Memorandum M-283

OPLEIDING TOT VLIEGTUIGBOUWKUNDIG
INGENIEUR AAN DE
UNIVERSITEIT VAN KANSAS

Enige vergelijkingen met
de Delftse opleiding

Aantekeningen van een voordracht door
prof.dr.ir. J. Roskam van het Department
of Aerospace Engineering,
The University of Kansas U.S.A.

gehouden te Delft op 4 mei 1977

Delft - Nederland
juni 1977
INHOUD

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Hoofdstuk 1

AE ENGINEERING PROGRAMS OVERVIEW

HIGH SCHOOL DIPLOMA
STATE OF KANSAS

K.U. SCHOOL OF ENGINEERING

B.S.A.E.

\[ \frac{2}{3} \text{ to industry} \]
\[ \text{govm't or military} \]

M.S.A.E. \quad 1-1\frac{1}{2} \text{ yrs}

M.E. \quad 1\frac{1}{2}-2 \text{ yrs}

Ph.D. \quad 1-3 \text{ yrs}

D.E. \quad 1-2 \text{ yrs}
Table I  Minimum Requirements for the B.S.
Degree in Aerospace Engineering

a) Aerospace Engineering Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>121</td>
<td>Aerospace Design Drafting</td>
<td>2</td>
</tr>
<tr>
<td>245</td>
<td>Introduction to Aerospace Engineering</td>
<td>3</td>
</tr>
<tr>
<td>290, 291</td>
<td>Aerospace Colloquium</td>
<td>0</td>
</tr>
<tr>
<td>507</td>
<td>Aerospace Structures I</td>
<td>3</td>
</tr>
<tr>
<td>508</td>
<td>Aerospace Structures II</td>
<td>3</td>
</tr>
<tr>
<td>510</td>
<td>Aerospace Materials &amp; Processes</td>
<td>3</td>
</tr>
<tr>
<td>521</td>
<td>Aerospace Systems Design I (Aircraft Design)</td>
<td>4</td>
</tr>
<tr>
<td>522</td>
<td>Aerospace Systems Design II (Advanced Aircraft Design)</td>
<td>4</td>
</tr>
<tr>
<td>430</td>
<td>Aerospace Instrumentation Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>440</td>
<td>Aircraft Aerodynamics</td>
<td>5</td>
</tr>
<tr>
<td>545</td>
<td>Advanced Aerodynamics I</td>
<td>5</td>
</tr>
<tr>
<td>550</td>
<td>Dynamics of Flight I (Stability and Control)</td>
<td>3</td>
</tr>
<tr>
<td>551</td>
<td>Dynamics of Flight II (Stability and Control)</td>
<td>2</td>
</tr>
<tr>
<td>571</td>
<td>Propulsion Systems (prop Systems)</td>
<td>6</td>
</tr>
<tr>
<td>572</td>
<td>Jet/Fan Systems</td>
<td>1 1/2</td>
</tr>
<tr>
<td>690</td>
<td>Aerospace Seminar</td>
<td>1</td>
</tr>
<tr>
<td>691</td>
<td>Aerospace Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

\[
\text{Total: 46 credits}
\]

b) Engineering Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 108</td>
<td>Engineering Drawing</td>
<td>3</td>
</tr>
<tr>
<td>CPE 184 or CS 200</td>
<td>Introduction to Computers</td>
<td>2</td>
</tr>
<tr>
<td>ME 212</td>
<td>Basic Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>NE 296</td>
<td>Science of Materials</td>
<td>3</td>
</tr>
<tr>
<td>CE 301</td>
<td>Statics and Dynamics</td>
<td>5</td>
</tr>
<tr>
<td>CE 310</td>
<td>Strength of Materials</td>
<td>5</td>
</tr>
<tr>
<td>EE 311 or EE 319</td>
<td>Basic Circuits</td>
<td>3</td>
</tr>
</tbody>
</table>

\[
\text{Total: 24 credits}
\]

c) Science Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem 144</td>
<td>College Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>Phys 211</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>Phys 212</td>
<td>General Physics II</td>
<td>4</td>
</tr>
</tbody>
</table>

