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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0604707N / <i>SEW Architecture/Eng Support</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	33.415	6.952	5.263	7.657	-	7.657	9.774	9.802	9.591	9.783	Continuing	Continuing
2356: <i>Maritime Concept Generation & Development</i>	33.415	6.952	5.263	7.657	-	7.657	9.774	9.802	9.591	9.783	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Maritime Concept Generation & Development (MCGD) project (2356) focuses on the generation, development and validation of warfighting concepts, Concept of Operations (CONOPS) and doctrine in order to eliminate war fighting gaps. Naval Warfare Development Command (NWDC) also manages the Fleet Experimentation program (formerly Sea Trial). In FY2019 the project will execute a number of new experimentations in the areas of Electromagnetic Maneuver Warfare (EMW), Mine Warfare, Naval Integrated Fires, and Unmanned systems and conduct experiments (war simulations, Modeling & Simulation (M&S), at-sea events) to develop emerging Naval concepts.

B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	7.230	5.263	8.662	-	8.662
Current President's Budget	6.952	5.263	7.657	-	7.657
Total Adjustments	-0.278	0.000	-1.005	-	-1.005
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.278	0.000			
• Program Adjustments	0.000	0.000	-1.000	-	-1.000
• Rate/Misc Adjustments	0.000	0.000	-0.005	-	-0.005

Change Summary Explanation

The FY 2021 funding request was reduced by \$1.000 million to account for the availability of prior year execution balances.

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Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0604707N / SEW Architecture/Eng Support				Project (Number/Name) 2356 / Maritime Concept Generation & Development			
COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2356: <i>Maritime Concept Generation & Development</i>	33.415	6.952	5.263	7.657	-	7.657	9.774	9.802	9.591	9.783	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Maritime Concept Generation and Development (MCGD) funding provides naval warfare subject matter expertise, experiment planning expertise, Modeling and Simulation (M&S) support, and analysis expertise to enable execution of the planned experiment efforts (and the individual experiment initiatives contained within) focused on critical warfighting capabilities and the development of Distributed Military Operations and other emerging Naval concepts.

Typical deliverables for each experimental effort include:

- Experiment control plan
- Data Collection and Analysis Plan (DCAP)
- Experiment Analysis Summary Reference Document
- Experiment Engineering Plan
- Final Experiment Report (with DOTMLPF recommendations)
- New/refined doctrine/Tactics, Techniques and Procedures (TTP).

The Maritime Concept Generation and Concept Development project funds four main efforts:

- (1) Provides critical concept development and experimentation manpower and warfighting subject matter expertise aligned with the Concept Generation/Concept Development (CG/CD) program. The priorities for the CG/CD program are to develop concept/concept of operations and explore near/far-term technological and non-technological solutions to war fighting gaps across all naval warfare areas. The associated experimentation efforts include planning, systems engineering and integration, modeling and simulation support, event execution, data collection, analysis, and assessment for a wide-range of experimentation efforts including the examination of prototypes, tactical development and evaluation, support for Science and Technology (S&T) innovation, and program of record system development; venues such as workshops, seminars, war games, limited objective experiments, limited technical experiments, and live at-sea events are used to execute these experimentation efforts.
- (2) Provides naval warfare subject matter expertise, experiment planning expertise, and analysis expertise to plan, execute, and assess experimentation for the fleets and warfighting development centers (WDC) at the operational and tactical levels. This includes a focus on WDC integration role, maritime command and control (C2), advanced cross-domain warfighting, and maritime operations centers (MOCS)/operational level of war (OLW) lines of operations. Seeks to solve fleet-identified warfighting gaps (referenced within the Integrated Prioritized Capability Lists (IPCL), Urgent Operational Needs Statements (UONS), Fleet Commander's Guidance, etc.). The experimentation and prototyping efforts support the "last tactical mile" of many Navy S&T programs by supporting those programs where the technology is mature enough, but requires evaluation on or by a "fleet asset" - ships, airplanes, submarines, and sailors.
- (3) Provides modeling and simulation (M&S) support to Navy experimentation efforts. M&S is used to stimulate decision making during seminar-style and system war gaming experiments and provides the simulated operational environment and capabilities with high-fidelity models such as the Joint Semi-Automated Force (JSAF)

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program. Additionally, where applicable, the Navy Simulation System (NSS) "Monte Carlo" model is also used to give high confidence solutions and outcomes to complex warfighting problems.

(4) Provides for focused, solution-driven tactics development and evaluation through experimentation. This effort is focused on developing near-term doctrine solutions to address specific fleet-identified tactical issues.

