

## **Joint Architecture/Engineering/Chemistry Sandwich MS and PhD Degree Programs between Mek'ele University, Dire Dawa University, and the University of Cincinnati**

### **Participants:**

Prof. Greg Beaucage, Chemical and Materials Engineering University of Cincinnati  
Prof. Nnamdi Elleh, Architecture, University of Cincinnati  
Prof. Tadele Hunde, Chemistry, Mek'ele University  
Prof. Semere Zeru, Architecture, Mek'ele University  
Prof. Getnet Sewnet, Director of the Institute of Technology, Dire Dawa University  
President Girma Goro Gonfa, Dire Dawa University

### **Funding Request:**

US Embassy Addis Ababa: \$30,000  
University of Cincinnati: \$30,150  
Mek'ele University: \$19,500  
Dire Dawa University: \$ 9,750

### **Synopsis:**

The simultaneous rapid expansion of undergraduate enrollment and the expansion of the Ethiopian university system have created a dramatic need for teaching faculty. Noteworthy is before 2001, Ethiopia had about one major University in Addis Ababa, and about 3 technical universities that were affiliated with the former. However, the need to develop the country since the end of the Civil-War in 1992 resulted in the creation of over twenty-seven new universities and institutes of technology.

The expansion of higher learning has also resulted in huge demand for specialized faculty members in different disciplines. This has largely been met by recent Bachelors graduates from Ethiopian Universities, and by visiting Asian and Middle-Eastern trained faculty members who hold Masters or Doctoral degrees in the respective programs (for example chemical engineering and architecture). However, the neither university is able to recruit the number of qualified expatriate faculty members to adequately support their degree programs.

### **The Need/Rationale for the Project:**

The cost of recruiting expatriate faculty members is too high; even when the universities are successful at recruiting staff from abroad, the visiting professors stay for a limited number of years, usually 1-2 years. The high-turnover of faculty from abroad disrupts the teaching curriculum and continuity in the programs. For viable undergraduate programs and graduate programs in the respective disciplines, there is a dire need for MS and PhD trained Ethiopian faculty members who can manage the departments in the new universities.

### **Project Objective:**

This proposed sandwich project expands relationships between Mek'ele and Dire Dawa Universities and the University of Cincinnati, Ohio. It was initiated and developed with seed funding from the US Embassy in Addis Ababa in 2014, in collaboration with the University of

Cincinnati's Office of International Affairs Out-Reach Program. Continuing the program will provide the following advantages:

- The proposed project will develop a sandwich MS and PhD program in which degrees are awarded by Ethiopian institutions while a substantial component of the degree work is carried out at and/or in collaboration with the University of Cincinnati.
- Qualified, Ethiopian teaching faculty members will be developed to manage the programs.
- Continuity in the Chemical and Materials Engineering, and in the Architectural and Interior Design curriculums will be ensured.
- The training will also include interdisciplinary programs resulting in leadership training in both programs.
- Professor Beaucage will encourage applied technology initiatives to entrepreneurial development. For example Beaucage has over 5-years experience in the production and installation of solar panels in Ethiopia. His goal is to train a new generation of Chemical Engineers who can locally market and manufacture solar panels.
- Professor Elleh would also like to expand the design program in area into fashion and industrial design, which are also available in the College of Design Art, Architecture and Planning at the University of Cincinnati.
- The program intends to mentor Ethiopian faculty members in research areas that interest them by connecting them with faculty members at the University of Cincinnati who research and publish in parallel areas of interest.
- Overall, the goal is to use the sandwich program to lay foundations for self-sufficient well-trained faculty who will manage the disciplines of chemical and material engineering and the allied fields of architecture and design in the two Universities.

The primary coordinators of the program are Prof. Greg Beaucage (Chemical and Materials Engineering University of Cincinnati), and Prof. Nnamdi Elleh (Architecture and Interior Design, University of Cincinnati). The project has the full support of Prof. Tadele Hunde, Chemistry, and Prof. Semere Zeru, Architecture, both at Mek'ele University. In addition, Prof. Getnet Sewnet, Director of the Institute of Technology, and the President Girma Goro Gonfa, of Dire Dawa University, are the primary participants in the latter university.

The proposed project will develop a sandwich MS and PhD program in which degrees are awarded by Ethiopian institutions while a substantial component of the degree work is carried out at and/or in collaboration with the University of Cincinnati. The project expands relationships between Mek'ele and Dire Dawa Universities and the University of Cincinnati developed under seed funding from the US Embassy in Addis Ababa in 2014.

