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Turkey's Space Policy

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Introduction

After the end of the Cold War, Turkey made plans to modernize its armed forces. The modernization issue reached a crescendo in 1991, after the secondary challenges posed by the first Gulf War, and the growing salience of ballistic missiles in the Middle East. During the conflict, President Turgut Ozal's embrace of the American backed military action in Kuwait and Iraq, forced Turkey's rather reluctant generals to deploy some 100,000 troops along the border with Iraq. The deployment was intended to protect against the Kurdistan Workers' Party, but also to provide the U.S. backed coalition with a coercive tool to signal to Saddam Hussein that the coalition could opt to open a second front, should authorization have been provided to march on Baghdad.

The Turkish operation was the largest movement of troops since the 1974 invasion of Cyprus. The Turkish General Staff (TGS) faced logistical difficulties in implementing the policy, which, in turn, prompted the formulation of a new land forces doctrine aimed at improving and modernizing the Turkish military. The TGS opted to decrease the size of the country's land forces and begin to focus more heavily on air and missile defense. The effort is intended to provide the armed forces with greater capabilities for mobile operations in the Middle East and the introduction of greater offensive military capabilities.¹ To support such operations, the TSG announced plans to develop and deploy space based assets to augment Turkey's "offensive, defensive and reconnaissance / surveillance and early warning resources and capabilities..."²

These efforts necessitated the development of space-based capabilities. Ankara first began in 1989 to procure civilian satellites, but since the mid-1990s, has begun to focus on the military specific applications of satellites. Turkey's future procurement and development of military specific satellites, as well as its interest in ballistic missile technologies necessitates that Ankara clearly articulate its current plans for space and its future plans to develop ballistic missile technologies.

¹ Ian O. Lesser, *Bridge or Barrier? Turkey and the West After the Cold War* (Santa Monica, CA: RAND Corporation, 1992). <http://www.rand.org/pubs/reports/R4204>.

² Turkey, Defense White Paper 2000, available at: <http://www.isn.ethz.ch/Digital-Library/Articles/Special-Feature/Detail/?lng=en&id=154907>

Turkey's Space Policy: Potential Problems and New Opportunities

Ankara signed the Outer Space Treaty in January 1967 and submitted its deposit of ratification in March 1968. The Treaty “limits the use of the moon and other celestial bodies exclusively to peaceful purposes and expressly prohibits their use for establishing military bases, installation, or fortifications; testing weapons of any kind; or conducting military maneuvers.”³ Yet, as Turkey moves ahead with its plans to launch military specific satellites, as well as develop ground based missile defenses, Ankara may have to contend with ancillary issues associated with the peaceful uses of outer space. As of now, Ankara has yet to fully articulate a policy vis-à-vis its efforts to develop ballistic missiles, as well as indigenous missile defense systems that could be used as a platform to develop anti-satellite technologies. In turn, Turkey's opacity could spark concerns amongst other states that are wary about the long-term threats posed by the proliferation of ASAT technologies and the militarization of space.

More specifically, the introduction of a long-range missile defense system could be construed as a “dual-use” weapon that could be used as a basis for an anti-satellite platform (ASAT). India and China have both pursued a similar policy and Ankara's potential cooperation with Beijing on missile defense technology could spark concerns about the ultimate intent of Ankara's anti-ballistic missile efforts.⁴ While Turkey has not announced any plans to develop anti-satellite weapons systems, the growing concern about the proliferation of ground-based missile defense, combined with Turkey's nascent BMD program, could indirectly impact Ankara's other efforts to develop a more robust presence in space.

To be sure, the threat of anti-satellite warfare is an issue largely for US-China and US-Russia relations, but Turkey, as an aspiring satellite/missile defense-producing nation, could be impacted by increased tensions, or diplomatic efforts to limit the use of missile defenses for ASAT purposes. While Ankara did support the third draft of an International Code of Conduct for responsible space-faring nations, the current draft has important carve-outs that allow for the continued development of anti-satellite weaponry.⁵

³ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Signed at Washington, London, Moscow, 27 January 1967, available at: <http://www.state.gov/t/isn/5181.htm#treaty>.

