Nuclear Criticality Safety Repository, Radiation Safety Information Computational Center (RSICC), & NDA Program

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2023 NCSP Technical Program Review

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U.S. DEPARTMENT OF ENERGY

Nuclear Criticality Safety Repository (ORNL IPD3)

- This was a new task for FY2022
- Task conceived at the 2019 TPR in Santa Fe, NM
  - NCSP discussions about the difficulties of finding NCS-related documents on the NCSP website and OSTI.gov
  - NCSP website was not intended as a document repository
- OSTI is a specialized repository for this document collection.
  - All documents in the collection are meant to be unlimited in distribution and publicly releasable
  - Many sites do not send their documents to OSTI
- Phase I
  - ORNL/OSTI are working together to ensure all products generated with NCSP funds are stored at OSTI, along with improved metadata to make the documents easier to find
  - NCSP GUI idea abandoned after a meeting with OSTI at multiple sites; some funding provided back to NNSA HQ for use elsewhere
- Phase II
  - Legacy documents from the Howard Dyer library and those listed in the LLNL Bibliography, LLNL-TR-760080 list legacy NCS documents
  - These documents will be searched for in the OSTI repository and metadata enhanced
  - Those documents that cannot be found will be considered for the OSTI repository
    - Depends upon documentation that can be found regarding approval for unlimited release
- FY2022 work focused on
  - Sending funds to OSTI via Purchase Order
  - Meetings arranged to focus work efforts in accordance with NCSP proposal
  - Marsha Henley started working on providing NCSP deliverables to OSTI for FY20-FY22 provided by sites each quarter

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NCSP NDA Program (ORNL TS13)

- NDA program is a continuation of the DNFSB 2007-1 Recommendation
- FY2022 funding – $100k
- Mission and Vision document published in FY2021
  - ORNL/TM-2021/2009 "Nondestructive Assay Technical Infrastructure Program Mission and Vision"
  - https://nda.llnl.gov/sites/nda/files/2022-07/ORNL_TM-2021_2009_NDA_Mission_and_Vision-FINAL.pdf
- Due to limited funding in FY22, the following task were supported
  - ORNL Nonproliferation Division successfully executed a Uranium Holdup Measurements Course at ORNL September 19-22, 2022
  - NCSP TS13 funds used to support additional SNAPSHOT work for software testing for NCS NDA measurements throughout the DOE complex (focus in FY22 was at Y-12)
    - The objective of the SNAPSHOT project is to provide a modern, sustainable Holdup Measurement System (HMS) for in situ nondestructive assay (NDA) of fissionable materials for nuclear criticality safety, security, and safeguards.
  - Bowen supported the revision of the ANSI/ANS-8.28 standard for NDA administrative requirements in NCS programs
    - Currently in NCSCC ballot comment resolution process

Uranium Holdup Measurements Course
September 12-15, 2022

Information about DNFSB 2007-1 Recommendation:
https://www.dnfsb.gov/board-activities/recommendations/safety-related-situ-nondestructive-assay-radioactive-materials

Information about SNAPSHOT:
https://www.ornl.gov/technology/800000049

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Nuclear Criticality Safety Repository, Radiation Safety Information Computational Center (RSICC)

Timothy Valentine (ORNL)

February 2022

Presented to NCSP Technical Review

Radiation Safety Information Computational Center (RSICC)

Mission:

