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Chicago's Dearborn Observatory: a study in survival

Ian R Bartky
7804 Custer Road, Bethesda, MD 20814, USA
E-mail: abartky@CapAccess.org

Abstract
The Dearborn Observatory, located on the Old University of Chicago campus from 1863 until 1888, was America's most promising astronomical facility when it was founded. Established by the Chicago Astronomical Society and directed by one of the country's most gifted astronomers, it boasted the largest telescope in the world and virtually unlimited operating funds. The Great Chicago Fire of 1871 destroyed its funding and demolished its research programme. Only via the sale of time signals and the heroic efforts of two amateur astronomers did the Dearborn Observatory survive.

Key words: *Dearborn Observatory, S W Burnham, refractor, meridian circle, timekeeping*

1 INTRODUCTION

Early in the nineteenth century Americans initiated their still-continuing love affair with astronomy. Observatories were established in major cities, some of them under the aegis of well-to-do amateurs, others closely linked to the college or university in their locale. In 1856 one contemporary historian of astronomy described twenty-five observatories, no more than three of which were situated west of the Alleghenies (Loomis, 1856). By 1902, 142 facilities scattered throughout the United States were in operation, most asserting a focus on research rather than just the instruction of students (Miller, 1970:117).

Directing a facility, especially one focused on research, is an enormously complex challenge. In *Dollars for Research* Miller (1970) documents the situation in nineteenth-century America, and the means by which scientists working in a variety of disciplines garnered resources. This country's astronomers were quite successful in finding patrons willing to establish, equip, and eventually upgrade their astronomical observatories; however, acquiring annual operating funds was a common, constant worry.

Chicago's Dearborn Observatory, conceived during the height of the Civil War and brought into operation early in the Reconstruction era, began as one of the country's most promising research facilities. Within five years it was the prototypical impoverished institution, unable to support a director, much less maintain its major telescopes and ancillary equipment. Dearborn Observatory remained in these dire straits for the next fifteen years, after which it relocated to Northwestern University's campus in Evanston. What is remarkable is that during much of its time in Chicago, the Observatory contributed significantly to the country's growing reputation in astronomy, a result almost as remarkable as its very survival.

2 PROPOSING A CITY TIME SERVICE

Nineteenth-century Americans managed their lives in a more leisurely manner than we do today. Yet, they, too, were time-conscious. Most had learned, some through bitter experience, that the passenger trains running on the country's burgeoning railway lines brooked no tardiness. So when in 1869 May 'J.C.D.' wrote to the editors of the *Chicago Tribune* urging the establishment of a precise source for city time, his words found a receptive audience among readers (J.C.D., 1869).

J.C.D., most likely Chicago Board of Trade president John C Dore, supported his proposal via a mixture of fiction and fact. He began with the remarkable assertion that the city's residents "... have no regular standard by which to regulate time-pieces." Surely he was aware that Giles Brothers & Company, a prominent jewellery firm located at 142 Lake Street, was City Timekeeper, and that it had been providing the official time without charge to the city government for the past four years, all the while supplying that same Chicago time to the railroads. Indeed, J.C.D. may even have known that for two decades the Common Council had been budgeting funds to pay various clockmakers and jewellers to determine the correct time for the bell ringers, subsequently having these expert timekeepers maintain the city-market clocks.

J.C.D. wanted "... the champion city...", as he termed it, to have an authoritative public signal equal to New York City's. There a time ball had been erected, one which fell exactly at noon every day upon receipt of a signal telegraphed from the Dudley Observatory in Albany, 150 miles away. He proposed that a similar device be erected at the top of a prominent Chicago building – either the Court House or a commercial one at the corner of LaSalle and Lake – and that the drop signal come via telegraph from the Dearborn Observatory, then located slightly more than three miles from the city's commercial centre. Perhaps J.C.D. was unaware that New York City's time ball, erected in the spring of 1860, operated for no more than a few months (Bartky, 2000:71). But even having that knowledge would probably not have deterred this civic booster.

As for current time errors, J.C.D. claimed that "... every regulator in each of our watch-dealer stores ... has [a] different time, varying from fifteen to forty-five seconds, and in some instances one or two minutes ..." Given such modest differences, it was well that an anonymous writer using the imaginative pseudonym, 'Time', rushed to his aid a week later with further evidence ('Time', 1869). "Time within two blocks of the Court House varies to day [sic] from five to ten minutes." he wrote in the *Tribune*, reinforcing his data with the impossible-to-judge comparison, "There is scarcely a jewelry firm or railroad in this city, whose time agrees with any other." A clever advocate, 'Time' certainly understood the value of ignoring the obvious question, "How closely need public clocks agree?" Further, this letter writer ended his list of timekeeping lapses with the observation that when the Court House bell announced noon, "... the time of one of the leading jewelers in the city, only across the street from the Court House, stands [at] 8 minutes of 12.", thereby implying that poor timekeeping might also be linked to the municipal government's own bell ringers.

In the matter of civic pride, 'Time' was J.C.D.'s equal. "Now this [sorry state of affairs] should not be in a city of the business and importance and public spirit of Chicago." he declared. "Millions of dollars worth of business is decided by the Court House time ... and the City authorities should see to it that time is correct." Fully supporting J.C.D.'s time-ball proposal, 'Time' urged the additional purchase of a marine chronometer so that the city's bells would be struck accurately at all times, ending his public communication with a challenge to the city authorities. "Chicago Time in every part of the city should agree, and with these suggestions carried into effect, it would agree." And so began a campaign to have the Dearborn Observatory determine Chicago's official time, an idea thrust upon its leadership. Fortunately, they made the most of it.

3 THE CHICAGO ASTRONOMICAL SOCIETY

Dearborn Observatory was a recent addition to the city's expanding suite of cultural assets. At the moment of J.C.D.'s proposal, it was rather a surprising choice for city timekeeper, for its efforts were focused entirely on advancing the science of astronomy.

In late 1862 a group of Chicago's business and social leaders met and concluded that astronomy should be a part of their interests. They discussed the acquisition of a

telescope in order to view the heavens, and decided to purchase the finest instrument they could locate. They also took steps to organize a group of like-interested citizens, a process which led to the incorporation of the Chicago Astronomical Society (Illinois House of Representatives, 1867).

3.1 The World's Largest Refractor

Almost at once the Chicagoans learned of what was then the largest telescope lens in the world: an 18½-inch (47 cm) aperture achromat that had been figured in the shop of Alvan Clark & Sons, Cambridgeport, Massachusetts. Completed in the autumn of 1862, the Civil War was preventing the firm from shipping it to astronomer and University of Mississippi chancellor Frederick A P Barnard, who had ordered it (Osterbrock and Briggs, 1999). Now the Clarks were hoping to sell the lens to Harvard College's Cambridge Observatory. However, negotiations regarding price were dragging, for the Observatory did not have the funds for its purchase in-hand.

