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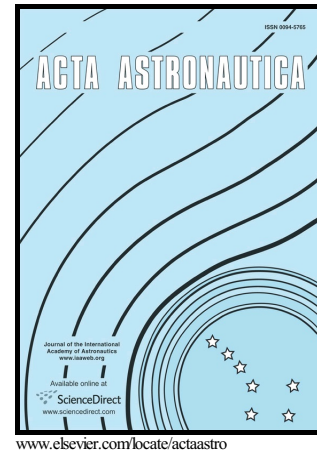
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Historical Space Steps of Turkey: It Is High Time to Establish the Turkish Space Agency

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Abstract

This paper discusses the importance of space in today's space driven world, the current space activities of Turkey, its space organizations with legislation background information and calls for the necessity for the establishment of the Turkish Space Agency (TSA). Firstly, the importance of space is given which is followed by a brief background and current space activities in Turkey. Then, the answers to why Turkey needs a National Space Agency are outlined by stating its expected role and duties. Additionally, the framework for space policy for Turkey is proposed and the findings are compared with other developing regional space actors. Lastly, it is proposed and demonstrated that Turkey is on the right track with its space policy and it is suggested that the establishment of the TSA is critical both for a coherent space policy and progress as well as the successful development of its national space industry, security and international space relations.

Keywords: Space Agency, Turkish Space Agency, Turkish Space Roadmap, National Space Agency, Turkish Space Organizations

1. THE IMPORTANCE OF SPACE FOR SECURITY, DEFENCE AND FOREIGN POLICY IN OUR INCREASINGLY SPACE DRIVEN WORLD

Though "the space age began as a race for security and prestige between two superpowers" [1], at the turn of the century, an increasing number of developing countries are recognizing the versatile capabilities of satellites. Now, they are seeking space challenges for their locally developed satellites and taking big steps for both initiating major space projects and establishing their own space agencies [1].

"Given the direct correlation between activities in space and those on Earth, international actors can no longer ignore the role of space in national security issues, the new opportunities it opens up and the challenges it presents, and the centrality of space in defining contemporary geopolitical configurations" [2]. Space power is also vital for Turkey since it may effect, increase or decrease, the importance of its geopolitical status. Hence, a country like Turkey, which has contemplated to put the moon and a star symbols in its flag a century ago, must take a front seat in the space club immediately.

Global space activities have largely expanded from earth observation and satellite communication to Positioning Timing and Navigation, Missile Early Warning and Defense, Weather Forecasting, Signal Intelligence, Surveillance and Reconnaissance, Battle Damage Assessment, Space Situational Awareness (SSA), Search and Rescue Operations, and Precision Striking and Targeting [3]. Although most of the international space projects are declared to have civilian purposes, dual usage of them for military requirements cannot be disregarded because of the nature of space [4].

The last published report named "2015 State of the satellite Industry" prepared for Satellite Industry Association reports the following interesting outcomes [5]: The global satellite revenue for 2014 increased more than the worldwide economic growth. For the year of 2014, the global space industry expanded and nearly every one of three satellites were commercial satellites. Trends show that the number of small satellites and LEO satellites are increasing, and cubesats are more popular choice than ever. Communication requirement is the driving force in

the space industry, hence nearly half of the operational satellites are specifically for communication purposes. Over the years as the numbers of satellites have been significantly increased, it has also stimulated the launch industry to meet expansion of satellite constellations in space. Recently more nations are eager to join the space industry due to the fact that it is an emerging challenging market and it is available at lower cost than before [5].

The other recently published report named “Profiles of Government Space Programs” with the other publications by a space consulting firm, Euroconsult, highlights similar trends and asserts that this trend will continue for the next decade [6]. Readers are referred to [5] and [6] for further details.

All these facts point in the direction that space is also strategically worthy for Turkey to continue to spend in this sector. It is also clear that space is one of the important pillars of Turkey’s and the EU’s Security, Defence and Foreign Policy (SDFP) and Turkey’s EU negotiations in Chapter-31. Keeping in mind the famous words of Atatürk, the founder of The Republic of Turkey, who many years ago said “The future is in the sky” referenced in many texts and publications, and as cited in [7], the space programs mentioned later in this paper highlight the worth and importance of space for Turkey.

2. BACKGROUND AND CURRENT SPACE ACTIVITIES IN TURKEY

The last decade was a period of greatly expanded economical, technological, social and cultural progress for Turkey. Turkey has also recognized space as a new and leading area for the sustainability of the rapid economic growth and an important tool for a fully independent country. In the literature, Turkey is considered as one of the emerging space countries with Argentina, Australia, Brazil, Chile, India, Indonesia, Malaysia, Mexico, Nigeria, Pakistan, South Africa, Taiwan and Thailand [8]. Space is a strategic key area for Turkey not only for improving its citizens’ daily life but also for enhancing global security.

The very first document to cover *space* in Turkey is the Turkish Science and Technology Policy for 1993-2003 [9]. Space was declared as one of the top five technologies with informatics, advanced technology materials, biotechnology and nuclear technology which affects the economy in all fields [9]. The Scientific and Technological Research Council of Turkey (TÜBİTAK) was appointed as the main organization responsible for coordinating space based activities in 1993. After it was designated to prepare Turkey’s national space policy in 1998 again, the establishment of the Turkish Space Agency (TSA) was firstly approved by the Turkish National Security Council in 2001 by the efforts and reports of TÜBİTAK jointly prepared with the Turkish Armed Forces, the Ministry of Defence and the Ministry of Transport Maritime Affairs and Communication (MTMAC) [9].

In 2001, “a governmental decision charged the Turkish Air Force with coordinating a national effort on space activities and making specific recommendations for a permanent central organization. With the participation of other relevant governmental agencies, a draft law for the establishment of the Turkish Space Agency has been prepared and is in the pipeline for parliamentary action” [4] which is still in progress today. Conversely, USA established National Aeronautics and Space Administration (NASA) in 1958, Russia established Russian Federal Space Agency (ROSCOSMOS) in 1931, European Space Agency (ESA) was established in 1975 while Turkey’s neighbours; Bulgaria established Space Research Institute Solar-Terrestrial Influences Institute (SRI-BAS) in 1969, Greece established Institute for Space Applications and Remote Sensing (ISARS) in 1955 and Iran established Iranian Space Agency (ISA) in 2003. It shall be recalled that all space power nations have accelerated their progress in space and managed these activities effectively by having a single agency for space.

