OBIGGS II

Applying Systems Engineering to Large Improvement Project

On Board Inert Gas Generation System (OBIGGS)

- **Today I'll cover:**
  - OBIGGS project
  - The state of Systems Engineering
  - SE implementation on project
  - Project results

OBIGGS II

OBIGGS II Improvement Project

OBIGGS II


(US Air Force Photo)

OBIGGS II Improvement Project

OBIGGS II

(US Air Force Photo)

OBIGGS II Improvement Project

OBIGGS II

How the Team was Prepared to Work Together in Addressing the Project

Executive Leadership

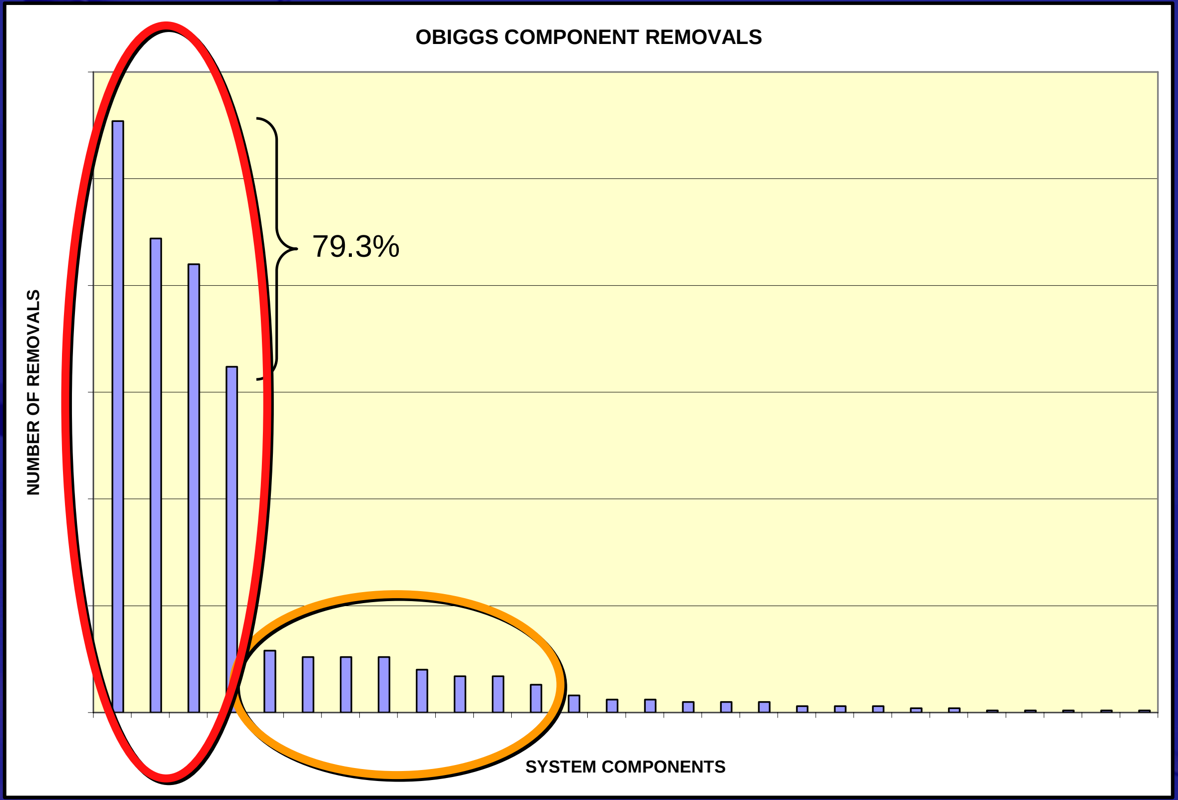
- OBIGGS II DIRECTOR
  - Engineering
  - Production
  - Supplier Management
  - Systems Engineering
  - Training
  - Field Services
  - Flight Test

Team Co-located Facilities

Dedicated Personnel

Team Analysis of Data to Identify Possible Root Causes

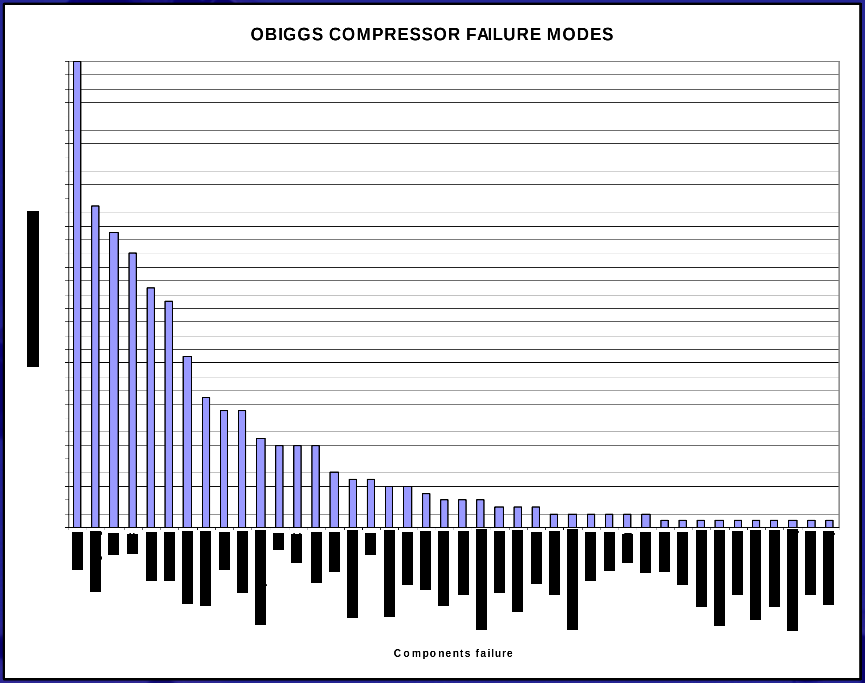
Pareto Analysis



4 main problem components were focus of initial improvement attempts

Team Analysis of Data to Select the Final Root Causes

Expanded Pareto analysis



Pareto results for just one of the driving components shows multiple issues

Identification of Root Causes and How the Team Validated the Final Root Cause

Final Root Cause :

The original design was inherently too complex and time consuming to fix to desired levels

Affected Organizational Goals/ Performance Measures and Strategies

BOEING

C-17 GLOBEMASTER III

Value Creation

Profitably Expand Markets

Operational Efficiency

Customer Solutions

Stakeholder Requirements & Expectations

- Customer
- Work Force
- Suppliers
- Community
- Shareholders

Run Healthy Business

- Achieve aggressive, sustainable improvements to safety, quality, schedule and cost
- Strengthen stakeholder relationships
- Relentlessly improve and integrate processes

Leverage to Emerging Opportunities

- Aggressively pursue a sustainable competitive advantage
- Capture additional C-17 business (C-17, BC-17X, International)
- Launch C-17A+
- Capture Performance Improvement contracts
- Expand alliances and partnerships

Create New Frontiers

- Create Agile Logistics Mobility and Systems Solutions
- Create Next Generation Airlift/Support
- Create Network-Centric Capability Integration
- Accelerate Technology Integration

