Models for Governance of Scientific Megaprojects

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This talk

- A bit of history
- A few questions
- The charge to the subcommittee on 3rd generation governance
  - Bottom up
  - Top down
- Phases, drivers, starting points, deliverables, science modes
- Governance options
- Collaboration parameters
- What is your vision?

A bit of history

LIGO Users Community

Gary H. Sanders

California Institute of Technology

Aspen Winter Conference on Gravitational Waves and Their Detection

January 24, 1995

LIGO-G950002-A-MAA

Traditional “Users” Models

- High Energy and Nuclear Physics
  - » Accelerators
    - – CERN, FNAL, TRIUMF, SIN, Frascati, Saclay
  - » Reactors
    - – Grenoble
- Astronomy
  - » Telescopes
    - – Palomar, Arecibo, Submillimeter, Owens Valley, Hubble
- Magnetic Fusion Machines
  - » TFTR, MFTF, ITER
- Materials Science
  - » Light Sources
  - » Spallation Sources

“User” Models
(recited by a high energy physicist)

- Facility capabilities supported by in-house team
- Access to facility generally open to international community
- Research can be collaboration between in-house and community scientists
- Research proposals are collaborative and submitted to peer review
- Review includes scientific/technical review and agency funding review
  - » Scientific review generally held by facility Director/Principal Investigator
  - » Agency holds funding review
- Facility creates a Program Advisory Committee
- Users organize a Users Group with elected leadership and charter
  - » Users Group becomes the “customers” voice

Immediate User Issues

- User requirements for facilities
  - » Visitor accommodations - offices, labs, food, sleeping quarters
  - » Clean room storage and work areas for test and assembly - “staging” areas and labs
  - » Computing
  - » Intellectual climate
- Computing infrastructure
  - » hardware environment
  - » software tools
    - – AVS vs. Khoros
- Review of proposals
  - » Early LIGO program
  - » Advanced detectors

National/International

- US groups
  - » NSF funding proposals
  - » LIGO project deliverables funded by LIGO
- International Gravity Wave Network
  - » Interlaboratory agreements to share data for combined results
  - » Share in technology development
- International joint projects
  - » Government to government

Tribe - “Sleeper”

tribe@world.std.com

SUPERCOLLIDER

Got the call just yesterday
And now it seems as if
It’s always been this way
Hasn’t told his wife
Hasn’t told his kids
If there was anything left
He’s forgotten it

He’s gone to Texas
To watch the holy fire burn
He’s gone to build
He’s gone to build the supercollider

Late at night
With no one else around
He sits there staring at
The atoms bouncing ‘round
Live your life
Another time
Let’s go to Texas
And watch the holy light shine
Let’s go to see
Let’s go to see the supercollider

LIGO Research Community

Gary Sanders

NSF Review

May 22, 1995

External Users and Advisors

- LIGO involvement with the scientific community
  - » All who are interested in exploiting the scientific opportunities offered by LIGO
  - » Nominating Committee
  - » Executive Committee
- Pre Program Advisory Committee
- Program Advisory Committee
- External Advisory Committee

Aspen Discussions

- "Users Group Charter" strawman (Berley/BNL model) discussed
  - » "Users" changed to "Research Community"
  - » Changes made to Executive Committee and nominating process
  - » Revised draft charter agreed to at end of day
- Communique sent internationally by Syd Meshkov
  - » Conference proceedings and communique (L950365) available
  - » comments on role of LIGO Research Community
  - » comments on nominating process
  - » comments on composition, membership, and organization
  - » names submitted for Nominating Committee and LIGO Pre Program Advisory Committee
- Response was very supportive and constructive

Discussions with VIRGO

- Barish/Sanders meeting with Giazotto/Brillet in March
- Broad agreement on need for intimate collaboration to optimize physics output of LIGO/VIRGO
- Draft of Memorandum of Understanding underway
- Agreement to exchange personnel, information, technical advice, technology
- Plan to form working groups on data collection, data analysis protocols, observing/maintenance cycles
- Possibility to jointly form LIGO/VIRGO Research Community with rotating meetings

Next Steps

- New communique to community will
  - Announce formation of LIGO Pre Program Advisory Committee to:
    - Advise on formation and process of LIGO Program Advisory Committee
    - Serve as interim External Advisory Committee on technical issues
    - Advise on formation of visitor's program
    - Serve as Nominating Committee in formation of LIGO Research Community
- Membership
  - P. Saulson(Syracuse) - Chair, S. Finn(Northwestern), A. Giazotto(Pisa/VIRGO), J. Hall(JILA), W. Hamilton(LSU), C. Prescott(SLAC), A. Ruediger(MPI-Garching/GEO)

