Computing Concepts and Systems

An in-depth exploration of foundational principles, systems, and operations in modern computing.

- Lenna Sjööblom’s Role in Image Compression History
- Technology
  - China’s 5 nm Chip Breakthrough – Geopolitical Implications

Lenna Sjööblom’s Role in Image Compression History

Every selfie you take, every photo you post, and every movie you stream owes something—surprisingly—to an image pulled from a **1972 *Playboy* centerfold**. The woman in the photo, **Lenna Sjööblom**, had no connection to computing, yet her image became an unlikely icon in the tech world.

In the mid-1970s, researchers at the **University of Southern California's Signal and Image Processing Institute** were seeking a high-quality, widely available image to use as a standard test in **digital image processing**. One engineer tore out a portion of Lenna’s centerfold and digitised it. That image—cropped to focus on her face and shoulder—became known as the "**Lenna** " image.

It is precisely this contradiction that makes her story so curious: a former *Playboy* model becoming a staple in programming labs, used by researchers who spent countless hours in front of screens refining **image compression algorithms**. Lenna’s photo served as a consistent benchmark to assess whether these algorithms preserved visual quality after compressing an image.

This work laid the foundation for formats like **JPEG (Joint Photographic Experts Group)** and **MPEG (Moving Picture Experts Group)**—technologies that make it possible to store thousands of images on your phone, post photos to social media, or stream films without massive data loads. Lenna’s image was used for decades in papers, presentations, and textbooks across the fields of **computer vision** and **image processing**.

Despite the controversial origin, Lenna’s image became both a **technological tool** and a **cultural phenomenon**. It has also sparked long-standing debates about ethics, representation, and the appropriateness of sourcing test data from non-consensual or sexualised contexts. Yet her presence in computing history is undeniable: **a face that launched a thousand file formats**.

Technology

A collection of entries focused on emerging technologies, innovation trends, and their broader implications. This category covers advancements in semiconductors, AI hardware, blockchain, quantum computing, and other developments shaping the geopolitical, economic, and social landscape of the digital age.

Technology

China’s 5?nm Chip Breakthrough – Geopolitical Implications

Overview

While the Biden administration focused on imposing sanctions and restricting China’s access to advanced microchip technology, **China has responded not with retaliation, but with fabrication — quite literally**.

In a bold display of technical resilience, China has reportedly developed **5 nm-class microprocessors** *without* the use of **EUV (Extreme Ultraviolet Lithography)** — a cutting-edge manufacturing process blocked under Western export controls. The breakthrough, led by **SMIC (Semiconductor Manufacturing International Corporation)**, was achieved using an alternative and more complex method: **DUV (Deep Ultraviolet Lithography)** combined with **SAQP (Self-Aligned Quadruple Patterning)**.

Though still limited in scale and efficiency, this achievement may carry **significant geopolitical implications**, with potential ripple effects across global trade, national defense, and the broader technology landscape.

Key Technologies Involved

Term	Meaning
SMIC	Semiconductor Manufacturing International Corporation
DUV	Deep Ultraviolet Lithography
EUV	Extreme Ultraviolet Lithography
SAQP	Self-Aligned Quadruple Patterning
AI	Artificial Intelligence
SoC	System-on-Chip

Term	Meaning
EDA	Electronic Design Automation
TSMC	Taiwan Semiconductor Manufacturing Company
IP	Intellectual Property

---

1. Export Controls Bypassed

> China has manufactured 5 nm-class chips **without EUV machines**, using older DUV tools with complex patterning techniques (SAQP).

Geopolitical Implication:

- Undermines **U.S.-led sanctions** and export controls.
- May prompt tighter restrictions on **DUV tools**, **EDA software**, or even **basic chip materials**.
- Erodes Western **tech leverage** in diplomatic or trade disputes.

---

2. Rising Tech Sovereignty

> By proving it can produce advanced chips domestically, China is moving toward **semiconductor independence**.

Impacts:

- Reduces reliance on foreign supply chains.
- Enables development of homegrown **AI chips**, **telecom SoCs**, and potentially **quantum computing platforms**.
- Protects strategic industries from future embargoes.

---

3. Military & National Security Concerns

> Advanced semiconductors are foundational to **modern warfare**, especially AI-enabled systems.

Strategic Implications:

- Supports **civil-military fusion** (China’s policy of applying civilian tech to military use).
- Could power more capable:
  - **Drones and swarming systems**
  - **Surveillance platforms**
  - **Autonomous vehicles**
  - **Command and control systems**

---

4. Escalation of the Tech Cold War

> The U.S.–China relationship is already fraught with **technological rivalry**.

Potential Fallout:

- Acceleration of **decoupling** from Chinese tech (e.g., Huawei, TikTok bans).
- Increased Western investment in **“friend-shoring”** chip fabs (in Taiwan, Japan, EU, etc.).
- Broader restrictions on international **collaboration in AI and chip R&D**.

---

5. Economic Leverage and Soft Power

> Even at lower yields and higher costs, China's domestic chip capacity allows it to **participate globally**.

Consequences:

- May flood **developing markets** with lower-cost chips and AI solutions.
- Strengthens China's ability to:
  - Compete with TSMC and Samsung in **budget segments**
  - Expand influence in the **Global South**
  - Shape **technology standards and norms**

Summary Table

Impact Area	Description
Export Controls	China circumvents EUV restrictions, weakening Western leverage
Tech Sovereignty	Enhances China’s independence and strategic resilience
Military Use	Supports AI-enabled military and surveillance systems
Tech Cold War	Escalates tension and retaliatory tech policy from the West
Global Market Influence	Boosts China’s soft power and ability to export chip tech

---

Final Notes

- China’s current yields and costs are **not yet competitive** with industry leaders like TSMC (Taiwan) or Samsung (South Korea).
- However, this move signals **determination and capability** to develop around restrictions.
- The long-term effect may be a **multipolar semiconductor world**, less dependent on Western or allied supply chains.