NASA Procedural Requirements

NPR 7150.2A
Effective Date: November 19, 2009
Expiration Date: November 19, 2014

COMPLIANCE IS MANDATORY

Printable Format (PDF)

Request Notification of Change (NASA Only)

Subject: NASA Software Engineering Requirements

Responsible Office: Office of the Chief Engineer

Appendix D. Requirements Mapping Matrix

Section of NPR	Requirement Descriptor**	SWE #	Responsibility	Class A OR Class A and Safety Critical Note 2	Class B OR Class B and Safety Critical Note 2	Classes C thru E and Safety Critical Note 2	Class C and NOT Safety Critical	Class D and NOT Safety Critical	Class E and NOT Safety Critical	Class F	Class G	Class H	Technical Authority for NPR 7150.2 by Requirement (Note 3)
Preface	Effective date	1	General	X	X	X	X	X	X	X	X	X	HQ CE
Organizational Capability	Agency software initiative	2	NASA Chief Engineer	X	X	X	X	X	X	X	X	X	HQ CE
	Center plan	3	Each Center	X	X	X	X	X	P (Center)	X	X	P (Center)	HQ CE
	Benchmark	4	NASA Chief Engineer	X	X	X	X	X	X	X	X	X	HQ CE
	Software processes	5	Each Center	X	X	X	X	X	P (Center)	X	X	P (Center)	HQ CE
	List of agency's programs & projects containing software	6	NASA Chief Engineer & Chief, Safety Mission Assurance	X	X	X	X	X		X	X		HQ CE/ CSMA
SW Life-Cycle Planning	Software plans	13	Project	X	X	X	X	P (Center)	P (Center)	X	P (Center)		HQ CE
	Execute planning	14	Project	X	X	X	X	X	X	X	P (Center)		Center Director*
	Cost estimation	15	Project	X	X	X	X	P (Center)	P (Center)	X	P (Center)		Center Director*
	Schedule	16	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
	Training	17	Project	X	X	X	X			X	P (Center)		Center Director*
	Reviews	18	Project	X	X	X	X	X		X	P (Center)		Center Director*
	model	19	Project	X	X	X	X	(Center)		OTS)	(Center)		Director*

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	Software classification	20	Project	X	X	X	X	X	X	X	X	X	HQ CE
SW Life-Cycle Planning	Software classification changes	21	Project	X	X	X	X	X	X	X	X	X	Center Director*
	Software assurance	22	Project	X	X	X	X	X		X	X		HQ CE/ CSMA
	Software safety	23	Project	X	X	X	X	X	X	X	X	X	HQ CE/ CSMA
	Plan tracking	24	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
	Corrective action	25	Project	X	X	X (SO if D-E)	X			X	P (Center)		Center Director*
	Changes	26	Project	X	X	X	X			X	P (Center)		Center Director*
Off The Shelf (OTS) SW	COTS, GOTS, MOTS, etc.	27	Project	X	X	X	X			X	P (Center)		Center Director*
Verification & Validation	Verification planning	28	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
	Validation planning	29	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
	Verification results	30	Project	X	X	X	X	X		X	P (Center)		Center Director*
	Validation results	31	Project	X	X	X	X	X		X	P (Center)		Center Director*
Project Formulation	CMMI levels for class A, B, and C software	32	Project	X	X (Note 1)	P (Center) for Class C only	P (Center)						HQ CE
	Acquisition Assessment	33	Project	X	X	X	X	X		X	X		Center Director*
	criteria	34	Project	X	X	X	X	X		X	X		Director*

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	Supplier selection	35	Project	X	X	X (SO if D-E)	X			X	X	P (Center)	Center Director*
	Software processes	36	Project	X	X	X	X	P (Center)		X (not OTS)	P (Center)		Center Director*
Project Formulation	Software Milestones	37	Project	X	X	X	X	P (Center)		X (not OTS)	P (Center)		Center Director*
	Acquisition planning	38	Project	X	X	X	X	X		X (not OTS)	P (Center)		Center Director*
Government Insight	Insight into software activities	39	Project	X	X	P (Center) + SO	P (Center)	P (Center)		X	P (Center)		Center Director*
	Access to software products	40	Project	X	X	P (Center) + SO	P (Center)			X	P (Center)		Center Director*
	Open source notification	41	Project	X	X	X (SO if D-E)	X			X	P (Center)		Center Director*
	Electronic access to Source code	42	Project	X	X	X (SO if D-E)	X			X	P (Center)		Center Director*
Supplier Monitoring	Track change request	43	Project	X	X	P (Center) + SO	P (Center)			X	P (Center)		Center Director*
	Software measurement data	44	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
	Joint audits	45	Project	X	X	X (SO if D-E)	X			X	P (Center)		Center Director*
	Software schedule	46	Project	X	X	X	X	X		X	P (Center)		Center Director*
	Traceability data	47	Project	X	X	X (SO if D-E)	X			X	P (Center)		Center Director*
	Solicitation	48	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
Software	Document	49	Project	X	X	X	X	X	(Center)	X	X		Director*