Memoranda of Understanding

- Standardized format
  - » MOU - broad areas of agreement, legal principles, description of general programs, no fixed term
  - » Attachments - written as needed with fixed terms and describing specific tasks, deliverables, dates and payments, if relevant. These may be rewritten and replaced without modifying the MOU
- NSF visibility/concurrence
  - » domestic, <$100K - NSF provided copies
  - » domestic, >$100K - NSF concurrence
  - » international, NSF concurrence
- Thorne(Caltech), Australia, Bender (JILA),VIRGO... in the works

Plans

- LIGO Research Community
- MOU's
- LIGO/VIRGO working groups
- LIGO Visitor's Program
- Program Advisory Committee
- External Advisory Committee

A few questions

Bottom Up and Top Down Analyses of Governance Models

- Charge - "By applying knowledge of the diverse structures of the global GW community, propose a sustainable governance model for the management of detector construction and joint working, to support planning of 3rd generation observatories"
  - Key **visions** are hinted at in this charge
- Subcommittee is considering studying many existing or past governance examples of diverse science megaprojects and subjecting them to SWOT analysis.
  - SWOT results would then be compared to what subcommittee feels the right solutions are for the global 3rd generation GW community
- This is a good process
- It is bottom up – analyze examples and compare with subcommittee's vision and heuristic sense of appropriate features
- In these slides, I attempt to display a top down view of the same problem
  - Not as an alternate approach
  - As a way to understand the landscape in a general sense
  - To help locate the analyzed examples in this landscape
  - To point out that the models have to match your **vision** going forward

The Top Down Landscape of Governance Models

- The models I will describe are the basis vectors of a space of governance models
  - …approximately…the models are idealized
- However, they map onto the space that contains the possible scientific, cultural, technical and competitive/cooperative visions that you have
  - Who are you and what is the 3rd generation…?

Phases of a megaproject

- Conceptual
- Development
- Construction
- Operations
- Decommissioning and Restoration

- Begin discussion by considering governance for Construction and Operations phases
- Earlier phases can be governed by same models or by transitional arrangements to be discussed

Starting Points – Originator structure drives governance

- Existing intergovernmental organization as host and originator
  - Community organized by originator
- Existing major national laboratory as host and originator
  - Community or collaborations organized by originator
- International funding agencies as originators via funding agency peer consultation
  - Each funding agency organizes its supported community
  - Funding agencies guide their communities into collaboration
- Peer to peer university and laboratory originators via collaboration
  - Collaboration forms and then approaches respective funding agencies or existing intergovernmental or national laboratories
- Multiple national laboratories or institutes originate
  - Coordination of parallel related efforts,
  - collaboration on unified effort
  - or joint project with unified management

Deliverables drive governance

- Single major instrument at single site
  - Determined site ?
  - Site to be determined ?
- Single or multiple instruments at multiple sites
  - Determined sites ?
  - Sites to be determined ?
  - Homogeneity or diversity of instrumentation ?
- Instrumentation to be delivered in succeeding phases
  - Is this a one time vision of governance or is it the first step in a long path through the future
    - LIGO 1, LIGO 2 – just two steps
    - CERN formed in the same yearning for a long peaceful future that started the European Union
    - Should we be talking about a single central global GW entity that endures?

Science Modes of Delivered Facility

- Delivers raw data products or delivers highly processed data products (promptly and publicly)
- Acts as service facility or is also a science participant
- Takes responsibility for delivered instrumentation or hosts instrumentation contributors who retain responsibility for delivered instrumentation
- Reviews proposed science or just hosts member utilization of their portions of science opportunity
- LIGO and Virgo have long ago transitioned from one science mode (builders do the science) to another (builders and non-builders do the science)

Starting Points – Driving/Retarding Conditions

- Supply chain or in-house technology
- Specific site allegiance or advocacy
- Specific design allegiance or advocacy
- Desire for industrial return
- Desire for lead role or preference for flat collaboration
- Nationalism, exceptionalism
- Globalism or regionalism

- Some of these lead to delayed or inefficient science
- Leadership is needed to resolve these issues and move the field forward

Options for Global Project Governance

- Intergovernmental (treaty) organization (strongest)
- International partnership of existing executive organizations via legal member corporation
- International collaboration of existing executives via single nonbinding member association
- International collaboration with multiple nonbinding agreements with multiple existing executive organizations
- International coordination of separate, but related, existing executive organizations
- Non-coordinated separate, but related, existing executive organizations (least strong)

Intergovernmental (treaty) organization (IGO)

- Governed by treaty
- Very powerful and stable over long periods of time
- Virtually assures that the scientific field will do well
- Stable funding stream by treaty though subject to sovereign funding availability
- Hierarchically matched – countries to countries
- Diplomatic immunities and privileges in host country and for staff of organization
- Bureaucratic and political
- Full top down control over staffing, procurement, financial policies
- Responsibility for tariffs, taxes, duties, and legal liabilities
- Procurements are political – "juste retour" of "noble work"
- Protective of privilege and status
- Examples – CERN, ESO, ITER, goal for SKA
- United States will not join such organizations as member
  - Will participate in other status

