Obscure Objects of Media Studies: Echo, Hotbird and Ikonos

By: Lisa Parks

To be obscure is to be faintly perceptible so as to lack clear definition, to be hidden, out of sight, not readily noticed or seen, inconspicuous, far from centers of the human population. The satellite has been a relatively obscure object of media studies, but it is not alone. As Amelie Hastie points out, many objects—from the ticket stub to the powder puff, from the videocassette case to the antenna tree—that are overlooked in media studies could be used to expand the field in productive ways. As Hastie explains, "…An emphasis on objects and material forms in relation to representational and time-based media might enable a delineation of the social and economic circuits of exchange in which we — and visual culture, in its various forms — participate."[i] Here, rather than adopt an object-oriented disciplinary approach and insist that there should be a field of satellite studies just as we have cinema, radio, television, and cyber-studies, I'll follow the suggestion of Siegfried Zielinski–that media not only have complex relational histories, but can be understood as entr'acts or in-between phases in a much deeper history of audio-visions. Like film and television, the satellite could be treated as part of an integrated history of media, as a *dispositif* –an arrangement of audio-visions interwoven with other media, architecture, transportation, science and technology, the organization of work and time, philosophical propositions and so on.[ii]

While a long-term goal may be to treat the satellite as a dispositif, the simple goal of this essay is to attempt to make the satellite less obscure in media studies by offering descriptive sketches of three satellites—Echo, Hotbird, Ikonos—and discussing possible modes of critical engagement with each of them. In the process I hope to make three

points. First, I want to suggest that since the field of media studies is so integrally bound up with, even contingent upon, processes of audiovisual perception, it might be useful to explore the opaque and imperceptible so that our historical and critical projects are not totally circumscribed by that which is visible and audible. Is it possible in media studies to develop a critical sensitivity to the obscure as we have to the spectacular? Second, I hope to suggest that by thinking about the processes and exchanges that occur in the space between earth and orbit that we might begin to imagine media morphologies that exceed the screen, the network, and the nation, terms that seem to have settled as implicit figurations (and unquestioned foundations) in the field of media studies. What terms can we use to describe the signal transactions that occur beyond the ionosphere and yet that are fundamental to media cultures on earth? Finally, I hope to suggest that there is a need for materialist histories of satellite technologies and that conducting such work involves taking distribution seriously as a site of media history and criticism. Why is it that we know the names of broadcast networks, major web portals, syndication companies, but

we don’t know the names of satellites?

[INSERT Fig1]

Echo

Echo was an experimental satellite launched on August 12, 1960. Developed by Bell Telephone labs in association with NASA, it was a passive, mirror or reflector satellite as opposed to an active/repeater. This means that it had the capacity to relay signals but not to store them. When Echo reached orbit, 1000 miles about the earth, the

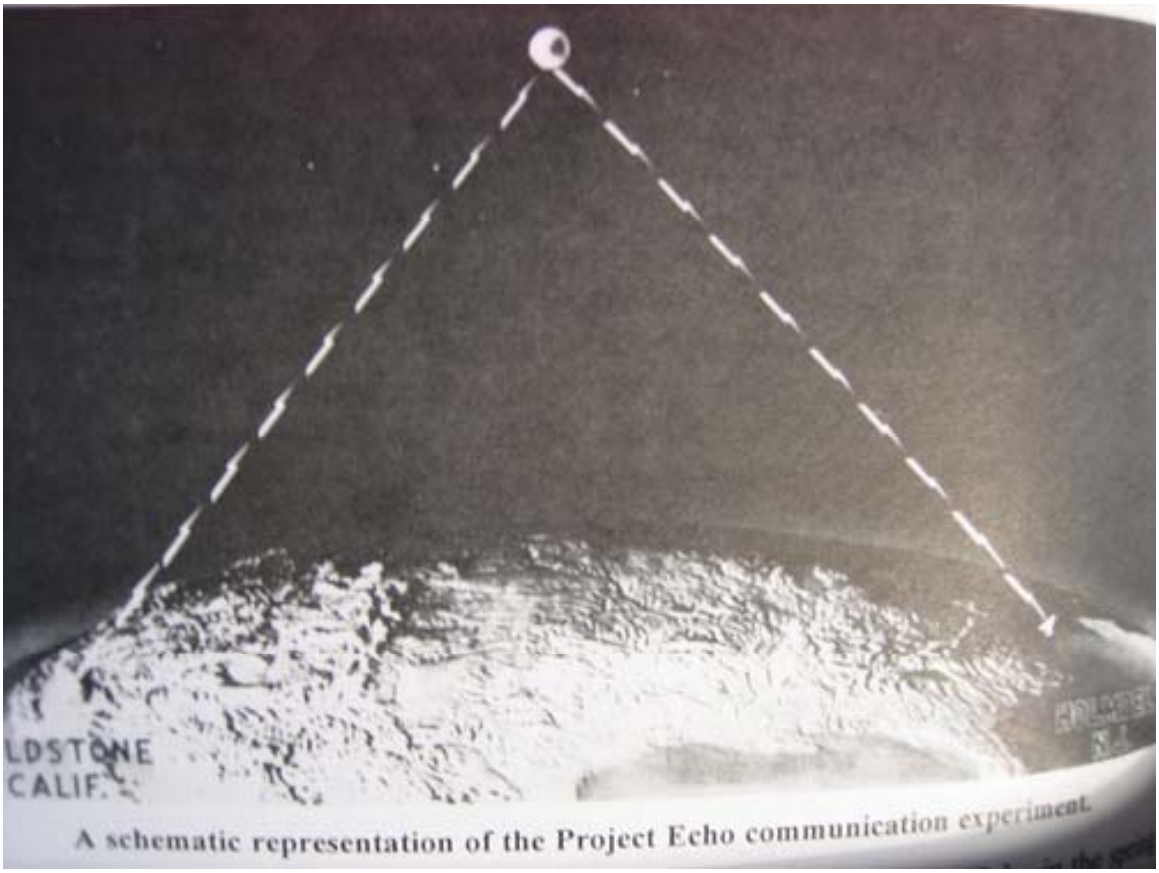
satellite inflated into a balloon 100 feet in diameter and encircled the earth every two hours. Its reflective mylar surface made it appear brighter in the sky than the north star. On August 14, 1960, during the 21st pass of the satellite, Bell Lab scientists transmitted a recording of the song "America the Beautiful" to the Goldstone facility in California. The story of the so-called "transcontinental melody" made front-page headlines and was documented in a Bell Labs film called *The Big Bounce* (1960).[iii] During the 22nd pass, a "double bounce" experiment relayed a recorded message from Stump Neck, Maryland to Holmdel, New Jersey and then on to Goldstone, CA. On August 18, 1960, Bell Labs sent a message to the Centre National d'Etudes de Telecommunication station at Issy les Maulineaux, France using Echo. And on Aug 19, 1960, technicians working for Collins Radio in Iowa used Echo to transmit an Associated Press picture of President Eisenhower from Cedar Rapids, Iowa to Richardson, Texas.[iv] These early signal exchanges marked the beginning of regularized satellite transmissions.

