Satellite Communication and Peacebuilding in East Africa

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The ICTs, Statebuilding, and Peacebuilding in Eastern Africa Project:

This occasional paper series is part of a larger project run by the Center for Global Communication Studies (CGCS) at the University of Pennsylvania, conducted in partnership with the Programme in Comparative Media Law and Policy (PCMLP) at University of Oxford, and funded by the Carnegie Corporation of New York (CCNY). This project seeks to bring greater clarity about the expectations and the realities of the use of communication technologies in developing contexts. In media and development theory, policy, and practice, strong normative statements about the transformative power of ICTs have often clouded the understanding of how people and communities actually make sense of, and engage with, the old and new communication technologies that surround them. Under this framework, this two-year project explores the use of ICTs in Eastern Africa.

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Introduction

During the past decade, political instabilities have intensified in East Africa. Al-Shabaab continues to operate in Somalia and has waged violent attacks on civilians, NGOs, and military units throughout the region. Conflicts in the country continue to jeopardize the formation of a functional Somali government. Kenya experienced internal conflicts and political violence in the aftermath of its national elections in 2007-2008. The country has been targeted in terrorist attacks in recent years and continues to be on high alert. In Ethiopia, the sudden death of Prime Minister Meles Zenawi in 2012 left the country in a period of political uncertainty. Under new leadership, Ethiopia's human rights record has deteriorated as a 2009 anti-terrorism law has been used to authorize intensified surveillance and strict censorship laws, especially targeting ethnic minorities (Human Rights Watch, 2014).

These conditions have prompted scholars and experts across the fields of international communication, strategic studies, and communication for peacebuilding to assess how information and communication technologies (ICTs) can be used to support governance, conflict prevention, and security initiatives in East Africa. Recent research has focused on the use of internet and mobile phone technologies to support governance (Hellström, 2008; Wachira & Arlikatti, 2010), security and policing (Livingston, 2013), and in the monitoring of post-election political violence (Stemlau & Price, 2009; Palmer, 2015). Researchers have also explored how East Africans use combinations of old and new technologies, or "hybrid media," to establish connections locally and with diasporic communities abroad (Gagliardone and Stremlau, 2011). Researchers in the area of communication for peacebuilding insist that communication-based activity can be used to support humanitarian programs, improve governance, and contribute significantly to processes of reconstruction and stabilization in post-conflict zones (Kalathil, Langlois and Kaplan, 2008; Bratic and Schirch, 2007). This approach moves beyond the idea of a technological fix. It insists on a participatory model that recognizes the cultural identities and input of local communities (Search for Common Ground, undated, 8).

While there is a growing field of research on ICTs, governance, and peacebuilding in East Africa, only a few scholars have considered the role of satellite technology. Feldman, for instance, has examined the use of satellite telecommunications and Hwala – a traditional practice of fund transfers based on trust – to finance terrorist campaigns in the region (2006). He has also analyzed the introduction of VSAT technology in Somalia (2007). Other research has used satellite imagery to conduct crisis mapping ("Horn of Africa Region," 2012), monitor electricity use (Shortland, et al, 2013), study participatory sensing initiatives (Georgiadou, et al, 2011), and track the effects of piracy in the region (Shortland, 2012). In general, research concerned with communication technologies and peacebuilding in East Africa has tended to focus on localized uses of ICTs rather than infrastructural issues such as satellite or fibre capacity, though, significantly, some have studied regional imaginings and perceptions of telecom technologies (Mbarika & Byrd, 2009; Graham & Mann, 2013).

Satellite and undersea fibre optic cable operators have scrambled to link the African continent to the internet backbone and broadband networks during the past decade. Motivated to help bridge the "digital divide" while tapping emerging markets, Western satellite operators such as Intelsat, Eutelsat, and SES have expanded their fleets and positioned new satellites above Africa where there are large "underserved" populations. New African operators RascomStar QAF and NigComSat have entered the scene and launched the first sub-Saharan African satellites in history. New satellite operators such as Avanti and O3b have entered the market in Africa, introducing innovative projects that have intensified competition and paved a path for future sector growth. As one industry analyst succinctly described the current situation in Africa, "All the fundamentals for a satellite telecom revolution are there: enormous land area, poor ground infrastructure, and a population of more than 1 billion people" (Curcio & Butani, 2014). Another analyst declared the direct to home (DTH) satellite market in Africa is "set to surge" ("DTH…," 2013).

In East Africa multiple satellite and undersea cable operators now compete, offering high capacity links to global telecommunication networks. The expansion of satellite capacity, innovation of "high through-put" satellites, and increasing competition with undersea cable operators have led to reduced costs and improved internet and mobile phone connectivity in some areas. Yet many East Africans – including many women, girls, rural, poor, and elderly people – still lack ICT access altogether. As satellite capacity becomes more available and affordable, it can be especially useful in politically volatile underdeveloped areas where physical threats to terrestrial infrastructure are pervasive, or in rural areas detached from electrical and telecom networks.

Drawing upon trade documents, regional press reports, industry data, and scholarly literature, this paper suggests that satellite communication is critical to peacebuilding in East Africa, focusing on Ethiopia, Kenya, and Somalia. By *satellite communication*, I am referring to the use of commercial satellites in geostationary (GEO) and middle earth orbit (MEO) to support practices such as direct satellite broadcasting, telephony, VSAT, and internet service as well as backhaul services for terrestrial broadcast, mobile phone (GSM), and internet providers (IP).

The paper is organized into three sections. Section one describes threats to terrestrial and undersea telecom infrastructure in East Africa arising from vandalism, theft, and sabotage. Section two delineates the unique affordances of communication satellites and then describes some of the major players in the African satellite market as well as their satellite assets. Finally, section three offers a series of recommendations for how satellite capacity can be used to support peacebuilding in East Africa. Undergirding this analysis is a recognition of the legal provisions of the Outer Space Treaty of 1967, which defined outer space, including orbit, as the province of all (hu)mankind, and mandated that it be used to benefit all countries regardless of "the degree of their economic or scientific development." (Treaty…, 1967). Given the glaring historical disparities and inequalities with regard to the use of orbital slots above African countries since the 1960s, there is an urgent need to return to and revive these treaty obligations and insist that nation-states and commercial satellite operators begin to uphold them.

Threats to Terrestrial and Undersea Telecom Infrastructure

During the past decade, there have been significant developments in the satellite market in Africa. Additionally, an increasing number of entities have needs for satellite capacity including government agencies, multinational media conglomerates, military units, mobile telephone providers, banking firms, civil society organizations, and world health organizations. More than fifteen established satellite operators now serve the African continent (Galace, 2012), and several offer specialized services in East Africa. The need for GSM, IP backhaul, VSAT networks, and video distribution are driving demand for satellite capacity across Africa (Ospina, 2014). Given saturation in urban markets, a growing number of mobile telephone operators are relying on satellite backhaul to deliver cellular services to rural areas (Patton, 2013). Another significant factor is an ITU mandate requiring African countries to switch over to HDTV by June 2015, which is impacting the distribution of TV across the continent.

