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Prospective analysis of the implications of using autonomous aerial systems in USAF Air Defense Interception Missions. From 2019 to 2035

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Empirical analysis of international collaboration in the provision of Defence assets: Advantages and Limitations



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Introduction to issue 15 of the IEEE journal

The circumstances in which, on this occasion, we have faithfully kept our rendezvous with you are admittedly very different from those we might have imagined when closing the previous issue of this Magazine. We at the Spanish Institute for Strategic Studies were well aware that the possibility of an epidemic –or pandemic as it finally turned out to be– was very considerable, and this was demonstrated by the timely publication, in February 2020, of *Cuaderno de Estrategia*, number 203, under the title “Pandemic Emergencies in a Globalised World: Threats to Security”. In the interim we have not been immune to the upheaval caused by the virulence and speed of transmission of this new coronavirus. Nevertheless, in spite of the difficulties, including widespread consternation, we were determined to turn up for our appointment with the academic community interested in the Security and Defence of our country and of the entire world in general. After all, if there is one thing that has been made clear by this crisis, it is that the highly interconnected and interdependent world in which we live leaves no room for indifference in the face of events and circumstances that, in other not so distant times, and precisely because of geographical distance, would have seemed alien to us.

On this occasion there are several articles that address issues with a pronounced military content. “Targeting as an enabling factor in NATO military operations” proposes an analysis of the concept of targeting, which seeks to maximise the effectiveness of armed interventions in order to – although this may seem paradoxical at first sight – minimise the damage caused and where possible resolve the conflicts in the shortest time; and all of this, within the strictest framework of international legality and the ethical conditions that democratic societies impose on themselves. This will mean revising and updating doctrines, structures and procedures. If the most advanced technologies play a predominant role in this particular article, they are no less relevant in the application of “The ‘Silver lining methodology for the development of strategic foresight exercises”, especially artificial intelligence. And the same goes for the

“Prospective analysis of the implications of using autonomous aerial systems in USAF Air Defence Interception Missions. From 2019 to 2035”, an area in which we should not ignore the obvious ethical repercussions that derive from the simultaneous use of human-operated and other autonomous platforms.

European initiatives to strengthen its industrial and technological infrastructure in the field of defence equipment, in search of the often proclaimed, but still incipient, European strategic autonomy, serve to highlight another of the contributions in this issue of the Journal: “An Empirical analysis of international collaboration in the provision of Defence assets: Advantages and Limitations”. This collaboration has many positive aspects, ranging from the strengthening of international relations to the always desirable interaction between the allied forces. These advantages are complemented by the catalytic effect for much-needed industrial restructuring, especially in the light of the impact of the economic crisis that will undoubtedly follow the health crisis caused by the COVID-19 pandemic. Finally, the article “The United States and Saudi Arabia Alliance in the 21st Century. The presidency of George Bush, Barack Obama and Donald Trump” provides a very interesting review of the evolution of relations between these two global actors throughout the first two decades of this century.

We complete this issue with a review of the book entitled “Hybrid Threats: Hybridisation Theory and the New International Order” by Pablo Andrés Mazurier and Claudio Augusto Payá Santos.

Once again, I would like to conclude by expressing the hope that the content of this issue of our Magazine will be of great interest to you, and furthermore that it will be entertaining and enjoyable to read. We look forward to meeting up with you again with the next edition of this, your Journal of the Spanish Institute of Strategic Studies.

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Targeting as an enabling factor in NATO military operations

Abstract

The conflicts of this new century are influenced by the complexity of the global socio-political scenario, rapid technological and doctrinal development or necessary compliance with international law. This changing scenario, among many other factors, greatly influences the planning of a military operation. Understanding the course of the last century's history provides a historical context that explains the reason –and the need– for NATO's 2010 organisational model; as well as the creation of the concept of targeting and its subsequent integration into the Alliance's organisational structure. This paper reviews targeting from a holistic perspective –doctrinal, legal and military innovation– in order to determine whether this concept fulfils an enabling role within NATO's military operation planning process.

Keywords

Targeting, military operation, capability, innovation, JFAC, NATO.

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Introduction

The complexity of the armed conflicts in which NATO has been involved over the past two decades has highlighted the importance of adapting its structure, doctrine and procedures to the demands of the international community and technological developments. Thanks to these processes of restructuring and innovation, the organisation seeks to intervene in conflicts more effectively and in accordance with international law.

In addition to technological development, NATO has advocated further in-depth research into which methods and techniques will give it an advantage in operations¹. One of them is the joint targeting process². This paper studies the concept as an enabler of military operations within the NATO framework. It considers the process from the point of view of innovation and international legality, and asks: is targeting an adequate method of assistance to the planning and implementation of these operations?

This study will be carried out in three fundamental stages, which serve to explain the most important concepts on the subject:

First of all, we will conduct a historical review of airpower, in which we examine the evolution of the concept and capabilities of the air force. Next, we will analyse NATO's organisational model³ created in 2010, given its importance for security-related organisations⁴, focusing on the Air Component Command⁵. Later, the concept of targeting will be defined, using the AJP 3.9 "Allied Joint Doctrine for Joint Targeting". Finally, with a view to reaching conclusions, we will examine the concept of targeting as an innovation, its relationship with the law and its application and suitability to the conduct of military operations.

The methodology used is fundamentally theoretical and descriptive, with a qualitative approach based on documentary analysis: on the one hand, specialised literature

1 Military advantage is the expected gain from the attack as a whole, not counting its particular actions. It refers more to the achievement of operational or strategic objectives than to tactical dividends.

2 A term that describes activities, operations and organisations involving elements of at least two armies. See: NATO STANDARDIZATION OFFICE. AAP-06 Edition 2018 NATO glossary of terms and conditions. Brussels: 2018, p. 70.

3 EZPELETA, José. A. «La reestructuración del Ejército del Aire». Monografía 138: Racionalización de las estructuras de la Fuerzas Armadas. Hacia una organización conjunta. Madrid: CESEDEN 2013, pp. 105-125.

4 AGUIRRE DE CÁRCER, Miguel. «La adaptación de la OTAN. 2014-2017». En Cuadernos de Estrategia 191. OTAN: presente y futuro. Madrid: Instituto Español de Estudios Estratégicos 2017, pp. 15-50.

5 The inherent characteristics of airpower make it suitable for dealing with all kinds of threats: speed of reaction, flexibility, precision, multi-response capability, mobility, concentration capacity, penetration capability, strength deployment capacity, adaptability, survival and scalability. See: LOMBO, Juan. A. «El poder aéreo, instrumento decisivo para la resolución de las crisis del siglo XXI». Revista Arbor. Madrid: 2002, pp. 231-257.

from/about NATO in general, its structure, capabilities and commitments in particular; on the other hand, scientific literature and academic publications by authors with sufficient experience and relevance in the field.

The relevance of the study of this concept and of the associated capability⁶ is justified, moreover, in terms of its impact on Spain's current military planning⁷. In 2014, the Defence Chief of Staff published the Joint Doctrine of Targeting⁸, as well as directives for its implementation and organisation⁹. In 2018, the Air Force certified the JFAC (Joint Force Air Component) capability as a NATO Response Force (NRF)¹⁰– including targeting activities¹¹– for effective execution for and during 2019.

Its influence due to diverse political and cultural factors, and the lessons learned from various military operations further indicate the need for study of the issue. The present analysis aims to contribute to a better understanding of present-day military capabilities, favouring the perception of targeting as a capability which, thanks to its procedures, legitimises military action. Targeting is a relatively recent concept, so it has certainly been difficult to find relevant academic publications. For this reason, most of the sources used come from the military sphere, particularly from NATO and the Spanish Armed Forces. Only freely accessible documentation has been used, so as to avoid the difficulties derived from classified documentation.

6 Capability is the «set of factors (weapons systems, infrastructure, personnel and logistical support means) based on doctrinal principles and procedures intended to achieve a given military effect at strategic, operational or tactical level, in order to fulfil assigned missions». See: GARCÍA, José. «Planeamiento por capacidades». *Revista Española de Defensa*. Madrid: 2006, pp. 38-43.

7 By definition, targeting has a dual nature. On the one hand, it is a capability, as described in the previous footnote, and at the same time it is understood as a command and control process that relates the different levels of command for the selection of targets.

8 JEMAD. PDC-3,9 Doctrina conjunta de Targeting. Madrid: Estado Mayor de la Defensa 2014.

9 JEMAD: Directiva 12/14 «Implantación de la capacidad de targeting conjunto en las Fuerzas Armadas». Madrid: Estado Mayor de la Defensa 2014; y JEMAD: Directiva 20/14 «Organización del targeting conjunto en las Fuerzas Armadas». Madrid: Defence Chief of Staff 2014.

10 The NRF was established in 2003 as a readily available, multi-domain force capable of rapid deployment. In 2014, in view of the new security challenges, a new structure was adopted for this Force, including the creation of the VJTF (Very High Readiness Joint Task Force): a multinational brigade that acts as a back-up in response to crises in a short period of time.

11 BONADAD, Pedro. «Capacidad del JFAC nacional». Monografía XVI CEMFAS. Madrid: Escuela Superior de las Fuerzas Armadas 2015, p. 1.

Considerations on Airpower

Since its creation, and during the first five years of the twentieth century, aviation and its application in the military arena were closely linked. In less than a decade, military aviation services were created in several countries, which began to operate effectively with unusual speed. Spain was the first country in the world to use airpower in the form of bombing¹², specifically during the conflict in the Protectorate of Morocco at the end of 1913¹³.

Its extensive use intensified during World War I, where both massive bombing campaigns and targeted actions in support of ground operations were carried out. Its effects were limited – both personal and material – although its psychological effects were extraordinary.

World War II served to demonstrate to the entire community of nations the superiority that airpower provided: its ability to break the political and military will of the adversary, as well as the undeniable advantage that aviation provided as a service separate from the ground element. As a result of campaigns in Europe and the Pacific, the concept of strategic bombing emerged¹⁴, since the effects of these actions fulfilled the objectives of the war as a whole, regardless of the particular terrain in question¹⁵.

From 1947 onwards, the use of airpower in the decades to come was the subject of much debate: the Korean, Vietnam and Gulf Wars were its playing field. Not only were lessons learned from the American conflicts, but Israeli tactics and results from the Six-Day War and Yom Kippur were studied. Airborne warfare took on the form and characteristics attributed to it today.

However, and very much in spite of the good results obtained and the avant-garde technological advances – laser guidance, cruise missiles, stealth technology – in the last decades of the 20th century, the relative importance of air interdiction¹⁶ with respect to the campaign as a whole remained overshadowed. An example of this was the famous final execution of Operation Desert Storm over Iraq in 1991, with a major

12 Bombing is the action of dropping bombs from planes or pieces of artillery over a specific location over a period of time.

13 SÁNCHEZ M., José. «La Aviación Militar española: una historia corta pero de gran intensidad». *Revista Arbor*. Madrid: 2002, pp. 187-216.

14 Strategic bombing is organised and executed to defeat the enemy and ensure his surrender by destroying his morale and his economic and industrial capacity. In the concept of the all-out war of the 1940s, these actions would include any human activity involved in these activities, which would make them legitimate targets See: ARMSTRONG, J. «The relevance of the concept of Strategic Bombing». *Airpower Development Centre Bulletin*. Canberra: 2015, p. 1.

15 JORDÁN, Javier. *El debate sobre la primacía del poder aéreo: un recorrido histórico*. Madrid: CESEDEN 2016, pp. 1-38.

16 An air operation conducted to «divert, disrupt, delay, degrade or destroy» the military potential of an enemy before it can effectively implement its defence, and at such a distance from friendly forces that it does not require the integration of gunfire and manoeuvres. See: NSO. *Op. cit.*, p. 5.

ground campaign, which disregarded others, such as those proposing an intensive bombing campaign to break the Iraqi resistance¹⁷.

In the Balkan War, specifically in Serbia and Bosnia, there were problems with the use of ground operations, due in part to the complexity of the conflict and the power of the Yugoslav armed forces. These experiences deterred the NATO High Command from using ground components during the Kosovo campaign¹⁸. As an alternative, an unprecedented air campaign was established over the region, resulting in a victory of historic importance for three reasons: the campaign was conducted solely by air, the conditions for peace were effectively imposed, and the coalition did not suffer any fatalities of its own¹⁹.

With the arrival of the new millennium came new conflicts. Following the 9/11 attacks, President George W. Bush declared war on the Taliban regime in Afghanistan. He chose an innovative approach to the combat: a mix of airpower, special operations and support from local forces on the ground. In the jargon of the military community, this became known as “the Afghan model”. This ground-breaking decision left the US Army out of the operation, at least in its early days. Assisted by the JTAC (Joint Terminal Air Controller), the USAF carried out an effective bombing campaign over the provinces controlled by the Taliban, which was key to the subsequent fall of the regime. The results were “adequate” so the model was repeated during the first phases of the campaign in Iraq in the autumn of 2003²⁰.

During the Libyan War²¹, NATO had to reinvent its campaign to develop it solely through its air component with a maritime component in the waters of the Mediterranean for support tasks and implementing an embargo on materiel for the Libyan Army. This mission marked a turning point in NATO's recent history, due to its centralised focus – at Poggio Renatico's headquarters – and its decentralised execution – the air units distributed along the Mediterranean basin without land support. Although the 2011 campaign represented a milestone, it also revealed problems in terms of interpreting the strategic-military objectives to be achieved and raised questions with regard to leadership and the establishment of an appropriate design for the mission²². A number of lessons were drawn that were to be applied in the following decade²³.

17 JORDÁN. *Op. cit.*, p. 22.

18 GRANT, Rebecca. «The Kosovo Campaign: Aerospace Power Made It Work». *Air Force Magazine*. Arlington: 1999, pp. 30-37.

19 LOMBO. *Op. cit.*, p. 235.

20 LABORIE, Géraud. «The Afghan Model More Than 10 Years Late». *Air and Space Power Journal*. Montgomery: 2013, p. 50.

21 UN. Resolution 1973 (Vol. S/RES/1973). New York: 2011, p. 3.

22 ARTEAGA, Félix. *La OTAN en Libia*. Red Iberoamericana de Estudios Internacionales. Madrid: Real Instituto Elcano 2011, p. 4.

23 NATO. «Six Strategic Lessons learned from Libya: NATO Operation Unified Protector». NATO Defense College Research Report. Rome: 2012, pp. 1-6.

In addition, the introduction of certain elements related to targeting was deemed necessary. Parallel to the gradual development of technology, which led to an enhanced fine-tuning of bombing capabilities, voices were raised underlining the importance of abandoning the intensive use of this capability in order to redefine it, relating it to the classic concept of coercion²⁴: a “negotiation process” for the surrender of the adversary, – regardless of whether resistance is still possible – whereby further harm is avoided. Such coercion focused, preferably, on the selection of those centres of gravity important to the enemy: leadership (government and command and control systems), military power centres, communication lines, energy supply and logistical networks²⁵.

Among these elements of power, specific physical entities could be identified: the so-called objectives or targets²⁶. For a given operation, and using available information concerning the adversary, a defined plan would be created to analyse and prioritize the enemy’s most critical and important targets²⁷.

It was not until two or three decades ago that targeting began to be applied with a doctrine similar to the one we work with today. Leadership in the study and development of this capacity has been eminently American, and the lessons drawn have been transmitted to the framework of NATO.

Targeting has also led to negative episodes when not properly applied. An example of this was the bombing of Iraqi nuclear plants during Operation Desert Storm. Although it affected the adversary’s command and control capability, it also posed a problem of supply to the civil population and for the country’s water treatment supplies, which led to epidemics of gastroenteritis and cholera with high mortality rates in some local communities²⁸.

It was during the Kosovo conflict that NATO specialists developed a suitable system of targets for the air campaign, based on the experience of Operation Deliberate Force in Bosnia. In addition, the adequate implementation of what would eventually become the current JFAC, provided the capability to meet these objectives in a more accurate and adequate manner²⁹.

24 Related to the concept of coercion is the concept of brute force: the total imposition of one’s will on the adversary, without the possibility of resistance, leading to possible total extermination. See: SCHELLING, Thomas. *Arms and Influence*. New Haven: Yale University Press 1966.

25 JORDÁN. *Op. cit.*, p. 21.

26 A target is defined as an area, structure, object, person or group of people (including their mindset, thought processes, attitudes and behaviours) against which lethal/non-lethal capability can be employed to create specific psychological or physical effects. See: NSO. *Op. cit.*, p. 122.

27 DOUGHERTY, Kevin. *The Evolution of Air Assault*. Washington: National Defense University 1999, pp. 51-58.

28 RIZER, Kenneth. «Bombing Dual-Use Targets : Legal, Ethical, and Doctrinal Perspectives». *Air and Space Journal*. Montgomery: 2001, pp. 1-2.

29 GRANT. *Op. cit.*, p. 28.

During the conflicts in Iraq and Afghanistan, the strategic use of airpower enabled forces on the ground to gain sufficient advantage, achieving operational objectives³⁰ thanks in part to the judicious selection of adversary targets and the catalytic effect of troops on the ground. In Libya, this was done equally and efficiently, incorporating new doctrinal and procedural developments³¹.

Command in Military Operations

From the first concepts on modern military doctrine outlined by Clausewitz, war has always been designed at both strategic and tactical levels. However, the magnitude of the military conflict during the two World Wars created the need to establish an additional third level of command at operational level, to direct operations in a specific scenario, clearly differentiating them from those taking place in other venues, even though they all contributed to achieving the common strategic objectives³².

The operational level in NATO

The Strategic Concept of the Alliance was approved after the Lisbon summit in 2010. The Heads of State and Government of the Organisation agreed on a new vision for the Alliance³³, setting out three key tasks: (1) the collective defence of another member on the basis of Article V of the Washington Treaty³⁴; (2) crisis management for conflict prevention³⁵ —even if a military response is established, it must be done within a comprehensive approach that includes adequate collaboration between the political and military response; and (3) the promotion of cooperative security, to create political links with relevant countries and international organisations.

NATO contemplates the option of deploying military operations, which are designed at three levels of command: the political-strategic level, where the main objectives, the command structure, its means and the legal framework are determined; the

30 OTAN. Op. cit., pp. 1-6.

31 ASARTA, Alberto. «El nivel operacional». En *Monografía 149: El nivel operacional*. Madrid: CESEDEN 2016, p. 13.

32 *Ibíd*, p. 10.

33 NATO. *Concepto Estratégico de la OTAN*. Lisbon,; 2010. Available at https://www.nato.int/cps/en/natohq/topics_56626.htm;

34 NATO. *North Atlantic Treaty*. Washington: 1949, p. 1.

35 In the case of the Libyan operation, this would fall into the second type. For these situations, the Alliance envisages a directive to conduct the process from crisis management to the establishment of the military operation. See: NATO. ACO «Comprehensive Operations Planning Directive» (COPD) Interim V2.0. Mons: 2013.

operational command level, where campaigns are “planned, conducted and sustained, in order to achieve strategic objectives³⁶ and synchronize actions in the Theatre of Operations³⁷; and the tactical level, where the operation is executed. On numerous occasions, the boundaries between them are difficult to distinguish, so it is necessary to ensure that they are well linked and synchronised³⁸.

The operational level carries out the tasks of C2, Command and Control³⁹, and must serve as a bridge between the strategic and tactical levels, and vice versa. To this end, it must apply specific procedures where the High Command’s top-level directives are translated into practical orders for the subordinate levels.

The Operational Command must act according to the principles of coherence – operating in synergy in pursuit of the same effect – and autonomy, avoiding interference from other actors. However, there is a differential factor in their planning: the scenario. No two operations will ever be the same, given all the important factors that characterise them: politics, religion, society, culture, history, geography, climate, etc.

The possibility should be considered of several components being involved –land, sea, air, special operations– in a single operation. In this context, it is precisely at operational level where “the joint action becomes an integrating element of the specific forms of action of each army”⁴⁰.

NATO’s organic structure

But, moving away from theory, where does this operational level actually fit into the Atlantic Alliance? NATO’s organic structure is designed in the form of a hierarchical tree, made up of various committees. The supreme body is the NAC (North Atlantic Council), an eminently political body, which is constantly assisted by other bodies, such as the IS (International Staff) from the civilian sector, as well as the MC (Military Committee) and its IMS (International Military Staff), heading up the political-military level. Subordinate to the NAC are two strategic commands: the ACT (Allied Command Transformation) and the ACO (Allied Command Operations).

36 Objective is that clearly defined and attainable goal for a military operation that will generate a desired outcome essential to a Commander’s plan and towards which the operation is directed. See: NSO. Op. cit., p. 90.

37 PÉREZ, Pedro; FERNANDÉZ, Jesús. «El nivel operacional. A modo de análisis». En Monografía 149: El nivel operacional. Madrid: CESEDEN 2016, pp. 203-215.

38 G. ARNAIZ, Francisco J. «La estructura de mando de la Alianza Atlántica». Cuadernos de Estrategia 191: OTAN: presente y futuro. Madrid: Instituto Español de Estudios Estratégicos 2017, pp. 51-82.

39 NSO. Op. cit., pp. 28-29 y 32.

40 ASARTA. Op. cit., p. 89.

This organisational structure has a dual nature, since it functions both in times of peace and in times of crisis⁴¹.

The ACO, with its headquarters in Mons, consists of two JFCs (Joint Force Command) - Brunssum and Naples - and three SSCs (Single Service Commands), one per domain - Izmir (LANDCOM), Northwood (MARCOM) and Ramstein (AIRCOM). There are other bodies under the ACO that carry out support tasks, including the IFC (Intelligence Fusion Centre)⁴².

When designing an operation – joint or not – the operational command of the NATO structure would be the COM JFC (Commander Joint Force Command), which would operate from either of the two JFCs. In this body, a headquarters (HQ) would be created for the JTF (Joint Task Force). Within a joint NATO operation⁴³, component commands can be created for each of the domains⁴⁴. According to their size, NATO operations can be SJO or MJO (Small/Major Joint Operations).

For all military operations, once the various Council directives have been published⁴⁵ – which would initiate the planning process – and the SPD⁴⁶ (Strategic Planning Directive) has been defined, an OPLAN⁴⁷ (Operational Plan) must be approved, with the requirements specific to the strategic and operational level. The indispensable elements of any OPLAN are as follows:

41 OTAN. NATO Command Structure. Mons: 2013. Available at Internet <https://www.nato.int/cps/en/natohq/structure.htm>;

42 The IFC stands out from other support bodies, because of its tasks related to military intelligence and its service to NATO targeting cells.

43 NATO operations can also be combined or multinational. Joint operations are considered to be any activity, operation or organisation in which more than one nation is involved. See: NSO. Op. cit., p. 84.

44 As far as NATO is concerned, only the traditional Land CC, Maritime CC and Air CC - or JFAC - are taken into account. However, the US army has already created the JSOC (Joint Special Operations Command) within the US Special Operations Command. See: RODRÍGUEZ, Raimundo; JORDÁN, Javier. «La importancia creciente de las fuerzas de operaciones especiales en Estados Unidos y su influencia en el resto de países de la OTAN». UNISCI Discussion Papers. Madrid: 2015, pp. 107-123.

45 The most important of these are the NAC Initiating Directive (NID) and the NAC Execution Directive (NED).

46 Together with the SPD, the NAC and the CM provide the essential direction and guidance; the COM JFC will use this to calculate an estimate of operational needs.

47 An OPLAN is a document that describes the basis of a joint operation, both at strategic and operational levels, serving as a framework for the deployment, employment, protection, support and sustainment of forces during the different phases of the operation. The difference between strategic and operational levels lies in the fact that the latter endeavours to translate the estimates of the former into a given scenario - in terms of the forces and capabilities to be implemented - by designing specific functions See: NSO. Op. cit., p. 91.

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| <ul style="list-style-type: none"> • Annex A: Concept of operations • Annex B: Task Organization and command relationships • Annex C: Forces and effects • Annex D: Intelligence • Annex E: Rules of engagement • Annex J: Force Protection • Annex P: Electronic Warfare • Annex R: Logistics • Annex S: Movements • Annex T: Environmental support • Annex AA: Legal • Annex GG: Non NATO force procedures | <ul style="list-style-type: none"> • Annex II: Joint Targeting • Annex JJ: NATO Crisis Response System • Annex OO: Operations Assessment • Annex QQ: Medical • Annex TT: Public Affairs • Annex UU: Information Operations • Annex VV: Psychological Operations • Annex XX: Record of change • Annex ZZ: Distribution |
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Source: Prepared by the author

The air operational component of a NATO operation

The *air-minded* approach to targeting applied in this research focuses on Ramstein's AIRCOM, forcing a more detailed breakdown of its structure. The CAOCs (Combined Air Operations Center) of Torrejón and Uedem, as well as the CAOC-D (Deployable CAOC) of Poggio Renatico depend on AIRCOM. These Air Operations Centres are responsible for controlling Europe's airspace in peacetime, as well as providing the necessary personnel to JFC HQ in the event that a military operation with an air component or JFAC is established.

Within the current NATO structure, and in order to overcome issues of lack of preparation or time – as was the case in the planning of the OUP – a permanent Core JFAC has been put in place. The main mission of this group, consisting of indispensable personnel, is to establish the doctrine and procedures for the creation and establishment of the JFAC in peacetime. In the event of an escalation of tension, it would be constituted as the JFAC at the service of the Alliance, receiving reinforcement personnel from the CAOCs, as well as from the reactive NRF for the corresponding year.

The JFAC concept complies with the principles of centralised control and planning and decentralised execution, which enables a more efficient use of air assets⁴⁸. JFAC's mission⁴⁹

48 NEBOT, Antonio F. «El nivel operacional. OUP/OTAN». En Monografía 149: El nivel operacional. Madrid: CESEDEN 2016, pp. 129-130.

49 OTAN. Joint Force Air Component Command. Ramstein: 2019. Available at <https://ac.nato.int/page8031753>.

in a crisis or conflict situation would be to plan, task⁵⁰, direct and supervise the air operations of the assigned resources. These tasks are synchronised through the ATO (Air Tasking Order), a cyclical process that details general and specific instructions for the handling of the air campaign⁵¹. An operation with an air component would be commanded by the JFAC Commander, who would be directly subordinate to the JFC Commander.

The JFAC core would include a Deputy Commander, a Joint Staff, a special support section (Legal Advisor, Political Advisor and Public Affairs) and a liaison section (both with the LCC, MCC and SOCC, and with the authorities of each participating country⁵²). In order to exercise an effective C2 covering operations, a JFAC Director would be created, to whom the five divisions that would effectively train JFAC would report:

- *Strategy Division* (SD), which serves as a doctrinal link between the strategic and operational levels. It is responsible for producing the ODA (*Air Operations Directive*), marking the commencement of mission planning.
- *Combat Plans Division* (CPD), in charge of planning daily execution plans with a 72-hour perspective. It estimates capabilities and their assignment.
- *Combat Operations Division* (COD), whose main mission is to monitor activities in real time. It is the “soul” of the JFAC as far as operations are concerned.
- *ISR Division* (ISRD), in charge of providing the necessary intelligence to support decision making and coordinating the “tasking” of ISR aircraft to comply with intelligence-gathering processes.
- *Combat Support Division* (CSD), which assists the JFAC in the management of personnel, logistics, CIS resources and financial aspects.

It should be noted that all divisions work closely together through a number of mixed functional positions across the units. Within the structure of a JFAC, the targeting section belongs to the ISRD. Other elements integrated in other divisions with liaison functions depend on this section. All targeteers⁵³ working together carry out the targeting cycle and advise the head of the ISRD Division. Due to the highly spe-

50 Assignment of an aircraft to carry out a specific activity. See: NSO. Op. cit., p. 123.

51 In terms of the size of the air operations, an estimated 350 departures/day would be involved in an SJO and 1000 departures/day in an MJO.

52 Each participating country has a Senior LNO (Liaison National Officer) as part of an operation. This officer has the power to resolve, on a case-by-case basis, any discrepancies arising from the use of the assets assigned to NATO. Thus, if they find any problems regarding their use, violation of agreements or failure to comply with national or international regulations, they could exercise their right to veto the non-use of their resources. This power is known as the Red Card Holder. In order to justify these objections, each country must declare its restrictions or caveats in an additional document to the mission's OPLAN.

53 This is the word most commonly used to designate the intelligence officer responsible for planning and coordinating all tasks related to targeting.

cialised nature of these positions, the Alliance sets minimum standards for specialised training, which the members of the targeting teams should meet⁵⁴.

The concept of targeting

The international community increasingly demands a limited and lawful use of force while minimizing collateral damage⁵⁵. The concept of targeting incorporates these requirements without losing operational efficiency.

The term targeting is synonymous with “target selection”. But these cannot be just any targets: they have to be those whose engagement delivers an advantage in the military campaign. For this purpose, reliable intelligence must be obtained, which can be gathered from multiple sources, and the necessary elements and data for the analysis of such a target must be identified. Once determined, the appropriate resources can be assigned to its engagement⁵⁶.

The current concept of targeting

Given the wide variety of conflicts in which NATO may currently become involved, the organisation has developed its own concept for effective joint targeting, which is defined as “the process of selecting and prioritizing targets, and matching the appropriate response to them, taking account of operational requirements and capabilities⁵⁷”. This doctrine is set out in AJP 3.9 *Allied Joint Doctrine for Joint Targeting*⁵⁸.

In a contemporary context, it is understood as the process that aims to obtain the desired effects on targets, relying both on traditional kinetic actions and on activities of another nature⁵⁹. The purpose of joint targeting is to provide a methodology

54 DA SILVA, Helder. A. «Los nuevos desafíos del targeting». *Revista Ejército*. Madrid: 2014, p. 27.

55 TEJERA, Juan. «Conceptos emergentes en la OTAN». *Revista Española de Defensa*. Madrid: 2014, p. 44.

56 The most commonly used term is engage, defined as «a fire control order used to direct or authorize units and/or weapon systems to fire on a designated target». See: LOMBO. *Op. cit.*, p. 253. See also: NSO. *Op. cit.*, p. 47.

57 See: NSO. *Op. cit.*, p. 123.

58 Other publications of interest, directly related to targeting, are ACO Directive 80-70 Campaign Synchronization and Targeting in ACO; ACO Directive 65-8; ACO Manual 80-70 Tactics Techniques and Procedures to prosecute Time Sensitive Target; and various STANAGs.

59 EKELHOF, Merel. «Lifting the Fog of Targeting: «Autonomous Weapons» and human control through the lens of military targeting». *Naval War College Review*. Newport: 2018, p. 63. (*) It should be noted that, within the targeting community, this action is not only meant for lethal methods, but also contemplates non-lethal options. However, the author does not intend to expand on this distinction here.

to advise the JFC, seeking to bring together the concept of joint fires⁶⁰ with other operational functions – C2, intelligence⁶¹, force protection, information operations (*INFOOPS*), etc. – to improve coordination, optimise synchronization and avoid unnecessary effort⁶².

The process is particularly flexible and designed to select and prioritise targets - each with an appropriate action strategy - so as to assist the decision-making process, from strategic to tactical level, and to contribute to the achievement of the objectives set.

The targeting process is based on the following principles⁶³:

- *Objective-based*: its main function focuses on achieving the JFC's objectives, within the guidelines of political and strategic doctrine.
- *Effects-driven*: it focuses on creating physical and psychological effects on the targets while striving to avoid undesirable effects.
- *Multidisciplinary*: it requires the coordinated and integrated efforts of functional experts from many disciplines and capabilities.
- *Intelligence*: products and processes that will empower decision makers.
- *Centralised control and coordination, decentralised execution*.

The doctrine of joint targeting is subject to international legislation and to the particular legislation of each participating State⁶⁴. To ensure that legal requirements are met, the entire cycle is assisted by legal advisors. The ethical-legal principles on which their advice is based are:

60 It is defined as the coordinated use of multiple weapon systems of several component controls to create a desired physical or psychological effect.

See: ALSA. Multi-service tactics, techniques and procedures for Joint Application of Firepower. Hampton: 2016, p. 1.

61 Significantly, this capacity is becoming increasingly influential and important in decision processes.

See: OTERO, Juan Carlos. «Evolución y empleo de las capacidades ISR aéreas ante las nuevas amenazas del siglo XXI». Monografía XII CEMFAS. Madrid: Escuela Superior de las Fuerzas Armadas, 2016, p. 13.

62 Joint targeting does not extend to so-called tactical targeting. Surface to surface firing or interdiction on deeper targets are not considered within the joint scope. They will be developed through a specific process of tactical targeting, such as that of the Army in Spain. See: MADOC. Targeting terrestre. Concepto derivado 02/16. Granada: 2016, p. 3.

63 NATO. AJP 3.9 Allied Joint Doctrine for Joint Targeting. Brussels: 2016, pp. 1-5.

64 A specific member may place as many restrictions or caveats as it deems necessary in order to further restrict the process, but it will never be more permissive than that prescribed by international law.

- *Military necessity*: that an attack on the target provides a definite military advantage and that there is never a breach of international law.
- *Humanity*: prohibits the infliction of more damage than is strictly necessary to achieve the desired effects.
- *Distinction*: an attack can only be directed at military objectives⁶⁵, which must be clearly distinguished from civilian elements.
- *Proportionality*: no combat action may be taken against a target if the military advantage it provides is not expected to outweigh the collateral damage⁶⁶ anticipated in the planning phase.
- *Validity*⁶⁷: only those that meet the definition of a military target can be attacked.
- *Responsibility*: the obligation to comply with legal constraints at all levels of decision-making (planning, authorisation and implementation).

The targeting cycle

The JTC (Joint Targeting Cycle) is a process consisting of an iterative six-phase cycle that links strategic direction with tactical actions. Due to the considerable variability of these phases and the development of the campaign itself, the steps in the process can be carried out simultaneously⁶⁸.

PHASE I: Commander's Objectives, Targeting Guidance, and Intent.

The JFC must be subordinate to the highest political and strategic bodies. For a particular operation, a JCO and a JFC OPLAN are created⁶⁹ and one which defines the objectives to be achieved, the nature of the current circumstances and the parameters whereby the force will act. The objectives set must comply with the characteristics of being observable, measurable and achievable.

65 A «military objective» is a target which by its nature, purpose, location or use makes an effective contribution to the military action of the adversary and whose destruction, capture or neutralisation offers a military advantage. See: NS. Op. cit., p. 90.

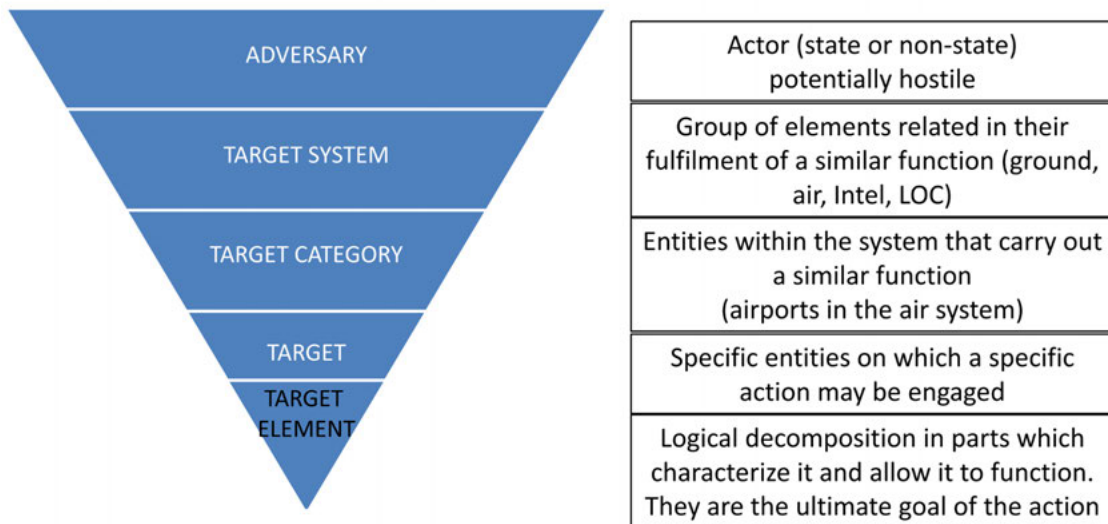
66 «Collateral damage» is accidental or unintentional damage to persons or objects that are not legally considered to be military objectives under the prevailing circumstances. See: JCS. No strike and the collateral damage estimation methodology. CJCSI 3160.01. Washington: 2009, p. B-7.

67 The author has decided to define it as such, while the AJP 3.9 Allied Joint Doctrine for Joint Targeting defines the heading as «determining military objectives».

68 BRAVO, Diego. Integración del proceso de selección y priorización de blancos en el planeamiento operacional. Trabajo Final Integrador. Buenos Aires: Escuela Superior de Guerra Conjunta de las Fuerzas Armadas 2013, p. 6.

69 The Joint Coordination Order provides the necessary direction and coordination for the subordinate commanders. .

At this point, the target system and the target category of the adversary (defined in phase 2) are selected. In addition, other important aspects for the subsequent phases are addressed, such as restricted targets⁷⁰, the no-strike entities⁷¹, time-sensitive targets⁷², target engagement authority⁷³ and the non-combatant casualty value⁷⁴.



Source: Prepared by the author

PHASE 2: Target Development and Prioritization.

An analysis of the adversary is conducted to determine which targets to attack and in order of priority, to ensure that the objectives of the JFC are achieved. To this end, an exhaustive study is carried out, based on multiple sources of intelligence, designing a taxonomy that consists of five stages, as shown in the following figure.

In this way, one begins to “unpeel” the adversary, getting a rough idea of its structures, organisation and vulnerabilities. The so-called systems, categories, targets and target elements

⁷⁰ Targets that are legally valid, but have temporary or permanent restrictions to be addressed.

⁷¹ Targets protected from the effects of military operations in breach of the Law of Armed Conflict, international law or campaign-specific ROE (Rules of Engagement).

⁷² Targets that require immediate action because: (1) they are, or will be, a threat to friendly forces; or (2) they are highly beneficial to the accomplishment of the target’s mission. They are ephemeral, so they are considered opportunity targets. See: CRESPO, Isaac M. «Time Sensitive Targeting». Monografía IX CEMFAS. Madrid: Escuela Superior de las Fuerzas Armadas 2008, p. 5.

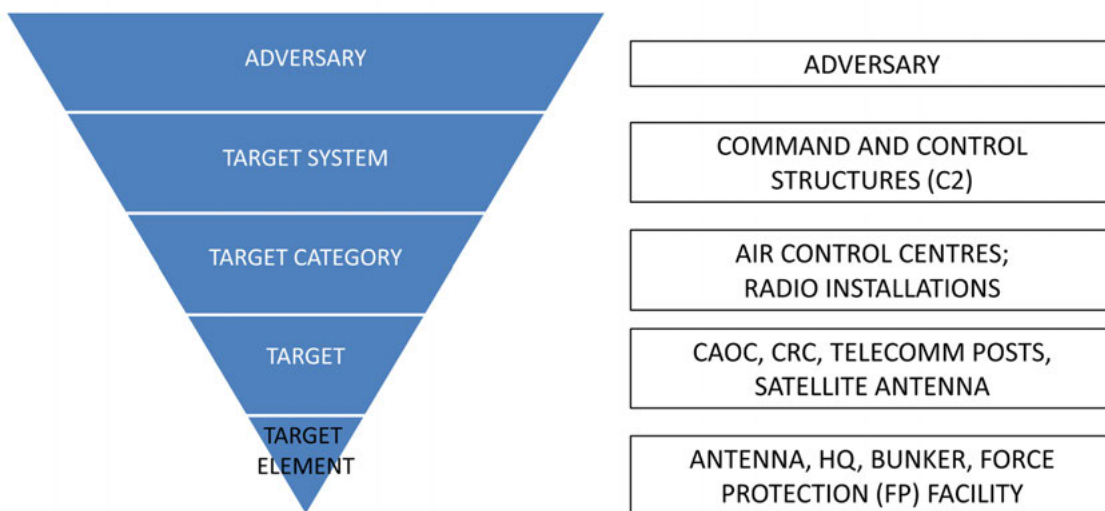
⁷³ The TEA will mark the level of authorization required for a particular engagement depending on the level of calculated collateral damage (may require authorization from SACEUR if it exceeds the NCV).

⁷⁴ The NCV (Non-Combatant Casualty Cut-off Value) is the numerical value established by SACEUR of acceptable deaths for an operation under given circumstances. As a rule, if the calculation of collateral damage exceeds the NCV, the target will not be undertaken. Anything below the NCV may be undertaken according to the relevant AER (Annual Emission Report).

are then defined. This analysis of its components enables one to determine an optimal target selection and carry out the appropriate attack on them, whether lethal or non-lethal⁷⁵.

Of all the possible targets, those that are legally valid must be selected⁷⁶. There will probably be a wide spectrum of targets that cannot be addressed for various reasons: legal, environmental considerations, dual use⁷⁷, etc.

Undoubtedly, the most comprehensive study is carried out at entity level (target and target elements), where a three-level analysis has to be carried out: basic, where an unequivocal physical identification of the target is undertaken; intermediate, where it is analysed with a sufficient degree of detail to be added to the list of valid targets; and advanced, where the characterisation process is completed and the method of engagement is designed.



