

REQUEST BY NVIDIA CORPORATION (NVIDIA) FOR WAIVER OF UNITED STATES MANUFACTURE IN SUBJECT INVENTIONS MADE IN THE COURSE OF OR UNDER RFQ 2028206 UNDER PRIME CONTRACT NO. DE-NA0003525; RELATED TO DOE WAIVER DOCKET W(A)2023-005

NVIDIA Corporation (NVIDIA) has requested a waiver of United States manufacture to any invention(s) that may be made in the performance of the work under RFQ 2028206 under SNL Prime Contract DE-NA0003525 entitled "Advanced Memory Technology."

The proposed project will include research into Advanced Memory Technologies, specifically stacking DRAM on top of high-performance processors to provide enormous amounts of memory bandwidth. The scope of work will include application studies, semiconductor technology assessments, architecture studies, and programming system development to exploit data and task locality. NVIDIA expects subject inventions to be developed in each of these areas. If successful, technology from these subject inventions would appear in future NVIDIA high-performance processors including GPUs. The market for such GPUs is worldwide and is valued in the billions of dollars per year.

The research project aims to investigate and de-risk advanced memory technologies so that they can be incorporated into future NVIDIA products. Specific challenges include:

- Packaging and signaling technologies that provide very fine pitch vertical interconnects across GPU and DRAM chips at very low energy.
- Cooling technologies that can remove heat from a power-hungry GPU through the DRAM stack.
- High-bandwidth GPU architectures that can effectively consume the increased bandwidth.
- Programming systems that allow expression and exploitation of data and task locality.

NVIDIA researches, designs, and develops hardware and software for advanced high-performance computing systems. As a fabless semiconductor company, NVIDIA partners with semiconductor fab vendors including Taiwan Semiconductor Manufacturing Company (TSMC) and Samsung to manufacture chips for these markets, which NVIDIA then incorporates into systems of many sizes, including high-performance computers and datacenters.

NVIDIA also partners with DRAM vendors such as Micron, Samsung, and SK Hynix (along with the DRAM standards bodies) to develop advanced memories to attach to our processors. In addition, NVIDIA develops and distributes software to run on its computer systems, including programming systems, compilers, and application libraries.

For the subject inventions of this waiver, NVIDIA would incorporate the technologies into its normal engineering and business processes. Hardware innovations would be incorporated into NVIDIA chips and system while programming system innovations would be incorporated into NVIDIA software offerings. All of these would ultimately be a part of NVIDIA's standard commercial products.

Currently, there is no leading-edge manufacturer in U.S. Although Intel is working to bring their capabilities to the leading edge. However, according to NVIDIA, leading-edge manufacturing capability is just one piece in being able to manufacture for third parties. To successfully use Intel fabrication, processes and procedures to efficiently support third party clients need to be in place

along with the faith of customers that their work will not be given a relatively lower priority to Intel's own internal work. In addition, domestic sourcing currently is more expensive than international sourcing. Should Intel get to the leading edge, work through these other issues and be cost competitive with foreign manufacturers and demonstrate these capabilities, NVIDIA would build within the U.S. However, at this time, this has yet to be shown and the line of sight to this on timelines NVIDIA have visibility into is not there yet.

Another option is a foreign company manufacturing on U.S. soil. However, as of today no foreign company plans to build their leading-edge facilities in the U.S. They will instead be a few years behind the capabilities in their home country. Should this change and be cost competitive, then using a foreign manufacturer in the U.S. would be another option.

In summary, NVIDIA agrees to the following:

To the extent that Subject Inventions are manufactured by NVIDIA, NVIDIA agrees to undertake commercially reasonable efforts to have products manufactured substantially in the US if NVIDIA determines in its discretion that there is a US-based supplier that meets all of NVIDIA's technical, business, and legal requirements for supply of such products under terms and conditions that are customary and reasonable for the industry.

NVIDIA also agrees not to manufacture the GPU chips incorporating the Subject Inventions in Countries of Risk (i.e., the People's Republic of China (PRC), Russia, North Korea, and Iran). This restriction does not apply to Taiwan and Japan. NVIDIA agrees to make this restriction for GPU chip manufacturing binding upon any licensee, assignee, contractor, and any other entity receiving rights to the Subject Inventions including any manufacturer making GPU chips for NVIDIA.

