Developing the 21st Century Aerospace Workforce

MIT Center for Technology, Policy and Industrial Development

Lunch Presentation, October 2001
Overview

- Introduction to the “Labor Aerospace Research Agenda”
- Sample Research Findings on Instability
- A Call to Action on Instability and Institutional Infrastructure
Introduction to Labor Aerospace Research Agenda

- Sponsor: USAF ManTech
- Lead Partners: UAW and IAM
- Principal investigators and Research Team:
  - Tom Kochan (Co-PI), Joel Cutcher-Gershenfeld (Co-PI), Betty Barrett, Rob Scott, Takashi Inaba, Eric Partlan, Shannon O’Callighan, Kevin Long, and other team members
- Links to LAI:
  - Organizations and People, Knowledge Deployment, Other Research/Product Teams, and Curriculum Development
- Funding:
  - ~$300K/yr
- Focus:
  - Impact of instability on employment and workplace innovation in the aerospace industry
  - Social capital and institutional infrastructure
- Methods:
  - National random sample survey (194 facilities)
  - Individual surveys (400+ surveys)
  - Case studies (6)
  - Collective bargaining contract analysis
  - Archival data analysis
LARA: Phases I and II

Phase I

- Instability and employment
  - National Random Survey (194 facilities)
  - Individual Surveys (400+)
  - Case Studies (6)
  - Collective Bargaining Analysis
  - Activity Based Costing Analysis
  - Global Supply Chain/Strategic Alliance Exploration
  - Conference Presentations and Briefings

Phase II

- Instability and employment
- Intellectual Capital & Institutional Infrastructure
  - Panel Study Follow-up on National Survey
  - Policy Recommendations
  - Case Studies (1-2)
  - Collective Bargaining Guide
  - Global Supply Chain/Strategic Alliance Chart
  - Conference Presentations, Briefings, Articles, Website and other Knowledge Deployment

June 2000 LAI Executive; March 2000 LAI Plenary; January 2000 “Enhancing the Effectiveness of the National Workforce”

May 2000 LAI Executive; April LAI Plenary
Why Worry About Instability?

Total U.S. Aerospace Employment

Year

1985 1987 1989 1991 1993 1995 1997 1999

(In Thousands)

0 100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400

Source: AIA
Prepared by: IAM Strategic Resources Department

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Why Worry About Instability?

SOURCE: Credit Suisse First Bank

"the money spent on canceled programs in recent years could have bought:

- 1,000 Abrams tanks,
- 100 F-16 Fighters
- 1,000 AMRAAM missiles
- 10 Titan Launch Vehicles
- 20 Joint STARS Aircraft
- 10,000 Javelin missiles
- 70,000 MLRS Rockets, and
- one nuclear attack submarine."

U.S. Engines and Parts Imports as a Share of Total Aircraft Sales, 1981-2000
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**Business & Labor Mitigation Strategies**
- Training Initiatives
- Product diversification
- Worker Flexibility

**Contextual Factors**
- Labor Markets
- Product Markets/Industry Segment
- Product Mix
- Public Policy
- Location, Size, Union Status, and Demographics

**Program Instability**
- Funding
- Technology
- Organizational Change

**Work Practice Adoption & Diffusion**
- Tangible and Intangible
- Manufacturing and Engineering
- Lean and other Workplace Innovations

**Outcomes**
- Employment
- Economic Performance
- Organizational Learning
Types of instability:

- Funding/orders
  - Shift from R&D to production funds
  - Fluctuations in demand for primary product in facility

- Technology
  - Changes in customer requirements
  - Shifts in materials
  - Rapid pace of change in computer capabilities
  - Environmental constraints

Organizational

- Acquisition/layoffs
- Mergers/restructuring
- Relocation of products among facilities
- Two-tier relationship between sister facilities

- Demographics -- retirements/gaps in past hiring, skill shortages
- Turnover -- management, engineering, and hourly
Observed mitigation strategies:

**Business Strategy**
- Increase proportion of commercial business sought
- Shift in product mix to increase focus on space

**Human Resource Management/Industrial Relations**
- Cross-training/flexible utilization/teams
- Informal no-layoff practice
- Labor-management partnership
- Employee involvement
- Intensified training of hourly and salaried employees
- Co-location of engineers, teams
- Two-tier wage system
- Multi-facility transfer agreements
Population and Sample

- Estimated Population: approx. 5,000
- Sample Size: two mailings to 2,123, with 2 follow-up card mailings and over 900 follow-up calls – many bad addresses, many no longer in industry
- Valid Responses: 198

Facility Profile

- Airframes and Mechanical Systems (n=54) 27.4% 1,051 1971
- Engines and Propulsion (n=19) 9.6% 880 1969
- Space and Missiles (n=8)* 4% 1,738 1971
- Avionics and Electronic Systems (n=40) 30.3% 318 1977
- Second/Third Tier Suppliers and Others (n=76) 38.6% 262 1976

Respondent experience in Aerospace 20.5 years

* Note that 33 facilities listed space or missiles as a secondary sector, but not as primary sector
Facility Survey: Sources of Instability

Focus on Four Categories of Instability

Budget and Market Instability
Changes in Product Demand, Changes in Government Budgets, Changes in Company Budgets, Changes in Government Acquisition

Technology Instability
Changes in Customer Requirements/Technical Design, Changes in Equipment/Technology, Problems from Technical Challenges,