Serve as a unique nuclear software and data center for government agencies, universities and private industry by providing a centralized resource for quality-controlled modeling and simulation tools, processed nuclear data, and evaluated experimental benchmarks
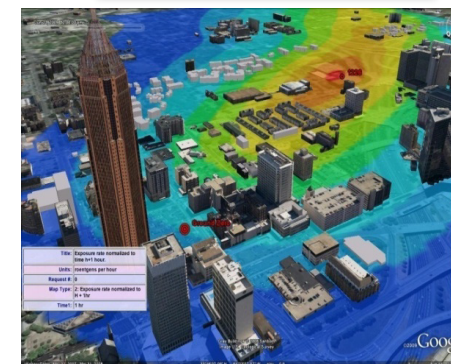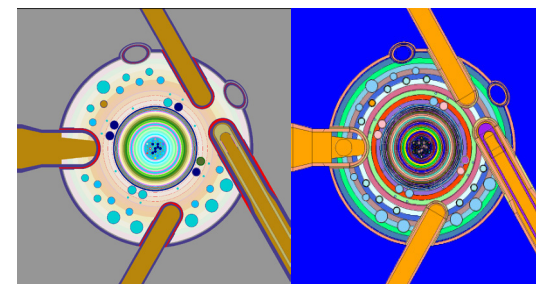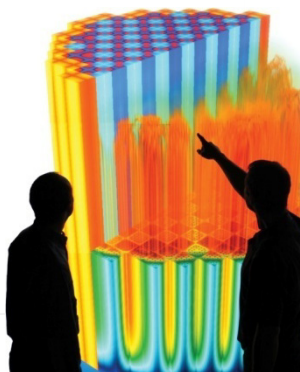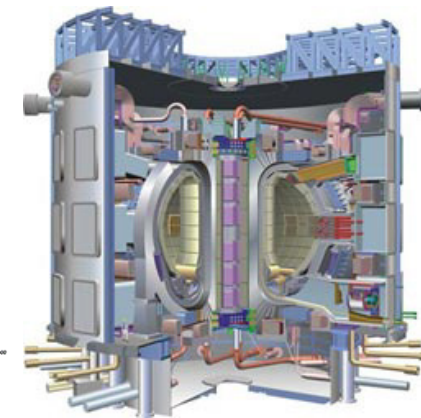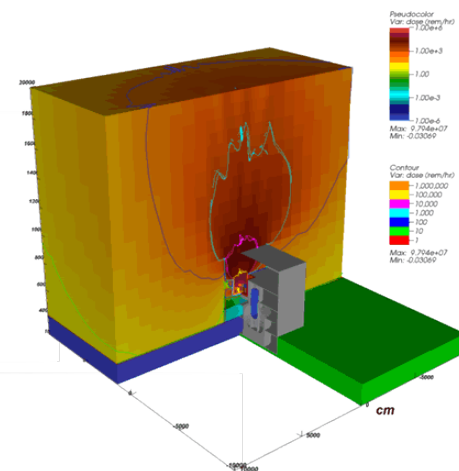
Strategy:

Engage domestic and international efforts that develop advanced M&S tools, evaluated nuclear data and benchmark experiments to make them available to our customers

Statistics:

Over 2,000 packages in the RSICC collection

Nearly 4,000 packages distributed annually

15,000+ active customers from 100+ countries

Operate secure CLOUD server to support international collaborations, e.g., ITER

Major sponsors:

NNSA Nuclear Criticality Safety Program, NNSA Non-Proliferation R&D, DOE Office of Nuclear Energy, Nuclear Regulatory Commission, NNSA Naval Reactors, DOE Office of Science

Radiation Source Terms

Fusion

Advanced Reactors

Nuclear Criticality Safety

Nuclear Security Modeling

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RSICC is a specialized information analysis center that collects and disseminates software and data for applications in nuclear science and technology

- RSICC's operations include various activities
  - Software Packaging and Quality Assurance
  - Customer Registration
  - Customer Request Processing
  - Website Maintenance and Updates
  - Software Exchanges with International Organizations
  - Production of monthly Newsletter
  - *Secure CLOUD operations*
- Records retention is a key aspect of RSICC's operations to allow the Federal government to monitor the use of U.S. nuclear technology

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RSICC's distribution of nuclear M&S tools falls under the regulation of the U.S. Federal Government

- **Department of Commerce: Bureau of Industry and Security (BIS)**
  - 15 CFR Parts 730-774

- **Department of Energy**
  - 10 CFR 810 (basis Atomic Energy Act of 1954)

- Department of State: Directorate of Defense Trade Controls (DDTC)
  - International Traffic in Arms Regulations (ITAR)
  - Military items including nuclear weapons
  - 22 CFR Parts 120-130

- Department of Treasury: Office of Foreign Assets Control (OFAC)

- MCNP® regulated by 10 CFR 810

- Assertion of DOE authority over SCALE under 10 CFR 810 is under consideration – formal letter from the NNSA expected shortly with assertion over current and past versions of SCALE