Our Vision:

People Working Together to Provide the World's First Choice for Global Airlift and Mobility Solutions

Time

Affected Organizational Goals/ Performance Measures and Strategies

OBIGGS II

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Time

Affected Internal and External Stakeholders and How they were Identified

Stakeholders
Internal
Engineering
Production
Supplier Management
Support Systems
Training
Field Services
Flight Test
External
Pilots
Maintainers
Customer Engineering
Suppliers

How Affected Stakeholders were Identified

- Internal stakeholders identified via project management process at kick-off meeting
- External customer stakeholders identified by Boeing Field Services and USAF engineering customers
- External supplier stakeholders identified through competitive bid process

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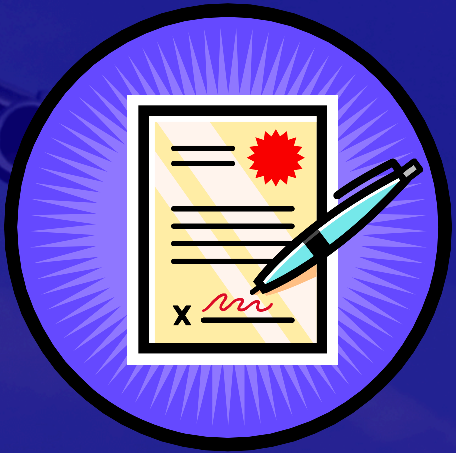
How the Team Members were Selected and Involved Throughout the Project

Representatives identified within each organization

Internal customers

Suppliers

Air Force customer



How the Team Members were Selected and Involved Throughout the Project

Involvement was maintained by establishing ownership from each team member and matching skills with needs

Agreed to team plans

Supplier partnerships

Control account responsibility

OBIGGS II

BOEING

How the Team was Prepared to Work Together in Addressing the Project

Training Class	Benefit
System Engineering Workshop	Requirements definition
Model Based Definition	Eliminate 2-D drawings
Earned Value Management	Performance and Cost control
Integrated Performance and Scheduling	Schedule adherence
Employee Involvement	Address barriers as a team
Accelerated Improvement Workshops	Tool use for root cause analysis

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How the Team was Prepared to Work Together in Addressing the Project

REVIEW	OCCURRENCE	ATTENDEES
Project Team Stand-Up	Daily	Internal – Supplier Management, Systems Engineering, Project Management
Action item review	Weekly	Customer, Project management
Program review	Weekly	Internal Stakeholders
Technical Interchange	Bi-monthly in person	Customer, Project management
Internal project review	Bi-monthly	Boeing executive leadership
Program review	Bi-Monthly video conference	Boeing and customer executive leadership

Open communication was emphasized and key to project success!

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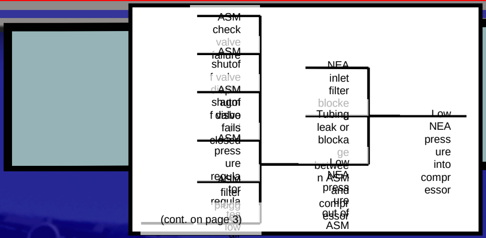
Methods and Tools Used to Develop Possible Solutions



