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CASS Manpower Analysis

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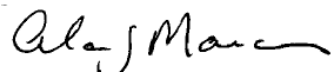

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Executive summary

The Navy is in the process of establishing new Naval Enlisted Codes (NECs) for the Consolidated Automated Support System (CASS) operators. The Navy has developed personnel requirements for the initial cadre of bench operators and maintainers. However, with the introduction of new NECs, the manpower requirement for the old NECs may not be valid, and the manning requirement for the new NECs has not yet been determined. PMA–205 tasked the Center for Naval Analyses (CNA) to develop these requirements based on current CASS maintenance data.

These new codes are:

AT–6704 CASS Test Station IMA Operator/Maintainer

AT–6705 CASS Test Station IMA Calibration/Advanced Maintenance Technician

AT–6723 CASS Test Station (RADAR) IMA Technician

AT–6724 CASS Test Station (EO) IMA Technician

AT–6725 CASS) Test Station (EW) IMA Technician

These technicians are assigned to an Aircraft Intermediate Maintenance Department (AIMD) based on the number and type of CASS benches assigned to each activity. Because the technician numbers are given as technicians per shift per bench, we first had to determine the number of test benches required to support various air wing operations, the number of direct maintenance man-hours required to efficiently process reparable components, and the number of technicians needed to satisfy these requirements. The results of this analysis are depicted in table 1. The top section of the table lists the number and type of benches, and the number of technicians needed to

support a peacetime requirement; the bottom section lists what is needed to support a wartime requirement.

Table 1. Number of benches and technicians required to support air wing operations

NEC	Hybrid	EO	RF	RF(HP)	CNI	Total	Man-hrs per day	Techs per bench per shift
AT–6704	3		2		2	7	167.13	1.49
AT–6723	2		4	1		7	150.02	1.34
AT–6724		2				2	31.00	0.97
AT–6725			1	1		2	27.08	0.85
Total	5	2	8	2	1	18	375.22	1.30
AT–6704	5		4		2	11	269.63	1.53
AT–6723	2		6	2		10	247.21	1.55
AT–6724	1	2				3	51.20	1.07
AT–6725			1	1		2	43.50	1.36
Total	7	2	11	3	2	26	611.54	1.47

General approach

The Navy is in the process of establishing new Naval Enlisted Codes (NECs) for the Consolidated Automated Support System (CASS) operators. The Navy has developed personnel requirements for the initial cadre of bench operators and maintainers. However, with the introduction of new NECs, the manpower requirement for the old NECs may not be valid, and the manning requirement for the new NECs has not yet been determined. PMA–205 tasked the Center for Naval Analyses (CNA) to develop these requirements based on current CASS maintenance data.

These new codes and their maintenance assignment are:

AT–6704 CASS Test Station IMA Operator/Maintainer

This technician will operate the CASS test station and conduct both scheduled and unscheduled maintenance, as well as execute and monitor test programs and repair various avionics units under test (UUTs) through removal and replacement (R&R) of faulty shop repairable assemblies (SRAs).

AT–6705 CASS Test Station IMA Calibration/Advanced Maintenance Technician

This technician will perform scheduled maintenance, including online calibration/certification, lubrication, and cleaning. He or she will also perform unscheduled maintenance that is beyond the operator's capabilities, including diagnostic troubleshooting, in-depth maintenance, and software analysis.

Note: The Navy is taking the 6705 tasks and merging them into 6704. New tasking and training for 6705 is now under study.

AT–6723 CASS Test Station (RADAR) IMA Technician

This technician will operate the CASS test station and conduct both scheduled and unscheduled maintenance. He or she will also perform fault isolation and maintenance on aircraft radar UUTs using the RF and High Power configurations of the CASS test station.

AT–6724 CASS Test Station (EO) IMA Technician

This technician will operate the CASS test station and conduct both scheduled and unscheduled maintenance. The technician will also perform fault isolation and maintenance on aircraft electro optics (EO) UUTs, using the EO configuration of the CASS test station. This will include in-depth circuit analysis, adjust/repair, and serviceability verification of aircraft forward-looking infrared (FLIR) systems.