As the satellite market in Africa has expanded, undersea cable operators have bolstered fiber capacity along East Africa's coastlines, multiplying the region's links to the internet backbone and creating increased competition for satellite operators. The first undersea cable to bring broadband internet access to East Africa –Seacom – went live in 2009, and by early 2015 there were two others in operation, EASSy and TEAMS. Coastal regions have benefitted from undersea cable developments, but the continent's interior remains gravely underserved since there is inadequate infrastructure interlinking coastal and inland areas. Terrestrial infrastructures are costly to develop and take time to build. In addition, when they are built, these facilities are often subject to theft, damage, and vandalism. Common problems include digging up and cutting cable to salvage the copper inside and stealing generators at telecom or electrical facilities. The cost of replacing stretches of cable is not the only challenge. Terrestrial operators also face loss of income, the disruption of essential services, labor costs to repair the affected networks, and expenses related to heightened security measures ("Cable theft…," 2009).

In East Africa cable theft and vandalism have increased in recent years. In Kenya in 2010 fibre optic cables that run around Nairobi were dug up and cut at night causing communication blackouts in certain areas. In 2011 another cut of a major Kenyan fibre link cost the country Sh 250 million (Kinyanjui, 2011). Both Safaricom and Telkom Kenya have reported millions of dollars in losses due to accidental and intentional cuts. Officials are uncertain whether this sabotage is performed by people trying to salvage cable materials, disgruntled employees, or rival firms seeking advantage in the emerging broadband market (Fides, 2010). In 2011, the Ethiopian government described cable vandalism as a "national security issue" after fiber optic cables were purposefully destroyed on forty-one separate occasions over a ten month period ("Ethiopia…," 2012). Stolen and vandalized network equipment cost Ethio-Telecom $3.6 million and Ethiopian Electric Power Corporation $4.2 million in losses in recent years (Abiodun, et al, 2012).

In Somalia, multiple telecom companies entered the market to provide communication within conditions of statelessness. Operators have chosen mobile broadband installations because they are less subject to the threat of vandalism than fixed cable infrastructure. As one report indicates, "Frequent violent attacks, the lack of sector regulation and an unstable political system in Somalia make maintaining a reliable network a huge challenge" ("Somali Operators…," 2014). Multiple other African countries, including Nigeria, Uganda, and Tanzania, have faced similar problems. In South Africa, companies report losing between $2.8 and 3.7 million a month to copper cable theft (Onyango-Obbo, 2014). Though telecom operators always factor in the costs of routine maintenance and upgrades, the replacement, labor, and security costs related to cable theft and sabotage in East Africa have created additional operational costs that are substantial.

Beyond theft and sabotage, terrorist groups in East and West Africa alike have waged attacks on telecom facilities. In Nigeria, Boko Haram bombed twenty-five mobile phone masts in North Eastern Nigeria in September 2012 alone, severely interrupting connectivity throughout the region (Abiodun, et al, 2012; Villareal, 2012). In Somalia in 2014, members of Al-Shabaab stormed into the headquarters of mobile phone provider Hormuud Telecom with guns demanding that staff shut down the network (Osman, 2014). On multiple occasions, Al-Shabaab raids have interrupted mobile phone and internet access in Somali districts

(Mohamud, 2014), and members of the organization have demanded that Hormuud pay $50,000 USD in "taxes" ("Somalia…," 2014). Given limited economic opportunities in Somalia, many people rely on remittances, whether from expats who live in the region, the US, or Europe. After Al-Shabaab's network interferences, people in Jilib experienced problems with their EVCPlus mobile money transfer accounts. Because of such problems, Hormuud now pays at least five people to work as security guards at every mobile site it operates throughout Somalia ("Somali…," 2014).

While there is a growing trend to securitize terrestrial telecom facilities in East Africa, undersea cables remain "poorly armored, rarely patrolled and only occasionally monitored" (Chang, 2013). Though multiple undersea cables have been installed off the coast of Somalia, one report claims, "security concerns and conflicts among the operators that are supposed to manage the system have so far prevented the service from becoming operational" (Gagliardone & Stremlau, 2012, 19). In 2009, the vessel installing the TEAMS cable, which links Mombassa and the UAE, had to be guarded by foreign navies, and the cable's position had to be shifted 200 km from the coastline due to concerns about Somali piracy (Nyambura-Mwaura, 2009). In February 2012 a ship dropped its anchor in a restricted area off the coast of Mombassa and cut the TEAMS cable, interrupting high speed internet access in six African countries for three weeks, costing Kenya $500 million (Hopkins, 2012; Moore, 2012). In March 2013 the EASSy and SEACOM cables serving East Africa failed due to a cut in the SMW4 cable (which connects East Africa to South Asia and the Persian Gulf), interrupting connectivity from Djibouti to South Africa (Hopkins, 2013). The causes and motivations of undersea cable failures and cuts are varied and complex, and detailed information about them is often not publicly available. Suffice it to say, these incidents cause enormous disruptions and financial losses for operators, governments, and businesses as well as for civilians who rely on internet and other telecom services that such cables enable.

The governments of Ethiopia and Kenya have responded to threats to terrestrial and undersea telecom infrastructure by passing stricter penalties for those who tamper with or steal telecom equipment or interrupt operations. They have also defined fibre systems as part of critical national security infrastructure, posted armed security guards along key parts of fibre networks, and installed motion-activated alarms along lines (Onyango-Obbo, 2014). Given conditions of political instability, poverty, market competition, and unenforced laws in the region, there is a need to consider the comparative advantages of telecom infrastructures and assess how their affordances may fit with particular needs or scenarios. Ongoing physical threats to terrestrial and undersea telecom infrastructure combined with the need to serve users in East Africa's rural areas position satellite communication as a favorable option.

The Affordances and Growth of Satellite Communication in Africa

Continuous and reliable links to international communication networks are integral to governance, information flows, financial transactions, and public safety and security. Since East Africans currently face acute challenges on a number of fronts – in areas of political violence, poverty, healthcare, and security – connections to international telecom networks are even more important. Satellite communication has multiple affordances that make it advantageous in the East African context.

First, satellite *footprints* (or coverage zones) can be used to deliver services throughout vast and topographically diverse regions. Footprints typically encompass urban and rural areas and traverse state borders, and as such can be used to serve remote communities as well as displaced persons and refugees who are often on the move and living without access to fixed terrestrial systems (Parks, 2005 & 2012). Satellite footprints can also be used to reinforce existing regional alliances and initiatives by providing an integrative architecture. The footprint structures a domain of interactions and transactions that can link, combine, and unify people or activities scattered across a regional or transnational territory.