Fault Tree Analysis

Brainstorming

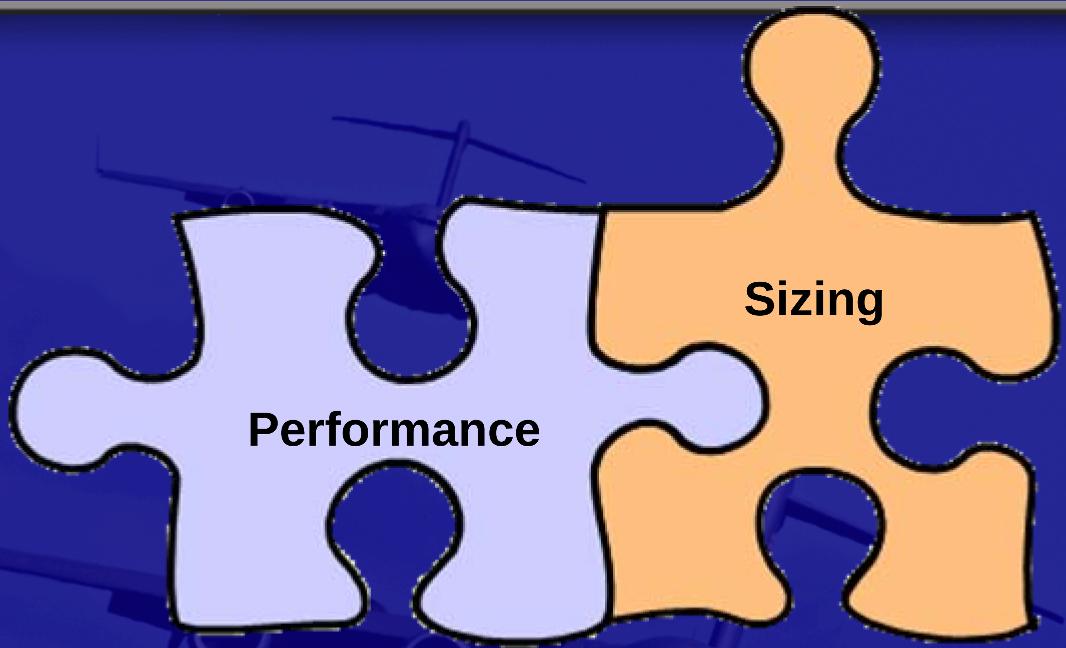
Benchmark Suppliers

Possible Solutions

Team Analysis of Data to Develop Possible Solutions

OBIGGS II

Team Analysis of Data to Develop Possible Solutions



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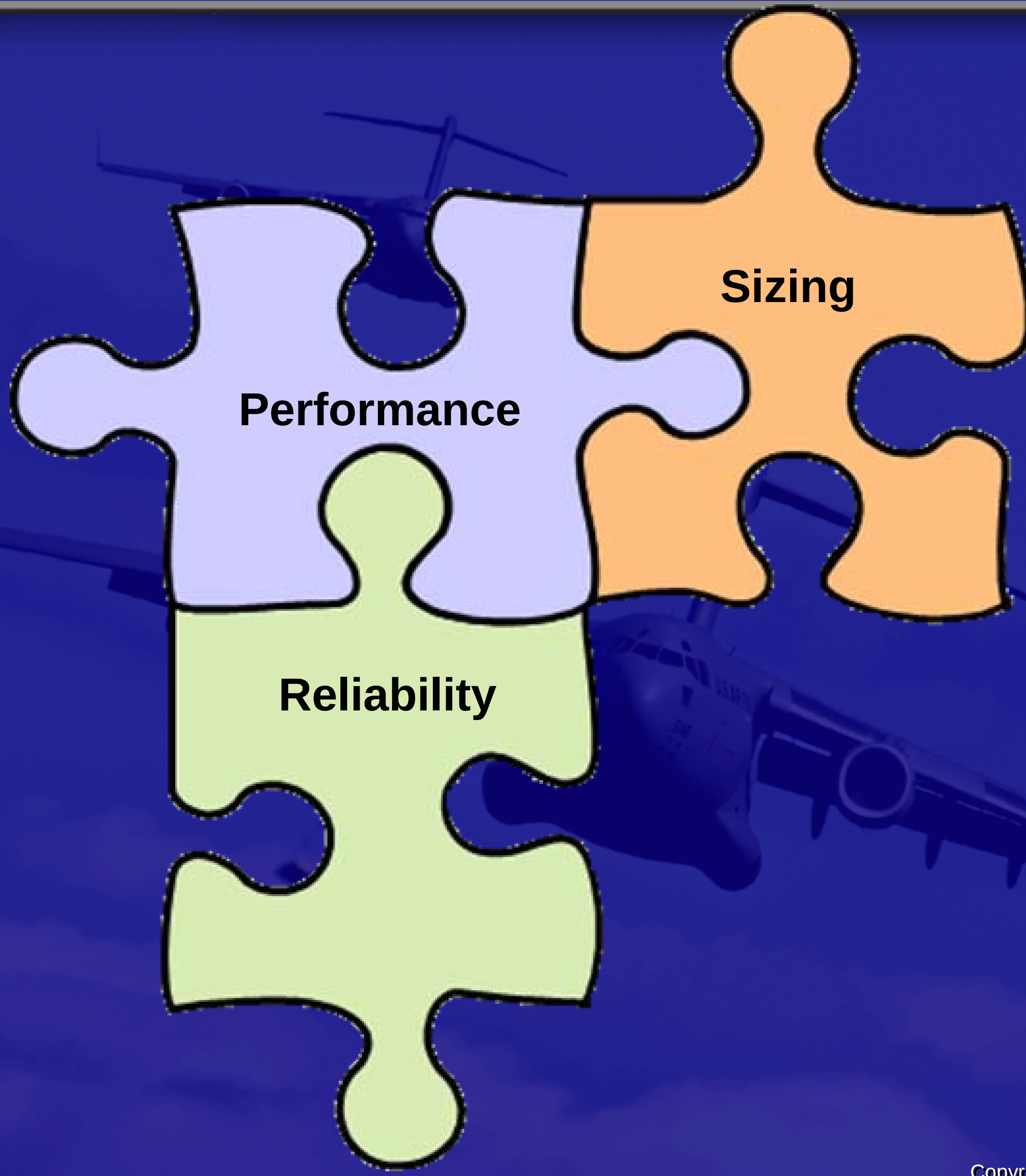

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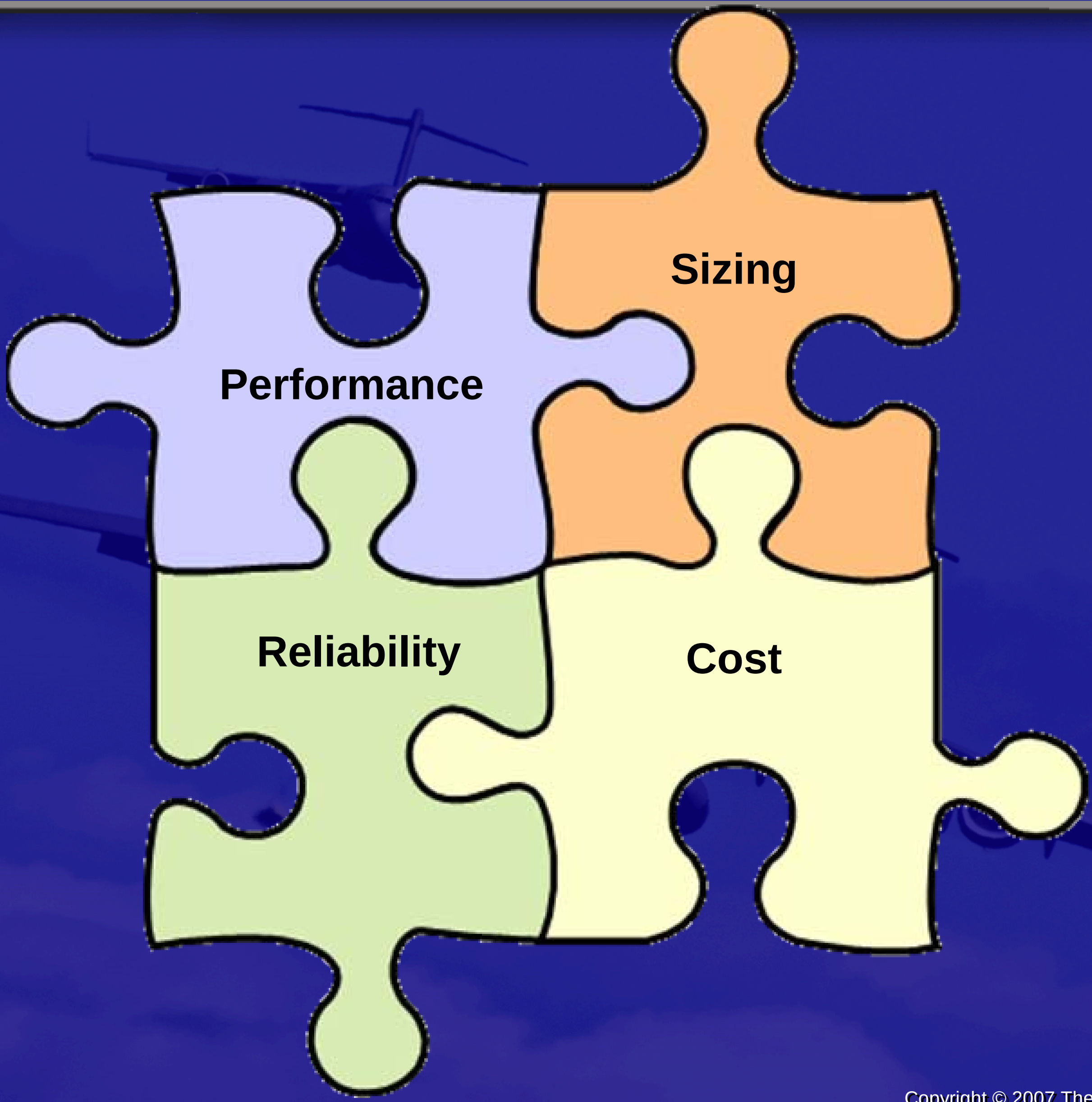


