

Project Connect – A Model for Immersive Professional Development of Future Engineers

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Introduction

Project Connect (PC) is an immersive professional development program designed to increase the number of students from underrepresented groups in engineering who pursue careers in the microwave engineering and related fields. Most of the professionals in this area have been educated in the electrical engineering (EE) field with a focus on applied electromagnetics, antenna theory and communication systems. The electromagnetics class in a typical electrical engineering undergraduate program involves vector calculus and abstract concepts without, in many cases, the right facilities or equipment to aid experiential learning. This leaves most students perplexed and disinterested in the field, while they do not fully realize the wealth of opportunities that lie beyond this course. This problem is even more pronounced for students from underrepresented groups as they may have less exposure to the professional and academic opportunities in microwave engineering. Project Connect was birthed out of the need to keep these students engaged in the field by exposing them to a broader view of the field and the impact that they can have on technology.

Each year, the PC program is housed within the Institute of Electrical and Electronics Engineers (IEEE) International Microwave Symposium (IMS). IMS is the flagship conference of the Microwave Theory and Techniques (MTT) Society and is based in North America. The typical attendance at the conference is over 9,000 and there is an associated industry exhibition with more than 700 companies. PC hosts approximately two dozen underrepresented students for four days of community building and professional development, most of whom are juniors or seniors in undergraduate programs, along with a smaller cohort of first year students in graduate programs. The groups, consistently mixed in gender and ethnicity, get an opportunity for direct interaction with fellow PC participants, practitioners and academics, and leaders in the field and of the MTT society. This interaction is central to the success of the program, and the integration with IMS is representative of the important role that professional societies can play in diversifying STEM participation [1]. PC has been in operation since 2014 [2-5] and is sponsored jointly by the National Science Foundation and the IMS Organizing Committee.

Program

The agenda for the four-day event at the IMS combines professional development with fun activities intentionally programmed to incorporate the local culture of the IMS host city and the thematic focus of the conference. The goal of experiencing local culture is combined with a community building activity for the students on the first full day of the conference; typically, this includes a team-based scavenger hunt that involves identifying key landmarks of historical significance in the city. The bonding opportunity is effective at building comradery and dissipating anxiety in students, many of whom have limited or even no experience in this kind of professional setting. Many of the students participating in this program have not traveled beyond their home state and are anxious about the benefits of PC. By interacting with their peers and

learning about a new city, they are able to open up to the new professional directions that they will be challenged to consider.

The second and third days are a combination of participating in general conference activities and focused group sessions on professional development, involving the program coordinators, practicing engineers, and faculty. To facilitate the former, the students are given assignments to engage with specific types of companies, attend technical presentations, introduce themselves to conference organizers, and the like. The students are required to “connect” with graduate students who are currently engaged in the profession and learn about their experiences beyond an undergraduate degree. The technical aspect of the conference is reinforced by connecting at least one focused PC session to the conference theme, e.g. biomedical applications of microwave engineering. Students may then attend a panel session or meet key influencers associated with the theme. A PC reception is also held where VIPs of the conference and professional society meet with the students for one-on-one interaction. The professional network of organizers from industry, government, and academia are also invited to talk with students about career opportunities. The importance of network building is frequently reinforced, and this includes the development of effective ‘elevator speeches’ and strong encouragement for the students to participate in social events that accompany the conference. On the fourth and final day, the students present “IMS Through Our Eyes” videos, prepared generally at the end of Day 3 by working in groups of 2 or 3, to capture their experience. The team videos are also utilized by the organizing team to share with constituent groups to seed commitment for future meetings.

The effectiveness of Project Connect can be attributed to it being embedded within the IMS conference setting. There are multiple generations of engineers in attendance, including graduate students, early-career professionals, managers and lab scientists, and high-level corporate officers. People at all of these stages welcome the opportunity to participate as panelists and engage directly with the students, providing a window into their career paths and the professional lives of working engineers. The large industry exhibition includes demonstrations of state-of-the-art microwave technology, and the showroom floor bristles with activity. With this backdrop and a carefully designed curriculum that utilizes the setting for engagement, the students have extra motivation to absorb what is shared with them about presenting themselves (the elevator speech) and ample opportunity to practice. Furthermore, the interaction with the panelists has the effect of shortening the perceived distance between a young student and a successful engineer, thereby improving the students’ ability to interact comfortably with others at the conference. Moreover, the IMS is simply a vibrant and entertaining event with a constant stream of technical and social activities.

