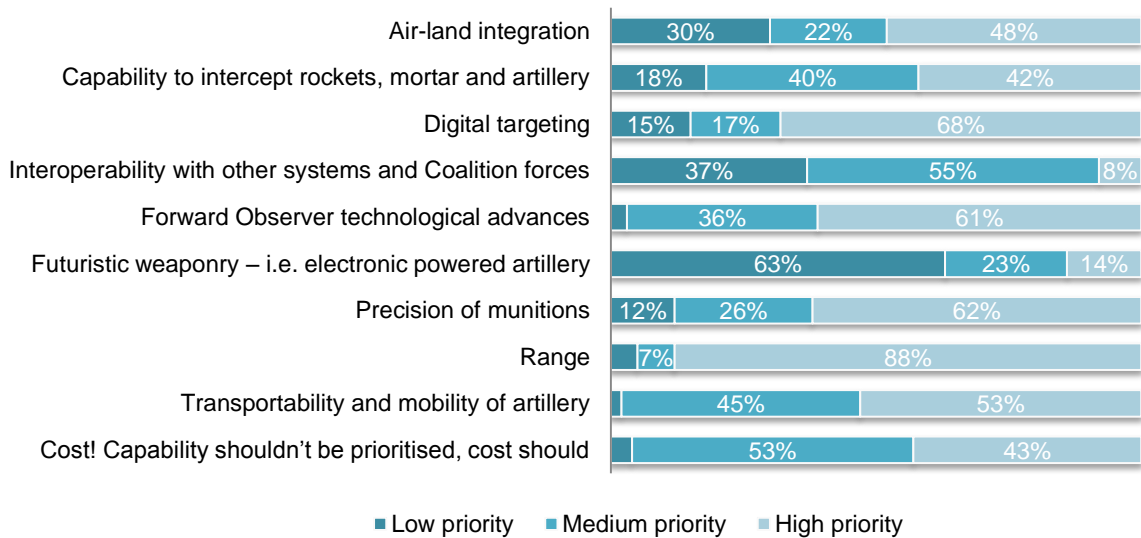


Figure 6b
Summary of key global growth markets
2012 – 2022 (*2012 data)



While China’s ambitions and wealth are undoubtedly accelerating, the question remains how to penetrate this market and take advantage of the country’s growing economy and military might. China is arguably a bigger market than India but respondents have indicated that while China may spend more money on defence over the next ten years, India is a more accessible market and the one in which industry can gain the most traction.

Figure 7a
Analysis of key capabilities for India to prioritise



Identical to Figure 2a, we asked respondents to suggest which capabilities India specifically should prioritise over the next ten years. The issue of cost is considered to be universal. Both Figures 1a and 7a show a similar trend for cost-over-capability, which is perhaps surprising considering India’s renown for squeezing value out of its equipment, often favouring the cheaper tenders it’s presented with. This suggests one of two things; either artillery procurement is a priority for India and will be acquired regardless of cost, or artillery system expenditure is considered to be relatively low-level and spiraling outlays are not a common occurrence.

How important is India’s acquisition of artillery in the context of its major security and defence infrastructure upgrade? The answer really depends on how the tense relationship with China and Pakistan plays out. Respondents were quick to point out that border security is a critical concern for India as it continues to brace against pressure from East and West. India is not an expeditionary force, but it does have vast borders and hostile neighbours. Border security is India’s primary issue; acquiring the appropriate artillery systems, and plenty of them, will continue to be a high priority over the next decade.

Interview:

Rear Adm. (Rtd) Massimo Annati on naval artillery

Defence IQ's Richard de Silva recently sat down with Rear Adm. (Rtd) Massimo Annati, formerly of the Italian Navy and currently working as chairman of the European Working Group on Non-Lethal Weapons (NLW). He has an abundance of first-hand knowledge on the subject of warship armaments, and as such, makes for an ideal guest to help us understand the shape of modern naval artillery...

Massimo, can you please outline the shape of the Italian Navy's use of shipborne medium calibre artillery systems and their strategic value?

Naval artillery has been around for a few centuries and someone, back in the early sixties, believed that missiles would have completely replaced its role. They were wrong and guns had to make a drastic comeback. In Italy we have always believed in naval guns, perhaps because many years ago missiles were so expensive and we hadn't enough money for procuring and maintaining a large missile inventory; or perhaps because we had (and we still have) a very close cooperation with one of the world's best industries in this small club of naval artillery manufacturers. Anyway the final result is that the Italian Navy warships were always fitted with a number of guns. When you compare missiles and naval guns you should remember that in terms of readiness, reaction time, reliability and cost per kill the gun is definitely better. The other main factor to take into account is that guns are inherently flexible. The guns can fire against surface or air targets. They can engage targets at closest ranges and at their full range (compatible with the specific performance of a given weapon). They can even be used to fire warning shots, i.e. intentionally miss a target to convey a message; a very useful job no missile could ever do. It is not a case that the OTO 76mm Compact and 76mm Super Rapid became the standard for medium calibre artillery worldwide.

The recent addition of smart, so to say, capabilities, thanks to sophisticated fuzes and guided munition, further expanded the operational envelope and opened new possibilities, previously just unthinkable. Of course these improvements don't require only the fitting of a new ammunition, but involve all the firing process: mission planning tools, fire control systems, automated ammunition magazines, ammunition feeders, stabilization, gun mount, etc. Once the entire system is upgraded you have a break-through improvement of your performances. What is, again, interesting, is that you can select the level of upgrading you want, without necessarily having to go to the very top, if your requirements don't need it, because the system is flexible and modular. And if you had already an existing gun in service, then you can just upgrade it, rather than discarding it and have to buy a new asset with all the new logistic, training, and related life-time cost to support it.