⁴ Jeffrey Lewis, “Chinese Missile Defense Test,” Arms Control Wonk, 12 January 2010, <http://lewis.armscontrolwonk.com/archive/2588/chinese-missile-defense-test>.

⁵ EU Statement - United Nations 4th Committee: Outer Space, 22 October 2013, http://www.eu-un.europa.eu/articles/en/article_14147_en.htm; Draft: International Code of Conduct for Outer

The current spread of missile defense technologies suggest that a complete ban on dual-use missile system that could be used to threaten satellites will be tremendously difficult to implement and verify.⁶ Nevertheless Turkey could opt to break from the United States, Russia, and China and clearly articulate its long-term missile defense plans and pledge not to develop anti-satellite weaponry. In articulating such a policy, Ankara could help to establish a precedent for other nations that have recently launched – or intend to develop in the near future – small earth observation satellites and ground based missile defense systems.

Turkey's First Satellite Tender: The Turksat Family of Space Craft

Turkey launched its first tender for a television and communication satellite in 1989. Paris-based Aerospatiale won the \$281 million tender to construct a satellite equipped with 16 Ku-band transponders (6 for medium-power TV broadcast) with X-band capacity for the government and military. At that time, Turkey was only partly in range of Western European communications satellites and required its own system to expand telephone coverage within Turkey and to extend local television broadcasts to the Turkish republics and Central Europe.⁷ The two sides signed a turnkey contract for the satellite on 21 December 1991 and the launch was planned for some three years later.

However, the rocket that was carrying Turkey's first satellite into orbit suffered a catastrophic failure during launch, and the Turksat 1 was destroyed. Shortly thereafter, Aerospatiale finished construction of late June 1994 and shipped to the French launch site in French Guiana in early July. The Turksat B was successfully launched on 12 August 1994.

Turkey has since launched other Turksat satellites and the company continues to operate the Turksat 2A, 3A, and 4A. The 2A and 3A were manufactured by Alcatel Alenia Space Industries and both use the 3000B3 platform. The 2A was launched in 2001 and the 3A in 2008.⁸ In March 2011, Turkey signed "a \$571 million contract with Japan's Mitsubishi Electric Corp to procure

Space Activities, 16 September 2013, http://eeas.europa.eu/non-proliferation-and-disarmament/pdf/space_code_conduct_draft_vers_16_sept_2013_en.pdf

⁶ Michael Krepon, "Will Gravity Lift the Space Code of Conduct?," Arms Control Wonk, 11 November 2013, <http://krepon.armscontrolwonk.com/archive/3944/will-gravity-lift-the-space-code-of-conduct>.

⁷ "\$100 Million Deal; ASIASAT Signs Thai Marketing Agreement; May Lose Chinese Interest," *Communications Daily*, 9 November 1989.

⁸ Turksat, Satellite Fleet, accessed on 26 March 2014, <http://www.turksat.com.tr/en>

and launch two communications satellites by 2014.”⁹ The contract for two satellites – the Turksat 4A and 4B – called for the delivery of a turnkey system. The satellites are based on Mitsubishi’s DS2000 satellite bus platform. The two satellites will allow for “Turksat to offer telecommunication and direct TV broadcasting services throughout Turkey, as well as in Europe, Central Asia, the Middle East and Africa.”¹⁰

Turksat 4A was launched using a Proton-M rocket at the Baikonur Cosmodrome in Kazakhstan. The 4A’s ground control segment was developed by Spain’s GMV. The Spanish company provided MHI with its Hifly satellite monitoring and control product and its FocusGEO flight dynamics system for orbit control. GMV oversaw the integration of these two components with Turkish systems at the Turksat’s Golbasi control center. GMV was also tasked with “migrating the flight dynamics system of Turksat’s whole fleet to focusGEO,” to ensure uniformity across its fleet of three satellites. GMV will construct a replica system at Mitsubishi Electronics in Japan. The 4B is scheduled to be launched in late 2014. In addition, Turksat selected Integral Systems Europe Limited (Kratos ISE UK), a business unit of Kratos Defense and Security Solutions, to deliver on a turnkey basis a full-motion antenna system for the Golbasi control center.¹¹

Turksat has also announced plans to contract with Turkish Aerospace Industries (TAI) for the construction of Turksat 5A. Little information about the project is publicly available, though there have been some reports that Mitsubishi could provide TAI with the DS 2000 bus for the project.

