# GSFC FY04 IRAD Proposal "Preparing Goddard for Large Scale Team Science in the 21st Century: Enabling an All Optical Goddard Network Cyberinfrastructure"

## L-Net Project Management Summary

J. Patrick Gary
Network Projects Leader
Earth and Space Data Computing Division
NASA Goddard Space Flight Center
pat.gary@nasa.gov
301-286-9539


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## *Key Features of GSFC L-Net Design*

- GSFC Local Network Part
  - » 10-GE connections for:
    - – Thunderhead cluster in B28
    - – SVS Hyperwall and/or GSFC SAN Pilot interface in B28
    - – Network test stations in HECN lab in B28 and ENP lab in B32
    - – Optical switch from UMBC/Ray Chen
  - » 10-GE ports for future connections:
    - – NCCS in B28
    - – One other cluster such as Houser's in B33
  - » Four 1-GE connections with GSFC's Science and Engineering Network

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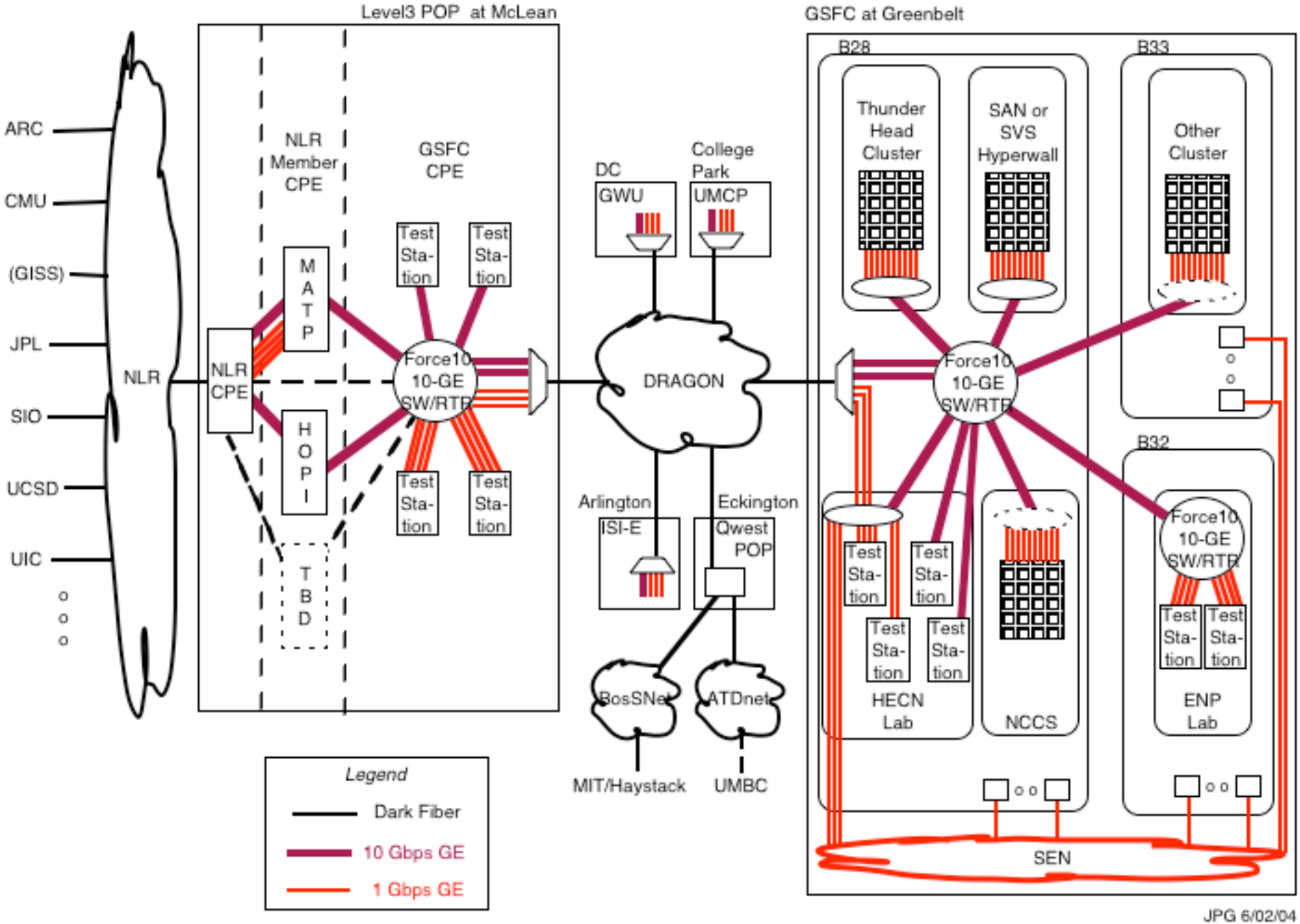
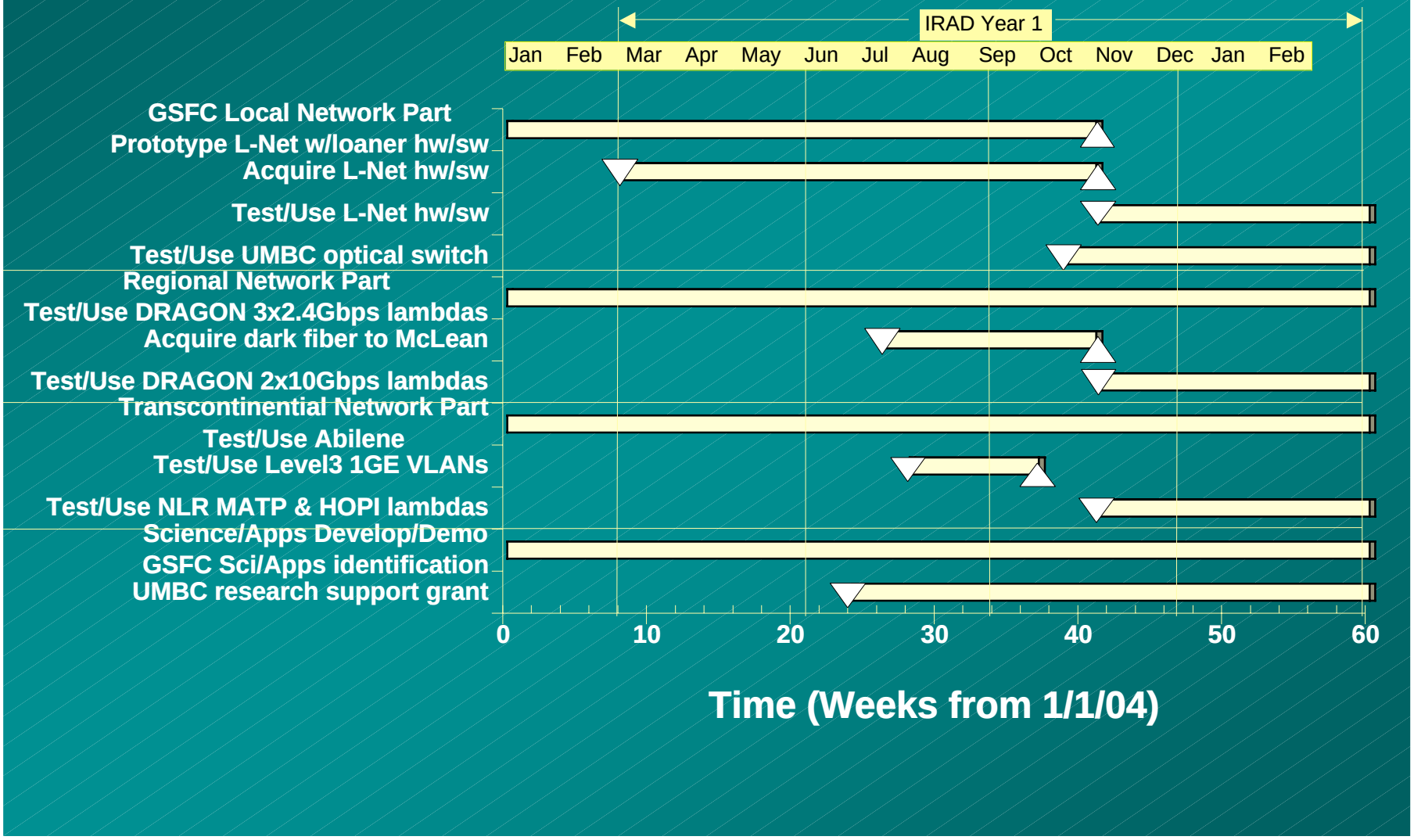
## *Key Features of GSFC L-Net Design (continued)*

