

Determining the Potential for IFDIS



Briefing to the Joint Intermittence Tester (JIT) Team

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Purpose

- Update the JIT on use of the Maintenance and Availability Data Warehouse (MADW) to determine potential candidates for the Intermittent Fault Detection and Isolation System (IFDIS)
- Update JIT on methodology used to determine potential savings by industrializing IFDIS process for all possible electronics components.

Maintenance and Availability Data Warehouse

- Started in FY2005 as a result of Congressional interest in reducing impact of corrosion on DoD weapons systems, infrastructure and facilities
- Involves obtaining all maintenance records, costs and non-availability results.
- Cost data back to FY04, availability data to FY08.
- Includes value added data elements such as:
 - 1) Object – solved through machine learning
 - 2) Action – solved through machine learning
 - 3) Standard work breakdown structure (WBS)
 - 4) Corrective and preventive work classifications
 - 5) Parts verses structure classifications
 - 6) Availability and cost results embedded together
 - 7) Environmental severity index (ESI)
 - 8) All cost and availability results reconciled to authoritative top-down totals

MADW – Sample of Data Record

(10 of the approximately 40 labor data fields showing)

ENDITEMUNIQUEID	AVAILCD	Maint NMC	Maint Operation	Maint Object	LMIWBS	UNITCD	Maintenance Cost	MAINTDLH	ESI
163989	Z	0.11	Adjust	Launcher	FM353	N39787	\$3,751.84	8	1
160107	Z	0.14	Strip	Door	RC020	M09383	\$6,285.91	18	7
166365	Z	0.07	Replace	Hydraulic hose	RR062	NF9823	\$414.25	1.2	12
166291	Z	0.11	Clean	Locking pin	RC034	N09822	\$681.00	2	3
166388	Z	0.13	Check	Track	RI351	M53923	\$3,300.35	3	5
164075	Z	0.09	Replace	Hydraulic hose	RR062	N09299	\$62.60	0.2	12
164075	Z	0.15	Replace	Hydraulic hose	RR062	N09299	\$62.60	0.2	18
164075	Z	0.14	Replace	Hydraulic hose	RR062	N09299	\$214.32	0.8	3
160825		0	Weld	Airframe	RF020	M09202	\$543.59	2	5
156438		0	Repair	Gearbox	RF053	M09793	\$3,164.43	5.8	6
154853		0	Repair	Gearbox	RF053	M52790	\$3,215.00	6	8
165910		0	Install	Computer	FL116	M09439	\$158.80	1	2
165931		0	Repair	Drive Unit	FF062	N09678	\$1,016.37	1	4
166407		0	Install	Alarm	FL194	N09355	\$257.80	1.2	11
166532		0	Install	Alarm	FL194	N4544A	\$257.80	0.2	10
166533		0	Configure	Controller	FM095	N55138	\$407.79	0.1	9
166532		0	Configure	Alarm	FM194	N55138	\$74.34	0.1	9

Approximately 800 million maintenance records for weapon systems for all services

All weapon systems studies now being executed on a yearly basis – soon to be quarterly