Space Command and Space Based Imagery

Turkey first began to pursue military specific spy satellites in the late 1990s. The purpose of the space program is to increase Turkey’s satellite, intelligence, and reconnaissance capabilities (ISR). In tandem, the development and deployment of satellites will facilitate communications and the transmission of information to military units operating in the mountainous region in the southeast, as well as the Mediterranean and Black sea. The Turkish military envisions a network

⁹ “Turkey Signs \$571 Million Deal with Mitsubishi Electric for Two Satellites,” *Satellite Today*, 8 May 2011.

¹⁰ “Mitsubishi Electric Wins Contract to Deliver 2 Communication Satellites to Turkey,” *Manufacturing Close-Up*, 11 March 2011.

¹¹ Kratos Selected by Turksat A.S. to Provide Full Motion Antenna System, Press Release, Kratos Defense and Security Solution Inc., 24 March 2014, <http://ir.kratosdefense.com/releasedetail.cfm?releaseid=834919>

of 16 satellites to provide a robust communication infrastructure, early warning for missile defense interceptors, and to provide imaging for the military's growing precision strike capabilities.¹²

To ensure that all branches of the armed forces have access to real time data, the TSK is eager to provide its soldiers with access to information transmitted via satellite data links, unmanned aerial vehicles, and manned reconnaissance aircraft.¹³ Turkey is intent on achieving this capability through coproduction arrangements that will eventually allow for Ankara to be independent of the major suppliers of defense equipment. And, in turn, this will allow for the development of a robust Turkish defense industry, capable of competing with the major suppliers for defense contracts in the Middle East, Central Asia, and elsewhere. Thus, the development of indigenous satellites is vital to implementing these ambitious plans.

In July 2000, the Turkish government selected Israel's state-owned Israeli Aircraft Industries (IAI) to construct a \$270 million spy satellite similar to the Ofek-3.¹⁴ Israel and Turkey had agreed to coproduce the system and IAI's bid was significantly lower than that of France's Alcatel.¹⁵ The satellite's optics would have been manufactured by Elbit's El-Op. It was unclear which components would have been manufactured in Turkey. During the bidding process, IAI lowered its initial offer from \$480 million to \$274 million, to undercut Alcatel. Nevertheless, just one month later, Turkish officials reopened the tender.

In August 2000, Turkey officially selected Alcatel, and the sides began exclusive bilateral negotiations, after the French firm dropped its price to \$204 million. However, the negotiations were annulled in January 2001, after the French parliament voted to recognize the Armenian Genocide. Later, in 2003, Turkish officials and the Israeli government reportedly reached an agreement to share Israeli satellite imagery of Iraqi Kurdistan and southeast Turkey, after the United States led invasion of Iraq in 2003.¹⁶ Yet, despite the increased need for satellite

¹² Burak Ege Bekdil, "For Turkey, Precision Is Maximum Lethality, Minimum Cost," *DefenseNews*, 21 January 2014, <http://www.defensenews.com/article/20140121/DEFREG01/301200037/For-Turkey-Precision-Maximum-Lethality-Minimum-Cost>

¹³ Burak Ege Bekdil, "Turkey To Add Satcom Capability to Anka," *DefenseNews*, 22 October 2013, <http://www.defensenews.com/article/20131022/DEFREG01/310220024/Turkey-Add-Satcom-Capability-Anka>

¹⁴ William A. Orme Jr., "Military Contract Secured: World Business Briefing," *The New York Times*, 5 July 2000.

¹⁵ Metehan Demir, "Turkey might solicit new bids for intelligence satellite," *The Jerusalem Post*, 3 August 2000.

¹⁶ Lale Sariibrahimoglu, "Turkey Seeks Increased Satellite Intelligence Input," *Jane's Defence Weekly*, 27 August 2003.

reconnaissance, Turkey was still engaged in negotiations for the procurement of its first spy satellite.

