



## Our point of view on the Russia – Ukraine crisis consequences on the Aerospace & Defense sector

### Introduction

On Feb. 24, 2022, Russia invaded Ukraine, starting a war whose impact has stretched globally into various geopolitical and economical dimensions. Russia's invasion of Ukraine has received harsh criticism internationally, and resulted in the reinforcement of international sanctions, from the US, EU, UK, and Japan. In response to these sanctions, Russia implemented extensive retaliation measures, especially regarding its gas exports towards Western Countries.

Consequences on Aerospace and Defense sectors are multiple, highly connected to the geopolitical developments and outcomes of this crisis, and complex ripple or snowball effects from other industries can have major impacts on A&D players' Global Supply Chain and Logistic & Transportation Systems. Currently daily developments of both battlefields and negotiations move-on in an almost Brownian way, making any deterministic predictions irrelevant.

Therefore, developing resilient strategies for A&D players should rather be based on the analysis of scenarios addressing a wide array of future possibilities to get a holistic view on the situation, and well understand the short-, medium- and long-term impacts of this crisis on Global Geopolitics, Global Economy and A&D business.

Key A&D players, should consequently try to answer the following questions:

- What are the key drivers, and signposts or events that can trigger disruptive events strongly impacting the Global Geopolitics, Economics and A&D sector?
- Which elements are certain ("Certainties") and which ones are not ("Uncertainties"), and what are the rough likelihood of those uncertainties?
- What are scenarios, built on "Certainties" as strong foundations, and covering the whole range of "Uncertainties", allowing to build resilient and well-informed strategies? How should Leaders drive their strategic thinking in such a fuzzy context.

We aim at providing to business leaders the right keys to decipher such a fuzzy business environment, and structure their strategic thinking the right way. Therefore, in this series of publications, we will explore the following topics:

- In this document, we will try to help the reader understand what the major macro-economic consequences of the Russia Ukraine crisis can be ;
- In a second publication, we will develop the key consequences of this crisis on A&D markets, across their different dimensions (commercial aviation, defense markets, space policies...);
- In a third publication, we will explore the key consequences of this crisis on A&D extended value chains ;
- Finally, we will propose a few options to structure strategic thinking on how to navigate in such a highly uncertain future environment.

## The current crisis has unexpected consequences, and ripple effects from other sectors (O&G, agriculture, financial markets) could impact the A&D sector in an unforeseen way

### Major economic sanctions have been established against Russia,

such as the freeze of SWIFT payment system for Russian (and Belarus) banks<sup>i</sup>, major personal sanctions against key persons of the Russian Regime (freeze of personal asset, travel bans...) and plans to progressively shift out from imports of hydrocarbons (and steel) by the end of 2022 – with as a corollary the withdrawal from some investments in Russian energy sector. Key uncertainties now come from the level of impact of gas supply disruptions on western industries (esp. in Germany and Italy)<sup>ii</sup> and financial conditions of companies with significant exposition to Russia or Ukraine. Beside O&G, many global value chains such as automotive, semi-conductors, industrial gases (neon), oilseeds, electrical and electronic equipment, fertilizer, pharmaceuticals... may be significantly impacted.

### Current macro-economic environment leads to higher than historical average inflation.

- Oil and gas prices, amongst other commodity prices, have escalated very quickly and are expected to remain high if the uncertainties persist. Russian retaliation measures on gas exports have disrupted European power markets, with soaring costs and detrimental impacts on both industries and individual consumers.<sup>iii</sup>
- Military actions have disrupted trade routes in the Black Sea—a key transit point for several important commodities, agricultural products (such as wheat and corn), and dry bulk exports. These disruptions strongly impacted availability and prices of corn or wheat. Even if the Ukraine Grain Deal established in July enables the exports of almost 22Mt of Ukrainian wheat, corn and other cereals

that have been accumulated in the ports of Odessa, Chornomorsk and Yuzhne.<sup>iv</sup> However, the situation is still vulnerable, and new disruptions could be again exacerbated as sanctions against Russian fertilizers exports are still subject to sanctions, potentially leading to political upheaval in MENA region (e.g., Algeria, Egypt...).