In addition to being used for inter and trans-continental audiovisual relays, Echo itself became an international spectacle. Donald Elder reports in his technical history of Echo that during an international trade fair in Damascus, Syria, fair guides stopped their lectures and led audiences to watch Echo in the sky when it passed overhead. In Kabul, Afghanistan, King Mohammed Zahir brought an entourage of seven hundred people with him to view an exhibition about Echo.[v] The USIA supplied over two hundred of its overseas posts with a program called "Echo in Space," narrated in over thirty languages. The show appeared in theaters and on television, and the USIA deployed mobile field units to distribute the film into villages and remote areas. The USIA also worked out an arrangement to record the messages of foreign diplomats relayed on Echo and then

distribute them for broadcast on Voice of America. Radio listeners in fifteen nations heard the messages.

Echo not only relayed audiovisual signals, but activated a field of relations between earth and orbit. The very installation of Echo in outer space altered practices taking place on the surface of the earth as people tried to spot it, up and downlink with it, and generate discourse about it. These circuits of exchange, however, are largely imperceptible. Moreover, it is difficult to access recordings of early satellite transmissions since only some have been preserved. In this sense, early satellite relays share more in common with theatrical performance or turn of the century wireless experiments in that they are ephemeral forms of culture that move through and vanish in the air, as opposed to being part of a culture of mechanical reproduction.[vi] What we can attempt to reconstruct, however, are the vectors of signal distribution—the lines, paths and directions of satellite use.

What I am proposing is an approach to the study of satellites that would embed the obscure processes of signal distribution within cartographic fields of representation as a way of beginning to provide a sense of the material histories of satellites. What places did signals originate from? Which satellites did those signals traverse? Where did those signals end up? It might seem like an impossible task to recover and represent such signal histories, but attempting to do so on even a limited scale may provide a more concrete sense of the dynamic field between earth and orbit.



A schematic representation of the Project Echo communication experiment.

[INSERT Fig2] In the case of Echo, a successful relay of a telephone conversation from California to New Jersey initiated a series of other such signal excursions and served a catalyzing function so that four decades later the satellite economy is so complex it seems beyond mapping or visualization altogether. And yet, it is impossible to fully appreciate what media globalization means unless there is a better way to account for mechanisms of distribution. Perhaps it would be possible to create visualizations of signal traffic so that we understand audiovisual media not only as narrative, ideology, and text, but also as imperceptible material that moves across and beyond the earth's surface. A model for this might be the "Flight Patterns" animation by Aaron Koblin, who used Federal Aviation Administration data to generate a representation of flight traffic patterns and density during a period from March 19-21, 2005.[vii] Generating a visualization of signals relayed

via Echo might be a good place to start. Since it was one of the first experimental satellites it had relatively limited use and would thus be simple to map.