All yearly maintenance costs accounted for relative to these systems

Standardized data structure across DoD

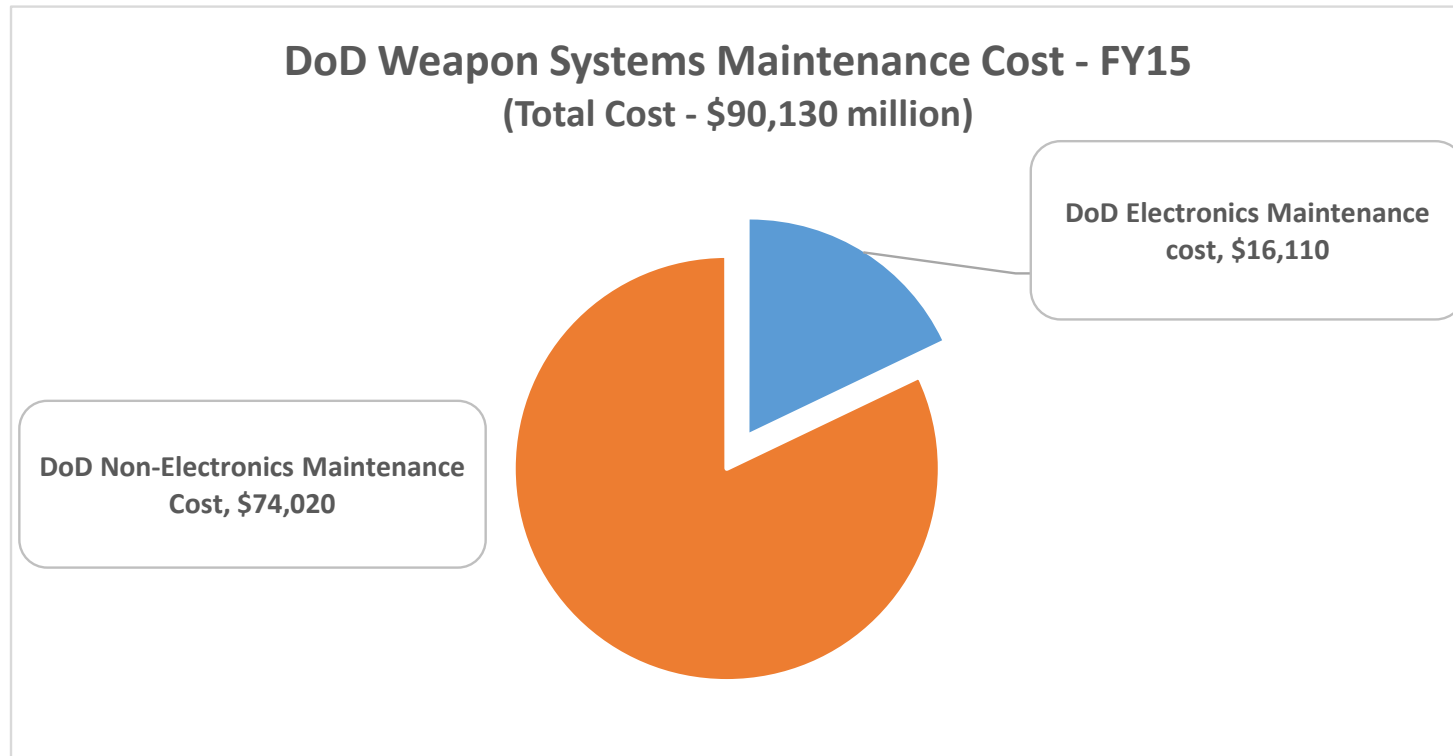
Availability results for ground, ships and aviation systems since FY2008.

The NMC totals equal the reported totals for each Service by weapon system.

Contains both labor (task) and materials (parts) detail. Parts are linked to labor through the job control number.

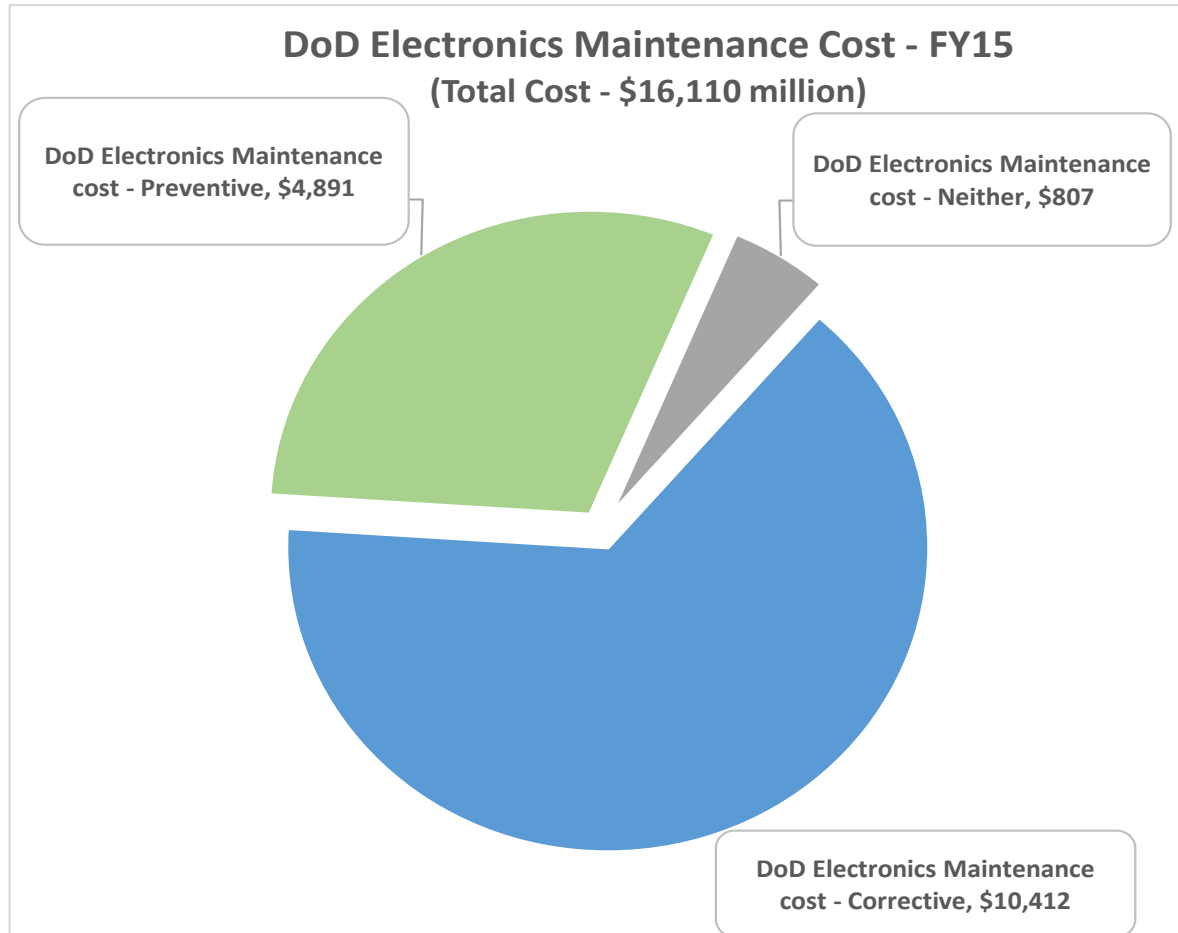
Results can be determined to the action and object level of detail

