STRATEGY ANALYTICS

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Enabling Technologies for the Defense Sector

Asif Anwar

aanwar@strategyanalytics.com

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The growing opportunity for solid state technologies such as GaN continues to be reflected in developments across military radar, electronic warfare and military communications systems. In the area of electronic warfare, there are several programs and platforms that are looking to use GaN to underpin electronic attack capabilities. One of the core drivers is the ability to use AESA architectures in conjunction with the capabilities offered by this technology to achieve both high power as well as digital flexibility. Strategy Analytics looks at how, where and why the GaN defense sector will grow and who are the major players supplying this enabling technology.

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Key Issues for Military Systems

Dealing with the Data Tsunami

- Better spectrum management
- Optimise bandwidth, latency and economics for next generation networks
- Use of more complex modulation and other approaches such as MIMO and phased arrays to increase spectral efficiency

Technologies of Choice from Antenna to Baseband

- Losses, power efficiency, linearity, leakage, parasitics
- Lower supply voltages and inherent challenges to device-level uniformity, drive capability, noise margins

Bridging the Energy Gap

- Transpose advances in energy technology from other sectors, including hybrid and electric propulsion
- Keeping pace with advances across baseband and applications processors

Increasing Demands on Semiconductor Performance

- Higher frequencies and broader band performance
- Integration trade-offs, both monolithic and module
- More digital processing with less power consumption

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The Evolution towards AI-enabled Systems and Platforms

Transmitter

- Single/discrete channels
- Systems with multiple transmitters
- Wideband capable

Receivers

- Noise performance
- Instantaneous bandwidth
- Wideband

ADC/DAC

- Higher resolution
- Sampling speed
- Closer placement to antenna

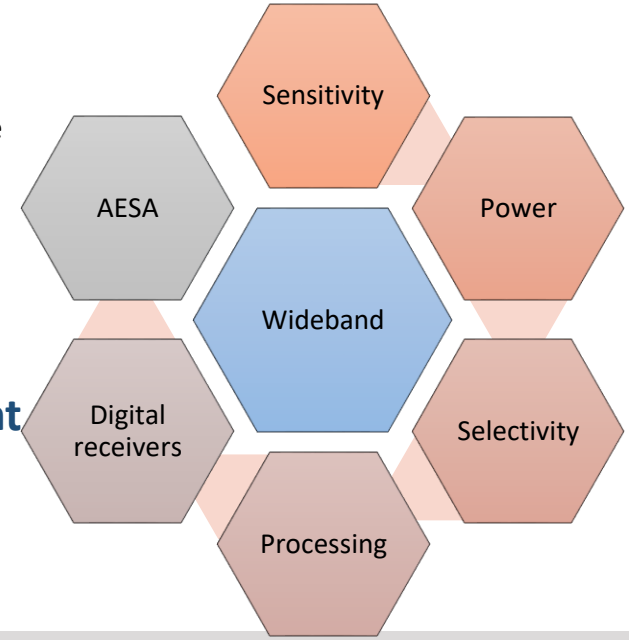
DSP

- Instantaneous real-time processing
- Continuous processing
- FPGA-based

Software

- Flexible configurability
- Field reprogrammable
- Spectrum management
- Automation to adaptation to cognitive capabilities

Multifunctional RF systems underpinned by AI-enabled resource management



Development of machine learning-based cognitive analysis of the threat environment for effective planning and countermeasures activity will dictate requirements for wideband materials and AESA architectures.