In 2001, the National Security Council formally approved the plan to establish a Turkish Space Agency. The planning for such an agency began in 1993, but progress on implementing Turkey's ambitions to increase its space based capabilities had lagged.¹⁷ After the plans for a dedicated space agency were first drafted in 2001, the Turkish Air Force outlined a space policy roadmap in December 2013. As part of this effort, the government increased space related research and development funding. The bulk of the funding was dedicated to military specific projects aimed at increasing the military's ability to use space based assets, along with its current – and planned – fleet of drones to increase Ankara's ISR capabilities. The plan envisions the establishment of a specific military entity tasked with satellite reconnaissance, communications, early warning, and the designing of a satellite launch vehicle.¹⁸ Ankara intends to inaugurate this facility in 2023 – the 100 year anniversary of the founding of the Turkish Republic.

To support these plans, TUBITAK-BILTEN contracted with the UK based Surrey Satellite Limited to collaborate on the manufacture of the BILSAT reconnaissance satellite in 2003. Turkey's use of a co-production/offset arrangement is consistent with Ankara's arms procurement policy and suggests that the initial satellite efforts will focus on low-cost minisatellites that weigh less than 500 kg. The BILSAT's design was based on an enhanced SSTL-100 platform and included “experimental payloads including a multi-band imaging system, a real time image compression module, a GPS attitude receiver and a Control Moment Gyro.”¹⁹

The 130 kg satellite carried “five Earth observation cameras, one panchromatic and the remaining four obtain images in the red, green, blue and near-infrared bands.”²⁰ In addition, engineers from TUBITAK-ODTU-BILTEN designed a nine-band low-resolution multi-spectral imager and a DSP based image-processing module that used the JPEG2000 algorithm to compress images taken by the onboard cameras. The BILSAT was launched on 27 September 2003 and operated as part of the international system known as the Disaster Monitoring Constellation until it was

¹⁷ Tamer Ozalp, “Space as a strategic vision for Turkey and its people,” *Space Policy*, vol. 25, no. 9 (November 2009), pp. 224-235.

¹⁸ Burak Bekdil, “Turkey Plots Path Toward Space Command,” *DefenseNews*, 9 April 2013, <http://www.defensenews.com/article/20130409/DEFREG01/304090011/Turkey-Plots-Path-Toward-Space-Command>.

¹⁹ BILSAT-1: The Mission, Surrey Satellite Technology Limited, accessed on 25 March 2014, <http://www.sstl.co.uk/Missions/BILSAT-1--Launched-2003/BILSAT-1/BILSAT-1--The-Mission>.

²⁰ Ibid

deactivated in 2006.²¹ The satellite has since been used as the design basis for Turkey's other satellite projects.

In 2004, TUBITAK launched the RASAT program. The RASAT program was intended to incorporate a higher resolution imaging system and to enhance Turkey's ability to construct small satellites without significant foreign assistance. The satellite was intended as a technology demonstrator, rather than a long-term answer to Turkey's intelligence requirements.

The RASAT's design is based heavily on the SSTL-100 - the system procured from Surrey Ltd. for the BILSAT - and its subsystems. The satellite uses the same flight computer as the BILSAT. Based on this design, TUBITAK has designed the Bilge – an updated flight computer that it intends to deploy on future satellites.²²

The UHF system was used during the commissioning phase and the S-Band is currently being used for Tracking Telemetry & Command (TT&C) communication. The S-band data link allows for a downlink rate of 2 mbps. While this rate of transmission is adequate for the RASAT, engineers required a faster rate of transfer for its future projects. Thus, in order to prepare for future satellite missions, TUBITAK-UZAY developed a X-band transmitter that will allow for speeds of up to 100 mbps.²³

The RASAT uses a South Korean imaging system with a resolution of 7.5 m for panchromatic and 15 m for multispectral imaging.²⁴ The camera is based on a push-broom type camera based on EOS-A. The camera allows for the taking of strip images, which allows for the construction of 3-D models based on the combining of multiple images taken of the same area from multiple different angles. The satellite can store up to 31 scenes in pass. The RASAT satellite was launched on 17 August 2011 and it transmitted its first image in October 2011.²⁵

²¹ "Russian rocket launches Nigeria into space," Agence France Presse, 27 September 2003;

²² Gokhan Yuksel, Altug Okan, and Ugur Murat Leloglu, "First LEO Satellite Built in Turkey: RASAT," Recent Advances in Space Technologies, 2007, RAST 2007, 3rd International Conference on, 14-16 June 2007.

