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Steven McLean, "Revolution as an Angel from the Sky": 37-61

Revolution as an Angel from the Sky: George Griffith's Aeronautical Speculation

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> There will be fights in the air with wind-guns, and bows and arrows.
>
> (Horace Walpole, "On Air-Balloons")
>
> Heard the heavens fill with shouting, and there rain'd a ghastly dew
> From the nations' airy navies grappling in the central blue;
> Far along the world-wide whisper of the south-wind rushing warm,
> With the standards of the peoples plunging thro' the thunder-storm;
> Till the war-drum throbb'd no longer, and the battle-flags were furl'd
> In the Parliament of man, the Federation of the world.
>
> (Alfred Lord Tennyson, "Locksley Hall")

Though hugely neglected in modern criticism, George Chetwynd Griffith (1857-1906) was an enormously popular author of the 1890s. Griffith shot to prominence when his romance, *The Angel of the Revolution: A Tale of the Coming Terror* (henceforth *Angel*), was serialised in *Pearson's Weekly* between January and September 1893. In the words of one critic, this archetypal aeronautical romance "attracted more attention than any other story that ever appeared in [. . .] a popular periodical" (*Hampshire Advertiser*). The *Dundee Courier* similarly remarked on how "[t]his wonderful story" enjoyed "a most successful career in the pages of *Pearson's Weekly*" (6). Following its publication in book form by the short-lived Tower publishing in October 1893, it soon became the first best-selling scientific romance, quickly passing through a number of editions (Moskowitz 18; see also: Stableford). A globe-trotting tale of aerial warfare and world conflict influenced by Jules Verne's *The Clipper of the Clouds* (1886) and Edward Bellamy's *Looking Backward* (1888), *Angel* typifies the way in which scientific romance synthesises the elements of adventure, discovery and widespread devastation found in its precursors – the medieval romance, the utopian fantasy and the future war story – with imaginative possibilities suggested by science. Griffith quickly capitalised on *Angel*'s success by penning a sequel, *Olga Romanoff; or the Syren of the Skies* (serialised in *Pearson's Weekly* between December 1893 and August 1894 and published in book form by Tower in November 1894), in which aerial fleets battle for world domination. Griffith published a further aeronautical story, *The Outlaws of the Air*, in 1895. Another of his significant scientific romances was *A Honeymoon in Space* (1901), which follows the adventures of a newly-wed couple who use a spacecraft powered by anti-gravity to tour the solar system and discover that the planets are characterised by different stages of evolution. Griffith was a varied and prolific author whose literary output also included poetry (under the pen name "Lara"), short stories (sometimes under the pseudonym "Levin Carnac") and adventure novels. He wrote travel narratives too, and urged on by Cyril Arthur Pearson – for whom he was now a staff writer – he proceeded to circumnavigate the globe in 65 days and published an account of his adventures under the title "How I Broke the Record Round the World" in fourteen instalments in *Pearson's Weekly*

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from June 1894. (Griffith's appetite for such a record-breaking feat was first demonstrated when, after leaving school, he became an apprentice on a Liverpool merchant vessel bound for Melbourne, but deserted his ship upon reaching Australia, and worked in various jobs, before taking to the sea again and travelling the world three times.) [1]

Griffith's work has exercised a considerable influence on modern science fiction, most notably on Michael Moorcock and novels in the 'Steampunk' tradition. Yet, for all his popularity during his lifetime and subsequent influence, Griffith remains an obscure figure in literary studies. Griffith's obscurity in academic circles mirrors his displacement in the latter half of the 1890s by the most famous of all authors of scientific romance, H. G. Wells. (Though ironically, Griffith's commercial success undoubtedly made it easier for Wells to find a niche for his work in a crowded literary marketplace (Moorcock 197).) The demise of Tower publishing and his premature death meant that Griffith's star soon faded altogether from view. His work is long overdue sustained critical attention, and offers fertile ground for scholars working in the field of literature and science. Though he did not possess Wells's formal scientific education, Griffith's work for Pearson undoubtedly made him aware of developments in science and technology. For example, he interviewed the inventor of the machine-gun turned aeronautical investigator Hiram S. Maxim about his experiments with aeroplanes for the August 13 1892 issue of *Pearson's Weekly*. Like Wells, Griffith consistently explores the potential for science to revolutionise human existence while sometimes acknowledging the threat posed to humanity by natural disasters (his short story, "The Great Crellin Comet" (1897) was the first to articulate the idea that human intervention might prevent a comet colliding with the earth and to introduce the notion of a ten-second countdown). Indeed, Griffith's preoccupation with aeronautics – which is particularly evident in *Angel* – reminds us of the need for literature and science to broaden its compass and investigate those sciences (and technologies) that have received little critical attention from scholars working in the field. As well as being Griffith's best work, *Angel* most invites renewed study, not least because it contains a plethora of *fin de siècle* preoccupations, including apocalypse, a hint of millennialism and the promise of regeneration. Central to the story's plot is a young English inventor's discovery of a solution to the problem of aerial navigation. Set in the near future (this 1893 romance commences in 1903), the narrative follows the adventures of the so-called Brotherhood of Freedom, a band of socialist revolutionaries led by the mysterious Natas, as they strive to use a fleet of newly invented airships to end capitalist oppression amid a cataclysmic world war between the Anglo-Teutonic Alliance (Britain, Germany and Austria) and the Franco-Slavonian League (France, Russia and Italy). The protagonist, and inventor of these aerial marvels, Richard Arnold, is especially motivated to accomplish this great deed by his desire to win the hand of Natasha, the angel of the romance's title. Griffith's conception of a secret society emerging to use aeronautical technology to enforce a new world order is undoubtedly original.[2] Yet his portrayal of aerial navigation and world revolution is deeply immersed in aeronautical speculation.

The cultural history of aeronautics – and more especially balloons – is the subject of a number of recent studies (see: Keen; Brant; Holmes). There has, however, been very little work that specifically investigates the relationship between literature and aeronautics. The dominance of Darwinism in discussions of nineteenth-century literature and science has undoubtedly obscured the contemporary importance attached to the emergence of disciplines like aeronautics. Another possible cause of its omission is the perception that aeronautics is a technology rather than a science. In the

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introduction to their collection of essays on *Literature and Technology*, Mark L. Greenberg and Lance Schachterle argue that technology has been neglected in literary studies because, unlike "science" and "art," it is not considered to occupy the realm of "pure knowledge": "The reason for this lack of attention to technology, we think, lies in the Arnoldian identification of technology with craft or skill – learned practices with measured objectives, rather than with the open-ended pursuit of pure knowledge for its own sake, as in science" (15). The OED defines aeronautics as "the science or practice of building or flying aircraft" – it is both a science and a technology and might thus be posited as an ideal discipline of study in terms of breaking down any lingering hint of the hierarchal division identified by Greenberg and Schachterle.

Once subject to ridicule and accusations of irrelevance (particularly in the immediate aftermath of the balloon's invention in 1783), by the late nineteenth century aeronautics was (in the minds of many) poised to revolutionise the world. The possibility of directed flight promised to irrevocably alter transportation. Indeed, some observers insisted that aeronautics was about to supplant railways, and that, for example: "The Londoner of the future will go down to his Business in the City, not in a stuffy compartment of an underground railway train [. . .] but will be wafted rapidly and noiselessly to his destination on the wings of the wind" (Vane, 303). As the passage from Tennyson's "Locksley Hall" cited in the epigraph confirms, aeronautics had long been a key feature of the Victorian preoccupation with the future. (It seems wholly appropriate that the word aeronautics literally means "sailing through the atmosphere," since the analogy between aerial navigation and maritime travel was commonplace during the nineteenth century.) Aeronautics is a persistent feature of late-Victorian speculation on the future of warfare. Indeed, a successful 'flying machine' was regarded as the most important imminent development in warfare, since a nation in exclusive possession of it could impose its will on others – thus marking the beginnings of the now familiar association of 'air superiority' with political influence. At the same time, though, aeronautics was seen as a potential catalyst for global peace, since it was thought that in transcending national territories controlled flight would foster mutual understanding. Indeed, the somewhat utopian hopes attached to aeronautics suggest parallels with the telegraph, another Victorian technology expected to facilitate globalisation and harmony.

