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A PREDICTION OF AVIATION LOGISTICS REQUIREMENTS (PALR) FOR THE --ETC(U)
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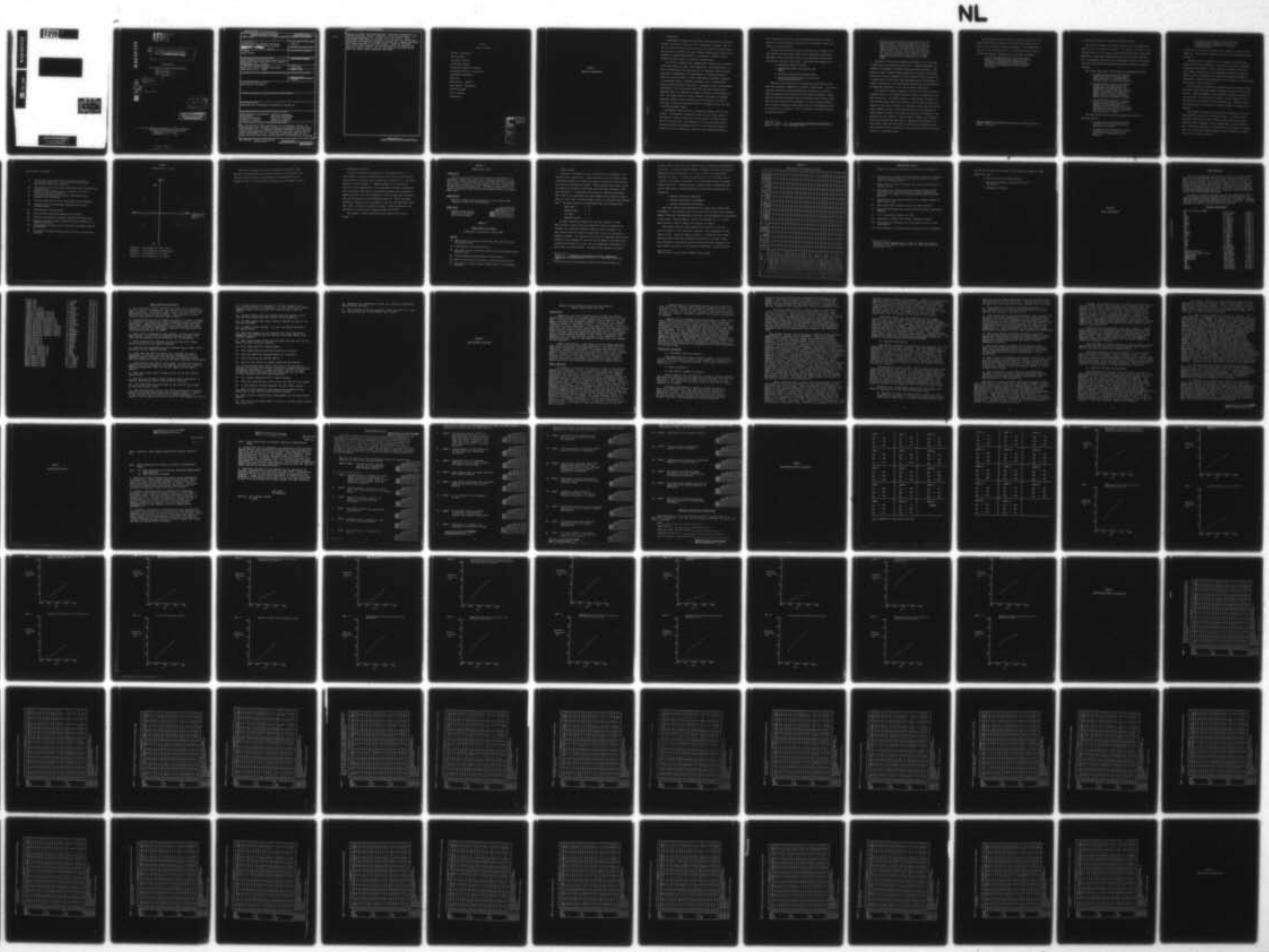

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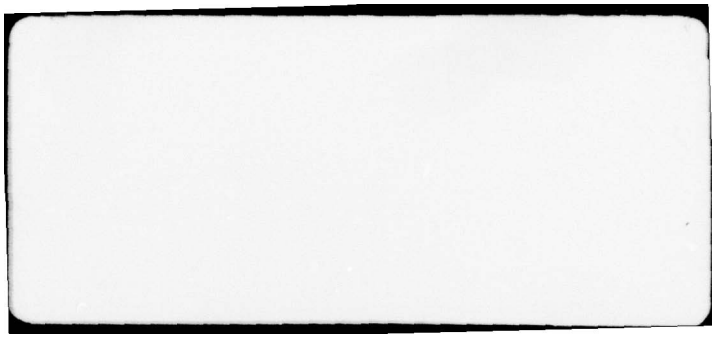

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(6) A Prediction of Aviation Logistics Requirements (PALR) for the Decade. Volume 2, ~~Details of Methodology~~

A PREDICTION

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(11) JUNE ~~1~~978

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The objectives of this study were to (1) develop a basis for forecasting naval aviation logistics requirements for the 1985-1995 decade, (2) to identify problems inherent in the logistic support environment of naval aviation that will surface during this time-frame, and (3) make Navy leadership aware of the opportunities that exist in the future to alleviate the problems.

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ENCLOSURE (

Employing widely used technological forecasting techniques e.g. (expert opinions, delphi, scenarios, trend extrapolation, etc.) the study projected 8 to 18 years into the future. Thus sufficient lead time is provided naval planners for developing efficient and effective systems to support the complex equipment and weapon systems of the near future. PALR has provided (A) a forum for industry and military experts to discuss the future of naval aviation (B) an awareness of existing trends that will exist unless remedies are taken.

VOLUME 2

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Panel Participants

List of Acronyms

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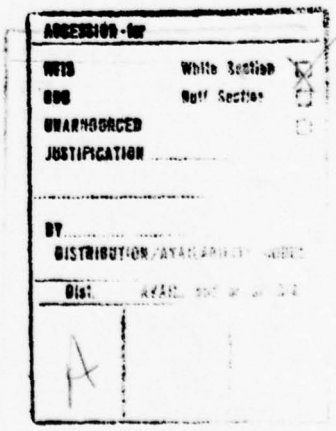

VOLUME 2

DETAILS OF METHODOLOGY

1. INTRODUCTION

A technological forecast gives the user a view which shows a path that progress will probably take if it is not consciously influenced. The user will see critical branch points in the road -- the situations where alternative futures are possible -- and gain a greater understanding of the price of admission to these branching paths: he is brought up against the hard realities of what he must do to achieve a desired result.

It is vital to remember that a technological forecast is not a picture of what the future will bring. Few forecasts are ever 100% accurate, but they are predictions, with a certain level of confidence, within a certain time frame of developments to be anticipated if no efforts are made to change the course of events. As such, they remain an essential ingredient of the planning process. Knowing, for example, that the present total active aircraft inventory of the Navy is X thousand and that it had declined approximately Y per cent annually since 1970, one could predict with a reasonable degree of confidence the number of aircraft to be maintained in 1980. The further ahead one tries to estimate, the greater the probable divergence between estimate and reality, but the figure can still be of value <u>now</u> in predicting the future workload of maintenance crews, and thus in setting enlistment quotas.

This example illustrates what is perhaps the commonest form of forecasting -- the extension of historical trends into the future, based on the assumption (often unstated) that the future will be a smooth continuation of the recent past. This assumption is rarely justifiable except for very short-term forecasting; there are various reasons for trends to deviate from their extrapolations, one major reason being perturbations

due to "unprecedented events", often involving technological or social innovation, or sudden changes in the policy or the economic status of the industry or nation concerned.

The best available forecast upon which planning can be based is one that examines both past history (which can be envisioned as providing a "momentum" toward a particular future), and those external events which can influence otherwise stable trends. The problem then becomes one of:

- identifying trends of interest;
- extrapolating these to the relevant time-frame;
- identifying potentially perturbing events;
- assessing the probable effect of these events on the established trends.

There are various techniques for accomplishing these tasks, all of which are necessarily judgmental to a greater or lesser extent. In a sense, intuitive forecasting has been performed for centuries, and is still of value where expert opinion provides the best forecast available. However, many more structured techniques have been developed since the early 1960's which are less intuitive and more explicit, so that it becomes possible to have a forecast checked by several people, just as any engineering design or calculation can be checked. As Lt. Col. Martino of the USAF stated in an introductory work:*

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*Martino, Joseph P. (ed.) An Introduction to Technological Forecasting (London, England: Gordon and Breach, 1972).

> One of the simplest methods of overcoming some of the disadvantages of intuitive forecasts is the use of a panel of experts. The notion behind this is that the interaction between several experts is more likely to ensure consideration of aspects which any single individual might overlook. More of the factors bearing on a situation are likely to be considered, and there is a better chance that a hidden bias of one panel member will be offset by a contrary bias in another member.

Forecasting of this type is generally performed in one of two ways. A method which is extensively used by the U. S. Federal government, especially the Department of Defense, has had considerable success. This employs a number of experts meeting together in a workshop, the largest such group being that assembled for the Air Force's Project Forecast over a 6-month period in 1963, which had representatives from 30 Department of Defense organizations, 10 non-DoD Federal organizations, 26 universities, 70 industrial corporations, and 10 not-for-profit corporations.

An alternative approach, designed to avoid the well-known problems of committee action, is the "Delphi Procedure" devised by researchers at the Rand Corporation. This employs a series of questionnaires circulated to the individual panel members; in the first, they are asked to make their forecast on the topic of interest. In subsequent rounds, they are provided with a composite forecast, which shows the extent of the differences of opinion among the members of the panel but preserves the anonymity of the panelists and their opinions. They are asked to comment on any disparity between this forecast and their own, for example giving arguments as to why an event would take place earlier or later than the majority of the panel believes, and this information is also circulated (without ascribing a source) in succeeding rounds.

Consensus-seeking procedures similar to these are utilized in the PALR study providing a forecast of the 1985-1995 environment from the point of view of aviation logistics requirements. (This methodology is outlined in the following section.) It is generally agreed among the leading technological forecasters that, as the field progresses,

> The different approaches will prove to be complementary. As additional time, funding and resources are allotted to technological forecasting, the synthesis or combination of the various methodologies will permit increasingly accurate forecasts to be made.*

*Preñoda, Robert W., "Technological Forecasting and Space Exploration", Q.E.D., October 1966.

2. TREND/EVENT METHODOLOGY UTILIZED FOR THE PALR PROJECT

The future environment is defined in terms of a set of "indicators" descriptive of characteristics relevant to the interests of NAVAIR. Typical descriptors are, for example, aircraft procurement costs, annual fuel expenditure, operational readiness rate, skill level of Navy inductees, etc. An internally consistent set of quantitative values of such indicators, with accompanying discussion and qualitative material, is termed a "scenario".

For a given time-frame, we will employ the following definitions:

- A base-line scenario describes relevant characteristics of the future environment, based upon the assumption that historic trends will continue unmodified.

- A "surprise-free" scenario is a modification of the base-line scenario to incorporate the consequences of the occurrence of high probability relevant events. In practice, this event set is usually limited to high probability events which also have high potential impact upon the environment of interest.

- An "alternative" scenario is a modification of the surprise-free scenario to incorporate the consequences of a specific relevant event which is of low probability in the time-frame of interest, but which has high potential impact upon the environment of concern.

The tasks involved in executing this methodology include the following elements:

- to decide what are the relevant characteristics of the environment which is the focus of the study;

- to identify indicators which can measure or assess these characteristics, or which serve as surrogates for such measures;

- to obtain historic values for these indicators, which when plotted establish trends which can be mathematically extrapolated to the time-frame of interest.

At this point, the base-line scenario can be described in terms of these indicators. The indicators selected for the NavAir environment are listed in Exhibit 1.

The next step is to identify a set of potential events which may influence this future environment. In general this set will include new technological developments, social, political or economic disturbances (war, famine, recession) etc. This identification process can never be complete, and it is important that a variety of individual judgments be incorporated. Starting from an original set of 235 events, the final listing (29) selected is shown in Exhibit 2.

Once the events are selected, an intensive search of relevant literature and/or consultation with experts is employed to acquire relevant data for each. Consensus judgment is again applied to estimate the probability of occurrence by the time period of interest, and the potential effect on the environment as described in the following section. Exhibit 3 shows the categorization of the event set, using the probability estimates thus obtained.

The surprise-free scenario is constructed by assessing the impacts of high probability events upon the baseline scenario. In order to place reasonable bounds upon the effort involved, those events which have low potential impact are ignored in most instances even if they are judged to have a significant probability of occurrence in the time frame of interest. Thus, the surprise-free scenario commonly reflects the impact of category 1 events upon the baseline scenario.

EXHIBIT 1

SELECTED INDICATORS

1. Navy budget
2. Aircraft reliability
3. Aircraft down-time
4. Manpower per flight hour
5. Maintenance costs at O, I and D levels
6. Number of NORS (Not operationally ready-supply)
7. Number of NORMS (Not operationally ready-maintenance)
8. Aircraft operational readiness
9. Time to repair (O and I level)
10. Number of aviation ratings
11. New procurement costs
12. Training costs
13. Mission capability
14. Total number of flight hours
15. Navy aircraft inventory
16. Maintenance cost per aircraft by type
17. Ratio of officers to enlisted personnel
18. Fuel costs

EXHIBIT 2

SELECTED EVENTS

1 Solicitations to industry for major weapons systems are expressed in terms of mission needs, freeing the contractors to propose their own technical approach.

2 300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.

3 Repair facilities at Naval Air Stations totally manned by civilians.

4 All NARFs managed and operated by contractors.

5 Decision made to extend the life of the F-4 through CILOP.

6 F-18 deployed to the operating fleet.

7 The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery.

8 Incorporation of the functions of ASO under the management of AIR-04.

9 Integration of all avionics functions into a single package, for each aircraft type.

10 RPVs replace 50% of manned aircraft for combat missions.

11 Long range land-based Navy aircraft perform the Navy's sea-control mission.

12 U. S. carrier force reduced to 8 CVAs.

13 No overseas bases available to the Navy in peacetime, outside the Western hemisphere.

14 Deployment of V/STOL-A as currently envisaged by NAVAIR

15 Utilization of fiber optics in operational aircraft for on-board data transmission.

16 Development and widespread use of non-fossil sources of power for aircraft.

17 50% replacement of training flight activity by use of simulators.

Selected Events (Continued)

18 Use of fault-tolerant design and performance monitoring, to the extent that pilot is only informed of malfunctions when mission capability is degraded.

19 Most Naval aircraft maintenance instructions stored electronically on-board ships.

20 Concept of VAST (Versatile Avionics Shop Test) for use in I-level maintenance is dropped.

21 Performance monitoring with automatic trend analysis will control O-level maintenance.

22 Civilian-manned ships used for intermediate-level maintenance.

23 No module repair at intermediate maintenance level, only test and replace.

24 Unionization of military forces

25 Cruise missiles controlled/guided by Navy aircraft

26 Effective anti-satellite capability deployed by hostile power.

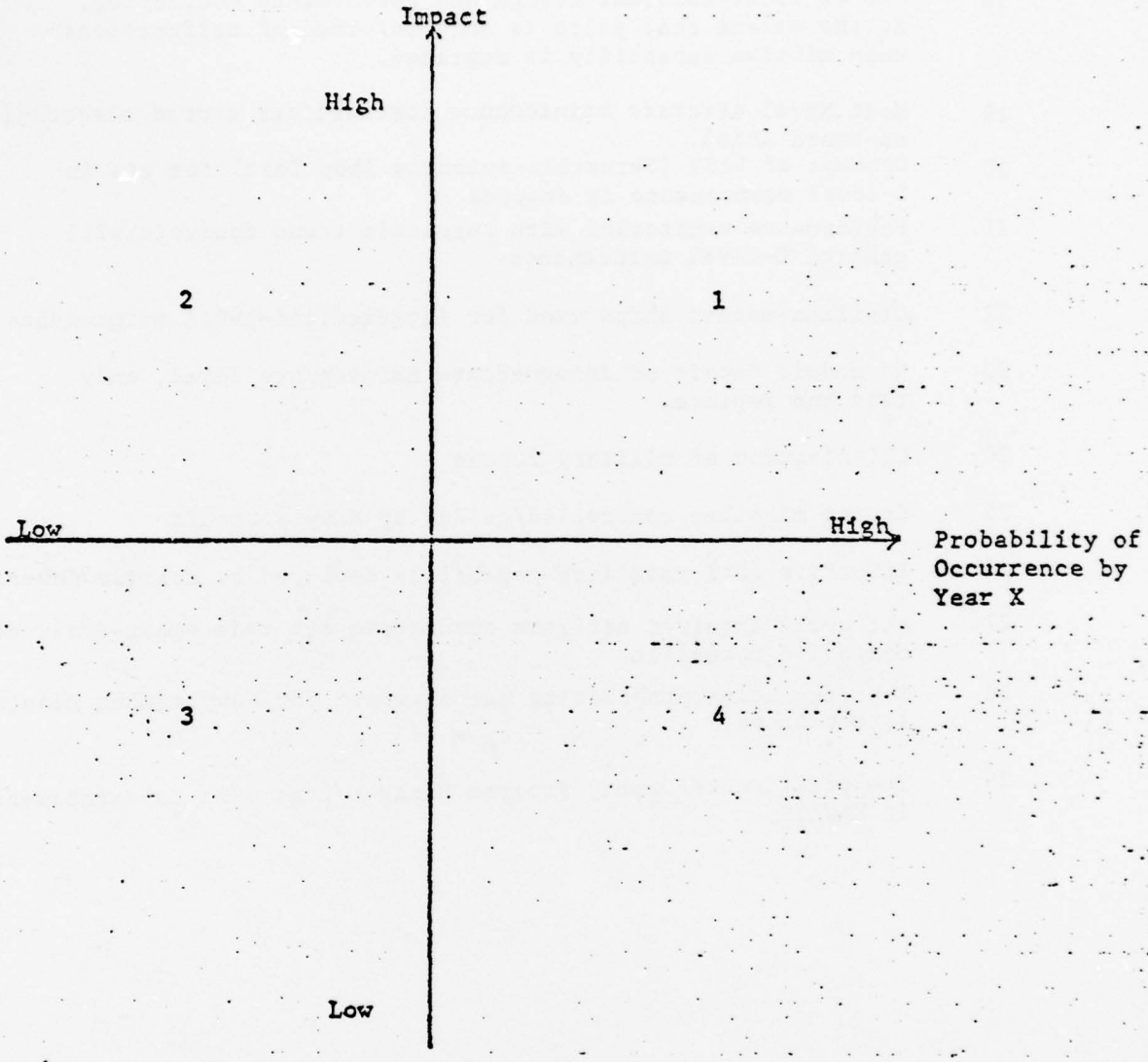
27 All newly acquired airframe structures are made exclusively of composite materials.

28 The regulation prohibiting use of women for Navy combat missions is abolished.

29 The position of Deputy Program Manager/Logistics is established in NAVAIR.

EXHIBIT 3

CATEGORIZATION OF EVENTS



Category 1: High probability, high impact.

Category 2: Low probability, but high impact.

Category 3: Low probability, low impact.

Category 4: High probability, low impact.

The events in category 2 are then re-examined, and specific events selected for the generation of alternative scenarios, each scenario incorporating the modification of the surprise-free environment due to one category 2 event, or to one internally consistent set of category 2 events.

3. PROBABILITY ESTIMATION

In order to estimate the probability of the selected events, a questionnaire was prepared and distributed to over 200 expert Navy/industry representatives in relevant areas of technology, management, etc. The format employed is shown in Exhibit 4. Although analysis of the results was carried out with categorization of the respondents according to rank/employment, as described separately, the probability estimation was performed by summing the total vote for each probability class for each year, associating this with the mid-point of the probability range (i.e. 30% for the range 21-40%) and dividing by the total number of votes for the years given (1985, 1990, 1995). An event was classed as Category 1 ("high probability") for the decade of interest if this average exceeded 50% by 1990.

The category 1 events resulting from this analysis are listed in Exhibit 5.

EXHIBIT 4

QUESTIONNAIRE FORMAT

INTRODUCTION

The list of questions which follow relate to the probability of occurrence of events which seem to be of potential significance to the area of Navy aircraft maintenance and/or the NAVAIR acquisition management process. For each of the thirty events considered, we would like you to indicate your opinion of the probability of its occurrence prior to 1985, 1990 and 1995 respectively. All that is needed is for you to check the appropriate boxes in the array provided as shown in the Sample Event below.

QUESTIONNAIRE

What do you believe is the probability of each of these events occurring no later than the date shown?

SAMPLE EVENT

Limited regional weather control at an acceptable cost becomes feasible.

EXHIBIT 5

"High Probability" Events

(Probability of Occurrence > 50% by 1990)

Event #

2. 300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.

6. F-18 deployed to the operating fleet.

19. Most Naval aircraft maintenance instructions stored electronically on-board ships.

25. Cruise missiles controlled/guided by Navy aircraft.

26. Effective anti-satellite capability deployed by hostile power.

29. The position of Deputy Program Manager/Logistics is established in NAVAIR.

4. IMPACT ANALYSIS

Estimates of the degree of impact resulting from the occurrence of the selected events, together with a detailed discussion of the rationale underlying these estimates, were obtained by means of a series of three workshops, involving Navy and industrial experts. These individuals were asked a series of questions of the form "to what extent does this event potentially affect this descriptor?". A logarithmic scale was used to quantify this measurement, based on the observation that human judgment employs geometric comparisons (i.e. this light is twice as bright as that) more naturally than arithmetic ones.* The method employed for quantification uses the following scale:

Major impact	=	8
Moderate impact	=	4
Low impact	=	2
Negligible impact	=	1

In order to complete an analysis of this type, answers to a great many individual queries of the type quoted above have to be generated and recorded, and a significant amount of time and effort is required. In many instances this task cannot be accomplished without the utilization of automated equipment. Such assistance is provided at Forecasting International workshops by the Consensor,** which provides each member of the panel with a terminal which permits him to enter his vote (preserving confidentiality) as each question is being discussed. The machine then computes and displays

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*Stevens, S. S., Handbook of Experimental Psychology: Mathematics, Measurement, and Psychophysics (New York, N.Y.: John Wiley & Sons, Inc., 1951).

**Electro-mechanical voting equipment supplied by Charles Williams, Inc.

the mean value of the vote of the panel as well as displaying the distribution of the vote. In case of extreme "spread", a general discussion can eliminate ambiguities, misinterpretations, etc., and a revote can be taken before recording the result. It should be emphasized that the individual vote of a specific participant is not known to the other members unless he himself informs them of it.* Using this device, three all-day workshops were held for the PALR project, dealing respectively with events and indicators pertaining to:

- o Material acquisition management
- o Aircraft maintenance and equipment
- o Aircraft maintenance and personnel

Each panel voted on each intersection of a matrix such as that shown in Exhibit 6. The arithmetic mean of the votes cast was used as the "average" impact of the event corresponding to that row, upon the descriptor corresponding to the column. The percentage of votes in each category (1, 2, 4, 8) was also recorded in order to examine the disparity of opinion.

Those events having an impact greater than or equal to 6 (on the scale 1 through 8) on any individual descriptor, were categorized as "high impact" events. These are listed in Exhibit 7, and form the set of candidates upon which significant alternative scenarios can be based. Using this information in conjunction with the discussions which occurred at the panel session, as well as at the individual interviews, the final decision

*This is thus a sort of instant feedback Delphi system.

EXHIBIT 6

PROVISIONAL NAVAIR RELEVANCE MATRIX

EVENTS \ DESCRIPTORS	Navy budget	Reliability	Aircraft down time	Manpower per flight hour	Maintenance costs at O, I and D levels	# NORS	# NORM	Aircraft operational readiness	Time to repair (O,I)	# aviation ratings	Key procure-ment costs	Training costs	Mission capability	Total flight hours	Navy air-craft inven-tory	Maintenance cost per air-craft by type	Ratio of offi-cers to en-listed pers.	Fuel costs
1. Proliferation of threat/mission and technology																		
2. Increase in price of aviation fuel (CPA)																		
3. Decrease facilities at Naval Stations caused by civilians																		
4. All Navy owned and operated by civilians																		
5. Decision made to extend the life of the A-6E through CIWP																		
6. Plan to level for the operating fleet																		
7. Increase type interacts through life cycle of weapon																		
8. Introduction of ASW, SPEC and PLA																		
9. Effectiveness of avionics functions																		
10. Navy option for 30% of manned A/C in combat aircraft																		
11. Increased utilization performed by Test Board vs. shore																		
12. U.S. combat force reduced to 8 CVAs																		
13. Navy assigns focus in pedestal for out-of-area deployments																		
14. Deployment of V STOL-A																		
15. Increase of time option for on-board air-craft due to utilization																		
16. Increased power sources for the fleet																		
17. Increase training requirements for training [illegible]																		
18. Increased [illegible] and performance [illegible]																		
19. Increased [illegible] storage of munitions [illegible]																		
20. Weapon concept dropped																		
21. Introduction of monitoring with automa-tic threat analysis, controls O-level [illegible]																		
[illegible] turned ships for [illegible] type																		
23. Need to repeat at I-level only [illegible]																		
24. Introduction of military forces																		
[illegible] aviation control [illegible]																		
26. [illegible] deployment of anti-satellite capability																		

"HIGH IMPACT" EVENTS

(Impact on individual descriptor ≥6, on scale of 0 through 8)

1. Solicitations to industry for major weapons systems are expressed in terms of mission needs, freeing the contractors to propose their own technical approach.

2. 300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.

7. The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery.

9. Integration of all avionics functions into a single package, for each aircraft type.

10. RPVs replace 50% of manned aircraft for combat missions.

11. Long range land-based Navy aircraft perform the Navy's sea-control mission.

12. U. S. carrier force reduced to 8 CVAs.

14. Deployment of V/STOL-A as currently envisaged by NAVAIR.

16.* Development and widespread use of non-fossil sources of power for aircraft.

17.* 50% replacement of training flight activity by use of simulators.

---

*Included because average impact of these was higher than those of previous entries, although maximum impact on individual descriptor was between 5 and 6.

was made by the study team to develop three alternative scenarios, based respectively upon:

- the use of RPV's for combat missions;
- the use of long-range land-based aircraft for sea control;
- deployment of V/STOL A.

VOLUME 2

PALR INTERVIEWS

PALR Interviews

One of the prime sources of data used to forecast the future of naval aviation support systems was drawn from frank and open discussions with people who, through their job or their natural interests, have a stake in naval aviation's future. The people were selected from both industry and Navy occupations, but all had one thing in common; their job was somehow related to the support of naval aircraft. The discussions were designed to draw out personal opinions as to how the Navy will adjust in the future to anticipated pressures and conditions. Questions listed following were used to evoke these in-depth discussions.

The number of different government agencies and companies involved in these interviews was not as extensive as would have been desired. Both time and funding limitations constrained the scope of coverage. The sample was sufficient however, that additional interviews yielded few new ideas. Following are listed all of the interview participants.