Space has become one of the priority and accelerated agenda of the Turkish National Program after 2004 [10] and has been granted a privileged status. At the Supreme Council for Science and Technology’s 11th Meeting in March 2005, TÜBİTAK was assigned to prepare Turkey’s national space research program. Due to lack of unique space authority in Turkey,

TÜBİTAK has attempted to coordinate the space activities [9], but it has been limited to funding space related R&D projects. To sum up, it can be said that “there is lack of country-wide initiatives that will guide space studies and even detailed strategic plans on specific sub-technologies to be focused on” [11].

Almost fifteen years later, the same studies and efforts are continuing through the coordination of the Ministry of Transport Maritime Affairs and Communication. Although the establishment of the TSA was approved 15 years ago [9], nevertheless, there has been no remarkable progress in bringing it to life.

With the others, TÜBİTAK Space Technologies Research Institute (TÜBİTAK Uzay) is one of the space related governmental organizations in Turkey. TÜBİTAK Uzay was founded in 1985 and named as TÜBİTAK Uzay on 06 May 2006. It is a research institute leading and taking part mostly in space-based projects. Designing, manufacturing and testing of small satellites are the main focus areas of TÜBİTAK Uzay as well as pioneering Turkish space program and space based international relations. Göktürk-2, Rasat, Bilsat, Imece and Türksat 6A are the ongoing satellite projects which TÜBİTAK Uzay is responsible for [12]. Among these projects, the Türksat 6A project is a good domestic case, showing that common requirements can be planned to achieve them domestically with a common goal as well as with good local actor partnerships.

The tasks of TÜBİTAK Uzay approved by the Official Gazette of the Turkish Republic No: 18667 on 15 Feb 1985 [13] are detailed in Table-1. In Table-1, the main functions which are not changed significantly by later regulations are shown in parenthesis.

In the same years, Türksat Satellite Communication and Operation Inc. (Türksat A.Ş.) was founded as an incorporated company. Since the satellite services are crucial for the security of Turkey, Türksat A.Ş., was not allowed to be privatized. During the restructuring and the privatization of Türk Telekom A.Ş., satellite communication and operation division were granted a privileged status. As a result, Türksat A.Ş. was founded on 22 July 2004 “in order to conduct satellite communication services, which was previously conducted by Türk Telekom A.Ş., under a new company whose whole shares are owned by the Undersecretariat of Treasury of the Republic of Turkey and an affiliated institution of the Ministry of Transport” [14]. Though Türksat A.Ş. is a young company, its experience dates back to 1994 when Türksat 1B was launched successfully and started its mission.

Türksat A.Ş. was founded by Law No. 5189 subject to the Turkish Commercial Code and Private Law. Its functions are given in Table-1. Türksat A.Ş. is currently the sole satellite operator of Turkey which provides satellite communications through their foreign procured Türksat 2A, 3A, 4A and 4B satellites. It has provided services for voice, data, internet, TV and radio broadcasting through the satellites across a wide area extending from Europe to North Africa and Asia [14] since its establishment. However, not much progress has been achieved in designing its own domestic communication satellites.

On the other hand, the Ministry of Transport Maritime Affairs and Communication is assigned to set the strategies and policies for satellite positions and frequency allocations. The Directorate General of Aeronautics and Space Technologies (DGAST) was added in the organizational chart of the MTMAC by the Legislative Decree No: 655 published in the Official Gazette on 01 November 2011 and No: 28102. Table-1 covers the missions of DGAST [15].

At present, there are more organizations over and the aforementioned ones above that are active in this area including the Information and Communication Technologies Authority (ICTA). The ICTA is the responsible body for the regulation function of the telecommunications sector including satellites in Turkey. The Electronic Communications Law No: 5809 describes the duties of the ICTA. ICTA’s tasks related to space/satellites are summarized in Table-1 [16].

However, most of the space and satellite based capability requirements of the Turkish Armed Forces, one of the biggest customers of space in Turkey, are procured through the Undersecretariat for Defence Industries (SSM). The SSM was established in 1985 under Law

No: 3238 with the task of developing a modern defence industry and to ensure the modernization of the Turkish Armed Forces. Three main principles of SSM's approach while fulfilling these tasks are to address the needs domestically, cost efficiently and utilizing the latest technologies [17]. Recently, the Department of Space was added into the SSM's reorganization to deal with space, satellite and satellite launch centre programs. Although the TAF is one of the biggest customer, TAF's requirements are mostly procured by SSM, a civilian organization. Hence, a civilian TSA organization is needed to tie together all of Turkey's space activities and space foreign relations coherently.

Major space organizations in Turkey and their missions according to their establishment Laws are detailed in a single Table (Table-1).

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Table-1: Main Space Organizations in Turkey and Their Functions

Organization	Main Missions
TÜBİTAK Uzay [13]	<ul style="list-style-type: none"> • Contribute the provision of knowledge and technology transfer (revised by the Official Gazette of the Turkish Republic No:20901 on 14 Jun 1991 as ...to produce the manufacture of prototypes of domestically produced devices, systems and components and providing the research and development of them until the initial production phase) (added by the Official Gazette of the Turkish Republic No:22294 on 26 May 1995 as ...to prepare the implementation plans and the technical information and documents required for mass production), • Find solutions to the research and development problems that may arise in the future (revised by the Official Gazette of the Turkish Republic No:22294 on 26 May 1995 as ...to prepare short and long-term research goals on issues of related interest area and put forward the problems, solve them or to help in their solution), • Constitute bridges between institutions with researchers and practitioners, • Cooperate, including the authorization of project giving to and taking from, with universities and other national research institutions, • Participate in international research projects (added by the Official Gazette of the Turkish Republic No:20901 on 14 June 1991 as ...to follow international technologies and to investigate their application possibilities) (added by the Official Gazette of the Turkish Republic No:22294 on 26 May 1995 as ...to provide recommendations and to coordinate the related activities in Turkey; to serve as a reference centre in Turkey; to do and to tailor the technologies imported through technology transfer methods according to the national requirements and conditions), • Assist in introducing the research results to the scientific community and help to practice them in Turkey, • Train researchers and technical staff of the Institute and assist in the training of researchers and technical staff in universities, research organizations and other industry sectors, • Organize seminars, symposia, congresses, conferences, scientific meetings like summer schools at national or international level on the subjects related to the Institute's work area, • Publish related studies and papers.
Türksat Satellite Communication and Operation Inc. (Türksat A.Ş.) [14]	<ul style="list-style-type: none"> • Have the authority of rights of the satellite orbital positions, management and operation within the scope of national sovereignty, • Fulfill the obligations related to this, • Run or grant to run the registered satellites in the name of Türksat A.Ş. or other operators' satellites, • Establish the communication and transmission infrastructure over satellites belonging to national and foreign operators, • Carry out the satellite platform operations,