What little work specifically investigates the literary response to aeronautics tends to focus on how fiction reflects developments in flight (see: Paris; Goldstein). What is required, however (especially in relation to the late Victorian era), is the emphasis on the reciprocal relationship between literature and science popularised by Gillian Beer. Once examined in the context of aeronautical developments, *Angel* assumes a whole new importance. Indeed, Griffith's scientific romance is the most sustained and influential of all literary engagements with late-nineteenth century aeronautics.[3]

This article examines how *Angel* contributes to discussions about aeronautics conducted in the periodical press and scientific publications more generally. (The importance of the periodicals as a context for understanding Griffith's romance is confirmed by the fact that the romance's protagonist Arnold has published on aerial navigation in the *Nineteenth Century*.) Griffith's depiction of heavier-than-air airships appropriates the principles of experimental heavier-than-air mechanisms like Gustave de Ponton d'Amécourt and Gabrielle de La Landelle's hélice. Griffith also draws on the Scottish naturalist J. Bell Pettigrew's account of the model provided by natural flight and on the aeroplane experiments of Samuel P. Langley and Maxim. The article demonstrates that, rather than merely appropriate the principles demonstrated by the

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aforementioned researchers for verisimilitude, Griffith assesses the merits of different heavier-than-air mechanisms and even suggests the most likely means of accomplishing controlled flight given the constraints of current technology. The analysis further investigates how *Angel* adds to speculation on the potential for controlled flight to revolutionise warfare and instigate radical social and political change. *Angel* modifies the invasion fiction genre established by George Chesney's *The Battle of Dorking* (1871), making aerial technology – or, more specifically, the French-invented war-balloons, a second solution to the problem of aerial navigation envisaged by Griffith – the key innovation enabling an invasion and occupation of southern England. The article relates the romance's depiction of the war-balloons to discussions of the potentially devastating impact of the dirigible on war – and more especially to periodical speculation on the potential for a combination of the navigable balloon and submarine to cripple a nation's coastal defences. The even more destructive capacity of the Brotherhood's airships is informed by Maxim's conjecture on the use of the aeroplane in warfare. The discussion relates Griffith's portrayal of aerial combat between the airships and war-balloons to the influence of Verne's *The Clipper of the Clouds*. Angel continues – and is in fact the culmination of – a nineteenth-century literary tradition in which aeronautical inventions symbolise revolution and the end of tyranny and poverty. The analysis examines how the socialist utopia enforced by Arnold's airships incorporates late-Victorian proposals designed to eradicate both extreme poverty and excessive wealth, specifically schemes for land nationalisation and graduated taxation. Other fictions before *Angel* had explored the potential for a particular nation or group to use 'flying machines' to enforce its political will, notably Tom Greer's *A Modern Daedalus* (1885). Yet – as this discussion shows – Griffith's portrayal of an inherently superior Anglo-Saxon race conflicts with his emphasis on internationalism. *Angel* demonstrates the important role of popular fiction in raising the public consciousness of the potential of aeronautics, thus creating support for funding of aeronautical research. Indeed, as the article reveals, the text implicitly argues that State funding of aeronautical research is imperative if Britain is to maintain its global imperial hegemony and stave off the threat of aerial invasion.

During the so-called 'balloonomania' of the late eighteenth century, numerous attempts were made to steer balloons using paddles or wings. Yet the continued absence of any means of guiding the balloon led to a growing conviction in the second half of the nineteenth century that controlled flight could only be accomplished via a heavier-than-air mechanism. As one article from 1867 put it, "if ever aerial navigation is to assume practical importance, it must be through the agency of some mechanism more manageable and less liable to derangement than an enormous bag filled with a material that has the greatest aptitude for escaping through the minutest pores" ("Flying Machines" 270). The achievement of Henri Giffard and others in constructing dirigibles that returned to their point of origin under favourable conditions meant that proponents of lighter-than-air flight maintained the balloon would prove capable of being steered in normal winds. Heavier-than-air advocates emphasised that neither the balloon nor the buoyancy associated with it had any analogue in nature and that – although light – flying creatures are heavier than the air they displace and control (rather than being controlled by) the wind.

Griffith's depiction of Arnold's airships draws on reports of experimental heavier-than-air mechanisms and research on natural flight. A key moment in the emergence of a sustained late-century preoccupation with heavier-than-air flight occurred in 1863 when the Frenchman Gaspard-**Félix** Tournachon (popularly known

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as Nadar) built a giant balloon, Le Géant, which he exhibited to raise funds for a heavier-than-air mechanism. Nadar was part of a group of heavier-than-air enthusiasts with d'Amécourt and La Landelle. Along with La Landelle, d'Amécourt, who is responsible for the word helicopter, made model hélices (or propellers) which ascended into the air by a rotary mechanism. One of d'Amécourt and La Landelle's models was demonstrated before the Association Polytechnique. According to a report in *Chamber's Journal* from January 1864, "The screw was made to revolve by means of a spring; and so long as the spring retained its tension, the model worked its way up through the air to the roof of the amphitheatre of the medical school" (38) . De Amecourt and La Landelle also made a steam-powered hélice which was photographed by Nadar in 1863. Although there is some disagreement in reports over this model's effectiveness, the blades at the top rotated in opposite directions. The idea of the hélice was incorporated in La Landelle's unrealised idea of the steam powered aeronef. As the illustration suggests (Fig. 1), La Landelle's aeronef uses hélices to ascend perpendicularly and derives its horizontal motion from the aeroplane (there was a recognition that an inclined plane travelling rapidly enough would be supported by the air, with observers making an analogy with the way a kite being pulled quickly along maintains flight because it does not disturb the inertia of the air). If La Landelle's aeronef seems ship-like, then that is because the analogy between aerial navigation and maritime travel was commonplace in the nineteenth century.

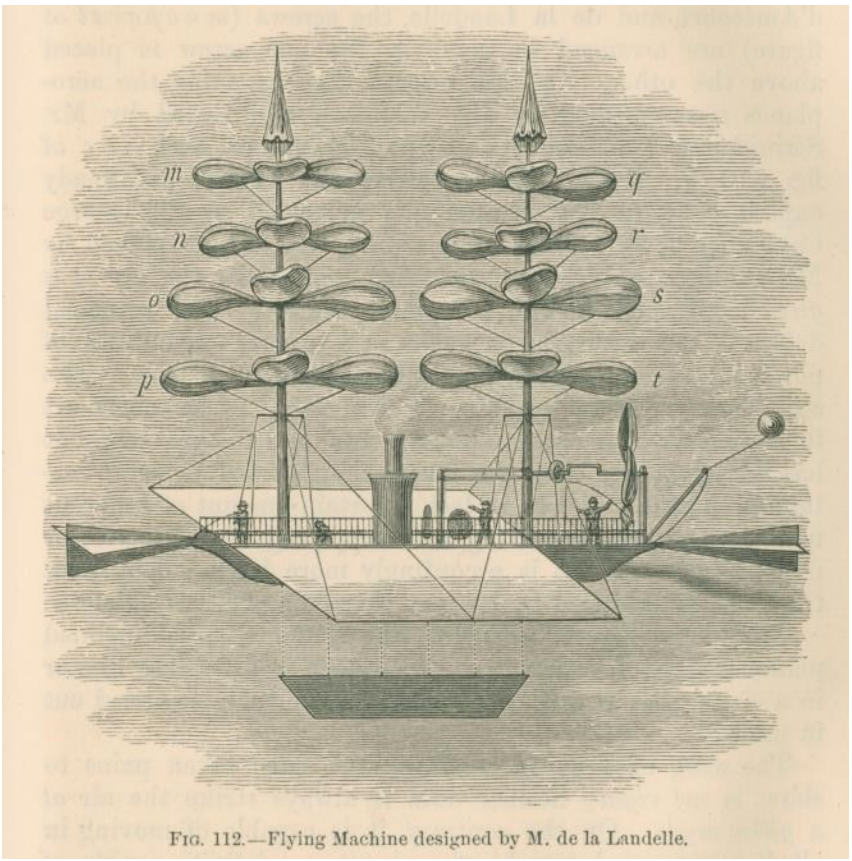

Fig. 1.
La Landelle's Aeronef. Illustration by William Ballingall, from James Bell Pettigrew's *Animal Locomotion*. Image reproduced by kind permission of The Royal Society.

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While aerial navigation was often compared to other forms of transportation, its accomplishment presented an unusual challenge for Victorian engineering. Much progress in Victorian engineering was based on escalating weight, such as making the tonnage of ships greater to allow larger cargos or increasing the size of train engines for improved speeds. The accomplishment of aerial navigation, on the other hand, appeared to necessitate that an efficient heavier-than-air mechanism be as light as possible. The study of natural flight appeared to highlight the necessary characteristics of a successful heavier-than-air flying machine. The combination of lightness and strength secured in the bird's anatomy suggested to a writer in *Cornhill Magazine* "that it is absolutely essential, that the weight of a machine intended for flight should be as small as may be, due regard being had to strength and completeness" (441-42).