Second, and relatedly, satellite communication systems have the potential to *access an unlimited number of end users quickly*, independent of existing infrastructure, terrestrial challenges or obstacles, and nation-state borders. They can be especially useful in facilitating and delivering service directly to end-users such as humanitarian aid or disaster relief and emergency response.

Third, unlike terrestrial or undersea cables, the earth stations and headquarters of most satellite operators are *situated in secured locations outside of this region.* As such, these facilities are relatively protected from sabotage or destruction, and can offer more reliable and continuous service. While this situation results in less local ownership and control over telecom infrastructure, it may be a necessary tradeoff in an area grappling with long-term political instability. Civilians living in conflict zones need reliable telecom services so that they can maintain contact with one another and seek assistance when needed. The siting of satellite installations outside of these areas enables connectivity if and when terrestrial systems are destroyed or interrupted. Though satellite phones or dishes may be subject to confiscation, vandalism or theft, these receivers are small and mobile and can be hidden, camouflaged, or positioned in secure areas. In addition, their replacement costs are much lower than cut coaxial or fibre lines.

Fourth, satellites serve as an important meta-infrastructure that can *flexibly and simultaneously support multiple types of communication platforms and technical standards*. This meta-infrastructure can be organized to relay the backhaul signals of second party distributors or to provide direct to home (DTH) broadcasting, telephony, and/or internet service to end-users. The flexible potentials of the technology allow for local, national, or regional stakeholders to participate in the satellite industry, while also providing the option of shutting out the middleman by offering direct to home or user service. Direct service via satellite is particularly useful in areas with limited or threatened terrestrial infrastructure, or in situations in which international connectivity is urgently needed, as has been evident from the popularity of VSAT services in the region (Feldman, 2007).

Finally, since communication satellites are positioned in orbit, they are *subject to the legal provisions of the international Outer Space Treaty* (1967), which defines outer space, including orbit, as the "province of all (hu) mankind" and states that the uses of outer space, including orbit, should benefit all countries and peoples "irrespective of the degree of their economic or scientific development." The Treaty also stipulates that its parties should use outer space in the "interest of maintaining international peace and security and promoting international co-operation and understanding." Commercial satellite operators that use this orbit therefore have an implicit obligation to serve African countries and peoples who have historically been excluded from and underserved by the use of orbital domains and the global satellite system. Since Ethiopia, Kenya and Somalia are among the treaty's eighty-nine signatories, these East African countries and their citizens deserve to benefit from the enforcement of its provisions.

In summary, the affordances of the communication satellite include: the capacity to deliver services throughout a regional footprint; an ability to access unlimited numbers of people quickly; the siting of critical infrastructure such as operational headquarters beyond the region; the ability to simultaneously support multiple platforms and technical standards; and the potential to uphold legal provisions of the Outer Space Treaty. Because of these affordances, telecom industry representatives insist that satellites are better and uniquely equipped to serve Africa's interior regions and support communication needs across the continent (Ospina, 2014, 4). Though some Africans continue to associate satellite communication with latency and high costs, satellite operators have worked to resolve these issues and change such perceptions during the past decade by expanding their fleets, increasing transponder capacity, and moving constellations into middle earth orbit. In the sections that follow, I describe growth in the satellite market in Africa, focusing on three satellite operator categories: dominant Western operators; African operators; and emergent operators.

Dominant Western Operators: Intelsat, SES, Eutelsat

During the past decade the three largest companies in the fixed satellite business—Intelsat, SES and Eutelsat—expanded satellite capacity across the African continent by launching several new satellites. As of 2014 there was an "over-capacity" situation in Africa's satellite market (Caleb, 2014; Curcio & Butani, 2014). Since Africans associate satellite services with high cost and latency, satellite operators have had to work to remedy these issues and highlight the technology's affordances and advantages in the African context. The ways prospective users imagine and perceive telecom technologies can be a significant factor in their economic viability and success (Graham & Mann, 2013).

As the largest operator in the world with fifty-three satellites, Intelsat currently operates twenty satellites that serve the African continent (Caleb, 2014). In March 2011, the company launched a $250 million satellite called "New Dawn" (also known as Intelsat 28) as part of an effort to dramatically expand capacity on the continent (see Figure 1). Motivated in part by mobile operators' interest in extending their networks to underserved rural areas in the continent's interior, the project set out to symbolize a "new dawn" in African telecommunication. Launched into orbit by an Ariane 5 rocket inscribed with Nelson Mandela's signature, the satellite was thrust into position at 33 degrees east. It has thirty transponders that operate in C & Ku bands and provides services for cellular backhaul, internet backbone, corporate networking, and TV relay and broadcasting (Intelsat 28, undated). Also significant was the satellite's innovative debt funding structure, which tried to maximize African participation and included contributions from the African Development Bank and South African investors ("AfDB Supports…," 2009).

In 2012 Intelsat launched another satellite into a position at 72 degrees east. Equipped with C, Ku and UHF band payloads, the Intelsat 22 satellite provides broadcast and data services to customers in Africa, Asia, and the Middle East. This satellite's UHF payload is leased to the Australian Defense Force (ADF) under a $500 million 15-year contract and the ADF holds a sub-contract with the US Navy (Clark, 2012). Military organizations are buying an increasing amount of satellite capacity from commercial operators as it allows faster access to orbit than traditional government procurement programs. As a sign of how rapidly new satellite capacity in Africa is leased, 80% of Intelsat 22's capacity was sold before launch (Wilson, 2012). Beyond supporting military customers, Intelsat 22 also has been used to target African regions where terrestrial connectivity remains scarce and to provide redundancy for terrestrial networks (Wilson, 2012). For instance, the satellite carries signals for Kenya Broadcasting Corporation (KBC) and Ethiopia Telecom. Ethiopia Telecom uses Intelsat 22 to distribute a new government voice and data network and to expand a distance-learning network that supports high school education in Ethiopia (Intelsat, 2012).