- Citizenship(s) of the end user determines export regime and approval process for all requests

- For the NCSP community there is limited impact of these regulations on the users

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Single User License Agreement

- ## Single User License Agreement
  - Restricts software to only be used by the Licensee
  - Restricts Licensee from redistributing the software or variants of the software to others
  - License is only valid while the individual is associated with the organization identified on the license agreement and for the approved end use
    - *Some end uses are not permissible under U.S. Federal regulations*
  - Licenses have always been linked with the customer's organization, location and end use – whether implicit, prior to Feb. 2015, or explicit, after Feb. 2015
    - <mark>RSICC is required to screen all organizations against denied parties list maintained by the Federal government to ensure compliance with U.S. export control regulations by the DOC, DOE, DOT, etc.</mark>
    - RSICC is required to review all end uses as not all end uses are permissible even if individuals are physically located and working in the U.S.
  - Prior licensing records have been utilized in several U.S. Federal government investigations of RSICC's customers including those by the DOE Inspector General, the FBI and the U.S. Attorney General's Office
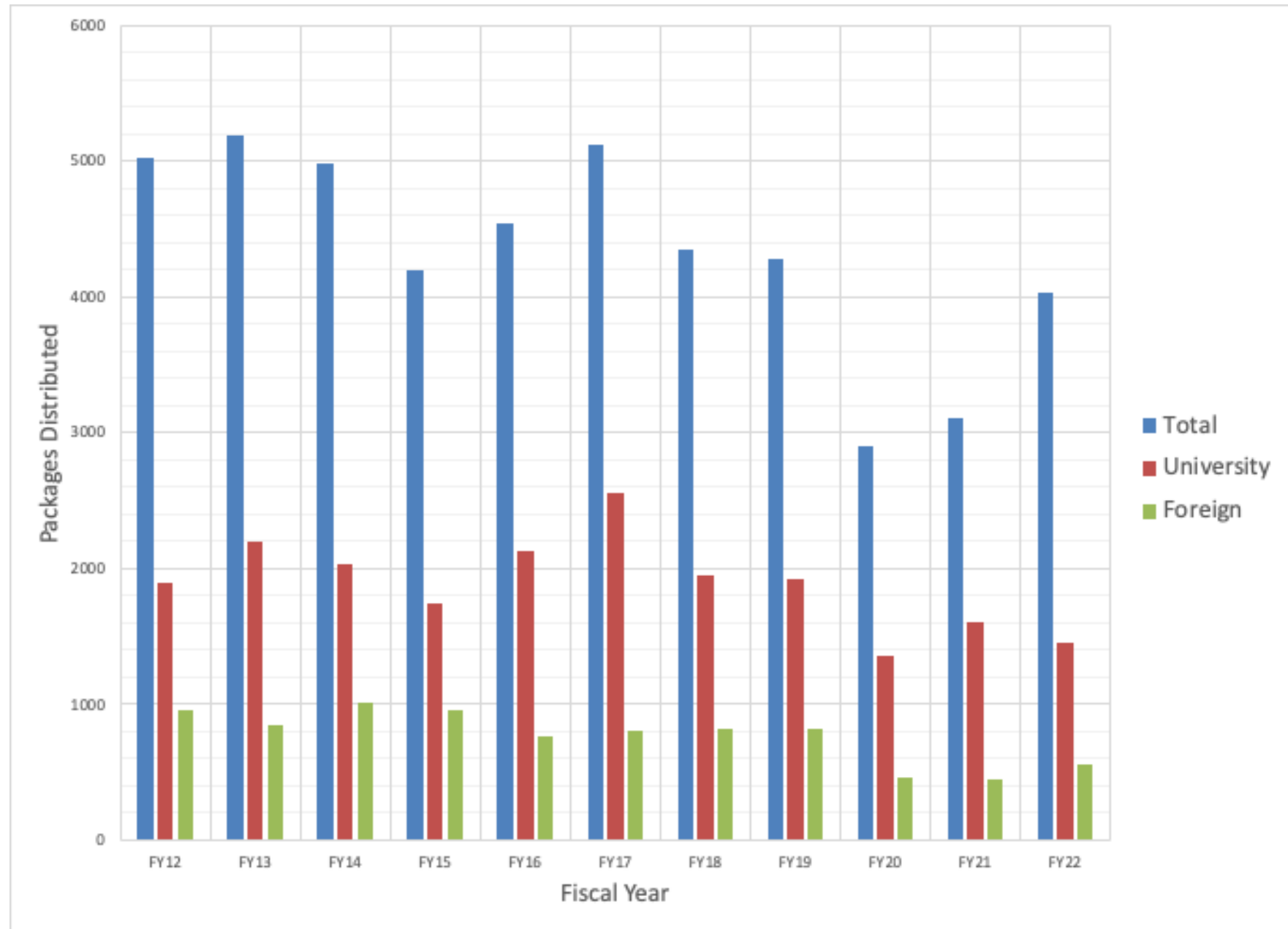