- Regional Network Part
  - » Two 10-GE connections with DRAGON at GSFC in Greenbelt
  - » Two 10-GE connections with DRAGON at Level3 POP in McLean
  - » Two 10-GE and multiple 1-GE connections for network test stations at Level3 POP in McLean
- Transcontinental Network Part
  - » 10-GE connection with NLR/MATP's IP Backbone and Switched Ethernet lambdas
  - » 10-GE connection with NLR/Internet2's HOPI lambda

# GSFC L-Net Configurations at McLean and Greenbelt



# GSFC L-Net Milestone Schedule



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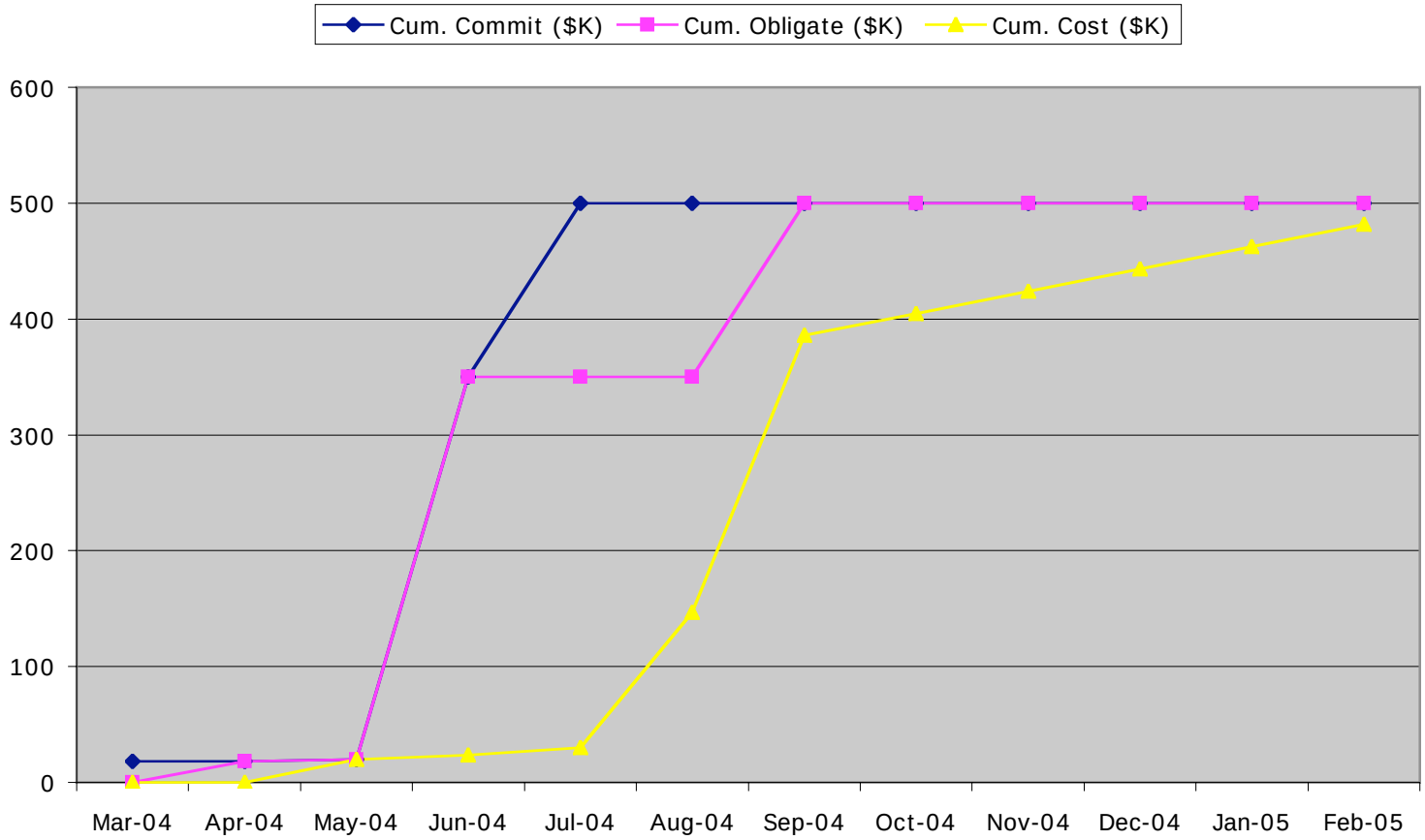
## *Key Acquisitions*