Interview Participants

Naval Air Systems Command		
04	RADM Faulders	9 Feb 77
401	B. Colmery	10 Feb 77
401B1	W. Knox	10 Feb 77
4101A3	L. Peterson	9 Mar 77
4114	G. Donovan	10 Mar 77
03P1B	J. Mulquin	14 Mar 77
30211B	R. Warren	17 Mar 77
4111	T. Mastic	17 Mar 77
412A	R. Grider	21 Mar 77
4121	M. Wallace	21 Mar 77
PMA-270	CAPT Dowd	23 Mar 77
4101B3	B. Meyer	24 Mar 77
5205	J. Wiggins	31 Mar 77
04F	F. Russo	4 Apr 77
4113A	D. Hish	6 Apr 77
503B	T. Smith	9 Apr 77
1014	D. Mason	1 Jul 77
340E	B. Poppert	7 Jul 77
01	RADM Seymour	19 Jul 77
4101	W. Anthony	30 Dec 77
NAVAIRSYSCOMREPLANT	M. Sanford	17 Jan 77
Naval Aviation Safety Center	CAPT Lemmon	17 Jan 77
COMNAVAIRLANT	CAPT Compton	18 Jan 77
COMNAVAIRPAC	COL Miller	28 Feb 77
COMNAVAIRPAC	CAPT Mallory	2 Mar 77
ASO	CDR Quarles	23 Feb 77
ASO	A.C. Barlow	28 Jun 77
ASO	O. Markowitz	28 Jun 77
NAILSC	CDR Lavalee	11 Feb 77
NAILSC	CAPT Hamilton	11 Feb 77

NAVMAT	CAPT Walker	14 Jan 77
NAVMAT	G. Newman	14 Jan 77
NAVMAT	CDR Searcy	27 Jan 77
NELC	LCDR Tinston	28 Feb 77
NELC	W. Darner	28 Feb 77
NAVELEXENGCTR	CAPT Rudolph	1 Mar 77
ONR	CDR James	25 Jan 77
NOP-514	CAPT Oslun	7 Feb 77
NOP-964C	I. Blickstein	23 Mar 77
NOP-05B	RADM Lawrence	30 Jan 77
NOP-121C1	Dr. N. Letsky	20 Dec 77
NOP-40	RADM Caughlin	22 Dec 77
Navy Comptroller's office	D. Lloyd	23 Mar 77
Center for Naval Analysis	Dr. H. Kanter	23 Mar 77
NAVWESA-193	W. Vardeman	24 Mar 77
NAVSUP-0431C	G. Bernstein	7 Apr 77
NAVSUP-03432	H. King	31 May 77
NADC	W. Slowick	24 May 77
NADC	A. Burstein	24 May 77
NADC	Dr. Stamfle	3 Jun 77
NADC	Dr. McQuillen	30 Jun 77
Defense Logistics Agency	RADM Crosby	25 May 77
NSRDC	T. Boyde	2 Jun 77
NSRDC	T. Clancy	3 Jun 77
NSRDC	Dr. Chaplin	6 Jul 77
Naval Training Center	V. Amico	10 May 77
Naval Training Center	E. Grace	10 May 77
Naval Training Center	Dr. Harvey	10 May 77
NAVMAT	J. Genovese	20 Jun 77
Naval Air Propulsion Test Center	M. Dell	29 Jun 77
Naval Air Propulsion Test Center	E. Lister	29 Jun 77
Naval Air Propulsion Test Center	L. Mogitti	29 Jun 77
NASA	D. Kier	26 May 77
Office of SECNAV	Dr. Waterman	5 Jul 77
Office of SECNAV	C. Smith	29 Sep 77
Dept of Commerce	G. Vaeth	5 Feb 77
Congressional Office of Technology Assessment	R. Gavert	10 Aug 77
Congressional Office of Technology Assessment	L. Jenny	10 Aug 77
NAS Miramay	CDR Iverson	11 Jul 77
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G.W. University	E. Napier	1 Jun 77
G.W. University	D. Wieland	1 Jun 77
The Analytic Sciences Corp.	Jacques Gansler	20 Oct 77
Grumman Aerospace Corp	A.J. Romeo	15 Feb 77

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Westinghouse Defense & Electronic	J. Turek	16 Mar 77
Westinghouse Defense & Electronic	W. Wakefield	16 Mar 77
Westinghouse Defense & Electronic	F. Kranz	16 Mar 77
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McDonnell Douglas Corp	R.C. Gehm	3 May 77
McDonnell Douglas Corp	R.O. Blatz	3 May 77
McDonnell Douglas Corp	H.D. Howard	3 May 77
McDonnell Douglas Corp	R.A. Baker	3 May 77
McDonnell Douglas Corp	G.J. Gerbert	3 May 77
McDonnell Douglas Corp	W.M. Toczylowski	3 May 77
McDonnell Douglas Corp	W.W. Lyle	3 May 77
McDonnell Douglas Corp	L.E. Quinlan	3 May 77
McDonnell Douglas Corp	T.L. Yount	3 May 77
McDonnell Douglas Corp	H.L. Swain	3 May 77
McDonnell Douglas Corp	F. Bernocas	3 May 77
McDonnell Douglas Corp	D. Barnett	3 May 77
McDonnell Douglas Corp	H. Flicker	3 May 77
General Electric Co	W.B. Sinninger	4 May 77
General Electric Co	E.E. MacMarland	4 May 77
General Electric Co	G. Agricola	4 May 77
General Electric Co	J. Hansee	4 May 77
General Electric Co	F. Euler	4 May 77
General Electric Co	P.C. Henning	4 May 77
Pratt & Whitney Aircraft Corp	J. Dolan	11 May 77
Pratt & Whitney Aircraft Corp	B. Weible	11 May 77
Pratt & Whitney Aircraft Corp	J. Isiminger	11 May 77
Pratt & Whitney Aircraft Corp	J. Vernon	11 May 77
Pratt & Whitney Aircraft Corp	G. Volin	11 May 77
Pratt & Whitney Aircraft Corp	J. Ponder	11 May 77
Pratt & Whitney Aircraft Corp	V. Jaramillo	11 May 77
Collins Radio Div. of Rockwell	F. Spencer	14 Jun 77
Collins Radio Div. of Rockwell	C. Fry	14 Jun 77
Collins Radio Div. of Rockwell	J. Ariana	14 Jun 77
Collins Radio Div. of Rockwell	W. Brice	14 Jun 77
Collins Radio Div. of Rockwell	B. Wall	14 Jun 77
Collins Radio Div. of Rockwell	D. Croft	14 Jun 77
Collins Radio Div. of Rockwell	T. Gleason	14 Jun 77
Texas Instruments, Inc	D. Roberts	15 Jun 77
Texas Instruments, Inc	N. Klutz	15 Jun 77
Texas Instruments, Inc	E. McClendon	15 Jun 77
Texas Instruments, Inc	H. Hoes	15 Jun 77

Vought Corp	C.J. Bitter	16 Jun 77
Vought Corp	J. Haynes	16 Jun 77
Vought Corp	G. Bahn	16 Jun 77
Vought Corp	F. Janes	16 Jun 77
Vought Corp NAVPRO	R. Connelly	16 Jun 77
Vought Corp NAVPRO	E. Cooley	16 Jun 77
Logistics Management Institute	R. Salzer	23 Jun 77
Logistics Management Institute	T. O'Donnell	23 Jun 77
Logistics Management Institute	W. Fisher	23 Jun 77
Logistics Management Institute	N. Betogue	23 Jun 77
General Dynamics, Electronics Div	R.Q. Aguais	11 Jul 77
General Dynamics, Electronics Div	A. Previt	11 Jul 77
General Dynamics, Electronics Div	P. Williamson	11 Jul 77
Litton Industries, Guidance & Control	R. McCurdy	12 Jul 77
Litton Industries, Guidance & Control	J. Kemps	12 Jul 77
Litton Industries, Guidance & Control	G. McLarnon	12 Jul 77
Litton Industries, Guidance & Control	R. Strozzula	12 Jul 77
Litton Industries, Guidance & Control	R. Maughmer	12 Jul 77
Litton Industries, Guidance & Control	H. Danbert	12 Jul 77
Boeing Aircraft Co	P. Grafton	14 Jul 77
Boeing Aircraft Co	D. Selvig	14 Jul 77
Boeing Aircraft Co	D. O'Brien	14 Jul 77
Boeing Aircraft Co	C. Olsen	14 Jul 77
Boeing Aircraft Co	J. Russel	14 Jul 77
Booz Allen & Hamilton Inc	F. Koester	20 Jul 77
Booz Allen & Hamilton Inc	M. Kahn	20 Jul 77
Booz Allen & Hamilton Inc	C. King	20 Jul 77
Booz Allen & Hamilton Inc	F. Marks	20 Jul 77
Booz Allen & Hamilton Inc	P. Mettam	20 Jul 77
Sperry Research Center	J.A. Dudrick	12 Aug 77
Sperry Research Center	Dr. R. Fuller	12 Aug 77
Sperry Research Center	Dr. R. Damon	12 Aug 77
Sperry Research Center	Dr. W. McBee	12 Aug 77
Sperry Research Center	Dr. G. Ross	12 Aug 77
Sperry Research Center	R. Wockinger	12 Aug 77

PALR Interview Questions

1. Per copy cost of Navy aircraft has risen at an increasing rate; in partial compensation, the quantity being procurred has been declining. To continue these trends into the 1985-95 time period would obviously be illogical. What course of action will the Navy take in altering these trends?

2. Historically the cost of labor has risen at a rate in excess of inflation, providing the drive to mechanize labor intensive activities. Amplifying this trend is a lower birth-rate that will yield 25% fewer candidates for recruiting into the armed forces in the 1985-95 time frame. How will the Navy cope with this skyrocketing cost of labor?

3. Fuel cost is forecast to rise sharply, in the time period under study, as the world's petroleum supplies dwindle. How will the Navy adjust to this condition in its operation?

4. What technological advances do you see that will impact naval aviation and its support systems?

5. How will the inevitable loss of overseas bases impact naval aviation and its support systems?

6. Given that the need for trade will increase the inter-dependency of nations, and that national boundaries will be extended greater distances into the sea and these new areas will be farmed and mined, how will the Navy's mission be affected?

7. Given that by the 1985-95 time frame, an effective counter-measure will be developed to the ICBM and nullify the threat of massive retaliation, what will be the impact on the Navy's mission?

8. What other Navy mission change do you see by the 1985-95 time period?

9. How will the pressure toward greater use of contractor vs organic maintenance impact naval aviation support?

10. Will VAST continue to be used in the 1985-95 time frame? Is the VAST concept valid?

11. The proliferation of off-line ATE and associated interface devices is already overcrowding the shipboard IMA's. In view of the forecast need for even more of these equipments to support future weapons, how do we crowd all this aboard the CVA's?

12. Future weapons are forecast to be more complex and to require higher skills to maintain. If well established trends continue where will the Navy find these skills to man the IMA's?

13. To what extent will the 1985-95 aircraft depend on BIT and condition monitoring for O level fault diagnosis?

14. To what extent will fault tolerant systems be used in the 1985-95 aircraft?

15. Is RIW a viable concept? If not, how should contracts be incentivised?

16. What new weapons do you forecast will enter the Navy's arsenal by the 1985-95 period, and how will they impact naval aviation support?

17. Will the military forces be unionized and what will be the impact on naval aviation support?

18. Will women serve on combat ships?

19. Will supply/repair ships be manned by civilians?

20. Will the NARF's be managed/manned by civilians?

21. Will civilians man NAS/CVA IMA's?

22. How will the naval air supply system be structured?

23. Is the concept that places the bulk of the aircraft in storage, ultilizing only 10%-30% for support systems development and system improvement, a viable concept? GSE will be used to keep the stored aircraft RFI and simulators will be used to train operator and maintenance personnel.

24. Is a supply dedicated COD a viable concept?

25. What will publications look like in the 1985-95 time frame?

26. Is the modular concept feasible for the V/STOL engine?

27. Will we have condition monitoring with automatic trend evaluation in the 1985-95 naval aircraft engine?

28. Will we see a revolutionary replacement for the gas turbine engine?

29. Will we see the development of fuels to replace those derived from pertroleum?

30. Describe the maintenance concept you visualize supporting 1985-95 naval aircraft.

31. What problem currently plagueing naval aviation will still be a serious problem in the 1985-95 time frame?

VOLUME 2

PRELIMINARY FINDINGS

Prediction of Aviation Logistics Requirements (PALR) Preliminary Findings

Background

Supporting the Navy's operational aircraft has become increasingly complex in a rapidly changing technological environment. The technically superior weapons that currently fill the Navy's inventory are helpless; however, without all the support elements needed to keep them working. It is here that we have witnessed a growing shortfall. The support systems have not kept pace with the weapon systems they were supposed to keep operational. Supply doesn't seem to have stocked the right parts; technicians have not always received adequate training prior to their assignments; ground support equipment doesn't seem to diagnose field problems with the same accuracy it did in the laboratory; and publications don't seem to get updated to keep pace with changes in the equipment.

These shortcomings in the support system become apparent only after the aircraft has been deployed to the operating fleet. Operational readiness has suffered and costs have skyrocked as "get well" schemes are employed. It becomes obvious that if the support requirements could be predicted with even a small improvement in accuracy, operational readiness would go up and huge savings would ensue. The PALR study objective was to predict aviation logistics requirements with sufficient lead time to enable efficient and effective preparation for system support.

Study Approach

To acquire a view over the horizon of time, a two-pronged approach was employed. First, an extensive review of existing literature was conducted in an effort to discover what research had already been done that could aid in developing the needed foresights into the future of naval aviation. Forecasts examined included the Navy Aviation Plan and the Extended Planning Annex, prepared by NAVAIR (Naval Air Systems Command) and OPNAV (chief of Naval Operations); the Navy Energy Plan, published by OSD (Office of Secretary of Defense); the Congressional Budget Issue Papers; the Roadmaps Through Technology, prepared by AIR-03; as well as many forecasts prepared by research firms. Publications from the Office of Naval Research germane to naval aviation were also studied, as were publications from the Institute for Defense Analysis, Defense Advanced Research Project Agency, the Congressional Office of Technology Assessment, and NASA. To ensure the data search was thorough, the Defense Documentation Center was interrogated to secure reports of work performed, or in progress, by both industry and government, that would in some way foretell the future of naval aviation.

A second means of information gathering was interviews with people who, through their background experience and their current interest, have given thought to changes likely to occur to naval aviation in the future. Personal opinions were sought in order to compile a forecast based on the intuitive judgements of experts.

Almost without exception the participants in these interviews were cooperative and willing to voice their individual opinions about the future of naval aviation. They were also enthusiastic about the PALR study and its objectives. As these interviews continued, a well defined picture of the future began to take shape. Not all responses to the interview questions were identical; in fact, there was a wide variety of answers. But, when opinions representing the current thinking of the majority interviewed were assembled, the resulting scenario appears plausibile. Additionally this scenario is corroborated by (or at least not at odds with) published research data. This scenario is presented here for information and discussion only, and should not be construed as representing the final conclusions of the PALR study.

Preliminary Findings

A. The Naval Aviation Mission.

To understand what naval aviation support will be like in the 1985-1995 decade we must first examine the changes taking place in the Navy's assigned missions. The Navy's two basic missions are:

- Power Projection
- Sea Control (Assertion/Denial)

Naval aviation will be involved in each of these missions. but both the tasks and the aircraft will be changed from what we see today. The importance of naval aviation is seen by this forecast to be growing in the future, but it will not be structured as it is today.

Strategic Deterrence, a subset of Power Projection, will be a subsurface Navy task only as long as the sea is a good place to hide. With the deployment of an effective underwater detection system that can pinpoint the location of the ballistic missile submarine or an effective defense against the ICBM (Intercontinental Ballistic Missile)

(such as satellite killer that intercepts the missile at its apogee), and either of these two possibilities (perhaps both) appear likely, the Strategic Deterrence task will no longer be the exclusive domain of the subsurface navy. Surface ship and air launched cruise missiles will share this responsibility.

The Naval Presence task, another subset of power projection, will still involve naval aviation but it will take on a new character. This task will be more ceremonial than a threat of force, but carrier based aviation will continue to play a prominent role. Fulfilling this role to the extent that it can remain a deterrent to armed aggression against the U.S. would require more than the 13 big deck carriers forecast by OP-96 to be operational in the 1990's. This forecast predicts the CVA population will be reduced to 8 by the time period of interest, one of the reasons for the retreat to the ceremonial role.

The primary mission involving naval aviation is Sea Control, where extensive changes are in prospect. There are several identifiable trends that will impact the shape of this Navy mission. Losing our overseas bases, either by being ejected completely or by having restrictions placed on our activities, is a well established trend. This may not alter the Sea Control mission, but it will alter significantly the manner in which naval aviation performs this mission. Another trend that is likely to continue is manifested in the growing interdependency among nations. The U.S. is no exception, an interdependency on trade is growing among all nations. In petroleum products alone the U.S. currently depends on imports to satisfy 48 percent of demand. It becomes apparent that a free flow of ship traffic is essential to the nation's economy. Another observable trend that will impact the Navy's Sea Control mission stems from the propensity of nations to extend their national borders into the sea, particularly where harvestable resources are invloved. The discovery of oil in the North Sea has caused a previously international area to be divided among its bordering nations. The recent 200 mile extension of the U.S. boundaries for the fishing industry is just one of the many signs that more and more of the ocean areas will be annexed by bordering nations. The impact of these factors on the Navy's Sea Control mission will be significant.

While the Sea Control mission grows more complex, we see the number of ships the Navy has to do the job growing smaller, currently down to 459 ships. There are several ways the Navy will adjust to this apparent shortfall. A drive is on to reverse the continuing decline in the number of ships, but there's little chance of success. Instead, we'll see an adjustment to fewer and fewer ships. To do this will require a greater use of aircraft, and a shrinking of the area controlled. More ships will have an air capability, not V/STOL (Vertical/Short Takeoff and Landing) but rotary wing type. The submarine is the greatest threat to Sea Control and LAMPS (Light Airborne Multi-Purpose Systems) is

the Navy's best counter to that threat. V/STOL will undoubtedly someday enter the Navy's inventory of operational aircraft, but, not during the 1985-1995 time window. We will also see a much greater use of fixed wing, shore based aircraft. The areas controlled will be confined to selected high priority shipping lanes, and the Sea Control will be in the denial mode, not the assertive mode. In other words, the U.S. will become even less of a power in the world of the future.

The Power Ashore task will continue to be a naval aviation job, and the 8 big decks will be more than adequate for a Vietnam type conflict. A full blown war against a nation like the Soviet Union will, however, find even 13 big decks to be woefully inadequate in number. Shore based aircraft carrying cruise missiles will be substituted for this ship shortfall. They may be Navy but will more likely be Air Force. Naval aviation will have an important role, however. Operating from small ships, they will provide surveillance and guidance for ship launched antisubmarine, antiship and antiaircraft missiles. These will be both manned and unmanned aircraft.

B. Aircraft Maintenance

100 percent accuracy in forecasting the future is not only impossible; it is not even necessary. What is necessary and preliminary to any planning activity, is a view of the direction progress will take if it is not consciously influenced. But conscious influence will be invoked. In fact, the trend must often be turned onto another path or we will be led to an untenable conclusion. It becomes obvious, then, that if we can identify the pitfalls toward which current trends are leading, we can take the necessary action to divert our course into more profitable channels.

Extrapolating current trends, that in some way shape naval aviation maintenance, will give us a picture of the future if these trends are not perturbed. By discussing these trends with both Navy and industry personnel who are closely associated with naval aviation maintenance, and who have given thought to its future, we are able to identify the perturbing factors. The collective inputs from these discussions also give us a view of the new direction forced by these perturbations, and thus a credible forecast of the shape of naval aviation in the future.

Currently well established trends that will shape naval aircraft maintenance in the 1985-1995 decade follow:

1. The cost of labor has historically risen at a rate in excess of inflation. Pushing this trend upward toward even higher labor costs is a lower birth-rate that will

yield 25 percent fewer candidates than are available today for recruiting into the 1990 Navy. Changes to the manner in which the Navy uses maintenance manpower are inevitable.

2. Technological advances in aircraft components, in test equipment and in maintenance techniques will alter the way Navy aircraft are maintained.

3. VAST (Versatile Avionics Shop Tester) was a concept developed to halt the profileration of ATE (Automatic Test Equipment) in the IMA (Intermediate Maintenance Activity). It now appears to be in trouble. The IMAs are crowded with interface devices, new ATE is sharing the load with an overworked VAST, and new equipment may not require VAST compatibility. This revolution in the IMAs will change drastically the manner in which Navy aircraft are maintained.

4. The trend toward increasing complexity with each new weapon system shows no sign of a turn-around. Higher skills will be required to maintain these more complex equipments further compounding the Navy's aircraft maintenance problem.

5. The trend toward a greater use of built-in test (BIT) and condition monitoring for organizational level fault diagnosis appears to be irreversible. The impact of this phenomenon on aircraft maintenance will be significant.

6. OMB (Office of Management and Budget) Circular No. A-76, as well as political and economic forces, has stimulated a well established trend toward the increasing use of contractor vs. organic maintenance. If this trend continues a significant change to the maintenance concept of naval aviation will result.

7. The introduction of RIW (Reliability Improvement Warranty) as well as other forms of contractor warranty is shifting the burden of aircraft maintenance from Navy personnel to the contractors.

The picture of naval aviation maintenance emerging from this investigation shows some very significant changes. Rapidly escalating labor costs, as well as other factors, will increase the pressure to improve reliability, thus reducing the need for maintenance. All systems will see improved reliability, particularly in avionics where an order of magnitude improvement is expected. Improved BIT will reduce false removals to nearly zero. Fiber optics will be used for all signal carriers in the aircraft permitting a redundancy that makes wiring changes unnecessary. Changes to the avionics can then be made without having to change interconnecting wiring.

Perhaps the greatest change to aircraft maintenance will be seen in the IMAs. The increased use of systems under contractor warranty plus a more reliable and comprehensive use of BIT will all but eliminate the IMA. BIT and performance monitoring will isolate to a removable module, which will be either discarded or sent to depot for repair. Engines will be truly modular, with performance monitoring of their vital signs and with automatic trend evaluation. This will allow removal and replacement of the offending module before a failure takes place, while permitting the failure free modules to continue in use unmolested.

VAST will all but disappear from the inventory. Modern multipurpose off-line automatic test equipment will still be used extensively at the depots and to a limited extent at the greatly reduced IMA's (particularly at IMA's located at Naval Air Stations). TPS's (Test Program Sets) will be computer generated reducing errors to near zero and making updating a simple and expedient function.

The sum effect of these changes will be to greatly reduce the maintenance work load of military personnel and to shift more of the load to contractor responsibility.

Aircraft readiness will be maintained at a much higher state (90 percent or better) than is possible today. High fuel costs will force greatly reduced flying hours, most of the air crew training being accomplished in simulators. The aircraft will be maintained in an "up" condition by exercising the systems using special GSE (Ground Support Equipment), much the same as a missile is maintained in a ready condition in its silo.

C. Material Acquisition Management

The forecasting of changes that are likely to occur in the way NAVAIR does its business has been derived from the needs expressed in many interviews, modified by what appears to be possible and also likely by the time frame of interest. The forces acting to change current procedures included the nearly universal belief that naval aviation support is not adequate, and that this condition will grow worse before improving. More money poured into supply will improve this condition, but common sense tells us that more money will not be available. Even a 3 percent real growth promised by the current administration will make little impression on the huge backlog of needs in aviation logistics. It becomes obvious that the cure to this support problem is as complex as the aircraft itself. There is no single answer and there are no easy solutions, just a lot of changes to the entire material acquisition process.

If we first identify the areas needing change and then examine the climate for change in each of these areas, we can arrive at a reasonable forecast. All of the changes refer to some aspect of the NAVAIR material acquisition process. Listed below are a number of areas that need improvement along with a discussion of the changes anticipated:

1. Navy aircraft should be designed to enhance their supportability. To accomplish this will require a restructuring of the acquisition process. It starts with a realistic concern for life cycle costs. This translates into more time and money being given to the development and test period in order to reap savings throughout the operating life of the system. Manifestation of this change will see Program Managers giving attention to aircraft support in the very early concept formulation stage. This concern will be translated into contract language that lays the responsibility on the contractor for developing a supportable aircraft, and provides the resources to accomplish this objective. Greater supportability will be created in several ways--higher reliability, lower time to repair, increased use of mature systems for which a support structure exists and an increased use of commercial components. BIT and condition monitoring with automatic trend evaluation will be used extensively, greatly reducing organizational level maintenance. Most systems will be truly modular with automatic fault isolation. This permits removal and replacement at organizational level and repair at depot, thus eliminating most intermediate level maintenance. To accomplish this requires a close and continuous liaison between the designer and the logistician, both in government and in industry, throughout the design and development process. Progress will be made toward achieving this objective.

2. We will also see a much higher fault tolerance in Navy aircraft, permitting failures to occur without degrading mission capability. To accomplish this will require substantial changes to the NAVAIR acquisition process. Much greater coordination of subsystem design and development will be required in order to achieve the necessary overall system integration. Considerable progress is expected in this area.

3. Systems will be designed to better cope with the actual operational environment. To do this will require a substantial change in procurement procedures with less dependance on military specifications and with new methods being developed for measuring contractor performance. We will also see system acquisition requirements measured in the same terms as are used to measure systems performance in the field, thus making possible realistic support planning. It will be possible to equate MTBF (Mean-Time-Between-Failures) as measured in the laboratory with that exhibited in the operational aircraft.

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4. The NAVAIR organization will be restructured so that maintenance and support will receive proper consideration throughout the aircraft's life cycle, beginning with DSARC (Defense System Acquisition Review Council) - zero. Major programs will have a deputy program manager for logistics. This means that beginning with the approval of the mission need statement, there will be an institutionally chartered person (with authority) whose job it is to insure adequate consideration is given to logistics. Additionally, the authority of AIR-04 will be expanded to encompass the management of all logistic support elements except squadron maintenance. This includes supply, training and training equipment, publication, test equipment and depot maintenance.

5. We will see greater use of contractor warranties that hold the contractor accountable for longer periods of time into the deployment period. By incentivising reliability and supportability, both the contractors and the Navy users will benefit.

One strong guiding force shaping each of these changes in procurement practices is the growing awareness that conflicts of the future involving naval aircraft will be fought with operationally ready aircraft on hand when the conflict is initiated. Unlike prior wars when there was time to acquire the spare parts, train the skilled maintenance manpower and assemble the other support needed to bring aircraft up to mission ready condition, future adversaries are not likely to be so cooperative. This will require operational readiness rates of 90 percent or better for all deployed aircraft. NAVAIR procurement practices must be structured so as to make that possible.

Another factor shaping future procurement practices grows out of a lesson learned in the 1973 Israeli war. "Surface to Air Missiles (SAM) are accurate, deadly and cause very high aircraft attrition rates." This translates into a requirement for higher quantities of aircraft in the future, which is counter to current well established trends. Since unlimited buying power is not likely to be bestowed on the Navy of the future, there are two courses of action that can be taken to meet quantity requirements. The first and most obvious solution is to update old aircraft through the use of SLEP (Service Life Extension Program) and CILOP (Conversion In Lieu Of Procurement). The second method of building up the inventory is through the purchase of cheaper new aircraft. The F-18 is a step in that direction, but it is far from being a cheap aircraft.