Pettigrew conducted an extensive study of natural flight which forms the basis of his book *Animal Locomotion* (1873) and article "Flight Natural and Artificial" (1881), which summarises his conclusions for a periodical readership. Pettigrew points out that natural wings take the form of inclined planes or true kites: "Wings, to be effective as flying organs, must be made to attack or strike the air as inclined planes and as boys' kites" ("Flight Natural" 233). Both the kite and the wing are flown in one of two ways: "either by causing their under, oblique surfaces to move rapidly against still air; or conversely, by causing rapidly moving air currents to strike the under, oblique surfaces of the kite and wing, these being more or less stationary" ("Flight Natural" 233). In the autumnal breeze, "the kite is flown principally by the air in motion playing upon its under, oblique surface" and "[i]t is in this way the albatross is flown by the trade winds of the Southern Ocean" ("Flight Natural" 233). Pettigrew stresses that wings, as highly elastic and mobile structures, are "twisted upon themselves [. . .] to form a helice or screw" (*Animal Locomotion* 136).

Unlike the fixed-angle screws employed in maritime navigation, wings are "made to attack the air at a great variety of angles" (*Animal Locomotion* 153). The sheer flexibility and movability of the portions of the wing explain its capacity to seize and utilise air currents: "The wing literally creates the whirlwind on which it rises and progresses, and on which it may be said to ride triumphantly" ("Flight Natural" 234). Pettigrew observes that: "When a bird wishes to fly in a horizontal direction, it causes the under surface of its wings to make a slight *forward* [upward] angle with the horizon. When it wishes to ascend, the angle is increased" (*Animal Locomotion* 202). He notes that "something like 30˚ with the horizon [. . .] is the greatest angle made by the wing in flight" (*Animal Locomotion* 177). Pettigrew criticises those aeronautical contraptions that do not embody the principles apparent in nature. Hence, the principle defect of d'Amecort and La Landelle's hélices is that they "are *rigid or unyielding*, and strike the air *at a given angle*" (*Animal Locomotion* 218) – a defect which also characterises the aeroplane designed by William Henson and John Stringfellow. For Pettigrew, the hélice at least possesses the advantage that it, "and the machine to be elevated by it, can be set in motion without any preliminary run" and has "a certain amount of inherent motion, its screws revolving, and supplying it with active or moving surfaces" (*Animal Locomotion* 218). The aeroplane, on the other hand, "must be precipitated from a height or driven along the surface of the land or water at a high speed to supply it with initial velocity" (*Animal Locomotion* 214) and is entirely immobile. Indeed, Pettigrew concludes that the artificial kite is a closer approximation of natural flight than the aeroplane, given its flexibility and the fact the "inclined plane formed by its body strikes the air at various angles – the angles varying according to the length of string, strength of breeze, length

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and weight of tail, etc" (*Animal Locomotion* 214). Pettigrew advocates elastic wings or screws that replicate the flexibility and mobility of natural wings.

Notwithstanding Pettigrew's objections, Samuel Pierpont Langley and Maxim began their widely publicised aeroplane experiments in the late 1880s. In "The Possibility of Mechanical Flight" (1891), Langley reports how his experiments with small sheets of metal shaped as inclined planes attached to a whirling arm provide experimental verification of the capacity of the air to sustain at great speeds "bodies thousands of times heavier than the air itself" (783).[4] Indeed, the "air can be made to offer support like an elastic semi-solid" to a plane "moving fast enough on it" (785). Langley conveys a somewhat surprising conclusion which applies to a plane in horizontal flight: "the more the speed is increased the less will be the power required to support and advance it, so that there will be an increasing economy of power with each higher speed, up to some remote limit not yet attained in experiment" (785). Langley is careful to stress that he is not attempting to describe the details of a particular flying-machine, nor is his intention to teach how to steer a horizontal course or descend in safety. However, he is certain the principles "here established for small machines will hold for indefinitely larger ones [. . .] at any rate far enough to enable us to transport, at speeds which make us practically independent of the wind, weights much greater than that of a man"(785). Maxim conducted similar experiments with larger planes and, like Langley, he is confident "that we are within measurable distance of a successful machine for navigating the air" (836).

The potential for navigating the air demonstrated by mechanisms like the hélice and the aeronef (as well as the kite) led to a consensus that heavier-than-air flight would be accomplished as soon as a sufficiently light yet powerful engine was invented. Maxim identifies the absence of an adequate engine as the principal obstruction to the invention of a successful aeroplane: "The reason why all experimenters with aeroplanes have thus far failed, has been because the motors employed to drive them were vastly too heavy in proportion to their weight" ("Progress" 447). Maxim considered the merits of various types of motor including an electrical one, before concluding a modified steam-engine presented the safest means of powering his proposed aeroplane. In 1891 he began construction of an enormous test aeroplane which was designed to run along rails in order to generate the momentum for flight. Maxim's aeroplane was constrained by an overhead rail designed to prevent it from soaring above the test rig.

Given the consensus that heavier-than-air flight would be accomplished as soon as an adequately light and powerful engine was developed, it is unsurprising that the breakthrough in Arnold's arduous struggle to solve the problem of aerial navigation occurs when he at last discovers "the true motive power" (3). In order to make Arnold's discovery of a means of propelling a heavier-than-air airship seem plausible, Griffith makes intelligent use of Maxim's recognition of the need for a lighter engine. Griffith identifies the same hindrance to early attempts to accomplish heavier-than-air flight: "Like every other inventor who had grappled with the problem, he [Arnold] had found himself constantly faced with that fatal ratio of weight to power" (3). Having been informed that previous attempts to attain heavier-than-air flight failed because the motors employed were vastly too heavy, the reader is more inclined to accept that Arnold's lighter engine (which does away with "all the ponderous apparatus of steam and electricity" (3)) succeeds. Griffith evades the empirical need to explain the secret of his protagonist's motive power by having Arnold refuse to disclose the composition of the two gases that fuel his invention.

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As Arnold makes explicit, his airship combines the principles "of the aeronef and the aeroplane" (42). Arnold refers to how the aeronef "reached its highest development in Jules Verne's imaginary 'Clipper of the Clouds'" (42). Influenced by Robur's helicopterial *Albatross,* Arnold's mechanisms ascend by utilising the principles demonstrated by *d'Amécourt and La Landelle.* Similar to d'Amécourt and La Landelle, Arnold exhibits a model of his invention before an expectant audience (the executive of the Brotherhood). Like d'Amécourt and La Landelle's hélice, Arnold's model rises toward the roof. Whereas d'Amécourt's hélice fell to the ground once the energy conveyed to it by the spring had exhausted, however, Arnold's model strains "hard at the piece of cord which prevented it from reaching the roof" (43), because it is supplied with a constant motive power. The screws Arnold employs are revealingly termed "helices," with "the centre one revolving in an opposite direction to the other two" (43), recalling the counter-rotating blades of d'Amécourt and La Landelle's model. With the three hélices on its masts "lift[ing] the dead weight of the ship perpendicularly" and the side-planes "used to regulate the vessel's flight when afloat" (42), Arnold's model (and the fleet of airships based on it) is highly reminiscent of La Landelle's aeronef (Fig. 2).

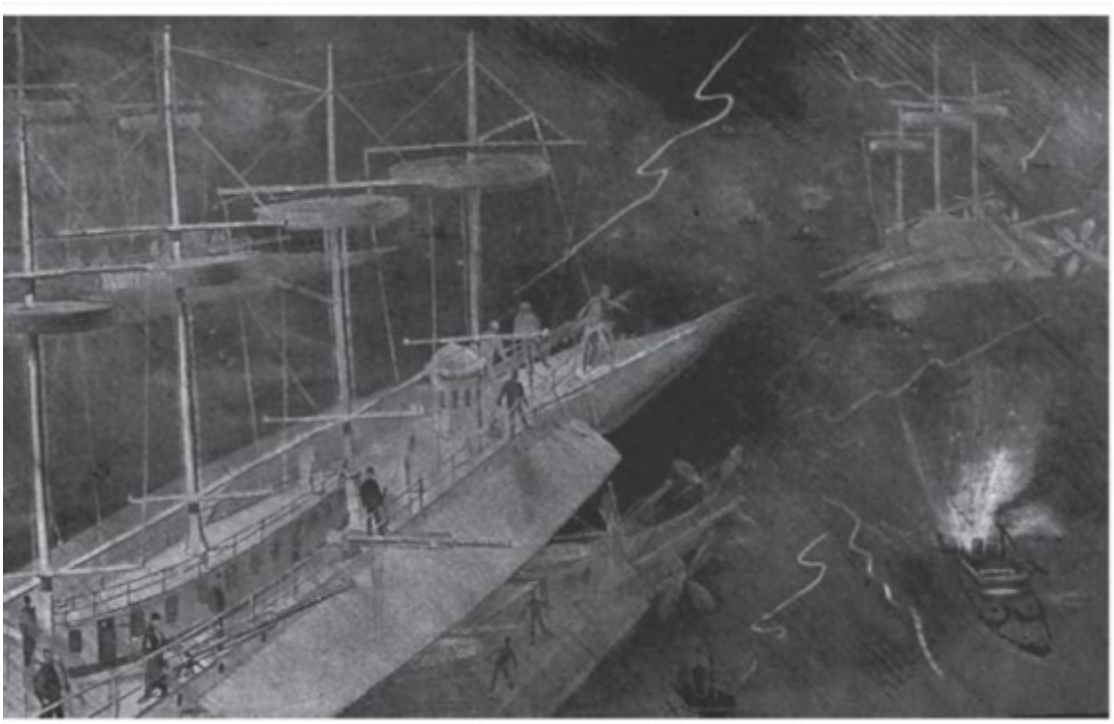

Fig. 2.
Griffith's Heavier-than-air Airship. Original illustration for *The Angel of the Revolution* by Fred T. Jane. Image taken from the Victorian Secrets edition of *The Angel of the Revolution*, ed. by Steven McLean, and reproduced by kind permission of Victorian Secrets.

