ASIA PROGRAM

POWER POLITICS IN A FLUID SPACE: THE KEY LEVER OF INFORMATION PRODUCTION FOR THE RISK MANAGEMENT PROCESS

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The completed sequence of ICBM (Intercontinental ballistic missile) test launch by North Korea revealed a new kind of threat in the airspace: collision risk of an airplane with missile parts. The mitigation of this risk highlights the lever of the political power in airspace through the production of information to reduce risk for aircraft. Any country which air traffic management organization is able to provide such information has de facto sovereignty within the airspace. This lever is playing an important role in the regional balance of power, especially above the China Sea between China, South Korea and Japan.

Until 2014, North Korea used to produce warning of all missile launches. The end of this information, the increase frequency of missile launches especially since 2017 and the inability to detect the missile, to track and to localize the splashdown area increase the collision probability between a missile debris and an airplane within the airspace above the Korean Peninsula and the Sea of Japan. The gravity of such collision is a potential loss of control of the airplane. The increase range of the North Korean ballistic missile test trajectories raised a systemic risk for air routes between Asia, Europe and North America. This new threat, from a North Korean missile technological breakthrough, was a serious risk on the airline security regime principle: « high flight level overflights are safe ». This ending threat highlights the critical variable of airspace security regime: information production to mitigate risks for airplanes. It helps us to analyse the balance of power around the China Sea with the unilaterally Air Defense Identification Zone recently created by China.

The rise of civil aviation unfolds a network of air routes highly used. The density of these routes in the airspace may be quantified through the passengers' number. In 1945, 0.5% of the world population had taken an airplane as a mean of transportation, i.e. 9 millions of passengers. In 1995, it was 25% of the world population, i.e. 1.25 billion passengers. In 2016 it was 3.7 billion passengers, which represents an annual increase of 6.3%. On the long term, airline traffic doubles every 15 years[1]. The UN agency for the civil aviation development, the International Civil Aviation Organization (ICAO) and the airline sector actors modelled this phenomenon with the flights numbers between airports. Actually, on the picture Fig. 1 in the Annexe, each yellow mark is an aircraft at a given time of the day (midday in East Asia). During the day, the flight numbers in the airspace changes. Given this data for an elementary airspace, it is possible to count the flights for a time unit and to compute the average to get the airplane density. This variable is an estimate of the probability density to get an aircraft within an elementary airspace and duration[2].

[1] AFP, 3/2/2017, Très forte hausse du trafic aérien en 2016, Le Quotidien du tourisme,
[2] A. BELLUCI, N. FUENTES, A. GEURRA-ALGABA ; M. COINTE-FOURRIER, JF GOESTER, Risk analysis between aircraft and space debris during atmospheric re-entry, 2017, IAASS

The North Korean ICBM development program has entailed missile launch tests from the North Korean territory through the airspace until extra atmospheric space and come back in the Japan Sea or further in the Pacific Ocean. The missile can destroy if it fails or if an anti-missile is fired by any neighbour armed forces or US forces. As a consequence there is a collision risk between a commercial aircraft and missile parts in the airspace. 1 minute after it has been launched, a missile reaches the height of 100 kilometres above a commercial airplane which is usually at a cruising altitude of 10 to 12 kilometres. The missile destruction probability is given either by the success rate of anti-missile systems in the region (Patriot, THAAD, AEGIS, GMD) or the failure probability of the test launched. Moreover, this probability has also been increased by the American cyber sabotage program « left of launch » (through the use of trapped electronic components) which unfolds high failure rate of ICBM launched in order to prevent North Korea from acquired nuclear weapons[3].