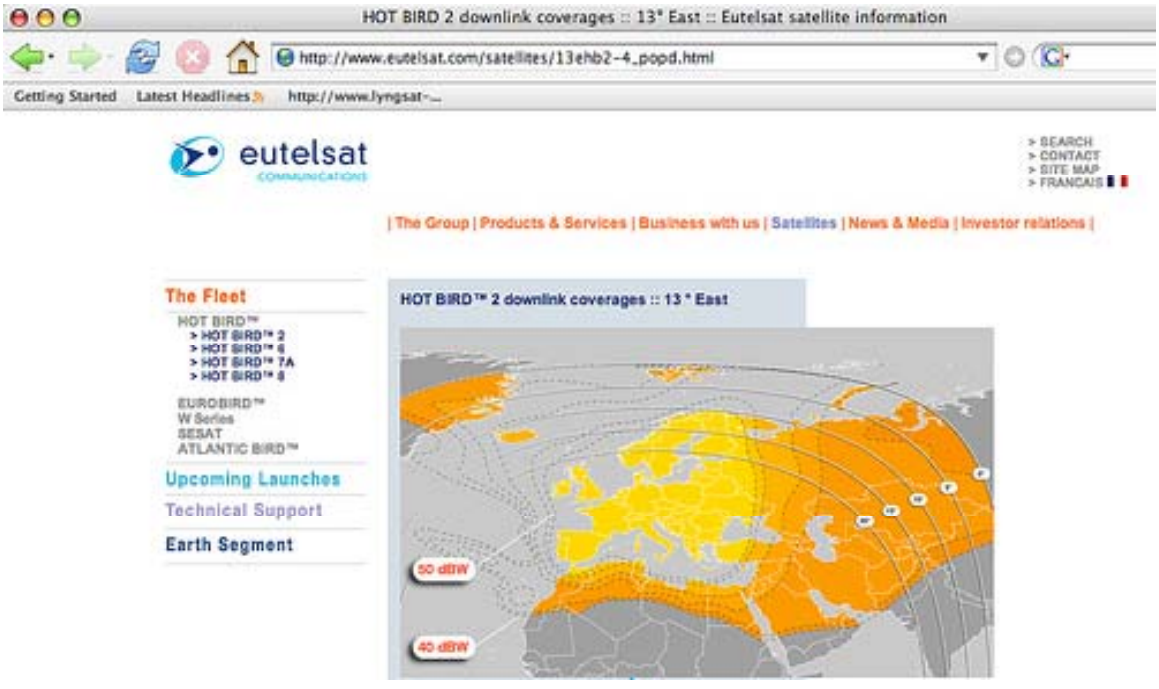
[INSERT Fig3]

Hotbird

While Echo was an early experimental satellite that reflected signals from one point to another, Hotbird is a fleet of commercial communications satellites owned by the French company, Eutelsat. In 2006, Eutelsat transmitted more than 1500 television channels to 120 million homes.[viii] The company uses twenty-three satellites to serve more than 150 countries, and specializes in coverage over Europe, North Africa, and the Middle East. The satellites in the Hotbird fleet are lined up at thirteen degrees east which the company claims is "Europe's most sought after orbital position."[ix] By lining satellites up in the same orbital location, Eutelsat is able to capitalize upon this position and maximize its

capacity by assembling a neighborhood or cluster of satellites and assert long-term ownership over this address. Though the satellites occupy the same orbital position, they have different launch histories and manufacturers. For instance, Hotbird 1 was launched on March 28, 1995 by the Ariane IV rocket from a launching base in French Guiana and was manufactured by Alcatel Space Industries. Hotbird 2 was launched on November 21, 1996 and was manufactured by Matra Marconi. Hotbird 3, manufactured by a UK company called Matra Marconi, was launched on September 2, 1997 by the Ariane V99 rocket. Hotbird 8, the most powerful broadcast satellite serving Europe, was launched on May 8, 2006 and was manufactured by EADS Astrium. The Hotbird footprints cover Europe and North Africa and extend as far east as Moscow and Dubai.

In addition to mapping signal distribution, it is possible to examine footprints to determine the geographic boundary in which a signal from a given satellite can be received.



[INSERT Fig4] These footprint maps serve as starting points for understanding how

satellite broadcasting turns continents into signal territories. In other words, the satellite footprint is not just an inert technical boundary; it is a transnational trade route, a technological zone, a site of cultural atmospherics, and a corporate claim to orbital, spectral, and geophysical property. While these maps hint at broader power relations, they are ultimately insufficient in that they tell us little about material conditions within the footprint boundary. They do not, for instance, provide information about the signals circulated within them. To understand the satellite's role in the global media economy, it is important to examine carriage lists, which are available at lyngsat.com. This website provides listings of communications satellites, the signals they carry, and the companies that generate them. In 2006 the Hotbird's carriage chart was thirty pages long and identified hundreds of radio and television signals located on different transponders, encrypted with different codes, and beamed into Hotbird footprints using different frequencies. Signals carried by the Hotbird fleet are either downlinked directly by satellite television viewers or by cable providers who bundle and distribute them to subscribers. These carriage lists are important guides for media studies; they provide a slice of the global media landscape by specifying which radio and television signals are circulated where in the world. Have you heard of or seen Iranian Cinema Channel, Baby TV, Viva Polska, Al Hayat, Jolly, Arabesque, Sex Gay TV, Tamil TV Network, Hallmark Channel Turkey, Croatian Music Channel, Pink Plus, or Public TV of Armenia?