Lessons Learned

The first five years of Project Connect were focused on defining, refining, and tuning the program curriculum content by the organizers to maximize linkages between the conference and the program and learning experiences. In year two, university housing was incorporated as a cost-savings measure created an unexpected benefit. We observed better student interactions within the group of strangers due to the familiarity of the common student housing platform and its convenient gathering spaces that fostered more social interactions than a hotel. In year four, a

community building activity was added to learn about the local community. Since then, the community building activity has become a part of the curriculum where local environment is used to teach about culture and to have fun while learning about team work. The application process has been fine-tuned to include a 3-minute video, an electronic form with basic information, reference letter and transcript. This drives efficiency in both the application submission and review process. Because the program is specialty specific, we look for student interest, review transcripts to make sure the student has taken courses that allow them to understand at a basic level the content of the conference, and feedback from the reference letter that the student will engage and participate actively since the curriculum requires active teamwork on an extremely short time line.

Recruiting Challenges

One on-going challenge has been recruitment. The program has received 30-50 preliminary applications each year, but often many of them are not completed. Recruitment has proven to be a two-part problem of first publicizing and attracting initial interest, and then having the students follow-through and complete the application process.

To publicize the program, electronic flyers are sent to faculty in organizer networks, electrical engineering department heads, and friends of Project Connect who have expressed interest. These include various types of campuses with electrical engineering programs at predominantly white institutions (PWIs), historically black college and universities (HBCUs), and minority serving institutions (MSIs). We have also informed local campus student groups (e.g. NSBE and SHPE) at our respective campuses, tried using the national level access to student groups occasionally, used social media platforms such as Facebook and Linked-in, as well as promotion through Project Connect Alumni. We have contacted minority program coordinators at PWIs, but microwave engineering, as a sub-discipline of electrical engineering, appears to be too specific for them to know if a student is interested. Contact with electrical engineering department advisors has been somewhat helpful for informing students, but in order to complete the application process students usually need guidance and support from someone who can explain the technical conference or the Project Connect program.

Even the most productive recruiting channels, through faculty in our network and Project Connect alumni, have challenges. For undergraduate students, effective recruitment by faculty generally happens with advocates in our professional network who are actively teaching courses in our sub-discipline thus providing access to potential PC participants. However, faculty roles often change over time, e.g. teaching a different set of courses or transitioning to an administrative role, and this has caused access points to be broken and sometimes lost. In a similar way, the effectiveness of recruiting by PC alumni is limited since familiarity with other students in a program usually extends one year (e.g. from senior to junior) at best. On campuses where we don't have faculty advocates, those interested students may not know about the program or have the confidence to apply even if they do. Finally, the cost-savings trend that is leading to more students attending community college is making it more difficult for faculty to meet and re-meet students in their junior year. Therefore, students who may be transferring into the university may have less access to participation.

For the graduate students who participate, they have self-identified interest in the sub-discipline but may not have clarity or committed fully to the specialty area. Some may also be unsure about whether they will pursue an MS only, or continue into a PhD program. Our aim is to provide them with more clarity to decide on an interest area and access to a network of people to keep them engaged and connected once they enter the workplace.

We will be exploring ways to develop effective recruitment strategies in the future. We will leverage what works and explore how to make better connections to students on different university campuses. Given the new privacy laws and changing access points to under-represented students through various diversity officer/staff networks, this will be important information for professional societies to become aware of as employers strive to create a more diverse workplace with the help of professional societies.

Program Evaluation

An external evaluator was engaged with Project Connect in 2018 and 2019 in order to determine how effectively the program is meeting its goals. Specifically, the following objectives were studied:

1. To what extent does PC increase participants' knowledge of the RF/microwave industry
2. To what extent does PC increase participants' awareness of career opportunities and expectations in electrical engineering generally and RF/microwave engineering specifically
3. To what extent does PC increase participants' interest in pursuing a career in the RF/microwave industry

The evaluator, in collaboration with the Project Connect organizers, designed a pre and post program survey that all students were asked to complete. The questions were designed to gain background information about the participants, measure the impact of the program as it relates to the stated goals, and collect feedback about the program structure and components. All quantitative questions were framed by asking participants to indicate agreement with various statements on a five-point scale (1=strongly disagree, 5=strongly agree). Survey responses were 100%. The data presented below are taken from the 2019 assessment results.