The world's second largest satellite operator, SES, covers Africa with nine satellites and plans to launch another in 2015 (SES, 2014). The company aspires to "bridge the digital divide via satellite" and help create a "connected Africa" (Guimba-Saidou, 2012). SES has focused on trying to expand the direct to home (DTH) satellite TV market in Africa. The company's NSS-12 satellite at 57 degrees east provides DTH hotspots over East Africa and carries nearly 150 channels including the popular Kenyan network Zuku TV, operated by the Wanachi Group (SES, 2015) (see Figure 2). SES has teleport networks in Ghana and Djibouti and local teams in Ghana, South Africa, and, as of 2013, opened

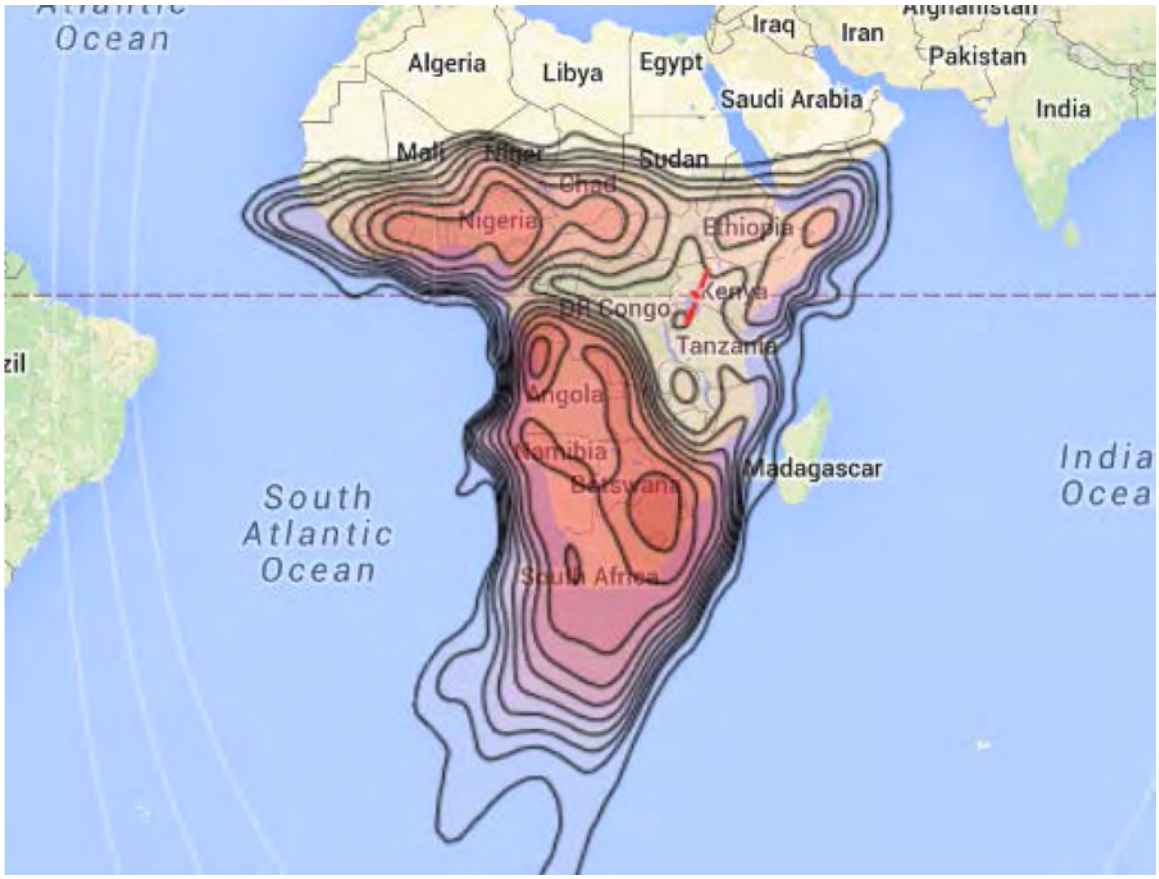

Figure 1: Footprint of the Intelsat 28 satellite, owned by Intelsat (source: http://www.satbeams.com/satellites?norad=37392).

an office in Addas Abbas, Ethiopia (SES, undated). In late 2014, the company signed a contract with Romantis to carry its VSAT services on NSS-12's Ku beam in East Africa ("East Africa…, 2014). SES's satellites Astra4A and SES 5, which are co-located at 5 degrees east, have a sub-Saharan Africa footprint and carry South Africa's Top TV and Zuku TV. SES launched another satellite with 62 Ku-band and 4 Ka-band transponders in 2014. This new Astra 2G satellite, located at 28.5 degrees east, was installed to bolster broadband and broadcast services in West Africa and link the region to Europe (Jackson, 2014).

Like its competitors, Eutelsat has also been aggressive in the African market. Its satellite, Eutelsat 36A, at 36 degree east, carries the longest running satellite TV service in sub-Saharan Africa, MultiChoice DStv, to viewers in fifty countries across Africa (Eutelsat, undated). In 2014 the company also partnered with the Wanachi Group's iSAT Africa to provide free to air digital channels in Kenya and across East Africa using the Eutelsat 70B satellite. This satellite's footprint includes an area with more than 160 million Swahili-speaking people (Eutelsat, 2014a).

In addition to carrying video packages, Eutelsat supports multiple VSAT companies. For instance, its Eutelsat 10A satellite is leased by Belgium Satellite Services (BSS) to provide VSAT networks to a client base of more than 150 businesses, NGOs and government administrations in over twenty-five countries in Africa and the Middle East (Eutelsat, 2013). In October 2014, Eutelsat signed a multi-year lease with Orange for C-band capacity on the Eutelsat 3B satellite, so that the company could extend its VSAT services in Africa (Eutelsat, 2014c) (see Figure 3). Liquid Telecom, a leading IP connectivity provider in Africa, recently signed a five-year contract with Eutelsat to lease bandwidth on Eutelsat 7B at 7 degrees east (Eutelsat 2014b). Beyond providing video, VSAT, and IP backbone, Eutelsat is also a partner in major military contracts. In 2014, the company signed a five-year contract to provide transponder space to support US Africa Command. This

Figure 2: East Africa Ku-band footprint of the NSS-12 satellite, owned by SES (source: http://www.globaltt.com/en/coverage_nss12.html).

is the first in a series of US military "Pathfinder" contracts with commercial satellite operators, signaling a new US Defense Department procurement method (Eutelsat, 2014). In 2015 Eutelsat plans to launch six more satellites, three of which have "high powered capacity dedicated to sub-Saharan Africa" (EastAfricaCom, 2015).

African Operators: RascomStar-QAF and NigComSat

While these Western operators continue to dominate the satellite market in Africa, it is highly significant that two sub-Saharan African satellite operators have emerged during the past decade – RascomStar-QAF and NigComSat. RascomStar-QAF is a pan-African satellite project that got off the ground during the 1990s (Mukasa, 1992) as part of an initiative that involved forty-five African countries as signatories and supporters. The project also received a substantial financial contribution from former Libyan President, Muammar Qadafi, which enabled two RascomStar-QAFs satellites to be launched (Parks, 2012). After the first one failed in 2007, a replacement satellite was launched in 2010 into a position at 2.9 degrees east. RascomStar-QAF1R has a continental footprint over Africa with 12 Ku-band and 8 C-band transponders (see Figure 4). The satellite is currently operated from RascomStar's headquarters in Mauritius. Nigerian satellite operator, NigComSat, launched its first communication satellite NigComSat-1 in 2007, but the satellite failed in November 2008 due to a problem with its solar array. Manufactured and launched by the China Great Wall industry corporation, the Chinese company helped NigComSat launch a replacement satellite—NigComSat-1R— in December 2011, but reports indicate that the satellite has yet to make a difference in sub-Saharan Africa (Eze, 2013).