Organizational Instability
Mergers/Acquisitions, Changes in Leadership Vision, Re-Engineering/Re-Structuring, Voluntary Staff Turnover

Supply-Chain Instability
Changes in Supplier Performance, Problems of Cooperation with Customers/Partners/Suppliers, Subcontracting of Work, Reducing the Number of Suppliers

% of Facilities Selecting Item as Most Significant

- Changes in product demand
- Changes in customer requirements
- Changes in government budgets
- Mergers/acquisitions
- Changes in leadership vision
High Levels of Instability and Facility Size

Remedies to Instability Have to Be Sensitive to Facility Size
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Impact of Instability on Retention of Critical Skills

- Funding & Market Instability
- Less Technology Instability
- Less Organizational Instability
- Less Supply Chain Instability
- More Technology Instability
- More Organizational Instability
- More Supply Chain Instability

% Reporting increased loss of people with critical skills
Facility Survey: Reported Use of Mitigation Practices – Five Most Extensively Used Practices (past 3 yrs)
Facility Survey: Reported Use of Mitigation Practices – Five Least Extensively Used Practices (past 3 yrs)

- Formal employment security
- Early retirement
- Work in from other facilities
- Sending people to other facilities
- Work sharing

Legend:
- Red: Never
- Yellow: Limited
- Blue: Extensive
Facility Survey: Selected Innovations and Employment Change

- With Lean Production (n=78)
- Without Lean Production
- With HPWO (n=25)
- Without HPWO
- With Kaizen Process (n=58)
- Without Kaizen Process

Legend:
- Employment Decrease
- No Change in Employment
- Employment Increase

19 -- Labor Aerospace Research Agenda © 2001 Massachusetts Institute of Technology
“I would highly recommend that my children work in this industry” (Agree or Strongly Agree, n=482)
Workshop held January 2000

- Approximately 65 participants – industry, labor, government, university
- Featured presentations on instability, HPWO and other innovations, policy dialogue

Workshop Recommendations covering:

- Fostering partnership with the workforce
- Identifying/addressing sources of instability that impact the workforce & innovation
- Supporting a broad definition of “lean” aimed at industry revitalization
- Briefing for LAI executives
- Briefing for DoD, Congressional officials and others
- Exploring industry-level and other initiatives

“One key principle and message I’m taking away from this session is that we can’t implement lean principles without partnership with the workforce. We should have been highlighting this 4 years ago so there is a sense of urgency here about this.”

Sheila Widnall, MIT, at “Enhancing the Effectiveness of Our National Workforce” (January 2000)
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A Call to Action:
LAI Executive Board

- Dimensions of an employment crisis in Aerospace:
  - Increasing skill shortages
    - Changing skill mix in a post-cold war era
    - Reduced investment in training and development
  - Divisive and immobilizing concerns over job security
    - Industry has lost over 500,000 jobs since 1990
  - Demographic “cliff”
    - Average age of IAM members is 44 in the Commercial Sector and 53 in Defense – with over 20% eligible to retire in next 3 years
  - Global competitive dynamics
    - Projected loss of jobs and revenue due to increased global competition
    - Projected increase in foreign content – with complex implications
    - Projected job growth in European Aerospace Industry
  - Inability to attract and retain a 21st Century workforce
“We believe that a declining experience level has been a contributing factor to the problems we observe in many recent aircraft programs.”

RAND
Executive Summary
Forward by Sheila Widnall
Preface on LARA and LAI

1.0 Statement of the Problem

- 1.1 Challenges in Attracting and Retaining a 21st Century Workforce
- 1.2 Inadequate Infrastructure for Enabling Wise Investment in Human Capital
- 1.3 Limited Mechanisms for Diffusing Best Practices Across the Aerospace Enterprise

2.0 Root causes and Research Findings

- 2.1 The end of the Cold War and the rise of global competition
- 2.2 Industry “maturity” with reduced opportunities for innovation
- 2.3 Instability in funding, technology, and organizations
- 2.4 Disincentives to train and invest in human capital – market failure
- 2.5 Slow rate of diffusion of workplace innovation (linking social and technical dimensions)
- 2.6 Gaps in training and development infrastructure
- 2.7 Gaps in workforce skill mix, curricula requirements, and educational completion
- 2.8 Imports, offsets and other global dynamics
- 2.9 Underlying assumption that responsibility lies at the level of the individual firm/facility
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Draft Overview of the White Paper (cont.)

3.0 Selected Innovative Models and Linkages

- 3.1 School-to-work transition programs in selected communities
- 3.2 Lean/high performance workplace transformation initiatives in selected locations
- 3.3 Joint training partnerships among major employers and unions
- 3.4 Industry-level forecasting and training in Canada
- 3.5 Linking R&D funding to workforce attraction and intellectual capital development
- 3.6 Core challenge: Moving beyond “islands of success”
  
  Note: There are additional topics and examples that will be added to this section

4.0 Conclusions and Recommendations

- 4.1 Public Policy Priority Protecting Investment in Intellectual Capital
- 4.2 Aerospace Capability Network
- 4.3 National Training and Development Partnership
- 4.4 Regional and Local Workforce Initiatives
- 4.5 Innovation by Government as an Employer
- 4.6 R&D Investment Driving Demand for the 21st Century Workforce