



## U.S. ATLAS Computing

- Overview
- Status of ATLAS computing
- U.S. ATLAS
  - u Project Management Organization
  - u Status of efforts
    - s Core software
    - s Subsystems
    - s Facilities
  - u Schedule
  - u Funding Profiles
- Summary

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## Scale of Computing Effort

- Rough scaling of factors of 5 to  $1E+3$  in relevant parameters from Tevatron Experiments
  - u Manpower x5
  - u CPU/event  $x1E+3$  (event complexity)
  - u Data volume  $x10$  to  $x1E+2$  (channel count)
  - u Distribution of data  $x10$
- U.S. effort comparable to scale of Tevatron experiment.
- Effort \$15M/year

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## Scales from experience

### HENP Computing Challenges



E895 (AGS)	10 TB/yr	600 SPECint95
BaBar (SLAC)	400 TB/yr	5,000 SPECint95
STAR (RHIC)	266 TB/yr	10,100 SPECint95
PHENIX (RHIC)	700 TB/yr	8,500 SPECint95
D0 Run II (FNAL)	280 TB/yr	4,075 SPECint95
CDF Run II (FNAL)	464 TB/yr	3,650 SPECint95
ATLAS (LHC)	1100 TB/yr	2,000,000 SPECint95

Experiment	Countries	Institutes	Collaborators	Time Frame
E895 (AGS)	3	12	49	2000
BaBar (SLAC)	9	85	600	2010
STAR (RHIC)	7	34	400	2010
PHENIX (RHIC)	10	41	400	2010
D0 Run II (FNAL)	11	77	500	2005
CDF Run II (FNAL)	8	41	490	2005
ATLAS (LHC)	34	144	1700	2015

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## Goals for this year

- **Project organization**
  - u **Management**
  - u **Organize efforts**
- **Integration into ATLAS**
- **Inception/development of software**
- **U.S. support facilities**
  - u **Planning/development of infrastructure**
- **Prepare for “Lehman” Review**

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## International ATLAS

- **Computing Coordinator**
  - u **Norman McCubbin (RAL)**
    - s **Responsibility: Core software**
- **Physics Coordinator**
  - u **Fabiola Gianotti (CERN)**
- **Detector specific sim/reconstruction**
  - u **Computer Steering Group (CSG)**
  - u **Organized within subsystem**
- **Report of Architecture Task Force**
- **Establishment of Architecture Team**
- **Hoffman Computing Review**

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## Architecture Taskforce

- **Software partitioned into work packages**
  - u **Katsuya Amako, KEK**
  - u **Laurent Chevalier, CEA**
  - u **Andrea Dell'Acqua, CERN**
  - u **Fabiola Gianotti, CERN**
  - u **Steve Haywood, RAL (Chair)**
  - u **Jurgen Knobloch, CERN**
  - u **Norman McCubbin, RAL**
  - u **David Quarrie, LBL**
  - u **R.D. Schaffer, LAL**
  - u **Marjorie Shapiro, LBNL**
  - u **Valerio Vercesi, Pavia**

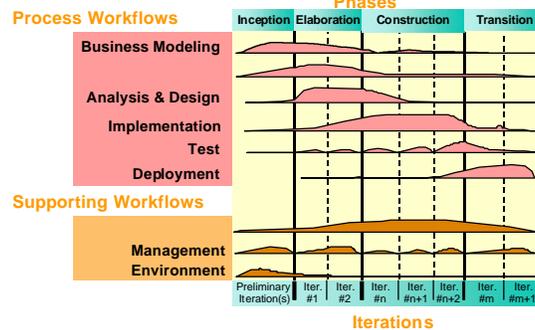
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## Stages in Software Management

### Software Development Process: USDP

n Workflows vs. Development Phase - Iterative and incremental [USDP p.11]



