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Inventory Management for Air Force Advanced Academic Degree Officers

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Inventory Management for Air Force
Advanced Academic Degree Officers

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23 June 2005
Overview

• Introduction
  • GEMS/AADS Background
  • Inventory Modeling Approach

• AADIM-E
  • Education Profiles
  • Quota Recommendations
  • AADIM-E Insights

• AADIM-U
  • Assignment Problem
  • Qualification Matrix
  • AADIM-U Insights

• Conclusions and Future Directions
• Graduate Education Management System (GEMS)
  • Guidance
    • DODD 1322.10, 26 Aug 04
      – Allows each service to manage their own graduate education programs
    • AFI 36-2302, 11 Jul 01
      – Source document for GEMS
  • Specific unit positions are coded and revalidated at least biannually
    • “Bottom up
  • Projected vacancies are basis for graduate education quotas
System is well designed to justify education requirements
- “One billet, one body”
- Incumbency rates are measurable
- Service Commitment fulfillment rates are measurable

System is poorly designed to develop officers
- Officers move from AAD billet
  - Professional Development
  - Dynamic unit environment
- AAD billets are not backfilled and commanders will delete AAD coded billets
• “Bottom-Up” approach is problematic
  • Specific billets are coded when actual requirement is for a level of expertise within a unit
  • Not consistent across units, wings, MAJCOMS
  • No grand strategy exists
• Despite design for accountability, GEMS/AADS does not adequately achieve or monitor goals
  • Historical billet incumbency rate: 50-60%
    • Tracking problems, e.g., no credit given for serving in related specialty billets
  • AAD officer payback—most don’t complete the 36-month requirement
Inventory Management

• Development Teams provide an opportunity to develop a grand strategy
  • “Health” of each career field
  • Centralized guidance from Career Field Managers (CFM)
    • Primary advocate for career field specific and officer development
  • Career field representatives from cross-section of the AF
  • Long-term planning approach
• Developmental Education Initiatives
  • Paradigm Change: Officers are educated to enhance overall development, not just to qualify for the next job
  • IDE: no billet system for assigning these AFIT graduates
Modeling Overview

- Model is partitioned into two sub-models
  - AADIM Entry (AADIM-E)
    - Requirements Definition (aggregate educational profiles)
    - Quota generation for new AAD inventory entries
  - AADIM Utilization (AADIM-U)
    - Assign AAD officers to maintain optimal unit profiles
AADIM-E: “Ideal” Educational Profiles

- Baseline for examination of the current and forecasted AAD inventories

- Two types of educational profiles
  - Career-field critical education
    - Officers obtaining these AADs are inventoried
  - Career-field enhancement education
    - Officers obtaining these AADs are not inventoried
AADIM-E: “Ideal” Educational Profiles

- Two Approaches
  - Senior Rater: “At least x% of my 13S officers should have an advanced degree in a discipline that satisfies an appropriate subset of educational competencies.”
  - CFM: “An educationally healthy 13S career field should have y% of its officers with an advanced degree that satisfies an appropriate subset of educational competencies.”

- Complimentary approaches yield aggregate profile for each career field
  - Former approach reflects unit requirements, e.g., an ops wing has different needs than a MAJCOM staff
  - Latter approach reflects aggregate time-phased (by CYOS) career field needs
AADIM-E: “Ideal” Educational Profiles

- Example “Idealized Career Field Profile”
  - Each career field is unique, but will have similar functional form

![Graph showing AFSC-Related AADs over years of service with ideal percentage of force with AAD.](image-url)
AADIM-E: “Ideal” Educational Profiles

