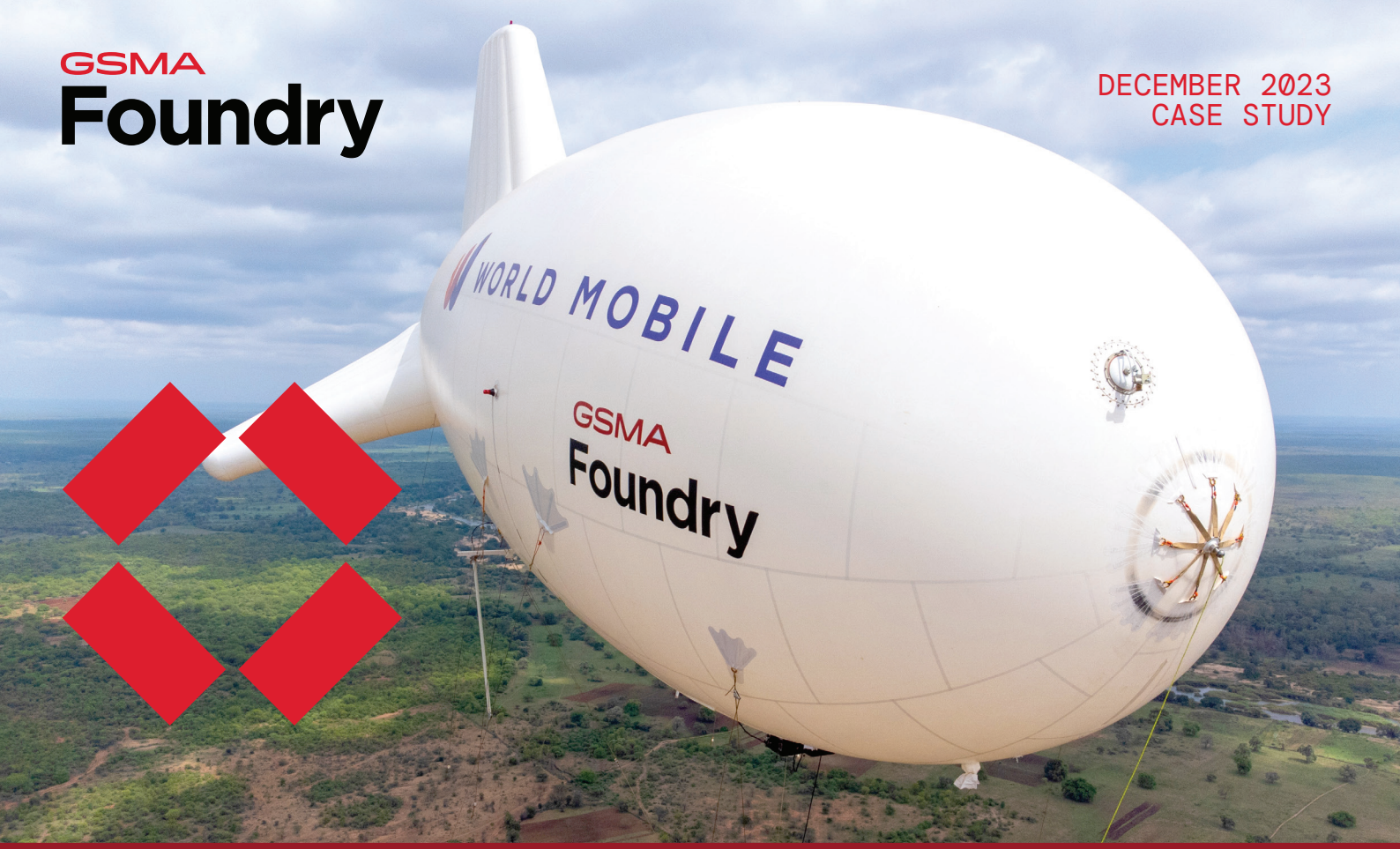
GSMA
Foundry

DECEMBER 2023
CASE STUDY



New Coverage **Takes to the Skies**

World Mobile tests the feasibility of mounting cellular base stations on aerostats in Mozambique

