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15 M-297

MEMORANDUM

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To: Clement, Collboins, Goodpasture, Habley,
Krueger, Lipp, Paxson, Root, Williams

Date: 2-22-49
M-297

From: D. J. Davis

Subject: COSTS ASSOCIATED WITH THE DEFENSE OF A TARGET BY GUIDED MISSILES

Copies to: Publications

The attention of holders of D(L)-367, "Typical Bombing Mission Against a Target Defended by Guided Missiles", is invited to Memorandum M-291 dated 2-21-49, from E. W. Smith to J. E. Lipp, "Costs Associated with the Defense of a Target by Guided Missiles".

In this memorandum, the cost of a defense net is evaluated in terms of operating personnel, cost, maintenance, and amortization of the field and expendable equipments associated with the defense net. Further, the cost of an individual missile has been increased to account for the larger missile size necessary to extend the range from that of Nike to the thirty mile range assumed in D(L)-367. This more sophisticated approach to cost estimation is recommended in place of the flat costs of \$2500/missile, \$2000/launching site, and \$175,000/guidance station used in D(L)-367.

D. J. Davis
D. J. Davis

DJD:sp

Encls M-291

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Chief, Records & Declass Div, WHS
Date: AUG 20 2015

Office of the Secretary of Defense
Chief, RDD, ESD, WHS
Date: 20 AUG 2015 Authority: EO 13526
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Reason: _____
MDR: 14 -M- 0529

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14-M-0529

To: J. E. Lipp

Date: 2-21-49
M-291

From: R. W. Smith

Subject: COST ASSOCIATED WITH THE DEFENSE OF A TARGET BY GUIDED MISSILES.

Copies: E. W. Paxson, R. W. Krueger, D. J. Davis

This is a preliminary study of the cost factors involved in a target defense system.

The costs of defending a target consist of fixed costs such as early warning equipment and variable costs dependent on the number of guidance stations and their cost plus costs connected with missiles expended. Further the cost of a guidance station consists of fixed costs such as the command guidance system and variable costs dependent on the number of launching sites required and their average costs.

This may be expressed on a yearly basis as:

$C =$ $W +$ N $G +$ M_1 $L +$ F B $C = \frac{W + N(G + M_1 L) + F B}{}$	<p>Cost of defending target.</p> <p>Cost of search radar and other costs associated with target only.</p> <p>Number of guidance stations per target.</p> <p>Costs associated only with command guidance.</p> <p>Number of launching sites per guidance installation.</p> <p>Cost of launching site operation.</p> <p>Number of missiles fired in defense of the target.</p> <p>Cost of missile.</p> <p>Total cost of defending the target per year.</p>
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The following assumptions were made:

1. That the defense installations will not be made until war is imminent.
2. That capital equipment will be amortized over a five year war.
3. That the housing facilities etc., given in Exhibit A may be adopted to the missile requirements and that they would accommodate 300 to 350 enlisted men.
4. That the 30 mile missile is about the size indicated in Exhibit B.
5. That the personnel required to handle the three mobile launching units of the A-4 operation could handle ten permanent launching units for the 30 mile missile whose weight is about one half that of the V-2 (A-4).
6. That the yearly costs of Officers and enlisted men are as given in Exhibits C and D.
7. That there will be a early warning network independent of the search radar system used in connection with the target defense, and that the costs of this network will not be included in this estimate.
8. That the cost of the 30 mile missile is comparable to the cost of the Nike '47 on a cost weight basis.
9. That the 80 percent improvement curve is applicable.

The cost as calculated for the missile includes fuel, fuel reserve, warhead etc.