While it is likely that advanced packaging of the DRAM will occur at the DRAM vendor's facility (U.S. for Micron, South Korea for Samsung or Hynix), if the stacking of the DRAM on top of the GPU should occur at an NVIDIA assembly vendor site, NVIDIA can request that the production plan avoid China. This program envisions utilizing volume-qualified packaging technology and building on emerging trends in hybrid bonding which are expected to be commercially available during the timeframe of the production of our result IP.

This is an early R&D project, and there are no products at present. If products result from this project the likely manufacturing partners would be TSMC, Samsung, and Micron. Locations would be the leading-edge facilities of the three named companies at the time of manufacture, which is likely four or more years in the future. NVIDIA does not want to speculate where partners will locate their facilities in that timeframe.

There are multiple benefits from non-U.S.-based manufacturing to the U.S. economy. These include that a U.S. based company would receive the profits from the resultant IP and help maintain the U.S. lead in technology and products. In addition, NVIDIA's GPUs are used to train leading-edge AI models and are present in all the leading U.S.-based cloud offerings, including Google, Amazon, and Azure. Finally, GPUs are used in leading-edge scientific computing in both U.S. national laboratories and companies for simulations that help make important scientific discoveries and design new products. All these use cases are important to U.S. economic development. U.S. leadership would be improved through faster, more efficient GPU computing.

The Funding Program supports NVIDIA's position. It stated that at present, there is no reasonable alternative in the United States except for the use of Intel, which is NVIDIA's competitor. The Funding Program believes that NVIDIA is agreeing to review the situation moving forward, and when new fabs come online from competitors (e.g., TSMC in Arizona and Samsung in Texas). The Funding Program does not expect the issue to be for a fairly significant period of time and so are apprehensive about forcing NVIDIA into domestic manufacturing when no credible path exists.

Although "more expensive" is not a good justification but, at present, the Funding Program believes that there are no substantial domestic technical alternatives to the use of TSMC in Taiwan for NVIDIA's production.

Considering the foregoing, it is believed that awarding the US manufacture waiver will provide NVIDIA the necessary support to enable technologies for next-generation high performance computing systems. Upon evaluation of waiver petition and the funding program's approval and acceptance of NVIDIA's conditions regarding the waiver of US manufacture, it is recommended that the requested waiver be granted.



Carmen Ekstrom  
NNSA Patent Attorney

Date: \_\_\_\_\_

Based on the foregoing US Manufacture waiver, it is determined that the interests of the United States and the general public will best be served by a waiver of US manufacture of the scope described above and therefore, the waiver is granted.

CONCURRENCE:



---

Brian Lally  
Assistant General Counsel  
For Technology Transfer and  
Intellectual Property (GC-62)

Date: \_\_\_\_\_

APPROVAL:



---

Simon D. Hammond, PhD.  
Federal Program Manager  
Office of Advanced Simulation and Computing &  
Institutional Research and Development Programs  
(NA-114)  
National Nuclear Security Administration  
US Department of Energy

Date: \_\_\_\_\_

t) U. S. Competitiveness

The Contractor agrees that any products embodying any waived invention or produced through the use of any waived invention will be manufactured substantially in the United States unless the Contractor can show to the satisfaction of the DOE that it is not commercially feasible to do so. For storage vessels installed outside the U.S., the Contractor may rely on international fabrication centers and field construction near or at the final installation location to construct and assembly the storage vessels provided any proprietary equipment needed to apply the insulation system for the storage vessels are manufactured in the U.S. and the applying of the insulation will be done by a U.S. based crew. All design and detail engineering activities related to the storage vessels embodying or made through the use of a waived invention will be in the U.S. and the personnel required for commissioning and startup of the storage vessels will be U.S. based labor. In the event the DOE agrees to foreign manufacture beyond the activities already provided for above, there will be a requirement that the Government's support of the technology be recognized in some appropriate manner, e.g., recoupment of the Government's investment, etc. The Contractor agrees that it will not license, assign or otherwise transfer any waived invention to any entity unless that entity agrees to these same requirements. Should the Contractor or other such entity receiving rights in the invention undergo a change in ownership amounting to a controlling interest, then the waiver, assignment, license, or other transfer of rights in the waived invention is suspended until approved in writing by the DOE.

(End of clause)