It is within this environment of high quantity requirements and constrained procurement budgets that the RPV (Remotely Piloted Vehicle) will find a sponsor. Simple, light, small and inexpensive, the RPV will satisfy many of the missions now performed by manned aircraft. But apropos to future naval aircraft missions (over-the-horizon intelligence gathering and ship launched weapon control), the RPV with its ability to stay on station for long periods without fatigue while presenting a small radar target is clearly superior to manned aircraft. Further, the RPV can be operated from most Navy ships using simple launch and recovery techniques, and could be deployed in quantities sufficient to sustain high casualty rates. Perhaps the RPV's most salient feature is that it has a fearless pilot.

VOLUME 2

QUESTIONNAIRE CONTENT

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ESA-835:HEF

8 DEC 83

From: Director, Naval Weapons Engineering Support Activity
To:

Subj: PALR (Prediction of Aviation Logistics Requirements) Study

Encl: (1) PALR (Prediction of Aviation Logistics Requirements) Questionnaire
(2) Self addressed envelope

1. Providing logistic support for today's naval aircraft is a complex task. Often, the problems are not clearly defined until long after the aircraft has been deployed, when correction of these defects is difficult and costly. Obviously if we could foresee these operational troubles during the aircraft developmental stage they might be avoided.

2. Under an assignment from the Research and Technology Department of the Naval Air Systems Command, we are seeking to predict naval aviation logistics requirements for the decade 1985-1995. One type of input into the formulation of the forecast is to solicit the opinions of people who are vitally interested in naval aviation and who have given serious thought to its future. It is to fulfill this objective that we are forwarding the PALR questionnaire (enclosure 1).

3. The events delineated for analysis have been selected from interview and research data and are based on the criterion that, occurring either singly or collectively, they would most significantly impact Navy air operations, maintenance and support. Event probability and time projection figures, from which the required support scenarios for the 1985-1995 period will evolve, can then be statistically determined.

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Subj: PALR (Prediction of Aviation Logistics Requirements) Study

4. Please feel free to duplicate and distribute these questionnaires within your organization to personnel whose response you feel will contribute to our objectives. Your response to this questionnaire is crucial to the success of this program. Forecast credibility is greatly dependent upon the number of responses received. In order to meet our schedule we would like your responses by 30 December 1977. A self addressed envelope (enclosure 2) is included for your use. If you have any questions, please feel free to call either Harry Foster or Pete St. Jean at (202) 433-4063 or Autovon 288-4063.

5. The final findings of this effort will be summarized in a report scheduled to be published in March 1978. Distribution will be made to all who have participated in formulating the forecast. Thank you for your cooperation in helping make this forecast a truly viable device that can be used with confidence by all of us in planning the future support of naval aviation.

L.R. Hunt
By direction

Prep by: H.E. Foster, X34063
L. Lopo

PALR QUESTIONNAIRE

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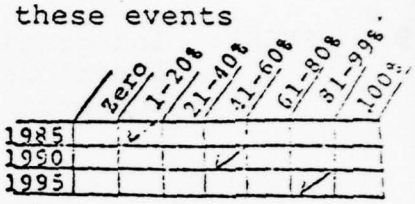
The list of questions which follow relate to the probability of occurrence of events which seem to be of potential significance to the area of Navy aircraft maintenance and/or the NAVAIR acquisition management process. For each of the thirty events considered, we would like you to indicate your opinion of the probability of its occurrence prior to 1985, 1990 and 1995 respectively. All that is needed is for you to check the appropriate boxes in the array provided as shown in the Sample Event below. If you feel yourself to be unable to provide even an estimate in a specific instance, please proceed to the next question.

What do you believe is the probability of each of these events occuring no later than the date shown?

SAMPLE EVENT: Limited regional weather control at an acceptable cost becomes feasible.



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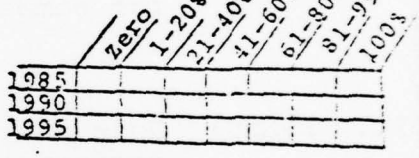
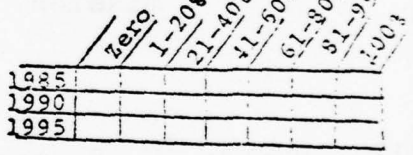
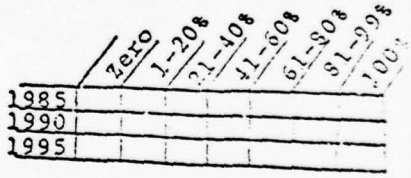
1. EVENT: Solicitations to industry for major weapon systems are expressed in terms of mission needs, freeing the contractors to propose their own technical approach.



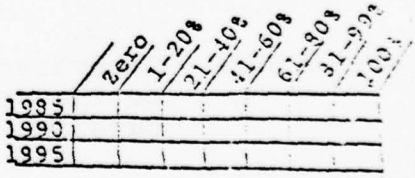
2. EVENT: 300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.



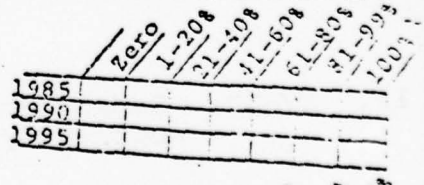
3. EVENT: Repair facilities at Naval Air Stations totally manned by civilians.



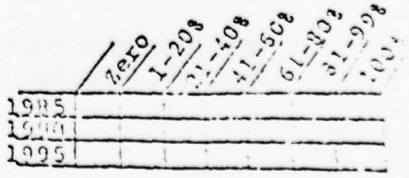
4. EVENT: All NARFs managed and operated by contractors.



5. EVENT: Decision made to extend the life of the F-4 through CILOP.

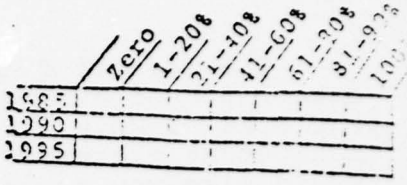


6. EVENT: F-18 deployed to the operating fleet.

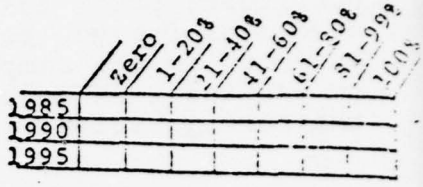


What do you believe is the probability of each of these events occurring no later than the date shown?

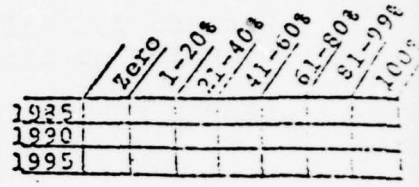
7. EVENT: The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery.



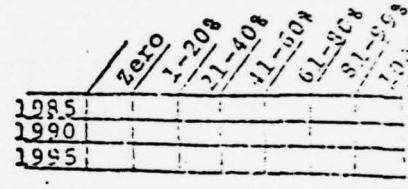
8. EVENT: Incorporation of the functions of ASO under the management of AIR-04.



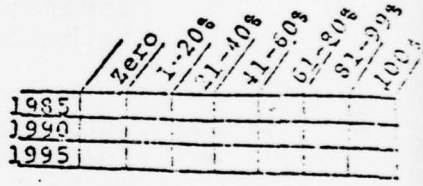
9. EVENT: Integration of all avionics functions into a single package for each aircraft type.



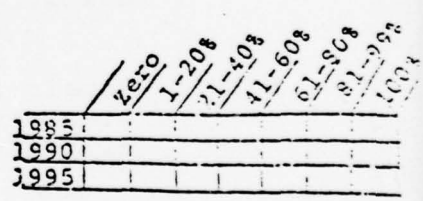
10. EVENT: RPVs replace 50% of manned aircraft for combat missions.



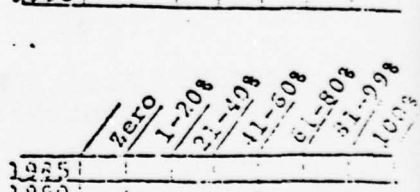
11. EVENT: Long range land-based Navy aircraft perform the Navy's sea-control mission.



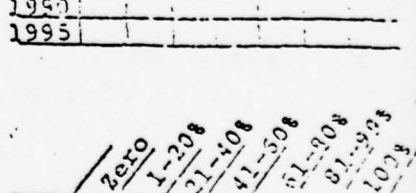
12. EVENT: U. S. carrier force reduced to 8 CVAs.



13. EVENT: No overseas bases available to the Navy in peacetime outside the Western hemisphere.



14. EVENT: Deployment of V/STOL-A as currently envisaged by NAVAIR.



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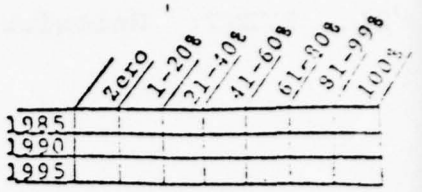
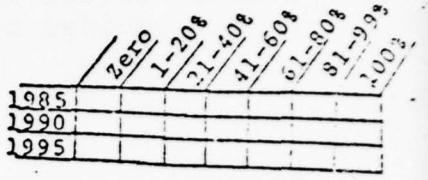
What do you believe is the probability of each of these events occurring no later than the date shown?

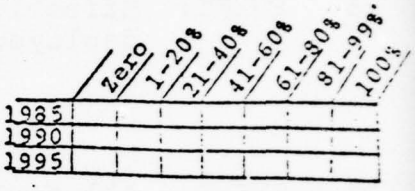
16. EVENT: Development and widespread use of non-fossil sources of power for aircraft.



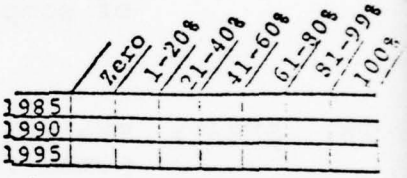
17. EVENT: 50% replacement of training flight activity by use of simulators.



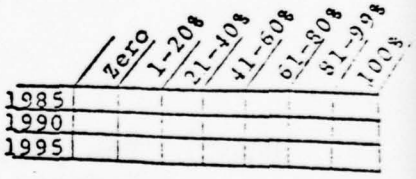
18. EVENT: Use of fault-tolerant design and performance monitoring to the extent that pilot is only informed of malfunctions when mission capability is degraded.



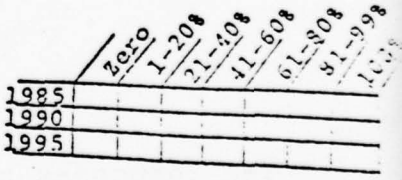
19. EVENT: Most Naval aircraft maintenance instructions stored electronically on-board ships.



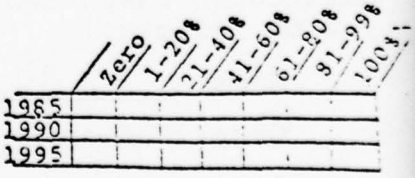
20. EVENT: Concept of VAST (Versatile Avionics Shop Test) for use in I-level maintenance is dropped.



21. EVENT: Performance monitoring with automatic trend analysis will control O-level maintenance.



22. EVENT: Civilian-manned ships used for intermediate-level aviation maintenance.



23. EVENT: No module repair in shipboard intermediate level maintenance, only test and replace.

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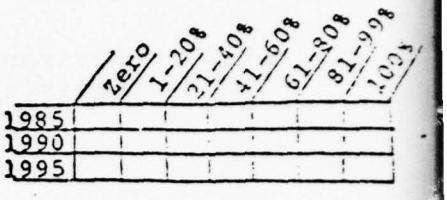
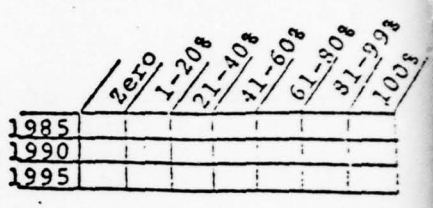
What do you believe is the probability of each of these events occurring no later than the date shown?

24. EVENT: Unionization of military forces.

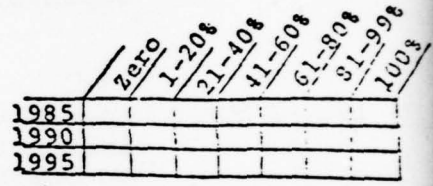
25. EVENT: Cruise missiles controlled/ guided by Navy aircraft.



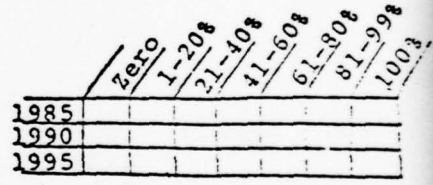
26. EVENT: Effective anti-satellite capability deployed by hostile power.



27. EVENT: All newly acquired airframe structures are made exclusively of composite materials.



28. EVENT: The regulation prohibiting use of women for Navy combat missions is abolished.



29. EVENT: The position of Deputy Program Manager/Logistics is established in NAVAIR.

OPTIONAL ADDITIONAL INFORMATION

The responses to this questionnaire will not be ascribed to a particular respondent. For our own information, however, we would like you to indicate:

Name _____

Organization _____

Military rank, if applicable _____

Management position _____

Area of primary responsibility _____

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VOLUME 2

QUESTIONNAIRE RESULTS (SYNTHESIS)

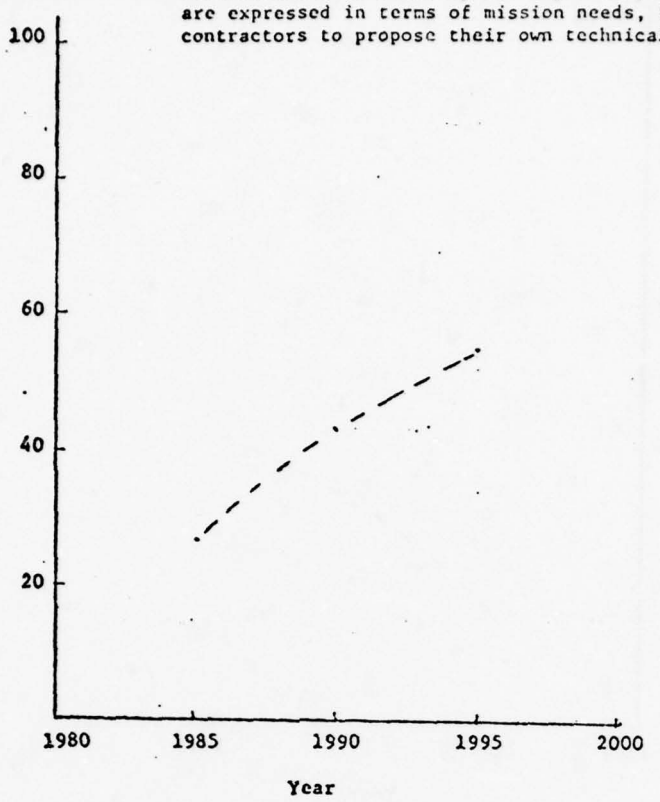
EVENT 1	EVENT 6	EVENT 11
P_{85}^{*} = 26%	P_{85} = 41%	P_{85} = 8%
P_{90} = 43%	P_{90} = 64%	P_{90} = 18%
P_{95} = 56%	P_{95} = 76%	P_{95} = 32%
EVENT 2	EVENT 7	EVENT 12
P_{85} = 26%	P_{85} = 28%	P_{85} = 14%
P_{90} = 51%	P_{90} = 47%	P_{90} = 33%
P_{95} = 74%	P_{95} = 60%	P_{95} = 52%
EVENT 3	EVENT 8	EVENT 13
P_{85} = 15%	P_{85} = 19%	P_{85} = 10%
P_{90} = 30%	P_{90} = 32%	P_{90} = 22%
P_{95} = 42%	P_{95} = 40%	P_{95} = 32%
EVENT 4	EVENT 9	EVENT 14
P_{85} = 13%	P_{85} = 12%	P_{85} = 8%
P_{90} = 25%	P_{90} = 28%	P_{90} = 25%
P_{95} = 36%	P_{95} = 41%	P_{95} = 50%
EVENT 5	EVENT 10	EVENT 15
P_{85} = 35%	P_{85} = 5%	OMITTED
P_{90} = 30%	P_{90} = 19%	
P_{95} = 26%	P_{95} = 34%	

*P_{xy} = probability of occurrence by year 19xy.

EVENT 16	EVENT 21	EVENT 26
P_{85} = 4%	P_{85} = 16%	P_{85} = 43%
P_{90} = 17%	P_{90} = 39%	P_{90} = 70%
P_{95} = 36%	P_{95} = 62%	P_{95} = 86%
EVENT 17	EVENT 22	EVENT 27
P_{85} = 23%	P_{85} = 4%	P_{85} = 11%
P_{90} = 46%	P_{90} = 13%	P_{90} = 30%
P_{95} = 66%	P_{95} = 20%	P_{95} = 44%
EVENT 18	EVENT 23	EVENT 28
P_{85} = 15%	P_{85} = 17%	P_{85} = 22%
P_{90} = 38%	P_{90} = 36%	P_{90} = 41%
P_{95} = 60%	P_{95} = 53%	P_{95} = 56%
EVENT 19	EVENT 24	EVENT 29
P_{85} = 24%	P_{85} = 8%	P_{85} = 41%
P_{90} = 51%	P_{90} = 15%	P_{90} = 58%
P_{95} = 71%	P_{95} = 21%	P_{95} = 68%
EVENT 20	EVENT 25	
P_{85} = 15%	P_{85} = 24%	
P_{90} = 37%	P_{90} = 52%	
P_{95} = 57%	P_{95} = 69%	

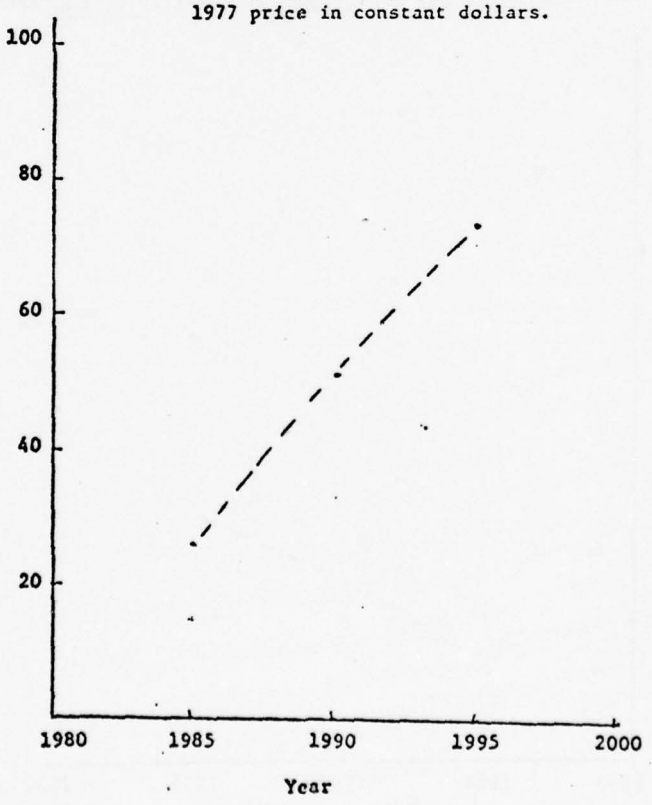
EVENT 1

Solicitations to industry for major weapons systems are expressed in terms of mission needs, freeing the contractors to propose their own technical approach.

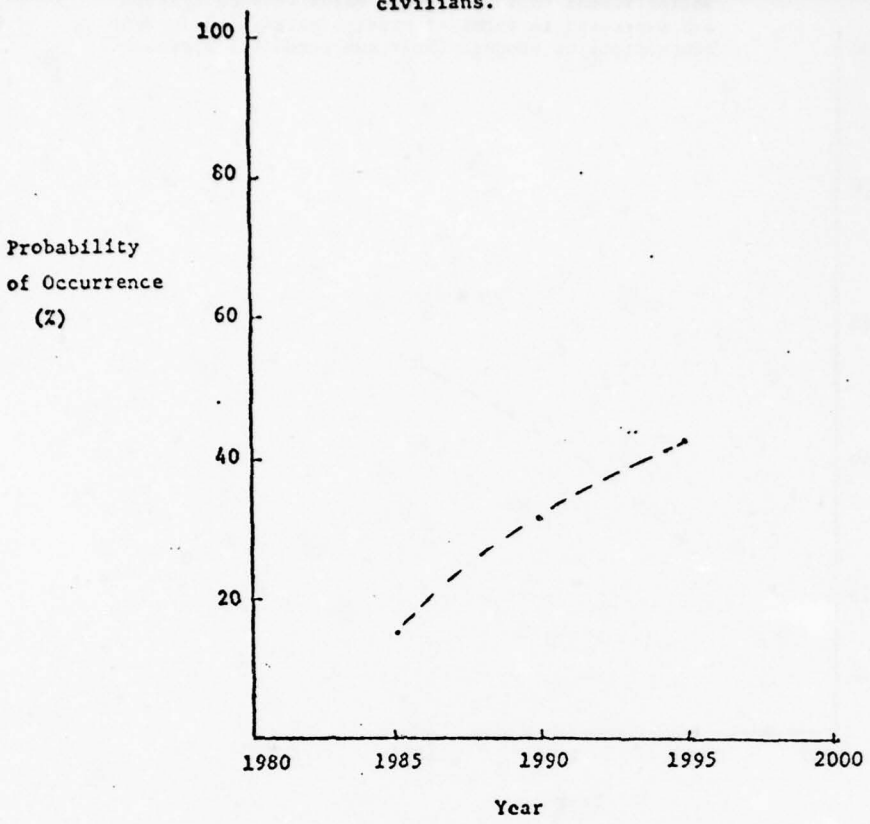


EVENT 2

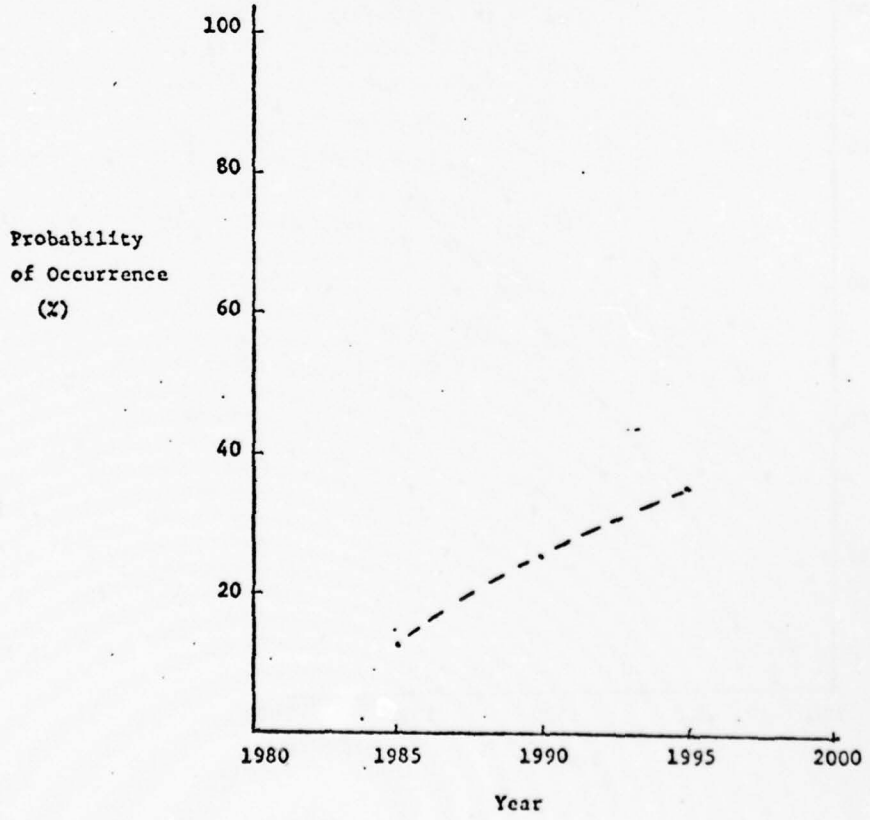
300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.



EVENT 3 Repair facilities at Naval Air Stations totally manned by civilians.

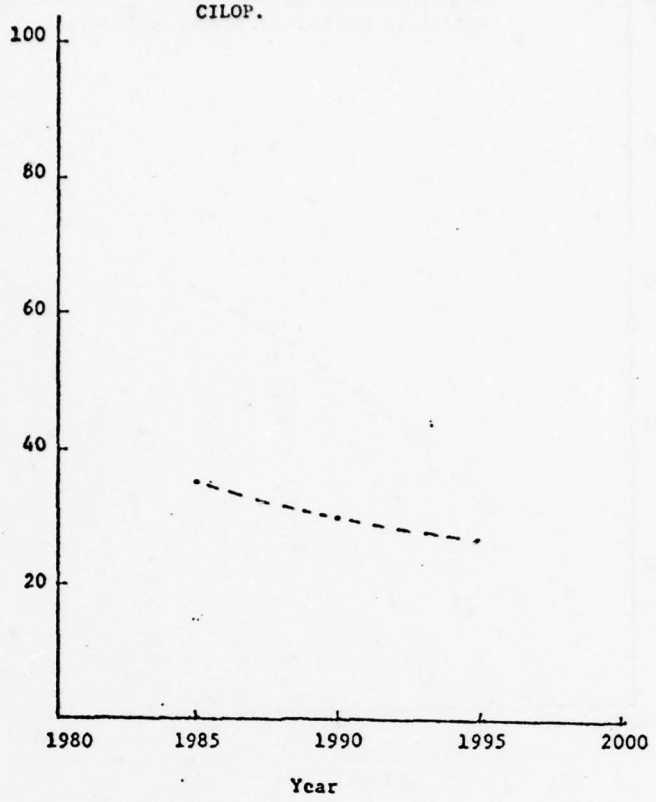


EVENT 4 All NARFs managed and operated by contractors.



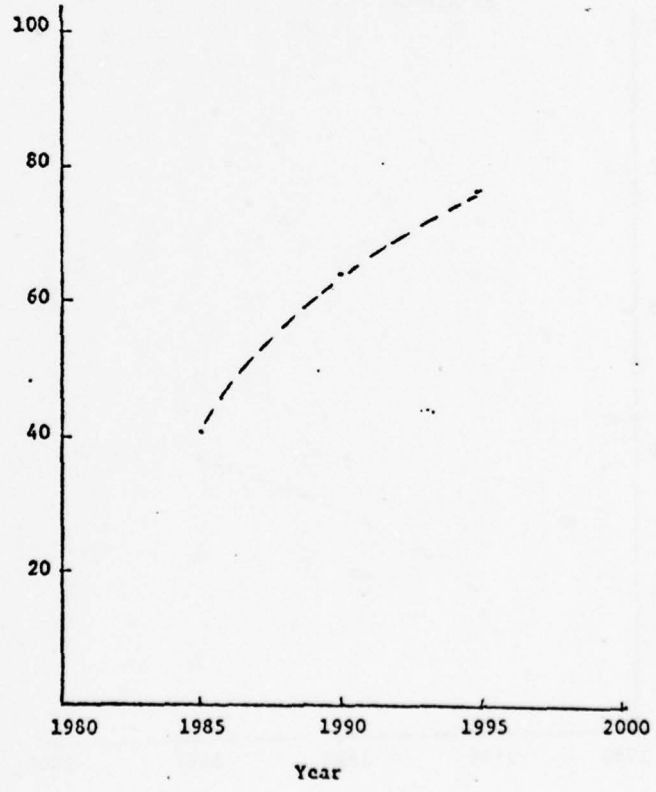
EVENT 5

Decision made to extend the life of the F-4 through CILOP.