<p>The Directorate of General Aeronautics and Space Technologies (DGAST) [15]</p>	<ul style="list-style-type: none"> • Run the aforementioned infrastructure and do related business activities. • Prepare the proposals on national aeronautics and space technologies, space policies, strategies and objectives related with developing, establishing, running or get them run, established and developed, improving the science of aviation industry and aerospace technology and getting the required skills for space science in coordination with related institutions and organizations, • Prepare the principles and procedures utilized for the usage of the rights under national sovereignty for space, their usage and the management of these rights and do the business and services to fulfil the requirements of national obligations relating to these rights, • Make arrangements, set standards, conduct the inspection, ratification, certification and authorization services for the aviation industry and space technologies as well as systems, • Make, build, establish, operate, develop or get others to make, build, establish, operate and develop a variety of products, technologies, systems, facilities, tools and supplies related to space and aeronautics including but not limited to satellite and aircraft design and testing centres, satellites, launch vehicles and systems, aircraft, simulators and space platforms; make or get others to make plans, projects and do the related jobs to domestically design, produce, integrate and test; support the realization of this objective with appropriate incentives; prepare principles and procedures for these incentives; arrange and make the necessary cooperation and coordination among commercial, industrial, public institutions, organizations and educational institutions about related issues, • Act or get others to act for developing the country, protecting of human health and the environment, reducing damage due to natural disasters through early detection, as well as evaluation of natural resources by taking advantage of the space environment and space technologies, • Ensure the use of all space systems in coordination with related institutions and organizations during the state of emergency, martial law, mobilization and the war times, • Do studies or get others to do studies related with aeronautics, space science and their applications and technologies, aviation and space law, related finance, management, marketing and other areas, • Conduct the related required international relations and undertake the necessary actions relating to agreements and joint committees as applicable.
<p>The Information and Communication Technologies Authority (ICTA) [16]</p>	<ul style="list-style-type: none"> • Planning and allocation of the satellite positions and frequencies, • Conducting international satellite frequency coordination with neighbouring or related countries, • Making relevant bilateral or multilateral frequency coordination agreements, • Carry out the planning for satellite positions, their allocation, their registration procedures and international coordination within the framework of international planning and criteria through the coordination of the Ministry of Transport Maritime Affairs and Communication.
<p>The Undersecretariat for Defence Industries (SSM) [17]</p>	<ul style="list-style-type: none"> • Developing a modern defence industry and ensuring the modernization of the Turkish Armed Forces.

3. DOES TURKEY NEED A NATIONAL SPACE AGENCY?

Today, space is a force multiplier for all countries, the necessity for welfare of their citizens, and one of the bedrocks of macro economy and global security. Turkey aims to have one of the top 10 economies in the world by 2023. Turkey's indigenous space related projects as well as their R&D projects have been increased in the last decade thanks to Turkey's vision of 2023 [18].

Some of the attempts including the establishment of TÜBİTAK Uzay, Türksat A.Ş., the DGAST and Department of Space of the SSM were brought to life just in the last decade. However, there are still numerous different independent actors in space decision making authority and space/satellite related suppliers in Turkey. Moreover, space and air organizations/programs have been discussed as space and air together most of the time in Turkey.

For the last decade, the following major space/satellite projects were managed by different organizations. Table-2 depicts the main actors in the primary space/satellite projects in Turkey.

Table-2: Main Actors in Main Space and Satellite Projects in Turkey.

Projects	Type	Dates	Main Actors
BİLSAT [12]	Remote Sensing LEO Satellite	Launch: 27 September 2003	TÜBİTAK Uzay
RASAT [12]	Earth Observation LEO Satellite	Launch: 17 August 2011	
Göktürk 1 (E/O payload) [17]	High Resolution Earth Observation and Reconnaissance LEO Satellite	In Assembly, Integration and Test (AIT) centre in Turkey since 2015 for testing.	The Ministry of Defence (SSM)
Göktürk 2 (E/O payload) [12]	Earth Observation and Reconnaissance LEO Satellite	Launch: 18 December 2012	TÜBİTAK Uzay The Ministry of Defence
Göktürk 3 (SAR) [17]	High Resolution Earth Observation and Reconnaissance LEO Satellite with SAR Payload	Contract Date: 08 Mayıs 2013	The Ministry of Defence (SSM)
Assembly Integration and Test (AIT) centre Project [17]	Space Launch System, Assembly Integration and Test Centre for LEO, MEO and GEO satellites	One part of Göktürk 1 Project.	The Ministry of Defence (SSM) Türksat A.Ş.
Space Launch System Project [17]	Space Launch System	Contract Date: 17 July 2013	The Ministry of Defence (SSM)
Regional Positioning and Timing System	Navigation Satellites (LEO/MEO or GEO)	In feasibility study phase.	The Ministry of Defence (SSM)

satellites [17]			
TÜRKSAT 2A [14]	In orbit GEO Communication Satellite	Launch: 10 January 2001	Türksat A.Ş. The Ministry of Defence
TÜRKSAT 3A [14]	In orbit GEO Communication Satellite	Launch: 13 June 2008	Türksat A.Ş.
TÜRKSAT 4A [14]	In orbit GEO Communication Satellite	Launch: 15 February 2014	Türksat A.Ş. The Ministry of Defence (SSM)
TÜRKSAT 4B [14]	In orbit GEO Communication Satellite	Launch: 16 September 2015	Türksat A.Ş.
TÜRKSAT 6A [14]	Ongoing Domestic GEO Communication Satellite Project	Project Started: 15 December 2014 (Preliminary Design Review is completed successfully)	TÜBİTAK UZAY MTMAC Türksat A.Ş.
TÜRKSAT 5A	Planned GEO Communication Satellite	In planning phase.	Türksat A.Ş.
TÜRKSAT 5B	Planned GEO Communication Satellite	In planning phase.	Türksat A.Ş.