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ESTIMATE OF COST OF TARGET DEFENSE

Since, in Table 1, the cost of the launching site operation is in terms of ten launching sites,

then let $M = \frac{M_1}{10}$

Substituting the values given in Table 1 in the general formula

$$C = \$115,000 + (\$85,000 + \$2,833,000M)N + \$12,000 F$$

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TABLE 1

A. COST OF EARLY WARNING SYSTEM (W)

1. FIXED EXPENSE

a. Search Radar (2)
(from Munitions Handbook page 108) \$ 220,000

2. YEARLY EXPENSE

a. Search Radar (2) - 5 years \$ 44,000
 b. Maintenance 10,000
 c. Enlisted Men (20) (Exhibit D) 58,000
 d. Miscellaneous 3,000
 TOTAL (W) \$ 115,000

B. COST OF COMMAND GUIDANCE (G)

1. FIXED EXPENSE

a. Command Guidance Equipment (1) \$ 137,000

2. YEARLY EXPENSES

a. Command Guidance Equipment (1) - 5 years \$ 27,400
 b. Maintenance 10,000
 c. Personnel
 i Officers (4) (Exhibit C) \$24,800
 ii Enlisted Men (6) (Exhibit D) 17,200
 d. Miscellaneous 5,600
 TOTAL (G) \$ 85,000

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TABLE 1 continued

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C. COST OF LAUNCHING PLATFORM OPERATION (L)

1. FIXED EXPENSE FOR TEN LAUNCHING UNITS

a. Equipment

i Firing Equipment Etc. \$ 16,000

b. Buildings

i From Exhibit A.	\$1,476,000	
Less Operations Building and Filter Station Costs	400,000	\$1,076,000
ii Operations Building at \$20/sq.ft.		170,000
iii Two additional Barracks		82,600
iv Launching Slabs (10)		20,000
v Propellant Storage Tanks for 100 missiles		7,000
vi Storage space for 100 missiles. Based on missiles requiring 3.4 x 34 ft. and stacked three high; Boosters req. 18.7 x 18.7 ft. and stacked two high; plus 25 percent of aisles. \$8.00 per sq. ft. per Exhibit A.		1,100,000
TOTAL		\$2,455,600

c. Vehicles

i Launching Trailers (20)	\$ 72,000
ii Tractors - Medium (3)	13,000
iii Command Car (1)	3,000
iv Jeeps (6)	12,000
v Trucks - 2 1/2 ton (2)	9,000
vi Trucks - 3/4 ton (2)	6,000
TOTAL	\$ 115,000

2. YEARLY EXPENSE FOR TEN LAUNCHING UNITS

a. Personnel

i Officers (30) (Exhibit C)	\$ 185,573
ii Enlisted Men (500) (Exhibit D)	1,431,545
TOTAL	\$1,617,188

b. Depreciation

i Equipment - 5 years	3,200
ii Buildings - 5 years	491,120
iii Vehicles - 2 1/2 years	46,000
iv Missiles Stored (100) - 5 years	240,000
v Missiles on Platforms - 5 years	24,000
TOTAL	\$ 804,320

c. Maintenance

i Equipment - 10 percent	\$ 1,600
ii Buildings - 5 percent	122,780
iii Vehicles - 20 percent	23,000
iv Missiles (110) 25 percent 4 times a year	264,000
TOTAL	\$ 411,380

TOTAL YEARLY EXPENSES

\$ 2,832,888

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HEADQUARTERS
CONTINENTAL AIR COMMAND
MITCHEL AIR FORCE BASE
NEW YORK

EXHIBIT A

19 JAN 1949

The Rand Corporation
1500 Fourth Street
Santa Monica, California
ATTN: Mr. P. D. Doersam

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Chief, Records & Declass Div, WHS
Date: AUG 20 2015

Gentlemen:

This Headquarters has been requested by Watson Laboratories, Air Materiel Command, Red Bank, New Jersey to forward a reply to that part of your letter, file L1352, 22 December 1948, which requested the estimated cost of a filter station to coordinate the activities of, say, 3, 5, 10 EN-GCI Radars.

The following itemizes the estimated cost of such a control center:

Operations Building, 75' x 113' 8"	\$ 400,000
Power Building, 20' x 20'	4,000
Fuel Storage 8000 gallons	3,500
Generators	15,000
Radio Stations 18' x 44' (2)	32,000
Officers Quarter 39' x 12' w/12' x 8' all	5,000
BOQ w/mess 30' x 166'	80,000
BOQ 30' x 118'	55,800
BOQ w/mess 30' x 136'	68,000
Barracks 25' x 110' (4)	165,200
Mess Hall 25' x 118'	29,600
Storehouse 25' x 108'	20,200
Motor Repair Shop 37' x 60'	16,700
Dispensary 31' x 136'	35,000
Recreation 37' x 99'	55,000
PX 37' x 84'	46,000
Central Heating Plant	180,000
Perimeter Fence	29,600
Gate House 12' x 16'	1,000
Water System & Reservoir	85,000
Sewer System	35,000
Electric Distribution System	20,000
Roads	45,000
Access Roads (Based on 5 mile est. average length)	50,000
Total Construction Costs	\$1,476,600

It is hoped that this information will prove sufficiently complete to meet your requirements.