Electronics Cost as a Subset of Weapons Systems Maintenance Costs



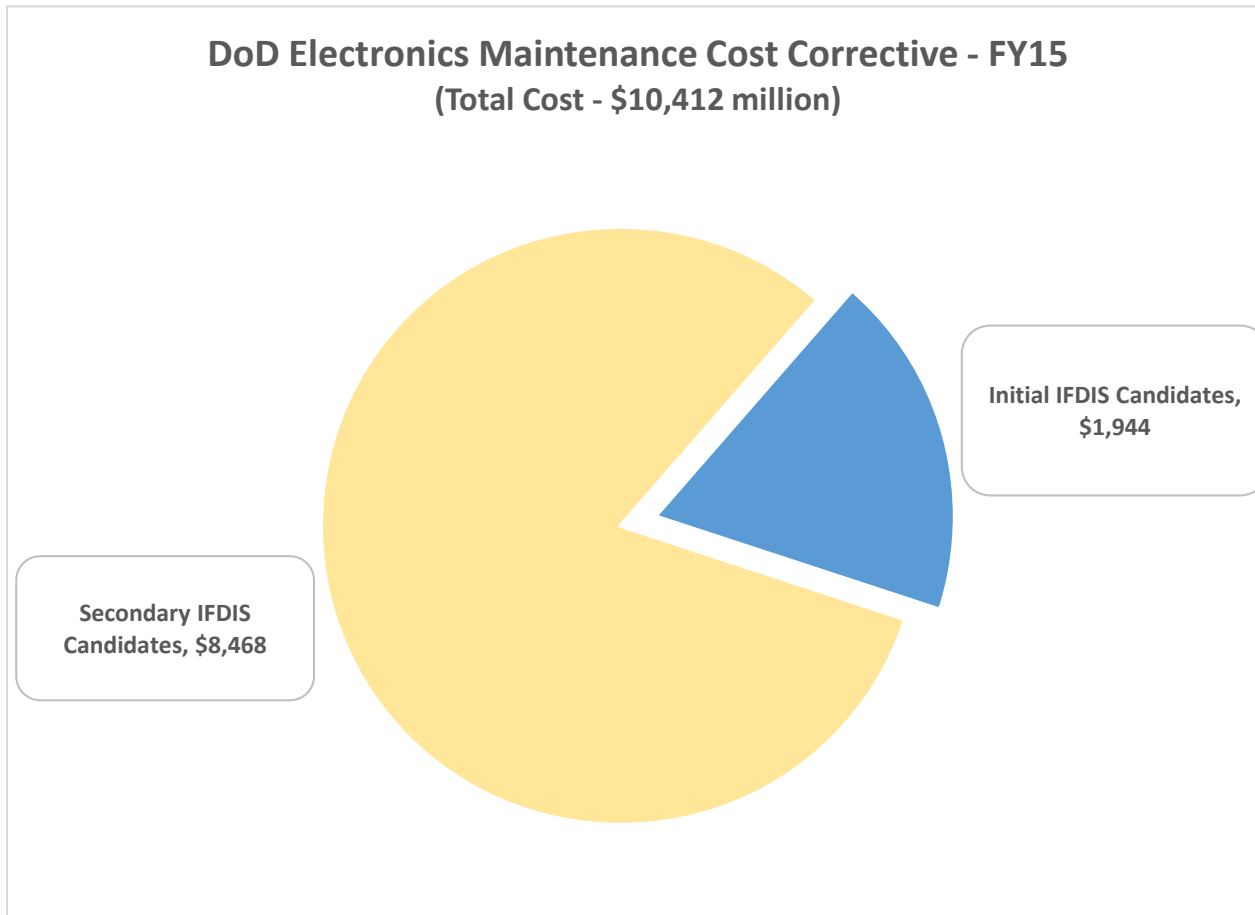
Electronics maintenance (\$16,110 million) includes all electronics, not just LRU's and WRA's