Prior to the program, students' career aspirations all seemed to include becoming an engineer, pursuing advanced education, or teaching about engineering. They ranged in their specificity: some students knew the exact field or position they were aiming for and others had vague conceptions. Examples of how the undergraduates described their career aspirations included:

- To be a researching RF and Microwave engineer
- Become an educator
- Be an engineer who masters the fundamentals of a chosen field in order to be capable of solving challenging design problems
- I would like to work in industry and apply my knowledge to improve our technology
- Continue graduate studies

- I would like to use my technical knowledge to help advance society in a way that helps other people or revolutionizes the way they live.

The responses from graduate students were similar, although generally more directed toward the field of RF and microwave engineering. For example:

- My career aspirations are to get a job working ideally on antenna design, hopefully at a national research lab.
- Either starting a business or working for a company doing RF
- I want to become a researcher in the RF/microwave engineering field, and be able to make a difference in the research community.

Coming into IMS Project Connect, students expected to learn more about RF/microwave engineering and have access to professional networking. More specifically, students stated the following expectations:

- greater knowledge of RF/microwave engineering, particularly industry applications
- good professional networking opportunity
- information to help refine their research interests and/or educational path
- opportunity to meet other students with similar backgrounds and goals

Greater Awareness about the RF Industry and Increased Professional Contacts

On 4 out of 6 pre-program and post-program survey questions aimed at measuring the stated goals of Project Connect, students' showed statistically significant gains, as shown in Figure 1. There was a nearly statistically significant gain on one of the remaining questions (Q5, $p=0.054$) and an extremely high pre-program score on the other (Q1) which may indicate that the lack of gain reflects a ceiling effect.

Based on their responses, students have greater awareness of career possibilities in the RF/microwave field, are more likely to have role models and professional contacts, are more likely to imagine themselves making a contribution to the field, and are more likely to know what aspect of RF/microwave engineering is of interest to them. Graduate and undergraduate students showed roughly the same gains for all questions except Q6 where undergraduates had much larger gains. Undergraduates were very uncertain about what aspect of RF/microwave engineering they would want to work in and after the program indicated much greater certainty. Figure 1 shows students' mean response to each pre and post question. The data from the 2018 assessment shows pre/post gains for each question that is consistent with the 2019 data.

Better Understanding of RF/Microwave Engineering and More Confidence

Following the program, students were asked to indicate whether, after participating in the Project Connect program, they had a better understanding of the RF/microwave engineering field, more confidence engaging in certain professional activities, and more interest in engineering generally and RF/microwave engineering specifically. Their responses are shown in Figure 2. Both undergraduate and graduate students showed fairly neutral levels of agreement on all items in this portion of the survey. The exception being Q16 asking about students' plans for taking technical electives in RF/microwave engineering with which they agreed more strongly.

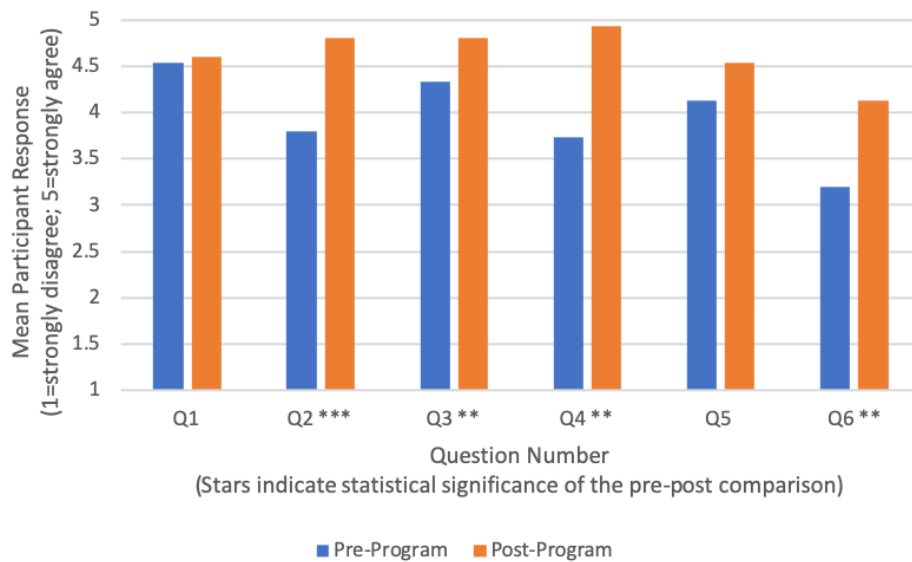


Figure 1. Project Connect participants had significant gains on most post-program survey questions as compared to pre-program survey responses. Each question asked about a different aspect of the primary goals of the Project Connect program. Stars next to a question number indicate a statistically significant gain as measured by a paired t-test (* indicates $p < 0.05$, ** indicates $p < 0.01$, *** indicates $p < 0.001$).