The prospect of mapping signal distribution via satellite becomes even more daunting, then, if we consider a contemporary satellite fleet such as Hotbird, which in January 2006 carried 445 radio and 706 television signals from more than thirty-four

countries. What would the map look like? The vectors of signal distribution would be so complex and unwieldy that they might evoke new morphologies that would shift our thinking beyond linear distribution models and toward a theory of cultural atmospherics, media fogs, or as mentioned earlier, signal territories. As Charles Acland suggests in his book *Screen Traffic*, "When concentrating on the present phase of globalization, the conventional definitions of the borders of social phenomena-nations, populations, ethnicities, countries, and so on—become ever more elusive; new and unforeseen organizations of social categories appear."[x] Given the globalization of signals, it seems clear that we need new categories for media as well. Studying signals transmitted via satellite would require shifting some critical attention beyond the screen, the theater, the home, the studio, or the nation and beginning to invent categories derived from the patterns of signal distribution. Such a project may share more in common with the flow studies funded by UNESCO during the 1960s and 1970s, which were conducted in the interest of understanding the uneven circulation of television programming on a global scale. As Mimi White explains, "the number and range of programs imported and exported around the world were counted by nation-state in an effort to quantitatively map the ways global power and influence are unevenly distributed."[xi] Rather than quantify signals to confirm Western hegemony in the global media marketplace (which is something we already know), I am interested in finding ways to visualize signal densities and vanishing points, concentrations and dispersals, and arrivals and departures. What I am proposing is kind of footprint analysis or a mapping or visualization of distribution that would help to clarify the satellite's relationship to world trade, geography and history.

[INSERT Fig5]

In part to explore this possibility, in 2005 I worked with a cartographer to develop a map of the satellites used by broadcasters from the new states of the former Yugoslavia. Before the break up of Yugoslavia, only one satellite was used by the Yugoslav Television to distribute six hours of programming per day to Europe and North America. After the war ended in 1995, the media sectors of new states were privatized, and by 2005 there were five public and fifteen commercial broadcasters in the region using fifteen different satellites to send their signals around the world. The fifteen satellites (Hotbird 2, 3, 4, and 6 among them) are owned by nine different companies, which have their financial and operational headquarters outside of the region. The map identifies the names of broadcasters, the satellites they used, the location of their footprints, and the companies that own the satellites. It was designed to specify the players, ownership, and cartographies of the regional satellite economy.

Ikonos

Thus far I have discussed an experimental satellite and a fleet of communications satellites used for television distribution and suggested the need for visualizations of signal distribution and footprint analysis. In this last section, I discuss a privately-owned, remote sensing satellite called Ikonos (named after the Greek word for image), launched on September 24, 1999 by Athena II rocket from Vandenburg Air Force Base in California. Unlike Hotbird, which occupies a geosynchronous orbital position, this satellite moves in a low earth orbit. It was manufactured by Lockheed Martin with

investments from companies such as Raytheon, Mitsubishi (Japan), Van Der Horst (Singapore), Hyundai Space and Aircraft (Korea), Europe's Remote Sensing Affiliates, Swedish Space Corp., and Loxley Public Company (Thailand). During its first several years, Ikonos was operated by a corporation called Space Imaging, which, in early 2006, merged with Orbimage to form Geoeye, which is now the largest commercial satellite imaging company in the world.[xii] I don't have time here to discuss the history of the remote sensing industry, but I want to suggest that the high resolution satellite image— now exchanged openly in a global economy— represents the possibility for making the satellite less obscure both in public culture and media studies.

Since its installation in 1999, Ikonos has been programmed to acquire image data over many parts of the planet. There now exist blockbuster satellite images, just like there are blockbuster films and hit television series. The Ikonos image gallery includes annual top ten lists, and special feature sections on a host of disasters including the 9/11 attacks on the World Trade Center and the Pentagon, operation Enduring Freedom in Afghanistan, the tsunami in Southeast Asia, the Pakistan and Kashmir earthquakes, and Hurricanes Katrina and Rita.[xiii] The circulation of such satellite images cannot be separated from a U.S.-dominated global media economy that selects and foregrounds a handful of events as newsworthy, spectacular and profitable and ignores most events in the world. Ikonos images have been used to reinforce already existing psychic and capital investments in particular world events and as such have a way of focalizing the mediated production of world history.