Criteria the Team Decided to Use in Selecting the Final Solution

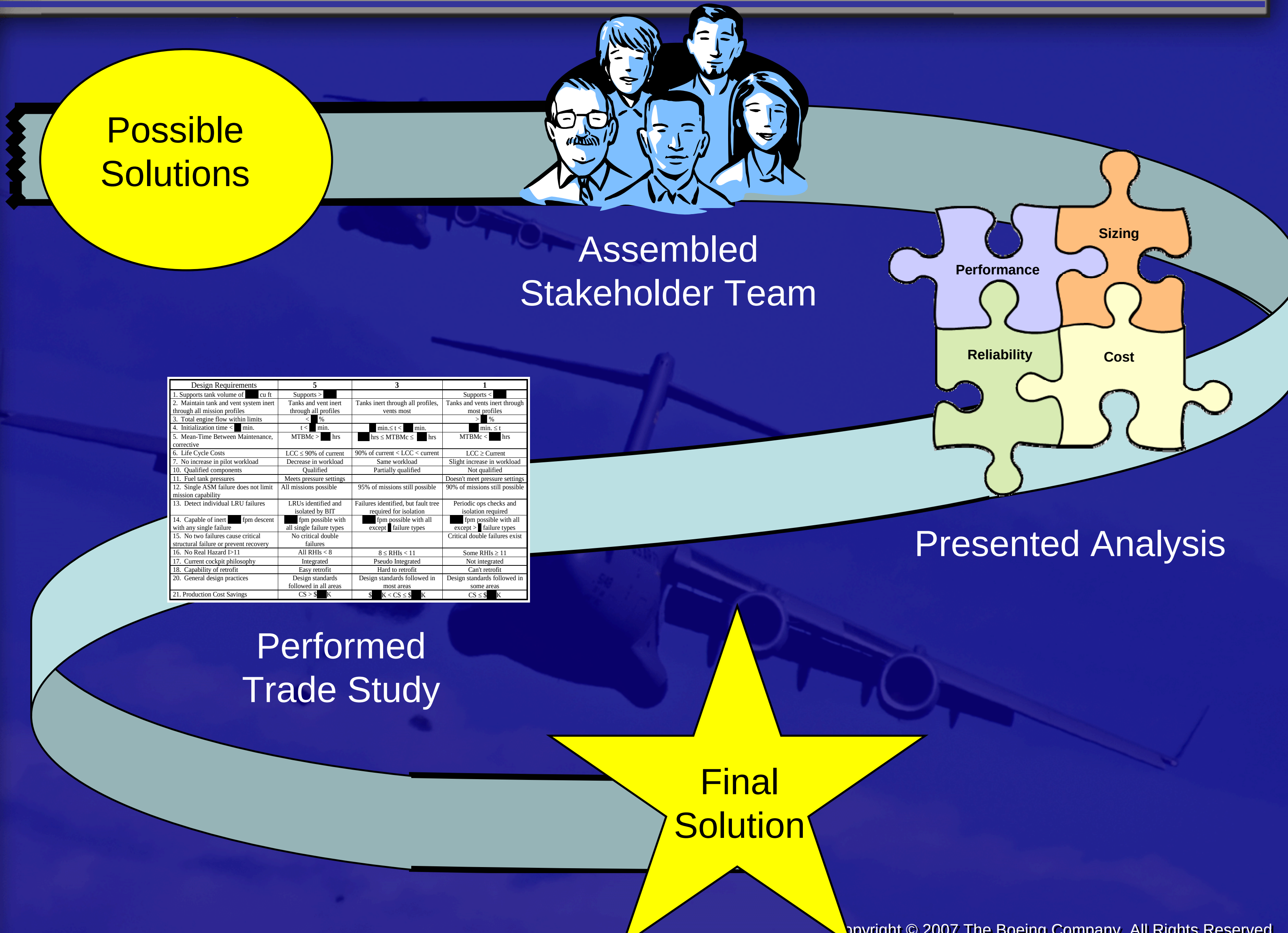
Design Requirements	5	3	1
1. Supports tank volume of [redacted] cu ft	Supports > [redacted]		Supports < [redacted]
2. Maintain tank and vent system inert through all mission profiles	Tanks and vent inert through all profiles	Tanks inert through all profiles, vents most	Tanks and vents inert through most profiles
3. Total engine flow within limits	< [redacted] %		> [redacted] %
4. Initialization time < [redacted] min.	t < [redacted] min.	[redacted] min. ≤ t < [redacted] min.	[redacted] min. ≤ t
5. Mean-Time Between Maintenance, corrective	MTBMc > [redacted] hrs	[redacted] hrs ≤ MTBMc ≤ [redacted] hrs	MTBMc < [redacted] hrs
6. Life Cycle Costs	LCC ≤ 90% of current	90% of current < LCC < current	LCC ≥ Current
7. No increase in pilot workload	Decrease in workload	Same workload	Slight increase in workload
10. Qualified components	Qualified	Partially qualified	Not qualified
11. Fuel tank pressures	Meets pressure settings		Doesn't meet pressure settings
12. Single ASM failure does not limit mission capability	All missions possible	95% of missions still possible	90% of missions still possible
13. Detect individual LRU failures	LRUs identified and isolated by BIT	Failures identified, but fault tree required for isolation	Periodic ops checks and isolation required
14. Capable of inert [redacted] fpm descent with any single failure	[redacted] fpm possible with all single failure types	[redacted] fpm possible with all except [redacted] failure types	[redacted] fpm possible with all except > [redacted] failure types
15. No two failures cause critical structural failure or prevent recovery	No critical double failures		Critical double failures exist
16. No Real Hazard I>11	All RHIs < 8	8 ≤ RHIs < 11	Some RHIs ≥ 11
17. Current cockpit philosophy	Integrated	Pseudo Integrated	Not integrated
18. Capability of retrofit	Easy retrofit	Hard to retrofit	Can't retrofit
20. General design practices	Design standards followed in all areas	Design standards followed in most areas	Design standards followed in some areas
21. Production Cost Savings	CS > $[redacted]K	$[redacted]K < CS ≤ $[redacted]K	CS ≤ $[redacted]K