Both of these sub-Saharan African satellite projects faced numerous challenges and the satellites have been relatively underutilized. In March 2012, however, RascomStar-QAF announced that it entered into an agreement with Mauritius-based "network extender" IPX Extenso to

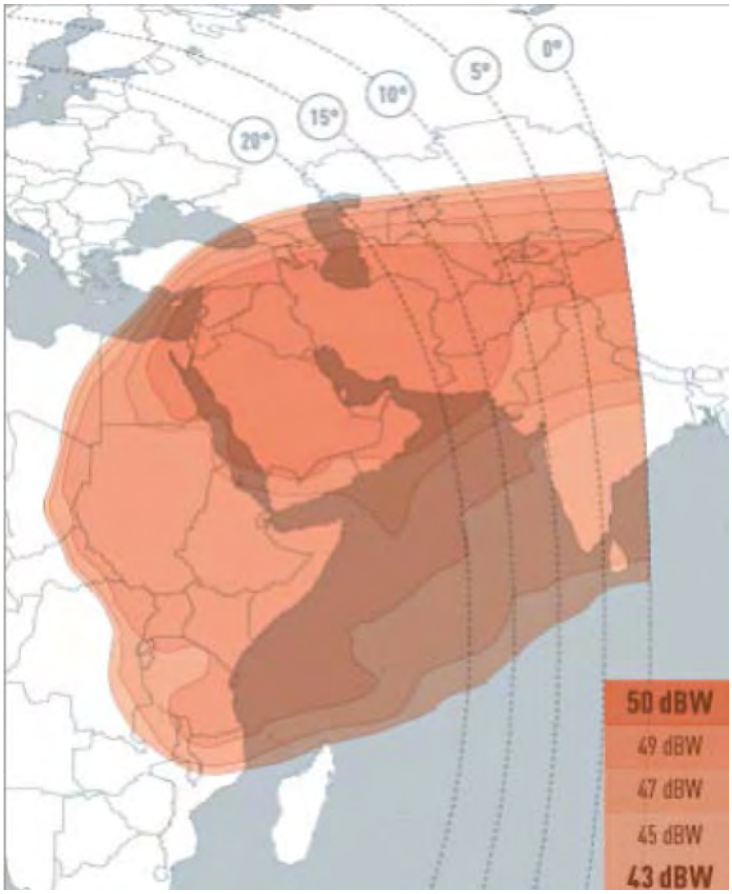

Figure 3: Ku-band East footprint of the Eutelsat 3B satellite, owned by Eutelsat Communications S.A. (source: http://www.eutelsat.com/en/satellites/the-fleet/EUTELSAT-3B-downlink-coverage.html).

jointly provide telephony services to rural communities in Congo. Under the contract, RASCOM contracted IPX to deploy GSM mobile and fixed telephony access in 50 remote and rural areas of Congo through RascomStar-QAF VSAT terminals ("RascomStar-QAF…," 2012). The satellite's continental footprint is also being used to relay Cameroonian TV channel Afrique Media as well as eight Congo TV channels and eight Congo radio channels. In addition, one transponder on the satellite is used to relay feeds for businesses, governments, or media companies (Lyngsat, 2015). Though there were intentions to use NigComSat-1R satellite to support Nigeria's government agencies and television networks, as well as to serve the telecom needs of other African countries, such as Ghana, it is unclear whether NigComSat currently has customers and what signals it carries ("Nigeria…," 2012).

Although neither of these satellites have been used to provide services in East Africa, these projects are symbolically significant as African-led satellite communication projects that may inspire others. At the same time, both of these projects demonstrate how challenging it is to launch operations in a high-tech and high-capital industry that has been dominated by Western operators for decades. Building national space agencies and technical facilities to administer satellite operations is a process that takes time, money, and expertise. Though RascomStarQAF and NigComSat can be understood as counter-hegemonic responses to Western domination of the satellite market in Africa (Parks, 2012), they were also both heavily dependent on foreign financial investment and technical support from Libya and China respectively. The "first come first served" process by which the ITU has allocated positions in the geostationary orbit combined with global economic inequalities have positioned African satellite operators at a structural disadvantage when it comes to reaping the benefits of orbital space. Because they entered the satellite industry much later than dominant Western operators, they lack the extensive business partnerships and capital development programs needed to sustain and expand satellite operations as well as a track record of success.

Nevertheless, it is important that such satellite projects be undertaken and assessed given provisions in the Outer Space Treaty of 1967. African nations, citizens, and businesses have a legal right to occupy, access, and use orbital space (Howell, 1988), and the viability of future projects in East Africa should be discussed and assessed. Ethiopia might be the next sub-Saharan African country to launch a satellite. In 2012, the country announced plans to develop ET-SAT, a low-cast cube satellite to be used for lower thermosphere research and to teach youth about satellite technology. ET-SAT is one of fifty cube satellites to be developed and launched as part of a collaborative international satellite network called QB50 funded by the European Commission (Ethiopian Space Science Society, undated).

Emergent Operators: O3b and Avanti

Alongside the dominant and African satellite operators, new operators have emerged in the African satellite communication market in recent years, including O3b and Avanti. O3b has deployed a constellation of eight Ka-based satellites into Medium Earth Orbit (MEO) in an effort to reach the "other three billion" people in Africa, South America, and Asia who lack broadband internet access. Positioning these satellites in MEO results in much lower latency, making satellite options much more competitive ("O3b and Somtel…," 2013). O3b initiated its service in August 2014 and has focused on providing satellite internet and mobile phone backhaul to emerging markets, seeking areas where fibre is absent. Backed by SES, Google, HSBC, Liberty Global, Development Bank of Southern Africa, and others, O3b was projected to bring the cost of bandwidth in southern markets down by ninety-five per cent (Edgecliffe-Johnson, 2008). The company has promised to "transform communications in Africa" by using its innovative satellite constellation to provide ISPs, mobile operators, businesses, and government customers with "high quality, fast and affordable connection" to the global internet backbone ("O3b and Somtel…," 2013). In 2013, O3b signed an agreement with Somali telecom operator, Somtel to support its 3G and 4G mobile and data services. O3b also signed an agreement with Somalian ISP, Glocall Telecoms for the delivery of high-speed, low-latency Internet capacity in "bandwidth-starved" Somalia ("O3b Networks…," 2013). Beyond Somalia, the company also signed agreements to provide capacity to South Sudan, Liberia, and the Democratic Republic of Congo ("O3b starts…," 2014).