Yet while La Landelle refers to a general notion of the aeroplane, Griffith draws specifically on Langley and Maxim's accounts to create verisimilitude for his depiction of side-planes. Langley's notion that the air can made to offer support like a

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semi-elastic solid is explicitly recalled in the description of the first airship, the *Ariel*, as gliding "through the elastic medium in which she floated" (76). During the maiden voyage of the *Ariel*, Arnold remarks that "The paradox of aerial navigation is 'the greater the speed, the less the resistance'" (71) - thus reiterating Langley's conclusion that aeroplanes would be more economical to power at higher velocities.

Like the aeroplanes envisaged by Langley and Maxim, Arnold's airships are (largely) independent of the wind. Indeed, the key confirmation that Arnold has been triumphant in his lifelong pursuit of heavier-than-air flight is provided when his model overcomes a strong breeze entering through the window: "In almost agonised suspense he watched it rise from the floor, float motionless for a moment, and then slowly forge ahead in the teeth of the wind, gathering speed as it went" (4). Griffith's decision to combine the aeroplane with the aeronef – rather than solely employing an aeroplane like Maxim – is explained by the fact that Maxim does not suggest any practical means of ascending and descending (Langley of course emphasises that he does not propose to resolve these difficulties). Indeed, Griffith has Arnold explicitly emphasise the impracticality inherent in Maxim's reliance on a rail for his aeroplane to ascend initially: "'You cannot carry a rail-way about with you, or a station to get a start from every time you want to rise'" (42). By emphasising how the usefulness of Maxim's contraption is negated by the need for it to gather momentum for flight by running along a rail, Griffith is reiterating Pettigrew's observation that a significant disadvantage of the aeroplane is the need to supply it with initial velocity on the ground. Like Pettigrew, Griffith identifies an advantage in the way the hélice can ascend without any preliminary run - a benefit that enables the *Ariel* to remain ready "to rise into the air *at a moment's notice* [emphasis added]" (85) during the hazardous rescue of Natasha from Russia.

Griffith's portrayal of Arnold's airships draws directly on Pettigrew's account of natural flight. Similar to the bird's wing as described by Pettigrew, the *Ariel* is said to ride triumphantly on "the current created by the vessel herself when flying through the air" (73). It would seem, though, that Griffith refers to the *Ariel* creating its own air currents solely as a matter of creating verisimilitude, since the vessel's side-planes are "as rigid as a plate of solid steel" (41) and thus lack the plasticity that Pettigrew identifies as crucial to the natural wing's capacity to seize and utilise the wind. (The rigid aeroplanes of Arnold's model weigh only "a few ounces" each but are "strengthened by means of wire braces" (41), thus substantiating the *Cornhill's* observation that a machine intended for flight should be as light as possible, without compromising strength or completeness. Arnold is able to further economise weight and space when building the full-size airships.) While Griffith's airships employ the type of rigid screws and planes Pettigrew objects to on the basis that they deviate from the principles apparent in nature, he concurs with the naturalist's insistence that the wings of an aeronautical mechanism must attack the air at different angles after the manner of the kite and the bird. Hence, Arnold's air-planes work "on an axis amidships" and can "be inclined either way through an angle of thirty degrees" (41) - a maximum that was undoubtedly determined by Pettigrew's observation that thirty degrees with the horizon is the greatest angle made by the bird's wing in flight. Just as the bird increases the angle the underside of its wing makes with the horizon when it wishes to ascend, so Arnold inclines "the planes to their utmost" (122) when he wants the *Ariel* to gain altitude as rapidly as possible. Griffith's description of the *Ariel* flying "over level plains fifty yards from the ground, like an albatross over the surface of a smooth tropic sea" (108) explicitly recalls Pettigrew's observation that this large bird is flown (kite-like) by the trade winds of the Southern Ocean.

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Arnold's airships are steered "by a wheel, like the rudder of a sea-going vessel" (43). Griffith makes use of the longstanding analogy between aircraft and sea-faring vessels. Like La Landelle's aeronef, Arnold's invention is highly reminiscent of a sailing ship (as the illustrations contributed to Griffith's romance by Fred T. Jane make clear). Indeed, the *Ariel* is explicitly compared to a ship in port:

> In this lay, like a ship in a graving-dock, a long, narrow, grey-painted vessel exactly like a sea-going ship, save for the fact she had no funnel, and that her three masts, instead of yards, each carried a horizontal fan-wheel. (72)

Survivors of the assault on the Kronstadt fortress describe this first airship "as looking more like a flying torpedo-boat than anything else" (98). Like a sea-going ship, the *Ariel*'s deck comprises "a sort of little conning tower forward, a wheel-house aft, and a deck saloon amidships" (73). The Brotherhood's fleet of airships is organised along the lines of a conventional navy, employing a series of signals and with Arnold appointed admiral of the air. Griffith even refers to this aerial armada as "A Navy of the Future" in one particular chapter heading (undoubtedly inspired by Tennyson's reference to futuristic "airy navies" in "Locksley Hall" (1842)).[5]

That the Brotherhood – rather than the British government or some wealthy patriot – provides Arnold with the means to construct his aerial navy reflects contemporary anxieties about the funding of aeronautics in the United Kingdom.[6] Griffith uses his romance to support the contention of many writers that British aeronautical researchers are not adequately financed. One such writer is Fred W. Brearey, who, writing in 1876, concludes that "earnest workers" seeking "the solution of the profoundest problem which ever absorbed the brain-power of aspiring man [aerial navigation] should be encouraged by the wealthy to go on and progress in Aeronautics" (374). Famous balloonist Henry Coxwell applauds the generosity of the French toward aeronautical research before confronting the relative paucity he and other aeronauts experience in Britain: "As 'a nation of shopkeepers,' not particularly patronised in matters of research, we, in Great Britain, have had to struggle on under disadvantages, and need not be ashamed of the risks encountered and the results obtained" (534). Maxim similarly notes that the French State has endowed aeronautical experiments and hints that the British government should follow suit: "Such experiments are too expensive to be conducted for any considerable time by private individuals" ("Progress" 448).

There is an acknowledgement that the contraptions proposed by researchers themselves have sometimes added to the public ridicule of aeronautics and made it less likely the science will attract funding. Thus Andrew T. Sibbald notes how: "Over and over again the most absurd contrivances have been represented as sure to achieve success" (297). Sibbald continues by mocking the promises made by the inventors of these absurd contrivances: "A little more money was the only thing required; and, if a sympathising public would only find the funds, blundering enthusiasts promised, and believed, that they would fly like jackdaws from the neighbouring steeple, or soar like eagles far above the haunts of men" (297). As if to counter the perception of the blundering enthusiast toying haphazardly with the problem of flight, Pettigrew emphasises that aeronautics is now "being grappled with in earnest by men of the highest scientific attainments" ("Flight Natural" 239). He points to the establishment of The Aeronautical Society in Britain (founded in 1866) and equivalent organisations in other countries as proof of the serious consideration now being given to the science. Undoubtedly intending to generate public sympathy for the funding of aeronautics,

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Pettigrew remarks that while the idea of aerial navigation might appear "[u]topian to the great mass of mankind [. . .] [t]here is nothing supernatural about it. It is simply a very complex physical problem" ("Flight Natural" 246). Indeed, Pettigrew insists that "there is no more difficult or important problem before the world at present" than the subject of artificial flight ("Flight Natural" 239).