**High volatility on FOREX markets** has also been observed, especially on Ruble and other emerging currencies (e.g., Indian Rupiah). Global inflation could result in US Federal Reserve<sup>v</sup> or ECB raising their rates more aggressively<sup>vi</sup>, changing the balance to global FOREX markets, with also impacts on the profitability of the A&D sector.

All those disruptions can strongly influence (favorably or unfavorably) military spending dynamics globally and should be therefore looked at in a geographically granular fashion. Ripple mechanisms linking other sectors (O&G, semiconductors, but also agriculture or financial markets) and global A&D spend should be also dissected.

## What's in it for the Aerospace and Defense markets?

The Russia – Ukraine crisis has a strong direct impact on A&D markets, both on the short term (consequences of sanctions or Russian retaliation measures, short to mid-term development of the conflict at a wider scale) and on the long term (emergence of new paradigms regarding public defense spend of space exploration policies).

**Beyond the potential decrease in global or regional economic health and its unfavorable impact on global or regional aviation traffic, commercial aviation is facing several major consequences:**

**Soaring jet fuel costs** (with a Brent price over 100\$/bbl.) put airlines under pressure – in a COVID recovery context. On the mid-term, such situation could accelerate fleets replacement towards fuel-efficient programs (e.g., A320/A330Neo Airbus programs, Leap or GE9X powered aircrafts, ...) and foster the introduction of SAF, as trials are encouraging. In the longer-term, new architectures (e.g., open rotor engine, LH2 aircrafts, ...) will become mandatory.<sup>vii</sup>



**Airspace embargoes**, as EU imposed sanctions by enacting Council Regulation (EU) 2022/334<sup>viii</sup>, prohibiting Russian aircrafts from taking off, landing in, or flying over any EU nation, and so did the UK and the US. Similarly, flight routes from 36 countries must avoid the Russian airspace.

- Such major transformation led “western” airlines usually flying over Russia to take alternative routes (e.g., polar), resulting in longer flight times and crew shift patterns, increased fuel consumption and disruption at airports. This directly gives a competitive advantage to airlines from China or from the Middle East (Turkey, UAE, ...). If sustained over time, this major transformation calls for a structural evolution in global fleets, with longer range aircrafts (A321XLR, A350, etc....)
- Sanctions also impact Russian airlines, no longer supported by Airbus or Boeing (no spare parts sent to Russia), having their “western” fleets stuck to the ground. Planes stranded in Russia (approx. 400, worth 10B\$) are losing their value, as they are either being robbed or because their maintenance is neither performed nor logged properly, resulting in write-offs for lessors and increased exposure for insurance companies.<sup>ix</sup>

**General beliefs regarding defense policies are also being challenged, changing European perception about major threats, and raising question marks about the NATO paradigm.**

**Western military spend should reach its pinnacle:** Western defense spending should steeply increase, European defense spend setting for its largest increase in 30 years, as many countries (Germany, Netherlands, Poland, Denmark, Sweden, Romania, and Latvia have all claimed significant increases in defense spending. In the US, the Senate voted to approve a record ~850B\$ in military spending for FY23<sup>x</sup>.

**However, many challenges arise:**

- As the terrestrial capabilities are concerned; on the one hand, Russian terrestrial army did not appear of highest performance, pushing western countries to re-evaluate the related threat, and therefore investment doctrines. On the

other hand, western capabilities shown also unambiguous limits when it comes to delivering to Ukraine enough equipment to cope with high intensity standoffs, questioning their own terrestrial capabilities.