Highlights

- Radio units mounted on aerostats could make it economically-viable to bring cellular coverage to rural areas
- World Mobile has run a trial in Mozambique that found that one aerostat could provide the same cover age as 12 conventional base stations
- Trial showed an aerostat is faster to deploy than traditional towers and could be installed and operated at one-eighth of the cost of a conventional base station
- World Mobile is hopeful that Mozambique's regulators will sanction commercial usage of aerostats to expand cellular coverage
- World Mobile believes aerostats could also play an important role in providing rural coverage in some developed countries, such as the US

Much of the world remains uncovered by mobile networks, including many populated rural areas. That's primarily because it isn't economically feasible to build conventional base stations near small villages and hamlets.

Entrepreneurs are looking to address this challenge with innovative solutions. One of these is to use a tethered aerostat as an aerial base station that can cover a much larger geographic area than a conventional cellular tower.

While this approach could be much more cost-effective than building conventional base stations, some technical and logistical challenges need to be overcome. Aerostats have to be able to cope with changing weather conditions and need to be topped up with helium gas to remain in the sky. That means they need to be continually supervised by a qualified aerostat operator.

To test the feasibility of using aerostats to extend cellular coverage, start-up World Mobile is running a number of

trials around the world. One of these took place for 20 days in Mozambique in November and December 2023. Having secured permission from the Mozambique Civil Aviation Authority (IACM) and the Instituto Nacional das Communicacoes de Mozambique (INCM), World Mobile deployed an aerostat in Massingir.

The trial was designed to test the extent to which the aerostat could extend the existing Vodacom footprint, with a focus on network coverage, rather than capacity. One of the key use cases is to provide locals with reliable access to the M-Pesa mobile money and banking service provided by Vodacom. This use case doesn't require a lot of bandwidth, but does rely on consistent connectivity.

The Massingir site was chosen by the World Mobile aerostat flight director and Vodacom technical team because it had a sufficiently large open space in the middle of the village, access to mains power and an optical fibre backhaul, but lacked adequate cellular coverage.

Flying at an altitude of 300 metres, the 25 metre-long aerostat was tethered with a cable to a ground station, which had a baseband unit with a fibre connection to Vodacom's national data network, as well as a connection to the local power grid and a back-up diesel generator. The aerostat carried a standard Vodacom remote 2G and 4G radio unit, operating in the 800 MHz and 900 MHz spectrum bands, with a pair of omni-antennas to create a circle of coverage over 360 degrees. The total weight of the payload on the aerostat is about 45 kg.

To operate the aerostat, World Mobile deployed specialist staff to Mozambique, along with two Tanzanian trainees who had been working in a ground school in Zanzibar for a year. It also hired four local Mozambique trainee operators. The shipping container used to transport the equipment to the site was turned into a temporary site office. World Mobile also installed a set of toilets designed and built to UN-approved standard and to be used by the village school (which borders the site) once the trial has ended.