The conjunction of airplane density in the airspace above the Sea of Japan and of the missile destruction probability gives us a good estimate of the collision probability of an airplane with a missile part. On July 28 2017, an ICBM Hwasong 14 launched from Mupyong-ni crossed the trajectory of an Air France B777 aircraft above the Sea of Japan, 10 minutes after the plane, which was at that time 100 kilometres further. When the missile re-entry in the atmosphere, it broke in many fragmented pieces creating a debris field. Any fragment hitting a plan structure induced a loss of control of the aircraft. 1 kg missile part at 230 m/s is a 52.9 kJ kinetic energy choc with an airplane which is certified to resist a 30 kJ. No warning had been sent to air navigation regional authorities about this hazard as required by international norms. It was a major shift of North Korea. It had provided warning of all missile launches until 2014 but ended after[4].

The increase in airplane density due to the development of airline traffic in the East Asia region and the rise of the missile test launch frequency illustrated by the graph fig. 2 in the Annexe, especially since 2017, unfolds an **increase of the collision probability between airplane and missile parts**.

The consequence of such event is catastrophic on the airworthiness of the plane and crew and passenger safety. There is a rise of the collision risk. If permanent, this risk will require a rigorous and precise estimate to evaluate its acceptability by airline transportation actors. If not acceptable, it is a potential source for a major shift of the commercial airline safety regime in one of the most dynamic regions of the world economy. This regime rest on the rule « overflights are safe » which may be removed. We will then analyse how the North Korean test launch ICBM has entailed a new temporary threat in the airspace which highlights a major feature in the commercial

[3] David SANGER, William BROAD, 4/3/2017, Trump Inherits a Secret Cyberwar Against North Korean Missiles, The New York Times.
[4] Reuter STAFF, 5/10/2018, North Korea agrees to warn of activity hazardous to aviation : UN agency, REUTERS

airline safety regime given the regional balance of power. This is the importance of information for the security regime of fluid space and its use as a key political lever. Indeed, as soon as North Korea asserts it would provide warning if it fired a missile, the ICAO is ready to remove risk management procedures about its airspace[5].

GENEALOGY OF A NEW THREAT FOR AIR SAFETY: NORTH KOREAN ICBM

We notice that the major part of an ICBM path is in the space above the height of commercial aircraft. It is a space where access is possible only for States with the required technological knowledge and capacities. Only the space great powers can use this space. The competition in this kind of space is coming from the need to test or use ICBM, rockets and satellites. The legal framework of this space is built around the freedom for users to go through the space, the forbidding of any sovereignty declaration and it excludes any space compartmentalization. This space regime is based on the 1967 treaty. It rests on principles to share this space between the two Cold War's Great powers, the Union of Soviet Socialist Republics (USSR) and the United States of America (USA) in the context of peaceful coexistence. It implies the possibility for military surveillance and the launch of ICBM for any spatial power. This regime enables cooperation but it doesn't have coercive means to enforce it. A security dilemma is a permanent possibility to shift from a mutual cooperation situation between North Korea and the international community to a defection situation where both actors, NKRD and US, confront and the resulting gain is sub optimal. Defection is coming from a small decrease of the cooperation gain in comparison with the gain one actor could get from making defection. Hence, the last sequence of North Korean missiles tests without warning illustrates the interest for North Korea to confront with the international community on the use of the space and making defection to the regional stability. North Korea maintains its regime survival goal and it defects from economic development facing economic sanctions. The last winter Olympic Games at PyeongChang showed how North Korea defection to regional and even global security finally brought to Pyongyang a superior gain to what it could get if it had renounced to its nuclear program and joined the international community. Following Professor Koo Kab-woo from the North Korean studies university, « it showed they were not a Rogue State » and they went around international sanctions[6].

The use of space for missiles tests induces a collision risk for civil aviation in the airspace. The burden of this temporary risk was supported by all users and the gain was