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Requirements Development	Software requirements	50	Project	X	X	X	X	X		X	X		Center Director*
	Flow-down & derived requirements	51	Project	X	X	X	X			X (not OTS)	P (Center)		Center Director*
Software Requirements Development	Bidirectional traceability	52	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	P (Center)		Center Director*
Software Requirements Management	Manage requirements change	53	Project	X	X	X	X	X	P (Center)	X	X		Center Director*
	Corrective action	54	Project	X	X	X				X	X		Center Director*
	Requirements validation	55	Project	X	X	X	X			X	X		Center Director*
Software Design	Document design	56	Project	X	X	X	X			X (not OTS)	X (not OTS)		Center Director*
	Software architecture	57	Project	X	X	P (Center) + SO	P (Center)	P (Center)		X (not OTS)	X (not OTS)		Center Director*
	Detailed design	58	Project	X	X	SO				X (not OTS)	X (not OTS)		Center Director*
	Bidirectional traceability	59	Project	X	X	SO				X (not OTS)	X (not OTS)		Center Director*
Software Implementation	Design into code	60	Project	X	X	X	X	X		X (not OTS)	X (not OTS)		Center Director*
	Coding standards	61	Project	X	X	X				X (not OTS)	X (not OTS)		Center Director*
	Unit test	62	Project	X	X	X	X	P (Center)		X (not OTS)	X (not OTS)		Center Director*
	Version description	63	Project	X	X	X	X	P (Center)		X (not OTS)	X (not OTS)		Center Director*
	Bidirectional traceability	64	Project	X	X	SO				X (not OTS)	X (not OTS)		Center Director*
Software Testing		65	Project	X	X	X	X	(Center)		X	(Center)		Director*

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	reports												
	Perform testing	66	Project	X	X	X	X	X	P (Center) (Note 6)	X	P (Center)		Center Director*
	Verify implementation	67	Project	X	X	X	X			X	P (Center)		Center Director*
Software Testing	Evaluate test results	68	Project	X	X	X	X	X		X	P (Center)		Center Director*
	Document defects & track	69	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
	Models, simulations, tools	70	Project	X	X	X (if Note 5 is true)	X (if Note 5 is true)	X (if Note 5 is true)		X	P (Center)		Center Director*
	Update plans & procedures	71	Project	X	X	X	X			X	P (Center)		Center Director*
	Bidirectional traceability	72	Project	X	X	X	X	X		X	P (Center)		Center Director*
	Platform or hi-fidelity simulations	73	Project	X	X	X	X			X	P (Center)		Center Director*
Software Operations, Maintenance, and Retirement	Document maintenance plan	74	Project	X	X	X	X			X	P (Center)		Center Director*
	Plan operations, maintenance & retirement	75	Project	X	X	X	X			X	P (Center)		Center Director*
	Implement plans	76	Project	X	X	X	X			X	P (Center)		Center Director*
	Deliver software products	77	Project	X	X	X	X	X	P (Center)	X	X		Center Director*
	documentation	78	Project	X	X	X	X			OTS)	OTS)		Director*

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Software Configuration Management	Develop configuration management plan	79	Project	X	X	X	X	X		X	P (Center)		Center Director*
	Track & evaluate changes	80	Project	X	X	X	X	P (Center)		X	P (Center)		Center Director*
Software Configuration Management	Identify software configuration items	81	Project	X	X	X	X	X		X	P (Center)	P (Center)	Center Director*
	Authorizing changes	82	Project	X	X	X				X	P (Center)	P (Center)	Center Director*
	Maintain records	83	Project	X	X	X	X			X	P (Center)	P (Center)	Center Director*
	Configuration audits	84	Project	X	X	SO				X	P (Center)		Center Director*
	Implement procedures	85	Project	X	X	X	X	P (Center)	P (Center)	X	P (Center)	P (Center)	Center Director*
Risk Management	Continuous risk management	86	Project	X	X	SO				X	P (Center)		HQ CE/ CSMA
Software Peer Reviews/ Inspections	Requirements, test plans, design & code	87	Project	X	X	X (SO if D-E)	X			X (not OTS)	P (Center)		Center Director*
	Checklist, criteria & tracking	88	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	P (Center)		Center Director*
	Basic measurements	89	Project	X	X					X (not OTS)	P (Center)		Center Director*
Software Measurement	Objectives	90	Project	X	X	(SO if D-E)	X			OTS)	(Center)		Director*