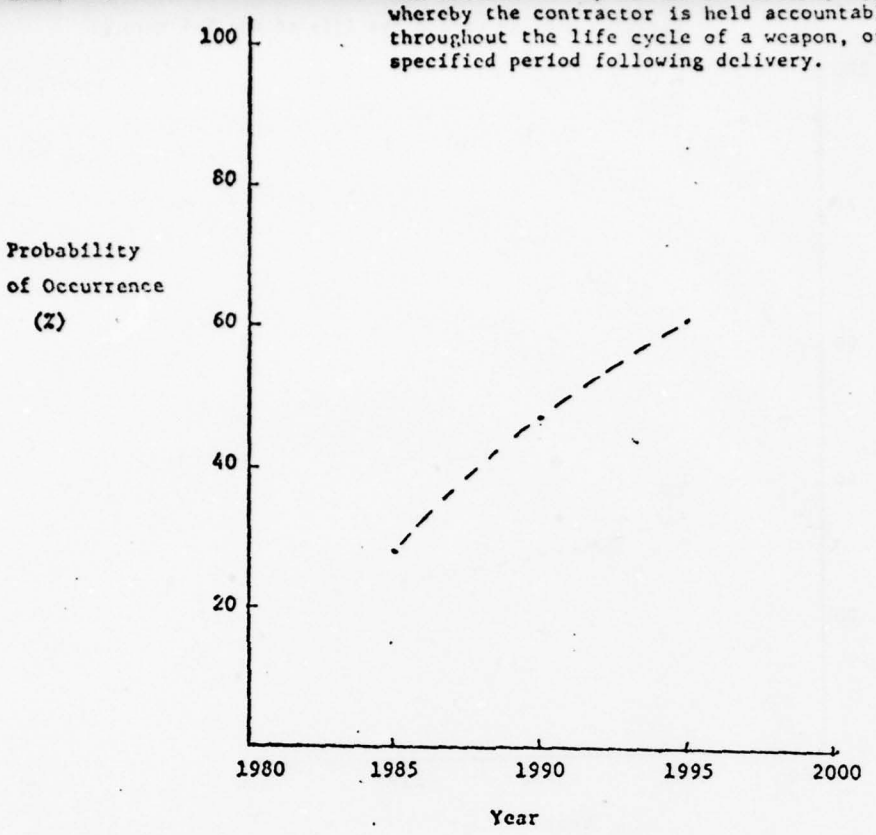
EVENT 6

F-18 deployed to the operating fleet.



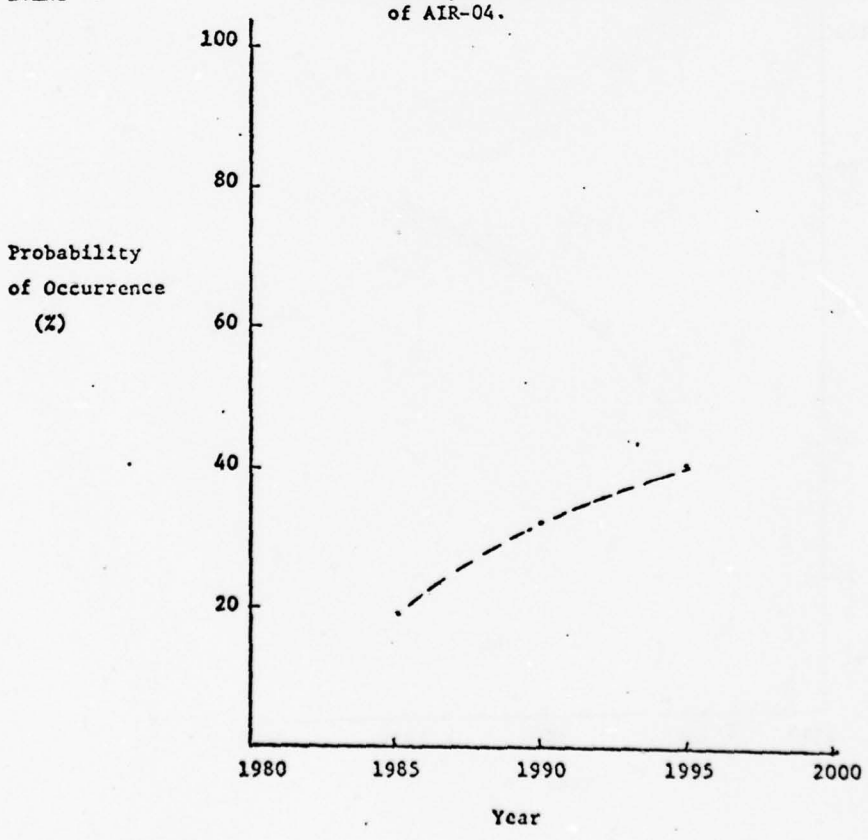
EVENT 7

The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery.



EVENT 8

Incorporation of the functions of ASO under the management of AIR-04.



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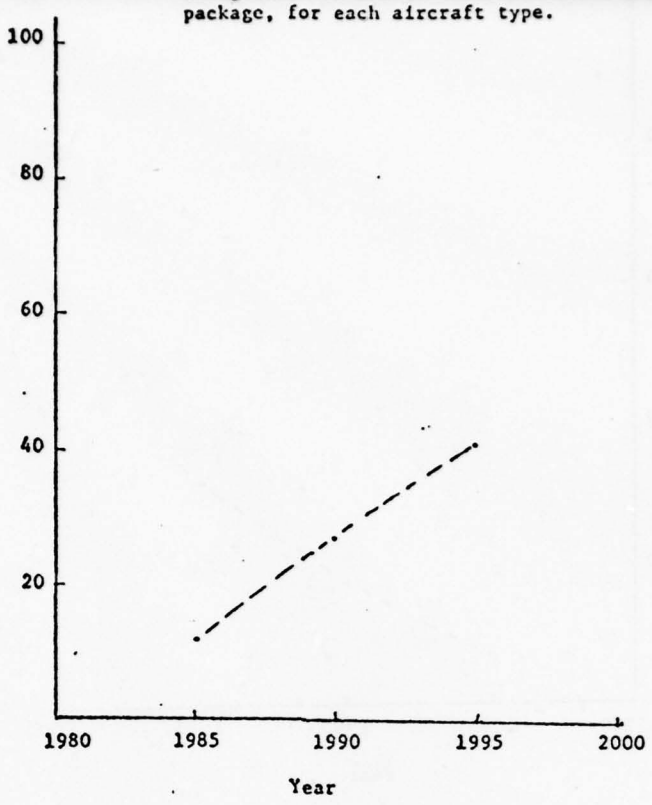
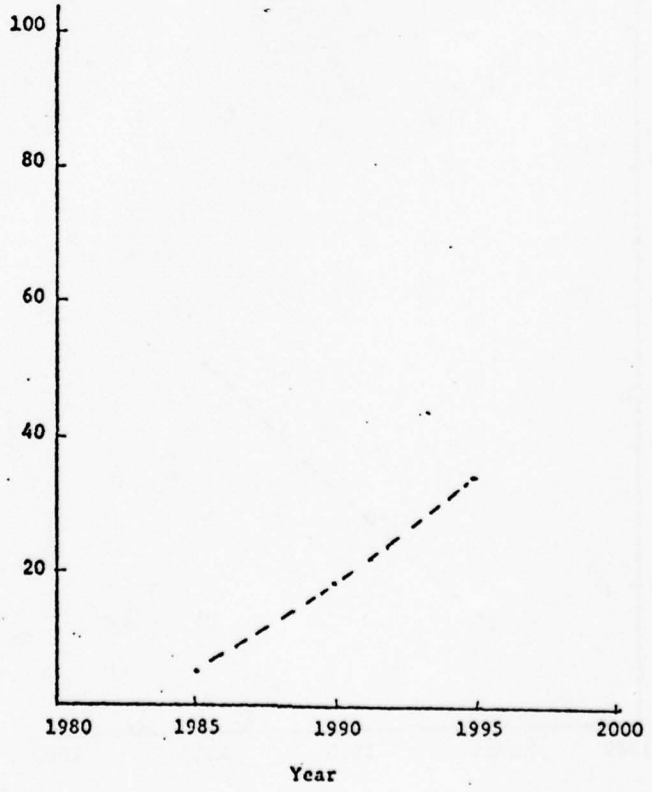
Integration of all avionics functions into a single package, for each aircraft type.



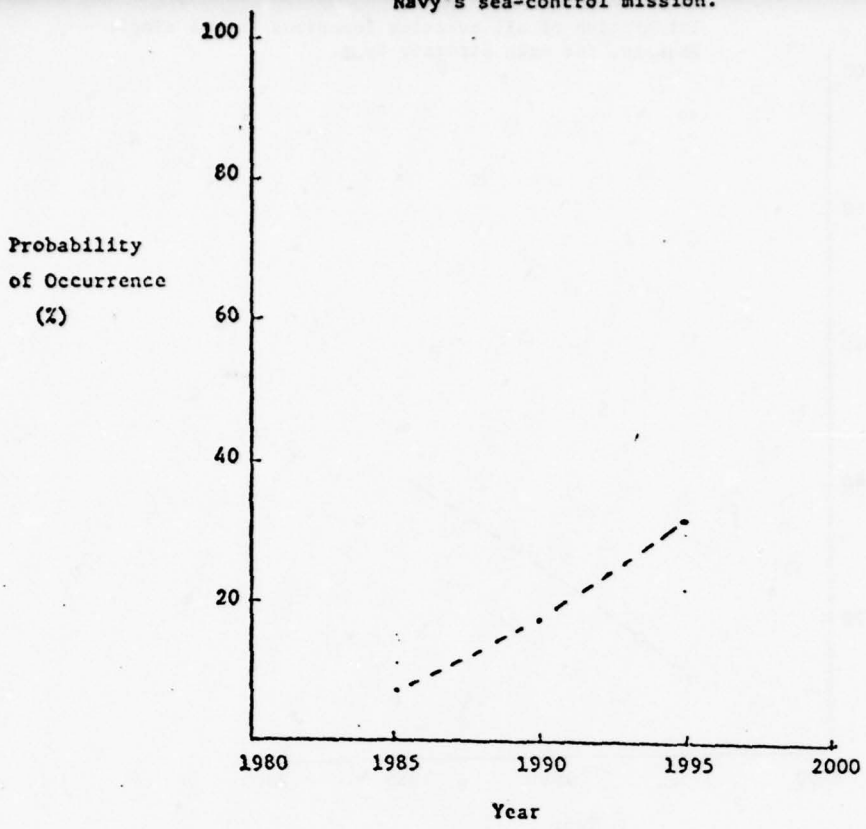
EVENT 10

RPVs replace 50% of manned aircraft for combat missions.



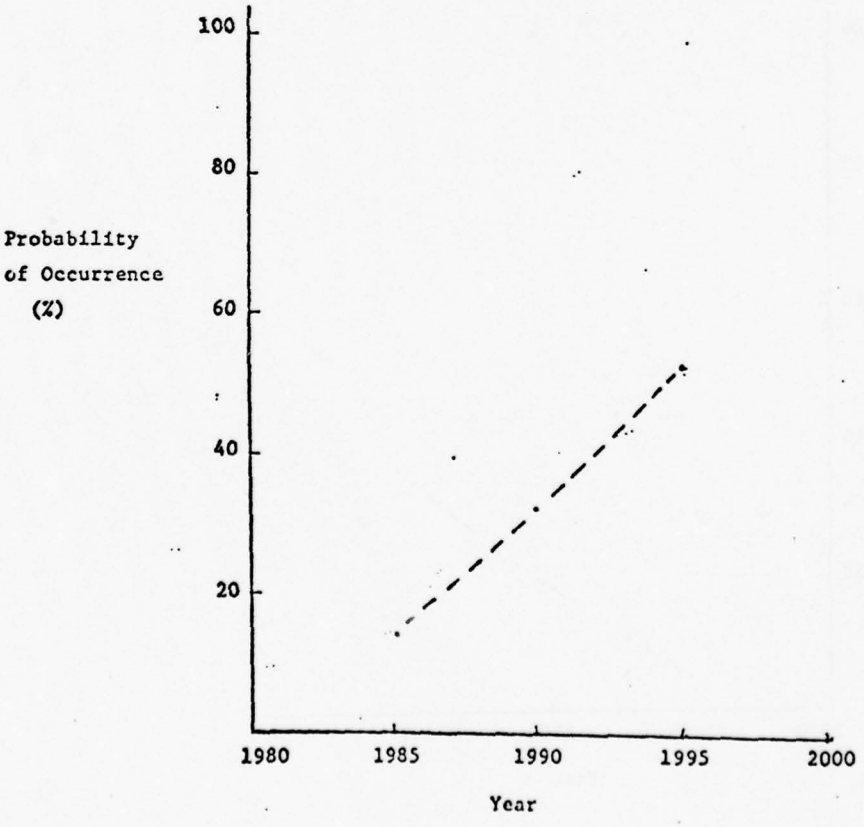
EVENT 11

Long range land-based Navy aircraft perform the Navy's sea-control mission.



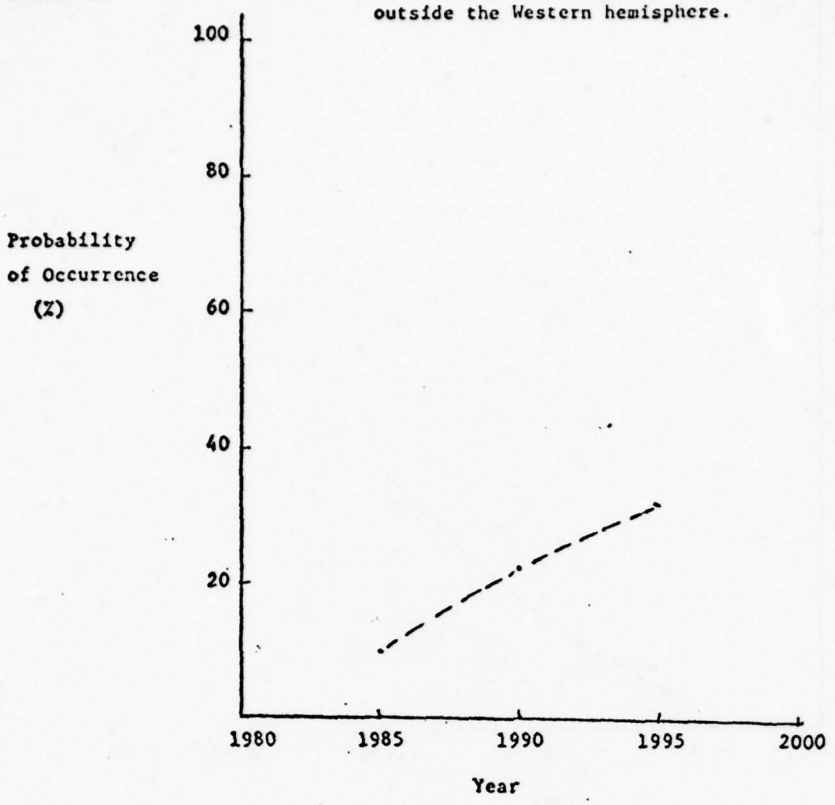
EVENT 12

U. S. carrier force reduced to 8 CVAs.



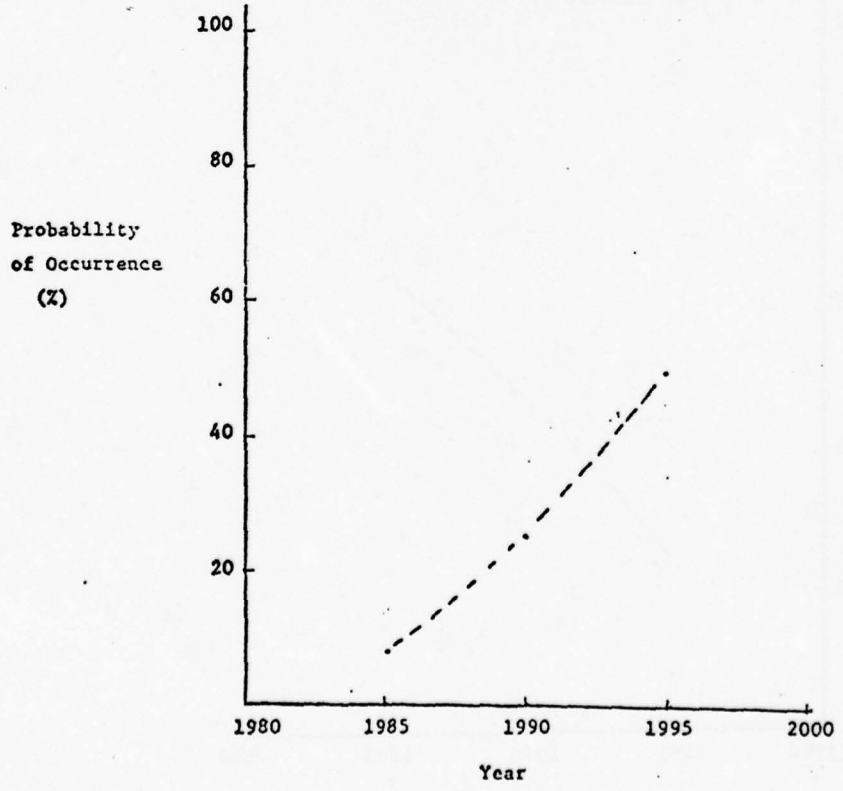
EVENT 13

No overseas bases available to the Navy in peacetime, outside the Western hemisphere.



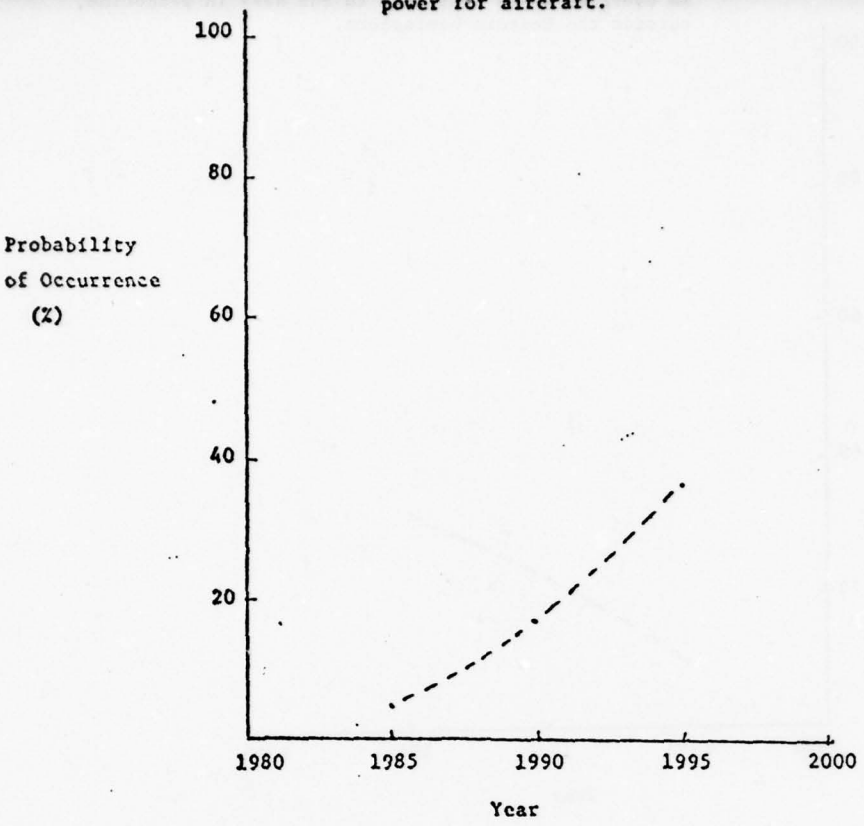
EVENT 14

Deployment of V/STOL-A as currently envisaged by NAVAIR.



EVENT 16

Development and widespread use of non-fossil sources of power for aircraft.



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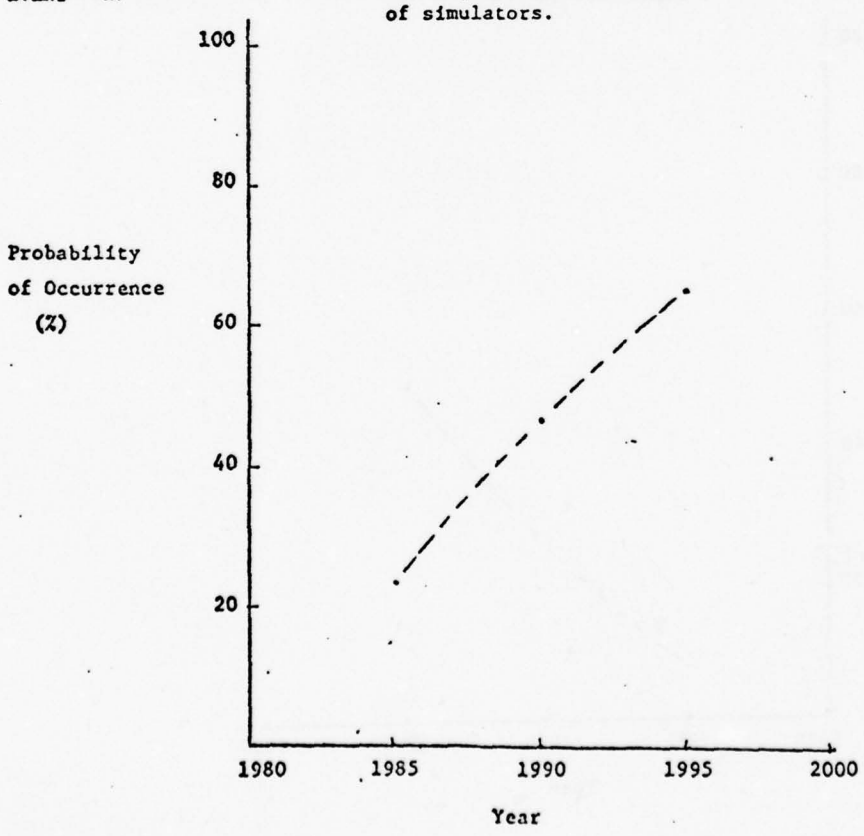
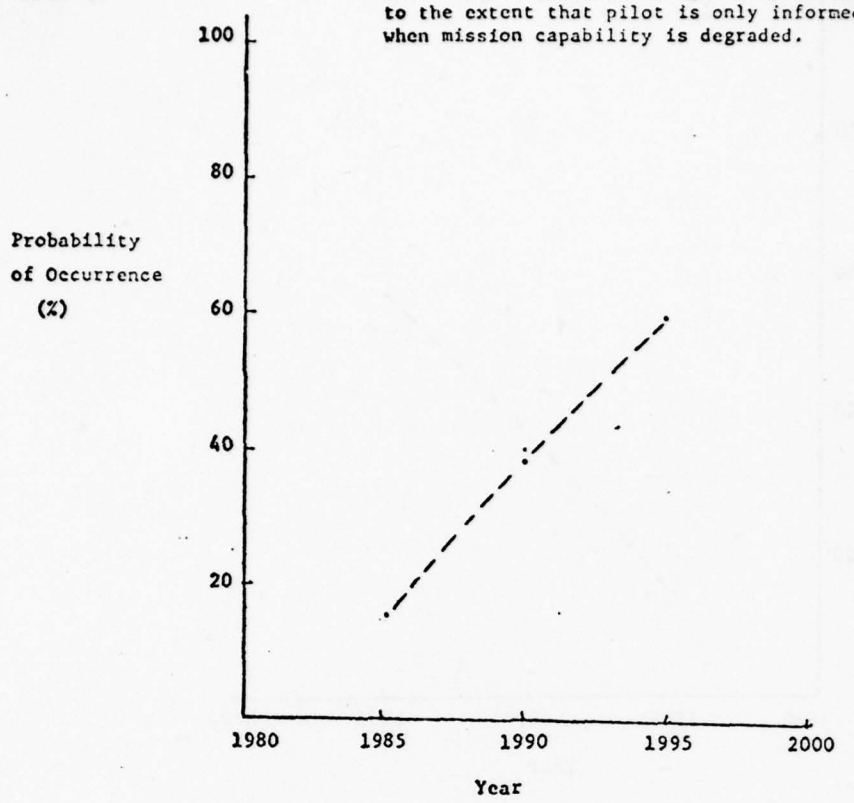
50% replacement of training flight activity by use of simulators.



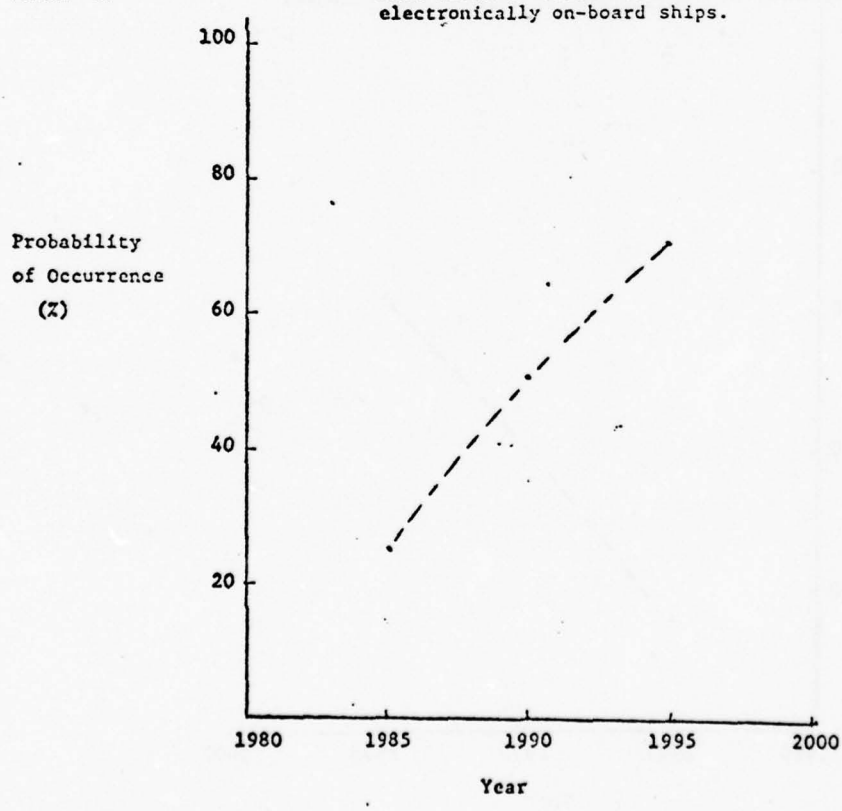
EVENT 18

Use of fault-tolerant design and performance monitoring, to the extent that pilot is only informed of malfunctions when mission capability is degraded.