- Beliefs concerning aerial capabilities are also being challenged, aerial and missile capabilities (nb: 50 - 75% of available firepower in OTAN countries) are contested by dense systems (e.g., S300) while drones (e.g., Turkish TB2 Bayraktar<sup>xi</sup>) proved to be a credible low-cost option to go through aerial defense and attack ground force, impacting key requirements for future EU military aircraft programs (SCAF).<sup>xii</sup>

**The consequences of the Ukraine / Russia on global defense markets and position of European players can be therefore influenced by many major variables:**

- Will Europe move towards a common defense policy? (“Europe de la Défense”) or will it rely on NATO? What is the expected behavior of Eastern Europe countries?
- How will war outcomes (Russian army performance, Russia disconnection from international banking system, depleted defense R&D budgets, ...) impact Russia's competitiveness on export defense markets, esp. on its traditional ones (e.g., India)?
- Is the current conflict expected to spread out more globally (e.g., China claims over Taiwan or developments of disputes in South China Sea, ...)? What will be the defense spending evolution in other areas (e.g., Middle East) with sustained high O&G prices? How global export control policies will move-on, with which consequences?

**Finally, space markets are being strongly disturbed by the current situation:**

While ISS program is being apparently safeguarded<sup>xiii</sup> (despite initial threats from Russia), **other space programs are jeopardized by disruptions coming from the entire ecosystem:**

- **Soyuz halted its collaboration with western space agencies**, not only in Kourou (Guyana)<sup>xiv</sup> from where pending

launches have been cancelled, but also in Baikonur, with for instance a 36 UK OneWeb (finally being acquired by Eutelsat<sup>xv</sup>) satellites launch cancelled in March 2022<sup>xvi</sup>. OneWeb shifted rather to an agreement with SpaceX<sup>xvii</sup>. Also, ESA will have to find rockets for at least five new space missions through 2023. Finally, ExoMars rover program will be probably postponed by 2028<sup>xviii</sup>.

- Disruptions in critical Russian or Ukrainian components are also critical. For instance, Roscosmos halted the supply of RD-180<sup>xix</sup>, used in Atlas III and Atlas V and RD-181<sup>xx</sup> used in Antares program (Northrop Grumman). In Europe, Vega-C's (launching Pleiades Neo satellites) EU upper stage uses “Yuzhnoye Design Bureau” Ukrainian RD-843 engine, raising concerns for future launches.<sup>xxi</sup>
- Antonov airlines, critical in satellites logistics (e.g., ADS Turksat 5B delivered to Space X in January<sup>xxii</sup>) after having suspended its operations, moved its operations base from Hostomel and its remaining fleet of 5 An-124 to Leipzig in Germany.<sup>xxiii</sup>

**The current conflict in Ukraine could also expand in space**, as the dual use of Starlink or Maxar satellites - which capabilities have been made available to Ukrainian belligerent - may qualify them as military objectives for Russia<sup>xxiv</sup>. Consequences could range from cyberattacks (e.g., GPS jamming or spoofing), up to direct attacks on the above-mentioned assets, generating dangerous space junk and forcing NATO members to invoke mutual-defense pact Article V.

**What's in it for the Aerospace and Defense value chains?**

The Russia – Ukraine crisis has a strong direct impact on A&D value chains, not only for many critical metals (e.g., titanium, nickel, palladium, ...) but also manufacturing value chains (semiconductors, high-power forgings) and global logistics. In this chapter, we will discuss key disruptions to be tackled by A&D players, and how some of them are being currently mitigated.

In terms of materials, **several value chains** are currently being impacted, yet **mitigation measures** are being implemented, limiting impacts on global A&D industry:

**Titanium:** Russia and Ukraine are critical in the global Titanium supply (esp. VSMPO Avisma), Airbus sourcing approx. 50% of its Titanium from Russia<sup>xxxv</sup>, while Russia is highly dependent on Ukrainian mineral concentrate (and as China controls most of the upstream value chain: 30% of global mineral concentrates<sup>xxvi</sup> and 55% of sponge<sup>xxvii</sup>).