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	Software measurement areas	91	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	P (Center)		Center Director*
	Collection & storage	92	Project	X	X	X (SO if D-E)	X			X (not OTS)	P (Center)		Center Director*
	Analyze data	93	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	P (Center)		Center Director*
	Report analysis	94	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	P (Center)		Center Director*
Software Measurement	Software measurement system	95	Each Mission Directorate	X	X	X	X			X	X		HQ CE
	Objectives & procedures	96	Each Mission Directorate	X	X	X	X			X	X		HQ CE
Best Practices	Agency process asset library	98	NASA Chief Engineer	X	X	X	X	X	X	X	X	X	HQ CE
	Identify applicable practices	99	Each Center	X	X	X	X	X	X	X	X	X	HQ CE
Training	Software engineering training	100	NASA Chief Engineer & Center Training Org.	X	X	X	X	X	X	X	X	X	HQ CE
	Software training plan	101	Each Center	X	X	X	X	X	X	X	X	X	HQ CE
Software Documentation Requirements	plan	102	Project	X	X	+ SO	(Center)	(Center)		OTS)	(Center)		Director*

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	Software configuration management plan	103	Project	X	P (Center) + SO	P (Center) + SO	P (Center)	P (Center)		X	P (Center)		Center Director*
	Software test plan	104	Project	X	X	P (Center) + SO	P (Center)	P (Center)		X	P (Center)		Center Director*
	Software maintenance plan	105	Project	X	P (Center) + SO	SO				X	P (Center)		Center Director*
	Software assurance plan	106	Project	X	X	X	X			X	X		HQ CE/ CSMA
Software Documentation Requirements	Center software training plan	107	Center	X (1 plan per center)	X (1 plan per center)	X (1 plan per center)	X (1 plan per center)	X (1 plan per center)	P (Center)	X (1 plan per center)	X (1 plan per center)	P (Center)	HQ CE
	Center software engineering improvement plan	108	Center	X (1 plan per center)	X (1 plan per center)	X (1 plan per center)	X (1 plan per center)	X (1 plan per center)	P (Center)	X (1 plan per center)	X (1 plan per center)	P (Center)	HQ CE
	Software requirements specification	109	Project	X	X	P (Center) + SO	P (Center)	P (Center)		X	X		Center Director*
	Software data dictionary	110	Project	X	P (Center) + SO	P (Center) + SO	P (Center)			X (not OTS)	X (not OTS)		Center Director*
	Software design description	111	Project	X	X	P (Center) + SO	P (Center)	P (Center)		X (not OTS)	X (not OTS)		Center Director*
	Interface design description	112	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	X (not OTS)		Center Director*
	problem report	113	Project	X	X	+ SO	(Center)			OTS)	OTS)		Director*

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	Software test procedures	114	Project	X	X	X	X			X	X		Center Director*
	Software users manual	115	Project	X	X	SO				X (not OTS)	X (not OTS)		Center Director*
	Software version description	116	Project	X	X	P (Center) + SO	P (Center)	P (Center)		X (not OTS)	X (not OTS)		Center Director*
	Software metrics report	117	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	X (not OTS)		Center Director*
Software Documentation Requirements	Software test report	118	Project	X	X	P (Center) + SO	P (Center)			X	P (Center)		Center Director*
	Software inspection/ peer review/ inspections	119	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	P (Center)		Center Director*
Tailoring of Requirements	Submit generic waiver request	120	Center or Project	X	X	X	X	X	X	X	X	X	HQ CE
	Document approved alternate requirements	121	Center or Project	X	X	X	X	X	X	X	X	X	HQ CE
Authority	approval	122	Center Director	X	X	X	X	X	X				HQ CE