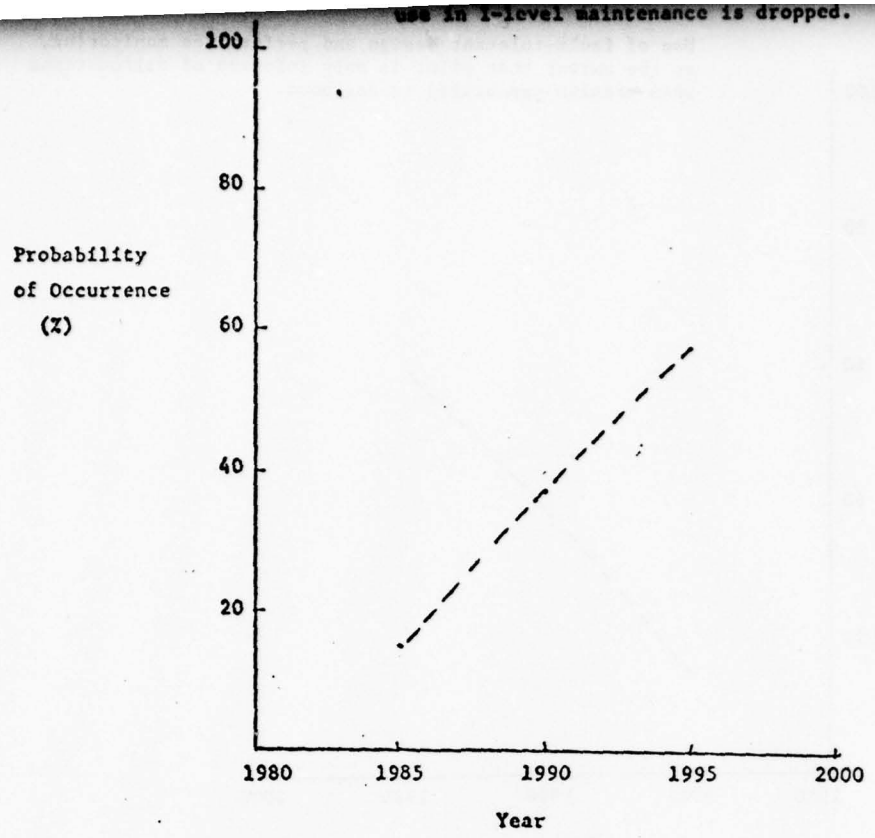


EVENT 19

Most Naval aircraft maintenance instructions stored electronically on-board ships.

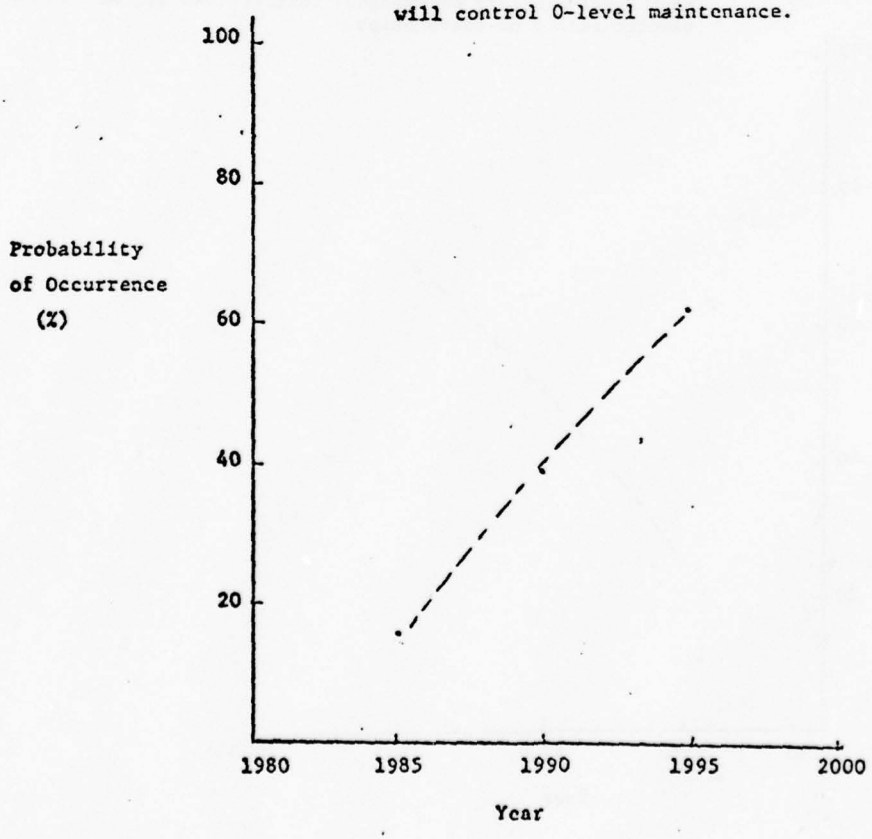


use in I-level maintenance is dropped.



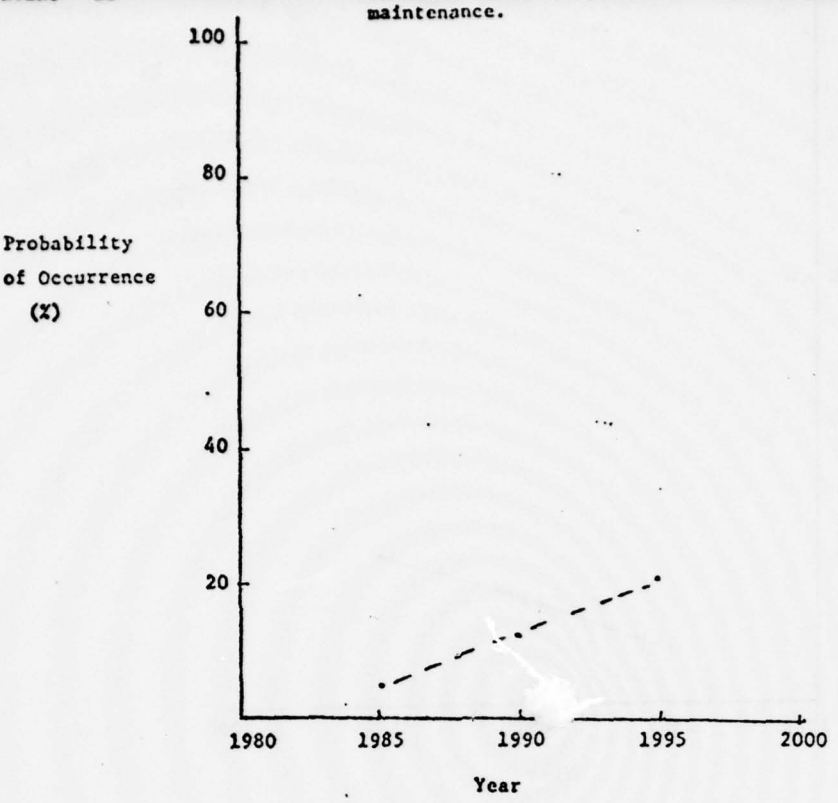
EVENT 21

Performance monitoring with automatic trend analysis will control O-level maintenance.



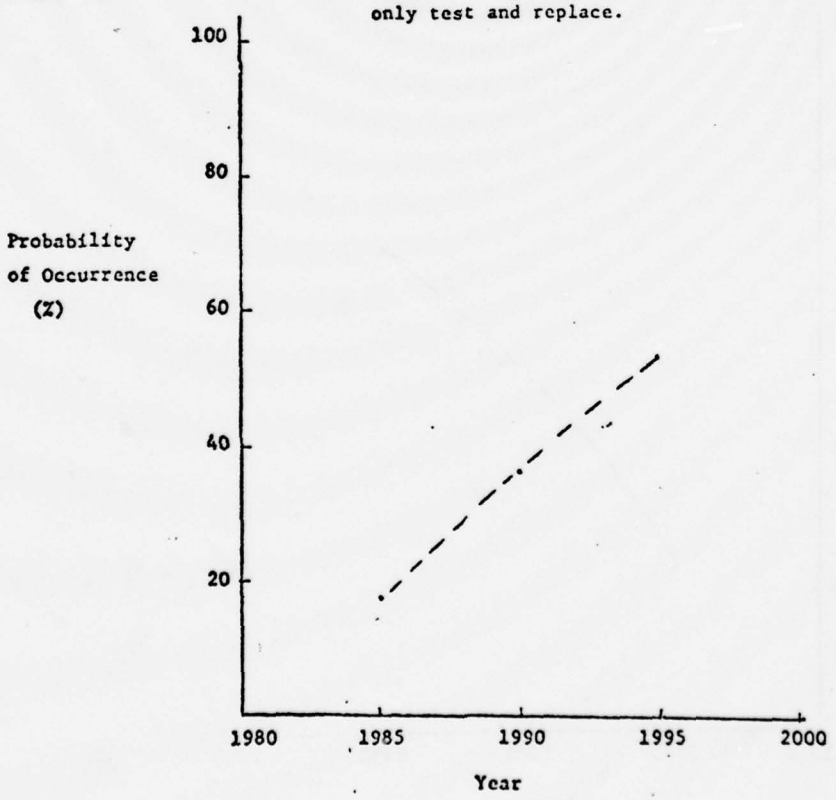
EVENT 22

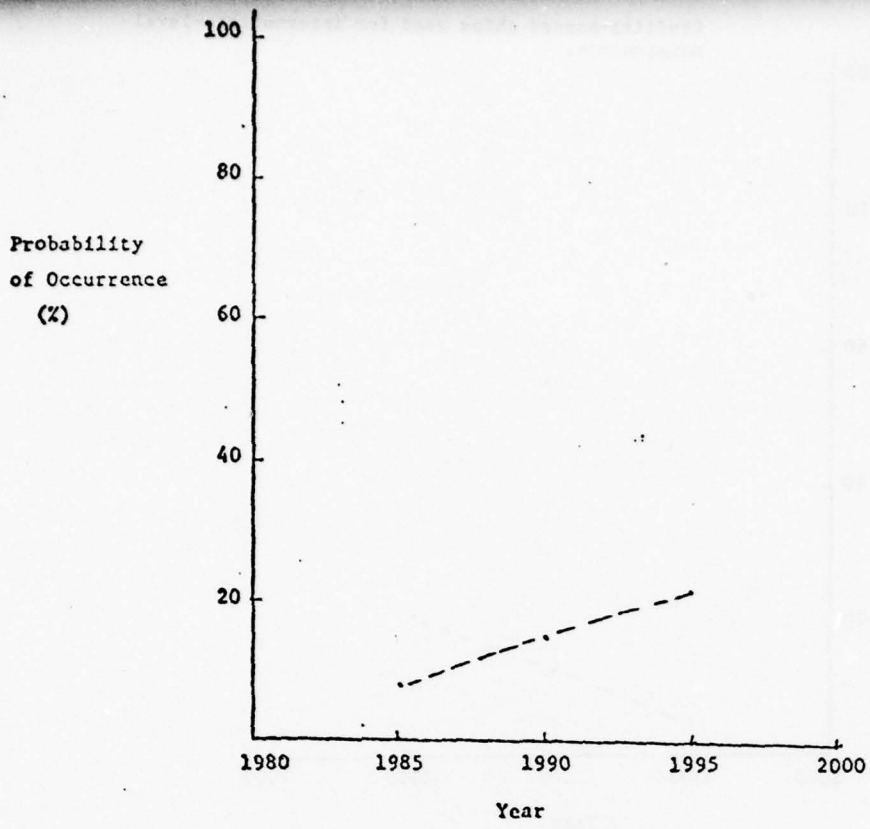
Civilian-manned ships used for intermediate-level maintenance.



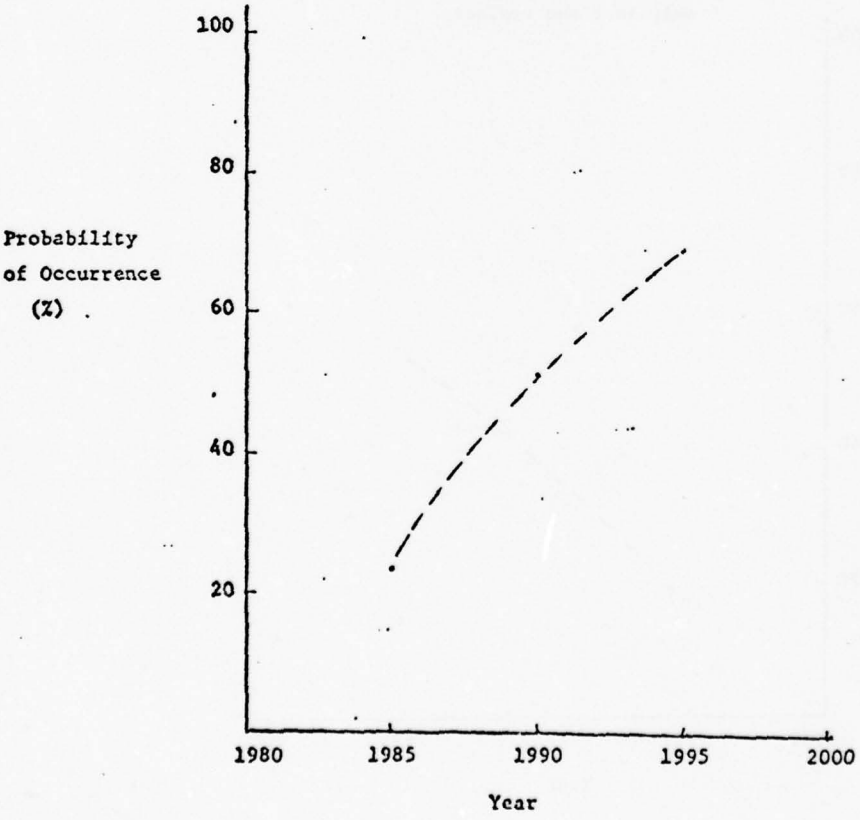
EVENT 23

No module repair at intermediate maintenance level, only test and replace.



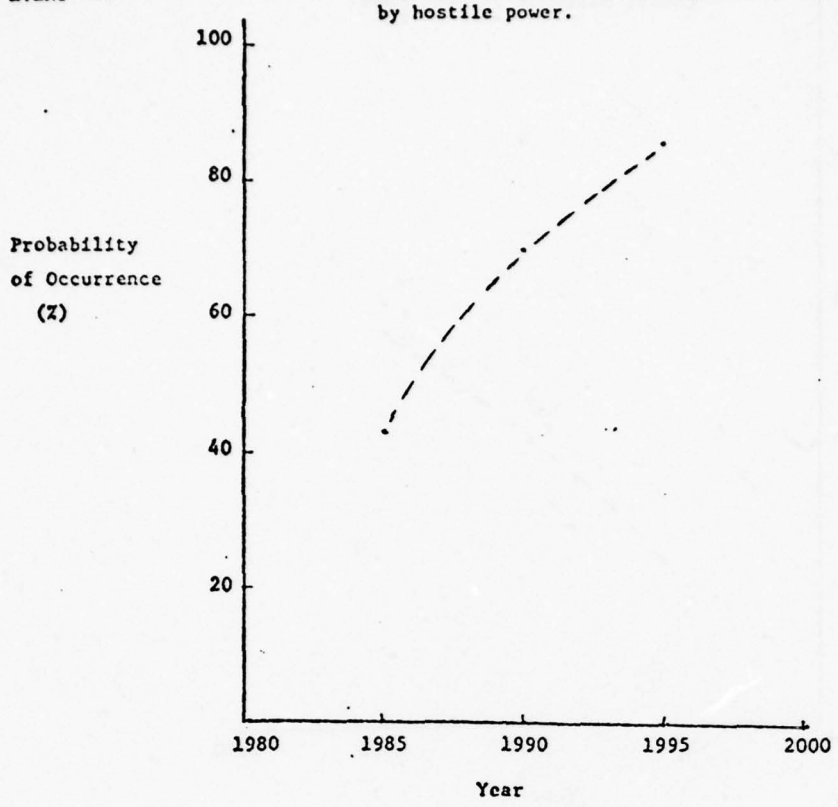


EVENT 25 Cruise missiles controlled/guided by Navy aircraft.



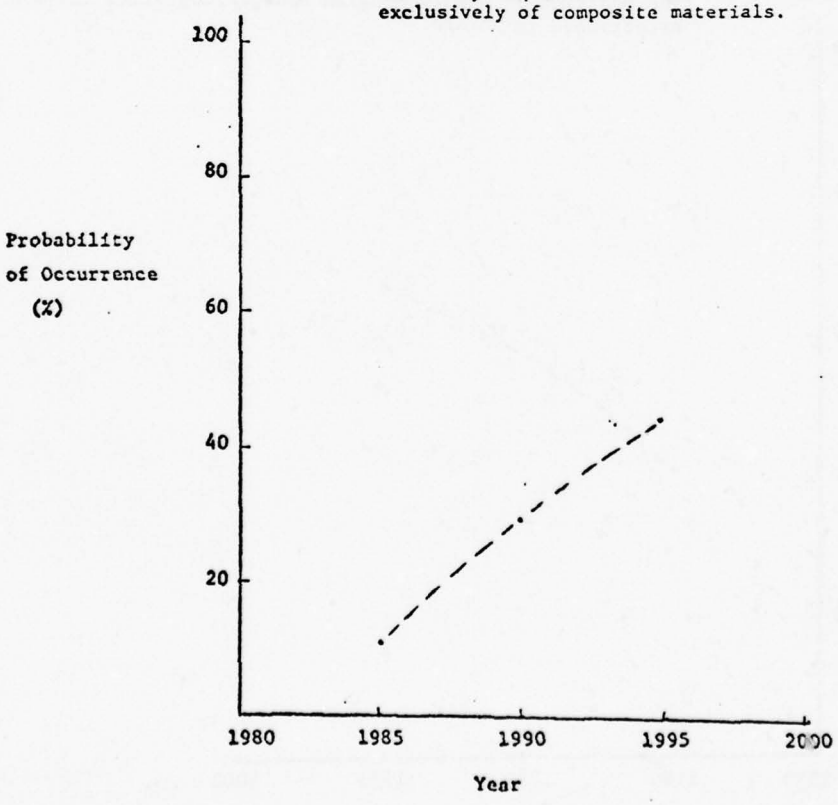
EVENT 26

Effective anti-satellite capability deployed by hostile power.



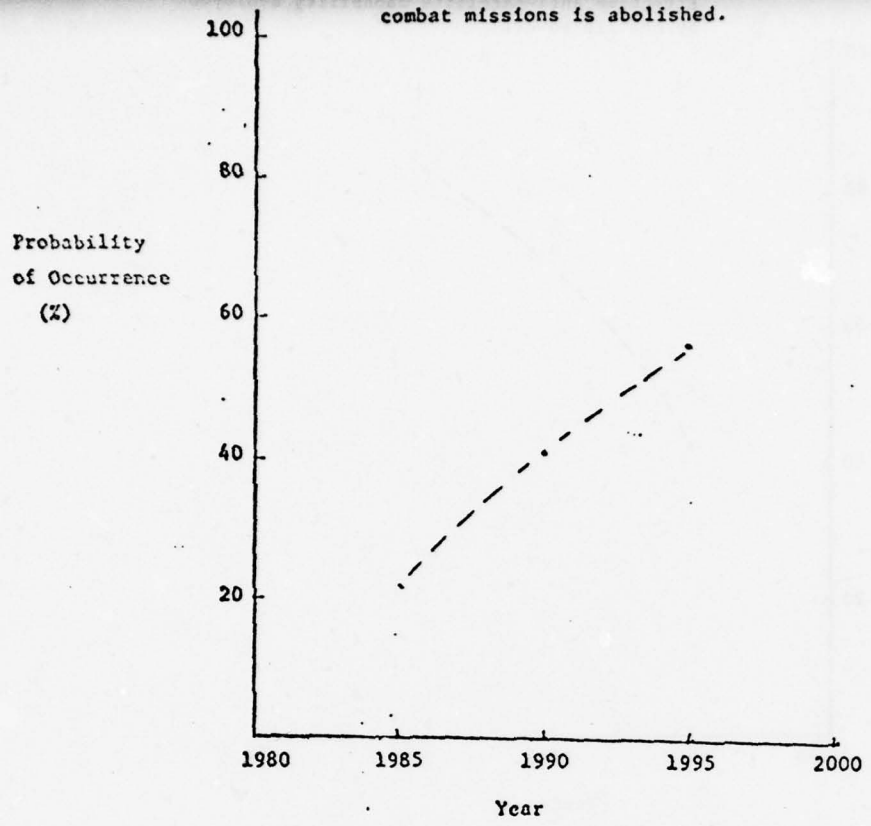
EVENT 27

All newly acquired airframe structures are made exclusively of composite materials.



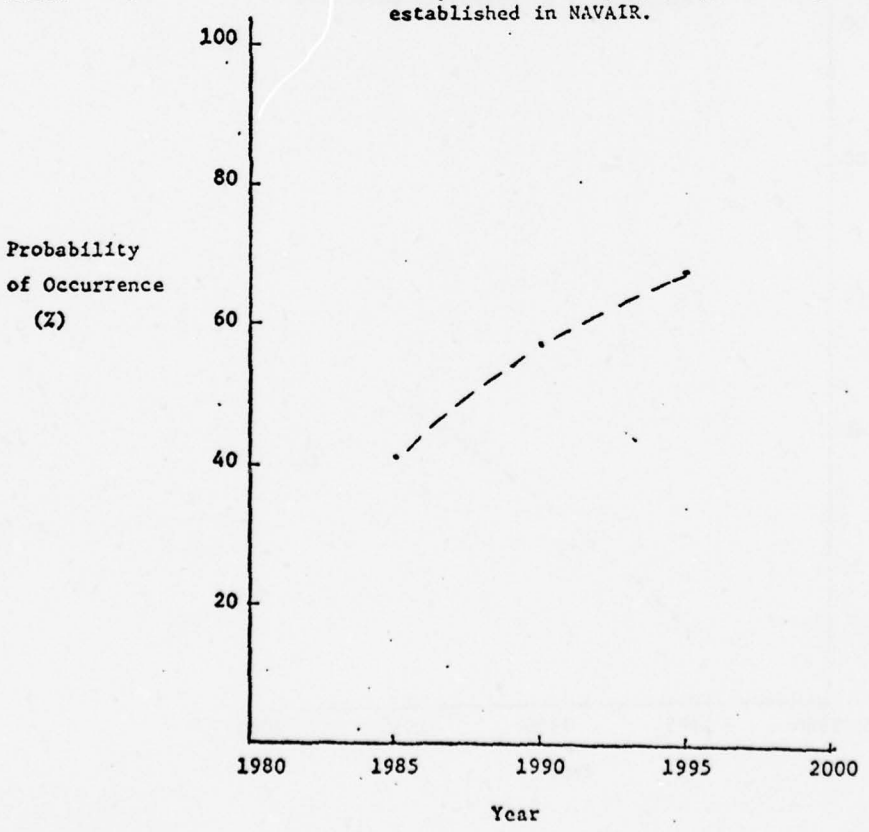
EVENT 28

The regulation prohibiting use of women for Navy combat missions is abolished.



EVENT 29

The position of Deputy Program Manager/Logistics is established in NAVAIR.



VOLUME 2

QUESTIONNAIRE RESULTS (DISTRIBUTION)

EVENT: 1 Solicitations to industry for major weapons systems are expressed in terms of mission needs, freeing the contractors to propose their own technical approach.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	18	34	15	7	5	8	2
	2	9	23	8	3	2	3	1
	3	5	16	1	6	1	1	1
	4	3	3	4	3	2	1	1
	5	0	2	0	0	1	1	0
	6	3	4	3	3	0	0	0
	Σ	38	82	31	22	11	13	5
1990	1	7	15	21	14	15	13	4
	2	6	7	14	11	6	3	2
	3	0	7	10	8	4	1	1
	4	1	2	5	3	3	1	2
	5	0	1	1	0	1	0	1
	6	0	5	2	3	1	2	0
	Σ	14	37	53	39	30	20	10
1995	1	6	11	11	13	13	22	12
	2	7	4	6	11	9	8	4
	3	0	3	9	7	6	5	1
	4	1	2	3	3	2	3	3
	5	0	1	0	1	1	0	1
	6	0	3	2	4	1	3	0
	Σ	14	24	31	39	32	41	21

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 2 300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.

Category Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	18	28	14	11	6	4	4
	2	10	19	8	8	3	1	0
	3	8	13	4	5	0	1	0
	4	4	4	3	2	2	1	1
	5	2	0	2	0	0	0	0
	6	2	7	3	2	0	0	0
	Σ	44	71	34	28	11	7	5
1990	1	3	10	11	23	21	7	10
	2	2	13	8	11	11	6	3
	3	2	6	7	6	8	1	1
	4	0	3	2	4	3	3	2
	5	0	2	0	1	1	0	0
	6	1	1	2	5	2	1	2
	Σ	8	35	30	50	46	18	18
1995	1	0	5	11	8	4	28	28
	2	0	3	5	5	7	14	15
	3	1	4	4	6	1	7	8
	4	0	2	0	2	3	3	7
	5	0	0	1	1	1	0	1
	6	0	1	1	2	1	3	6
	Σ	1	15	22	24	17	55	65

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 3 Repair facilities at Naval Air Stations totally manned by civilians.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	33	37	9	5	5	1	1
	2	29	13	5	1	0	1	0
	3	15	11	3	2	0	0	1
	4	2	4	3	5	1	1	1
	5	3	1	0	0	0	0	0
	6	5	6	2	1	0	0	0
	Σ	87	72	22	14	6	3	3
1990	1	20	16	22	12	12	6	2
	2	15	18	9	4	2	1	0
	3	9	8	4	5	2	2	0
	4	0	1	4	5	3	3	1
	5	2	2	0	0	0	0	0
	6	1	4	4	3	1	0	0
	Σ	47	49	43	29	20	12	3
1995	1	15	15	11	13	10	16	10
	2	14	12	10	5	5	3	0
	3	8	7	1	4	4	4	2
	4	0	1	1	5	3	4	3
	5	2	2	0	0	0	0	0
	6	1	4	3	0	4	1	0
	Σ	40	41	26	27	26	28	15

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 4 All NARFs managed and operated by contractors.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	42	22	14	9	0	1	1
	2	31	11	4	2	1	0	0
	3	21	5	5	2	0	0	0
	4	6	4	1	2	2	0	1
	5	3	0	1	0	0	0	0
	6	4	2	1	1	0	0	0
	Σ	107	44	26	16	3	1	2
1990	1	22	24	14	16	10	2	2
	2	18	16	8	2	4	1	0
	3	10	9	6	2	4	1	0
	4	2	4	4	2	1	2	1
	5	0	3	1	0	0	0	0
	6	0	3	1	0	3	0	0
	Σ	52	59	34	22	21	6	3
1995	1	19	16	10	15	12	9	8
	2	19	13	12	3	2	3	2
	3	8	8	4	3	6	2	2
	4	2	3	2	2	3	1	3
	5	0	1	3	0	0	0	0
	6	0	1	1	2	1	1	1
	Σ	48	42	32	25	24	16	16

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 5 Decision made to extend the life of the F-4 through CILOP.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	15	17	11	18	7	5	0
	2	6	12	4	6	7	4	6
	3	1	14	8	6	1	0	1
	4	1	4	5	3	1	1	1
	5	1	0	1	0	0	0	2
	6	2	4	4	2	0	1	0
	Σ	26	51	33	35	16	11	10
1990	1	22	16	12	11	6	4	2
	2	18	6	8	2	1	6	4
	3	6	7	4	4	4	0	1
	4	4	3	3	3	2	0	1
	5	2	0	0	0	0	0	1
	6	2	7	2	0	1	1	0
	Σ	54	38	29	20	14	11	9
1995	1	32	14	6	6	5	5	5
	2	24	7	3	1	1	4	5
	3	11	2	0	5	5	0	1
	4	9	2	1	0	3	0	1
	5	2	0	0	0	0	0	1
	6	7	4	0	1	0	1	0
	Σ	85	29	10	13	14	10	13

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 6 F-18 deployed to the operating fleet.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	10	23	19	14	8	3	1
	2	4	12	5	13	5	4	5
	3	2	5	3	5	7	3	5
	4	1	4	3	4	1	3	0
	5	0	0	0	1	2	1	0
	6	1	2	2	4	3	0	1
	Σ	18	46	32	41	26	14	12
1990	1	4	9	11	14	17	10	11
	2	1	4	4	4	8	14	13
	3	2	0	3	4	4	6	11
	4	0	1	3	5	3	1	3
	5	0	0	0	0	0	3	1
	6	0	0	1	3	3	2	4
	Σ	7	14	22	30	35	36	43
1995	1	4	6	4	10	11	19	22
	2	1	2	4	2	3	14	22
	3	2	0	0	1	4	6	17
	4	0	1	1	5	2	2	5
	5	0	0	0	0	0	2	2
	6	1	0	1	1	1	3	6
	Σ	8	9	10	19	21	46	74

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 7 The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery.