AT–6725 CASS) Test Station (EW) IMA Technician

This technician will operate the CASS test station and conduct both scheduled and unscheduled maintenance. He or she will also perform fault isolation and maintenance on aircraft electronic warfare units UUTs using the RF and High Power configurations of the CASS test station.[1]

These technicians are assigned to an Aircraft Intermediate Maintenance Department (AIMD) based on the number and type of CASS benches assigned to each activity. Because the technician numbers are given as technicians per shift per bench, we first had to determine the number of test benches required to support various air wing operations, the number of direct maintenance man-hours required to efficiently process reparable components, and the number of technicians needed to satisfy these requirements. The results of this analysis are depicted in table 1. The top section of the table lists the number and type of benches, and the number of technicians needed to support a peacetime requirement; the bottom section lists what is needed to support a wartime requirement.

1. *Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards*, Vol. II, NAVPERS 18068F.

We extracted cruise data from ten cruises sailed by five ships. Table 2 lists each ship and the dates of the cruises.

Table 2. Ships and cruises used for analysis[a]

Name	IMA	UIC	DepBegin1	DepEnd1	DepBegin2	DepEnd2
CV–63 *Kitty Hawk*	D97	N03363	2/19/2004	5/21/2004	1/23/2003	5/6/2003
CVN–68 *Nimitz*	D9K	N03368	3/3/2003	11/5/2003	9/1/1997	3/1/1998
CVN–71 *Theodore Roosevelt*	C9C	N21247	2/3/2003	6/11/2003	9/19/2001	3/19/2002
CVN–72 *Abraham Lincoln*	D9M	N21297	7/20/2002	5/2/2003	8/17/2000	2/17/2001
CVN–*Harry S. Truman*	CGA	N21853	12/5/2002	5/23/2003	11/28/2000	5/24/2001

a. Ships used were designated by CDRF M. Huff, PMA-205.

Because AIMD performance varies between ships and even between cruises for the same ship, we consolidated these cruise data into a composite set of data that better represented typical ship performance. Also, because air wings may vary in composition, we formed a notional air wing in order to reflect the actual number of missions and hours flown. That air wing composition is shown in table 3.

Table 3. Notional air wing

Type/model/ series	Number of squadrons	Aircraft/squadron
E–2C	1	4
EA–6B	1	4
FA–18C	2	10
FA–18E	1	12
FA–18F	1	12
HH–60H	1	3
S–3B	1	8

In our previous studies, we treated the AIMD as one large work center that had the ability to move work from one area to another as workload requirements shifted.

To define the number and type of benches and the resultant requirement for technicians in each NEC, we modified our approach and defined four separate work areas that represented the equipment that would be processed by each NEC. We made model runs for each of the specialty NECs, i.e., radar, EW, and EO to determine the number of benches required and manpower requirements. Finally, we assigned the remainder of the workload to the general CASS operator/maintainer work center. We extracted additional CASS maintenance data and used these data to determine the number of technicians that would be required to support CASS bench maintenance operations.

Workload modeling approach

We developed a simple simulation to analyze configurations of interface devices and test stations. The simulation can be configured to search for least-cost configurations of interface devices, or least-cost configurations of test stations. It cannot be used to trade off interface devices and test stations.

The simulation replays a sequence of repairs specified in a workload table. For each repair, the workload table specifies the type of part being repaired, the required interface device, the required station, the historical elapsed maintenance time, and the historical awaiting maintenance time. The elapsed maintenance times are replayed in the simulation. The awaiting maintenance times are averaged across the interface device required and the station required. These averages are used to constrain the mix of interface devices or stations selected by the model. Historical times between inductions are multiplied by the ratio of simulated flight hours to historical flight hours to generate times between inductions.

The workload records are read in chronological order. Each induction is assigned to an appropriate interface device and test station for execution. The simulation maintains the average wait time

for each type of interface device and test station. When no hybrid bench is available to process a hybrid assembly, the assembly may be assigned to any other type of bench that has a lower average wait time than its historical average. Similarly, RF inductions may be assigned to CNI stations.

