PUBLIC NOTICE

In accordance with the statutes of the State of Illinois and the ordinances of the City of Highland Park, a Regular Meeting of the ***Historic Preservation Commission*** of the City of Highland Park is scheduled to be held at the hour of 7:30 p.m., Thursday, May 12, 2016, at Highland Park City Hall, 1707 St. Johns Avenue, Highland Park, Illinois, during which meeting there will be a discussion of the following:

City of Highland Park
Historic Preservation Commission
Thursday, May 12, 2016
1707 St. Johns Avenue, City Hall
7:30 p.m.

REGULAR MEETING AGENDA

I. **Call to Order**

II. **Roll Call**

III. **Approval of Minutes**

A. April 14, 2016 Regular Meeting

IV. **Scheduled Business**

A. **Determination of Significance**

- 1199 Linden Avenue
- 1880 Garland Avenue

B. **Certificate of Appropriateness**

- 418 Sheridan

V. **Discussion Items**

VI. **Business From the Public**

VII. **Other Business**

A. Next meeting scheduled for June 9, 2016

VIII. **Adjournment**

MINUTES OF A REGULAR MEETING OF HISTORIC PRESERVATION COMMISSION OF THE CITY OF HIGHLAND PARK, ILLINOIS

MEETING DATE: Thursday, April 14, 2016

MEETING LOCATION: Pre-Session Conference Room, City Hall, 1707 St. Johns Avenue, Highland Park, IL

CALL TO ORDER
At 7:32 p.m., Vice Chair Becker called the meeting to order & asked Staff to call the roll.

ROLL CALL

Commissioners Present:	Vice Chair Becker, Commissioners Reinstein, Temkin, Fradin, Illes, Salamasick
Commissioner Absent:	Chairwoman Thomas
Ex-Officio Member Present:	Axelrod
Park District Liaison Present:	Mike Evans
Library Liaison Absent:	Julia Johnas
Councilman Present:	Blumberg
Student Council Present:	Burroughs

Staff declared that a quorum was present.

Staff Present:	Cross, Jahan
Also Present:	Cerabona

APPROVAL OF MINUTES

1. Commissioner Temkin moved to approve the March 10, 2016, regular meeting minutes as presented. Commissioner Fradin seconded the motion.

   On a roll call vote
   Voting Yea: Vice Chair Becker, Commissioners Reinstein, Temkin, Fradin, Illes, Salamasick
   Voting Nay: None

   Vice Chair Becker declared that the motion passed unanimously.

SCHEDULED BUSINESS

1. <u>Determination of Significance</u>
   - 876 Piccadilly Road

   Planner Jahan reviewed this house:
   - Built in 1924
   - Craftsman style
   - 2,160 sq. ft.
   - Architect is unknown
   - Photos were shown

DRAFT

Petitioner, Andrew Venamore, 602 Academy, NB introduced himself and stated he is representing Dreamhome LLC. He advised the home is in disrepair. In February, a notice was posted on the front door. The current owner wishes to replace this home with a new one.

Some HPC comments are:

- is someone living there? Petitioner advised – not presently; an elderly woman lived there in the Fall
- was there an inspection (to potentially renovate)? Petitioner advised – no

It was asked what makes this home a Craftsman style? Vice Chair Becker advised – the deeper overhangs, window subdivisions – though she believes this house doesn't meet any landmark criteria.

Commissioner Reinstein moved that the house does not meet any landmark criteria. Commissioner Fradin seconded the motion.

On a roll call vote
Voting Yea: Vice Chair Becker, Commissioners Reinstein, Temkin, Fradin, Illes, Salamasick
Voting Nay: None

Vice Chair Becker declared that the motion passed unanimously. Commissioner Reinstein noted there is a difference between utilities being turned off and it being uninhabitable.

Mike Evans arrived at 7:35 p.m.

- 1847 Spruce Avenue

Planner Jahan reviewed the house:

- Built in early 1955; addition in 1968
- Modern Ranch style
- 2.428 sq. ft.
- Architect is Jerome Brown
- Original cost was $15,000
- Photos were shown

Petitioner, Matt Pollack with Red Rock Custom Homes, advised the owner wishes to build a new home.

Some HPC comments are:

- Wonderful example of a unique ranch in the 1950s; charming
- Meets #4 landmark criteria
- Currently is stylish
- Meets #6 criteria

Senior Planner Cross reminded that if the house has some historic significance, it is duly noted and a 180-demolition delay may be terminated. Discussion took place on #6 criteria being met.

Commissioner Reinstein moved to terminate the 180-day review. Commissioner Illes seconded the motion.

On a roll call vote
Voting Yea: Vice Chair Becker, Commissioners Reinstein, Temkin, Illes
Voting Nay: Fradin, Salamasick

Vice Chair Becker declared that the motion passed unanimously.

DRAFT

- 106 Central Avenue

Planner Jahan reviewed this house:

- Built in 1940
- Colonial Revival
- 2,898 sq. ft.
- Architect is unknown
- Local "C-Contributing" significance rating
- Photos were illustrated

Petitioner, Scott Crow, Thomas Schaeffer Architects, who is representing the owner advised the home will be torn down and a new one built. He noted the building is not in good condition; windows may not meet current energy standards.

Some HPC comments are:

- Do you know when it was last occupied? Petitioner advised -- no
- When was it purchased? Petitioner advised – earlier this year
- Doesn't meet any of the criteria; nothing unique
- Are there plans yet for the home? Petitioner advised – yes

Commissioner Reinstein moved that the house does not meet any landmark criteria. Commissioner Fradin seconded the motion.

On a roll call vote

Voting Yea:	Vice Chair Becker, Commissioners Reinstein, Temkin, Fradin, Illes, Salamasick
Voting Nay:	None

Vice Chair Becker declared that the motion passed unanimously.

2. <u>Certificate of Appropriateness</u>
    - 326 Central Avenue

Julie Ehrlick, one of the Directors of the Highland Park Historical Society stated she is here to propose removal of the driveway and the garage (if the lot is subdivided). She noted the house has been on the marketing for 7 months and listed at $850,000. It is estimated at $500,000-$600,000 to repair the house. The intent is to sell the property and house (separately) if subdivided.

Some HPC comments are:

- Why not sell the whole lot for $500,000? Petitioner advised – being a non-profit, we are obligated to garner as much revenue as possible. There are still costs for education, etc.

Councilman Blumberg reminded it should be decided if the garage and driveway contribute to the landmark status.

More HPC comments:

- When it was landmarked, it was in totality
- This will remove parts that were part of the landmark
- The age, quality, etc. add to the status
- Various examples (of excluding parts of a property) were shared

Petitioner gave a brief history of when all the parts were added.

DRAFT

Commissioner Fradin moved to deny the COA. Commissioner Temkin seconded the motion.

Discussion took place on the Petitioner going to City Council or the ZBA. Also discussed was the position of previous Historical Society members. It was asked if there might be some press articles available on when the bricks were donated. Ex-Officio Member Axelrod remembered that these two items were given careful thought when being added to carry on the character. It was noted this is not a teardown case.

On a roll call vote
Voting Yea: Vice Chair Becker, Commissioners Reinstein, Temkin, Illes, Salamasick
Voting Nay: Fradin

Vice Chair Becker declared that the motion passes, and the COA is denied.

DISCUSSION ITEMS

Senior Planner Cross asked the HPC to consider the budget for the Ravinia events. He suggested that potentially some monies be directed toward revising historic coloring books that could be converted to digital format.

Commissioner Temkin shared and distributed information on the Design Challenge 2016 (regarding building a playhouse or doghouse). She noted there is a fundraising aspect.

Senior Planner Cross reminded the HPC of the yard sign idea for historic homes.

BUSINESS FROM THE PUBLIC

There was no public.

OTHER BUSINESS

Next meeting is scheduled for May 12, 2016.

ADJOURNMENT

Commissioner Fradin moved to adjourn the meeting at 9 p.m. Commissioner Reinstein seconded the motion.

On a roll call vote
Voting Yea: Vice Chair Becker, Commissioners Reinstein, Temkin, Fradin, Illes, Salamasick
Voting Nay: None

Vice Chair Becker declared that the motion passed unanimously.

Respectfully Submitted,

Gale Cerabona
Minute Taker

MINUTES OF MARCH 10, 2016, WERE APPROVED WITHOUT CORRECTIONS

DRAFT

Ravinoaks Ln
Lincoln Ave S
Beech Ln
Linden Ave
Cedar Ave

Historic Preservation Commission

1199 Linden Avenue Demolition Review

To: Historic Preservation Commission

From: Nusrat Jahan, Planner

Date: 5/12/2016

Year Built:	1946
Style:	Ranch
Petitioner:	Sperling LLC.
Size:	2,750 square feet
Original Owner:	Maurice E. Paradise
Architect:	Henry Newhouse
Original Cost:	$27,000.00
Significant Features:	Rough Cut Stone, Wide Chimney; Row of Casement Window
Alterations:	No Alteration
Staff Opinion:	Staff recommends that the Commission discuss the structure at 1199 Linden Avenue and how it may satisfy any of the landmark criteria identified in Chapter 24.

A demolition application has been submitted for the house at 1199 Linden Avenue. The subject property is located within the 2001 south central survey area. The home is rated as a Contributing "C" by the historical survey research. This means it would contribute to a historic district if one were established in the area, but was not found to have enough historical significance to be designated as a Local Landmark on its own merit. Lake County Tax Assessor's data indicates that the original house was built in 1947. The City of Highland Park Building Division records indicate the home was built in 1946 for a cost of $27,000. The original owner of 1199 Linden Avenue was Maurice E. Paradise. There is a partial addition at the back of the garage but no permit document was found in the city archives.

Location Map – 1199 Linden Avenue

1199 Linden Avenue is located within Arthur L. Hardin's subdivision, which was plated in 1939. The original address of the property was 920 South Linden Avenue. The history of much of the east side of Highland Park is associated with the Highland Park Building Company, which was formed in 1867 by a group of Chicago businessmen. These businessmen purchased 1200 acres from Walter Gurnee, president of the Chicago and Northwestern Railroad. The railroad had opened its first commuter service from Chicago in 1855. The South Central Survey Report included the following description of the planning and development of the area:

> The resident manager of the Highland Park Building Company, Frank Hawkins, hired the landscape architecture firm of Cleveland and French to lay out residential home sites. The principals in this firm were H. W. S. Cleveland, who had been associated with Frederick Law Olmsted in the winning design for Central Park in New York City, and William M. R. French, a civil engineer and brother of the famous sculptor Daniel Chester French. Together with additional lands purchased south of what was to become Central Avenue, Cleveland and French eventually platted a large triangular-shaped area that stretched along the lakefront from what is now Walker Avenue in the northern part of Highland Park, west to the eastern boundary of Highwood and Sunset Road, and south to a quarter section boundary just south of Cedar Avenue. The south part of the Cleveland and French plan, an area beginning south of Hazel Avenue, was recorded in 1873 and is part of the survey area [plats on record at the Lake County Recorder of Deeds office... [i]

<u>Architectural Analysis</u>

Front View – 1199 Linden Avenue

Back View – 1199 Linden Avenue

2001 Highland Park South Central Historical Research noted that the original house is a one story ranch house and the exterior has rough stone cladding. The house has a hipped and gabled roof with paired casement tall windows and a recessed entry. The South Central Survey Report included the following description of the Ranch House style:

"Ranch houses became popular in the late 1940s and 1950s, when the idea was widely published, and were built nationwide in suburban communities. Characteristics of a Ranch house include its wide, ground-hugging profile, low-pitched roof, and deep eaves. Due to the

popularity of the car, the garage has a prominent position in the front of the house and is an integral part of the architecture of the Ranch house".

Biographical Information

Maurice Elliott Paradise was born in 4 August 1904, Chicago, Cook County, Illinois. Mr. Paradise was in U.S. Navy, World War II. He died in 7 December 1977, Los Angeles, California.

The 1930 Census listed his occupation as radio engineer. The 1940 census listed his occupation as plastics manufacturing. Mr. Paradise holds several patents relating to radio receivers and the use of solar power. He was founder and president of National Fabricated Products. His company manufactured the first solar cells. His name appeared various time in Chicago tribune and *Time Magazine* articles (see attachments). Julia Johnas provided the following historical background regarding Mr. Paradise's work on solar technologies:

> "….On April 25 1954, Bell Laboratories unveiled a solar cell that converted light into energy using a silicon semiconductor. The result of the work of three scientists at Bell Laboratories, Daryl Chapin, Calvin Fuller, and Gerald Pearson, the solar cell was developed in response to Bell's need for sources of freestanding power for their telephone system. Chapin undertook working on the problem in 1952, and began looking into solar power. Along with Fuller and Pearson, they began experimenting with selenium, but soon turned to silicon, which proved to be successful, and they were awarded a patent on March 5, 1954 for their "Solar Energy Converting Apparatus". After the first cell was tested on April 25th, 1954, Bell had two solar panels manufactured by National Fabricated Products of Chicago for the Bell Corp. Each panel contained 432 individual silicon cells, each capable of generating about half a volt of energy when exposed to sunlight. A square yard of the cells, which is close to the size of the present panel, could run an electric fan, or light a 100-watt lamp. The panels were sent to a Bell facility for testing, and at the conclusion, one panel was scrapped, and the other sent to Chapin to carry on testing as he saw fit[ii]."

Landmark Criteria

Below are the landmark criteria from the City Code:

1) It demonstrates character, interest, or value as part of the development, heritage, or cultural characteristics of the City, county, state, or country.

2) It is the site of a significant local, county, state, or national event.

3) It is associated with a person or persons who significantly contributed to the development of the City, County, State, or Country.

4) It embodies distinguishing characteristics of an architectural and/or landscape style valuable for the study of a specific time period, type, method of construction, or use of indigenous materials.

5) It is identifiable as the work of a notable builder, designer, architect, artist, or landscape architect whose individual work has influenced the development of the City, County, State, or Country.

6) It embodies, overall, elements of design, details, materials, and/or craftsmanship that renders it architecturally, visually, aesthetically, and/or culturally significant and/or innovative.

7) It has a unique location or it possesses or exhibits singular physical and/or aesthetic characteristics that make it an established or familiar visual feature.

8) It is a particularly fine or unique example of a utilitarian structure or group of such structures, including, but not limited to farmhouses, gas stations or other commercial structures, with a high level of integrity and/or architectural, cultural, historical, and/or community significance.

9) It possesses or exhibits significant historical and/or archaeological qualities.

Recommended Action

In accordance with Section 170.040 Demolition of Dwellings(E)(1) Historic Preservation Commission Review, the Commission is asked to review the structure per Section 24.015 of the Historic Preservation Regulations. If the Historic Preservation Commission determines that the Structure that is the subject of the Demolition Application satisfies:

(1) Three or more of the Landmark Criteria within Section 24.015 of the Historic Preservation Regulations, then a mandatory 365-day Review Period commencing on the Application Completion date will be in effect.
(2) One or two of the Landmark Criteria within Section 24.015 of the Historic Preservation Regulations, then a mandatory 180-day Review Period commencing on the Application Completion date will be in effect,
(3) None of the Landmark Criteria within Section 24.015 of the Historic Preservation Regulations are met, in which case the Application for Demolition shall be processed.

Attachments

Location Map
Site Photos
County Assessor Data
News Paper Articles

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[i] Excerpted from the South Central Survey Report on file at the Department of Community Development.
[ii] Source: https://www.bonhams.com/auctions/21652/lot/144/

City of HIGHLAND PARK

ILLINOIS URBAN ARCHITECTURAL AND HISTORICAL SURVEY

STREET # 1199

DIRECTION

STREET LINDEN

ABB AV

PIN 1625110005

LOCAL SIGNIFICANCE RATING C

POTENTIAL IND NR? (Y OR N) N

Criteria

CONTRIBUTING to a NR district? (C or NC) C

Contributing secondary structure? (C or NC) F

LISTED ON EXISTING SURVEY? (IHSS, NR, etc.)

GENERAL INFORMATION

CATEGORY building

CONDITION Good

INTEGRITY Not altered

SECONDARY STRUCTURE

SECONDARY STRUCTURE 2

CURRENT FUNCTION Domestic - single dwelling

HISTORIC FUNCTION Domestic - single dwelling

ARCHITECTURAL DESCRIPTION

ARCHITECTURAL CLASSIFICATION Ranch

ARCHITECTURAL CLASSIFICATION2

ORIGINAL CONSTRUCTION DATE 1946 1948

DATE SOURCE building permit

EXTERIOR WALLS (current) Stone

EXTERIOR WALLS (original) Stone

OVERALL SHAPE OR PLAN L

NO. OF STORIES 1

WINDOW MATERIAL, TYPE(S) Wood Aluminum paired row casement

PORCH Recessed entry

ROOF (type and materials) Hipped; Gable Asphalt

FOUNDATION Concrete

SIGNIFICANT FEATURES Rough-cut stone; wide chimneys; row of casement windows

ALTERATION(S)

Lake County, Illinois

Property Tax Assessment Information by PIN

Property Address

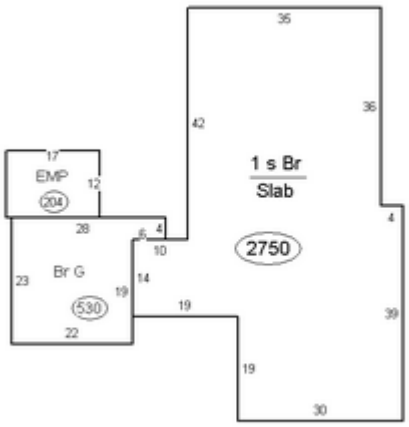
Pin:	16-25-110-005
Street Address:	1199 LINDEN AVE
City:	HIGHLAND PARK
Zip Code:	60035
Land Amount:	$97,619
Building Amount:	$84,163
Total Amount:	$181,782
Township:	Moraine
Assessment Date:	2015

Property Characteristics

Neighborhood Number:	1825414
Neighborhood Name:	EAST Ravinia
Property Class:	104
Class Description:	Residential Improved
Total Land Square Footage:	12599
House Type Code:	43
Structure Type / Stories:	1.0
Exterior Cover:	Brick
Multiple Buildings (Y/N):	N
Year Built / Effective Age:	1947 / 1947
Condition:	Average
Quality Grade:	Good
Above Ground Living Area (Square Feet):	2750
Lower Level Area (Square Feet):	
Finished Lower Level (Square Feet):	
Basement Area (Square Feet):	0
Finished Basement Area (Square Feet):	0
Number of Full Bathrooms:	2
Number of Half Bathrooms:	1
Fireplaces:	1
Garage Attached / Detached / Carport:	1 / 0 / 0
Garage Attached / Detached / Carport Area:	530 / 0 / 0
Deck / Patios:	0 / 0
Deck / Patios Area:	0 / 0
Porches Open / Enclosed:	0 / 1
Porches Open / Enclosed Area:	0 / 204
Pool:	0

Click here for a Glossary of these terms.

Click on the image or sketch to the left to view and print them at full size. The sketch will have a legend.



Property Sales History

Sale valuation definitions

Date of Sale	Sale Amount	Sales Validation	Compulsory Sale
No Previous Sales Information Found.			

Changes made to the sketch drawings are uploaded to the website every two weeks. The property characteristics appearing on this page show any changes made by an assessor the following day.

Please note that the characteristic information shown above is only a summary of information extracted from the Township Assessor's property records. For more detailed and complete characteristic information please contact your local township assessor. Likewise, any errors/omissions/discrepancies should be discussed with the appropriate township office.