\[
\text{Total: 13 credits}
\]

d) Mathematics Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 121</td>
<td>Calculus and Analytic Geometry I</td>
<td>5</td>
</tr>
<tr>
<td>Math 122</td>
<td>Calculus and Analytic Geometry II</td>
<td>5</td>
</tr>
<tr>
<td>A) Math 123</td>
<td>Linear Algebra &amp; Multivariable Calculus</td>
<td>5</td>
</tr>
<tr>
<td>B) Math 250 &amp; ME 250</td>
<td>Math. of Engineering Systems</td>
<td>2 1/2</td>
</tr>
<tr>
<td>A) Math 320 or Elem. Differential Equations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>B) Math 124</td>
<td>Multivariable Calculus</td>
<td>3</td>
</tr>
</tbody>
</table>

\[
\text{Total: 18 credits}
\]
e) Other Required and Elective Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Communication</td>
<td>6</td>
</tr>
<tr>
<td>Humanities and Social Science Electives</td>
<td>17*</td>
</tr>
<tr>
<td>Technical Electives</td>
<td>10</td>
</tr>
<tr>
<td><strong>TOTAL SEMESTER HOURS</strong></td>
<td><strong>134</strong></td>
</tr>
</tbody>
</table>

* Must include a 4 hr. course in Economics (Econometrics)

1 semester = 15 weeks lectures
Table II  Preferred Sequence in the Aerospace Curriculum

<table>
<thead>
<tr>
<th>Fall Semesters</th>
<th>Freshman</th>
<th>Spring Semesters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 121</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>Engl 101</td>
<td>Composition &amp; Lit. I</td>
<td>3</td>
</tr>
<tr>
<td>Chem 144</td>
<td>College Chem I</td>
<td>5</td>
</tr>
<tr>
<td>AE 290</td>
<td>Aero Colloq.</td>
<td>0+</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 250 &amp; ME 250 Engr. Systems</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>Math 123 Linear Algebra &amp; Multi Calculus</td>
<td>5</td>
</tr>
<tr>
<td>Phsx 212</td>
<td>General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>CE 301</td>
<td>Statics and Dynamics</td>
<td>5</td>
</tr>
<tr>
<td>AE 121</td>
<td>Aero Design Drafting</td>
<td>2</td>
</tr>
<tr>
<td>AE 290</td>
<td>Aero Colloq.</td>
<td>0+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Junior</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 319 Basic Circuits</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>EE 311 Circuits &amp; Elect.I</td>
<td>3</td>
</tr>
<tr>
<td>AE 545</td>
<td>Adv. Aerodynamics I</td>
<td>5</td>
</tr>
<tr>
<td>ME 296</td>
<td>Sci. of Materials</td>
<td>3</td>
</tr>
<tr>
<td>AE 507</td>
<td>Aero Structures I</td>
<td>3</td>
</tr>
<tr>
<td>AE 550</td>
<td>Dynamics of Flight I</td>
<td>3</td>
</tr>
<tr>
<td>AE 290</td>
<td>Aero Colloq.</td>
<td>0+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Senior</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 690</td>
<td>Aero Seminar</td>
<td>1+</td>
</tr>
<tr>
<td>AE 521</td>
<td>Aero Systems Design I</td>
<td>4</td>
</tr>
<tr>
<td>Engl. 336</td>
<td>Tech. Writing</td>
<td>3</td>
</tr>
<tr>
<td>AE 290</td>
<td>Aero Colloq.</td>
<td>0+</td>
</tr>
<tr>
<td>AE 572</td>
<td>Aero Propulsion II</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>6</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electives</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Humanities &amp; Social Sci.</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>TOTAL HOURS</td>
<td>134</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

Note 1: ROTC Substitution: 5 hours of ROTC course work may be substituted for 5 hours of technical electives, provided the ROTC program is completed by the student.

Note 2: The curriculum is arranged to avoid conflicts with prerequisites. Deviation from this curriculum is possible. However, the student should consult his advisor about possible conflicts with prerequisites.

