Trusted CI Impacts Report

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For Public Distribution

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About Trusted CI

Trusted CI is funded by NSF's Office of Advanced Cyberinfrastructure as the NSF Cybersecurity Center of Excellence (CCoE). In this role, it provides the NSF community a coherent understanding of cybersecurity's role in producing trustworthy science and the information and know-how required to achieve and maintain an effective cybersecurity program. Trusted CI achieves this mission through a combination of one-on-one engagements with NSF projects, training and best practices disseminated to the community through webinars, and the annual, community-building NSF Cybersecurity Summit.

For information about Trusted CI , please visit the project website: https://trustedci.org

Using & Citing this Work

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Executive Summary

Trusted CI, the National Science Foundation's Cybersecurity Center of Excellence (NSF CCoE), is charged to address cybersecurity challenges "affecting small projects, multi-institution collaborations, international collaborations and large facilities."[4] This report aims to quantify Trusted CI's impact on NSF projects. This is Trusted CI's second Impacts Report. Trusted CI published its first Impacts Report in 2018.[5] This report provides updated statistics about Trusted CI's impacts on NSF projects, with a focus on impacts since 2019 under the current NSF cooperative agreement (award #1920430)[6] for Trusted CI. Since 2012, Trusted CI has interacted with over 500 NSF projects through engagements, summits, webinars, and training events, including over 300 NSF projects during the last 3 years (2019-2021).

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[4] NSF CICI solicitation (2019): https://www.nsf.gov/pubs/2019/nsf19514/nsf19514.htm
[5] The 2018 Trusted CI Broader Impacts Project Report: https://hdl.handle.net/2022/22148
[6] NSF Award #1920430: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1920430

1 Introduction

Trusted CI, the National Science Foundation's Cybersecurity Center of Excellence (NSF CCoE), is charged to address cybersecurity challenges "affecting small projects, multi-institution collaborations, international collaborations and large facilities." This report aims to quantify Trusted CI's impact on NSF projects. This is Trusted CI's second Impacts Report. Trusted CI published its first Impacts Report in 2018. This report provides updated statistics about Trusted CI's impacts on NSF projects, with a focus on impacts since 2019 under the current NSF cooperative agreement (award #1920430) for Trusted CI.

2 Quantifying Community Impact

2.1 The NSF directorates

NSF is composed of seven directorates[7] that support science and engineering research and education, which are:
- Biological Sciences (BIO)
- Computer and Information Science and Engineering (CISE)
- Education and Human Resources (EHR)
- Engineering (ENG)
- Geosciences (GEO)
- Mathematical and Physical Sciences (MPS)
- Social, Behavioral and Economic Sciences (SBE)

In addition to the seven directorates, Trusted CI has impacted science projects funded by NSF's Office of Integrated Activities (OIA), including the COVID Information Commons.[8] Thus, in subsequent sections of this report, we provide impact statistics across eight award groups: the seven directorates plus OIA.

2.2 Total number of NSF awards impacted by Trusted CI

We define "impact" as the number of NSF projects (awards) that have had an engagement with Trusted CI or have had staff attend a Trusted CI event (including the NSF Cybersecurity Summit, webinars, and training events). When counting impact, we eliminate duplicates to avoid double-counting awards that have had multiple interactions with Trusted CI. For Trusted CI events, our totals include only the project affiliations that were provided voluntarily by the attendees, so they undercount the true project impact of our events. Further, our impact numbers do not include broader impacts such as use of Trusted CI materials by NSF projects

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[7] NSF Research Areas: https://www.nsf.gov/about/research_areas.jsp.
[8] COVID Information Commons: https://www.nsf.gov/awardsearch/showAward?AWD_ID=2028999

outside of engagements and events or indirect impacts such as NSF projects supported by an NSF facility that was impacted by Trusted CI.

Using the above impact metric, we find that since 2012, Trusted CI has interacted with over 500 NSF projects, through engagements, summits, webinars, and training events, including over 300 NSF projects during the last 3 years (2019-2021). In subsequent sections of this report, we provide a breakdown of these impacts across the NSF directorates (plus OIA).