The severe deprivation Arnold has to endure in order to conduct his initial research acutely emphasises the scarcity of funding for aeronautics in Britain. Having "devoted himself, soul and body [. . .] to the so far unsolved problem of aerial navigation" (1) for nearly six years, Arnold is precisely the type of "earnest worker" who Brearey insists should be encouraged by the wealthy to go on and progress in aeronautics. Yet the only reward the protagonist's dedication to the fulfilment of his life's ambition receives from British society is poverty and isolation. Indeed, the sole reason Arnold was able to conduct research on aerial navigation is that "he had inherited a couple of thousand pounds" from his father (2). That Arnold's "money melted away in costly experiments" substantiates Maxim's point that aeronautical trials are too expensive for private individuals to conduct for any length of time (3). Arnold's early hardship is an extreme instance of the struggle with fate that Coxwell says all aeronautical researchers in Britain experience given the lack of funding. Griffith emphasises how in order to continue his research Arnold has had little choice but to clothe and lodge himself meanly and to deny "himself everything but the barest essentials of life" (3). The effects of his long struggle are apparent in the romance's opening paragraph, where Arnold is introduced as "a pale, haggard, half-starved looking young fellow [living] in a dingy, comfortless room on the top floor of a South London tenement-house" (1). That the protagonist has been able to discover a solution to the problem of aerial navigation while living "for days on bread and cheese" substantiates Coxwell's claim that British researchers have been able to achieve significant results in the midst of severe disadvantage (3). The paucity of funding for aeronautics in Britain becomes bluntly apparent as, needing thousands of pounds to realise his invention and about to be evicted, Arnold has nowhere to turn for support. Despite Pettigrew's claim that the establishment of The Aeronautical Society confirms the problem of flight is being treated seriously, there is no indication that Griffith's protagonist is able to approach this or any other organisation for assistance. More pointedly, the only answer to his cry of despair at having finally triumphed in his life's research merely to be confronted by the prospect of "be[ing] turned into the street"– "'God help me? What *am* I to do?'"– is "'the silence of the room and the inarticulate murmur'" coming from the pavement below (4-5).

Griffith hints that the type of prejudice towards aeronautics Sibbald attributes to absurd proposals for flying machines compounds Arnold's desperate situation. That Arnold fears he could "starve to death before he could persuade any one that there was money" (5) in his invention suggests the failed schemes of "blundering enthusiasts" have made it immensely difficult for serious researchers to appeal for funding. Following Pettigrew, Griffith seeks to redress public misconceptions about aeronautics by emphasising the paramount importance of the subject of artificial flight, even calling Arnold's solution to this problem "the greatest triumph in the history of human discovery" (106). The hallmarks of Pettigrew's attempt to create public sympathy for funding aeronautics by emphasising how flight is a complex (though solvable) physical problem rather than a mysterious supernatural occurrence is distinctly apparent as Arnold refutes the suggestion his invention is a "miracle": "'It is no miracle, but only the logical result of thought and work'" (58), he says. Griffith encourages public support for endowment of aeronautics by creating sympathy for

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Arnold's plight. Thus despite being on the verge of destitution, Arnold is sustained by a "heroic resolution" (5). Later, Colston praises this "'hero of science'" for choosing to live in squalor to pursue his dream rather than "'grow fat on the loaves and fishes of conventionality'" (43). The author stresses how the ingenuity of the protagonist's invention compares favourably to that of other futuristic innovations portrayed in the romance, like the huge tidal-powered "electric suns" that illuminate the Embankment from Westminster to Blackfriars at night: "He was the maker and possessor of a far greater marvel than anything that helped to make up this splendid scene, and yet the ragged tramps [. . .] were hardly poorer than he was" (9). The implication of this comparison is that, rather than Arnold hurtling toward destitution, his invention should be State funded (or at least supported by benevolent investors for the national benefit) as *Angel*'s electric lights on the Thames appear to have been. Griffith warns that Britain's continued failure to provide substantial funding for aeronautics could lead to inventions like Arnold's being lost to the world, or, more worryingly, poached by an international rival – a possibility suggested by the Tsar's offer of a million sterling for a craft capable of navigating the air in the manner of a ship at sea. Britain's failure to back the protagonist's invention leaves it at the mercy of a potentially hostile power (the Brotherhood's true intentions remain a mystery to the outside world for much of the narrative – indeed the fact they are known as the "Terrorists" pre-empts more recent disputes about the status of armed revolutionaries) and deprives it of an opportunity to enforce global hegemony through control of the sky.

Aeronautics is an integral aspect of the late-Victorian preoccupation with the future of warfare. Indeed, many thought the accomplishment of controlled flight would prove the key innovation in the warfare of the near future. *Angel* is substantially engaged with speculation on the potential impact of aeronautics on war and exemplifies the importance of fiction in imagining the horrors of aerial bombardment. Griffith remarks that Arnold's success in solving the problem of aerial navigation makes "the Brotherhood lords of a realm as wide as the atmospheric ocean that encircles the globe" (44). To readers of the periodical press in particular, this statement would not seem hyperbolic. Indeed, one article from 1886 speculates that a mechanism capable of controlled flight will be "lord of the air" and thus "lord of both the grosser and lower elements, earth and water" ("Aerial Navigation" 455). The Brotherhood does not intend to use its vast arsenal and millions of members around the world to prevent the outbreak of war. Indeed, it provokes the outbreak of war, because a cataclysmic clash between the forces of European militarism will facilitate the Brotherhood's plan to destroy the very fabric of existing civilisation before it emerges with Arnold's invention to reorganise the world in favour of the oppressed multitudes.

In the absence of the airships, it is the second solution to aerial navigation depicted by Griffith, the French and Russian war-balloons, that determine the course of the war. The cigar-shaped war-balloons recall William Pole's observation that the dirigible must be elongated and ship-like if it is to travel through the air (Pole). The idea that balloons might be used to drop explosives on enemy lines had been widely mooted and even tried (unsuccessfully) by Austria in 1849. *Blackwoods Edinburgh Magazine*'s 1886 article on "Aerial Navigation" mentions the devastating possibilities associated with the dirigible balloon in this respect. It is precisely by dropping dynamite and combustibles into enemy lines that the war-balloons turn battles on the European continent into "butcheries" (191), allowing the Franco-Slavonian armies to march triumphantly across Europe, until only the "silver streak" stands between

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Britain and certain invasion. The complacent belief that the war-balloons are unable to lead an assault across the English Channel because "'their effective range of operations is confined to the land'" (186)) further underlines the need for Britain to take aeronautics (and the threat of aerial invasion) seriously.

Griffith modifies the invasion fiction genre popularised by Chesney's *The Battle of Dorking*, making aerial technology the key innovation in the invasion and occupation of Britain. Whereas Chesney's antagonists use vaguely described "fatal engines" (13) to sink the Royal Navy, two specific technological innovations enable the Franco-Slavonian league to disable British coastal defences: the submarine and the war-balloon. The combined destructiveness of the submarine and the dirigible had already been conjectured in the aforementioned *Blackwoods* article, where the author states that:

> There is a weirdness in the methods of attack, both of the submarine boat and of the balloon waging war from out of heaven, which almost shocks the imagination. The former approaches her foe, invisible, possibly at a depth of 50 feet below the surface of the water, until within range for the deadly Whitehead torpedo wherewith she is armed – and after firing which she invisibly retires – while ironclads, mercantile shipping, arsenals, fortifications, and every architectural structure, all will be at the mercy of the aerial monster sailing high out of the reach of harm, and at night invisible, like the Angel of destruction over them. (454)

The assault on the English coast in *Angel* demonstrates the terrible combined effectiveness of the methods highlighted in this passage. It begins with the war-balloons stationing themselves over fortifications and raining down explosives upon their helpless adversaries. With night fast approaching, the submarines of the French navy join the attack. Sinking to about 20 feet, rather than the fifty estimated by *Blackwoods*, these "insignificant looking craft" are equipped with searchlights which enable "them to find the hulls of hostile ships in the dark" (298). Like those described by *Blackwoods*, the French submarines retreat after they launch their torpedoes, "head[ing] away at full speed in an opposite direction out of the area of the explosion" (299).[7] The notion that ironclads will be at the mercy of dirigibles is substantiated as the war-balloons "soon [. . .] take their part in the work of destruction and death" at sea (299). Griffith introduces an interesting innovation: angled mirrors which enable the crew of the war-balloons to drop dynamite on the most vulnerable part of a ship with deadly precision. That the submarines and dirigibles continue the work of destruction into the night is emphasised as the last warship protecting the British coast is sunk before dawn.[8]