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http://apps01.lakecountyil.gov/SPASSESSOR/COMPARABLES/PTAIpin.ASPX?Pin=1625110005

1199

Dec. 17, 1957 M. E. PARADISE 2,817,067

ELECTRICAL CONNECTOR

Filed June 24, 1953

FIG. 1

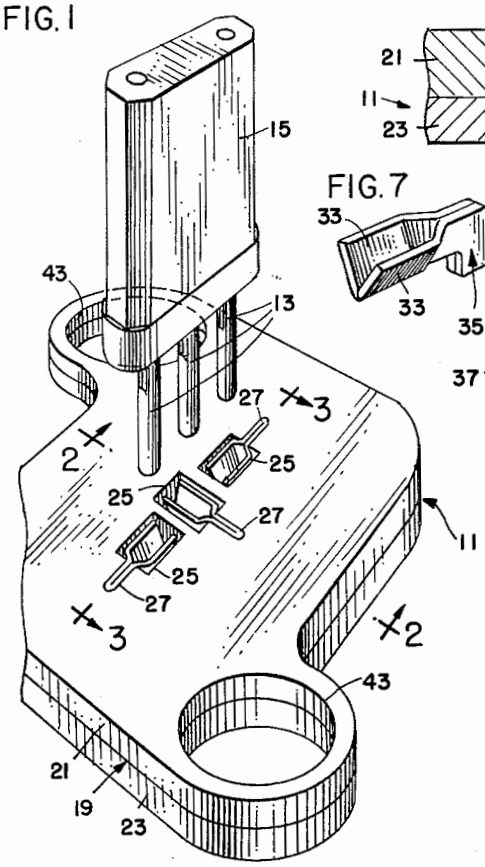


FIG. 2

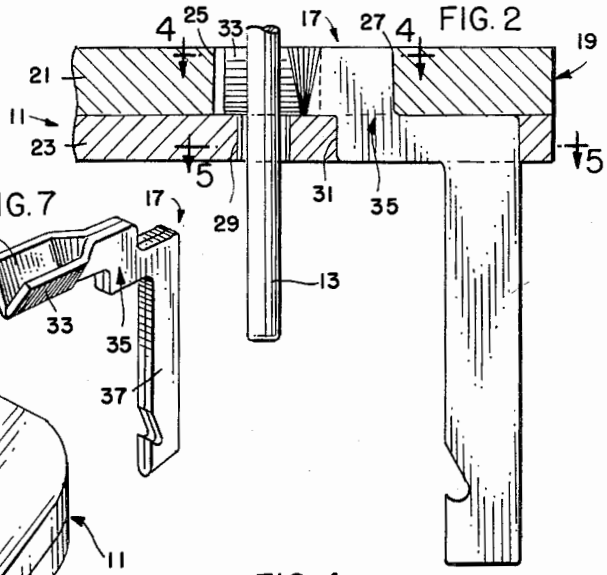


FIG. 7

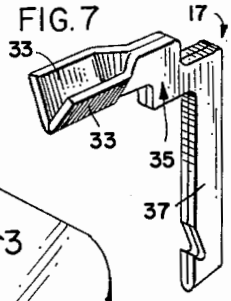


FIG. 4

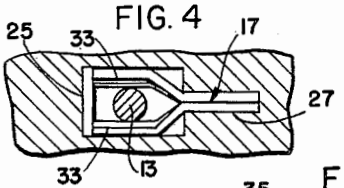


FIG. 5

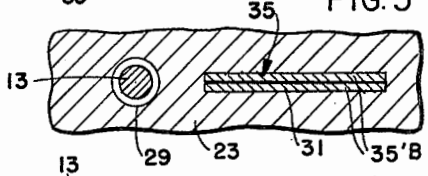


FIG. 3

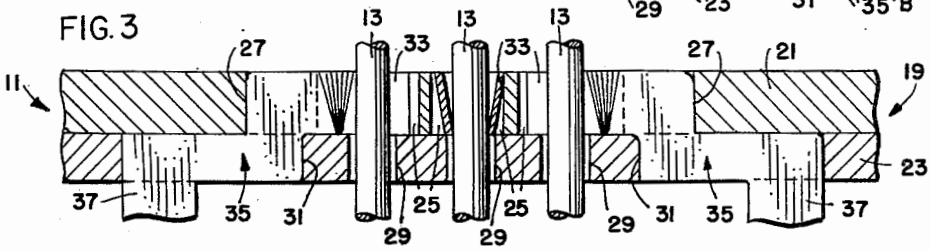
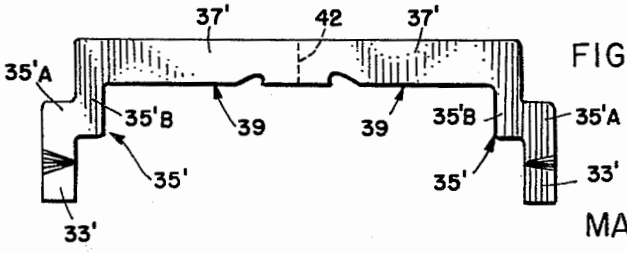


FIG. 6



INVENTOR:-

MAURICE E. PARADISE

BY:-

Spencer, Johnston, Cook & Root

ATTORNEYS

United States Patent Office

2,817,067

Patented Dec. 17, 1957

1

2,817,067

ELECTRICAL CONNECTOR

Maurice E. Paradise, Highland Park, Ill., assignor, by mesne assignments, to Hoffman Electronics Corporation, Los Angeles, Calif., a corporation of California

Application June 24, 1953, Serial No. 363,735

3 Claims. (Cl. 339—192)

The present invention relates in general to electrical circuit forming means, and has more particular reference to an improved electrical connection device, more particularly a connection making socket receptacle.

The invention, more specifically, pertains to a socket receptacle especially adapted to receive and support subminiature electrical elements of the sort recently developed for use in translation systems for signal detecting and amplifying purposes and as oscillators, such elements comprising relatively tiny units embodying a small piece of semi-conductor material enclosed in a suitable casing having projecting connection prongs of wire-like character, electrically connected with the piece of semi-conductor material and disposed in relatively closely spaced relationship on the casing for electrically connecting the unit in an electrical translation system.

Germanium, by way of example, is an electrical semiconductor metal which has recently been developed as a means for performing many of the functions of an electron flow tube in electronic systems, germanium elements for such service being of relatively tiny size and being embedded in usually plastic housings from which extend electrical connection prongs of diametral size of the order of 0.03 inch, said prongs being usually disposed in parallel spaced relationship on centers spaced apart distances of the order of 0.1 inch.

An important object of the present invention is to provide an electrical connection socket structure particularly adapted to receive, support, and make firm and adequate electrical contact with the connection prongs of subminiature devices of the character mentioned.

A further object of the invention is to provide a socket structure embodying prong engaging contact electrodes of a sort adapted to removably receive prongs having a diameter of the order of 0.03 inch; a further object being to provide a receptacle structure having prong engaging electrodes spaced on centers of the order of 0.1 inch, such contact electrodes being formed to provide resilient prong wiping action whereby to assure satisfactory positive electrical engagement between the contact and a prong in mounted position therein.

Another important object resides in providing a receptacle of the character mentioned embodying a prong engaging contact comprising thin gauge sheet metal strip means forming cooperating half sections, said sections being preferably integrally united and folded together to provide resilient yieldingly spreadable arms for wipingly engaging and electrically contacting the opposite sides of a prong inserted therebetween; a further object being to provide mounting means for supporting the contact member in operating position.

Another important object is to provide a receptacle of the character mentioned embodying one or more prong engaging contacts comprising sheet metal means providing resilient yieldingly spreadable arms for wipingly engaging and electrically connecting a prong inserted therebetween, and a mounting portion for interlockingly mounting the contact on a support panel structure; a further object being to form a contact of the character described with a pair of relatively offset mounting portions adapted respectively for interfitting reception in relatively offset slits in a pair of overlying plates secured together to form a mounting panel structure on which the contact element is retained by interlocking interfitment thereof in said relatively offset slits of said plates.

Another important object is to provide a receptacle of the character mentioned embodying a pair of relatively stacked plates secured together in stacked relationship to form a panel structure, one of said plates having a contact blade receiving opening and a relatively narrow slot connected at its inner end with and extending outwardly of said opening, the other plate having a perforation therethrough in registration with said opening and a slit spaced from and extending radially of said perforation, said slit extending in alinement with said lateral slot and having its perforation adjacent portions in communication therewith, said slit having its perforation remote end portions disposed outwardly of the outer end of said lateral slot, and a sheet metal prong engaging contact element having mounting portions extending in said slot and slit and prong engaging portions disposed in said opening in position to make wiping contact with a prong inserted therebetween; a further object being to form said contact element with relatively offset mounting portions extending snugly and interlockingly within said lateral slot and said radial slit, whereby to interfittingly secure said contact element in said panel structure.

Another important object is to form the lateral slot, the radial slit and the relatively offset element mounting portions in fashion permitting the contact element to move floatingly in said slot and slit and thereby adjust itself, within limits, with respect to said blade receiving opening.

Another important object is to provide a receptacle of the character mentioned in which the contact supporting panel structure comprises a pair of plates secured together in facing engagement, whereby the plates may be sealed, as by means of adhesive or by integrating the material thereof at the contacting surfaces of said plates, to thereby exclude the possibility of moisture penetration and consequent formation of electrical leakage paths between the plates.

The foregoing and numerous other important objects, advantages, and inherent functions of the invention will become apparent as the same is more fully understood from the following description, which, taken in conjunction with the accompanying drawings, reveals a preferred embodiment of the invention.

Referring to the drawings:

Fig. 1 is an enlarged perspective view of a socket receptacle embodying the present invention;

Figs. 2 and 3, respectively, are enlarged sectional views taken substantially along the lines 2—2 and 3—3 in Fig. 1;

Figs. 4 and 5, respectively, are sectional views taken substantially along the lines 4—4 and 5—5 in Fig. 2;

Fig. 6 is a plan view of a sheet metal stamping or blank from which may be made an electrode of the sort embodied in the structure shown in Figs. 1–5; and

Fig. 7 is an enlarged perspective view of an electrode element made from the blank shown in Fig. 6.

To illustrate the invention, the drawings show a connection making socket receptacle **11** adapted to removably receive the contact prongs **13** of an electrical element **15**, whereby to support the element in the receptacle and to electrically connect the prong or prongs **13** each with a corresponding contact structure **17** mounted in and forming a part of the socket receptacle, said contact structures **17** being adapted for electrical connection in external circuits in which it may be desired to electri-

cally connect the element **15** through the prongs **13** thereof.

While some of the aspects of the present invention may be applied to advantage in socket receptacles of any size, its several novel features are particularly well suited for incorporation in receptacles for receiving and supporting so-called sub-miniature electrical elements **15** in which the mounting prongs **13** are of small dimension and are relatively closely spaced apart. As an example of a sub-miniature element recently developed for signal detecting and amplifying purposes, reference may be made to semi-conductor elements comprising a small piece or crystal of a desired semi-conductor material, such as germanium, such piece of material being enclosed in a suitable, usually plastic, container and electrically connected with contact prongs formed on and extending outwardly of the container. Elements of the character mentioned, recently available on the market, comprise a piece of germanium metal, of size of the order of that of a grain of wheat, encased in a container, of size of the order of 5/8 inch x 5/16 inch x 1/8 inch, with contact prongs projecting outwardly of the casing, at one end thereof, said prongs having a projecting length of the order of 3/16 inch and being disposed with the axes of the pins extending in a common flat plane and spaced apart a distance of the order of 0.1 inch, the prongs having diameter of the order of 0.03 inch.

In order to provide a suitable receptacle for detachably receiving and making electrical connection with the prongs **13** of such a sub-miniature element **15**, the present invention provides a socket base comprising a panel structure **19** in which is mounted one or more of the contact structures **17**, three contact structures **17** being embodied in the socket structure shown in the drawings. Each contact element is disposed in the structure in position to receive and electrically connect with a corresponding one of the contact prongs **13** of the element **15**.

The panel structure **19** preferably comprises a pair of cooperating panel elements or plates **21** and **23**, said plates and said contact structures **17** being formed for interfitting engagement to interlockingly secure the contact elements in the panel structure when the plates **21** and **23** thereof are secured together in stacked relationship. To this end the plate **21** may be provided with an opening **25** for each of the prongs **13**. The openings **25** are preferably of rectangular configuration and of size of the order of 0.1 inch x 0.07 inch. The openings **25** are spaced apart in the plate **21** in accordance with the spacement of the prongs **13** in the element **15** to be accommodated in the receptacle. The openings **25** are each preferably elongated in one direction and each opening, at one end thereof, communicates with the inner end of a slot **27**, formed in the plate **21** as a lateral extension of the opening **25** with which it connects, each slot **27** being centered upon and in alinement with the longitudinal axis of the elongated opening **25**. If desired, the longitudinal axes of the openings **25** and of the slots **27** may be mutually parallel, although it is preferable that the several slots **27** extend in planes radiating from a common center for a reason hereinafter more fully explained. As shown in the illustrated embodiment, wherein there are three openings **25** disposed in alinement in the plate **21**, the extension slots **27** of the two outermost openings **25** extend in a common plane and mutually outwardly in opposite directions and on opposite sides of the longitudinal axis of the medial opening **25**. The extension slot **27** of the medial opening, however, extends in a plane at right angles with respect to the common medial plane of the other two openings.

The plate **23** is provided with a perforation **29** in alinement with each of the openings **25**, the perforations **29** being sized and disposed in the plate in position to snugly receive the prongs **13** for axial movement therein after the same shall have been inserted through the openings **25** and into the porforations **29**. The plate **23** is

also formed with slits **31**, there being one slit for each perforation **29**, each slit extending outwardly of its associated perforation and having an inner end spaced from the adjacent perforation. The several slits **31** are disposed each in a common plane with the slot **27** of its associated opening **25**, whereby the inner or perforation adjacent end portions of each slit **31** will be in overlapping registration with the outer portions of the slot **27**. The outer or perforation remote portion of each slit **31**, however, extends outwardly of the outer end of its corresponding slot **27**.

Each contact structure **17** comprises cooperating prong engaging blades **33** adapted for assembly in an opening **25** of the plate **21**, mounting portions **35** adapted for interlocking engagement in the slot and slit **27** and **31**, which are associated with the opening **25**, in which the blades **33** are mounted, and a connection portion **37** formed on said mounting portion **35** in position extending outwardly of the panel structure **17** preferably from the outwardly facing surface of the plate **23**, that is to say, the side of the panel structure opposite from the side at which the blade containing openings **25** are exposed.

It will thus be seen that the prongs **13** of the element **15** may be inserted into the openings **25** and between the blades **33** and thence through the perforations **29** to thereby mount the element **15** in the receptacle **11** and electrically connect the element prongs **13** each with the blades **33** of a corresponding contact structure **17**, to thereby electrically interconnect the prongs **13** each with electrical circuit conductors that may be connected upon the leg portion **37** of the contact structure **17** with which such prong **13** is in engagement.

Each of the contact structures **17** may comprise a pair of sheet metal strips **39** of relatively thin gauge material, said strips being of substantially identical configuration and adapted to be supported in facing engagement to provide a contact structure **17**. The strips **39**, to this end, may each comprise a blade portion **33'**, a mounting portion **35'** comprising relatively offset carrying and locking zones **35'A** and **35'B**, respectively adapted to extend in the slot **27** and slit **31** of the panel structure in which mounted, and an arm portion **37'**. The blade portions **33'** of a cooperating pair of strips **39** are preferably mutually inclined upwardly and outwardly to form an upwardly opening prong receiving pocket therebetween when the strips are supported in facing engagement. The blade portions **33'** of a cooperating strip pair so supported in facing engagement may extend in an opening **25**. The carrying portions **35'A** of the strip pair may extend in the slot **27**, which is connected with said opening. The locking portions **35'B** of said strip pair may extend in the slit **31**, while the arm portions **37'** thereof may extend in side-by-side engagement outwardly of the panel portion on which mounted. The cooperating strips **39** are preferably integrated at the remote ends of the portions **37'**, as shown more particularly in Fig. 6, so that each contact structure **17** may be formed from a unitary stamping or blank as shown in Fig. 6, merely by folding the blank, on a line of bend **42**, in order to produce the contact structure **17**, in form as shown in Fig. 7.

The receptacle **11** of the present invention may be fabricated by preforming the panels **21** and **23** with the required number of openings **25**, slots **27**, perforations **29** and slits **31** therein, and by preforming the requisite number of contact structures **17**. Thereupon the locking portions **35'B** of the contact structures **17** may be assembled in the slits **31** of the panel **23**. The panel **21** may then be applied upon the panel **23** in position receiving the blades **33** of the contact structures, in the openings **25**, the blade carrying portions **35'A** of said several contact structures being received in side-by-side relation in the slots **27**. The panels **21** and **23** may then be secured together in facing engagement by any suitable or preferred plate fastening means. To this end, if de-

sired, the plates **21** and **23** may be riveted together, or the plates may be secured by cementing the contacting faces thereof, or the facing surfaces may be integrally united in any suitable or preferred fashion in order to retain the contact elements interlockingly in assembled position in the panel structure.

Where contact prongs **13** are of sufficient diameter and exhibit a reasonable amount of rigidity and a less secure contact with external circuitry can be tolerated contact structure **17** may comprise a single blade **33** with associated mounting, locking and connecting portions having the same configuration as the half of the contact structure shown to the right of folding line **42** in Figure 6. A contiguous relation between one side of mounting portion **35** and cooperating sides of slot **27** and slit **13**, respectively, provides the requisite rigidity to assure a pressure contact between blade **33** and prong **13** of an external component.

It will be seen that the structure inherently applies the inwardly facing surfaces of the plates **21** and **23** in tight intimate contact, the one with respect to the other, thereby minimizing the possibility of moisture penetration between the plates, such penetration affording the possibility of formation of electrical leakage paths between the contact elements **17**, especially in structures wherein the contact elements **17** are mounted in closely spaced relationship in the panel structure. The present invention thus provides a structure in which the establishment of electrical leakage paths between adjacent contact elements is effectively inhibited, even where the plates **21** and **23** are secured together merely by means of fastening members such as rivets. The construction, however, also affords the possibility of sealing the contacting surfaces of the plates **21** and **23** either by integrally uniting the same or by joining the plates with an intermediate layer of cement. In such case, the establishment of electrical leakage paths between adjacent contact elements by moisture penetration is positively and entirely prevented. Suitable openings **43** may be provided in the panel structure in any suitable preferred or convenient location in order to accommodate fastening members, such as rivets, for mounting the receptacle on a support base.

It will be seen that the connection arms **37** of the contact elements extend at the end of the slits **31**, in line with and outwardly of the slots **27** and remote from the contact blade openings. The distance between the blades **33** and the connection arm **37** of each contact structure may be of the order of twice the spacement between adjacent prongs of the unit to be accommodated in the receptacle. Accordingly by disposing the slots **27** and cooperating slits **31**, of a receptacle structure in planes radiating outwardly of a common center, the connection arms **37** of the several prong contact structures may be sufficiently widely spaced apart to allow electrical connection thereof with external conductors to be made with comparative ease. In the arrangement shown in Fig. 1, for example, when sized to accommodate prongs **13** having diameter of the order of 0.03 inch and spaced on 0.1 inch centers, the connection prongs of the two outermost contact structures will be spaced apart a distance of the order of 0.6 inch, and each will be spaced a distance of not less than 0.3 inch from the contact arm of the medial contact structure **17**, such spacements being entirely ample to allow for the easy attachment of conductors on the arms **37**.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts of the electrical connector without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the

form herein disclosed being a preferred embodiment for the purpose of demonstrating the invention.