Maritime Concept Generation and Concept Development products include:

- Concepts (signed by the CNO that influence future funding and technological development)
 - Enabling concepts
 - Concepts of operations (CONOPS)
 - Final experimentation reports (including findings, insights, and recommendations and DOTMLPF change recommendations and plans for action)
 - Experiment Analysis Summary Reference Documents
 - New/revised doctrinal and Tactics/Techniques/Procedures publications
 - White papers (think pieces) intended to generate further discussion within Navy leadership
- Specific products are listed in the Accomplishments/Plans section of this exhibit.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>Title: Maritime Concept Generation and Development</p> <p align="right">Articles:</p> <p>FY 2020 Plans: Through FY20 Maritime Concept Generation and Development (MDGD) experiment efforts, Navy will continue to provide experiment, analytical and naval mission subject matter expertise support throughout the planning and execution process; identify warfighting deficiencies through experimentation; identify and capture innovative solutions for experiments that address prioritized warfighting gaps; and identify suitable events to support the execution of the following Experimentation Campaigns:</p> <p>FLEET DESIGN EXPERIMENTS In keeping with the CNO's Design for Maintaining Maritime Superiority, the emerging concept "Fleet Design" has been developed. Continuing the development of the supporting doctrine, Tactics, Techniques and Procedures (TTP), Command and Control (C2) as well as the integration and interoperability required between weapon systems and decision makers requires a methodical experimental approach. FY20 experiments (both at-sea and via war simulation) will strive to achieve the objectives as laid out in the accompanying action/implementation plan. Specific events planned for FY20 include:</p>	6.952	5.263	7.657	0.000	7.657
	-	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
HUMAN-MACHINE INTEGRATION (HMI) OF ARTIFICIAL INTELLIGENCE (AI) EXPERIMENTATION - This effort will examine the incorporation of AI capabilities into Naval technologies, TTPs, and C2 processes such as the development of AI-enabled Tactical Decision Aids that autonomously transition data into information.					
ELECTROMAGNETIC MANEUVER WARFARE (EMW) EXPERIMENTATION Navy will conduct multiple events designed to synchronize and align experiment initiatives with Electromagnetic Maneuver Warfare (EMW) tasks to provide solutions to EMW capability gaps and to ensure development of doctrine and Tactics, Techniques and Procedures (TTP) is synchronized with the introduction of new technology and provides the Fleet and Fleet trainers with required doctrine tools at the tactical and operational levels.					
OFFICE OF NAVAL RESEARCH (ONR) TECHNOLOGY INNOVATION GAMES (TIGS). This series of workshops executed in conjunction with ONR will give Fleet operators the opportunity to examine emerging capabilities and determine potential concepts of employment to effectively incorporate innovative capabilities into Fleet warfighting missions and tasks.					
MARITIME CYBERSPACE EXPERIMENT - This classified effort builds upon prior year experiments to further examine Navy vulnerabilities to adversary cyber capabilities.					
PANDARRA WAVE 20 At-Sea Experiment - This classified effort builds upon prior year experiments to further examine Navy vulnerabilities to adversary Intelligence, Surveillance, and Reconnaissance (ISR) capabilities.					
RED NITRUM 20 At-Sea Experiment - This classified effort builds upon prior year experiments to further examine Navy vulnerabilities to adversary electronic attack capabilities.					
COUNTER-UNMANNED SYSTEMS (C-UXS) EXPERIMENT SERIES - This effort will build upon prior year experimentation by examining emerging TTPs and technologies to counter the proliferation of unmanned undersea, surface, and air vehicles. The series will consist of workshops focused on countering various types of unmanned systems culminating in an at-sea cross domain Counter-Unmanned Systems (C-UxS) experiment.					
NAVAL FORCE INTEGRATION EXPERIMENTATION Naval Force Integration experiments (workshops, War simulations, and at-sea events) will examine integration and interoperability issues associated with coordinated USN-USMC operations. The primary goal of the					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>campaign is to reexamine Navy and Marine Corps organizational and command relationships in order to enable effective Naval operations across the maritime domain. Specific events currently planned for FY20 include:</p> <p>LARGE SCALE EXERCISE (LSE) 2020 - This Naval exercise at the Operational to Tactical Level of War in a maritime theater with assigned live and synthetic assets in stressing competitor conditions will provide a comprehensive assessment of the three enabling components of Fleet design - Integration, Distribution, and Maneuver.</p> <p>MINE WARFARE (MIW) EXPERIMENTATION Through workshops, war simulations and at-sea events, the FY20 efforts will continue to examine TTP and C2 construct for our future Mine Counter Measures (MCM) force as new programs of record and unmanned systems come on line, and legacy systems begin to decommission.</p> <p>OPERATIONAL LEVEL OF WAR/TACTICAL LEVEL OF WAR (OLW/TLW) INTEGRATION EXPERIMENTATION OLW/TLW Integration experiments (workshops, war simulations and at-sea events) will examine current and emerging TTPs and current and emerging technologies with a goal of identifying innovative solutions that will support the capstone naval concept of a Fleet Design based on integration, distribution, and maneuver. Specific events planned for FY20 include:</p> <p>DISTRIBUTED MARITIME OPERATIONS (DMO) Experimentation - This effort will address key DMO concept action plan items such as the examination of Fleet Command and Maritime Operation Center (MOC) capabilities, and the employment of unmanned systems in support of DMO.</p> <p>SPACE EXPERIMENT SERIES - This effort will build upon prior year experimentation on the employment of space-based capabilities at the OLW/TLW.</p> <p>EMERGING CONCEPTS WAR SIMULATIONS - This effort will employ multiple seminar war simulations to examine emerging concepts such as Fleet Design, Distributed Maritime Operations, and multiple feeder concepts.</p> <p>FOR FY20 CONCEPT GENERATION/CONCEPT DEVELOPMENT (CG/CD) Continue CG/CD development efforts that carry-over from FY19:</p>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>Additional concepts and CONOPs to be developed in FY20 will be determined through the CG/CD development process and additional external factors. Concepts under consideration include Unmanned Systems in support of DMO, Command and Control in support of DMO, Offensive Mine Warfare, Targeting in support of DMO, and Advanced Autonomous/Semi-autonomous Sustainment Systems.</p> <p>FY 2021 Base Plans: FY21 MCGD experiment efforts, NWDC will continue to provide experiment, analytical and naval mission subject matter expertise support throughout the planning and execution process; identify fleet warfighting deficiencies through experimentation; identify and capture innovative solutions for fleet experiments that address prioritized fleet warfighting gaps. Experiments will address the following areas:</p> <p>COUNTER-INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE AND TARGETING (ISRT) This series of experiments will build upon similar Electromagnetic Maneuver Warfare (EMW)-related experiments completed in recent years to explore technologies and associated Tactics, Techniques and Procedures (TTP).</p> <p>DECEPTION This series of experiments will explore technologies and associated TTP designed to provide the Fleet with effective deception capabilities.</p> <p>RESILIENT COMMUNICATIONS AND MISSION COMMAND This series of experiments will explore technologies and associated TTP designed to provide the Fleet with communication capabilities that can be relied upon in contested environments.</p> <p>LOGISTICS MOBILITY, CAPACITY, AND PROTECTION This series of experiments will explore technologies and associated TTP designed to enhance Fleet logistics capabilities to support operations in contested environments.</p> <p>SPACE AND CYBERSPACE INTEGRATION This series of experiments will explore technologies and associated TTP designed to enhance the capability to integrate space and cyberspace operations.</p> <p>REMOTE AND PASSIVE SENSING INTEGRATION</p>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>This series of at-sea events and workshops will explore technologies and associated TTP designed to enhance capability to take advantage of all available sensor data.</p> <p>LONG RANGE FIRES This series of experiments will explore technologies and associated TTP designed to enhance long range fires capabilities.</p> <p>POINT DEFENSE This series of experiments will explore technologies and associated TTP designed to enhance the capability to provide "last line" of defense against adversary manned and unmanned threats.</p> <p>NAVAL OPERATIONAL ARCHITECTURE This series of experiments will explore technologies and associated TTP designed to provide an integrated operational architecture.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY20 to FY21 increase of \$2.394 million provides for experiment planning and execution support for events designated in the experimentation plan approved by the Commander, United States Fleet Forces (CUSFF), Commander, Pacific Fleet (CPF), and Commander, Naval Forces Europe (NAVEUR). The increase supports the expansion from three (3) to six (6) experiment teams required to support the FY21 experiment execution schedule.</p> <p>The FY 2021 funding request was reduced by \$1.000 million to account for the availability of prior year execution balances.</p>					
Accomplishments/Planned Programs Subtotals	6.952	5.263	7.657	0.000	7.657