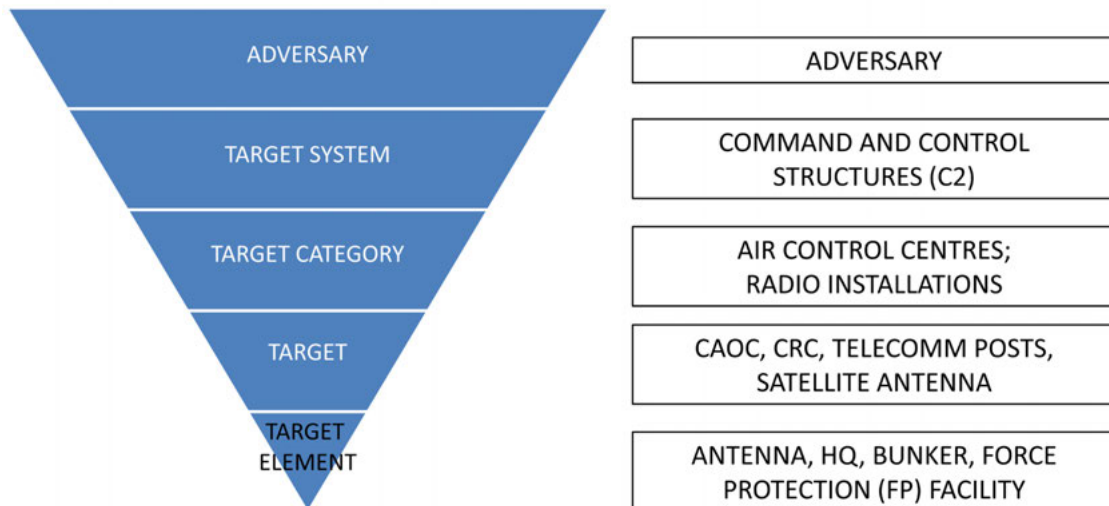
Source: Prepared by the author

With a view to better understanding this procedure, the process of determining the taxonomy in two case studies is presented here by way of example. On the one hand,

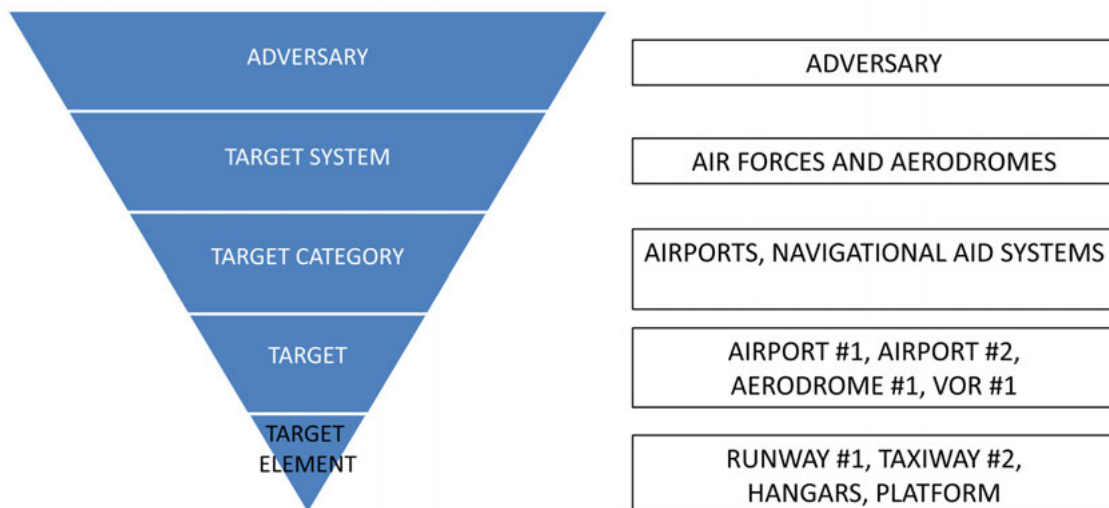
75 The term “lethal” refers to an action whose purpose is to destroy the target. However, the “non-lethal” option can also be considered, where the result will be the degradation, disruption or disabling of the target, or influence on it. See: DI MARZIO, Giulio. «The Targeting Process...This unknown process». NRDC-ITA Magazine. Solbiate Olona: p. 11.

76 A “valid” target is defined in legal terms as one against which an action can be lawfully carried out. This definition has generated discussions, when theoretically invalid targets (houses, schools, hospitals, etc.) have been processed because they have been used by enemy factions. In these cases, intelligence is critical in determining whether they can be accepted as valid. See: RODRÍGUEZ, Guillermo. «Dinámica de los blancos militares». Revista de la Escuela Superior de Guerra Aérea. Buenos Aires: 2013, p. 52.

77 Dual use is defined as a target that fulfils both a civil and a military function. During the target definition process, it is very important to define this field, because it will probably limit its possibility of being implemented. See: RIZER. Op. cit., p. 2.



Source: Prepared by the author



Source: Prepared by the author

is the analysis of the taxonomy of a Command and Control system structure, which is broken down into different target categories, and subsequently focuses on single targets and their elements. On the other hand, we have the study of the taxonomy of a target of the enemy's air force system. Its categories classify the objects and then define them as specific targets together with their main elements.

PHASE 3: Analysis of capabilities

In this JTC phase, one's own capabilities are evaluated with respect to the target, in order to provide senior staff with adequate information on the appropriate method(s) to achieve the desired effect in the given circumstances. To this end, a two-phase study is carried out: (1) weaponeering, where the type of lethal/non-lethal means to be used to achieve the desired effect is determined, and (2) a collateral damage estimate

(CDE)⁷⁸ of the target whereby the possible undesired damage is assessed in terms of the selected method – if a lethal method has been selected – in order to mitigate its accidental or unintended effects on civilian or non-combatant personnel, non-military property or the environment⁷⁹.

PHASE 4: Commander's Decision, Planning and Force Allocation

To improve decision-making, not only is it a matter of enhancing the processing capacity of military targets for the purpose of presenting proposals, but it is also essential for the JFAC Commander to have the best available information developed to the highest quality⁸⁰. At this point, the analysis of own capabilities and available forces is merged with the operational considerations at the time. Thus, each valid target is assigned to the appropriate component Command, which then undertakes it with the desired effect in mind.

PHASE 5: Mission planning and Execution:

This phase consists of direct action planning and monitoring. It is based on the process called F2T2E2A (Find, Fix, Track, Target, Engage, Exploit, Assess), which includes the necessary coordination to achieve all the necessary intelligence on the results obtained.

PHASE 6: Assessment

The purpose is to assess the effectiveness of the actions taken. It is a two-component process: the MoP and MoE (Measures of Performance and Measurements of Effectiveness), where the level of fulfilment of the mission and the level of effectiveness are studied; and the BDA (Battle Damage Assessment)⁸¹, a three-phase process where the effects resulting from the military action are assessed. An additional study may be conducted to determine the effects of INFOOPS activities on the behaviour of the population.

78 The CDE methodology contemplates five levels, from the lowest (1) to the highest (5), which give the target a level of «dangerousness», based on arithmetic calculations. At each level, an authority must be determined to authorize the attack. In most cases, the first three levels correspond to the authority of the head of air operations, the fourth to the COM JFAC and the fifth to the COM JFC.

79 MARTÍNEZ, Segundo. «Targeting en las operaciones COIN actuales». Monografía XII CEMFAS. Madrid: Escuela Superior de las Fuerzas Armadas 2010, pp. 22-23.

80 HALL, Nicholas. *Preparing for Contested War: Improving Command and Control of Dynamic Targeting*. Montgomery: Air Command and Staff College 2017, p. 3.

81 The BDA methodology assesses whether the intended effects on the target are achieved. The process is done through three phases: (1) quantitative estimate of the physical damage or the influence achieved; (2) estimate of the effects achieved in terms of the functionality of the target; (3) assessment of the effect with respect to the entire target system to which it belongs. Each of the levels requires further elaboration and assessment by experts, based on the gathering of intelligence.

The database and the targets list

- NATO has created an integrated database (IDB), where it centralises target intelligence files (descriptive information, images, geolocation, etc.). In peacetime, this activity is aimed at intelligence gathering and coordinated by the NATO IFC. Once compiled, the Alliance provides the necessary material to the requesting member countries, to other agencies that require it or to a specific NATO operation. From this database, several standardised lists are generated to group the targets:
- *No-strike list* (NSL): A list of entities not considered as targets and accordingly protected from the effects of military operations.
- *Joint Target List* (JTL): list of all valid and available targets to be selected for attack.
- *Target nomination list* (TNL): A prioritised list nominated by component commanders, which contains targets of greatest interest for the appropriate agencies.
- *Joint Prioritised Target List* (JPTEL): list of targets that have been validated and prioritised for attack.
- *Prioritised target list* (PTL): list pertaining to each component commander detailing the targets that have been assigned to them.
- *Restricted target list* (RTL): A list of valid but temporarily or permanently restricted targets.

Targeting as an enabling factor in NATO military operations

Wars are more than just a material and technological confrontation between two adversaries: doctrinal and organisational approaches also come into play⁸². This paper does not intend to enter into a discussion on treating targeting as an RMA (Revolution in Military Affairs), which in itself would be the subject of further research. However, it does consider its innovative character, its relationship with current legislation and its usefulness in the execution of operations.

Targeting as a military innovation

Within the academic community, there are various definitions of the concept of innovation as applied to the sphere of the armed forces. It is understood as referring to

82 BAQUÉS, Josep. *Revoluciones militares y revoluciones en asuntos militares. Manual de Estudios Estratégicos y Seguridad Internacional*. Madrid: Editorial Plaza y Valdés 2013, p. 121.

a change of relevant scope affecting the doctrinal apparatus, the design of techniques, tactics and procedures, as well as the organisational structure itself. Every innovation must lead to an increase in effectiveness⁸³.

Innovation processes occur thanks to a drive from the political sector, rivalry between organisations, countries, armies or even within services – which can lead to emulation between them – changes in the organisation's mentality, the results drawn from experiences, technological developments and various cultural factors⁸⁴.

Can targeting be considered as a military innovation? Targeting has become part of the military legacy due to the influence of various concurrent political and cultural factors of our time, and through the recognition of lessons learned from experience in operations of various kinds.

After its successful and effective deployment in the Kosovo war⁸⁵, it has acquired a high level of maturity over time consolidating its effectiveness⁸⁶, both in operations and in exercises, as well as its capacity to adapt to the new security challenges of the twenty-first century, such as asymmetric warfare or counter-insurgency⁸⁷.

Currently, the United States, France, Great Britain, Italy, Spain, Turkey and Germany have available and certified JFAC capabilities for both domestic and NATO missions.

Targeting and its relationship with the law.

According to the concept of coercion, “it would be enough” to select the right targets to overcome the will of the adversary. Because the international community and societies demand a limited use of force from the armed forces, the concept of targeting is a useful tool to meet this requirement.

The ethical-legal principles of targeting create a legal framework that, if respected, legitimises military action. However, the targeting process uses other, much more tangible tools that make military action viable, such as (1) the international legal

83 GRISSOM, Adam. *The future of military innovation studies*. Cambridge: *Journal of International Security* 2018, p. 907.

84 JORDÁN, Javier. «Un modelo explicativo de los procesos de cambio en las organizaciones militares: la respuesta de Estados Unidos después del 11-S como caso de estudio». *Revista de Ciencia Política*. Madrid: 2017, pp. 205-209.

85 GRANT. *Op. cit.*, p. 14.

86 HOROWITZ, Michael. *The diffusion of Military Power: Causes and Consequences for International Politics*. Princeton: Princeton University Press 2010.

87 DARLING, Paul. «Joint Targeting and Air Support in Counterinsurgency». *Air and Space Power Journal*. Montgomery: 2012, p. 51.

framework (International Humanitarian Law, International Law of Armed Conflict, Geneva Conventions, United Nations Charter, etc.), common law, the operation's ROEs, national caveats or self-defence; mathematical methods such as collateral damage assessment; (2) legitimisation methods such as positive identification or behavioural patterns, and (3) approval methods such as the TEA. Under all this apparatus, targeting will always converge with legality, because actions may be more restrictive but never more permissive than what is established by law..

All these considerations have influenced the design of the process, and are taken into account when classifying targets, distinguishing between those classified as restricted or prohibited – those included in the NSL – those affected by property or environmental considerations – which do not delegitimise the action, but may restrict it – or dual use.

The close relationship between targeting and the legal system requires considerable involvement by legal advisors at all levels (planning, authorisation and management), where they must assess aspects such as the legitimacy of the target or the methods used to combat it⁸⁸.

In addition, the targeting process must be considered as a tool that provides legal coverage in the event that, through misfortune or manoeuvres of the adversary, the actions undertaken cause collateral damage⁸⁹. Similarly, the process is used to report on any action undertaken and guarantee to the media the legality and proportionality employed, thus counteracting the effects of the adversary's propaganda.

Targeting and the implementation of military operations

The broad spectrum of future challenges requires security organisations to be prepared for a diverse range of tasks. From humanitarian and stabilisation tasks to assignments involving the use of force, NATO is preparing to use its lethal and non-lethal capabilities against different adversaries.

In the 1990s, military operations were still designed in a “classic” way: no operation was contemplated without the existence of the ground component⁹⁰. However, following the experiences in Kosovo and the proven effectiveness of the “Afghan model”, innovations were introduced in the design of military operations, with greater emphasis on the air component in percentage terms.

88 JEMAD. Op. cit., p. 72.

89 ASENSIO, Pablo. «Targeting aéreo en COIN y la influencia de los daños colaterales». Monografía XII CEMFAS. Madrid: Escuela Superior de las Fuerzas Armadas 2010, p. 10.

90 JORDAN. Op. cit., p. 30.

The success of the OUP in Libya was particularly significant thanks to the preferential use of air capability⁹¹. The mission served to put into practice the doctrinal and procedural advances that were being conceived within NATO. Furthermore, the case of Libya is exemplary given the excellent results in terms of the cost-benefit ratio and the number of one's own and collateral casualties⁹². During the OUP, a total of 26,500 air operations were carried out, of which 9,700 were used in targeting tasks. In a seven-month air campaign, about 5,900 targets were engaged⁹³, adequately complying with CDE methodology.

According to the US Air Force, targeting shares certain common characteristics with the concept of airpower and related concepts, such as flexibility, precision, mobility, penetration capacity and adaptability. For all these reasons, the targeting process contributes to airpower since it seeks to generate the physical and psychological effects sought in an operation⁹⁴.

The joint targeting mindset is also ideal for helping to achieve the objectives set at political and strategic level, thanks to the possibility of synchronising fires, in conjunction with the tasks of C2, Intelligence or INFOOPS. The iterative nature of the targeting cycle allows for more coherent, effective and efficient work.

All levels of command are involved in the targeting process: strategic level, which issues the guidelines and limitations; operational level, which synchronises and coordinates them; and tactical level, which executes and assesses them within its possibilities. It is precisely the flexibility of the process that allows the component commands to act without having to constantly consult the JFC, thereby enhancing its agility.

Targeting relies on multiple tools, such as CDE, BDA, MoE, MoP, among others, which make use of many different sources of intelligence (MISREP, INFLIGHTREP, GEOINT, SIGINT, HUMINT, OSINT), and allows the different levels of command to understand how the mission is being planned and how it is being executed, in order to later evaluate its outcome, thus reinforcing synergies with the COM JFC decision-making process.

Conclusions

The atrocities committed in the great wars of the last century generated a trend of thought within the international community that advocated a more limited use of force, subject to the principles of international law. Consequently, the development of

91 ASARTA. *Op. cit.*, p. 13.

92 NEBOT. *Op. cit.*, pp. 95-138.

93 NATO. *Operation Unified Protector. Final Mission Stats. Mons: 2011*, pp. 1-2.

94 NATO. *Op. cit.*, pp. 1-2.

technology and doctrine was gradually oriented towards research into more accurate, precise and effective techniques that would limit the suffering caused by war.

Changes in the international political panorama, the emergence of international organisations, and the status quo governed by the UN Security Council have limited the possibility of states taking part in conflicts unilaterally. The society of nations has methods to avoid this but, in the event of an “unavoidable” situation, it also has methods for dealing with armed conflicts.

The experiences acquired in international missions in the last part of the twentieth century, in addition to the results obtained in Afghanistan and Iraq in the first years of the new millennium – thanks to the greater use of airpower and special operations – paved the way for planning and directing military operations in a way that was different and innovative in comparison with what had been done in the past. The Libyan OUP mission was a historic milestone for the pre-eminent use of airpower and for the achievement of strategic and operational objectives through the Air Component Command. These results were achieved thanks to NATO’s organisational, technological and doctrinal superiority. One of the major advances at regulatory level was the use of targeting capabilities.

In order to be able to use all its capabilities, in 2010 NATO designed a permanent structure that allows it to carry out its tasks in times of both peace and war. Its dual structure, with a Transformation Command – or Doctrine, as it was understood in Spain – and an Operations Command, enables it to improve the Alliance’s forces and capabilities and to incorporate new doctrinal concepts, while at the same time conducting multi-dimensional military operations. These operations are carried out autonomously at an operational level, through its component Commands, but they are fully coherent and generate the appropriate synergies at a strategic-political level.

The creation of the JFAC has provided NATO with the necessary versatility to conduct air operations efficiently and effectively. Centralised control and coordination, together with decentralised execution, facilitates flexibility of execution. The divisions that make up the JFAC bring together the different functions and organisational levels, from strategic guidance to the actual operation, including and integrating the multiple support tasks.

The targeting section is part of the SRI Division – coherent because of its intrinsic relationship with intelligence – although it performs a multitude of tasks directly related to operations. The future feasibility of this capability will be underpinned by the continuous training of targeteers, who will also have to train in exercises before taking part in any real operations.

The drive demonstrated by the Chief of Defence Staff in Spain is but a prime example of the overriding importance of the model of the component commands – and their interoperability – for the years ahead. This model has modified the training of the forces and their level of enlistment.

The same analysis of its definition specifies the following aspects:

- *It is a multi-stage and iterative process:* linking political-strategic leadership with tactical actions, through operational command. The steps of the targeting cycle can be developed simultaneously, which speeds up the development of the operation itself;
- *In which targets are selected and prioritised:* thanks to previous intelligence tasks, it helps the decision-making process and better synchronises the campaign. Taking into account the operational requirements at the given time, and its own capabilities, an adequate C2 is provided to the operational command
- *certain resources are assigned:* from the most appropriate service, since these are arranged under Joint Command. In this way, the necessary capabilities can be optimally employed in order to obtain the best possible result
- *with lethal or non-lethal effects:* the versatility of the joint and combined means available – since not only the use of force is contemplated, but also influence tasks or INFOOPS – provide a wide range of options for the Command to select the appropriate method for use.
- *to obtain the desired effects:* The common characteristics of targeting and air-power make this possible. The desired results must be marked before attacking the target, since these were the main reason why the attack on the target was prioritised over others. Apart from the “classic” destruction, there are different effects – interruption, dissuasion, disturbance, refusal, among others – that can generate the expected result;
- *and fulfil the operational objectives:* the tactical action makes it possible to meet the operational objectives set for the operation, which are fully consistent with decisions at political and strategic level.

Joint targeting is an innovation in the military field since it has modified – or caused to evolve – the doctrine, techniques, tactics and procedures, together with the natural development of technology. Its over-riding focus on operational objectives generates enabling synergies for military action. Its multidisciplinary and joint approach assists in coordination, participation and integration, which in turn provides it with extensive knowledge. The ongoing design and execution of NATO exercises for the practice and use of these mechanisms suggests the importance that the organisation attaches to them for the years ahead.

Its mechanisms for compliance with international law are another of its main features. The ethical-legal principles under which it is protected provide it with validity before the international legal system and before modern society. Targeting carried out in an effective manner will “sufficiently coerce the adversary” so that operational objectives are met in the least harmful manner. The involvement of legal advisors – at all levels – allows the process to be constantly checked so that no crimes against international law are committed. The existence of the national liaison officers also serves to ensure that no military force employed contravenes its own legal system.

Joint targeting has generated –or is generating– a real revolution in the mechanisms for conducting military operations due to its inherent characteristics. It is a capability for the future.

References

- AGUIRRE DE CÁRCER, Miguel. La adaptación de la OTAN. 2014-2017. In *Cuadernos de Estrategia 191. OTAN: presente y futuro*. Madrid: Instituto Español de Estudios Estratégicos, 2017, pp. 15-50.
- ALSA. *Multi-service tactics, techniques and procedures for Joint Application of Firepower*. Hampton: 2016, p. 1.
- ARMSTRONG, J. «The relevance of the concept of Strategic Bombing». *Airpower Development Centre Bulletin*. Canberra: 2015, p. 1.
- ARTEAGA, Félix. *La OTAN en Libia. Red Iberoamericana de Estudios Internacionales*. Madrid: Real Instituto Elcano 2011, p. 4.
- ASARTA, Alberto. El nivel operacional. In *Monografía 149: El nivel operacional*. Madrid: CESEDEN 2016, p. 13.
- ASENSIO, Pablo. «Targeting aéreo in COIN y la influencia de los daños colaterales». *Monografía XII CEMFAS*. Madrid: Escuela Superior de las Fuerzas Armadas, 2010, p. 10.
- BAQUÉS, Josep. *Revoluciones militares y revoluciones en asuntos militares. Manual de Estudios Estratégicos y Seguridad Internacional*. Madrid: Editorial Plaza y Valdés 2013, p. 121.
- BRAVO, Diego. *Integración del proceso de selección y priorización de blancos en el planeamiento operacional. Trabajo Final Integrador*. Buenos Aires: TFI Escuela Superior de Guerra Conjunta de las Fuerzas Armadas, 2013, p. 6.
- BONADAD, Pedro. «Capacidad del JFAC nacional». *Monografía XVI CEMFAS*. Madrid: Escuela Superior de las Fuerzas Armadas, 2015, p. 1.
- CRESPO, Isaac M. «Time Sensitive Targeting». *Monografía IX CEMFAS*. Madrid: Escuela Superior de las Fuerzas Armadas, 2008, p. 5.
- DA SILVA, Helder A. «Los nuevos desafíos del targeting». *Revista Ejército*, Madrid: 2014, p. 27.
- DARLING, Paul. «Joint Targeting and Air Support in Counterinsurgency». *Air and Space Power Journal*. Montgomery: 2012, p. 51.
- DI MARZIO, Giulio. «The Targeting Process...This unknown process». *NRDC-ITA Magazine*. Solbiate Olona: p. 11.

- DOUGHERTY, Kevin. *The Evolution of Air Assault*. Washington: National Defense University 1999, pp. 51-58.
- EKELHOF, Merel. «Lifting the Fog of Targeting: “Autonomous Weapons” and human control through the lens of military targeting». *Naval War College Review*. Newport: 2018, p. 63.
- EZPELETA, José A. «La reestructuración del Ejército del Aire». *Monografía 138: Racionalización de las estructuras de la Fuerzas Armadas. Hacia una organización conjunta*. Madrid: CESEDEN 2013, pp. 105-125.
- G. ARNAIZ, Francisco J. «La Estructura de Mando de la Alianza Atlántica». *Cuadernos de Estrategia 191: OTAN: presente y futuro*. Madrid: Instituto Español de Estudios Estratégicos 2017, pp. 51-82.
- GARCÍA, José. «Planeamiento por capacidades». *Revista Española de Defens*. Madrid: 2006, pp. 38-43.
- GRANT, Rebecca. «The Kosovo Campaign: Aerospace Power Made It Work». *Air Force Magazine*. Arlington: 1999, pp. 30-37.
- GRISSOM, Adam. «The future of military innovation studies». *Journal of International Security*,. Cambridge: 2018, p. 907.
- HALL, Nicholas. *Preparing for Contested War: Improving Command and Control of Dynamic Targeting*. Montgomery: Air Command and Staff College 2017, p. 3.
- HOROWITZ, Michael. *The diffusion of Military Power: Causes and Consequences for International Politics*. Princeton: Princeton University Press 2010.
- JCS. «No strike and the collateral damage estimation methodology. CJCSI 3160.01». Washington: 2009, p. B-7.
- JEMAD: Directiva 12/14 «Implantación de la capacidad de *targeting* conjunto en las Fuerzas Armadas». Madrid: Estado Mayor de la Defensa 2014.
- JEMAD: Directiva 20/14 «Organización el *targeting* conjunto en las Fuerzas Armadas». Madrid: Estado Mayor de la Defensa 2014.
- JEMAD. *PDC-3.9 Doctrina conjunta de targeting*. Madrid: Estado Mayor de la Defensa 2014.
- JORDÁN, Javier. *El debate sobre la primacía del poder aéreo : un recorrido histórico*. Madrid: CESEDEN, 2016, pp. 1-38.
- JORDÁN, Javier. «Un modelo explicativo de los procesos de cambio en las organizaciones militares: la respuesta de Estados Unidos después del 11-S como caso de estudio». *Revista de Ciencia Política*. Madrid: 2017, pp. 205-209.
- LABORIE, Géraud. «The Afghan Model More Than 10 Years Later». *Air and Space Power Journal*. Montgomery: 2013, p. 50.

- LOMBO, Juan A. «El poder aéreo, instrumento decisivo para la resolución de las crisis del siglo XXI». *Revista Arbor*. Madrid: 2002, pp. 231-257.
- MADOC. *Targeting terrestre. Concepto derivado 02/16*. Granada: 2016, p. 3.
- MARTÍN PÉREZ, Miguel A., *et al.* *Monografías 140. Capacidades futuras de las Fuerzas Armadas*. Madrid: CESEDEN 2014.
- MARTÍNEZ, Segundo. «Targeting en las operaciones COIN actuales». *Monografía XII CEMFAS*. Madrid: Escuela Superior de las Fuerzas Armadas 2010, pp. 22-23.
- NEBOT, Antonio F. «El nivel operacional. OUP/OTAN». In *Monografía 149: El nivel operacional*. Madrid: CESEDEN 2016, pp.129-130.
- NSO. «AAP-06 Edition 2018 NATO glossary of terms and conditions». Brussels: 2018, p. 70.
- ONU. «Resolución 1973 (Vol. S/RES/1973)». Nueva York: 2011, p. 3.
- OTAN. «Tratado del Atlántico Norte». Washington: 1949, p.1.
- OTAN. «Concepto Estratégico de la OTAN». Lisbon: 2010.
- OTAN. «AJP 3. Allied Joint Doctrine for the Conduct of Operations». Brussels: 2011.
- OTAN. «Operation Unified Protector. Final Mission Stats». Mons: 2011, pp. 1-2.
- OTAN. «Six Strategic Lessons learned from Libya: NATO Operation Unified Protector». *NATO Defense College Research Report*. Rome: 2012, pp. 1-6.
- OTAN. «ACO “Comprehensive Operations Planning Directive” (COPD) Interim V2.0». Mons: 2013.
- OTAN. *NATO Command Structure*. Mons: 2013. Available at <https://www.nato.int/cps/en/natohq/structure.htm>;
- OTAN. «AJP 3.5 Allied Joint Doctrine for Operational-Level Planning». Bruselas: 2013.
- OTAN. «AJP 3.3. Allied Joint Doctrine for Air and Space Operations». 2016.
- OTAN. «AJP 3.9 Allied Joint Doctrine for Joint Targeting». Brussels: 2016, pp. 1-5.
- OTAN. «Joint Force Air Component Command». Ramstein: 2019. Available at <https://ac.nato.int/page8031753>;
- OTERO, Juan Carlos. «Evolución y empleo de las capacidades ISR aéreas ante las nuevas amenazas del siglo XXI». *Monografía XII CEMFAS*. Madrid: Escuela Superior de las Fuerzas Armadas 2016, p. 13.
- PÉREZ, Pedro; FERNANDÉZ, Jesús. «El nivel operacional. A modo de análisis». En *Monografía 149: El nivel operacional*. Madrid: CESEDEN 2016, pp. 203-215.

- RIZER, Kenneth. «Bombing Dual-Use Targets : Legal, Ethical, and Doctrinal Perspectives». *Air and Space Journal*. Montgomery: 2001, pp. 1-2.
- RODRÍGUEZ, Guillermo. «Dinámica de los blancos militares». *Revista de la Escuela Superior de Guerra Aérea*. Buenos Aires: 2013, p. 52.
- RODRÍGUEZ, Raimundo; JORDÁN, Javier. «La importancia creciente de las fuerzas de operaciones especiales en Estados Unidos y su influencia en el resto de países de la OTAN». *UNISCI Discussion Papers*. Madrid: 2015, pp. 107-123.
- SÁNCHEZ M., José. «La Aviación Militar Española: una historia corta pero de gran intensidad». *Revista Arbor*. Madrid: 2002, pp. 187-216.
- SCHELLING, Thomas. «Arms and Influence». *Yale University Press*. New Haven: 1966.
- TEJERA, Juan. «Conceptos emergentes en la OTAN». *Revista Española de Defensa*. Madrid: 2014, p. 44.

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*The United States and Saudi Arabia alliance
in the 21st century.*

*The presidency of George W. Bush, Barack
Obama and Donald Trump*

Abstract

The alliance between the United States and Saudi Arabia has been in place for over seventy years, but the paradigms on which it is based have suffered numerous tensions in recent decades. The Saudi State and the House of Saud remain important political and economic partners of the US Administration in the Middle East and the Muslim world, although the differences between the two countries seem more apparent at the present time.

Under the presidencies of George W. Bush and Barack Obama, there was a marked distancing from their Arab ally, due to the deep differences of interests on issues as sensitive as security and defence. In the first years of Donald Trump's mandate, relations with the Saudi Crown seem to have improved, through joint efforts to counter potential threats in the area. This article analyses the changes in the relationship between the two allies and the areas of disagreement in the regional agenda of both.

Key words

United States, Saudi Arabia, Middle East, Muslim world, defence

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Introduction

The relationship established between the United States and Saudi Arabia since 1945 is one of the most important alliances in the Middle East and even in the international community. Two states with such disparate political regimes have been able to preserve a complicated partnership despite the constant changes in the surrounding region. Although the many differences between the two sides are considerable, there is still a minimum consensus on safeguarding the principles of bilateralism, which in general terms has brought significant benefits to the US government and the Saudi monarchy for more than seventy years. Nevertheless, the twenty-first century has brought to light deep differences between the two and has led to a gradual distancing, requiring a redefinition of their respective strategies.

The relationship between the American power and the Saudi Arabian state is the result of a convergence of specific interests, which have prevailed in spite of upheavals and tensions in the regional scenario. The Saudi princes represent one of the most reliable interlocutors that the United States has in the area, while the White House has always represented the most prominent international support for the Arab nation. Without Washington's tacit support, the Saudis' survival on the throne and their leadership position in the Muslim sphere would have been less likely. Likewise, without Saudi Arabia's assistance, the Americans would not have been able to consolidate their country's influence in that difficult enclave, either during the Cold War or in later times of great uncertainty.

The alliance is usually characterised as an exchange of oil for military security, but it conceals more complex and constantly evolving principles. The United States approaches Saudi Arabia with the aim of finding both a trading partner and a political supporter, while the latter is emerging as a privileged energy supplier to the powerful US economy, which is helping to place it high on the US international agenda. The Saudis have used the singularities of their political and religious model to set themselves up as a useful tool capable of containing revolutionary currents in the region. As a result, they have been in close harmony with the security strategies of successive Republican and Democratic administrations, which have positioned them as an essential condition in terms of their national interests.

The alliance with the United States is of vital strategic importance to the Saudi Arabian regime, which is one of the central pillars on which the power of the Saudi royal family rests. The Saudi leadership not only regards the Americans as preferential investors and buyers, but also as key to the survival of the Saudi crown. In a difficult local context where conflicts occur and traumatic changes in power have taken place, the royal family has been able to turn this relationship into a further guarantee of stability and defence of the monarchy. The Americans' need for a safe and clear reference point in the area has prompted them to provide unwavering support to the ruling family.

Relations started to become more complicated after September 11, 2001, and this trend of deterioration and mistrust intensified in the wake of the Arab spring. The rise

of jihadism and terrorist attacks on a global scale put the spotlight on Saudi Arabia, Wahhabism and the type of networks they maintain with certain groups. The issue of radicalism and security opened a deep rift between the Bush Administration and the Saudi crown. The situation became even more corrosive with the Iraq War in 2003 and the US plans for Iran. King Abdullah did not share the direct and belligerent strategy proposed by the White House, deeming the United States to no longer be an element of stability for the region. The Saudis felt delegitimised in the eyes of Arab public opinion on account of the actions of the American superpower.

Barack Obama's promises of change in foreign policy had a direct effect on regional dynamics. The Democratic president's interest in rapprochement with Iran and avoiding a nuclear escalation earned him the opposition of his main allies in the area. Saudi Arabia did not share the views of US diplomacy, believing that they would serve to strengthen the position of the Iranian regime. The Saudi kingdom began to ratify what had already happened years earlier with Bush, because the US was making decisions without taking into account its closest interlocutors. The Arab revolts of 2011 and the decision of the United States not to take an active part in the conflicts of some countries generated a tremendous climate of insecurity for most monarchies, who realised that the American force was no longer one of their most important supporters.

The standoff between the two allies appears to have been redressed somewhat under the presidency of Donald Trump, who is trying to revitalise close cooperation with Saudi Arabia. The harmony between both governments is leaving behind more than ten years of erosion and fracture in a historic bilateral relationship. The current US president and King Salman have made progress in bringing their positions closer by strengthening the cornerstones of the alliance. In economic matters, the United States continues to be one of the kingdom's most important trading partners. In the area of defence and security, Saudi Arabia's rearmament and modernisation programmes are largely supported by the American power. Although the main point of rapprochement between both sides is the congruence of political interests, above all, due to their concerns about the rise of Iran in the region.

This article starts from the premise that the first decades of the twenty-first century (2001-2020) represent a decisive period for the relationship between the United States and Saudi Arabia, since the changes that have taken place at international and regional level, together with the transformations in the national policies of both countries, are making the interests of the two allies less and less congruent and compatible. Despite the recent efforts of Donald Trump and King Salman to improve the climate of understanding and collaboration, the priorities of the governments for the Middle East and the Muslim sphere are in many respects different. The presidencies of George W. Bush (2001-2009) and Barack Obama (2009-2017) marked a turning point in this alliance, giving rise to a series of failures and frictions that demand a redefinition of the Saudi-American relationship.

History and cornerstones of the alliance

The relationship between the United States and Saudi Arabia represents an encounter between the greatest world superpower of the second half of the twentieth and early twenty-first centuries and one of the most significant references in the Middle East and the Muslim world. Throughout more than seventy years, bilateralism has evolved both in the form of its development and the content of their common agenda. During this long period, there have been moments of close collaboration and harmony, but also moments of confrontation and disagreement. The peculiarity derived from the presidencies of George W. Bush and Barack Obama is that the Saudi-American alliance seems to have been consigned to a phase of limited mutual trust. Despite the efforts of Trump and King Salman, the alliance is beginning to show limitations that are proving very difficult to overcome.

The rise and maintenance of this partnership cannot be fully understood without taking into account the circumstances of each country, the region and international society. In 1932, after ten years of incessant tribal strife, Saudi Arabia's Prince Abdulaziz bin Saud achieved the reunification of the kingdom under a single crown. From that moment, the House of Saud took full control of the central territories of the Arabian Peninsula surrounding Mecca and Medina. The modern Saudi state emerged under the political authority of the royal family and according to the religious precepts of Wahhabism¹, which is a minority current of Islam that was established as official in the country². The monarch's efforts were focused on consolidating his internal power and gaining the trust of foreign powers. In this sense, already at the end of the thirties, the monarchy had begun to authorise the first oil explorations to be undertaken by British and American companies.

Until the end of the Second World War, the Saudi kingdom's contact with the outside world were to a large extent limited to mainland Britain, whose protectorates extended over the Gulf, and some American investors who were beginning to explore for oil in the eastern region of the country. Saudi Arabia's international policy began to change dramatically after the meeting between King Abdulaziz and President Roosevelt in February 1945 in Egypt's Great Bitter Lake. The Americans had approached the House of Saud with the purpose of gaining access to the area³. The Saudis viewed the US as an emerging hegemonic hub, whose support could well be essential to the interests of the crown, which at the time were centred on internal stability and avoiding external aggression. Initial meetings focused on commercial exchange based on oil and gas, foreign investment and technology transfer, as well as agreed political strategies for the region.

1 On the subject of Saudi state building and Wahhabism, see: HOUSE, K.E. (2012): *On Saudi Arabia. Its people, past, religion, fault lines and future*; VALENTINE, S.R. (2015): *Force and fanaticism. Wahhabism in Saudi Arabia and beyond*; COMMINS, D. (2006): *The Wahhabi mission and Saudi Arabia*; MOULINE, N. (2014): *The clerics of Islam religious authority and political power in Saudi Arabia*.

2 BASKAN, Birol; WRIGHT, Steven. «Seeds of change: comparing state-religion relations in Qatar and Saudi Arabia». *Arab Studies Quarterly*. Vol 33, N.º 2. Spring 2011, pp. 96-111.

3 BOWMAN, Bradley L. «Realism and idealism: US policy toward Saudi Arabia, from the Cold War to today». *Parameters* 35, 4. Winter 2005/2006: pp. 91-105.

The origin of the alliance stems from the security needs of the Saudi princes to have strong allies to ensure the survival of the regime and the demands of a growing U.S. economy to expand markets and diversify sources of supply. But the onset of the Cold War soon shifted the relationship into a more political one, accelerating the conformity of objectives between the two countries. During the 1950s, the Middle East efforts of Presidents Truman (1945-1953) and Eisenhower (1953-1961) focused on stemming the expansion of Soviet influence in the region. The pan-Arabist movements and the current led by Gamal Abdel Nasser in Egypt⁴ posed a threat to both the US and Saudi Arabia. Both governments were working together to prevent revolutionary aspirations from undermining their aims. The emergence of new socialist republics in the region represented a direct threat to the Saudi Arabian crown's political and social model. For Washington it meant a serious danger of losing its influence in a key geostrategic area.

In 1953, the King and founder of the modern state, Abdulaziz bin Saud, died, and his son Saud bin Abdulaziz succeeded him, whose reign was marked by serious economic problems and socialist revolts in the surrounding area. He was accused within his own family and among Saudi power circles of being somewhat ineffectual and lacking in leadership⁵. In 1964, the monarch was forced to resign under pressure from the political and religious establishment. His brother Faisal took over and introduced major reforms in the kingdom's security and foreign policy. The struggle between the Saudi princes affected relations between the United States and Saudi Arabia, since Washington refused to interfere in such matters. The Americans were only demanding stability and internal security from the Saudis, regardless of who was in power.

King Faisal was to rule the country until his death in 1975. He is considered the mastermind of Saudi Arabia's ambitious regional policy, setting out the principles and objectives that were later developed by his brothers Khalid and Fahd during the 1980s and 1990s. Under his reign, the first major note of dissension between the US and Saudi Arabia was struck due to the Yom Kippur War in 1973 and the oil crisis in the following month⁶. The Saudis looked upon oil and gas not as mere sources of wealth but as levers of political power. Faced with the vacuum created by Nasser's disappearance, the Saudis took up the cause against Israel as their own, and added a strong religious component to it.

Saudi Arabia still recognised its significant political, economic and defensive dependence on the United States, but used the problematic situation generated by the 1973 crisis to try to restore balance to the relationship with Washington. The Palestinian-Is-

4 BRONSON, Rachel. «Understanding US-Saudi relations» in Aarts, Paul. y Nonneman, Gerd. (eds.). *Saudi Arabia in the balance. Political economy, society, foreign affairs*. London: Hurst Publishers. C. Hurst & Co. (Publishers) Ltd. 2006. Second impression, pp. 378-380.

5 AL-RASHEED, Madawi. «Mystique of monarchy: the magic of royal succession in Saudi Arabia» in Al-Rasheed, Madawi. (ed.). *Salman's legacy. The dilemmas of a new era in Saudi Arabia*. London: Hurst & Company 2018, pp. 52-54.

6 MIRZADEGAN, Amin. «Nixon's folly. The White house and the 1970s oil price crisis». *The Yale Historical Review*. An undergraduate publication. Spring 2016, pp. 40-57.

raeli conflict was to become, from that date onwards, the main point of contention between the two allies. At the end of his mandate, President Nixon (1969-1974) sought to strengthen ties with Saudi Arabia, which he considered a priority partner, as expressed in the “twin pillars” strategy⁷. The regime of the Shah of Persia and the Crown of the Saud became the two fundamental allies on which Washington could rely to secure its economic and political interests. The White House intended to constitute a cross-cutting axis of countries that would isolate the Middle East from currents of change.

The Iranian revolution in 1979 was a traumatic event for the whole region. The establishment of the Islamic Republic of Iran and the fall of the Shah represented a direct threat to Saudi Arabia and the USA. The Saudi kingdom was faced with a new political and religious regime whose ideas were in competition with the ideology of Riyadh. The American power lost one of its closest allies and had to face a government with a strong anti-imperialist stance. These circumstances led to a strengthening of ties between Casa Saud and its counterparts in Washington. The leaders of the White House focused greater attention on the needs of the Arab monarchies, in order to prevent another potential partner from succumbing to unrest and losing influence.

Two events occurred in the 1980s that would strengthen ties between Saudis and Americans, taking the alliance to a greater level of cooperation. On the one hand, President Jimmy Carter established a new doctrine in 1980 stating that the US would use all necessary means, including military force, to protect its interests. This proclamation served to reaffirm the commitment of the Western power in the defence of Arab monarchies such as Saudi Arabia. On the other hand, the war in Afghanistan between Soviet troops and Mujahideen rebels was projecting a different international dimension from Saudi Arabia. The kingdom changed from being a mere ideological retaining wall in the region to become a promoter and protector of Islamist views, which initially were also backed by the White House and the Pentagon.

US tolerance of the Saudi policy of using religion to gain ground among Islamic communities resulted in Saudi Arabia's leadership not being limited to the Middle East. The Americans were faced with a regional ally but also with a self-proclaimed leader in the Arab and Muslim sphere. The war between Iraq and Iran during much of the 1980s identified the regimes of Saddam Hussein and that of the Ayatollahs as the greatest threats. The creation of the Gulf Cooperation Council (GCC) in 1981, formed by Saudi Arabia, Oman, the United Arab Emirates (UAE), Qatar, Bahrain and Kuwait, represented an area of direct influence for Saudi Arabia, where it could exercise a predominant status, while for the White House it meant a security area with dynasties favourable to its presence in the area⁸. The creation of the Gulf Cooperation Council

7 FÜRTIG, Henner. «Conflict and cooperation in the Persian Gulf: the interregional order and US policy». *Middle East Journal* Vol 61, N.º 4. Autumn, 2007, pp. 627-640.

8 ALLISON, Marissa. «U.S. and Iranian strategic competition: Saudi Arabia and the Gulf states» in Center for Strategic & International Studies. CSIS. Burke Chair in Strategy. December 6, 2010. Available at <https://www.csis.org/analysis/us-and-iranian-strategic-competition-3>.

(GCC) in 1981, formed by Saudi Arabia, Oman, the United Arab Emirates (UAE), Qatar, Bahrain and Kuwait, represented a sphere of direct influence for Saudi Arabia, where it could exercise a leading role, while for the White House it was a security area with dynasties that favoured its presence in the area.

The invasion of Kuwait in 1990 by Saddam Hussein's army and the Gulf War in 1991 almost coincided with the collapse of the Soviet Union. The victory of the international coalition represented the consecration at that time of the United States as the greatest world power and protector of its allies in the Middle East. However, in Saudi Arabia the most conservative and rigorous sectors called into question the relationship with Washington⁹. Strong opposition to the installation of Western troops in the country emerged in Saudi society, despite the fact that their presence there was to defend against possible aggression from Iran or Iraq. The Saudi princes were forced to reformulate their alliance with the American hegemon. Since then, the Wahhabi kingdom has become the only Arab monarchy in the Gulf that does not officially allow the establishment of foreign troops and military bases in its territory.

