University Program Assessment

Herman A. Rediess, PhD
Director, University Programs

Council Of Deans Meeting
April 14, 2004
Topics

- Aeronautics University Program Council (AUPC) activities
- Aeronautics Research Mission Directorate (ARMD) university programs
- Aeronautics FY04 Budget and investment in universities
- Office of Education FY04 funding for higher education programs
- University program assessment by Centers
- University Engineering, Research, and Technology Institutes (URETI) assessment
- Inter-agency and foreign collaboration
- University support options - process
- FY2004 to FY 2010 Budgets
- Budget impact on university investments
Purpose

• Provide baseline for existing programs

• Background for COD advisory activities

• Starting point for new aeronautics university strategy
Aeronautics University Program Council (AUPC)

• Aeronautics Research Mission Directorate (ARMD) group to develop and assist implementation of a new aeronautics research university program strategy....

.....working with the Council of Deans
Aeronautics University Program Council

Members:

– Dr. Herm Rediess, Director, University Programs, ARMD, Headquarters, Chairman
– Dr. Skip Fletcher, Director of Aeronautics, Ames Research Center
– Dr. Kajal Gupta, R&T Directorate, Dryden Flight Research Center
– Dr. Ted Keith, Director, Research and technology, Glenn Research Center
– Dr. Christine Darden, Director, Office of Communications and Education, Langley Research Center
– Dr. Frank Aguilera, Deputy Director, Airspace Systems Program
– George Finelli, Director, Aviation Safety and Security Program
– Dr. Rich Wlezien, Director, Vehicle Systems Program
– Bill Anderson, Office of Education, NASA Headquarters
AUPC Schedule

April - Internal assessment complete
April to September - COD inputs to strategy solicited
July - Initial strategy drafted for ARMD management consideration
August - Draft to COD for comments
September - COD concurrence solicited at September meeting
October - Begin implementing new strategy
After October - Continue to improve strategy with COD help
ARMD University Research Programs

• Research
  – Directly funded from the ARMD R&D Programs
    • Airspace Systems Program; Aviation Safety and Security Program; and Vehicle Systems Program
    • Grants, Cooperative Agreements, Contracts, Purchase Orders
    • Collaborations with other Agencies
  – Office of Education Programs research programs in which ARMD participates
    • University Research Centers (URC - Minority institutions)
    • Faculty Awards for Research (FAR)
    • NASA Summer Faculty Research Program (NSFRP)
    • Experimental Program to Stimulate Competitive Research (EPSCoR)
    • NRC Resident Research Associates Program (to become the NASA Postdoctoral Program in 2005)
    • Graduate Student Research Program (GSRP)
    • Undergraduate Student Research Program (USRP)
    • Science and Technology Scholarship Program (STSP)
    • Achieving Competency in Careers in Engineering and Space Science (ACCESS) - on-site summer work for students with disabilities
    • Student Cooperative Research Program and Internships at Centers
    • National Space Grant College and Fellowship program (Space Act Grant)
ARMD Participation in Office of Education Programs

- Workforce Development Programs (higher education)
  - NASA Administrator’s Fellowship Program (NAFP)
  - Faculty Fellowship Programs
  - Harriet Jinkins Pre-doctoral Fellowship Program
  - Graduate Students Fellowship/Internship Programs
  - Undergraduate Student Fellowship/Internship Programs
  - Education/Academic Grants
  - Education/Research Grants
    - Space Act Grants - opportunity for education and research at NASA Centers
  - NASA Center-Unique Programs
    - Education Associates Internship and Fellowship Program - Ames
    - National Association for Equal Opportunity (NAFEO) Ames Academy
    - Langley Aerospace Research Summer Scholars (LARSS) Program
    - Lewis Educational Research and Collaborative Internship Program (LERCIP) - Glenn
ARMD University Research Programs

- Special NASA (ARMD) Affiliated Institutes/Consortia
  - *University Affiliated Research Center - Ames
  - *AERO Institute (California Space Grant) - Dryden
  - *Ohio Aerospace Institute - Glenn
  - Aeropropulsion and Power University Research, Engineering, and Technology Institutes (URETI) - Glenn
  - *National Institute of Aerospace - Langley