#### **Project Description/Method:**

The project will follow the model of the International Science Program (ISP) of Uppsala University in Sweden. The goal of the ISP is "to ... build broader institutional capacity at Universities in developing countries to plan and manage their own research and teaching." [Swedish International Development Cooperation Agency. *Report on the Evaluation of the International Science Programme* 30 September 2011] The ISP program has evolved over more

than 50 years of operation and is an international model for western intervention in sub-Saharan African higher education development.

The project will fund three Masters degree candidates at Mek'ele and Dire Dawa Universities to spend four months in Cincinnati to work on thesis topics in Architecture, Planning, Chemistry and Chemical Engineering. The students will join existing research groups at the University of Cincinnati during the period. Students will attend elective courses at the University of Cincinnati that are not available in Ethiopia. The thesis will be coupled with required course work at Mek'ele and Dire Dawa Universities to satisfy degree requirements at the home institutions. The Masters and Doctoral programs at the Ethiopian Universities will be designed to produce degrees equivalent to degrees at the University of Cincinnati through interaction with Cincinnati faculty and administrators. The program will initiate and/or improve the quality of graduate degrees issued by the two Ethiopian institutions.

#### **Fields of Faculty Development/Interactions:**

A primary goal of the program is to develop viable graduate programs at the home institutions. An example of the success of such a sandwich degree program is the long-term program between Uppsala University and the Chemistry Department of Addis Ababa University. The interaction has resulted in 70% of the Chemistry faculty at Ethiopia's premier university over 20 years of the interaction. In turn AAU has served as the primary source of Chemistry faculty across Ethiopia. Graduate programs will be developed in coordination with faculty and administrative advisors from the University of Cincinnati.

The proposed program will develop interaction between Chemistry, Chemical Engineering, and Architecture with the goal of coordinated research efforts that target implementation of technological solutions to development projects in architecture and architectural archeology. Five areas of interest to DDU and MU where seeds of such interactions already exist were identified during a visit by Beaucage and Elleh to DDU and MU in May/June, 2014 funded by a seed grant from the US Embassy in Addis:

- 1) Environmental/Energy- Solar energy, wind energy, environmental impact of textile manufacturing and other industries.*
- 2) Construction Materials- Corrosion, concrete additives, catalytic paint for carbon soot reduction, other uses of chemistry and chemical engineering in the design of buildings in Ethiopia.*
- 3) Restoration of Archeological Sites- Work with the Institute of Paleo-Environment and Heritage Conservation of the Mek'ele University and the Architecture and Planning Department in conjunction with Chemistry and Engineering to develop technologies for restoration of archeological sites.*
- 4) Waste Water Treatment- Heavy metals in wastewater, water treatment and testing, alternative water treatment technologies incorporated into architectural design.*
- 5) Design of Health Posts and Clinics- Application of technology to new designs for health posts and clinics.*

In each of these five areas we have identified 3 to 5 participating faculty members in Chemistry and Chemical Engineering and a similar number of faculty members in Architecture, Design, and Planning. There are strong interests in these areas at the University of Cincinnati and we can identify partner team leaders at Cincinnati who can host visitors in these topical areas, participate in joint proposals, and coordinate sandwich Masters and Doctoral studies. The interaction developed through this sandwich program will be leveraged to apply for other funding targeting these five topical areas.

The interactions will lead to deliverables associated with human resources but also in terms of developing a team approach to accessing funding in Ethiopia and from international development aid from both private and public sectors.

### **Funding Requested:**

A typical Masters program requires two years of study while a Doctoral degree requires approximately four to six years of study. Due to these time constraints a sandwich program will require plans for somewhat extended funding while this request is for a single year of support so this represents the initial demonstration stage for a long-term commitment. The Masters degree can be seen as the initial stage of the Doctoral degree in some cases. We propose to support three students as noted in Table 1. The total one-year funding request from the Addis Embassy is \$30,000 with matching funds of about \$30,000 from the University of Cincinnati, \$20,000 from Mek'ele University, and \$10,000 from Dire Dawa University.