As you say, naval artillery is far from a new concept in itself but with more advanced systems than catapults and culverins today, precision remains a key priority. But how precise is “precise enough”, and what’s driving the real progress in this field as the demand increases for longer range rounds?

Naval artillery is not new, but firing a guided munitions from a naval gun is quite a new concept. There were a number of attempts worldwide, failed attempts so far, but to my knowledge only the Italian Navy Strales and Vulcano projects reached the reliability required to go onboard of fighting vessels. Strales is the 76mm guided munition, mostly for anti-ship missile defence, while Vulcano is the 127mm long range guided munition for shore bombardment. To better address your question, air defence requires precision because the threat is extremely dangerous. If you don’t stop an incoming missile at a safe keep-out range you’ll suffer extreme consequences. Usually we operate with layered defence, with missiles taking care of outer layers. In case they fail, you have to engage the so-called leakers at close range and there is no a second chance. I used the expression “safe keep-out range” because if you destroy the missile at very close range you are going to be hit by a number of fragments, with possible severe consequences. Incoming missiles can be supersonic, leaving a very short reaction time, or very manoeuvrable, creating problems of engagement. The beauty, with an artillery system, is that you can use the very same weapon system to engage also unconventional asymmetric threats, such as helicopters, UAV, slow-low fliers, surface craft and even fast and stealthy motor boats, with the same precision and lethality.

Precision has instead a different mean and a different requirement for long-range surface fires. Traditional non-guided munition have an extremely low probability to hit the intended target at their full range, severely reducing their effectiveness. If you use guided munition, either GPS or Semi-Active Laser, or Infra-Red, you can achieve nearly the same hit probability all over the entire possible engagement range. The extent of range is also an important issue. The fires against coastal targets put the warships in a dangerous situation to be hit by longer-range, larger-calibre, field artillery batteries. Increasing the current range by a factor of 3-4 times, while maintaining the required precision, change the balance of power and a simple frigate can now engage long range targets which previously required expensive (and not always available) assets such as land-attack missiles or tactical aviation.

To what extent is the usability of naval artillery improving?

New technologies are a real game changer. Today a piece of naval artillery can be used in ways previously unthinkable. The 76mm Vulcano, now under development, will provide small warships, including corvettes and FAC, with the capability to engage surface targets with high precision at ranges previously not achievable by medium calibre rounds. Far from being obsolete, the medium calibre gun has become a real Swiss Army knife of naval warfare. It is a tool good for nearly any task: air defence, anti-ship missile defence, anti-surface craft, anti asymmetric threats, precision shore bombardment, while maintaining the inherent capabilities to fire warning shots, or to disable a merchant vessel without having to sink it. And all this within one gun mount, and one weapon system.

The 76mm calibre is a very good solution because its size is probably the minimum to allow room enough for smart solutions, such as guidance, while retaining an adequate single-shot lethality and a very high rate of fire of 120 rounds per minute. No other calibre can match this combination.

What do you envision as the future capabilities of tomorrow's warship armament? Where do you see the requirement based on the predicted importance of naval dominance in the coming years?

Everybody is now talking of electromagnetic rail guns and high-energy laser. Both technologies are very promising and suitable to open a brand-new world of tactical opportunities. They are however still in a sort of demonstration phase. The development history of high-energy laser is full of failed programs and there is even a joke saying that high-energy laser are just five years away and will always be so...

Seriously, power requirement is a critical issue as well as electromagnetic compatibility and onboard footprint. I believe both technologies can change the future of naval warfare, but this requires long time, huge investments and risk-acceptance, all factors that are nowadays seldom available at will.

So I believe we are going to see missiles and guns for quite a time onboard our warships.

You have particular expertise in non-lethal onboard weapons. Why is the acceptance of such systems seemingly so slow, and to what extent do they offer operational flexibility?

Military forces were trained for centuries to kill and destroy: the more lethal the better. Nowadays, while required to keep our warfighting capabilities at best, we are instead often engaged in different types of operations.

Counter-piracy, embargo, drug enforcement, fishery protection have become daily business not only for coast guards, but also for the navies. And in these types of operations you are not supposed to kill, unless for self-defence.

The acceptance of non-lethal weapons (NLW) in the naval field is still low because, I'm afraid, we have yet to build an adequate mentality. The first military uses of NLW were mostly related with police-like riot control and check point operations, all totally stranger to navies. Additionally, the naval operation environment poses some very tough challenges to deploy NLW, first of all the requirement for a much longer range.

Another serious challenge deals with force protection in close waters: inshore patrols, transiting across choke points, and even sitting in foreign harbours. In all these cases the problem is not destroying your adversary, but determining the intent, and therefore avoiding either an international incident, if you kill the wrong guy, or an hostile action by some terrorists or militias.

NLW can solve the problem, buying time and determining the intentions, therefore supporting the further decision to escalate to lethal options, if required. In most of the cases traditional lethal weapons can't do this job alone, and NLW are not enough in case of a real threat, so both families must work in close coordination to provide the required level of security to deployed naval forces.

FUTURE ARTILLERY



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