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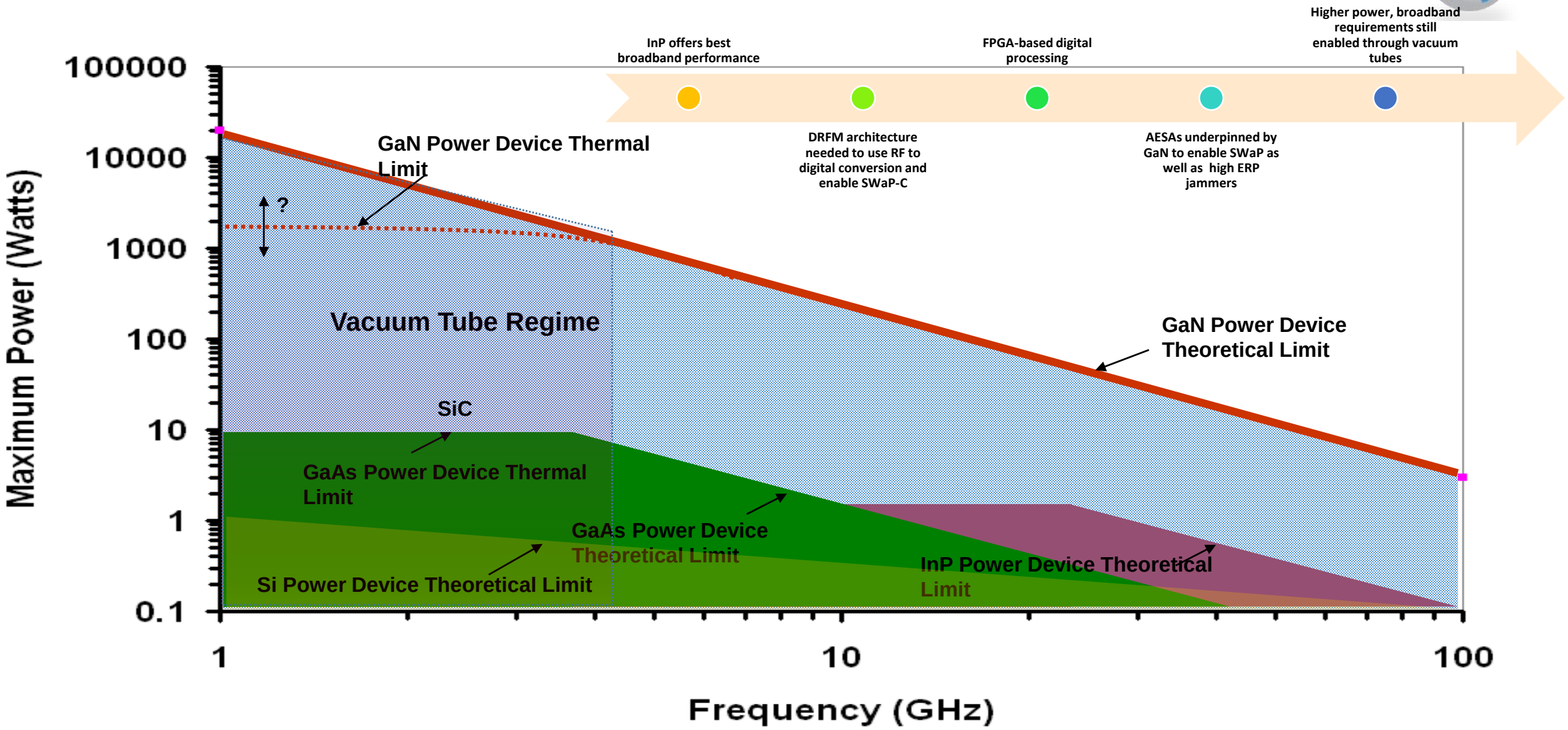
Which Enabling Technologies will Prevail?



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What are the advantages that have driven GaN growth?