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Compliance	Direction for Technical Authority	124	Center level Engineering Technical Authority	X	X	X	X	X	X	X	X	X	HQ CE
	Compliance matrix	125	Project	X	X	X	X	X	X	X	X	X	HQ CE
	Considerations for waivers	126	Engineering Technical Authority	X	X	X	X	X	X	X	X	X	HQ CE
	Review of "P(Center)"	127	NASA HQ CE	X	X	X	X	X	X	X	X	X	HQ CE
Compliance	Compliance records	128	Center level Engineering Technical Authority	X	X	X	X	X	X	X	X	X	HQ CE
	Check compliance	129	NASA HQ OCE	X	X	X	X	X	X	X	X	X	HQ CE
Software Lifecycle Planning	Software safety plan	130	Project	X	X	X				X (if Safety Critical)	X (if Safety Critical)	X (if Safety Critical)	HQ CE/ CSMA
	IV&V Plan	131	IV&V Program	X (if selected for IV&V)	X (if selected for IV&V)	X (if selected for IV&V)	X (if selected for IV&V)						HQ CE/ CSMA
	Assessment	132	organization	X	X	X	X	X	X	X	X	X	CSMA

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	Software safety determination	133	Project & SMA organization	X	X	X	X	X	X	X	X	X	HQ CE/ CSMA
	Safety-critical software requirements	134	Project	X	P (Center)	(see Note 7)							Center Director* (joint Engineering TA & SMA TA if delegated)
Software Implementation	Static analysis	135	Project	X	X	X (SO if D-E)	X						Center Director*
	Validation of software development tools	136	Project	X	X	X (if Note 4 is true)	X (if Note 4 is true)	X (if Note 4 is true)					Center Director*
Software Peer Reviews/ Inspections	Peer Review/ inspections of Software plans	137	Project	X	X	P (Center) + SO	P (Center)			X (not OTS)	P (Center)		Center Director*
Software Documentation Requirements	Software safety plan contents	138	Project	X	X	X				X (if Safety Critical)	X (if Safety Critical)	X (if Safety Critical)	HQ CE/ CSMA
Compliance	"Shall" statements in this NPR	139	Project, Center	X	X	X	X	X	X	X	X	X	HQ CE
	"P (Center)"	140	Project, Center	X	X	X	X	X	X	X	X	X	HQ CE

* Center Director or the Center Director's designed Engineering Technical Authority

** See Requirement in NPR for full description

Grey shaded box indicates that the responsibility for that requirement is not at the project level

X - "Required" - Responsible party is required to meet the requirement as written.

X (not OTS) - Project is required to meet except for off-the-shelf software.

P (Center) - Per approved Center defined process which meets a non-empty subset of the full requirement.

SO - "Safety Only" - Project is required to meet this requirement to the extent necessary to satisfy safety critical aspects of the software.

P (Center) + SO - Responsible party is required to meet this requirement to the extent necessary to satisfy safety critical aspects of the software and follow Center defined P (Center) processes for other aspects of the software.

Blank Space - Project is not required to meet the requirement.

Note 1 - For Class B software, in lieu of a CMMI rating by a development organization, the project will conduct an evaluation, performed by a qualified evaluator selected by the Center Engineering Technical Authority, of the seven process areas listed in SWE-032 and mitigate any risk, if deficient. This exception is intended to be used in those cases in which NASA wishes to purchase a product from the "best of class provider," but the best of class provider does not have the required CMMI rating. When this exception is exercised, the Center Engineering Technical Authority should be notified.

Note 2 - Note that there are additional safety requirements in NASA-STD-8719.13, NASA Software Safety Standard.

Note 3 - NASA Headquarters' Chief, Safety and Mission Assurance has co-approval on any waiver or deviation decided at the HQ level that involves safety-critical software. NASA Headquarters' Chief Medical Officer has co-approval on any waiver or deviation decided at the HQ level that involves software with health and medical implications. Waivers and deviations decided at the Center level are to follow similar protocol when software safety critical or health and medical issues are involved.

Note 4 - When software development tools are used to develop or maintain Class A, B, C, or safety-critical software.

Note 5 - When software models, simulations, and analysis tools are used to perform qualification of flight software or flight equipment.

Note 6 - No test plans are required but the project shall perform software testing.

Note 7 - This NPR does not require SWE-134 for Classes C thru E and Safety Critical; however it is highly recommended that software within this category use SWE-134 as a checklist to support the identification of safety related risks and their mitigations.

HQ CE - NASA Headquarters' Chief Engineer

HQ CSMA - NASA Headquarters' Chief, Safety and Mission Assurance

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