The invention is hereby claimed as follows:

1. An electrical socket receptacle embodying a contact structure comprising a pair of juxtaposed strips of sheet metal, each having a blade carrying portion and an adjacent relatively offset locking portion, a prong engaging blade formed integrally on each of said carrying portions and a pair of panel elements forming support means for said contact structure, one of said panel elements being formed with an opening therethrough providing a pocket for the reception of said prong engaging blades and a slot connected with and extending outwardly of said pocket to snugly receive and firmly support the blade carrying portions of said strips in facing engagement, to thereby support said blades in said pocket, the other of said panel elements being formed with a prong receiving perforation therethrough and a slit spaced from and extending radially of said perforation, said panel elements being secured in stacked relation with said perforation disposed in alignment with said pocket and said slit extending in end overlapping registration with respect to said slot in position snugly receiving the locking portions of said strips to anchor the same in said panel elements.

2. An electrical socket including a contact structure comprising a strip of sheet metal having a blade carrying portion and an adjacent relatively offset locking portion, a prong engaging blade formed on said carrying portion, and a pair of panel elements forming support means for said contact structure, one of said panel elements being formed with an opening therethrough providing a pocket for the reception of said prong engaging blade and a slot connected with and extending outwardly from said pocket to snugly receive and firmly support the blade carrying portion of said strip to thereby support said blade in said pocket, the other of said panel elements being formed with a prong receiving perforation therethrough and a slit spaced from and extending radially from said perforation, said panel elements being secured to each other in stacked relation with said perforation disposed in alignment with said pocket and said slit extending in end-overlapping registration with respect to said slot and snugly receiving the locking portion of said strip to anchor the same in said panel elements.

3. An electrical receptacle including a plurality of contact structures each contact structure comprising a pair of juxtaposed strips of sheet metal, each such strip having a blade carrying portion and an adjacent relatively offset locking portion, a prong engaging blade formed integrally on each of said carrying portions and a pair of panel elements forming support means for said contact structures, one of said panel elements being formed with a plurality of openings therethrough equal to the plurality of said contact structures providing a pocket for each pair of prong engaging blades, and a slot connected with and extending outwardly from each of said pockets to snugly receive and firmly support the blade carrying portions of each pair of said strips in facing engagement, to thereby support each pair of said blades in its respective pocket, the other of said panel elements being formed with a plurality of prong receiving perforations therethrough in number corresponding to the number of said pockets, each such perforation having a slit spaced from and extending substantially radially from its associated perforation, said panel elements being secured in stacked relation with each of said perforations disposed in alignment with respective ones of said pockets and each of said slits extending in end-overlapping registration with respect to its associated slot and snugly receiving the locking portions of associated strips to anchor the same in said panel elements.

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Photovoltaics Based on Semiconductor Powders

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More than 50 years ago a first patent was granted to utilize powder materials for solar cell production [1] submitted by Hoffman Electronics Ltd., the very first company ever selling photovoltaic modules. Different approaches mainly focusing on silicon crystals or spheres have been tried in the past of which as yet only Philips´/Volvo's CdS Monograin Membrane Photoconductors (in the 1980's and 1990's) and Kyosemi's Sphelar (Mini) Modules (recently) made it to the market. Our own groups in Germany/Austria and in Tallinn have been working with Monograin Membrane Solar Cells based on Philips company´s technology also already since more than 30 years, first using CdS, CdSe and CdTe, for about ten years with CIS and CIGS and since about 6 years now with the new copper zinc tin (sulfo) selenides, CZTS.

Keywords: solar cell; photovoltaics; Kesterite; CZTS; monograin; powder; spheres;

0. Frame and aim

After nearly 60 years of development photovoltaics reached visibility in primary power diagrams at least in some countries. Exponential growth of solar panel production, steady improvements in efficiencies and thereby a pronounced decrease of module costs by meanwhile more than a factor of 1000 (from more than 1000 to less than 1 $\$/W_p$) today lead already to grid parity in some countries, including Germany. Leading scientists analyzing the possibilities to save the planet's climate and the potential for sustainable power use on a global level therefore see solar electricity and wind power as the main options [1]. According to these calculations 10 - 30 TW of renewable power will be needed. Assuming that half of it would have to be provided by photovoltaics this accounts to 30 - 100 TW_p installed modules assuming an average capacity factor of 15 %. With a lifetime of 30 years this requires an annual production rate of 1 - 3 TW_p/a or 1-3 km^2/hour for an assumed future plant efficiency of 20 %. In other words: 250 - 830 production lines would have to produce photovoltaic modules with an output of 1 m^2/s. For comparison: the 2012 world's largest producer, Yingli, produced about 2.2 GW_p that year [2]. Therefore, in order for a substantial contribution of photovoltaics to a global power supply very fast, large scale and low-cost production methods need to be developed. Here powder technologies may be the ideal solution to combine this requirement with high module efficiencies, as will be shown below.

1. The roots

The idea to produce solar cells from powder materials is nearly as old as the modern silicon-based solar cells. Already three years after AT&T Bell Lab's Chapin, Fuller and Pearson published their first commercially interesting silicon solar cell [3], their licensee and cell and module producing company Hoffmans Electronics patented a method to produce solar modules from silicon powders obtained obviously from grinding their precious crystals [4]. Maurice Elliott Paradise, the inventor, thereby not only became the grandfather of powder-based solar cells, of which monograin membrane solar cells are modern variants, he also paved the way for spheral and sphelar solar cells (see below).

First origins of the monograin layers idea were possibly taken from paving plate constructions [5] at least according to Ties Siebold te Velde, who took up these ideas at Philips Gloilampenfabrieken Eindhoven, in 1967 (see below). Of these early inventions that of William P. Carr [6] finally claims a general possibility to produce „a molded article“ by first putting „an adhesive substance of nonpermanent nature“ on a mold, partly embedding inert particles in it, fixing these with molding material, which hardens, and then „removing any nonpermanent adhesive substance“. In 1965 Armin Elmendorf [7] even filed a patent for a continuous tile production process which actually resembles very much Crystalsol's solar cell production process including embedding particles in a (here concrete) binder so that they form the surface and removing this binder to expose this surface, however on a completely different size scale (cm instead of µm) and without the particles being exposed on both sides of the binder.

However, the first real radiation-sensitive electronic device was invented by John E. Jacobs [8] of General Electric Company, New York. Here „a sensitive panel element comprising a layer of crystalline semi-conductor material in finely comminuted condition applied in a carrier binder and baked on and in intimate electrical contact with a sheet of electrical conducting material throughout the surface area of the layer“ is claimed and was patented on Oct. 14, 1958. However, there are still pronounced differences to powder-based solar cells since the particles are comminuted and - at least following the description and due to the aim to produce an X-ray sensor which requires a thick sensor, a multi-layer is used, not a monolayer.

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2. The early years

As mentioned above the true birthday of powder-based solar cell technology should probably be defined as Sept. 15, 1959, when patent US2904613, filed August 26, 1957 by Hoffman Electronics Corporation, Los Angeles, was granted [4]. Maurice Elliott Paradise at that time used silicon particles ground from at that time very expensive silicon crystals or wafers as produced by this first solar module company, based on a Bell Labs license. The particles had diameters of about 2 mm.

Hoffmann Electronics at this time was the leading supplier of commercial solar modules, having started to sell 2% efficient cells already in 1955 for $25/cell or $1,785/Watt. In 1957 they had already 8 % efficient solar cells, in 1958 9% [9]. In 1959 they filed modifications of this new type of cell. Matlow embedded "a plurality of semiconductor pieces in a transparent conductive supporting material" [10] Ralph claimed a "large area solar cell panel" produced by depositing semiconductor particles (here still silicon) onto a metal film (e.g. Au/Sb), which upon heating forms an Ohmic contact, then sealing this with a plastic film between the particles before preparing a surface junction (e.g. an Al_2O_3 Schottky-junction) and a transparent front contact with a metal grid [11]. How far these developments really went is unknown to the author. Unfortunately in 1977, after 36 years in business, the Board of Directors at Hoffmann Electronics decided to sell off the main division to Gould Electronics. The company still exists, however, now focusing on integrating audio and video components system integration [12].

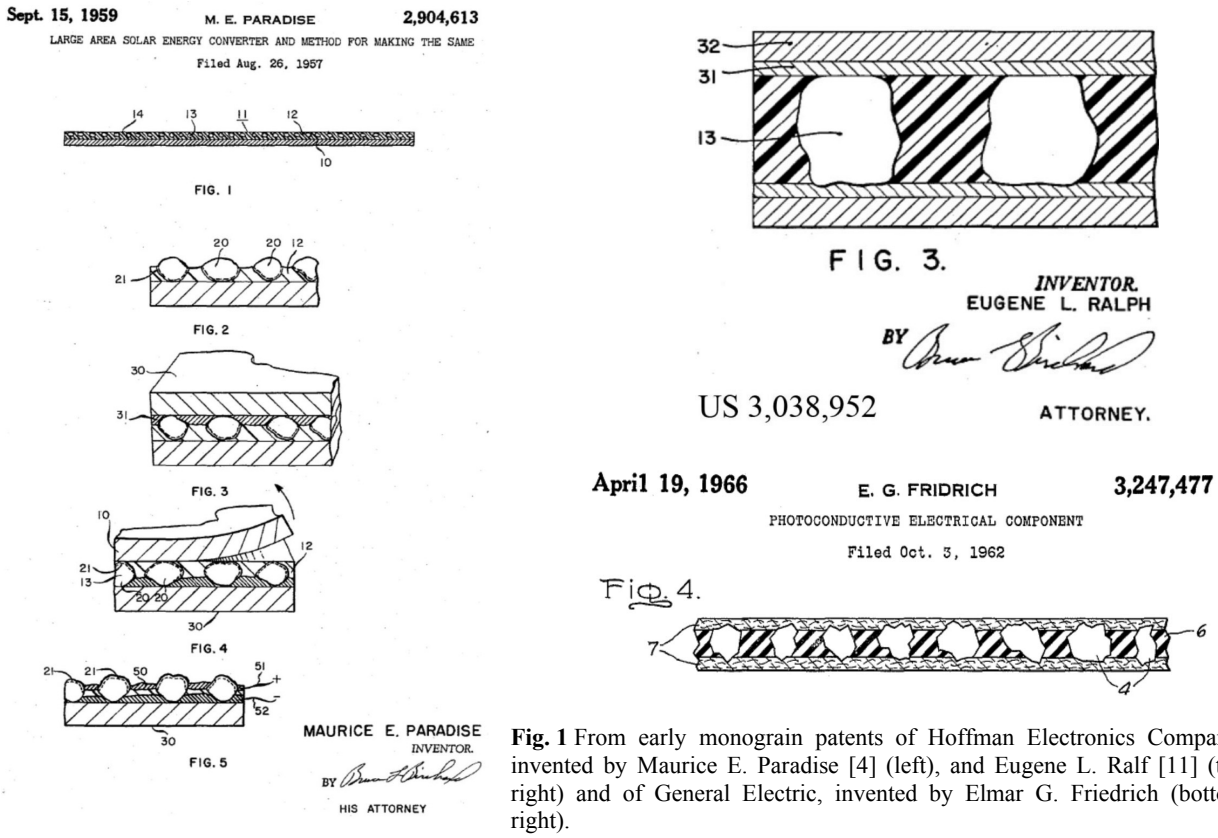

Fig. 1 From early monograin patents of Hoffman Electronics Company, invented by Maurice E. Paradise [4] (left), and Eugene L. Ralf [11] (top right) and of General Electric, invented by Elmar G. Friedrich (bottom right).

Two years later in 1961 Frederick L. Johnson and William Needham of Associated Electrical Industries Ltd. in London, England, filed a patent [13] claiming "a lamina of electrically insulating material in which is constrained a layer of granular non-linear resistance material comprising granules which each protrude from both surfaces of the lamina" contacted by electrically conductive films on both sides. Another year later, Elmer G. Fridrich of General Electric Company claimed an "electric component compromising a solid electrically insulating sheet interlocking a plurality of dispersed single crystals" of a photosensitive material "having major intermediate portions embedded in and irregular end portions protruding from and exposed at both sides of said sheet" with contacts on both sides [14]. In this patent also for the first time other materials than silicon are mentioned such as PbS and the sulfides, selenides and sulfo-selenides of cadmium. In their examples CdS is used. With this patent the single crystalline heterojunction monograin solar cell was born.

3. First products

3.1 Philips/Valvo's monograin membranes

Based on several of above patents Philips Company in Eindhoven started to work on monograin membranes. A main goal at that time was already light emitting diodes (LEDs). Ties Siebold te Velde had filed a first patent in 1964 on LEDs based on ZnS or CdS films (NL6404898), using already a p/n junction [15]. During the next year he filed a first Philips patent on monograin membrane devices [16]. Here a monograin membrane device was patented with "a transparent contact containing areas of higher conductivity between the grains and lower conductivity above the grains". Main applications given in this patent are radiation detection, solar battery and LED. 18 further patents were filed until 1973 specifying methods of membrane production as well as new applications such as the production of printed circuits.

Philips also developed different variants of p/n-type photovoltaic monograin membranes with similar and relatively complicated ways to produce p/n-grains [17]. "Radiation-sensitive" devices were later specially protected in [18]. Based on these developments Philips even demonstrated PV monograin membrane modules powering small toys such as their solar cart following a moving light spot in a dark room [19]. However, probably due to the in that time not existing mass market, solar cells were never produced and marketed.

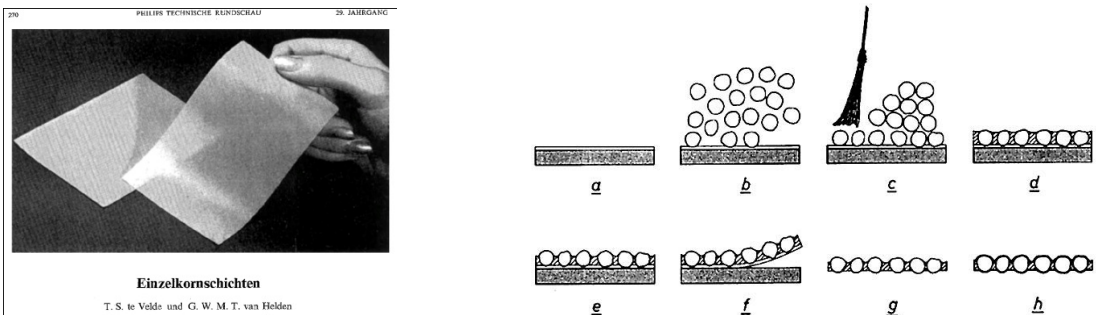

Fig. 2 Philips production technology for CdS monograin membranes (left), and monograin membranes as produced in Valvo, Hamburg, until the 1990's [19].

However, Valvo, Philips' production-company in Germany, was producing monograin membrane based photoconductive elements containing 35 to 45 µm Cu-doped CdS particles in Hamburg until mid of the 1990s [18]. It was a very small production line operated by one lady one day per week to produce about 100 monograin membranes of 10x15 cm^2, which were processed during the rest of the week, i.e. overlapping In/Au contacts (5x5 mm^2) were evaporated on the two opposite sides, the membranes cut to the final pieces of 25 mm^2, metal wires glued to the contacts and the membranes dipped into a transparent glue to seal and protect the device, followed by a quality control measurement of the photoconductivity.

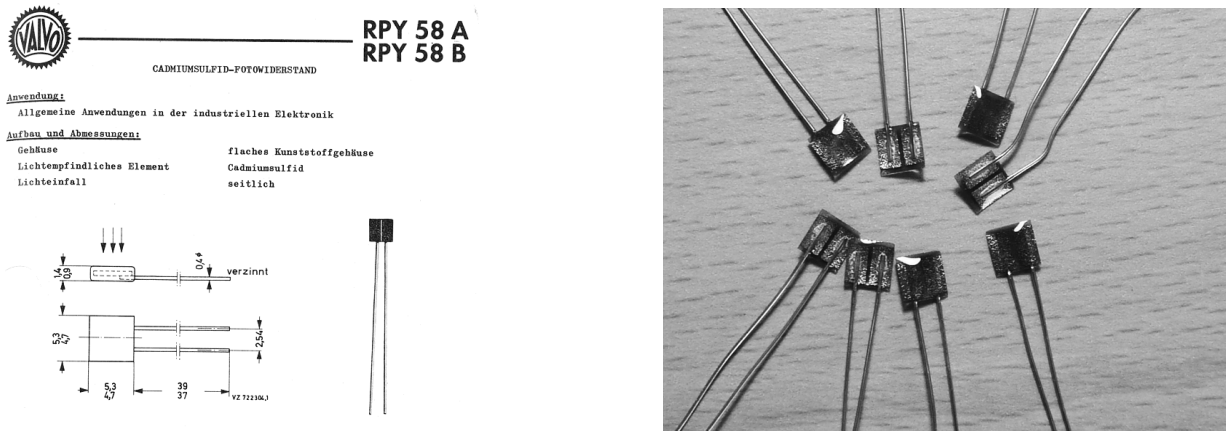

Fig. 3 Volvo's monograin devices: page from the 1980 Valvo "Halbleiterbauelemente für die Optoelektronik"-catalogue (left) [20], photograph of the 5x5 mm^2 photoresistors (right).

This extremely easy and low-cost production method was taken over by the author and became the basis of Crystalsol's production process (see below). After finishing the photoconductor production at Valvo the monograin membrane production was stopped in Hamburg.

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3.2 Spheral Solar

Another already historical production process is that of spheral solar cells, which was still in 2004 called "a revolutionary solar electricity technology breakthrough that provides an extremely versatile and cost-effective method of generating solar electricity".

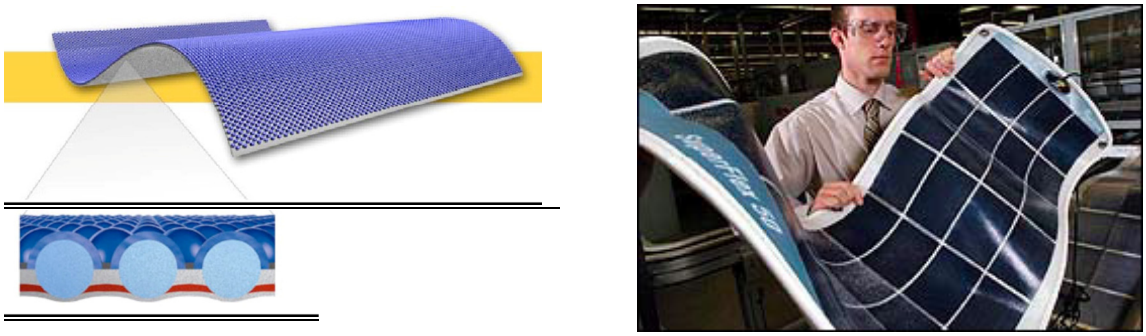

Fig. 4 Schematic drawing (left) [21], and 2006 photograph of Sphelar Solar Cells [28].

A result of more than 30 years of development and 40 worldwide patents, this technology comprises thousands of tiny silicon spheres, bonded between thin flexible aluminum foil substrates to form solar cells, which are then assembled into durable, lightweight modules that can be applied to virtually any surface. Spheral Solar™ spheres are bonded between two sheets of aluminum foil. The front foil determines the spacing of the spheres and acts as the electrically negative contact to the n layer. The back foil acts as the electrically positive contact to the p-type core of the spheres. Those design characteristics allow cells to be manufactured in different sizes for different uses [21].

The technology to use a monolayer of n- and p-type semiconductor spheres parallel and series connected (depending on the type) for direct conversion of solar energy into chemical energy by electrolysis of hydrogen bromide (HBr) had been developed and patented by Jack Kilby, Jay W. Lathrop and Wilbur A. Porter [22]. Here all spheres were covered with a metal film acting as electrodes in a HBr solution. Such arrangements were then combined with an appropriate fuel cell to regenerate HBr and use the stored energy in an electric circuit. Besides for military and space applications TISES, the Texas Instruments Solar Energy System, was also developed for residential applications [23].