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Export Control Agreements
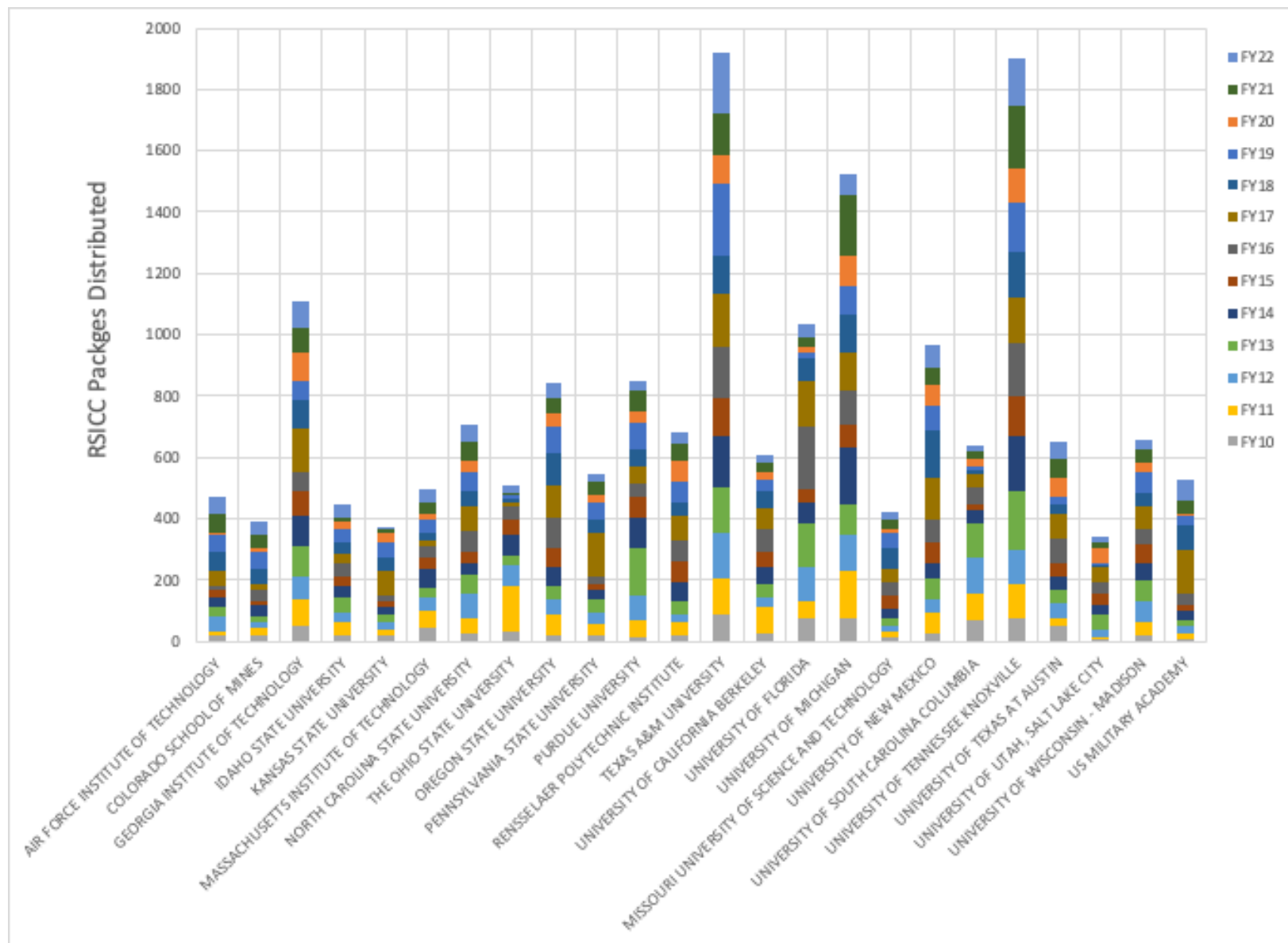
- ## Export Control Agreement
  - Restricts re-export of the software to other locations
  - Restricts use of the software for military or defense purposes unless authorized and approved by the U.S. Government for persons physically located in the U.S.
  - Requires the Licensee to assert that they are not identified on a denied persons' lists or a citizen of a country identified on a parties' lists
  - Identifies the export control jurisdictions for the software
  - Not all end uses are permissible even if the individual is in the U.S. and working for a U.S. organization per U.S. Code of Federal regulations (10 CFR 810)
    - A specific authorization by the U.S. Secretary of Energy is required for engaging in or providing technology for activities listed in 10 CFR 810 (810.7(C)) to foreign persons.
      - Uranium isotope separation (enrichment), plutonium isotope separation, etc.
      - Fabrication of nuclear fuel containing plutonium
      - Heavy water production
      - Development, production or use of a "production" accelerator-driven subcritical assembly (an accelerator driven system for production of weapons grade materials)
      - Development, production or use of a "production" reactor
      - Reprocessing of irradiated nuclear fuel or targets containing special nuclear material