Atlas Software Week 1999.09.01

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## ATLAS/CERN Schedule '00

- **Jan '00**
  - u Start preparations for software agreement
  - u Launch Architecture Team
  - u First meetings of Hoffman Review
- **May '00**
  - u First release of control/framework from A-Team
- **June '00**
  - u Report from Hoffman Review
- **Fall '00**
  - u Preparations for MOU's

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## U.S. Leadership Roles

- Frank Paige - Co-convener of SUSY working group
- David Malon - Co-leader of database group
- Craig Tull - Architecture Team
- Ian Hinchliffe - Leader of Event Generator group
- David Quarrie – Architecture Team, Task Force
- Paolo Califiura – Architecture Team
- John Parsons - Co-convener of Top working group
- Misha Leltchouk - L Ar simulation coordinator
- Michael Shupe - Convener of Background working group
- Fred Luehring - TRT software coordinator
- Steve Goldfarb - Muon Database Coordinator
- Tom LeCompte - Tilecal Database Coordinator
- Krzys Sliwa - Chair of ATLAS World-wide computing group
- Frank Merritt - Training contact, Tilecal Reconstruction coord.
- Bruce Gibbard - Regional center contact
- John Huth- National Board contact

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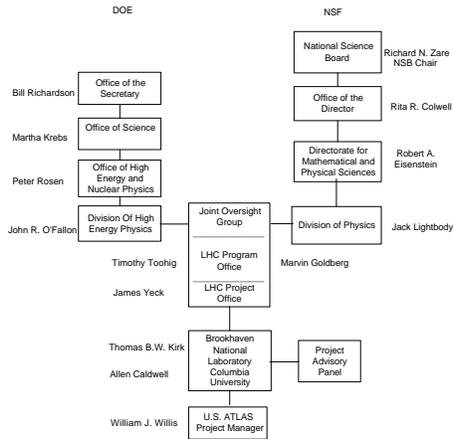
- NSF, DOE: LHC computing activities are to be a “project”
- Implications for U.S. ATLAS:
  - u Direct reporting lines through Project Manager (Bill Willis) and BNL Directorate (Tom Kirk)
  - u Appointment of Associate Project Manager for Computing and Physics (John Huth)
- Reporting lines through Joint Oversight Group (JOG)