[5] Reuter STAFF, 5/10/2018, North Korea agrees to warn of activity hazardous to aviation: UN agency, REUTERS
[6] AFP, 26/2/2018, JO-2018: la Corée du Nord, médaille d'or de la diplomatie olympique, jugent les analystes, LE POINT

only for North Korean regime survival. Airline had to avoid the airspace above North Korea and the Sea of Japan by taking indirect routings which induced fuel over cost and flight time increase. Carriers had no other option due to the threat posed from unannounced missile launches which were not detected and tracks by air traffic centres[7]. Indeed, the space regime doesn't define a frontier between atmospheric space and extra atmospheric one. Fluidity doesn't allow building a separation between commercial and military use of these spaces. This fluidity/liquidity features were tragically illustrated by the failure of an Hawsong 12 launch test in April 2017. Actually, North Korea proceeds to a missile test since the Pukchang airport field near Sunchon. The missile disintegrated, and the pieces fall down on the suburb of Tokchon nearby 39 kilometres on an industrial building. This is the first stage of the missile which exploded at a height of 70 kilometres. It may be one of the reasons which entailed North Korean authorities to test missiles above the Japan Sea. The disintegration of the missile covered a large surface with parts. The crash area is surrounded by a residential neighbourhood and commercial buildings. As a consequence, the two Hawsong 12 missiles test which has occurred since were above the Japanese Sea & territory. The key feature since 2014 is missile launches without any warning even formal notice like a Notice to airmen (NOTAM). These tests triggered civil protection measures for the population under the missiles trajectories by the Japanese authorities[8]. A NOTAM is the actual procedure to warn for a temporary hazard in the airspace, it should be provided by the air traffic management authority of the country at the origin of the hazard. Hence, the collision of a plane with missile parts is a probable risk.

It is based on the probability estimate of a collision between a missile part and a plane in the airspace. It is derived either from the destruction successful rate of an antimissile or the disintegration during the reentry phase of the missile time and the plane density. The conjunction of this probability with the gravity of a collision with missile parts, for each company of the airline sector gives the risk value. Based on this estimate, acceptability may be decided for each actor regarding the required safety level.

Numerical examples illustrate the challenge of the safety level. In 2016 following the Aviation Safety Network, there were 19 accidents with 325 deaths. In 2017, no accident with a heavy loss, only 10 accidents and 44 deaths on flight and 35 on ground. It is a death ratio of one for 7.36 million flights in comparison with 1.25 million deaths in car accidents in 2013 according to the World Health Organization.

Hence, information is essential to risk mitigation. The collision threat between missile parts and commercial airplane conditions the use of airspace. The production of this information requires an actor, which function is to reduce the risk at an acceptable level.

[7] Reuter STAFF, 5/10/2018, North Korea agrees to warn of activity hazardous to aviation: UN agency, REUTERS
[8] Ankit PANDA, Dave SCHMERLER, 3/1/2018, When a North Korean missile accidentally hit a North Korean city, The Diplomat.

The first stage of collision risk mitigation may be an Early Warning System to provide alert information few hours before a test launch. It was the case until 2014, North Korea used to notify all missile launches to the ICAO which produce warning information about the splashdown area. Following the Pentagon, a North Korean ICBM launched was detected 1 hour before it left its base. Hence, intelligence agencies, both regional and American, could send warning information through NOTAM in order to rise the crews awareness level. On real time, the disintegration of an ICBM or a rocket or a Space station may be followed by the Japanese Defense Force, the US STRATCOM or the US Joint force space component command as illustrated by the recent monitoring of the fall of the Chinese space station TIANGONG-1 in the Pacific Ocean. After an immediate detection, warning information would be sent to the Japanese radar controller to provide alert to enroute flight traffic in the airspace. However, the decrease of the detection time to 12 minutes is a serious challenge to the warning information process[9].

AIRSPACE AND BALANCE OF POWER

This ICBM test sequence highlights the main feature of the balance of power within and around airspace. Actually, the airspace is instrumentalized by regional powers as leverage to shift the balance of power on the China Sea little islands and rocks. Let's have a look on the key actors' strategies, either cooperative or confrontational, within the regional airspace at the economic and political levels.