There is considerable overlap between the projected capabilities of heavier-than-air and lighter-than-air mechanisms. Indeed, Maxim's assessment of the likely application of the aeroplane to warfare reveals marked similarities to *Blackwood's* appraisal of the impact the dirigible will inevitably have on armed conflict:

> When the first flying-machine succeeds, its first great use will be for military purposes. It will at once become an engine of war, not only to reconnoitre the enemy's positions, as has been attempted with the so-called dirigible balloons, but also for carrying and dropping into the enemy's lines and country large bombs charged with high explosives. It does not require a prophet to foresee that successful machines of this character would at once

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> make it possible for a nation possessing them to paralyse completely an enemy by destroying in a few hours the important bridges, armouries, arsenals, gas and water works, railway stations, public buildings, etc., and that all the modern means of defence both by land and sea, which have cost untold millions, would at once be rendered worthless. ("Aerial Navigation" 836)

Given that a perfected dirigible and the aeroplane were both expected to dominate warfare in near identical ways, it is perhaps unsurprising that the invading war-balloons have the same decisive impact on warfare Maxim envisaged for the aeroplane. As well as carrying out aerial reconnaissance, the effectiveness of these highly advanced dirigibles for dropping explosives into enemy lines is emphasised as they reduce "the magnificently disciplined and equipped armies of Germany and Austria [. . .] into fragmentary and isolated army corps" (192) – a tactic repeated when the war-balloons rain death on the valiant defenders of London. The capacity of the war-balloons to paralyse an enemy is emphasised by the fact that "[t]he havoc wrought by the bombardment on the public buildings of the great city had been terrible" (323). The control over indigenous infrastructure that the war-balloons grant the invaders is revealed when "[a] chain of war-balloons between Barking and Shooter's Hill closed the Thames" (303).

While the war-balloons possess a deadly effectiveness, the airships are the real "angels of destruction" in the romance. There are indications that *Angel* continues the longstanding fascination with the potential of aeronautics to revolutionise transportation, with the airships able to cross "'oceans and continents in a few hours'" (189); Colston is at first incredulous when he learns he is to travel at 120 miles an hour aboard the *Ariel*, while the Russian who assists in Natasha's rescue initially refuses to believe that Colston has arrived from London in little more than a day. For the most part, though, the airships substantiate Maxim's contention that the first great use of the heavier-than-air flying machine will be for military purposes. Maxim's assertion that "[b]ig ships armed with big guns will not be able to protect themselves, much less the country they belong to, from attack" ("Progress" 449) is recalled as Arnold predicts no "'fleet could exist for twelve hours with two or three'" airships "'hovering above it'" (24). Whereas the war-balloons cripple warships, the airships annihilate an entire squadron of them in a mere instant.

Griffith's depiction of the battles between the airships and the war-balloons is informed by heavier-than-air advocate Verne's *The Clipper of the Clouds*. The portrayal of the world's first aerial battle in Chapter 28, "A Skirmish in the Clouds," reveals the influence of a passage of Verne's novel in which Robur demonstrates the superiority of his airship, the *Albatross*, to the *Go Ahead* and all other lighter-than-air contrivances. In Verne's novel, the *Go Ahead* seeks to evade the *Albatross* by travelling in a vertical direction, "seeking a zone where she could not perhaps be reached" (230). Similarly, in Griffith's romance, the one advantage the war-balloons have over the airships is the ability to rise to a greater height. The way in which Colston is able to extract a prisoner by hovering alongside a Russian war-balloon recalls Robur's success in forcibly rescuing Uncle Prudent and Phil Evans by descending next to the helpless aerostat after its envelope has burst. In *The Clipper of the Clouds*, the likening of aeronef hunting the aerostat to "the swordfish and the whale" suggests the potential for the *Albatross* to pierce the gas envelope of the much larger *Go Ahead* (230). In *Angel*, this potential is fulfilled as the incomparably speedy airships ram the gas-holders of their slow and cumbersome adversaries (Fig. 3).

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Fig. 3.
Heavier-than-air Superiority. Original illustration for *The Angel of the Revolution* by Fred T. Jane. Image taken from the Victorian Secrets edition of *The Angel of the Revolution*, ed. by Steven McLean, and reproduced by kind permission of Victorian Secrets.

Of course, the crucial role the war-balloons play in the Franco-Slavonian conquest of Europe confirms that Griffith is not as sceptical about the potential of lighter-than-air contrivances as Verne. Rather, Griffith's position is encapsulated in Arnold's remark that the Tsar is "'a good deal too cock-sure about these old gas-bags of his, and it's time to give him a lesson in real aerial warfare'" (209-10): the dirigible of the near future will be an efficient engine of destruction, but will dominate warfare only in the absence of a comparable heavier-than-air mechanism. There is a significant difference between the Brotherhood and the Franco-Slavonian league in terms of the ethics governing the use of aeronautical mechanisms. There were hints of a consensus that balloons and other aerial contraptions should not be used to bombard civilians. Despite the enormous power of its aerial fleet, the Brotherhood is especially careful not to blow "'perfectly innocent people to pieces'" (80), reserving its wrath instead for the aggressively expansionist French and Russian armies. The Franco-Slavonian League, on the other hand, intentionally uses dirigibles to bombard civilians, as Natas reminds Tremayne: "'You read this morning in the *Times* how one of the Russian war-balloons went the night before last and hung in the darkness over a sleeping town on the Austrian frontier, and dropped dynamite shells upon it, killing and maiming hundreds who had no personal quarrel with Russia'" (144). In a chapter excised from the final version, "The Fall of Berlin," the danger of exposing "the inhabitants of Berlin to the horrors of an aerial bombardment, and the city to probable destruction" prompts the surrender of the German Empire to Russia (*Angel*, 2012

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415). During the invasion of southern England, the war-balloons set houses and entire towns ablaze. Interestingly, Griffith stresses how the use of (what would now be called) anti-aircraft fire in Dover "was even more disastrous to the town than it was to its assailants" (297). For the remains of the four war-balloons whose envelopes are pierced by fire from Maxim and Nordenfelt guns plunge downwards, detonating their cargo as they strike the earth causing "frightful explosions" which spread death and destruction across Dover: "The emmensite and dynamite tore whole streets of houses to fragments, and hurled them far and wide into the air, to fall back again on other parts of the town, and at the same time the fire-shells ignited, and set the ruins blazing like so many furnaces" (297).

Contemporary reviewers thought the relentless detail Griffith employs in his depiction of warfare excessive. The *Dundee Courier* commented: "The descriptions of the annihilation of towns and nations gets a trifle wearisome, and the extravagance of these detracts from the value of the story" (6). The *Saturday Review*, which roundly condemned *Angel*, declared: "We are sick of reading about blood – and still more sick of Mr. George Griffith – long before we have got near the end" (151). Yet Griffith's purpose in providing such descriptions is to emphasise the destructiveness and futility of war. Griffith's anti-war message is eloquently articulated in a passage that describes the aftermath of a major continental engagement:

> As the sun rose and shed its midsummer splendour, as if in sublime mockery, over the scene of suffering and desolation, hideous features of the landscape were brought into stronger and more horrifying relief; the scorched and trampled fields were seen to be strewn with unburied corpses of men and horses, and ploughed up with cannon shot and torn into great irregular gashes by shells that had buried themselves in the earth and then exploded. (217)

For Griffith, the horrors of armed conflict must be realised before lasting peace can be attained. *Angel* was influenced by Bellamy's *Looking Backward*, which recounts the oppression fostered by outwardly Christian society and the transition to socialist co-operation. In *Angel*, the passage from oppressive competition to co-operation cannot be smooth. The social Darwinist "jungle must be cleared" forcibly before the promise of regeneration is realised (145). (Revealingly, the revolutionaries base themselves in Aeria, a utopian paradise untouched by the "struggle for existence.") The romance's Apocalypse has definite religious connotations. As Stableford notes (46), Natas is something of a reversed Satan: an avenging angel directing his wrath at those responsible for creating oppression and poverty through their own luxuriance. The vision of an avenging angel is suggested more explicitly by Natasha's christening the Terrorist flagship "the *Ithuriel*, after the angel who was sent to seek out and confound the Powers of Darkness in that terrific conflict between the upper and nether worlds" (133). Natas remarks that even Britain, the "'Mother of Nations [. . .] must pass through the fire'" (147) – suggesting that humanity must be cleansed through a form of purgatory.