OBIGGS II

Note: Sensitive data blocked out

Methods and Tools Used by the Team to Select the Final Solutions

OBIGGS II



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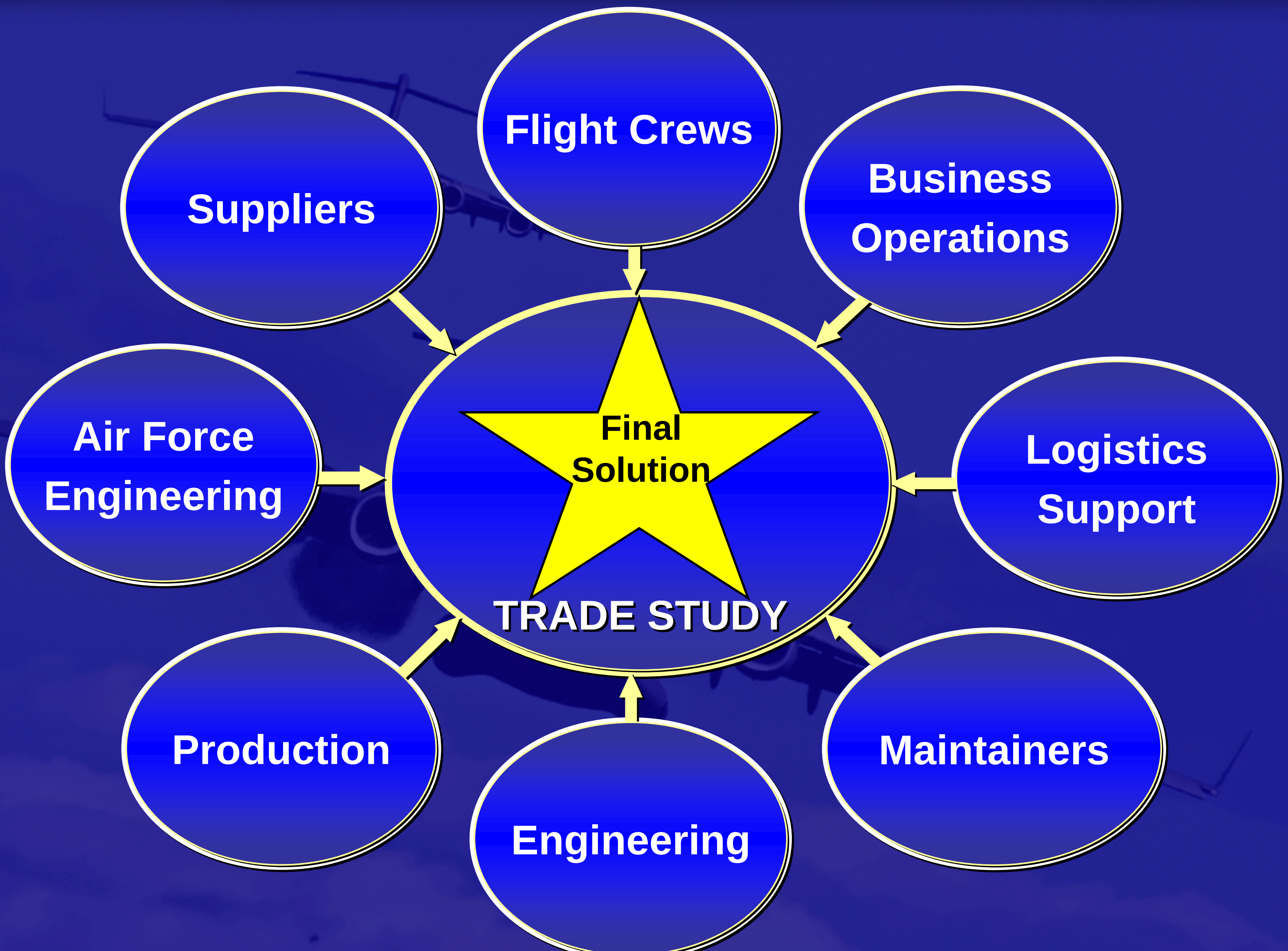
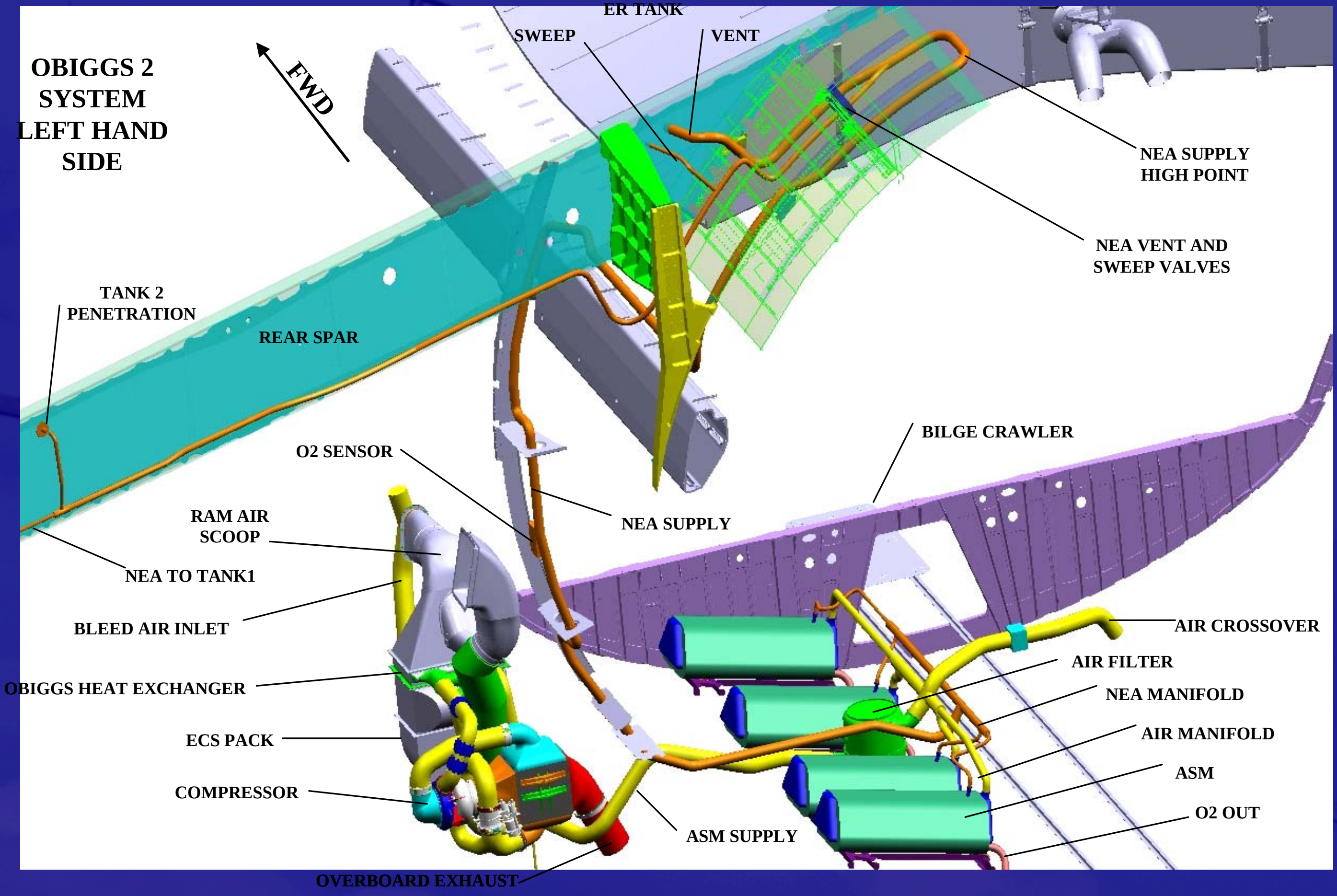
Involvement of Stakeholders in the Selection of the Final Solution