As discussed earlier and seen in Table-1 and Table-2, there is not a single decision maker for space related activities in Turkey. The tasks given by the Laws to different organizations were discussed in the second section of this paper. As detailed, there are duplicate duties for different bodies. The need for a good coordination for highly expensive and risky space projects, the necessity of eliminating the possible duplications of projects and disjointed research areas can easily be observed from Table-2.

“Turkey’s potential and ability in the space field have been hampered by a lack of governance mechanisms and necessary institutional legislation” [9]. Since then, this situation has not been changed either. Although the establishment of TSA was decided 15 years ago, it is not wrong to say that Turkey has not yet succeed in realizing this strategic aim so far. In this time frame, Turkey tried to activate some mechanism but little was achieved since there was not a single “space authority” in Turkey. At present, sometimes even ESA authorities are complaining about the lack of a point of contact for space related matters for Turkey [19].

Although Turkey is not a new player in the space club and has major space related projects, there is not a single space authority in Turkey to streamline Turkey’s national and international space related activities. Instead, every space organization in Turkey performs in its specific area. Table-2 depicts Turkey’s major space projects and their authorities. All Türksat in-orbit satellites are turnkey satellites hence, Leloğlu and Kocaoğlu [20] states that “...Turkey... did not acquire any capability in terms of satellite technology from the first three satellites”. The situation has not changed yet from the following Türksat satellites. As seen from the discussions, there is not a single “responsible body” for the space organization in Turkey. Moreover, there are many revised regulations for the current space related organizations as mentioned before and detailed in Table-1.

The studies done by Dede [21] and followed by Dede and Akçay [11] detailed the SWOT analysis of Turkey’s current space industry’s Strengths, Weaknesses, Opportunities and Threats. This latest study shows that the first and second most important weaknesses of Turkey

are “lack of coordination in space/satellite planning process and roadmap implementation” and “absence of an institution responsible for carrying out cooperation at international level and for conducting national space policies and activities” [11].

Space is not only a useful tool for economy but it is also a very important area for security and defence. “In the context of new opportunities and threats, questions arise over security, governance and power relations in space. How is it possible to make the best use of promising new opportunities, and at the same time contain existing and potential future threats?” [2]. On the other hand, space has been considered as one of the most focused emerging areas in foreign relations. Nayef [2] describes the new role of space: “as the world became more globalized, and with the development of advanced technologies for air and space power, space has emerged as another determinant or criterion of political relationships.”

Therefore, for the good coordination and governance of space related projects, elimination of the multiplicity in space authority and for the sustainability of the long term strategic space vision of Turkey, ***it is high time to establish the TSA as a single space authority in Turkey***. There are many participants in Turkey in authority for space as detailed earlier. The TSA is to be a single “space decision maker” and cooperate the space/satellite programs all over the country. The other important decision about the TSA is its reporting mechanism. It is proposed that the TSA shall report directly to the Prime Minister, since space related applications are not restricted just to the functional area of a single Ministry. They are closely related with the Turkish Armed Forces, the Ministry of Transport Maritime Affairs and Communication, the Ministry of Defence, the Ministry of Science Industry and Technology, the Ministry of the Interior and the Ministry of Foreign Affairs as well. This is normal practice for similar authorities such a NASA being linked to the President of the USA, and likewise ESA being an independent agency working closely with the European Commissions.

The TSA will also provide more visibility and prestige for Turkey among the others. Nayef [2] describes the importance of national space programs: “...as applied to space, it means that domestic politics, the economic situation, demographic trends, health and social conditions, access to natural resources, vulnerability to natural disasters, the availability of a highly skilled workforce and technological know-how, national military and security considerations, as well as diplomatic leverage will together determine the importance a state gives to a national space programme”.

On the other hand, the TSA will prevent the delays for the planned space projects in Turkey. The satellite roadmap prepared by the SSM (cited by Dede [21] p.53) in 2012 is as in Figure-1.

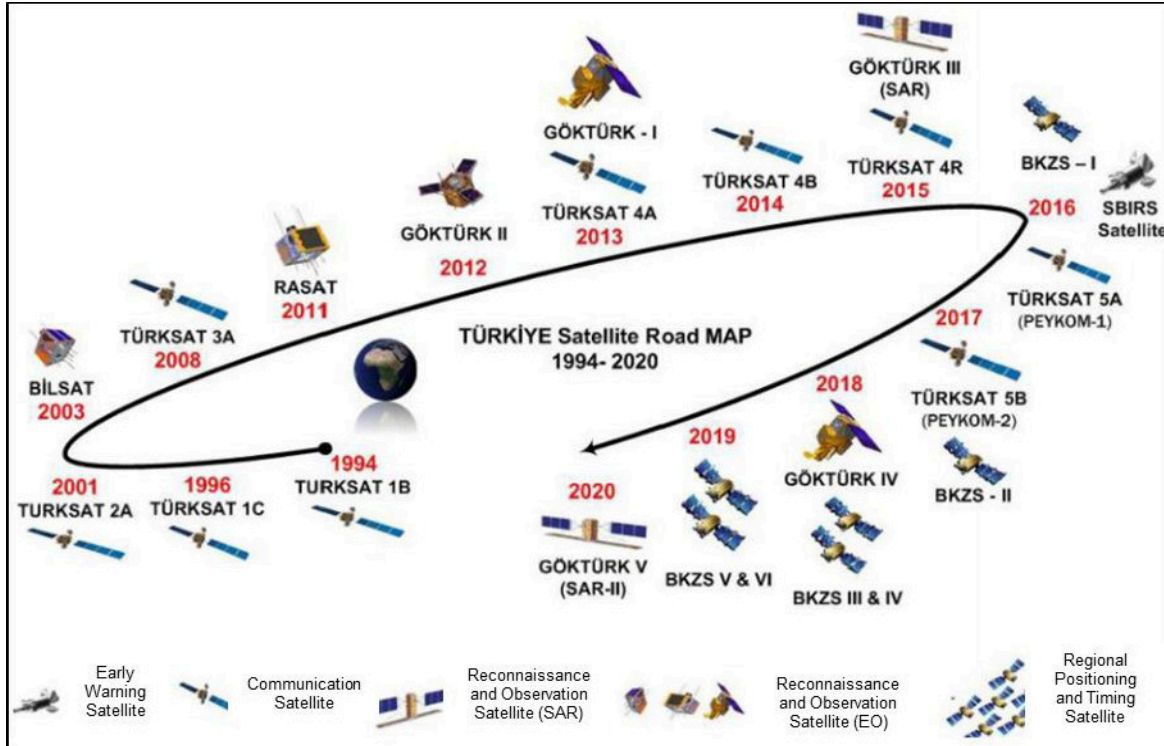


Figure-1: Turkey's Satellite Roadmap (used with permission from [21])