If there is any doubt about the intersection of satellite imaging and film and media studies, we could consider some more literal intersections. For instance a 2001 animation

featured in the NASA Scientific Visualization Studio made out of “mosaic-ed” Ikonos, Terra and Landsat images take us directly from an orbital position to one hovering over the Hollywood sign.[xiv] The sequence implies that the remote sensing satellite 423 miles above the earth offers a meta-perspective that exceeds the visualizing potential of even Hollywood’s.

[INSERT Fig6 and Fig7] Or consider the use of Ikonos images to expose the location of CBS facilities during the production of *Survivor: Africa* in Kenya's Shaba National Reserve in August 2001.[xv] Dan Bollinger, a fan from Layfayette, Indiana, sent a request to Space Imaging to acquire the image data over Kenya, and after spotting the CBS facilities, Space Imaging executives waived their "special mission" fee of $3500 because they felt this would be good publicity for Ikonos.[xvi] Rather that simply reveal a Hollywood production site, satellite images could be used to examine the environmental and economic effects of Hollywood's on-location productions around the world, whether with *The Beach* in Thailand, *Titanic* in Mexico or *Survivor* in Kenya. Maybe the meta, or

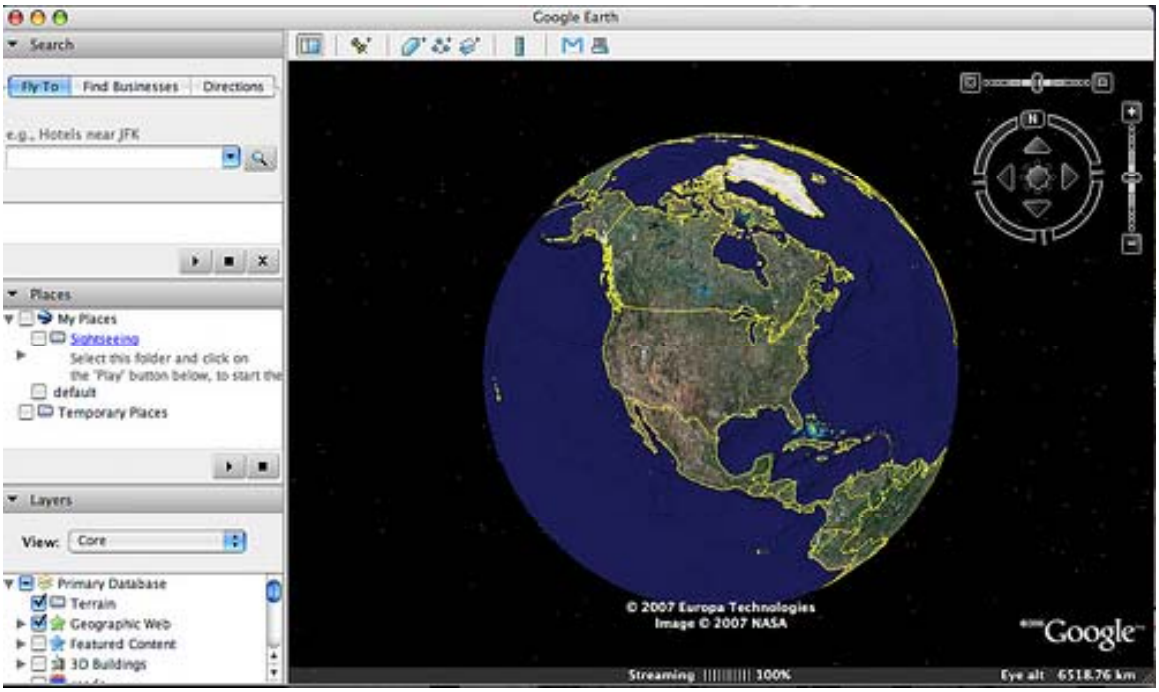
panoptic perspective of Ikonos isn't as daunting when it exposes what Hollywood studios have been up to in other countries' coastlines or national parks.

It is more likely that Ikonos images will be used for corporate landscaping than eco-friendly film production. One of the most bizarre uses of the satellite in recent times involved Kentucky Fried Chicken's development of an 87,5000 square foot Colonel Sander's logo that could be seen from orbit.

[INSERT Fig8] More than 50 designers, engineers and scientists worked for 3000 hours to create the "Face from Space" near Area 51 in Rachel, Nevada, also known as the "UFO Capital of the World."[xvii] As a KFC press release explained, "The event marks the

official debut of a global re-image campaign that will contemporize 14,000-plus KFC restaurants in over 80 countries over the next few years."[xviii] KFC purchased an Ikonos image of the site and distributed it through global media circuits to address its 4.5 billion customers worldwide including those in emerging markets of India, Russia and Brazil.[xix] While satellites have historically passed over the earth to observe "naturally unfolding" phenomena, now events are staged precisely so they can be viewed from an orbital perspective. Whether we call this corporate landscaping or orbital marketing, remote sensing satellites are now being used to pitch products and address global consumers just as other media such as commercial television or the world wide web.