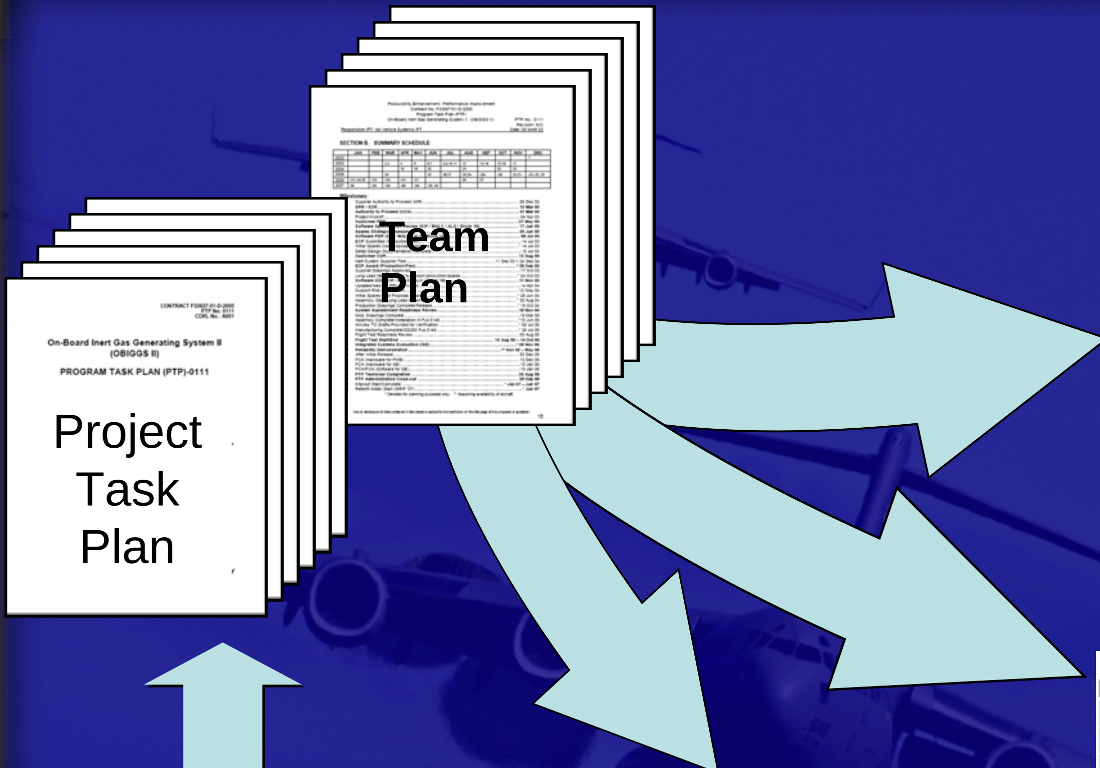
Functional Analysis

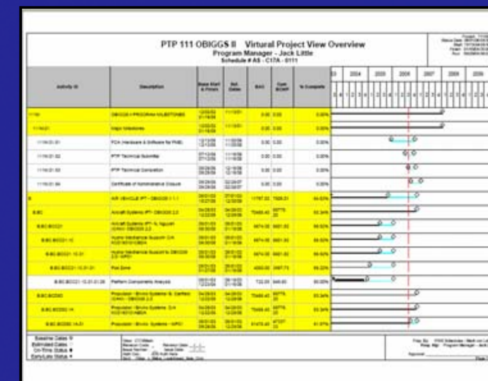


OBIGGS II

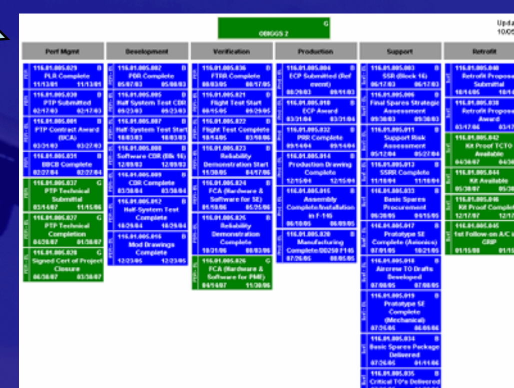
Risk Management

Plan Developed by the Team to Implement its Solution





Integrated Master Schedule



Integrated Master Plan

Stakeholders	Types of Impact
Internal	
Engineering	Create 750 new drawings for system and support equipment
Production	Plan, install, and test new system components
Supplier Management	Procure 1400 new parts
Support Systems	Create tech manuals and provision spares
Training	Create new training course
Field Services	Prepare to assist USAF maintenance
Flight Test	Install instrumentation and verify new system performance
External	
Pilots	Understand display changes and reduced initialization time
Maintainers	Use new maintenance procedures
Customer Engineering	Monitor project performance/verify specification compliance
Suppliers	Design and deliver new system components

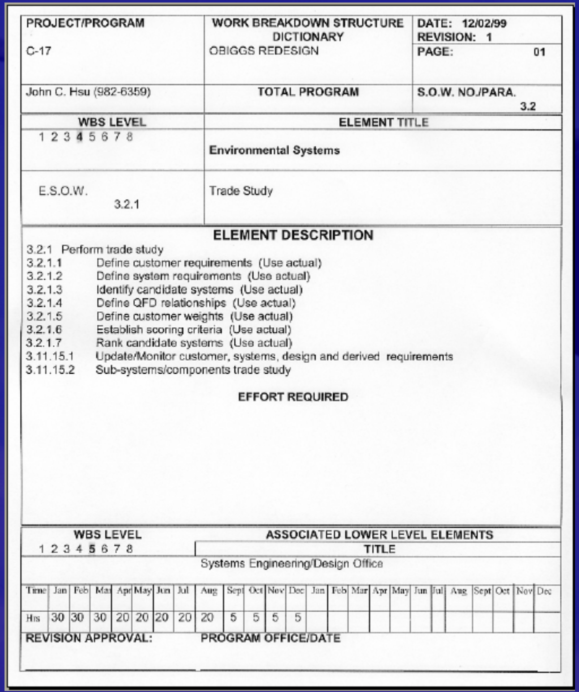
Stakeholders

Risk Mitigation Plans

How the Team Members were Selected and Involved Throughout the Project

Identified functional impacts within each department

- Work Breakdown Structure created
- Detailed Statement of Work created



PROJECT/PROGRAM C-17	WORK BREAKDOWN STRUCTURE DICTIONARY OBIGGS REDESIGN	DATE: 12/02/99 REVISION: 1 PAGE: 01
John C. Hsu (982-6359)	TOTAL PROGRAM	S.O.W. NO./PARA. 3.2
WBS LEVEL 1 2 3 4 5 6 7 8	ELEMENT TITLE Environmental Systems	
E.S.O.W. 3.2.1	Trade Study	

ELEMENT DESCRIPTION

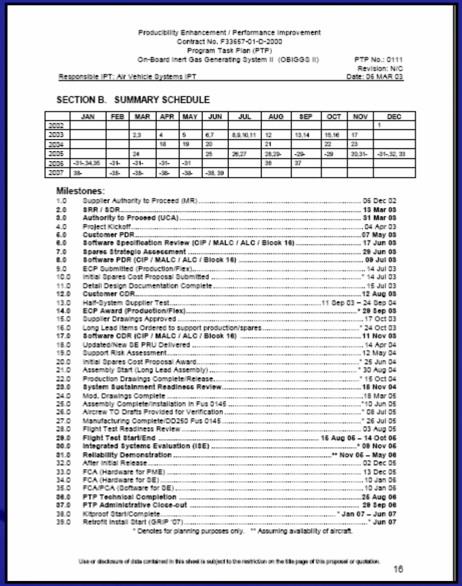
3.2.1 Perform trade study
3.2.1.1 Define customer requirements (Use actual)
3.2.1.2 Define system requirements (Use actual)
3.2.1.3 Identify candidate systems (Use actual)
3.2.1.4 Define QFD relationships (Use actual)
3.2.1.5 Define customer weights (Use actual)
3.2.1.6 Establish scoring criteria (Use actual)
3.2.1.7 Rank candidate systems (Use actual)
3.11.15.1 Update/Monitor customer, systems, design and derived requirements
3.11.15.2 Sub-systems/components trade study