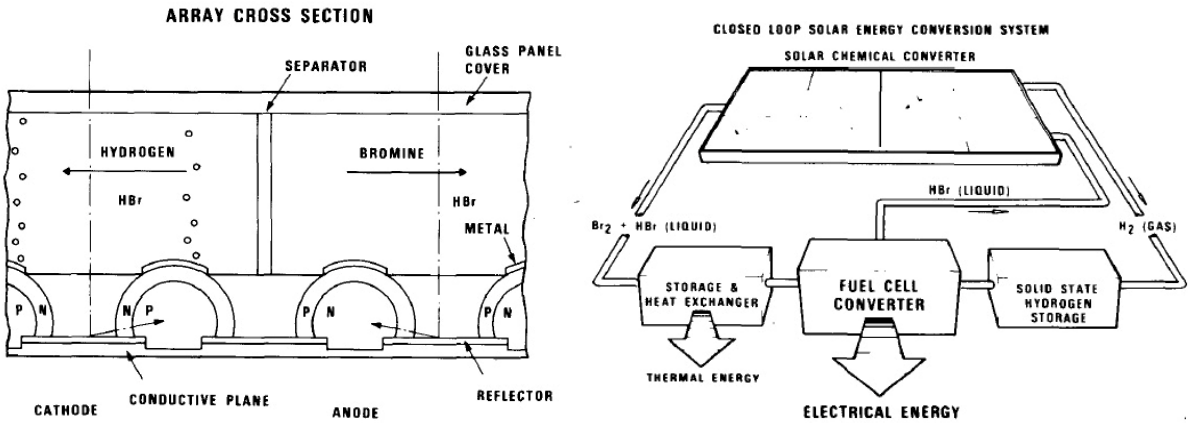

Fig. 5 Schematic cross section of TISES solar chemical converter (left) and Block diagram of TISES [21].

Also a low-cost production process of cells and modules had to be developed [24]. The silicon spheres were inserted into pre-perforated aluminum foils (as used in shadow masks in the at that time common cathode ray TV screens). Here every semiconductor particle is only partly coated with a p/n-junction forming contact material contacting the aluminum foil. The uncoated inner part of the particle is here contacting a back contact separated from the aluminum foil be an insulating layer. In 1987 Milfred D. Hammerbacher and his team at TI started in cooperation with the Southern California Edison Company (SCE) to develop a Spheral Solar Cell using metallurgical silicon of low purity. After 6 years of research a pilot production plant was built in 1991 for testing and evaluation. About 30 x 30 cm^2 large cells contained about 17.000 silicon spheres built into an aluminum foil connected to a second Al-foil, producing a maximum of 100 W. The tiny Si-spheres grown by fast cooling of a melt are pressed into a perforated Al-foil and covered by a second Al-foil.

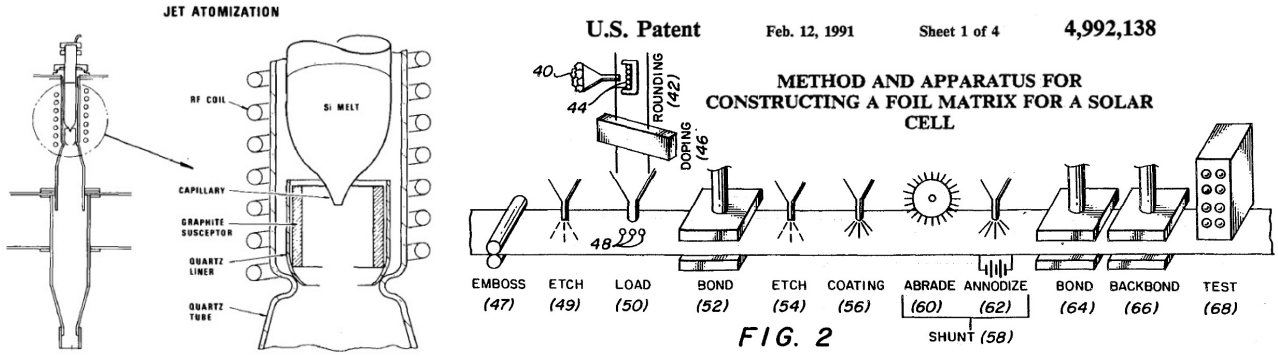

Fig. 6 Cross section of jet atomization apparatus used for producing spherical silicon particles (left), and Example of a Spheral Solar Cell Production Line [21].

The series production should have started in 1993, to allow for an electricity kWh-price of only 0,23 $. However, as part of a corporate restructuring, the company divested itself in 1995 of its solar technology project, which was sold to Ontario Hydro. Probably due a lack of support by the Canadian government the project was sold in 1997 to ATS, a former part of the team at Texas Instruments in the early 1990s as a supplier of automated equipment. Here Hammerbacher, who joined ATS the same year, continued research and development. In 2002 ATS newly created a subsidiary, Spheral Solar Power Inc. (SSP), to begin commercial manufacture of the "next generation solar cells" at a 120,000-squarefoot-facility [25]. In 2004 they started a partnership with building supplies giant Elk Corp. to develop solar-integrated roofing and building material products [26]. In 2006 ATS decided to spin off it's solar activities under the name of Photowatt Technologies but delayed it "because of production troubles" [27]. In 2007 finally ATS announced that its subsidiary, Photowatt Technologies Inc., has signed a non-binding letter of intent to enter into a business relationship with Clean Venture 21 Corporation ("CV21") of Kyoto, Japan and Fujipream Corporation ("Fujipream") of Hyogo, Japan, in order to advance the development of its Spheral Solar™ Technology [28]. ATS then treated Spheral for years as „a halted development project that has been wound down" [29]. After in 2011 ATS's PV producer Photowatt had started bankruptcy procedures all assets were finally sold in 2012 to Électricité de France SA (EdF) [30].

3.3 Kyosemi's Sphelar Solar Cell

Kyosemi Corporation, Japan, was founded in 1980 in Joyo City, Kyoto, Japan, as a research and development-oriented company. Today, it conducts business in the fields of "opto semiconductor devices" and solar power generation, and commercializes and markets original products including optical communication devices, optical sensing and control devices, and the spherical photovoltaic solar cell Sphelar® [31]. Sphelar® is the trademark given in 2004 to a proprietary spherical solar cell product Kyosemi Corporation has developed on its own.

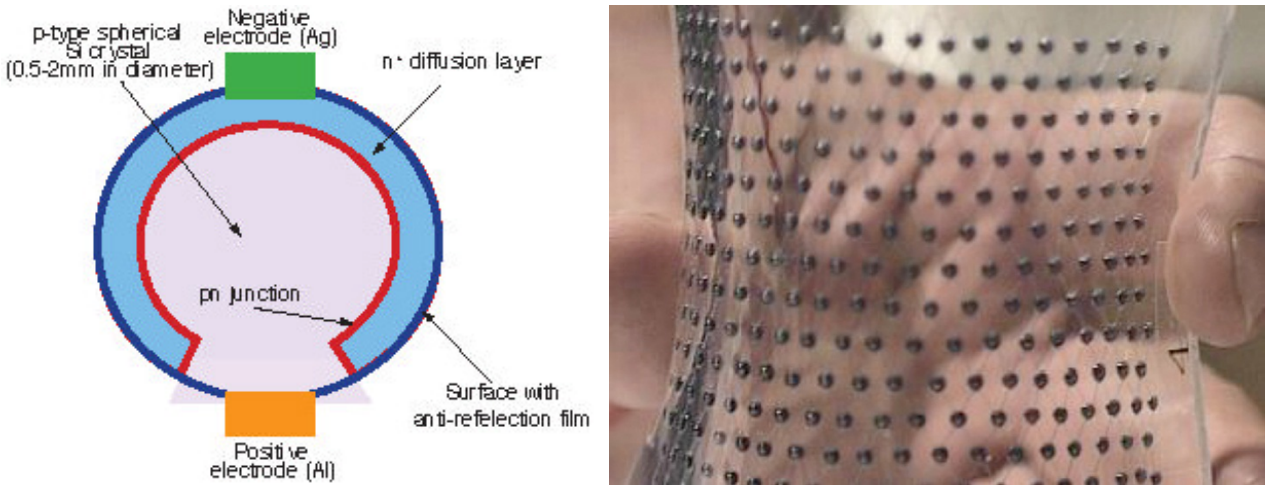

Fig. 7 Scheme of a Kyosemi Sphelar®silicon particle, contacted (left) and Sphelar® Solar Module [31].

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This tiny solar cell measuring a mere 1-2 mm across "holds huge potential, standing ready to contribute to the realization of everything from ubiquitous network society to clean-energy society". Kyosemi patents are mainly connected with the microgravity crystallization of silicon particles. In May 2012 Sphelar Power Corp. was established. Their products are aiming at highly transparent windows (Sphelar® BIPV) and consumer products (Sphelar® EIPV) such as Sphelar Lanterns, Garden Lights or even textiles [31].

3.4 Kyocera Corp.

Kyocera Corporation was founded in 1959 to manufacture advanced ceramics and became a major supplier of solar cells, semiconductor packages, cameras, laser printers, electronic components and telecommunications equipment. Kyocera today is one of the world's largest vertically integrated producers and suppliers of solar energy panels. The company started in 2000 to file patents on semiconductor particle-based photovoltaic devices very similar to the original Hoffman-devices [32] as described above. The devices are based on p-type crystalline silicon particles contacted on top by an amorphous n-type silicon film. Also the fabrication silicon spheres by using a dropping methods [33] or a plate-based method [34] were protected. Of special interested is the use of reflectors between the particles increasing the active area of the device [35], compare also the CV 21-modules below.

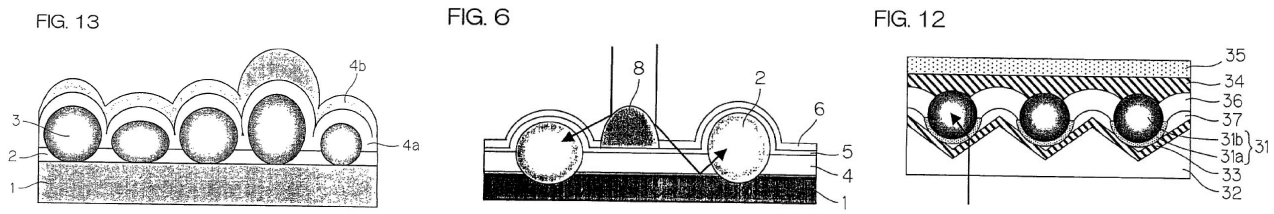

Fig. 8 Some of the many schemes of grains-based solar cells shown in Kyosemi's patents. Left fig. 13 in US 2002/0023674 A1 [32], right figures 6 and 12 in US 2002/0117667 A1 exhibiting different forms of reflectors or light trapping structures between and on top of the grains [35].

Kyocera continued research at on the manufacturing of silicon particles at least until 2008 [36], commercial products are not known to the author.

3.5 Clean Venture 21

Clean Venture 21 Corporation was founded in 2001 in Kyoto by the former director of Matsushita´s R&D center for PV Mikio Murozono, and installed its first molten silicon-dropping furnace at the University of Tokyo [37]. In a first patent of November 2000 Yoshihiro Hamakawa and coworkers already outline the final version of their silicon spheres-based device as well as their production process [38]. The silicon spheres are produced in a dropping process from a melt including a second heating process of the falling drop by a laser beam (compare Fig. 9). In contrast to the above-mentioned processes the cooling happens in a few stories high falling tower, so that nicely spherical particles with diameters of about 1 mm are formed. After doping the outside they are picked up one by one, polished on one side and inserted into a substrate made from an array of small reflector cups, compare Fig. 8.

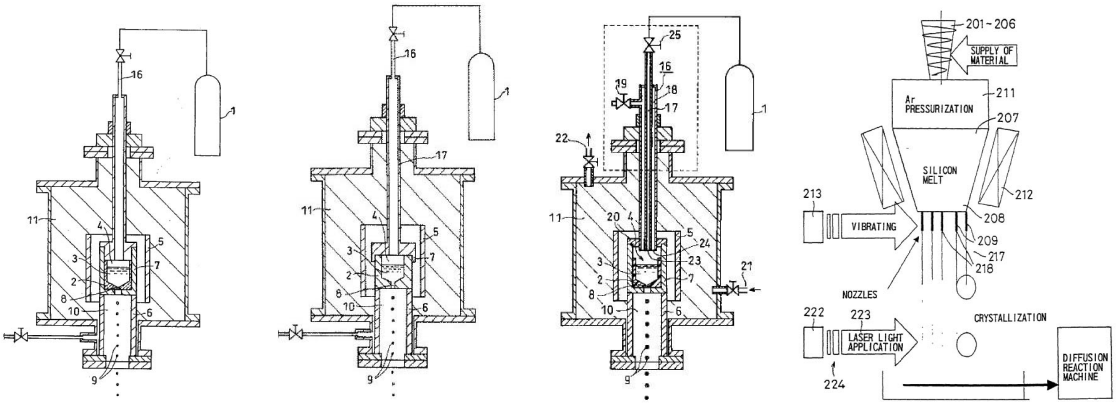

Fig. 9 CV 21 schemes of silicon sphere production setups. From left: fig. 7 in US2004007790 (A1) fig. 9 in JP2004244670 (A), fig. 1 in JP2006206406 (A), and fig. 19 in US2002096206A1

In 2005 they displayed a first module at PVSEC Shanghai and signed a partnership for research, development, volume production and commercialization of photovoltaic Si solar cells with Fujipream Corp. of Hyogo, Japan [39]. At that time they claimed a conversion efficiency of 11.7 % and flexible cells. In 2007 they shipped the first 5x15 cm^2 cells with micro reflector cups. Modules are then assembled from these cells. In July 2008 they installed the first 15 MW line and in August opened a new plant at Kisshoin, Minami Ward, Kyoto. Meanwhile several installations have been made in Japan and modules up to 130 W_p are offered on their website. CV21´s rich patent portfolio deals with particle preparation as well as placing spheres at defined places and interconnecting them.

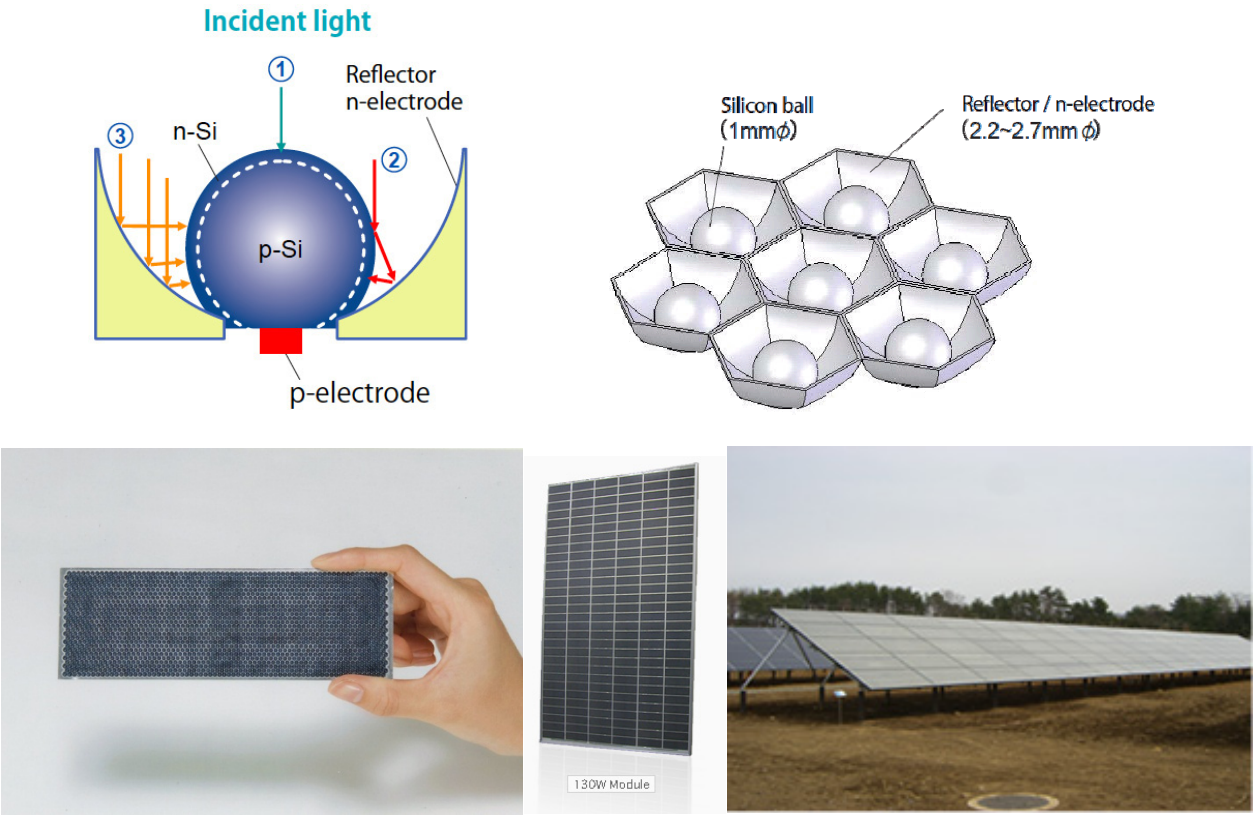

Fig. 10 Scheme of a CV 21 silicon sphere / reflector assembly and a cell, a 1130 W module and a 20 kW system installed in Hokuto City, Japan [37].

3.6 Other Activities

In 1996 Ball Semiconductor Inc. [40] was founded in Texas to commercialize applications based on silicon balls of about 1 mm in diameter demonstrating besides different electrical sensors and circuits in 2000 also a solar cell made from an assembly of these balls. The company also worked with different Japanese Universities through their Japanese office. Main application had been MEMS and three-dimensional acceleration sensors [41]. Their company website unfortunately is not accessible anymore.

In 1999 Mitsui High Tec (formerly Mitsui Mfg.), calling itself "the world's foremost supplier of lead frames for integrated circuits" [42], filed a patent describing a PV device resembling closely the appearance of a powder-based device, however, actually being based on a "a board with a surface with a plurality of spherical segments projecting from the board surface" [43]. Onto this board thin film solar cells are deposited. So this type of device is actually not a powder-based solar cell. It is unknown to the author if Misui High tec continued their development.

Other companies active in spheral silicon solar cell developments include Fuji Machine Manufacture [44] and ZT Solar, Texas [45].

4. New monograin membrane developments

4.1 TUT Monograin Membranes

Using Philips' Monograin Membranes the author worked on photoelectrochemical solar energy utilization already since 1980 under the supervision of Rüdiger Memming and Bertel Kastening at Hamburg University [46]. When Valvo stopped their production line 15 years later the technology was transferred to his group at that time in Hannover, later

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Jülich. Even before this Enn Mellikov at Tallinn's Polytechnical Institute in Estonia developed powder improvement and growth techniques under the supervision of Jaan Hiie [47] to produce very high quality single-crystalline II/VI, mainly CdS-powders, well aware of the use of such powders in monograin membrane devices by Philips as described above. Soon later they had also developed their own monograin layer technology to produce microwave, light and x-ray sensors [48]. Since this was still the Soviet time unfortunately most of their research was classified and even their patents kept secret, so that not much became really known to west until Estonia's independence in 1991 [49]. Immediately after the author met the Tallinn group in a conference and a very close collaboration started focusing on monograin membrane solar cells, first still based on chalcogenides such as CdSe, CdTe and their solid solutions [50], then on CIS and CIGS [51], and finally on CZTS [52]. A basic patent on the molten salt growth of complex semiconductor powders was filed in 1998 [53] and became the basis of a first commercialization attempt together with the glass company Scheuten.