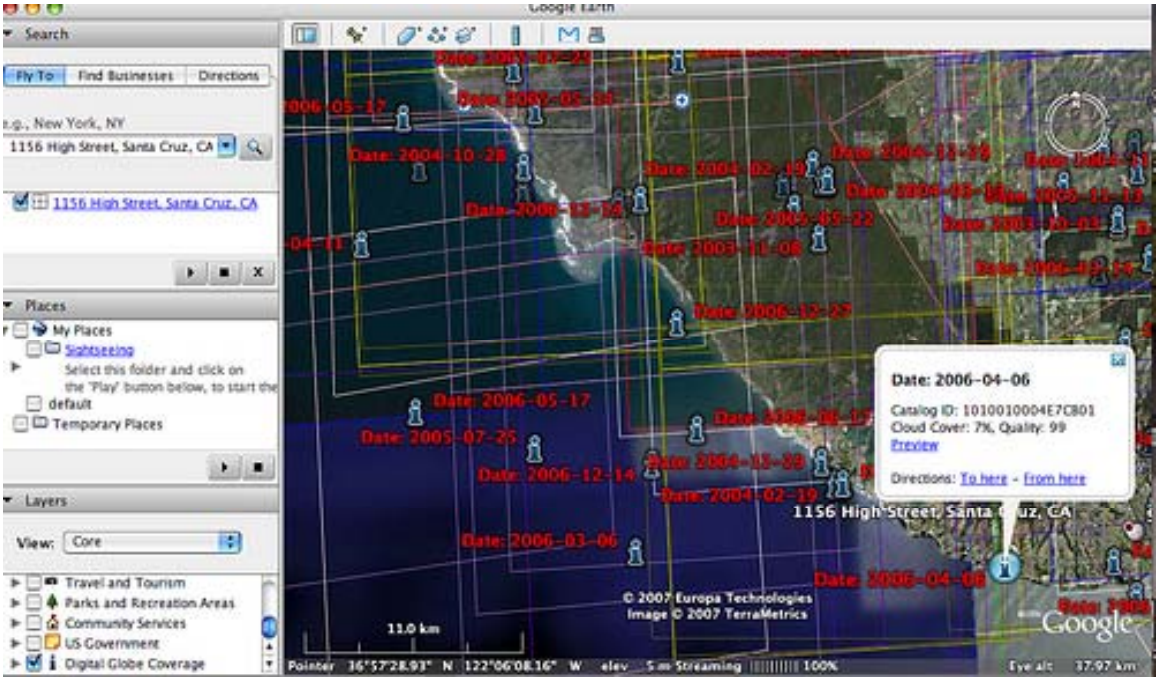
If there is any recent development, however, that makes us reflect upon the obscurity or presence of satellites in our media culture, it may be Google Earth.



[INSERT Fig9] This web application, which builds upon past initiatives such as Al Gore's Digital Earth Project[xx] of the 1990s, emerged in 2005 and has since generated a vibrant community of users from geographers to businesspeople to artists. Scholars

across fields are also using and writing about this application from an array of perspectives. What I want to address here, however, is the fact that Google Earth tends to efface information about satellites at its interface. In the basic version of Google Earth, there is no information about the satellites that acquire the image data used to construct the world as a navigable digital domain. Google Earth announces on its website that the information comes from a variety of sources and is "mosaic'ed" together and "a single city may have imagery taken from different months."[xxi] On another page in response to the question "When were these pictures taken?" the company explains, "Our photographs are taken by satellites or aircraft sometime in the last three years."[xxii] With such vague responses, unfortunately a web application with great potential to inform large numbers of users about satellites such as Ikonos ends up keeping them in the dark.