| | *Amount ($K)* | *Commit Date* | *Obligate Date* | *Cost Start Date* |
|---|---|---|---|---|
| ● Lease dark fiber between GSFC & DRAGON@UMCP | 18.0 | 3/15/04 | 4/15/04 | 5/15/04 |
| ● UMBC research support grant | 79.1 | 6/1/04 | 6/15/04 | 7/15/04 @ $6.7K/mo |
| ● Hw/sw from SEWP<br>» For McLean<br>– Six 10-GE ports for Force10 E300 10-GE switch<br>– Two 10-GE lambda interfaces with DRAGON<br>» For GSFC<br>– One Force10 E600 10-GE switch with eight 10-GE ports<br>– Four Extreme Network Summit 400 1-GE switches with one 10-GE uplink<br>– One 10-GE lambda interface with DRAGON | 352.9 | 6/30/04 | 6/30/04 | 9/30/04 |
| ● Lease dark fiber between DRAGON & McLean and co-lo space in Level3 POP | 50.0 | 7/15/04 | 9/15/04 | 9/15/04 |
| ● NLR MATP membership | 100.0 | 7/15/04 | 9/15/04 | 9/15/04 @ $12.5K/mo |

# GSFC L-Net Fund Commit, Obligate, & Cost Plans




| | Mar-04 | Apr-04 | May-04 | Jun-04 | Jul-04 | Aug-04 | Sep-04 | Oct-04 | Nov-04 | Dec-04 | Jan-05 | Feb-05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cum. Commit ($K) | 18 | 18 | 20 | 350 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Cum. Obligate ($K) | 0 | 18 | 20 | 350 | 350 | 350 | 500 | 500 | 500 | 500 | 500 | 500 |
| Cum. Cost ($K) | 0 | 0 | 20 | 23.3 | 30 | 146.6 | 385.8 | 404.9 | 424.1 | 443.2 | 462.4 | 481.5 |

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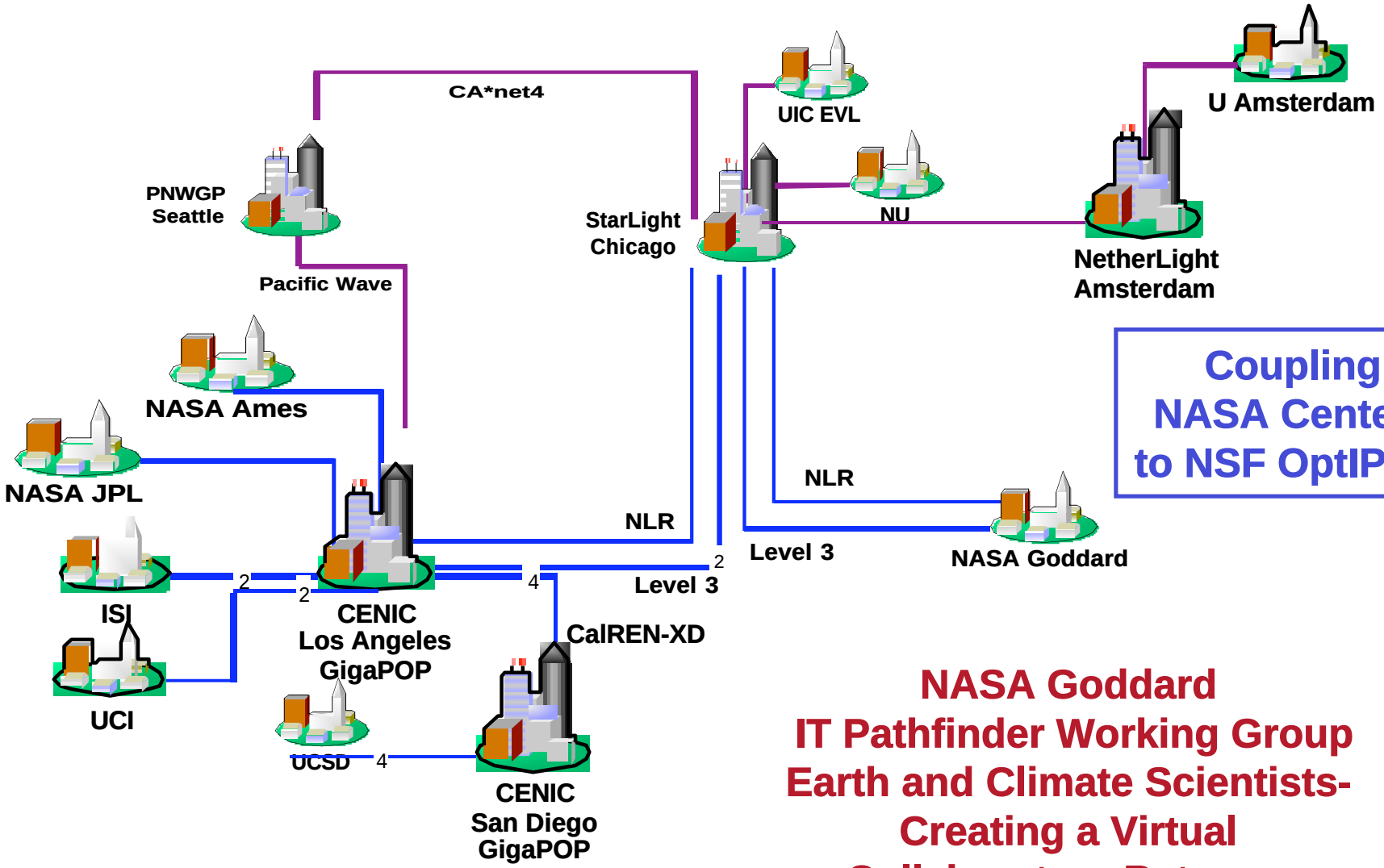
*Backup Slides*