- Europe currently exempted Titanium from its sanctions policy<sup>xxviii</sup>, but a pressure on Ti cost for both SQ (landing gears, aerostructures) and PQ/DQ (engine parts: fan blades, disks...) quality should be expected when the EU players inventories are being depleted, as aviation quality titanium is controlled by US suppliers (ATI, Howmet, PCC/Timet) with a modest European footprint (Timet Savoie, Ecoti/UKAD).
- US applied stronger sanctions, and Boeing – having cut its relationships with VSMPO Avisma<sup>xxix</sup>, i.e., 30 to 40% of its total supply - is forced to slow down the production of the B737Max.

**Nickel:** Russia a major producer of nickel (3rd mining production, Nornickel #1 nickel metal player with 12% global MS<sup>xxx</sup> and lowest production costs), a key component of superalloys (e.g., Inco718, Rene) used in jet engine parts (e.g., disks), special steels (e.g., MarvalX12<sup>xxxi</sup> used in fasteners and structural parts of missiles & aircrafts). However, raw material price volatility impact would be limited as supply is covered by medium to long-term contracts and hedging vehicles. Short-term disruption risks should be limited too, superalloys (ATI, PCC, Carpenter, GE) and special steels (Aubert & Duval, Swiss Steel, Bohler / Voestalpine) being mostly provided by western players.

**Palladium:** Russia is the 1st global producer of palladium (37% market share, mainly at Nornickel), widely used in A&D value chains, especially in semiconductors (electronic connectors, multi-layer ceramic

capacitors, ...), jet engines (fuel nozzles, heat exchangers). Palladium supplies from Russia face disruption from widespread flight bans, Nornickel examining alternative routes to supply customers (e.g., shipments through China...)<sup>xxxii</sup>

**Neon:** Before the crisis, approximately 50%<sup>xxxiii</sup> of semi-conductor grade neon came from Ingas (Odessa) and Cryoin (Mariupol) in Ukraine (as by-product from Russian steel production), and both companies shuttered their operations. Large chip producers have prepared, therefore do not see short-term (2 – 3 month) supply problems as they built safety stocks of neon and have a privileged access to inventories / alternative supply. The ramp-up of new neon productions outside of Ukraine is estimated between 9 months to 2 years but further unrests (e.g., South China Sea) could strongly hurt the semi-conductors supply chain.

**High-power closed die forgings are of high criticality too.** Indeed, most of the largest close die forging presses are in Russia (VSMPO 75kt<sup>xxxiv</sup>, Arconic SMZ Samara 72kt – being put on sales since May' 22<sup>xxxv</sup>). Comparable equipment exists in China (80kt, Erzong), France (65kt A&D) and to a lower extent in the US (Otto Fuchs 54kt<sup>xxxvi</sup>, PCC Grafton 50kt<sup>xxxvii</sup>).

- Currently, if Arconic Samara suspended taking new business they continue fulfilling their contractual obligations. VSMPO continues fulfilling a few contractual obligations too.
- Airbus and Safran initiative to takeover Aubert & Duval to stabilize its industrial operations and financial resilience is therefore critical to ensure European sovereignty.<sup>xxxviii</sup> It has however the challenge to transfer to France in a short time frame critical titanium product from VSMPO, developing a competitive and sustainable domestic titanium value chain based mainly on recycling.

**Finally, the transportation and logistics activity has also been severely shacked:**

All transportation means are experiencing disruptions at various levels of magnitude:

- Soaring jet fuel prices and sizeable reduction in air-cargo capacity for EU airlines (e.g., Lufthansa claiming a 10% reduction<sup>xxxix</sup>, Russian or polar routes impaired) resulted in rates jumping by x 2 to x 3. Middle East hubs are potentially an alternative solution but with limited spare capacity at gulf airlines and ME airport slots.
- Post pandemic cost for maritime transport cost accelerated the need innovative vessels ownership and shared utilization models, as well for fuel saving measures
- Finally, land cargo experiences a reduced land freight capacity in Western Europe, as cabotage (incl. illegal one) will go down (Ukrainian drivers went back home<sup>xxxx</sup>, Russian & Belarussian trucks forbidden in EU since 17th of April<sup>xxxi</sup>, disturbed cross-border flows with Belarus & Kaliningrad) leading also to inflationist pressure on costs.