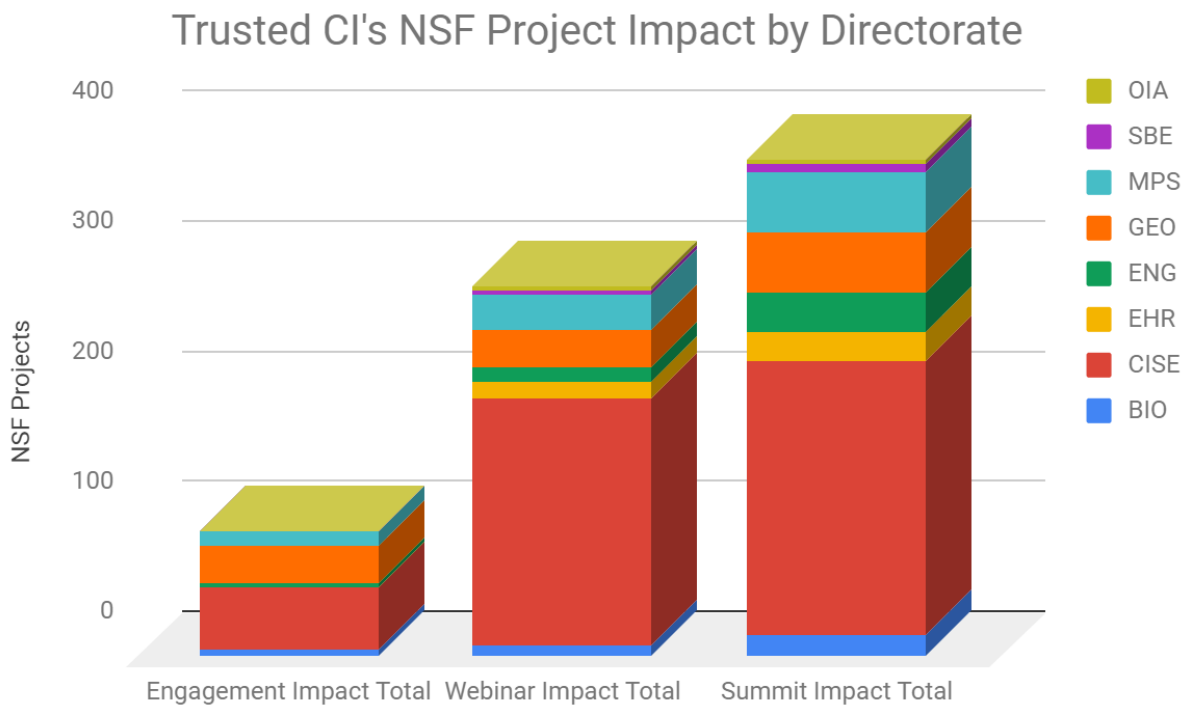## 2.3 Breaking down Trusted CI's impact by interaction

Figure 1. Trusted CI's NSF Project Impact by Directorate

Figure 1 shows Trusted CI's impact on NSF projects broken down by interaction type and NSF directorate (plus OIA). Our greatest outreach impact is the NSF Summit, followed by the webinar series, and engagements. Regarding NSF directorates, our greatest impact is in CISE, GEO, and MPS.
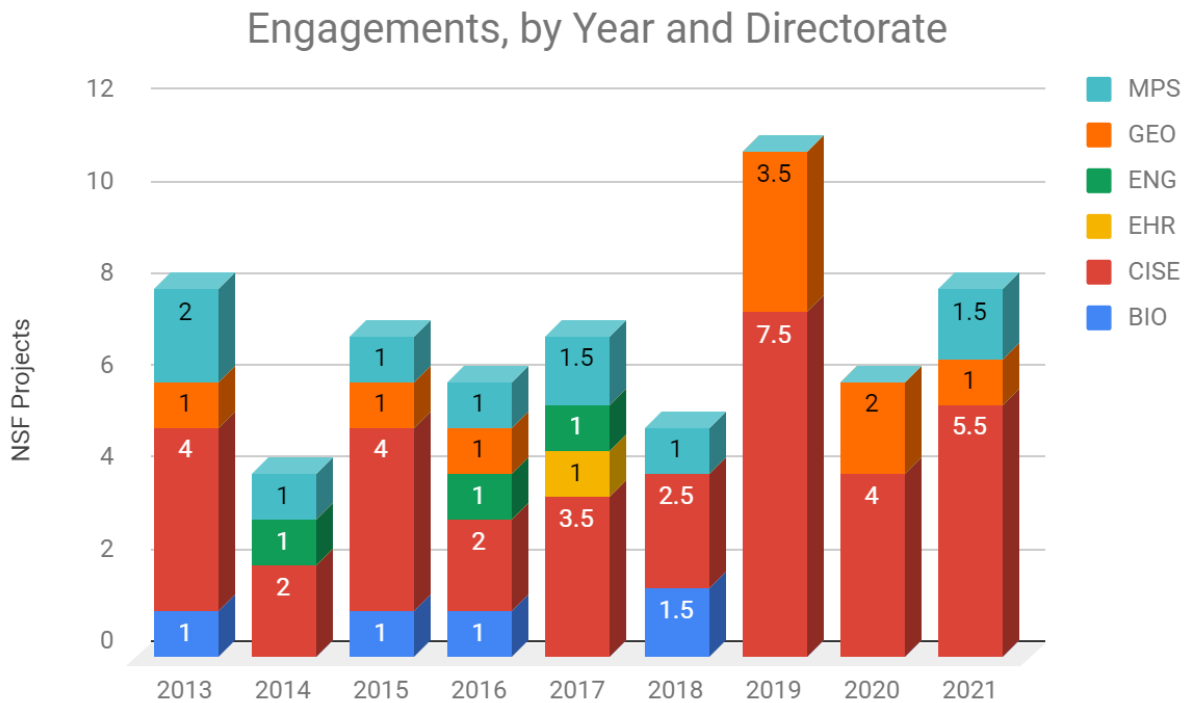
2.4 Engagements, by Year and Directorate

