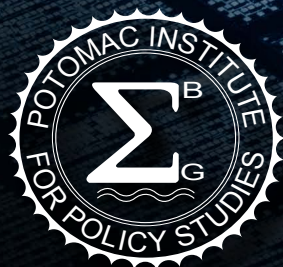


TRUSTED STATE-OF-THE-ART FOUNDRY ACCESS

Impact Analysis, Assessment, and Strategy Report

OCTOBER 2018



POTOMAC INSTITUTE FOR POLICY STUDIES

EXECUTIVE SUMMARY

The Department of Defense (DoD) is at very high risk of soon losing access to its sole-source supplier – GlobalFoundries U.S. (GFUS2) – of unique state-of-the-art (SOTA) trusted microelectronics components. This would have a severe impact on a wide variety of critical programs which rely on this source of advanced electronics parts.

Currently, there is no plan in place to handle this loss of access to key microelectronic components. These are components that are critical to the operation of some of the most sophisticated systems the DoD operates. This is a risk that could have significant national security implications. The implementation of a contingency plan to mitigate this high-risk, high-impact situation is urgently needed. This study provides such a plan.

IBM began work with the DoD as its Trusted Foundry in 2004, with a ten-year contract that expired in 2013. The DoD and IBM then agreed upon a follow-on ten-year renewal of this contract beginning in 2014 and running until 2023, executed in one-year renewable options. In July 2015, IBM sold its microelectronics manufacturing capability to GlobalFoundries (GF), a foreign-owned company. Due to the national security implications of this sale, a process under the Committee on Foreign Investment in the United States (CFIUS) was triggered that resulted in the formation of a U.S. subsidiary GlobalFoundries U.S. 2 (GFUS2), which signed a new Special Security Agreement under the CFIUS process until the Trusted Access Program Office (TAPO) could novate the USG Trusted Foundry Access contract from IBM to GFUS2. TAPO authorized the novation of the balance of IBM's 2014-2023 Trusted Foundry contract to GFUS2 in 2015, making GFUS2 the new performer operating the Trusted Foundries in East Fishkill, NY and Burlington, VT. GFUS2 maintained the terms of the original contract, retaining options to renew each year until 2023. While the contract extends until 2023, both parties have the option of ending their contractual relationship each year.

It is important to realize that GF is in a highly competitive global microelectronics foundry market and has failed to achieve profitability since it was founded in 2009. The Trusted Foundry contract is estimated to account for less than two percent of GF annual revenue.¹ The implementation of a contingency plan for assured access to SOTA microelectronics should GF exit the Trusted Foundry contract during an annual renewal phase is therefore extremely prudent. Financial pressures on GF make this scenario a likely one to envision. Abruptly losing access to the trusted GFUS2 technologies that DoD currently relies upon would severely impact key systems in terms of lost time, cost, and mission readiness. Many of these technologies currently have no other

1. Rulison, Larry. 2018, May 11. So is GlobalFoundries Profitable? Yes and No. *Times Union*. Retrieval at: www.timesunion.com/business/article/So-is-GlobalFoundries-profitable-Yes-and-no-12906650.php.

supplier, making them very difficult to replace. This potential loss would mean DoD would lose access to secure microelectronic components essential to the development of a large number of DoD systems and platforms. The issue of secure microelectronics components has received recent attention in light of allegations that China tampered with the hardware of Supermicro servers.² Furthermore, the field of companies pursuing the most-advanced production technology has become increasingly smaller.^{3,4}

The current study follows up on the 2015 “Trusted State-of-the-Art Microelectronics Strategy Study” conducted by the Potomac Institute for Policy Studies. This study identified and evaluated five overarching alternative options for DoD trusted SOTA access, including ten total sub-options within the broader categories considered. The Potomac Institute studied these alternatives in response to the then pending sale of IBM Microelectronics and presented a clear set of recommendations for SOTA access moving forward. Developing a split fabrication capability where a commercial front-end-of-the-line (FEOL) is paired with a secure USG back-end-of-line (BEOL) was one of these recommendations as well as backing up IBM-unique technologies such as partially-depleted silicon-on-insulator (PDSOI) complementary metal oxide semiconductor (CMOS) and SiGe BiCMOS. A compelling benefit of split fabrication is that it works with any front-end fab supplier the government elects to partner with, addressing supply chain risks related to reliance on single suppliers for critical parts. However, DoD has not implemented all the study’s recommendations, leaving DoD in an even more precarious position today than it was in 2015 immediately following the IBM sale.