Q1 - I am interested in pursuing a career in the RF/microwave engineering field/industry

Q2 - I am aware of career possibilities in the RF/microwave engineering field/industry

Q3 - I have role models (i.e. someone who inspires me or my career/education) in the RF/microwave engineering field/industry

Q4 - I have professional contacts and/or mentors (i.e. someone who I could contact with questions or to seek advice) in the RF/microwave engineering field/industry

Q5 - I can imagine making contributions to the RF/microwave engineering field/industry in the future

Q6 - I know what aspect of the RF/microwave engineering field I'd like to work in

Two conclusions could be drawn from this data: (1) the program does not impact students' understanding of the field or their confidence interacting with professionals, or (2) this particular group of students already had high levels of interest and confidence so the program could be valuable but doesn't allow additional growth in these areas. Given the students' high level of interest as indicated in Figure 1 and their otherwise strong satisfaction with the program, conclusion 2 seems more plausible. It is also worth noting that in the 2018 assessment, the scores on Q7-9 and Q12-16 were all above 4.3 and the programming for the events in 2018 and 2019 was essentially the same.

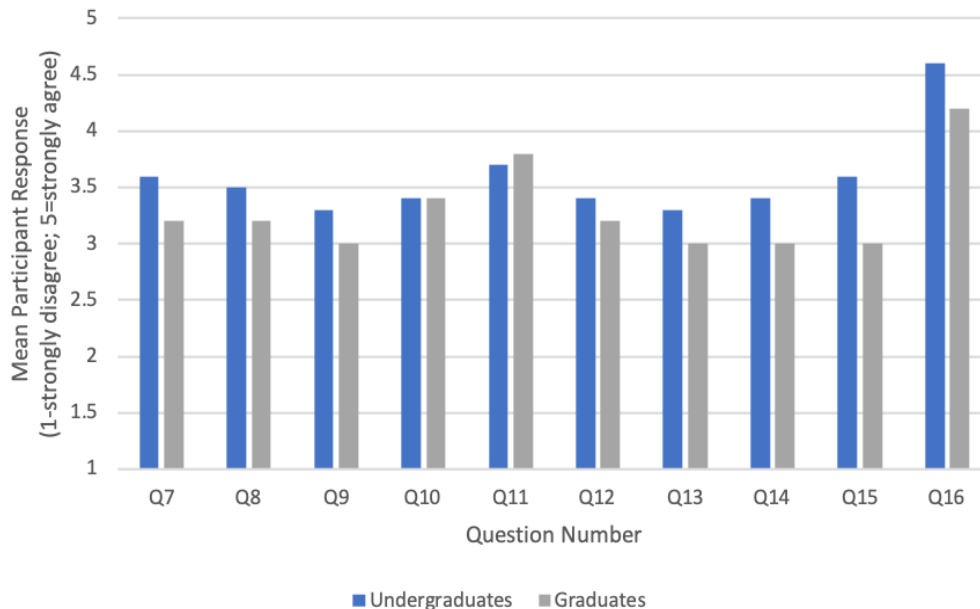


Figure 2. Graduate and undergraduate Project Connect participants indicate neutral levels of agreement post-program that they better understand RF/microwave engineering, feel more confident in their professional skills and are more interested in the industry/field.