• Assignment sequence of ops/staff tours through CGO years
  • Each time officers are available for assignment a fixed percentage is sent to graduate school
  • Preliminary model assumes a constant “selection rule”
  • Different rules can be utilized for each assignment timing
• Two-directional model
  • “Assignment Rule” yields Notional Profile
  • Desired Notional Profile yields “Assignment Rule”
• Inventory Factor (IF): Percentage of officers holding a career field related AAD for a given CYOS
• Aggregate Idealized Educational Profile ($\bar{IF}$)
  \[
  \bar{IF} = \frac{\sum_{i=1}^{n} IF (CYOS = i)}{n}
  \]
$$\text{CYOS} = 0 \quad \text{CYOS} = 3 \quad y(1-x)^2$$

$$x = 12\%$$

$$y(1-x) \quad x y(1-x)$$

$$y = 50\%$$

**Initial Tour Length:**

\[ y = 3 \text{ yrs, } (1-y) = 4 \text{ yrs } \]

\[ y = 50\% \]
AADIM-E: “Ideal” Educational Profiles

Notional AAD Profiles

Selection Rule
- 4%
- 6%
- 8%
- 10%
- 12%

CYOS

IF

AYR FORCE INSTITUTE OF TECHNOLOGY
Graduate School of Engineering and Management
AADIM-E: Quota Recommendation

- Compare “Ideal” with actual MilPDS data
  - Delta between ideal and current profiles indicates educational needs
  - Provides the basis for a quota recommendation

![Graph showing % of Officer w/Related MS over Total Active Duty Year](image-url)
AADIM-E: Quota Recommendation

- Educational assignment alternatives for Inventory Entry
  - Career Field specific needs
  - Officer career timing for entry to AAD inventory
  - Officer preferences (T-OPD)

- Multiple year output—current FY plus projected
  - Requirements visibility facilitates long-term DT, AFPC and AFIT planning, as well as “advertising” to interested officers
Idealized Educational Profile and Actual AAD Inventory for 61S Career Field

- Percentage selected to attend graduate education each cycle = 20%
- Percentage with initial 3 year assignment = 50%
- IF = 30%
- Actual Aggregate AAD Inventory Percentage for FY02 = 10.6%
Idealized Educational Profile and Actual AAD Inventory for 13S Career Field

- Percentage selected to attend graduate education each cycle = 6%
- Percentage with initial 3 year assignment = 67%
- IF = 10%
- Actual Aggregate AAD Inventory Percentage for FY02 = 1.7%

FY2002 AAD Inventory Levels for 13S Career Field

- Surpluses
- Shortages
- Actuals
- Idealized Profile

CYOS

AAD Manning Percentage
• Graphical Analysis of Alternatives

![Graph showing education alternatives over fiscal years 2005 to 2014. The graph illustrates the aggregate percentage of career field with AAD for each alternative. Alternative #1 consistently remains at around 70%, Alternative #2 shows a slight increase from 70% to 80% over the fiscal years, Alternative #3 starts at 70% and increases to 85% by 2014, and Alternative #4 begins at 70% and steadily increases to 95% by 2014.](image-url)
Forecasted Educational Requirements: 61S

Total Yearly Educational Requirements for 61S Career Field

Aggregate AAD Inventory Percentages for 61S Career Field
Forecasted Educational Requirements: 13S

Total Yearly Educational Requirements for 13S Career Field

Aggregate AAD Inventory Percentage for 13S Career Field
Forecasted Educational Requirements: 13S

Total Yearly Graduate Education Requirements for 13S Career Field

Aggregate AAD Inventory Percentage for 13S Career Field
• Data Collection
  • Generate report with current profile status
  • Identify assignment availability of AAD inventory officers
  • Officers identify assignment preferences

• AAD Inventory Management
  • Match AAD officers to potential assignments
    • AAD-Only Assignments: e.g. AFIT Faculty
    • AAD-Profile Assignments: Satisfy unit profile requirements
• Model should include Measures of Merit to indicate current health of AADIM process
  • % Weighted Average Incumbency of AAD-only assignments
  • % Weighted Average Incumbency of AAD-profile assignments
  • Overall measures and sub-measures by aggregation level and career field

• Model output: “Optimal” assignment recommendations
  • Sensitivity Analysis to show robustness of decision
  • Available “what if” analysis of assignment swaps
AADIM-U Model Development