Since the commercial airline transportation beginning, the airspace status was a matter for state or non-state actors. Fundamentally, airspace above a territory is under the State sovereignty. Any State has full and exclusive sovereignty on his airspace included the use of force at least for self-defence. Indeed, in 1983 a South Korean commercial airliner penetrated the Soviet airspace without authorization and it was destroyed by a fighter jet above the Soviet territory. As a result, the ICAO set a legal framework prohibiting the use of force against civilian airplane. But this international norm doesn't preclude the use of force for self-defence. As a matter of fact, in 1988 a civilian Iranian airliner was destroyed by the Navy in the Persian Gulf under similar circumstances. As soon as a threat is observed, the State, with his air forces can use coercion to oust a plane from his airspace. Since 9/11, the communication loss from commercial aircraft is systematically managed by fighter jet interventions to ensure it has not been hijacked. Since the end of the Cold War, sovereignty is still the keystone of the airspace international norms. In December 2012, a Chinese plane from the oceanographic administration penetrated the Japanese airspace above the Senkaku islands in the South China Sea (named the Diaoyu by the Chinese). Japan immediately sent fighter jets. It is

[9] Laurent LAGNEAU, 31/1/2018, La CIA avertit qu'un missile nucléaire nord-coréen pourra bientôt atteindre les États-Unis ; Le Pentagone relativise, OPEX360

an acknowledged behaviour by the international community in this airspace infringement case.

As an extension of a territory, the airspace is a place for the power balance between rival powers in the same neighbourhood. The airspace is even a tool for power politics like the Chinese foreign policy has illustrated it toward its South Korean and Japanese neighbours in the China Sea. In November 2013, Beijing unilaterally defined an air defence identification zone (ADIZ) in this region, twice the size of Great Britain's surface[10]. China has been requesting the airline to submit their flight plans in the ADIZ. The crew must identify its flight number, its nationality and must obey orders from the Chinese air traffic controller (ATCO) [11]. The ADIZ come close to 130 kilometres from Chinese neighbour's shores. It also covers a part of their Exclusive Economic Zone (EEZ). It even covers the Japanese ADIZ above the Senkaku islands and the South Korean ADIZ on the Leodo rock (named Suyan by the Chinese) as illustrated by the fig. 3 in the Annexe[12]. As soon as the ADIZ was announced by the Chinese diplomacy, Japan jets from the coast guards flew in the ADIZ without informing the Chinese ATCO of their flight plans or to answer its call. No Chinese fighter jets were sent in the ADIZ. The American, as a keystone of the regional security architecture had sent two B52 bombers from Guam to clearly signal to the Chinese diplomacy that this ADIZ wouldn't be acknowledged as illustrated by the Fig. 4 in the Annexe. In addition to these two bombers, a South Korean military jet went through the ADIZ without informing the Chinese authorities[13].

In the international law framework, the Chicago Convention of 1944 (which ended by the creation of the ICAO), gave the right to fly above a territory without nationality discrimination. Moreover, it had granted the freedom to fly through the EEZ and High Sea. But the convention is not compulsory. Each state may determine the access conditions to its airspace. For instance, it could ask fees for its management of the air traffic. This right is theoretical, without coercive power. Indeed, above the Senkaku islands, the two most important Japanese airline companies, the JAL and the ANA, have decided they won't inform Chinese authority of their flight plans. But the commercial issue is such that most airlines, except the JAL and the ANA, conformed to the Beijing decision when they go through the ADIZ or simply avoid this route. The US advised its commercial airlines to submit their flight plans to Chinese authorities pending its classification request from Beijing. As a consequence, the creation of airspace and its management, the production of information for the crews and air traffic control operators in order to mitigate risks and to develop a soft navigation to avoid weather risk, collision even with ICBM, or any threats, enable the State to exert de facto

[10] AFP, 26/11/2013, Mer de Chine : comprendre la crise de la zone aérienne, l'Express,
[11] Daï KAHO, 26/11/2013, Pékin revendique l'espace aérien des îles Senkaku, Japan Infos
[12] Philippe MESMER, 30/11/2013, La Chine s'arroge une zone de défense aérienne incluant les îles Senkaku, Le Monde
[13] AFP, 28/11/2013, Chine : des avions japonais survolent la "zone aérienne d'identification" sans opposition, La Croix

sovereignty on the airspace. The safety necessity imposed by the safety pact between an airline and its passengers, imposes a simple alternative to the crews, acknowledge the de facto situation to get required information to mitigate risk or go around the airspace. This situation has shown that cooperation between state actors and the users of airspace is not guided by law but by the requirement to mitigate the risks. Economic activities are conditioned by acceptability of risks which critical variable is providing information.