4.2 Scheuten´s "Sunrise" approach

In 2000 the glass-coating company Scheuten from Venlo, The Netherlands, started collaborating with the research group at Tallinn University of Technology on glass-based CIGS monograin solar cells. However, in 2003 they filed their own (extremely narrow) patent [54] claiming CIGS coated glass balls as a base material. This finally lead to a new concept called "Sunrise" based on sputtering layers of molybdenum, Cu, In, Ga and converting the letter in a sulfur/selenium atmosphere, followed by inserting the today about 200 µm-spheres into metal coated polymer film [55]. Scheuten also applied for two patents with members of Enn Mellikov group at TUT [56] on details of the $Cu(InGa)Se_2$ production process, which again are extremely narrow strictly limiting them to this material and in the first case a first step of forming a CuIn- and/or CuGa-alloy and in the second case treating powders of this composition in a sulfur atmosphere. The collaboration stopped in 2007 and was finally terminated in 2008.

In 2007 Scheuten opened a pilot production facility in Venlo, The Netherlands. A 250 MW factory, planned already for 2009, has not been realized. In October 2008 Scheuten signed an agreement with RITEK, a leading optical disc and OLED group world-wide, to start a Joint Venture Company to manufacture CIGS thin film solar cell with issued capital of NT$ 600 million at first stage, where each party takes 50% share holding. The JV Company is located at Hsin-Chu in Taiwan. "Production facilities for the manufacture of 30MW of solar cells will be in place towards the end of 2008. Capacity will be doubled each year from 2009 to 2010, reaching 120MW by 2010. Production can be increased still further in the light of the future growth of market demand" [57].

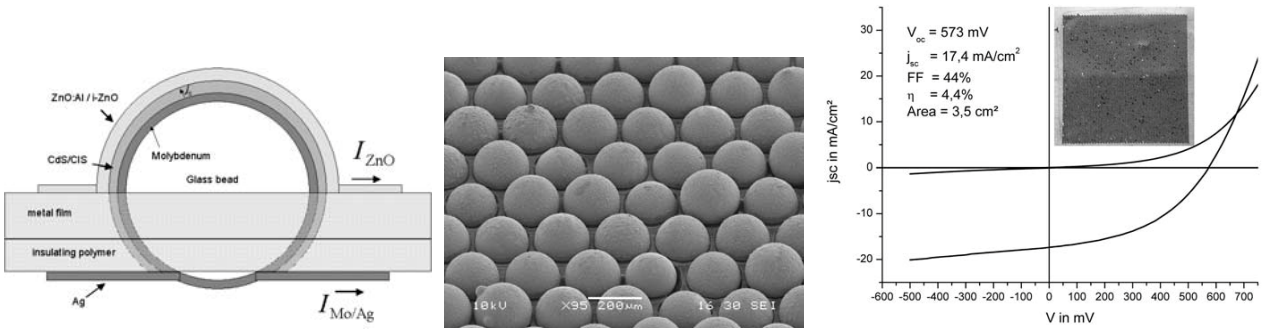

Fig. 11 Scheme of a coated sunrise glass bead embedded into a metal film (left), CIS covered glass beads in metal film, and I/V-curve of a Efficiency of a 3.5 cm2 glass bead solar cell including a picture of the module exhibiting a large number of missing beads [55].

A key problem of all technologies based on perforated foils seems to be the filling of all holes with spheres. As can be seen in a picture of an Scheuten Sunrise cell (fig. 11 right) a large number of defects seem result of an automated production process [55]. As can be seen already from the patents of the different "spheral" companies (from Texas Instruments to ATS) an amazing effort was put into automating the placement of silicon spheres into all holes of the perforated Al-foil.

4.3 *Crystalsol's* Monograin Membrane Solar Modules

Based on the above-described Philips/Valvo monograin membrane technology the author further developed the technology to produce a powder-based monograin module production process. By using this approach the semiconductor formation is separated from cell / module manufacturing, leading to substantial advantages during processing / manufacturing of such solar cells. A pilot production line was set up in its R&D facility already in 2007. In 2007 the author and his TUT colleagues decided to start the TUT spinout company *crystalsol OÜ* together with two colleagues from Austria willing to manage such a startup venture. A year later Crystalsol GmbH was founded by these 3 with Crystalsol OÜ later becoming its daughter.

Crystalsol is currently upscaling its proprietary powder production process [59] in Tallinn, Estonia, and developing a roll-to-roll module production in Vienna, Austria. The semiconductor crystal powders are produced in a molten salt, followed by surface treatment and annealing steps. A buffer layer is deposited on the surface in a classical chemical bath deposition (CBD) process forming the active interface and protecting the particles against ageing. Small solar cells are produced from this powder for quality control before it is supplied for module production.

Fig. 12 shows an early stage module production scheme [60]. The production starts with the deposition of a polymer binder onto a temporary substrate foil 1. Conductive lines are introduced enabling the series connection of cells for monolithic integration followed by inserting a single layer of powder particles (4). A transparent front contact (TCO) is deposited (6) in stripes for series connection, and a transparent encapsulation foil 9 seals the front side. The temporary substrate foil is removed from the back-side (19), which in a next stage is opened in an abrasion process 11. A carbon-based back contact is printed (12) and contact stripes are deposited, finalizing the series connection. A final encapsulation foil is applied and the modules cut off in desired lengths.

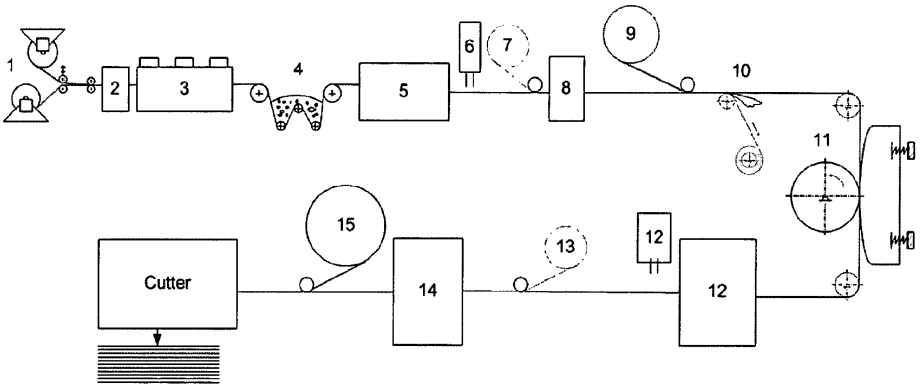

Fig. 12 Crystalsol's patented production process as described in WO 2010 000581 [60]

This process allows a roll-to-roll (R2R) module production started by a printing process of a polymer layer and directly ending with a sealed ready-to-use module. The solar cell material itself is prepared before in a bulk process allowing for any temperature and very high process control in the form of an about 50 µm single crystal powder of highest quality and homogeneity. Thereby all area upscaling problems - as crucial for all thin-film technologies - are avoided and the advantage of Silicon's wafer technology, to separate materials and module production and thereby being able to optimize both independently, is preserved, while on the other hand replacing the tedious cell handling, stringing and encapsulation by an ultra-fast R2R process.

Due to the crystalline structure of the semiconductor particles exhibiting different crystals planes and approaching a pyramidal structure packing densities of above 90 % are achieved. Spherical particles allow for only 85 % in dense packing as shown in Fig. 13 together with a 20 x 20 cm^2 module. The shiny spots seen on this module are reflections from some of the crystals, which give the module a very special precious appearance. Monolithic serious connection is achieved by use of metal wires embedded into the module allowing for a very cost effective production.

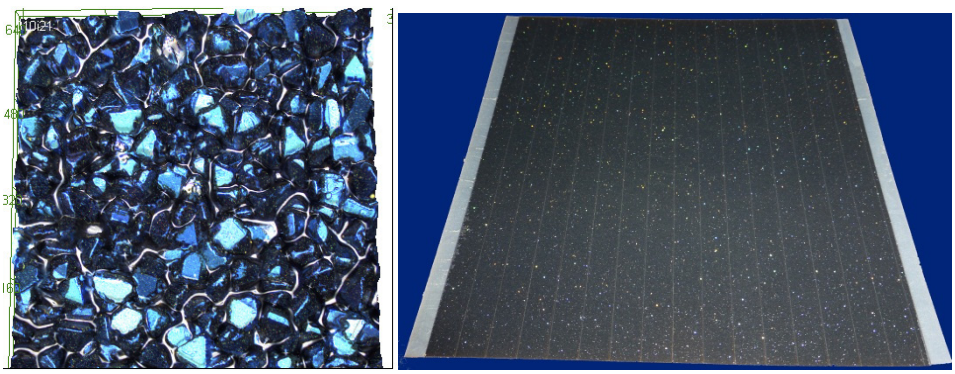

Fig. 13 CZTS Monograin Membrane, Powder size 50-60µm (left) and crystalsol monograin module of 20 x 20 cm^2

Crystalsol currently develops a production process based on the Kesterites $Cu_2ZnSn(S_xSe_{1-x})_4$ (CZTS) of different compositions, compounds very similar to the chalcopyrite CIGS but replacing the resource-limited and very expensive Indium by the abundant elements Zink and Tin. However, basically all compound semiconductors can be used in this process including also CIS, CIGS or CdTe (which also have been used already in TUT).

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Copper-zinc-tin-chalcogenides (CZTS), especially Cu_2ZnSnS_4, $Cu_2ZnSnSe_4$ and their solid solutions, often called also Kesterites due to their crystal structure, is considered as one of today´s most promising new materials for photovoltaics [61]. Efficiencies of up to 6.8 % as certified by Fraunhofer ISE (Fig. 14) have been achieved as of today and will be further optimized in the future [58].

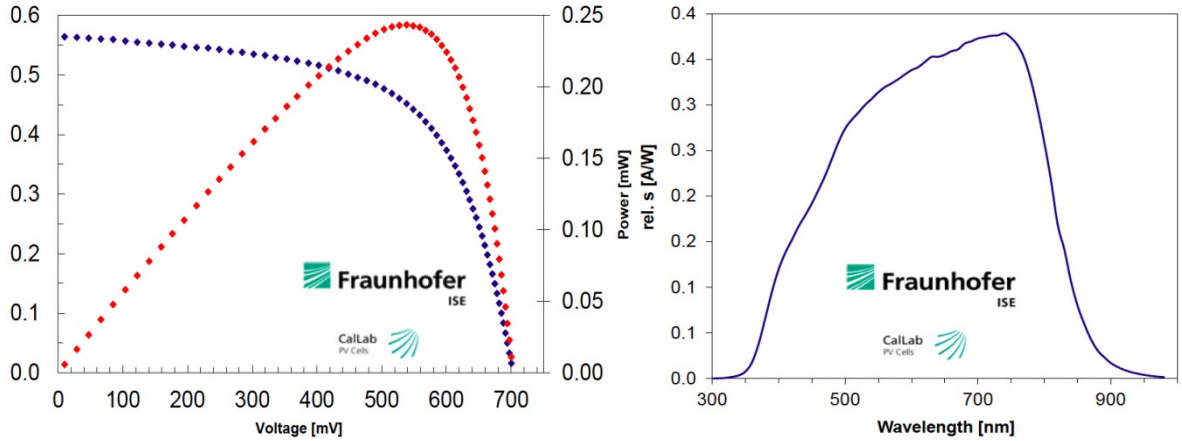

Fig. 14 I/V curve and Quantum Yield spectrum of a crystalsol solar cell as certified by ISE Freiburg (Eff. = 6,8 %, U_{oc}= 703 mV, I_{sc} = 19,4 mA/cm^2, FF= 61,34 %)

5. Summary

Although the idea to produce large-scale solar cells or modules of very high quality based on crystalline grains has been around since more than 50 years and several companies developed technologies to utilize this idea only recently first modules became commercially available. However, of the three companies currently active in commercializing this type of solar cells only crystalsol aims at an ultra-cheap production process. Kyocera ns CV 21 both handle their spheral particles one by one in order to form Ohmic contacts to the inside and a p/n-junction on the rest of the surface, and place them in preformed structures. This does not allow for a fast large scale production process as needed for the high production rates required for a TW production in the near future to replace fossil fuel utilization and to save the world's climate.

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Sun Electricity

Monday, Jul. 04, 1955

When Bell Telephone Laboratories announced its silicon solar battery (TIME, May 3, 1954), it fired the imaginations of the science fictionists, and the solar system was soon abuzz with solar-powered space ships. Trimming their silicon sails to catch the sunlight, spacemen used the electricity generated by the batteries to push themselves from planet to planet.

More practical imaginations were fired too. Last week National Fabricated Products Inc., a Chicago electronics manufacturer, announced that it has had more than 500 inquiries about the silicon batteries which it has just started making commercially under license from Bell Lab's parent company. Western Electric. Inquiries have come from industrial laboratories all over the world, including India.

Most customers ask for a dozen or so ($25 each), and seldom say what they hope to use them for.

N.F.P.'s version of the battery is a thin, blackish wafer about the size of a half dollar, enclosed in protective glass. It has two electric terminals like any other battery, and when it is exposed to bright sunlight it generates about half a volt. A square yard of the batteries would light a 100-watt lamp or run an electric fan. A few acres would give enough power for a fair-sized town.

Large-scale uses are unlikely until the price comes down. The batteries are expensive because they are made of highly purified silicon ($280 per lb.), which must be "grown" by a tricky process into a single crystal about the size of a fat banana. The wafers are cross sections one-fiftieth of an inch thick, and they must go through a subtle chemical treatment be fore they will work as batteries.

While the cost remains high, the chief practical uses will be to supply minute amounts of current for relays, electronic instruments or small radio transmitters.

Bell Labs, looking ahead, is experimenting with them for charging the storage batteries of rural telephone lines. Frames of them set on poles at Americus, Ga. are performing well, but Bell is worried about the effects of indifferent birds and stone-throwing boys.

President Maurice E. Paradise, of National Fabricated Products, is sure that the solar batteries can be made much more cheaply. He hopes that eventually the magic silicon can be sprayed on a surface as a crystalline metallic varnish. Then really big batteries will be cheap. They are rugged and last practically forever. A house roofed with sun-absorbing silicon could generate all the current it needs whenever the sun is shining.

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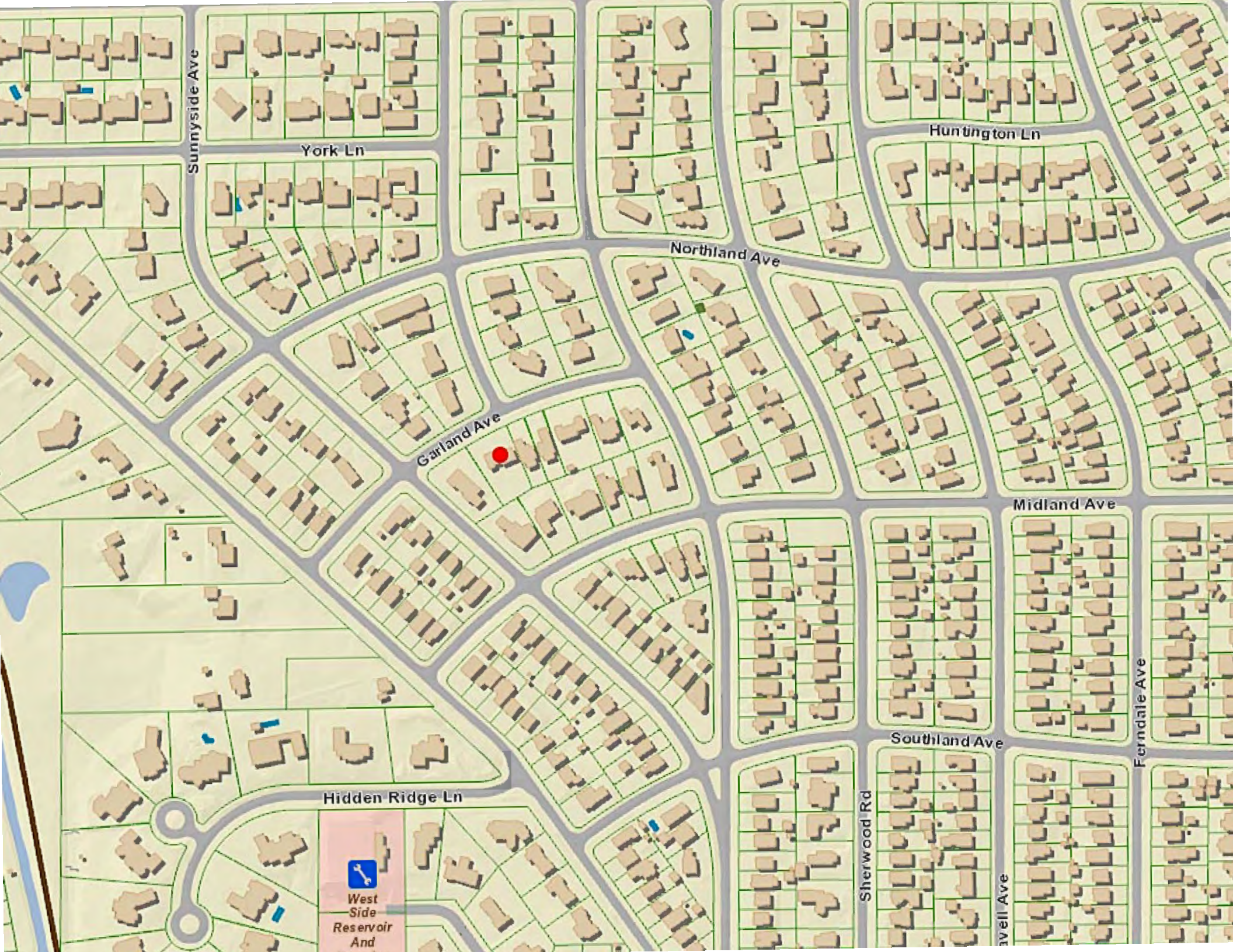

Sunnyside Ave
York Ln
Huntington Ln
Northland Ave
Garland Ave
Midland Ave
Southland Ave
Ferndale Ave
Sherwood Rd
Hidden Ridge Ln
West Side Reservoir And

Historic Preservation Commission

1880 Garland Avenue Demolition Review

To: Historic Preservation Commission

From: Nusrat Jahan, Planner

Date: 5/12/2016

Year Built:	1951
Style:	Partial Two Story
Petitioner:	Gregory and Jamie Goodman
Size:	1,904 square feet
Original Owner:	Unknown
Architect:	Unknown
Original Cost:	Unknown
Significant Features:	Various Height, wide chimney, Mix exterior Cladding, 2nd Floor Picture Window, Window Shutters
Alterations:	• 1954 Garage and Porch • 1962 Addition Two Bedrooms and Bathroom
Staff Opinion:	Staff recommends that the Commission discuss the structure at 1880 Garland Avenue and how it may satisfy any of the landmark criteria identified in Chapter 24.

A demolition application has been submitted for the house at 1880 Garland Avenue. 1880 Garland Avenue is located within the west side survey area and no determination of significance has been made. The Lake County Tax Assessor's data indicates that the original house was built in 1951. However, no permit document for the original home construction was found in the City archives. The City of Highland Park Building Division records indicate that in 1954 architect Jones and Duncan remodeled the house for the owner William R. Lueders. The permit cost was $3,600.

In 1962, owners Gregory and Jamie Goodman constructed a second floor addition of two bed rooms and a bath room which was designed by the same architect Jones and Duncan.