# GSFC FY04 IRAD Proposal "Preparing Goddard for Large Scale Team Science in the 21st Century: Enabling an All Optical Goddard Network Cyberinfrastructure"

*Summary of Purpose*

- "…establish a "Lambda Network" (in this case using optical wavelength technology and 10 Gbps Ethernet per wavelength) from GSFC's Earth science Greenbelt facility in MD to the Scripps Institute of Oceanography (SIO) through the University of California, San Diego (UCSD) facility over the National Lambda Rail (NLR), a new national dark optical fiber infrastructure."
- "…make data residing on Goddard's high speed computer disks available to SIO with access speeds as if the data were on their own desktop servers or PC's."
- "…enable scientists at both institutions to share and use compute intensive community models, complex data base mining and multi-dimensional streaming visualization over this highly distributed, virtual working environment."

# R&D Test: Move to Internet Protocol Over Dedicated Optical Lightpaths




**Coupling NASA Centers to NSF OptIPuter**

**NASA Goddard IT Pathfinder Working Group Earth and Climate Scientists- Creating a Virtual Collaboratory Between Goddard and SIO (UCSD)**

## National LambdaRail (http://www.nationallambdarail.org/)

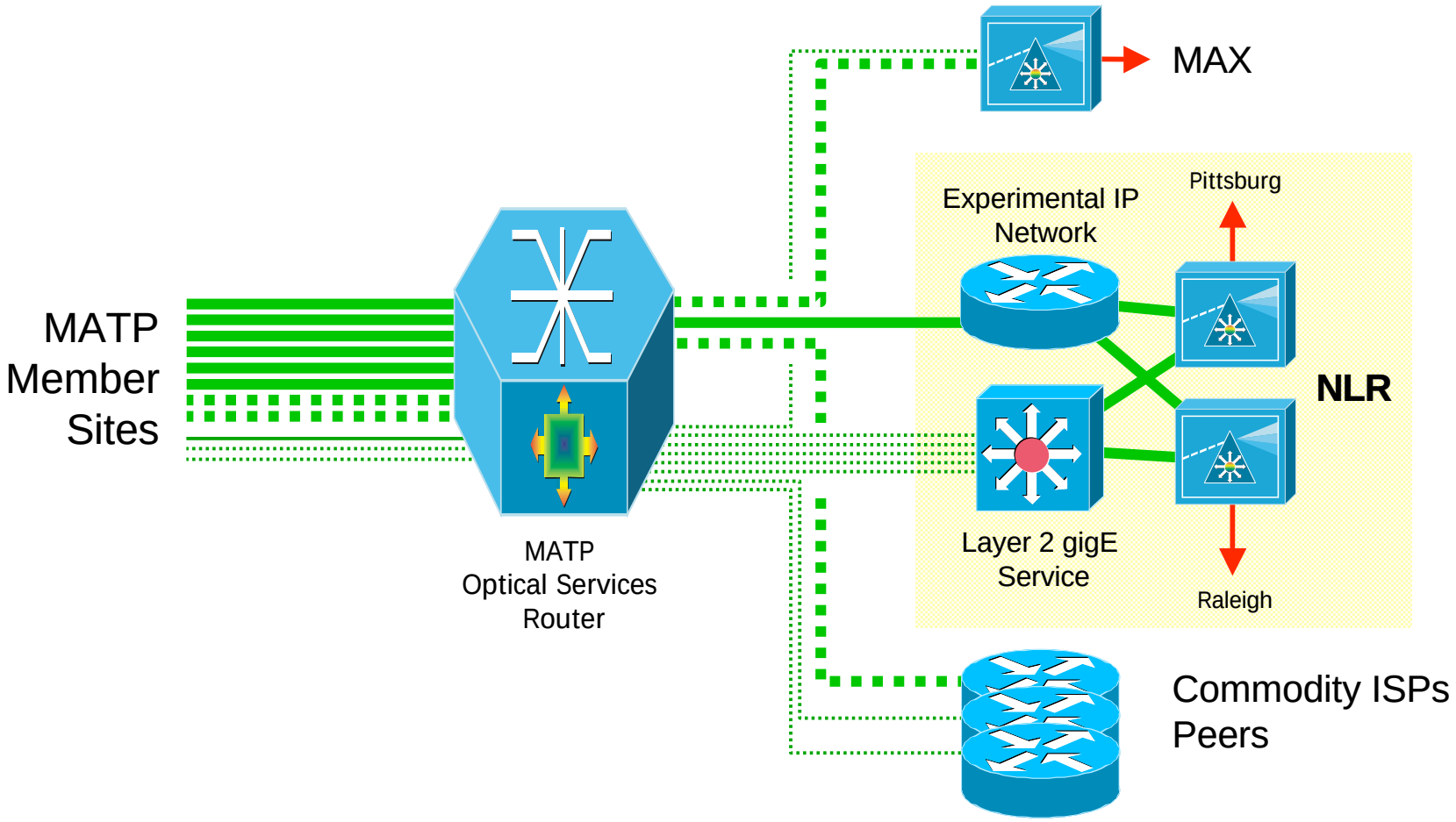
- **Provide an enabling network infrastructure for new forms and methods for research in science, engineering, health care, and education as well as for research and development of new Internet technologies, protocols, applications and services.**
- **Provide the research community with direct control over a nationwide optical fiber infrastructure, enabling a wide range of facilities, capabilities and services in support of both application level and networking level experiments and serving diverse communities of computational scientists, distributed systems researchers and networking researchers.**