Electronics Cost By Nature of Work



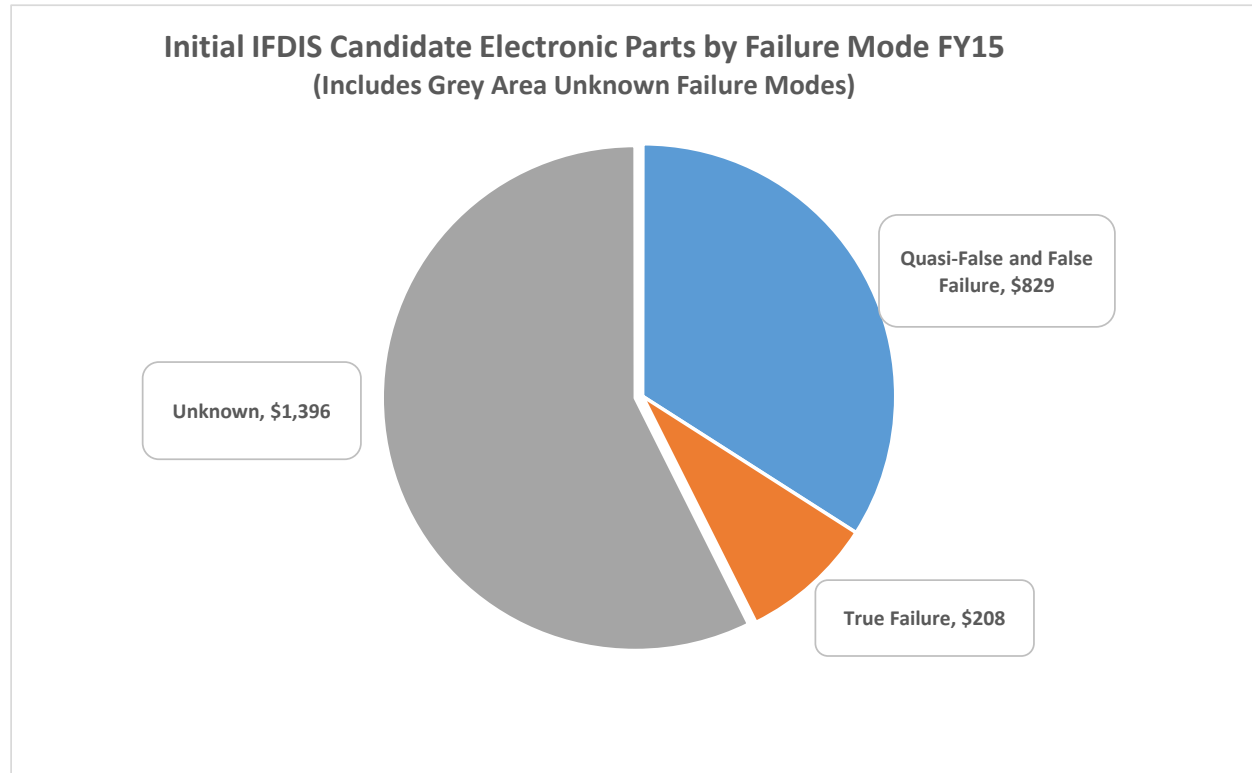
We will focus on only the corrective maintenance portion (\$10,412 million)

Corrective Electronics Cost IFDIS Potential



We can isolate initial IFDIS candidates (LRU's, WRA's) and secondary IFDIS candidates (non LRU's and WRA's)