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks

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D. Acquisition Strategy

This funding is used to acquire intellectual capital in emerging conceptual and technical areas through contracts providing expertise in concepts and experiment design, execution and analysis to mitigate fleet-identified current and future war fighting gaps.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy											Date: February 2020				
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Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
System Test and Evaluation	C/CPFF	Defense Technical Information Center : Ft Belvoir VA	16.493	3.870	Jan 2019	2.315	Jun 2020	3.525	Dec 2020	-		3.525	Continuing	Continuing	Continuing
System Test and Evaluation	Various	NIWC Atlantic : Charleston, SC	2.734	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
System Test and Evaluation	Various	ONR : Washington, DC	1.370	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
System Test and Evaluation	Various	NAVSEA : Washington, DC	1.334	0.000		0.000		0.000		-		0.000	0.000	1.334	-
System Test and Evaluation	PO	Naval Underwater Warfare Center : Newport RI	0.500	0.000		0.000		0.000		-		0.000	0.000	0.500	-
System Test and Evaluation	C/CPFF	NAVSUP : Norfolk VA	8.120	3.082	Jan 2019	2.948	Jun 2020	4.132	Feb 2021	-		4.132	0.000	18.282	-
Center for Naval Analysis	IA	Center for Naval Analysis : Norfolk, VA	0.154	0.000		0.000		0.000		-		0.000	0.000	0.154	-
Subtotal			30.705	6.952		5.263		7.657		-		7.657	Continuing	Continuing	N/A