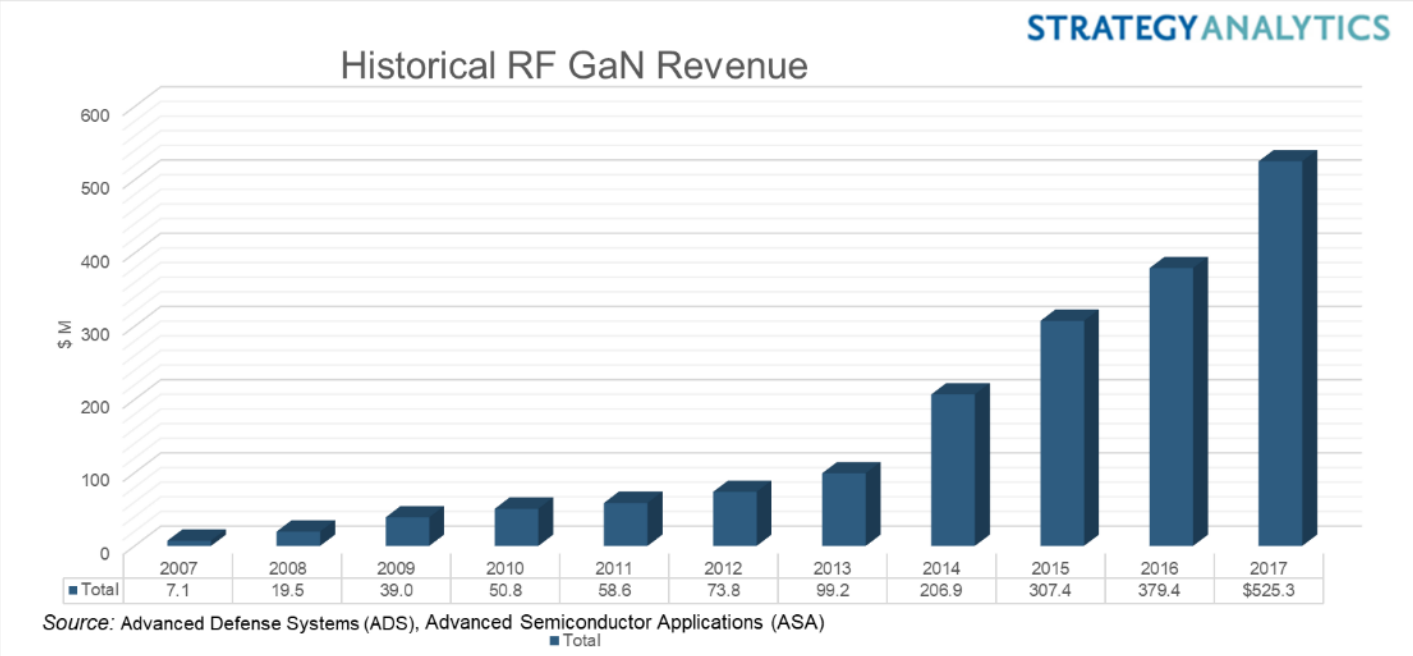
Source: Strategy Analytics

Material Properties	Si	GaAs	GaN
Saturation velocity (cm/s)	1×10^7	0.8×10^7	2.5×10^7
Breakdown E-field (MV/cm)	0.3	0.4	3.0
e^- mobility (cm^2/Vs)	1350	8000	1500
E_g bandgap (eV)	1.1	1.4	3.4
F_t (GHz) FET	20	150	150
Power density (W/mm)	0.2	0.5	>30
Thermal conductivity (W/cm/K)	1.5	0.5	~2.0

Superior frequency, efficiency, voltage breakdown, speed, temperature, power density, current density performance

Device characteristics provide a host of benefits:

- Higher efficiency = less DC power, less cooling
- Higher frequency = more applications
- Temperature performance = less cooling, electronics close to the antenna
- Higher power density = higher power output performance
  - Or the same power output = fewer components



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RF GaN Market Continued its Growth Trajectory

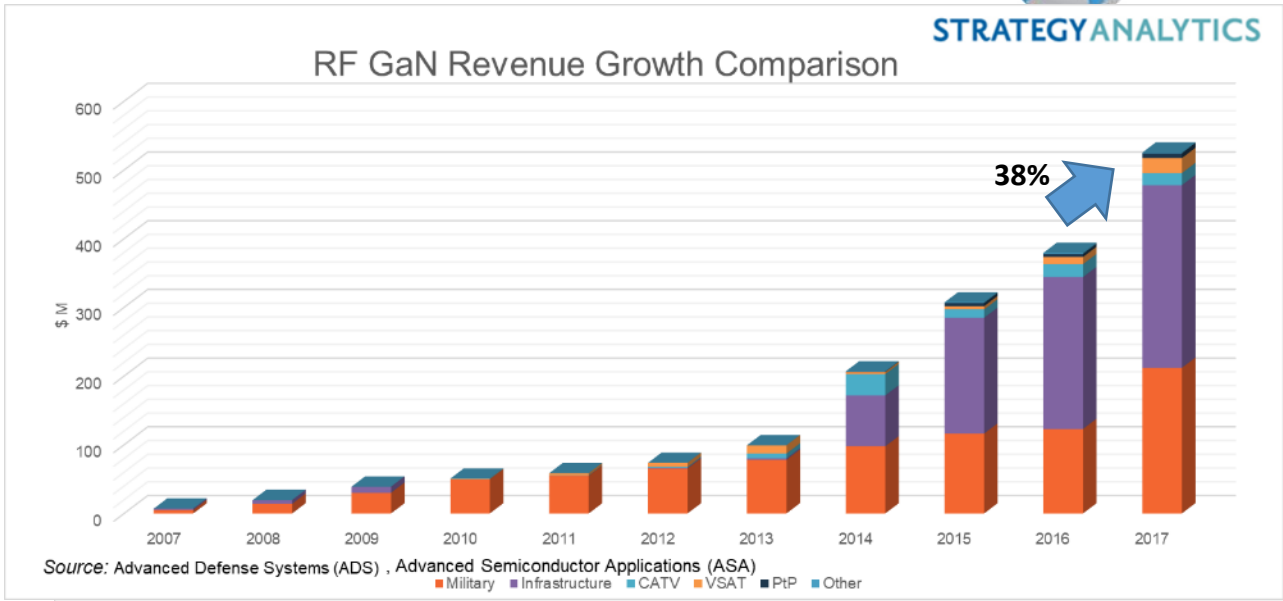
Defense applications have been the early primary driver for RF GaN revenue.