Q7 - I better understand the types of projects, products, and research being done in the RF/microwave engineering field/industry

Q8 - I better understand the types of projects, products, and research that I can contribute to in the RF/microwave engineering field/industry

Q9 - I feel more confident talking with industry professionals

Q10 - I feel more confident preparing graduate school application materials

Q11 - I feel more confident preparing my resume for a job in RF/microwave engineering

Q12 - I have a greater interest in engineering

Q13 - I have a greater interest in electrical engineering

Q14 - I have a greater interest in RF/microwave engineering

Q15 - I am more likely to pursue a career in RF/microwave engineering

Q16 - I plan to take technical elective courses related to RF/microwave field in the future

Changing Descriptions of RF/Microwave Engineering and Satisfaction with Project Connect

Students were asked to use up to 10 words to describe RF/Microwave Engineering both pre and post program. Their responses were generally similar, but contained more emphasis on community post program. The words they chose most frequently are presented in word clouds in Figure 3. Finally, as shown in Figure 4, both graduates and undergraduates indicated in their quantitative ratings that nearly all aspects of the program are useful.

Pre-Program



Post-Program

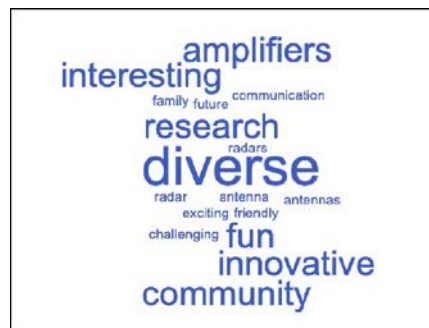


Figure 3. Words used pre- and post-program by more than 2 Project Connect participants to describe RF/Microwave engineering. The size of the words represents the relative frequency with which it was used. Post-program, participants more frequently choose enthusiastic and community-oriented words.

Changes to Education Plans to Engage with RF/Microwave Engineering and Pursue PhDs

When asked what things they would do differently in their education as a result of participating in Project Connect many students reported that they have an increased commitment to engaging in the RF/Microwave engineering community and increased interest in pursuing a PhD.

Their individual responses are listed below:

- I would be more open to ask questions about things I don't understand and follow more graduate classes in RF
- Make a better effort to network within the industry and to participate in IMS every year.
- I think Project Connect has mostly inspired me to invest more into the microwave community itself, and broadened my knowledge of what parts of the field I can steer my research towards.
- I will be thinking more about pursuing a PhD in rf.
- Be more curious about RF/microwave engineering during my bachelor.
- The Project Connect program was the opportunity for me to meet professional and other students in the domain of RF/microwave engineering. Prior to the conference, I was hesitating about pursuing graduate school. However, being able to hear their experiences allowed me to reaffirm my decision to obtain a Ph.D. I now have a more precise goal.

- My education has thus far been nebulous at best. I have declared my degree path in electrical engineering, and I have known for some time that I wanted to pursue RF and Microwave Engineering. But I was almost certain that I would not be able to pursue it as a field. Now, I intend to pursue my degree and career with as much compassion and support as though I were cheering on my best friend.
- I learned what it will take if I want to continue my education after my undergraduate and I hope to do so.
- Get a research mentor that pushes me into RF/microwave
- I don't think there is anything I would do any differently; I had already determined the future steps for my education prior to attending IMS
- Keep searching for the area of interest within electrical engineering
- I now know that I want to pursue my PhD degree in RF
- I am considering getting a PhD more than before IMS Project Connect
- Come back to IMS and expand my network as a graduate student.
- I am now fully committed to pursuing a PhD as a result of my experiences during the Project Connect.

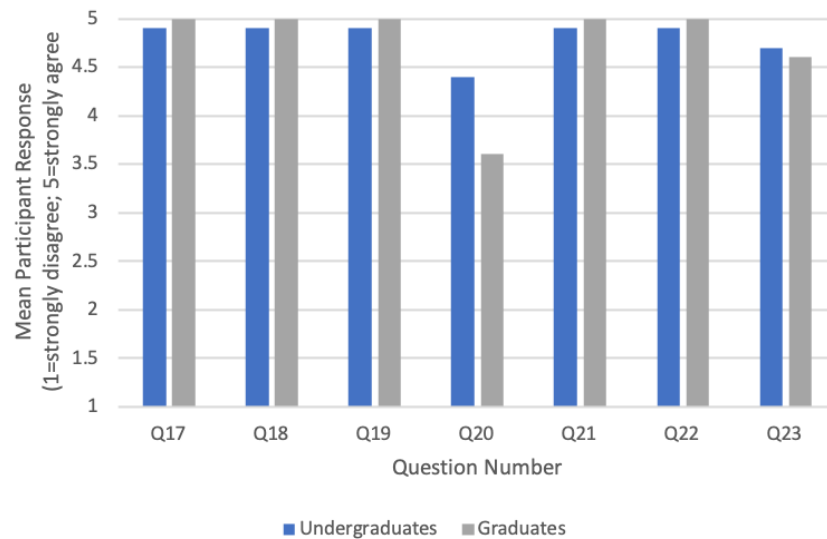


Figure 4. Graduate and undergraduate Project Connect participants indicate that they found most aspects of the IMS Project Connect program useful, with industry panelists as the exception.