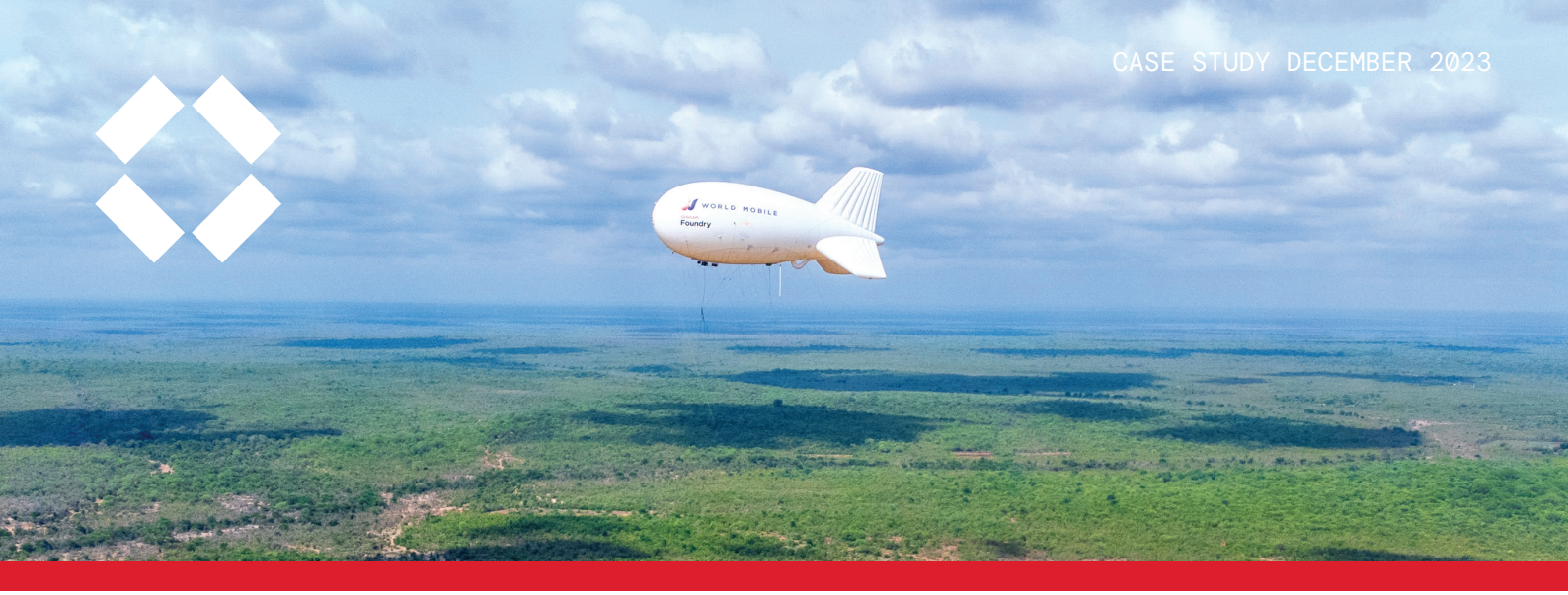
Reaching many more people

As the cell site was in commercial service, Vodacom was also able to evaluate the increase in traffic, usage and related top-ups. Once the TMA had been installed, World Mobile says the aerostat was able to provide effective coverage over 1,384 square kilometres, compared to 113 square kilometres covered by a conventional terrestrial base station. As a result, 93% people living in the vicinity of Massingir could get a cellular signal.

Although the ground site needs to be roughly double the size of the aerostat radius (100 metres diameter) and be secured with a perimeter fence, the trial confirmed that an aerostat is faster to deploy than traditional towers. World Mobile estimates an aerostat can be installed and operated at one-eighth of the cost of a conventional base station. Once economies of scale kick in and the team gains experience, the cost savings could be even higher.

In practice, the economics will depend on local conditions. Parts of Mozambique see very gusty winds in the early afternoon, caused by "dust devils" (mini-tornados) during periods of hot weather. As a precautionary measure, World Mobile's operators have been lowering the aerostat during these conditions. "It's actually very robust and you might consider that actually you should have left it in the sky. The team is building confidence that that's probably the safer place for it," says Gregory Gottlieb, Head of Aerial Platforms at World Mobile. "But at the moment they pull it down and it sits on the ground station, which then pivots as the dust devil comes through." World Mobile says the wind speed has to be below 15 knots for launch and recovery of the aerostat, while the helium pressure needs to be checked every 30 minutes, 24 hours a day when in flight.

The height at which the aerostat operates can dictate the extent to which it is impacted by weather patterns. "The higher the aerostat gets, the less it's affected by the local topography, so actually it's a more steady and predictable wind at higher altitudes," explains Gregory Gottlieb. "There's a really



interesting meteorological piece to bring in here in terms of the prevailing winds and how we best position the aerostat to alleviate weather risks." Ideally, World Mobile would like to operate aerostats at about 1,000 metres where it is generally less windy, but aviation regulators would need to be comfortable with that, based on local airspace characteristics.