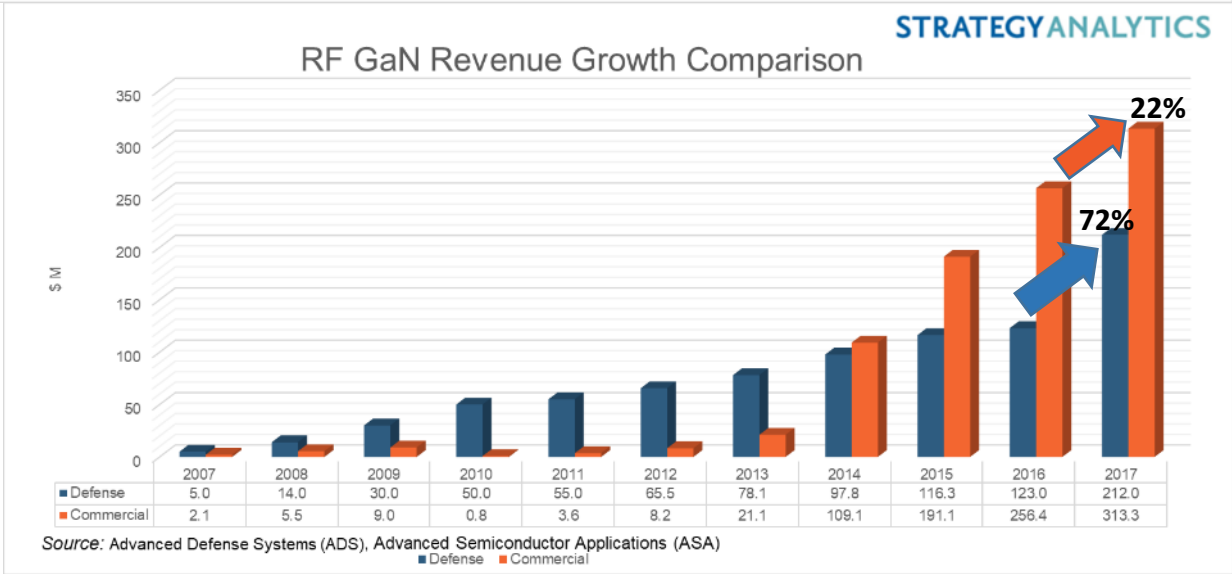
Wireless market remained “on the cusp” until 2014.

Revenue spiked in response to the adoption of RF GaN devices in base station power amplifiers in Chinese LTE base station deployments.

Massive boost to the overall RF power market and GaN.

Major upgrades and new platforms reaching production in defense applications, increased year-on-year growth.