Already this telescope objective was famous among the world's astronomers. While testing it on the evening of 1862 January 31, Alvan Graham Clark, younger son of the firm's founder and also a distinguished optician and instrument-maker, discovered the 'dark companion' of Sirius, a long-postulated, but hitherto unseen star that was affecting the brighter star's motion (Bond, 1862). Thus not only did the lens surpass in size those mounted in the world's largest telescopes, at Pulkova Observatory in Russia and at Harvard College's observatory in Cambridge, Massachusetts, but this demonstration of its resolving power catapulted the firm into the front ranks of the world's telescope-makers, where it remained for many decades. The following January, France's Academy of Sciences awarded its Lalande Prize to Alvan Graham Clark for his discovery (Warner and Ariail, 1995:35-38).

3.1.1 The Telescope Comes to Chicago

Back in Illinois, the Chicagoans made ready their plans. Lawyer and civic leader Thomas Hoyne (Figure 1), the nascent Chicago Astronomical Society's eventual secretary, left the city on Thursday, 1863 January 20, arriving in Boston on Saturday morning. It was well that he went directly to the Clark firm, for news of the Chicagoans' interest had preceded him. As Hoyne (1874:7-8) subsequently recounted

> On arriving there, he [Hoyne] found himself in time to intercept – and he did certainly interfere, by the merest accident, with an arrangement for the transfer of the Glass to the Cambridge Observatory which had been pending since the spring before [1862], but was now being hurried to a consummation, on account of our Chicago movement.

Hoyne learned that the senior Clark had just left to meet with Observatory director George P Bond and a group of would-be donors residing in Boston. On seeing the telescope lens stored in its wooden box, Hoyne asked one of the younger Clarks the firm's price and terms. Immediately, and without any hesitation, the Chicagoan agreed to it, and proffered the first instalment of $1,500.

Offer in hand, young Clark and Hoyne sought out and met with a greatly disappointed senior Clark, who wanted his magnificent lens close by. After much discussion, Alvan Clark agreed that the Chicagoans were the first to make a definite offer, and at the price quoted to the University of Mississippi. Thanks to Hoyne's acumen, the finest telescope objective in the world was coming to Chicago. The editors of the *American Journal of Science and Arts* offered their congratulations, noting that this first step implied significant additional funding, "... of which Chicago lacks neither the spirit nor the means." (Silliman, 1863).

3.1.2 Housing the Great Refractor

Having purchased the lens for $11,187 (about $150,000 today), the Chicagoans contracted for a suitable telescope mount; Clark agreed to design and fabricate one for

an additional $7,000. Deciding the observatory's location was scarcely a problem. In addition to being a founder of the Chicago Academy of Sciences and the Chicago Historical Society, lawyer, banker and insurance company president J Young Scammon (Figure 2) was also a trustee of the University of Chicago (Demise of Mr. Scammon, 1890; Scammon, Jonathan Young, 1999). The civic leader provided the entire $30,000 needed to erect a building on the University's campus at 3400 South Cottage Grove Avenue.[1]

Figure 1. Thomas Hoyne (1817-1883), *c.* 1868 (Courtesy: The Chicago Public Library).

Now officially termed the Old University of Chicago, the campus occupied ten acres of land donated in 1856 by Chicagoan and famous political leader Stephen A Douglas. Already on the grounds in 1863 was one wing of a planned building, its erection having forced the Board of Trustees to mortgage the site. After the Chicago Astronomical Society's acquisition of the telescope, the Board, wanting to provide a memorial to the now-deceased Senator Douglas, voted "that steps be immediately taken for the completion of the main building of the University the *erection of which has become indispensable to the proposed Observatory.*", with emphasis probably supplied by historian T W Goodspeed to indicate a well-founded scepticism. So Douglas Hall (Figure 3) was erected at a cost of nearly $125,000, plunging the school deeper into debt and creating a burden from which it never recovered (Goodspeed, 1916:15-18).

Prior to approving the observatory building's design, the Society sent William W Boyington, an important early Chicago architect,[2] to the East Coast to visit

observatories. During his trip Boyington received advice from astronomers at Harvard College and Dudley Observatories, as well as from telescope-maker Alvan Clark (The [Dearborn] Astronomical Observatory, 1863). His final design, one constrained by location, was a tower structure linked to Douglas Hall, with the telescope's pedestal mounting supported on a massive, tapered, masonry column that reached eighty-two feet into the air, the column isolated from the exterior structure. The top of the revolving hemispherical dome, thirty-five feet in diameter and mounted on the exterior structure, was ninety-six feet above the ground. Providing stability for the supporting column required the driving of over one hundred oak pilings into the site's sandy soil, on top of which a twenty-seven-foot diameter, ten-foot-thick concrete foundation was poured (Andreas, 1884:516; Koenitzer, 1927:42, 72).

Figure 2 J Young Scammon (1812-1890), *c.* 1868 (after *Biographical Sketches*, 1868: facing 25; Courtesy: The Newberry Library, Chicago).

In naming the observatory (Figure 4), donor Scammon honoured the memory of his late wife, Mary Ann Haven Dearborn – a famous name in Chicago, for Fort Dearborn had been named for one of her relatives. Scammon, by far the most significant individual in the Chicago Astronomical Society, served as its president for twenty years. The organization attracted other donor-members by offering viewing rights on the telescope in exchange for monetary support of the endeavour.

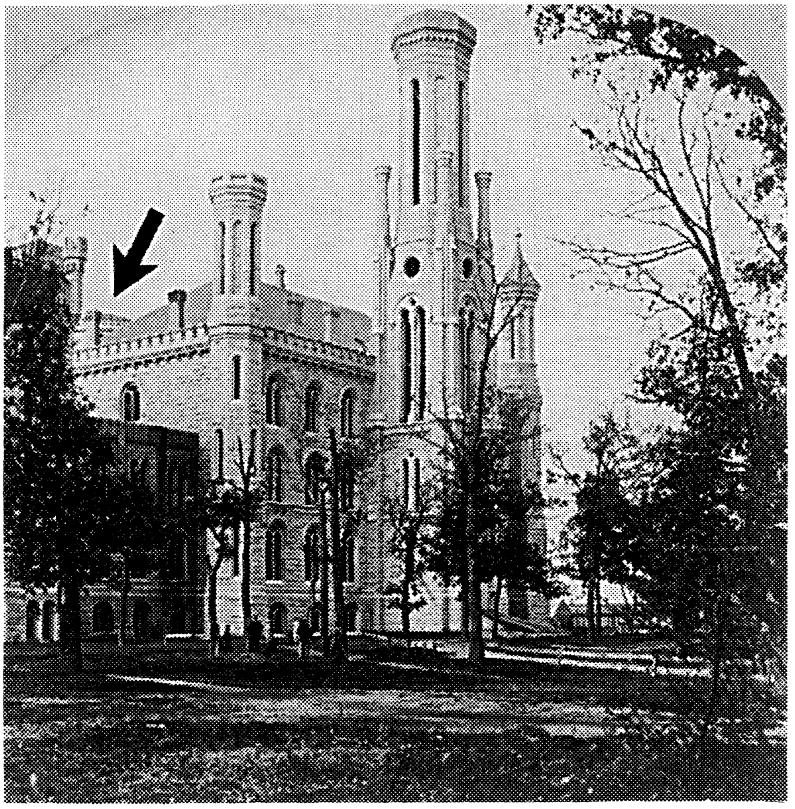

Figure 3. Douglas Hall of the Old University of Chicago, late-1860s, from a stereograph by John Carbutt. The top of the Dearborn Observatory's first dome is visible (see arrow) behind the building (Library of Congress, LC-USZ62-58571. An 1880s view, including the first wing, is in Goodspeed, 1916:facing 14).

