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Aerospace Industry Sector & the University of Manitoba

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Faculty of Engineering



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Faculty of Engineering - Programs

- Biosystems Engineering
 - Civil Engineering
 - Electrical Engineering
 - Computer Engineering
 - Mechanical Engineering
 - Biomedical Engineering → Master's & Ph.D. introduced 2012
- Bachelor, Master & Ph.D.
- Internationally Educated Engineers Qualification
 - New Canadians with foreign credentials
 - Engineering Access Program
 - Aboriginal Canadians
 - Cooperative Education & Industrial Internship Program
 - WISE/Kid-Netic – reaches >30,000 Manitoba youth each year

Recommendations 15 outreach

PS 6



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Faculty of Engineering - Students

- ≈ 1900 students
- Undergraduates ≈ 1500
- Masters 235
- Ph.D. 190 } 22% graduate students
- $\approx 13\%$ of Undergraduates are International Students
- $\approx 40\%$ of Graduate Students are International
- 17.5% of undergraduates students are female
- 20% of graduate students are female



Faculty of Engineering - Research

- 85 Academic Staff - 60 Support Staff
- >\$9 million in external research support
- >10% of faculty hold externally funded Research Chairs
- 3 externally funded Research Chairs in development
- NSERC Chairs supported by industry or industrial sectors
 - *Heavy Ground Vehicles and Transportation Equipment*
Structural Health Monitoring & Dynamics
Dr. Christine Wu – supported by -Motor Coach Industries Int'l Inc.
 - *Power Systems Simulation*
Dr. Ani Gole – supported by
 - Manitoba Hydro
 - Manitoba HVDC Research Center
 - RTDS Technologies
 - Teshmont Consultants
 - Electranix Corporation
 - TransGrid Solutions Inc.



Aerospace Sector ↔ University of Manitoba

- University of Manitoba R&D focussed on industrial objectives
- Faculty of Engineering
 - Many industry directed R&D collaborations
 - Considerable existing Aerospace R&D and training
 - Aero sector Engineers-in-Residence – supported by consortia
- Mandate of Faculty of Engineering
 - Provide engineers with skills that Manitoba industry requires
 - Work with industry to ensure most appropriate training
 - Work with industry to ensure relevant University based R&D
- We want to work with you to help you grow your businesses in Manitoba



Aerospace Engineering Option

- Major option within Mechanical Engineering program
- Aerospace option developed in collaboration with MAA and industry
 - Nearly 450 students in Mechanical Engineering
 - Aerospace option is popular
- A few relevant current courses:
 - MECH 3170 Project Management
 - MECH 3420 Vibrations & Acoustics
 - MECH 3430 Measurements & Controls
 - MECH 4182 Aerospace Structures: Analysis and Design
 - MECH 4192 Aerospace Materials and Manufacturing Processes
 - MECH 4200 Gas Turbine Propulsion Systems
 - MECH 4452 Aircraft Performance, Dynamics and Design
 - MECH 4550 Noise Control
 - MECH 4322 Applied Instrumentation
- Possible course topics:
 - Airworthiness & certification
 - Sensor Design & Integration
 - Dynamics/Vibrations/Balancing of Rotating Machinery



Aerospace Engineering Option

Engineers-in-Residence

- Teaches at least one course of particular interest to industrial sector
- Solicits / supervises capstone design courses of interest to industrial sector
- Liaises with industrial sector to ensure that they are maximizing training / research opportunities with University
- Ensures that students are aware of careers in the industrial sector
- Coordinates industrial events on campus
- The EiR is the *agent* for an industry sector in the Faculty!

Recommendations PS 1, 2 human capital, workforce management
TDDC 4 develop skilled workforce
16 upskilling



Aerospace Engineering Option *Engineers-in-Residence*

Two Aerospace Engineers-in-Residence

- Aerospace EiR:
 - Ed Hohenberg, P.Eng.
 - SAE team projects
- Aero-Engine Test EiR:
 - Kathryn Atamanchuk, P.Eng.
 - Applied Instrumentation & Project Management Courses
 - Projects associated with gas turbine testing/instrumentation/certification
- Result → Aero Sector viewed very favourably as employment destination by students
→ Good preparation of BSc students for aero sector jobs