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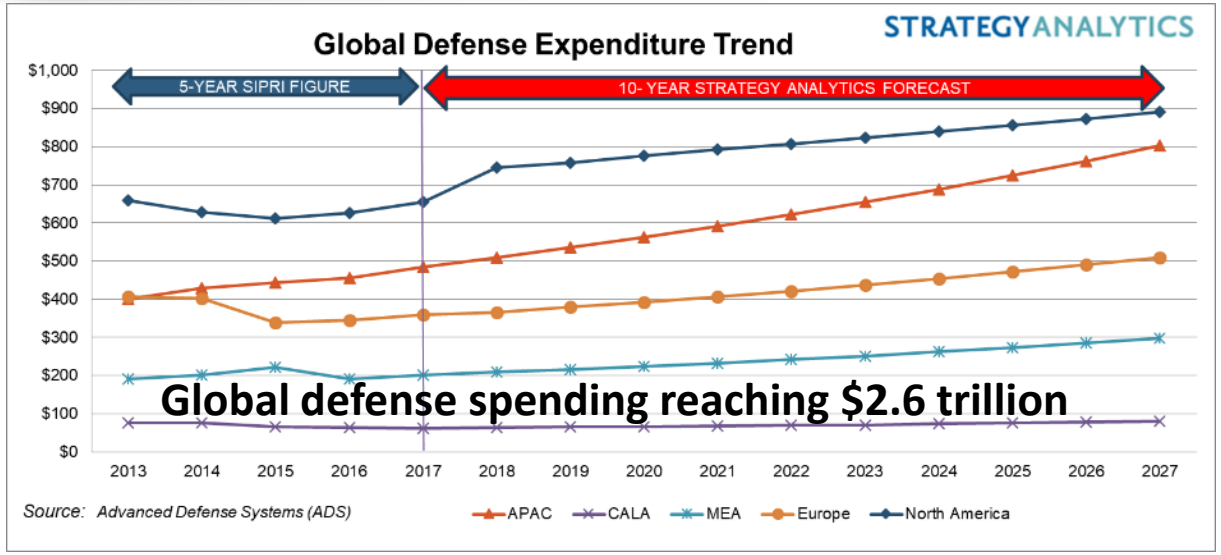
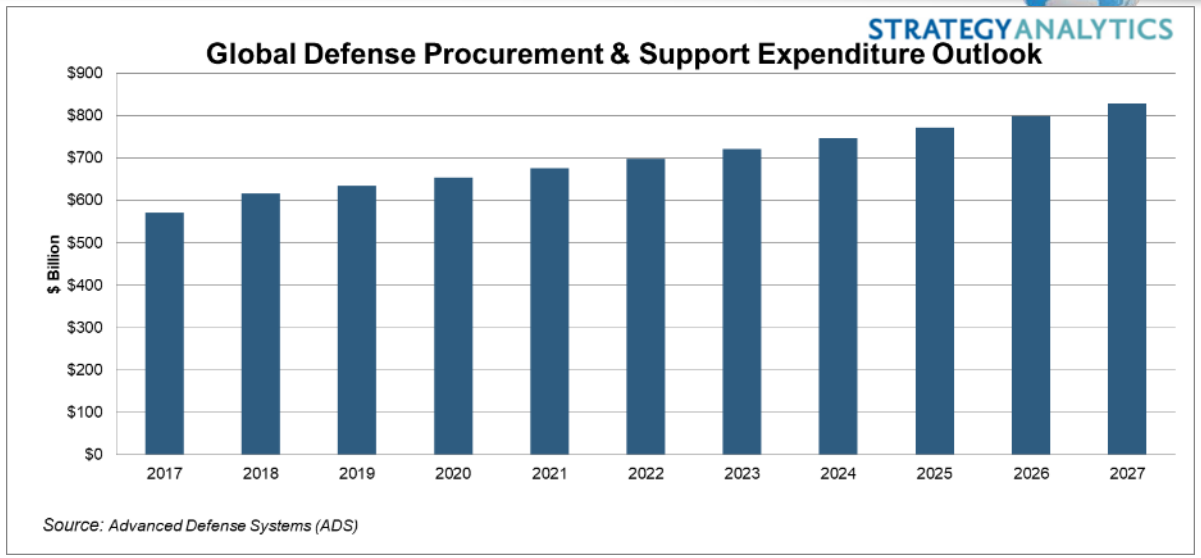
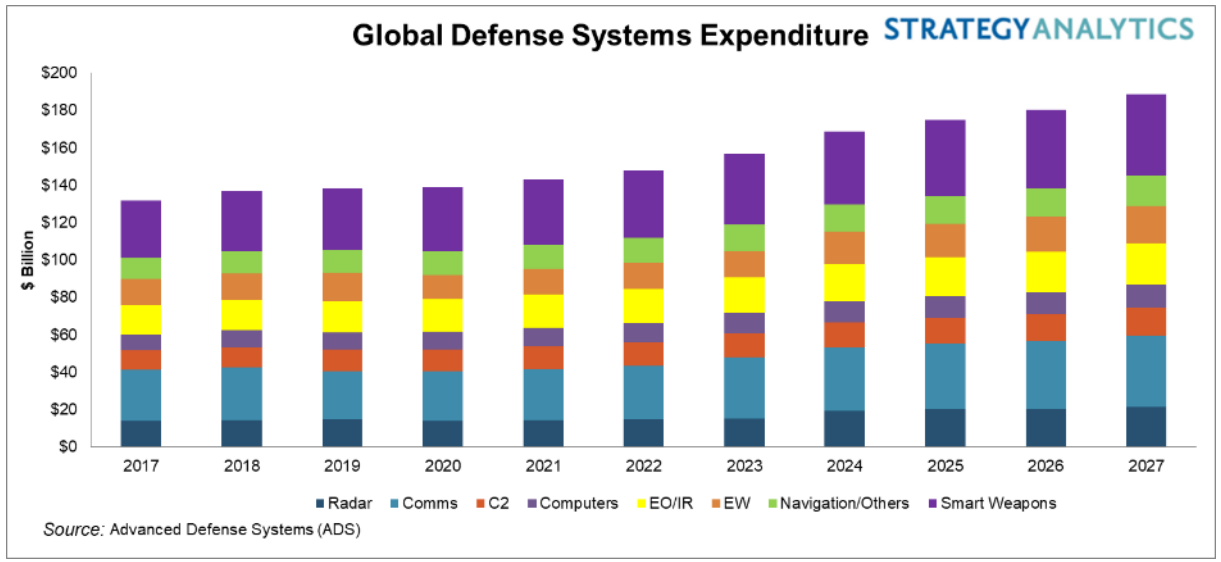
Global Defense Spending Metrics Driving GaN







