SMARTSAT
COOPERATIVE RESEARCH CENTRE

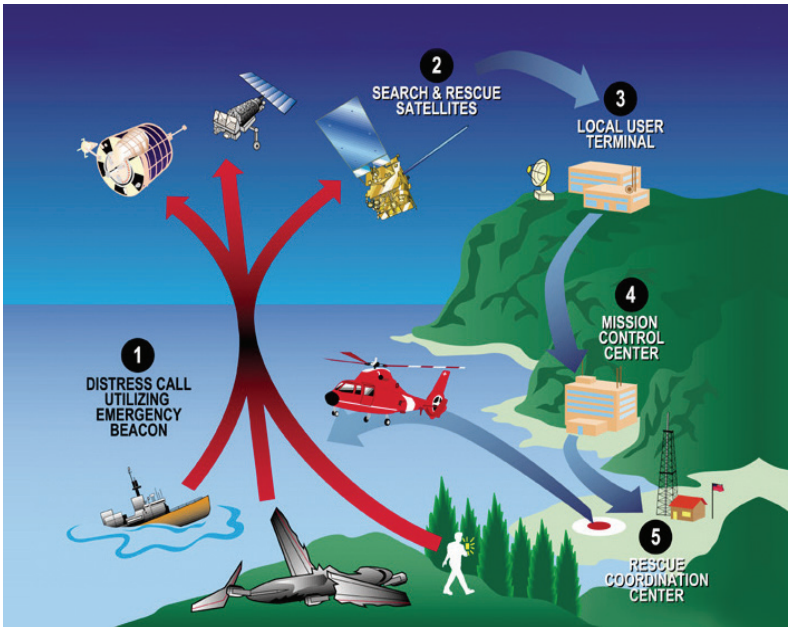
Resilient Emergency and Search and Rescue (SAR) Communications

Building emergency and disaster resilience

Mission Goal: To improve Australia's emergency management response with advanced distress-related communications and navigation technology.

Emergency services require reliable communication systems to ensure rescue efforts and disaster response capabilities are effective and prevent loss of life. Significant gaps in emergency management exist that can be filled by new generation space-based technologies working in tandem with current ground-based emergency management systems.

This project is addressing the limitations of current emergency beacon systems, ensuring emergency management professionals and first responders have access to the most advanced satellite technologies to provide incident reports from remote locations on both land and sea. Specifically, the project will investigate next generation radio signal designs and receivers in the 406 MHz band used by the Cospas-Sarsat network.



The first phase of work on the project will develop enhanced system requirements and resilient architectural designs, waveforms and protocols for selected concepts of operation and use cases. This will enable a data centric approach, and presents automation opportunities through use of data analytics and Artificial Intelligence techniques.

The goals are greater efficiency and improved safety for responders, which could streamline and fundamentally change what are currently highly manual mission operations.

Partners in the project are NASA Goddard Space Flight Center, Safety from Space, University of South Australia, Myriota, Black Art Technologies, Flinders University, the Australian Maritime Safety Authority (AMSA) and the Defence, Science and Technology Group. The project is contributing Australian expertise and technology options for NASA's Artemis missions and is part of a more systematic and broader collaboration between NASA Goddard Flight Center and SmartSat.

NASA's Search and Rescue office is led by mission manager Dr Lisa Mazzuca who represents NASA both nationally and internationally to set policy and standards for the SAR community, and leads technological innovation for satellite-aided emergency transmitters. Building on previous cooperation with project participants through Cospas-Sarsat technical committees, NASA invited

IN COLLABORATION WITH:

NASA
SAFETY FROM SPACE
University of South Australia
Flinders UNIVERSITY
Myriota
Australian Government
Australian Maritime Safety Authority
black art technologies