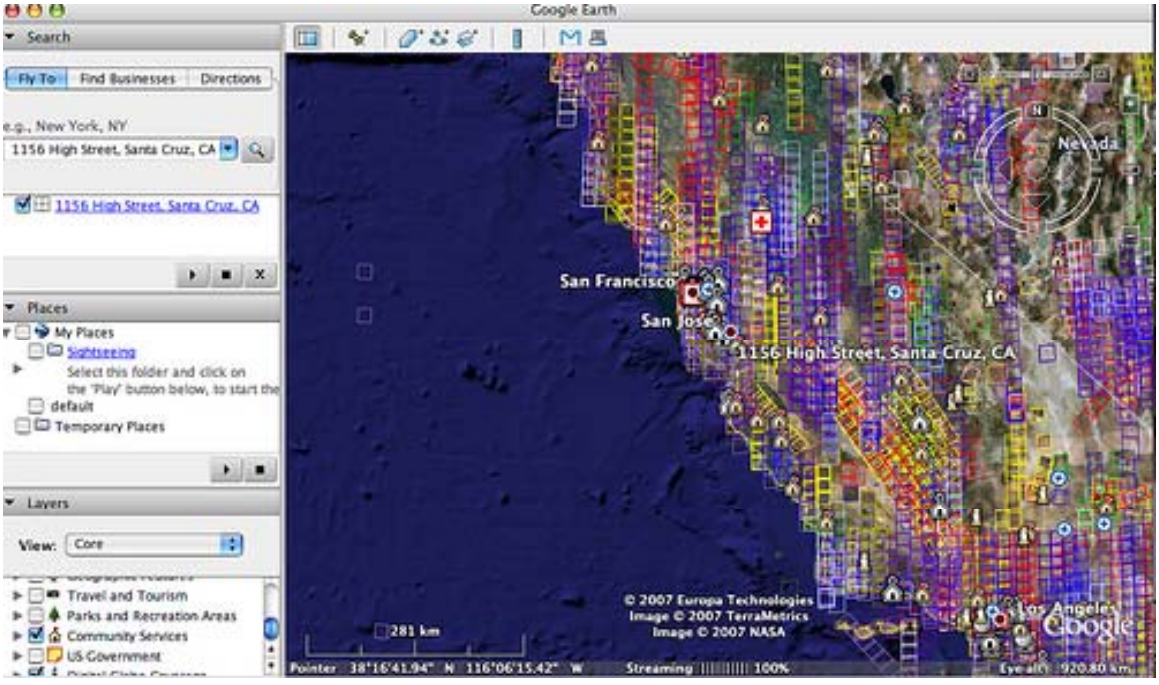
We can get a better sense of the difference it makes to have satellite image details by examining the layer of Digital Globe, the only company that provides date information for satellite images that are part of Google Earth.



[INSERT Fig10] When the user activates the Digital Globe layer, color-coded squares and “I” icons appear in the visual field. Clicking on an “I” opens a frame with data about the image including the acquisition date, cloud cover, and an environmental quality rating. The satellite name is not provided, but it was likely acquired by Digital Globe’s Quickbird satellite.

[INSERT Figure 11] If the user clicks on “preview,” she enters a meta-browser featuring the single satellite image captioned with information about how to purchase it or others from Digital Globe.

Clearly, Digital Globe is providing date information (when other companies are not) as part of a marketing strategy. When the user activates the layer, Digital Globe and its product stand out in bold relief amongst a sea of unidentified and undifferentiated satellite image data. In a sense, there is scant difference between this strategy and the KFC ad in that both corporations use satellites to turn plots of earth into giant billboards. Still, I find the Digital Globe layer useful because the inscription of date information and color-coded squares helps us to understand which parts of the earth’s surface a satellite has scanned and when. The color-coded squares (sometimes called scene footprints) function as traces of a satellite’s pass over a specific part of the earth. When composited like this



[INSERT Fig12] they form a historical record of satellite image data acquisitions, as well

as a slice of Digital Globe's inventory. Just as visualizations of signal distribution and footprints can help to emphasize the different morphologies and materialities of satellite media, this view provides a series of tracks or traces of the obscured technology in use.

Conclusion

If we accept that experimental satellite relays, the distribution of hundreds of radio and television channels, and constantly snapped satellite images of earth are relevant to the field of media studies, then we either need a theory of obscure media or we need ways of making the satellite less obscure. In this essay I have suggested that the uses of Echo, Hotbird and Ikonos have generated a set of interplays between earth and orbit that demand different media morphologies and mappings. This call for maps of signal distribution should not be understood as a positivist gesture to see, know and master, but rather an attempt to generate critical spaces for exploring other obscure objects of media studies. I have only discussed three satellites, and there are about 3500 functioning satellites in orbit. Each satellite is a symptom of a complex institutional history and imperceptible signal traffic. While imagining and specifying the contours and vectors of this traffic, it is also important to explore in greater detail the financial, temporal, regulatory, and intermedial dimensions of the satellite economy and to recognize that this part of the culture industry synthesizes and alternates between scientific, military, entertainment, and educational modalities.

I'd like to close by making three points. First, studying the signal territories and cultures that form in relation to satellites can help make them less obscure in media

studies. In his provocative essay, "Popular Secrecy and Occultural Studies," Jack Bratich makes a case for a tactical secrecy, suggesting that publicity is a "a truth-telling strategy" often aligned with the Enlightenment project and is swept up in the fickle dynamics of concealment and revelation that shape our public culture. He asks, "In an age where secrecy is virtually everywhere as a strategy of domination, can we begin to experiment with an insurgent secrecy, a minor secrecy or a popular secrecy?"[xxiii] While Bratich offers a sharp analysis of the nuances of power and knowledge in the current political moment, I find it difficult to apply this logic to satellites since their secrecy (or, as I have termed it in this essay, obscurity) is so bound up with institutions that require more public oversight and scrutiny, whether NASA, the U.S. military, or the telecommunications and media conglomerates. In short, the stakes are too high for keeping the satellite secret, in both media studies and public culture.