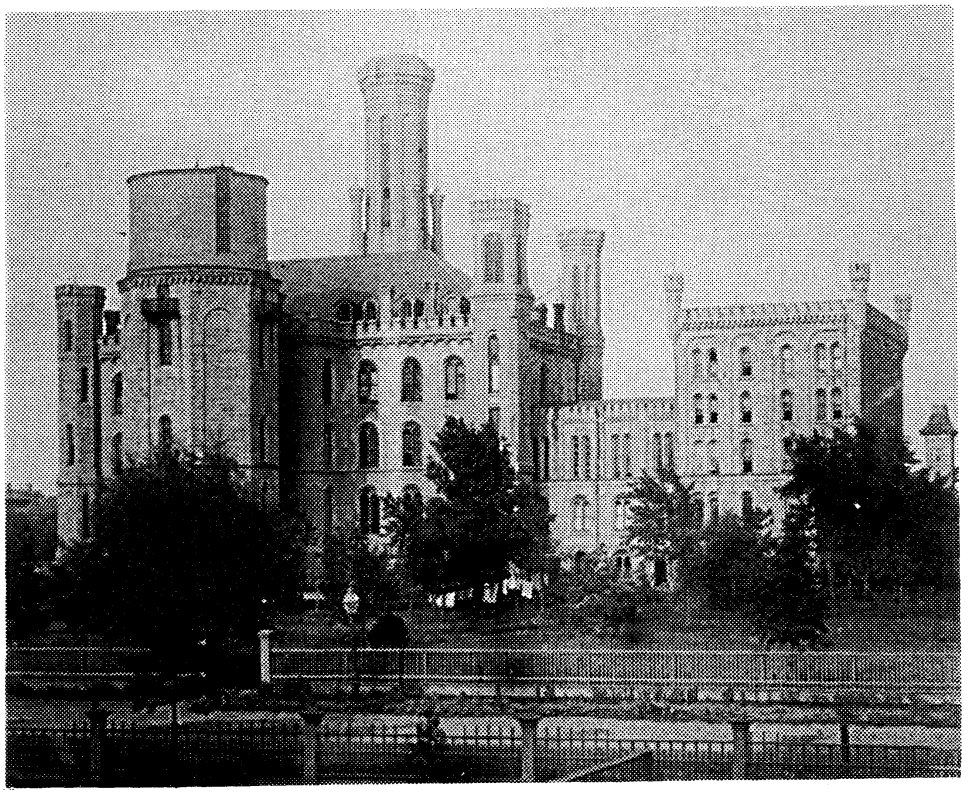

Figure 4. Dearborn Observatory tower at the rear of Douglas Hall (after CAS, 1882:frontispiece. A 'sanitized' version of this image is in Fox, 1915:facing 4).

3.2 The Dearborn Observatory's First Director

With the building finished and the Clark telescope waiting to be installed, the Chicago Astronomical Society turned to the question of an Observatory director. Here, too, they were enormously successful, for Truman Henry Safford (Figure 5), acting director of the Harvard College Observatory since George P Bond's death in 1865, was available. He had just been rejected for the permanent position by Harvard's president and a faculty faction anxious to place its own candidate in the directorship (Rothenberg, 1974:115-117). Safford's years of experience, an impressive list of publications and recognized gifts as an astronomer made him the perfect choice for what was becoming the most advanced astronomical facility in the United States. Late in 1865 December, he accepted the Society's offer to become director of the Dearborn Observatory and professor of Astronomy at the University of Chicago. During the negotiations, Safford proposed the acquisition of a meridian circle – a telescope constrained to view only a north-south arc of the sky and used both for the determination of stellar positions and precise observatory time.

Figure 5. Truman Henry Safford (1836-1901), *c.* 1877 (Courtesy: Williams College Archives).

On Safford's arrival early the next year, the Society placed an order with the German firm of Repsold & Son, Hamburg, for a second major telescope: a 6-inch (15.2 cm) aperture meridian instrument equipped with 40-inch (1 m) diameter graduated circles. Former mayor and successful businessman Walter Gurnee gave $5,000 toward its eventual $7,400 cost, so the telescope was named the Gurnee Meridian Circle

The 18½-inch primary telescope, with its equatorial mounting and clock drive allowing the observation and tracking of objects in any sector of the sky, arrived in March (Colbert, 1866a, 1866b, 1866c, 1916:477). Installed by the Clark firm, it was ready for use on 1866 April 16 (Figure 6).[3] In July Alvan Clark received an honorary Master of Arts degree from the University of Chicago for his accomplishments (Warner and Ariail, 1995:20, 88-89). In order to begin work at the frontiers of astronomy, the Society had invested nearly $60,000 in buildings and equipment.

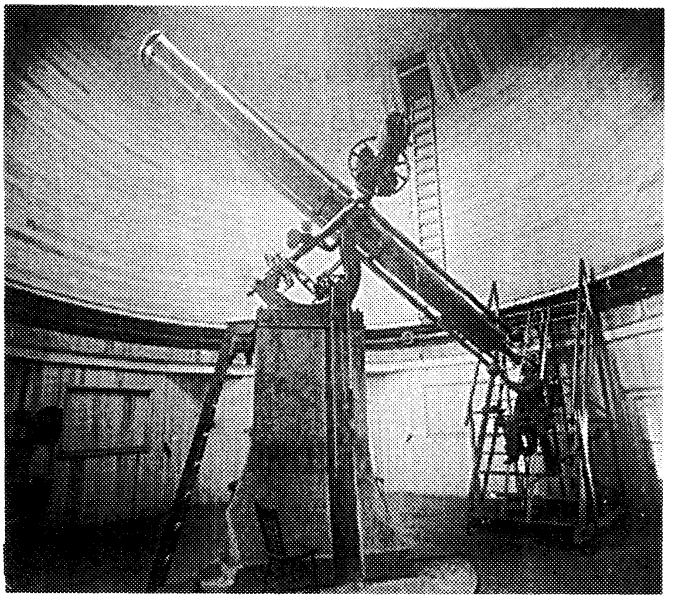

Figure 6a. Dearborn Observatory's 18½-inch refractor at the Chicago site; the seated observer is G W Hough (after CAS, 1882:facing 52).