In 1919, the Paris Convention acknowledged the absolute sovereignty principle of a state on the airspace above its territory. It also acknowledged the economic need for a greatest freedom of navigation compatible with sovereignty. The treatment of a plane must be performed on a non-discrimination basis, especially on its nationality. Procedures must be developed to prevent from the risks. The Chicago Convention was the starting point of the development of services for airspaces and airports equally available for all aircrafts. Setting standard operation procedures for radio communication, navigation helps, maps and weather reports[14], etc.

Hence, a traffic increase on the air routes through the different airspaces, required an increasing volume of information to mitigate a rising risks. For instance, data about the destination airport capacities are required to avoid traffic jam in the airspace under a fuel limitation constraint. Moreover, this information is simply the transcript of the objective occupational state of the airspace. It is coherent and useful to any crew. Exchanging and sharing this information require simply coordination between data providers, the States which express their sovereignty rights on their airspace. The coordination task is imposed by the airspace continuity above territories and seas for instance weather reports, navigation aids on territories for air routes, etc. Data are produced by each State air navigation organization and are used by all crews, for example for traffic management by successive air control centres which help to maintain separation threshold between any pair of aircrafts. Coordination rests on standardization of operational procedures to reduce misunderstanding and misused of data. Standard operating procedure also reduces the overhead of these data production costs. The main driver of these processes is to produce and exchange data to mitigate risks to maintain acceptable level of safety for passengers and their preferred airlines.

This necessity is a strong incentive for a state to implement all the required systems and infrastructures to produce enough traffic information and to coordinate with other neighbour's airspace States air traffic management organizations. The need to provide information depends on the aircraft density which is a conditional factor of the collision risk. Given the level of commercial aircrafts flow and the separation requirement with other aircrafts, some joined procedures are implemented. Navigation data producers

[14] Alexander WELLS, John WENSVEEN, Air transportation, a management perspective, 5th ed, Thomson, 2004

will focus on the airspace where aircraft density is high. Hence, the airspace covered by this information depends on altitude. In the airspace below 5 800 m (of Flight Level 195, in abbreviate form FL195), there are a lot of different airspaces classes defined,an important volume of data and multiple procedures are required. In these controlled airspaces, air traffic control services are provided in accordance with the airspace classification. For class A, airspace is generally the airspace from the ground to 18 000 feet (5 800 m or FL 195) Mean sea level including the airspace overflying the water within 12 nautical miles of the coast. All operations in class A airspace will be conducted under instrument flight rules (IFR). It requires the use of systems and exchange of data and the use of information from Air Traffic Control Operator (ATCO).

On the contrary, the airspace above FL195 defined a Flight Information Region (FIR) from the level FL195 (5 800 m) to FL 660 (20 000 m). The airspaces concerned by the North Korean ICBM test launch program are: Pyongyang FIR (closed), Vladivostok FIR (open), Fukuoka FIR (open) even the Oakland FIR (open). If they are closed, it is all the air traffic to and from the East Asian region which is simply stopped. Actually, the increase range of the North Korean missile test induces a systemic risk. Even if the Pyongyang FIR was closed, the neighbour FIR Fukuoka above the Sea of Japan became risky. If carriers could avoid Pyongyang FIR, the over cost to avoid the Fukuoka FIR is a systemic threat to the airline business sector. But a FIR is a space much less controlled where the volume of information is less dense and the procedures less numbered because civil traffic density is much less important. This classification of airspace may be defined more precisely based on the nature of airspace. Special use airspace exists where activities must be confined because of their nature. In special use airspace, limitations may be placed on aircraft that are not a part of the activities. For instance, zone with a particular status is defined: zone D, stand for dangerous are defined to announce a danger. Zone R has restricted to protect a zone for military aircraft. Restricted areas denote the existence of unusual, often invisible hazards to aircraft such as guided missiles or ICBM. An aircraft may not enter a restricted area unless permission has been obtained from the controlling agency. Zone P is prohibited. These zones may be permanent or temporary.