*Potential for hybrid government/non-government Center staffing and operations
• Total Aeronautics FY04 Budget (A$) $1,056.8M
  – Total University Investment $106M (10% of A$)
    • University Education and Outreach investment $2.25M
  – Programs
    • Airspace Systems $232.3M
      – Procurement dollars (P$) $133.6M
      – University investment $21.25M (16% of P$)
    • Aviation Safety and Security $183.1M
      – Procurement dollars (P$) $82.7M
      – University investment $16.82M (20% of P$)
    • Vehicle Systems $641.4M
      – Procurement dollars (P$) $248.6M
      – University investment $65.67M (26% of P$)
  – Congressional earmarks $87M (8.2% of A$)
    • University earmarks $9.87M
Office of Education Higher Education Programs* - FY04

<table>
<thead>
<tr>
<th>Program</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA Administrator’s Fellowship Program</td>
<td>$2.6M</td>
</tr>
<tr>
<td>NASA institutional Research Awards</td>
<td>$1.8M</td>
</tr>
<tr>
<td>Experimental Program to Stimulate Competitive Research</td>
<td>$4.6M</td>
</tr>
<tr>
<td>University Research Centers</td>
<td>$22.8M</td>
</tr>
<tr>
<td>Minority Undergraduates in Science and Technology</td>
<td>$6.8M</td>
</tr>
<tr>
<td>Faculty Awards for Research</td>
<td>$5.5M</td>
</tr>
<tr>
<td>Graduate Student Research Program</td>
<td>$6.2M</td>
</tr>
<tr>
<td>Harriett Jenkins Pre-Doctoral Fellowship Program</td>
<td>$2.7M</td>
</tr>
<tr>
<td>NAFEO/Ames Academy</td>
<td>$1.2M</td>
</tr>
<tr>
<td>LERCIP/Glenn Program</td>
<td>$1.2M</td>
</tr>
<tr>
<td>LARSS/Langley Program</td>
<td>$1.2M</td>
</tr>
<tr>
<td>NASA Summer Faculty Research Program</td>
<td>$1M</td>
</tr>
<tr>
<td>Science and Technology Scholarship Program</td>
<td>$9.8M</td>
</tr>
<tr>
<td>Undergraduate Student researchers Program</td>
<td>$0.75M</td>
</tr>
<tr>
<td>NRC Resident Research Associateship Program</td>
<td>$12.3M</td>
</tr>
<tr>
<td>National Space Grant College and Fellowship program</td>
<td>$19.1M</td>
</tr>
</tbody>
</table>

* Includes Space and Aeronautics
Assessment - By Center
Ames

• Research
  – Curiosity-driven research may be interesting, but rarely contributes to NASA Mission
  – Focused/mission-driven research is productive and more beneficial
  – Multiple-year grants are most productive
  – Single-year grants rarely produce results unless there are clearly defined deliverables
  – Success requires continued monitoring/pressure from the NASA grant/contract monitor
Assessment - By Center
Ames

• University Affiliated Research Center (UARC)
  – Partnership between Ames and University of California System
    • Managed by UC Santa Clara
      – Portal to UC System
      – Research conducted at Ames, NASA Research Park and UC campuses
      – Access to UC faculty, staff, facilities and national labs
    • Ten year performance-based task-order contract - $330M max value
    • FY04 funding $15M, currently at $20M/year
      – Research to enhance and assist Ames’ aerospace mission
      – Supports education through “Systems Teaching Institute”
        • San Jose State University lead through subcontract
      – Create opportunities for new partnerships

• NASA Research Park at Ames Research Center
  – World-class, shared-use R&D campus for government, academia, non-profits and industry

• UC Santa Clara Silicon Valley Initiative
  – Technology and Management Complex at NASA Research Park
    • 100,000 Ft² Lab and educational facility - $55.5M initial investment - operational in 2008
Assessment - By Center
Dryden