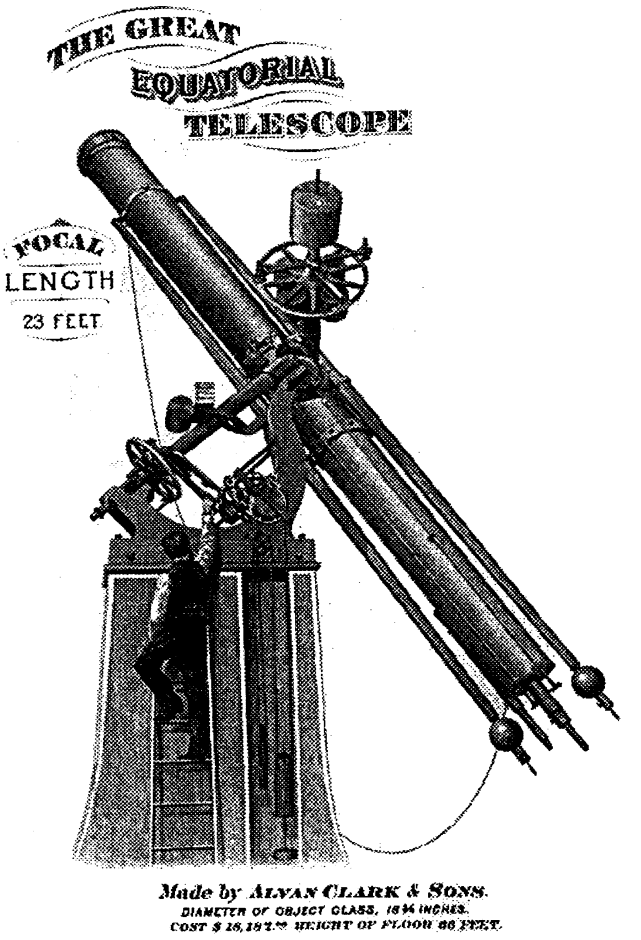

Figure 6b. Detail from a Life Member certificate of the Chicago Astronomical Society (see Figure 10, below). An identical image, without surrounding text, is in Andreas, 1884:516.

Safford, whose salary was paid by Scammon, embarked on a programme of observing nebulae with the equatorial. However, the design of the revolving dome was

faulty, and within a short while keeping its opening in front of the equatorial became a major effort. The problem worsened and Safford's observing programme was crippled, with the astronomer able to observe only a narrow, fixed slice of the night sky. Thus when the Gurnee Meridian Circle arrived in 1868 and was mounted between two massive brick piers inside a small transit house some yards west of the main observatory tower (Figures 7 and 8), Safford immediately shifted his research efforts. Early in 1869 he embarked on a multi-year, multi-national co-operative effort of precision measurements of stellar positions, his responsibility a particular zone of the sky (Safford, 1869a).

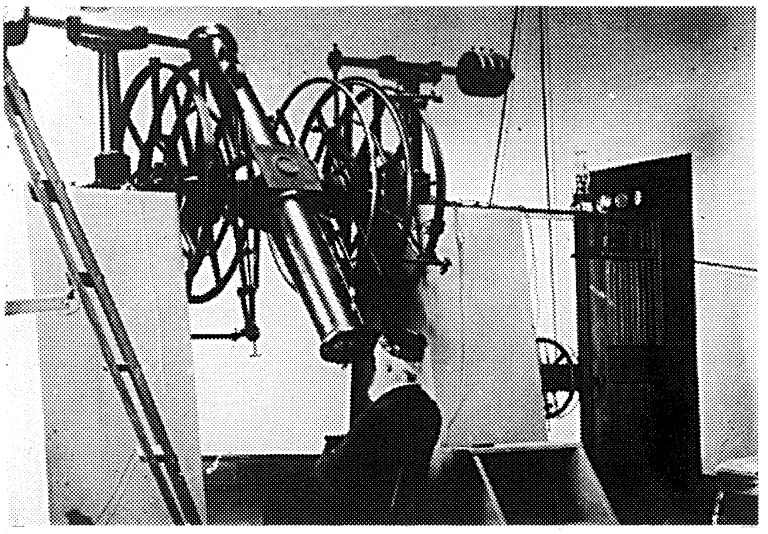

Figure 7. Gurnee Meridian Circle, photograph taken after Dearborn Observatory's relocation to Northwestern University; the observer is G W Hough (Courtesy: Northwestern University Archives). The transit instrument was removed in 1957 ([History of the] Dearborn Observatory, 1985:4).

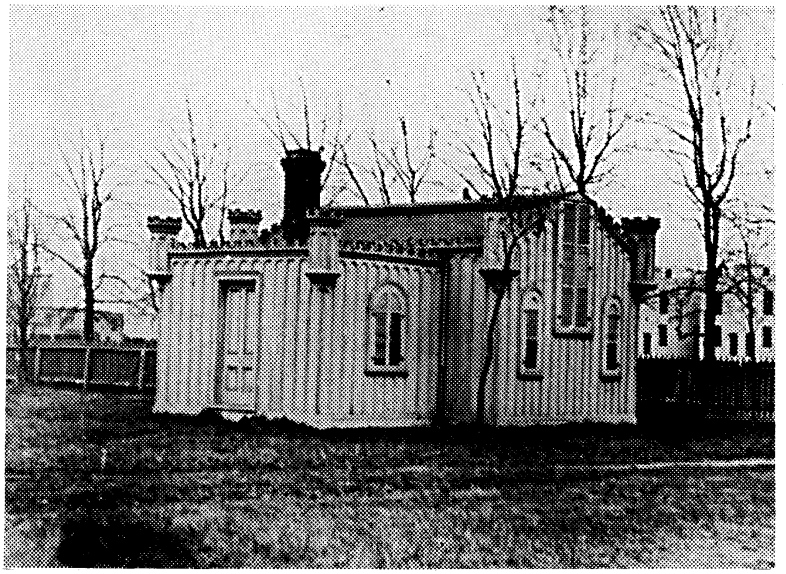

Figure 8. Transit house on grounds of the Old University of Chicago (after Koenitzer, 1927:75; Courtesy: University of Chicago Archives).

3.3 Considering a Time Service

There is no evidence that the Chicago Astronomical Society's leaders or Dearborn's director were considering the distribution of time to the general public when J.C.D.'s appeal for an authoritative source of city time appeared in the *Tribune*. In their research, astronomers use sidereal time, a system of highly-precise timekeeping not

based on the public's mean solar time. Of course sidereal time can be converted to mean time; however, the two letter-writers were arguing for the distribution of mean time every day and that meant that a second astronomical-grade clock had to be purchased. And if the Dearborn Observatory was expected to guarantee the accuracy of its transmitted signal – a not-unexpected requirement – then staff would have to compare the mean-time clock frequently against the in-house sidereal standard, thereby committing large blocks of the observatory's most precious resource – those clear nights suitable for observing – to a programme of measuring transits of so-called clock stars. In contrast to a research activity, where one observes clock stars for modest periods before and after a cluster of stellar observations, such a programme would have to be on-going and, given the nature of contractual obligations, have priority. Certainly Safford, who had been at the Harvard College Observatory during the years it provided mean-time signals to Boston, was quite aware of the difficulty in maintaining a contractual service, a service that did not advance the field of astronomy one whit (Bartky, 2000:57-58, 75-76).