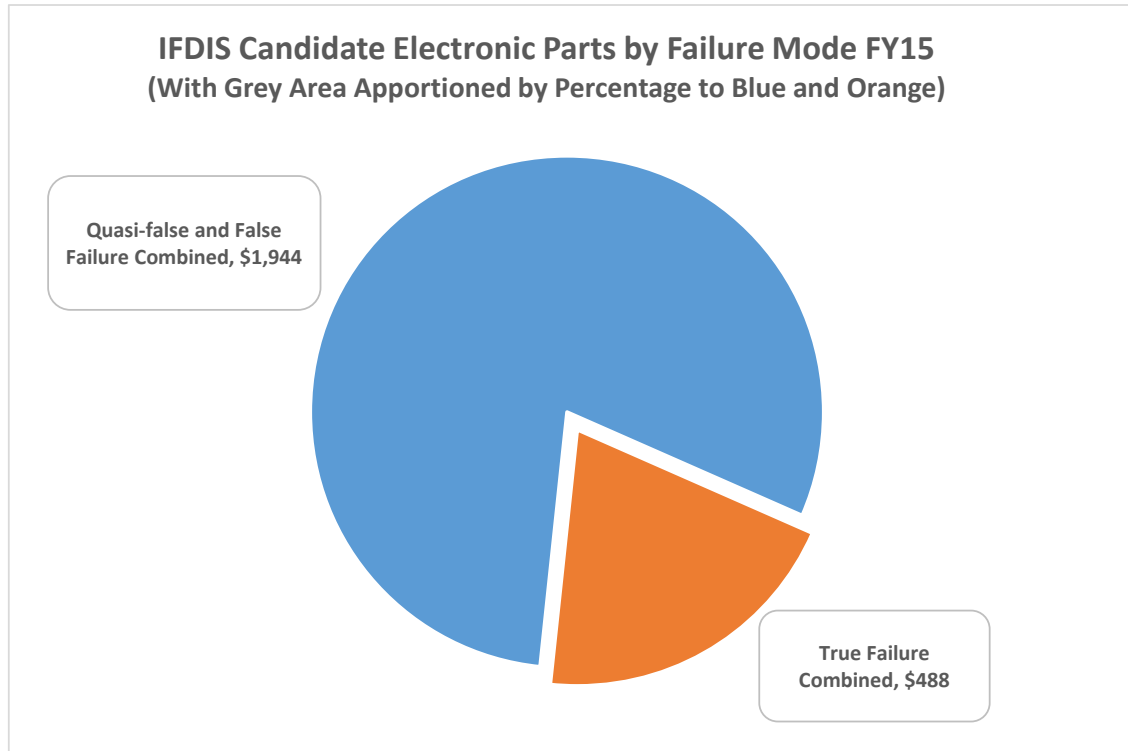
Determining Initial IFDIS Candidates



Using FY15 data and isolating potential LRU, WRA type objects and NIINs, the failure recipe tagged \$829 million costs as quasi-false and false failures and \$208 million in cost as true failures.

There was another \$1,396 million of the same objects and NIINs, which had corrective maintenance actions but not tagged by the failure recipes. We apportioned this population into the blue and orange by ratio.

