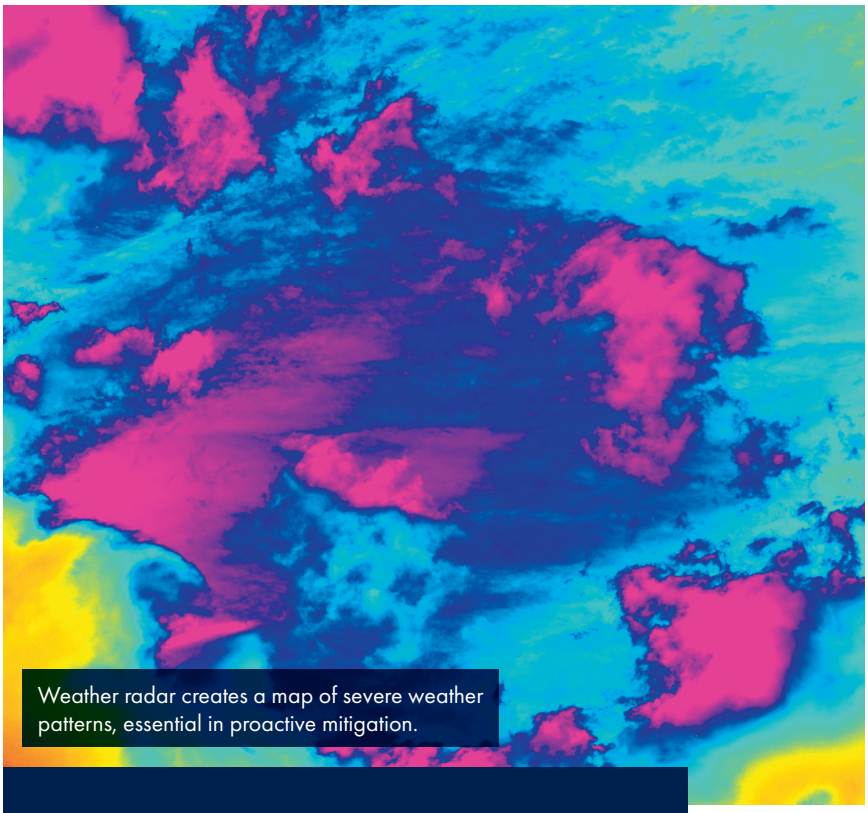
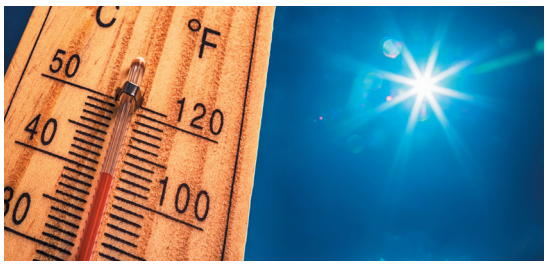
CSIR C3
collaborate.create.commercialise.



Weather radar creates a map of severe weather patterns, essential in proactive mitigation.



CSIR scaleable phased-array technology.

IMPROVED WEATHER MONITORING FOR A WORLD BATTERED BY EXTREME WEATHER EVENTS

Modern radar antenna technology for weather forecasting and monitoring

Addressing a problem and fulfilling a market demand

Weather-related disasters threaten lives and livelihoods

Around the world, a changing climate has led to the destruction of infrastructure and the loss of human life. Weather-related anomalies and disasters – heatwaves, severe storms and large-scale flooding – have been on the increase. This has emphasised the need for effective means of detecting weather conditions and, in particular, means of early warning so that mitigating measures can be implemented proactively, where possible.

This is driving growth in the market for weather radar to continuously map the motion and intensity of weather patterns over a broad area. Accurate monitoring and forecasting are used pervasively across sectors such as aviation, agriculture, tourism and maritime operators.

As a result, countries are investing in weather radar coverage and more accurate and capable weather radar systems. Advanced antennas are expected to be the fastest-growing segment of weather radar components.