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# Reporting Lines

DOE-NSF-U.S. ATLAS Organization

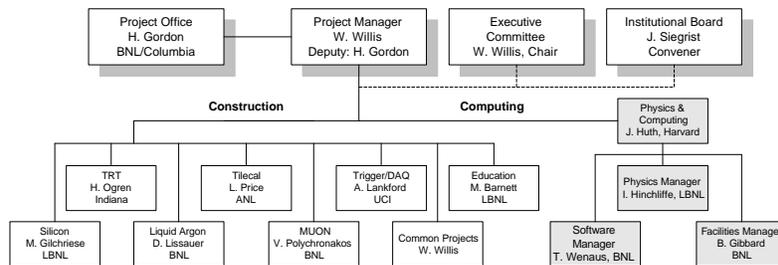


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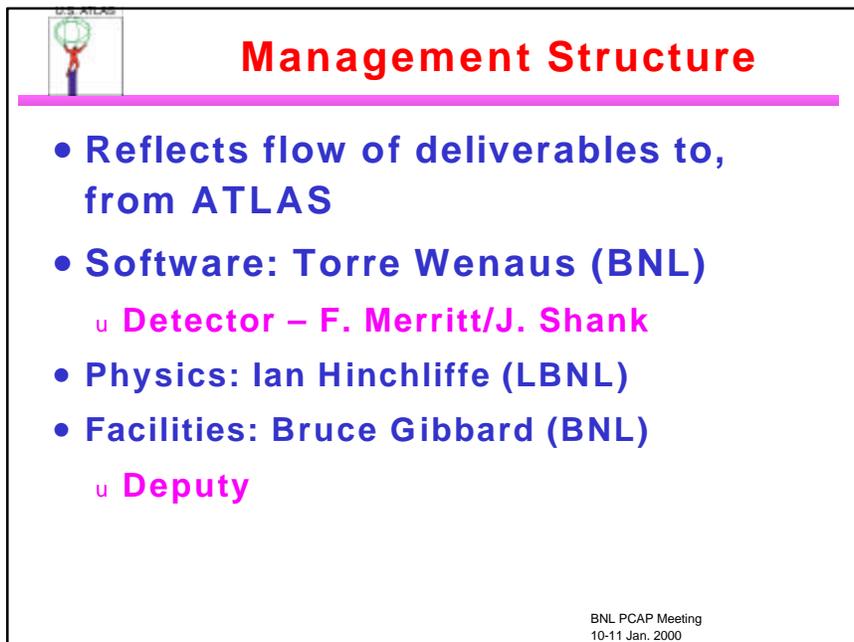
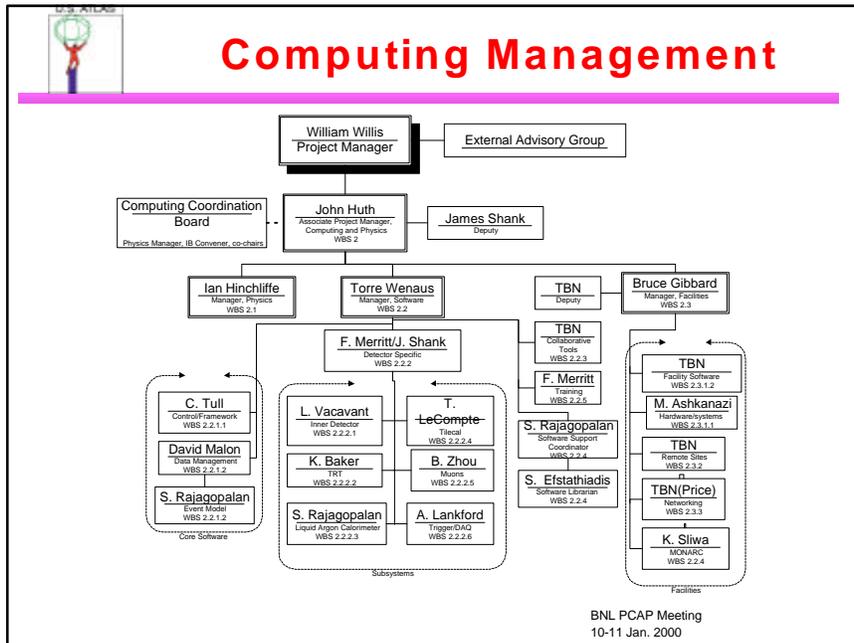


# Computing in U.S. ATLAS

U.S. ATLAS Organization



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## Management Plan

- **Associate Project Manager**

- u **Member of E.C.**
- u **Develop and execute project plan**
- u **Establish and maintain project organization+Tracking**
- u **Develop annual budget requests**
- u **Liason to ATLAS Computing Management**
- u **Appoint L2 managers**
- u **Review and approve MOU's to CERN and Institutes**
- u **Exercise change control authority**
- u **Establish advisory committees where appropriate**
- u **Provide reports and organize reviews**

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## Level 2 Managers

- **Appointed by APM, concurrence of Exec. Comm.**
- **Members of E.C. (+ APM, + deputy)**
- **Generic responsibilities**
  - u **Develop definition of milestones and deliverables**
  - u **Define, with APM, organizational substructure of level 2**
  - u **Develop, with APM, annual budget proposals**
  - u **Identify resource imbalances within subprojects and recommend adjustments**
  - u **Deliver scope of subproject on time within budget**
  - u **Maintain cost and schedule**
  - u **Provide reports to APM, PM**
  - u **Liason with counterparts at CERN**

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## Specific Responsibilities

- **Physics Manager**
  - u Generators, physics objects, benchmark studies, mock data challenge
- **Software**
  - u Core
  - u Detector specific sim/recon
  - u Training
- **Facilities**
  - u Tier 1,2, networking, support

