OAK RIDGE National Laboratory

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

NCSP
NUCLEAR CRITICALITY SAFETY PROGRAM

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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

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/80000049

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

Timothy Valentine (ORNL)

February 2022

Presented to NCSP Technical Review

ORNL is managed by UT-Battelle, LLC for the US Department of Energy

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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

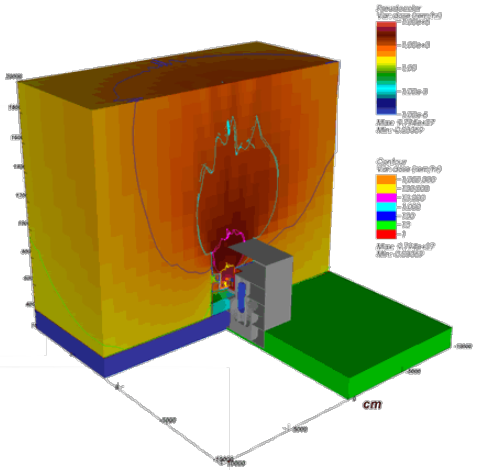
Nearly 4,000 packages distributed annually

15,000+ active customers from 100+ countries

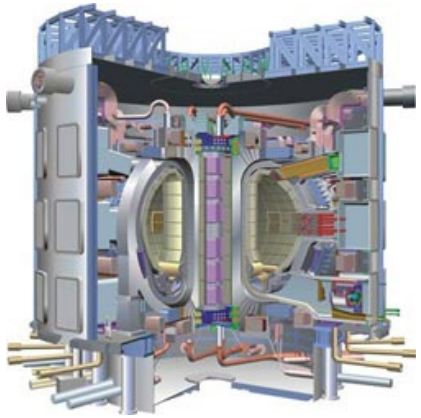
Operate secure CLOUD server to support international collaborations, e.g., ITER

Major sponsors:

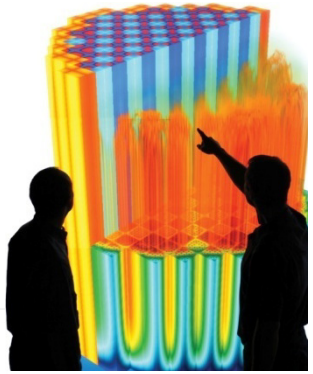
NNSA Nuclear Criticality Safety Program, NNSA Non-Proliferation R&D, DOE Office of Nuclear Energy, Nuclear Regulatory Commission, NNSA Naval Reactors, DOE Office of Science