At that moment no more than five of the country's half-a-hundred observatories were providing public time in their locales. Of these, only the U.S. Naval Observatory was engaged in a strong programme of astronomical research, and its time service was the result of a long-standing directive from the Secretary of the Navy to provide Washingtonians with a daily time signal (Bartky and Dick, 1981, 1999). Undoubtedly the idea of taking over a local jeweller's function, one that simply did not require accuracies at the state of the art, carried scant appeal for a research-oriented astronomer, no matter how many public-clock discrepancies existed.

Nevertheless, with city time now a public issue, the Dearborn Observatory director had to consider it. No doubt Safford discussed the situation with the directors of the Chicago Astronomical Society; he probably also consulted with Elias Colbert (Figure 9), one of the Society's most enthusiastic members and also a *Chicago Tribune* editor. Safford probably did not speak with those running the railroads in Chicago, for in mid-July railway superintendents and others petitioned the city's Common Council for "... the establishment of a system whereby the correct time shall be furnished to the people, by means of a telegraphic connection of the city clock with the Dearborn Observatory."

Included in the railroads' petition were the purchase and installation of slave-clock dials at the city's rail depots, which would be kept in synchrony within fractions of a second via electrical pulses from a master clock placed at some central location in the city. This timekeeper would also control the striking of the hours on the Court House bell. The petition closed with an appeal for the appointment of a specific watchmaker as City Timekeeper (Chicago Common Council, 1869; A Prayer for Standard Time, 1869).

4 SETTING THE STAGE FOR PUBLIC TIMEKEEPING[4]

After reporting the submission of the railroads' appeal to the city government, the *Chicago Tribune* printed two editorials, both probably written by Elias Colbert (1869a, 1869b). The first dismissed J.C.D.'s proposal for an Observatory-controlled time ball, arguing that such a device was unsuitable since it was used to calibrate marine chronometers on ocean-going ships. The editorial did not mention a time ball's second use: to provide a daily, authoritative signal for the general public.

In the second editorial, the writer supported the idea of establishing a standard time for Chicago, but opposed the use of public funds to purchase the timekeepers. Moreover, he claimed that time accurate to within five seconds was sufficient for all business purposes. He noted that authoritative time meeting that level of quality could be obtained at modest cost via a twice-weekly signal, either telegraphed or brought to the city by chronometer, from the Dearborn Observatory. He (Colbert) also declared

that the Observatory's astronomers were "... the most suitable person[s] to entrust with the regulation of the city time."; that is, one of them should be, *de facto,* City Timekeeper.

Figure 9. Elias Colbert (1829-1921) (Courtesy: Chicago Historical Society).

4.1 Enter the Dearborn Observatory

The very next day the *Tribune* printed a letter from Safford (1869b), in which the astronomer asserted that the Dearborn Observatory was ready and willing "... to undertake the regulation of the principal clocks in the city to uniform standard time ..." To do so, however, would require some sort of compensation, for he and his assistants – Safford's students – were completely engaged in a scientific programme and could not be spared even to undertake this worthy public service.

The astronomer went on to describe the great advantages of electrically-regulated clocks and to explain how easy it would be to connect an automatic bell striker to a central public clock. A fair distribution of costs among the interested groups –"... the municipality, the general public, and railway and other corporations. " – was certainly feasible, Safford concluded, reiterating the importance of assuring time uniformity throughout the city.

Having laid to rest both competing proposals, all that remained was to assure the proper fee for the Dearborn Observatory. A month later the Common Council received Safford's proposal, submitted on behalf of the Chicago Astronomical Society. Dearborn Observatory time signals would actually save the city money, he argued, for the Society was requesting only $1,000 a year for a time service, while the combined annual salaries of the watchmen assigned to strike the hours on the Court House bell

totalled $1,800. (Ignored, of course, was the primary service these city employees provided). Safford also promised no additional municipal costs, for the $1,500 needed for the equipment – a central clock and strikers – would be raised by a private appeal for funds (Chicago Common Council, 1869-1870).

4.2 The Common Council Manoeuvres

Since the Society's proposal already had been endorsed by the city's Board of Fire and Police Commissioners, Common Council approval appeared certain. However, its formal submission came too late in the legislative process, and the matter was held over. It was not until mid-April in 1870 that the new Council's members approved a resolution supporting the funding request, and the Society launched its public appeal for funds to purchase equipment.

Giles Brothers, seeing itself about to be superseded as the city's official timekeeper, battled to retain its position. In August the firm presented a petition, signed by a number of Chicago businesses and individuals, offering to place an astronomical-grade timekeeper – one varying no more than five seconds a month – in the rotunda of the Court House. The clock would be equipped with electro-mechanical devices for striking the City Hall bell every hour and driving subsidiary dials in city offices. Offered at a price of two thousand dollars, Giles Brothers promised to maintain it " ... free of expense to the city."

The municipal authorities now faced a delicate choice: to approve a one-time capital expenditure of two thousand dollars to pay for a clock, or to authorize an annual expenditure of one thousand dollars for accurate time signals. The Council referred the Giles Brothers' proposal to its Committee on Finance.

Learning of the jewellery firm's petition, Chicago Astronomical Society officials immediately accelerated their canvassing for equipment funds. Simultaneously the Society's secretary informed the city's Board of Public Works of their continuing interest in providing Dearborn Observatory time to the city.

Almost at once, the Board of Public Works declared that "It would greatly add to the usefulness of this [time standard] project if there should be erected ... large dials showing the correct time at all hours." The Board then informed the Common Council's Committee on Finance of the negotiations currently underway with the Chicago Astronomical Society. The Committee responded with a recommendation to the Common Council that Giles Brothers' petition be tabled. The jewellery firm's manoeuvre had failed (Chicago Common Council, 1869-1870).

In November the Common Council passed an ordinance directing that illuminated clock dials be erected on the cupola of the Court House, at a cost not to exceed $2,000. Chicagoans would have the city's true time all day and all night, but that luxury came with a price: $3,500 in capital costs, and $1,000 annually (Chicago Common Council, 1869-70; Ranney, 1869:284-291).