Location Map – 1880 Garland Avenue

The City's 2000 survey data of the west side indicates that 1880 Garland is a ranch structure and was assigned a local significance rating of "NC – Non- Contributing." 1880 Garland Avenue is Lot 217 – 218 in Sherwood Forest Subdivision, which was plated in 1930. The survey also indicates that this subdivision was developed during 1930s and 26% of the total building were built before 1950s and 60% are from the 1950s.

Front View – 1880 Garland Avenue

Architectural Analysis

As the photographs depict, the original house was a traditional one story structure. The front elevation reflects the original home as a smaller brick ranch, low pitched roof and rectangular windows. The partial second floor addition with vinyl sidings and the first floor has brick cladding and wider chimney on the south side. If there's interest, the commission may conduct further discussion regarding the architectural style of the house.

Biographical Information

William Robert Lueders, who owned the house in 1954,was born in December 20, 1915 in Cook County, Illinois. His father was Carl George Lueders and mother, Vera Simpson. His wife was Dolores and their children were Scott, Robert, Thomas, and James. Mr. Leuders served in U.S. Army, World War II, the 163 Signal Photo Company with the 5th and 7th Army in North Africa, Italy, France, Germany, and Austria. William Robert Lueders died in February 2015.

Landmark Criteria

Below are the landmark criteria from the City Code:

1) It demonstrates character, interest, or value as part of the development, heritage, or cultural characteristics of the City, county, state, or country.

2) It is the site of a significant local, county, state, or national event.

3) It is associated with a person or persons who significantly contributed to the development of the City, County, State, or Country.

4) It embodies distinguishing characteristics of an architectural and/or landscape style valuable for the study of a specific time period, type, method of construction, or use of indigenous materials.

5) It is identifiable as the work of a notable builder, designer, architect, artist, or landscape architect whose individual work has influenced the development of the City, County, State, or Country.

6) It embodies, overall, elements of design, details, materials, and/or craftsmanship that renders it architecturally, visually, aesthetically, and/or culturally significant and/or innovative.

7) It has a unique location or it possesses or exhibits singular physical and/or aesthetic characteristics that make it an established or familiar visual feature.

8) It is a particularly fine or unique example of a utilitarian structure or group of such structures, including, but not limited to farmhouses, gas stations or other commercial structures, with a high level of integrity and/or architectural, cultural, historical, and/or community significance.

9) It possesses or exhibits significant historical and/or archaeological qualities.

Recommended Action

In accordance with Section 170.040 Demolition of Dwellings(E)(1) Historic Preservation Commission Review, the Commission is asked to review the structure per Section 24.015 of the Historic Preservation Regulations. If the Historic Preservation Commission determines that the Structure that is the subject of the Demolition Application satisfies:

(1) Three or more of the Landmark Criteria within Section 24.015 of the Historic Preservation Regulations, then a mandatory 365-day Review Period commencing on the Application Completion date will be in effect.
(2) One or two of the Landmark Criteria within Section 24.015 of the Historic Preservation Regulations, then a mandatory 180-day Review Period commencing on the Application Completion date will be in effect,
(3) None of the Landmark Criteria within Section 24.015 of the Historic Preservation Regulations are met, in which case the Application for Demolition shall be processed.

Attachments

Location Map
Site Photos
County Assessor Data

FOR
SALE

1880 Garland

Lake County, Illinois

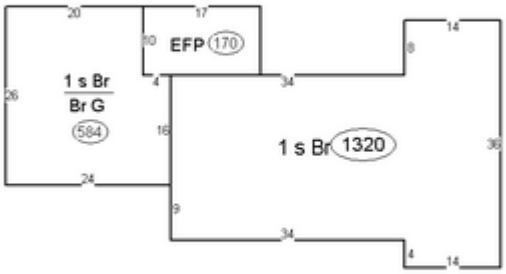
Property Tax Assessment Information by PIN

Property Address	
Pin:	16-28-215-002
Street Address:	1880 GARLAND AVE
City:	HIGHLAND PARK
Zip Code:	60035
Land Amount:	$75,555
Building Amount:	$84,156
Total Amount:	$159,711
Township:	West Deerfield
Assessment Date:	2015

Property Characteristics	
Neighborhood Number:	1721150
Neighborhood Name:	SHERWOOD FOREST 1
Property Class:	104
Class Description:	Residential Improved
Total Land Square Footage:	0
House Type Code:	62
Structure Type / Stories:	2.0
Exterior Cover:	Brick
Multiple Buildings (Y/N):	N
Year Built / Effective Age:	1951 / 1951
Condition:	Average
Quality Grade:	Gd+
Above Ground Living Area (Square Feet):	1904
Lower Level Area (Square Feet):	
Finished Lower Level (Square Feet):	
Basement Area (Square Feet):	818
Finished Basement Area (Square Feet):	0
Number of Full Bathrooms:	2
Number of Half Bathrooms:	0
Fireplaces:	1
Garage Attached / Detached / Carport:	1 / 0 / 0
Garage Attached / Detached / Carport Area:	584 / 0 / 0
Deck / Patios:	0 / 0
Deck / Patios Area:	0 / 0
Porches Open / Enclosed:	0 / 1
Porches Open / Enclosed Area:	0 / 170
Pool:	0

Click here for a Glossary of these terms.

Click on the image or sketch to the left to view and print them at full size. The sketch will have a legend.



Property Sales History

Sale valuation definitions

Date of Sale	Sale Amount	Sales Validation	Compulsory Sale
No Previous Sales Information Found.			

Changes made to the sketch drawings are uploaded to the website every two weeks. The property characteristics appearing on this page show any changes made by an assessor the following day.

Please note that the characteristic information shown above is only a summary of information extracted from the Township Assessor's property records. For more detailed and complete characteristic information please contact your local township assessor. Likewise, any errors/omissions/discrepancies should be discussed with the appropriate township office.

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http://apps01.lakecountyil.gov/SPASSESSOR/COMPARABLES/PTAIpin.ASPX?Pin=1628215002

Date 1-20-1954 Building Permit No. 757

Inspected by ..... Date .....
For certificate of occupancy

Location of Building — No. 1880 Street Garland Ave

Name of Owner Wm R. Luebers

Present Address Same as Above Phone HI 2-7435

Type of Construction Fr & Br Ac & Porch

Architect Jones & Duncan Address 508 Central Ave Phone Th 2-1404

General Contractor owner Address ..... Phone .....

Permit issued to Architect to ~~construct~~ remodel a Single Family Dwelling

building on Lot 217-218 Blk. ..... Sub'n. Sherwood Forest

Builder's estimate 3,600- Permit fee 13- Job Order No. N-P Amt. $—

Location of building on Lot verified 1-21- 1954 by H. Sasek

Sanitary provisions approved by .....

Other Inspections Posted Bldg Permit

DATE PERMIT ISSUED	BUILDING ADDRESS	BUILDING PERMIT NUMBER
August 24,1962	1880 Garland Ave	11933

BUILDING ON

OF LOT BLOCK SUBDIVISION

NAME OF OWNER	ADDRESS	PHONE NUMBER
William R Lueders	same	Td 2 7435
ARCHITECT	ADDRESS	PHONE NUMBER
Jones & Duncan	210 Skokie Valley Rd	Td 2 4041
GENERAL CONTRACTOR	ADDRESS	PHONE NUMBER
same		
PERMIT ISSUED TO	ADDRESS	PHONE NUMBER
owner		

TYPE OF CONSTRUCTION	SQUARE FEET	CUBIC FEET	LOT AREA
SFD addition 2 bedrooms and bath			

BUILDER'S ESTIMATE	BUILDING DEPT. EST.	PERMIT FEE	BUILDING DEPOSIT	GUARANTEE DEPOSIT NUMBER
$ 10,000	$ 10,000	$ 34.00	$	

TYPE OF HEAT	PERMIT NUMBER	MAKE OF BURNER	DATE INSTALLED	LOCATION

DRIVEWAY PERMIT NO.	DEPOSIT NUMBER	DATE ISSUED	CONTRACTOR

SITE INSPECTION	8/28/62 WR	BY
FOOTING AND FOUNDATIONS		BY
FRAMING	9/24/62 WR	BY
ROOFING	—	BY
HEATING	2/4/63 WR	BY
DRIVEWAY	none	BY

OCCUPANCY CERTIFICATE

PLUMBING CONTRACTOR		ADDRESS				PHONE NUMBER
WATER TAP NO.	GUARANTEE DEPOSIT NO.	FEE	DATE ISSUED	SEWER TAP NO.		STORM TAP NO.
NO. LAVATORIES	NO. LAUNDRY TUBS	NO. TOILETS	NO. BATHS	NO. SINKS	NO. SHOWERS	NO. STACKS
OTHERS		DOWNSPOUTS CONNECT TO				DATE COMPLETED
ELECTRICAL CONTRACTOR Deerfield Electric Co.		ADDRESS 708 Waukegan, Deerfield				PHONE NUMBER Wi 5-3849
ELEC. PERMIT NO. 9912	DATE ISSUED 9/24/62	NO. FIXTURES 5	FLOOR AREA	SIZE OF MAIN WIRE		SIZE OF BRANCH WIRE
SYSTEM	NO. 15 AMP CIRCUITS	NO. 20 AMP CIRCUITS		NO. OPENINGS		NO. SOCKETS 22
NO. CIRCUITS	NO. MOTORS	NO. RANGES		OTHERS		

DRAINAGE none	BY
PLUMBING 9/13/62 WR	BY
ELECTRICAL Rough 9-18-62 B Final 2-5-63 B	BY
FIRE REGULATIONS	BY
FINAL INSPECTION 2/4/63 WR	BY
PLOTTED SURVEY SUBMITTED NR	CERTIFICATE OF OCCUPANCY ISSUED 2/7/63 [illegible]

CITY OF HIGHLAND PARK, ILLINOIS
BUILDING DEPARTMENT

BUILDING PERMIT FILE CARD

With AMERICA'S FIGHTERS
Chicago Daily Tribune (1923-1963); Nov 4, 1945; ProQuest Historical Newspapers: Chicago Tribune
pg. N6

With AMERICA'S FIGHTERS

Lt. William R. Lueders, 2212 Sunnyside av., is at home awaiting discharge from the army after serving four years, two of which were in Europe. He participated in the African, French, Italian, and Alsatian campaigns, and holds the Presidential unit citation and bronze star medal. He was in charge of photographic crews with the 163d photo signal company.

Lt. Lueders

Raymond G. Brandt Jr., 2703 Clark st., has been promoted to technician third grade with the 8th arm in Yokohama, Japan.

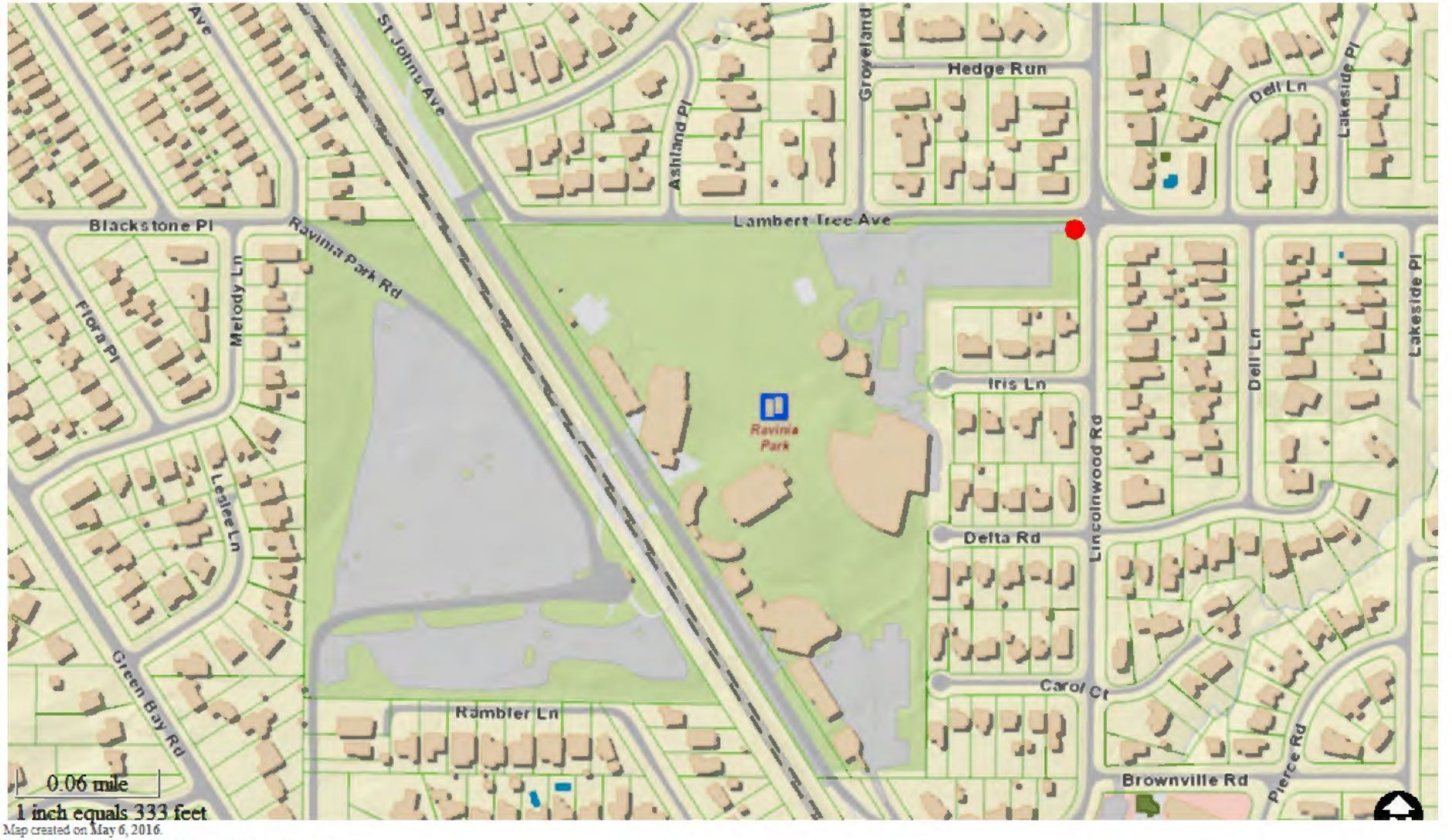
The Purple Heart and air med recently were presented Lt. Geor Rich, 6577 N. Winthrop av., at Greensboro, [N. C.] AAF replacement depot and redistribution center. He then received an honorable discharge.

Laurence H. Brown, Highland Park, has been

Kelley Spaulding Funeral Home

GIS consortium MapOffice™

Ravinia Park



Map created on May 6, 2016.

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Disclaimer: This map is for general information purposes only. Although the information is believed to be generally accurate, errors may exist and the user should independently confirm for accuracy. The map does not constitute a regulatory determination and is not a base for engineering design. A Registered Land Surveyor should be consulted to determine precise location boundaries on the ground.

418 Sheridan Road
Martin Theater at Ravinia Festival
Application for a Certificate of Appropriateness

TO:	The Historic Preservation Commission
DATE:	May 12, 2016
FROM:	Nusrat Jahan, Planner
SUBJECT:	Installation of Two Cellular Antennas

PETITIONERS / OWNERS:
Ravinia Festival
418 Sheridan

PROPERTY LOCATION:
418 Sheridan Road

STRUCTURE
Style: Arts and Craft
Built: 1904
Original Architect: Peter J. Weber

HISTORIC STATUS:
National Landmark (1982)
Local Landmark (1987)

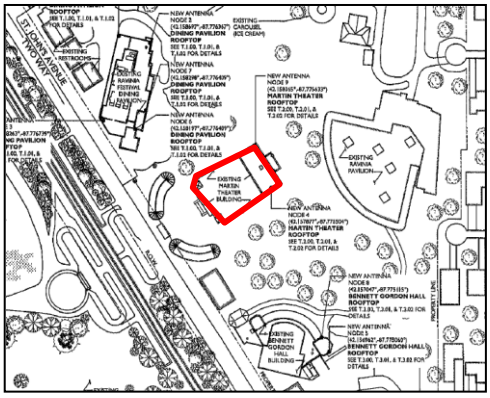
ARCHITECT/BUILDER:
Peter J. Weber

BACKGROUND OF THE SUBJECT PROPERTY

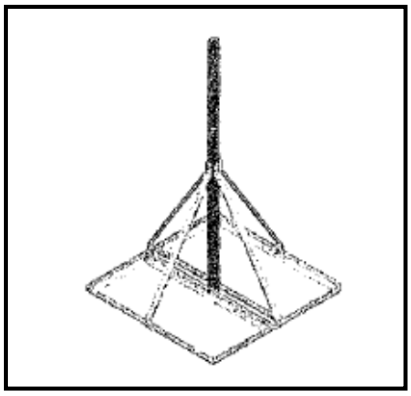
The Martin Theater was built in 1904 and the original architect was Peter J. Weber[i]. Ravinia Park was built by the Chicago and Milwaukee electric railroad as a high class amusement park. This theater is the only remaining original building. It was restored in 1992 and has become the home for Jazz, chamber music and recital program. The theater was designated as a national landmark in 1982 and a local landmark in 1987. The original name of theater was Murry Theater which was become Martin Theater later. The Ravinia Festival Association has applied for a Certificate of Appropriateness to install two antennas on the Martin Theater Stage House at 418 Sheridan Road.

SUMMARY OF PROPOSAL

Highland Park residents living near Ravinia Festival have indicated that mobile phone service deteriorates significantly during large concert events on the festival grounds. Since many



residents rely on mobile service and do not have land-line telephones, even emergency calls which is a potential threat to public safety. To solve the identified data congestion as a safety issue the city officials directed Ravinia festival to install equipment that would mitigate Ravinia Park concert patrons load on local cell towers. After exploring various options Association decide to install Digital Antenna System (DAS) to be the solution. The applicant is proposing to mount two wireless telecommunication system on non-penetrating tripod on the roof of Martin Theater structure.



Proposed non-penetrating Mount

Proposed DAS Antenna

POLICY

The house at Martin Theater is a Regulated Structure because of its status as a Local Landmark. The mount the wireless antenna on the building is subject to a historical review because of the potential impact it may have on the historic home.

STANDARDS FOR CERTIFICATES OF APPROPRIATENESS

The following are the Standards for Certificates of Appropriateness as listed in Section 24.030(D) of the City Code. Few will apply to this application because there are no alterations to the house.

(1) Height. The height of a Landmark, Regulated Structure, or a Contributing Regulated Structure shall be visually compatible with properties, structures, sites, public ways, objects, and places to which it is visibly related.

(2) Proportion of front facade. The relationship of the width to the height of the front elevation of a Landmark, Regulated Structure, or a Contributing Regulated Structure shall be visually compatible with properties, structures, sites, public ways, objects, and places to which it is visually related.

(3) Proportion of openings. The relationship of the width to height of windows and doors of a Landmark, Regulated Structure, or a Contributing Regulated Structure shall be visually compatible with properties, structures, sites, public ways, objects, and places to which the building is visually related.

(4) Rhythm of solids to voids in front facades. The relationship of solids to voids in the front facade of a Landmark, Regulated Structure, or a Contributing Regulated Structure shall be visually compatible with properties, structures, sites, public ways, objects, and places to which it is visually related. .

(5) Rhythm of spacing and structures on streets. The relationship of a Landmark, Regulated Structure, or a Contributing Regulated Structure or object to the open space between it and adjoining structures or objects shall be visually compatible with the properties, structures, sites, public ways, objects, and places to which it is visually related.