# NLR – Optical Infrastructure - Phase 1

# NLR – Phase 1 +
# Route to NY & ORNL Waves & Salt Lake City

# MATP Aggregation Facility Architecture

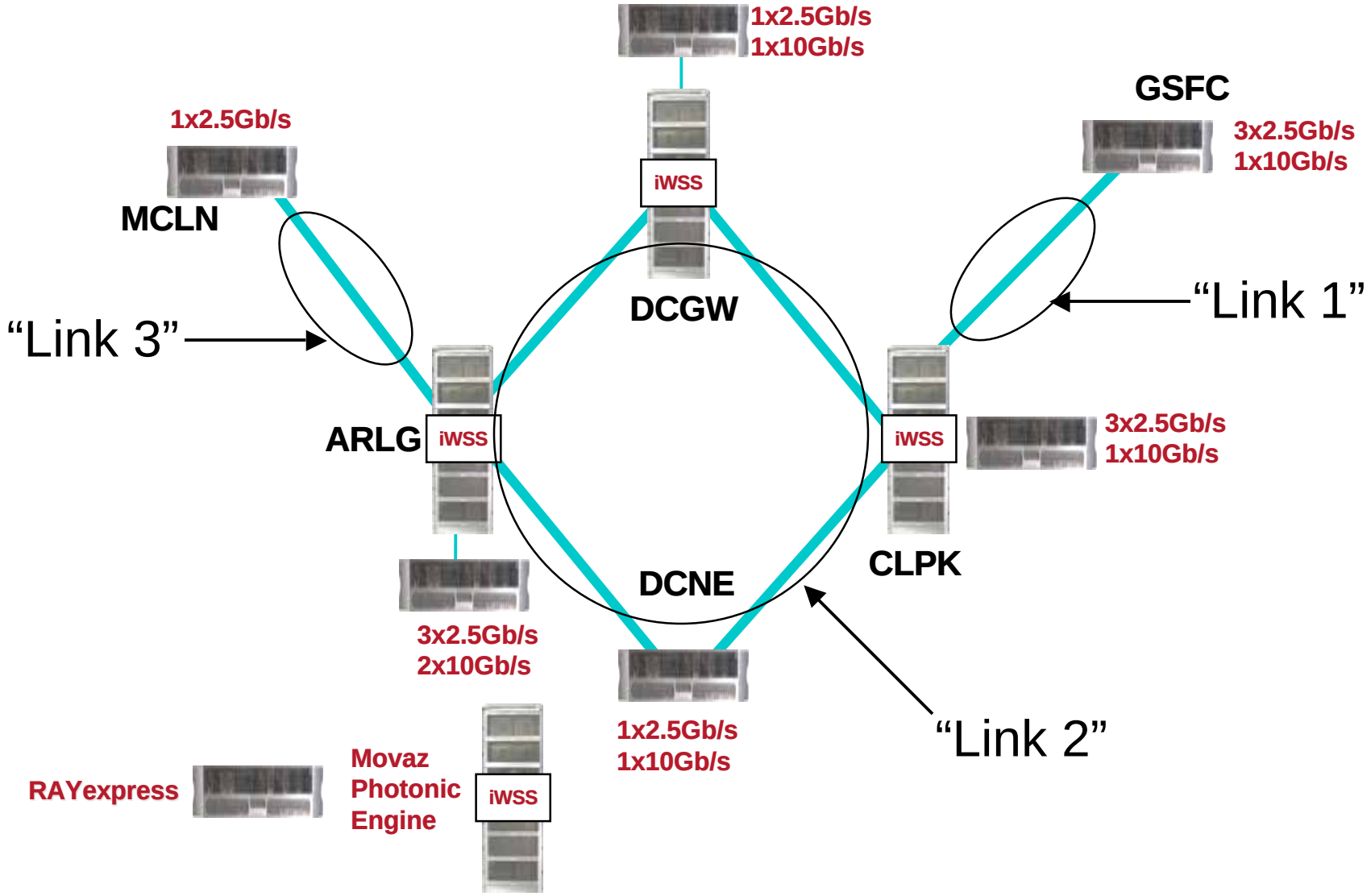
DRAFT



# Fibers Considered in DRAGON-based Approach

- Fibers already “deployed” for all needed DRAGON links; and usage contracts in various states of progress
  - “Link 1” GSFC -- UMD at College Park (UMCP): Order placed with FiberGate; expect available use in ~1 month
  - “Link 2” UMCP -- ISI/E at Arlington & GWU in DC: In contract negotiations with Qwest; expect available use in ~2 months
  - “Link 3” ISI/E (& GWU) -- Level(3) POP in McLean: Have quote for 20 year Indefeasible Right to Use (IRU)