5 CONSTRUCTING CHICAGO'S PUBLIC-TIME SYSTEM

Over the next ten months the many actions needed to bring Dearborn Observatory's time to the heart of the city were completed. E B Chandler, the city's Fire Alarm Telegraph superintendent, designed an electrically-controlled bell-striking mechanism, and then oversaw its construction and placement in the cupola of the Court House. In addition he had wires run to connect the striker directly to his office (What O'Clock, 1871). A pendulum-regulated clock capable of automatically transmitting hour signals was placed there and checked daily by observatory astronomers. Adjusted to conform to the time defined by the Dearborn Observatory meridian, this master clock's display was approximately four seconds faster than the official time at the Court House, a constant difference that scarcely mattered to any citizen. Starting in mid-January of 1871, hours were struck on the Court House bell (What the Dearborn Observatory is Doing, 1871).

In mid-February a sidereal-time clock made by E. Howard & Co. arrived at the Dearborn Observatory and was placed in service. In June the Common Council appropriated three thousand dollars to cover Observatory operating expenses and the city's share of the Court House clock. Also that summer a Howard tower clock, purchased by the Chicago Astronomical Society, was installed in the cupola of the Court House and set to time. In early October the Dearborn Observatory received its first payment from the appropriation for City Time. (Still to come were the four, large-diameter, gas-illuminated clock dials which had been ordered from England. At that moment they were on a train bound for Chicago).

6 DISASTER STRIKES

More than two years had passed since J.C.D. and 'Time' had proposed that Dearborn Observatory provide time for Chicago's citizens; its leaders had responded. Apparently the next phase in Dearborn's plan was to set up a system of synchronized clocks for Chicago railroad depots and businesses linked by wires to its new activity. Safford had already described such an installation.

The Great Chicago Fire of 1871 October ruined everything. Although Dearborn Observatory remained untouched by the conflagration, the Chicago Astronomical Society was devastated. All Society records were lost, considerable assets of its primary benefactor, J Young Scammon, burned to the ground, and his insurance company was bankrupted by the magnitude of its fire losses. Owing enormous sums, Scammon could no longer pay the director's salary. Safford became a wandering astronomer, employed by the federal government in its Western boundary surveys. Although Scammon himself remained ever-hopeful of economic recovery, Safford's career at the Dearborn Observatory was over. Receiving an official leave of absence two-and-a-half years later (Safford, 1874), the astronomer eventually resigned as director and accepted a professorship in astronomy at Williams College (Elliott, 1979:225).

6.1 First Attempts at Recovery

With the Chicago Astronomical Society now destitute, with its primary telescope unable to function, and with no astronomer available to continue the stellar observing programme with the Gurnee Meridian Circle, Elias Colbert became the force driving the Dearborn Observatory's endeavours (Andreas, 1886:428). This committed amateur astronomer, who had been elected Assistant Director during the Society's time-service negotiations with the city of Chicago prior to the Great Fire, continued working full-time at the *Chicago Tribune*, and taught Safford's courses in astronomy at the University of Chicago. In articles and editorials, Colbert cajoled and pleaded, reminding readers that the Society's Dearborn Observatory remained one of Chicago's great cultural assets.

Results were painfully slow in coming. The Panic of 1873, followed by the Chicago Fire of 1874, crushed any hope of attracting monies that could be used to create an endowment. Nonetheless, Colbert's tactics succeeded in attracting members (Figure 10); their annual dues allowed the Society to accumulate funds in anticipation of repairing the observatory dome, whose failure had made Dearborn's primary telescope almost useless.

6.2 Competition for Time Services

In early 1874 June, a new issue arose. Chicago's Western Electric Manufacturing Company, then at 220 Kinzie Street and having strong ties to the Western Union Telegraph Company, began to experiment with the distribution of time. Already producing and selling fire alarms, telegraph equipment, and other electrical

instruments, Western Electric was contemplating the installation of an advanced system of electrically-regulated clocks throughout the city. Needing a source of precise time, it was receiving the daily signal transmitted by the Allegheny Observatory, a university facility across the river from Pittsburgh and over 450 miles from Chicago. These experiments had the unintended consequence of restarting the Dearborn Observatory's mothballed time service, for by the end of the month Western Electric was receiving time from Chicago's observatory (Hamblet, 1874).

Figure 10. Life Member certificate of the Chicago Astronomical Society, early 1900s(?), 16¾ by 11¾ inches. The central figure is J Young Scammon (From the collections of Northwestern University Archives).

Undoubtedly the company's switch to a local time-giver was the result of Colbert's vigorous efforts to find sources of income for the Society's near-moribund Observatory. Colbert continued along this path, and in late 1875 the Chicago Astronomical Society arranged with Western Electric to have Dearborn Observatory time signals automatically transmitted every minute to various organizations, including the Chicago Board of Trade, several area railroads, Giles Brothers and other city jewellers, Western Union, and the Elgin Watch Company factory outside the city. Negotiations over the next several months led in 1876 May to the Chicago Astronomical Society signing a five-year time-service contract with Western Electric, for which Dearborn Observatory received five hundred dollars annually for its signals (CAS, 1876:42, 44-45).

6.3 Enter Burnham

Elias Colbert, who had been appointed Acting Director at the time of Safford's leave of absence, was also anxious to restore Dearborn Observatory to its proper place in the field of astronomy. An opportunity to do so came in 1873. Sherburne Wesley Burnham (Figure 11), an amateur astronomer who resided a few blocks from Dearborn, was starting to become known in the professional community for his catalogues of hitherto-unknown double stars. To Colbert's great chagrin, Burnham was discovering these visual binaries with a 6-inch (15.2cm) Clark telescope mounted in his own backyard. In a May editorial alerting readers to Burnham's accomplishments, the *Chicago Tribune* editor warned that the 18½-inch refractor was "... now rusting in the Dearborn Observatory." and, further, that "The dome that protects it from the rain is

also an efficient protector from observation.... It is simply a disgrace to the city," scolded Colbert (1873), "that the Dearborn telescope should remain in its present condition."