		PROBABILITY						
Category / Year		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	12	30	23	13	8	5	2
	2	14	15	7	6	2	3	2
	3	5	13	8	6	0	0	0
	4	2	4	5	4	0	0	1
	5	1	1	0	1	1	0	0
	6	1	6	3	1	2	1	0
	Σ	35	69	46	31	13	9	5
1990	1	8	9	14	24	20	9	7
	2	7	9	11	9	4	6	3
	3	1	4	11	8	5	2	1
	4	0	3	2	4	5	0	1
	5	0	0	1	2	0	1	0
	6	1	1	4	2	3	3	0
	Σ	17	26	43	49	37	21	12
1995	1	6	7	8	11	19	25	15
	2	5	8	3	13	5	10	5
	3	1	1	7	8	5	5	5
	4	1	3	1	2	3	5	1
	5	0	0	0	3	0	1	0
	6	1	1	2	2	3	5	0
	Σ	14	20	21	39	35	51	26

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 8 Incorporation of the functions of ASO under the management of AIR-04.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	21	16	4	4	3	1	1
	2	18	12	6	7	1	2	0
	3	16	2	1	5	2	0	0
	4	2	2	4	0	1	0	1
	5	1	1	0	0	0	2	0
	6	1	2	1	0	0	0	0
	Σ	59	35	16	16	7	5	2
1990	1	9	13	10	9	5	2	2
	2	8	14	10	4	5	4	1
	3	10	5	1	5	2	2	1
	4	1	1	3	3	0	1	1
	5	1	0	1	0	0	2	0
	6	0	2	1	1	0	0	0
	Σ	29	35	26	22	12	11	5
1995	1	9	7	10	8	5	7	4
	2	8	11	9	3	7	5	3
	3	8	6	2	2	2	3	3
	4	1	1	2	2	1	1	1
	5	1	0	1	0	0	2	0
	6	0	1	1	1	0	1	0
	Σ	27	26	25	16	15	19	11

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 9 Integration of all avionics functions into a single package, for each aircraft type.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	47	21	7	4	4	0	0
	2	26	13	3	3	2	2	0
	3	18	11	1	1	0	0	0
	4	5	4	3	1	3	0	0
	5	2	0	1	0	0	1	0
	6	7	4	0	2	0	0	0
	Σ	105	53	15	11	9	3	0
1990	1	23	23	12	12	7	5	0
	2	9	12	13	6	4	3	2
	3	9	12	4	2	4	0	0
	4	3	5	1	2	2	3	0
	5	1	1	0	0	1	0	1
	6	2	3	2	4	2	0	0
	Σ	47	56	32	26	20	11	3
1995	1	21	11	14	10	11	9	6
	2	7	9	8	5	7	8	5
	3	5	11	4	4	2	4	1
	4	3	3	1	3	2	1	3
	5	1	0	1	0	0	0	2
	6	2	0	3	3	0	3	2
	Σ	39	34	31	25	22	25	19

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 10 RPVs replace 50% of manned aircraft for combat missions.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	48	24	5	2	0	0	0
	2	35	12	1	1	0	0	0
	3	25	2	0	0	0	0	0
	4	10	4	2	1	0	0	0
	5	4	0	0	0	0	0	0
	6	10	4	0	0	0	0	0
	Σ	132	46	8	4	0	0	0
1990	1	20	30	15	10	3	1	0
	2	15	17	5	9	1	1	1
	3	14	11	1	1	0	0	0
	4	2	8	3	1	3	0	0
	5	2	2	0	0	0	0	0
	6	4	5	4	1	0	0	0
	Σ	57	73	28	22	7	2	1
1995	1	14	15	19	14	10	4	3
	2	7	13	6	12	6	2	3
	3	5	14	5	1	1	1	0
	4	1	6	2	2	1	3	2
	5	2	1	0	1	0	0	0
	6	1	3	4	4	2	0	0
	Σ	30	52	36	34	20	10	8

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 11 Long range land-based Navy aircraft perform the Navy's sea-control mission.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	52	23	3	3	3	0	0
	2	36	11	1	1	0	0	0
	3	23	5	3	0	1	0	0
	4	7	3	4	3	0	0	0
	5	4	0	0	0	0	0	0
	6	10	4	0	0	0	0	0
	Σ	132	46	11	7	4	0	0
1990	1	28	27	14	9	3	2	0
	2	21	18	7	1	1	0	1
	3	14	9	4	5	0	0	0
	4	0	6	2	6	2	1	0
	5	3	1	0	0	0	0	0
	6	2	6	4	1	1	0	0
	Σ	68	67	31	22	7	3	1
1995	1	19	18	13	13	10	6	5
	2	15	13	13	3	2	2	1
	3	9	10	6	0	5	2	0
	4	0	3	4	3	2	3	2
	5	3	0	1	0	0	0	0
	6	1	3	5	3	0	1	1
	Σ	47	47	42	22	19	14	9

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 12 U. S. carrier force reduced to 8 CVAs.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	39	18	13	7	1	3	0
	2	23	19	3	4	0	0	0
	3	14	10	2	6	0	0	0
	4	6	5	2	3	1	0	0
	5	2	1	0	1	0	0	0
	6	8	2	1	2	0	0	0
	Σ	92	55	21	23	2	3	0
1990	1	11	22	12	20	10	3	2
	2	9	18	8	10	3	0	1
	3	3	10	9	3	2	4	1
	4	2	1	4	6	3	1	0
	5	2	1	0	1	0	0	0
	6	1	4	3	1	3	0	1
	Σ	28	56	36	41	21	8	5
1995	1	6	9	15	10	11	18	11
	2	7	6	9	13	8	3	3
	3	2	4	9	5	4	4	4
	4	0	1	3	4	3	3	3
	5	1	0	0	3	0	0	0
	6	0	2	2	2	5	1	1
	Σ	16	22	38	37	31	29	22

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 13 No overseas bases available to the Navy in peacetime, outside the Western hemisphere.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	51	22	6	5	1	2	0
	2	30	12	3	2	1	0	0
	3	19	8	5	0	0	0	0
	4	6	6	3	2	0	0	0
	5	3	0	0	0	1	0	0
	6	10	2	2	0	0	0	0
	Σ	119	50	19	9	3	2	0
1990	1	34	20	11	11	6	5	1
	2	10	21	10	3	4	0	0
	3	9	12	7	2	2	0	0
	4	1	6	4	4	2	0	0
	5	2	1	0	0	1	0	0
	6	3	7	2	2	0	0	0
	Σ	59	67	34	22	15	5	1
1995	1	26	20	8	10	11	7	5
	2	8	19	5	7	5	3	1
	3	8	5	11	1	3	3	1
	4	1	3	4	6	2	1	0
	5	2	1	0	0	1	0	0
	6	3	5	2	3	1	0	0
	Σ	48	53	30	27	23	14	7

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 14 Deployment of V/STOL-A as currently envisaged by NAVAIR

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	39	23	9	2	0	1	0
	2	28	15	2	0	0	0	0
	3	20	5	3	3	0	0	0
	4	11	3	2	1	0	0	0
	5	4	0	0	0	0	0	0
	6	9	3	0	0	0	0	2
	Σ	111	49	16	6	0	1	2
1990	1	14	25	15	12	6	2	0
	2	8	13	15	7	2	1	0
	3	6	10	8	4	2	0	1
	4	3	7	2	4	1	0	0
	5	2	0	1	1	0	0	0
	6	1	3	7	0	1	0	1
	Σ	34	58	48	28	12	3	2
1995	1	4	12	15	16	12	12	4
	2	3	4	12	11	6	7	3
	3	0	7	2	10	7	4	1
	4	1	3	3	4	3	3	0
	5	1	1	0	0	2	0	0
	6	0	0	3	5	3	1	1
	Σ	9	27	35	46	33	27	9

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 16 Development and widespread use of non-fossil sources of power for aircraft.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	63	21	3	0	0	0	0
	2	32	14	1	1	0	0	0
	3	21	7	0	0	0	1	0
	4	13	2	1	0	1	0	0
	5	2	2	0	0	0	0	0
	6	12	3	0	0	0	0	0
	Σ	143	49	5	1	1	1	0
1990	1	30	29	15	10	3	0	0
	2	13	22	9	2	2	0	0
	3	6	13	4	6	0	0	0
	4	7	7	1	0	1	1	0
	5	0	3	0	1	0	0	0
	6	6	3	5	1	0	0	0
	Σ	62	77	34	20	6	1	0
1995	1	10	26	21	16	5	10	0
	2	0	12	17	7	6	3	3
	3	2	8	9	3	3	3	1
	4	2	4	5	3	1	1	1
	5	0	1	2	0	0	1	0
	6	2	3	5	3	2	0	0
	Σ	16	54	59	32	17	18	5

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 17 50% replacement of training flight activity by use of simulators.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	15	33	18	15	1	4	2
	2	15	18	7	4	2	0	0
	3	8	10	7	3	2	1	0
	4	3	7	1	1	1	2	1
	5	3	0	0	1	0	0	0
	6	3	8	1	2	0	0	0
	Σ	47	76	34	26	6	7	3
1990	1	4	9	21	21	20	7	4
	2	5	8	11	10	7	5	1
	3	1	3	11	9	5	2	1
	4	1	1	6	4	0	2	2
	5	1	1	1	0	1	0	0
	6	1	3	4	4	1	0	1
	Σ	13	25	54	48	34	16	9
1995	1	1	9	4	18	11	33	11
	2	1	5	7	9	6	10	7
	3	0	2	2	9	8	5	6
	4	0	3	1	4	2	2	4
	5	1	0	1	1	0	1	0
	6	0	2	1	4	2	4	1
	Σ	3	21	16	45	29	55	29

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 18 Use of fault-tolerant design and performance monitoring, to the extent that pilot is only informed of malfunctions when mission capability is degraded.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	24	36	17	8	5	0	1
	2	18	18	9	1	1	0	0
	3	10	13	4	0	1	0	0
	4	6	7	2	1	0	0	0
	5	1	2	1	0	0	0	0
	6	8	5	0	0	0	0	0
	Σ	67	81	33	10	7	0	1
1990	1	8	12	25	25	15	5	2
	2	5	9	17	6	9	1	0
	3	3	4	9	9	3	1	0
	4	3	4	2	6	0	1	0
	5	0	1	2	0	1	0	0
	6	1	5	3	3	0	1	0
	Σ	20	35	58	49	28	9	2
1995	1	6	5	16	13	12	27	11
	2	1	6	3	13	8	12	4
	3	2	4	2	4	8	6	3
	4	2	3	2	2	4	2	1
	5	0	0	2	0	0	1	1
	6	1	1	2	5	2	1	1
	Σ	12	19	27	37	34	49	21

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 19 Most Naval aircraft maintenance instructions stored electronically on-board ships.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	14	29	18	14	7	4	3
	2	16	15	9	5	2	0	0
	3	12	12	5	2	2	0	0
	4	3	4	5	3	2	0	1
	5	2	0	0	2	0	0	0
	6	6	5	3	0	0	0	0
	Σ	53	65	40	26	13	4	4
1990	1	2	8	17	19	21	14	8
	2	1	12	9	11	8	5	1
	3	1	10	5	8	7	1	1
	4	0	2	2	7	3	3	1
	5	0	0	2	0	1	1	0
	6	1	3	4	4	2	0	0
	Σ	5	35	39	49	42	24	11
1995	1	2	3	4	12	17	28	22
	2	1	4	7	8	9	9	9
	3	0	4	8	1	4	9	7
	4	0	1	0	4	2	6	4
	5	0	0	0	1	1	1	1
	6	1	1	1	4	2	2	2
	Σ	4	13	20	30	35	55	45

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 20 Concept of VAST (Versatile Avionics Shop Test) for use in I-level maintenance is dropped.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	30	23	14	8	4	2	1
	2	23	14	5	1	1	0	0
	3	17	7	1	2	0	1	0
	4	4	5	0	1	0	0	0
	5	3	1	0	0	0	0	0
	6	2	4	1	0	0	0	1
	Σ	79	54	21	12	5	3	2
1990	1	8	15	14	17	8	9	6
	2	10	14	6	4	5	4	1
	3	6	9	3	5	3	1	1
	4	1	0	6	3	1	0	0
	5	2	1	1	0	0	0	0
	6	0	3	2	0	1	1	1
	Σ	27	42	73	29	18	15	9
1995	1	6	10	8	6	11	13	23
	2	7	14	6	2	3	4	8
	3	4	5	5	1	3	5	5
	4	1	0	0	7	1	2	0
	5	2	1	1	0	0	0	0
	6	0	1	1	1	2	2	1
	Σ	20	31	21	17	20	26	37

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 21 Performance monitoring with automatic trend analysis will control O-level maintenance.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	23	34	8	10	5	1	1
	2	20	19	7	0	0	0	0
	3	14	8	2	3	1	0	0
	4	2	8	4	1	0	0	1
	5	1	2	1	0	0	0	0
	6	4	3	0	1	0	0	0
	Σ	64	74	22	15	6	1	2
1990	1	4	15	20	21	12	6	4
	2	1	17	10	13	5	0	1
	3	5	7	7	5	3	2	0
	4	0	2	5	9	0	0	1
	5	0	1	1	2	0	0	0
	6	0	1	3	3	0	1	0
	Σ	10	43	46	53	20	9	6
1995	1	3	4	10	15	13	25	12
	2	1	5	7	9	11	10	3
	3	5	1	6	4	5	6	2
	4	0	1	1	2	8	2	3
	5	0	0	2	0	2	0	0
	6	0	0	2	1	2	3	0
	Σ	9	11	28	31	41	46	20

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 22 Civilian-manned ships used for intermediate-level maintenance.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	60	23	3	0	1	0	0
	2	37	8	2	0	0	0	0
	3	28	4	0	0	0	0	0
	4	9	5	0	1	0	0	1
	5	4	0	0	0	0	0	0
	6	11	3	0	0	0	0	0
	Σ	149	43	5	1	1	0	1
1990	1	39	23	17	5	2	1	0
	2	22	18	6	1	0	0	1
	3	21	9	1	1	0	0	0
	4	2	7	4	1	0	1	1
	5	3	1	0	0	0	0	0
	6	3	9	1	1	0	0	0
	Σ	90	67	29	9	2	2	2
1995	1	28	27	9	12	7	3	1
	2	18	14	7	8	0	0	1
	3	17	10	3	0	2	0	0
	4	1	4	6	1	1	2	1
	5	2	1	0	1	0	0	0
	6	3	6	1	2	1	0	0
	Σ	69	62	26	24	11	5	3

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 23 No module repair at intermediate maintenance level, only test and replace.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	34	16	17	12	5	2	2
	2	30	15	3	2	0	0	0
	3	12	12	3	1	2	0	0
	4	4	3	7	2	0	0	1
	5	3	1	0	0	0	0	0
	6	6	4	2	1	1	0	0
	Σ	89	51	32	18	8	2	3
1990	1	12	17	14	17	16	7	5
	2	13	12	13	4	3	3	0
	3	6	7	6	7	2	2	0
	4	0	3	3	7	3	0	1
	5	2	1	0	0	1	0	0
	6	1	4	2	2	3	2	0
	Σ	34	44	38	37	28	14	6
1995	1	9	11	9	7	17	19	16
	2	9	8	10	9	2	6	5
	3	3	6	3	3	8	4	3
	4	0	2	2	1	5	6	1
	5	2	1	0	0	0	1	0
	6	1	0	1	5	2	3	2
	Σ	24	28	25	25	34	39	27

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 24 Unionization of military forces

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	64	17	4	3	1	0	1
	2	29	13	4	1	1	0	1
	3	25	3	2	0	1	0	1
	4	12	2	0	2	0	0	0
	5	3	0	1	0	0	0	0
	6	9	4	1	0	0	0	0
	Σ	142	39	12	6	3	0	3
1990	1	43	30	6	6	3	1	1
	2	14	19	6	6	2	1	1
	3	17	8	5	0	0	1	0
	4	7	7	0	2	1	0	0
	5	1	2	0	1	0	0	0
	6	3	5	4	1	1	0	0
	Σ	85	71	21	16	7	3	2
1995	1	35	26	12	8	1	4	2
	2	13	16	5	6	5	2	2
	3	16	4	7	2	1	1	0
	4	4	6	4	1	1	1	0
	5	1	2	0	0	1	0	0
	6	4	5	1	3	2	0	0
	Σ	73	59	29	20	11	8	4

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 25 Cruise missiles controlled/guided by Navy aircraft.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	17	32	18	11	7	0	1
	2	9	18	13	3	1	1	2
	3	11	10	1	2	4	0	3
	4	1	10	4	0	1	0	1
	5	1	0	3	0	0	0	0
	6	5	6	2	1	0	0	0
	Σ	44	76	41	17	13	1	7
1990	1	2	11	20	11	26	9	5
	2	2	1	11	14	10	5	4
	3	0	6	7	8	3	4	1
	4	0	3	4	5	1	3	1
	5	0	0	0	2	2	0	0
	6	2	2	4	2	4	0	0
	Σ	6	23	46	42	46	21	11
1995	1	3	5	8	17	11	20	18
	2	0	3	1	11	11	13	8
	3	0	3	4	5	2	8	7
	4	0	2	0	3	2	6	4
	5	0	0	0	1	2	0	1
	6	2	0	3	2	3	4	0
	Σ	5	13	16	39	31	51	38

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 26 Effective anti-satellite capability deployed by hostile power.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	7	20	17	18	11	9	7
	2	3	14	10	10	3	3	5
	3	1	9	6	4	6	0	3
	4	0	4	1	3	7	1	1
	5	0	0	1	1	0	1	1
	6	2	4	1	3	1	2	1
	Σ	13	51	36	39	28	16	18
1990	1	2	2	10	14	22	21	17
	2	0	2	8	10	10	7	11
	3	0	0	5	4	6	10	3
	4	0	0	1	3	3	9	1
	5	0	0	0	1	0	1	2
	6	0	1	0	3	4	4	2
	Σ	2	5	24	35	45	52	36
1995	1	0	2	1	9	15	26	36
	2	0	0	3	5	7	14	19
	3	0	0	0	2	4	8	14
	4	0	0	0	1	1	5	10
	5	0	0	0	0	1	0	3
	6	0	1	0	1	1	4	7
	Σ	0	3	4	18	29	57	89

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 27 All newly acquired airframe structures are made exclusively of composite materials.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	44	19	11	4	2	0	0
	2	29	10	3	1	2	1	0
	3	17	4	2	3	1	1	0
	4	5	7	3	0	0	0	0
	5	3	1	0	0	0	0	0
	6	5	3	3	0	0	0	0
	Σ	103	44	22	8	5	2	0
1990	1	14	27	18	10	6	5	0
	2	10	11	11	6	3	3	2
	3	7	8	3	2	7	2	0
	4	3	3	3	5	2	0	0
	5	2	1	0	1	0	0	0
	6	1	1	2	4	2	1	0
	Σ	37	51	37	28	20	11	2
1995	1	7	21	13	13	11	10	4
	2	4	11	6	9	7	6	3
	3	5	5	6	1	2	9	1
	4	1	3	2	2	4	2	1
	5	1	2	0	1	0	0	0
	6	1	0	0	2	4	4	0
	Σ	19	42	27	28	28	31	9

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 28 The regulation prohibiting use of women for Navy combat missions is abolished.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	28	31	12	10	2	1	6
	2	9	22	11	4	0	2	1
	3	13	11	1	1	0	5	0
	4	6	5	3	0	2	0	1
	5	0	0	2	1	0	1	0
	6	4	5	1	1	1	1	1
	Σ	60	74	30	17	5	10	9
1990	1	12	13	24	20	7	4	10
	2	2	10	13	11	4	5	4
	3	6	10	4	5	2	3	1
	4	0	5	4	2	2	2	1
	5	0	0	0	2	0	2	0
	6	2	2	2	4	2	2	0
	Σ	22	40	47	44	17	18	16
1995	1	10	5	13	20	22	9	16
	2	1	4	8	10	8	8	10
	3	5	6	6	4	1	5	4
	4	0	3	3	3	2	1	4
	5	0	0	0	1	1	1	1
	6	2	0	3	2	2	4	1
	Σ	18	18	33	40	36	28	36

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

EVENT: 29 The position of Deputy Program Manager/Logistics is established in NAVAIR.

Category / Year		PROBABILITY						
		Zero	1-20%	21-40%	41-60%	61-80%	81-99%	100%
1985	1	5	14	13	18	7	4	9
	2	10	12	6	8	4	1	3
	3	4	5	5	2	2	1	5
	4	0	2	4	5	2	0	1
	5	0	0	0	3	0	0	1
	6	1	0	5	0	0	2	0
	Σ	20	33	33	36	15	8	19
1990	1	0	6	5	15	19	14	10
	2	3	11	8	8	6	5	3
	3	3	2	3	4	2	3	7
	4	0	1	2	3	4	2	1
	5	0	0	0	3	0	0	1
	6	1	0	0	2	3	0	2
	Σ	7	20	18	35	34	24	24
1995	1	0	3	3	9	6	20	27
	2	3	10	6	8	4	7	6
	3	3	1	2	4	1	3	10
	4	0	1	1	3	1	5	2
	5	0	0	0	3	0	0	1
	6	1	0	0	0	2	3	2
	Σ	7	15	12	27	14	38	48

Category 1: Civilians working for large industrial concern.
Category 2: Military working for the military (except Admirals).
Category 3: Civilians working for the military.
Category 4: Miscellaneous.
Category 5: Admirals.
Category 6: Late respondents -- mainly War College.

VOLUME 2

QUESTIONNAIRE RESPONDENTS

AD-A060 488 NAVAL WEAPONS ENGINEERING SUPPORT ACTIVITY WASHINGTON D C F/G 15/5
A PREDICTION OF AVIATION LOGISTICS REQUIREMENTS (PALR) FOR THE --ETC(U)
JUN 78 H FOSTER

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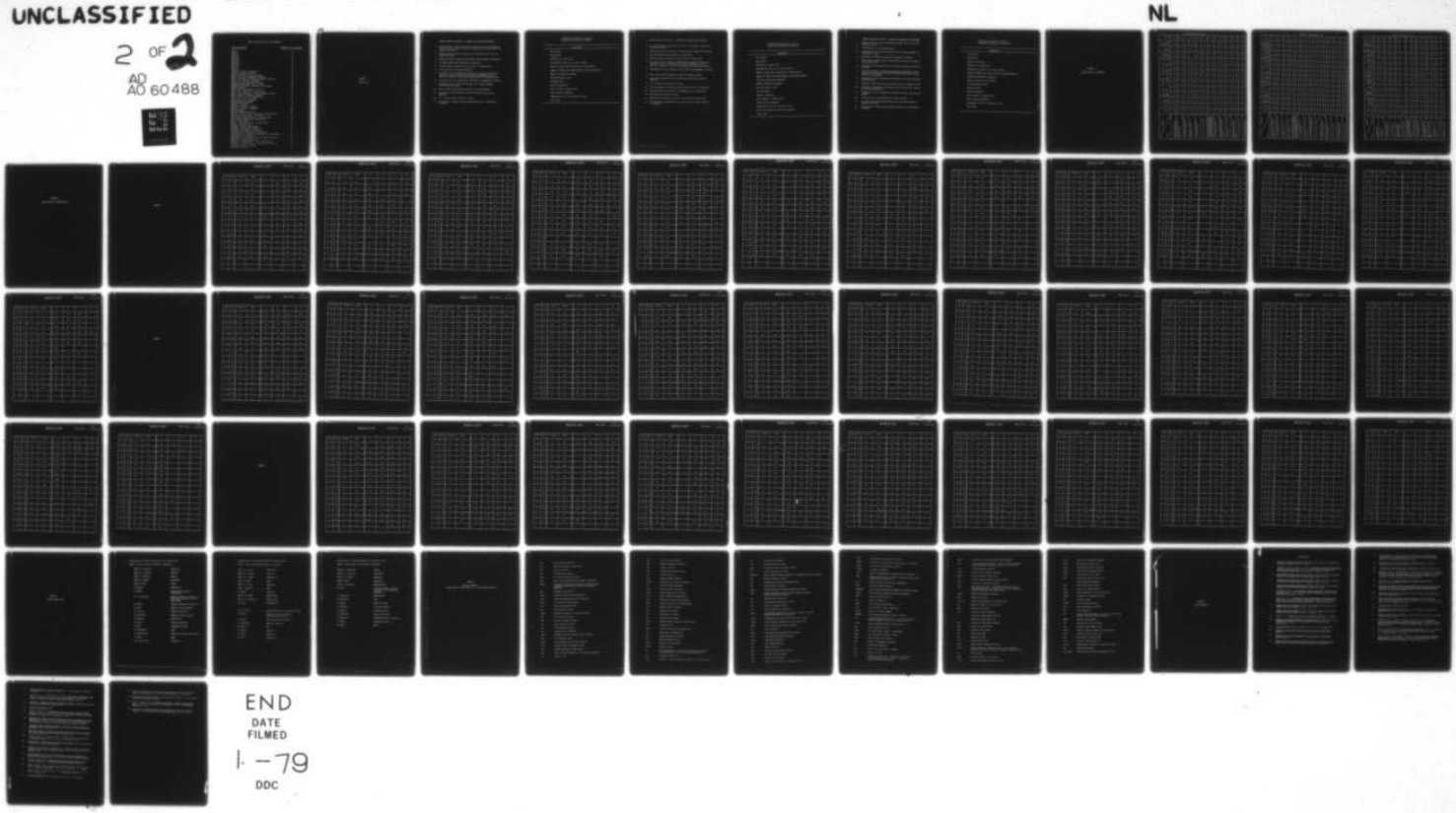

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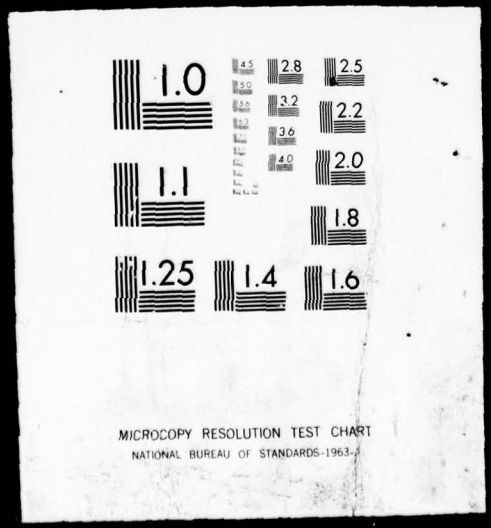

PALR Questionnaire Respondents

Agency/Company	Number of Responses
AIR-01	1
AIR-03	1
AIR-04	1
AIR-340	1
AIR-401	2
AIR-411	1
AIR-412	2
AIR-4101	1
PMA-270	2
NOP-05	3
NOP-514	3
Defense Logistics Agency	1
Aviation Supply Office	5
Naval Aviation Safety Center	3
Naval Training Equipment Center	1
Naval Aviation Integrated Support Center	2
Naval Air Station, Miramar	2
Naval Air Engineering Center	3
COMNAVAIRPAC/NARF North Island	19
NAVELEX Engineering Center, San Deigo	1
NARF Pensacola	6
Naval Air Development Center	3
Naval Air Propulsion Test Center	1
Naval Ship Research & Development Center	4
Naval Supply Systems Command	3
Navy Office of the Comptroller	1
Office of Naval Research	1
Naval Material Command	1
NAVAIRSYSCOMREPLANT	2
General Dynamics	2
Boeing Aerospace Company	1
General Electric Company	5
Westinghouse	29
Sperry Research Center	2
Collins Radio Group, Rockwell International	8
Logistics Management Institute	1
Booz Allen and Hamilton, Incorporated	2
The George Washington University	3
Texas Instruments	8
Pratt & Whitney Group, United Tech.	7
Vought Corporation	10
NAVPRO, Vought Corporation	1
Lockheed California Company	3
Grumman Aerospcae Corporation	5
The Analytic Sciences Corporation	1
Congressional Office of Technology Assessment	1
Department of Commerce	1
National Aeronautics & Space Administration	3
Honeywell, Incorporation	3
Textron Incorporation, Bell Helicopter	8
Rockwell International, Aircraft Division	4
Lockheed Georgia Company	1
Sikorsky Aircraft	3

VOLUME 2

PANEL DATA

EVENTS RELEVANT TO GROUP 1: MATERIEL ACQUISITION MANAGEMENT

1. Solicitations to industry for major weapons sytems are expressed in terms of mission needs, freeing the contractors to propose their own technical approach.