• Research
  – Grants to a wide variety of universities should be balanced among small & large, known or unknown, regular or minority institutions
    • Chosen on the basis of PI qualifications who are results-driven
  – Crucial that proposed grants support Dryden projects
  – Technically knowledgeable NASA monitor critical for achieving useful deliverables
  – Long-term grants are most effective - typically 3 - 10 years
  – Including foreign universities may be beneficial

• Education
  – Higher education program supports -
    • Pipeline for aerospace and engineering workforce
    • Workforce enhancement
    • Research for Dryden’s mission
  – Consortium with local and state government, local industry, and local academic institutions is important for making the Center more competitive
  – The recently established AERO Institute for education, research and operational programs is instrumental for meeting our future workforce competencies
Assessment - By Center
Dryden

- Aerospace Education, Research and Operations (AERO) Institute
  - Non-profit organization to act as innovator, facilitator and integrator for joint NASA, university and industry programs
    - Focus on human capital development, educational outreach, applied research and operational improvements
    - Provide comprehensive technical, undergraduate and graduate education
    - Conduct leading edge aerospace research
    - Incubate, stimulate and commercialize intellectual property
    - Promote aerospace science and engineering
  - Partnerships with Dryden, California Space Grant Consortium and others
  - Cooperative Agreement with Dryden - $250K/year base plus project funding
  - Leverage assets of Dryden, other government agencies, Space Grant Universities and local industry
    - Dryden issues task orders under Cooperative Agreement
    - Space Act Grant funding
    - Plan to team with Dryden and other partners to bid on NASA Research
  - Facilities in Palmdale California
Assessment - By Center
Glenn

• Research
  – Very productive University Research Program
    • Numerous long term research collaborations were established
  – Faculty often obtained grant after developing relationship with researcher/administrator
    • Relationships develop from conferences, visits, sabbaticals, presentations, short courses and/or participation in the Summer Faculty Fellowship Program (SFFP)
  – Summer Faculty Fellowship Program relatively large (SFFP) - 40 to 80 faculty
    • Glenn leveraged Headquarters base funding
    • Reduction in base funding has negatively impacted SFFP
  – Glenn reorganized in ‘90s dividing the research community into two groups:
    • Projects and Programs (has all of the money)
    • Research & Technology (has all of the researchers)
  – Grants and Cooperative Agreements funding generally come through the Projects and Programs Directorate
  – Funding to faculty is greatly diminished, limiting Glenn-academic interactions
    • Several larger efforts continue: URETI, Small Turbine Institute
Education

- Undergraduate Student Research Program (USRP)
  - Widely acclaimed popular program, with highly qualified productive students
  - Program termination beyond 2005 viewed as unfortunate
- Graduate Students Researchers Program (GSRP)
  - Good program that effectively compliments in-house research projects
  - HQ funding increase desired to increase students above 3-5 per year
- NRC Resident Research Associateship Program (RRAP)
  - Excellent program that adds near-term value to in-house research projects
  - National security concerns and loss of HQ funding decrease participation
- Summer Faculty Fellowship Program
  - Summer faculty program enjoyed widespread reception and highly beneficial
  - 2004 termination of program ill-advised
    - Diminishes opportunity for curriculum improvement and new course offering
  - Uncertainty of replacement pilot program may drive faculty away
- Overall, without much improvement on current funding outlook, future effectiveness of higher education programs may be shaky.
Assessment - By Center

Glenn

- Ohio Aerospace Institute (OAI)
  - Mission - to build Ohio’s aerospace economy through R&T development partnerships, education programs and networking
  - Private, not-for-profit institute founded in 1990 by
    - NASA Glenn, Air Force Research Lab, 10 Ohio universities and aerospace industry
    - Located adjacent to Glenn
    - Annual budget ~ $24M - about $15M from NASA Glenn ~ 70% aeronautics
    - 108 personnel - 63 supporting Glenn on-site
  - Ten NASA related research partnerships with industry and universities
  - Human capital development programs at Glenn