Without such information and rules, a commercial aircraft would have no other choice than to avoid such airspace or to accept the information provided by any free rider State aircraft navigation agency, whatever the legal framework. The airspace defines the access to it: the type of aircrafts and the procedures to follow in order to use available information.

The management of airspace may be seen as a constraint for the States. It is also an opportunity to assert de facto sovereignty. The control of the systems which support high level of safety for air transportation, guided systems, navigation systems, anti-collision systems radar for aircraft separation, etc. entails an economic cost for the

States and airline companies. But this economic cost has political benefits. It is associated with political capacities which are political lever for actions: aircraft identification and access to the airspace. This political level may be implemented unilaterally to assert de facto sovereignty and commercial aircraft are confronted to the simple alternative: take it or leave it!

If economic competition is taking place in the airspaces, then political competition between sovereignties is for airspaces control. This control is based on information production capacities which mitigate the risk of collision. The strategic value of airspace on the long-term is conditioned by the following factors[15] :

- Relativity: airspace is not important by itself but only from the way the States are using the airspace. It represents a virtuality of a future power.

- Inequality: geographic differences between states contribute to their hierarchy in international society.

- Ambiguity: similar situations could result in different balances of power configuration.

The features apply in the case of airspace above the China Sea. Remember that the Chinese strategic goal is to maintain civil order and the territory integrity, because it conditions the political regime legitimacy. The economic development is the main lever of this legitimacy. Hence, the securitization of sea lane, most notably in the China Sea is a vital interest for the Sate and the CCP survival. Then China mobilizes its resources to assert its control over islands in the China Sea where it builds civil and military infrastructure. It even builds airfield tested with civilian aircrafts[16]. Moreover it extends its control in the Senkaku a part of the China Sea where it doesn't have any infrastructure, through an ADIZ. The airspace gets a strategic value in that particular power configuration.

This strategy rests on the economic size of China it is the main importer of its neighbour economies which restrains their diplomacy and military forces in front of a rising Chinese military power as illustrates the first aircraft carrier the Liaoning. But military capacities are not always the most important lever to exert the control of a strategic asset like airspace. The control of airspace is based first on the control of the capacities for its economic use: guided systems, navigation systems, anti-collision systems, air control systems. The control of these systems determines the acceptability of the risks and enables a permanent control of the access to the airspace. These systems provide information available to all actors of the air transport, crew of inflight aircraft,

[15] Serge SUR, 2011, Relations internationales, ed. Montchrestien, 6e édition
[16] Simon TOMLINSON, 7/1/2016, China lands more planes on its man-made island in the disputed South China Sea, sparking fears it will impose an 'air defence zone' over the area, MailOnLine

dispatched and operations centre of airlines, air control traffic in order to mitigate the collision risk. The level of cooperation is a simple accessibility to information. Hence, the management of airspace is a functional necessity conditioned by the balance of power in the international society. It will determine if there is cooperation among several States or if only one of them is going to impose its will to the others by providing the information to the flights in order to help for their safety. This behaviour which imposes a de facto sovereignty upon this space under the restriction that it doesn't use military coercive means against a civil aircraft. But the international society rests on global markets. Any interruption of air route in FIR around Japanese islands, the Korean Peninsula and the China Sea is not an economic option. The country which ensures the information production for safety would be the country which will exert de facto sovereignty. In this frame, the current dynamic of the threats associated with the ADIZ condition the possible strategies for actors involved in flight safety.