(6) Rhythm of entrance porches, storefront recesses and other projections. The relationship of entrances and other projections of the proposed new Structure to sidewalks shall be visually compatible with the properties, structures, sites, public ways, objects, and places to which it is visually related.

(7) Relationship of materials and texture. The relationship of the materials and texture of the façade of a Landmark, Regulated Structure, or a Contributing Regulated Structure shall be visually compatible with the predominant materials used in the structures to which it is visually.

(8) Roof shapes. The roof shape of a Landmark, Regulated Structure, or a Contributing Regulated Structure shall be visually compatible with the structures to which it is visually related.

(9) Walls of continuity. Facades and Property and site structures, such as masonry walls, fences, and landscape masses, shall, when it is a characteristic of the area, form cohesive walls of enclosure along a street, to ensure visual compatibility with the properties, structures, sites, public ways, objects, and places to which such elements are visually related.

(10) Scale of a structure. The size and mass of a Landmark, Regulated Structure, or a Contributing Regulated Structure in relation to open spaces, windows, door openings, porches, adjacent structures, and balconies shall be visually compatible with the properties, structures, sites, public ways, objects, and places to which they are visually related.

11) Directional expression of front elevation. A Landmark, Regulated Structure, or a Contributing Regulated Structure shall be visually compatible with the properties, structures,sites, public ways, objects, and places to which it is visually related in its directional character, whether this be vertical character, horizontal character, or nondirectional character.

(12) Destruction or alteration of the historic features. *The distinguishing historic qualities or character of a Landmark Regulated Structure or Contributing Regulated Structure and its environment shall not be destroyed. The Alteration of any historic or material or distinctive architectural features should be avoided when possible.*

(13) Archaeological and natural resources. Every reasonable effort shall be made to protect and preserve archaeological and natural resources affected by, or adjacent to any project.

(14) Architectural Compatibility. In considering new construction, the Commission shall not impose a requirement for the use of a single architectural style or period, though it may impose a requirement for compatibility.

(15) Use compatibility. Every reasonable effort shall be made to provide a compatible use for a Regulated Structure or Contributing Regulated Structure that requires minimal alteration of the Regulated Structure or a Contributing Regulated Structure and its environment, or to use a Regulated Structure or Contributing Regulated Structure for its originally intended purpose.

(16) Maintenance of Time Period Appearance. All Regulated Structures or Contributing Regulated Structures shall be recognized as products of their own time and so alterations that have no historical basis and which seek to create an earlier appearance than is properly attributable to the particular Regulated Structure or Contributing Regulated Structure that is being altered shall be discouraged. However, contemporary design for Alterations and additions to

Regulated Structures or Contributing Regulated Structures shall not be discouraged when such Alterations and additions do not destroy significant historical, architectural, visual, aesthetic, archaeological or cultural material, and such design is compatible with the size, scale, color, material, and character of the Regulated Structure or Contributing Regulated Structure, neighborhood or environment.

(17) Significance of changes made in the course of time. Changes that may have taken place in the course of time are evidence of the history and development of Regulated Structure or Contributing Regulated Structure and their environments. These changes may have acquired significance in their own right, and this significance shall be recognized and respected.

(18) Sensitivity to distinct features. Distinctive stylistic features or examples of skilled craftsmanship or artistry, which characterize a Regulated Structure or Contributing Regulated Structure, shall be treated with sensitivity.

(19) Repair to deteriorated features. Deteriorated architectural features shall be repaired rather than replaced, wherever possible. In the event replacement is necessary, the new material need not be identical to but should match the material being replaced in composition, design, color, texture, and other visual qualities. Repair or replacement of missing architectural features should be based on accurate duplications of features, substantiated by historic, physical, or pictorial evidence rather than on conjectural designs or the availability of different architectural elements from other buildings or structures;

(20) Surface cleaning. The surface cleaning of the Regulated Structure or Contributing Regulated Structure shall be undertaken with the gentlest means possible. Sandblasting and other cleaning methods that will damage the historically, visually, aesthetically, culturally or archaeologically significant materials used in such Landmark, Regulated Structure, or a Contributing Regulated Structure shall not be undertaken;

(21) Wherever possible, additions or Alterations to a Regulated Structure or Contributing Regulated Structure shall be done in such manner that if such additions or Alterations were to be removed in the future, the essential form and integrity of the Landmark, Regulated Structure, or Contributing Regulated Structure would not be impaired.

RECOMMENDATION

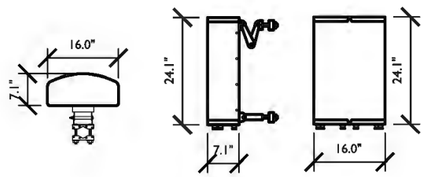
Staff recommends that the Historic Preservation Commission discuss the proposed Certificate of Appropriateness for installing two Distributed Antenna System (DAS), located at 418 Sheridan Road and whether the standards listed above are satisfied. The Commission may approve the COA or render a denial.

ATTACHMENTS

- Project Narrative
- Photographs of the house and property

---

[i] http://www.artic.edu/aic/collections/artwork/190674?search_no=1&index=0



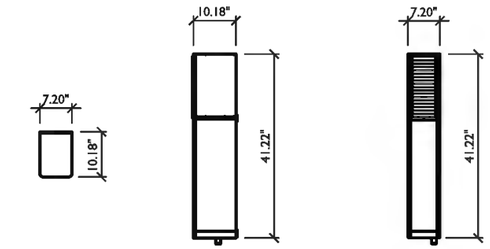
PLAN VIEW SIDE VIEW FRONT VIEW

AMPHENOL - HTXCWW4513Fxy-0

FREQUENCY RANGE	696-806 MHz 806-960 MHz 1710-1880 MHz 1850-1990 MHz 1900-2170 MHz
ANTENNA	11.7 LBS
WITH BRACKET	17.7 LBS

ANTENNA DETAIL

SCALE: 3/4" = 1'-0" | 1



PLAN VIEW SIDE VIEW FRONT VIEW

TEKO T7S8C8A19AWWVAS

DIMS = 41.22"H x 7.20"W x 10.18" D
WEIGHT : 88.18 Lbs

REMOTE UNIT DETAIL

SCALE: 3/4" = 1'-0" | 2

AMPHENOL - HTXCWW4513Fxy-0
TRI BAND PANEL ANTENNA

ANTENNA PHOTO

3

TEKO T7S8C8A19AWWVAS

REMOTE UNIT PHOTO

4

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CROWN CASTLE, USA
947 PARKVIEW BLVD.
LOMBARD, IL 60148

FULLERTON ENGINEERING DESIGN
1100 E. WOODFIELD ROAD, SUITE 500
SCHAUMBURG, ILLINOIS 60173
TEL: 847-908-8400
www.FullertonEngineering.com

CHECKED BY:	CJ
APPROVED BY:	MB

#	DATE	DESCRIPTION	INT.
	3/28/16	ZONING REVIEW	MV

NOT FOR CONSTRUCTION

VENUE:
RAVINIA PARK

PROJECT:
CROWN CASTLE oDAS INSTALLATION

SITE ADDRESS:
200 RAVINIA PARK ROAD
HIGHLAND PARK, IL 60035

SHEET NAME:
ANTENNA AND REMOTE UNIT DETAILS

SHEET NUMBER:
T.4.00

APPLICATION FOR HISTORIC PRESERVATION REVIEW

CITY OF HIGHLAND PARK
1150 Half Day Road
Highland Park, IL 60035
phone: 847/ 432-0867 fax: 847/432-0964
www.cityhpil.com

OFFICE USE ONLY

Submission Date: _____

Case No.: _____

Hearing Date: _____

Address: 418 Sheridan Road **Within a District or an Individual Landmark?** _____

Brief Description of Project: Ravinia proposes 2 cellular antennas to be mounted on the Martin Theatre stagehouse.

Petitioner's Name (s): Jim Schmitz

Address: 418 Sheridan Road **Daytime Phone:** 847-432-5787

Home Phone: 847-266-5000 **Fax:** 847-266-1560

Email: jim@ravinia.org

Property Owner Name(s): Ravinia Festival Association

Address: 418 Sheridan Rd

Phone: 847-432-5787 **Fax:** 847-266-1516

Email: jim@ravinia.org

If Petitioner Is Different From Property Owner, Please Define Relationship:

Employee

Attorney's Name (if applicable): N/A

Address: _____

Phone: _____ **Fax:** _____

Architect/Builder: N/A **Contact:** _____

Address: _____

Phone: _____ **Fax:** _____

Email: _____

Signatures

Jim Schmitz 4/20/16
Property Owner(s) Date

Jim Schmitz 4/20/16
Petitioner, if different from Property Owner Date

APPLICATION FOR HISTORIC PRESERVATION REVIEW CHECKLIST

CITY OF HIGHLAND PARK
1150 Half Day Road
Highland Park, IL 60035
phone: 847/ 432-0867 fax: 847/432-0964
www.cityhpil.com

TYPE OF REVIEW REQUESTED: (check all that apply)

X Certificate of Appropriateness
____ Certificate of Economic Hardship (see staff for additional requirements)
____ Other (please describe)

TYPE OF WORK PROPOSED: (check all that apply)

X Addition
____ Alteration
____ New Construction
____ Restoration/Rehabilitation
____ Relocation
____ Demolition

CHECKLIST: (One full-sized copy, one digital copy, and eight (8) reduced 11x17 copy to be submitted)

For Alteration/Additions

____ Existing and Proposed Floor plans
X Existing and Proposed Elevations
X Photographs of all exterior elevations which will be impacted
____ Building materials described in relation to existing materials
X Written Narrative Describing the Project
X Other supporting documentation (please describe below)
Site Plan & Photo Simulations

For New Construction

____ Floor plans for each level of proposed construction
____ Front, side yard and rear yard elevations
____ Site plan showing existing trees, driveway, walkways, required ravine setbacks, zoning information (setbacks and FAR calculations, etc.)
____ Photographs of the site and its surroundings within 250' radius
____ Samples of major building materials
____ Typical building details
____ Written Narrative Describing the Project
____ Other supporting documentation (please describe below)

RAVINIA

JOHN L. ANDERSON
Chairman

WELZ KAUFFMAN
President and
Chief Executive Officer

4/21/16

City of Highland Park
Historic Preservation Commission
1150 Half Day Road
Highland Park, IL 60035

Dear Commissioners:

City officials from Highland Park identified data congestion as a public safety issue during the summer of 2014, and requested that Ravinia install equipment that would mitigate concert-goers' traffic on local cell towers. Working closely with the City, Ravinia explored many options and found the installation of a Digital Antenna System (DAS) to be the best solution. This may require Ravinia to mount two cellular antennas on the Martin Theatre, a registered historic building.

The attached documents represent the scope of work as it relates to the proposed antennas as well as specific information about the antennas and mounting equipment. Ravinia is comfortable with the idea of painting the antennas to match the Martin Theatre exterior paint should that be recommended by the Commission.

Thank you for your consideration of this proposal. Please let me know if you have any questions or concerns.

Sincerely,

Jim Schmitz
Director of Facilities
jschmitz@ravinia.org
847-432-5787

HTXCWW4513Fxy0

Tri Band | Panel | XXX-Pol | 45° | 13.9 / 14.4 / 14.4 | Fixed Tilt

- Tri Band, XXX-Pol, fixed tilt, panel antenna
- Features ultra wide low band frequency range

Ordering Options

When ordering, replace the "x" in the model number with the value of electrical downtilt for the 696-960 MHz frequency and replace the "y" in the model number with the value of electrical downtilt for the 1710-2690 MHz range. Select from the options listed below under Electrical Downtilt.

Electrical Characteristics		696-960 MHz			(2x) 1710-2690 MHz		
Frequency Bands (MHz)		696-790	790-880	880-960	1710-1880	1920-2170	2200-2690
Polarization		±45°			(2x) ±45°		
Horizontal Beamwidth		47°	42°	37°	49°	42°	38°
Vertical Beamwidth		40.6°	35.4°	30.8°	24.8°	23.0°	21.7°
Gain		12.2 dBi	13.3 dBi	13.9 dBi	12.9 dBi	14.1 dBi	14.4 dBi
Electrical Downtilt		(x) 0			(y) 0		
Impedance		50Ω			50Ω		
VSWR		≤ 1.5:1			≤ 1.5:1		
Front-to-Back Ratio		> 24 dB			> 25 dB		
Isolation Between Bands		> 30 dB			> 30 dB		
Isolation Between Ports		≥ 25 dB			≥ 25 dB		
IM3 (2x20W carrier)		< -150 dBc			< -150 dBc		
Input Power		(2x) 500 W			(4x) 300 W		
Lightning Protection		Direct Ground					
Total Number of Connectors		Antenna has 6 connectors located at the bottom					
Connectors Per Band, Type, Location	R1 696-960 MHz	2 Connectors / 7/16-DIN Female / Bottom					
	Y1 1710-2690 MHz	2 Connectors / 7/16-DIN Female / Bottom					
	Y2 1710-2690 MHz	2 Connectors / 7/16-DIN Female / Bottom					

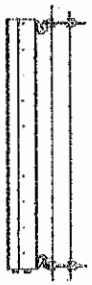
Mechanical Characteristics

Dimensions (Height x Width x Depth)		611 x 412 x 185 mm	24.1 x 16.2 x 7.3 in
Weight without Mounting Brackets		7.1 kg	15.7 lbs
Survival Wind Speed		241 km/hr	150 mph
Wind Area	Front	0.25 m²	2.7 ft²
	Side	0.11 m²	1.2 ft²
Wind Loads (160 km/hr or 100 mph)	Front	305 N	68 lbf
	Side	135 N	30 lbf

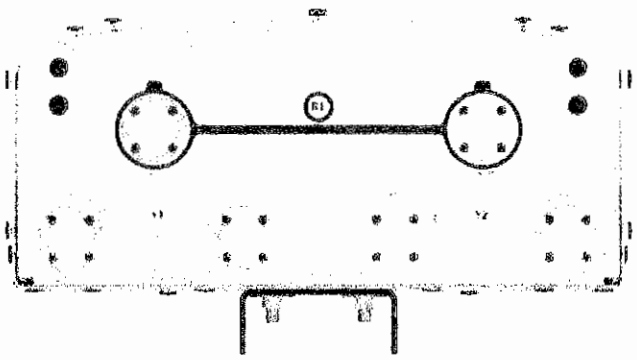
Quoted performance parameters are provided to offer typical, peak or range values only and may vary as a result of normal testing, manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to products may be made without notice.

HTXCWW4513Fxy0

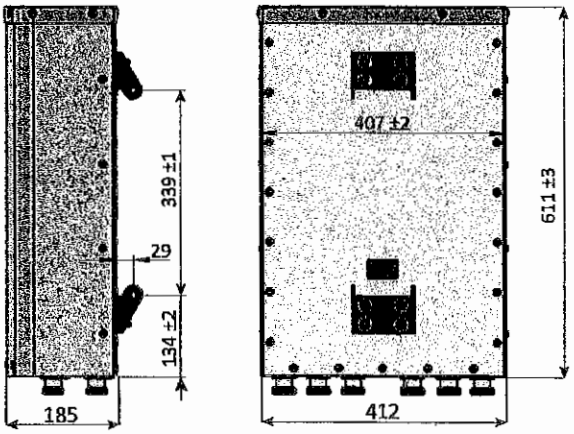
Tri Band | Panel | XXX-Pol | 45° | 13.9 / 14.4 / 14.4 | Fixed Tilt

Mounting Options	Part Number	Image	Fits Pipe Diameter	Weight
The following mounting and downtilt bracket kits are included with the antenna.				
2-Point Mounting Bracket Kit	0900181/00		48-115 mm 1.9-4.5 in	3.4 kg 7.5 lbs
Kit to Add Mechanical Downtilt [0°-10°]	0900397/00		----	3.0 kg 6.6 lbs

Bottom View of Antenna



Dimensions



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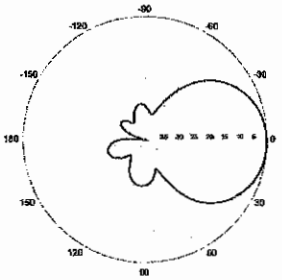
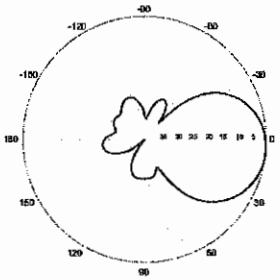
HTXCWW4513Fxy0

Tri Band | Panel | XXX-Pol | 45° | 13.9 / 14.4 / 14.4 | Fixed Tilt

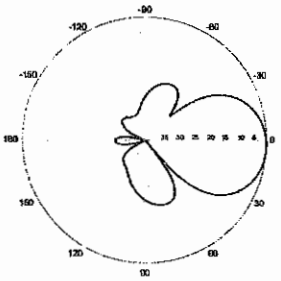
696-960 MHz (R1)



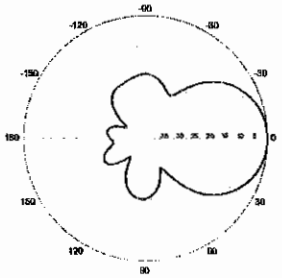
Horizontal | 696-790 MHz



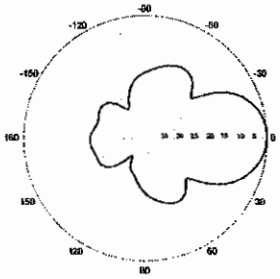
Horizontal | 790-880 MHz



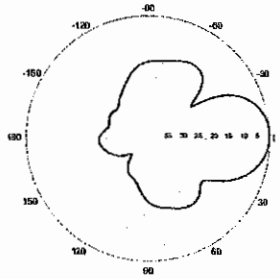
Horizontal | 880-960 MHz



0° | Vertical | 696-790 MHz

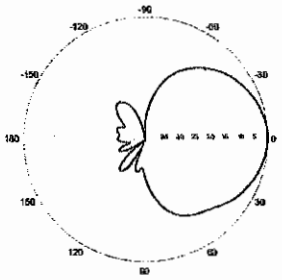


0° | Vertical | 790-880 MHz

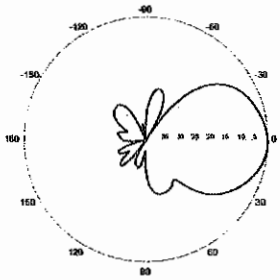


0° | Vertical | 880-960 MHz

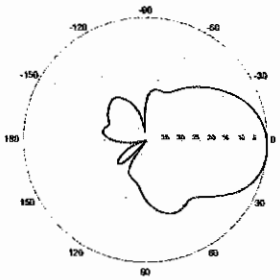
1710-2690 MHz (Y1 & Y2)



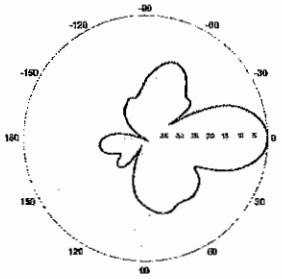
Horizontal | 1710-1880 MHz



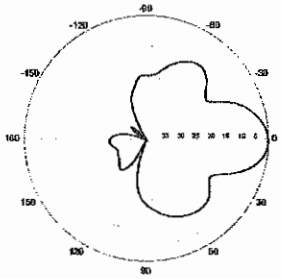
Horizontal | 1920-2170 MHz



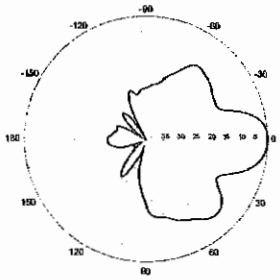
Horizontal | 2200-2690 MHz



0° | Vertical | 1710-1880 MHz



0° | Vertical | 1920-2170 MHz



0° | Vertical | 2200-2690 MHz

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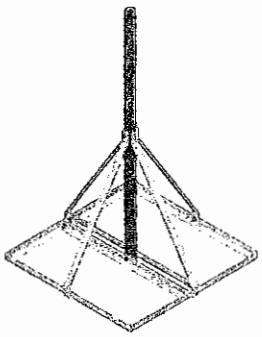
Product Specifications