²³ Ibid

²⁴ RASAT, SI Satrec Initiative, accessed on 25 March 2014, https://www.satreci.com/eng/ds1_1.html?tno=5.

²⁵ "First Turkish satellite begins to send photos, officials say," *Today's Zaman*, 18 October 2011, <http://www.todayszaman.com/news-260300-first-turkish-satellite-begins-to-send-photos-officials-say.html>.

The know-how gained from the technology transfer of the BILSAT project, combined with the infrastructure built to support the RASAT program, has since been used to support the Gokturk project. The Gokturk project began in 2007 and includes both a locally produced satellite and a second satellite currently being built by a foreign vendor. On the local side, The Gokturk-2 was designed and developed by a consortium of Turkish Aerospace Industries (TAI) and TÜBITAK UZAY. The consortium was tasked with developing an improved satellite for the Turkish Air Force. The satellite has an improved electrical power subsystem that relies on an increased number of solar panels.

The panels were procured from Germany's SpaceTech GmbH Immenstaad and consist of four arrays with three strings of twenty cells each.²⁶ And, like in the case of the RASAT, the Gokturk-2 uses an electro optical imager provided by South Korea's SI Satrec Initiative. The satellite relies on an S-Band TX/RX communications system, but, unlike the RASAT, the Gokturk-2 uses an X-band communications for data downlink of some 100 mbps.²⁷ The payload includes a "multi-spectral imager (MSI) equipped with EOS-C panchromatic (PAN) and EOS-C multispectral (MS) electro-optical sensors" to take high-resolution images of earth."²⁸

The Gokturk-2 also has an increased memory and can store some 8 gigabytes of images and 32 gigabytes of scientific information. Thus, in one rotation around the earth, the satellite's memory can store up to 45 frames measuring 20km x 20km each.²⁹ The satellite was launched from China in December 2012 and started to transmit images shortly thereafter. The Gokturk-2 is controlled by the Turkish air force from a fixed and mobile ground station.³⁰

Yet, in total, the use of foreign suppliers for critical equipment, like the optical imaging system, suggests that Ankara will continue to have to rely on foreign vendors in the near future for its space program. In doing so, one specific goal for the current space plans could be to develop the indigenous capability to supply systems like the optical imaging system and the solar panels for future Turkish satellites. This would require the development of a more robust solar cell producing sector, which could also be used to support Ankara's interest in renewable energy sources. And, in the case of the optical imaging system, Turkey's indigenous efforts could be

²⁶ Göktürk-2 Imaging Mission, Turkey, accessed on 25 March 2014, <https://directory.eoportal.org/web/eoportal/satellite-missions/g/gokturk-2>.

²⁷ Ibid

²⁸ "GÖKTÜRK-2 Earth Observation Satellite, Turkey," airforce-technology.com, accessed on 26 March 2014, <http://www.airforce-technology.com/projects/gktrk-2-earth-observation-satellite/>.

²⁹ Ibid

³⁰ Veronica Magan, "Turkey's First Observation Satellite Successfully Transmits Images," *Satellite Today*, 8 January 2013.

used to support a minisatellite industry in the future that could then be marketed to other developing space nations, eager to procure complete systems from emerging low-cost suppliers. In doing so, Ankara could also seek to codify a code of business conduct vis-à-vis offsets in the space technology sector. If implemented, this policy would fit nicely with Ankara's step-by-step approach to develop the indigenous capabilities needed to indigenously manufacture the system's components.