# Dynamic Resource Allocation with GMPLS on Optical Networks (DRAGON) Configuration



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**GSFC - McLean Regional Network Option Comparison Highlights**

| Key Factors / Approach Options | | L3 Dark Fiber | L3 Wave Service | DRAGON |
|---|---|---|---|---|
| Installation complete | | Sep/Oct04 | Sep/Oct04 | Sep/Oct04 |
| Technical Risk | | High | Low | Low |
| Cost* Regional Network Only | | | | |
| - 1st year | | $ 243.5 | $ 266.1 | $ 71.0 |
| - 2nd thru 5th year each | | $ 108.2 | $ 246.1 | $ 51.2 |
| | - 5 year total | $ 676.3 | $1,250.5 | $ 275.8 |
| ***Cost Totals** | | | | |
| **Only Regional Network and Common Equipment** | | | | |
| - 1st year | | $ 493.4 | $ 516.0 | $ 320.9 |
| - 2nd thru 5th year each | | $ 163.9 | $ 301.8 | $ 106.9 |
| | - 5 year total | $1,149.0 | $1,723.2 | $ 748.5 |
| **All Components 1st Year Only** | | | | |
| - UMBC Grant | | $ 79.1 | $ 79.1 | $ 79.1 |
| - NLR/MATP Membership | | $ 100.0 | $ 100.0 | $ 100.0 |
| - Regional Network and Common Equipment 1st Year Only | | $ 493.4 | $ 516.0 | $ 320.9 |
| | Grand Total 1st Year Only | $ 672.5 | $ 695.1 | $ 500.0 |
| **All Components 2nd thru 5th year each** | | | | |
| - UMBC Grant | | $ 85.0 | $ 85.0 | $ 85.0 |
| - NLR/MATP Membership | | $ 100.0 | $ 100.0 | $ 100.0 |
| - Regional Network and Common Equipment 2nd thru 5th year each | | $ 163.9 | $ 301.8 | $ 106.9 |
| | Grand Total 2nd thru 5th year each | $ 348.9 | $ 486.8 | $ 291.9 |
| | **Grand Total 5 Years** | $2,068.1 | $2,642.3 | $1,667.6 |

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*Overall Schedule Given 2Mar04 "effective start" (I.e., date of permission to use awarded funds)*

- By 31May04 demonstrate initial use of 10-GE and multi-wavelength network technologies within GSFC in test of L-Net designs
- By 30Aug04 with DRAGON project demonstrate use of optical network technology switching among three 2.4 Gbps wavelengths among GSFC, UMCP, and USC/ISI-E in Arlington, VA
- By 30Nov04 connect GSFC at 10 Gbps with NLR at McLean, VA
- By 28Feb05 demonstrate science/applications between GSFC and UCSD/SIO across the NLR