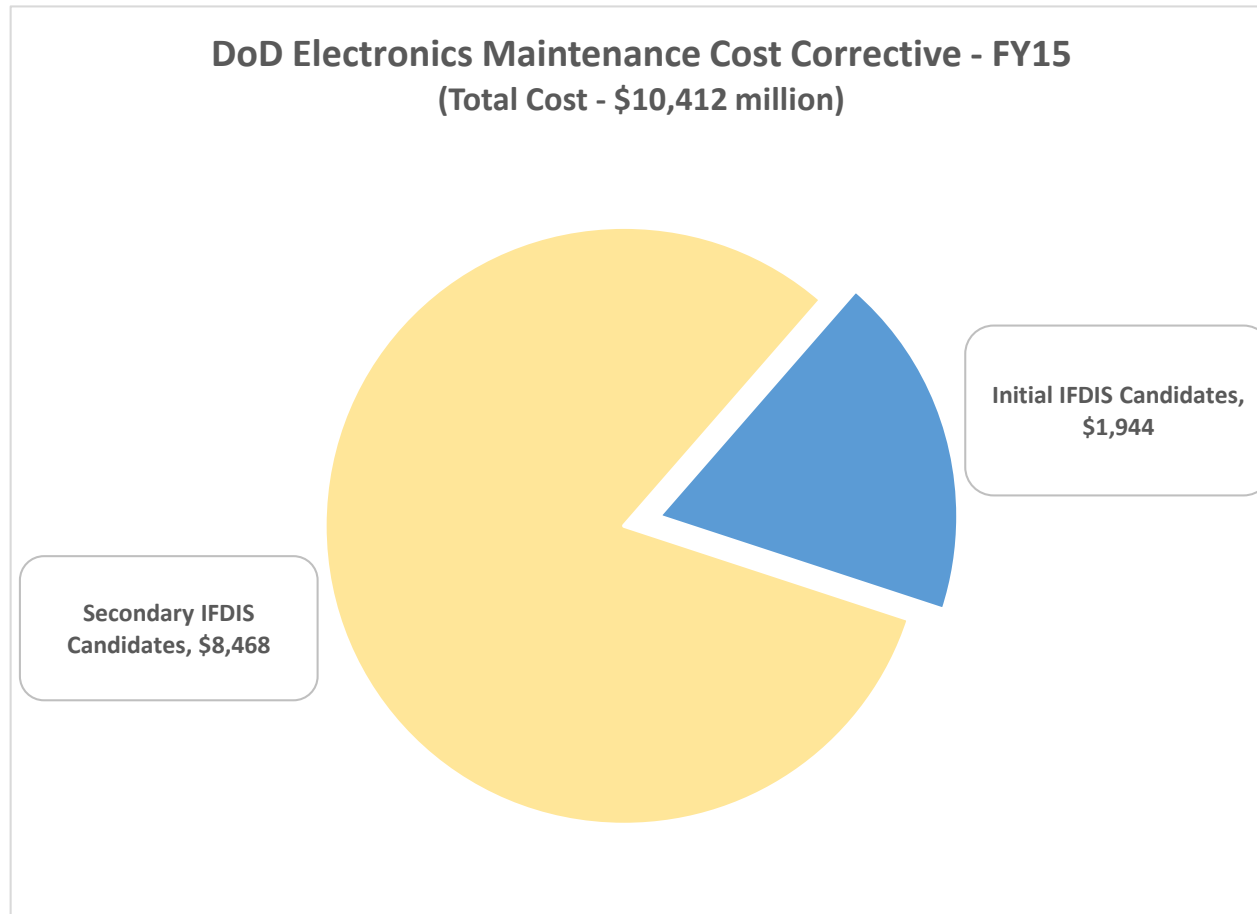
Determining Initial IFDIS Candidates



The resulting true failure (orange area) and quasi-false and false failure (blue area) totals are as depicted above after the “Unknown” (grey area from previous slide) is apportioned into orange and blue areas.

The annual total for the true failure (orange area) is \$488 million. The annual total for the quasi-false and false failures (blue area) is **\$1,944 million**. This is the initial IFDIS candidate total.

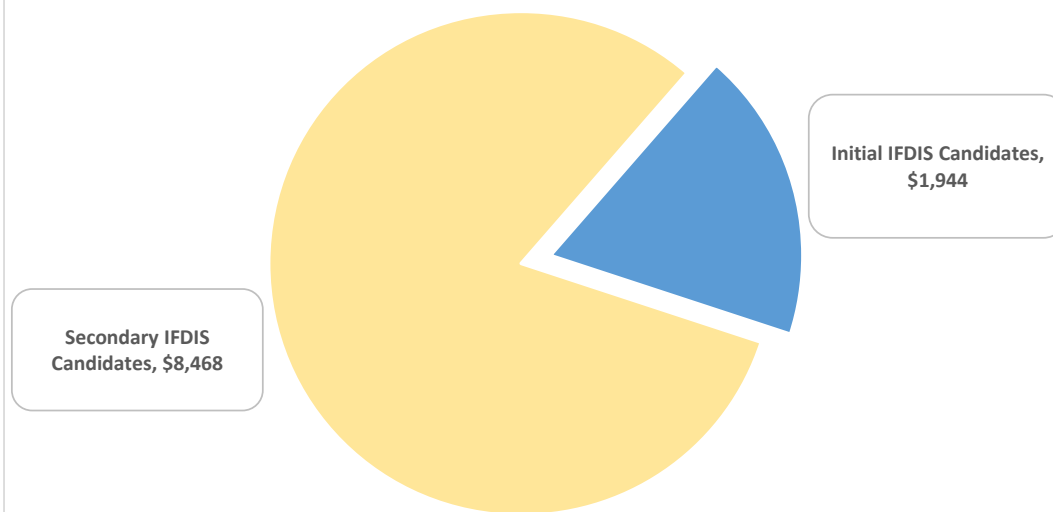
Determining Secondary IFDIS Candidates



The secondary IFDIS candidates are electronics components that have experienced corrective maintenance work that are not initial IFDIS candidates