In addition to its efforts on the RASAT, BILSAT, and Gokturk-2, Turkey turned to a foreign consortium for the larger Gokturk-1. The segmenting of Ankara's approach – i.e. the indigenous development of smaller satellites vs. the outsourcing of the development of larger and more capable satellites to established foreign vendors – further suggests that Ankara's intent is to develop the capability to produce smaller earth observations satellites, before moving on to the more complicated task of developing larger satellites. In 2007, the discussions with Israel continued about the sale of the Ofek satellite system, but Turkey refused to acquiesce to a restriction that would have barred the system from photographing Israeli territory. Israel was eliminated from the tender shortly thereafter, but talks with three European suppliers – Italy's TeleSpazio Germany's Ohb-Systems and Britain's EADS Astrium – continued.

In 2008, Turkey's procurement agency, Savunma Sanayii Müsteşarlığı (SSM), signed a €250 million contract with TeleSpazio for the coproduction of the Gokturk-1 satellite.³¹ The program is managed by Telespazio, while Thales is responsible for construction of the satellite, and the oversight of local contractors TAI, Tubitak Uekae, Maleri, Aselsan, and Roketsan.

The Gokturk-1 is a different design than the Gokturk-2. The satellite has a dry-weight of 1,000 kg, compared to the 400 kg Gokturk 2. In 2010, Thales Alenia Space announced that it had begun work on the Gokturk-1's optical imaging system. The optical system is similar to the system used on France's two Pleiades imaging satellites.³² The Pleiades satellite is intended to provide dual use imagery for defense purposes, and civilian applications related to "cartography, agriculture and forestry, geology and hydrology, marine applications, Earth science, resource management, land use, law enforcement and risk management."³³

³¹ "Italy winning majority of Turkey's purchases," *DefenseNews*, 26 January 2009.

³² Peter B. Selding, "Thales Alenia Begins Work on Turkish Sat," *SpaceNews*, 7 September 2010, <http://www.spacenews.com/article/thales-alenia-begins-work-turkish-sat-0>

³³ M. Alain Gleyzes, Lionel Perret, and Philippe Kubik, "Pleiades System Architecture and Main Performances," International Archives of the Photogrammetry, Remote Sensing and Spatial

The Thales designed optical instrument on the Pleiades has a resolution of 1 meter in the “performance domain” and “.70 meters at nadir” (the direction directly below a particular location).³⁴ At nadir, the camera’s swath is 20 km and it operates in panchromatic, red, green, blue and near-infrared bands. The design of the camera is based on KORSCH telescope, which uses four mirrors, protected by a shutter mechanism. The system is some 1.9 meters in length by 1.2 meters in diameter and weighs 200 kg. The Gokturk-1 uses the same system.

The data is compressed using an on-board Payload Data Compression Unit and “then transmitted to the ground with a 4.5 Gbits/s output rate.” The satellite has a memory of 600 gigabytes and images are transferred via an X-band link at up to 155 mbps. The satellite also has the capability to maneuver, which allows for the camera to capture multiple angles of the same image. This allows for more area to be covered and, if necessary, to create “a sequence of animated images allowing to highlight human activities on the targeted.”³⁵

The international consortium is responsible for manufacturing 80 percent of the components, while members of the Turkish consortium will contribute 20 percent of the satellite’s systems. The satellite itself will be delivered as a turnkey system.³⁶ Telespazio has agreed to construct a satellite integration and testing center in Turkey. The Turkish contractors are reported to be responsible for the building of the “data acquisition station, the satellite integration center, mission planning systems, and remotely sensed data processors.”³⁷

Thales delivery of the electro-optical system, however, has been delayed, due to Israeli pressure on Thales to prevent the satellite from taking high-resolution imagery of Israel. The United States bars the U.S. companies from using commercial satellite imagery of Israel that is in excess of 1

Information Sciences, Volume XXXIX-B1, 2012 XXII ISPRS Congress, 25 August – 01 September 2012, Melbourne, Australia.

³⁴ Jean-Luc Lamard et. al, “Design of the High-Resolution Optical Instrument for the Pleiades HR Earth Observation Satellites,” Proceedings of the 5th International Conference on Space Optics (ICSO 2004), 30 March - 2 April 2004, Toulouse, France.

³⁵ M. Alain Gleyzes, Lionel Perret, and Philippe Kubik, “Pleiades System Architecture and Main Performances,” International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XXXIX-B1, 2012 XXII ISPRS Congress, 25 August – 01 September 2012, Melbourne, Australia, available at: <http://www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XXXIX-B1/537/2012/isprsarchives-XXXIX-B1-537-2012.pdf>.