Remarks
 The vast majority of the contract costs are for contract labor; primarily on two large Multi-Award contracts, one through DTIC (Defense Services MAC) and one through Joint Staff J-7 MAC. Task orders on the DS MAC contract provide the majority of the Modeling & Simulation support for experimentation and some of the experiment planner support. Task orders on the JS J-7 MAC provide the majority of the experiment design, planner, and execution support.

Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	C/FFP	Navy Warfare Development Command : Norfolk, VA	2.710	0.000		0.000		0.000		-		0.000	0.000	2.710	-
Subtotal			2.710	0.000		0.000		0.000		-		0.000	0.000	2.710	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy							Date: February 2020				
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	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract		
Project Cost Totals	33.415	6.952	5.263	7.657	-	7.657	Continuing	Continuing	N/A		

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
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FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Proj 2356	
Maritime Concept Generation and Development Efforts: Emergent Concepts and Enabling Concepts	
Maritime Concept Generation and Development Efforts: Develop Distributed Maritime Operations Concept / Enabling Concepts	
Maritime Concept Generation and Development Efforts: Unmanned Systems Concept	
Maritime Concept Generation and Development Efforts: Mining Concept	
Experimentation Efforts: Electromagnetic Maneuver Warfare Enablers Experimentation Campaign	
Experimentation Efforts: Unmanned Systems experiment series	
Experimentation Efforts: Counter unmanned Systems experiment series	
Experimentation Efforts: Space Experiment SHF SATCOM Agility	
Experimentation Efforts: Red Nitrum At-Sea Experiment	
Experimentation Efforts: Maritime Cyberspace Experiment Workshop	
Experimentation Efforts: Naval Tactical Grid Enablers At-Sea Experiment Series	

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 2356				
Maritime Concept Generation and Development Efforts: Emergent Concepts and Enabling Concepts	1	2019	4	2025
Maritime Concept Generation and Development Efforts: Develop Distributed Maritime Operations Concept / Enabling Concepts	1	2019	4	2024
Maritime Concept Generation and Development Efforts: Unmanned Systems Concept	1	2019	4	2021
Maritime Concept Generation and Development Efforts: Mining Concept	1	2019	4	2021
Experimentation Efforts: Electromagnetic Maneuver Warfare Enablers Experimentation Campaign	1	2019	4	2019
Experimentation Efforts: Unmanned Systems experiment series	1	2019	4	2019
Experimentation Efforts: Counter unmanned Systems experiment series	1	2019	4	2019
Experimentation Efforts: Space Experiment SHF SATCOM Agility	1	2019	4	2019
Experimentation Efforts: Red Nitrum At-Sea Experiment	1	2019	4	2019
Experimentation Efforts: Maritime Cyberspace Experiment Workshop	1	2019	4	2019
Experimentation Efforts: Naval Tactical Grid Enablers At-Sea Experiment Series	1	2019	4	2019
Experimentation Efforts: ONR Technology Innovation Game (TIG) Workshops- Article Mobile Observation System	1	2019	4	2019
Experimentation Efforts: ONR Technology Innovation Game (TIG) Workshops Artificial Intelligence	1	2019	4	2019
Experimentation Efforts: Distributed Maritime Operations Experiment Series	1	2019	4	2024
Experimentation Efforts: MCM Adaptive Force Package (AFP) at sea experiment	1	2019	4	2019
Experimentation Efforts: Fleet Deception Experiment Series	1	2020	4	2024
Experimentation Efforts: FLEX in Large Scale Exercise (LSE) 2020	1	2019	4	2020

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Experimentation Efforts: Counter-ISRT Experiment Series	1	2020	4	2025
Experimentation Efforts: Resilient Communications and Mission Command Experiment Series	1	2020	4	2025
Experimentation Efforts: Logistics Mobility, Capacity and Protection Experiment Series	1	2020	4	2025
Experimentation Efforts: Space and Cyberspace Integration Experiment Series	1	2020	4	2025
Experimentation Efforts: Remote and Passive Sensing Experiment Series	1	2020	4	2025
Experimentation Efforts: Long Range Fires Experiment Series	1	2020	4	2025
Experimentation Efforts: Point Defense Experiment Series	1	2020	4	2025