CONCLUSION

The ICBM tests in the regional airspace entailed a collision risk between a commercial aircraft and missile parts during the test phase, especially the last two years. This threat was a challenge for all the actors concerned by flight safety. The main rule for anti-collision, « see and avoid » was not a possibility. The management of these threats required the production of information to mitigate the collision risk by any crew. Hence, it was a challenge for the regional safety regime. If this threat would have become permanent, two barriers may be implemented: an early-warning system by intelligence agencies from South Korea, Japan and the US and a real-time tracking system of the ICBM trajectory by the military in order to keep informed the air traffic management organizations and the civilian flights within the involved airspace. These barriers would have been implemented without any legal framework. They would have been motivated only by the requirement to mitigate the collision risk. This temporary ICBM threat case highlights the main feature of airspace. It is a space where the safety risk management determined the actor in charge of the security issues. Especially through the information production process to mitigate risks.

As a consequence, in the airspace above the Senkaku/Diaoyu islands, the actor in charge of information production to reduce the collision risk between aircraft through the definition of an ADIZ and the exchange between the crews and the air traffic controllers will express de facto sovereignty on this airspace and he will reinforce its position on the islands. As illustrated by the behaviour of most airline companies, henceforth the crews submit their flight plans to the Chinese air traffic control organization or simply avoid this airspace by going around which increase the fuel cost of the flights. The State which helps to increase air safety plays a stabilizing role in the international society regarding

economic activities like the airlines sector even when it alters the political balance of power. It seems to be the key lever of the Chinese foreign policy in the China Sea. ■

ANNEXES

Fig. 1: Picture from the dynamic simulation « A Day in the Life of Air Traffic Over the World » (accessible à l'url: *https://www.youtube.com/watch?v=G1L4GUA8arY* le 9/3/2018)

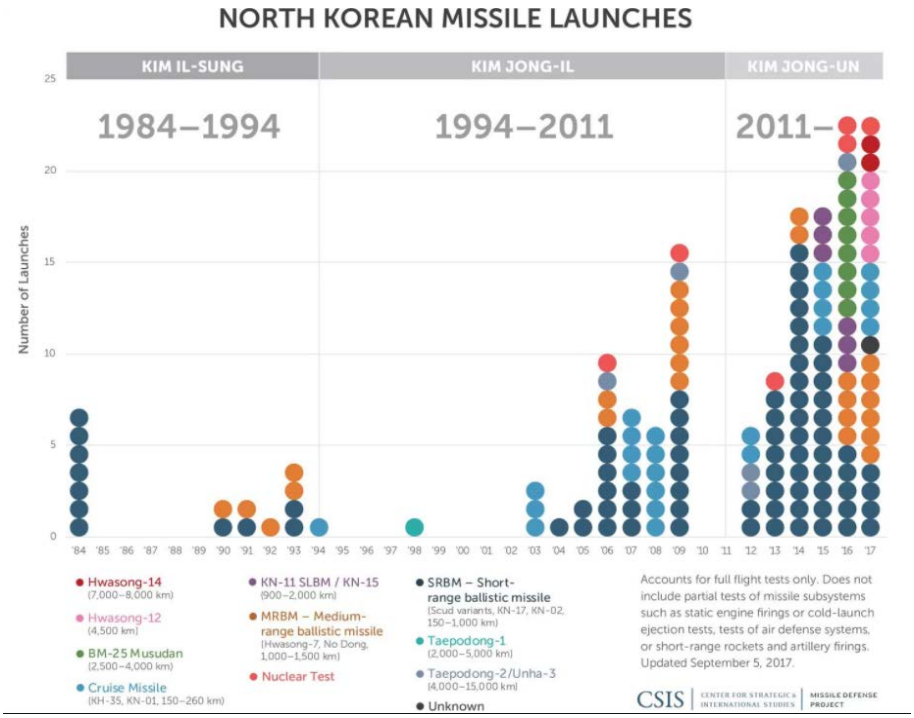

Fig. 2: the trend of the number of North Korean ICBM launched tests

Fig. 3: the overlapping of airspaces in East Asia

Fig. 4: the new Chinese ADIZ and the American reaction

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