Figure 2. Engagements, by Year and Directorate

Figure 2 shows the impact of our engagements with NSF projects broken down by year and NSF directorate. Some engagements were affiliated with 2 directorates, leading to the decision to include .5 in both directorates, which can be seen in Figure 2. In 2019 we saw a notable increase in engagements. We attribute the increase to a record number of applications that year (18 total). The totals in 2020 and 2021 exclude two engagements that occurred but were not affiliated with an NSF award.[9] Also, in 2020 an engagement was abruptly ended due to the engagee not being able to fulfill the time commitment to complete the engagement.

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[9] In 2020 we conducted an engagement on managing regulated data with UC Berkeley, which was not affiliated with an NSF award. In 2021 we conducted an engagement with the Jupyter Security Coordination Team. While Jupyter is not affiliated with an NSF award, its software is commonly used in the NSF research community.
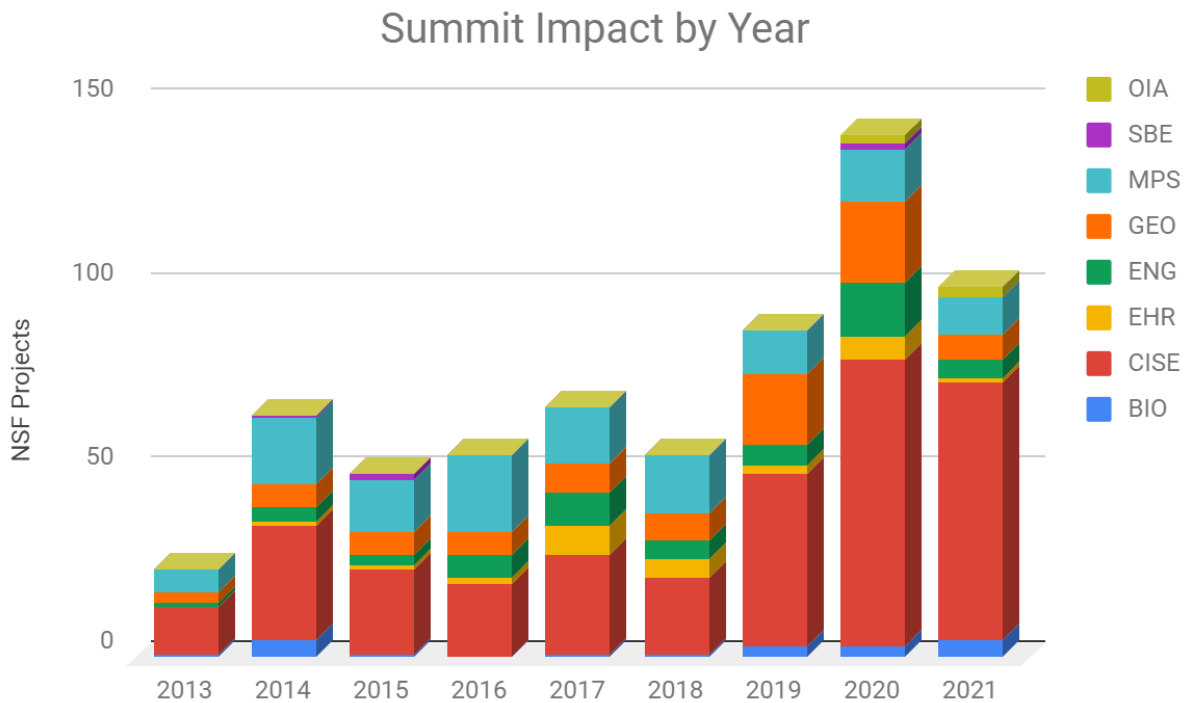
2.5 Summit impact by year and Directorate