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## Project Engineer

- **Same roles as project engineer's for construction project**
  - u Tracking
  - u Reviews, oversight
  - u Reporting
  - u Technical input
- **Needs further definition**
  - u **Analogs in Construction Project**
    - s Mechanical
    - s Electronics

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## Computing Coordination Board

- Main path of input from collaboration
- Physics Manager, Institute Board Chair are co-chairs
- APM, Deputy, Facilities Manager, Software Manager + 3 at-large members
- Role:
  - u Provide input on priorities and requirements for facilities
  - u Selection of Tier 2 sites

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## High Levels of WBS

- Draft WBS
  - u 2.1 Physics
    - s Generators, benchmarks, mock data challenges, physics objects
  - u 2.2 Software
    - s 2.2.1 Core
      - Control/Framework, database, event model, analysis tools
    - s 2.2.2 Detector specific simulation and recon.
    - s 2.2.3 Collaborative tools
    - s 2.2.3 Training
  - u 2.3 Facilities
    - s Regional center, remote sites, networking, support

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## Policy Issues

- **Local Computing Support**
  - u Until Tier 2 centers – limited development support, in coordination with BNL site
- **Physicist Support**
  - u Not on project funds
  - u N.B. expect/need approx. 50 postdocs by 2005
- **Relation to Construction Project**
  - u Adjudication by Proj. Manager, APM
  - u Common areas:
    - s Computing in support of detector configuration
    - s Trigger/DAQ common software

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## Activities Since May '99

- U.S. ATLAS Web-site
- Regular video conferences
- Computing support at BNL
- Organization of funding requests
- Advisory group appointment
- PMP, project planning
- NSF ITR proposal with LIGO, CMS, SDSS
- Negotiations with ATLAS on deliverables
- Interactions with agencies
  - u JOG, Computing review

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## Software

- **Core Software**
  - u Control/Framework (Tull)
  - u Database, Tilecal Pilot Project (Malon)
  - u Event Model (Rajagopalan)
- **Detector-specific sim/reconstruction**
  - u Mainly physicists – base program
  - u Estimate 2 software prof./ subsystem in support
- **Training (Merritt)**
  - u Establishment of OO courses (BNL, U. Chicago)

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## General Requirements

- **Software must last over lifetime of experiment, yet track language changes**
  - u Well defined interface layers
- **Maintainability, engineering critical**
  - u Number of users, use of software professionals
- **Adaptability to distributed environments**
- **Learn from experiments working on OO (BaBar, D0, CDF, STAR)**

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## Software Development

- Asymptotic level - est. 10 software professionals
- Peak load (circa 2003) est. 20 S.P.'s
- Extrapolations based on existing experiments and proposed areas of responsibility, fractional of U.S. participation
- Choice of "technology", requirements can influence actual needs.

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## Core Software Projection

																Total	Total \$k	
Control	0.6	120	2.2	440	4	800	4	800	4	800	3	600	2	400	2	400	21.8	4360
Data management	0.7	140	3	600	5	1000	6	1200	7	1400	7	1400	7	1400	7	1400	42.7	8540
Subtotal	1.3	260	5.2	1040	9	1800	10	2000	11	2200	10	2000	9	1800	9	1800	64.5	12900
Contingency	1		1		1.4		1.4		1.4		1.4		1.4		1.4			
Subtotal w/ cont.		260		1040		2520		2800		3080		2800		2520		2520		17540

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## Detector Support

Sim/recon	FTE	Fy 99\$K	FY 00	FY 01	FY02	FY 03	FY 04	FY 05	FY 06	Sum	Sum					
Inner Detector			0	0	0	1	150	2	300	2	300	1350				
TRT			0	0	1	150	2	300	2	300	2	1650				
E-Cal	0.5	75	1	150	2	300	2	300	2	300	13.5	2025				
Tilecal			1	150	2	300	2	300	2	300	2	1950				
Muons			0	0	1	150	2	300	2	300	2	1650				
Trigger/DAQ			0	0	0	1	150	2	300	2	300	1350				
Subtotal		75	2	300	6	900	10	1500	12	1800	12	1800	#	1800	66	9975
Contingency	1		1		1		1		1		1					
Subtotal w/ cont.		75		300		900		1500		1800		1800		1800		9975