Although the roadmap was prepared in 2012 [21], all the satellite programs have been slightly postponed due to some reasons. Generally, it is very well known that most of the satellite projects are over budget and late. Turkey's roadmap is not exception with a slight lateness. For example, Türksat 4A was launched in 2014 and Türksat 4B was launched in 2015 with a one-year delay for both. Göktürk-1 was not launched as planned in 2013 and likewise Göktürk-3 was not launched in last year according to the planned timeline. Though the PTN satellites were supposed to be launched in 2016, the PTN project (named as BKZS standing for Regional Positioning Timing Satellite system as seen in Figure-1) is currently in the initial phase [17]. Moreover, there are no agreements for Türksat 5A and Türksat 5B which were planned for this and next year respectively. Figure-1 demonstrates that there is a great need for coordination of satellite projects both nationally and internationally for Turkey.

4. PROPOSED GOALS OF TSA

In this context, the ultimate goals of establishing of the TSA are proposed and detailed in Table-3:

Table-3: Proposed missions of Turkish Space Agency.

Organization	Goals
Turkish Space Agency (TSA)	<ul style="list-style-type: none"> • Benefit from space for peaceful purposes, • Act in space in accordance with the relevant international laws and treaties, • Act safely in space operations, • Prepare the space policies, plans and guidelines and implement them, • Develop, encourage and implement international space collaborations, cooperation and partnerships, • Support and encourage space related projects including launching human and non-human robotic scientific research projects as well as outer space

	<p>projects,</p> <ul style="list-style-type: none"> • Improve the global capability for earth observation, weather forecasting, space situational awareness and search and rescue operations, • Develop, maintain and implement regional/global positioning, timing and navigation capability, • Provide and increase space situational awareness, space surveillance, space traffic collaboration and management, • Educate space skilled scientists, technicians, employees and next generation, attract the space researches and establish a dedicated specialist space high school that feeds a new space technical university with a complying dedicated space techno park, • Help to improve the well-beings of Turkish citizens by sharing and spreading the space applications for the society, • Develop and governance new space strategies and space infrastructure for Turkey to be a regional leader in space, • Coordinate the space spectrum management and ensure to get additional frequencies and protect existing allocated frequencies for Turkey, • Maintain and integrate the commercial, security and defence requirements and their R&D needs, • Support and provide space based assets for national security and defence requirements, • Provide and implement the space guidelines for the commercial and private sector, • Create and strengthen a competitive domestic commercial space industry and make space an attractive sector for industry, research institutes and universities, • Maintain, enhance and modernize the space based organizations, activities and capabilities (including launch systems) for both public welfare and government requirements.
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With these goals in mind, the way forward is clearly in the establishment of the TSA, as it is clear that without a single authority in the field, these goals can only be a wish list. Since there is a limited study on the space activities of Turkey in the literature, next section proposes an extended space related framework for Turkey which is an emerging regional space actor. A comparison with the other emerging countries' space timelines is also discussed.

5. THE CURRENT AND FUTURE FRAMEWORK FOR TURKISH SPACE POLICY

Although the nearly two third of global space expenditures is done by just two countries USA and Russia [6] and the space world has been dominated and ruled over by them in the past decades, it is not the same case for today when it comes to the growing number of countries dealing with space activities. Many developing countries like India, South Africa, Malaysia, Nigeria, Brazil, Turkey and many others recognize the space challenges and now, more countries are seeking benefits from space related engagements.

Wood and Weigel [22, 23] proposed a theoretical framework including four technology categories named as "Space Technology Ladder" for developing countries. In their study, the situations of eight countries were explored. Our study, in this section, is mostly based on the same proposed framework. However, two additional milestones are proposed. For the first lowest portion category of triangle in Figure-2, we added two proposed sub-categories: "establishing space policy" and "establishing space infrastructure/assembly, integration and test

(AIT) centre”. Hence, the name of first category is proposed to be revised as “establishing space policy, agency and infrastructure”. The reason is that every government space activity starts with a space policy and autonomy in space requires space infrastructure. Additionally, MEO satellites are considered in the category of GEO satellites, bearing in mind that their radiation environments are more similar to those of GEO’s rather than LEO’s. Therefore, the third category is renamed as “owning and operating MEO/GEO satellite” rather than including only GEO satellites.

The space technology ladder, adapted from Wood and Weigel [22, 23], and the current situation in Turkey are depicted in Figure-2. There are four categories whose complexities grow up as one moves up the ladder. Firstly, establishing a national space policy, agency and infrastructure; secondly, owning and operating LEO satellite; thirdly, owning and operating MEO/GEO satellites, and lastly, launching satellites. In each category, the autonomy of the countries increases as the step moves up [23].

Although Turkey has reached the second and third stages on the ladder, it is lacking from the first and fundamental step which is the establishment of a national space agency. Turkey has initiated projects both for the first and last categories. Currently, Turkey has no independent satellite launch capability.