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RSICC's customers and software distribution

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Decrease in RSICC's Distributions in FY20 due to COVID

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RSICC Distributions to Top Universities in FY2022

266 universities have obtained software from RSICC

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RSICC's Most Demanded Software Packages

Annual Distribution Statistics

- Increase in software demand corresponds to:
  - Growth in enrollments in nuclear engineering departments and their greater dependence on modeling and simulation tools
  - Releases of new versions of codes

- Over 24K copies of MCNP® and over 10K copies of SCALE distributed since 2010

- Growing demand for SERPENT that is only available for research purposes and ADVANTG

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RSICC's Commonly Requested Software Packages
MCNP and SCALE are most in-demand packages

Fiscal Year	MCNP	SCALE	ADVANTG	SERPENT	VESTA	SWORD	PENELOPE	RELAP	SAPHIRE	VARSKIN	RASCAL
2010	931	588	0	27	0	22	20	20	0	27	0
2011	1828	818	0	34	1	60	23	15	0	118	5
2012	2422	760	0	47	12	43	43	27	0	138	25
2013	2333	713	0	98	21	28	19	62	0	115	65
2014	2413	589	0	104	15	35	18	42	53	113	361
2015	2196	540	53	117	8	26	23	35	113	48	124
2016	1888	901	101	131	6	34	26	16	115	38	35
2017	1991	1663	64	169	3	30	23	22	97	30	32
2018	1917	1001	67	138	5	17	19	19	113	17	31
2019	1981	712	89	136	4	29	14	9	84	25	17
2020	1174	564	107	134	3	10	6	4	62	11	24
2021	1354	626	118	161	5	10	4	10	82	8	21
2022	1657	872	137	133	5	10	3	5	94	16	31

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RSICC's Operations Summary

- Rigorous process for processing requests and approvals
- Records retention and management that meet needs of the Federal government
  - Records have been solicited for civil and criminal prosecutions
- Quarterly Distribution of NCSP Supported Software
  - Q1: 421 MCNP®, 191 SCALE, and 0 COG
  - Q2: 375 MCNP®, 201 SCALE, and 0 COG
  - Q3: 391 MCNP®, 251 SCALE, and 0 COG
  - Q4: 502 MCNP®, 224 SCALE, and 0 COG
- FY2022 Packages Distributed
  - Total: 4,025
  - University: 1,456

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