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## Physics

- Analysis activities are coordinated overall with International ATLAS
- U.S. Contributions:
  - u Software as deliverables (e.g. support of event generators, interfaces)
  - u Computing support via facilities
- Project “calls” on funds for physics:
  - u Person to maintain interfaces
  - u Effort associated with benchmark studies, mock data challenges
- Expect 1 FTE “level of effort” on project from FY '01 on

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## Training

- All by Object Mentor (BaBar, others)
- Organized by Frank Merritt
- Courses approximately 1 week long
- Aug. 9 - BNL - OO Design - 13 people
- Sept. 20 - U.C. - OO Design - 15 people
- Oct. 18 - ANL or BNL - Advanced OO - 10 people
- Nov. 8 - FNAL - GEANT 4 - 14 people

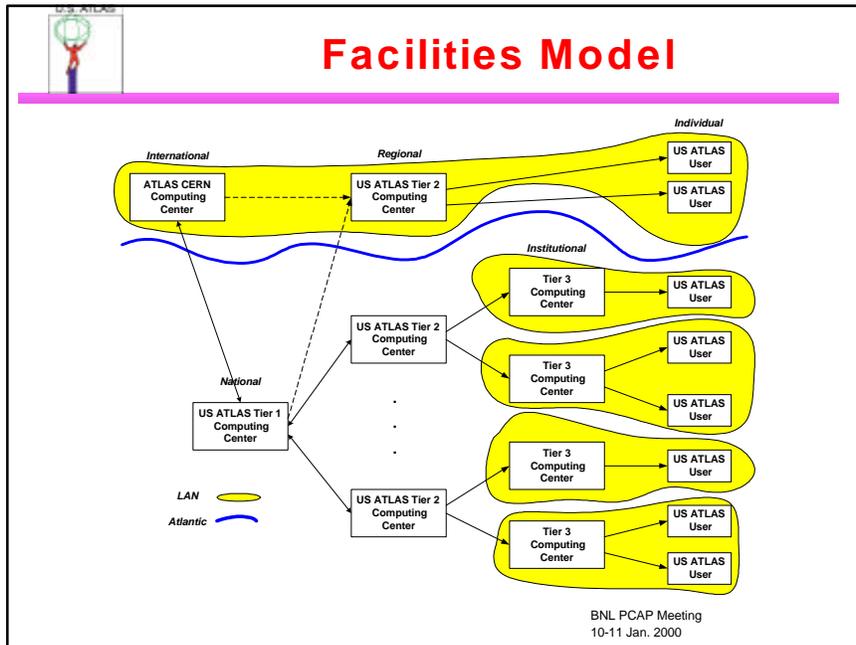
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## Facilities

- BNL ramping up support facility
  - u Taps into RHIC Computing Facility
- Issue of Tier 1/2 facilities
  - u Scale of Tier 2 sites
    - s Size for support staff, infrastructure
    - s Computing model for U.S. (e.g. grids)
    - s R+D being addressed in NSF ITR proposal
- In the process of developing policy on usage, support of platforms at institutions