EFFORT REQUIRED

WBS LEVEL 1 2 3 4 5 6 7 8 — ASSOCIATED LOWER LEVEL ELEMENTS — TITLE: Systems Engineering/Design Office

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Hrs	30	30	30	20	20	20	20	20	5	5	5	5												

REVISION APPROVAL: PROGRAM OFFICE/DATE



Producibility Enhancement / Performance Improvement
Contract No. F33657-01-D-2000
Program Task Plan (PTP)
On-Board Inert Gas Generating System II (OBIGGS II)
PTP No.: 0111
Revision: N/C
Responsible IPT: Air Vehicle Systems IPT
Date: 06 MAR 03

SECTION B. SUMMARY SCHEDULE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002												1
2003			2,3	4	5	6,7	8,9,10,11	12	13,14	15,16	17	
2004				18	19	20		21		22	23	
2005			24			25	26,27	28,29-	-29-	-29	30,31-	-31-,32, 33
2006	-31-,34,35	-31-	-31-	-31-	-31			36	37			
2007	38-	-38-	-38-	-38-	-38-	-38, 39						

Milestones:
1.0 Supplier Authority to Proceed (MR) .... 06 Dec 02
2.0 SRR / SDR .... 13 Mar 03
3.0 Authority to Proceed (UCA) .... 31 Mar 03
4.0 Project Kickoff .... 04 Apr 03
5.0 Customer PDR .... 07 May 03
6.0 Software Specification Review (CIP / MALC / ALC / Block 16) .... 17 Jun 03
7.0 Spares Strategic Assessment .... 29 Jun 03
8.0 Software PDR (CIP / MALC / ALC / Block 16) .... 09 Jul 03
9.0 ECP Submitted (Production/Flex) .... 14 Jul 03
10.0 Initial Spares Cost Proposal Submitted .... * 14 Jul 03
11.0 Detail Design Documentation Complete .... 15 Jul 03
12.0 Customer CDR .... 12 Aug 03
13.0 Half-System Supplier Test .... 11 Sep 03 – 24 Sep 04
14.0 ECP Award (Production/Flex) .... * 29 Sep 03
15.0 Supplier Drawings Approved .... 17 Oct 03
16.0 Long Lead Items Ordered to support production/spares .... * 24 Oct 03
17.0 Software CDR (CIP / MALC / ALC / Block 16) .... 11 Nov 03
18.0 Updated/New SE PRU Delivered .... 14 Apr 04
19.0 Support Risk Assessment .... 12 May 04
20.0 Initial Spares Cost Proposal Award .... * 25 Jun 04
21.0 Assembly Start (Long Lead Assembly) .... * 30 Aug 04
22.0 Production Drawings Complete/Release .... * 15 Oct 04
23.0 System Sustainment Readiness Review .... 18 Nov 04
24.0 Mod. Drawings Complete .... 18 Mar 05
25.0 Assembly Complete/Installation in Fus 0145 .... *10 Jun 05
26.0 Aircrew TO Drafts Provided for Verification .... * 08 Jul 05
27.0 Manufacturing Complete/DD250 Fus 0145 .... * 26 Jul 05
28.0 Flight Test Readiness Review .... 03 Aug 05
29.0 Flight Test Start/End .... 15 Aug 05 – 14 Oct 05
30.0 Integrated Systems Evaluation (ISE) .... * 09 Nov 05
31.0 Reliability Demonstration .... ** Nov 05 – May 06
32.0 After Initial Release .... 02 Dec 05
33.0 FCA (Hardware for PME) .... 13 Dec 05
34.0 FCA (Hardware for SE) .... 10 Jan 06
35.0 FCA/PCA (Software for SE) .... 10 Jan 06
36.0 PTP Technical Completion .... 25 Aug 06
37.0 PTP Administrative Close-out .... 29 Sep 06
38.0 Kitproof Start/Complete .... * **Jan 07 – Jun 07**
39.0 Retrofit Install Start (GRIP '07) .... * **Jun 07**

* Denotes for planning purposes only. ** Assuming availability of aircraft.

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16

How the Team Managed its Performance to Ensure it was Effective as a Team

OBIGGS II

OBIGGS II CCB# IC040215
PROJECT PERFORMANCE

Financials Updated 09/26/06
11 Panel Updated 10/05/06

Aug 06 ME

Target Cost	BCWS	BCWP	ACWP	BAC	EAC	%COMP$_{BAC}$	% SPENT$_{BAC}$
[redacted]	[redacted]	$[redacted]	$[redacted]	$[redacted]	$[redacted]	97.44%	96.89 %

Calculations:

CPI = 1.00
SPI = 1.00
Schedule Variance = $[redacted]
Schedule Variance % = 0.02%

TCPI$_{EAC}$ = .46
EAC>BAC Ratio = 1.00
Cost Variance = $[redacted]
Cost Variance % = 0.35%

PRA=$110K

Systems Group Lead:

Boeing Lead:

Aug 06 Ratings

Performance Status	Rating R/Y/G	Issues / Comments
(01) Technical Performance Measures	G	
(02) System Engineering	G	
(03) Performance to Change Implementation Plan	G	
(04) Configuration Compliance	G	
(05) Support Systems	G	
(06) Training	G	
(07) Schedule	G	
(08) Cost Performance	G	
(09) Expenditures / ROI	G	
(10) Supplier Performance	Y	10.01 - Schedule Performance Index (SPI): SPI = 0.99. Some performance for completed work was not taken because of late receipt of an invoice from one supplier. Will be corrected in October
Project Manager Overall Assessment - August	G	
Project Manager Overall Assessment - Forecasted September	G	
Project Manager Overall Assessment - Forecasted October	G	