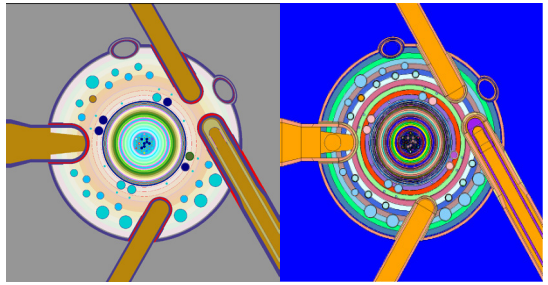
Radiation Source Terms



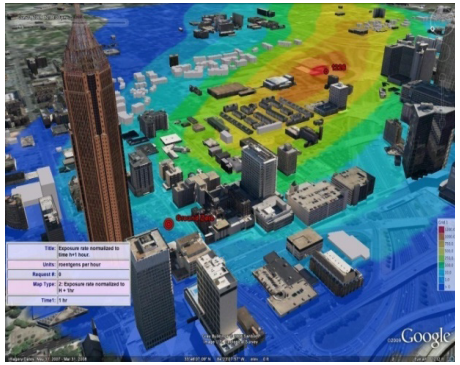
Fusion



Advanced Reactors



Nuclear Criticality Safety



Nuclear Security Modeling

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

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

Single User License Agreement

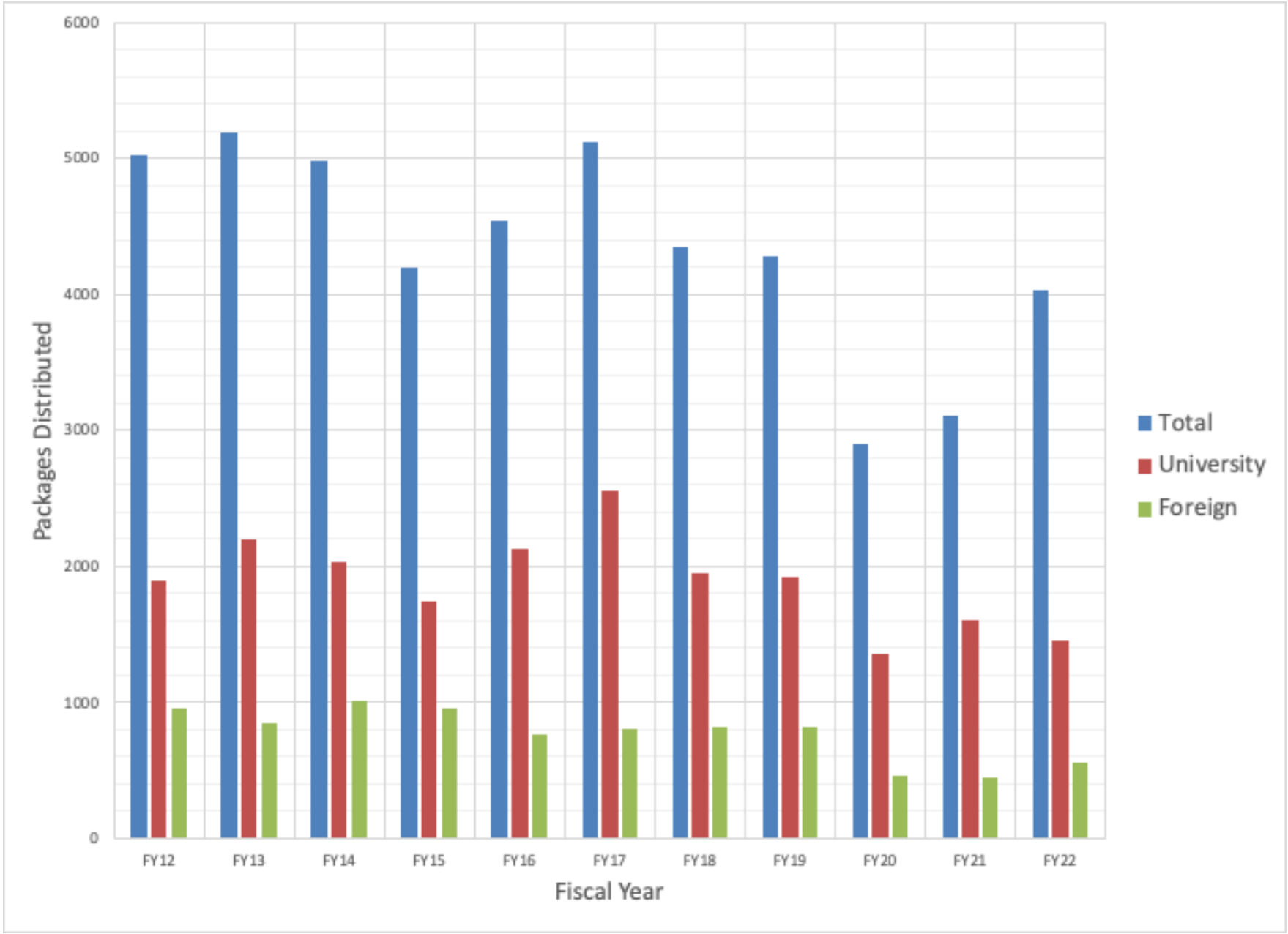
- Single User License Agreement
  - Restricts software to only be used by the Licensee
  - Restricts Licensee from redistributing the software or variants of the software to others
  - License is only valid while the individual is associated with the organization identified on the license agreement and 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
    - 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.
    - 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