2. 300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.

3. Repair facilities at Naval Air Stations totally manned by civilians.

4. All NARFs managed and operated by contractors.

5. Decision made to extend the life of the F-4 through CILOP.

6. F-18 deployed to the operating fleet.

7. The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery.

8. Incorporation of the functions of ASO under the management of AIR-04.

9. Integration of all avionics functions into a single package, for each aircraft type.

10. RPV's replace 50% of manned aircraft for combat missions.

11. Long range land-based aircraft perform the Navy's sea-control mission.

12. U. S. carrier force reduced to 8 CVA's.

13. The position of Deputy Program Manager/Logistics is established in NAVAIR.

DESCRIPTORS RELEVANT TO GROUP 1:
MATERIEL ACQUISITION MANAGEMENT

DESCRIPTOR
Navy budget
Reliability
Manpower per flight hour
Maintenance costs at O, I and D levels
Number of NORS (Not operationally ready-supply)
Number of NORMs (Not operationally ready-maintenance)
Number of aviation ratings
New procurement costs
Training costs
Mission capability
Total number of flight hours
Navy aircraft inventory
Maintenance cost per aircraft by type
Fuel costs

EVENTS RELEVANT TO GROUP 2: AIRCRAFT MAINTENANCE AND PERSONNEL

1. No overseas bases available to the Navy in peacetime, outside the Western hemisphere.

2. Repair facilities at Naval Air Stations totally manned by civilians.

3. All NARFs managed and operated by contractors.

4. Decision made to extend the life of the F-4 through CILOP.

5. The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery.

6. Incorporation of the functions of ASO under the management of AIR-04.

7. RPV's replace 50% of manned aircraft for combat missions.

8. Long range land-based aircraft perform the Navy's sea-control mission.

9. U.S. carrier force reduced to 8 CVAs.

10. 50% replacement of training flight activity by use of simulators.

11. Civilian-manned ships used for intermediate-level maintenance.

12. Unionization of military forces.

13. Effective anti-satellite capability deployed by hostile power.

14. The regulation prohibiting use of women for Navy combat missions is abolished.

DESCRIPTORS RELEVANT TO GROUP 2:
AIRCRAFT MAINTENANCE AND PERSONNEL

DESCRIPTOR
Navy budget
Reliability
Manpower per flight hour
Maintenance costs at O, I and D levels
Number of NORS (Not operationally ready-supply)
Number of NORMs (Not operationally ready-maintenance)
Aircraft operational readiness
Number of aviation ratings
New procurement costs
Training costs
Mission capability
Total number of flight hours
Navy aircraft inventory
Maintenance cost per aircraft by type
Ratio of officers to enlisted personnel
Fuel costs

EVENTS RELEVANT TO GROUP 3: AIRCRAFT MAINTENANCE AND EQUIPMENT

1. 300% increase in price of aviation fuel (JP5) over 1977 price in constant dollars.

2. F-18 deployed to the operating fleet.

3. Integration of all avionics functions into a single package, for each aircraft type.

4. Deployment of V/STOL-A as currently envisaged by NAVAIR.

5. Utilization of fiber optics in operational aircraft for on-board data transmission.

6. Development and widespread use of non-fossil sources of power for aircraft.

7. Use of fault-tolerant design and performance monitoring, to the extent that pilot is only informed of malfunctions when mission capability is degraded.

8. Most Naval aircraft maintenance instructions stored electronically on-board ships.

9. Concept of VAST (Versatile Avionics Shop Test) is dropped for IMA.

10. Performance monitoring with automatic trend analysis will control all O-level maintenance.

11. No module repair at intermediate maintenance level, only test and replace.

12. Cruise missiles controlled/guided by Navy aircraft.

13. All newly acquired airframe structures are made exclusively of composite materials.

14. The position of Deputy Program Manager/Logistics is established in NAVAIR.

DESCRIPTORS RELEVANT TO GROUP 3:
AIRCRAFT MAINTENANCE AND EQUIPMENT

DESCRIPTOR
Navy budget
Reliability
Aircraft down-time
Manpower per flight hour
Maintenance costs at O, I and D levels
Number of NORMs (Not operationally ready-maintenance)
Aircraft operational readiness
Time to repair (O and I level)
New procurement costs
Training costs
Mission capability
Total number of flight hours
Navy aircraft inventory
Maintenance cost per aircraft by type
Fuel costs

VOLUME 2

PANEL RESULTS (SYNTHESIS)

EVENTS \ DESCRIPTORS	Navy budget 1	Reliability 2	Manpower per flight hour 3	Maintenance costs at O, I and D levels 4	Number of NORS 5	Number of NORPs 6	Number of aviation ratings 7	New procurement costs 8	Training costs 9	Mission capability 10	Total number of flight hours 11	Navy aircraft inventory 12	Maintenance cost per aircraft by type 13	Fuel costs 14
Solicitations for major weapons systems in terms of mission needs 1	4.8	4.8	5.3	5.6	4.0	6.1	2.4	7.1	3.9	4.2	2.9	3.7	7.0	3.3
300% increase in price of aviation fuel (JP5) 2	6.1	3.2	3.2	2.0	2.5	3.3	1.8	4.5	3.7	3.9	7.6	3.8	3.6	5.8
Repair facilities at Naval Air Stations totally manned by civilians. 3	5.6	3.8	4.3	4.9	3.7	3.5	3.7	3.2	3.9	3.4	2.2	2.1	5.6	1.5
All NARFs managed and operated by contractors 4	3.4	3.4	3.5	4.5	2.8	2.3	2.8	2.8	3.1	2.4		1.7	3.8	1.5
Decision made to extend the life of the F-4 through CILOP 5	3.8	3.8	2.6	3.4	3.7	3.2	1.9	4.5	4.0	4.7	2.4	3.2	3.7	2.8
F-18 deployed to the operating fleet 6	4.2	4.8	4.8	4.8	4.5	4.1	1.7	4.0	3.9	5.1	2.8	2.8	4.5	2.4
The routine use by NAVAIR of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery 7	4.6	7.0	5.5	5.1	6.3	4.8	2.1	3.8	3.7	3.5	2.5	2.0	4.1	1.3
Incorporation of the functions of ASO under the management of AIR-04 8	4.1	2.7	3.0	2.9	4.7	3.1	1.9	2.2	1.0	2.3	2.0	1.2	2.2	1.2
Integration of all avionics functions into a single package, for each aircraft type 9	3.6	6.2	5.0	4.3	5.0	4.2	2.0	5.4	4.6	4.5	2.4	1.5	4.9	1.3
RPV's replace 50% of manned aircraft for combat missions 10	4.5	4.6	3.8	5.2	5.4	4.6	2.3	5.2	3.2	4.6	4.4	6.4	4.9	3.5
Long range land-based Navy aircraft perform the Navy's sea-control mission 11	5.1	4.4	3.7	4.2	2.7	2.7	1.6	5.0	3.1	5.8	6.0	5.2	5.1	4.8
U.S. carrier force reduced to 8 CVA's 12	5.6	3.0	2.5	5.9	4.2	4.2	1.5	5.9	4.8	7.5	6.4	7.3	4.0	6.0
Deputy Program Manager/Logistics	1.7	1.9	1.9	2.3	2.4	2.3	1.0	2.3	1.4	1.3	1.0	1.1	2.3	1.0

GROUP 2: AIRCRAFT MAINTENANCE AND PERSONNEL

EVENTS \ DESCRIPTORS	Navy budget 1	Reliability 2	Manpower per flight hour 3	Maintenance cost at O, I and D levels 4	Number of NOLS 5	Number of NORMs 6	Aircraft operational readiness 7	Number of aviation ratings 8	New procurement costs 9	Training costs 10	Mission capability 11	Total number of flight hours 12	Navy aircraft inventory 13	Maintenance cost per aircraft by type 14	Ratio of officers to enlisted personnel 15	Fuel costs 16
No overseas bases available to the Navy in peacetime, outside the Western hemisphere 1	4.1	1.9	1.9	2.4	3.6	2.9	3.1	1.2	1.6	1.2	4.5	3.8	3.7	2.2	1.1	4.2
Repair facilities at Naval Air Stations totally manned by civilians 2	4.0	2.7	2.4	2.8	1.1	1.4	2.4	3.3	1.5	3.7	2.3	1.1	1.4	3.0	1.9	1.2
All NARFs managed and operated by contractors 3	4.2	1.2	1.6	2.5	1.2	1.1	1.7	1.4	1.6	1.5	1.2	1.0	1.2	2.7	1.0	1.0
Decision made to extend the life of the F-4 through CILOP 4	3.8	3.1	2.9	3.1	2.6	2.2	2.5	1.0	4.3	2.5	3.0	1.8	1.7	2.6	1.0	1.0
Use of warranty-type contracts whereby the contractor is held accountable for repair throughout the life cycle of a weapon, or for some specified period following delivery 5	4.5	4.6	4.0	4.3	3.4	3.6	4.0	1.7	5.6	4.3	2.7	1.5	1.8	4.4	1.4	1.4
Incorporation of functions of AIO under AIR-04 management 6	2.0	1.7	1.3	1.7	3.0	2.0	2.5	1.0	1.6	1.5	2.0	1.0	1.0	1.6	1.0	1.0
RPV's replace 50% of manned aircraft for combat missions 7	6.0	4.2	4.1	4.0	3.5	3.6	3.9	2.2	6.0	4.3	5.1	5.5	6.6	6.3	2.0	5.7
Long range land-based Navy aircraft perform the Navy's sea-control mission 8	5.5	3.6	4.2	4.3	3.5	3.7	4.3	1.5	5.7	4.2	5.4	7.2	6.2	4.8	2.4	5.8
U.S. carrier force reduced to 8 CVA's 9	6.5	2.1	2.5	4.2	2.9	3.0	2.2	1.1	4.7	3.7	6.7	5.4	6.6	2.5	1.6	5.2
50% replacement of training flight activity by use of simulators 10	5.7	2.0	4.3	5.3	4.0	3.7	2.6	1.7	4.8	5.6	2.9	5.4	4.6	2.7	1.5	5.8
Civilian-manned ships used for intermediate-level maintenance 11	5.4	1.7	1.4	3.5	1.8	1.4	2.5	1.7	1.6	2.7	2.0	1.6	1.1	3.9	2.2	1.0
Unionization of military forces 12	3.9	1.2	1.8	3.1	1.1	1.2	1.2	1.1	1.0	1.6	1.5	1.1	1.0	2.5	1.7	1.0
Effective anti-satellite capability deployed by hostile power 13	4.4	2.3	1.0	1.0	1.2	1.0	1.0	1.0	3.3	1.9	5.4	1.6	1.4	1.1	1.0	1.2
Women used for combat missions 14	1.2	1.3	1.2	1.2	1.0	1.0	1.2	1.0	1.2	1.3	1.4	1.0	1.0	1.2	1.0	1.0

EVENTS \ DESCRIPTORS	Navy budget 1	Reliability 2	Aircraft downtime 3	Manpower per flight hour 4	Maintenance cost at O, I and D levels 5	Number of MOMs 6	Aircraft operational readiness 7	Time to repair (O and I level) 8	New procurement costs 9	Training costs 10	Mission capability 11	Total number of flight hours 12	Navy aircraft inventory 13	Maintenance cost per aircraft by type 14	Fuel costs 15
300% increase in price of aviation fuel (JP5) 1	5.5	2,0	2.3	4.8	3.9	3.5	3.1	2.2	2.9	4.7	3.2	6.9	3.2	3.1	7.2
F-18 deployed to the operating fleet 2	3.9	3.6	3.6	3.6	3.6	2.9	4.2	3.4	5.4	3.5	4.1	2.4	3.5	3.8	2.3
Integration of all avionics functions into a single package, for each aircraft type 3	3.4	6.0	5.7	4.6	5.8	5.1	4.6	6.2	6.8	5.2	3.6	1.5	1.5	5.1	1.0
Deployment of V/STOL-A as currently envisaged by NAVAIR 4	5.2	5.4	4.9	4.6	6.3	5.4	4.9	4.8	6.7	5.5	6.5	4.0	3.7	5.7	4.0
Utilization of fiber optics in operational aircraft for on-board data transmission 5	2.3	4.3	2.8	1.9	2.8	2.3	2.6	2.7	2.5	1.9	4.2	1.1	1.0	2.5	1.0
Development and widespread use of non-fossil sources of power for aircraft 6	5.0	2.6													
Use of fault- tolerant design and performance monitoring, to the extent that pilot is only informed of malfunctions when mission capability is degraded 7	2.3	3.1	3.4	2.9	2.9	2.8	4.2	2.5	2.6	2.6	3.5	2.1	1.2	2.9	1.1
Aircraft maintenance instructions stored electronically on-board ships 8	3.4	2.1	2.8	2.2	3.0	2.2	2.5	3.5	2.9	2.5	1.4	1.1	1.0	2.1	1.0
Concept of VAST (Versatile Avionics Shop Test) is dropped for IMA 9	1.9	1.7	2.0	1.9	2.8	2.3	3.1	3.9	2.9	2.2	1.7	1.5	1.2	2.9	1.0
Performance monitoring with automatic trend analysis will control all O-level maintenance 10	3.6	1.8	4.1	4.1	4.2	4.6	5.5	4.0	3.4	3.1	2.7	1.7	1.2	3.6	1.0
No module repair at intermediate maintenance level, only test and replace 11	3.8	2.6	3.2	2.0	4.4	2.7	3.5		4.2	3.5	2.0	1.4	1.3	4.1	1.2
Cruise missiles controlled/guided by Navy aircraft 12	3.7	1.6	1.7	2.1	2.6	2.0	1.9	2.0	2.7	2.5	4.3	2.2	2.6	2.1	1.7
Use of composites for airframes 13															
Deputy Program Manager/Logistics in NAVAIR 14	2.2	1.9	2.1	1.7	2.3										

GROUP 3: AIRCRAFT MAINTENANCE AND LOGISTICS

VOLUME 2

PANEL RESULTS (DISTRIBUTION)

GROUP 1

RECORDING SHEET

ROW	COL.	# VOTING	MEAN	1	2	4	8
1	1	12	4.8		25	42	33
1	2	12	4.8		25	42	33
1	3	12	5.3		17	42	42
1	4	12	5.6		17	33	50
1	5	12	4.0	17	8	58	17
1	6	12	6.1		8	33	58
1	7	12	2.4	33	42	17	8
1	8	12	7.1		8	8	83
1	9	12	3.9	8	42	25	25
1	10	12	4.2	25	17	25	33
1	11	12	2.9	33	17	42	8
1	12	12	3.7	25	8	50	17
1	13	12	7.0			25	75
1	14	12	3.3	50	8	17	25

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
2	1	12	6.1		8	32	59
2	2	12	3.2	42	25	8	25
2	3	12	3.2	58		17	25
2	4	12	2.0	42	33	25	
2	5	12	2.5	42	25	25	8
2	6	12	3.3	33	17	33	17
2	7	12	1.8	67	25		8
2	8	12	4.5		25	50	25
2	9	12	3.7	25	25	25	25
2	10	12	3.9	17	25	33	25
2	11	12	7.6			8	92
2	12	12	3.8	17	17	50	17
2	13	12	3.6	8	42	33	17
2	14	12	5.8		8	42	50

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
3	1	12	5.6	8	17	17	58
3	2	12	3.8	25	33	8	33
3	3	12	4.3	17	25	25	33
3	4	12	4.9	8	25	25	42
3	5	12	3.7	17	25	42	17
3	6	12	3.5	8	25	58	8
3	7	12	3.7	25	25	25	25
3	8	12	3.2	25	33	25	17
3	9	12	3.9	8	25	50	17
3	10	12	3.4	25	25	33	17
3	11	12	2.2	42	25	33	
3	12	12	2.1	50	33	8	8
3	13	12	5.6		33	8	58
3	14	12	1.5	75	8	17	

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
4	1	12	3.4	8	50	25	17
4	2	12	3.4	25	25	33	17
4	3	12	3.5	33	8	42	17
4	4	12	4.5		25	50	25
4	5	12	2.8	25	33	33	8
4	6	12	2.3	33	33	33	
4	7	12	2.8	67	8		25
4	8	12	2.8	25	33	33	8
4	9	12	3.1	42	17	25	17
4	10	12	2.4	33	42	17	8
4	11						
4	12	12	1.7	42	50	8	
4	13	12	3.8	17	17	50	17
4	14	12	1.5	75	8	17	

RECORDING SHEET

ROW	COL.	# VOTING	MEAN	1	2	4	8
5	1	11	3.8	9	27	45	18
5	2	11	3.8	9	27	45	18
5	3	11	2.6	9	54	36	
5	4	11	3.4	18	36	27	18
5	5	12	3.7	17	25	42	17
5	6	12	3.2	25	33	25	17
5	7	12	1.9	58	17	25	
5	8	12	4.5	33	8	17	42
5	9	12	4.0		50	25	25
5	10	12	4.7	8	17	42	33
5	11	12	2.4	42	33	17	8
5	12	12	3.2	25	33	25	17
5	13	12	3.7	8	17	67	8
5	14	12	2.8	25	33	33	8

ROW	COL.	# VOTING	MEAN	1	2	4	8
6	1	12	4.2	8	25	42	25
6	2	12	4.8		8	67	25
6	3	12	4.8		8	67	25
6	4	12	4.8		8	67	25
6	5	12	4.5	8	25	33	33
6	6	12	4.1		25	58	17
6	7	12	1.7	58	25	17	
6	8	12	4.0	25	8	42	25
6	9	12	3.9	8	25	50	17
6	10	12	5.1		25	33	42
6	11	12	2.8	17	50	25	8
6	12	12	2.8	8	58	25	8
6	13	12	4.5		25	50	25
6	14	12	2.4	25	42	33	

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
7	1	12	4.6	17	8	42	33
7	2	12	7.0			25	75
7	3	12	5.5		8	50	42
7	4	12	5.1		8	58	33
7	5	12	6.3		17	17	67
7	6	12	4.8		42	17	42
7	7	12	2.1	33	42	25	
7	8	12	3.8		25	67	8
7	9	12	3.7	8	33	42	17
7	10	12	3.5	17	33	33	17
7	11	12	2.5	25	50	17	8
7	12	12	2.0	42	33	25	
7	13	12	4.1	8	17	58	17
7	14	12	1.3	67	33		

RECORDING SHEET

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ROW	COL.	# VOTING	MEAN	1	2	4	8
8	1	10	4.1	30	10	30	30
8	2	10	2.7	30	40	20	10
8	3	10	3.0	20	40	30	10
8	4	10	2.9	10	60	20	10
8	5	10	4.7				
8	6	11	3.1	27	36	18	18
8	7	11	1.9	73	18		9
8	8	11	2.2	27	45	27	
8	9	11	1.0	91	9		
8	10	11	2.3	36	27	36	
8	11	10	2.0	40	40	20	
8	12	11	1.2	73	27		
8	13	11	2.2	27	45	27	
8	14	11	1.2	91		9	

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
9	1	11	3.6	18	9	64	9
9	2	11	6.2	9		27	64
9	3	11	5.0		18	45	36
9	4	11	4.3		18	64	18
9	5	11	5.0		18	45	36
9	6	11	4.2	9	27	36	27
9	7	11	2.0	64	18	9	9
9	8	11	5.4			64	36
9	9	11	4.6		18	54	27
9	10	11	4.5	9	27	27	36
9	11	11	2.4	45	27	18	9
9	12	11	1.5	64	27	9	
9	13	11	4.9		9	64	27
9	14	11	1.3	82	9	9	

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
10	1	11	4.5	9	27	27	36
10	2	11	4.6		18	54	27
10	3	11	3.8	9	27	45	18
10	4	11	5.2		9	54	36
10	5	11	5.4		18	36	45
10	6	11	4.6		18	54	27
10	7	11	2.3	36	27	36	
10	8	11	5.2		9	54	36
10	9	11	3.2		36	64	
10	10	11	4.6		18	54	27
10	11	11	4.4	24		48	28
10	12	11	6.4	9		24	67
10	13	11	4.9		9	62	28
10	14	11	3.5	28	19	33	19

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Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
11	1	10	5.1	10	21	21	47
11	2	10	4.4		37	31	31
11	3	10	3.7	10	16	63	10
11	4	10	4.2		47	21	31
11	5	10	2.7	21	47	21	10
11	6	10	2.7	21	42	21	10
11	7	10	1.6	53	37	10	
11	8	10	5.0		31	26	42
11	9	10	3.1		42	58	
11	10	10	5.8			53	47
11	11	10	6.0		10	31	58
11	12	10	5.2		10	53	37
11	13	10	5.1		26	31	42
11	14	10	4.8	21		42	37

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
12	1	10	5.6		10	42	47
12	2	10	3.0	37	31	10	21
12	3	10	2.5	26	53	10	10
12	4	10	5.9		21	21	58
12	5	10	4.2		63		37
12	6	10	4.2		63		37
12	7	10	1.5	68	21	10	
12	8	10	5.9		21	21	58
12	9	10	4.8		10	63	26
12	10	10	7.5			10	89
12	11	10	6.4		10	21	68
12	12	10	7.3		10		89
12	13	10	4.0	5	31	42	21
12	14	10	6.0		10	31	58

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
13	1	10	1.7	50	40	10	
13	2	10	1.9	50	30	20	
13	3	10	1.9	50	30	20	
13	4	10	2.3	50	30	10	10
13	5	10	2.4	40	20	40	
13	6	10	2.3	50	10	40	
13	7	10	1.0	100			
13	8	10	2.3	30	40	30	
13	9	10	1.4	60	40		
13	10	10	1.3	70	30		
13	11	10	1.0	100			
13	12	10	1.1	90	10		
13	13	10	2.3	30	40	30	
13	14	10	1.0	100			

GROUP 2

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
1	1	16	4.1	25	19	25	31
1	2	15	1.9	60	13	27	
1	3	15	1.9	40	27	20	13
1	4	16	2.4	25	50	19	6
1	5	16	3.6	25	19	37	19
1	6	15	2.9	40	20	27	17
1	7	15	3.1	27	27	33	13
1	8	15	1.2	93		7	
1	9	15	1.6	80		20	
1	10	16	1.2	87	6	6	
1	11	16	4.5	6	25	37	31
1	12	15	3.8	20	20	40	20
1	13	15	3.7	27	13	40	20
1	14	15	2.2	20	60	20	
1	15	16	1.1	87	12		
1	16	15	4.2	27	13	27	33

RECORDING SHEET

Page Number ____

ROW	COL.	# VOTING	MEAN	1	2	4	8
2	1	15	4.0	13	40	13	33
2	2	16	2.7	31	37	19	11
2	3	16	2.4	50	25	12	12
2	4	16	2.8	37	25	25	12
2	5	16	1.1	81	19		
2	6	16	1.4	69	25	6	
2	7	16	2.4	31	44	19	6
2	8	15	3.3	40	13	27	20
2	9	16	1.5	69	19	12	
2	10	16	3.7	12	31	37	19
2	11	16	2.3	44	31	19	6
2	12	16	1.1	81	19		
2	13	16	1.4	69	25	6	
2	14	16	3.0	19	44	25	11
2	15	16	1.9	56	31	6	6
2	16	15	1.2	87	7	7	

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
3	1	16	4.2	12	19	44	25
3	2	16	1.2	75	25		
3	3	16	1.6	56	31	12	
3	4	16	2.5	44	19	31	6
3	5	16	1.2	81	12	6	
3	6	16	1.1	81	19		
3	7	16	1.7	75	12	6	6
3	8	16	1.4	81	6	12	
3	9	16	1.6	81	6	6	6
3	10	15	1.5	67	20	13	
3	11	15	1.2	93		7	
3	12	15	1.0	100			
3	13	16	1.2	72	25		
3	14	15	2.7	13	67	7	13
3	15	16	1.0	94	6		
3	16	15	1.0	93	7		

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
4	1	15	3.8	13	40	20	27
4	2	15	3.1	27	27	33	13
4	3	15	2.9	27	40	20	13
4	4	15	3.1	20	40	27	13
4	5	15	2.6	53	13	20	13
4	6	15	2.2	60	13	20	7
4	7	15	2.5	47	27	13	13
4	8	15	1.0	100			
4	9	15	4.3	27	7	33	33
4	10	15	2.5	33	47	7	13
4	11	15	3.0	27	33	27	13
4	12	15	1.8	73	13	7	7
4	13	15	1.7	67	27		7
4	14	15	2.6	33	40	13	13
4	15	15	1.0	100			
4	16	15	1.0	93	7		

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
5	1	15	4.5	7	27	33	33
5	2	15	4.6		20	53	27
5	3	16	4.0	19	19	37	25
5	4	16	4.3		19	62	19
5	5	16	3.4	19	37	25	19
5	6	16	3.6	12	37	31	19
5	7	16	4.0	6	37	31	25
5	8	16	1.7	75	12	6	6
5	9	16	5.6	6	6	37	50
5	10	16	4.3	19	12	37	31
5	11	16	2.7	19	56	12	12
5	12	16	1.5	50	50		
5	13	16	1.8	62	25	6	86
5	14	16	4.4	6	31	31	31
5	15	16	1.4	87	6		6
5	16	16	1.4	94			6