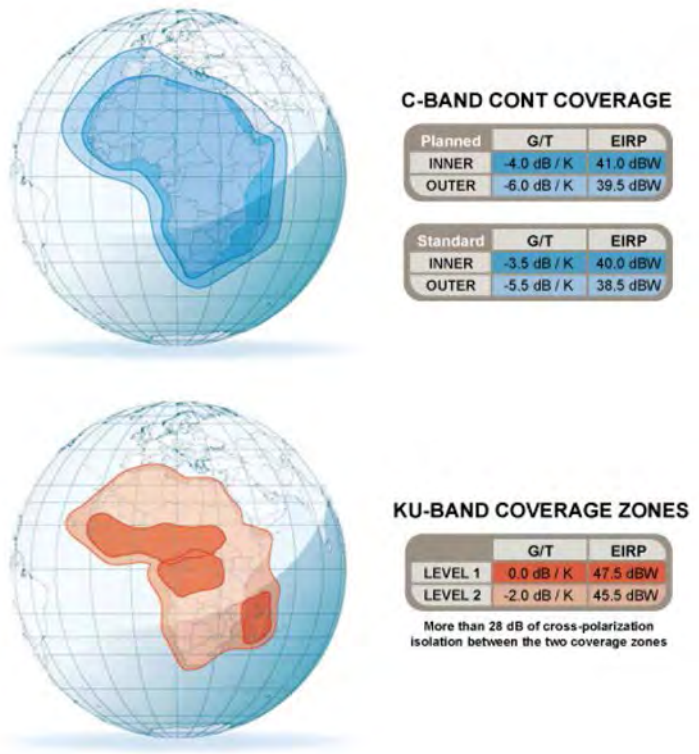

Figure 4: Footprint of the RASCOM-QAF1R satellite, owned by RascomStar-QAF. (source: http://www.rascomstar.com/fleet.php).

Another emergent satellite operator in Africa is the London-based Avanti, which currently operates two satellites, HYLAS 1, launched in 2010 for services in Europe, and HYLAS 2, launched in August 2012. The HYLAS 2 satellite at 31 degrees east has twenty-four active and six gateway Ka beams covering Northern and Southern Africa, Eastern Europe and the Middle East (see Figure 5). It also has steerable spot beams that can be used to direct extra capacity to certain areas when needed (Avanti, 2012). The company specializes in providing broadband data communication, offering 20 Mg per second internet services, and plans to launch three more satellites by 2017 (Williams, 2014). Avanti is known for pioneering the use of "high throughput" satellites that maximize the use of less congested Ka-band frequencies, which allow higher download and upload speeds at lower cost. Satellite operators in Africa have reported price declines of ten to twenty percent between 2013 and 2014 due to over-capacity, but Avanti continues to receive the highest amount for satellite capacity, earning an average price point of more than $864,000 per year for a 36-megahertz transponder, or $2,000 per megahertz per month, prices it set for itself in 2008 (de Selding, 2014).

Many organizations use Avanti's satellites for cellular backhaul, IP trunking, government and enterprise networks, and video services. In 2014 Pan-African telecom operator Gondwana partnered with Avanti to power its VOIP and broadband satellite services in Kenya, Tanzania, and parts of Zimbawbwe, Uganda, and South Africa (Gondwana, 2014). In addition, Avanti has developed a new education service entitled "Avanti Connected Education" which will connect African schools to high speed satellite internet and is currently running as Project Imlango in Kenya (Magan,

Figure 5: Footprint of HYLAS 2 satellite, owned by Avanti Communications Ltd. (source: http://www.avantiplc.com/hylas2/#where-we-cover).

2014). Avanti has entered a high profile partnership with Facebook as part of an effort to provide free internet and Facebook access across vast parts of Africa. By signing a deal with Avanti, Facebook could bypass mobile operators on the continent and provide Facebook across Africa at a relatively low cost (Williams, 2014).

As dominant Western, African, and emergent satellite operators now compete in the satellite market in Africa, competition has intensified, capacity prices have dropped, and satellite projects have demonstrated innovation in the areas of technology, financing, and global partnerships. Despite these innovations and reduced costs, *the reality is that there is little, if any, satellite capacity explicitly allocated for peacebuilding initiatives in East Africa.* Since there are more players and more capacity in the satellite sector in Africa than ever before, there is an opportunity to call for and demand such usage.

Recommendations

Given the challenges faced by terrestrial and undersea telecom operators, the affordances of satellite technologies, and growth of the satellite market in Africa, there are new opportunities to integrate satellite communication into peacebuilding initiatives in East Africa. It is important to remember that communication for peacebuilding is "a field that is relatively new with little hard evidence to back up claims for effectiveness, although much anecdotal evidence to suggest that interventions are making a practice difference on the ground" (Search for Common Ground, undated, 2). Rather than provide hard evidence, this section recommends four ways that satellite capacity can be used to support peacebuilding in East Africa, focusing on issues of regional organization, cultural diversity, emergency services, and rural communities.

Recommendation 1

Regional organizations should use satellite footprints to intensify and reinforce existing regional cooperation and initiatives in East Africa.

Many of the communication satellites that provide service in East Africa have footprints whose territorial boundaries include the countries that make up various regional economic organizations such as the East African Community (EAC), the Inter-Governmental Authority on Development (IGAD), and the Common Market for Eastern and Southern Africa (COMESA). The visions and projects of these organizations can be articulated with and serviced by satellite footprints. The EAC's vision, for instance, is to create a "prosperous, competitive, secure, stable and politically united East Africa" and to "widen and deepen Economic, Political, Social and Culture integration in order to improve the quality of life of people of East Africa through increased competitiveness, value added production, trade and investments" ("East Africa's…," 2104, 11). The IGAD covers almost six million square kilometres and has a total population of 200 million, and is focused on conflict prevention, management and resolution, and humanitarian affairs in East Africa. Piracy and terrorism have also featured prominently in the organization's agenda. Another focus of the organization is infrastructure development, especially in the areas of transport and communication ("East Africa's…," 2014, 12). Finally, COMESA has twenty member states with a total population exceeding 400 million and a regional territory of thirteen million square kilometres. The organization's vision is to "be a fully integrated, internationally competitive regional economic community with high standards for all its people ready to merge into an African Economic Community" ("East Africa's…," 2014, 13).