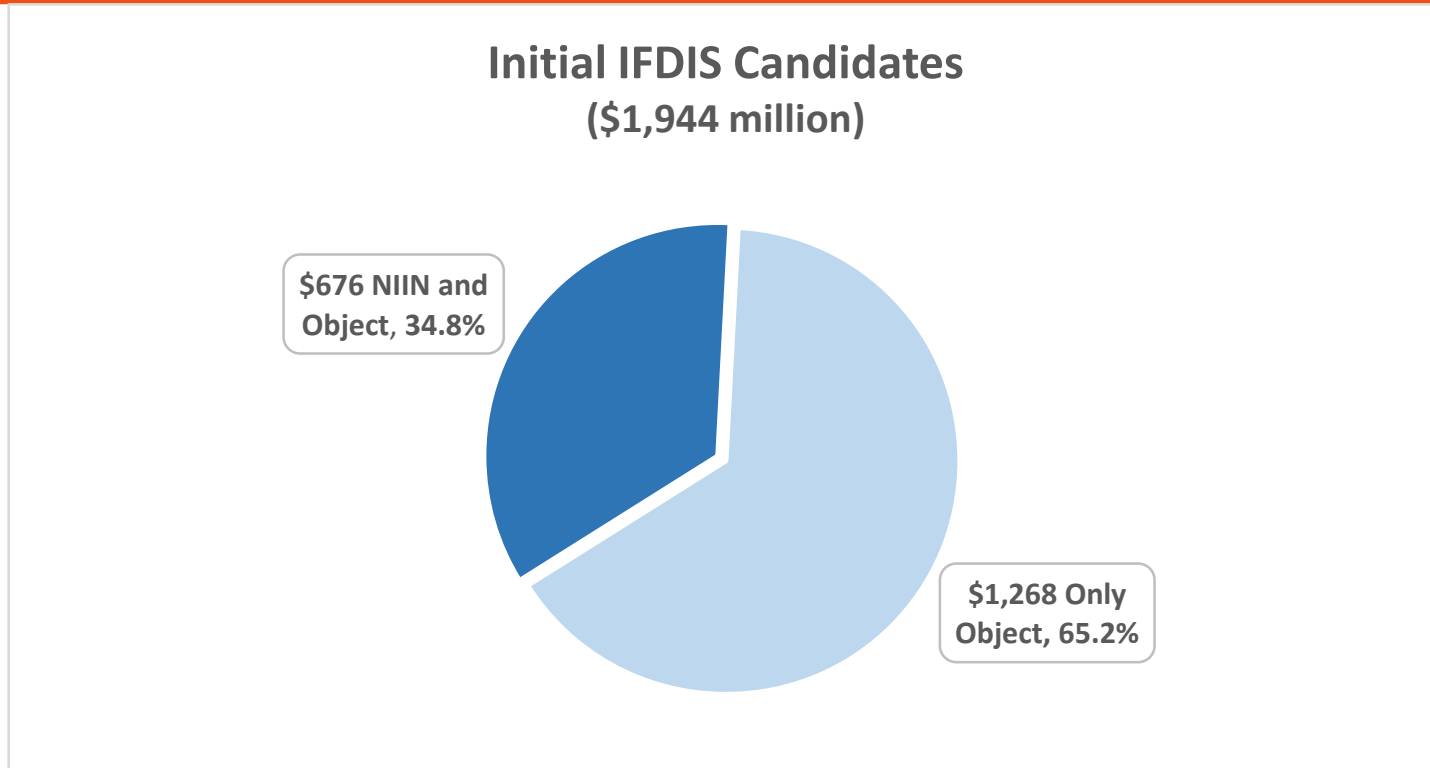
Total IFDIS Potential Savings

DoD Electronics Maintenance Cost Corrective - FY15
(Total Cost - \$10,412 million)



Category	Annual Costs (\$ millions)	Total potential annual gains (\$ millions)
IFDIS gains from Quasi-false and false failure remedy (Initial IFDIS candidates)	\$1,944	\$1,944
Potential secondary IFDIS electronic component gains with 10% improvement	\$847	\$2,791
Potential secondary IFDIS electronic component gains with 20% improvement	\$1,694	\$3,638
Potential secondary IFDIS electronic component gains with 30% improvement	\$2,541	\$4,485
Potential secondary IFDIS electronic component gains with 40% improvement	\$3,387	\$5,331
Potential secondary IFDIS electronic component gains with 50% improvement	\$4,234	\$6,178

Initial IFDIS Candidate ID by NIINs and Objects



Of the data records which comprise the \$1,944 million worth of initial IFDIS candidates cost, 34.8% percent of these records identified the item being worked on by NIIN. All of the records identified the item being worked on by object. We therefore present two lists of initial IFDIS candidates for each service – one by NIIN and the other by object and type/model series of the end item.