The rising technology advances in antennas are enabling ever-improving sensing. Major weather radar manufacturers are seeking to modernise their product lines with such advanced antennas to remain relevant and meet market needs.

The CSIR's proven low-cost scalable C-band phased-antenna technology is well positioned for competitive adoption in modern weather radar systems. This has been validated through engagement with a major weather radar supplier in the United States of America (USA).

The technology on offer

Tiled antenna builds up the weather picture

Traditional weather radar utilises a dish-based antenna to form fixed beams in elevation. The antenna is scanned in azimuth to form a 360-degree map of the world.

The CSIR's C-band phased-array antenna technology, enabling active electronic steering, is at the cutting edge of modern radar technology and can be innovatively incorporated into compelling weather radar applications.

A modern phased-array antenna consists of many small antennas (patches), which, by independently controlling the driving signal to the patches, results in a radar beam that can be rapidly steered without moving the antenna. By using the phased array to scan the beam in elevation, while the antenna still rotates in azimuth, a cost-effective small mobile weather radar can be realised that can optimally measure weather at different heights to form an improved 3D weather map.

The CSIR's technology – with its flexibility in beam steering provided by the phased-array antennas – is also well positioned to fulfil another emerging market requirement. Increasingly, governments are requiring weather radar to also perform aircraft detection to maximise return on investment by avoiding the need for another radar in the same vicinity, and in the same way, also minimise the need for additional bandwidth.

Value proposition and competitive advantage

Proven phased-array technology

The CSIR low-cost C-band phased-array technology is a scalable building block (antenna panel) that allows the realisation of different-sized antennas by tiling the antenna panels vertically and horizontally. The panels have been matured across three generations and are now proven building blocks that are being used on multiple radar innovations at the CSIR, including multiple search radars, airborne radars and spaceborne radars.

The panels have been commoditised and are ordered as integrated, tested panels from local industry. In addition, the designs to integrate multiple panels to form larger antennas are also mature.

The weather radar antenna opportunity is a mechanism to extract further value from mature radar building blocks by supplying array antennas to well-chosen, established weather radar suppliers that are well positioned in specific markets.

Market opportunity

Opportunities for commercialisation of advanced antennas

The primary opportunity is to partner with an existing weather radar supplier in the USA who has indicated that the CSIR C-band array technology is uniquely positioned to enable it to develop a low-cost C-band weather radar to respond to planned acquisitions in the USA defence domain and the rest of the global market. The first opportunity is expected to be for the delivery of more than 50 systems with a conservative margin estimate of USD50 000 per antenna, resulting in a potential return of R45 million from such a sale.

The 2022 floods in KwaZulu-Natal wreaked havoc in the Port of Durban and surrounds.

This will open the door for many more sales, given the global and proven footprint of the weather radar partner. The scaleability of the antenna panels also opens an opportunity to, in the longer term, capitilise on the strong interest for antennas for higher end weather radars.

In addition, the CSIR is in discussion with the South African Weather Services to develop a replacement radar for the country's weather network and to potentially commercialise these into the rest of Africa.

Business opportunity

Technology development and production partnership

Given the mature nature of the antenna technology, the technical risk in realising the antenna is largely low. The advantage of partnering with an established weather radar supplier is to benefit from a strong industry-relevant understanding of the required price and other market-related insights, needed to strengthen the prospects for commercial success.

Investment is required to realise the product-level antenna for the primary opportunity. The development is phased with the first step being the completion of the current feasibility phase and upgrading the technology with multipolarisation capability, followed by the realisation of a prototype antenna and then the establishment of the production partnerships and process. This requires an investment of R25 million, for which there is ample scope for returns to be generated and for early payback to be achieved as the antennas are delivered to the industry partner and weather radars are sold.

A team with a track record and strong global network in place

The CSIR radar development team has a track record in the development of advanced and complex radar systems locally as well as for international clients. The applicable C-band phased-array technology is mature and commoditised and has been proven through its use in multiple radar innovations at the CSIR.

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