East African regional organizations should seize satellite footprints as important structures for reinforcing already existing regional alliances, cooperation, and initiatives. Satellite footprints can be thought of as domains of regional (trans)action that can enable multiple kinds of stakeholders to work together to formulate and administer an array of services and initiatives within and across sovereign territories. Drawing on the provisions of the Outer Space Treaty, these organizations should submit a proposal to the ITU or to dominant Western, African, or emergent satellite operators requesting subsidized satellite capacity that can be used to facilitate peacebuilding activities such as interstate communication and cooperation, infrastructure development, education, public health, and regional security. These organizations could pilot a five-year East African Public Satellite Services program that would use low-cost satellite capacity to support a list of prioritized regional projects.

Other such satellite-based development initiatives, such as Intelsat's Project SHARE (Satellites for Health and Rural Education), were attempted in during the 1980s (Pelton, 1997). More recently, the European Space Agency, Openet Technologies, and SES have partnered with rural African communities to run a project called Sway4edu, which uses satellites to support farmers, voters, and educators in the Democratic Republic of Congo and Mali (European Space Agency, 2014). One of the most useful long-term models is PEACESAT (Pan-Pacific Education and Communication Experiments by Satellite). For thirty years this organization has run satellite-based experiments to facilitate "development" and "public service" communications in the Pacific Islands region (PEACESAT, undated).

Recommendation 2

Eastern Africans should have access to satellite television dramas, news, and public affairs and talk shows that embrace regional linguistic, ethnic, and religious diversity.

In post-conflict regions or areas characterized by political instability, authoritarianism, corruption, or vulnerability to terrorism, satellite footprints can be used to build and solidify regional relationships through a common media culture. While scholars have studied the unfortunate ways that radio technology was used in Rwanda during the 1990s, which has been attributed with fomenting ethnic divisions, political violence, and genocide (Fellow & Steeves, 1998; Thompson, 2007), less research has explored how satellite broadcasting in Africa might help build regional cultures that embrace social differences and promote tolerance (Mukasa, 1992). The NGO Search for Common Ground, which defines media content as a core part of communication for peacebuilding, suggests that when producing and distributing media content it is important to think about a region's ethnic and religious diversity and produce programs that *model people living together*. For instance, the organization created a dramatic TV series in Nigeria about a fictional TV news station called *The Station* and another about soccer players called *The Team*, both of which were designed to address ethnically and religiously diverse audiences (Search for Common Ground, 19). This organization uses "drama and popular culture to inspire individuals from conflict-torn communities as they mend fences and rebuild their societies, teaching the next generation about new possibilities for living harmoniously within complex situations" (Search for Common Ground, 19)

Researchers have also shown that international and regional satellite distribution of news and public affairs programming can be used both to support and undermine the rights of ethnic minorities (Price, 1999 & 2012) and function as "offshore democracies" when repressive nation-states refuse to recognize minority rights or address particular social or political issues, such as gender issues (Sakr, 2002). This was the case when Al Jazeera first emerged in Arabic-speaking countries. It was the material location of the programs as being "elsewhere" or "in orbit" that enabled people to feel free to express their ideas about taboo or difficult to broach subjects.

One key difference, of course, in the case of East Africa is that of language. While Al Jazeera could transmit talk and public affairs shows in Arabic to people throughout its Middle Eastern footprint, there are thousands of unique languages and dialects spoken across East Africa, which makes it challenging to create programming that will appeal to and be comprehensible to all audiences throughout a regional footprint. Nevertheless, if one considers the popularity of Christian satellite broadcasting in Africa, which is often broadcast in English or French to massive transnational audiences, it seems feasible to develop East African talk and public affairs satellite TV shows that invite people to discuss key issues related to their lives and political futures in some of the major languages of the region. As it evolves, satellite television programming in East Africa needs to be opened to local/regional input and indigenized so that this content will be desirable and resonate with the cultural practices, interests, and needs of the region's people. Currently there are several free to air satellite television channels in Somalia, Ethiopia and Kenya (see Lyngsat), and these should be explored as platforms for the transmission of regionally produced programming.

In addition to representing diversity in satellite television content, it is vital that people in rural and poverty-struck regions have access to satellite-based services and feel they are part of the region's media and telecom culture. In 2012 North Eastern Kenyans were shut off from the signals of the Kenya Broadcasting Corporation and several privately owned Kenyan TV stations because these media outlets claimed they could not raise enough ad revenue in that region. Residents of the region demanded access to information and pooled resources to buy one television set, which was kept it in a community center. Since some residents of the community have been able to poach satellite television from hotel restaurants and bars, they discovered what they were missing. Given residents' frustration, a saying surfaced in the region: "If you thought information is expensive, try ignorance" (Boniface, 2012). Given such an anecdote, it is vital that East African satellite TV programming not only represents the region's cultural diversity, but also that diverse audiences, across urban and rural areas, are reached by its signals. The initiative of the Wanachi Group to build an East African satellite TV service across Kenya, Ethiopia, Eritrea, South Sudan, Burundi and Somalia ("Wanachi…," 2011) is a very promising plan. Yet to be successful, it will need to involve an array of stakeholders from across the region at

every level, in its business operations, media content, and distribution arrangements.

Future satellite TV services for rural East Africans could be funded by partnerships between satellite operators, nation-states, regional organizations, media companies, NGOs, and citizens groups, all of whom have a stake in peacebuilding throughout the region. Such a project was recently initiated in Northern Nigeria. A free-to-air Hausa-language satellite TV channel (AREWA24) has been launched to encourage "peaceful resolution of complex conflicts" by addressing such issues in a two-episode-per-week soap opera (Radio for Peacebuilding, undated). The channel, which is carried on Nilesat 102, is supported through a partnership between fifty Nigerian media professionals, Equal Access, and broadcast and telecom companies from Jordan and Dubai (Equal Access, undated).

Recommendation 3

Satellite capacity should be allocated for interactive mobile emergency communications and used to protect the most vulnerable in remote communities, post-conflict zones, or areas of sustained political violence and instability.

Emergency communication in East Africa takes a variety of forms (word of mouth, landline, radio, cellular, internet), but it is most often carried out via terrestrial infrastructures. As established in section I, such systems have been subject to attack and interruption in recent years.