With French and Russian forces on British soil, the newly-founded Anglo-Saxon Federation (or International) – formed in North America after the Ring of Capitalists at the centre of the United States government is exposed[9] – launches a counter-invasion of Britain. Tellingly, the romance's "Armageddon" is precipitated by an aerial signal, as the *Ithuriel* flashes a blood-red light over Edinburgh, Glasgow and towns in northern England to inform adherents of the Brotherhood to descend on

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London by train now the hour of the revolution is at hand. (Appropriately enough, the signal is operated by Natasha, the angel of the revolution herself.) The airships initiate and lead the assault on the invaders as Griffith imagines the disturbing possibilities associated with virtually unstoppable heavier-than-air mechanisms. Like other aeronautical fictions of the long nineteenth century, *Angel* emphasises the natural beauty apparent from the sky and the insignificance of human activity when seen from an aerial perspective, such as the instance where innumerable crowds of people are likened to "tiny ants upon the ground" (202-03). Yet Griffith also cleverly emphasises the apparent insignificance of hitherto unimaginably destructive aeronautical mechanisms viewed from the ground, underlined by the fact that none in the Russian camp notices the "twelve little points of shining light hanging high in [the] air over the batteries of the besiegers" (328). Almost instantaneously, however, the significance of these "little points of light" becomes forcefully apparent as the airships flit "hither and thither wherever a battery got into action, and destroyed it before the second round had been fired" (328). Along with the airships, the war-balloons commandeered by the International play an important role in establishing aerial supremacy. Walpole's half-facetious prophecy that there will be fights in the air with bows and arrows assumes a serious aspect in Griffith's identification of these archaic instruments as "the strangest weapons that had yet been used in the war" (340). The effectiveness of the "curious anachronism" that is the bow and arrow "amidst the elaborate machinery of destruction evolved by the science of the twentieth century" (340) is highlighted as the occupants of the war-balloons piloted by the members of the International discharge a barrage of arrows at the gas-holders of those still occupied by the invaders:

> Considering the apparent insignificance of the means employed, the effects were absolutely miraculous. The explosion of the fulminate on striking either the hard cordage of the net or one of the steel ribs used to give the gasholder rigidity, broke the two tubes full of liquid. Then came another far more violent explosion, which tore great rents in the envelope. The imprisoned gas rushed out in torrents, and the crippled balloons began to sink, at first slowly, and then more and more rapidly, till the cars, weighted with crews, machinery, and explosives, struck the earth with a crash, and exploded, like so many huge shells, amidst the dense columns of the advancing army corps. (340-41)

The full horror of direct aerial bombardment is distinctly evident as Arnold uses a new fire-shell to rain death on his adversaries:

> Wherever one fell a blaze of intense light shone for an instant upon the earth. Then this burst into a thousand fragments, which leapt into the air and spread themselves far and wide in all directions, burning with inextinguishable fury for several minutes, and driving men and horses mad with agony and terror. (335)

Under such an intense aerial barrage and with Federation troops closing in, the Russian army is completely annihilated. (The dominance of the airships over other, earth-based, new technologies is emphasised when the *Ithuriel* destroys a detachment of French submarines with casual ease.) The danger posed by Arnold's airships is not restricted to the rank and file. Maxim's assertion that the aeroplane will make warfare

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"quite as dangerous and disagreeable to the rulers themselves as to the common soldier" ("Progress" 449) is recalled as Generals le Gallifet and Cosensz hold a council of war aware that "[e]ven the building in which the council was being held might be shattered to fragments at any moment by a discharge of their [the airships'] irresistible artillery" (347). Griffith emphasises his conviction that the next war will end war by making even leaders of nations denounce mechanised conflict. Maxim's belief that war will cease "when all the great nations find out how to fly successfully" (449) is invoked as General le Gallifet renounces warfare: "'I have seen enough of modern war, or, as I should rather call it, murder by machinery, for such it only is now. They spoke truly who prophesied that the solution of the problem of aerial navigation would make war impossible'" (370).

The conspicuous part Arnold plays in the world revolution enables him to attain his "heart's desire" and marry Natasha (384). Barbara Arnett Melchiori points out that *Angel* is "a variant of the chivalric quest motif of the medieval romance" (140). The protagonist of the medieval romance undertakes an extraordinary quest. The knight's love for his lady is an important aspect of medieval romance, and the hero's triumph benefits his race. Arnold, as "the central hope of the revolution" (53), is the pivotal figure in the Brotherhood's quest for peace. His duty towards the Brotherhood is inextricably bound with his love for Natasha, a peerless beauty who can be won only by "great deeds" (53). Arnold is able to accomplish such deeds because he is "armed with almost supernatural powers" (55) (traces of the magical and supernatural elements found in the medieval romance are apparent in the description of the *Aeriel* as a flying demon and in Colston's feeling that "he had been suddenly transported into fairyland" after stepping onto its deck (76)). He is then able to claim his right to marry Natasha. Arnold's deeds benefit his nation and race, and are crucial to establishing an Anglo-Saxon world federation.

One problem Griffith creates for himself in the establishment of a global federation is that he assumes its leaders will not abuse their power. As Melchiori points out, internationalism is another problem for Griffith, since "[i]n theory he accepts it, but in practice he is very strongly pro-British" (142). Griffith's internationalism is emphasised as Arnold's Englishness is described as "nothing but the accident of his birth" (226). He resists Eurocentrism by locating the Brotherhood's base in Africa. Yet Griffith undercuts his own emphasis on internationalism by making the Anglo-Saxon race the dominant factor in the new world order. Thus the new European constitution recognises "the supremacy of the Anglo-Saxon Federation in all matters of international policy" (386). This statement reveals the further probable influence of Maxim, who foresees the emergence of a "congress of nations" at which "the Anglo-Saxons, on account of our immense numbers, our vast possessions, and our enormous wealth, will be permitted to occupy a front seat" ("Progress" 449). The dominance of the Anglo-Saxon race Griffith portrays is such that even outsiders recognise the superiority of the "mother race." Hence Natas abdicates power in favour of Tremayne, "'the flower of this splendid race'" (146), while Mazanoff, a Russian "'without a drop of English blood'" in his veins, looks "'upon the British race as the real bulwark of freedom'" (312). For the archaeologist John McNabb, *Angel* is about "race war and Social Darwinism," with the Anglo-Saxons having "earned their destiny as the pre-eminent race in Europe" (314).

That it requires the Brotherhood to gift the "mother" country of the Anglo-Saxon race the means to dominate the globe encapsulates Griffith's emphasis on the need for Britain to invest in aeronautical research. Maxim makes explicit his belief

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that Britain should focus on the heavier-than-air mechanism to excel the French (a nation he identifies as master of the dirigible) in aerial navigation:

> If we in England wish to excel the French in aerial navigation, I think we should turn our attention to the aeroplane, which alone is capable of being driven through the air at a speed which makes it independent of the wind, and which if driven at such a speed will lift and carry a load quite equal to that of the so-called "dirigeable" balloon. Complete success may be a long and expensive task, and all the points necessary to success may not be the work of any one man, but I do believe that a staff of engineers and scientists could be found among the Anglo-Saxon race, without going outside of England, who, if provided with unlimited means, could produce a machine a machine that would actually fly without a gas-bag, and in much less time than it took the French engineers to evolve their present "dirigeable" balloon, and render it quite as unsafe to attempt the invasion of England through the air as it is now by water. (448-49)

Maxim's dictum is substantiated in so far as it is a young Englishman who invents the heavier-than-air mechanisms that drive the French-invented war-balloons from British soil (as if to emphasise Maxim's point that the performance of the dirigible can be affected by wind, the progress of the war-balloons across Europe is – albeit temporarily – impeded by a succession of violent storms and gales). The implicit message conveyed in *Angel*, however, is that had it not been for the unlimited means made available to Arnold by the Brotherhood, Britain would have been left at the mercy of its aerial invaders. Hence depicting an aerial invasion of southern England occurring in the near future is Griffith's most forceful way of impressing on his popular readership the urgent need for Britain to invest substantially in talented aeronautical engineers and scientists like Arnold. As David Trotter puts it, "Without airships, Britain and Germany would have been defeated; without the Brotherhood, there would have been no airships" (173).

The Pax Aeronautica established with the protagonist's invention is essentially utopian socialist in character. *Angel* continues – and is in fact the culmination of – a nineteenth-century literary tradition in which aeronautical innovation acts as a catalyst for freedom from want and oppression and the establishment of world peace. Griffith's indebtedness to Tennyson's "Locksley Hall" in his depiction of a new world order is acknowledged by the reviewer in the *National Observer*, who remarks on how the potency of the airships makes the act of "establish[ing] the Parliament of Man, the Federation of the World [. . .] the work of a moment" (668). Another possible influence on Griffith's socialist Federation is Victor Hugo. In his "Letter on Flight" (1864), Hugo speculates on the benefits that navigable flight will bring to the human race: "Armies will vanish, and with them the horrors of war, the exploitation of nations, the subjugations of populations. [. . .] It will bring a sudden golden dawn, a brisk flinging open of the ancient cage door of history, a flooding in of light. It will mean that liberation of all mankind" (qtd. in Holmes 175).[10] The Federation essentially fulfils Hugo's prophecy, having successfully "plotted the destruction [. . .] of a civilisation and a social order that it had taken twenty centuries to build up" and ushering in a new enlightened era (45). Armies are disbanded, warships are consigned to the bottom of the sea and "the fleet of air-ships [. . .] remain[s] the sole effective fighting force in the world" (391).