- Partition assignment characteristics into two categories
  - Required
    - Absolute must-haves
    - Prescreening
      - Grade
      - Security Clearance
  - Desired
    - “Goodness of fit” between an officer and an assignment
    - Desirable Attributes
      - Grade
      - Academic Specialty Code (ASC)
      - Security Clearance
      - Experience Level
      - Training Level
      - DT Vector
      - Officer Preferences
Modified Assignment problem

maximize $\sum_{i=1}^{m} \sum_{j=1}^{n} p_j a_{ij} x_{ij}$

subject to $\sum_{j=1}^{n} x_{ij} \leq 1 \ \forall \ i$

$\sum_{i=1}^{m} x_{ij} \leq 1 \ \forall \ j$

$x_{ij} = \begin{cases} 
1 & \text{if officer } i \text{ is assigned to assignment } j \\
0 & \text{otherwise} 
\end{cases}$

$p_j = \text{relative assignment priority for assignment } j$

$a_{ij} = \text{qualification score for officer } i \text{ with respect to assignment } j$
Qualification Matrix, $A$

• Multi-attribute Additive Value Function

$$a_{ij} = V \left\{ x_{ij}^1, x_{ij}^2, \ldots, x_{ij}^7 \right\} = \sum_{a=1}^{7} k^a v^a (x_{ij}^a), \quad \forall (i, j)$$

- $a_{i,j}$ = qualification score for officer $i$ with respect to assignment $j$
- $k^a$ = relative weighting constant for attribute $a$

• Modeling Assumptions
  - Preferential independence between attributes holds
  - Each attribute has two levels
    - Meet the qualification, $v^a(x^a) = 1$
    - Does not meet the qualification, $v^a(x^a) = 0$
  - The weighting constants sum to 1 (Additive Independence)
**AADIM-U : Weighting Constants**

- Conducted interviews with 61 DT members to examine two sets of weighting constants for the four attribute case
- Performed notional assignment matching experiments

### Decision Maker 1

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### Decision Maker 2

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<tr>
<td>Officer Preferences</td>
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</table>
AADIM-U Sensitivity Analysis

**Average Percentage of Identical Assignments for DM 1**

**Average Percentage of Identical Assignments for DM 2**
• AADIM-E
  • Capable of predicting long term education requirements
  • Useful to investigate different educational policies
  • Increasing the AAD inventory is a long term initiative

• AADIM-U
  • Provides a tool that matches AAD officers in AAD positions given a qualification score
  • The assignment matching is highly sensitive to the weighting constants
  • Flexible
Further Research

- Manpower forecasting that does not rely on past policies
- More dynamic options for specifying graduate education policies
- Refinement of Job Qualification scoring tool
- Refinement of Multi-Attribute Value Function Weighting Constants
- Validation using data from actual assignment cycle
AADIM Model Summary

• Aggregation level for educational profiles--recommend Senior Rater ID
  • Senior Rater span of control is similar across AF

• Eliminates management of individual AAD billets
  • Key shortfall of current system
  • Compliance Issues with DODD 1322.10 and AFI36-2302

• Flexibility to assign new AAD inventory officers
AADIM Model Summary

• Flexibility for internal reassignments
  • Adaptability to rapidly changing unit requirements and missions
  • Supports officer development (e.g., progression from entry-level to supervisory positions)
Where To Next?

• Conceptual Approval
• Data Requirements
  • Preliminary 13S educational profiles
    • Current 13S-related AAD billets
    • 13S CFM & Development Team inputs
  • Current 13S AAD personnel assignments
    • By grade, YOS, and time-on-station (TOS)
• Model Development
  • AADIM-E
  • AADIM-M
Where To Next?

• Comparison with 15W (Weather) Career Field
  • Education Goals are satisfied using current GEMS
• Career Field Guides
  • Add “technical & educational competencies”
  • Set expectation for officers to pursue advanced education
Questions?