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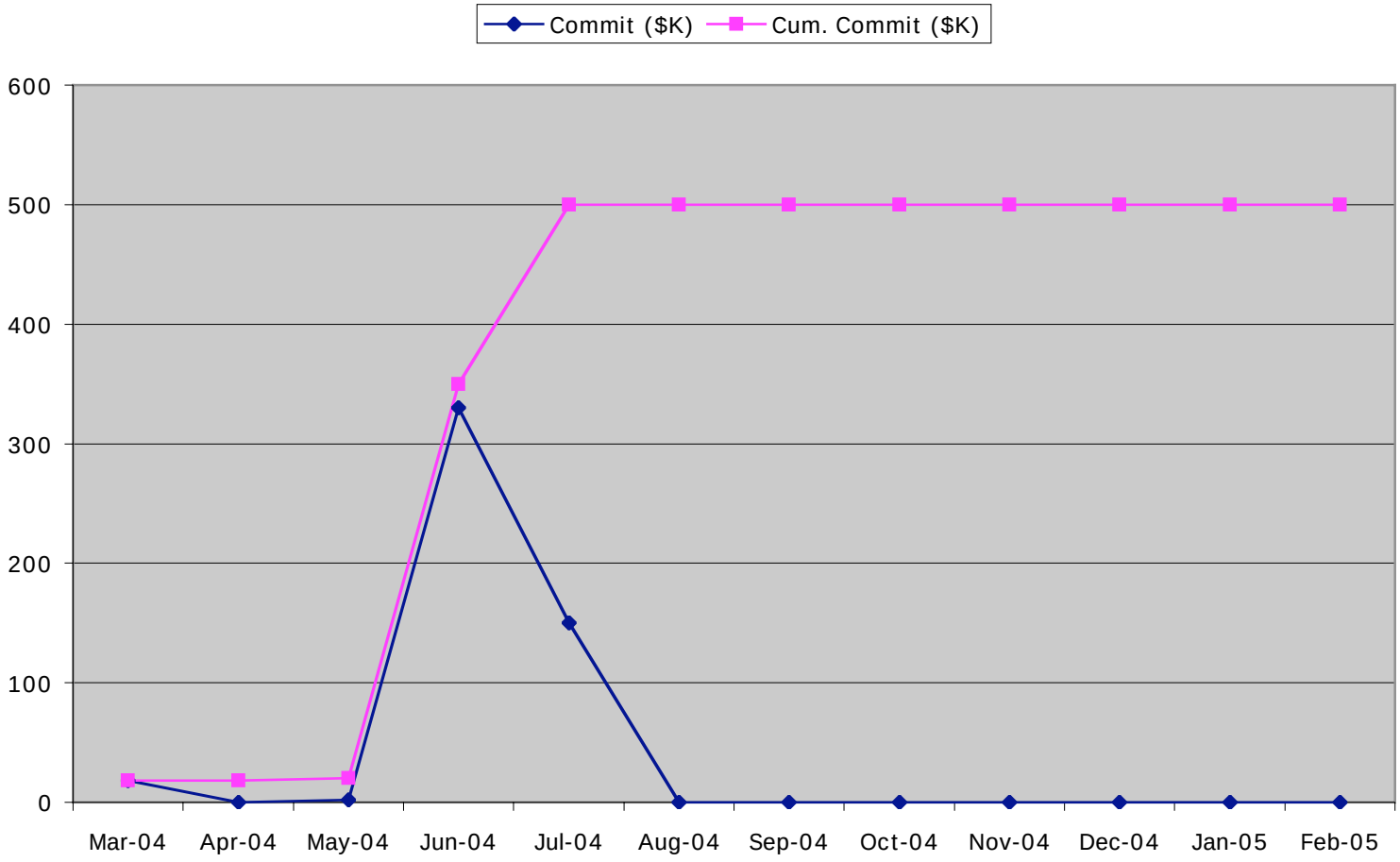
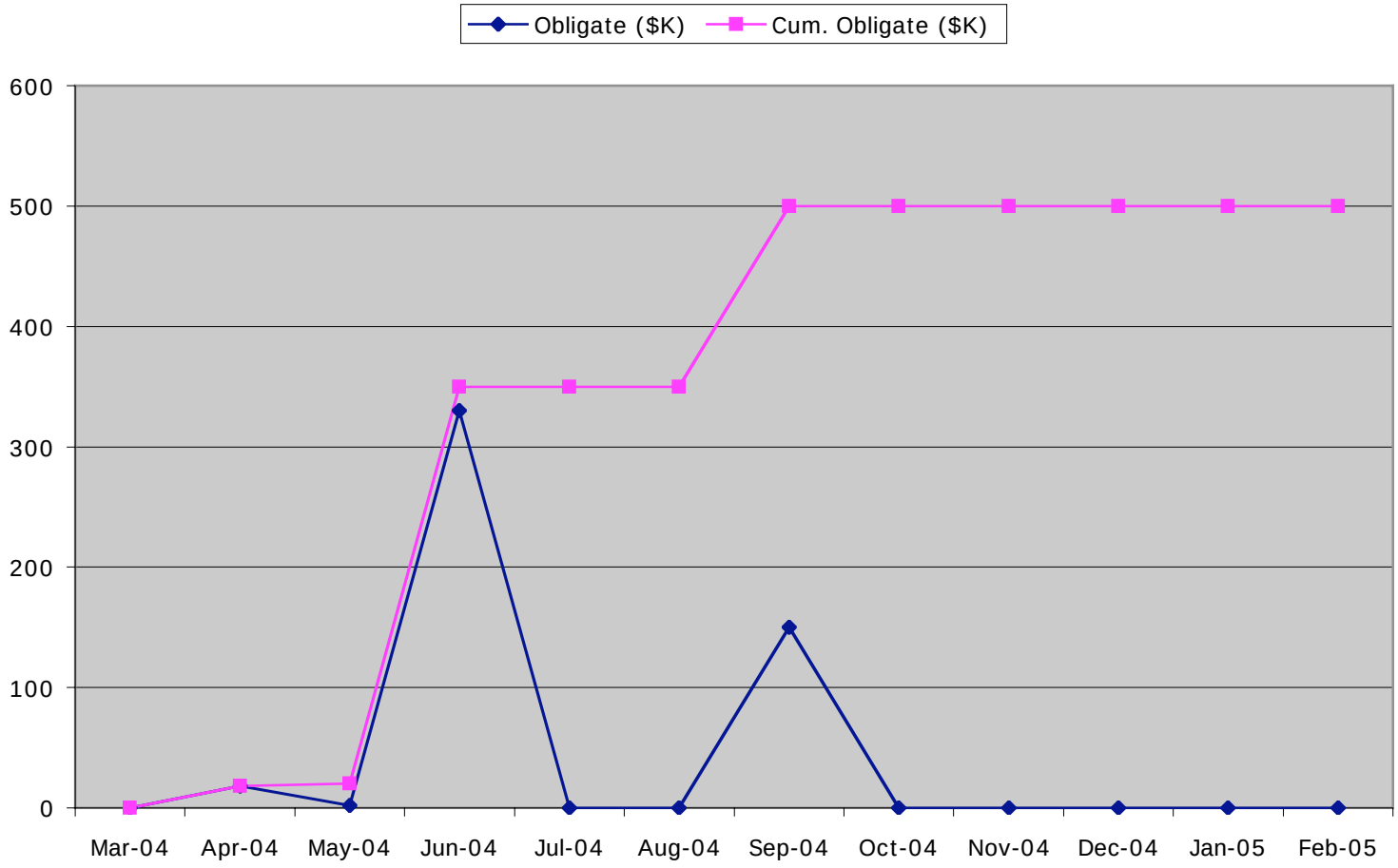
| Milestone Topic | Start Date | End Date | Start Week# | Duration |
|---|---|---|---|---|
| **GSFC Local Network Part**<br>Prototype L-Net w/loaner hw/sw | 1/1/04 | 10/15/04 | 0 | 41 |
| Acquire L-Net hw/sw | 3/2/04 | 10/15/04 | 8 | 33 |
| Test/Use L-Net hw/sw | 10/15/04 | 2/28/05 | 41 | 19 |
| Test/Use UMBC optical switch | 9/1/04 | 2/28/05 | 39 | 21 |
| **Regional Network Part**<br>Test/Use DRAGON 3x2.4Gbps lambdas | 1/1/04 | 2/28/05 | 0 | 60 |
| Acquire dark fiber to McLean | 7/1/04 | 10/15/04 | 26 | 15 |
| Test/Use DRAGON 2x10Gbps lambdas | 10/15/04 | 2/28/05 | 41 | 19 |
| **Transcontinential Network Part**<br>Test/Use Abilene | 1/1/04 | 2/28/05 | 0 | 60 |
| Test/Use Level3 1GE VLANs | 7/15/04 | 9/15/04 | 28 | 9 |
| Test/Use NLR MATP & HOPI lambdas | 10/15/04 | 2/28/05 | 41 | 19 |
| **Science/Apps Develop/Demo**<br>GSFC Sci/Apps identification | 1/1/04 | 2/28/05 | 0 | 60 |
| UMBC research support grant | 6/15/04 | 2/28/05 | 24 | 36 |