Figure 3. Summit's Project Impact by Year and Directorate

Figure 3 breaks down the Trusted CI NSF Cybersecurity Summit attendees, grouped by NSF project, by year and NSF directorate. Attendees who did not indicate affiliation with an NSF projects are not included. Due to the pandemic, the 2020 and 2021 Summits were virtual. More NSF-award recipients attended the 2020 Summit than in previous years. We attribute this increase to removing the financial burden of traveling to an in-person event. However in the following year we saw our attendance decrease. We attribute the dip to Zoom fatigue, along with overlapping events competing for our community members' attention.[10]

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[10] Zeek Week was held the same week as the Summit in October 2021.
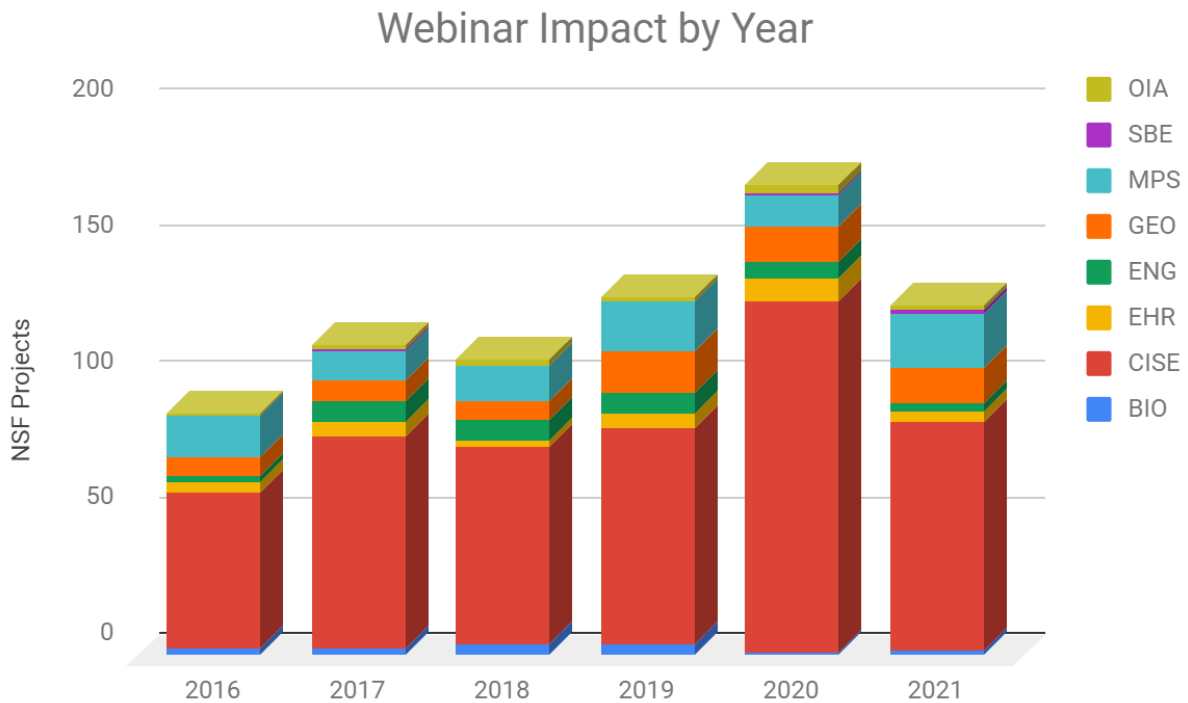
2.6 Webinar impact by year and Directorate

Figure 4. Webinar Project Impact by Year and Directorate

Figure 4 breaks down webinar attendance, grouped by NSF directorate, since the webinar series began in 2016. Each year displays the count of projects for which a representative attended at least one webinar. We see the majority of attendees from CISE projects, particularly Campus Cyberinfrastructure (CC*)[11] and Cybersecurity Innovation for Cyberinfrastructure (CICI)[12] awardees.