At the end of the 20th century, Saudi Arabia began a progressive modernisation of its military capabilities. After the crisis with the Iraqi regime, the Saud crown realised that it was necessary to advance its autonomy in the field of defence and to reduce its high dependency on the United States in this area. In this sense, the Saudi Arabian crown had practically consigned such issues to US military protection since the end of World War II, focusing almost exclusively on internal security mechanisms. However, this trend began to change in the 1990s and is also reflected in Riyadh's interest in diversifying its international relations. A process of expanding trade and political partnerships commenced both in Europe and among the emerging Asia-Pacific economies. The American power remained among the preferential circles on the foreign agenda¹⁰, but it would no longer be the only actor seeking to support the regime in order to consolidate its power. The twenty-first century ushered in the beginning of a period marked by the rapid deterioration of the alliance.

Mistrust with George W. Bush

The presidency of George W. Bush had a decisive effect on the regional status quo and on bilateral relations with Saudi Arabia. Its consequences conditioned Barack Obama's political vision and also the relationship that the countries of the region would have with the US in the subsequent period. The measures adopted during those eight years were conditioned by the White House's urgent need to respond to the

9 POLLACK, Kenneth M. «Securing the Gulf». *Foreign Affairs* Vol, 82. Number 4. Jul- Aug 2003, pp. 2-16.

10 HERNÁNDEZ, David. *La política exterior de Arabia Saudí tras la Primavera Árabe en Oriente Medio. Objetivos y estrategias regionales (2011-2016)*. Tesis doctoral. Madrid: Universidad Complutense de Madrid 2019. Available at: <https://eprints.ucm.es/51661/>.

emerging challenges of the new century. A secondary effect of the US strategy for the Middle East was the erosion of its alliance with the Saudi kingdom, which no longer trusted its historical partner to preserve some of its interests in the area. The American power began to emerge as a proactive and transforming factor in the region, attempting to promote certain changes in the Arab and Muslim sphere in accordance with its interests, although this was to generate growing unease among its allies.

9/11 marked a turning point in US foreign policy and priorities in its relations with most Arab countries¹¹. Security cooperation became a cornerstone of the multilateralism implemented by Washington. A reductionist operational framework was presented in which there was no room for ambivalence, and two types of fronts were set up: allies and members of the US bloc and those considered to be propellers of the axis of evil. Nuances and possible discrepancies were subjugated to a policy driven by US criteria and the defence of principles that should be globalised. Monarchies such as Saudi Arabia were left in a complicated situation since the main US initiatives for the area contravened some of their regional objectives, weakening their status as Arab and Muslim leaders.

The Bush Administration recognised that the causes of the rise of international jihadism stemmed from the socio-political situation in the Middle East¹². The region became a priority for the United States' own security. The rationale was that only direct involvement in local problems could solve growing radicalism and the terrorist threat. The approach taken was based on a Global War on Terror (GWOT), the concept of which was reflected in President Bush's "Freedom at War with Fear" speech in the House of Representatives on September 20, 2001, where he stated that the strategy would not be limited exclusively to combating Al Qaeda, but would be extended to all organisations and institutions that supported this kind of player and that all available resources would be used to that end. The degree of involvement of each government in these proposals would condition how their American counterparts would engage with them. Saudi Arabia had certain reservations about the great ideas presented by Washington, since they could lead to a generalised criminalisation of the different currents of Islam, just as the military presence of the United States would have destabilising effects on the region.

George W. Bush's ultimate goals were to put an end to those regimes that could sponsor terrorists and extremists and those that posed a threat to US and allied interests. Iraq and Iran fell directly into this category, which placed them at the centre of pressure from the international community. The Americans also introduced a democratic and economic axiom into their regional security strategy. Stability does not only

11 AL-QAHTANI, Fawz. «Continuity and change in United States' foreign policy towards Gulf region after the events of September 11th, 2001. A comparative vision between the Bush and Obama administrations». REPS, Review of Economics and Political Science Vol 4, N.º 1. 2019, pp. 2-19.

12 MARKAKIS, Dionysius. US democracy promotion in the Middle East. The pursuit of hegemony. Routledge. London: Taylor & Francis Group 2016, pp. 64-68.

mean putting an end to terrorism and the most conflictive regimes, it also requires improving local governance and facilitating political and social models where democratic syntheses similar to the American one prevail¹³. The premises employed by the United States directly attacked systems based on totally different ideological theses, such as that of Saudi Arabia.

The United States and Saudi Arabia had had their differences in previous times, but these were disagreements that were overcome and did not weaken the alliance. Under the Bush presidency, divergences on central issues were not channelled and gave rise to a climate of estrangement. Jihadism, Palestine, military action in Iraq and measures against Iran became apparently insurmountable issues for both sides. In this sense, the presence of many Saudi Arabian nationals in terrorist cells, such as those that attacked on 9/11, damaged the crown's external image and confidence vis-à-vis its Western partners. First, the country itself and the royal family were threatened by such groups, which considered the monarchy to be an enemy of the Jihadist cause. Second, the policy of funding Muslim communities, mosques and madrassas was called into question by the US and other governments that directly accused Saudi Wahhabism.

The image of the Saudi state was seriously damaged by the persistence of jihadism. The US administration began putting pressure on them to improve cooperation in the fight against terrorism and not to encourage factions of dubious reputation. The problem was that the Wahhabi current was singled out, since its rigorous and conservative discourse was accused of serving as a moral inducement for many radicalised groups¹⁴. The Saudi Arabian government was faced with the troubling reality that the pillars on which its power rested were colliding. On the one hand, the princes were unable to break away from Wahhabism, which represented the essential tool for legitimising their authority. On the other hand, they had to ensure alignment with the US, their historical ally and the main international supporter of the royal family.

A profound debate arose among the most prominent figures in the clan in relation to their links to the most radical elements of Wahhabism and their American association. A bloc of Saudi princes emerged, led by Abdullah and his nephew Mohammed bin Nayef, that advocated strengthening a foreign policy more closely linked to the United States, promoting a series of reforms in the system that would gradually facilitate the disengagement of official bodies from these currents. Moreover, jihadism itself was to hit Saudi territory at a distance¹⁵, such as the series of attacks on residential areas in Riyadh and the headquarters of Western companies in May and November 2003.

13 FLORIG, Dennis. «Hegemonic overreach vs imperial overstretch». *Review of International Studies* Volume 36, N.º 4. Oct 2010, pp. 1103-1119.

14 CHOKSY, Carol E.B.; Choksy, Jamsheed K. «The Saudi connection: Wahhabism and global jihad». *World Affairs Journal*. May/June 2015. Available at: <https://yaleglobal.yale.edu/content/saudi-connection-wahhabism-and-global-jihad>.

15 HEGGHAMMER, Thomas. «Islamist violence and regime stability in Saudi Arabia». *International Affairs* 84: 4. 2008, pp. 701-715.

The monarchy's efforts to combat terrorism brought it closer to the Bush Administration's theses in the fight against terrorism, presenting it not only as a contest between civilisations, but also between Muslims.

However, the White House no longer saw its Arab partner as a bulwark of security and stability, being inevitably linked to jihadist terrorism. During his reign, King Abdullah persevered in improving collaboration and cooperation in this regard, but his efforts were hampered by disagreements over the Palestinian question, Iraq and the Ayatollah regime. The same Saudi monarch was unable to advance the 2002 peace plan or Arab Initiative promoted by Saudi Arabia and supported mostly by the Arab League¹⁶, which proposed the recognition of two states and the normalisation of relations with Israel. Riyadh was particularly opposed to such a US proposal, which linked its perspective on the problem to the premises defended by the executives Ariel Sharon (2001-2006) and Ehud Ólmert (2006-2009).

Discontent over Saudi Arabia's unproductive efforts to place the Palestinian issue on George W. Bush's agenda grew with the strategy followed by Iraq¹⁷. The crown did not support the action against Hussein because it appreciated that the risks of a power vacuum in that state would be detrimental to the region. Besides, there was the possibility that Iran could take advantage of the circumstances to expand its influence in the region. Moreover, the Saudis could not put up with such interference in the face of Arab public opinion, which was mostly against what was branded an imperialist action. The Saudi leaders were again faced with the challenge of balancing the objectives of their Arabist and Sunni discourse with the continued existence of the American alliance, highlighting the contradictions of their political and religious programme.

The Iranian energy programme was regarded with mistrust. Both governments shared the concern that Iran would provoke a nuclear race, but there was no desire from Riyadh for violence to spread further afield, as had happened in Iraq after the disastrous post-war period. These circumstances led the monarchy to disassociate itself from the aggressive policy of the Bush presidency, promoting a détente with its Persian counterparts, simply to reduce tensions in the local scenario¹⁸. The credibility that the Saudis had afforded the US for so long was called into question. With its discretionary and overbearing behaviour, in the eyes of the crown the United States had ceased to be a source of certainty and stability.

16 Blanchard, Christopher.M. «Saudi Arabia: background and U.S. relations» in *CRS Report for Congress*. Congressional Research Service. The library of Congress. April 22, 2016. Available at <https://apps.dtic.mil/dtic/tr/fulltext/u2/1017814.pdf>.

17 BAXTER, Kylie; AKBARZADEH, Shahram. *U.S. foreign policy in the Middle East. The roots of anti-americanism*. London: Routledge, Taylor & Francis Group 2008, pp. 170-172.

18 OTTAWAY, Marina. «Iran, the United States, and the Gulf: the elusive regional policy» in *Carnegie Papers. Middle East Program*. Carnegie Endowment for International Peace Number 105. November 2009. Available at https://carnegieendowment.org/files/iran_us_gulfi.pdf.

Alienation with Barack Obama

The relationship was at a very low point when the Democratic president succeeded Bush. Saudi Arabia had stopped trusting its American allies because of its aggressive and unilateral stance in Iraq and on Iran. In Washington's circles of power, there remained a deteriorating image of the Saudi crown, which was associated with jihadist radicalism and political authoritarianism. King Abdullah thought that bilateralism could return to positive channels with the new leader, but reality soon revealed that the US and the Saudi kingdom were still on completely different political planes. The disagreements revolved around two fundamental issues in the region: Iran and the Arab Spring, which marked a course of numerous disagreements and growing tensions between the two.

Barack Obama proposed a doctrine far removed in ideology from the decisions made by George W. Bush, but with respect to Saudi Arabia he came up with some points of agreement. The American leader differed from his predecessor in the way he tackled the problem of terrorism, the relevance he gave to the Middle East in his foreign policy and the type of leadership he sought to develop. GWOT was excluded, and the White House was considering a withdrawal of its military forces to enclaves such as Afghanistan and Iraq. American diplomacy was beginning to focus on the Asian-Pacific region¹⁹, which was regarded as the key area for the main economic, political and security objectives of the United States on the international stage. The hegemonic and dominant attitude of the previous Administration made way for foreign action that sought spaces for dialogue, allowing for the lowering of tensions and the reduction of wear and tear on US leadership.

Obama's speech at Cairo University in 2009 reflected the kind of commitments the U.S. executive was willing to make in the region²⁰. The president wanted to put aside the belligerent approach of the Bush strategy in order to focus on new ways of working. The hegemonic multilateralism of his predecessor had only led to worsening levels of insecurity and instability in the Middle East. It was necessary to reduce pressure on Iran in order to improve confidence margins. This approach received the approval of a large part of his Arab allies, although the possibility of dialogue with the Ayatollah regime raised suspicions in governments, including the Saudi leadership, which above all wanted to prevent Iran from re-emerging as a relevant actor in the region.

The Arab Spring forced Barack Obama to review the principles of his doctrine. The United States was not going to interfere in the internal affairs of the countries in the

19 KITCHEN, Nicholas. «The contradictions of hegemony: the United States and the Arab Spring». Kitchen, Nicholas. (ed.). *After the Arab Spring. Power shift in the Middle East?* LSE Ideas special report. SRO11, May 2012. Available at <http://www.lse.ac.uk/ideas/Assets/Documents/reports/LSE-IDEAS-After-the-Arab-Spring.pdf>.

20 TOVAR, Juan. «¿Una estrategia coherente para una región en cambio? La política exterior de la Administración Obama y la Primavera Árabe». *UNISCI Discussion Papers*, N.º 36. October 2014, pp. 29-50.

area, nor was it going to promote political transformations as it did in the past. But the massive movements in countries such as Egypt, Syria and Libya put the Americans in the position of having to redefine their role in the new context²¹. American concerns focused on deciding how much responsibility they should take. In the case of Egypt, whether it should continue to support the allied regime or meet democratic demands. In the Syrian or Libyan territory, it was a question of what kind of support would it give to the opponents and to what extent would it be willing to participate in these conflicts. The response on each of these fronts was bound to be disappointing for Saudi Arabia and most Arab allies.

US confidence in Saudi Arabia was already damaged by suspicions of jihadism and compounded by the Obama Administration's misgivings over reviving the alliance with Riyadh²², as they no longer perceived it as an element of certainty and security for the region. The work of the kingdom for decades as a retaining wall had ceased to have any meaning. The usefulness of sustaining such a monarchy became questionable. The Saudi Arabian princes acted in general terms as counter-revolutionary elements in 2011, but they did not manage to completely stabilise the region, and therefore were no longer so indispensable. Their support for certain factions in Libyan and Syrian territory placed their American allies in an awkward position. The White House did not want to link its regional policy to Saudi premises or to support certain actors whose aims were totally distant from the objectives of the US, which in the wake of the Arab Spring focused on trying to reduce the levels of conflict in the area and prevent the rise of the most radical religious and political currents.

Obama ended up taking the same line as Bush on the Saudi Arabian issue. In view of the tenor of events, the president tried to limit the relationship with the monarchy as much as possible, avoiding an absolute rupture but without conditioning his foreign policy on Saudi actions. King Abdullah II also promoted a certain distancing from the Americans because he found the US strategy inadequate. There are three moments that reinforce the Saudi prince's belief in the urgency of taking independent action. The fall of Mubarak in Egypt in February 2011, the intensification of the conflict in Syria from 2012 and the agreement on the Iranian nuclear programme in 2015 are the central issues that separated Saudi Arabia from Washington's decisions and interests. There was a fracture in bilateral relations because both parties no longer considered the other as an indispensable piece of regional stability and a preferential ally in the most relevant issues.

Mubarak's dismissal set an extraordinary and traumatic precedent for Arab monarchies. The United States decided not to act on behalf of a historic ally, leading other

21 GERGES, Fawaz A. *The end of America's momento? Obama and the Middle East*. New York: Palgrave Macmillan 2012, pp. 108-109.

22 GOLDBERG, Jeffrey. «The Obama doctrine. The U.S. president talks through his hardest decisions about America's role in the world». *The Atlantic*. April 2016 ISSUE. Available at <https://www.theatlantic.com/magazine/archive/2016/04/the-obama-doctrine/471525/>.

regimes to fear a similar political end²³. Saudi Arabia discovered that its alliance with the American power was no longer a guarantee of protection for the Saud family. This meant that one of the original principles of the alliance between the two countries was not being adhered to, as Washington seemed unwilling to ensure the security of its partner. The Saudi monarchy could definitely no longer expect the full backing of the White House, so it accelerated its plans to improve its resources and capabilities in security areas. The ultimate goal of the Saudi strategy was to minimise the political and defensive dependence it continued to have on the American power, presenting the kingdom as an increasingly autonomous power.

The diverging stances on the crises arising from the Arab Spring also translated into conflicts in Libya and Syria. At first, both governments had a common interest in favouring the fall of the Gaddafi and Al Asad regimes, which for decades had been two powerful forces critical of Western presence and Saudi hegemony. However, contradictions emerged regarding how to deal with the opposition groups. The attack on the US consulate in Benghazi in 2012 by Libyan Salafist factions increased Washington's restraint in its engagement with the revolts²⁴ while Saudi Arabia showed strong support for rebel factions, aligned with the Wahhabi discourse. The dissimilarity in priorities between the two allies meant that action plans were developed separately and with little collaboration.

The core issue that fractured the US-Saudi alliance was the nuclear deal with Iran in July 2015. The Saudis had initially rejected violent action against the Iranian state as Bush had intended, since that could mean more instability in the environment. However, neither did the Arab monarchy want dialogue between the foreign powers and the Iranian regime to serve Tehran as a way of bolstering its status as a major player in the region²⁵, thus directly weakening the Saudi leadership. The pact finally signed tacitly granted special recognition to the Iranians, excluding the rest of the neighbouring countries from the solution of the conflict. The Saudi leaders changed their perspective on the matter and began to press for a shift in the US position, establishing a surprising connection with Netanyahu's Israeli executive, who was very critical of the rapprochement with Tehran.

The rift between the two sides was evident in the first months of Salman's reign and Obama's last year in office. The new monarch and the Crown Prince Mohammed bin Salman were trying to be more decisive in their foreign policy, contravening the de-

23 QUANDT, William B. «U.S. Policy and the Arab revolutions of 2011». Gerges, Fawaz A. (ed.). *The New Middle East. Protest and revolution in the Arab World*. New York: Cambridge University Press 2014, pp. 422-424.

24 HUBER, Daniela. «A pragmatic actor- The US response to the Arab Uprisings». *Journal of European Integration*, 37 (1). 2014, pp. 57-75.

25 WEHREY, Frederic. «Saudi-US discord in a changing Middle East». *Research Paper*. Arab Center for Research & Policy Studies, July 2015. Available at https://www.dohainstitute.org/en/lists/ACRPS-PDFDocumentLibrary/SaudiUS_Discord_in_a_Changing_Middle_East.pdf.

cisions made by their American counterparts in the region. The absence of the Saudi leadership from the meeting between the Gulf monarchies and their US ally at Camp David in 2015²⁶, revealed the stark gap that separated the two countries. In September 2016, the US Congress ratified the law approved in the Senate in May of the same year, which allowed the victims of the 9/11 attacks to denounce in court any organisation or state accused of covering up terrorism. The White House opposed this measure, aware that it would further damage relations with the Saudi House. However, the political panorama in both countries confirmed that the alliance between the Saudi state and the American power was much weakened.

Reconciliation with Donald Trump

During the 2008 election campaign, Barack Obama claimed that he would introduce major changes in US foreign policy, leaving behind the more controversial approaches of George W. Bush. Upon arriving in the White House, the Democratic president attempted to change the strategy inherited from his predecessor in office, although the Arab Spring marked out some of his expectations for the region. In the run-up to the 2016 elections, Donald Trump was very critical of the international action of former leaders, placing special emphasis on the issue of Iran and the fight against terrorism. The US had been unable to maintain a coherent and lasting programme for the Middle East, as it had been subject to the varied ideological conditioning and perceptions of threat of each administration.

The profound differences in the way the three presidents have acted have resulted in the national image being branded as unpredictable and volatile. The Arab allies and Saudi Arabia have been forced to formulate new strategies that are not so dependent on the US variable, restricting issues of cooperation between the two parties²⁷, as there has been no way of knowing what kind of commitment and involvement the American power would adopt. The ambivalence emanating from Washington regarding its involvement in regional dynamics has given rise to greater independence of action for the regimes. The actors most opposed to American hegemony and their main partners are finding fewer obstacles to undertaking their own initiatives without having to consider the American response.

For Bush, the priorities in the Middle East were the fight against terrorism and overthrowing those regimes that posed a threat to regional security. He focused on Al Qaeda networks and religious radicalism, the fall of Saddam Hussein and the ex-

26 LEGRANZI, Matteo. «Shaking things up: Gulf security after the Iran deal». *INSSSL Defence Review 2017*. Published by: Institute of National Security Studies Sri Lanka 2017. Available at <http://www.nesa-center.org/wp-content/uploads/2017/02/Defencereview.pdf#page=51>.

27 MASON, Robert. «Back to realism for an enduring U.S.-Saudi relationship». *Middle East Policy*, Vol. XXI, N.º 4. Winter 2014, pp. 32-44.

clusion of the Islamic Republic of Iran. For Barack Obama, stability meant reaching minimum agreements with the Iranians, curbing sectarian tensions in Iraqi territory and formulating a type of political cooperation that would make all states participants in possible solutions. The dichotomy between the two doctrines lay in the role that the US should assume. The United States acted as the predominant instigator of the local agenda until 2008. With the change of government it tried to claim a more consensual and flexible figure, which would help to reduce tensions, restricting their incidence and points of action.

Donald Trump seeks to amend the most elementary aspects of policies carried out in the past, but certain components of his perspective are influenced by the work done by the other two presidents. The current leader has taken the Bush administration's approach to tackling major regional problems, inferring the need for the US to play a proactive and energetic role on issues such as Iran, in order to assert its position of strength over the rest. Despite his misgivings regarding Barack Obama, he is also taking a more limited view of the issues facing the US government, leaving greater autonomy to his main allies in Middle Eastern affairs which he does not consider to be paramount.

Relations between Saudi Arabia and the United States have returned to a climate of rapport during the Trump presidency, leaving behind the contradictions that arose with Bush and Obama²⁸. King Salman and Prince Mohammed bin Salman had begun their reign strongly opposed to U.S. regional policy, but their criticisms were overshadowed by the fact that under the new administration the agenda was similar. The Saudis' goal will now be to maintain a close alliance with the White House on very concrete issues, while not demanding a higher level of involvement on other issues. Washington's aim is to stabilise a new regional axis with Israel, Egypt and Arab monarchies in order to face challenges that affect everyone equally, thus fuelling the polarisation of the area into a like-minded segment and the pro-Iranian current.

The alliance is being revived on two transcendental fronts: political status and security. One of Donald Trump's first official visits abroad was to the Saudi Kingdom in May 2017, which led to the signing of several defence contracts between the two countries. In this sense, the new US Administration reaffirmed the Saudi House as one of its preferential interlocutors in the Arab world, while Riyadh regained Washington's support for its regional strategy. King Salman and Mohammed bin Salman have managed to keep the US as the most important international supporter of the crown and its foreign policy. The reforms undertaken by the young prince have clear support in the White House, despite recent controversies²⁹. The American superpower not only

28 AL-RASHEED, Madawi. «King Salman and his son: winning the USE, losing the rest». Al-Rasheed, Madawi (ed.). *Salman's legacy. The dilemmas of a new era in Saudi Arabia*. London: Hurst & Company 2018, pp. 236-238.

29 LIPPMAN, Thomas W.; COLE, Juan. «U.S.-Saudi relations in the Era of Trump and Mohammed bin Salman» in *Washington Report on Middle East Affairs*. January/February 2019. Available at <https://www.wrmea.org/2019-january-february/what-now-for-u.s.-foreign-policy-and-the-crown-prince.html>.

supports the institution of the entire royal family, but also specifically endorses the rise of the king's son and his most important initiatives, such as reform plans set out in the Saudi Vision 2030 Plan and his actions at local level, whether it be the war in Yemen or belligerence towards the Iranian hub.

Conformity of interests in the field of security is again demonstrated by the Iranian threat. Donald Trump has reiterated the belief that stability in the Middle East will not be fully guaranteed if a regime with Iranian characteristics persists in its plans. This type of proposal leads him to align himself with the requirements of Netanyahu's executive and the pressures of his Saudi partners³⁰. The White House and the Saudi Arabian crown are back working together on a regular basis because they believe they share the same enemy, sharing a common view of how to deal with the vicissitudes of this complex reality. Increased pressure on Iran is a way for the United States to reaffirm its authority and weaken a critical government. In the case of the Saudis, they want to reduce the margins of Shiite influence and once again establish themselves as the sole point of reference.

The connivance between Trump's plans and those of King Salman is limited exclusively to the erosion of Iranian power, while other notable aspects of regional dynamics are set aside. Saudi princes and American diplomats are trying to avoid issues that could generate friction between the two parties, such as the war in Syria, the Israeli-Palestinian conflict or the intervention in Yemen. The alliance is gradually transforming itself into a sort of *ad hoc* coalition that only operates on specific issues. The intention of the two states is to recover a favourable climate of cooperation, but the evolution of local and international circumstances means that the Saudi kingdom and the Anglo-Saxon power are less and less dependent on each other.

Conclusion

The alliance between the United States and Saudi Arabia was anchored in a common framework of interests and perceptions, which in some areas was broken under the presidencies of George W. Bush and Barack Obama. The American outreach to the nascent Saudi kingdom after World War II came in response to a need. The American power needed to establish allies in the area, which would serve to guarantee supplies to its economy and also contain communist expansion. The House of Saud then saw an opportunity to strengthen its international presence and safeguard the regime through foreign assistance. Bilateralism was developed in an effort to respond to the objectives of each party and under the principle of maximum trust and mutual assistance.

30 COOK, Steven A. «The Middle East is now split between red states and blue states» en *Foreign Policy*. July 8, 2019. Available at <https://foreignpolicy.com/2019/07/08/the-middle-east-is-now-split-between-red-states-and-blue-states/>.

For more than fifty years, international and regional circumstances favoured close ties in the Saudi-American alliance, based on economic, political and defence cooperation. The conflicts, revolutions and transformations that occurred in the Middle East were viewed in a similar light by both countries. But the most significant events of the beginning of the twenty-first century have highlighted divergences on essential points. The Saudi Arabian kingdom and the United States no longer perceive the risks, threats and opportunities in the region in the same way, which means that their needs no longer have as much similarity and this has led to a distancing of priorities. For the White House, the Saudi partners are no longer a preferential ally, while the House of Saud is seeking to diversify its relations and reduce its dependence on the outside world.

The boost now being given to the relationship under Donald Trump's presidency will not succeed in reversing the previous years of mistrust and suspicion. The current US Administration shares the same political approach as the Saudi kingdom on certain regional issues. The two counterparts have their sights set on Iran and share the same perception of concern about it. However, the trajectory of US foreign policy is to focus increasingly on other parts of the world, reducing its presence in the Middle East. In fact, the isolationist vision of the current American leadership confirms the inclination in Washington not to become so intensely involved in local problems. The only elements driving renewed cooperation are the Iranian issue and the desire to amend the previous Obama doctrine.

King Salman and Crown Prince Mohammed bin Salman enjoy significant support for their foreign policy in the US Government, although this is nuanced and always linked to the concentration of forces against the common threat that is the Ayatollah regime. The Americans have not put obstacles in the way of Saudi military action in Yemen, the blockade established in Qatar or their interference in the internal politics of Lebanon or Iraq, but neither have they made Saudi Arabia's regional agenda their own. The current US administration is not so much concerned with pockets of instability or the kind of local order that might be established, but rather with reducing Iran's influence in the region. The Saudi princes continue to consolidate the independence of their foreign policy in light of this tolerance demonstrated by the US, which prefers not to undermine the recently recovered climate of goodwill.

The differences between the three US presidents with regard to Saudi Arabia relate to both content and form. For Bush, the alliance with the Arab monarchies and the Saudi crown was based on the principle of subsidiarity, by which the US undertook a series of actions in the region that the other countries were to join. Consensus and the search for common positions were relegated to a secondary plane, since what was intended to be applied was a hegemonic multilateralism where the other players had to adapt their premises to Washington's interests. Moreover, the former president's strategy included reinforcing pressure on the Saudis and the rest of the partners on such sensitive issues as security, the fight against terrorism and democratic principles. The White House believed that only with direct intervention would it be able to put an end to threats.

Barack Obama posed a totally different doctrine for the countries of the Middle East and the Muslim world, including Saudi Arabia. The Democratic president was seeking to abandon the hegemonic approach of his predecessor in favour of a more conciliatory approach based on dialogue. The purpose was none other than to regain the trust of his Arab allies and foster security margins in the area. The Saudi problem arose because during those years the American administration did not feel entirely comfortable under Abdullah and the early years of King Salman's rule. The very inflexible and authoritarian approach proposed by the Saudi princes did not fit in with the US programme objectives, which advocated a more cooperative and adaptive perspective to the new circumstances. The American power conceived the Saudi monarchy as a point of instability.

Donald Trump appeared at a time when the Saudi-American alliance was in a very delicate situation. The actions of the Bush administration meant that most Arab regimes no longer saw the US as a regional security enforcer. Differences between Obama and his Saudi counterparts led Washington to increasingly perceive the Wahhabi kingdom as an element of distortion and imbalance. The new President decided to leave behind these preconceptions and restore the trust of both parties by cooperating on common points, such as the strategy to be followed with respect to Iran and in the main local conflicts. In short, Trump's attitude towards Saudi Arabia consists in paying full attention to those areas in which both sides obtain high returns through cooperation, leaving aside any issues in which differences may arise. This marks the beginning of a new phase in which the alliance's framework is demarcated in order to ensure that it survives

The most obvious result of the problems that have arisen between the two countries is that Saudi Arabia has become more independent in its foreign policy, while the United States has lost its influence within Saudi circles of power. Bilateralism remains in place because both states still need each other to face challenges that affect them, but the nature of the relationship has been totally altered. On the one hand, the Middle East and the Saudi kingdom are no longer a major concern of US diplomacy. On the other hand, the American power no longer plays a special role in Saudi strategies, which is less mindful of its traditional ally. The Saud family is now seeking to safeguard its status as a regional leader without US protection.

Bibliography

- ALLISON, Marissa. «U.S. and Iranian strategic competition: Saudi Arabia and the Gulf states» in *Center for Strategic & International Studies. CSIS. Burke Chair in Strategy*. December 6, 2010. Available at <https://www.csis.org/analysis/us-and-iranian-strategic-competition-3>.
- AL-QAHTANI, Fawz. «Continuity and change in United States' foreign policy towards Gulf region after the events of September 11th, 2001. A comparative vision between the Bush and Obama administrations» in *REPS, Review of Economics and Political Science*, Vol 4, N.º 1. 2019, pp. 2-19.

- AL-RASHEED, Madawi. «Mystique of monarchy: the magic of royal succession in Saudi Arabia» in Al-Rasheed, Madawi (ed.). *Salman's legacy. The dilemmas of a new era in Saudi Arabia*. London: Hurst & Company 2018a.
- AL-RASHEED, Madawi. «King Salman and his son: winning the USE, losing the rest» in Al-Rasheed, Madawi (ed.). *Salman's legacy. The dilemmas of a new era in Saudi Arabia*. London: Hurst & Company 2018b.
- BASKAN, Birol; WRIGHT, Steven. «Seeds of change: comparing state-religion relations in Qatar and Saudi Arabia» in *Arab Studies Quarterly*, Vol 33, Number 2. Spring 2011, pp. 96-111.
- BAXTER, Kylie; AKBARZADEH, Shahram. *U.S. foreign policy in the Middle East. The roots of anti-americanism*. London: Routledge, Taylor & Francis Group 2008.
- BLANCHARD, Christopher M. «Saudi Arabia: background and U.S. relations» in *CRS Report for Congress*. Congressional Research Service. The library of Congress. April 22, 2016. Available at <https://apps.dtic.mil/dtic/tr/fulltext/u2/1017814.pdf>
- BOWMAN, Bradley L. «Realism and idealism: US policy toward Saudi Arabia, from the Cold War to today» in *Parameters* 35, 4. Winter 2005/2006, pp. 91-105.
- BRANDS, Hal. «Barack Obama and the dilemmas of American Grand Strategy» in *The Washington Quarterly*, 39:4. Winter 2017, pp. 101-125.
- BRONSON, Rachel. «Understanding US-Saudi relations» en Aarts, Paul; Nonneman, Gerd (eds.). *Saudi Arabia in the balance. Political economy, society, foreign affairs*. London: Hurst Publishers. C. Hurst & Co. (Publishers) Ltd. 2006. Second impression.
- CHOKSY, Carol E. B.; CHOKSY, Jamsheed K. «The Saudi connection: Wahhabism and global jihad» in *World Affairs Journal*. May/June 2015. Available at <https://yaleglobal.yale.edu/content/saudi-connection-wahhabism-and-global-jihad>.
- COOK, Steven A. «The Middle East is now split between red states and blue states» en *Foreign Policy*. July 8, 2019. Available at <https://foreignpolicy.com/2019/07/08/the-middle-east-is-now-split-between-red-states-and-blue-states/>.
- FLORIG, Dennis. «Hegemonic overreach vs imperial overstretch» in *Review of International Studies*, Volume 36, N.º 4. Oct 2010, pp. 1103-1119.
- FÜRTIG, Henner. «Conflict and cooperation in the Persian Gulf: the interregional order and US policy» in *Middle East Journal*, Vol 61, N.º 4. Autumn, 2007, pp. 627-640.
- GERGES, Fawaz A. *The end of America's moment? Obama and the Middle East*. New York: Palgrave Macmillan 2012.
- GOLDBERG, Jeffrey. «The Obama doctrine. The U.S. president talks through his hardest decisions about America's role in the world» in *The Atlantic*. April 2016 ISSUE. Available at <https://www.theatlantic.com/magazine/archive/2016/04/the-obama-doctrine/471525/>.

- HEGGHAMMER, Thomas. «Islamist violence and regime stability in Saudi Arabia» in *International Affairs* 84: 4. 2008, pp. 701-715. DOI: <https://doi.org/10.1111/j.1468-2346.2008.00733.x>.
- HERNÁNDEZ, David. *La política exterior de Arabia Saudí tras la Primavera Árabe en Oriente Medio. Objetivos y estrategias regionales (2011-2016)*. Tesis doctoral. Madrid: Universidad Complutense de Madrid 2019. Available at: <https://eprints.ucm.es/51661/>.
- HUBER, Daniela. «A pragmatic actor- The US response to the Arab Uprisings» in *Journal of European Integration*, 37 (1). 2014, pp. 57-75. DOI: <https://doi.org/10.1080/07036337.2014.975989>.
- KITCHEN, Nicholas. «The contradictions of hegemony: the United States and the Arab Spring» in Kitchen, Nicholas (ed.). *After the Arab Spring. Power shift in the Middle East?* LSE Ideas special report. SRO11, May 2012. Available at <http://www.lse.ac.uk/ideas/Assets/Documents/reports/LSE-IDEAS-After-the-Arab-Spring.pdf>.
- KRIEG, Andres. «Trump and the Middle East: ‘Barking dogs seldom bite’» in *Insight Turkey*, Volume 19, N.º 3. Summer 2017, pp. 139-158. DOI: [10.25253/99.2017193.07](https://doi.org/10.25253/99.2017193.07).
- LEGRANZI, Matteo. «Shaking things up: Gulf security after the Iran deal» in *INSSSL Defence Review 2017*. Published by: Institute of National Security Studies Sri Lanka 2017. Available at <http://www.nesa-center.org/wp-content/uploads/2017/02/Defencereview.pdf#page=51>
- LIPPMAN, Thomas W.; COLE, Juan. «U.S.-Saudi relations in the Era of Trump and Mohammed bin Salman» en *Washington Report on Middle East Affairs*. January/February 2019. Available at <https://www.wrmea.org/2019-january-february/what-now-for-u.s.-foreign-policy-and-the-crown-prince.html>.
- MARKAKIS, Dionysius. *US democracy promotion in the Middle East. The pursuit of hegemony*. London: Routledge, Taylor & Francis Group 2016.
- MASON, Robert. «Back to realism for an enduring U.S.-Saudi relationship» in *Middle East Policy*, Vol. XXI, N.º 4. Winter 2014, pp. 32-44.
- MIRZADEGAN, Amin. «Nixon’s folly. The White house and the 1970s oil price crisis» in *The Yale Historical Review*. An undergraduate publication. Spring 2016, pp. 40-57.
- OTTAWAY, Marina. «Iran, the United States, and the Gulf: the elusive regional policy» in *Carnegie Papers. Middle East Program. Carnegie Endowment for International Peace*, Number 105. November 2009. Available at https://carnegieendowment.org/files/iran_us_gulfi.pdf.
- POLLACK, Kenneth M. «Securing the Gulf» en *Foreign Affairs*, Vol, 82. Number 4. Jul- Aug 2003, pp. 2-16.

QUANDT, William B. «U.S. Policy and the Arab revolutions of 2011» in Gerges, Fawaz A. (ed.). *The New Middle East. Protest and revolution in the Arab World*. New York: Cambridge University Press 2014.

TOVAR, Juan. «¿Una estrategia coherente para una región en cambio? La política exterior de la Administración Obama y la Primavera Árabe». In *UNISCI Discussion Papers*, N.º 36. October 2014, pp. 29-50.

WEHREY, Frederic. «Saudi-US discord in a changing Middle East» en *Research Paper*. Arab Center for Research & Policy Studies, July 2015. Available at https://www.dohainstitute.org/en/lists/ACRPS-PDFDocumentLibrary/SaudiUS_Discord_in_a_Changing_Middle_East.pdf.

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The “Silver lining” methodology for the development of strategic foresight exercises

Abstract

Innovation consists of producing new and more effective solutions to old problems, thanks to technological development. Nowadays, many foresight projects still use methods and techniques that belong to the past century; consequently many think-tanks are still solving old problems with old methods. In this article we are going to introduce an example of innovation in the field of the strategic analysis of future scenarios. The *Silver lining* methodology is designed to help strategic analysts envision and analyse the set of possible future scenarios that can influence the development of a strategic plan. *Silver lining* is a flexible methodology which facilitates the rapid collection and processing of data provided by a range of experts. We use artificial intelligence procedures to process these expert opinions and gather all of them into a single group answer. The methodology has been validated by performance of numerous foresight exercises conducted by the Spanish Institute of Strategic Studies.

Keywords

Strategy, foresight, methodology, futures scenarios, innovation

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Strategic foresight planning

We live our day-to-day lives constantly concerned about the present, the here and now. When we shift that concern to the near future we begin to discover the need for short-term planning or tactical planning. We could say that short-term planning consists of the ordering of tasks or actions with the intention of reaching a specific goal. Planning a weekend trip, participating in a military mission, developing the model for a new car, or even writing this article are all part of tactical or short-term planning.

When our focus shifts from the pursuit of specific objectives to achieving general objectives belonging to a higher sphere, we begin to move into the field of strategic planning. Maintaining a certain social or economic status, a company's business competitiveness or a nation's defence model are all part of strategic or long-term planning.

Our concern for the present means that we pay more attention to tactical planning than to strategic planning. One gets the impression that strategic planning is relegated to a second level compared to tactical planning, and that our activity is almost exclusively geared to the achievement of short-term objectives. In reality, this is not the case. What happens is that we pay more attention to the tangible reality, to the tasks that concern us, than to the ultimate or strategic goal on which we are focusing our tactical planning.

All objectives of a tactical nature obey an objective of a strategic nature; what happens is that sometimes this last objective is taken for granted or is intermingled with other objectives of the same nature.

In terms of its temporality, it seems that first comes "the day to day" and then the future; but this should not be the case, since the future is yet to be built, it is not a deterministic or inexorable future. For this reason, we should be concerned about the future in order to focus the actions of the present on the achievement of future objectives. Consequently, strategic planning should prevail over tactics. That is to say, first the general strategic or long term objectives are set out and next, in order to achieve them, the partial or short term plans are formulated, bearing in mind throughout their development that they are all oriented towards the achievement of strategic objectives.

Objectives of strategic planning

From the smallest organisation with just one person to the largest company or organisation with thousands of workers, all of them express their objectives in terms of strategic planning and tactical planning (in that order).

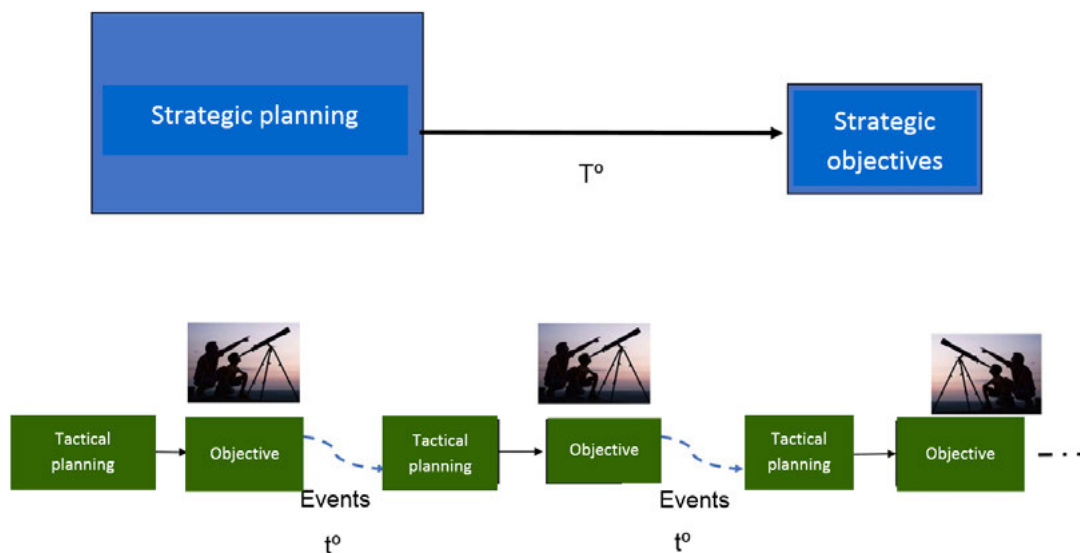
Strategic planning often seems to be less important than tactical planning because its objectives are implicit and not formally or explicitly expressed. Individuals do not formally document or communicate their strategic plans, but they tend to do so with

tactical planning, such as when they have to prepare a budget for a trip or when they book flights or accommodation after the budget has been accepted, or when they make a list of what they will need to pack. All these actions involve calculation and note-taking activities that are present in our memory, while the strategic objectives that prompted us to carry them out took only a few minutes of reflection.

On the other hand, organisations that move in a competitive or risky environment are forced to constantly innovate and revise their strategic plans and they also need to make their strategic objectives explicit in a formal way so that the governing body of the organisation is aware of them, shares them and aligns its decisions around these objectives. As events unfold and the scenarios with which the organisation is faced change, the strategic objectives must be reviewed and, consequently, all strategic planning must be revised (Castillo, 2012a).

Therefore, stability, coherence, collectivity and competitiveness are the main characteristics that mark strategic plans in an explicit and formal way.