Aerospace Research

- Aerospace Materials
 - Intelligent Processing of Polymer Composites: (Jayaraman)
 - Evaluation of Autoclave Processing
 - Low Cost Tool Design & Manufacturing
 - E-Beam Processing
 - Long-Term Durability of Composites
 - High Temperature Engine Alloys: (Ojo, Beddoes)
 - Superalloy Processing-Microstructure-Property Relationship
 - Forming and Joining of Superalloys
 - Thermo-mechanical Processing of Metallic Materials
 - Titanium aluminides for hot section applications
 - Damage Tolerance / Fracture: (Bassim, Beddoes)
 - Stress corrosion – damage tolerance high strength Al alloys
 - High strain rate / impact behaviour
 - Crack propagation / arrest



Aerospace Research

- Aerospace Structures
 - Impact Tolerance of Aerospace Structures: (Telichev, Bassim)
 - High strain rate behaviour
 - Analysis of impact: damage and failure
 - Low velocity impact – handling / tool damage
 - High velocity impact – orbital debris impact
- Biofuels
 - Combustion: (Birouk)
 - Liquid fuel breakup & droplet formation
 - Droplet Vapourization & Combustion
 - Flame Speed & Stability
 - Production: (Levin)
 - Production via Direct Cellulose Fermentation
 - Lipid Based Fuels



Aerospace Research

- Manufacturing
 - Integrated Manufacturing: (Balakrishnan)
 - Modeling & computerized control: intelligent fixtures for machining & assembly
 - Optimal & near optimal scheduling algorithms for computer controlled machine cells
 - Virtual Manufacturing: (Peng)
 - Computer-aided Product Development
 - Reverse Engineering
 - Simulation Modelling & Applications
 - Fluid Power & Robotics: (Sepehri)
 - fault diagnosis and fault tolerant controls.
 - control of actuation
- Antennas/Communications
 - Miniaturization of antennas: (Shafai)
 - laminated conductive materials
 - virtual antennas



Aerospace Sector ↔ University of Manitoba Opportunities

1. Coop/Internship Students
 - 4 to 16 month terms, starting January, May or September
 - Ideal opportunity to ‘test drive’ potential long term employees
2. IDEAS Final Year Capstone Projects
 - 3 to 5 final year students work on project defined by industry partner
 - direct involvement & participation in project
 - Opportunity to solve minor technical issues
 - Ideal opportunity to ‘test drive’ potential long term employees
3. Expand *Engineers-in-Residence*
 - Focus on specific requirements of Manitoba Aerospace sector
 - Composites technology
 - Airworthiness & Certification



Aerospace Sector ↔ University of Manitoba Opportunities

4. R&D Collaborations

- a. NSERC Engage – started in 2009-10 – 31 so far in Engineering
 - \$25k for 6 month project – no requirement for industry cash
 - rapid decision on funding proposals
 - industry owns arising IP
 - excellent/low risk short term solution to technical & development objectives
- b. NSERC Collaborative Research & Development grants
 - industry cash contributions matched by NSERC 100%
 - industry in-kind contributions matched 50%
 - typically 2-3 year project
 - opportunity to engage graduate students at University or industry facility
 - develop solutions to development objectives & cultivate future employees
- c. Mitacs Accelerate
 - graduate students apply knowledge to industry related research challenges
 - 50% of internship on-site with industrial partner – scalable 4 month internship
 - scalable 4 month internship - \$7,500 per 4 mth from industry
 - matched by Mitacs
 - 28 so far in Engineering



Aerospace Sector ⇔ University of Manitoba Opportunities

5. R&D Consortia

- a. CRAIQ/University of Manitoba-Manitoba industry/ Quebec University-industry
 - leverage expertise from other universities & industry partners
 - strategic development of business/technical opportunities
 - development of National/Manitoba aerospace technical objectives

Recommendation 5 Canada wide collaboration

- b. University of Manitoba – Red River College – industry – NRC – NSERC
 - complimentary NSERC Industrial Research Chairs
 - Red River College
 - University of Manitoba
 - focus on training & R&D of critical industrial importance
 - framework to support major joint facility – NRC-Red River-University of Manitoba
 - comprehensive training of current/ future employees from technicians to PhD's
 - opportunity to address major technical & training challenge

Recommendations PS 9 regional centres of excellence

TDDC 3 create research & innovation consortium

3 large scale technology demonstration



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INNOVATOR CHALLENGER REBEL VISIONARY
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