**Table 1. Proposed number of students.**

	<b>Architecture</b>	<b>Chemistry</b>	<b>Chemical Engineering</b>
<b>Mek'ele University</b>	1	1	-
<b>Dire Dawa Univ.</b>	1	-	-

**Table 2. Per student expense for 120 days residence in Cincinnati for the US Embassy contribution (about 1/3 of the total costs per student).**

	<b>Per Day (USD)</b>	<b>Total, USD</b>
Airfare	½ Costs	1150
Lodging*	83.33 (127/2)	5000
Food*	41.67 (56/2)	2500
Supplies	½ Costs	1100
Miscellaneous	½ Costs	250
<b>Total</b>		<b>10,000</b>

\* = GSA Rate for Cincinnati, OH in bracket

**Table 3. Per student matching fund expense for 120 days covered by the University of Cincinnati.**

		<b>Total, USD</b>
Tuition	One Semester	2300
Faculty Time	75 hours	7500
Miscellaneous	½ Costs	250
Total		10,050

**Table 4. Per student matching fund expense for 120 days covered by the Ethiopian University.**

	<b>(USD)</b>	<b>Total, USD</b>
Airfare	½ Costs	1150
Lodging*	83.33 (127/2)	5000
Food*	41.67 (56/2)	2500
Supplies	½ Costs	1100
Total		9,750

\* = GSA Rate for Cincinnati, OH in bracket

**Project Evaluation Methods and Metrics:** The project should result in three masters degree students, the majority of whom will return to careers in higher education in Ethiopia. The Swedish program has resulted in a return of >95% domestic careers for Ethiopian students trained in the sandwich program. The students will continue to interact with one of the research thrusts indicated above and to participate in the Ethiopian research teams involving architecture, chemistry, and engineering through their early careers in Ethiopia. The project should result in one topical research proposal at each institution involving facilities enhancement and faculty support in Ethiopia in an effort to develop regional expertise at the targeted universities.

*Relevance:* The impact of the research projects will be assessed in terms of their relevance to economic and social development in Ethiopia. This will be quantified in terms of specific impact on communities.

*Impact on Capacity at the Participating Institutions:* The project will be evaluated by the outcome of related grant applications, new equipment purchase and expansion of the undergraduate and graduate programs in terms of effected students and faculty.

*Publications:* The one-year funding should result in several peer-reviewed publications as well as an internal report.

*Impact on University of Cincinnati:* The project will positively impact undergraduate and graduate education at the University of Cincinnati both in terms of research productivity and in terms of broadening the exposure of US students and faculty to Ethiopia. This will be quantified by surveys at UC.

*Broader Development Goals:* Expansion of higher education should have a direct impact on economic development, improvement in underrepresented groups, and social development. This will be quantified by specific examples showing the program impact.

*Sustainability of this program:* The project will be assessed in terms of how the program will function after termination of Embassy funding.

**Context of Proposal:**

This proposal is based on a recent trip to the respective universities by the Cincinnati coordinators, Beaucage and Elleh, from April 25<sup>th</sup> through May 9<sup>th</sup> 2014 funded by a seed grant from the US Embassy in Addis. Beaucage and Elleh discussed the existing curricula, interviewed the faculty members, observed the infrastructures, interacted and talked with the students at both universities, and noted the needs, which are presented in this proposal. This proposal is an opportunity to implement what was found in this preliminary study with the aim of development of MS and PhD faculty for the Ethiopian universities. Figures 1 to 7 show some of the interactions during the April/May exploratory trip.



*Figure 1. Presentation to Architecture Department Mek'ele University*



*Figure 2. Meeting with Architecture and Planning faculty members Mek'ele University.*



*Figure 3. Nnamdi Elleh, UC and faculty members from Mek'ele University.*



*Figure 4. Nnamdi Elleh, UC, and administrators of Chemistry and Chemical Engineering Mek'ele University.*

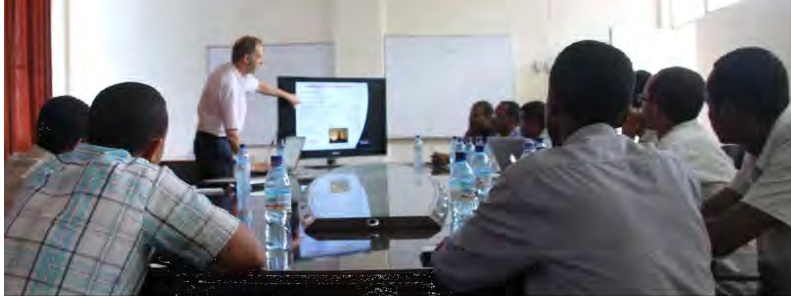


*Figure 5. Greg Beaucage, UC, and faculty of Chemistry at Dire Dawa University*



*Figure 6. Greg Beaucage, Nnamdi Elleh and faculty of Architecture at Dire Dawa University.*





*Figure 7. Beaucage presenting to the administration of Dire Dawa University.*