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[11] NSF CC* program: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf21528
[12] NSF CICI program: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf21512

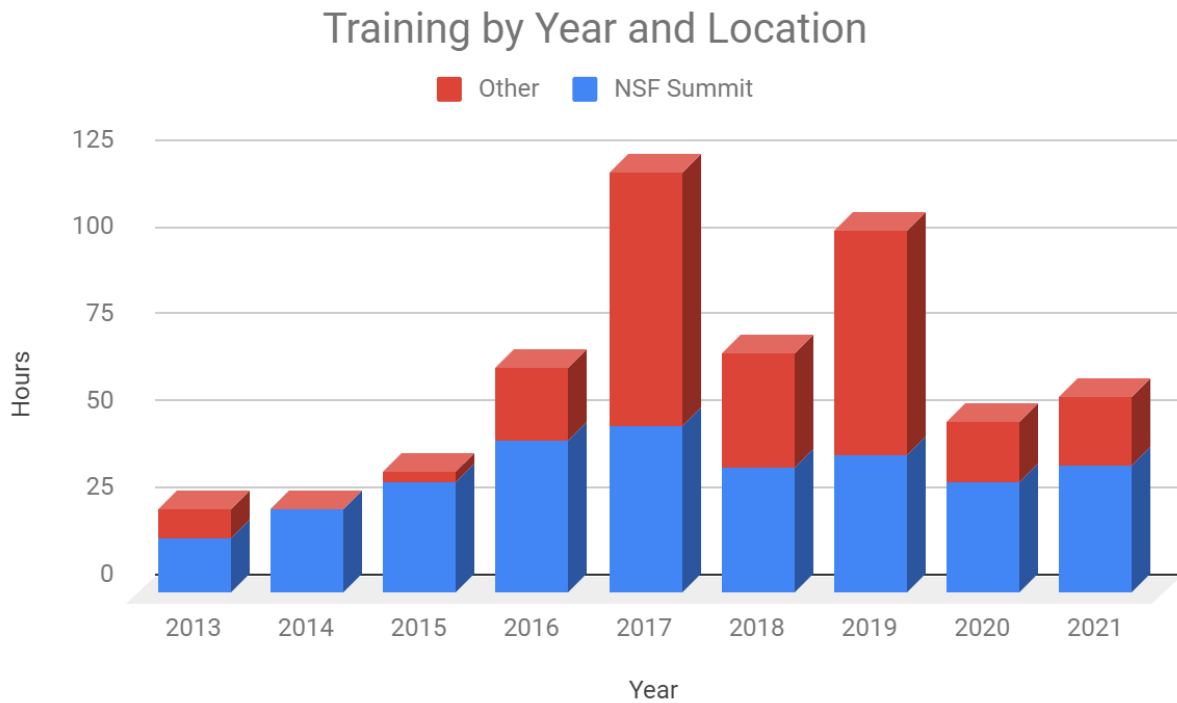## 2.7 Analysis of Training by Year and Location

Figure 5. Training hours by Year and Source

Figure 5 is a summary of the total hours of training delivered to NSF projects in a year, broken down by the NSF Cybersecurity Summit and other training events at which Trusted CI was invited to present. Due to the pandemic, we saw a significant decrease in training events not affiliated with the Summit. However the training opportunities at the Summit have remained fairly consistent throughout the pandemic.