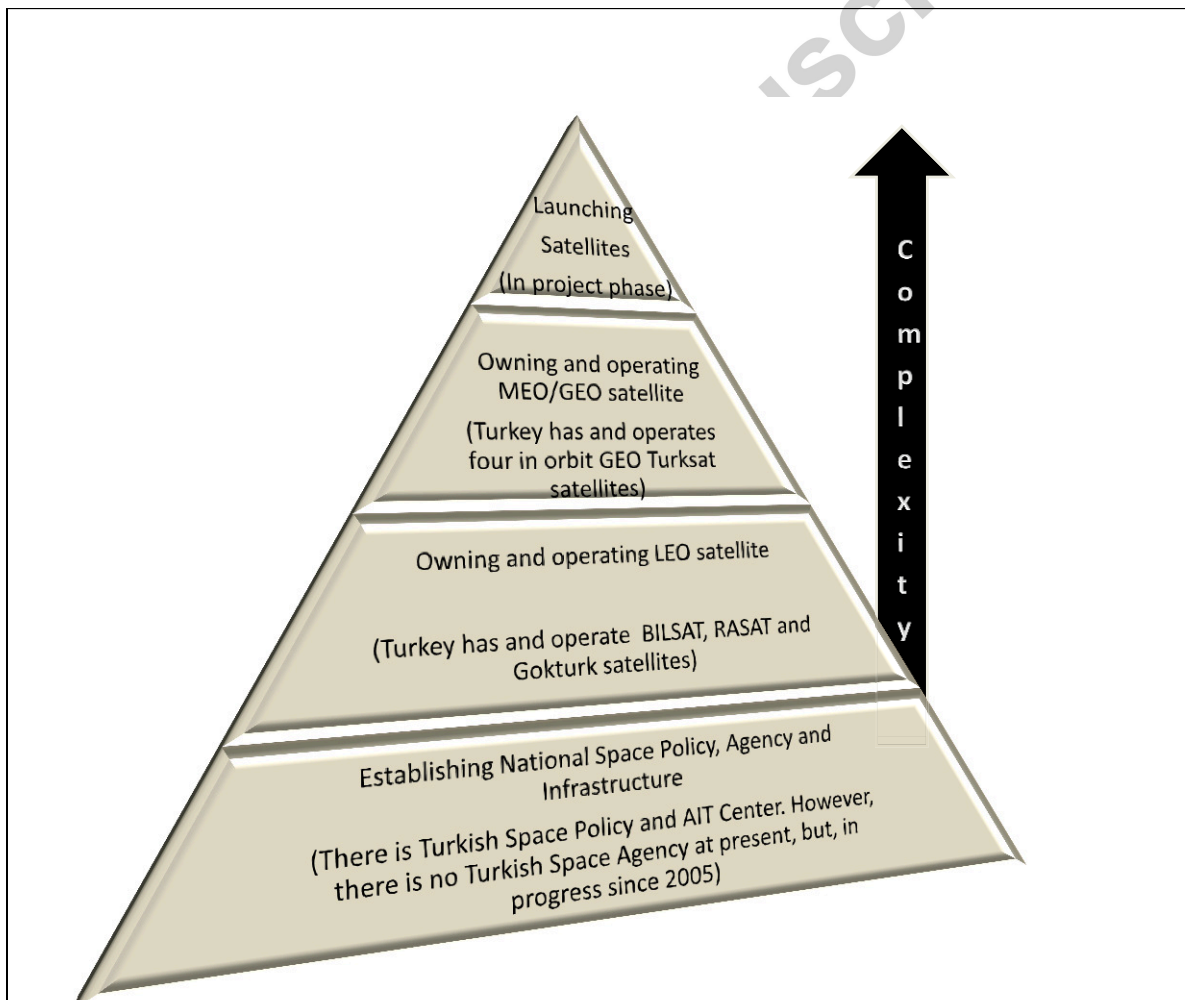


Figure-2: Space Technology Ladder for Turkey and the current situation in Turkey
(Adapted from [22, 23])

Figure-3 shows the sub-categories of the proposed Space Technology Ladder adapted from Wood and Weigel [23]. Turkey's current positions in these milestones are given in Figure-3 and detailed in the following sections.

Figure-4 depicts the common technology milestones for Turkey's space historical path since the first space policy was declared and Türksat 1B was launched successfully in 1994. The vertical axes of the graph in Figure-4 shows the 15 major milestones for the proposed framework, while the horizontal axes shows the year in which related action was achieved or planned to be achieved. This figure shows the past, present and future space levels of Turkey by considering the adapted Space Technology Ladder proposed by Wood and Weigel [22, 23].

Figure-4 shows the space related timelines for Turkey. The years for the organizations show the dates for reorganized space bodies instead of their first establishment. The year for the satellite shows the launch times or planned launch times. Although the path is normally expected to be linearly rising [23], Turkey's path is nothing but linear with random fluctuations.