Given current political instability in East Africa, it is vital that the leaders of public schools, women's organizations, and hospitals have access to satellite communication services such as VSAT and satellite phones. These technologies should be available to civic leaders in the event of emergencies such as political violence, terrorist raids, natural disasters, or terrestrial network interruptions. In rural communities, women, children, ethnic minorities, and elderly people are particularly vulnerable. In an effort to address such issues, the Inter-Governmental Authority on Development in Eastern Africa has developed a Conflict Early Warning and Response Mechanism (CEWARN) to respond to and prevent conflict in Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan, and Uganda. CEWARN has partnered with ICT4Peace to determine how ICTs could be used in areas with no communication technologies, and they started using satellite phones, radios and other equipment (CEWARN, undated). Just as organizations such as Human Rights Watch, Amnesty International, Refugees International, and the Satellite Sentinel project have used high-resolution commercial satellite imagery to monitor conflict zones, locate displaced people and render services, equivalent satellite communication projects should be developed to enable end-users to use direct satellite connections to request emergency services or seek assistance when needed. Typically, mobile phones can be used in such situations; however, if cellular networks are shut down there is a need for satellite redundancy. Given acts of cable vandalism and terrorist attacks on telecom facilities discussed earlier, all critical telecommunication infrastructures in the region should consider the option of satellite redundancy.

While some might argue local, federal, or regional authorities should provide reliable policing and emergency services in East Africa, there have been serious problems in some cases. For instance, in recent years soldiers from the African Union Mission in Somalia (AMISOM) assigned to help maintain the peace and protect community members in Somalia have sexually abused and exploited Somalis women and girls on bases in Mogadishu, becoming the perpetrators of rape and sexual violence rather than protectors (Human Rights Watch, 2014). Gender-based violence is often unreported not only due to gendered power dynamics and taboos, but also because there is often limited technical and/or legal infrastructure in place to report and prosecute these crimes and support victims who need assistance. Moreover, the prosecution of sexual perpetrators is sometimes deterred or buried because of bribes and corruption.

In East Africa, satellite phones are used by wealthy businessmen, Somali pirates, and members of terrorist organizations such as Al-Shabaab (van Nierkerk & Maharaj, 2013; Goldman, 2014; Botha and Abdile, 2014). Why are these technologies not being used to support the lives of women, youth, rural, poor, and elderly people in East Africa? Since communication for peacebuilding involves using technologies to support victim rights and gender equity campaigns, civil society organizations should work with regional partners to develop direct interactive satellite services (such as satellite telephony, VSAT, and IP) that can be used to support victims of gender-based violence and other vulnerable and disenfranchised constituencies.

Recommendation 4

Local stakeholders, satellite operators, nation-states, and NGOs should intensify efforts to provide low cost broadband satellite internet services to rural African communities.

In order for the first three recommendations to be effective, it is also necessary to extend connectivity and broadband services to rural East Africans. Though VSAT technologies have been used in rural Africa for more than two decades and mobile operators have extended their networks into remote regions, services in rural communities remain limited and many parts of East Africa are unconnected and underserved.

Rural communities that are shut off from communication systems are particularly vulnerable to political violence, terrorist attacks, and kidnappings as manifest in various Africa countries in recent years, from Sudan to Nigeria, from Mali to Somalia. In some cases, militant groups have commandeered or destroyed terrestrial telecom infrastructure to deter or thwart calls for help from those in the community. In addition to the potential for political violence, gender-based violence rates are very high in rural communities where incest, rape, sexual assault, and other forms of abuse are common. Such violence injures, traumatizes, and even kills young people, especially girls, preventing them from fulfilling their potential. Schools in rural areas are crowded and lack access to basic resources such as chalk, books, paper, and pencils. While satellite communication itself will not solve such problems, it can make telecommunication services and informational resources more widely available to rural African communities and provide a sense of national, regional, and/or global integration. Local awareness of a rural community's instant connectivity to entities elsewhere has the potential to alter behavior and practices in that community. Such alternations may range from how classes are taught in schools to how gender-based violence is reported and addressed.

A limited amount of satellite capacity should be set aside to provide broadband internet and media services to rural East Africans who lack the financial capacity to initiate or sustain service. The financing of these satellite communication services requires creative solutions that combine subsidies from dominant Western operators and nation-states in the region with universal service obligations, NGOs, and local collectives of chiefs, farmers, and business owners who generate revenue by participating in local and regional economies. Such hybrid funding models are vital as they provide opportunities for local participation and the formation of vested interests in devising schemes for sustainable connectivity in rural communities. These kinds of projects surfaced in the U.S. during the 1930s as radio broadcasting developed. Farmers in rural communities used battery- powered radios and pooled together funds to subsidize local radio stations that transmitted announcements about weather, crop prices, and community events to residents scattered across vast remote areas (Craig, 2004).

The drive to provide satellite communication services in rural areas needs to occur in conjunction with the expansion of electricity options in these communities. Since many rural African communities are not connected to national electrical grids, the use of satellite communication in rural areas is not viable without affordable and sustainable energy solutions. Satellite operators need to work with national energy companies to determine ways of outfitting rural communities with affordable energy solutions that will enable connectivity, particularly in rural public schools, hospitals, and community centers. Satellite communication can be used to drive development across telecom and energy sectors in rural areas. The challenge is to invent hybrid financing scenarios for rural connectivity that can involve local stakeholders in ways that move beyond dependency paradigms.

Conclusion

The physical threats to terrestrial and undersea telecom infrastructure, the growing number of players in the satellite and long haul telecom markets, the resolution of satellite latency, and the drop in prices for satellite capacity create new opportunities for exploring satellite communication as a technology to facilitate peacebuilding in East Africa. Though there was a surplus of satellite capacity in late 2014 (Caleb, 2014), this situation is not expected to last as there is growing demand for bandwidth on commercial satellites from a variety of entities, especially from military organizations. The US military, for instance, sees satellite communication as a "mission critical resource" and now uses more commercial communication satellites than military satellites, becoming a major customer of some operators. Commercial satellites provide 40% of all US Department of Defense satellite communication and this figure is expected to increase to 68% over the next decade (Defense Business Board, 2013, 35).

Commercial satellite operators have major incentives to sign these large contracts because they help to subsidize the enormous costs of manufacturing, launching, operating, and insuring a satellite over its lifespan, not to mention the ground infrastructure that supports it. If commercial satellite operators sign a growing number of military contracts, there will be less satellite capacity available for peacebuilding projects. It is important that the ITU monitor this situation and ensure that satellite capacity continues to be allocated for non-military use so that orbital platforms can be used in peacebuilding initiatives in East Africa and beyond.

Keeping the satellite market in Africa open to African operators, investors, and stakeholders is vital. Intelsat has provided satellite service in Africa since 1965 and has controlled the market for decades, charging African customers exorbitant fees for international telephony and intra-continental links. Now that there are more players in the market, there is greater potential to challenge this hegemony (Parks, 2012). In order for satellites to be genuinely articulated with peacebuilding projects, however, there is a need for greater African involvement at every level – not only in satellite design, manufacturing, and operation, but also in shaping the diversity of content and signals that satellites carry. For such satellite-supported peacebuilding to emerge, there is a need for more visionary thinking, creative partnerships, and socio-technical experimentation.

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