Countries look to maintain a mix of both conventional and leading edge capabilities, to counter both symmetric and asymmetric threats.

The Procurement and Support TAM, which includes all new procurement including RDT&E, outsourced training and support contract expenditure, will account for 32% of overall defense spending.

Emphasis on improved capabilities at system level will drive demand for military systems and provide opportunities for enabling technologies such as GaN

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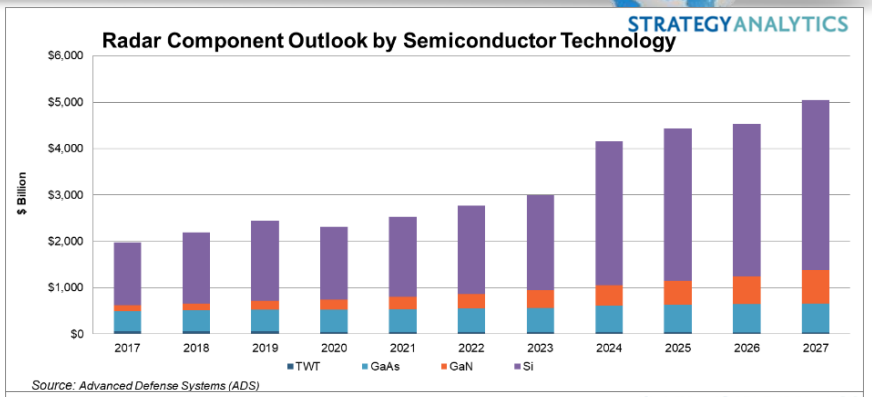
Military Radar, Comms and EW to Underpin Defense Demand

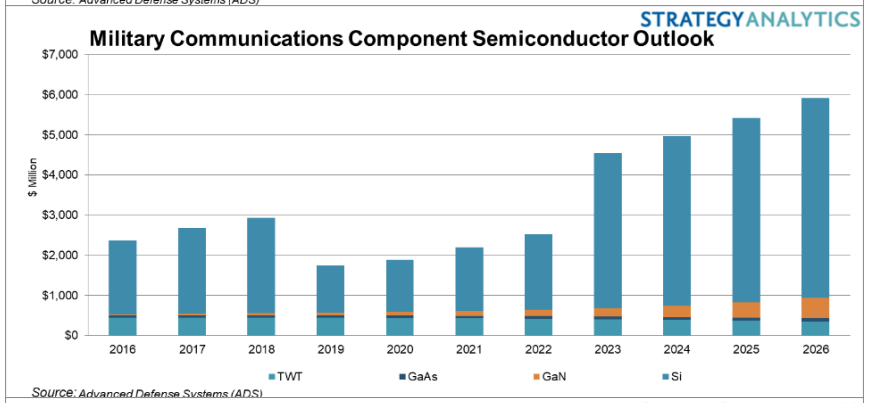
Military radar segment will remain the largest user of GaN devices for the defense sector.