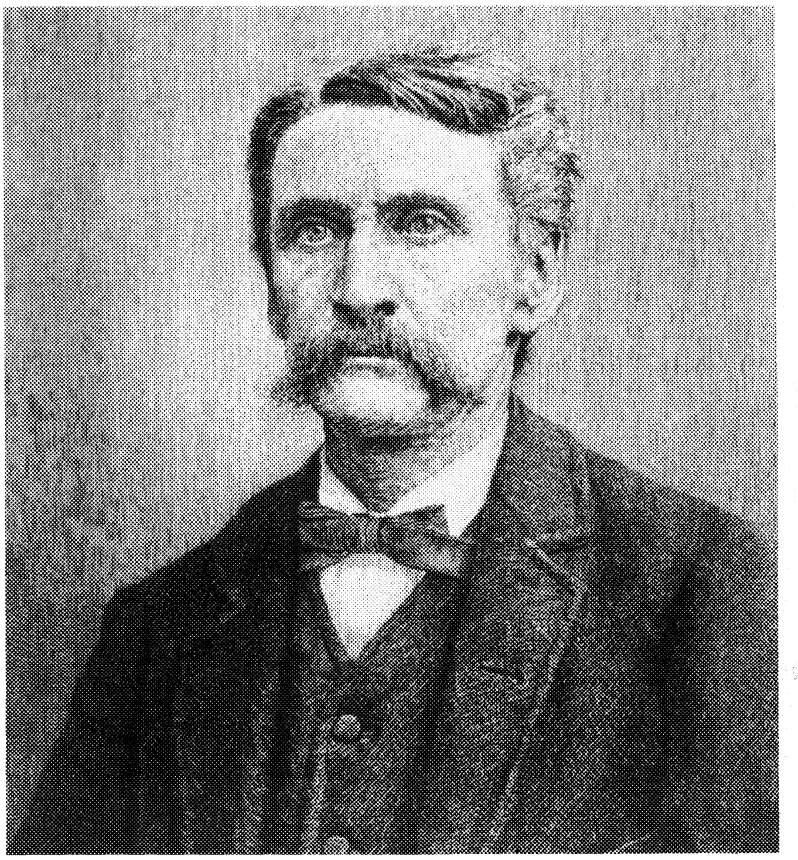

Figure 11. Sherburne Wesley Burnham (1838-1921), *ca.* 1884 (after Fraser, 1889:301; Courtesy: Mary Lee Shane Archives of the Lick Observatory, University of California-Santa Cruz).

Burnham, a full-time court reporter by profession, possessed extremely keen eyesight. He was also an efficient observer, able to quickly check his sightings against prior findings. And he was resourceful, as his success with his own modest equipment already demonstrated. Invited to use the Society's library and the Dearborn's near-immobile telescope, Burnham (1874:382-384) discovered his 188th companion star on 1873 December 22.

6.3.1 Management Conflict Erupts

Over the next months, Burnham made further discoveries; his fame, and that of the Dearborn Observatory's 18½-inch refractor, spread. Then in 1875, thanks to Colbert's success in garnering funds, a new dome was constructed and installed; once again the telescope could be pointed at will to any sector of the sky. In mid-September 1876 Burnham became Acting Director of the Dearborn Observatory – an unpaid appointment proposed by Colbert, who resigned his own unpaid directorship.

Unfortunately, Burnham's observational programme came into direct conflict with the pledges – viewing rights on the primary instrument – made by Colbert to those who had given funds to the Society. Accordingly, on 1877 April 11 Burnham was removed from the directorship and denied the use of the Society's telescope. Embarrassing publicity followed (Burnham, 1877:31; Fraser, 1889:305-306). One of the country's important science journals, noting that "For many years this large instrument ... has lain idle ...", when it ought to have been "... steadily doing service in astronomy, such

service as no other instrument can do.", called on "... friends of science in Chicago ..." to take action to aid Burnham (Silliman, 1877). On July 22 the part-time astronomer was once again observing with the Dearborn refractor, continuing his remarkable string of discoveries of double stars, but sharing telescope time with member-visitors. Placing Colbert in charge of the facility again, Chicago Astronomical Society officers monitored the uneasy peace between their indispensable fund-raiser and Burnham, the now-world-famous observer (CAS, 1877:4-5). Burnham's efforts over the next four years, carried out with the now-functioning telescope, restored Dearborn Observatory's scientific reputation. His subsequent career at the Washburn, Lick, and Yerkes Observatories is well known to historians of astronomy (Ashbrook, 1970; Barnard, 1921; Burnham, 1900:vii-xii; Frost, 1921).

6.4 Enter Hough

The Chicago Astronomical Society's policy of having its equipment used to further the study of astronomy continued. George Washington Hough (Figure 12), who had been director of the Dudley Observatory for a number of years, came to the Chicago area in 1874 to establish a scientific equipment manufacturing enterprise in Riverside (present-day Belvidere). Some years later he, and one or two other astronomers from Midwestern colleges, began observing with the Dearborn's primary instrument (Andreas, 1886:429). In 1879 May, after Colbert's resignation, Hough became the full-time director of the Dearborn Observatory. The position remained an unpaid one.

Figure 12. George Washington Hough (1836-1909), *c.* 1882 (Courtesy: Mary Lee Shane Archives of the Lick Observatory, University of California-Santa Cruz).

Hough revived the Dearborn Observatory's research programme while Colbert continued writing editorials and manœuvring behind the scenes. In 1881 January the newspaperman's efforts finally paid off: the city of Chicago renewed its long-dormant time-service contract with the Chicago Astronomical Society. Dearborn Observatory began by sending a daily signal to the Fire Alarm Telegraph Office. Then with the purchase of transmitting clocks, it extended its service to continuous transmissions. The municipal government agreed to pay $2,000 a year for this 'Time Service of the City of Chicago'.

7 PATHWAYS TO A SECOND DISASTER

The future looked bright. The Dearborn Observatory had survived, its reputation had been restored, and once again the Chicago Astronomical Society was able to pay the salary of a full-time astronomer. Even a programme of facility rehabilitation and modernization appeared feasible. Unfortunately, it was a false dawn. Still lacking an endowment, Dearborn remained dependent on income from its time-service contracts.

Several disturbing signs already lurked on the horizon. In 1880, the Western Electric Manufacturing Company, which owned the clock used to transmit the observatory's time signals, refused to renew its annual contract with the Chicago Astronomical Society. While continuing to purchase Dearborn's authoritative Chicago time, it hinted that in the future it might be acquiring its primary signals from another source: either Allegheny or the U.S. Naval Observatory. The latter's daily noon signal had been available nationally since 1877 via the wires of Western Union, with the telegraph giant quoting an annual fee of three hundred dollars to receive them in Chicago. The Chicago Astronomical Society began exploring the possibility of serving private customers directly.

7.1 The University of Chicago Falters

The University of Chicago's plight added to the general uncertainty surrounding the Observatory's future. Heavily in debt, with its mortgage holder threatening foreclosure, the University's property included the tower building housing the Dearborn Observatory's primary telescope. Legal actions commenced in 1881 June.

7.2 The City of Chicago Adopts Standard Railway Time

Timekeeping itself began to change, adding yet another concern. On 1883 November 18, almost all of North America's railroads changed to Standard Railway Time, a voluntary system of operating times designed by and for the industry (Bartky, 1989). Replacing a myriad of unrelated railroad times were five separate times, each differing from its neighbouring one by exactly one hour. (Although of no real interest to the continent's railway companies, the new set of operating times had been deliberately linked to the time defined by the meridian instrument situated on the grounds of the Royal Observatory at Greenwich, England). Companies whose rail operations were centred in and around Chicago, and which were using Chicago time, were asked to adopt Central Railway Time, six hours earlier than Greenwich meridian time. Most of the thirty-six affected railway companies switched on that November Sunday. The holdouts expressed the fear that Chicago commuters would miss trains, since the city's time differed by more than nine minutes from the new time.