# GSFC L-Net Fund Commit Plan



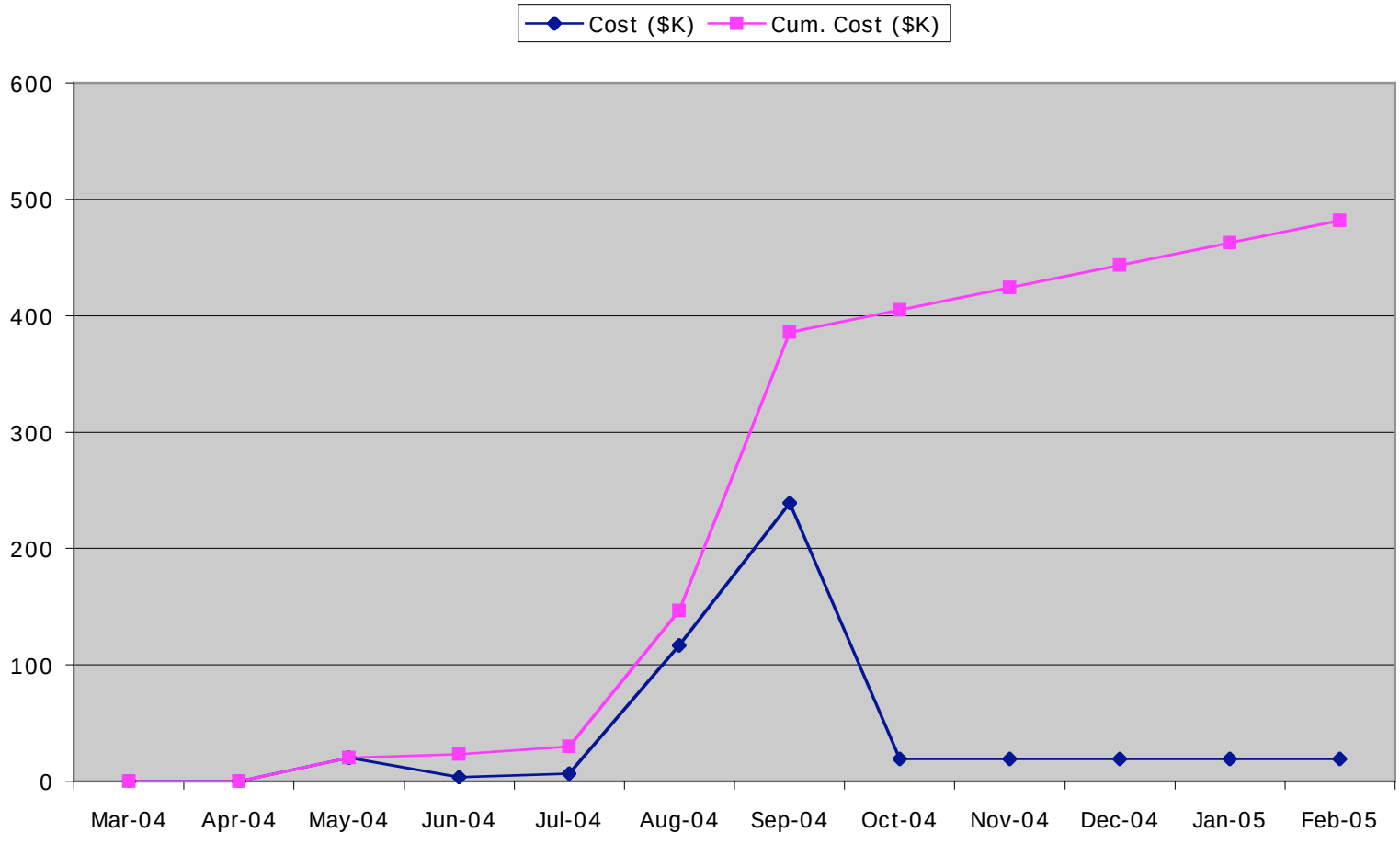

| | Mar-04 | Apr-04 | May-04 | Jun-04 | Jul-04 | Aug-04 | Sep-04 | Oct-04 | Nov-04 | Dec-04 | Jan-05 | Feb-05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commit ($K) | 18 | 0 | 2 | 330 | 150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cum. Commit ($K) | 18 | 18 | 20 | 350 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |

# GSFC L-Net Fund Obligate Plan




| | Mar-04 | Apr-04 | May-04 | Jun-04 | Jul-04 | Aug-04 | Sep-04 | Oct-04 | Nov-04 | Dec-04 | Jan-05 | Feb-05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Obligate ($K) | 0 | 18 | 2 | 330 | 0 | 0 | 150 | 0 | 0 | 0 | 0 | 0 |
| Cum. Obligate ($K) | 0 | 18 | 20 | 350 | 350 | 350 | 500 | 500 | 500 | 500 | 500 | 500 |

# GSFC L-Net Fund Cost Plan




| | Mar-04 | Apr-04 | May-04 | Jun-04 | Jul-04 | Aug-04 | Sep-04 | Oct-04 | Nov-04 | Dec-04 | Jan-05 | Feb-05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cost ($K) | 0 | 0 | 20 | 3.3 | 6.7 | 116.6 | 239.2 | 19.1 | 19.2 | 19.1 | 19.2 | 19.1 |
| Cum. Cost ($K) | 0 | 0 | 20 | 23.3 | 30 | 146.6 | 385.8 | 404.9 | 424.1 | 443.2 | 462.4 | 481.5 |

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*Principal Investigator & Co-Investigators*


- Name: Pat Gary (930) & Jeff Smith (585) Co-PI's & GSFC's Information Technology Pathfinder Working Group (ITPWG) as Co-I's
- Organizations: Code 420, Code 580, Code 920, & Code 930
- Telephone: 301-286-9539 & 301-614-5038 for Co-PI's
- E-mail: Pat.Gary@nasa.gov, Jeff.Smith@nasa.gov for Co-PI's