- Aeropropulsion and Power University Research, Engineering, and Technology Institutes (URETI)
  - One of 7 URETIs established competitively in 2002 - only one left in aeronautics
  - $3M/year for 5 years - jointly funded: $2M NASA, $1M AFOSR
  - Georgia Tech lead, Ohio State and Florida A&M
  - Assessed by Glenn and AFSOR sponsors very effective and productive
University Programs In General - Objectives

- Prepare next generation engineers, scientist, and researchers
- Collaborate on and make advances in basic and applied knowledge

Research

- Cooperative agreements and contracts often essential elements of NASA mission via projects
  - Usually 3-5 years with required project deliverables
  - Sponsoring PI usually an expert in field
  - Students working with PI grow in NASA mission-related knowledge
- Grants may result from NRA or via unsolicited proposal
  - Provide very important fundamental knowledge
  - Monitoring and frequent discussions necessary for best NASA benefit
  - Curiosity-based research may not support NASA mission
Education

- Programs are hugely successful in -
  - Generating interest in aerospace research careers and continued education
  - Developing skills, knowledge and interest to better prepare future scientists and engineers
- Undergraduate student program require mentoring for mission related knowledge
  - Researcher’s mentoring time more difficult with increased critical-path projects
- Graduate student and post-doc researchers make substantial contributions to NASA mission
  - Many have become NASA employees
- Summer faculty program often result in stronger relationships with the university
- University grants, cooperative agreements and contracts provide opportunities to bring faculty and their students to bear on fundamental NASA challenges
Assessment - By Center Langley

• National Institute of Aerospace (NIA)
  – Independent, non-profit research and graduate education institution formed in 2002 by 6 universities and the AIAA Foundation
    • Won Langley cooperative agreement - 5 years with three 5-year options
    • Georgia Tech, Hampton University, North Carolina A&T, North Carolina State, University of Maryland, University of Virginia, Virginia Tech
    • Located near to Langley
    • 60 employees and 4 vacancies
    • FY04 revenue $14M, FY05 budget $22M
  – Research scope covers Langley’s aerospace mission
    • Conducts collaborative research with Langley, university faculty, resident staff, industrial partners, other agencies and non-profit institutes
  – Offers full-time and part-time resident graduate education in engineering and science from member universities
    • 10 full-time and part-time faculty in residence and 4 vacancies
    • 27 full-time graduate plus 16 part-time students
    • Plus seminars, colloquia, workshops, short courses, summer visiting faculty
  – Planning new NIA research campus within 2 miles of Langley
URETI Assessment

- Aerospace Technology Office awarded 7 URETI in 2002
  - Competitive procurement
    - Cooperative agreements - $3m/year for 5 years with one 5-year option
  - Six moved to Space Exploration in 2004
    - Four in nano-bio-technology with aero as well as space applications
    - Now focused on space applications
  - One remains in ARMD
    - Aeropropulsion and Power URETI at Glenn

- Assessment (Rediess)
  - Based on discussions with managers and researchers on 5 of the 7 URETI
  - URETI focuses significant, high quality university research on NASA Mission and specific Programs - strong NASA researcher involvement
  - University partners have beneficial collaboration
  - Believe universities involved supportive of UERTI concept
  - Center URETI managers and researchers like them
    - All concerned about continued funding commitment
  - One Program Director believes individual grants more effective
    - $3M/year for one URETI = 15 $200K grants
Inter-agency University Collaboration

• FAA
  – Joint University Program (MIT, Princeton, Ohio University)
    • Jointly funded by NASA and FAA for over 30 years
  – Center of Excellence for Noise and Emissions Research (MIT lead)
  – Center of Excellence for Air Transportation Operational Research (UC Berkeley lead)

• DOD
  – AFOSR - Aeropropulsion and Power URETI Co-sponsor
  – Multidisciplinary University Research Initiative (MURI)
    • Proposal evaluations and reviewing research

• NSF
  – Engineering Research Centers (ERC)
    • Proposal evaluations and reviewing research
  – Considering other collaborations