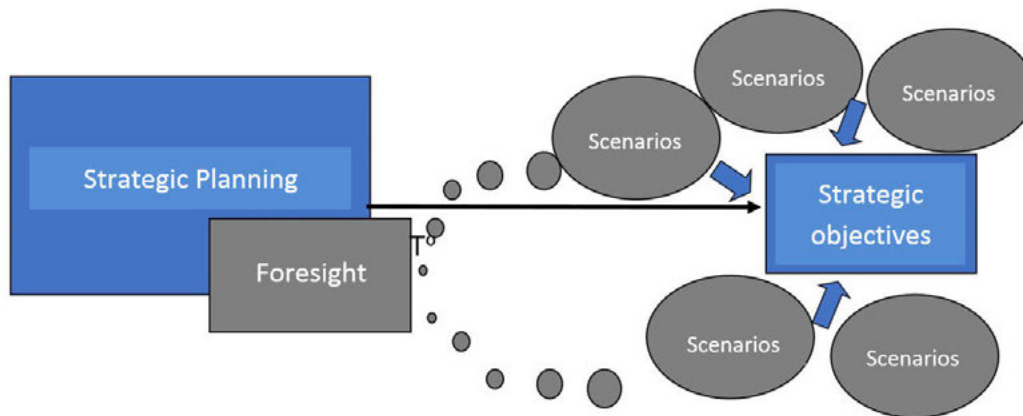
Large national and international companies regularly update their strategic plans at intervals of no more than five years. The time period for updating strategic plans depends on the stability of the system in which they are developed. In stable systems, it is possible to shorten the updating period of the strategic plan considerably, while in unstable systems exposed to variability, there is a need to check that the strategic plan is adjusted to the succession of scenarios modified by unforeseen events. Accordingly, strategic planning places special emphasis on the objectives to be achieved and on the means and ways of achieving them, whereas tactical planning focuses on achieving short-term objectives, without losing sight of and always geared towards achieving strategic objectives.



The relationship between strategic and tactical planning

On the other hand, foresight aims to foresee possible futures and the possibilities they present to us.

Although foresight and strategic planning are intimately related, it is important to distinguish between the two. Foresight, as such, asks what can happen and what can be done. Strategic planning, however, starts with action itself, since it asks what am I going to do and how am I going to do it. Strategic planning needs foresight to complete the analysis of possible futures before taking action.



The relationship between strategic planning and foresight

The analysis of possible scenarios plays an essential role, since the achievement of strategic objectives will be strongly conditioned by the characteristics of the scenario that ultimately becomes a reality in the future.

Foresight

Foresight is defined as the science of studying possible futures within the field of strategic planning (Bas, 2013). An organisation turns to Foresight to analyse which of the possible futures best suits its interests.

The true usefulness of Foresight is based on its capacity to drive strategic decisions, with the intention of achieving a desired future.

Foresight analysis allows one to visualize possible undesired future scenarios that could be avoided if a series of smaller decisions are made that can redirect the future towards a more favourable situation.

Participants in a foresight study

The essence of Foresight lies in collective reflection, which is why it is necessary to have teams of people who carry out the processes described in classic foresight methodology.

Traditionally, foresight studies are conducted by two groups with different profiles and specialisations. The first group is made up of analysts who belong to the organi-

sation and have a perfect knowledge of its needs and objectives. The second group is made up of experts who are usually independent and have extensive experience in the areas on which they are consulted.

The expert group is comprised of people with experience in the field of study, whose mission is to make informed estimates, which will be contrasted with the opinions of other experts with a view to carrying out the successive phases of the method. The experts must know the system in question, and have the capacity to analyse its flexibility to change and evolve.

The analysis group has the task of controlling the consultation process with the experts by confirming and consolidating the experts' individual responses, converting them into group feedback, but ensuring that their interpretation is unbiased at all times.

The scenario method

Foresight methodology seeks a desired situation for the organisation in all its possibilities, considering its inherent characteristics and competencies. The objective is to propose strategic actions in the context of the scenario in which they are developed.

A scenario is a set formed by the variables illustrating visions of a possible future situation. However, any set of hypotheses is often mistakenly described as a scenario.

Scenario planning consists of representing possible futures and the path that leads to them, looking for the strongest trends and points of instability that may occur within the organisation, in its rivals and in the general environment.

The scenario method is an ideal, comprehensive procedure for analysing and re-interpreting the information collected through other techniques, whether explicitly forward-looking or not.

Finally, when drawing up scenarios it is necessary to take into account the following:

- Carrying out a correct definition of the object studied and its scope.
- Updating environmental knowledge, both at the present time and with regard to its future prospects. This environment determines the variables that will make up the scenario.
- Definition in quantitative or qualitative terms of the behaviour of the variables. It is important to bear in mind that the information obtained has to underpin the development of a set of hypotheses that relate the causes to the behaviour of the different actors.
- Each set of hypotheses will usually result in a certain scenario. Scenarios should be mutually exclusive; however, this does not mean that the same conclusion can be reached with different scenarios.

- In order to serve as a basis for decision-making and for eliciting expert opinion, scenarios must be concrete, concise, understandable and possible.
- Finally, given that scenarios are the basis on which information is obtained, it is essential to reflect on the way in which the scenarios will be presented in writing (Biermann, 1986).

The Delphi method in scenario analysis

According to the mathematical scientist Norman Dalkey (Dalkey, 1972), the Delphi method is used to obtain the opinions of a specific group of experts in relation to a specific field or area of consultation. The process has the following characteristics:

- Feedback is anonymous. Opinions of members of the group are obtained by formal questionnaire.
- Iteration and controlled feedback. Several consultation processes are carried out on the same subject. Feedback from one round serves as input for the next.
- Group feedback. By applying statistical techniques, an appropriate aggregate of individual responses is achieved.

The Delphi method requires the participation of a group of experts and a group of analysts.

Its goal is to collect the opinions of a group of experts in order to arrive at a certain degree of consensus (Turoff, 2009).

This is achieved by sending several successive questionnaires to the group.

The method consists of the following stages:

- Presentation of the issue to be addressed through a questionnaire that poses specific, objective and to some extent measurable questions.
- Selection of the expert group. Regardless of the supposed knowledge of the subject to be dealt with, the expert must have a “future-oriented attitude”, namely the ability to face the future. Experts are interviewed by mail, so that their opinions are independent.
- Consultation and analysis of results. The first questionnaire is sent to a large number of experts, who, apart from answering the questions, must also evaluate their own knowledge of each question. In the second round of questions, the experts are informed of the results of the first round and asked to respond again, justifying their response where there is a strong divergence between them and the group. If necessary, the third round of consultation asks for comments on the divergent aspects. A fourth round allows for an average consensus opinion and a range of differing views.

Cross-impact analysis

One of the shortcomings of the Delphi method is that it does not take into account interaction between events. In order to solve this problem, the Cross Impact (X-I) method was developed, which not only takes into account the opinions expressed about individual events but also the interdependence of events. It therefore provides a more global vision in line with the aims of Foresight.

This method seeks to determine the changes that can occur in certain hypotheses due to the simple and conditioned probabilities they possess caused by their interactions.

Under the umbrella term of Cross Impact, other methods have appeared that simplify its application, such as the SMIC techniques (Duperrin, 1975) (Duval, 1975), or ExplorSIM, whose objective is the search for the most probable of all possible future scenarios by simplifying the generic calculation of the Cross Impact method.

The stages of the cross-impact method can be described as follows:

- Formulation of the hypotheses. Due to the large number of scenarios generated from a large number of hypotheses (2^n), it is not possible to establish a large number of these.
- Selection of the experts. As with all expert methods, a selection of experts is needed who not only have a broad knowledge of the subject matter, but also a prospective attitude.
- Probability of the scenarios. All possible scenarios are ordered according to the greater or lesser probability of their occurrence, starting with the most probable up to a certain limit of accumulated probability.

Evaluation of the choices and their associated strategic options.

Adjusting Bayes' conditional probabilities

This consists in applying the formulas derived from Bayes' Theorem to determining the so-called conditional probabilities.

An overview of classic foresight methodology

The generic phases into which the strategic planning process using foresight procedures can be divided can be summarised as follows:

- Presentation of the problem and analysis of key events.
- Selection of the expert group.
- Consultation with experts on the probability of occurrence of the key events.
- Application of the Delphi method to bring the expert group to a common assessment of the estimated probabilities.

- Consultation with experts on the conditional probability of the occurrence of key events using the cross-impact technique.
- Application of the Delphi method to lead the expert group to a common understanding of estimated probabilities.
- Use of Bayes' theorem to perform an "a priori" probability adjustment.
- Selection of the most probable scenarios within the wide spectrum of scenarios.
- Comparison of the probabilities obtained for each scenario and selection of the most likely ones.

Initially the group of analysts selects the issue to be studied and provides a list of possible events related to the future scenario.

The expert group rates the influence of events in terms of probability of occurrence. The Delphi method (Dalkey, 1972; Linstone, 2010) is used to lead the group to a common response. Because of the use of conditioned probabilities, it is necessary to apply Bayes' theorem to adjust them accordingly. Analysts then proceed with the collection of scenario probabilities. The scenarios with the highest probability of occurrence will be subject to a more detailed analysis. At the end of the process, a matrix is obtained, which represents the probabilities of the most representative scenarios and the events comprising them.

The following figure illustrates an example of a matrix with ten scenarios with the greatest likelihood of occurrence out of a possible two hundred and fifty-six (2^8) involving up to a total of eight events (listed in the first column). The last line expresses the probability of occurrence of each scenario in a hypothetical example.

| Ev | Scen1 | Scen2 | Scen3 | Scen4 | Scen5 | Scen6 | Scen7 | Scen8 | Scen9 | Scen10 | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|------|
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| Prob. | 0.067 | 0.059 | 0.048 | 0.045 | 0.037 | 0.029 | 0.022 | 0.022 | 0.021 | 0.014 | Σ Esc= | 1.00 |

Grey cells: the event does not exist

Grey cells: The event does not exist. Probability of scenarios

According to the axioms of probability, the sum of the probabilities of all the scenarios that can be generated with the participation of the eight events has to be equal to the unit.

Criticism in relation to the application of classic methods in Foresight

There are certain flaws in the classic prospective method which have been the subject of criticism from the scientific community (Hsu, 2007). The following is a list of the most relevant issues:

- Probability is defined as the relationship between the number of times an experiment has a positive result and the total number of possible cases. In terms of strategic planning, the use of probability as a means of measurement does not seem appropriate, as the situation or scenario has not occurred before and the total number of possible futures would be unpredictable.
- Although the Delphi method is applied with independent experts without direct communication between them, the use and dissemination of the average feedback in the successive four phases of the method can nevertheless condition the expert group’ freedom of response.
- Human logic, and especially that of the experts, when grading conditioned probabilities does not naturally accept the adjustment that must be made when formally applying Bayes’ theorem on conditioned probabilities.
- Although from a quantitative point of view it is possible to discern which of the scenarios has a higher probability, the poor resolution between them makes the certainty of its occurrence disappear. An illustration of this can be found in the previous figure where the probability obtained for Scenario 1 is 6.7% and for Scenario 2 is 5.9%. In quantitative terms the probability of the former is higher, yet it is almost guaranteed that neither will happen.
- With the application of this procedure, we are not aware of the more sensitive events on which action could be taken with the aim of consolidating or avoiding a given scenario.

The “Silver lining” methodology

Silver lining is the name given by the creator and author of this article to the methodology for conducting foresight exercises based on fuzzy techniques for the elaboration of expert opinions. Some of the benefits of these techniques

were published in a previous article (Castillo, 2012b)¹, techniques that are now integrated into the processes of the methodology and detailed in the work «*Planeamiento estratégico. El diseño del futuro a través de las opiniones de expertos*» (Castillo, 2015).

This methodology is intended to provide an alternative solution to the formal difficulties presented by the application of traditional procedures when carrying out foresight exercises, but without losing sight of the general objective for which forecast techniques had been traditionally applied.

The aim is to make foresight exercises affordable in terms of time and cost by processing expert opinion using procedures based on innovative technologies.

Silver lining is an adaptable tool that provides the manager-strategist with the possibility of obtaining information by processing the opinions of a group of experts with the aim of supporting their decisions. In this way a manager can make decisions in an active and justified way aimed at adopting attitudes and measures to consolidate or avoid future scenarios.

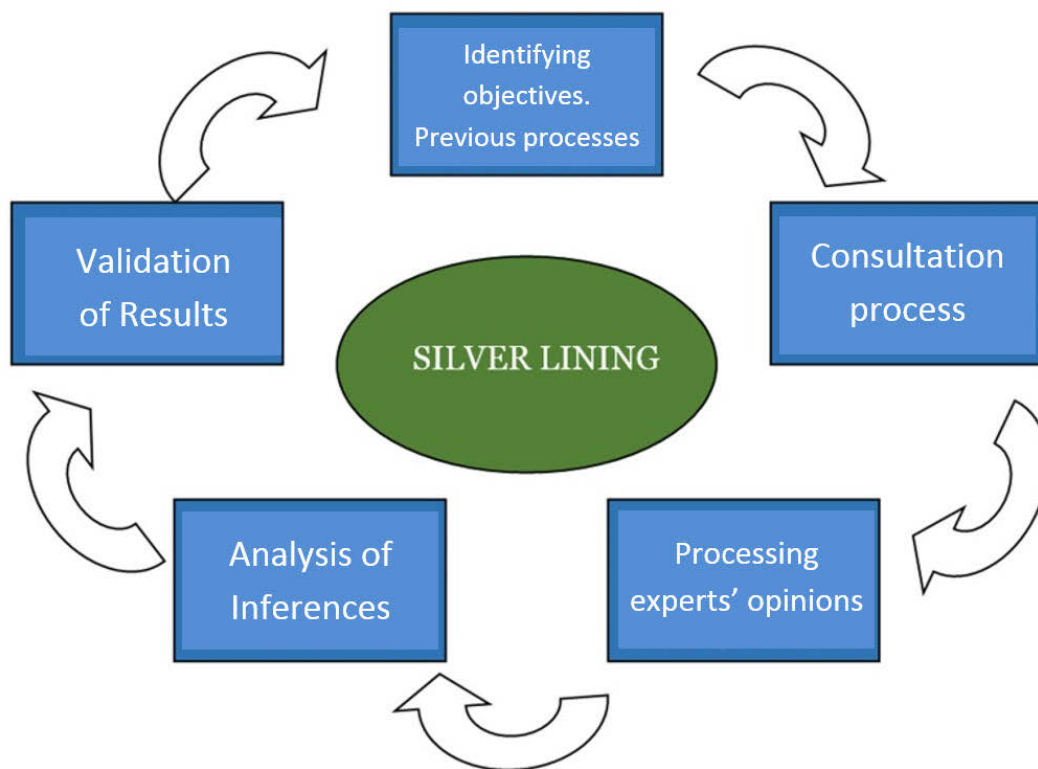
According to the positive idea of constructing a future from a diversity of events, the author has entitled the methodology “Silver lining”, a term that conveys hope and light after the storm.

Phases of the Silver Lining Methodology

The general procedures of the Silver lining methodology are as follows:

- Identifying objectives. Preparation and previous processes
- Consulting experts
- Processing experts’ opinions
- Analysing inferences
- Validating results

¹ It is possible to view the content of this article in its entirety at http://www.ieee.es/Galerias/fichero/Revista_Digital/RevistaIEEE_Num_o.pdf.



Silver lining general procedures

Normally, anticipatory foresight exercises are interlinked. The centres or departments that carry out this type of study generate foresight exercises on a continuous basis. There is feedback between successive exercises. Thus, isolated exercises that do not provide continuity in the analysis of the future would not be consistent with the ultimate objective of Foresight. Hence the need to create foresight centres or departments in large organisations or companies, providing continuity in the adaptation of strategic plans to future scenarios analysed through foresight.

Participants in a foresight study

Traditionally, two groups have been involved in carrying out a foresight study: analysts and experts.

The *Silver lining* process requires a new group of participants who know how to extract solutions from new technologies that facilitate the foresight process. This is the so-called group of “ICT Specialists”, who are given the responsibility of collaborating with the analysts in the preparation of scenarios, consulting experts via the Internet, selecting sensitive events after the first round of consultations with the experts, extrapolating scenarios with neural networks and obtaining the group feedback with fuzzy logic.



Group of experts



Analysts



ICT Specialists

Participants in a foresight study

Methodology Processes

Identifying objectives. Preparation and previous processes

1. Selection of scope, range and time frame
2. Identifying the stability of the system or environment
3. Selection of participants and job profiles
4. Selection of expert group
5. Evaluation of expert group
6. Selection of events

Organising consultations

1. Drafting of questionnaires. Round 1
2. Consultation. Round 1
3. Qualitative data processing. Round 1
4. Selection of sensitive events
5. Preparation of questionnaires. Round 2
6. Consultation. Round 2
7. Qualitative data processing. round 2
8. Confirmation of sensitive events

Processing experts' opinions

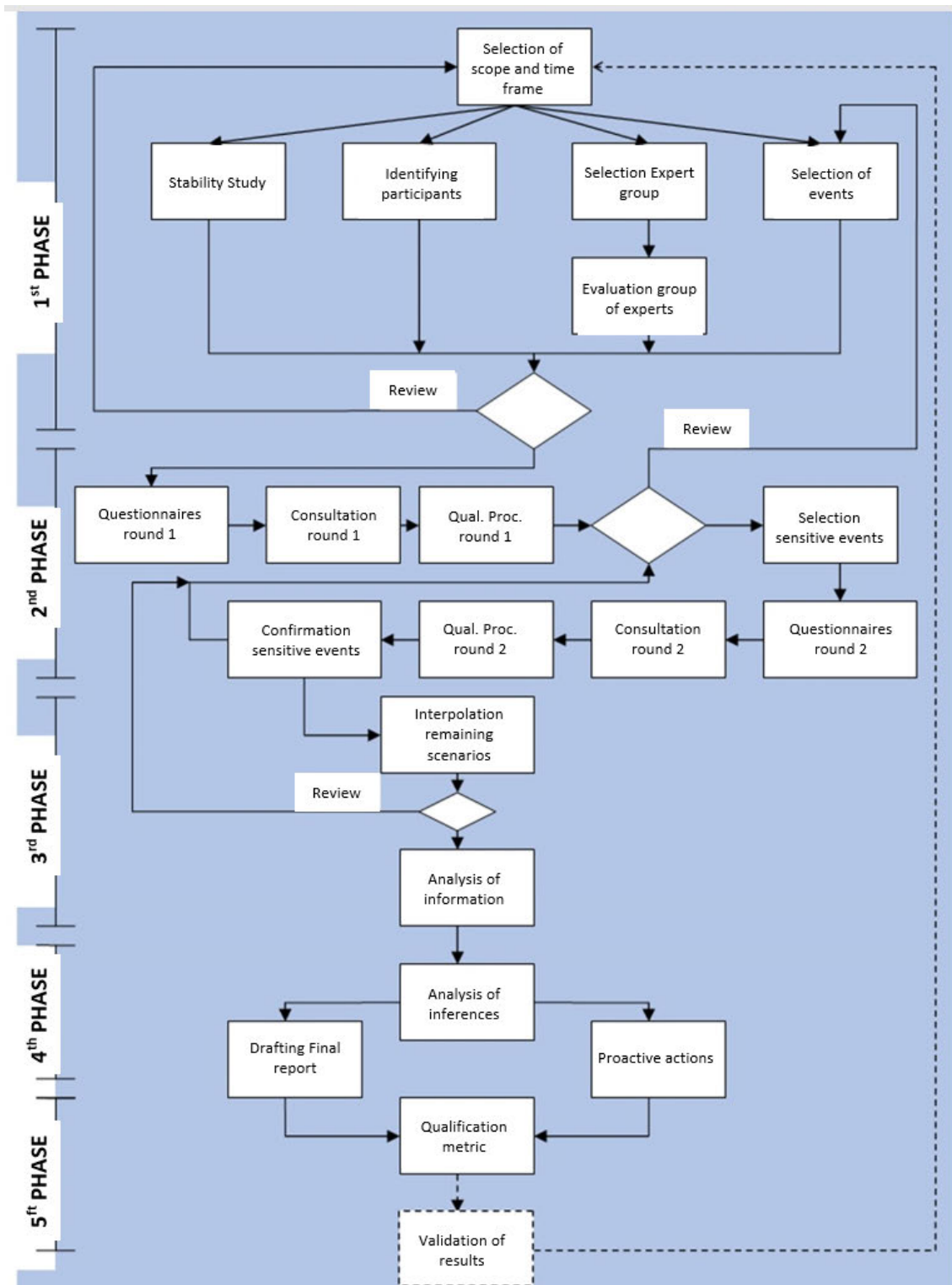
1. Interpolation and validation of opinion on remaining scenarios
2. Information analysis

Analysis of inferences

1. Analysis of inferences from environment
2. Drafting final report
3. Proactive actions

Validating results

1. Qualification Metric Methodology Application
2. Validation of results



Silver lining flow chart

Most of the methodology processes are not carried out sequentially.

The processes included in the first phase ‘Identifying objectives. Preparation and prior processes’ may be developed almost simultaneously since they are activities that do not require any input from previous processes. Most of them are based on the selec-

tion of the scope and time frame of the study. The evaluation of the group of experts can only be done after the selection of the group components.

Once the first phase of the methodology has been completed, it is important to consider whether the appropriate foundations have been laid for the exercise to proceed, or whether some of the previous processes ought to be reviewed, the scope of the study reduced, the number of experts increased or whether the study should be discarded altogether due to the instability of the system as a whole for which a foresight study cannot be guaranteed with any degree of certainty.

The processes included in the consultation phase of the methodology are sequential, that is to say, each one receives information from the previous one, with the exception of those cases in which an incorrect selection of the event has been detected or there is certain ambiguity in their interpretation by the experts. In the latter case, it may be necessary to reconsider the selection and definition of the events that may be part of the scenario in the first and second rounds.

In the third phase of the methodology the opinion of the experts is processed and the knowledge elicited from the experts is interpolated to the rest of the scenarios not consulted and the information is analysed. An analysis of inferences is conducted in the fourth phase of the methodology which is composed of three tasks that can be developed simultaneously.

Finally, the fifth phase of the methodology is focused on checking the quality and validity of the exercise. The first activity is carried out at the end of the foresight exercise while the second is extended over a period of time and aimed at verifying whether the foreseen future is materialising in the way it was expected. This latter activity is recursive, since it will encourage a new study in the event that the forecast has been wrong or the course of events has changed the initial premises.

Selecting scope, range and time frame

One of the first activities at the beginning of a foresight exercise is the selection of the goals of the study. To do this, it is necessary to define the problem to be addressed and to frame it within a specific time frame. Let us not forget that our society operates in a dynamic system in which one of the main variables is time and the other is the set of events or actions that can influence it. When you set a time frame, you are specifying a period of time in which certain events are expected to have an influence.

The selection of the scope outlines and delimits the problem. Statements for a foresight project such as “The technological future in Spain in 2025” only define the scope. Starting a foresight project with this sole delimitation will lead to ambiguity and lack of definition. This does not preclude the exercise, since it can be carried out, but the results will be as extensive and general as the statement of the exercise. It is therefore necessary to define the range of the study within the scope described. For example, we could specify the statement of the previous example with “Influence of the Spanish automotive industry on the Spanish technological future in 2025”. The scope of the

study has thus been limited and possible scenarios will be obtained that are limited to the automobile industry within the Spanish technological environment.

From a strategic perspective, Foresight has always been linked to a distant time frame because it goes hand in hand with Strategic Planning. Notwithstanding, foresight techniques can be applied to shorter periods of time. Specifically, they can be applied in decision-making procedures regardless of the time period in which the decision is to be made. Decision on a business merger that can be considered in a few weeks, the international expansion of a company due to a specific window of opportunity, the investment in certain assets in the stock market, or a political decision in response to an unexpected economic situation are all examples that require a foresight study and are not framed in a distant timescale, although they fall within the framework of strategic planning.

Identifying the stability of the system or environment

Identifying the issue that is the subject of foresight is not sufficient for describing the environment and its evolution. It is essential to know whether the issue under consideration is part of a system that is deemed stable or whether, on the other hand, the system is subject to multiple fluctuations due to uncertainties that may or may not be quantifiable.

The lack of stability of the system or uncontrolled instability may mean that the foresight exercise should not be carried out or that its scope and reach should be reduced to sub-problems in which instability is limited. If a foresight exercise were carried out on a system with uncontrolled instability, the result would only be valid within a short period of time. This circumstance may need to be acknowledged and justified in the results of the study.

At the end of this process, the system should be qualified as “stable”, “unstable” or “chaotic” and the reasons provided in support of whichever qualification is selected.

Selection of participants and job profiles

As explained in section 4.2 “Participants in a foresight study”, experts, analysts and ICT specialists should be included in the foresight study.

It is possible that the agency that decides to undertake this type of study will have all three groups of participants, which would make the project more adaptable and compartmentalised. In certain organisations, the analysts may also act as experts, or the analysts may also assume the role of data processors as ICT experts. In both cases, although there may be a certain economy of resources, it is possible that the results obtained may be biased or that the efficiency of the procedure may be negatively influenced. If the analysts were to take on the experts’ tasks, this would reduce the scope of experience on which the answers are based, almost to the point of invalidating it. On the other hand, the overlap between the roles of ICT specialists and analysts would also lead to limitations in the technological resources that could be employed.

At the conclusion of this methodology process, the participants and their job profiles should be identified, justifying the reassignment of tasks between groups, as required.

Selection of the expert group

At this point in the methodology, two questions arise: Who should we select as an expert, and how many experts do we need?

As far as the first question is concerned, we must rule out the choice of friends or acquaintances simply because we have a fluid relationship with them. We should also rule out analysts, who at some point may be influenced by the very management of the reflection process.

In the first instance, personnel should be chosen with experience in the field of prospective analysis and with special skills in discerning consequences and interactions.

People need to receive a certain reward for their work; this is inherent in human psychology. Experts can be rewarded for their participation in the form of financial compensation, or in the form of acknowledgement, appreciation and increased prestige for participating in this type of exercise. Whatever the means of compensation used, it must ensure that experts are sufficiently motivated to focus their undivided attention, albeit on a one-off basis, when responding to the questionnaires.

The number of experts ought to be sufficient to generate feedback that is appropriate to the problem in hand (Ludwig, 1997)². A minimum of fifteen experts is desirable and will depend on the type of exercise, the maximum being determined by the possibility of handling the entire foresight process smoothly.

On completion of this process, a list of experts will have been obtained, the reasons for their selection and the number of experts that would be desirable.

Evaluation of the expert group

The experts are assessed individually, since the aim is not to form a team but to extract individual opinions from each of them.

In validating the choice of the expert group, the following factors will be taken into account:

- The result of the validation of their opinions in previous exercises
- Their experience
- Their prestige
- Their social intelligence
- Their intrapersonal intelligence

² To complete Ludwig's contribution (Ludwig, 1997), we can affirm that the ideal expert group would be composed of a number of experts with the capacity to generate answers whose judgment would be representative with regard to the problem in question and who possess a homogeneous and high level of social experience and intelligence.

If the organisation has a database or history of previous foresight exercises in which the expert has participated, it will be able to check the validity of their opinions over time. This may be the main method of evaluating the quality of an expert.

In the case where an expert has been selected for the first time, the other four factors should be analysed. Both their experience and the accuracy of their opinions can be ascertained through their curriculum vitae and through references from their participation in other organisations.

Intrapersonal intelligence reveals the individual’s ability to have a real image of his/her own person, while social intelligence reveals the ability to foresee relationships and consequences of events that occur in a given scenario. Both intelligences are measurable by means of an “ad hoc” testbed.

It is recommended that any organisation that conducts foresight exercises on an ongoing basis should have a department or team of experts in which to conduct its own selection tests.

At the end of this process of the methodology, the suitability of each of the experts in the group should have been ascertained (Castillo, 2019)³.

Selection of events

The definition of events is a fundamental part of the foresight study. A good definition of these events will ensure that the scenario is uniformly understood by all the participants, while an ambiguous definition will not allow the exercise to progress quickly. For this reason in foresight exercises in which *Silver lining* is employed, the validity of the definition of the events must be corroborated after the first round of consultations with the experts. Should it be concluded that the definition is either deficient or ambiguous, a return to the process of defining the events will be considered necessary.

Events are happenings that influence or characterise a certain scenario. Events must be independent of each other and should not, in principle, be the cause or consequence of other events that are part of the same scenario. For example, if A is part of B, when B happens it is possible that A will also happen.

If both events are intended to appear in the scenario, it is quite possible that there is an event C that encompasses both of them; therefore, it is preferable that event C be part of the scenario instead of events A and B.

There are two initial and normally mutually exclusive situations when it comes to choosing events:

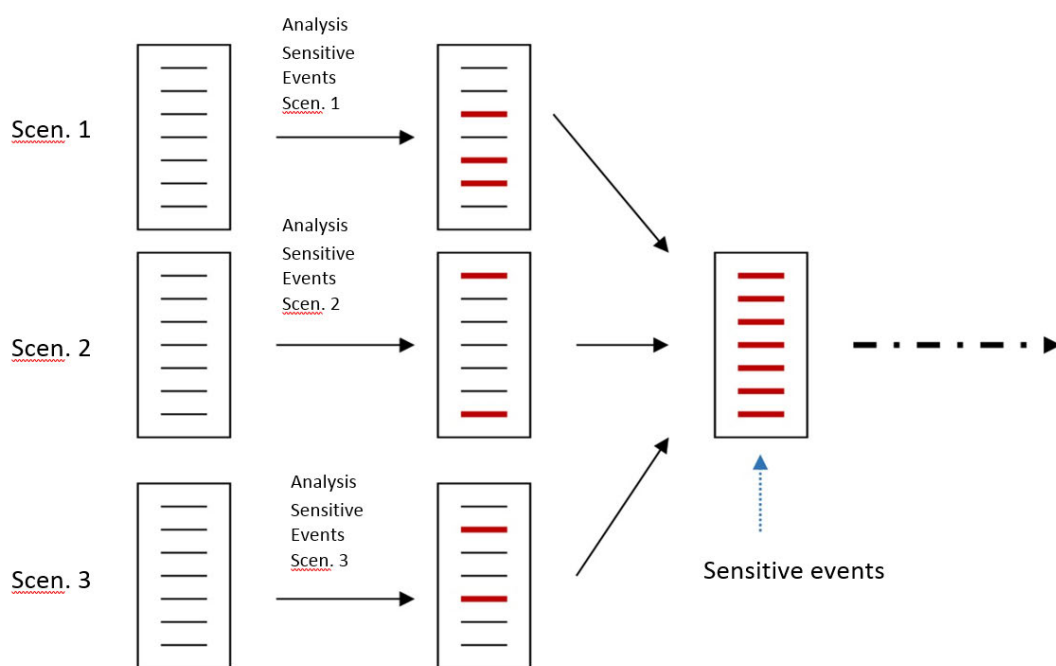
- The analysts know the main events of the problem in hand.
- The analysts have a general idea, but are unable to pinpoint the main events

³ The opinion article entitled «The profile of the perfect strategist» sets out the characteristics that are required of a genuine expert and how to select one.

In the first case, the group of analysts selects the events; while in the second case, they need support in order to make their selection. In this second case, it would be advisable to carry out a brainstorming exercise with the group of experts.

This exercise consists of asking the group of experts a generic question, in which it is put to them that with a degree of imagination and based on their experience they list some of the key events that would form part of the study problem (Castillo, 2015).⁴

The number of events conditions the total number of scenarios that can be generated in a foresight exercise. With seven events, 128 scenarios can be generated (2^7). This could limit the study of complex scenarios in which it is necessary to handle a higher number of events. Should it be necessary to work with a significant number of events, it is possible to group the scenarios into cascades. This would involve carrying out several linked studies on scenarios that are related through new events and sensitive events. The process would consist of prioritising the list of events and dividing it into groups of seven events. Subsequently, experts would be consulted with a view to arriving at the sensitive events for each of the groups of scenarios consulted.



Cascading scenarios

In the case of sensitive events, a new list of seven events would be compiled and the process outlined in *Silver lining* would be continued until its completion.

By way of comparison, traditional procedures use complex algebraic processes to reduce the number of events by analysing dynamic scenarios (Turoff, 2015).

4 In (Castillo, 2015) Case Study 3 (Chapter 11 of his doctoral thesis) a previous brainstorming exercise is developed for the selection of events.

Drafting of questionnaires. Round 1

In a typical case where it has not been necessary to undertake the process of generating cascade scenarios, the analysts will have generated a list of events with a number not exceeding seven that could form part of the scenario for consultation.

The analysts will order these seven events in order of possibility of occurrence and, in the event of equality, importance will prevail. The ordered list will be sent to the ICT specialists, who will draw up fifteen out of the one hundred and twenty-eight possible scenarios in which a representative mix of the most important and the least relevant events appears.

The consultation process. Round 1

Today, ICTs play an important role in carrying out consultations. Internet-based mobile technologies facilitate the delivery of information to individuals in real time and their feedback is either synchronous or asynchronous depending on the availability of the user.

Furthermore, when consulting a group of experts, it is necessary to ensure secure access and individualised feedback. To this end, it has proved extremely useful to send an e-mail with a personalised link or access that, by correctly identifying the experts, allows them to navigate between the different questionnaires on which they are consulted.

José Miguel Castillo Chamorro Closing date 28 march 2011

Descripción del ejercicio Eventos Descripción eventos Cuestionarios

C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20

Questionnaire 20

Scenario events

| |
|--|
| Event 1. The Council of Europe unanimously decides to implement a common European defence, in accordance with Article 42(2) of the Treaty on European Union of Lisbon |
| Event 2. The EU establishes a new single civil-military strategic approach structure for CSDP operations and missions by increasing coherence between civilian and military issues as this is the specific added value of the Union. |
| Event 3. The European Union has the capacity to meet the level of ambition set by the 2008 'Council Declaration on Strengthening Capacities' for its CSDP military operations. |
| Event 4. The main ongoing initiatives in the field of military capabilities are successfully completed, taking as a reference the Capability Development Plan (CDP) approved by the EDA in July 2008. |
| Event 5. On the basis of operational and economic efficiency criteria, projects are carried out to develop and optimise the EU's military capabilities, exploring the pooling of efforts, specialisation and cost sharing. |
| Event 6. A European Defence Technological and Industrial Base (EDTIB) is achieved, capable of responding to the requirements of the EU Member States and supporting the CSDP, based on the strategy established by the EDA in May 2007 |
| Event 7. In accordance with the "Civilian Capability Goal 2010" the EU's ability to anticipate, react, plan and execute its civilian missions is enhanced, to ensure that they are deployed rapidly and effectively |

Grade the possibility of existence of this scenario:

C1: ✓ C2: ✓ C3: ✓ C4: ✓ C5: ✓ C6: ✓ C7: ✓ C8: ✓ C9: ✓ C10: ✓ C11: ✓ C12: ✓ C13: ✓ C14: ✓ C15: ✓ C16: ✓ C17: ✓ C18: ✓ C19: ✓ C20: ✗

Consulting on a given scenario

On the other hand, the consultation aims to be as intuitive as possible; so that on simply reading the questionnaire, which contains the scenario with the events that comprise it, the expert only has to select from a drop-down list if he/she considers that the possibility of the scenario occurring is “Very High”, “High”, “Medium”, “Low” or “Very Low”.

Qualitative data-processing. Round 1

Once the deadline for feedback from the experts has passed, the responses provided by the experts are analysed. A first analysis is made concerning the questionnaire and the expert's understanding of the process.

Regarding the questionnaire, the experts' answers are usually grouped according to a central value, which allows us to see a certain amount of variation.

| | | | | | | | | | |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Very High | 0 | 1 | 0 | 2 | 2 | 1 | 0 | 0 | 0 |
| High | 0 | 1 | 1 | 4 | 1 | 2 | 1 | 5 | 3 |
| Medium | 0 | 2 | 1 | 8 | 8 | 5 | 2 | 5 | 7 |
| Low | 2 | 6 | 5 | 0 | 3 | 5 | 4 | 4 | 3 |
| Very Low | 12 | 4 | 7 | 0 | 0 | 1 | 7 | 0 | 1 |
| Total | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |

Grouping of expert responses and their breakdown in a consultation process with 14 scenarios and nine experts (represented in each column)

As far as the expert's understanding of the process is concerned, it is also necessary to analyse whether there is any dispersion in his/her responses or whether most of them have the same qualification.

| Individual questionnaires results | | | | | |
|-----------------------------------|------|--------|-----|----------|-------|
| Very High | High | Medium | Low | Very Low | Total |
| 1 | 3 | 5 | 4 | 2 | 15 |
| 0 | 3 | 4 | 3 | 5 | 15 |
| 5 | 2 | 7 | 0 | 1 | 15 |
| 0 | 3 | 4 | 0 | 8 | 15 |
| 2 | 4 | 1 | 6 | 2 | 15 |
| 0 | 1 | 2 | 5 | 7 | 15 |
| 0 | 0 | 10 | 5 | 0 | 15 |
| 0 | 2 | 4 | 5 | 4 | 15 |
| 0 | 3 | 9 | 1 | 2 | 15 |
| 0 | 0 | 1 | 5 | 9 | 15 |
| 1 | 5 | 8 | 0 | 1 | 15 |
| 0 | 0 | 2 | 10 | 3 | 15 |
| 0 | 0 | 3 | 6 | 6 | 15 |
| 2 | 1 | 3 | 1 | 8 | 15 |

For example, in this figure we observe a range of responses from all the experts with the exception of the responses given by expert number 7, who has qualified the fifteen questionnaires exclusively between the values “Medium” and “Low”.

In an initial estimate, these two indicators confirm the quality of the selection of events and the questionnaire, as well as the suitability of including any given expert in successive rounds (in the previous case, expert 7 should not be included in the next round).

Once this assessment has been made, the experts’ answers need to be converted into rules, in the form

IF “Event_Num#Exists” And « EventoNum#_ Exists”

THEN “Possibility_Ocurrence_Value”

- The set of all the rules generated by the experts will form the fuzzy inference module.
- If we assume a total of fifteen questionnaires for the first round and a number of
- thirty experts, we get an inference module made up of four hundred and fifty rules.
- When we analyse the fuzzy inference module we can obtain the group’s opinion concerning the scenarios with a greater possibility of occurrence.
- Selection of sensitive events

Once the scenarios with the greatest possibility of occurrence have been obtained, the common events that make the scenario a good candidate for future materialisation are analysed. These common events are called sensitive events. Drafting of questionnaires. Round 2

- Starting from the sensitive events, new and different questionnaires from those used in the first consultation are made, with combinations of sensitive and other events.
- The Consultation process. Round 2
- Once the questionnaires have been collected, the experts are consulted following the same procedure as for the first round.
- Qualitative data processing. Round 2
- Once the deadline for the feedback from the experts has expired, this is processed qualitatively in the same way as for the first round of consultations.
- Confirmation of sensitive events
- Once the scenarios most likely to occur have been identified from the second round, the next step is to analyse the common events offering the greatest pos-

sibility of materialising. These events are then compared with those obtained from the first round.

Should the majority of these coincide, as is generally the case, the analysts verify and register the list of sensitive forward-looking events, which will provide the basis for the final report on the exercise.

Should they not coincide or if there is a certain discrepancy in the behaviour of the sensitive events, it would be advisable to reconsider their selection for the second round, or if necessary the selection of events from the first round.

Interpolation and validation of opinions on remaining scenarios

On completion of the first and second rounds of expert consultation, a total of thirty out of a possible one hundred and twenty-eight scenarios have been explored. For the validation of the rest of the scenarios (the remaining ninety-eight) a neuronal network based on a multilayer perception is used (Castillo, 2015).

The network learns from the answers provided by the experts to the thirty scenarios. Once the network receives this information, the ICT specialists validate that the withdrawal of the remaining ninety-eight scenarios does not produce any scenario with a higher probability of occurrence than the thirty consulted by the experts.

In the event of any anomaly in the validation, the network can be retrained with a new topology in order to confirm the anomaly. If the anomaly is confirmed, the selection of sensitive events should be reconsidered. At this point, if a validation of the interpolations made by the neural network is needed, the analysts could propose a further round of consultations with the experts to verify that the responses provided by the neural network are endorsed by the group of experts.

Information analysis

With the information generated by the group of ICT specialists regarding the scenarios with the greatest possibility of occurrence, the analysts carry out an in-depth analysis of the individual characteristics of the sensitive events and their effects on the scenario as a whole.

The analysts select one or more characteristic scenarios and specify the appropriate premises for them to materialise, as well as examining the causes that could prevent these scenarios from taking shape in the future.

Analysis of inferences from the environment

Once the main characteristics of the selected scenarios have been analysed, and based on the hypothesis of their future materialisation, the influence and inference of this scenario on the social, political and economic environment is considered. Ac-

ordingly, a comprehensive panoramic picture is obtained of the scenario within its environment.

Drafting the final report

All the studies, analyses and ideas implemented and gathered during the foresight exercise must be reflected in the final documentation. This material is usually generated at three different levels:

- Executive Report: A one-page document, describing the objective of the study and its outcome.
- Informative report: This is the document that will be circulated to all levels. The content of the report must be clear, concrete and justified.
- Technical report: This document presents, in a structured format and in accordance with the steps of the methodology, all the data obtained from the experts and its processing, as well as the ideas generated by the analysts and ICT specialists. TIC.

Proactive actions

Carrying out a foresight exercise is not a simple exercise in forecasting. It implies promoting action involving the implementation of the appropriate measures that will lead to the manager’s or governor’s consolidation or avoidance of scenarios.

Foresight departments or organisations are responsible for recommending actions and must give their reports the necessary momentum to ensure that their proposals reach the highest level of management.

Qualification of Metric Methodology Application

The last phase of *Silver Lining* includes a form that serves as a check-list to evaluate the rigour with which the foresight process has been followed in order to ensure that it meets quality standards and was carried out in full compliance with the methodology.

The result of the metrics set out in this section provides a fairly approximate idea, for both the foresight department and the manager, of the validity of the contents of the final report of the exercise.