Test stations are assigned an efficiency factor. The elapsed maintenance time specified in the workload record is divided by the corresponding efficiency factor to determine how long the bench is unavailable for other inductions. The simulation can be configured to simulate continuous intermediate maintenance activity (IMA) operations, or 11 8-hour shifts per week. The simulation assumes all repair parts are available when required. The model searches for the least-cost mix of interface devices or stations. It reports the mix of interface devices and stations as well as average utilization and waiting times for each type of interface device and test station.

Analytical results

Our first approach was to define our requirements by the data we had retrieved from our ten cruises. We performed the model runs for each of our four defined areas. The results of these runs are reflected by the quantity of each bench configuration listed in table 4.

We derived the number of technicians per bench by the following method:

Technicians per bench per shift = Man-hours documented per day/ number of available benches /20-hour productive workday.[2]

Note: the number of available benches is the number of required benches adjusted by 80-percent bench availability[3].

2. OPNAV INSTRUCTION 1000.16J

3. Readiness figures given to CNA by PMA-260

We then accelerated the number of hours flown by our notional air wing to wartime rates. Table 5 lists the results of this model run. In these analyses, we made the assumption that personnel provided by the SEAOPDET would perform all aircraft component work.

Table 4. Number of benches and technicians required to support air operations flown during a typical peacetime cruise

NEC	Hybrid	EO	RF	RF (HP)	CNI	Total	Man-hrs per day	Techs per bench per shift
AT–6704	3		2		2	7	167.13	1.49
AT–6723	2		4	1		7	150.02	1.34
AT–6724		2				2	31.00	0.97
AT–6725			1	1		2	27.08	0.85
Total	5	2	8	2	1	18	375.22	1.30

Table 5. Number of benches and technicians required to support air operations flown during a typical wartime cruise

NEC	Hybrid	EO	RF	RF (HP)	CNI	Total	Man-hrs per day	Techs per bench per shift
AT–6704	5		4		2	11	269.63	1.53
AT–6723	2		6	2		10	247.21	1.55
AT–6724		2				3	51.20	1.07
AT–6725	1		1	1		2	43.50	1.36
Total	7	2	11	3	2	26	611.54	1.47

We also looked at the number of technicians that would be required to maintain the CASS benches. These technicians would be ship's company personnel whose primary duty would be to maintain the CASS benches. To determine the number of technicians needed, we used CASS maintenance data from our five ships' second deployment. We determined the number of CASS stations on each ship, the number of cruise days, and the number of maintenance man-hours used. We calculated the number of technicians required by taking the number of maintenance man-hours/the number of CASS bench days/20 hours of productive labor per day. Table 6 depicts the results.

Table 6. Number of required technicians per bench required to maintain CASS

Ship	Number of CASS stations	Cruise days	CASS maint. man-hrs	CASS bench days	Maint.techs per bench per shift
CV–63 *Kitty Hawk*	15	103	4,361.4	1,545	0.141146
CVN–68 *Nimitz*	16	181	1,181.8	2,896	0.020404
CVN–*Theodore Roosevelt*	13	181	4,108.2	2,353	0.087297
CVN–72 A*braham Lincoln*	9	184	2,374	1,656	0.071679
CVN–75 *Harry S. Truman*	11	177	1,498.5	1,947	0.038482
Total			13,523.9	1,0397	0.065038

Note: It has been our experience that bench maintenance has not always been documented well, so the requirements stated above may be slightly low.

Conclusion

In a previous study[4] that looked at CASS operator manning, we determined that manning requirements per bench, over several carrier cruises, varied between 1.42 to 1.77 technicians per bench per shift. That study used a slightly different methodology that looked at the average number of technicians per maintenance action whereas we used the total number of man-hours documented while performing maintenance. The previous study used maintenance data from the period when legacy testers supported production. This study used data for components repaired using CASS to support production. Since the previous study, the Navy has changed its productive workweek from 67 hours per week to 70. The results of this study, 1.30 to 1.47 technicians per shift per bench, appear to be consistent with the results from our previous study.

4. Monica J. Giovachino. *Manpower Requirements for CASS Operators,* March 1997 (CNA Research Memorandum 96-124).

List of tables

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