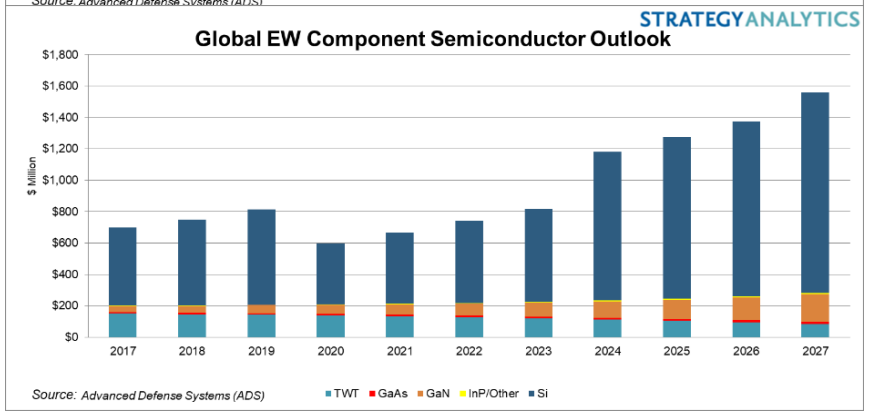
Substantial production activity in AESA radars for land-based and naval systems in particular is driving increasing demand for RF GaN, as many systems previously in development move to production.

Communicating voice, data and video simultaneously and securely over wider and higher bandwidths in an increasingly complex spectrum environment will underpin trends for military communications system design.

Operational requirements to operate in contested and congested environments, as well as being able to counter modern agile radar and communications, will drive opportunities for RF GaN for the EW market.







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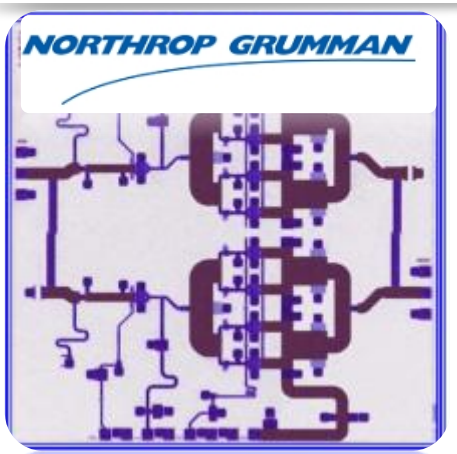
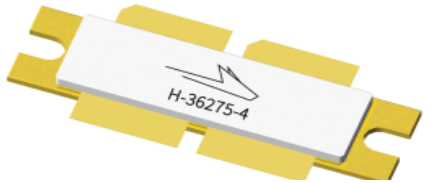
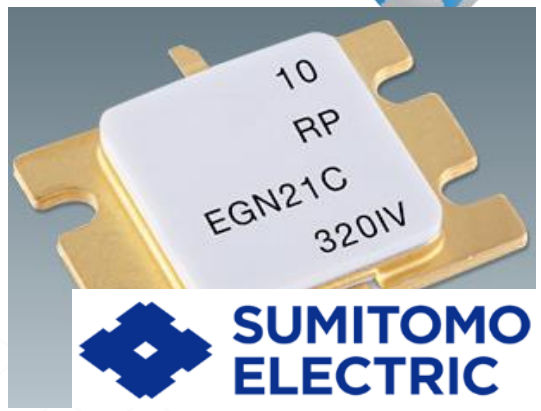
Who makes up the GaN Landscape?







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ANALOG DEVICES

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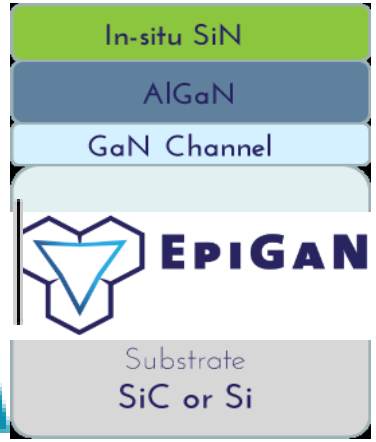
United Monolithic Semiconductors