The form presented in this section ends by rating the exercise with a “High”, “Medium” or “Low” level of reliability, depending on the weighted values assigned to the activities carried out during the foresight exercise.

| |
|--|
| <p><i>Silver lining</i> Methodology <u>Qualification Metric</u> Name of exercise: Date:</p> |
|--|

| | | |
|---|-----|------|
| Actions Phase 1: Setting objectives. Preparation | | |
| From the stability study, it appears that the system is "Stable" | (*) | 0,7 |
| From the stability study, it appears that the system is "Unstable" | | 0,5 |
| The number of experts is less than 15 | | 0,3 |
| The number of experts is greater than 15, but still a manageable number | | 0,5 |
| The experts have not been evaluated | | 0,2 |
| The experts' qualifications are well known. | | 1,5 |
| The experts' qualifications are moderately well known | | 0,7 |
| The experts' qualifications are not well known | | 0,4 |
| The number of events is equal to or less than seven | | 0,5 |
| The number of events is greater than seven | | 0,3 |
| Actions Phase 2: Consultation process | | |
| Web technologies have been used for the consultation process | | 0,5 |
| In round 1 a certain grouping of answers was observed | | 0,5 |
| In round 1 there was coherence in the individual answers | | 0,5 |
| The sensitive events were clearly identified in round 1 | | 0,5 |
| In round 2 the sensitive events were corroborated | | 0,8 |
| Actions Phase 3: Data-processing | | |
| The interpolation of scenarios was carried out successfully | | 0,5 |
| The interpolation of scenarios has been validated by the experts | | 0,5 |
| Actions Phase 4: Analysis of inferences | | |
| The information has been analysed | | 0,25 |
| An analysis of inferences with the environment has been conducted | | 0,25 |
| A final report has been produced in its three forms | | 0,25 |
| The final report has been circulated for information | | 0,25 |
| Proactive actions have been undertaken | | 0,5 |
| Actions Phase 5: Validation of results | | |
| Follow-up and validation initiatives have been scheduled | | 0,5 |
| The whole exercise took less than two months | | 0,7 |
| The whole exercise lasted between two and five months | | 0,3 |
| | | |
| Consultation qualification index number | | |

(*)Mark with an X the action performed during the exercise

Calculate the sum of the numerical factors of the actions carried out

| | |
|------------------|------------------------|
| Index number | Exercise qualification |
| Between 7 and 10 | High |
| Between 4 and 7 | Medium |
| Less than 4 | Low |

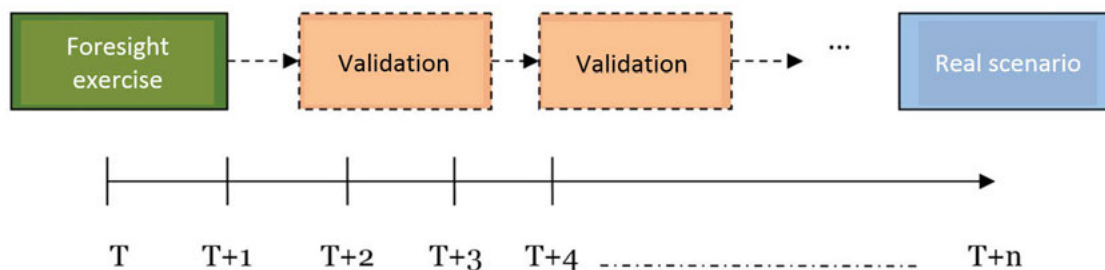
Validation of results

In the past, with the use of traditional methods foresight exercises lasted a long time, sometimes even years. Foresight must be dynamic and cannot be exposed to changes in the initial conditions of the study because of excessive delays in the dura-

tion of the exercise. The average duration of a complex exercise should be less than two months. Depending on the stability of the system under consideration, it should take no longer than five months. The activities that usually have an impact on the length of time spent on an exercise are:

- Specifying the objectives of the foresight study
- Selecting the expert group
- The experts’ answers to the questionnaires

Moreover, the coherence between the generated scenario and the real scenario needs to be validated. The scenario-based prospective method is normally proposed within a medium or long-term time frame, for this reason it is necessary to monitor the evolution of the events considered key to the materialisation of the scenario. Should the situation change over time, it is necessary to rethink the problem from a fresh approach that includes the new events that have occurred. For foresight exercises over a ten-year period, it is advisable to carry out a follow-up exercise on the evolution of the scenario every two years or when the events that affect the scenario vary, or when the stability of the system changes.



Comparing “Silver lining” with traditional methodologies

Traditional prospective methodologies are useful today, but the complexity of their mathematical-statistical methods and their rigour make the development of any prospective project difficult to the point of rendering it unfeasible on many occasions.

Information technology usually provides an almost immediate response to any social problem that arises. Mobile technologies, social networks and a long etcetera are a good example of technological response. However, if we try to make a list of the computer solutions that support the process of foresight, we will see that it is practically empty. There are programmes for the implementation of a specific process such as the MICMAC, but it is difficult to find computer applications that support the complex and iterative Delphi method based on probabilities and the cross impact method with its corresponding probabilistic adjustment due to the conditioned probabilities. From the point of view of information technology, the problem of anticipatory forecasting is posed in order to provide a precise solution to a problem that is *subjective* in nature and demonstrates *considerable variability* over time. This is most probably the reason

why the important process of anticipatory forecasting has not been addressed by IT developments to date, together with the fact that the structures of traditional methodologies do not facilitate technological support.

On the other hand, the connectivity provided by the use of the Internet facilitates all kinds of consultations with the experts, regardless of whether they relate to traditional methods or the *Silver lining* methodology.

Silver lining and the incorporation of technologies based on the processing of natural language labels simplify the problem and frame it exactly within the corresponding problem-solving classification: *a multivariable qualitative problem which is dynamic in its evolution, requires a quick solution and permits a certain margin of error that will be adjusted in the validation phase.*

The following table expresses the differential characteristics of the *Silver lining* methodology in comparison with traditional methodologies applied to the scenario-based prospective method.

| | Silver lining | Traditional methods |
|--|---|---|
| Type of calculation methods | Multi-value logic | Mathematical-statistical |
| Type of variables | Qualitative (Possibilities) | Quantitative (Probabilities) |
| Acceptance by the experts | High | Low |
| Evaluation of experts | Included in the methodology | Not included |
| Complexity of information processing | Low | High |
| Influence of group feedback | No influence | average |
| Resolution for differentiating between scenarios | Medium-High | Low |
| Analysis of sensitive events | Included in the methodology | Not included |
| Proactive Actions | Included in the methodology | Not included |
| Type of final report | Adaptive and pending valuation according to its evolution | Probabilistic. Does not explain validation milestones |
| Evaluation metrics of the process | Included in the methodology | Not included |
| Versatility in its application | High | Low |
| Exercise completion time | 2-5 months | 1 year or more |

Silver lining comparative table

Examples of the application of “Silver lining”

The future of CSDP by the year 2020

At the initiative of the Spanish Institute for Strategic Studies (IEEE.es), a project was launched at the beginning of 2010 to carry out foresight studies in various fields based on the opinions of groups of experts.

The application of conventional prospective methods was a laborious task not without complicated mathematical operations in the field of probability. The expert consultation process was lengthy, as the means of communication did not allow for an immediate response from the expert.

Through this IEEE initiative, the aim was to apply new technologies in the field of strategic planning and more specifically in the field of production and analysis of future scenarios through foresight.

The study was limited to the analysis of the future scenario for the development and implementation of the *Common Security and Defence Policy by the year 2020*⁵.

This study applied novel technologies ranging from consulting experts online through the Internet, the elaboration of expert opinions through blurred techniques, to the generation of the most possible scenarios based on pattern analysis through neural networks, all of which was guided by the processes established by the *Silver lining* methodology.

The result of the exercise was a convergence of expert opinions towards a clear scenario that could be expressed according to events. As a result, it was concluded that in 2020 “we will face a scenario in which structures will have been streamlined to enhance the planning and implementation of CSDP missions and the CFSP will have been developed in a coherent manner in accordance with the instruments provided for in the Lisbon Treaty”.

Qualification metrics in the application of the methodology

The following table calculates the reliability of the result of the exercise (Castillo, 2015)⁶.

| | | |
|---|---|-----|
| Silver lining Methodology | | |
| <u>Qualification Metric</u> | | |
| Name of exercise: <i>The future of the CSP in the 2020 timeframe</i> | | |
| Date: February-June 2010 | | |
| Actions Phase 1: Setting objectives. Preparation | | |
| From the stability study, it appears that the system is “Stable” | X | 0,7 |
| From the stability study, it appears that the system is “Unstable” | | 0,5 |
| The number of experts is less than 15 | | 0,3 |
| The number of experts is greater than 15, but still a manageable number | X | 0,5 |
| The experts have not been evaluated | | 0,2 |
| The experts’ qualifications are well known. | | 1,5 |
| The experts’ qualifications are moderately well known | | 0,7 |

⁵ The entire study can be consulted at http://www.ieee.es/Galerias/fichero/docs_analisis/2010/DIEEEA09-2010Estudio_prospectivo_futuroPCSD_UE2020.pdf.

⁶ Chapter 9 of the book contains a detailed explanation of how *Silver lining* can be used to process expert opinions and obtain group information.

| | | |
|---|---|------|
| The experts' qualifications are not well known | X | 0,4 |
| The number of events is equal to or less than seven | X | 0,5 |
| The number of events is greater than seven | | 0,3 |
| Actions Phase 2: Consultation process | | |
| Web technologies have been used | X | 0,5 |
| In round 1 a certain grouping of answers was identified | X | 0,5 |
| In round 1 there was coherence in the individual answers | X | 0,5 |
| The sensitive events were clearly identified in round 1 | | 0,5 |
| In round 2 the sensitive events were corroborated | | 0,8 |
| Actions Phase 3: Data-processing | | |
| The interpolation of scenarios has been carried out successfully | X | 0,5 |
| The interpolation of scenarios has been validated by the experts | | 0,5 |
| Actions Phase 4: Analysis of inferences | | |
| The information has been analysed | X | 0,25 |
| An analysis of inferences with the environment has been conducted | | 0,25 |
| A final report has been produced in its three forms | X | 0,25 |
| The final report has been circulated for information | X | 0,25 |
| Proactive actions have been undertaken | | 0,5 |
| Actions Phase 5: Validation of results | | |
| Follow-up and validation initiatives have been scheduled | X | 0,5 |
| The whole exercise took less than two months | | 0,7 |
| The whole exercise lasted between two and five months | X | 0,3 |
| | | |
| Consultation qualification index number | | 5,65 |
| | | |

| Index number | Exercise qualification |
|----------------|------------------------|
| Between 7 & 10 | High |
| Between 4 & 7 | Medium |
| Less than 4 | Low |

Towards a European Armed Force by the year 2020

In 2011, at the initiative of the Spanish Institute of Strategic Studies, a foresight study for the Analysis of a Common European Defence for the year 2020 was proposed.

More specifically, this foresight exercise was called “The EU’s Common Security and Defence Policy (CSDP) towards 2020 - Phase II of the Foresight Study”⁷.

7 The complete document on the description and conclusions of the exercise is available at http://www.ieee.es/Galerias/fichero/docs_analisis/2011/DIEEEA02_2011EstudioProspectivoSegundaFasePCSD_UE2020.pdf.

The study was carried out during 2011, and was a consequence of the foresight exercise carried out in 2010 and the strategic interest in the subject.

The *Silver lining* methodology permitted the exercise to be developed in a structured, dynamic and timely manner.

The experts’ feedback to the questionnaires converged into a clear scenario that can be expressed in terms of events.

Consequently it was concluded that there was a high possibility that by the year 2020 “*The EU would establish a new single civil-military strategic planning structure for CSDP operations and missions, increasing coherence between civil and military issues, as this is the specific added value of the Union; and that the main initiatives underway in the field of military capabilities would be successfully completed, based on the Capability Development Plan (CDP) approved by the EDA in July 2008*” (Castillo, 2015)⁸.

Qualification metrics in the application of the methodology

The following table calculates the reliability of the results of the exercise.

| <i>Silver lining</i> Methodology | | |
|---|---|-----|
| Qualification Metric | | |
| Name of the exercise: The future of the CSP by the year 2020 | | |
| Date: February-June 2010 | | |
| Actions Phase 1: Setting objectives. Preparation | | |
| From the stability study, it appears that the system is “Stable” | X | 0,7 |
| From the stability study, it appears that the system is “Unstable” | | 0,5 |
| The number of experts is less than 15 | | 0,3 |
| The number of experts is greater than 15, but still a manageable number | X | 0,5 |
| The experts have not been evaluated | X | 0,2 |
| The experts’ qualifications are well known. | | 1,5 |
| The experts’ qualifications are moderately well known | | 0,7 |
| The experts’ qualifications are not well known | | 0,4 |
| The number of events is equal to or less than seven | X | 0,5 |
| The number of events is greater than seven | | 0,3 |
| Actions Phase 2: Consultation process | | |
| Web technologies have been used | X | 0,5 |
| In round 1 a certain grouping of answers was identified | X | 0,5 |
| In round 1 there was coherence in individual answers | X | 0,5 |
| The sensitive events were clearly identified in round 1 | | 0,5 |
| In round 2 the sensitive events were corroborated | | 0,8 |
| Actions Phase 3: Data-processing | | |
| The interpolation of scenarios has been carried out successfully | | 0,5 |

8 Chapter 10 of the book contains a detailed explanation of the application of *Silver lining* for processing expert opinions and obtaining group information.

| | | | |
|---|------------------------|---|------|
| The interpolation of scenarios has been validated by the experts | | | 0,5 |
| Actions Phase 4: Analysis of inferences | | | |
| The information has been analysed | | X | 0,25 |
| An analysis of inferences with the environment has been conducted | | | 0,25 |
| A final report has been produced in its three forms | | X | 0,25 |
| The final report has been circulated for information | | X | 0,25 |
| Proactive actions have been carried out | | | 0,5 |
| Actions Phase 5: Validation of results | | | |
| Follow-up and validation initiatives have been scheduled | | X | 0,5 |
| The whole exercise took less than two months | | | 0,7 |
| The whole exercise lasted between two and five months | | | 0,3 |
| | | | |
| Consultation qualification index number | | | 4,65 |
| Index number | Exercise qualification | | |
| Between 7 & 10 | High | | |
| Between 4 & 7 | Medium | | |
| Less than 4 | Low | | |

Implementation of the “Pooling and sharing” concept by the year 2020

At the beginning of 2013, the Spanish Institute for Strategic Studies undertook a foresight study on European “Pooling and Sharing” in the field of defence, attempting to foresee the European and Spanish scenario by the year 2020⁹. For this purpose, a large group of experts in the various areas related to this field were consulted.

Silver lining was used as a foresight methodology for the study on account of its adaptability and the use of new technologies for the processing of information. The results obtained show that in 2020, with respect to the European scenario, “it is worth noting the advance of multipolarity from a geopolitical perspective at global level and the slow progress in consolidating a common security and defence policy”.

From a Spanish perspective « *the scenario in which the P&S will develop will be marked by a recovery from the economic crisis, but with a strong commitment to the European initiative. This will possibly favour and encourage this endeavour at national level insofar as the EU considers it to be necessary*”.

Although both scenarios (European and Spanish) are not overly optimistic, they leave open a path of hope for the P&S initiative provided that events at political level continue to develop and with the expectation that external threats are

9 The complete study concerning the description and conclusions of the exercise can be found at http://www.ieee.es/Galerias/fichero/docs_investig/DIEEEINV-or_Estudio_Prospectivo_TECNALIA_IEEE.pdf.

not consolidated in the face of a Europe still fragmented in terms of defence and security (Castillo, 2015)¹⁰.

Qualification metrics in the application of the methodology

The following table assesses the reliability of the results of the exercise.

| <i>Silver lining</i> Methodology | | |
|---|------------------------|------|
| Qualification Metric | | |
| Name of exercise: The future of the CSP by the year 2020 | | |
| Date: February-June 2010 | | |
| Actions Phase 1: Setting objectives. Preparation | | |
| From the stability study, it appears that the system is “Stable” | X | 0,7 |
| From the stability study, it appears that the system is “Unstable” | | 0,5 |
| The number of experts is less than 15 | | 0,3 |
| The number of experts is greater than 15, but still a manageable number | X | 0,5 |
| The experts have not been evaluated | | 0,2 |
| The experts’ qualifications are well known. | X | 1,5 |
| The experts’ qualifications are moderately well known | | 0,7 |
| The experts’ qualifications are not well known | | 0,4 |
| The number of events is equal to or less than seven | X | 0,5 |
| The number of events is greater than seven | | 0,3 |
| Actions Phase 2: Consultation process | | |
| Web technologies have been used | X | 0,5 |
| In round 1 a certain grouping of answers was identified | X | 0,5 |
| In round 1 there was coherence in individual answers | X | 0,5 |
| The sensitive events were clearly identified in round 1 | X | 0,5 |
| In round 2 the sensitive events were corroborated | X | 0,8 |
| Actions Phase 3: Data-processing | | |
| The interpolation of scenarios has been carried out successfully | X | 0,5 |
| The interpolation of scenarios has been validated by the experts | | 0,5 |
| Actions Phase 4: Analysis of inferences | | |
| The information has been analysed | X | 0,25 |
| An analysis of inferences with the environment has been carried out | X | 0,25 |
| A final report has been produced in its three forms | X | 0,25 |
| The final report has been circulated for information | X | 0,25 |
| Proactive actions have been carried out | X | 0,5 |
| Actions Phase 5: Validation of results | | |
| Follow-up and validation initiatives have been scheduled | X | 0,5 |
| The whole exercise took less than two months | | 0,7 |
| The whole exercise lasted between two and five months | X | 0,3 |
| Consultation qualification index number | | |
| | | 8.8 |
| Index number | Exercise qualification | |

¹⁰ Chapter 11 of the book contains a detailed explanation of the how *Silver lining* can be used in processing expert opinions and obtaining group information.

| | | | |
|----------------|--------|--|--|
| Between 7 & 10 | High | | |
| Between 4 & 7 | Medium | | |
| Less than 4 | Low | | |

Overview of the methodology

The interest of human groups in the future is reflected in Foresight as one of its tools, and thus awakens great interest in Sociology. The social sciences cover all relevant aspects of other sciences whose repercussions on social reality have a certain relevance.

The application of *Silver lining* can be summarised in five clearly differentiated Phases:

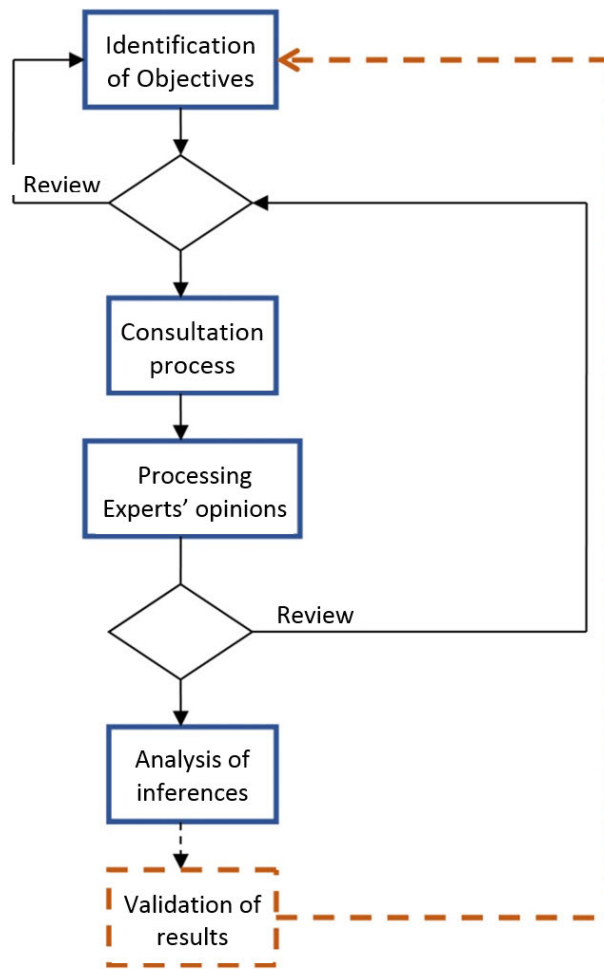
- Setting objectives. Preparation and previous processes
- Consultation process
- Processing of expert opinions
- Analysis of inferences
- Validation of results

By setting objectives, the aims of the prospective study are defined and preparatory processes such as the selection of the time frame, the events that can be part of the scenario and the selection of the experts are established. This activity can be recursive, since at its conclusion some of the objectives of the study can be reconsidered.

Once consultations with the group of experts have been concluded, the information is processed using new technologies. The resulting information and its inferences are then analysed or it can give rise to a new approach in relation to the consultations because some anomaly has been detected in the process.

Finally, the validation phase is carried out, which consists of corroborating how the planned scenario materialises over time. In the event of new events occurring that could impact on the scenario, an analysis of these events is conducted and the need to conduct a new study is reassessed, as required.

These five phases can be demonstrated in an execution model in the following flow chart.



Synthesis of the Silver lining flow chart

Analysis of results

It is worth highlighting that the consolidation process of the *Silver lining* methodology has followed an iterative cycle during its almost five years of research. Following a pattern of continuous improvement, the phases have been refined and perfected throughout the entire process of their creation and validation.

The main difficulty facing the research has been the scarcity of reference scientific literature relating to the latest publications in anticipatory forecasting. Most centres carrying out foresight studies either rely on a hermeneutical approach or technical forecasting. This corroborates the hypothesis that current methodologies and their associated procedures are not dynamic and do not respond to present-day needs, and therefore their use is abandoned.

One of the advantages that has facilitated the development and application of the research has been the opportunity to collaborate with centres involved in foresight studies, such as the Spanish Institute of Strategic Studies and the ISCRAM group from the New Jersey Institute of Technology.

After analysing the results obtained from real cases, the time required to carry out foresight exercises has been shortened in all of them and a high degree of satisfaction

obtained from the groups of experts, the analysts and the recipients of the final reports. In all exercises, the structure of the methodology, the experts' level of knowledge and the metrics used to evaluate the level of quality of the exercise have been described as very useful.

Future work

Based on the objectives achieved with the application of *Silver lining* and an analysis of the processes involved, new research work could be carried out in the future that would allow us to continue innovating.

Below is a list of some of the tasks that need to be addressed:

- Convergence of technical and anticipatory forecasting: this convergence would help to assess the future with greater precision, since on many occasions some of the variables that make up the scenarios can be affected by marked trends in their evolution over time.
- Promoting the development of support tools: information technologies, and specifically the development of computer applications, will make it possible to standardise and consolidate the use of procedures.
- Expert validation: the success of anticipatory forecasting will be greater to the extent that the experts are truly knowledgeable in the field and have a high level of social intelligence. The types of tests affecting two particular areas need to be explored and studied in greater depth: a generic test to establish links between events and a specific test for the particular field in which experience is required.
- Integration with social networks: social networks are a very useful tool for obtaining information. There is no doubt that the integration of social networks in the process of consulting experts would speed up the feedback while allowing the number of experts to be increased, and perhaps facilitating their selection.
- New solutions to restrict the number of events: *Silver lining* offers the solution of cascading scenarios for the design of exercises based on sensitive events. Although this solution is viable and effective within the process, it may not be the most suitable option. For this reason, it appears necessary to open a new line of investigation that easily allows the management of scenarios with a greater number of events.

Conclusions

Having achieved the objectives that gave rise to the initiative to obtain a Spanish methodology for carrying out foresight exercises in support of strategic planning, in conclusion its contributions can be grouped into three main areas:

- From a methodological perspective

Silver lining is an adaptable, well-structured methodology that can be applied to any area where prospective scenario analysis is required for the benefit of strategic planning. In addition, it incorporates a metric that allows for the evaluation of the quality of the foresight exercises carried out.

- From a technical perspective

Nowadays there are technologies that can replace the mathematical-statistical methods that have been used until now. These technologies, based on the processing of natural language adjectives, have a better acceptance among participants in foresight exercises and provide a more realistic solution

- From a strategic planning perspective

Strategic planning usually relates to the long term, but there may be decisions of a strategic nature to be made in the medium or short term. For this reason, new solutions are needed that are adapted to technological development and provide answers in a short period of time. Such is the case of the technological contribution and reduction in runtime provided by *Silver lining*. On the other hand, the application of strategic planning is not limited exclusively to organisations or companies, but is present in all areas where social sciences are used.

Bibliography

BAS, E.; GUILLO, M. *Prospectiva e innovation* (Vol. 1: visiones). Barcelona: Plaza y Valdés 2013.

BIERMANN, L. *Futuristics*. Ed. Franklin Watts 1986.

CASTILLO, J. M. *Getting Experts' Agreement in Strategic Planning*. Dubrovnik (Croatia): Proceedings of the Agreement Technologies International Congress 2012a.

CASTILLO, J. M. *Tecnología y prospectiva: Un reto hecho realidad*. Madrid: Instituto Español de Estudios Estratégicos 2012b, N.º 0, pp. 111-132. NIPO: 083-12-238-7.

CASTILLO, J. M. *Planeamiento estratégico. El diseño del futuro a través de las opiniones de expertos*. Tesis doctoral. Facultad de Ciencias Políticas y Sociología. Universidad Pontificia de Salamanca 2015.

CASTILLO, J. M. «El perfil del perfecto experto estratega». Documento de Opinión IEEE 73/2019. 2019.

http://www.ieee.es/Galerias/fichero/docs_opinion/2019/DIEEEO73_2019JOSCAS_estratega.pdf.

- DALKEY, N. C. The Delphi method: An experimental study of group opinion. Studies in the quality of life: Delphi and decision-making. Lexington Books 1972, pp. 13-54.
- DUPERRIN, J. C. «SMIC 74. A method for constructing and ranking scenarios». Futures, vol. 7, n.º 4. 1975, pp. 302-312.
- DUVAL, A. Innovative methods. Ginebra: Dematel reports 1975.
- HSU, Ch.; SANDFORD, B. «The Delphi Technique: Making Sense of Consensus». Practical Assessment, Research & Evaluation, Volume 12, Number 10. 2007.
- IEEE.ES. «El futuro de la Política Común de Seguridad y Defensa (PCSD) en el horizonte de 2020 (DIEEEA09-2010)». 2010.
http://www.ieee.es/Galerias/fichero/docs_analisis/2010/DIEEEA09-2010Estudio_prospectivo_futuroPCSD_UE2020.pdf.
- IEEE.ES. «La Política Común de Seguridad y Defensa (PCSD) de la UE en el horizonte de 2020 -Segunda Phase del estudio prospectivo- (DIEEEA02-2011)». 2011.
http://www.ieee.es/Galerias/fichero/docs_analisis/2011/DIEEEA02_2011EstudioProspectivoSegundaPhasePCSD_UE2020.pdf.
- IEEE.ES. «Estudio prospectivo sobre la implementation del concepto “Pooling and Sharing” en el horizonte de 2020 (DIEEEINV01-2013)». 2013.
http://www.ieee.es/Galerias/fichero/docs_investig/DIEEEINV-01_Estudio_Prospectivo_TECNALIA_IEEE.pdf.
- LINSTONE, H.; TUROFF, M. «Delphi: A brief look backward and forward». Rev. Technological Forecasting and social Change, Vol. 18, num. 9. 2010.
- LUDWIG, B. «Predicting the future: Have you considered using the Delphi methodology?». Journal of Extension, 35(5). 1997, pp. 1-4.
- TUROFF, M. «The Past, Present, and Future of Delphi». Rev. Futura. Helsinki: 2009, pp. 32-44.
- TUROFF, M. et al. Collaborative Evolution of a Dynamic Scenario Model for the Interaction of Critical Infrastructures. Kristiansand (Norway): ISCRAM International Congress 2015.

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*Prospective analysis of the implications of
using autonomous aerial systems in USAF
Air Defence Interception Missions. From
2019 to 2035*

Abstract

The introduction of robotics on the battlefield is no longer a concept from science fiction. Successful trials with autonomous weapon systems are giving way to a new Revolution in Military Affairs, set in the emerging era of robotics and nanotechnology. Through the technique of scenario building and analysis, four scenarios and their implications in air defence interception missions in US domestic airspace are examined. With 2035 set as the time horizon, in terms of this study the key concept within the autonomous UAS is the “loyal wingman”.

Keywords

Autonomous UAS, USAF, Air defence, NORAD, FAA, Interception, loyal wingman.

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Introduction

In this research analysis, the possible progressive implementation of autonomous airborne weapons systems – and therefore equipped with artificial intelligence (AI) – in the United States Air Force (USAF) is evaluated through the construction and analysis of scenarios. With a time horizon of 2035, these scenarios have been limited to Air Defence (AD) interception operations. Having established the objective, the first step involves explaining why humanity is facing a Military Revolution (MR), discussing the current state of autonomous unmanned aircraft, and tracking the publications of other authors on this subject. Secondly, the methodology involved in scenario building and analysis will be explained and applied in the context of this study. Finally, it will be established which of the proposed scenarios is the most plausible.

At a time when Remotely Piloted Aircrafts (RPAs) are increasingly involved in certain military air operations, and are becoming more popular in the civilian sphere – both for private recreational use and for business activities – humanity has taken a step forward. This is a new reality in which the successful testing of unmanned autonomous aircraft (UAS) prototypes may lead to their being operated in conjunction with manned aerial platforms and RPAs. In the context of the USAF, this could materialise into one of the most important – if not the most important – mission of a nation's air force: the air defence of its territory, its critical areas and its citizens.

As with the RPAs, the incorporation of autonomous military UAS will require deconflicting and making the use of US airspace more flexible, through civil-military coordination, and the effective use of technical solutions¹. This being a process of innovation, it can originate either from political authorities or from the military; for, contrary to what certain groups may think, the armed forces of a state, far from constituting itself as an isolated group and alien to its environment, interacts and interrelates with it. Consequently, its influences can have different origins, including society, political, economic and cultural situations, state institutions and, ultimately, the international arena².

UAS as a catalyst for an RMA

Robotics is clearly one of the most fascinating technological advances of recent decades: a science and technology that is present in many areas of society, and an area of research that is continually advancing, both for civil and military applications. The first successful tests of autonomous UAS represent a milestone, which, together with

1 CHEATER, Julian C. *Accelerating the kill chain via future Unmanned Aircraft*. Air War College 2007.

2 JORDÁN, Javier. «Un modelo explicativo de los procesos de cambio en las organizaciones militares. La respuesta de Estados Unidos después del 11-S como caso de estudio». *Revista de Ciencia Política*, n.º 1. 2017, pp. 203-226.

other military autonomous weapon systems, are beginning to revolutionise the very nature of warfare. However, to date this milestone does not depend exclusively on technological advances, but is also a function of other variables, which together are allowing humanity to witness a new era.

To speak of “revolutionise” or of an “era” extends beyond the mere use of these terms, and has important associated theoretical concepts. Authors such as Murray have identified RMs over the past half a millennium, these extended periods of time being characterised by social, economic and political factors that condition the general character of war, and which have their origin and end in turning points³. However, of the various authors who have written about revolutions, of particular interest are the Tofflers⁴, for they identify three great waves – as they call the eras or revolutions – that are the origin of a fourth wave. These authors maintain that the first two waves belong to the past and that the present corresponds to the third, that of “post-industrial society”. In this wave, communications, computer systems, globalisation, monitoring and tracking systems, etc. are key to business and military development⁵. However, it is the fourth wave, which the Tofflers identify with an emerging era of robotics and nanotechnology independent of the third wave⁶, that is most relevant to this work and which is already beginning to bring about profound changes such as those discussed in the present analysis.

With regard to changes in the military field, they are not only the direct result of technological advances but, above all, of innovation processes systematically applied in all functional areas and military capabilities. In a broad sense, military innovation can be doctrinal, technological, or organisational, or a combination of all of these. If such innovation involves a profound change in any of these three aspects, a revolutionary change – which, moreover, will normally lead to transformations in some of the other two aspects of the triad – will generate a Revolution in Military Affairs (RMA). In conjunction with the above, a RM will normally comprise

3 BAQUÉS, Josep. «Revoluciones militares y revoluciones en los asuntos militares». In JORDÁN, Javier (coord.). *Manual de Estudios Estratégicos y Seguridad Internacional*. Madrid: Plaza y Valdés 2013, pp. 119-127.

4 Alvin Toffler was a futurologist and sociologist known for his works like *Future Shock*, *The Third Wave* or *Power shift: Knowledge, Wealth, and Violence at the Edge of the 21st Century*. Together with his wife, Heidi Toffler, he also produced works of a futurist tendency, notably: *War and Anti-War: Survival at the Dawn of the Twenty First-Century*, and *Creating a New Civilization: The Politics of the Third Wave*.

5 BALOCH, Qadar B.; KAREEM, Nasir. «Review of The Third Wave», by Alvin TOFFLER. *The Journal of Managerial Sciences*, n.º 2. 2007, pp. 115-143.

6 BAQUÉS, Josep. «Revoluciones militares y revoluciones en los asuntos militares». In JORDÁN, Javier (coord.). *Manual de Estudios Estratégicos y Seguridad Internacional*. Madrid: Plaza y Valdés 2013, pp. 126-127.

a series of RMAs⁷. Accordingly, the autonomous UAS can be qualified as an RMA within the RM that develops on the back of the Toffler's fourth wave. This fact will consequently imply – if the processes of investigation and experimentation prove successful – extensive transformations in the doctrine, organisation and resources of future military air operations.

Unmanned autonomous aircraft

Once again, the United States is at the forefront of military innovation, having achieved successful results in testing prototypes of autonomous and unmanned airborne weapons systems. As indicated in the previous section, this constitutes a genuine RMA that adds to the ongoing process of adaptation, integration and standardised operation of the increasingly used RPAs. It is therefore advisable that the civil and military authorities should begin to plan the implementation, use and regulations in the medium term, and even in the short term, of autonomous UAS. In addition, for the purpose of this study it should also be borne in mind that in order to carry out an AD mission a certain type of aircraft must be capable of performing air combat and winning it, if required.

If an autonomous UAS is to be capable of beating another aircraft, first and foremost the AI with which it is equipped must demonstrate that ability. The University of Cincinnati developed an AI dubbed ALPHA, based on genetic-diffusion systems, capable of beating a retired USAF experienced pilot, thus fulfilling the first system requirement, and of course representing a huge step forward in this field. Likewise, ALPHA was designed for use with Unmanned Combat Aerial Vehicles (UCAV) for research purposes⁸, which is yet another indicator of the viability of this phenomenon. However, already a decade before, Captain Nidal of the USAF produced a thesis dealing extensively with the development of autonomous UAS through design, modelling and flight tests in simulation, using various mathematical and engineering tools⁹.

However, the steps taken so far go beyond that thesis and ALPHA, with already autonomous UAS prototypes already in existence. Of particular relevance is PERDIX, the system used by the US Department of Defense, consisting of a swarm of micro-UAVs with shared AI. Launched from an F-18 US Navy capsule –103 drones in the case of the example – they embark on the flight coordinating with each other and

7 BAQUÉS, Josep. «Revoluciones militares y revoluciones en los asuntos militares». In JORDÁN, Javier (coord.). *Manual de Estudios Estratégicos y Seguridad Internacional*. Madrid: Plaza y Valdés 2013, pp. 119-127.

8 REILLY, M. B. «Beyond video games: New artificial intelligence beats tactical experts in combat simulation». *University of Cincinnati Magazine*. 27/06/2016. Available at <https://magazine.uc.edu>.

9 NIDAL, Jodeh M. *Development of autonomous Unmanned Aerial Vehicle research platform: modeling, simulating and flight testing*. Thesis. Ohio: Air Force Institute of Technology 2006.

deciding at each moment the best way to execute the assigned missions. This system stands out as a “collective organism”, and is also very low cost compared to other weapon systems, as the micro-UAVs employed were manufactured using 3D printing¹⁰.

Illustrating the interest that this swarming technique arouses in researchers are the numerous studies on algorithms used for the collective decision-making of these swarms¹¹, as well as analysis in civil¹² and military publications¹³ on the different modes of military operation, capabilities and limitations, countermeasures, command and control needed in these systems and other aspects related to their use.

However, autonomous micro-UAV swarms are not the only players in this RMA, as significant progress has also been made with considerably larger aerial platforms. In this respect, the success achieved in tests with autonomous F-16s is particularly innovative. This fighter and attack aircraft, the most manufactured and acquired in history, has been successfully “robotised”, operating together with manned fighter planes under the concept of “loyal wingman”. This consists of associating a certain number of autonomous aircraft (F-16) with a manned aircraft (F-35). In this way, a team is established in which the UAS is subordinated to the command of the pilot of the main aircraft, but carrying out the assigned missions autonomously, manoeuvring, attacking, defending and meeting again with its leader autonomously¹⁴. Also of note are projects related to autonomous Air-to-Air Refuelling (AAR) for unmanned platforms¹⁵, the legal and ethical aspects of which have also been widely discussed by authors such as Gillespie & West¹⁶ and Thurnher¹⁷, among others.

¹⁰ UNITED STATES DEPARTMENT OF DEFENSE. Department of Defense announces successful micro-drone demonstration. Virginia: 2017 [consulted on 27 January 2019]. Available at <https://www.defense.gov/Newsroom/Releases/Release/Article/1044811/departement-of-defense-announces-successful-micro-drone-demonstration/>.

¹¹ FRANTZ, Natalie R. Swarm intelligence for autonomous UAV control. Thesis. California: Naval Postgraduate School 2005.

¹² SCHARRE, Paul. «Robotics on the battlefield part II. The coming swarm». Center for a new American security 2014.

¹³ UNITED STATES AIR FORCE. USAF RPA vector. Vision and enabling concepts 2013-2038. Washington D.C.: 2014.

¹⁴ LOCKHEED MARTIN. U.S. Air Force, Lockheed Martin demonstrate manned/ unmanned teaming. Maryland: 2017 [consulted on 30 January 2019]. Available at <https://news.lockheedmartin.com/2017-04-10-U-S-Air-Force-Lockheed-Martin-Demonstrate-Manned-Unmanned-Teaming>.

¹⁵ BURNS, Brian S. Autonomous Unmanned Aerial Vehicle rendezvous for automated aerial refueling. Thesis. Ohio: Air Force Institute of Technology 2007.

¹⁶ GILLESPIE, Tony; WEST, Robin. «Requirements for autonomous unmanned air systems set by legal issues». The International C2 Journal, n.º 2. 2010, pp. 1-30.

¹⁷ THURNHER, Jeffrey S. No one at the controls: the legal implications of fully autonomous targeting. Rhode Island: Naval College of War 2012.

Whilst not intending to go into detail on the subject matter and scope of publications related to autonomous UAS, let us say, after consulting many academic databases and open sources, that most of these works are ambitious and generalist, with some attempting to cover a wide range of aspects of these systems. However, they do not go into the detail and specificity of these works with respect to a particular type of operation. A work with similar objectives to those of this research analysis – albeit more extensive as it is a thesis – is the work of Donald Brown, who, by means of analysis and scenario building, studies the implications of the use of different types of autonomous UAS in SEAD (Suppression of Enemy Air Defenses) missions¹⁸.

The “loyal wingman” model

As we have seen in the previous section, there are currently two main models – at prototype stage – for the use of autonomous UAS using American technology: the swarm drones and the “loyal wingman”. Without referring to specific prototypes, the phenomenon of swarming is the one that has received most attention in existing publications. This is due to the innovative nature of its robotic technology, its similarity to biological organisms and the incipient economy of scale in its development. This has been the case with Work and Brimley¹⁹, and Scharre²⁰, among others. These authors highlight advantageous aspects of the use of autonomous UAV swarms such as:

- *Greater survival capacity.* As a set of micro-UAVs with shared AI, the shooting down or any inappropriate operation of one element of the cluster simply means that the remaining operational micro-UAVs continue with the fulfilment of the mission.
- *Suitability for certain missions.* They can act as a communications relay, perform logistical-military functions, carry out reconnaissance, surveillance, intelligence, jamming, and enemy saturation – the latter thanks to the multiple elements that make up the swarm.
- *Reduced size.* This makes it difficult to neutralise each individual micro-UAV and to detect it, for example, by means of primary radar.

However, despite all these advantages and characteristics – widely discussed in reference texts – for several reasons this study suggests that the “loyal wingman” should be the leading autonomous UAS for air defence interception missions.

¹⁸ BROWN, Donald. *Bolts from Orion: Destroying mobile Surface-to-air Missile Systems with lethal autonomous aircraft*. Alabama: Air Command and Staff College. Air University 2016.

¹⁹ WORK, Robert O.; BRIMLEY Shawn. «Preparing for war in the Robotic Age». Center for a new American security 2014.

²⁰ SCHARRE, Paul. «Robotics on the battlefield part II. The coming swarm». Center for a new American security 2014.

First of all, the target date of 2035 must be borne in mind. This implies that the time frame in which conventional aircraft and RPAs will continue to exist is short to medium term. Therefore, the autonomous UAS – still in their most advanced state of development, but prototypes nevertheless – will not exist in exclusivity. Second, and related to the former, the possible threats that will have to be faced in this timeframe correspond to platforms of (relative) size. Consequently, in view of the possibility of having to neutralise them, similar systems – either (remotely) manned or autonomous UAS – are needed in terms of speed, manoeuvrability and armament. Thirdly, humanity is in a necessary transition, where, although the nation that we are concerned with here is at the technological forefront, possible airborne threats from other countries could appear. Many of them within the set timeframe will have available at most RPAs – including, for example, conventional fighters and attack aircraft. Fourth, in terms of similarity, a scenario such as that set out by Manson is considered unlikely²¹, which conceives micro-UAV swarms capable of very high speeds, theoretically capable of beating conventional fighter planes and in general large aerial platforms. Even for the USA, and for this research analysis, it is estimated that this scenario falls outside the established time frame.

For all of these reasons, and as already mentioned in the previous section, scenarios will be built and analysed using the concept of “loyal wingman” as a starting point.

Construction technique and scenario analysis

Although it is not our intention to provide a detailed explanation of this technique or of prospective analysis in general, it is worth commenting briefly on its implications and its use in military-related studies.

In this context, as indicated in a study commissioned by the USAF from the RAND Corporation in the late 1970s, a “scenario” is the “description of the conditions under which a certain system under analysis, design or operation is supposed to operate”. In this study, “system” means not only a specific weapon system, but also a combination of weapon systems with the facilities and logistics surrounding them, and even an organisation²². The system under analysis here is the “loyal wingman” operating on intercept missions, at the North American Aerospace Defense Command (NORAD).

For Brown, the construction of the scenarios in which to analyse a system is related to the four levels of decision-making it establishes, these being (1) operations management; (2) choice of tactical alternatives; (3) systems engineering, design and research; and finally (4) determination of major policies.

21 MANSON, Katherine. «Robot soldiers, stealth-jets and drone armies: the future of war». *Financial Times*. 16/11/2018. Available at <https://www.ft.com>.