COMMSCOPE®



RM-SM238-60

Non-Penetrating Roof Mount, 2-3/8 in x 60 in (60.3 mm x 1.5 m) pipe included

Dimensions

Height	1524.0 mm | 60.0 in
Length	889.0 mm | 35.0 in
Pipe Outer Diameter	60.3 mm | 2 3/8 in
Width	889.0 mm | 35.0 in
Weight	30.0 kg | 66.1 lb

Environmental Specifications

Wind Rating	For specifications—contact 828-324-2200 or 1-800-982-1708 (toll free), or your local CommScope representative

General Specifications

Product Type	Tripod mount
Mounting	Non-penetrating
Pipe Length	1524.0 mm | 60.0 in
Pipe, quantity	1
Includes	Brackets | Hardware | Pipe
Material Type	Hot dip galvanized steel
Package Quantity	1

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Wind Rating	BWS—Base Wind Speed; FBC—Florida Building Code

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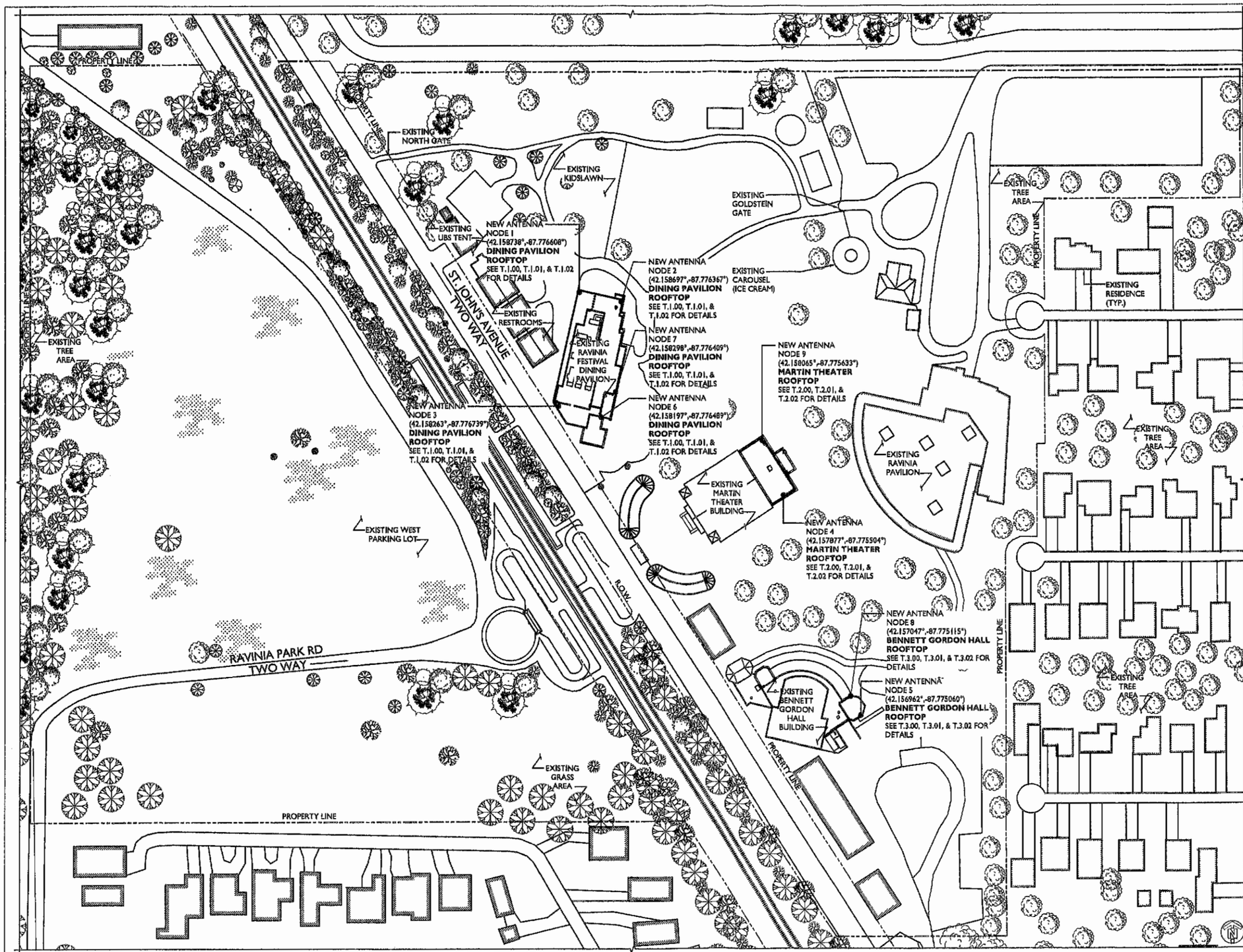
All specifications are subject to change without notice. See www.commscope.com for the most current information. Revised: January 16, 2016



SITE PLAN

SCALE: 1/64" = 1'-0" | 1

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LOMBARD, IL 60148

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SCHAUMBURG, ILLINOIS 60173
TEL: 847-908-8400
www.FullertonEngineering.com

CHECKED BY:	CJ		
APPROVED BY:	MB		
#	DATE	DESCRIPTION	INT.
	3/28/16	ZONING REVIEW	MV

NOT FOR CONSTRUCTION

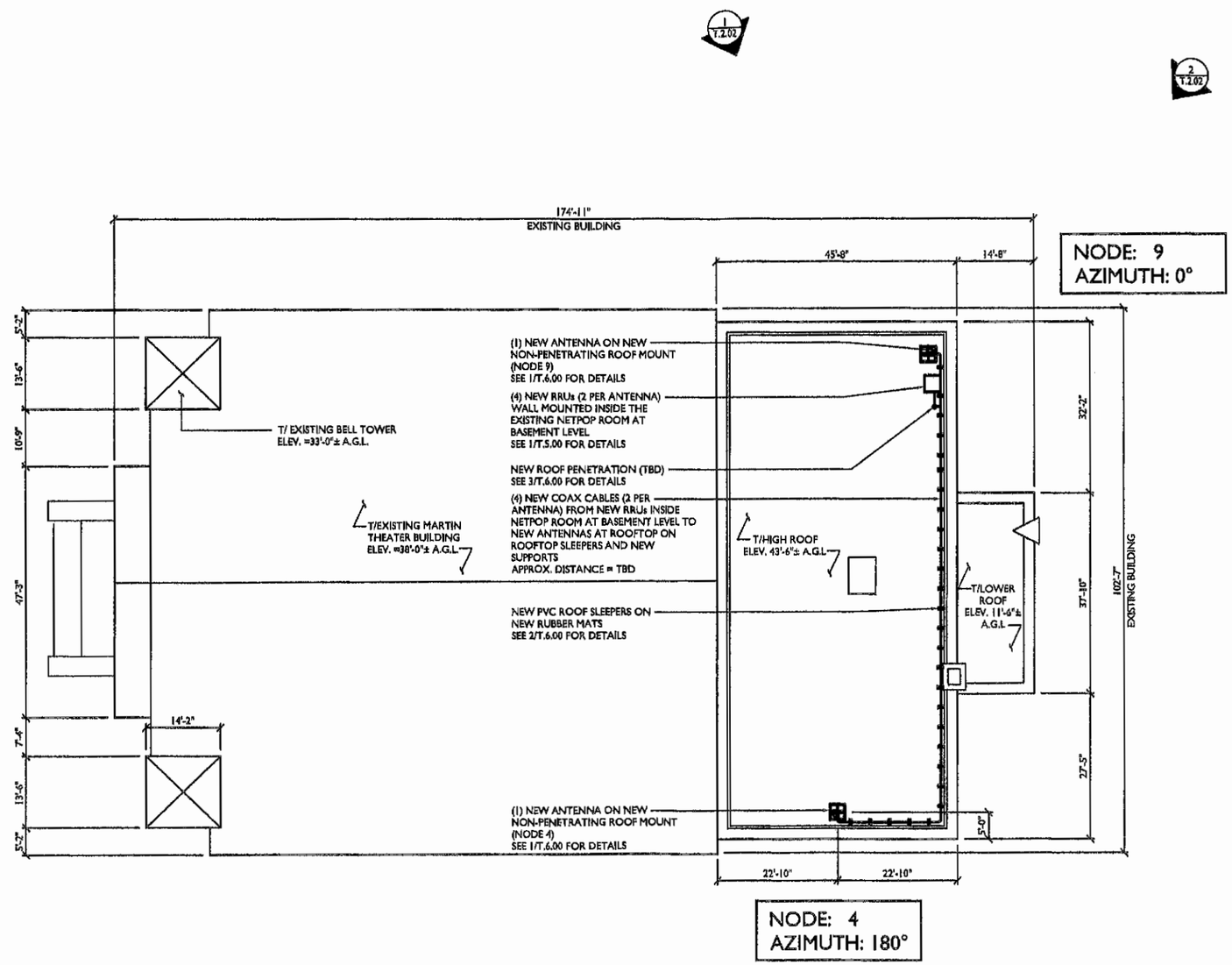
VENUE:
RAVINIA PARK

PROJECT:
CROWN CASTLE oDAS INSTALLATION

SITE ADDRESS:
200 RAVINIA PARK ROAD
HIGHLAND PARK, IL 60035

SHEET NAME:
SITE PLAN

SHEET NUMBER:
T.0.00



MARTIN THEATER BUILDING ROOF PLAN (NODES 4 & 9)

SCALE: 3/32" = 1'-0" | 1

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APPROVED BY:	MB

#	DATE	DESCRIPTION	INT.
	3/28/16	ZONING REVIEW	MV

NOT FOR CONSTRUCTION

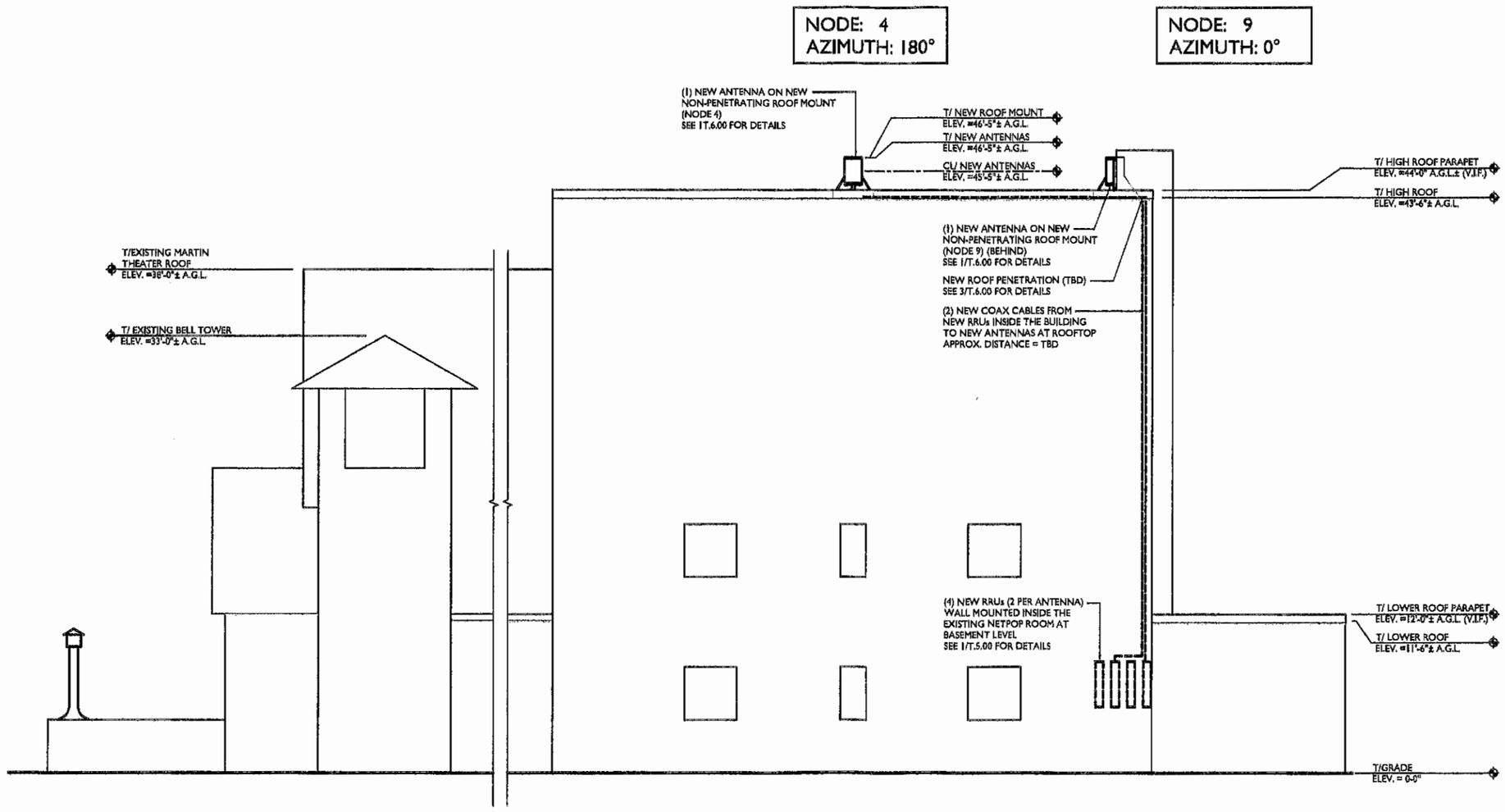
VENUE:
RAVINIA PARK

PROJECT:
CROWN CASTLE
oDAS
INSTALLATION

SITE ADDRESS:
200 RAVINIA PARK ROAD
HIGHLAND PARK, IL 60035

SHEET NAME:
MARTIN THEATER BUILDING
ROOF PLAN
(NODES 4 & 9)

SHEET NUMBER:
T.2.00



MARTIN THEATER BUILDING ELEVATION (NODES 4 & 9)

SCALE: 1/4" = 1'-0"

1

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APPROVED BY:	MB

#	DATE	DESCRIPTION	INT.
	3/28/16	ZONING REVIEW	MV

NOT FOR CONSTRUCTION

VENUE:
RAVINIA PARK

PROJECT:
CROWN CASTLE
oDAS
INSTALLATION

SITE ADDRESS:
200 RAVINIA PARK ROAD
HIGHLAND PARK, IL 60035

SHEET NAME:
MARTIN THEATER
BUILDING ELEVATION
(NODES 4 & 9)

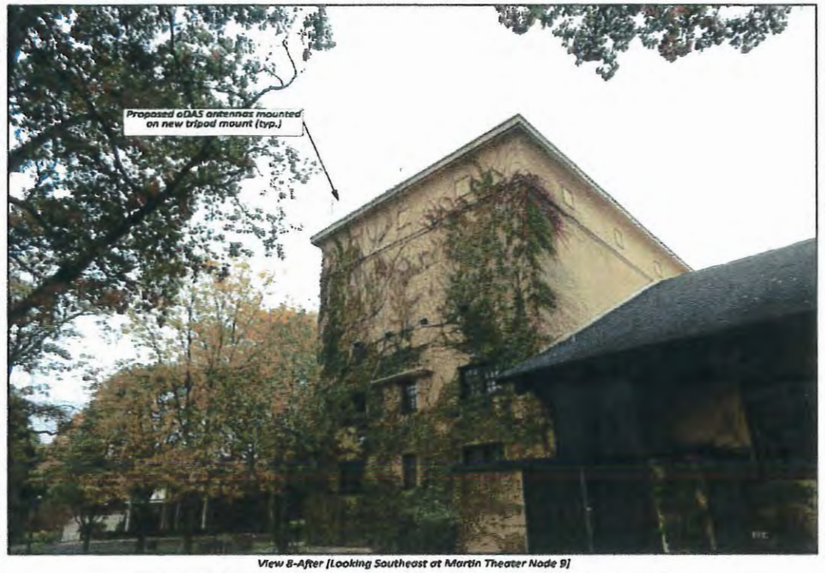
SHEET NUMBER:
T.2.01

CROWN CASTLE

Site Name: Ravinia Park
Martin Theater

Address: 200 Ravinia Park Road
Highland Park, IL 60035

FULLERTON



View 8-After [Looking Southeast at Martin Theater Node 9]

MARTIN THEATER BUILDING PHOTOSIM (NODE 9) | 1

CROWN CASTLE

Site Name: Ravinia Park
Martin Theater

Address: 200 Ravinia Park Road
Highland Park, IL 60035

FULLERTON

View 9-After [Looking South at Martin Theater Node 9]

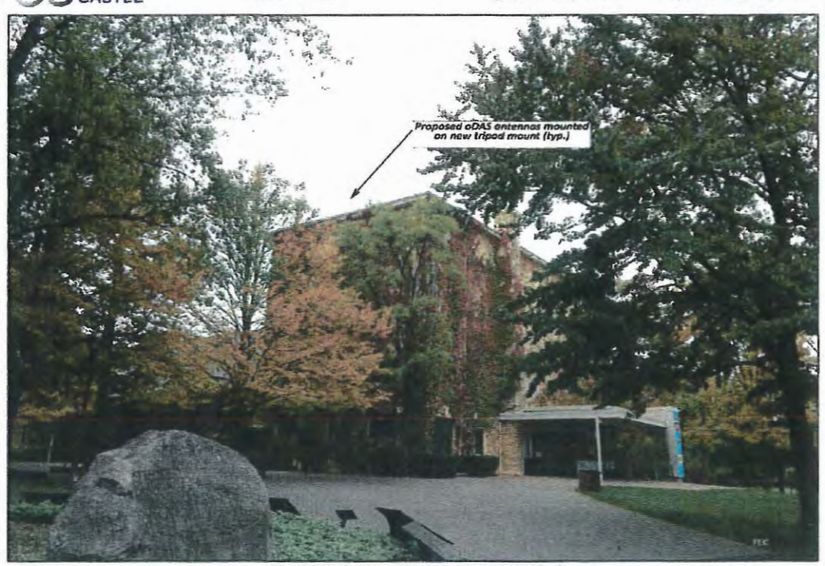
MARTIN THEATER BUILDING PHOTOSIM (NODE 9) | 2

CROWN CASTLE

Site Name: Ravinia Park
Martin Theater

Address: 200 Ravinia Park Road
Highland Park, IL 60035

FULLERTON



View 10-After [Looking West at Martin Theater Node 4]

MARTIN THEATER BUILDING PHOTOSIM (NODE 4) | 3

CROWN CASTLE

Site Name: Ravinia Park
Martin Theater

Address: 200 Ravinia Park Road
Highland Park, IL 60035

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View 11-After [Looking North at Martin Theater Node 4]

MARTIN THEATER BUILDING PHOTOSIM (NODE 4) | 4

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TEL: 847-908-8400
www.FullertonEngineering.com

CHECKED BY:	CJ
APPROVED BY:	MB

#	DATE	DESCRIPTION	INT.
	3/28/16	ZONING REVIEW	MV

NOT FOR CONSTRUCTION

VENUE:
RAVINIA PARK

PROJECT:
CROWN CASTLE oDAS INSTALLATION

SITE ADDRESS:
200 RAVINIA PARK ROAD
HIGHLAND PARK, IL 60035

SHEET NAME:
MARTIN THEATER BUILDING PHOTOSIMS (NODES 4 & 7)

SHEET NUMBER:
T.2.02