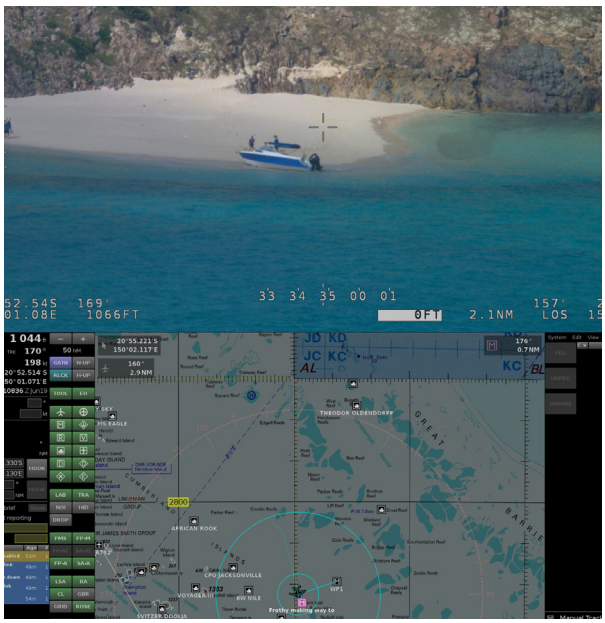
SmartSat to collaborate in technology development to support the Artemis mission. This mission will intially return humans to the Moon for the first time since Apollo, and later to Mars. Artemis will rely on LunaSAR - a safety system for the space environment - which will equip the mission's astronauts with emergency beacons.

Another key project partner is the AMSA, responsible for search and rescue in the Australian region, which is around 10% of the world's surface. AMSA has identified challenges faced by users and operators with current beacon systems. AMSA's contribution to the project includes facilitation and consultation with end-users and other stakeholders, as well as operational experience with world's best practice on search and rescue and vital domain expertise. ASMA will be a keen participant in field testing and demonstrations.

The aim of the project is to provide highly reliable connectivity for those who may encounter a hazardous situation while living or working in places where reliable terrestrial network coverage is not guaranteed.

The research area is satellite communications technologies supporting space and ground infrastructure to enable a system that is available everywhere. A challenge faced is high false activation rates for beacons, and the solution being pursued is to provide sufficient incident information to enable accurate decision making about the nature and severity of the incident. Current technologies do not provide a practical solution as they are either too expensive, too power hungry, too large e.g. sat phones, or current offerings lacking in functionality. While devices such as Personal Locator Beacons (PLBs) provide critical functionality in a small package, they do not address the systemic issues with the current systems. Low Size, Weight and Power (SWAP) devices for the user are needed which are not prohibitively expensive for widespread and infrequent usage.

By designing a more efficient waveform that complies with regulations and works alongside current systems, the aim is to be able to operate with significantly reduced power, and enhanced transmission characteristics that will minimise interference with



current system – a critical aspect as the integrity of the SAR system is paramount. New coding, modulation and access schemes need to be assessed for technical and commercial viability.

The proportion of unregistered beacons creates problems in maintaining safety critical information on the beacon user such as an emergency point of contact. Two way messaging capability for beacons will add significant value from the user perspective and encourage maintenance of registration. A restriction has been sending of transmissions to the beacon which is only partly being addressed through the introduction of the European Return Link Service for simple acknowledgements only. This does not provide the required capability and faces an uphill struggle for global adoption as it is not accepted by key countries.

Beacon location accuracy is a pre-requisite to a rescue mission and may be hampered especially in a GPS denied environment. Techniques to improve independent geolocation are being researched.

In summary, overcoming these limitations creates opportunities for new services which can help to pre-empt or avert danger. This projects brings together emergency services experts and world leading satellite technology experts from Australia and the US to address these challenges and ultimately improve search and rescue outcomes both on the Earth and for future space colonisation.

For further information, please contact:

SmartSat CRC
info@smartsatcrc.com
Level 3, McEwin Building, Lot Fourteen
North Terrace, Adelaide SA 5000

Australian Government
Department of Industry, Science, Energy and Resources

Business Cooperative Research Centres Program