The Kenneth J. Johnston NPOI: Plans for the 1.8-meter Array

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D.J. Hutter, Director NPOI
+ Lowell Team + NRL Team + Past players

_Upper:_ Current 5” Siderostat Beam compared to full use of 1.8m aperture.

Expected optical mag limit to V~9.5
### “How We Got Here”

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>2006</td>
<td>First Official Indication Keck Outriggers May Be Available</td>
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<tr>
<td>2006</td>
<td>Discussions with CARA/NASA Initiated</td>
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<tr>
<td>2007</td>
<td>Papers– Array defined</td>
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<tr>
<td>2008</td>
<td>Preliminary Engineering Plan Developed</td>
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<tr>
<td>2009</td>
<td>CARA Officially Offers Gift of Four 1.8m Telescopes to Naval Observatory</td>
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<tr>
<td>2009</td>
<td>USNO Visits Australia; Disposed Surplus</td>
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<tr>
<td>2009</td>
<td>$6.02 \times 10^{23}$ Navy/CARA/NASA/EOS Lawyers later…</td>
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<tr>
<td>2010</td>
<td>U.S. Navy Officially Accepts Ownership of Telescopes, Transfer to NOFS (UNSECNAV Robert O. Work)</td>
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<tr>
<td>2011</td>
<td>Initiated Final Engineering Plan; JMAPS…</td>
</tr>
<tr>
<td>2012</td>
<td>Facility Engineering Plan Complete.</td>
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<tr>
<td>2012</td>
<td>USFS Approved; WBS/GANTT/Strawman Contracts/FISC Review</td>
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<tr>
<td>2012</td>
<td>Bulk Funded to $10.5M/18.3M, failed in 3Q (Navy Fuel Shortage)</td>
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<tr>
<td>2013</td>
<td>Back on Table – POM for FYDP starting FY15</td>
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<tr>
<td>2014</td>
<td>Funded to $8.5M in FY15, in POM for 10M more; Moving some left?</td>
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<tr>
<td>2015+</td>
<td>Install Cont’d – Telescope Plan, 4\textsuperscript{th} Scope Plan, Integration (NRL 1.4m etc)</td>
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**U.S. Naval Observatory**

**Precise Time & Astrometry**
$18.3M OMN/OPN/RDTE Install
Current FY14-16 POM Plan

FY14 UNK/TBD – Possible partial Slide from FY15 into FY14

FY15 ($3.1M RDTEN) **** UPDATE IN FOLLOWING SLIDE***
In Core - $2.2M civil works construction (RDTEN)
In Core - $0.9M structures & electrical (RDTEN) In Core

FY16 ($0.9M RDTEN)
In Core - $0.9M structures & electrical (RDTEN)
In Core - FY16 ($2.3M RDTEN)
Above Core - $0.2M structures & electrical (RDTEN)
Above Core - $0.6M COTS domes (RDTEN)
Above Core - $0.6M new telescope control system (RDTEN)
Above Core - $0.6M telescope installation (RDTEN)
Above Core - $0.3M feed system upgrade (RDTEN) Above Core

OMN= Operational “Maintenance”;
1 year in FYDP
Oceanographer of the Navy
RDTEN=R&D; 2 years per…
Office of Naval Research
OPN=Operational Procurement
3 yrs

U.S. Naval Observatory
Precise Time & Astrometry
$18.3M OMN/OPN/RDTE Install
Current FY17-19 POM Plan

**FY17** ($2.0M RDTEN / $3.4M OPN)
- Above Core - $0.2M feed system upgrade (RDTEN)
- Above Core - $0.4M Cterm metrology (RDTEN)
- Above Core - $0.5M IR beam combiners & fringe tracking prototypes (RDTEN)
- Above Core - $0.9M final array integration & test (RDTEN)
- Above Core - $2.0M AO system (OPN)
- Above Core - $1.4M IR beam combiners & fringe tracking systems (OPN)

**FY18** ($1.0M RDTEN / $1.0M OPN)
- In Core - $1.0M final array integration & test (RDTEN)
- In Core - $1.0M Upgrade lab & control building facilities (OPN)
- In Core - FY18 ($0.5M OPN / $2.5M OMN)
- Above Core-$0.5M Upgrade lab & control building facilities (OPN)
- Above Core-$2.5M 1.8m array ops & maintenance (OMN)

**FY19** ($2.5M OMN)
- In Core - $2.5M 1.8m array ops & maintenance (OMN)

... $19.2M in sum
From Pentagon’s Program Buget Information System (PBIS)

on 14 March 2013…
“The Oceanographer of the Navy had three issues LOCKED in PBIS this morning for the Presidential FY15 and FYDP Budget for SECDEF”….
…...and for NPOI:

16201 - Navy Precision Optical Interferometer, *plus-up $8.5M* across FYDP

*Notable for Fiscal Climate & SECDEF Hagel approach to Sequestration;*

**UPSHOT:**

Four Domes and Infrastructure First @ FY15 (FY14?)

Then Telescopes…

*U.S. Naval Observatory*  
*Precise Time & Astrometry*
Contracted Facility Engineering Team

...to “Shovel Ready”

**Project Coordination:** Loven Contracting

**Civil Engineering:** Civil Design Engineering (CDE)

**Structural Engineering:** Tor Engineering

**Electrical Engineering:** Tor Engineering
NPOI 1.8 m Facility Engineering Plan: Construction Ready Drawings

**Civil**: including all grading, drainage, road and fence realignment, light pipe locations and orientations, and locations of all excavations and pours.

**Structural**: including foundation details, building structural and finish details, doors, dome, piers, flooring, stairs, decking, and ventilation louvers.

**Electrical**: including power feeds, disconnects, grounding, transformers, TVSS, lighting, receptacles, and special power allocation for cooling.

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Civil Detail: Layout and Detail Notes

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Civil Plan: Grading, Roads, Drainage (North and West)
Note 60 Degree included Angles (|| to opposite baseline)... Turns to match #/reflections etc.
Engineering Layout:
Structural Cross Sections
Infrastructure Electrical Plans

Electrical Feed Details
Extensive isolation & lightning protection

Electrical...
Grounding, Lighting, Receptacles

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Precise Time & Astrometry
1- Implement NOW, in advance

- Sid Control systems upgrades (AES)
- Replacing VME-based control systems (AES)
- New Fast Delay Line (FDL) controller prototype
- New Fringe Engine
- Long Delay Lines (LDL’s)

2- Control Sys, IW 1.8m Upgrades:

- Modified NPOI siderostat controller using existing telescope motors and encoders (AZ Embedded Systems)
- Existing Motors and Encoders, New Motor Drivers
- Vision Back End (NSF-covered)

3- Vacuum Feed Pipe Installation/Integration Acquisition:

- 5 array center cans
- 24 light pipe support stands
- 12 lengths of pipe (6m)
- 9 flats/mounts
- M7 vacuum can and window (new)  
  (detail next Slide)

4- Adaptive Optics:

- Test bed system built in-house (ICW USNA; in test on NOFS 1.55m)
- NGS

5- Telescope Installation:

- Reviewed proposals from “3rd party” engineering consultants for installation and commissioning

Precise Time & Astrometry

U.S. Naval Observatory
.... Assured Future… (Considering!)