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The new world order established in *Angel*'s final chapters is highly characteristic of the late-Victorian political utopia. As well as abolishing all laws which are difficult to understand, the Brotherhood implements two key measures to eradicate the gulf between excessive wealth and grinding poverty. As with Bellamy's *Looking Backward*, land nationalisation is an essential characteristic of the future landscape.[11] In his "Land Nationalisation" (1892), Clement M. Bailhache argues that land ownership conflicts with the paramount right of every human being to live. Land nationalisation would destroy "the undue wealth and grinding poverty, which are a perpetual menace to the happiness of men and the safety of society" (517). Bailhache stresses that land should be reserved "for all who want to occupy and cultivate" (515). In *Angel*, the soil of each country becomes "the sole and inalienable property of the State" (387). Furthermore, "'the only rights to the possession of it that will be recognised [by the Federation] will be occupation and cultivation'" (368). Echoing figures like Bailhache, Tremayne remarks how "'Experience has shown that the holding of land for mere purposes of luxury or speculative profit leads to untold injustices to the general population of a country'" (368). The Federation also imposes progressive taxation rising to fifty per cent on incomes reaching £10,000 a year, recalling proposals for progressive taxation like John Robertson's "A Scheme of Taxation" (1886). Those subject to increased taxation are offered the chance to undertake equivalent work in the community, but, without exception, agree to pay the tax. Griffith's vision of world free of oppression and poverty found support in the *Dundee Courier*, which noted that "the story somehow suggests an undercurrent of truth," since: "Everything in these *fin-de-siècle* days points to the sore need of some power that is to sweep from the face of the earth the tyranny, the sin, the selfishness of the few in power under whose yoke the multitude groan" (6).

Griffith's radicalism is seemingly confirmed when he depicts an English king abdicating his throne because he concludes being an English gentleman under an Anglo-Saxon Federation is preferable to being monarch of an invaded country. Yet Griffith undercuts his own radicalism and emphasis on equality by endowing the leaders of the revolution with inherently aristocratic characteristics. Arnold is described as "an aristocratic and decidedly good-looking man" (17), while Louis Holt, the discoverer of Aeria, greets the members of the Brotherhood with "a well-bred gesture" (125) and gives them tours of the colony "as though it were a private estate to which the[y] [. . .] had come by his special invitation" (134). Treymane's noble ancestry is said to make him incapable of dishonesty and his wife, the daughter of a Cornish nobleman, is "alike by lineage and nature" (150). So readers might detect a conservative element to Griffith's portrayal of a social revolution led by the aristocracy.

George Griffith's *The Angel of the Revolution*, then, assumes a renewed significance examined in the context of late-nineteenth century aeronautics. Griffith makes intelligent use of aeronautical speculation in order to create verisimilitude for his protagonist's discovery of a solution to the problem of aerial navigation. Griffith does not merely appropriate contemporary aeronautics to create verisimilitude, however. Rather he uses fiction to intervene in debates concerning the means to accomplish aerial navigation. Though clearly influenced by Maxim and Langley, Griffith identifies the difficulty inherent in enabling the aeroplane to take off and land. Hence the author suggests that – granting the invention of a sufficiently light yet powerful engine – combining the aeronef and the aeroplane is the most probable means of accomplishing aerial navigation with current technology. While Griffith departs from Pettigrew's insistence that artificial wings must incorporate the elasticity

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of their natural counterparts, he concurs with the naturalist's resolve that the inclined planes of aeronautical contraptions need to attack the air at various angles. *Angel* affirms the importance of popular fiction in imagining the horrors of aerial bombardment. By showing how the war-balloons and the airships have a comparable impact on armed conflict, Griffith implicitly intervenes in debates between advocates of lighter-than-air and heavier-than-air flight – suggesting that both types of mechanism will be realised in the near future, but that the latter will manifest a distinctive advantage in aerial combat given its speed, manoeuvrability and independence from the wind. For his portrayal of aerial combat between the war-balloons and airships, Griffith is indebted to Verne's *The Clipper of the Clouds*. By emphasising how Arnold's remarkable invention is almost lost to the world because this nearly destitute investigator has nowhere to turn, Griffith underlines the urgent need for Britain to provide substantial funding for aeronautics. Indeed, his text implies that the invasion of Britain could have been avoided had Arnold's project been funded by the British State. Though curiously Anglo-Saxon, the "Pax Aeronautica" established by the newly-founded International Federation is the culmination of a nineteenth-century literary tradition in which aeronautical innovations act as a catalyst for world peace and freedom from want and oppression – a tradition encapsulated in Tennyson's "Locksley Hall" and Hugo's "Letter on Flight." Griffith's world federation is clearly socialist and incorporates late-Victorian proposals for land nationalisation and graduated taxation. Yet, for all his emphasis on the need to create equality through schemes to redistribute wealth, Griffith perhaps undercuts his own radicalism by making the leaders of the revolution inherently aristocratic. Overall, with its deep engagement with contemporary aeronautics and portrayal of a world transformed by controlled flight, George Griffith's *The Angel of the Revolution* deserves to wing its way into the modern critical consciousness.

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Notes

1. For more on the publishing history of *Angel* and on the scant details of Griffith's life, see Sam Moskowitz's Critical Biography.

2. Griffith's influence is apparent in the Aerial Board of Control represented in Rudyard Kipling's stories, "With the Night Mail" (1905) and "As Easy as ABC" (1912) and in the Basra airmen of H. G. Wells's *The Shape of Things to Come* (1933).

3. Edward Douglas Fawcett's *Hartmann the Anarchist* (1893) is another significant late-century engagement with aeronautics, and the serialisation of Fawcett's romance overlapped with *Angel*'s. However, *Angel* is the more complete engagement with aeronautics, not least because it depicts political transformation effected through aeronautical invention (Hartmann's plot to enforce anarchism is foiled).

4. Langley's conclusions were summarised for British readers in an article on "Artifical Flight" published in the *Saturday Review*.

5. Natas refers to Tennyson's "Crossing the Bar" (1889) in a discussion with Tremayne.

6. There were, of course, wider anxieties about the funding of science in nineteenth-century Britain. As Martin Willis points out, the Devonshire Commission on the State of science proved that: "Britain's European counterparts – most significantly Germany and France – held the same values as the British but also supported their scientists through state funding" (210).

7. Griffith's fascination with submarine warfare forms the basis of his 1901 short story, "The Raid of Le Vengeur."

8. Significantly, *The Portsmouth Evening News* of 25 November 1893 uses Griffith's war-balloons as a point of reference in assessing a report detailing the construction of a dirigible - armed with "'bombs [which] have been prepared for its special use'" and powered by "'an electric motor by means of which the balloon, it is said, can be steered perfectly'" – for use against insurgents in Brazil. The newspaper remarks that "[a] few weeks ago this [report] might have been taken for the commencement of a chapter in 'Hartmann, the Anarchist,' or 'The Angel of the Revolution,'" but "[t]oday we are asked to accept it as a sober fact"(2). While no evidence suggests this dirigible succeeded (claims exaggerating the success of navigable balloons were commonplace), fact eventually imitated fiction when German Zeppelin and Schütte-Lanz airships began bombing raids against Britain in the First World War.

9. Griffith's exposure of the United States Constitution as a sham perhaps explains why he never gained widespread popularity in America.

10. As Richard Holmes points out (175), there is a certain naivety in the assumption that controlled flight would lead necessarily to the liberation of all mankind, particularly since many would argue it has led to the subjugation of some nations by others. Another globalising technology believed to act as a catalyst for global peace was the telegraph. In his study, *The Victorian Internet*, Tom Standage points out how Sir John Pender "suggested that telegraphy had 'prevented diplomatic ruptures and consequent war, and been instrumental in promoting peace and happiness [. . .] no time was allowed for the growth of bad feeling or the nursing of a grievance. The cable nipped the evil of misunderstanding leading to war in the bud'" (149).

11. Interestingly, *Looking Backward* contains a reference to balloons that anticipates the aerial reconnaissance evident in Angel: "'It is easier for a general up in

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a balloon, with perfect survey of the field, to manoeuvre a million men to victory than for a sergeant to manage a platoon in a thicket'" (154).

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