Note 3: The 17 hours of HSS work must include a 4 hour course in Economics. For rules of selecting HSS courses, see page 6.0 of departmental handbook.

Note 4: The AE courses, except AE 690 and AE 691 are offered only in the semesters indicated above.

Note 5: Aero Seminar is 1 speech/semester/student.
At B.S. level

134 - 23 = 111 hrs are

COMPULSORY!

\[ \begin{align*}
23 & \rightarrow 13 \\
10 & \rightarrow 13 \\
& \quad \text{HSS by choice} \\
& \quad \text{Technical by choice}
\end{align*} \]

H.S.S. = Humanities Social Sciences
Hour & load interpretation

All hours → semester hour

Example of one semester:

Fall Aug. 15 – Dec. 15
excluding vacations 15 weeks

1 hr → 1 hr per week
for 15 weeks

Student load in fact:

1 hr → 4 actual hours*

so, a 16 hr semester means
~ 4 x 16 = 64 hours of work.

* Homework, study, quiz-preparation.
## Hours Reqd. Comparison

<table>
<thead>
<tr>
<th></th>
<th>Delft</th>
<th>K.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year</td>
<td>35.5</td>
<td>34</td>
</tr>
<tr>
<td>Second year</td>
<td>29.5</td>
<td>34</td>
</tr>
<tr>
<td>Third year</td>
<td>19.9</td>
<td>33</td>
</tr>
<tr>
<td>Fourth year AVE</td>
<td>24.4</td>
<td>33</td>
</tr>
<tr>
<td>TOTAL</td>
<td>109.3*</td>
<td>134*</td>
</tr>
</tbody>
</table>

Subtract from K.U. 13 hrs H.S.S. (not Econ.) 6 hrs English

\[134 - 19 = 115\]

Add to Delft ~ 6.9 hrs for 103 afternoons of reqd. instr. (3rd yr.)

<table>
<thead>
<tr>
<th></th>
<th>Comparable totals</th>
<th>116.2</th>
<th>115</th>
</tr>
</thead>
</table>

Fifth yr. + Delft no hrs reqd.
K.U. + M.S. or M.E. see

* K.U. student work a lot harder!
### Semester hourly 4-years comparison

<table>
<thead>
<tr>
<th>Course</th>
<th>Delft</th>
<th>K.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics, Geom.</td>
<td>x 13/15</td>
<td></td>
</tr>
<tr>
<td>Computer Sc. + Appl.</td>
<td>25 (21.6)</td>
<td>23</td>
</tr>
<tr>
<td>Chemistry, Physics,</td>
<td>4 (3.5)</td>
<td>16</td>
</tr>
<tr>
<td>Electricity, El. Circ.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid Mechanics, Aero-Dynamics</td>
<td>13 (11.3)</td>
<td>10</td>
</tr>
<tr>
<td>Thermodynamics,</td>
<td>8 (6.9)</td>
<td>9</td>
</tr>
<tr>
<td>Propulsion Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statics, Dynamics,</td>
<td>30 (26)</td>
<td>22</td>
</tr>
<tr>
<td>Stress, Structures, Matl's</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumentation, Stability control (Stat. + Dyn.)</td>
<td>3 (2.6)</td>
<td>7</td>
</tr>
<tr>
<td>Introd. Aerospace, Design,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configuration Design, Aero Systems Design</td>
<td>9 (7.8)</td>
<td>14</td>
</tr>
<tr>
<td>Econometrics</td>
<td>4 (3.5)</td>
<td>4</td>
</tr>
<tr>
<td>Technical Electives</td>
<td>29.3 (25.4)</td>
<td>10</td>
</tr>
<tr>
<td>Reqd. Noon Instr. Equiv.</td>
<td>8.7 (7.6)</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>134 (116.2)</td>
<td>115*</td>
</tr>
</tbody>
</table>

**Notes:**

A) **TOTALS EXCLUDE:**

1. Noon Labs. + Drafting Reqmt's

B) Delft semester = 13 weeks
K.U. semester = 15 weeks

Delft ( ) numbers are adjusted to K.U. semester
Typical Class Sequence

AE 550  Dynamics of Flight I  
(Fall)  3 hrs  (Static S+C)

AE 551  Dynamics of Flight II  
(Spring)  2 hrs  (Dynamic S+C)

. Book required: Roskam: Flt. Dyn.  (CH. 1 t/m 6)

. Weekly homework is graded + returned to students with "standard answers".