22 BROWN, Sayom. «Scenarios in systems analysis». In QUADE, E. S.; BOUCHER W., I. (coords.). *Systems analysis and policy planning: applications in defense*. Santa Monica, California: The RAND Corporation 1968, pp. 298-310.

Therefore, for the purpose of this analysis, our main focus will be on levels one, two and four. In Level four we will be examining the “loyal wingman” in the US air defence system, which is the responsibility of the strategic command. Level two, because this analysis and the operation of this weapons system will be limited to interception missions in airspace for which NORAD is responsible – and not, for example, a conflict zone in the Middle East – and because, furthermore, a series of tactical considerations will be entered into for this type of mission, which will be explained later. And finally, level one, because we want to determine whether the combination of manned aircraft and “loyal wingman” is an efficient and effective mode of operation.

As one might expect, scenario building implies always being aware of one’s own technological and economic aspects, but also those of the enemy, if needs be. Likewise, the functions and political implications of the system’s performance must play a leading role. The political aspects, based on the construction of scenarios, must be consistent with the political-military context proposed. However, a realistic scenario –which is derived from such consistence – should not be confused with a high probability of its occurrence. The probability can be low, and it can still be a realistic scenario²³.

The ideas outlined so far can be supplemented by a previous study by the RAND Corporation. It establishes a series of general points to consider when building scenarios for research purposes related to the military and defence²⁴.

Along with the concepts developed in the works of Brown and DeWeerd, of particular relevance is the article *La técnica de construcción y análisis de escenarios en estudios de Seguridad y Defensa (The technique of construction and scenario analysis in Security and Defence Studies)*²⁵ which provides a systematic approach to prospective analysis, recasting and synthesising the works of various authors. It offers a clear explanation of this technique, including the steps to be followed to carry out a complete prospective study. These steps will be developed further on and applied directly to the subject matter of this study.

Application of the technique to the “loyal wingman” model

As a prerequisite to establishing the final set of scenarios, and the further analysis of their implications, the initial scenarios have to be drawn up. To this end, through an initial five steps, a number of key elements must be delimited and identified, which will form the support base for this research. A correct analysis in these first phases will enable us to learn from the hypothetical future scenarios proposed.

Step 1. Defining the basic parameters of the analysis

As indicated in its title, this research analysis is limited in terms of geography and time, besides setting out the subject matter of the study. The analysis is centred on the

23 BROWN, Sayom. «Scenarios in systems analysis». En QUADE, E. S.; BOUCHER, W. I. (coords.). *Systems analysis and policy planning: applications in defense*. Santa Monica, California: The RAND Corporation, 1968, pp. 302-307.

24 DEWEERD, Harvey A. *Political-military scenarios*. Santa Monica, California: The RAND Corporation 1967.

25 JORDÁN, Javier. «La técnica de construcción y análisis de escenarios en estudios de seguridad y defensa». *Análisis GESI* 24/2016. Grupo de Estudios en Seguridad Internacional 2016.

plausible use of autonomous UAS in air defence interception missions in US airspace, between now and the year 2035.

Step 2. Identifying the research requirements

As Jordan observes, this is an iterative process that is found throughout the application of the technique. Through its execution, the construction of the scenarios and their subsequent analysis will be refined. As a starting point, the need to consider possible scenarios is established and deduce in each of them the consequences of integrating the autonomous military UAS into the exploitation and use of American domestic air space. Specifically, those that in the future could be dedicated to air defence together with the RPAs already in use, and, of course, conventional aircraft. As already indicated, this study arises from the need to go beyond generalist studies with respect to the introduction of robotics in military airborne platforms, applying more specific, mission-oriented approaches.

Step 3. Identifying the main actors involved

Only three key players will be considered in this study: the USAF, NORAD and the Federal Aviation Administration (FAA). That said, another option would be to dive into the entire US institutional fabric, where other stakeholders would certainly appear. One of them could be the legislative power and the controls, commissions, and regulations that it approves and applies in relation to the use of UAS - including autonomous systems. Another could be the judicial power and the sentences it adopts with respect to complaints from any individual or legal entity on this matter. Of course, public opinion, which is constantly evolving, could also be considered. However, in this investigation the three agents mentioned at the beginning are considered the most suitable for the scenarios used, because of their close relationship with civil and military air operations, their own room for manoeuvre, and their status as American institutions.

- *The United States Air Force.* With the “loyal wingman” as the chosen autonomous UAS model in this study, the US Air Force, rather than the US Navy and its swarm clusters, will emerge as the major player. Of crucial importance in evaluating the USAF’s position regarding the use of such systems are the strategic documents published by the Air Force. These present the vision and plans for the future of an organisation with autonomy within its jurisdiction, but which in turn is part of the Department of Defence (DOD). In this context, the acceptance and introduction of autonomous UAS into the Techniques, Tactics and Procedures (TTPs) of the USAF is not sufficient. The authorisation of the use of such platforms in military missions in domestic airspace is also needed, which is the responsibility of other actors. It is therefore logical to think also about the influence that the approval of the President

of the United States (POTUS) has on this type of mission, as well as the indications that his advisors in matters of Defence and National Security give him. In particular, it would be up to the Secretary of Defense, if he so wished, to defend the continuation of the project within the objectives he would set for his Department²⁶.

- *The North American Aerospace Defense Command (NORAD)*. A nation's air defence involves many more resources than a combat aircraft. For this reason, it is also worthwhile to provide a general explanation of the US air defence system, the main components that make it up, and the mission of each one. This is not an exclusively US organisation, since it comprises the bilateral action and cooperation of the USA and Canada in terms of North American air defence. Its areas of responsibility are divided into three main zones: the Alaskan NORAD Region (ANR), the Canadian NORAD Region (CANR) and the Continental US NORAD Region (CONR). Although the ANR and CONR airspace also falls under US sovereignty, for the purposes of simplification and illustration we will refer solely to continental US (CONUS).

Confirming the first lines above, in addition to the F-15, F-16 and F-22 used as fighter and attack aircraft – on alert for CONR defence – the area has an integrated air defence system. This also consists of command and control systems, early warning radars and other detection devices, several telecommunications systems, and US Army anti-aircraft artillery systems.

NORAD's mission includes the warning and control of airspace, as well as the warning of maritime threats, an aspect that we will not enter into here. In terms of airspace, the tasks to be carried out continuously are detection, identification, validation and, where necessary, warning – of both civil and military aircraft, aerospace vehicles and missiles²⁷. This whole package of technical and human resources, including the currently manned hunting and attack platforms, is what executes, when necessary, interception missions in air defence.

- *The Federal Aviation Administration (FAA)*. The FAA is an agency of the United States Department of Transportation (US DOT), whose corporate mission is to provide the world's most efficient and safest airspace management system. Through its operational arm, the FAA aims to safely and efficiently provide air navigation services in US airspace and in areas of US responsibility. This means providing such services to both commercial and private aircraft, as well as military aircraft – if they are subject to general aviation rules in their flight plan. The FAA, through its Office of Government and Industry Affairs,

26 UNITED STATES DEPARTMENT OF DEFENSE. Meet the team. Virginia: 2019 [consulted on 20 March 2019]. Available at <https://www.defense.gov/Our-Story/Meet-the-Team/>.

27 NORTH AMERICAN AEROSPACE DEFENSE COMMAND. About NORAD. Colorado: 2019 [consulted on 21 March 2019]. Available at <https://www.norad.mil/About-NORAD/>.

ensures that its actions are consistent with DOT guidelines. With respect to UAS, the FAA currently contemplates four main blocks of operators: those with recreational goals, those geared towards educational use, RPA certified pilots – including commercial operators – and finally those related to public safety and other government purposes²⁸. As we have done with the USAF, for the purpose of this study its current strategic vision will be taken as a reference.

Steps 4, 5 and 6. Identify basic trends and their impact, identify key uncertainties and construct initial scenarios

As Jordán explains²⁹, compared to the option of building the initial scenarios from a matrix based on a combination of basic trends and key uncertainties (drivers), there exists the possibility of doing so using two orthogonal axes. In order to do so, it is necessary to be able to concentrate on the main drivers, to be clear about the subject of the study and to establish which are the main actors.

The objective of this study is not to build scenarios where the possible existence of autonomous UAS is analysed in a general fashion, but to concentrate on USAF developments. Thus, of interest in this context are autonomous UAS with military purposes intended for use in AD missions. Focusing on a particular type of mission does not necessarily imply that the aircraft in question is designed and intended exclusively for that type of mission. Accordingly, it can be multi-purpose like most fighter and attack aircraft today.

It will therefore be crucial for the scenarios to know whether the USAF, following the first real test successes of its prototypes, is going to continue improving and perfecting their capabilities. In this case, it will opt for the progressive implementation of these weapons systems in its operational organisation, in order to include them in a safe and controlled manner in the different tasks of the Air Force.

On the other hand, it is not only the improvement and maintenance of these prototypes over time that must be considered, but also the management of their area of operation. Since this study considers only AD missions, the area in which these systems will operate will be the US domestic airspace. In this way, it is not only that the USAF has them, but also that NORAD has to admit them as yet another of the various means at its disposal to fulfil its mission. Finally, the knowledge and acceptance of the FAA, as the state entity in charge by default of civil aviation matters in the United States, must also be obtained.

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28 UNITED STATES DEPARTMENT OF TRANSPORTATION. Federal Aviation Administration. Washington D.C.: 2019 [consulted on 23 March 2019]. Available at <https://www.faa.gov/>.

29 JORDÁN, Javier. «La técnica de construcción y análisis de escenarios en estudios de seguridad y defensa». Análisis GESI 24/2016. Grupo de Estudios en Seguridad Internacional 2016,

Based on these considerations, two main drivers are identified to form the basis of the four scenarios. On the one hand, continuity in research, development and innovation (R&D&I) of autonomous UAS from the USAF. On the other hand, coordination and a level of mutual understanding between NORAD and FAA. In figure 1, both drivers and the four resulting scenarios are represented. In this way, establishing a relationship between the two most characteristic drivers of this study by means of two orthogonal axes, we can describe the fundamental elements of each of the four initial scenarios, which will be developed in the following section.

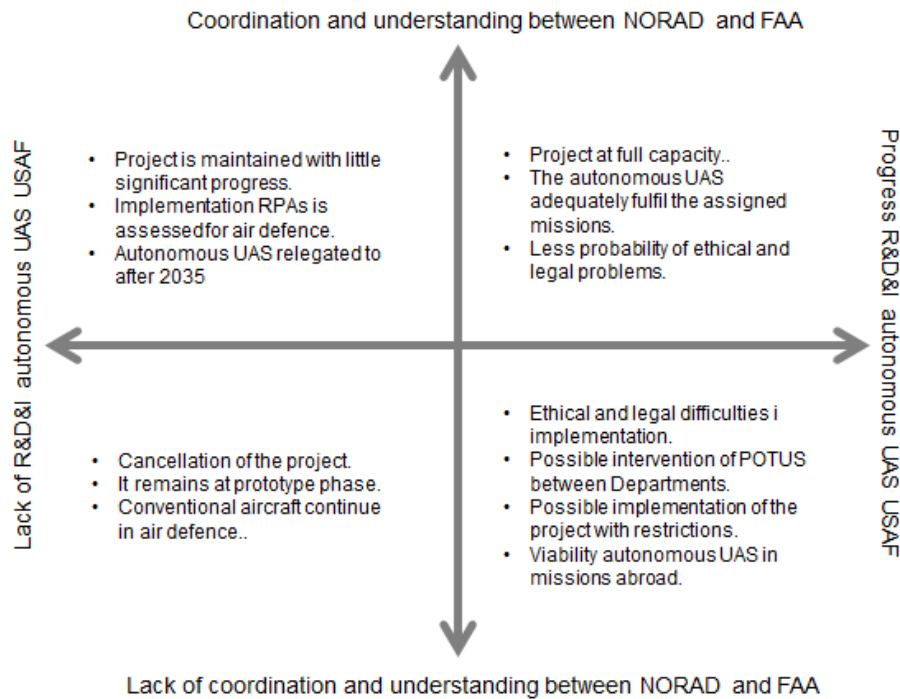


Figure 1: setting up of scenarios. Source: prepared by the author

Presentation of scenarios

Steps 7 and 8. Checking the internal consistency and plausibility of the scenarios, and establishing the final set of scenarios

Because of their importance, before showing a complete description of the four scenarios, we should clarify a series of concepts that have been named so far:

- *Air Defence.* According to *Annex 3-01 Counterair Operations*³⁰, defensive and offensive operations aimed at achieving and maintaining the desired level of control of certain airspace make up the counterair mission. In this way, the objective of the AD - or its synonym *defensive counterair* - is that of protecting its own forces and vital positions of interest from any air attack of enemy

30 UNITED STATES AIR FORCE. *Annex 3-01. Counterair Operations*. Alabama: 2016.

origin. In turn, AD can be divided into two main blocks of action: active and passive. The active block comprises defensive actions that seek to “destroy, nullify or reduce” the effectiveness of air attacks carried out by missiles and aircraft – including UAS. On the other hand, the passive block seeks to minimise enemy effectiveness through actions that fall into the following categories: detection and alert; chemical, biological, radiological and nuclear (CBRN) defence; camouflage, concealment and deception; physical protection of installations, reconstitution, dispersal, redundancy, mobility, infrared and electronic countermeasures and, finally, stealth technology³¹.

It is also interesting to note that the desired control of airspace can be classified at the following levels: air parity, air superiority and air supremacy³². If the aim is to guarantee air defence in the airspace under US sovereignty, it is logical to think that superiority is not enough, but rather air supremacy, and that the actions included in passive defence are also practised as preventive measures. This last aspect, which does not exclude the active defence missions necessary to preserve air supremacy, will mainly depend on the level of real threat and the economic capacity of the nation.

Applied directly to US national security, through *Annex 3-27 Homeland Defense* in its joint doctrine, the USAF describes its fundamental mission: “to protect national sovereignty, territory, citizenship, and critical infrastructure from external threats or aggression, or others as determined by the President”. Here, counterair operations play an important role, particularly the surveillance, control, warning and direction of air defence operations – including interception missions. For this reason, collaboration and coordination between the different USAF and NORAD Commands are essential to guarantee national security. This is due to the fact that the resources and personnel that the USAF contributes to NORAD, even though they depend organically on the Air Force, have a functional dependence and are under NORAD’s operational control³³.

- *Interception operations.* This type of mission falls within the scope of the active AD. Thanks to an agile and robust command and control system, and through the integration of weapons systems – mainly combat aircraft and sensor systems – it is possible to detect, fix, pursue, and target an airborne threat, in order to destroy, nullify or reduce its effectiveness³⁴.

31 When applied to an aircraft, stealth technology seeks to make it invisible to the radar. To this end, shapes and materials are used in the construction of the aircraft, which by means of absorption and reflection allow for this to be achieved..

32 UNITED STATES AIR FORCE. Annex 3-01. Counterair Operations. Alabama: 2016, pp. 2-24.

33 UNITED STATES AIR FORCE. Annex 3-27. Homeland Operations. Alabama: 2016.

34 UNITED STATES AIR FORCE. Annex 3-01. Counterair Operations. Alabama: 2016.

Without going into detail about the complexity of US airspace, the aircraft using it, and the actions to be taken by these aircraft before, during and after a flight, we will now attempt to synthesise the sequence and actions of an intercept operation.

As we have seen above, CONUS is continuously monitored by a variety of sensors, with primary and secondary radars providing uninterrupted information on the general aerial situation (picture). In order to fly over the Air Defense Identification Zone (ADIZ), which covers an area larger than the United States' own airspace, both civil and military aircraft require clearance, even more so if the latter come from another jurisdiction. Such clearances set out a number of limitations and procedures to be followed by the cleared aircraft, such as the route to be flown, mandatory reporting points with air control, or restriction – and even prohibition – of overflying through certain areas and at certain altitudes. Failure to comply with the limitations to which the aircraft must be subjected will trigger alarms – via a sequence of procedures – and focus the interest of air traffic control on that aircraft.

Either at the request of FAA air traffic controllers, or by direct identification by NORAD, the latter will take over the detection, tagging, and tracking of that aircraft until further inquiry. If NORAD's procedures and controls so determine, they will, initiate an interception mission against that aircraft by means of a scramble³⁵. In that operation, thanks to the military air control provided by NORAD's ground control interceptors (GCIs), the interceptor aircraft - a fighter and attack aircraft - will be guided by them to the aircraft of interest. Once intercepted, it will visually assess whether it is indeed who it previously claimed to be by radio, whether it poses a threat, or whether abnormal activity is perceived inside the aircraft. For the security of the intercepting aircraft – and bearing in mind that the aircraft of interest may be a non-U.S. military aircraft – if resources, availability and personnel permit, the interception will be carried out with an aircraft pairing. In this scenario while one of them identifies and approaches the aircraft of interest, the other maintains a position behind the possible threat, so that, in extreme cases, it can be neutralised. If there is no reason to proceed to such an extreme, once the interception has been made, the aircraft may be authorised to continue its established route, be forced to land at an airfield determined by NORAD, or be escorted to the ADIZ limit, amongst other actions.

Although relatively small documents, a nonetheless more detailed explanation of interceptions can be found in the Homeland Security Digital Library for the FAA and users who rely on their administration³⁶.

35 «Scramble» is a term in military aviation that refers to a military aircraft taking off in the shortest possible time.

36 NORTHAMERICAN AEROSPACE DEFENSE COMMAND. NORAD intercept procedures, Air Defense Identification Zone, & Temporary Flight Restrictions. Colorado: 2011 [consulted on 3

- *NORAD-FAA Coordination.* Coordination between civil and military aviation is essential for the safety of both types of aircraft, deconfliction³⁷ and flexibility in the use of airspace. The main reference document is the Memorandum of Understanding between NORAD and the FAA³⁸. Based on the legal and normative texts on which both organisations are based, this document presents a series of general points aimed at establishing agreements. However, the ultimate goal, without prejudice to the responsibilities of either entity, is that air defence is guaranteed in CONR and ANR. Coordination, bilateral communication, and the establishment of procedures and liaison personnel between both entities are essential. This allows for the correct development of the duties of each entity, promoting and enhancing the exchange of information of interest, and an awareness that efforts aimed at guaranteeing national security are a priority.

Among the various types of incidents that NORAD and FAA must be prepared to deal with, and one of the most interesting for the general public, is the hijacking of an aircraft, how the incident unfolds and its outcome. Of particular relevance were the hijackings of four commercial aircraft carrying passengers during the 9/11 attacks. The prevention and response to this type of incident involves the joint and coordinated efforts of FAA and NORAD. In such a situation, decision-making has to be swift, but also properly conveyed to higher levels. Consequently, each regional level must correctly apply – by means of established procedures – tactical solutions to the development of events. This entails maintaining uninterrupted communication, both horizontal and vertical – including civil-military – acting coherently to achieve the strategic objectives with respect to the incident. Any action by NORAD requires this level of coordination, which, in the case of the use of military interceptor aircraft, must be at a maximum³⁹.

Put very simply, one could say that the limitations on flight rules to be met by a military interceptor aircraft on an air defence mission are minimal compared to general aviation rules. The interceptor aircraft will have priority in the use of airspace to successfully carry out its mission. However, it should be stressed that there must be continuous coordination between civil and mi-

April 2019]. Available at <https://www.hsdl.org/?abstract&did=748300>.

37 «Deconfliction» is a term used in aviation, referring to those actions aimed at reducing the risk of collision between users in a given airspace, based on the coordination of their movement. The action is extendable to military users, including not only aircraft, but also for example missiles, or artillery fire. In the context of this analysis, the aim is to avoid conflicts and dangerous situations between civil and military aircraft, without prejudice to their operation.

38 NORTH AMERICAN AEROSPACE DEFENSE COMMAND. Memorandum of understanding between NORAD and the FAA. Colorado: 1987.

39 RUTGERS UNIVERSITY. Law Review. The FAA and NORAD. New Jersey: 2011 [consulted on 2 April 2019]. Available at <http://www.rutgerslawreview.com/2011/1-the-faa-and-norad/>.

lilitary air control. As the main users are commercial airlines and their passengers, it is essential that the regulations are available to them for consultation and compliance. Among the general aviation regulations, of particular note is the section on FAA Air Traffic Plans and Publications⁴⁰. Also, as an illustration of civil-military coordination, it is worth highlighting the NORAD summary sheets on intercepted civil aircraft⁴¹, or the previously mentioned NORAD document in 2011⁴².

Having presented the most relevant aspects of Air Defence, NORAD-FAA Interception and Coordination missions, each hypothetical scenario resulting from the analysis will be described below. The scenarios are ordered from lowest to highest in terms of implementation of autonomous UAS, for the type of mission that has been established.

Scenario 1: The fifth jet fighter generation.

The first scenario is based on the main premise that there is little investment by the USAF in R&D&I projects related to the design and use of autonomous UAS, and that there is a lack of coordination and tension between NORAD and FAA. Therefore, this is the worst scenario of the four that arise from the future use of these autonomous platforms in interception missions, and in general, in any type of mission.

In this scenario, the USAF is unable to secure the necessary funding and support to initiate or continue these projects. Despite successful initial trials, the projects are still in their infancy, as researchers have not been able to have them designated as high priority and consequently obtain the large financial resources they need to continue. Other costly programmes, such as the development of the F-22, the F-35, and different RPA models, are attracting the attention of military commanders, who are looking for ways to recoup the respective investments already made.

Although the RMA derived from the autonomous UAS has aroused interest and enthusiasm, no progress has been made in the development of these systems beyond the prototype phase, as it is considered that with the current resources and investments, the objectives set for 2035 can be met with certainty. Aware of its usual position of technological leadership, the USAF considers it unlikely that another nation will operationally integrate such weapons systems into its air forces within two deca-

⁴⁰ FEDERAL AVIATION ADMINISTRATION. Air Traffic Plans and Publications. Washington D.C.: 2019 [consulted on 6 April 2019]. Available at https://www.faa.gov/air_traffic/publications/#manuals.

⁴¹ NORTH AMERICAN AEROSPACE DEFENSE COMMAND. Civil Aviation Resources. Colorado: 2019 [consulted on 21 March 2019]. Available at <https://www.norad.mil/General-Aviation/>.

⁴² NORTH AMERICAN AEROSPACE DEFENSE COMMAND. NORAD intercept procedures, Air Defense Identification Zone, & Temporary Flight Restrictions. Colorado: 2011 [consulted on 3 April 2019]. Available at <https://www.hsdl.org/?abstract&did=748300>.

des, making it even less likely that they will seek to use them against the United States. The successes achieved will serve as a basis for future investments, as the present moment is not appropriate.

The latter decision is reinforced by the friction and tension generated as a result of the RMA between NORAD and FAA. The latter considers it inadmissible to develop autonomous UAS operations in US airspace in the short and medium term, in particular if such platforms are intended to approach within a few metres of commercial aircraft carrying passengers. Although regulations already exist for the use of RPAs in sovereign airspace – as seen above – the use of RPAs for interception operations in the ADIZ has never been addressed. Thus, since no guidelines have been established for the execution of this type of mission with RPAs – in which there is a remote operation by an USAF pilot – it makes no sense to propose interceptions by autonomous platforms. The transfer of the FAA's stance to the USAF by NORAD strengthens and feeds the line of thought that the situation is not yet right for more rapid progress in autonomous UAS projects. Therefore, their use is already ruled out, not only in interception assignments, but also in other types of operations. In this way, manned combat aircraft will continue to ensure national air defence, on constant alert for any suspicious flying objects.

Scenario 2: Contained enthusiasm.

The second scenario arises from the consideration that, despite the fact that the USAF has made hardly any progress in R&D&I in terms of the development of autonomous UAS, there is harmony and willingness for dialogue in NORAD and FAA with respect to this new RMA. Although the USAF has other priorities in terms of project promotion and capital injection, it is aware that the development and application of autonomous platforms to real missions is a new technological-military race. It is therefore a new reality that should not be ignored, as there is a risk that nations with conflicting interests will gain an advantage in their development and employment.

Thus, projects are not suspended, but merely moved to a non-priority level. This means that, as far as resources allow, progress can be made on them. FAA's favourable attitude towards these new technologies makes it possible to create NORAD-FAA working groups at both tactical and strategic levels. The objective is to start designing the future implementation of these systems in interception missions, although it is acknowledged that this is unlikely to happen in the next two decades.

As an intermediate step, there is merit in starting with tests in segregated airspace, in which interceptions are carried out by RPAs associated as escorts to manned combat aircraft, thus establishing a previous level of "loyal wingman". In this way, while trials are being conducted, air defence alert aircraft will continue to be manned. In the event that the tests meet the appropriate conditions of safety and reliability, an interception will be carried out by the manned fighter jet and its RPA escort. The background and experience gathered from such interceptions will be of great help for the future implementation of the "loyal wingman" from autonomous UAS.

Scenario 3: Interdepartmental discrepancies.

The third scenario is based on progress being made in R&D&I, but, on the other hand, without adequate coordination and understanding between NORAD and FAA. Aware of the milestone reached and the race that has begun between the great powers, the USAF is capitalising on the success achieved with the prototype, directing more resources and efforts to achieve significant advances. The goal is the integration of the autonomous UAS into their operational weapon systems. Such proposals have been submitted to the FAA by NORAD, where, however, civil aviation has expressed the same reticence as in the first scenario, despite the relevant technological advances that the USAF has achieved in the short term.

They are similarly opposed to performing trials in segregated airspace, not even with RPAs, to test the feasibility of using autonomous UAS in interceptions in the ADIZ, which means that negotiations are stalled, considerably complicating the objectives of the USAF. Faced with such a situation, POTUS is forced to mediate between departments, suspending, as a precautionary measure, the use of these weapons systems except for the purpose of testing. In addition, there are protests from certain groups and demands regarding the ethics and legality of the use of autonomous robots, especially in national territory. The suspension will be applicable until detailed reports on the operation of autonomous UAS in missions abroad allow for the provision of reliable data that the systems are safe. If it is demonstrated that they perform such missions and others in an appropriate manner, POTUS may reconsider its position. Until then, interception missions will be carried out as in the first scenario.

Scenario 4: The mixed binomial

The fourth scenario is ideally suited to the “loyal wingman”, thanks to the advances in R&D&I achieved by the USAF, and also to the coordination and understanding between NORAD and FAA. This latter aspect, which gives priority and establishes working tables, agreements, procedures and regulations for the implementation of autonomous UAS by the government and its institutions, allows the general public to accept the new reality, which at the same time is fascinated by it. In this case, the chances of certain groups presenting and managing to hinder the project through ethical and legal approaches are substantially lower.

The USAF’s major technological investment has resulted in the combination of a manned fighter plane and a “loyal wingman” for interception missions. This makes it possible for aircraft such as the F-35 to carry more than one autonomous escort for more difficult or risky missions. The concept of the “loyal wingman” is not only associated with the F-35, but also with the F-22, or even another manned F-16, among other platforms. The same considerations could apply to the autonomous UAS itself.

Not surprisingly, the integration of the autonomous platforms into the USAF affects its entire structure, bringing its advantages to various types of missions both at home and abroad. This means, for example, that a logistics aircraft on a transport mis-

sion can also benefit from a robotic escort. The progressive implementation and the multiple experiences obtained in the different missions in which one or more “loyal wingman” is used, set the foundations for future projects. One must highlight the possibility of seeking total autonomy for the autonomous UAS, with the technological and security implications that this will entail in order to guarantee the success of the missions in which it participates.

Step 9. Analysing the implications of each scenario

Implications of Scenario 1

With the F-22 and F-35 – two of the pioneering aircraft of the fifth generation of fighter and attack aircraft – in full operation, and considering the demanding investment that the USAF has had to make and must maintain, it is unlikely that military commanders will venture into another multi-million dollar project aimed at R&D&I in autonomous UAS. The question is not whether these novel weapon systems are viable *per se*, but, firstly, the ability to defray the investments made so far, and, secondly, whether the USAF, even if the bold investment in the “loyal wingman” is successful, will be able to acquire the appropriate number of such platforms to make the expenditure justifiable⁴³. As Glade points out⁴⁴, aircraft automation implies a significant increase in the cost of the weapons subsystems that make up the aircraft, which favours traditional platforms and, to a lesser extent, RPAs.

Conversely, the very presence of humans on the platforms also entails higher costs associated with pilot protection systems – besides increasing the weight of the aircraft – and conditions its performance due to acceleration limits, gravitational forces and pilot fatigue. Therefore, autonomous UAS may represent a partial solution to the enormous monetary effort required by modern manned platforms today⁴⁵.

The considerable investment involved in the training of military pilots, the departure of many servicemen to join the labour market after completing the minimum number of years of service, the large number of air bases to be served, and the availability of conventional platforms on them, are some of the various factors affecting the USAF operation. This may mean that, in “peacetime”, certain interception operations do not meet the minimum security requirements, due to the fact that the mission is carried out by a single manned aircraft – instead of two – and is poorly armed. Nor-

43 BROWN, Donald. Bolts from Orion: Destroying mobile Surface-to-air Missile Systems with lethal autonomous aircraft. Alabama: Air Command and Staff College. Air University 2016, p. 45.

44 GLADE, David. Unmanned Aerial Vehicles: implications for military operations. Alabama: Air War College 2000.

45 PIETRUCHA, Michael W. «The next lightweight fighter. Not your grandfather’s combat aircraft». Air & Space Power Journal. 2013, p. 40.

mally, such a situation would not pose any major concerns, but when the aircraft to be intercepted does indeed pose a threat, a single interceptor would be more vulnerable as it would not have an escort to protect it while identifying the suspect platform.

Finally, the perception of the USAF's military superiority with the F-22 and F-35, along with the FAA's unwillingness to negotiate the operation of autonomous UAS in the ADIZ, may prove dangerous, as what is advantageous today will become obsolete tomorrow, if R&D&I and the use of RMAs are not pursued.

Implications of Scenario 2

Although autonomous UAS are not a priority in this scenario, the US authorities should avoid falling into the complacency and overconfidence of the previous analysis. On the one hand, progress, although long-lasting, must be of a high quality and reliable, to prevent, for example, poor security in telecommunications and electronic countermeasures from leading to a loss of control of the systems⁴⁶. On the other hand, the stance that potential opponents adopt regarding these systems must be taken into account. Growing concerns about the possible effects of an AI-based arms race⁴⁷ can be appreciated, for example, in China's demonstrations of civil uses. These show the great potential of this nation to participate fully in such a race⁴⁸.

One of the keys to progress in the integration of the autonomous UAS is the goodwill of NORAD-FAA. Working tables, coordination measures, concessions, agreements, flexible use of airspace and the generation of regulations are, among others, a necessary condition but not sufficient for this venture. In the absence of further definition, the testing and subsequent operation of RPAs as "loyal wingman" clearly represents progress, as well as valuable experience for the future full implementation of the autonomous UAS.

However, in view of the advantages of RPAs over conventional aircraft – greater autonomy, smaller size, diminished possibility of detection by the enemy and the ability to take greater risks⁴⁹– the staffing problem persists. This is because interception will continue to require two pilots – even if one operates remotely – in order to meet adequate security conditions. On the other hand, the UAS – whether RPA or autonomous – will be required to ensure that their sensors, information processing and decision-making are reliable according to the sensitivity of the mission; among other

46 WORK, Robert O.; BRIMLEY Shawn. «Preparing for war in the Robotic Age». Center for a new American security 2014, p. 23.

47 ROMANIUK, Scott N.; BURGERS, Tobias. «China's swarms of smart drones have enormous military potential». The Diplomat. 03/02/2018. Available at <https://thediplomat.com>.

48 ROMANIUK, Scott N.; BURGERS, Tobias. «China's swarms of smart drones have enormous military potential». The Diplomat. 03/02/2018. Available at <https://thediplomat.com>.

49 GLADE, David. Unmanned Aerial Vehicles: implications for military operations. Alabama: Air War College 2000, pp. 12-14.

reasons, because its operation can affect dozens of civilians. For this reason, automation is preferable, because of the semi-direct control that the manned plane has over an autonomous aircraft, and because of the minimum delay in communications.

Finally, with the lack of R&D&I available in this scenario, in order to climb up the USAF's priority level, autonomous UAS must be economically more cost-effective compared to traditional aircraft. Limited capacity designs such as those of Pietrucha⁵⁰ can gain ground. The type of aircraft proposed reflects a concept of "loyal wingman" viable in the short term, and capable of participating in operations with guarantees of success. This aircraft would shorten the deadlines for the deployment of autonomous UAS, which could be available before 2035, and even be used directly without going through an intermediate phase of greater RPA involvement.

Implications of Scenario 3

In its strategic documents, the USAF contemplates the development and use of autonomous UAS, even demonstrating very concrete possible scenarios⁵¹. The aim is for these systems to be highly adaptable and flexible and to increase capabilities in environments with all kinds of risks, in order to enjoy an advantageous position vis-à-vis their adversaries. Such platforms are expected to fulfil all kinds of missions, such as intelligence, surveillance and reconnaissance, SEAD, air-to-ground attacks, casualty evacuation, logistics, and others. In turn, they describe the technical needs, support and prospects for these systems to accomplish such missions, either exclusively or as components of a larger team. To this end, they consider, among others, the concepts of swarming and "loyal wingman"⁵².

Nevertheless, the USAF is aware that legal, ethical and doctrinal aspects cannot be ignored⁵³. Mirroring the different opinions expressed in the third scenario, Guetlein⁵⁴ argues that, even when achieving a very high level of sophistication in autonomous weapons, the human component will always intervene. He states that their low tolerance of their own casualties and collateral damage may favour robotics. Furthermore, it advocates the development of conceptual and doctrinal approaches, testing in controlled environments, and TTPs that take for granted that such systems will be inte-

50 PIETRUCHA, Michael W. «The next lightweight fighter. Not your grandfather's combat aircraft». *Air & Space Power Journal*. 2013, pp. 39-58.

51 UNITED STATES AIR FORCE. *Air Force future operating concept. A view of the Air Force in 2035*. Washington D.C.: 2015, p. 20.

52 UNITED STATES AIR FORCE. *USAF RPA vector. Vision and enabling concepts 2013-2038*. Washington D.C.: 2014.

53 UNITED STATES AIR FORCE. *America's Air Force. A call to the future*. Washington D.C.: 2014, p. 19.

54 GUETLEIN, Mike. *Lethal autonomous weapons. Ethical and doctrinal implications*. Rhode Island: Naval War College 2005.

grated into real military operations. Nonetheless, it conditions the implementation of these, primarily, on the trust they create in military commanders.

Thurnher⁵⁵ adopts an approach that focuses on the arms race. Leaving the legal discussion to one side, he asserts that the United States must remain at the forefront of the development and use of autonomous weapons systems, or other nations will take over. In contrast, Mousazadeh et al.⁵⁶ attach greater importance to the legal framework, believing that the use of autonomous UAS is unlikely to meet the criteria of international humanitarian law. On the other hand, similar to Guetlein, Gillespie & West⁵⁷ suggest that, regardless of the level of autonomy that weapons systems achieve, the authorisation to carry out an attack should arise from an appropriate hierarchical command and control structure, identifying the need for human decision-makers at critical points. This idea is also shared by the USAF itself, which conceives of the mixed use of conventional, remotely operated and autonomous weapons systems, reserving the management of critical tasks to military personnel⁵⁸.

Due to the wide variety of missions, the requirements to be met by autonomous platforms will vary. The difficulties in achieving a high level of effectiveness and efficiency for specific missions makes the development of multipurpose platforms much more complex, although missions with similar characteristics can be fulfilled by the same platform. Favourable statistics on the use of “loyal wingman” in foreign operations will be decisive for obtaining presidential authorisation to use autonomous UAS in interception missions in US airspace. Therefore, minimum failure levels will be required, as well as the successful completion of escort functions, both in interceptions, air-to-air combat, or in SEAD. Conditioning such a decision, the idea defended by Cheater will surely be key⁵⁹, according to which the algorithms that form the AI of the autonomous UAS, must be designed in such a way that the system acts in one way if it is in a civilian domestic environment, and in another way if it is in combat. Within such statistics, the command and control requirements must also be satisfied to ensure that operations are in compliance with the law. The total absence of humans in the decision-making process is outside the established timeframe.

55 THURNHER, Jeffrey S. *No one at the controls: the legal implications of fully autonomous targeting*. Rhode Island: Naval College of War 2012.

56 MOUSAZADEH, Reza et al. «Analyzing the legal dimensions of Unmanned Combat Aerial Vehicle in the International Law». *Journal of Politics and Law*, n.º 10. 2016, pp. 1-11.

57 GILLESPIE, Tony; WEST, Robin. «Requirements for autonomous unmanned air systems set by legal issues». *The International C2 Journal*, n.º 2. 2010, pp. 5-6.

58 UNITED STATES AIR FORCE. *Air Force future operating concept. A view of the Air Force in 2035*. Washington D.C.: 2015, p. 21.

59 CHEATER, Julian C. *Accelerating the kill chain via future Unmanned Aircraft*. Air War College 2007, p. 22.

Implications of Scenario 4

The fact that the fourth scenario brings together the best conditions for the development of the project does not mean that there are no expectations that the autonomous UAS should meet. Some (partially) ambiguous statistics regarding the reliability of the systems may trigger the kind of mistrust displayed in the third scenario. The integration of these systems in the USAF – and by extension in NORAD – will modify the doctrine and affect operations⁶⁰. In order to develop these, the autonomous weapon system, in this case the “loyal wingman”, needs to be reliable. It must therefore be robust against hacking, safe against cyber-attacks and electronic warfare, and have advanced computing and autonomy. In addition, it is crucial to have AI techniques capable of acting according to rules of engagement and other discriminating factors⁶¹. Similarly, it would be important that, by linking a “loyal wingman” to a pilot of another aircraft, the AI of the associated autonomous UAS should learn and retain in its “know-how” the tactical considerations and modus operandi of the missions carried out by the pilot, in order to optimise the performance of the team. In this way, what is really important is that the AI corresponding to a given pilot is loaded – as if it were software – into the autonomous platform that is going to escort him for a given mission⁶².

In interception, the most sensible way to reduce the human risk would be for the autonomous UAS to carry out visual recognition, while the manned aircraft has a shot at the intercepted aircraft. This would require the UAS to have the ability to interpret the information it collects – for example, by using cameras that record in various spectrums – alerting the pilot and taking action if necessary. Another option is that the information collected should be transferred directly to the monitor of the manned aircraft – notwithstanding the fact that the UAS will act without waiting for orders from the crew, even if only in defensive actions. However, switching positions should not be ruled out, allowing the crew to make visual reconnaissance, while the UAS remains alert behind the intercepted aircraft. In this case, the “loyal wingman” would be given freedom of action – under the rules of engagement – if the situation so required.

Here too, NORAD-FAA coordination will be crucial. In this sense, it should be noted that the civil sector already acknowledges that humanity is “on the edge” of a new great era in aviation, with a leading role for the UAS, including autonomous

60 PALMER, Adam A. *Autonomous UAS: A partial solution to America's future airpower needs*. Alabama: Air Command and Staff College 2010, p. ii.

61 WORK, Robert O.; BRIMLEY Shawn. «Preparing for war in the Robotic Age». Center for a new American security. 2014, pp. 22-25.

62 BROWN, Donald. *Bolts from Orion: Destroying mobile Surface-to-air Missile Systems with lethal autonomous aircraft*. Alabama: Air Command and Staff College. Air University 2016, p. 48.

systems. This is why it is committed to the integration of such systems, guaranteeing safety in airspace at all times⁶³.

Finally, faced with the possibility that this scenario will lay the foundations for fully automated platforms, a number of different positions exist. Pietrucha⁶⁴ advocates that autonomous UAS represent a “force multiplier, but not a replacement” for experienced and well-trained crews, setting the RMA limit on the fledgling “loyal wingman”. A more optimistic position, foresees the assumption of more and more types of missions by autonomous UAS, with the corresponding progress in doctrine, TTPs and technology. However, it also argues that aviators will continue to play a key role, thus advocating a mixed team of manned aircraft, RPAs and autonomous UAS⁶⁵.

Conclusions

The emerging era of robotics and nanotechnology is encouraging the use of robotics on the battlefield. Autonomous weapon systems are an RMA that cannot be ignored, and are making their way into the various branches of the US Armed Forces. In the case of interception operations in Air Defence, the battleground is the sovereign airspace and of responsibility of the United States, and the autonomous weapons systems of interest are those that would operate in that environment.

Using the technique of scenario building and analysis, we have carried out a future-oriented analysis of the implications that the use of autonomous UAS may have on the type of operation described. Enhancing the use of such systems will depend mainly on the decisions and agreements reached between the USAF, NORAD and FAA. The four proposed scenarios are only some of many others that can be proposed and analysed. However, they are deemed to be characteristic of the different degree of implementation of such autonomous systems within NORAD’s mandate.

As far as their use is concerned, the automation of the aerial platforms has given rise to two different models: swarming, and the “loyal wingman”. The former seems to have aroused more interest among researchers in the military aerospace field, mainly because of its low cost and greater survival capacity. However, with a 2035 target date, the “loyal wingman” is considered to be the ideal model for air defence interception missions. The achievements to date, the need to continue to effectively address major platforms, and the differences in military organisation, doctrine and technology between the various nations, all justify this.

63 FEDERAL AVIATION ADMINISTRATION. *FAA Strategic Plan. FY 2019-2022*. Washington D.C.: 2019, pp. 1 and 7.

64 PIETRUCHA, Michael W. «The next lightweight fighter. Not your grandfather’s combat aircraft». *Air & Space Power Journal*. 2013, p. 40.

65 PALMER, Adam A. *Autonomous UAS: A partial solution to America’s future airpower needs*. Alabama: Air Command and Staff College 2010.

A transition from conventional military aircraft to fully autonomous UAS, involving a hybrid operation, is therefore necessary. The ethical and legal concerns of some authors regarding total autonomy, as well as the ideas expressed in the USAF strategic documents, advocate a human presence at critical points in the decision-making process. The total automation of such systems, as well as their operation on the battlefield without any supervision, exceeds the established time horizon.

All this makes the last scenario the most plausible of the four. The relative simplicity of a peacetime interception mission should not present many difficulties in implementing the manned fighter/attacker combination with the “loyal wingman” in such missions. Favourable results will also allow for its implementation in more complex missions.

In view of the establishment – not without its difficulties – of the joint operation, the United States, as an important and influential component of NATO, must be able to exploit this RMA, heading up a progressive and across-the-board transition among the members of the Alliance. As a clear reference of doctrine and TTP’s, the US commitment will be key to strengthening NATO, and securing an advantageous position in comparison with other alliances.