Major European A&D players logistics contracting strategies will have to be updated, to cope with both increased risks (necessary aggiornamento of incoterms) and cost volatility (4PL contracting strategies, fuel surcharge management, space guarantee contracts, performance level agreements)

Some new business opportunities are arising, for instance in the oversized / heavy-duty air cargo. Antonov Airlines had to relocate to Leipzig and will operate only 5 of its An-124 from there, while Volga Dniepr Airlines started to exit many markets and started staff cuts<sup>xxxii</sup>, as its owner Alexey Isaikin – impacted by sanctions – withdrew from managerial structures, and ceded ownership<sup>xxxiii</sup>. Consequently, some room to developed oversized cargo transportation on Beluga XL<sup>xxxiv</sup> or A380 P2F conversions could be contemplated in the short-to-midterm.

## How to strategically navigate in a highly uncertain future environment?

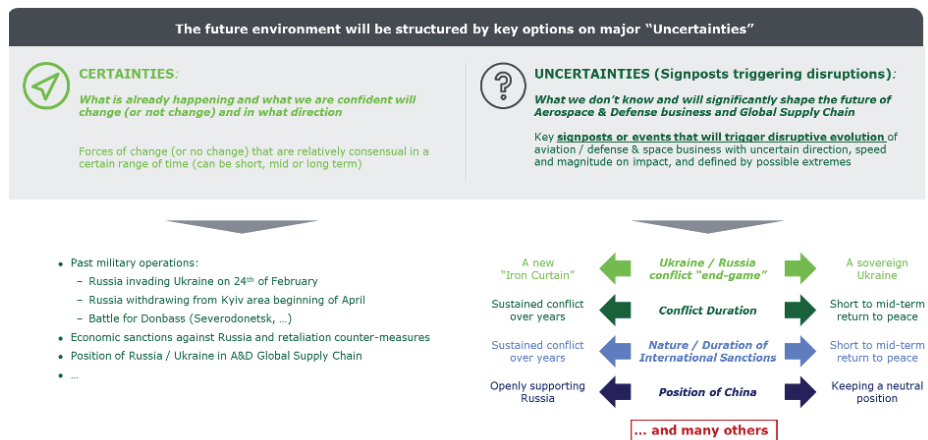
In previous chapters, we explained how the Russia – Ukraine conflict, through the complexity of its developments, and the unforeseeable ripple effects it can have on various markets and industries has potentially multiple and deep impacts on both A&D markets and value chains.

To cope with this issues and risks, Aerospace & Defense players will have to make the best possible decisions while the global environment is clearly unruly. The development of the Ukraine / Russia conflict and its consequences on the global economy and A&D environment are highly volatile. Interconnectedness and unpredictability of its influencing factors yield uncertainty in decision-making and problems of trustworthiness of data sources lead to ambiguous interpretations of available information.

Therefore, predicting the future in a deterministic way is almost impossible, conventional forecasts must be augmented to operate in dynamic and longer-term periods, while strategies should be developed to cope both with our current certainties (i.e., forces of change – or no change – that are relatively consensual in a certain range of time), but also to be resilient regarding major uncertainties (i.e., key signposts of events that can trigger disruptive evolutions with a certain direction, speed and magnitude of impact, and defined by certain extremes).

A scenario planning approach should be deployed to challenge assumptions and provide more options and enable better decisions in more dynamic and uncertain environments in the mid to long-term.

With military and diplomatic developments evolving at a daily basis, it is critical to well understand the different “Certainties”, but also “Uncertainties” on the crisis outcome that will triggering disruptive environment evolutions.