In Mozambique, the low cost of labour makes it feasible to extend the existing fibre network to connect the aerostat's ground station. However, in other locations, it may be impractical to extend the fibre network in this way. Therefore, World Mobile is also testing whether it can used fixed wireless links to provide the required backhaul capacity.

Another key consideration is the local sources of power. World Mobile says solar panels aren't efficient enough yet to provide the necessary power, so the ground station needs a grid connection and/or a diesel generator.

Both Mozambique's telecoms regulator and aviation regulator are highly supportive of the project and helped the team overcome a range of logistical challenges, according to World Mobile. "We understand the importance of working with regulators, to enable access to spectrum in areas where it is not utilised for the whole benefit of the country, including underserved areas," says Gareth Hamer, Director of Carrier Services. World Mobile explains that the World Bank is also very keen to explore how aerostats can be used to extend mobile coverage, partly to support economic growth by extending both digital and financial inclusion.

Exploring the options for commercial deployments

World Mobile is hopeful that Mozambique's regulators will sanction commercial usage of aerostats to expand cellular coverage in the country's rural areas. The company believes that aerostats could be particularly valuable in the north of the country where there is little cellular coverage, but several key industrial sites. To that end, World Mobile is in discussions with the regulators and mobile operators in Mozambique about potential business and funding models.

At the same time, the company is exploring whether it can establish an academy in Mozambique to train local people to become qualified aerostat operators. "You can't fly out expatriates and expect the business case to work: you have to train up a local team," notes Gregory Gottlieb.

As well as serving emerging markets, World Mobile believes aerostats could play an important role in providing rural coverage in some developed countries, such as the US. In such markets, capacity will be an important consideration, and World Mobile is considering whether it can add more radio units to an aerostat to boost the available bandwidth.

One complication is that an aerostat will always turn its nose into the wind, meaning the propagation pattern of its on-board radios will change over time. To counter that, World Mobile is developing a 'de-spin' that would keep the antenna pointing accurately in one direction, regardless of the motion of the aerostat, so that individual radios can each be dedicated to sectors of the cell – a much more efficient means of utilising the available spectrum.

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Gareth Hamer - Director of Carrier Services

However, Gregory Gottlieb estimates that each additional radio would add about 20 kg to the payload of the aerostat. As one cubic metre of helium is required to lift 1 kg, adding new radios would increase the helium required, as well as the power consumed by the aerial base station.

One project that World Mobile is undertaking in the Middle East will tether an aerostat from a ground station on a plateau halfway up to this ridge of hills. That deployment should give it greater insight into the effectiveness and economics of aerostat-mounted base station in hilly terrain.

More broadly, World Mobile wants to encourage end-users to flag where additional cellular coverage is required. The company has developed a scanning tool inside the World Mobile app that individuals can use to check the quality of coverage in specific locations. “Moving forward, we will be implementing a sharing economy model and part of that whole journey is that they will be scanning for that data themselves,” explains Gregory Gottlieb. “Then we will get feedback directly from the people who are using the service. It’s a really nice way of bringing the whole model together. This means that end-users can directly contribute to the development and improvement of the network, creating a truly community-driven experience.”

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Gregory Gottlieb - Head of Aerial Platforms

About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

For more information, please visit the GSMA corporate website at gsma.com

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About the GSMA Foundry

The GSMA Foundry is the go-to place for cross-industry collaboration and making positive change happen, supported by leading technology organisations and companies. By bringing together members and key industry players, engaging, and unifying the end-to-end connectivity ecosystem, the GSMA is solving real-world industry challenges.

Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. This enables the mobile industry's mission: to connect everyone and everything to a better future.

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About World Mobile

World Mobile is democratizing global connectivity through its blockchain-based network. Unlike traditional telecom providers, World Mobile operates on a sharing economy model, allowing individuals and businesses to run nodes, connect their communities, and generate revenue.

For more information, visit https://worldmobile.io/

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