. 3 Quizzes* during semester announced 1 week ahead.

. 1 final examination* at end of semester (dates of finals set by Univ. Council).

→ Students must do these at times indicated by prof.

* Graded + returned to student with "standard answers".
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THE STUDENT

Students where from?

50% State of Kansas
30% U.S. (outside Kansas)
20% Outside U.S.

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Woman</th>
</tr>
</thead>
<tbody>
<tr>
<td>K.U. total</td>
<td>~65%</td>
<td>~35%</td>
</tr>
<tr>
<td>Engineering</td>
<td>~85%</td>
<td>~15%</td>
</tr>
<tr>
<td>A.E.</td>
<td>~98%</td>
<td>~2%</td>
</tr>
</tbody>
</table>

Student Sources of Income:

- Mom + Dad
- GI-Bill
- Work (self)
- Work (wife)
- R.O.T.C.
- Scholarship
- Loans
- U.S. Navy Professional (NECEP)
Student Grades

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>85-100</td>
<td>70-85</td>
<td>60-70</td>
<td>50-60</td>
<td>&lt; 50%</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTS</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

GPA = GPA (Grade Point Average)

. To get B.S.A.E. C average is minimum accepted (GPA=2.0)

. No F grades allowed!

. For admission to graduate school GPA = 3.0 is required

. Ph.D. or D.E. candidates must carry CPA = 3.5 or they will be rejected

NOTE: Starting salary is influenced significantly by GPA, according to most employers.
Costs (2 semesters)

. Tuition for 2 semesters

$ 700.00  KS residents
$1,400.00  others

. Book + Supplies

~ $ 300.00

. Room in dormitory

$ 300.00 – $ 500.00
(double occupancy)

. Board in dorm.

$ 750.00

. Health Insurance

$ 140.00 (single)

. Other costs: Trans., Entert. ??

For 1 calendar year, total expenses may vary* from

$ 5,000 – $ 7,000

* No "niceties" included.
Class Attendance by Students

- No class attendance is required by K.U.
- Individual professors may require class attendance. Most do not.
- The "system" makes it difficult for students not to attend classes.

Consequence:
Class attendance is generally very high.

Student Living Conditions

- Freshman + dorms or frats (sors)
- Sophomore + on + own choice
- Married students + own choice
- Grad. students + own choice

Many rent apartments.
Costs $200 – $600 per month depending on size, luxury, location.

Transportation

- Buses on campus
- Bicycles
- Most own a car.

* ROTC + NECEP students must attend all classes.
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PROFESSORS

Professorial Rank

- Assistant Professor
  "tenure" in 5-7 yrs or upon promotion
- Associate Professor
  "tenure" in 3-5 yrs or upon promotion
- Professor
  immediate "tenure"

Spacial rank:
  Distinguished (named) or University Professor

Large salary differences possibly

Starting salary for 9-month appointments
\[ \approx \frac{9}{12} \times \text{industry equivalent} \]

Mention privilege to chair doctoral committees.
Evaluation of Professors for salary + promotion

Criteria
  . Teaching  40%
  . Research + publications 40%
  . Service  20%

Teaching Evaluation
  . Primarily by students, via questionnaires
  . Awards

Research + Publications
  . Publications in recognized Journals + Conferences
  . Other publications
  . Involvement of students in research
  . $ value research

Service
  . Important University Committees
  . State Committees
  . Federal Committees
  . Important Civic Work