**Certainties** are what is already happening and what we are confident will change (or not change) and in what direction. These forces of change (or no change) are relatively consensual in a certain range of time (can be short, mid, or long term) and can encompass past military operations (e.g., Russia invading Ukraine on 24th of February, withdrawing from Kyiv or Kharkov areas, recent Donbass back – and forth military actions on Russian and Ukrainian side, economic sanctions against Russia and retaliation countermeasures, the position of Russia / Ukraine in the Global A&D Supply Chain).

**Uncertainties** are what we don't know and will significantly shape the future of A&D sector. Those signposts will trigger disruptive evolutions of A&D industry, with an uncertain direction, speed, and magnitude, and can be for instance (and not exhaustively)

- **The Russia / Ukraine conflict “end-game”**, leading either to Ukraine recovering its full territorial sovereignty, or to a “New Iron Curtain”
- **The conflict duration**, with either a short to mid-term return to peace, or a sustained conflict over years, with direct consequences on the nature and duration of international sanctions and related Russian retaliation measures.
- **The position of China**, either keeping a neutral position, or openly moving to a support of any of the parties.

Depending on the combination of those uncertainties, **boundary scenarios can be contemplated as references for developing resilient strategies:**

To develop both relevant strategies, A&D players should try to answer the three following questions, aiming at getting answers resilient to boundary strategic scenarios:

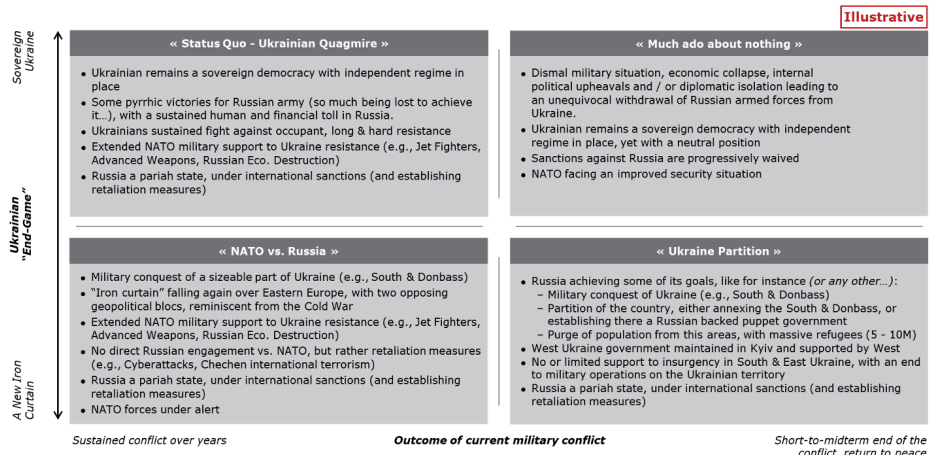
**On which business segments**

(commercial, defense, space, communication), **value chain stages** (materials or parts sourcing, specific manufacturing activities...) or **activities** (engineering centers, ...) should managerial focus be put on in priority, given threats and opportunities arising from the current context and its potential developments?

Which strategic moves should be contemplated to cope with the new paradigm:

- **Transformation of business portfolios:** reconfiguration of product portfolios (e.g., development of UAS or cybersecurity, fine-tuning of new military aircraft programs...), acceleration of fuel savings technology and accelerated introduction of SAF, leverage of distinguishing assets (e.g., leverage of proprietary fleets of jumbo carrier aircrafts for external clients...)
- **Reconfiguration of value chains** and transformation of business model: capitalistic moves to secure critical industrial assets or supply sources (e.g., diversification in geographical industrial footprint; forging or semiconductors production; supply of titanium or specialty alloys – superalloys, aluminum-lithium...), recast of make-or-buy options (e.g., insourcing / outsourcing of 4PL logistics)

Finally, how to enable those moves, through the development of targeted critical capabilities, transformation of management processes and systems?



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