Second, studying satellites may enable media scholars to develop new ways of conceptualizing and visualizing the dynamic field of signal distribution that has taken shape across continents and between earth and orbit for nearly fifty years. The year 2007 marks the fifty year anniversary of the first earth satellite, Sputnik, and while there are plenty of images and models of satellites, we still do not have adequate visualizations of signal territories and traffic. Generating visualizations, then, can help us imagine signals as material phenomena and allow us to invent new conceptual categories and metaphors for media theory and history. The vectors of signals moving through the world may share more in common with patterns of weather systems or other creatures of flight, whether birds, hurricanes, or airplanes. Developing ways of conveying the imperceptible or

obscure aspects of satellite media may also allow us to recognize our field's overlap with environmental studies.

Finally, although one could conceive of an object-oriented field of satellite studies, such a project, it seems to me, ultimately privileges institutional legitimation over passionate investigation. Put in the historical perspective of what Zielinski calls the "deep history of the media," the satellite is but a passing interlude of audiovisions.[xxiv] Thus rather than fetishize the object and call for another field of study, I am more interested in using satellites and signal exchanges as objects to think with in a way that may expand possibilities for historical and critical research in media studies. At the very least, Echo, Hotbird, and Ikonos spark questions about the definition of signal territories, paths of signal distribution, and new economies of global imaging. Perhaps the best we can hope for in an object is for it to spin us into the orbit of new curiosities.

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Notes

[i] Amelie Hastie, Curator's Statement for "The Object of Media Studies," *Vectors: Journal of Culture and Technology in a Dynamic Vernacular*, Spring 2006, available at http://vectors.iml.annenberg.edu/index.php?page=7&projectId=65, accessed Jan. 3, 2007.
[ii] Siegfried Zielinski, *Audio-Visions: Cinema and Television as Entr'actes in History* (Amsterdam: Amsterdam University Press, 1999), 18.
[iii] The film is available at the Internet Movie Archive, available at http://www.archive.org/details/BigBounc1960, accessed Jan. 10, 2007.
[iv] Donald C. Elder, *Out from Behind the Eight-Ball: A History of Project Echo* (American Astronautical Society, 1995), 116-121.
[v] Ibid., p. 122.

[vi] For a discussion of satellite-based art that values impermanence and theatricality, see my essay, "Art in the Age of Ionospheric Exchange: Orbital Performers and Satellite Translators," *Quarterly Review of Film and Video* (forthcoming 2007).
[vii] Aaron Koblin, "Flight Patterns," Nov. 4, 2006, available at http://www.youtube.com/watch?v=dPv8psZsvIU, accessed Nov. 10, 2006. High resolution version available at http://www.aaronkoblin.com/work/faa/, accessed Jan. 10, 2007.
[viii] "Hotbird" publicity brochure, Eutelsat website, available at www.eutelsat.com/news/media_library/brochures/hotbirds.pdf, p. 2, accessed Jan. 30, 2006.
[ix] Ibid., p. 3.
[x] Charles Acland, *Screen Traffic* (Durham: Duke University Press),15.
[xi] Mimi White, "Flow and Other Close Encounters with Television," in *Planet TV*, Lisa Parks and Shanti Kumar, eds. (New York: New York University Press, 2003), 103.
[xii] See Geoeye website at http://www.geoeye.com/, accessed Jan 10, 2007.
[xiii] Ikonos Image Gallery http://www.spaceimaging.com/gallery/, accessed March 1, 2006.
[xiv] The sequence is available at http://svs.gsfc.nasa.gov/vis/a000000/a002100/a002108/, accessed Jan. 30, 2006.
[xv] These images are included in the Space Imaging online gallery, available at http://www.spaceimaging.com/gallery/survivor/default.htm, accessed Jan. 30, 2006.
[xvi] Dan Vergano, "Scouting the new 'Survivor' Location," *USA Today*, Aug. 29, 2001, available at http://www.usatoday.com/life/television/2001-08-29-survivor-location.htm, accessed Mar. 1, 2006.
[xvii] As one KFC spokesperson quipped, "If there are extraterrestrials in outer space, KFC wants to become their restaurant of choice." Kentucky Fried Chicken Press Release, Nov. 14, 2006, available at http://www.kfc.com/about/pressreleases/111406.asp, accessed Jan 7, 2007.
[xviii] Ibid.
[xix] Ibid.
[xx] For a critical analysis of this project, see my essay, "Satellite and Cyber Visualities: Analyzing 'Digital Earth,'" in *The Visual Culture Reader 2.0*, ed. Nicholas Mirzoeff (New York and London: Routledge, 2003), 279-294.
[xxi] Google Earth, "Images and Dates," available at http://earth.google.com/images_dates.html, accessed Jan. 11, 2007.
[xxii] Google Earth, "Common Questions about Google Earth," available at http://earth.google.com/faq.html#1, accessed Jan. 11, 2007.
[xxiii] Jack Bratich, "Popular Secrecy and Occultural Studies," *Cultural Studies* 1:1 (January 2007), 48.
[xxiv] Siegfried Zielinski, *Deep Time of the Media: Toward an Archaeology of Hearing and Seeing by Technical Means* (Cambridge: MIT Press, 2006).