In short, given the leading doctrinal and technological position in which the United States has regularly found itself, the arms race that has already begun, and the level of importance that this nation attaches to national security, these all generate a propitious environment for the emergence of robotics on the battlefield. Consequently, the USAF should not miss out on the opportunity to continue developing and improving this fascinating project.

Bibliographic references

- BALOCH, Qadar B.; KAREEM, Nasir. «Review of The Third Wave», by Alvin TOFFLER. *The Journal of Managerial Sciences*, n.º 2. 2007, pp. 115-143.
- BAQUÉS, Josep. «Revoluciones militares y revoluciones en los asuntos militares». In JORDÁN, Javier (coord.). *Manual de estudios estratégicos y seguridad internacional*. Madrid: Plaza y Valdés 2013, pp. 119-127.
- BROWN, Donald. *Bolts from Orion: Destroying mobile Surface-to-air Missile Systems with lethal autonomous aircraft*. Alabama: Air Command and Staff College. Air University 2016.
- BROWN, Sayom. «Scenarios in systems analysis». In QUADE, E. S.; BOUCHER, W. I. (coords.). *Systems analysis and policy planning: applications in defense*. Santa Monica, California: The RAND Corporation 1968, pp. 298-310.
- BURNS, Brian S. *Autonomous Unmanned Aerial Vehicle rendezvous for automated aerial refueling*. Thesis. Ohio: Air Force Institute of Technology 2007.

- CHEATER, Julian C. *Accelerating the kill chain via future Unmanned Aircraft*. Air War College 2007.
- DEWEERD, Harvey A. *Political-military scenarios*. Santa Monica, California: The RAND Corporation 1967.
- FEDERAL AVIATION ADMINISTRATION. *Air Traffic Plans and Publications*. Washington D.C.: 2019 [consulted el 6 de abril de 2019]. Available at https://www.faa.gov/air_traffic/publications/#manuals.
- FEDERAL AVIATION ADMINISTRATION. *FAA Strategic Plan. FY 2019-2022*. Washington D.C.: 2019.
- FRANTZ, Natalie R. *Swarm intelligence for autonomous UAV control*. Thesis. California: Naval Postgraduate School 2005.
- GILLESPIE, Tony; WEST, Robin. «Requirements for autonomous unmanned air systems set by legal issues». *The International C2 Journal*, n.º 2. 2010, pp. 1-30.
- GLADE, David. *Unmanned Aerial Vehicles: implications for military operations*. Alabama: Air War College 2000.
- GUETLEIN, Mike. *Lethal autonomous weapons. Ethical and doctrinal implications*. Rhode Island: Naval War College 2005.
- JORDÁN, Javier. «La técnica de construcción y análisis de escenarios en estudios de seguridad y defensa». *Análisis GESI 24/2016*. Grupo de Estudios en Seguridad Internacional 2016.
- JORDÁN, Javier. «Un modelo explicativo de los procesos de cambio en las organizaciones militares. La respuesta de Estados Unidos después del 11-S como caso de estudio». *Revista de Ciencia Política*, n.º 1. 2017, pp. 203-226.
- LOCKHEED MARTI, N. *US Air Force, Lockheed Martin demonstrate manned/ unmanned teaming*. Maryland: 2017 [consulted 30 January 2019]. Available at <https://news.lockheedmartin.com/2017-04-10-U-S-Air-Force-Lockheed-Martin-Demonstrate-Manned-Unmanned-Teaming>.
- MANSON, Katherine. «Robot soldiers, stealth-jets and drone armies: the future of war». *Financial Times*. 16/11/2018. Available at <https://www.ft.com>.
- MOUSAZADEH, Reza *et al.* «Analyzing the legal dimensions of Unmanned Combat Aerial Vehicle in the International Law». *Journal of Politics and Law*, n.º. 10. 2016, pp. 1-11.
- NIDAL, Jodeh M. *Development of autonomous Unmanned Aerial Vehicle research platform: modeling, simulating and flight testing*. Thesis. Ohio: Air Force Institute of Technology 2006.
- NORTH AMERICAN AEROSPACE DEFENSE COMMAND. *Memorandum of understanding between NORAD and the FAA*. Colorado: 1987.

- NORTH AMERICAN AEROSPACE DEFENSE COMMAND. *NORAD intercept procedures, Air Defense Identification Zone, & Temporary Flight Restrictions*. Colorado: 2011 [consulted el 3 de abril de 2019]. Available at <https://www.hsdl.org/?abstract&did=748300>
- NORTH AMERICAN AEROSPACE DEFENSE COMMAND. *About NORAD*. Colorado: 2019 [consulted 21 March 2019]. Available at <https://www.norad.mil/About-NORAD/>.
- NORTH AMERICAN AEROSPACE DEFENSE COMMAND. *Civil Aviation Resources*. Colorado: 2019 [consulted 21 March 2019]. Available at <https://www.norad.mil/General-Aviation/>.
- PALMER, Adam A. *Autonomous UAS: A partial solution to America's future airpower needs*. Alabama: Air Command and Staff College 2010.
- PIETRUCHA, Michael W. «The next lightweight fighter. Not your grandfather's combat aircraft». *Air & Space Power Journal*. 2013, pp. 39-58.
- REILLY, M. B. «Beyond video games: New artificial intelligence beats tactical experts in combat simulation». *University of Cincinnati Magazine*. 27/06/2016. Available at <https://magazine.uc.edu>.
- ROMANIUK, Scott N.; BURGERS, Tobias. «China's swarms of smart drones have enormous military potential». *The Diplomat*. 03/02/2018. Available at <https://thediplomat.com>.
- RUTGERS UNIVERSITY. *Law Review. The FAA and NORAD*. Nueva Jersey: 2011 [consulted 2 April 2019]. Available at <http://www.rutgerslawreview.com/2011/1-the-faa-and-norad/>.
- SCHARRE, Paul. «Robotics on the battlefield part II. The coming swarm». *Center for a new American security* 2014.
- THURNHER, Jeffrey S. *No one at the controls: the legal implications of fully autonomous targeting*. Rhode Island: Naval College of War 2012.
- UNITED STATES AIR FORCE. *America's Air Force. A call to the future*. Washington D.C.: 2014.
- UNITED STATES AIR FORCE. *USAF RPA vector. Vision and enabling concepts 2013-2038*. Washington D.C.: 2014.
- UNITED STATES AIR FORCE. *Air Force future operating concept. A view of the Air Force in 2035*. Washington D.C.: 2015.
- UNITED STATES AIR FORCE. *Annex 3-01. Counterair Operations*. Alabama: 2016.
- UNITED STATES AIR FORCE. *Annex 3-27. Homeland Operations*. Alabama: 2016.
- UNITED STATES DEPARTMENT OF DEFENSE. *Department of Defense announces successful micro-drone demonstration*. Virginia: 2017 [consulted 27 Jan-

uary 2019]. Available at <https://www.defense.gov/Newsroom/Releases/Release/Article/1044811/department-of-defense-announces-successful-micro-drone-demonstration/>.

UNITED STATES DEPARTMENT OF DEFENSE. *Meet the team*. Virginia: 2019 [consulted 20 March 2019]. Available at <https://www.defense.gov/Our-Story/Meet-the-Team/>.

UNITED STATES DEPARTMENT OF TRANSPORTATION. *Federal Aviation Administration*. Washington D.C.: 2019 [consulted 23 March 2019]. Available at <https://www.faa.gov/>.

VINCENT, James. «China is worried an AI arms race could lead to accidental war». *The Verge*. 06/02/2019. Available at <https://www.theverge.com>.

WORK, Robert O.; BRIMLEY Shawn. «Preparing for war in the Robotic Age». Center for a new American security 2014.

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An Empirical analysis of international collaboration in the provision of Defence assets: Advantages and Limitations

Abstract

Despite the fact that collaboration in European armaments programmes has existed for more than seventy years, the difficulties facing such collaboration persist. These include the harmonisation of requirements and building consensus, generally motivated by national interests, preferences and budgetary priorities that do not match those of prospective partners. This study of the potential advantages and the main drawbacks inherent in international collaboration programmes, together with an analysis of cases of success and failure in Europe, leads us to conclude that collaboration makes it possible to strengthen international security and defence relations, and share risks, efforts and resources in obtaining new, more advanced common capabilities that improve interoperability among allies. Furthermore such collaboration can also act as a catalyst for industrial restructuring that rationalises the number of main contractor companies, encourages specialisation and improves their international competitiveness.

Keywords

International collaboration; defence assets; states; defence industry; collaboration programmes.

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Introduction

Since the end of the Cold War, the European security environment has changed, with collaboration between the armed forces of different member states on prolonged missions abroad becoming more common, as a result of the EU's Common Security and Defence Policy (CSDP). The growing needs for military interoperability, insufficient national capabilities, increasing development costs, programme uncertainty and risks make collaboration in the procurement of defence goods advisable. However, in many cases the autarkic character of the member states prevails, with countries still opting for national developments, examples of which are the French *Rafale* or the Swedish *Gripen* fighter planes.

Against this background, this article analyses the advantages of state participation in international industrial collaboration programmes, as well as the main drawbacks, problems and limitations that may arise, through a review of cases of success and failure of this type of programme in Europe since the end of the 1960s.

The efforts of European collaboration

Some of the earliest traces of international collaboration on defence projects date back to 1945, with work performed by German scientists at the Berlin Institute of Ballistics alongside French scientists in fields such as ballistics, aerodynamics and electronic research¹. From the 1950s onwards, a strong initiative emerged in favour of European industrial cooperation between states with the strongest technological, industrial and economic capabilities, due to concerns about low exports that could offset the rising unit costs of military equipment and systems². Among the first projects were the agreement to manufacture the French military transport aircraft *Nord Noratlas* under licence on German soil in 1956; the manufacture of the long-range air reconnaissance aircraft, *Br. 1150 ATL*, with an initial agreement between France and Germany, in 1959, and the subsequent incorporation of Belgium, Holland and Italy; the Franco-German *MILAN* anti-tank guided missiles, in 1962; the joint Franco-German developments in *HOT* and *ROLAND* missiles; the *Alpha* light attack and advanced training aircraft, manufactured by the German company Dornier and the French Dassault-Breguet, with the flight of the first French prototype in 1973; and the entry into service of the Anglo-French *Jaguar* aircraft in the same year. These collaborations have promoted different industrial restructurings: mergers, such

1 WILLIS, F.R. *France, Germany, and the New Europe, 1945-1967*. California: Stanford University Press 1968, pp. 314-330.

2 WALKER, W.; GUMMETT, P. «Nationalism, internationalism and the European defence market». *Chaillot Papers*, 9. Paris: Institute for Security Studies of WEU 1993, pp. 22-25.

as EADS, MBDA; strategic alliances, such as *ANZAC Alliance*; consortiums, such as *Eurofighter GmbH* or *Euromissile*; or ad hoc agreements between member states for specific projects strengthening the industry at a European level. In parallel, at an institutional level, the idea of European collaboration in defence matters goes back to the efforts of integration at the beginning of the Cold War, before the establishment of the European Coal and Steel Community (ECSC) in 1951 which marked the beginning of the integration of Europe. These include the 1948 Treaty of Brussels, which led to the beginnings of the Western European Union (WEU); the 1963 Elysée Treaty between France and Germany to coordinate security and defence matters; the creation of the Independent European Programme Group (IEPG) in 1976 by the European NATO countries, except Iceland, which in 1992 became the Western European Armaments Group (WEAG), within the framework of the WEU; the creation of the Western European Armament Organisation (WEAO) and the Organisation for Joint Armament Cooperation (OCCAR) in 1996; the 1998 Letter of Intent (LoI) to restructure the defence industry, and the subsequent ratification of a Framework Agreement in 2000. In 2004, the European Defence Agency (EDA) was established to promote the CSDP³ and to create a strong European Defence Technological and Industrial Base (EDTIB) with a view to fostering collaboration and strengthening the EU's security and defence capabilities. For its part, the European Commission, in a bid to encourage collaboration in research and the development of joint armament programmes, created the European Defence Fund (EDF) in 2017, and defined seventeen cooperative projects in March 2018, extended to thirty-four in November of the same year, based on joint spending on capabilities previously agreed by the member states to act as a catalyst for technological capability building in the EU.

Analysis of International Cooperation Programmes in Europe

This section provides an analysis of unsuccessful and successful examples of different collaborative programmes since the late 1960s.

Unsuccessful Cases

In most collaborative programmes, a variety of factors coincide, generated by the environment or as a result of unresolved disagreements, which can ultimately undermine them. The following table includes a review of some cases of failure, the main causes and the countries involved

3 Following the implementation of the Lisbon Treaty in December 2009, the European Security and Defence Policy (ESDP) was renamed the CSDP.

| Programme | Countries | Main causes of failure | Consequence |
|--|--|--|---------------------------------|
| VAK 191B ⁴ | Germany, Italy, UK | Disagreement on harmonisation of requirements. Increase in costs. | They only made three prototypes |
| Anglo-French Variable Geometry (AFVG) ⁵ | France, UK | Disagreement on harmonisation of requirements. Discrepancies in cost criteria | Cancelled |
| Main Battle Tank (MBT-70) ⁶ | Germany, USA. | Disagreement on harmonisation of requirements. Increase in costs | Cancelled |
| European Fighter Aircraft (EFA) ^{7 8 9} | Germany, France, UK, Italy, Spain | Disagreement on work-sharing. Purchase reduction due to budget restrictions. | France withdraws |
| NATO Frigate Replacement (NFR-90) ^{10 11} | France, Italy, Germany, UK, Holland, Spain, USA., Canada | Large number of participating countries. Disagreement on harmonisation of requirements. | Cancelled |
| TRIGAT MR ¹² | France, UK, Germany, Belgium, Netherlands | Delays in signing agreement by some countries. Reduction in the number of units requested. | UK & Netherlands withdraw |
| Horizon CNGF ¹³ | France, Italy, UK | Disagreement on harmonisation of requirements. | UK withdraws |

4 FLIGHT INTERNATIONAL. «VAK 191B cancelled... Flight». International.com. 7/12/1972, p. 798. <https://www.flightglobal.com/FlightPDFArchive/1972/1972%20-%203225.pdf>.

5 WOOD, D. Project Cancelled: Disaster of Britain's Abandoned Aircraft Projects. London: Macdonald and Jane's Publishers 1975, pp. 202-204.

6 GLOBALSECURITY. «MBT-70/XM803». Globalsecurity.org. 2011. <https://www.globalsecurity.org/military/systems/ground/mbt-70.htm>.

7 The acronym EFA identifies the initial stage of the European fighter aircraft programme with the participation of France, whose withdrawal along with a reduction of the number of units almost brought about the cancellation of the programme. However, the remaining countries finally produced the Eurofighter.

8 TUCKER, J. B. «Partners and Rivals: A Model of International Collaboration in Advanced Technology». International Organization, 45 (1). 1991, pp. 112-115.

9 LORELL, M. A. The Use of Prototypes in Selected Foreign Fighter Aircraft Development Programs. Santa Monica, CA: RAND 1989, p. 12.

10 GLOBALSECURITY. NATO Frigate Replacement for the 1990s [NFR-90]. Globalsecurity.org, 2013. <https://www.globalsecurity.org/military/world/europe/nfr-90.htm>

11 RUIZ, R. M. «El último vástago del programa NFR-90». Revista Ejércitos, 5. 2010, pp. 30-47. https://issuu.com/ejercitos/docs/revista_ejercitos_n_5?q=NFR-90.

12 THINK DEFENCE. «Javelin Anti-Tank Guided Weapon (ATGW). UK Complex (Guided) Weapons – Reference». ThinkDefence.co.uk. 2018. <https://www.thinkdefence.co.uk/uk-complex-weapons/javelin-anti-tank-guided-weapon-atgw/>.

13 RUIZ, R.M. Op.cit., pp.30-47. https://issuu.com/ejercitos/docs/revista_ejercitos_n_5?q=NFR-90.

| | | | |
|---|---|--|--------------|
| Multi-Role Armoured Vehicle (MRAV) ¹⁴ | Germany, UK, Netherlands | Disagreement on harmonisation of requirements. | UK withdraws |
| Tonal Light Attack Helicopter (LAH) ^{15 16} | Italy, Netherlands, Spain, UK | Disagreement on harmonisation of requirements. Poor coordination. Reduced national budgets. Withdrawal to acquire another system. | Cancelled |
| Modular Standoff Weapon (MSOW) ^{17 18 19} | Germany, Italy, UK, Spain, France, USA., Canada | Withdrawal of countries over disagreement work-sharing & costs. Disagreement on harmonisation of requirements. Inadequate national financing | Cancelled |
| Autonomous Precision Guided Munitions Programme (APGM) ^{20 21} | Germany, France, Italy, Spain, Netherlands Turkey, USA., Canada | Disagreement on harmonisation of requirements. Inadequate national financing. Mismanagement due to number of states. Technology transfer problems. | Cancelled |

Table I. Summary main causes of failure of programmes analysed.

Based on the data collected in the table above, the following graph represents a statistical analysis of the most common causes of programme failure, highlighting the disagreement on harmonisation of requirements, which is present in 83% of the programmes. In some cases, such as the *AFVG*, disagreement was due to the need for solutions with different roles and exclusive characteristics; in others, like the *NFR-90*, it was mainly due to the complexity of achieving unanimity in large groups, this being the case in forty-two percent of the cases analysed. In short, we are dealing with two sides of the same coin.

14 GLOBALSECURITY. «Multi-Role Armoured Vehicle (MRAV)». Globalsecurity.org. 2016. <https://www.globalsecurity.org/military/world/europe/mrav.htm>.

15 BRZOSKA, M.; LOCK, P. Restructuring of Arms Production in Western Europe. SIPRI Monographs. United States: Oxford University Press 1992, pp. 97-107.

16 DATAQUEST. Military Electronic Systems Markets. Dataquest. San José: CA 1991, pp. 92-93.

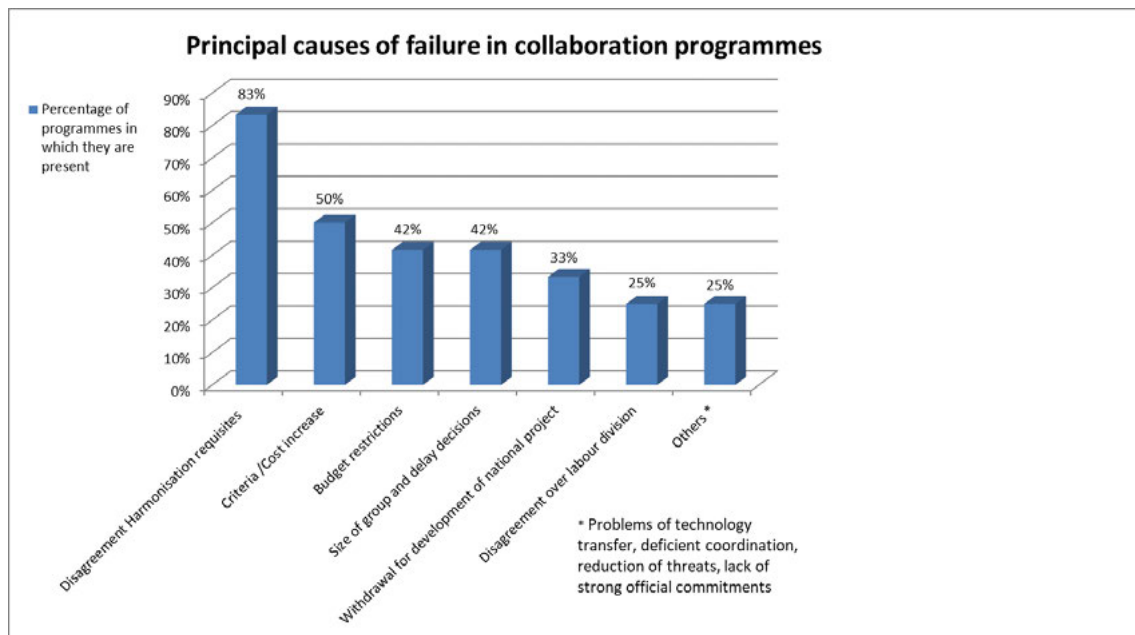
17 DATAQUEST. Op. cit., p. 94.

18 BLEAKLEY, G.A. International Armaments Cooperation: A Case Study of the Modular Standoff Weapons. Thesis. Ohio: Wright-Patterson Air Force Base 1988, pp. 3-7.

19 THINK DEFENCE. «Storm Shadow Conventionally Armed Stand Off Missile (CASOM)». ThinkDefence.co.uk. n.d. www.thinkdefence.co.uk/uk-complex-weapons/storm-shadow-conventionally-armed-stand-off-missile-casom/.

20 JOHNSON, E. L. Howitzer Ammunition System Procurement (HASP). Alexandria, Virginia: U.S. Army Material Command 1991, p. 73.

21 SMITH, D. Weaponry after the Gulf war - New equipment requirements for restructured armed forces. Document 1272, 14/05/1991, p. 23. <http://aei.pitt.edu/53851/1/Bo979.pdf>.



Graph 1. Main causes of failure of programmes analysed. Source: Prepared by the author.

Another cause of failure highlighted in the collaboration programmes is the increase in costs, present in fifty percent of the cases, for example, in the *MBT-70* programme, caused by a lack of agreement on the requirements and by technical problems due mainly to the development of new experimental systems, in addition to budgetary restrictions present in forty-two percent of the cases. The withdrawal of states, present in one third of the programmes analysed, is in some cases more a consequence of the first three causes mentioned, as occurred with the *NFR-90* and *Horizon CNGF* frigates and the *MRAV* armoured vehicle. In the first case, countries withdrew to meet the needs of a new partnership programme, while in the remainder they did so to meet the needs of national programmes. In other cases, national programmes are one of the main causes of abandonment, as illustrated by the French government's abandonment of the *EFA* programme to develop the *Rafale*; or the UK and Netherlands' withdrawal from the *LAH* helicopter to acquire the *AH-64 Apache*. Finally, at the lower end of the graph, there are disagreements on the division of labour – one of the keys to France's withdrawal from the *EFA* – problems related to technology transfer, poor coordination and division of labour among the participants, a reduction of threats and the lack of serious official commitment.

These problems will be examined more closely in the section devoted to factors limiting collaboration programmes.

Success stories

There are also success stories in European collaboration programmes where, despite the limitations analysed in previous sections, the common interest of the countries involved has ensured that – despite adversity, delays and cost overruns – development and manufacture have been successfully completed (see table below).

| Programme | Countries involved | Estimated orders European market | Exports (estimated orders) |
|------------------------------------|---|-------------------------------------|-------------------------------|
| Eurofighter (EF2000) ²² | Germany, United Kingdom, Italy, Spain | 487 | 136 |
| A400M ^{23 24} | Germany, France, Spain, Turkey, United Kingdom, Belgium, Luxembourg | 170 | 4 (+17 possible) |
| Tiger (EC665) ²⁵ | France, Germany, Spain | 184 | 22 |
| NH-90 ²⁶ | France, Germany, Spain, Italy, Netherlands | 440 | 103 |
| COBRA ^{27 28} | Germany, France | 29 | 3 |

Table II. Success stories International Cooperation Programmes. Source: Prepared by the author

Notable examples include the *Eurofighter* programme, currently the largest European defence procurement programme with over 600 orders and the highest number from outside the EU (over 20 per cent of total orders). This programme has served to maintain and enhance the European fighter jet industry, achieve further consolidation of the aerospace sector and reduce dependence on the US. However, mainly due to collaboration agreements and technological complexity, it has had cost overruns of more than seventy-five percent over the initial estimate and delays of roughly fifty-four months; values which, on the other hand, are typical of modern weapons systems development projects (see table below), as was the case with the *A400M*, with cost overruns of around fifty percent over the initial estimate and delays of approximately four years due mainly to technical problems, similar to the rest of the European and North American programmes.

22 AIRBUS. «Orders, Deliveries, In Operation Military Aircraft by Country – WorldWide». Airbus.com. 30/04/2018. <http://www.airbus.com/defence.html>.

23 AIRBUS. Op. cit. <http://www.airbus.com/defence.html>.

24 JAARSMA, M. «A400M». Phantomaviation.nl. 2018. www.phantomaviation.nl/Aircraft/A400M.htm.

25 OCCAR. TIGER – A New Generation of Helicopters. 2018. www.occar.int/programmes/tiger.

26 JAARSMA, M. «NH90». Phantomaviation.nl. 2018. www.phantomaviation.nl/Aircraft/NH90.htm.

27 DEFENCEWEB. «First export success for the COBRA Radar in Gulf region». DefenceWeb.co.za. 25/02/2009. http://www.defenceweb.co.za/index.php?option=com_content&view=article&id=1165.

28 EURO-ART. «Roll-out of 29 COBRA Systems for France, Germany and the United Kingdom completed». thalesgroup.com. 2007. <http://www.defense-aerospace.com/articles-view/release/3/85494/cobra-radar-deliveries-now-complete.html>.

| Programme | Estimated delay (months) | Estimated cost over-run |
|--|--------------------------|-------------------------|
| Eurofighter (collaboration) ^{29 30} | 54 | 75% |
| F/A-22 (USA.) ³¹ | 117 | 127% |
| JSF (collaboration) ³² | 30 | 50% |
| Submarine class <i>Astute</i> (UK) ³³ | 43 | 35% |
| A400M (collaboration) ^{34 35} | 48 | 40%-50% |

Table III. Cost over-runs and delays different programmes.

In other cases, such as the *TIGER* or *NH-90* helicopter programmes, member states opted for the development of a common and versatile platform on which to incorporate modifications to develop different versions. In particular, the *NH-90* has been acquired by more than ten countries, including European allies that have previously collaborated in international programmes generating both industrial and military synergies. However, when the range of versions is very different, as for example in the case of the *F-35* fighter plane³⁶, it has meant a loss of efficiency in production, delays and cost overruns, mainly due to the large differences in the various versions, and not because it is a joint programme. In short, despite budgetary constraints, significant cost overruns and delays in the development of the programmes, in addition to varying national interests, the EU's desire to unify armament models, invest in the European defence industry and create highly skilled technological jobs, has favoured the success of cooperation agreements, as will be analysed in greater depth in the following section on the factors that promote collaboration.

29 NAO. Management of the Typhoon Project. Report by the Comptroller and Auditor General HC 755 Session 2010–2011. London: National Audit Office (NAO) 2011, p. 7.

30 NAO. Major Projects Report 2005. London: National Audit Office (NAO) 2005, p. 27.

31 GAO. Tactical Aircraft: Changing Conditions Drive Need for New F/A-22 Business Case. Report GAO-04-391. Washington: U.S. Government Accountability Office (GAO) 2004, p. 5.

32 GAO. Joint Strike Fighter - Strong Risk Management Essential as Program Enters Most Challenging Phase. Report GAO-09-711T. U.S. Government Accountability Office (GAO), GAO.gov., 2009, pp. 17-18. www.gao.gov/new.items/do9711t.pdf.

33 NAO. Op. cit., 2005, pp. 26-27.

34 REUTERS. «Airbus says A400M deal with buyers will limit future losses». Reuters.com. 07/02/2018. <https://www.reuters.com/article/us-singapore-airshow-a400m/airbus-says-a400m-deal-with-buyers-will-limit-future-losses-idUSKBN1FR19Y>.

35 EXPANSIÓN. «Airbus quiere revitalizar el A400M, el avión militar de los 20.000 millones». Expansion.com. 10/07/2018. www.expansion.com/empresas/transporte/2018/07/10/5b43be04268e3e2e428b460b.html.

36 Avión de combate diseñado en tres versiones distintas: F-35A, para despegue y aterrizaje convencional; F-35B, para despegues cortos y aterrizajes verticales; F-35C, variante naval para portaaviones.

Factors promoting international collaboration.

In the following sections, we examine the main driving factors behind international collaboration in defence programmes.

Operational

The growing need for a greater alignment of mission capabilities among partners and the opportunity for operational benefits from interoperability and standardisation of equipment and systems make operational capabilities one of the main reasons for collaboration and synergy in joint operations. Therefore, an excessive variety of systems – such as the high number of different models of fixed-wing aircraft deployed in NATO's Allied Force in Kosovo³⁷ – does not make sense, as it hinders interoperability between the armed forces of different States. However, a certain degree of diversity is necessary to allow for different complementary capabilities and to avoid dependence on a single weapons system. This balance can be achieved through an annual EU-wide defence review coordinated by the EDA which defines and harmonises the necessary capabilities, with the Council launching the appropriate collaborative projects, so that states can subsequently participate in Permanent Structured Cooperation (PESCO). The availability of common equipment helps to improve a rationalised approach to military interoperability capabilities by making it possible to obtain more spare parts, use the same type of ammunition or even develop a common military doctrine that reduces collective expenditure and avoids redundancies.

Technological and industrial

In terms of research, the life cycles of the different technologies are very diverse and becoming increasingly shorter in the field of information technology. Although a country can produce different technologies, the increased technological complexity of defence equipment and systems makes it difficult to develop new capabilities on an individual basis. In this scenario, cooperation makes it possible to take advantage of the diversity of resources among the member states, improve industrial capacity and reduce innovation cycles³⁸, and foster mutual trust for the development of new technologies and capabilities for future collaborative programmes. Greater diversity is always enriching. For example, with its participation in the *Eurofighter* programme

37 LARSON, E. et al. Interoperability of US and NATO Allied Air Forces: Supporting Data and Case Studies. RAND 2003, p. 81. www.rand.org/content/dam/rand/pubs/monograph_reports/2005/MR1603.pdf.

38 PISANO, G.P. «The R&D Boundaries of the Firm: An Empirical Analysis». *Administrative Science Quarterly*, 35 (1). 1990, pp. 153-176.

the UK improved its skills in airborne radar and defence devices, and its participation in the *A400M* enabled it to retain its leadership in wing design within the European Airbus consortium. Experience and confidence are acquired through collaboration; for example, the Turkish Engine Industry (TEI) was awarded a contract by the US multinational *Lockheed Martin* to manufacture parts for the *General Electric F136* engine in the JSF programme. The success of the contract allowed it to garner further engineering and manufacturing contracts with this same company³⁹, and as a result they were able to strengthen the relationships of trust between the parties resulting in the creation of social capital and the sharing of common values and interests, thus facilitating further cooperation.

Political

The participation of states in partnership programmes allows them to be perceived as a constructive partner in the common defence of an increasingly integrated EU across all areas. This partnership strengthens international security thinking and fosters a common defence culture, thus providing for sustained cooperative links and the strengthening of international ties. At European level, progress towards closer cooperation is reflected in both the creation of a common CSDP within the EU and the setting up of PESCO.

Economical

The average cost of defence systems and equipment has increased over the years, exceeding the average increase in GDP (see table below). This situation makes purely national developments less and less economically viable, with international collaboration becoming necessary to preserve military capabilities.

| Arena et al. (2006, 5) | | Arena et al. (2008, 11) | |
|---------------------------|---------------|-------------------------|---------------|
| Type of vessel | Annual growth | Type of aircraft | Annual growth |
| Amphibian ship | 10,8% | Patrol | 11,6% |
| Surface fighters | 10,7% | Cargo | 10,8% |
| Attack submarines | 9,8% | Training | 9,1% |
| Nuclear aircraft carriers | 7,4% | Bomber | 8,4% |

39 GE AVIATION. «GE and TAI Extend Tusas Engine Industries, Inc. Joint Venture for Another 25 Years». GEAviation.com. 29/01/2010. <https://www.geaviation.com/press-release/services/ge-and-tai-extend-tusas-engine-industries-inc-joint-venture-another-25-years>.

| | | |
|----------------------|------------------------|------|
| | Attack | 8,3% |
| | Combat | 7,6% |
| | Electronic war | 6,7% |
| | Inflation rates | |
| | IPC | 4,3% |
| | DoD Purchase deflator* | 3,8% |
| | PIB deflator | 3,7% |
| *Ministry of Defence | | |

Table IV. Average increase in ship and aircraft costs and inflation rates, 1974 to 2005⁴⁰

⁴¹In this sense, collaboration favours increased common investment in research and development, avoiding duplication of effort and encouraging greater production runs to take advantage of economies of scale through the common integration of equipment and systems that result in reductions per unit of approximately twenty percent in labour costs, and about ten percent of the total production cost by doubling manufacturing⁴². However, while economies of scale are achieved from a manufacturing point of view, there are also management overruns, which are proportional to the number of participating countries, as identified below under costs and delays for unanimous decision-making. On the other hand, collaborative programmes, such as the European *Eurofighter*, can have wider benefits, where the main partner companies (BAE Systems, Leonardo and Airbus), and the whole supply chain have led to the creation of around one hundred thousand highly qualified jobs at European level, in approximately four hundred companies⁴³, sharing technology and intellectual property rights, with national production lines for the part corresponding to each nation, in addition to lines of national integration - in particular four manufacturing lines. This illustrates how international programmes have not always sought efficiency, mainly due to national claims of commercial and industrial rights, as will be seen below in detail among the factors that limit international collaboration; allowing opportunities for the transfer of capabilities to other sectors and maintaining an internationally

40 ARENA, M.V. et al. *Why Has the Cost of Navy Ships Risen? A Macroscopic Examination of the Trends in US Naval Ship costs over the Past Several Decades*. Santa Monica, CA: RAND 2006, p. 5.

41 ARENA, M.V. et al. *Why Has the Cost of Fixed-Wing Aircraft Risen? A Macroscopic Examination of the Trends in U.S. Military Aircraft Costs over the Past Several Decades*. Santa Monica, CA: RAND 2008, p. 11.

42 HARTLEY, K. «The European Defence Market and Industry». En P. Creasey y S. May, (eds.), *The European Armaments Market and Procurement Cooperation*. London: Palgrave Macmillan 1988, p. 48.

43 INFODEFENSA. «Eurofighter Typhoon for Belgium - Media Guide, BAE Systems». Infodefensa.com. 07/10/2016, p. 6. [https://www.infodefensa.com/archivo/files/I61007_eurofighter_belgica%20\(i\).pdf](https://www.infodefensa.com/archivo/files/I61007_eurofighter_belgica%20(i).pdf).

competitive industry⁴⁴. In this way, states can acquire more advanced weapons systems while sharing costs and risks.

Exports

Although the difficulty of exporting a developed product increases with the number of partners, mainly due to the time delay in Community decisions, this situation could be favoured if the member states were to agree on setting up an independent marketing organisation such as the European *Eurofighter* consortium, instead of engaging in export activities as individual partner companies trying to secure national sales, as occurred in the past with the *Tornado* fighter. In this way, the countries involved could use the sales networks of the companies in the partnership already established in certain regions of the world, facilitating access to potential customers and reducing trade costs⁴⁵. For example, taking advantage of the good international relations between the United Kingdom and India, or Spain and the United Arab Emirates (UAE), so that the different export campaigns are led by the state with the best relationships backed by the countries participating in the cooperation programme.

Factors limiting international collaboration

In the following sections, we analyse the main drawbacks, problems and limitations encountered in international collaboration programmes.

Sovereignty and National Autonomy

Historically, there has been a strong national tradition in the defence industry where national interests and state support for large national companies with various types of assistance have existed in order to promote their development, consolidate their position and strengthen their competitiveness on the international market, creating so-called “national champions”⁴⁶, such as the French group Thales or the Italian industrial group Leonardo. In this way, supported by trade union lobbies, production companies and research centres, governments protect national productive autonomy

44 HARTLEY, K. The industrial and economic benefits of Eurofighter Typhoon. Reino Unido: Universidad de York 2006, pp. 25-26.

45 Para más información profundizar en el concepto de Piggyback, como fórmula de cooperación que aprovecha la estructura comercial de una empresa ya implantada en el país donde se pretende exportar.

46 TAYLOR, T. «West European Defence Industrial Issues for the 90's». Defence Economics, 4, 1993, p. 116.

by closing off the possibility of tenders from beyond their national borders – avoiding the possibility of international offers that are economically or technically more competitive⁴⁷ – based on the premise that sovereignty and national autonomy are violated by cooperation. However, defence systems and equipment increasingly require components acquired outside national borders due to technological complexity, as already discussed in the section on technological reasons for collaboration. Furthermore, the European Parliament and the Council establish, according to point 1 of Directive 2014/24/EU of 26 February 2014, that:

“The award of public contracts by or on behalf of Member States’ authorities has to comply with the principles of the Treaty on the Functioning of the European Union (TFEU), and in particular the free movement of goods, freedom of establishment and the freedom to provide services, as well as the principles deriving therefrom, such as equal treatment, non-discrimination, mutual recognition, proportionality and transparency”.

However, the rules on defence procurement provide for a derogation in Article 346(b) of the TFEU, as consolidated on 30 March 2010 (formerly Article 296 of the EC Treaty), corresponding to “production of (and trade in) arms and war material”, which has permitted – to an increasingly reduced extent – non-compliance with Community principles of equality, non-discrimination or transparency. This has to some extent hampered the development of a single defence market and favoured the consolidation of the European defence industry. Apart from this exception, there have been increasing efforts by the Commission to create a European Defence Equipment Market (EDEM), which includes PESCO⁴⁸, the coordinated annual review on defence (CARD) and the EDF.

Harmonising requirements

While there is some similarity in the security policy priorities of European states (national security and defence, regional security and international stability), the divergence of high-level criteria, largely influenced by geostrategic location⁴⁹ and foreign policies, has fuelled differences of opinion on the needs of the armed forces at European level. This situation turns the harmonisation of requirements into a complex

47 HARTLEY, K. *The Economics of Defence Policy: A new perspective*. London: Routledge 2011, pp. 170-175.

48 Although PESCO has other goals, such as intensifying cooperation between EU Member States in the field of security and defence – Articles 42(6) and 46, and Protocol 10 to the TFEU ref. 2012/C 326/01 of 26 October 2012 – it can contribute indirectly.

49 For example, the British Royal Navy has historically operated in harsher ocean conditions than the Italian Navy. The latter have had to provide short-term responses in Mediterranean and Gulf operations, opting for short-range naval air defence systems.

process and one of the main causes of failure of collaborative projects, as identified in the analysis of unsuccessful cases. The results obtained through identifying these high-level needs are used to define specific operational requirements based on operational, technological and industrial factors. In this process, adding an international dimension increases the complexity⁵⁰ and raises a variety of common considerations and challenges. For example⁵¹: different national models can define different solutions for a common scenario, and it is necessary to identify how the military requirements were derived in order to facilitate common harmonisation. The intransigence of states when it comes to abandoning certain national requirements generates extensive specifications that reduce the likelihood of compromise and lead to increased costs and technological and industrial complexity, thus favouring national industry by requiring services that only they can provide. When harmonisation cannot be achieved by agreement and it is considered inappropriate to comply with the rigidity of national requirements, it is possible to opt for the development of national variants on the basis of a common basic platform, with national modifications leading to increased unit development and production costs. States with inflexible budgets, lack of familiarity with the process of drawing up requirements, limited experience with development projects and the growth of associated costs may opt to purchase from third countries and implement the national modifications at a later date; they may also opt to develop a national programme.

Harmonisation of budget priorities and replacement schedules

While there is a degree of flexibility in the timetables for the replacement of weapons systems once they reach the end of their useful life, the alignment of equipment plans between different states is a problem that, together with changes in national budgetary priorities, has had a negative impact on collaboration programmes. For example, in 1992, due to the huge costs of German unification, the government announced its intention to abandon the *Eurofighter* programme⁵². In this scenario, we must add that there are marked differences between the useful life of the platforms, systems and technologies. For example, aircraft and ships have a service life of more than twenty years – in certain cases, such as the *B-52* bomber, more than fifty years – but less than ten years for weapons

⁵⁰ HAYWARD, K. «Towards a European Weapons Procurement Process: The Shaping of Common European Requirements for New Arms Programmes». Chaillot Paper, 27. France: Institute for Security Study of WEU 1997, p. 14.

⁵¹ For further details, see: CATINGTON, R. C.; KNUDSON, O. A.; YODZIS, J. B. *Transatlantic Armaments Cooperation: Report of the Military Research Fellows, DSMC 1999-2000*. Fort Belvoir, VA: Defense Systems Management College 2000.

⁵² VOSS, W.; BRZOSKA, M. *Eurofighter 2000: Consequences and Alternatives*. Bonn-Germany: BICC 1996, pp. 10-14.

and sensor subsystems⁵³. In the field of information technology, while on the one hand, there are activities, such as artificial intelligence, that have been under development for more than fifty years but only now beginning to show results, on the other hand, there are ongoing software updates that allow for the continuous improvement of security and optimise the performance of systems. In certain situations, such as low involvement in conflicts or reduced perception of threats, a difference of five years between replacement dates of systems from different states is no longer an insurmountable barrier to collaboration⁵⁴. Nevertheless, the decision to wait depends mainly on both the conflict situation in which the country in question finds itself and the potential threat to which it could be exposed with obsolete or unsuitable equipment. It could temporarily opt for the purchase or lease of certain equipment or systems on a provisional basis, such as the tender issued by the Spanish Ministry of Defence in 2019 for the purchase of a training turboprop as an interim solution until a definitive solution can be found to replace the *C101*, the *F-5* and the *Pillan*⁵⁵.

Reduction in the number of orders

The future uncertainty of the development of a given programme, in the face of the potential for partner states to reduce the number of orders or withdraw from the programme, is another constraint on collaboration. In both cases, the estimated economies of scale are significantly reduced, generating situations of fragility that may lead to the total cancellation of the programme. For example, the reduction of the order by Germany for the *COBRA* system could have led to the cancellation of the programme as it meant a twenty-five percent increase in the unit production cost, a situation that meant negotiating a reduction in costs and an associated delay of forty-two months⁵⁶.

National Commercial and Industrial Rights Claims

States generally endeavour to ensure that commercial factors influence views on requirements so that the national industrial fabric achieves the highest value-added jobs and capabilities, with an overall share that is proportional to or exceeds the

53 NRAC. Life cycle technology insertion. Washington: The United States Naval Research Advisory Committee (NRAC) 2002, p. 27.

54 TAYLOR, T. Defence, Technology and International Integration. NY: St. Martin's Press 1982, p. 80.

55 DEFENSA. «La DGAM convocará un polémico concurso para comprar un avión que reemplace a los C101 del Ejército del Aire». Defensa.com. 12/07/2019. www.defensa.com/espana/dgam-convocara-inminentemente-polemico-concurso-para-comprar.