International partnership of existing executive organizations via legal member corporation

- True binding legal partnership if signed by financial authorities of members (funding agencies,…)
  - Except for limitation subject to sovereign funding availability
- Stable over long periods of time due to binding nature of agreements
- Several international corporate structures exist that can achieve this model with full international recognition (GmbH, Delaware LLC,…)
- Full control within corporation over staffing, procurement, financial policies as in a commercial corporation
- Full responsibility for tariffs, taxes, duties, and legal liabilities
- Members (funding agencies) can assign their performing organizations (national labs, institutes,…) to act for them in partnership
- Can even mix national governments and private Nongovernmental Organizations (NGO's) though this raises hierarchical issues
- Examples – TMT, current SKA preconstruction phase project

Single international collaboration of existing executives via single nonbinding member association

- Nonbinding agreement shifts performance burden towards "best effort by scientific collaborators"
- Financial contribution agreements are also best effort
- Less stable over long periods of time
- Preserves independence and "sovereignty" of collaborating executive organizations
- Requires existing executives to be fully responsible for legal actions such as hiring, contracting, tariffs, duties, intellectual property and liability
- Collaborating executives can assign their performing organizations (national labs, institutes,…) to act for them in partnership
- Can even mix national governments and private Nongovernmental Organizations (NGO's) though this raises hierarchical issues
- Examples – ALMA

International collaboration with multiple nonbinding agreements with multiple existing executive organizations

- Nonbinding agreements shift performance burden towards "best effort by scientific collaborators"
- Financial contribution and in-kind contribution agreements are also best effort
- Less stable over long periods of time
- Preserves independence and "sovereignty" of collaborating executive organizations
- Requires existing executives to be fully responsible for legal actions such as hiring, contracting, tariffs, duties, intellectual property and liability
- Collaborating executives can assign their performing organizations (national labs, institutes,…) to act for them in partnership
- Can even mix national governments and private Nongovernmental Organizations (NGO's) though this raises hierarchical issues
- Examples – Typical CERN or Fermilab high-energy physics collaborations

International coordination of separate, but related, existing executive organizations

- Similar to previous case though typical when different instrumentation or facilities are delivered and operated in a related and coordinated effort
- Example: LIGO, Virgo, LSC, VSC, GWIC

Non-coordinated separate, but related, existing executive organizations

- Examples: Underground laboratories such as Gran Sasso, Kamioka, SNO, US Sanford Lab
- (Advanced LIGO and Advanced Virgo) with KAGRA

Collaboration Parameters

- All contributions in cash to governing entity?
- Cash used for procurements in manner to provide "juste retour"
- Contributions divided between in-kind and common expense cash funds?
- Uniform policies across partnership?
- Contribution policies for conceptual, developmental, construction, operations, decommissioning and restoration phases?
- Scientific credit or equity tied to contributions?
- Voting percentage tied to contributions?
- Time value of contributions?
- Value basis for contributions rather than actual cost experience?
- Authority of central management?
- Governance, oversight vs. management authority?
- Management of poor performance by partners
- Consequential damages when one partner prevents performance by another
- Policy for addressing cost growth
- Policies on partner default
- Default and authorship and termination of access to data
- Withdrawal policies
- …

What is your vision for 3rd Generation GW or for a longer future

- Single world GW laboratory with multiple sites
  - Vision extends beyond 3rd generation
- Vision of 3rd generation only
- Coordination or unified management of technology development
- Only one 3rd generation IFO design deployed at multiple sites
  - One construction project
- Diverse designs deployed at different sites but coordinated in operation and production of science
  - Construction managed separately
  - …
- Is the starting point of opening the field of gravitational wave astrophysics established by the current generation or is the 3rd generation when that threshold will be realized or …
- These overwhelmingly influence the proposed governance model
- Who are you and what do you want to be?

Phases: One Example

- Conceptual
- Development
- Construction
- Operations
- Decommissioning and Restoration

- SKA has had the first two phases and is preparing the third phase
  - PrepSKA – conceptual design and technology development
    - Precursor arrays of antennas built and operated for astronomy as working full science prototypes in different countries with different designs
    - Governed as loose association and guided by top down funding agency consultations
  - Preconstruction phase – preparing for construction readiness, a legal member international corporation was set up and is coordinating design efforts funded by cash contributions from partners and disbursed as funded work packages to member executing organizations
    - IGO is being designed for construction phase
  - Construction and Operations phases will be executed by IGO as if it were CERN or ESO

Things To Consider

- Vision of future
- One step or a path
- Starting point
- Nature of originators
- Appropriate models
- Collaboration parameters
- Phase progression

- Decide the leading options in your vision? Then the governance follows.