³⁶ Thales Alenia Space, accessed on 26 March 2014, <https://www.thalesgroup.com/en/thales-alenia-space>.

³⁷ Gokturk Programme, Telespazio, accessed on 26 March 2014, <http://www.telespazio.com/Gokturk.asp>

pixel per one square meter. While European firms are not bound by this law, Israel is likely to have pressured Thales to abide by a similar standard.³⁸ The Turkish government maintains that it will have complete discretion over the areas that it photographs. And, in a bid to pressure Thales, Turkey suspended payments.³⁹ The launch of the satellite was then delayed from 2013 until sometime in 2014.

In January 2013, SSM began negotiations with TUBITAK, Aselsan, and TAI for the development of the Gokturk-3 satellite. The Gokturk-3 is intended to carry a synthetic aperture radar payload, which would allow for it to take radar images of the earth's surface. Currently, there are numerous SAR equipped satellites in operation.⁴⁰ The project is currently in the design phase, but is likely to be based on the Gokturk-2's structure, rather than the larger Gokturk-1.

The Satellite Launch Vehicle: A Stepping Stone to a Ballistic Missile?

As part of its ambitious space plans, Ankara has announced its intention to construct a satellite launch center.⁴¹ In July 2013, SSM concluded a contract with Roketsan to begin pre-conceptual work on a satellite launch vehicle (SLV). SSM has asked that the proposed SLV be capable of launching satellites into low-earth-orbit. Roketsan has also been asked to begin design work on the satellite launch center, which will be operated by the Turkish Air Force.⁴² Roketsan has indicated that it will invest some \$100 million to support the project. Ankara has indicated that the intended aim of the SLV is to increase the nation's independence and to support its growing space program. Moreover, Ankara has also hinted that it will seek to commercialize its planned space capabilities and offer launch services for other nations.

However, there are concerns that Ankara intends to use the SLV as a platform to develop a ballistic missile. Professor Yucel Altinbasak, the head of TUBITAK, has indicated that Prime Minister Erdogan is intent on developing a 2,500 km range missile. There is, however, conflicting

³⁸ "Private eyes in the sky," *The Economist*, 4 May 2000, <http://www.economist.com/node/333111>.

³⁹ Emre Soncan, "Ankara-Paris arasında 'Göktürk-1 savaşı'," *Zaman*, 17 December 2012, <http://www.zaman.com.tr/gundem/ankara-paris-arasinda-gokturk-1-savasi-2033462.html>

⁴⁰ ITC's database of Satellites and Sensors, Faculty of Geo-Information Science and Earth Observation of the University of Twente, accessed on 26 March 2014, <http://www.itc.nl/research/products/sensordb/allsensors.aspx>.

⁴¹ "Turkey plans to build own satellite launch base for peaceful purposes," *Cihan News Agency*, 6 September 2012.

⁴² Burak Ege Bekdil, "Turkey's Sat-Launcher Plans Raise Concerns," *DefenseNews*, 28 July 2013, <http://www.defensenews.com/article/20130728/DEFREG04/307280004/Turkey-s-Sat-Launcher-Plans-Raise-Concerns>.

information about whether or not the missile be ballistic or cruise.⁴³ Given the role Roketsan is expected to play in both projects, there are concerns that the SLV could be used as a platform to develop ballistic missiles.

As of now, there has been little information released about the design. TUBITAK has, however, released a Youtube video that shows a silo-based system, purportedly intended to launch the RASAT.⁴⁴ Roketsan's Youtube video shows a more traditional SLV launching pad, with a rocket similar in design to India's Polar SLV.⁴⁵ While the two promotional videos reveal little about the SLV's design, Turkey's focus on developing small earth observation satellites suggest that the initial payload requirement for the planned SLV will be some 500 kg. The Gokturk-2, for example, weighs 400 kg. The BILSAT weighed 130 kg. It is unclear how much the Gokturk-3 will weigh, but Roketsan's promotional video includes a computer-generated image of the Gokturk-3. The satellite clearly resembles the Gokturk-2, albeit with much larger photovoltaic cells.