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

RSICC's customers and software distribution

Decrease in RSICC's Distributions in FY20 due to COVID



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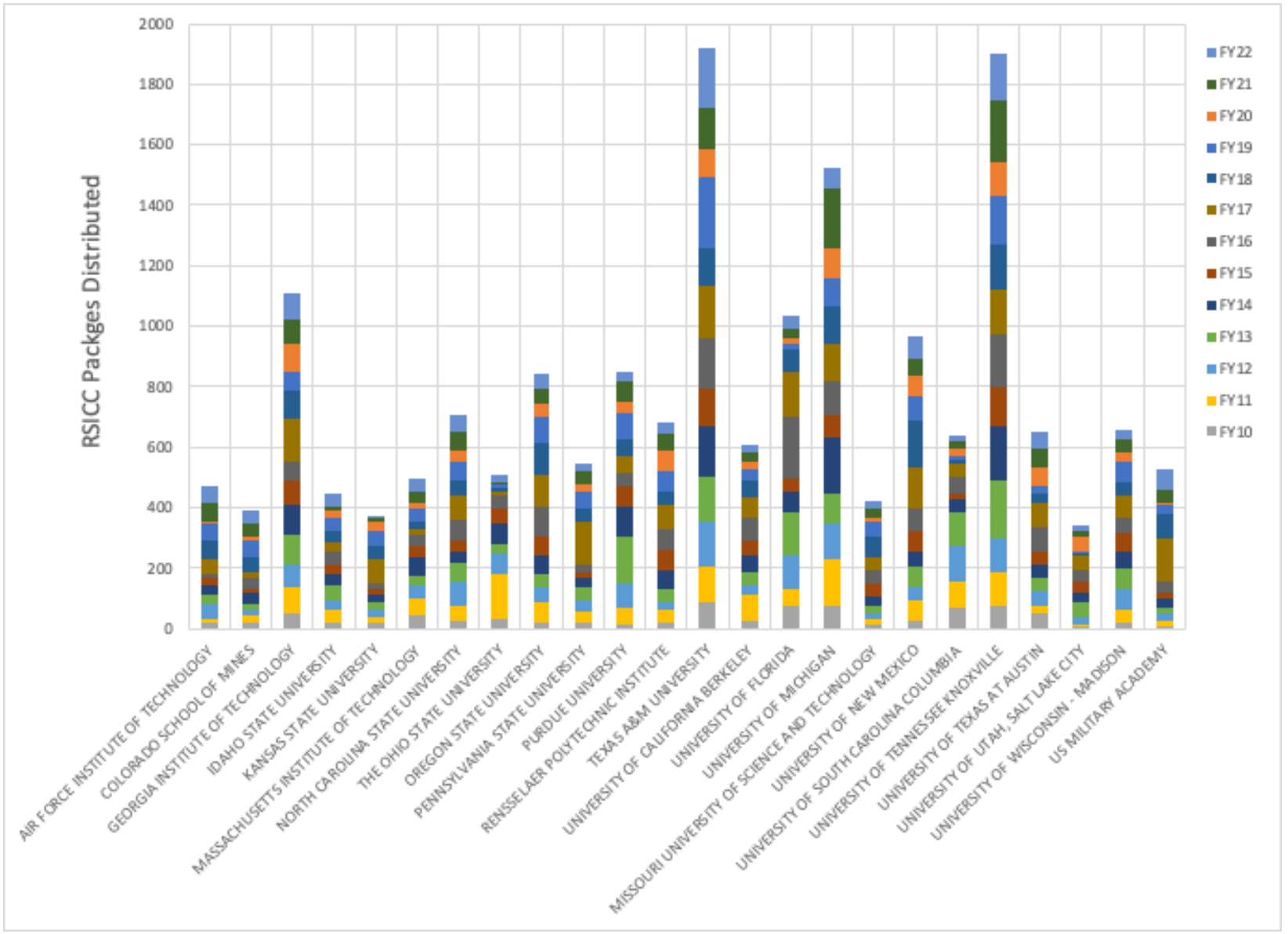
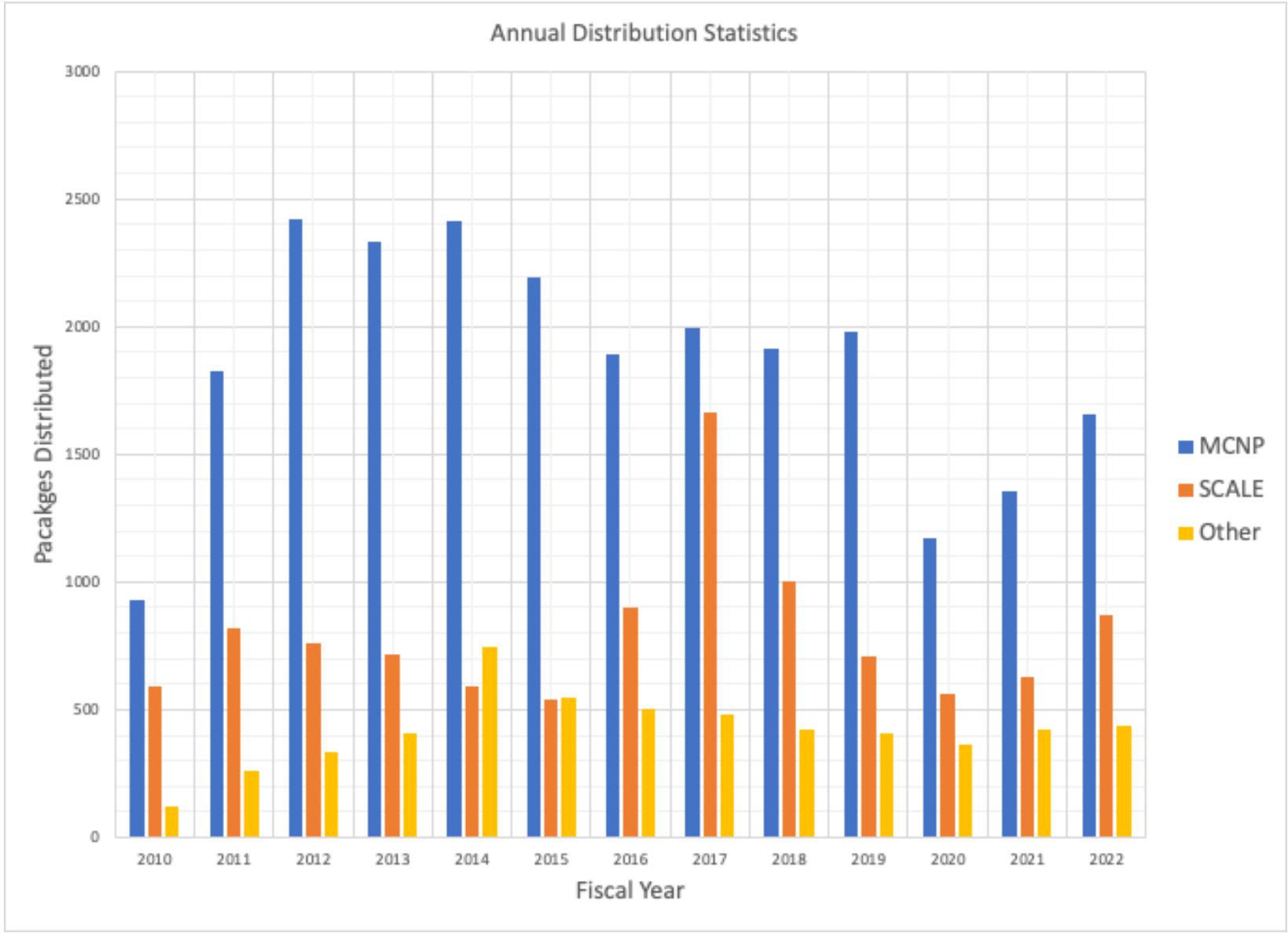
RSICC Distributions to Top Universities in FY2022



266 universities have obtained software from RSICC

RSICC's Most Demanded Software Packages



- 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

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

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
- FY2021 Packages Distributed
  - Total: 4,025
  - University: 1,456