To provide such a contingency plan, the Potomac Institute for Policy Studies (PIPS) performed the Trusted State-of-the-Art Foundry Access Study (TSFA), which analyzed possible options (see Table 1) and presented a set of recommendations to ensure continued access to trusted SOTA microelectronics. Five principle options were evaluated based on the following criteria: trust, product diversity, long-term viability, time to production, and cost.

-
2. Robertson, Jordan and Riley, Michael. 2018, October 4. The Big Hack: How China Used a Tiny Chip to Infiltrate U.S. Companies. *Bloomberg Businessweek*. Retrieval at <https://www.bloomberg.com/news/features/2018-10-04/the-big-hack-how-china-used-a-tiny-chip-to-infiltrate-america-s-top-companies>.
 3. 2018, August 30. GlobalFoundries to abandon new chip, cut 455 New York jobs. Associated Press. Retrieval at: <https://www.apnews.com/f4fc18ee997a45e1ad16194844448391>.
 4. Victorino, Corazon. 2018, September 11. Intel Outsourcing 14nm Chipset Amid Struggle To Advance To 10nm Process. *International Business Times*. Retrieval at: <https://www.ibtimes.com/intel-outsourcing-14nm-chipset-amid-struggle-advance-10nm-process-2715760>.

Table 1: Alternative Acquisition Options Evaluated for SOTA Microelectronics Access

| Alternatives Assessed for Post-GFUS2 Contingency Plan | |
|--|--|
| Option #1 | Rebid Current Trusted Foundry Contract |
| Option #2 | Build Full-Flow GOGO Foundry |
| Option #3 | Purchase Existing GFUS2 Foundries |
| Option #4 | Split Fabrication with GOGO BEOL |
| Option #5 | Buy SOTA Commercial-off-the-Shelf Parts (COTS) |

The output of the TSFA study produced one clear recommendation for how the DoD should proceed to assure long-term access to SOTA microelectronics.

RECOMMENDATION FOR ASSURING LONG-TERM TRUSTED SOTA ACCESS

Develop a trusted SOTA split fabrication manufacturing capability in which the front-end-of-the-line (FEOL) is produced by a commercial supplier and the back-end-of-line (BEOL) by a secure Government-Owned/Government-Operated (GOGO) facility.

This option would guarantee the DoD long-term access to trusted SOTA microelectronics. Split fabrication (or split fab) would provide DoD with low-cost, steady access to trusted SOTA microelectronics for as long as required. It allows for a high level of trust, without the DoD having to incur the cost of building and continuously updating a full fab or suffer the consequences of acquiring untrusted commercial SOTA components. Split fab provides DoD with a viable, long-term option that takes advantage of the cost savings benefits of using commercial FEOL features, independent of suppliers, and adding trust at the BEOL wiring step. Pursuant to past government national strategy recommendations, such as the presidential directive in July 2017 addressing gaps in national security due to single points of failure in supply chains as well as other DoD directives, split fab addresses single-point-of-failure concerns as it works with any FEOL fab the USG chooses to partner with.^{5,6}

We recommend the DoD pursue a split fabrication capability as the most cost-effective way to provide a necessary backup to at-risk GFUS2 technologies. The severe impact of such a loss of access is too serious not to begin working such a contingency plan immediately.

5. A Presidential Document by the Executive Office of the President. 2017, July 21. "Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States." Executive Order 13806. <https://www.federalregister.gov/documents/2017/07/26/2017-15860/assessing-and-strengthening-the-manufacturing-and-defense-industrial-base-and-supply-chain>.
6. Department of Defense Instruction, Number 5000.60. 2014, July 18. "Defense Industrial Base Assessments." <http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500060p.pdf?ver=2017-12-04-074058-300>.