Professorial Loads

<table>
<thead>
<tr>
<th>Lectures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No research</td>
<td>9-12 hrs</td>
</tr>
<tr>
<td>½ research</td>
<td>6-9 hrs</td>
</tr>
<tr>
<td>¼ research</td>
<td>3-6 hrs</td>
</tr>
<tr>
<td>Full research</td>
<td>not at KU</td>
</tr>
</tbody>
</table>

. Normal academic appointment is for 9 months.
. One day per week may be devoted to consulting.
. Summer appointments possible, depending on:
  teaching requirements
  research contracts

* Committee service not included. This normally is carried as a voluntary overload.
* Student advising same.
Experience level K.U./A.E. Faculty

<table>
<thead>
<tr>
<th>at KU yrs</th>
<th>Name</th>
<th>Rank</th>
<th>Degrees</th>
<th>experience in industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>J. Roskam*</td>
<td>Ackers Distinguished Professor</td>
<td>M.S.A.E. Ph.D.</td>
<td>14 yrs Aviolanda/Cessna/Boeing</td>
</tr>
<tr>
<td>12</td>
<td>D.L. Kohlman*</td>
<td>Professor</td>
<td>M.S.A.E. Ph.D.</td>
<td>5 yrs Boeing</td>
</tr>
<tr>
<td>12</td>
<td>V.U. Muirhead*</td>
<td>Professor</td>
<td>M.S.A.E. M.Cal.Tech.</td>
<td>25 yrs U.S. Navy</td>
</tr>
<tr>
<td>7</td>
<td>H.K. Smith</td>
<td>Professor</td>
<td>M.S.A.E. Ph.D.</td>
<td>16 yrs Boeing</td>
</tr>
<tr>
<td>1</td>
<td>R.R. Ross*</td>
<td>Visiting Professor</td>
<td>M.S.A.E. Ph.D.</td>
<td>12 yrs Lockheed, Learjet</td>
</tr>
</tbody>
</table>

* Active pilots

. All are also active as industry consultants + have research grants thru CRINC
A.E.

Student/Staff Comparison

<table>
<thead>
<tr>
<th></th>
<th>Delft</th>
<th>K.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td>General services (Adm., Libr., Technicians)</td>
<td>23</td>
<td>4+2</td>
</tr>
<tr>
<td>Technical Staff</td>
<td>26</td>
<td>0+1</td>
</tr>
<tr>
<td>Scientific Staff</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>Professors (all ranks)</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>114</td>
<td>10+3</td>
</tr>
<tr>
<td>Students</td>
<td>~550</td>
<td>150</td>
</tr>
<tr>
<td>Ratio Students/Staff</td>
<td>3.9</td>
<td>11.5</td>
</tr>
</tbody>
</table>

Factor 3 difference in productivity

\[ * \text{CRINC} \]

\[ ** \frac{114}{13} \approx 9 \] K.U. produces ~ 8-10 major publications per year. Does Delft produce \( 9 \times 8 = 72 \)?
University Governance

State of Kansas Legislature

Governor

Board of Regents

Chancellor

Executive Vice Chancellor

V.C.
Finance

Vice Chancellor
Academic Affairs

V.C.
Research +
Grad. Studies

V.C.
Student Affairs

V.C.
Operations +
Planning

- College of Liberal Arts + Sciences
- School of Education
- School of Engineering
- School of Fine Arts
- School of Journalism

All Graduate School(s) +
School of Law
School of Pharmacy

22,000 students
2,000 in K.C.
20,000 in L.
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UNIVERSITY GOVERNMENT + $?

Exec. V.C. 

Council of Deans → University Council → Student Council

All Student → Student Affairs only

100 professors

25 students → 25% representation on all committees, but

- no vote in academic affairs

Committees

NOTE:

1) Student interest in Univ. Governance is very low.

2) Students have no voice in academic program decisions in engineering.
School of Engineering

Dean

→ 1,600 students

Dept. of Aerospace Engrg.

Dept. of Civil Engr.

Dept. of Chem. + Petr. Engr.

Dept. of Electrical Engrg.

Dept. of Mechanical Engrg.