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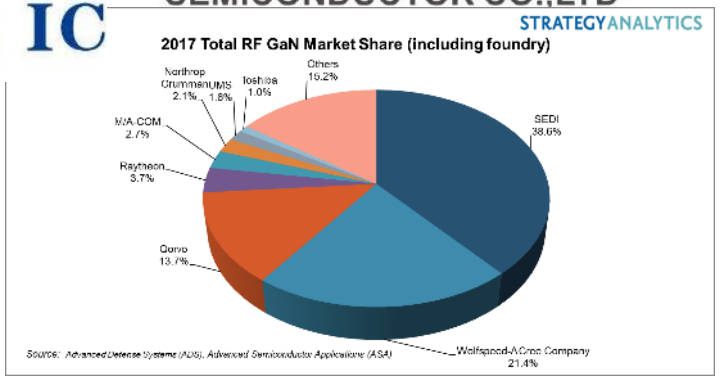

Electronic Warfare Europe

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Conclusions and Implications

The military radar segment will remain the largest user of GaN devices for the defense sector.

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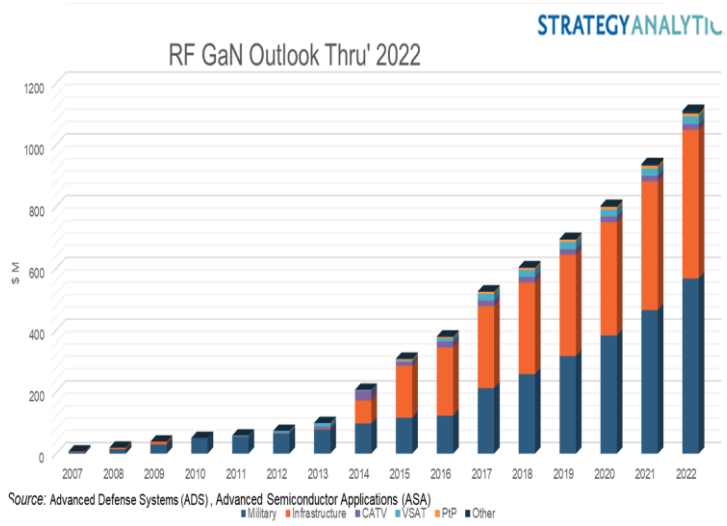

Strategy Analytics forecasts the overall RF GaN revenue will cross the $1 billion barrier by 2022.

GaN is now a key enabling technology across both military and commercial markets

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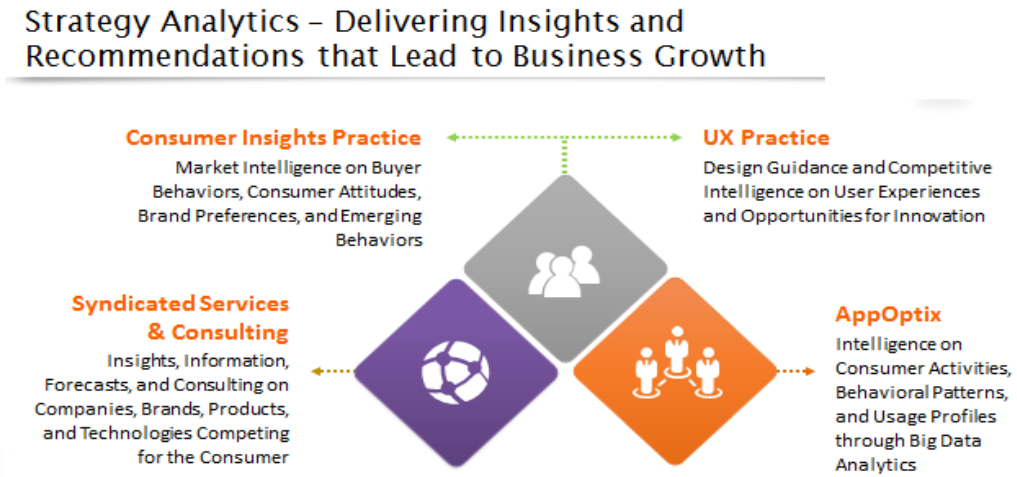
Contact Details

- Asif Anwar
  - Executive Director,
  - Strategic Component Applications (SCA) Group
  - +44 1908 423635
  - aanwar@strategyanalytics.com



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Let's Talk…

- Market sizing
- Product direction
- Industry trends
- Opportunity assessment
- Future path
- What else?

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