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
6	1	13	2.0	58	25	8	8
6	2	13	1.7	77	15		8
6	3	13	1.3	85	8	8	
6	4	13	1.7	77	15		8
6	5	13	3.0	46	8	31	15
6	6	13	2.0	69	8	15	8
6	7	13	2.5	54	23	8	15
6	8	13	1.0	100			
6	9	13	1.6	85	8		8
6	10	13	1.5	92			8
6	11	13	2.0	69	8	15	8
6	12	13	1.0	92	8		
6	13	13	1.0	100			
6	14	13	1.6	85	8		8
6	15	13	1.0	100			
6	16	13	1.0	100			

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
7	1	16	6.0	6		37	56
7	2	16	4.2	37	6	19	37
7	3	16	4.1	25	25	12	37
7	4	16	4.0	19	31	19	31
7	5	16	3.5	31	12	37	19
7	6	16	3.6	19	25	37	19
7	7	16	3.9	31	6	37	25
7	8	16	2.2	56	12	25	6
7	9	16	6.0		6	37	56
7	10	16	4.3	19	12	37	31
7	11	16	5.1	12	12	31	44
7	12	16	5.5	6	12	31	50
7	13	16	6.6		6	25	69
7	14	16	6.3		6	31	62
7	15	16	2.0	75	6	6	11
7	16	15	5.7	13	13	13	60

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
8	1	16	5.5	6	12	31	50
8	2	15	3.6	33	20	20	27
8	3	16	4.2	6	37	25	31
8	4	16	4.3		44	25	31
8	5	16	3.5	31	37		31
8	6	15	3.7	33	27	7	33
8	7	15	4.3	13	27	27	33
8	8	16	1.5	81	12		6
8	9	15	5.7	7	20	13	60
8	10	16	4.2	12	31	25	31
8	11	16	5.4	6	31	6	56
8	12	16	7.2			19	81
8	13	16	6.2	6		31	62
8	14	16	4.8	12	12	37	37
8	15	16	2.4	50	25	12	12
8	16	16	5.8		6	44	50

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
9	1	15	6.5		7	27	67
9	2	15	2.1	53	27	13	7
9	3	15	2.5	40	40	7	13
9	4	15	4.2		40	33	27
9	5	15	2.9	27	40	20	13
9	6	15	3.0	27	33	27	13
9	7	15	2.2	53	20	20	7
9	8	15	1.1	87	13		
9	9	15	4.7	20	13	27	40
9	10	15	3.7	7	27	53	13
9	11	15	6.7		7	20	73
9	12	15	5.4		7	53	40
9	13	15	6.6			33	67
9	14	15	2.5	40	27	27	7
9	15	15	1.6	80	13		7
9	16	15	5.2	7	7	47	40

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
10	1	15	5.7	7	20	13	60
10	2	15	2.0	53	20	27	
10	3	15	4.3	20	20	27	33
10	4	15	5.3		13	47	40
10	5	15	4.0	13	33	27	27
10	6	15	3.7	13	33	33	20
10	7	15	2.6	40	33	13	13
10	8	15	1.7	80	7	7	7
10	9	15	4.8		40	20	40
10	10	15	5.6		13	40	47
10	11	15	2.9	20	47	20	13
10	12	15	5.4		20	33	47
10	13	15	4.6	20	20	20	40
10	14	15	2.7	27	40	27	7
10	15	15	1.5	87	7		7
10	16	15	5.8		13	33	53

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
11	1	15	5.4	7	13	33	47
11	2	15	1.7	47	40	13	
11	3	15	1.4	60	40		
11	4	15	3.5	20	33	27	20
11	5	15	1.8	60	33		7
11	6	15	1.4	60	40		
11	7	15	2.5	27	60		13
11	8	15	1.7	80	7	7	7
11	9	15	1.6	73	20		7
11	10	15	2.7	27	40	27	7
11	11	15	2.0	53	33	7	7
11	12	15	1.6	73	20		7
11	13	15	1.1	87	13		
11	14	15	3.9	7	47	20	27
11	15	15	2.2	60	13	20	7
11	16	15	1.0	93	7		

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
12	1	15	3.9	40	7	20	33
12	2	15	1.2	73	27		
12	3	15	1.8	60	20	20	
12	4	15	3.1	33	33	13	20
12	5	15	1.1	87	13		
12	6	15	1.2	80	20		
12	7	15	1.2	80	20		
12	8	15	1.1	87	13		
12	9	15	1.0	100			
12	10	15	1.6	60	27	13	
12	11	15	1.5	67	20	13	
12	12	15	1.1	87	13		
12	13	15	1.0	100			
12	14	15	2.5	47	27	13	13
12	15	15	1.7	67	27		7
12	16	15	1.0	100			

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
13	1	15	4.4	20	27	13	40
13	2	15	2.3	47	27	20	7
13	3	15	1.0	100			
13	4	15	1.0	100			
13	5	15	1.2	93		7	
13	6	15	1.0	100			
13	7	15	1.0	100			
13	8	15	1.0	100			
13	9	15	3.3	53	7	13	27
13	10	15	1.9	60	13	27	
13	11	15	5.1	33	0	7	60
13	12	15	1.6	73	7	20	
13	13	15	1.4	80	7	13	
18	14	15	1.1	87	13		
13	15	15	1.0	100			
13	16	15	1.2	86	7	7	

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
14	1	15	1.2	73	27		
14	2	15	1.3	87		13	
14	3	15	1.2	80	20		
14	4	15	1.2	93		7	
14	5	15	1.0	100			
14	6	15	1.0	100			
14	7	15	1.2	93		7	
14	8	15	1.0	100			
14	9	15	1.2	93		7	
14	10	15	1.3	80	13	7	
14	11	15	1.4	73	20	7	
14	12	15	1.0	100			
14	13	15	1.0	100			
14	14	15	1.2	73	27		
14	15	15	1.0	100			
14	16	15	1.0	100			

GROUP 3

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
1	1	17	5.5		18	35	47
1	2	17	2.0	59	23	12	6
1	3	17	2.3	41	29	23	6
1	4	17	4.8	12	12	41	35
1	5	17	3.9	6	29	47	18
1	6	17	3.5	23	23	35	18
1	7	16	3.1	12	37	44	6
1	8	17	2.2	53	10	23	6
1	9	17	2.9	29	29	29	12
1	10	17	4.7	6	12	53	29
1	11	17	3.2	18	35	35	12
1	12	17	6.9		6	18	76
1	13	17	3.2	18	35	35	12
1	14	17	3.1	29	35	18	18
1	15	17	7.2			18	82

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
2	1	17	3.9	6	10	65	12
2	2	17	3.6	29	12	41	18
2	3	17	3.6	18	29	35	18
2	4	17	3.6	12	35	35	18
2	5	17	3.6	6	23	65	6
2	6	17	2.9	12	47	35	6
2	7	17	4.2	6	10	59	18
2	8	17	3.4	6	29	59	6
2	9	17	5.4			65	35
2	10	17	3.5	12	18	65	6
2	11	17	4.1	6	29	41	23
2	12	17	2.4	23	41	35	
2	13	16	3.5	25	6	56	11
2	14	17	3.8	6	35	41	18
2	15	17	2.3	35	41	18	6

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
3	1	17	3.4	23	29	29	18
3	2	16	5.9	6	6	31	56
3	3	17	5.7		6	47	47
3	4	17	4.6		23	47	29
3	5	17	5.8		12	35	53
3	6	17	5.1		12	53	35
3	7	17	4.6		12	65	23
3	8	17	6.2		6	35	59
3	9	17	6.8		12	12	76
3	10	16	5.2		12	50	37
3	11	17	3.6	12	35	35	18
3	12	17	1.5	65	23	12	
3	13	17	1.5	70	18	12	
3	14	17	5.1	6	6	53	35
3	15	17	1.0	94	6		

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
4	1	17	5.2	12		47	41
4	2	17	5.4	6	12	35	47
4	3	17	4.9	6	12	47	35
4	4	17	4.6	6	18	47	29
4	5	17	6.3			41	59
4	6	17	5.4	6	12	35	47
4	7	17	4.9		23	41	35
4	8	17	4.8		18	53	29
4	9	17	6.7			29	70
4	10	17	5.5		18	35	47
4	11	17	6.5		12	18	70
4	12	17	4.0	12	23	41	23
4	13	17	3.7	18	29	29	23
4	14	16	5.7			56	44
4	15	16	4.0		37	44	19

RECORDING SHEET

Page Number

ROW	COL.	# VOTING	MEAN	1	2	4	8
5	1	17	2.3	47	23	23	6
5	2	17	4.3	6	29	35	29
5	3	16	2.8	19	37	37	6
5	4	17	1.9	29	59	12	
5	5	17	2.8	18	41	35	6
5	6	17	2.3	23	47	29	
5	7	17	2.6	23	41	29	6
5	8	17	2.7	12	47	41	
5	9	17	2.5	41	23	29	6
5	10	16	1.9	57	19	24	
5	11	16	4.2	6	37	25	31
5	12	17	1.1	82	18		
5	13	17	1.0	100			
5	14	17	2.5	18	47	35	
5	15	17	1.0	100			

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
7	1	16	2.3	44	31	19	6
7	2	16	3.1	19	37	31	12
7	3	16	3.4	12	31	44	11
7	4	16	2.9	12	44	37	6
7	5	16	2.9	6	44	50	
7	6	16	2.8	12	50	31	6
7	7	16	4.2	6	19	56	19
7	8	16	2.5	44	31	12	12
7	9	16	2.6	25	50	12	12
7	10	15	2.6	33	33	27	7
7	11	16	3.5	12	25	50	12
7	12	16	2.1	50	19	31	
7	13	16	1.2	75	25		
7	14	16	2.9	12	44	37	6
7	15	16	1.1	81	19		

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
8	1	17	3.4	12	33	42	12
8	2	17	2.1	53	23	18	6
8	3	17	2.8	18	41	35	6
8	4	17	2.2	23	53	23	
8	5	17	3.0	23	23	47	6
8	6	17	2.2	23	53	23	
8	7	16	2.5	31	50	6	12
8	8	17	3.5	12	29	47	12
8	9	17	2.9	47	18	18	18
8	10	17	2.5	18	59	18	6
8	11	17	1.4	65	29	6	
8	12	17	1.1	82	18		
8	13	16	1.0	100			
8	14	16	2.1	37	37	25	
8	15	17	1.0	100			

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
9	1	15	1.9	27	60	13	
9	2	15	1.7	40	53	7	
9	3	14	2.0	21	64	14	
9	4	15	1.9	27	59	13	
9	5	14	2.8	14	36	50	
9	6	15	2.3	27	40	33	
9	7	15	3.1	7	47	40	7
9	8	14	3.9	7	36	36	21
9	9	15	2.9	33	27	27	13
9	10	15	2.2	27	47	27	
9	11	15	1.7	47	40	13	
9	12	15	1.5	60	33	7	
9	13	15	1.2	80	20		
9	14	15	2.9	33	27	27	13
9	15	15	1.0	100			

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
10	1	17	3.6	6	47	29	18
10	2	17	1.8	47	35	18	
10	3	17	4.1	12		76	12
10	4	17	4.1		18	70	12
10	5	17	4.2		23	59	18
10	6	17	4.6	6	18	47	29
10	7	17	5.5		6	53	41
10	8	17	4.0	12	35	23	29
10	9	17	3.4		53	35	12
10	10	17	3.1	6	35	59	
10	11	17	2.7	6	65	23	6
10	12	17	1.7	53	35	12	
10	13	17	1.2	76	23		
10	14	17	3.6	6	35	47	11
10	15	17	1.0	94	6		

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
11	1	14	3.8		50	28	21
11	2	15	2.6	33	40	13	13
11	3	14	3.2	14	28	36	14
11	4	15	2.0	47	27	27	
11	5	15	4.4	13		67	20
11	6	15	2.7	40	27	20	13
11	7	15	3.5	20	20	47	13
11	8						
11	9	15	4.2	20	13	40	27
11	10	15	3.5	7	27	59	7
11	11	15	2.0	50	21	28	
11	12	15	1.4	73	20	7	
11	13	15	1.3	80	13	7	
11	14	15	4.1		33	47	20
11	15	14	1.2	78	22		

RECORDING SHEET

Page Number _____

ROW	COL.	# VOTING	MEAN	1	2	4	8
12	1	15	3.7	7	27	53	13
12	2	15	1.6	33	67		
12	3	14	1.7	28	71		
12	4	14	2.1	21	57	21	
12	5	15	2.6	27	27	47	
12	6	15	2.0	40	40	20	
12	7	14	1.9	43	36	21	
12	8	14	2.0	36	43	21	
12	9	14	2.7	14	43	43	
12	10	14	2.5	14	50	36	
12	11	14	4.3	7	14	57	21
12	12	14	2.2	36	36	28	
12	13	14	2.6	7	57	36	
12	14	15	2.1	13	73	13	
12	15	14	1.7	43	50	7	

VOLUME 2

PANEL PARTICIPANTS

Participants in Panel Discussion of 24 January 1978

Topic: Naval Aviation Maintenance (Equipment)

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LCDR L. Army	OP-96
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J. Brown	NALC
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Participants in Panel Discussion of 25 January 1978

Topic: Naval Aviation Maintenance (Personnel)

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CDR W. T. Jordan	BUPERS-446B
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Topic: Naval Aviation Procurement Management

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LIST OF ACRONYMS
(Used either in this report or in referenced material)

AAA	Anti-aircraft artillery
AALC	Amphibious Assault Landing Craft
AAW	Anti-air warfare
ABM	Anti-ballistic missile
ACMR	Air combat maneuvering range
ADM	Atomic demolition munitions (manually emplaced)
AEGIS	Integrated, computer-controlled air defense system comprising radar network, missiles and missile launchers
AEW	Airborne Early Warning
AFAP	Artillery fired atomic projectiles
AH/OV	Attack helicopter and armed observation
ALCM	Air-launched cruise missile
APN	Aircraft Procurement Navy
ARM	Anti-radiation missile
ASALM	Advanced Strategic Air-launched Missile
ASM	Air-to-surface missile
ASMD	Anti-ship missile defense
ASO	Aviation Supply Office
ASW	Anti-submarine warfare
ATE	Automated Test Equipment
ATIGS	Advanced Tactical Inertial Guidance System
AVF	All Volunteer Force
AWACS	Airborne Warning and Control System
AWMS	Airborne Weapon Management System
BCM	Beyond capability of maintenance
BIBI	Built-in blade inspection (on Sikorsky helicopter)
BIT	Built-in test

BITE	Built-in test equipment
BMC	Beyond maintenance capability
CAP	Combat Air Patrol
CBO	Congressional Budget Office
CBU	Cluster bomb unit
CER	Complete engine removal
CILOP	Conversion in lieu of procurement
CNO	Chief of Naval Operations
COD	Carrier on-board delivery
CRAW	Combat Replacement Air Wings
CS & M	Central Supply and Maintenance
CTOL	Conventional Take off and Landing
DECM	Defensive Electronic Countermeasures
DLA	Defense Logistics Agency
DOE	Department of Energy
DOD	Department of Defense
DSA	Defense Supply Agency
DSARC	Defense System Acquisition Review Council
DTC	Design to Cost
ECCM	Electronic Counter-countermeasures
ECM	Electronic countermeasures
ECP	Engineering change proposal
ECR	Engine component repair
ELINT	Electronic Intelligence
EMCON	Emission control
EP	Earth penetrator -- a device that mechanically buries a nuclear warhead in the ground before detonation
ESL	Extended service life
ESM	Electronic Support Measures (extension of the former ECM)

FBS	Forward-based systems
FLIR	Forward-looking infrared
FOBS	Fractional orbital ballistic system
GCI	Ground Controlled intercept
GERAEPS	Global Extended Range Automated Environmental Prediction System
GPA	General Personnel Activity
GPS	Geographical Position System/Satellites
GSE	Ground Support Equipment
ICAPS	Integrated Carrier Acoustics Prediction System
ICBM	Intercontinental ballistic missile (delivers nuclear weapons 3000 nautical miles)
IFF	Identification Friend/Foe
IMA	Intermediate Maintenance Activity
INS	Inertial navigation system
IOC	Initial operational capability
IRBM	Intermediate range ballistic missile (delivers nuclear weapons 1500-3000 nautical miles)
IREPS	Integrated Refractive Effects Prediction System
JTIDS	Joint Tactical Information Distribution System
LAMPS	Light Airborne Multi-purpose System
LCC	Life Cycle Cost
LMNA	Land-based Multi-purpose Naval Aircraft
LOR	Long-range Operating Requirement
LORAN	Long Range Navigation
LRU	Line replaceable unit
LTA	Lighter than Air
MAAS	Multiple Array Avionics System
MAC	Military Airlift Command
MAW	Marine Aircraft Wings
MBFR	Mutual and Balanced Force Reduction talks

MDCS	Maintenance Data Collection System
METRIC	Multi-echelon Technique for Recoveralble Item Control
MFHBF	Mean Flight Hours Between Failure
MICRAD	Microwave radiometer
MIRV	Multiple Independently Targetable Reentry Vehicles
MRBM	Medium range ballistic missile (delivers nuclear weapons 600-1500 nautical miles)
MRV	Multiple reentry vehicle (not independent)
MTBF	Mean Time Between Failures
NALCOMIS	Naval Logistics Command Management Information System
NALDA	Naval Aviation Logistics Data Analysis System
NARF	Naval Air Rework Facility
NAS	Naval Air Station
NASE	Non-acoustic Surface Effects
NATO	North Atlantic Treaty Organization
NAVAIR	Naval Air Systems Command
NAVWESA	Naval Weapons Engineering Support Activity
NCA	National Command Authority (U. S. national decision-makers responsible for use of nuclear forces)
NIFTS	Naval Integrated Flight Training system
NOP	Nuclear operations plan
NORM	Not operationally ready -- maintenance
NORS	Not operationally ready -- supply
NTDS	Naval Tactical Data System
OMB	Office of Management and Budget
OR	Operational Readiness
OSD	Office of the Secretary of Defense
OTH	Over the horizon
PAL	Permissive action link. Coded device attached to nuclear weapons deployed abroad to impede un-authorized arming or firing

PALR	Prediction of Aviation Logistics Requirements
PGM	Precision-guided munition. A bomb or missile capable of being guided during terminal phase of its trajectory
PGO	Precision-guided ordnance
PGSE	Peculiar Ground Support Equipment
PHM	Patrol hydrofoil missile ship
PSP	Priority strike program (nuclear targets)
QMA	Qualified for Military Activity
QRA	Quick reaction alert. Specified numbers of aircraft and Pershing missiles are readied to deliver designated nuclear strikes at very short notice
RADAG	Radar Area Correlator Guidance
R&R	Remove and replace
RDT & E	Research Development Test and Evaluation
RFI	Ready for Issue (i.e. good parts)
RFP	Request for Proposal
RIP	Recoverable Item Program or
	Reduction Implementation Plan or
	Reliability Improvement Plan
RIW	Reliability Improvement Warranty
RPV	Remotely piloted vehicle
SAM	Surface to air missile
SAR	Search and Rescue
SCS	Sea-control ship
SES	Surface effect ship
SINS	Ships Inertial Navigation System
SIOP	Single Integrated Operational Plan (for coordinated delivery of nuclear strikes by strategic nuclear forces)
SL	Service life
SLAT	Surface launched, air targeted
SLBM	Submarine launched ballistic missile

SLEP	Service Life Extension Program
SLOC	Sea lines of communication
SMAC	Scene-matching Area Correlator
SOSUS	Sound and Surveillance System
SPCC	Ships Parts Control Center
SRA	Specialized repair activity or Shop-replaceable assembly
SRAM	Short-range attack missile
SSM	Surface to surface missile
SWATH	Small Water-plant Area Twin Hull craft
TACAN	Tactical Air Navigation System
TAT	Turnaround time
TERCOM	Terrain reference system
TOA	Total Obligational Authority
TPS	Test Program Set
TSP	Tactical Strike Program - Plan for nuclear strikes against other than priority targets
UNREP	Underway replenishment
UPT	Undergraduate Pilot Training
URG	Underway Replenishment Group
UTTAS	Utility tactical transport aircraft system
VAST	Versatile Avionics Ship Test
VIFF	Vectoring In Forward Flight
VOD	Vertical Onboard Delivery
V/STOL	Vertical/short take-off and landing aircraft
WRA	Weapons Replacement
3-M System	Maintenance and Material Management System

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BIBLIOGRAPHY

BIBLIOGRAPHY

1. Air Force Command Technology Forecasts, The Director of Laboratories Technology Forecast, June 7, 1972.

2. Alexander, Arthur J. and J. R. Nelson, Measuring Technological Change: Aircraft Turbine Engines, Report for ARPA and USAF Project Rand, R-1017ARPA/PR (Santa Monica, California: RAND, May 1972).

3. Annual Defense Department Report FY 1975, Budget Report for Congress, Secretary of Defense James P. Schlesinger, March 4, 1974.

4. Annual Defense Department Report FY 1978, Budget Report for Congress, Secretary of Defense Donald H. Rumsfeld, January 17, 1977.

5. Annual Defense Department Report FY 1979, Budget Report for Congress, Secretary of Defense Harold Brown, February 2, 1978.

6. Blechman, Barry M., The Control of Naval Armaments: Prospects and Possibilities, Studies in Defense Policy (Washington, D. C.: The Brookings Institution, 1975).

7. Boren Jr., H. E., A Computer Model for Estimating Development and Procurement Costs of Aircraft (DAPCA-111), Report for USAF Project Rand, R-1854-PR (Santa Monica, California: RAND, March 1976).

8. Budget and Forces Summary (Office of the Navy Comptroller Internal Review, Systems and Reports Branch, May 1977).

9. Budget and Forces Summary (Office of the Navy Comptroller Internal Review, Systems and Reports Branch, November 1977).

10. Casey, D. L., Logistics Impacts of Longer C-5 Missions, LD# 36877A.

11. The Costs of Defense Manpower: Issues for 1977, Budget Issue Paper, Congressional Budget Office, Congress of the United States (Washington, D. C.).

12. Cruise Missiles, USAF Fact Sheet, OIP No. 192.77, December 1977.

13. Department of the Navy Extended Planning Annex, FY 1983-1992, Secret.

14. Department of the Navy Extended Planning Annex, FY 1984-1993, Secret (Draft).

15. Domestic and World Trends Affecting the Future of Aviation (1980-2000), NASA Outlook for Aeronautics, Appendix C, March, 1976.

16. Electronics-X: A Study of Military Electronics with Particular Reference to Cost and Reliability, Institute for Defense Analyses, Report R-195, January 1974 (Two volumes).

17. Employment and Training Reporter, Supplement No. 177, Manpower Information, Inc., April 27, 1977.

18. A Forecast of Space Technology, 1980-2000, NASA SP-387, January 1976.

19. Friedman, Norman, William Overholt, John Thomas and Anthony J. Wiener, Domestic and World Trends Affecting the Future of Aviation (1980-2000), Prepared for NASA Outlook for Aeronautics Study (Croton-on-Hudson, New York: Hudson Institute, Inc., March 1976).

20. Ganssler, Jacque, Defense Outlook--As Viewed from "The Hill" Presentation, October 5, 1977.

21. Hearings on Military Posture and HR 5068 [HR 5970], DoD Authorization for Appropriations for FY 1978, Research and Development Title II (H.A.S.C. No. 95-4) Two volumes.

22. Historical Budget Data, United States Navy Chief of Naval Operations, April 1976 and March 1977.

23. Integrated Logistic Support Planning Policy, Report for NAVMAT, Inst. 4000.20B (Washington, D. C.: Department of the Navy Headquarters, Naval Materiel Command, June 1975).

24. Interavia Data (September, 1975).

25. International Economic Indicators, U. S. Department of Commerce, September 1977.

26. Jane's All the World's Aircraft, Various editions (New York, New York: Franklin Watts, Inc.).

27. Large, Joseph P., Harry E. Campbell and David Gates, Parametric Equations for Estimating Aircraft Airframe Costs, Report for Assistant Secretary of Defense, R-1693-1-PA8E (Santa Monica, California: RAND, February 1976).

28. Lenz Jr., Ralph Charles, Technological Forecasting, 2nd ed., ASD-TOR-62-414 (Wright-Patterson AFB, Ohio: Aeronautical Systems Division, A. F. Systems Command, June 1962).

29. Lewis, Donald E. and Thomas T. Tierney, Meeting Tomorrow's Logistics Challenges with "Now" Research, Report for the USAF Project Rand, R-686-PR (Santa Monica, California: RAND, March 1971).

30. Long Term Economic Growth, 1860-1970, U. S. Department of Commerce, June 1973.

31. Lum, M. D., L. L. Blair and J. R. Stuart, Predictive Techniques Study Phase I Comparison of Some Forecast Techniques, for Air Force Logistics Command (Wright-Patterson AFB, Ohio, May 1970).

32. Materials: Renewable and Non-renewable Resources, American Association for the Advancement of Science, 1976.

33. Naval Aviation Plan, 1975.

34. O'Neil, William D., Land-based Multi-purpose Naval Aircraft (LMNA) Concept, Memorandum for the Record, Office of the Director of Defense Research and Engineering, September 15, 1976.

35. Operating and Support Costs of New Weapon Systems Compared With Their Predecessors, Report to the Senate Committee on Appropriations by the Comptroller General of the United States, October 17, 1977.

36. Outlook for Space Reference Volume, A Forecast of Space Technology 1980-2000, NASA, July 15, 1975.

37. Outlook for Space: Report to the NASA Administrator by the Outlook for Space Study Group, NASA SP-386, January 1976.

38. Parker, Robert N., "Cruise Missile: Double Insurance for Defense", in Commanders Digest Vol. 19, No. 20, September 23, 1976.

39. Planning U. S. General Purpose Forces: The Navy, Budget Issue Paper, the Congress of the United States.

40. Preyss, Col. Albert E., Commander A. F. Flight Dynamics Laboratory, Flight Vehicle: Functional Area Review (Wright-Patterson AFB, Ohio: November 1976).

41. Project 2000: A Study of Trends Bearing on the Future Shape and Environment of the U. S. Navy, June 1974, DDC# AD5-31682,3,4, Secret.

42. Prothso, Randall Hurt, 1985 Anti-Air Warfare System Study, Report for NASC (AER-360), (Defense Documentation Center, July 1974).

43. Rausa, Rosario, Cdr., "Aviation and Surface Effects: Focus on the Future," Naval Aviation News, August 1975 (Bethesda, Md.: NSRDC).

44. Tsipis, Kosta, "Cruise Missiles", in Scientific American, Vol. 236 No. 2, February 1977.

45. U. S. Navy Energy Plan, Prepared for CNO (OP-413), (June 1977).

46. The United States and the World in the 1985 Era, Syracuse University Research Corporation, May 1964 (DDC Clearinghouse, AD 613 528).

47. Use of Women in the Military, Background Study, Office of the Assistant Secretary of Defense, May 1977.

48. White, William D., U. S. Tactical Air Power: Missions, Forces and Costs, Studies in Defense Policy (Washington, D. C.: The Brookings Institution, 1974).

49. World Military Expenditures and Arms Transfers, Bureau of Economic Affairs, U. S. Arms Control and Disarmament Agency, 1972 and 1976.