Q17 - Overall, the Project Connect Program was useful to me in my career development

Q18 - The government participants on the panel was useful to me

Q19 - The academic participants on the panel was useful to me

Q20 - The industry participants on the panel was useful to me

Q21 - The workbook activity was useful to me

Q22 - Networking with professionals at the mixer was useful to me

Q23 - Networking with my fellow participants/peers was useful to me

Goal #1: Students' Knowledge Related the RF/Microwave Industry

From the 2019 data, it is unclear whether the program succeeded in reaching Goal #1. Based on their quantitative survey responses (Q7-15), students didn't indicate that they better understand the types of projects, products and research being done in the industry and what aspects of the industry they can and want to contribute to. However, in pre- and post-program comparisons on other questions (Q1-6) they did indicate increased understanding of what aspects of the RF/microwave engineering field they want to work in and showed enhanced interest in pursuing a career in the area. In addition, they all noted learning about the industry in their videos, and cited the ability to learn from industry professionals as a strength of the program. Furthermore, the 2018 assessment data shows more positive results for Q7-15 which suggests that the demographics of the schools from which students come plays a role in this area.

Goal #2: Students' Awareness of Career Opportunities and Expectations in RF/Microwave Industry

There was strong evidence in the survey data that the Project Connect positively impacts students' awareness of career opportunities. Post-program, nearly every participant strongly agreed that they were aware of career possibilities within the RF/microwave industry. In addition, students indicated they have a better understanding of the types of projects, products and research being done in the industry. Students also indicated a high degree of satisfaction with the networking opportunities provided by the program and indicated that following the program they were more likely to have role models and mentors in the field. These contacts, if students utilize them, can serve an ongoing role in students' understanding of the expectations of industry professionals.

Goal #3: Students' Interest in Pursuing a Career in the RF/microwave industry

Students are clearly more interested in pursuing a career in the RF/microwave industry following the Project Connect Program. They directly indicated that they have a greater interest in engineering and electrical engineering generally, and also RF/microwave engineering specifically. In addition, they directly indicated that they are more interested in pursuing a career in the industry after the program.

Conclusion

This paper describes an approach for broadening participation by students from underrepresented groups in the field of RF/microwave engineering. The Project Connect program embeds professional development and networking opportunities within a professional society technical conference. Assessment data shows that the program is increasing participants' knowledge of the industry, increasing awareness of career opportunities and expectations in the field, and is increasing their interest in pursuing a career as an RF/microwave engineer. In the first six programs (2014 – 2019), 104 students from 34 different universities have participated. However, recruiting students from schools with diverse demographics is a significant challenge. To date, approximately 40% of the students have come from just three campuses (1 HBCU and 2 Hispanic Serving Institutions).

References

- [1] Morris, V.R., and Washington, T.M. (2017) The Role of Professional Societies in STEM Diversity. *Journal of the National Technical Association*, 87(1), 22-31. ISBN-978-0-9993666-0-8.
- [2] Duwel, A., R. Franklin, J. Frolik, M. Ghosal, M. Grady, R. Henderson, M. Reece, M. Weatherspoon and T. Weller, IMS2014 Project "Connects" Undergraduate Students to the Microwave Field, *IEEE Microwave*

Magazine, 2014, Vol. 15, Issue 3.

[3] Henderson, R., T. Weller, A. Duwel, and R. Franklin, IMS2015 Project Connect, IEEE Microwave Magazine, 2015, Vol. 16, Issue 3.

[4] Harvey, D., R. Franklin, R. Henderson, and T. Weller, IMS2018 Project Connect – Five Years and Counting, IEEE Microwave Magazine, 2018, Vol. 19, Issue 3.

[5] Franklin, R., C. Gordon, M. Grady, D. Harvey, R. Henderson, N. Pillay and T. Weller, IMS2019 Project Connect – It's Your Time to Connect, IEEE Microwave Magazine, 2019, Vol. 20, Issue 4.