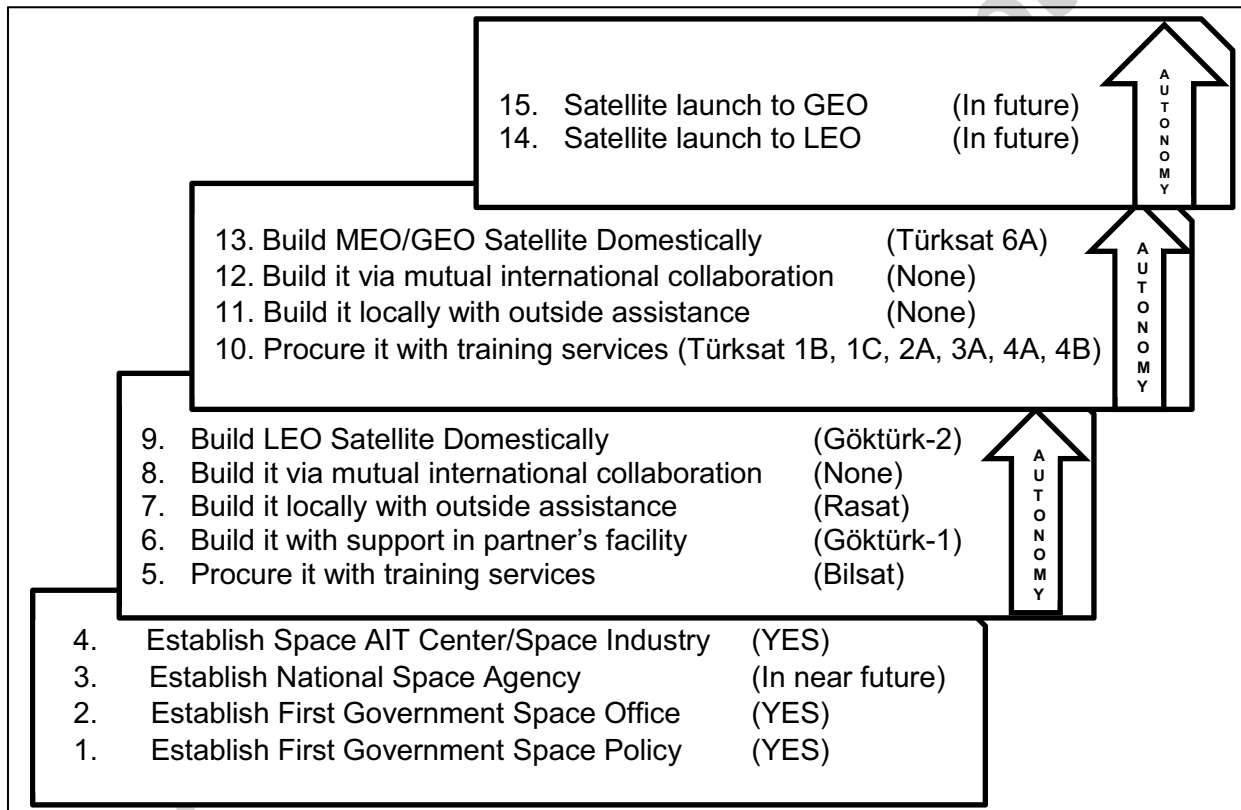


Figure-3: Space technology ladder sub-categories and the Turkey's current situation on the ladder (Adapted from Wood and Weigel [22, 23])

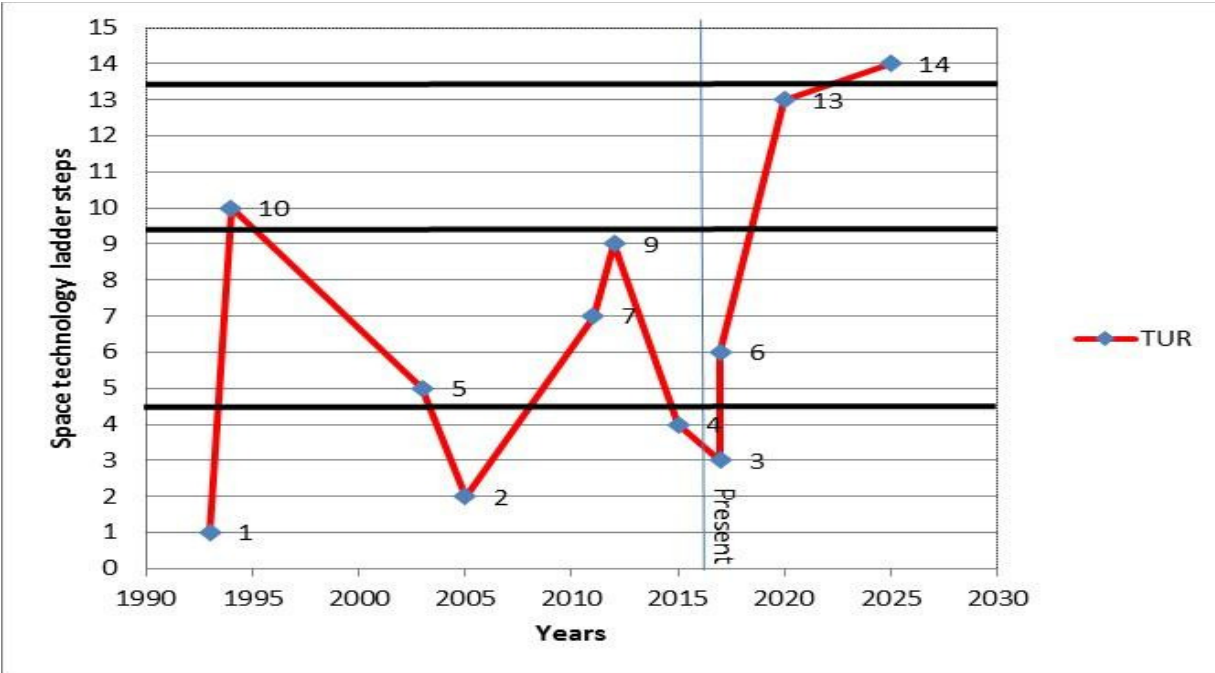


Figure-4: Turkey's Historical Space Path

For category one, the first space policy of Turkey was included in the governmental document of the Turkish Science and Technology Policy for 1993-2003 [9]. Turkey reorganized its distributed governmental bodies and established space offices in 2005. At the second lowest level, establishing a national office for space activities, has been completed in the last decade by reorganizing and completing the organizational structures of TÜBİTAK Space Technologies Research Institute, TÜRKİSAT Satellite Communication and Operation Inc., the Directorate General of Aeronautics and Space Technologies (under the organization of the Ministry of Transport Maritime Affairs and Communication) and Department of Space (under the organization of Undersecretariat for Defence Industries) in the civilian side of the government. Unfortunately, the third lowest level, establishing a national space agency, has not been realized. However, there is a decision and governmental support to establish the TSA in the near future as it is declared to be included in the action plan of the 64th Government of Turkey [24]. On the other hand, Turkey has its own assembly, integration and test (AIT) centre for designing, building and testing of LEO and GEO satellites simultaneously which was established in 2015.

Turkey has traversed up and down the ladder during its space history timelines, not similarly to the ones of developed or other developing space actors. Turkey achieved category two and three by procuring and operating LEO and GEO satellites. Immediately after establishing its space policy, in 1994, Turkey has jumped directly to category three by owning the first GEO communication satellite (Türksat 1B) procured from a foreign satellite company. Although, the satellites were previously seen just as a means for satellite communications, this perception of Turkey has much changed after the millennium. After a decade, Turkey's next achieved category becomes in category two that is for LEO satellites. Turkey procured its first LEO satellite, Bilsat, in 2003; designed and developed its second and third LEO satellites, Rasat and Göktürk-2, in 2011 and 2012 respectively and has started to test foreign procured Göktürk-1 in its own AIT centre since 2015.