On Monday Chicago's City Council received, and immediately accepted, the Mayor's proposal for the city to adopt the railroads' new time. With the city's legal time now identical to Central Railway Time, the holdout railway companies switched to the new operating time. For the Dearborn Observatory, changing its authoritative time signals to conform to the new public time was a simple enough task: the mean-time transmitting clock was stopped for nine minutes, thirty-three and seven-tenths seconds and then restarted.

Throughout the country, more and more municipalities continued the necessary process of making Standard Railway Time a legal one for public purposes. The creation of America's time zones had begun.

The Central Railway Time that Dearborn was now transmitting was exactly one hour earlier than the time signals that both Allegheny and the Naval Observatories were transmitting. Significantly, the daily noon signal from Washington was being received in Chicago at exactly eleven o'clock; to use it to regulate a clock there no longer required minute and second adjustments. No one understood the implications of this country-wide simplification in time distribution better than the engineers at Western Union and Western Electric, and a rapidly growing group of electrical inventors.

7.3 New Timekeeping Technologies

Timekeeping technology was already changing. In the 1870s, after decades of trials and failures, a reliable, battery-driven clock synchronizer was finally demonstrated. Now, weight- and spring-powered clocks could be set to time and then kept in close synchrony even when they were hundreds of miles apart. Railroad and telegraph companies showed great interest in the development, the former because the displays on station clocks would differ by no more than a few seconds when synchronized periodically, the latter because the line of telegraph needed to send the synchronizing pulses had to be dedicated to that purpose no more than a very few minutes every hour, thereby leaving the wire available for transmitting telegrams.

A second advance in timekeeping technology made the wider distribution of time signals from some central source an even more profitable opportunity. In the fall of 1884 Chester H Pond, a well-known electrical inventor, received a patent for a clock whose mainspring was wound once every hour via a long-lasting, internal battery. This invention of a 'self-winding' clock meant that large companies, once their timekeepers were installed and set to time, would not have to employ people to wind them every week. And if such clocks were also synchronized hourly via a line of telegraph, then time displays would always be the same throughout the enterprise.

In 1885, tests of a bank of fifty clocks equipped with synchronizers began, using a Western Union line in Chicago (Bartky, 2000:172). Also early that year Western Electric removed its clocks from the Dearborn Observatory, and terminated its annual payment to the Chicago Astronomical Society. Scrambling to borrow another timekeeper in order to replace its lost income, Dearborn Observatory began offering Chicago time directly to private customers (CAS, 1885:194, 201; Western Notes, 1885). Only a tiny handful of firms signed up for the service.

7.4 Questions of Ownership

The Chicago Astronomical Society was facing even graver difficulties. The court decisions in the bankruptcy of the University of Chicago had brought into question the ownership of the Dearborn Observatory itself. The tower building had been University property since 1863, but not until 1886 did the courts recognize that the telescopes, clocks, library and associated equipment within the structure belonged to the Chicago Astronomical Society. Society records document the gratitude owed to lawyers Thomas Hoyne, who died before the final decision was announced, and J Young Scammon, for their years of effort to gain a favourable decision in the courts. But the victory was bittersweet; all understood that the Dearborn Observatory's remaining days on the University's campus were numbered (CAS, 1887:3-5).

8 EXIT THE DEARBORN OBSERVATORY

Early in 1888 the inevitable move from the Cottage Grove Avenue site began; the telescopes were dismantled and the ancillary equipment placed in storage. In March,

the city of Chicago terminated its $2,000 annual contract and began purchasing its time from Western Union – at a cost of three hundred dollars per year. Despite the large annual saving, the selection of another time purveyor could not have come any sooner: the directors who negotiated the Society's contract in 1881 were influential Chicagoans, and the Dearborn Observatory was an important cultural asset. Only with the Observatory's relocation to Northwestern University in Evanston (Fox, 1915:9-13; Hough, 1889b, 1889c) did the telegraph company have any chance to win Chicago's business – no matter what it charged.

A rather tragicomical footnote to this final anecdote must be mentioned. Hough, who had relocated the Gurnee Meridian Circle to temporary quarters in Evanston while an observatory building on Northwestern's campus was being constructed, tried to retain Dearborn's other Chicago time-service customers: two banks and one jewellery store (Hough, 1888:276-278). Placing a mean-time transmitting clock at the offices of the *Chicago Tribune*, he and Colbert had a telegraph wire brought in and commenced the transmission of time signals; occasional stellar observations made in Evanston checked the transmitting clock's display of Chicago time. The following April this observatory time service was discontinued, Hough (1889a:285) deeming it "... unprofitable...", as it surely must have been. Throughout Chicago, public time was now the responsibility of the Western Union Telegraph Company, with the primary synchronizing signal – noon at the 75th meridian (Washington time) – arriving every day at its city office.

9 THE ELDERS OF CHICAGO'S DEARBORN OBSERVATORY

Despite the loss of a significant cultural resource, Chicagoans can be proud of the stewardship of the Dearborn Observatory by these nineteenth-century citizens, of whom four must be cited. First is Thomas Hoyne, whose negotiating skills created the opportunity. Next is J Young Scammon, on whose retirement as president of the Chicago Astronomical Society it was noted:

> Whenever a history of Chicago shall be written in which justice shall be done to those who have made our city what it is, then will the name J.Y. Scammon be found to occupy an honored place in the records of those whose benefactions have contributed most to the growth and prosperity of the city and its institutions. (Hough, 1882:20).

Third is court reporter and amateur astronomer S W Burnham, who brought fame to the near-useless Observatory during its darkest days. And fourth on the list is *Chicago Tribune* editor and amateur astronomer Elias Colbert, the now-forgotten fund-raiser, who prevented the institution's collapse by marketing its Chicago time.

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11 NOTES

1 This location is sometimes confused with Douglas Park, on the city's West Side. Close to the Dearborn Observatory's original site is the Stephen A. Douglas Tomb State Memorial Park, with its monument to 'The Little Giant.'

2 The Chicago Water Tower, completed in 1869, was also designed by Boyington. One of the few structures to survive in the path taken by the Great Chicago Fire of 1871, arguably it is the city's most beloved landmark.

3 Another contemporary image of the refractor at the Chicago site is in Burnham (1900:facing xii); Osterbrock (2000) has shown that the observer here is Burnham himself and dates the photograph as not later than 1883-1884. The Northwestern University Archives holds an extensive collection of photographs taken around 1894, at the time G W Hough modified the telescope's driving mechanism. Alvan Clark & Sons' mahogany mounting tube was replaced in 1911 and is on permanent display at the Adler Planetarium and Astronomy Museum in Chicago.

4 A portion of this section and the next are excerpted from *Selling the True Time* (Bartky, 2000:78-83), with the permission of the publishers, Stanford University Press. Copyright 2000 by the Board of Trustees of the Leland Stanford Junior University.

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Dr Ian R Bartky formerly worked at the National Bureau of Standards and the U.S. Army Laboratory Command, both in the Washington, DC, area. His detailed investigation of nineteenth-century public-time services from American observatories, *Selling the True Time,* was published this year by Stanford University Press.