Sincerely,



R. B. TRAVIS
Colonel, USAF
Asst. Adj. General

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30 MILE NIKE

$\sqrt{\quad} = 0.39$ for Booster and Missile

Total Gross Weight of Missile and Booster	15,400 pounds	
Gross Weight of Missile	3,180 "	
Gross Weight of Booster	12,220 "	
Propellant - Missile	1,360 "	120 gallons
Propellant - Booster	6,000 ""	
Empty Weight of Missile	1,650 "	
Empty Weight of Booster	6,220 "	
Warhead Weight	170 "	

Factors to use to scale up standard Nike.

Let l_n be a linear dimension of the 15,400 # Nike

l_0 be a corresponding linear dimension of the Nike '47 (or contemporary Nike)

Then l_n equals 1.7 l_0

The weight ratio is 4.85

The 30 Mile Nike is $\frac{1}{2}$ the weight of the V-2 and $\frac{2}{3}$ the size.

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Source: Cost Accounting Records, Fiscal Office
Fort MacArthur, San Pedro, Calif.

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Prepared by: Margaret C. Whitnah

Contact: Capt. Frederick L. Orr, Officer-In-Charge
Fiscal Office

Date: 11-24-48

Exhibit C.

ARMY PERSONNEL MAINTENANCE COST* - OFFICER FOR ONE YEAR

<u>Item</u>	<u>Amount</u>	<u>Remarks</u>
Average Salary - 0	\$4437.96	Average salary of all ranks with 12 years service (fogies incl.).
Dental Care	9.00	Includes cost of supplies and labor.
Medical Care	25.87	Includes cost of dispensary and hospitalization.
Housing	1080.00	Based on \$90 per month.
Food	511.00	Based on allowance of \$1.40 per day.
Clothing	21.00	Based on \$250 allowance for average of 12 years service.
Recreation (Special Services)	22.08	Includes operation of PX, library, and other special service activities.
Chaplain (Religious Services)	15.72	Includes cost of chaplain, assistant, etc.
Legal Affairs & Claims	12.00	Labor and supplies for handling
Administrative Work	51.15	
Total Cost	<u>\$6185.78</u>	

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* Average Cost - July 1, 1948 to Nov. 1, 1948, incl.

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Source: Cost Accounting Records, Fiscal Office
Fort MacArthur, San Pedro, Calif.

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Prepared by: Margaret C. Whitnah

Contact: Capt. Frederick L. Orr, Officer-In-Charge
Fiscal Office

Date: 11-24-48

Exhibit D.

ARMY PERSONNEL MAINTENANCE COST* - ENLISTED MAN FOR ONE YEAR

<u>Item</u>	<u>Amount</u>	<u>Remarks</u>
Average Salary - EM	\$1498.32	Average salary of all grades with 9 yrs. services (fogies incl.).
Dental Care	9.00	Includes cost of supplies and labor.
Medical Care	25.87	Includes cost of dispensary and hospitalization.
Housing	324.00	Based on 90¢ per day charged first three grades occupying government quarters.
Food	642.40	Includes cost of ration and operation of mess (labor).
Clothing	153.62	Based on 2/3 of initial cost of issue for yearly cost, since initial issue includes 3 O.D. suits, and items are replaceable.
Recreation (Special Services)	22.08	Includes operation of PX, library, and other special service activities.
Chaplain (Religious Services)	15.72	Includes cost of chaplain, assistant, etc.
Legal Affairs & Claims	12.00	Labor and supplies for handling
Administrative Work	160.08	Includes handling of service records, preparation and payment of pay vouchers, sorting personal mail, duty rosters, commanding officer and 1st sgb. supervision, etc.
Total Cost	\$2863.09	

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