Turkey started with a GEO communication satellite from a foreign company and continued its space history with a home procured first LEO satellite. However, keeping in mind

that “with all of the capabilities of satellite services, the benefits cannot be achieved by simply operating satellites” [21], Turkey has decided to design and build Türksat 6A GEO satellite and following Göktürk constellation LEO satellites domestically. In the Türksat 6A project, both the payload and the bus will be designed domestically, but the launching of Türksat 6A will not be done locally. Turkey aims to build its own LEO and GEO satellites using its own AIT centre locally in order to gain technical independence. This category shows that Turkey has depended on foreign companies to execute its entire LEO (except Rasat) and GEO satellites up to now.

Lastly, it is a very well-known fact that conceptual defence requirements need independent launch capacity to put the satellites in their orbits whenever it is needed [25]. Turkey has not been able to reach the fourth level yet. Unfortunately, Turkey has no capability and freedom at will of reaching satellite orbits by launching either LEO or GEO satellites. However, there is an ongoing project currently named as Space Launch System Project with the aim of “supporting the sustainability of the Turkish Satellite Programs and reaching space independently. The scope of the projects consists of Satellite Launch Vehicle development, the establishment of a Satellite Launch Center, the establishment of a Remote Earth Stations or related service procurement” [17].

Generally speaking, Turkey’s space related activities were slow during 1993 and 2004. However, they have accelerated after 2005. The reason behind this reality is the decision taken by government on increasing R&D spending and increased funding by TÜBİTAK. When compared with other emerging space countries (studied by Wood and Weigel [22, 23]), it can be easily observed that Turkey’s space history is impressive. Turkey has achieved seven major milestones (1, 2, 4, 5, 7, 9 and 10) and will reach 3 milestones (3, 6 and 13) out of the 15 steps on the ladder of space technology as depicted in Figure-3. Turkey has reached the third category earlier than the other developing actors, except India and Brazil which have established their first governmental space offices in the 1960s. Turkey may consider the eighth step by building the navigation satellites through mutual collaboration with the EU as being a candidate member of the Union in the context of Chapter 31 during the negotiations related with Security, Defence and Foreign Policy.

It is assumed that countries shall move up linearly with increasing their space capabilities in the time horizon [23]. As depicted in the four Figures (1, 2, 3 and 4), Turkey’s historical space path has been doing well for the last decade and 7 out of the 15 actions have been achieved by Turkey. Additionally, another 4 steps are actively in progress.

As a lesson learned, Turkey experienced one-year postponement of its Türksat 4B satellite, although the satellite was tested and ready to be launched. Since a Russian-built proton rocket crashed on 16 May 2015, launching from the Baikonur launch site in Kazakhstan suspended for a while for further investigation [26]. From the strategic view, the establishment of own Turkey’s satellite launch centre will allow Turkey to lessen the time and technology dependence on foreign launcher companies.

As a conclusion, from the sustainability perspective, it is not desirable to supply these space based requirements abroad. The result from the discussions and historic timelines is that the model of space technology, satellite procurement and adoption of Turkish Space Policy depended on foreign capabilities. However, Turkey has decided on major steps to be a technologically independent country in the space club and increased its space organizations and domestic capabilities. During the last two decades, Turkey has gained much knowledge and expertise in the space sector and improved its space organization and national space industry.

To sum up, Turkey’s space activities have been on the increase since 2005. All the necessary organizations and the infrastructure are established and the TSA is expected to be established in the very near future. As shown in the Figures (1, 2, 3 and 4), the historical space achievements of Turkey are on the increase. Turkey is on the right way of establishing the Turkish Space Agency to enhance the whole national space efforts, to coordinate nationwide

space programs, and to manage the possible challenges and collaborations. As a discussion of strategic decisions faced by Turkey is to establish the TSA as soon as possible. Building a single space authority in Turkey is one of the foremost important steps to open and negotiate the SDFP chapter (Chapter 31) with the EU. Another decision may be to take part in a common satellite program through cooperation with space actors including the EU. The Athena-Fidus French-Italian satellite program is a good example for this kind of cooperation in the exponentially growing space with the other space actors.

6. RESULTS, DISCUSSIONS AND CONCLUSIONS

Today, the goal of space activities is not limited to pure research only; additionally, it has become a leading area for the most fundamental sectors including the economy, politics, social, education, agriculture, health, security, defence, foreign relations and many other areas. Space is also a must for continual economic growth since the necessity for satellites of Turkey is increasing exponentially when the regional situation and Turkey's strategic geopolitical location is considered. It is one of the most sensitive areas for a country which has the aim of being a technologically independent state.

Turkey's space independence must be taken into consideration from the different global aspects. Space is one of the vital legs of Turkey's economy, security, defence and external policy. As discussed above, the first step to provide the sustainability of development and growth is to establish a central body for the space programs in Turkey. Domestic politics as well as international relations will get benefits from a successful and coherent space programs and applications of the TSA. The harmony between the commercial and defence space and satellite programs of Turkey can be easily met by the establishment of the TSA in a timely and efficient manner. The lack of the TSA will procrastinate both the long term national space programs and national space guidelines. Hence, there should be only one captain on Turkey's space ship. Establishing the Turkish Space Agency will also leverage its space programs and support the national space developments.

Today, space has become a cornerstone in SDFP. Thus, international cooperation is a very helpful tool for improving space based national policies and space related tacit knowledge. Turkey being an EU candidate country, the EU may be a good source of knowledge for Turkey in the context of technology, security, defence and foreign relations that come from space. On the other hand, the formation of a single space agency, TSA, will give impetus for future streamlining space related activities and EU negotiations in Chapter 31-Security, Defence and Foreign Policy for better management of global security.

The proposed leading space authority, the TSA, will eliminate the multiplications and the dependencies which are needed for Turkey's strategic vision of being a regionally independent actor and will contribute much for the vision 2023. The TSA will activate the space potential of Turkey, respond to the space challenges quickly, develop cost effective, safe and sustainable space policy and preserve the national sovereignty rights for the future generations.

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HIGHLIGHTS

- Turkey's space activities and achievements have been on the increase since 2005.
- There are numerous different independent actors in Turkey's space decision making.
- It is high time to establish the Turkish Space Agency as a single space authority.
- The framework for space policy, expected role and duties of TSA have been proposed.
- Space is an important pillar of Turkey/EU's Security, Defence and Foreign Policy.

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