Initial IFDIS Candidate ID by NIIN

(Navy example – costs and non-availability are two year totals for FY14-15)

Service	Criticality Code	Safety Critical?	NIIN	Maintenance Cost	Non-available days	Nomenclature
Navy	Y	No	013042152	\$15,370,010	754	CONVERTER UNIT,GENE
Navy	Y	No	015911354	\$15,050,678	33	SENSOR UNIT,ELECTRO
Navy	Y	No	014950012	\$14,818,493	0	INERTIAL MEASURING
Navy	Y	No	015518187	\$6,448,118	0	TRANSFORMER,POWER
Navy	X	No	014554501	\$5,773,131	477	DISPLAY UNIT,HEAD-UP
Navy	Y	No	015340697	\$5,652,936	0	CIRCUIT CARD ASSEMBLY
Navy	S	Yes	010595889	\$5,392,032	0	CIRCUIT CARD ASSEMBLY
Navy	0	No	010874423	\$4,525,048	72	RECEIVER-TRANSMITTER,RADAR
Navy	V	No	008157282	\$4,500,733	13	INDICATOR
Navy	X	No	014814599	\$4,239,823	0	MODEM ASSEMBLY,COMMUNICATIONS
Navy	Y	No	015507849	\$4,200,337	31	CONVERTER FREQUENCY
Navy	F	Yes	015087987	\$4,030,519	370	COMPUTER,FLIGHT CONTROL
Navy	N	No	012168124	\$3,988,943	57	PROCESSOR,RADAR TARGET DATA
Navy	X	No	010121938	\$3,940,351	40	NAVIGATION SET,TACTICAL AIR NAVIGATION SYSTEM
Navy	N	No	013336621	\$3,742,916	193	DISPLAY UNIT,HEAD-UP
Navy	Y	No	015221457	\$3,733,621	197	COMPUTER,FLIGHT CONTROL
Navy	X	No	013726234	\$3,452,113	0	REGULATOR,VOLTAGE
Navy	Y	No	013755187	\$3,405,498	13	COMPUTER,RADAR DATA
Navy	F	Yes	015486318	\$3,380,616	108	COMPUTER,FLIGHT CONTROL
Navy	0	No	007196882	\$3,245,462	21	TRANSMITTER,ANGLE OF ATTACK

Initial IFDIS Candidate ID by Object/TMS

(Air Force example - costs and non-availability are two year totals for FY14-15)

Service	Object	TMS	Maintenance cost	Non-available days
Air Force	DATA DISPLAY UNIT	F-16C	\$48,293,131	1,235
Air Force	TARGET ACQUISITION SYSTEM	F-16C	\$44,843,636	2,972
Air Force	IFF SYSTEM	F-16C	\$25,614,521	916
Air Force	NAVIGATION SYSTEM	F-16C	\$14,310,433	1,013
Air Force	NAVIGATION SYSTEM	C-130H	\$12,402,740	628
Air Force	INDICATING, ORDER AND METERING	KC-135R	\$11,324,172	206
Air Force	DATA DISPLAY UNIT	MQ-9A	\$10,377,094	48
Air Force	TARGET ACQUISITION SYSTEM	A-10C	\$9,299,788	647
Air Force	WIRING	C-17A	\$9,297,600	101
Air Force	RADAR WARNING SYSTEM	F-15E	\$8,548,591	35
Air Force	SENSOR	U-2S	\$8,374,846	4
Air Force	TRAFFIC ADVISORY SYSTEM	B-52H	\$8,310,182	22
Air Force	INDICATING, ORDER AND METERING	F-15E	\$8,269,354	113
Air Force	WIRING	B-1B	\$8,243,270	47
Air Force	TARGET ACQUISITION SYSTEM	F-16D	\$8,141,758	568
Air Force	TRANSMITTER	KC-135R	\$7,381,988	168
Air Force	NAVIGATION SYSTEM	KC-135R	\$7,184,340	220
Air Force	RADAR WARNING SYSTEM	F-16C	\$7,128,060	190
Air Force	WIRING	KC-135R	\$7,024,458	118
Air Force	AUTOMATIC FLIGHT CONTROL	F-16C	\$6,937,634	235

IFDIS Candidate Analysis - Summary

Spreadsheets are available for each service that identifies their top IFDIS candidates by NIIN and objects/TMS along with the corrective costs and availability loss totals

The failure recipe is available as well and can be modified for future use. The new results can be determined based on the new recipe fairly quickly.

Followup analysis of IFDIS implementation to determine the impact can be made available as well.