• Inter-agency and multi-agency offices/collaborations
  – FAA Offices at Ames, Glenn and Langley
  – Langley establishing office at Naval Air Systems Command
  – Power and Propulsion Systems Alliance - NASA, FAA, DOD & DOE
Foreign University Collaborations

- NASA Policy on foreign university involvement
  - In general, research with a foreign organization will not be conducted through grants or cooperative agreements, but instead on a no-exchange-of-funds basis
  - In rare instances, NASA may enter into an international agreement under which funds will be transferred to a foreign recipient.
    - Requires strong justification and approval through External Relations and General Counsel

- Aeronautics has several collaborations with foreign universities on a no-exchange-of-funds basis
  - Generally scientist-to-scientist basis and two-way exchange of information
  - Often initiated through professional meeting contacts, visits to research centers or foreign Postdoctoral Fellow at a NASA Center
University Support Options

- Grants (excluding Space Act Grants) - *34%
  - Most flexibility for university - no formal products and minimal monitoring
  - Has been preferred by individual researchers and scientists
  - No NASA-wide announcements - Center implemented
- Space Act Grant Agreements - *12%
- Cooperative Agreements - *40%
  - Most flexible for NASA - options for program focus, product deliverables, close monitoring, task orders, funded and unfunded tasks, collaborations with industry, other universities and agencies
  - Preferred by program managers and researchers supporting focused programs
  - All URETI use cooperative agreements - competed from Headquarters
- Contracts and Purchase orders - *15%
  - Generally used for specific product or service deliverables
- Competitive vs sole source
  - NASA Research Announcement (NRA) often used for competitive solicitations
    • Can award grants, cooperative agreements or contracts
  - Congressional mandates and earmarks generally sole source
    • Largest is the Space Act Grant - 53 US states and territories

*Percentages of university funding in FY04 even if awarded in an earlier year.
## FY2004-2010 Budgets ($M)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA</td>
<td>15,378</td>
<td>16,070.4</td>
<td>16,763.0</td>
<td>16,962.0</td>
<td>17,305.9</td>
<td>17,611.9</td>
<td>18,027.1</td>
</tr>
<tr>
<td>Aeronautics</td>
<td>1,056.8</td>
<td>906.2</td>
<td>852.3</td>
<td>727.6</td>
<td>730.7</td>
<td>727.5</td>
<td>717.6</td>
</tr>
<tr>
<td>Education</td>
<td>230.4</td>
<td>216.7</td>
<td>166.9</td>
<td>154.9</td>
<td>154.7</td>
<td>155.4</td>
<td>155.4</td>
</tr>
</tbody>
</table>

* FY2006 Presidential budget request
Budget Impact

• General comment
  – Decreasing aeronautics and education budget reflects Administration’s priorities
    • Aeronautics community has not made the case for government R&D investment

• Aeronautics Research Mission Directorate
  – Reducing Center institutional support and staffing commensurate with budget reductions is very challenging, which impacts available procurement dollars.
  – Industry and university research investments already impacted by budget reductions in FY2005 and will continue to be impacted through FY2010
  – Research programs being refocused on fewer high priority technologies and breakthrough demonstrations
  – Directorate committed to significant university involvement in Aeronautics research
    • Every Center uses and benefit from on-site researchers from universities - undergraduate, graduate, post-doc, faculty - considers high priority
    • Important for innovation and “breakthrough” technologies
  – Foundational Research program element to be added
    • Long-term aeronautics mission goals - foundation for future focused research
    • External peer-reviewed university research

• NASA ARMD University Affiliated Institutes being considered to help Center institutional challenges
Budget Impact

- Office of Education
  - Program Evaluation
    - Self Evaluation of All Programs Underway
    - External Evaluation of All Programs Planned
    - Restructure program based on evaluations
  - Vision for Space Exploration
    - Full commitment for support
    - All Missions involved
  - Space Exploration Academy
    - Increase priority on teacher training
    - Provide for better integration of existing science, technology, engineering, and mathematics education initiatives across government, industry and professional organizations
    - Explore options to create a university-based virtual space academy for training the next generation technical workforce
    - Mission Directorates expected to share in funding - TBD