2.8 Trusted CI, the Framework, and Major Facilities

In early 2022 we announced plans[13] to expand adoption of the Trusted CI Framework by creating the Framework cohort, which focuses specifically on NSF Major Facilities. In addition to the cohort, Trusted CI has assembled a group of Ambassadors whose purpose is helping the facilities to establish, evaluate, implement, and evolve their cybersecurity programs, following the methodology established by the Trusted CI Framework.
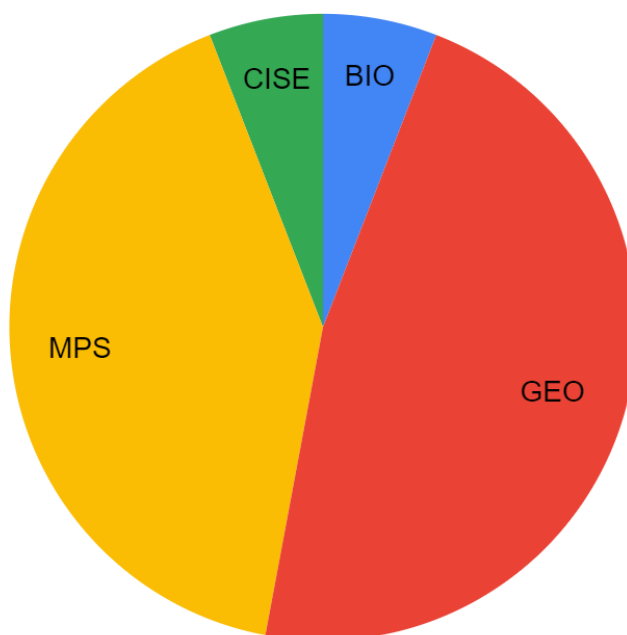

Figure 6. Major Facilities in NSF Directorates

Figure 6 is a pie chart tallying the directorates of the NSF Major Facilities.[14] All but two of the facilities are managed under either the Mathematical and Physical Sciences (MPS) and Geosciences (GEO), and in some cases (Arecibo and IceCube), management of the facility is split between those two directorates. The two exceptions are the Leadership-Class Computing Facility (LCCF), in design phase in the CISE directorate, and the National Ecological Observatory Network (NEON), in operations phase in the BIO directorate. Thus, our increasing focus on the Major Facilities means direct impacts on these four directorates in particular.

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[13] Trusted CI Tackling Major Facilities' Cybersecurity and Ransomware in 2022: https://blog.trustedci.org/2022/01/trusted-ci-tackling-major-facilities.html
[14] Revised 2022-02-23: https://www.nsf.gov/bfa/lfo/docs/major-facilities-list.pdf

The inaugural 2022 Framework cohort[15] includes the following NSF Major Facilities:
- Geodetic Facility for the Advancement of Geoscience (GAGE) - GEO Directorate
- Laser Interferometer Gravitational-wave Observatory (LIGO) - MPS Directorate
- National Optical-Infrared Astronomy Research Laboratory (NOIRLab) - MPS Directorate
- National Radio Astronomy Observatory (NRAO) - MPS Directorate
- National Solar Observatory (NSO) - MPS Directorate
- Ocean Observatories Initiative (OOI) - GEO Directorate

3 Conclusion

In our analysis, Trusted CI's impact on NSF projects has grown significantly since the 2018 Impacts Report.[16] The prior report identified impacts on 190 NSF projects over 5 years (2013-2017), and this report identifies total impacts on over 500 NSF projects over 9 years (2013-2021). Growing attendance at the NSF Cybersecurity Summit and Trusted CI webinars has significantly increased Trusted CI's impacts in recent years.

The publication in 2021 of the "Trusted CI Framework Implementation Guide for Research Cyberinfrastructure Operators"[17] provides a fresh approach to establishing and refining cybersecurity programs for NSF projects and facilities. Our Ambassadors and Framework Cohort programs, new in 2022, demonstrate new approaches for supporting the NSF Major Facilities, in particular. Thus, we look forward to continued growth in Trusted CI impacts in the future, in both breadth and depth.

Additional details about Trusted CI activities are available in our annual project reports, Summit reports, and engagement reports.[18] Also, Trusted CI has summarized the output of our engagements in a collection of success stories.[19]

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[15] 2022 Framework Cohort: https://blog.trustedci.org/2022/01/trusted-ci-launches-operation-framework.html
[16] The 2018 Trusted CI Broader Impacts Project Report: https://hdl.handle.net/2022/22148
[17] Trusted CI Framework Implementation Guide: https://doi.org/10.5281/zenodo.4562446
[18] Trusted CI Reports: https://www.trustedci.org/reports
[19] Trusted CI Success Stories: https://www.trustedci.org/successstories