This suggests that the design will more closely resemble the Gokturk-2, rather than the heavier Gokturk-1. If the weight is similar, the satellite should be between 400 and 500 kg. In turn, one can assume that Turkey's first generation SLV will be designed to carry 500 kg objects into low-earth-orbit. If this is the case, Ankara will face difficulties in procuring the equipment to support the program. Turkey's satellite development program underscores the extent to which Turkish industry remains dependent on foreign assistance for its space program. Roketsan is certain to face similar development issues, as it seeks to move from pre-conceptual design work to the actual construction of a SLV/missile.

Turkey is a member of the missile technology control regime (MTCR). This informal group of 34 states has agreed to adopt national export-control policies that incorporate a common export-control list. Controlled items are divided into two categories. Countries are expected to apply the greatest restraint to the export of Category I items, which include rockets, missiles and drones capable of flying more than 300 kilometers while carrying a payload of 500 kilograms.

⁴³ Ümit Enginsoy, "Turkey aims to increase ballistic missile ranges," *Hurriyet Daily News*, 1 February 2012, <http://www.hurriyetdailynews.com/turkey-aims-to-increase-ballistic-missile-%20ranges.aspx?pageID=238&nID=12731&NewsCatID=345>.

⁴⁴ Tubitak UZAY RASAT Satellite, youtube, uploaded on 15 June 2011, <http://www.youtube.com/watch?v=Ae1RoPh-j3c>.

⁴⁵ Turkey's New Launcher Concept, youtube, uploaded on 16 July 2013, <http://www.youtube.com/watch?v=4UTVNZrQpA>.

As of now, Roketsan's longest-range missile is the J-600 Yildirim, which is reported to have a range of 150 km with a 480 kg warhead. Thus, the development of a SLV – or ballistic missiles – would represent a serious advance in Roketsan's capability. Absent more information about Roketsan's SLV plan, it is unclear whether or not the project can be implemented in the near future. In any case, the MTCR is sure to place a number of restrictions on Ankara's import of technologies needed to support such an ambitious program, which likely means that the development of such a system will take quite a bit of time.

Conclusion

Turkey has remained committed to developing space capabilities for close to two decades. While Turkey may not meet its self-imposed deadline of launching 16 satellites by 2023, it will nevertheless continue to invest in indigenous capabilities to further develop its nascent satellite industry. In doing so, Ankara will continue to have to cooperate with foreign suppliers to support the development of the infrastructure needed to support the program in the near-to-medium term.

Ankara has embarked on a very practical approach to developing a satellite industry. The main focus of the indigenous program is on low-cost minisatellites, designed to perform dual-use functions. Moreover, TUBITAK and TAI have demonstrated a willingness to rely on European suppliers for the larger and more complex Gokturk 1, in favor of focusing their efforts on developing the indigenous capability to support systems similar to that of the Gokturk-2. TUBITAK and TAI's approach suggests that the crux of Turkey's indigenous research will continue to focus on building upon the experience gained from the BILSAT, RASAT, and Gokturk programs.

Turkey does not appear to have the local capacity to develop the rocket engines needed to lift 500 kg payloads into low-earth orbit. Moreover, the MTCR will complicate any effort to procure such systems from abroad. Thus, it is more likely that Turkey will continue to rely on commercial launch companies to support its satellite industry in the near future. Nevertheless, the commitment to developing such a system could, in turn, impact Turkey's approach to other missile related procurements. For example, Ankara could prioritize the acquirement of rocket engine related technology for other programs, like TLORAMIDs, to support its space ambitions.

To be sure, the program would benefit from greater transparency. As of now, SSM's failure to clearly articulate the scope of the SLV project has led to concerns that Ankara is intent on developing a ballistic missile technology. Moreover, Ankara has the opportunity to clearly define its future ambitions in space and to take a number of steps to explain how its emphasis on the military uses of space will preclude the development of ASAT technology, as well as decrease regional tensions. Yet, such concerns should not detract from the sustained commitment the Turkish government has shown for the development of satellites. While Turkey's space program is still in its infancy, Ankara is certain to further develop its ISR and communications capabilities in the near future.