150 students
6 professors
2 secretaries
2 technicians

Engineering Program Quality Control

- Accredited Programs
  - Industry Advisory
- Not-accredited Programs

All K.U. B.S.E. Programs are E.C.P.D. - accredited

Engineering Council for Professional Development

AIAA IEEE ASME SAE
ASCE AACPE etc.

- ECPD prescribed minimum program quality + quantity.
- Accreditation is valid for 5 years, then reviewed.

NOTE: No State or Federal Interference!
$-sources for K.U.

1. State of Kansas Legislature
   - House of Representatives
   - Senate

   Yearly budget is negotiated between legislat. finance committee, governor's
   budget bureau, board of regents + chancellor of K.U.

2. K.U. Endowment Association
   - Donations
   - Investments
   - Revenue Farmland

   Example: $ 2,000,000.00 Spencer Fine
   Art Center donated by Mrs. Spencer.

3. K.U. Athletic Association
   - Kansas Jayhawks
     Football
     Basketball

4. K.U. Center of Research Inc.

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C.R.I.N.C.
(Center for Research, Inc.)

- CRINC is 100% supported by contracts or grants
- CRINC is a NON-PROFIT U.S. corporation → wholly owned by K.U.
- CRINC provides management flexibility to lab. directors + to professors doing research.
Typical M.E./D.E.
Project run thru CRINC

K.U./Beech/NASA/Boeing M59
SSSA Project

1970 - 1976

$ 950,000.00 \begin{cases} \sim 250,000 & \text{Student wages} \\ \sim 50,000 & \text{Prof. wages} \\ \sim 650,000 & \text{Beech Boeing} \end{cases}

4 D.E. degrees + 1 Ph.D. degree
10 M.E. degrees
6 M.S. degrees

\sim 25 \text{BSAE students gained practical experience}

D.E. or M.E. candidates run the project under supervision of a "principal investigator"

numerous \begin{cases} & \text{conference papers} \\ & \text{journal articles} \\ & \text{theses or project reports} \\ & \text{interim or progress reports} \end{cases}

Keeps everyone on the ball!

Advances state-of-the-art
Hoofdstuk 8

OBSERVATIONS

1. Institutional
2. Program

Observations (Institutional)

1. Delft students don't work as hard as K.U. students.
2. Class attendance + class response is poor (no questions asked) in Delft.
3. Much of Delft staff has no or little hard industry experience + are "inbred".
4. Delft professors are "shielded" from students by scientific and technical staff:
   - students have little access to professors
   - student don't get benefit of experience + knowledge of professors
   - M.S. level students are sometimes treated unfairly by scientific staff
   - clear lines of authority + decision power on quality, quantity and progress of M.S. level work are important to the student, yet are not always clear to student.
5. A lot of time is wasted in meetings: there is too much "democracy"!
6. All technical reports should be written in English: a lot of truly outstanding work goes unnoticed in Dutch.
7. Laboratory and equipment facilities are superb.
8. General attitude of professors and staff: very good.
9. The "system" does not stimulate nor reward top performers.
10. Productivity in $\frac{\text{students}}{\text{staff}}$ and in research publications is very low.

Observations (Program)
A) B.S. (first four years Delft).
   In general Delft & K.U. are quite comparable in quality + quantity.
   Only minor differences exist in emphasis.
B) M.S. (fifth year Delft).
   1. K.U. requires 30 - ~ 8 = ~ 22
      \[\text{thesis}\]
      hours of course work, Delft none. Is this good?***

   2. K.U. M.S. work is \textit{controlled directly} by professors.
      Delft M.S. work is generally controlled by scientific staff.
      Is this good?**

   3. K.U. requires \textit{formal thesis}.\textsuperscript{m}
      Delft requires \textit{informal report}.\textsuperscript{**}
      Is this good?**

C) Trend toward "no-exam" lecture-subjects is dangerous.

\textsuperscript{m} Rigid quality + editorial control + placed in library system.
\textsuperscript{**} Poor quality + editorial control.
\textsuperscript{***} For the student!