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- The diagram, titled "Facilities", illustrates the organizational structure of ATLAS computing facilities. It is divided into four levels: International, Regional, National, and Institutional. At the International level, the ATLAS CERN Computing Center is connected to US ATLAS Tier 2 Computing Centers in the Regional level. A dashed line indicates a connection between the CERN center and a US Tier 2 center. A blue wavy line, representing the Atlantic Ocean, separates the International/Regional levels from the National level. The National level features the US ATLAS Tier 1 Computing Center, which is connected to multiple US ATLAS Tier 2 Computing Centers. A yellow oval, representing a LAN, encloses the US ATLAS Tier 1 center and one of the US ATLAS Tier 2 centers. Each US ATLAS Tier 2 center is further connected to multiple Tier 3 Computing Centers. A yellow oval encloses each Tier 2 center and its associated Tier 3 centers. Finally, each Tier 3 center is connected to one or more US ATLAS Users, with a yellow oval enclosing each Tier 3 center and its users. A legend at the bottom left identifies the yellow oval as "LAN" and the blue wavy line as "Atlantic".
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- **Tier 1 (Regional Center)**
    - u **BNL**
    - u **Leverages RCF**
      - s **ATLAS specific needs, however.**
    - u **Primary support function for U.S.**
      - s **Code release, support**
      - s **Major processing, event store**
    - u **Personnel scale estimate:**
      - s **Roughly linear ramp from 3 FTE's (now) to 26**
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## MONARC

- **Models of Networked Architecture at Regional Centers (ATLAS+CMS)**
  - u **Alexander Nazarenko, Tufts**
  - u **Tasks:**
    - s **Validate simulation models**
    - s **Perform first simulations of LHC architectures**
    - s **Now focus on planning for regional centers**
  - u **Model validation**
- **Understanding of U.S. computing facilities**

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## Priorities

- **Critical personnel**
  - u **People who would otherwise be lost, fulfilling a critical role**
- **Core software effort**
  - u **Prerequisite to inclusion of sim/recon software**
  - u **Architecture team support**
- **Support of U.S. efforts (facilities)**
- **Critical studies**
- **Transition to OO**

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## Priorities

- **Coherency in development of plan**
  - u **Matching of facilities scope to usage**
    - s **E.g. database effort, simulations**
  - u **Contiguous/overlapping areas**
    - s **E.g. event model, database, control/framework**

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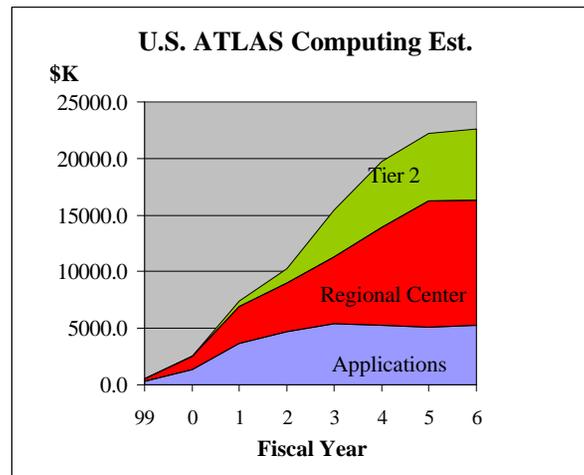
## Summary of Profile

	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	Sum
FY Multipliers	0.98	1	1.025	1.0517	1.0811	1.114	1.1436	1.1779	
Application Sub	328	1240	3649	4670	5427	5280	5100	5253	30948
Tier 2 Facilities	0	0	474	1310	4162	5786	5972	6299	24052
Tier 1 Facilities	206	1220	3257	4329	5842	8656	11111	11082	45703
Sum	534	2460	7380	10309	15432	19722	22184	22635	100703

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## Profile Breakout



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## Schedule for 2000

- **Jan 00**
  - u NSF/DOE Review
  - u Preparations for software agreements
  - u Adjust to FY 00 funding
  - u Architecture team
- **May 00**
  - u A team milestone
- **July**
  - u Hoffman review report
  - u Preparations for MOU's
  - u Ratification of PMP
- **Aug 00**
  - u Prepare for full Lehman review
- **Fall 00**
  - u Full Lehman review

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## Summary/Issues

- The U.S. is taking a significant role in ATLAS Computing
  - u We are ahead of ATLAS proper
- Funding will be tight for FY 00, 01
  - u Must adjust priorities
- Policy issues must be settled with collaboration/agencies
- Close to making software agreements

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