56 NAO. Maximising the benefits of defence equipment co-operation. National Audit Office (NAO), Ministry of Defence, Report by the Comptroller and Auditor General, HC 300 Session 2000-2001. London: The Stationery Office 2001, p. 17.

capital provided. Thus, for example, in the EFA programme, the French State continuously insisted on getting a disproportionate share of the development work, but due to the refusal of the other countries involved, it ended up withdrawing to develop the Rafale nationally, as we have seen in the section on unsuccessful cases. Other countries, reluctant to share critical technological capacities, provoke situations of instability that lead to an unwillingness to collaborate. For example, in the JSF programme, US restrictions on sharing knowledge on critical technological capabilities generated such dissatisfaction in the other partners that they threatened to withdraw from the programme⁵⁷. Traditionally, in an attempt to resolve these conflicts over the division of labour, European procurement projects have been implemented according to the principle of *juste retour*⁵⁸, as illustrated with the Tornado and Eurofighter programmes. Industrial rights claims and work-sharing policies based on this principle complicate the elaboration of requirements and increase technological complexity as partners can request the development of technologies in areas where they lack the sufficient technical expertise required to improve their national capabilities⁵⁹ ⁶⁰, posing considerable challenges in terms of distributing and allocating the load and value of the work. Furthermore, they may use this principle as a justification for having assembly lines in their own territory in order to guarantee industrial and commercial capacities, security of supply and protection of employment. This has led to the inefficient allocation of work, duplication of resources, production lines and necessary investment – such as in the Eurofighter programme – resulting in reduced economies of scale and increased production costs. This situation has not been repeated with the A400M which has only one assembly line. In short, the strategic nature of this sector means that industrial distribution at European level is not left in the hands of market forces alone, as there is a strong political and national interest in ensuring that this distribution is carried out in an appropriate manner, which requires the use of formulas such as the criterion of *juste retour*, which obliges industries to achieve a distribution of work according to the number of units that their country has agreed to acquire; industrial offsets, such as profits from the purchase of other types of goods, technology transfer or foreign investment, as was the case with the F-16 fighter⁶¹; or the Global Balance criterion, used by OCCAR in its collaboration programmes, which seeks to balance the member states' workload

57 GERTLER, J. J. «F-35 Joint Strike Fighter (JSF) Program: Background and Issues for Congress». CRS Report, RL30563. Washington: Congressional Research Service, 27/11/2009, pp. 12-15. <https://fas.org/sgp/crs/weapons/RL30563.pdf>.

58 Distribution proportional to the economic contribution of each country, seen as a focal point of Schelling (1960), without which it would be difficult to reach an agreement even if it could produce an inefficient division of labour and the reduction of common benefits. SCHELLING, T. C. *The Strategy of Conflict*. Cambridge, Massachusetts: Harvard University Press 1960.

59 HAYWARD, K. Op. cit., p. 19.

60 WALKER, W.; GUMMETT, P. Op. cit., pp. 22-25.

61 RICH, M. et al. «Multinational Coproduction of Military Aerospace Systems». RAND Paper, R-2861. Santa Monica, CA: RAND 1981, pp. 103-104.

over several years and in various programmes, ensuring at least sixty-six per cent of their financial contribution, allowing the rest to be allocated on the basis of the best market proposals. However, an inherent problem is that it gives preference to the industries of OCCAR member states rather than opening up to the EU market as a whole⁶². In this regard, OCCAR is beginning to suffer operational pressures, because some programmes managed under its auspices, such as the A400M, have suffered delays and shortfalls in agreed capacities leading to the renegotiation of the contract and increased funding, mainly due to technical problems⁶³, similar to those in the American programmes JSF and C-17. This situation affects the confidence of the countries concerned and generates uncertainty as to the efficiencies expected from the use of this model. It could even manifest the same problems as previous labour-sharing formulas. Therefore, the continuous intervention in the market to achieve this adjustment between the various states has limited the establishment of a true European Defence Equipment Market (EDEM)⁶⁴, by distributing work based on economic contribution instead of opening it up to technological and industrial competition in the market. As an alternative, there is the concept of Earned Workshare, based on competitive tendering, i.e. participation based on experience and proven skills. In this way, the collaborating companies contribute according to their strengths, being forced to specialise to guarantee their survival in the market, which implies a reform of the European defence industry and increased transnational dependence, interdependence and reciprocity. In this sense, if the relationship between financing and work-sharing were completely eliminated and work was allocated to the companies that present the most competitive offers, governments could concentrate on agreeing on the high-level performance requirements, such as speed, autonomy or scope, leaving the low-level specifications in the hands of the industry, thus improving the economic efficiency of the joint programmes by simplifying unanimous decision-making⁶⁵. However, right now, this concept would mean radical reform in the design of collaboration programmes, with the challenge of convincing potential partners to agree to this new type of social contract without ensuring industrial participation equivalent to their investment. In this scenario, the creation of the EDF, where the EU is contributing money, allows all nations the opportunity to participate and benefit from the development of a joint programme even if they have reduced industrial capacities.

62 TRYBUS, M. *Buying Defence and Security in Europe. The EU Defence and Security Procurement Directive*. Cambridge: Cambridge University Press 2014, p. 224.

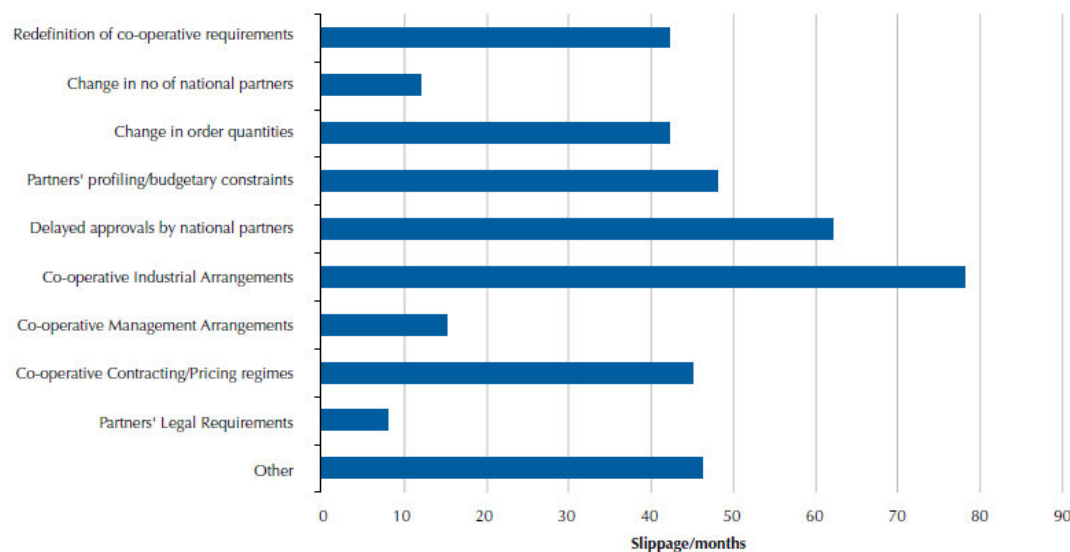
63 REUTERS. Op. cit. <https://www.reuters.com/article/us-singapore-airshow-a400m/airbus-says-a400m-deal-with-buyers-will-limit-future-losses-idUSKBN1FR19Y>.

64 EDGAR, A. D.; HAGLUND, D. G. *The Canadian Defence Industry in the New Global Environment*. Montreal: McGill-Queen's University Press 1995, p. 27.

65 KEOHANE, D. *The EU and armaments co-operation*. London: Centre for European Reform 2002, p. 25.

Costs and delays over unanimous decision-making

Generally speaking, international collaboration programmes incur delays prior to their launch due to the establishment of the programme, harmonisation of requirements, obtaining funding and agreement on the division of labour between the industries in the partner states, delivery deadlines and national procurement procedures^{66 67}, together with the need for consensus among participating states in decisions affecting programme development. By way of example, the following graph includes the cooperative factors that have been the main cause of the average total delay in collaborative programmes in which the British Ministry of Defence has participated.



Graph 2. Factors causing delays in the UK Ministry of Defence cooperative procurement programmes⁶⁸.

In this graph we see how delays in industrial agreements and national approvals are the causes of postponement with the greatest impact on planning. This is closely followed by delays in securing the necessary funds for future phases of the programme, resulting from the financial profiles and budgetary restrictions of the different participating states, together with the redefinition of requirements, the withdrawal of some states, or the reduction in the number of orders. As a result, these programmes generally show an increase in their duration in proportion to the cubic root of the number of participating countries and an increase in cost in relation to the square root⁶⁹, as a result of these delays and the main factors driving them, in addition to having a

66 RICH, M. et al. Op. cit., pp. 87-88.

67 LORELL, M. A. «Multinational Development of Large Aircraft: The European Experience». RAND Paper, R-2596. Santa Monica, CA: Rand 1980, p. 5.

68 NAO. Op. cit., 2001, fig. 14.

69 For example, in programmes involving four states, the cost would be double that of an equivalent national programme.

negative impact on economies of scale⁷⁰. The *TRIGAT* programme discussed above, for example, was delayed because nations underestimated the time needed to reach administrative and industrial agreement and obtain national approval to proceed with future phases. Another example is the JSF programme with delays of up to thirty months in its planning compared to the initial estimate⁷¹, and cost increases due to different causes, both technical and in terms of consensus (see table and graph below).

| Year | Total estimated cost [millions of dollars] | Total annual estimated cost increase [%] | Number of planes | Average unit cost [millions of dollars] | Main cause of variation total estimated cost |
|------|--|--|------------------|---|--|
| 2001 | From 218,554 to 226,458 | +3.6 | 2,886 | 78.47 | Delayed decision on the development and demonstration phase of the system, inclusion of two flight test aircraft and a new cost estimate model ⁷² |
| 2002 | 199,736 | -11.8 | 2,457 | 81.29 | Decrease of 409 Navy aircraft ⁷³ |
| 2003 | 244,834 | +22.6 | 2,457 | 99.65 | Revised labour costs and contractor overheads, extended development phase for additional design development, delayed start of procurement from 2006 to 2007 and delayed contractor production scheduling ⁷⁴ |
| 2004 | 256,617 | +4.8 | 2,458 | 104.40 | Further design development, refined definition of support requirements and delay in initial procurement from 2007 to 2008 with a revised purchase profile for all variants ⁷⁵ |
| 2005 | 276,458 | +7.7 | 2,458 | 112.47 | Increased cost of fuselage materials, review of inflation impact, review of work shared between prime contractor and subcontractors, configuration update, change in sub-contract manufacturing plan for the wing, and realignment of funds due to budget reductions ⁷⁶ |

70 FONTANEL, J.; SMITH, R.; BOLTON, P. «A European Defence Union?». *Economic Policy*, 6 (13). 1991, pp. 406–409. JSTOR, www.jstor.org/stable/1344631.

71 GAO. Op. cit., 2009, p. 18. www.gao.gov/new.items/d09711t.pdf.

72 OUSD (AT&L). Selected Acquisition Report (SAR) Summary Tables. Washington: 2002, pp. 10-11. <https://www.acq.osd.mil/ara/am/sar/2001-Dec-SARSUMTAB.pdf>.

73 OUSD (AT&L). SAR. 2003, p. 8. <http://www.acq.osd.mil/ara/am/sar/SARST1202.pdf>.

74 OUSD (AT&L). SAR. 2004, p. 5. <http://www.acq.osd.mil/ara/am/sar/2003-Dec-SST.pdf>.

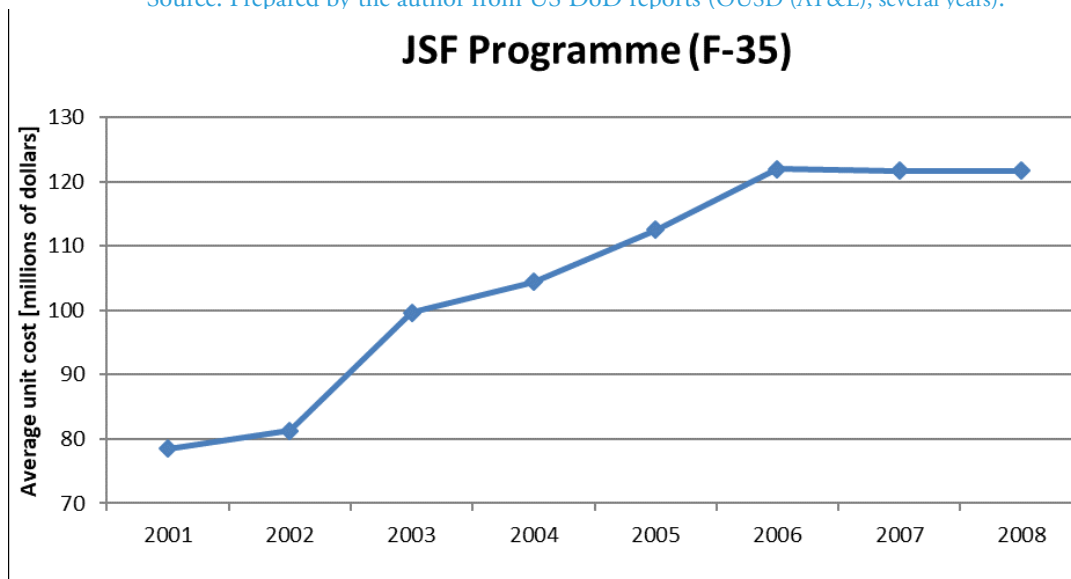
75 OUSD (AT&L). SAR. 2005, pp. 8-9. <http://www.acq.osd.mil/ara/am/sar/2004-DEC-SST.pdf>.

76 OUSD (AT&L). SAR. 2006, p. 9. <http://www.acq.osd.mil/ara/am/sar/2005-DEC-SST.pdf>.

| | | | | | |
|------|---------|------|-------|--------|---|
| 2006 | 299,824 | +8.5 | 2,458 | 121.98 | Decrease in annual purchase quantities, increase in purchase lead time from 2027 to 2034, update of aircraft configuration, revision of acquisition profile ⁷⁷ |
| 2007 | 298,842 | -0.3 | 2,456 | 121.68 | Application of revised escalation rates, lower material estimates in prime contractor agreements, incorporation of revised labour costs ⁷⁸ |
| 2008 | 298,842 | - | 2,456 | 121.68 | Unchanged ⁷⁹ |

Table V. JSF programme increases and main causes (2001-2008).

Source: Prepared by the author from US DoD reports (OUSD (AT&L), several years).



Graph 3. Evolution of the estimated unit cost of the JSF programme (F-35) Source: prepared by the author.

An in-depth and judicious assessment of the associated costs and potential benefits of international cooperation programmes is essential for consideration. An erroneous assessment based on excessive optimism can negatively affect the development of the programme as well as future opportunities for international collaboration, and resulting in decisions that are inappropriate both for the states involved and for economic-political relations.

Withdrawal of a member state

The different factors limiting international collaboration explored in previous sections of this article can lead to states withdrawing from a programme at any stage, even before its launch, causing a reorganisation of work, delays and associated costs

77 OUSD (AT&L). SAR. 2007, p. 7. <http://www.acq.osd.mil/ara/am/sar/2006-DEC-SST.pdf>.

78 OUSD (AT&L). SAR. 2008a, p. 6. <http://www.acq.osd.mil/ara/am/sar/2007-DEC-SST.pdf>.

79 OUSD (AT&L). SAR. 2008b. <http://www.acq.osd.mil/ara/am/sar/>.

that generate instability and inefficiency in contracts and a climate of distrust for future cooperation, as seen in the section on unsuccessful cases.

Conclusions

Despite the fact that collaboration in European armament programmes is over seventy years old, the commitment to industrial collaboration is not a trivial issue as has been observed in the cases analysed. It has been demonstrated that the harmonisation of national requirements to establish a common specification remains one of the main stumbling blocks along with the division of labour, since, from a political and national sovereignty perspective, arms-producing states have historically sought to protect their national industrial fabric and their respective expertise in key technologies and highly skilled jobs, resulting in the existence of some 180 different weapons systems in the EU in 2016, compared to 30 in the USA.⁸⁰

However, from a technological, industrial and economic perspective, the current environment of globalisation, an ongoing increase in technological complexity and the growing average cost of defence systems and equipment, make purely national developments less viable. In this sense, collaboration favours the increase of common investment in research and development, avoiding duplication of efforts and favouring the existence of larger production series, thus taking advantage of economies of scale. In this sense, for the purpose of creating a European Defence Equipment Market (EDEM) and giving strong support to the EU industrial fabric, over the last few years the Commission has launched different initiatives such as the European Defence Fund (EDF), within the European Defence Action Plan (EDAP)⁸¹, and the launch of a new European Defence Industrial Development Programme (EDIDP) from 2019, in addition to PESCO established in 2017, with the aim of jointly achieving the development and acquisition of defence goods and capabilities. All these initiatives will provide greater transparency on defence capabilities, shortfalls and future needs at EU level, facilitating the allocation of resources and the development of joint defence capabilities under the CSDP in an atmosphere of trust and smooth communication between the parties. Moreover, they are designed to favour the identification of future opportunities for industrial cooperation, increased competitiveness in the sector at European level and reduced dependence on the US, together with the ability to act as a catalyst for industrial restructuring that will rationalise the number of prime contractors, promote specialisation, improve their international competitiveness and strengthen the EU's security relations and security and defence identity.

80 MSC. «Munich Security Report 2017: Post-Truth, Post-West, Post-Order?». Munich Security Report (MSC). 2017, p. 21. www.eventanizer.com/MSR/MSR2017/.

81 Developed between the Commission, the European External Action Service (EEAS) and the European Defence Agency (EDA).

In this new scenario, it is recommended that partner states coordinate their needs to foster international industrial cooperation, taking advantage of the collaborative projects approved by the Council within the framework of PESCO and financed by the EDF. These projects provide an opportunity to strengthen international security and defence relations and to share risks, efforts and resources to jointly analyse, develop and produce more advanced equipment and systems – difficult to obtain nationally mainly due to the lack of industrial capabilities – and to strengthen skills in key technological areas by taking advantage of common investment in innovation and development, and also making savings by appropriating part of the economies of scale.

Analysing existing mechanisms, such as the European Defence Fund (EDF) and the European Defence Industrial Development Programme (EDIDP), coupled with the increase in the proposed funding of 13 billion euros for the period 2021-2027 – pending Council approval and Parliament’s consent, a figure very likely to be reduced due to the departure of the United Kingdom from the EU (Brexit), and the Finnish proposal⁸² at the end of 2019 to reduce the EDF by half – gives credibility to the new scenario established so far. Thus, the Commission is opting for the use of an economic-financial formula to encourage cooperation by applying different incentives to collaboration projects involving at least three member states – thereby avoiding duopolies – where a minimum of three different companies collaborate and where there is integration of SMEs from different countries in consortiums and as subcontractors, as well as an additional incentive if these projects are developed within the framework of PESCO. In this way, the new European institutional context and the existing mechanisms represent for the first time a serious commitment on the part of the EU, which is considered ideal in the current scenario to promote industrial competition and to favour the path towards the establishment and consolidation of a true European Defence Equipment Market (EDEM). It must be acknowledged that in recent years the EU has taken firm steps to promote defence cooperation in the EU, but there is still a long way to go.

For future research work, we recommend a detailed analysis of the situation of the Spanish State in comparison with the remainder of the partner states in terms of participation and the outcomes of the cooperation programmes in which Spain has collaborated, as well as the internal initiatives to be promoted in order to place Spain in a more dominant position in the future of European defence collaboration initiatives and programmes⁸³.

82 See, Note to the MFF/OR negotiating team. Decoding the Finnish presidency numbers: a preliminary analysis of the MFF negotiating box. Committee on Budgets European Parliament, 11/12/2019. <https://www.europarl.europa.eu/resources/library/media/20191213RES69015/20191213RES69015.pdf>.

83 In the first 47 PESCO projects, France, Italy and Spain are the countries most involved. France participates in 30 projects, heading up 10; Italy participates in 26 projects, heading up 9; and Spain participates in 24 projects, heading up 2. <https://www.consilium.europa.eu/media/41333/pesco-projects-12-nov-2019.pdf>.

Bibliography

AIRBUS. «Orders, Deliveries, In Operation Military Aircraft by Country – World-Wide». *Airbus.com*. 30/04/2018. <http://www.airbus.com/defence.html>.

ARENA, M. V. et al. *Why Has the Cost of Navy Ships Risen? A Macroscopic Macroscopic Examination of the Trends in US Naval Ship costs over the Past Several Decades*. Santa Monica, CA: RAND 2006.

ARENA, M. V. et al. *Why Has the Cost of Fixed-Wing Aircraft Risen? A Macroscopic Examination of the Trends in U.S. Military Aircraft Costs over the Past Several Decades*. Santa Monica, CA: RAND 2008.

BLEAKLEY, G. A. *International Armaments Cooperation: A Case Study of the Modular Standoff Weapons*. Thesis. Ohio: Wright-Patterson Air Force Base 1988.

BRZOSKA, M.; LOCK, P. *Restructuring of Arms Production in Western Europe. SIPRI Monographs*. United States: Oxford University Press 1992.

CATINGTON, R. C.; KNUDSON, O. A.; YODZIS, J. B. *Transatlantic Armaments Cooperation: Report of the Military Research Fellows, DSMC 1999-2000*. Fort Belvoir, VA: Defense Systems Management College 2000.

DATAQUEST. «Military Electronic Systems Markets». *Dataquest*. San José: CA 1991.

DEFENCEWEB. «First export success for the COBRA Radar in Gulf region». *DefenceWeb.co.za*. 25/02/2009. http://www.defenceweb.co.za/index.php?option=com_content&view=article&id=1165.

DEFENSA. «La DGAM convocará un polémico concurso para comprar un avión que remplace a los C101 del Ejército del Aire». *Defensa.com*. 12/07/2019. www.defensa.com/espana/dgam-convocara-inminentemente-polemico-concurso-para-comprar.

EDGAR, A. D.; HAGLUND, D. G. *The Canadian Defence Industry in the New Global Environment*. Montreal: McGill-Queen's University Press 1995.

EURO-ART. «Roll-out of 29 COBRA Systems for France, Germany and the United Kingdom completed». *thalesgroup.com*. 2007. <http://www.defense-aerospace.com/articles-view/release/3/85494/cobra-radar-deliveries-now-complete.html>.

EXPANSIÓN. «Airbus quiere revitalizar el A400M, el avión militar de los 20.000 millones». *Expansion.com*. 10/07/2018. www.expansion.com/empresas/transporte/2018/07/10/5b43be04268e3e2e428b460b.html.

FLIGHT INTERNATIONAL. «VAK 191B cancelled...». *Flight International.com*. 7/12/1972. <https://www.flightglobal.com/FlightPDFArchive/1972/1972%20-%203225.pdf>.

FONTANEL, J.; SMITH, R.; BOLTON, P. «A European Defence Union?». *Economic Policy*, 6 (13). JSTOR 1991, pp. 393–424. www.jstor.org/stable/1344631.

GAO. «Tactical Aircraft: Changing Conditions Drive Need for New F/A-22 Business Case». *Report GAO-04-391*. Washington: U.S. Government Accountability Office (GAO) 2004.

GAO. «Joint Strike Fighter - Strong Risk Management Essential as Program Enters Most Challenging Phase». *Report GAO-09-711T*. U.S. Government Accountability Office (GAO), *GAO.gov.*, 2009. www.gao.gov/new.items/do9711t.pdf.

GE AVIATION. «GE and TAI Extend Tusas Engine Industries, Inc. Joint Venture for Another 25 Years». *GEAviation.com*. 29/01/2010. <https://www.geaviation.com/press-release/services/ge-and-tai-extend-tusas-engine-industries-inc-joint-venture-another-25-years>.

GERTLER, J. J. «F-35 Joint Strike Fighter (JSF) Program: Background and Issues for Congress». *CRS Report, RL30563*. Washington: Congressional Research Service, 27/11/2009. <https://fas.org/sgp/crs/weapons/RL30563.pdf>.

GLOBALSECURITY. «MBT-70/XM803». *Globalsecurity.org*. 2011. <https://www.globalsecurity.org/military/systems/ground/mbt-70.htm>.

GLOBALSECURITY. «NATO Frigate Replacement for the 1990s [NFR-90]». *Globalsecurity.org*. 2013. <https://www.globalsecurity.org/military/world/europe/nfr-90.htm>.

GLOBALSECURITY. «Multi-Role Armoured Vehicle (MRAV)». *Globalsecurity.org*. 2016. <https://www.globalsecurity.org/military/world/europe/mrav.htm>.

HARTLEY, K. «The European Defence Market and Industry». En P. Creasey y S. May, (eds.). *The European Armaments Market and Procurement Cooperation*. London: Palgrave Macmillan 1988.

HARTLEY, K. *The industrial and economic benefits of Eurofighter Typhoon*. United Kingdom: Universidad de York 2006.

HARTLEY, K. *The Economics of Defence Policy: A new perspective*. London: Routledge 2011.

HAYWARD, K. «Towards a European Weapons Procurement Process: The Shaping of Common European Requirements for New Arms Programmes». *Chaillot Paper*, 27. France: Institute for Security Study of WEU 1997.

INFODEFENSA. «Eurofighter Typhoon for Belgium - Media Guide, BAE Systems». *Infodefensa.com*. 07/10/2016, p. 6. [https://www.infodefensa.com/archivo/files/161007_eurofighter_belgica%20\(1\).pdf](https://www.infodefensa.com/archivo/files/161007_eurofighter_belgica%20(1).pdf)

JAARSMA, M. «A400M». *Phantomaviation.nl*. 2018. www.phantomaviation.nl/Aircraft/A400M.htm.

JAARSMA, M. «NH90». *Phantomaviation.nl*. 2018. www.phantomaviation.nl/Aircraft/NH90.htm.

JOHNSON, E. L. *Howitzer Ammunition System Procurement (HASP)*. Alexandria, Virginia: U.S. Army Material Command 1991.

KEOHANE, D. *The EU and armaments co-operation*. London: Centre for European Reform 2002.

LARSON, E. *et al. Interoperability of US and NATO Allied Air Forces: Supporting Data and Case Studies*. RAND 2003. www.rand.org/content/dam/rand/pubs/monograph_reports/2005/MR1603.pdf.

LORELL, M. A. «Multinational Development of Large Aircraft: The European Experience». *RAND Paper, R-2596*. Santa Monica, CA: Rand 1980.

LORELL, M. A. *The Use of Prototypes in Selected Foreign Fighter Aircraft Development Programs*. Santa Monica, CA: RAND 1989.

MSC. *Munich* «Security Report 2017: Post-Truth, Post-West, Post-Order?». *Munich Security Report (MSC)*. 2017. www.eventanizer.com/MSR/MSR2017/.

NAO. *Maximising the benefits of defence equipment co-operation*. National Audit Office (NAO), Ministry of Defence, Report by the Comptroller and Auditor General, HC 300 Session 2000-2001, London: The Stationery Office 2001.

NAO. *Major Projects Report 2005*. London: National Audit Office (NAO) 2005.

NAO. *Management of the Typhoon Project*. Report by the Comptroller and Auditor General HC 755 Session 2010-2011. London: National Audit Office (NAO) 2011.

NRAC. *Life cycle technology insertion*. Washington: The United States Naval Research Advisory Committee (NRAC) 2002.

OCCAR. *TIGER – A New Generation of Helicopters*. 2018. www.occar.int/programmes/tiger.

OSD (AT&L). *Selected Acquisition Report (SAR) Summary Tables*. Washington: 2002. <https://www.acq.osd.mil/ara/am/sar/2001-Dec-SARSUMTAB.pdf>.

OSD (AT&L). SAR. 2003. <http://www.acq.osd.mil/ara/am/sar/SARST1202.pdf>.

OSD (AT&L). SAR. 2004. <http://www.acq.osd.mil/ara/am/sar/2003-Dec-SST.pdf>.

OSD (AT&L). SAR. 2005. <http://www.acq.osd.mil/ara/am/sar/2004-DEC-SST.pdf>.

OSD (AT&L). SAR. 2006. <http://www.acq.osd.mil/ara/am/sar/2005-DEC-SST.pdf>.

OSD (AT&L). SAR. 2007. <http://www.acq.osd.mil/ara/am/sar/2006-DEC-SST.pdf>.

OSD (AT&L). SAR. 2008a. <http://www.acq.osd.mil/ara/am/sar/2007-DEC-SST.pdf>.

OSD (AT&L). SAR. 2008b. <http://www.acq.osd.mil/ara/am/sar/>.

PISANO, G. P. «The R&D Boundaries of the Firm: An Empirical Analysis». *Administrative Science Quarterly*, 35 (1). 1990.

REUTERS. «Airbus says A400M deal with buyers will limit future losses». *Reuters.com*. 07/02/2018. <https://www.reuters.com/article/us-singapore-airshow-a400m/airbus-says-a400m-deal-with-buyers-will-limit-future-losses-idUSKBN1FR19Y>.

RICH, M. *et al.* «Multinational Coproduction of Military Aerospace Systems». *RAND Paper, R-2861*. Santa Monica, CA: RAND 1981.

RUIZ, R. M. «El último vástago del programa NFR-90». *Revista Ejércitos*, 5. 2010. https://issuu.com/ejercitos/docs/revista_ejercitos_n_5?q=NFR-90.

SCHELLING, T. C. *The Strategy of Conflict*. Cambridge, Massachusetts: Harvard University Press 1960.

SMITH, D. *Weaponry after the Gulf war - New equipment requirements for restructured armed forces*. Document 1272, 14/05/1991. <http://aei.pitt.edu/53851/1/Bo979.pdf>.

TAYLOR, T. *Defence, Technology and International Integration*. NY: St. Martin's Press 1982.

TAYLOR, T. «West European Defence Industrial Issues for the 90's». *Defence Economics*, 4. 1993.

THINK DEFENCE. «Javelin Anti-Tank Guided Weapon (ATGW). UK Complex (Guided) Weapons – Reference». *ThinkDefence.co.uk*. 2018. <https://www.thinkdefence.co.uk/uk-complex-weapons/javelin-anti-tank-guided-weapon-atgw/>.

THINK DEFENCE. «Storm Shadow Conventionally Armed Stand Off Missile (CASOM)». *ThinkDefence.co.uk*. n.d. www.thinkdefence.co.uk/uk-complex-weapons/storm-shadow-conventionally-armed-stand-off-missile-casom/.

TRYBUS, M. *Buying Defence and Security in Europe. The EU Defence and Security Procurement Directive*. Cambridge: Cambridge University Press 2014.

TUCKER, J. B. «Partners and Rivals: A Model of International Collaboration in Advanced Technology». *International Organisation*, 45 (1). 1991.

VOSS, W.; BRZOSKA, M. *Eurofighter 2000: Consequences and Alternatives*. Bonn-Germany: BICC 1996.

WALKER, W.; GUMMETT, P. «Nationalism, internationalism and the European defence market». *Chaillot Papers*, 9. Paris: Institute for Security Studies of WEU 1993.

WILLIS, F. R. *France, Germany, and the New Europe, 1945-1967*. California: Stanford University Press 1968.

WOOD, D. *Project Cancelled: Disaster of Britain's Abandoned Aircraft Projects*. London: Macdonald and Jane's Publishers 1975.

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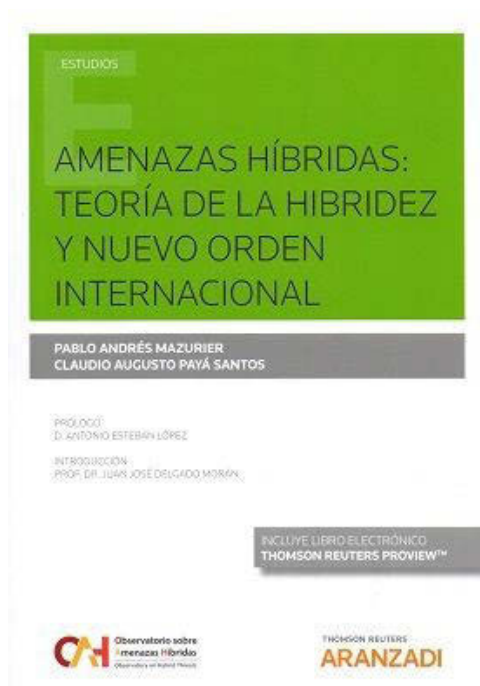
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Book review

AMENAZAS HÍBRIDAS: TEORÍA DE LA HIBRIDEZ Y NUEVO ORDEN INTERNACIONAL Pablo Andrés Mazurier y Claudio Augusto Payá Santos. Navarra: editorial Aranzadi, S.A.U. 2018, p. 246.

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The veil has been drawn back. The end of certainties has arrived. The illusion of a solid, predictable and easily controlled world has vanished. The nature of international reality has changed dramatically, not only in the midst of an unprecedented process of asymmetrical globalisation of capital, but also as a result of the exercise of two forces that drive a transcomplex world: *chronopolitics* and *techno-strategy*. These two forces constitute the basis of the theory of dromology proposed by Paul Virilo, as the study of the acceleration of historical transformations, and the concepts of time, virtuality, cyberspace and consequently of the image that man has of himself and his sense of being in the world. The fusion between technology and speed is a fact; borders, limits and materialities have also vanished; the different subjects of the international world seem to be suspended, as if the law of gravity had disappeared, and are immersed in a process of high uncertainty and strategic myopia, as they are deprived of the tools to explore and know a contingent reality, in its present and future state.

For the above reasons, the change in the ontological nature of the world has forced experts and academics involved in different disciplines and fields of knowledge located in different parts of the planet to challenge their perspectives and try out new models, reinventing nomenclatures and languages; re-dimensioning conceptual categories and innovating analytical routes, through a continuous metacognitive exercise of evaluation of the production of knowledge with respect to phenomena such as hybrids, which have unleashed an intricate epistemic and methodological journey aimed at decoding and revealing the emerging rationalities and their frameworks, whose nature is not linear but rhizomatic. Thus, since the beginning of the twenty-first century the hybrid phenomenon in matters of security such as defence and intelligence – without being either new or an exclusively Anglo-Saxon production – has unleashed an intense debate and academic production with diverse accents and – why not say it? – political-ideological interests across an asymmetric range of countries considered as powers – including emerging powers – as well as less developed countries.

A complex web. The woven threads guarantee an articulate dialectical montage and its intended aim

Undoubtedly, the web presented to us by the notable and experienced Spanish academics Pablo Andrés Mazurier and Claudio Augusto Payá has been spun from beginning to end with manifest rigour, the result of solid training and interdisciplinary scientific practices. Undoubtedly, it is this factor that allows the reader to immerse himself in the provocative reflections about the proposal of building a highly significant body of knowledge, derived from the subject in question, the hybrid phenomenon as an all-encompassing paradigm that can explain the dynamics of today's world, which is metaphorised by the authors, as “...a kind of mist that hovers over the structure of certainties in the modern world, making its specific determination, its vision and dynamics as a whole, and its operability, impossible” (page 102).

Thus, the dialectic strategies of the entire book in its different parts are not linear, but rather, starting from its theoretical core – hybridity – they respond to a texture based on abductive thought, through which the authors are permanently and carefully weaving all their theoretical-conceptual positions and incorporating different nuanced foundations with relevance, sufficiency and acceptability. This leads to a permanent questioning: a well-founded critical position that has allowed Mazurier and Payá to move with scholarly competence in diverse textual and contextual dimensions, to approach the subject in all its complexity, accepting innovative elements of discussion, which are derived from the arguments developed, such as the meaningful historical discussion and development of the phenomenon, the correlation of case studies, a contrasted analytical dynamic and advances in the discussion of wars, conflicts and more comprehensively of the hybrid world as a component of globalisation. All of the above is amply demonstrated by the use of extensive, updated and multidisciplinary literature that highlights the parameters of consistency and sufficiency of the discussions and findings.

A transcendental element – which few authors who have worked on the subject have developed – consists in establishing the onto-epistemic starting-point for the consolidation of the guiding dialectic thread. Although the development of the various questions discussed in subsequent chapters is apparently linear, the presentation of theoretical and methodological discussion is systemic and developed in loops, taking the arguments from a critical standpoint to progressively develop subsequent arguments with new meaning values and, in the form of a spiral, affecting the intelligibility of the key concepts, the analytical categories and the results of what is proposed. Thus, the semantic content of the text is enriched, transcending a simple phenomenological study of hybridity towards the proposal of its implementation in state multisector policy and its adaptation to current local-global institutional architectures.

The entire analytical process has been woven together according to various constraints: the definitional, political, economic, pragmatic, social conditions of the hybrid world that sway in a pendular movement between the domestic and the international, showing the political component as the driving force of all these reflections, which from beginning to end do not disregard the ethical responsibility of states and different non-state actors of the international system in their interagency development to move intelligently in the dynamics of conflict in the hybrid world, recognizing that in the midst of this “...new global context, the superpowers will continue to struggle for greater shares of dominance, increasingly resorting to hybrid logic to implement and manage progressively more complex, interconnected and specific dynamics of hybridity for each actor and social context” (page 224).

Thus, in *Chapter 1, Approaches to the Concept of Hybrid Threats*, the selected threads allude to the evolution of hybrid threats, conceptual plots, the insights in contemporary discussions, and above all the differential emphasis between purely military – the ones most written about – and social positions. The characterisations of hybrid as an adjective of strife, threats and types of war have been highlighted with great precision, expanding it as a paradigm enveloping nature in the present global world. It explores

the vision of Chinese doctrine, the Russian stance, the American military perspective, the NATO doctrinal notion of hybrid threats, the positions of the European Union and the multidisciplinary perspective of the Spanish Higher Centre for National Defence Studies, and finally the view of the issue in France. However, one thing that is missing is an understanding of hybridity or hybrid threats in the Latin American region; I refer in particular here to the work carried out in the Estudios de la Cultura Canclini (1989), Mignolo and Walsh (2018). In Estudios de la Comunicación (Manucci) 2010; Estudios Sociales, Boaventura de Sousa (2010) whose contributions are valid and relevant to the understanding of hybrids; it goes without saying that both in Brazil, Saint-Pierre (2003), and in Argentina, Massoni (2017), and in Colombia, Massé (2003) are becoming increasingly important and must be considered in the context of the region itself and not, – as has all too often been attempted – by using analytical prostheses that do not correspond to our realities; all of which does not imply disregarding lessons learned from other latitudes.

Similarly, Chapter 2, *Institutional and Operational Development to Combat Hybrid Threats*, weaves a thought-provoking review of the academic material on the levels of European institutional development to deal with this type of threat and a detailed study of operational theories for the management and deterrence of such threats as well as defence measures against them through collaboration between the EU and NATO. The different operational frameworks are discussed with great wisdom and precision, demonstrating the efforts made to seek consensus, interagency actions that constitute institutional innovations, and *cooperative networking*, supported by operational theories that serve as a guide for the assessment of the use of the instruments of power based on the vulnerabilities and opportunities of the different actors in the international world, all of which refer to various publications produced by contemporary experts.

The weft becomes more intricate with the appearance in Chapter 3 of *The Guidelines for a Hybrid World Theory*, which I consider to be the cornerstone of this whole argumentative construction. Thus, from an interdisciplinary approach, a number of theoretical and empirical elements are called into play, constituting a true analytical line of thought on the issue, given that the contemporary interdisciplinary debate on International Relations, Political and Sociological Studies has been established, with authors such as Michel Foucault, Zygmunt Bauman, Ulrich Beck, James Rosenau, Manuel Castells, among others, involved in the contemporary debate on the global world. This transdisciplinary crossing rightly enriches the political-epistemic horizon of hybridity, its logics and potential variabilities, revealing the different materialities that make up this new paradigm – the organising principle of a system of thought – and its relevance as a reflective neo-focus, theoretically rigorous and also methodologically feasible.

Following this substantial chapter, comes Chapter 4, *Open Societies in a Hybrid World*, systemically following on from its predecessor, with an in-depth characterisation of the new style of societies with their own multi-agent dynamics without true central control, which calls into question the traditional concepts of state-centred democratic systems, demonstrating the counterweight of open democratic societies

and their vulnerabilities – global and local threats – and the proposal for governance in their integral dynamics, generating specific capacities, raising awareness, strengthening and emulating values and community building dynamics as strategic survival mechanisms in a hybrid world.

Finally, by means of a systemic thematic study, Chapter 5, *The Global Map of Hybrid Conflict*, places special emphasis on making the dialectic content of the hybrid phenomenon intelligible in its entirety, and explores countless aspects in order to study the panorama which fosters the development of “... all the threats or maximizing variables of hybridisation related to human development and the environment” (page 169). The authors allude to strategic variables, chaos, geopolitical tensions between Russia and the West and the emergence and consolidation of China as a superpower, among others, as modelling factors with a significant impact on global governance, characterised by tensions and discontinuities that permanently require governments to change, redefine and rearticulate their institutional architectures and their mechanisms for inter-state links in various fields: political, economic, commercial, security and cultural. A relevant point in this chapter is the allusion to the geopolitics of fear and its potential mechanisms of resilience and protection to guarantee the sustainability of democracies and the axiological commitment of all actors as a collective co-responsibility for the common welfare of survival in this new paradigm.

One final counterpoint...

Unpredictability, contingency, diffuse configuration, mutant flows and interactions, fog nodes, loss of objectivity, deficits in domestic and global governance, convergences, emergencies, disruptions are some of the interweaving nuclei of meaning of the entire discourse built within the framework of comparative contexts and challenging the institutional and framework discourse on which it is based.

Moreover, the masterful weft of this book provides a transversal appreciation of the multiform and transdisciplinary nuclei of global reality. This also favours understanding from the South, supporting decentralisation and de-simplification in the epistemic production on hybridity by those historically situated as co-transformers of the phenomenology of today's international world, with flows, mutations, unsuspected speeds, and high uncertainty. In fact, all this dynamism implies transcending our understanding of hybrid beyond that of a legitimising, instrumental commodity of meaning, utility and added value to the economic dimension of our countries towards achieving the circulation and knowledge of new hybrid rationalities. Finally, this involves situating, from a relational framework inscribed in an ethical-collective commitment of the actors of the international system and social responsibility towards the search for a cognitive sensibility - more than pure fiction - the entire “hybrid” paradigm, which, as a socio-cognitive construction derived from a permanent problem-solving process and multiple meta-points of view, becomes a new magnifying glass to

conceptualise and impact through strategic actions on the hybrid phenomenology. In this sense, this scholarly publication constitutes a necessary guide in this process.

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