Note: Sensitive data blocked out

SUCCESSFUL PROJECT PERFORMANCE RESULTS FROM EFFECTIVE TEAM MANAGEMENT AND ACTION TO RESOLVE ISSUES EARLY

INDIVIDUAL ACCOUNTS MONITORED WEEKLY FOR COST AND SCHEDULE PERFORMANCE

Element	Description	Current SPI	Current CPI	Cum SPI	Cum CPI	TCPI	ariance npletion	Current Sch Var	Current Cost Var	Cum Sch Var	Cum Cost Var
KC01901012BDA	ECP PROPOSAL PREP - ALL EXCE	1	0.61	1	0.65	1.04	-24	0	-7	0	-24
KC01901013BDA	AVIONICS /FLIGHT CONTROL INTE	-2	-2	0	n/a	1.03	0	-3	-4	-3	-1
KC01901014BDA	AVIONICS - HSC/LFCP/RIU/MMP, A	4.09	4.5	1.31	3.59	0.78	-3	35	35	24	70
KC01901015BDA	PTP 111 OBIGGS 2.0 - FUSE DESI	0.15	0.33	0.21	0.41	1.07	0	-22	-8	-60	-23
KC01901016BDA	AF: PTP111 OBIGGS 2.0 STANDAR	1	0.78	1	1.22	0.95	0	0	-2	0	4
KC0190101ABDA	PROPULSION / ENVIRONMENTAL	0.22	0.09	0.79	1.13	0.96	-53	-194	-576	-292	129
KC0190101BBDA	PROPULSION / ENVIRONMENTAL	-5.47	-3	0	n/a	1.06	-14	-221	-249	-221	-102
KC0190101CBDA	PTP-111, OBIGGS 2.0 - HYDRO-M	1.15	1.21	1.03	0.98	1.01	0	3	4	3	-2
KC0190101DBDA	PTP-111 OBIGGS 2.0 - ELECTRIC	0.91	0.98	0.8	0.92	1.02	-1	-6	-1	-74	-26
KC0190101EBDA	PTP111 OBIGGS 2.0-SUPPLIER SV	1	0.67	1	1.08	1	0	0	-2	0	1
KC0190101FBDA	SYSTEM INTEGRATION LABS OBIG	0	n/a	0	n/a	1.01	-2	-32	-6	-79	-11
KC0190101GBDA	PTP111 OBIGGS 2.0-AVIONICS SW	0	n/a	0.92	1.75	0.91	0	-168	-183	-45	228
KC0190101HBDA	PTP 111 OBIGGS 2.0 - AVIONICS	0.23	0.03	1.3	1.22	0.9	0	-20	-202	74	68
KC0190101JBDA	PTP 111 OBIGGS 2.0 - FUSE STRE	1.4	2.33	0.67	1.2	0.99	-1	3	4	-6	3
KC0190101KBDA	PTP 111 OBIGGS 2.0 - WING STRU	0.53	0.53	0.81	0.83	1.02	0	-7	-7	-8	-8
KC0190101LBDA	AV/SS I & DO: PTP111 OBIGGS 2.	1	1.17	1	1.83	0.94	0	0	1	0	14
KC0190101MBDA	AV/SS I & DO: PTP111 OBIGGS 2.	1	0.29	1	1.16	0.96	-2	0	-16	0	6
KC0190101NBDA	SE & OP/TOOLS: PTP111 OBIGGS	1	0.3	1	0.77	1.13	-1	0	-73	0	-34
KC0190101PBDA	AVIONICS /FLIGHT CONTROL INTE	1	1	0.2	0.5	1.19	5	-1	0	-5	-1
KC0190101RBDA	PTP 111 OBIGGS 2.0 - SW QA	1	0.8	1	0.93	1	0	0	-2	0	-2
KC0190101TBDA	SYSTEM INTEGRATION LABS OBIG	1	0.33	1	0.33	1.01	0	0	-2	0	-6
KC0190101VBDA	AV/SS I & DO: PTP111 OBIGGS 2.	1	0.53	1	1.21	0.94	-2	0	-22	0	19
KC0190101WBDA	SYS INTEG LABS OBIGGS II SERV	1	0	1	7.67	0.9	0	0	8	0	20
KC0190101XBDA	PTP 111 OBIGGS 2.0 - SUPP EQUI	0	n/a	0.53	0.5	1.13	0	-30	-36	-43	-51
KC0190101YBDA	PTP 111 OBIGGS 2.0 - SUPP EQUI	0	n/a	0.08	0.5	1	-2	-1	0	-21	-1
KC0190101ZBDA	PTP 111 OBIGGS 2.0 - CHNG MGM	1	1.86	1	1.79	0.96	-1	0	6	0	19
KC01901020BDA	PTP111 OBIGGS II - ECP PROPOS	1	0.17	1	0.42	2.17	0	0	-5	0	-8
KC01901021BDA	PTP111 OBIGGS II - LSCA/LCC &	0.1	1	0.13	1	1	0	-9	0	-34	0
KC01901022BDA	OBIGGS II - SUPPORT SYSTEMS F	1	1	1	1.11	0.99	0	0	-1	0	3
KC01901023BDA	OBIGGS II - SUPPORT ANALYSIS	0	n/a	0.42	0.63	1.02	0	-6	-1	-14	-5
KC01901024BDA	OBIGGS II - TRAINING IPT INTEG	1	0	1	3	0.88	0	0	1	0	2
KC01901025BDA	PTP 111 OBIGGS II PROVISIONING	n/a	n/a	0	n/a	1.05	-1	0	0	2	-2
KC01901026BDA	OBIGGS II - TECHNICAL PUBLICAT	n/a	n/a	n/a	n/a	1	0	0	0	0	0
KC01901028BDA	OBIGGS II - TYPE 1 TRAINING	n/a	n/a	0	n/a	0.98	0	0	0	-1	0
KC01901030BDA	PTP111 OBIGGS 2 - C13 LABOR	1	16	1	1.5	0.56	-12	0	15	0	22
KC01901031BDA	PTP 111 ASSY SUPT PLNG PKG	n/a	n/a	n/a	n/a	0.09	-223	0	-18	0	-20
KC01901040BDA	PTP 111 OBIGGS 2.0 BUYERS LAE	1	1.13	1	0.83	1.05	0	0	-2	0	-15
KC01901041BDA	PTP 111 OBIGGS 2.0 BUYERS LAE	1	0.76	1	1.56	0.84	-2	0	-3	0	18
KC01901050BDA	PTP 111 OBIGGS 2.0 FLT OPS	1	0.5	1	2.5	0.75	0	0	-1	0	3
KC01901060BDA	PTP 111 OBIGGS 2.0 AVIONICS MA	1	0.24	1	1	1	0	0	-1,429	0	0
KC01901061BDA	PTP 111 OBIGGS AIRFRAME MATE	n/a	0.38	0.42	1	1	0	60	-100	-642	0

OBIGGS II

Types of Internal and External Stakeholder Involvement in Implementation

FORMAL DESIGN REVIEWS

- System Requirements Review
- System Design Review
- Preliminary Design Reviews (Supplier and Customer)
- Critical Design Reviews (Supplier and Customer)

Teamwork

DESIGN FOR MANUFACTURING AND ASSEMBLY

- Assembly Simulations
- Prototype Fit Checks on Aircraft
- Document Quality Inspections

PRODUCTION SUPPORT

- Proactive Issue Resolution
- First Article Inspections

Communication

VALIDATION / VERIFICATION

- Combined Validation/Verification Component Reviews
- Flight Test
- In Service Evaluation

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How Stakeholder Buy-in Was Ensured

Stakeholders	Plan to Ensure Buy-in:	Validated By:
Engineering	Developing own implementation plans. Reported progress to them regularly.	Dedicated support to the project. Commitment to plan evident during regular status reviews.
Production	Early involvement for development of installation plans. Collocated engineers on first assembly. Full scale mockups of large parts.	Requests for manufacturing features on designs. Strong participation in mockup trial installations. Positive feedback during first installations.
Supplier Management	Early close coordination with engineering, participation in drawing release reviews	Strong participation. Provided part-by-part status weekly. Aggressive resolution of issues.
Support Systems	Development of own performance metrics and reporting progress to stakeholders	Enthusiastic participation in design reviews. Early coordination of validation impacts with customer.
Training	Early coordination with engineering aided course development	Early development of plan, communication with project team and customer
Field Services	Early visibility from design reviews. Aided planning of future customer support	Initiative in learning the system prior to first delivery
Flight Test	Full time interaction with design team, from development through test flights	Outstanding management of installation of instrumentation in production. Close coordination with engineering when developing test plans.
Pilots	Dramatic potential improvement of inerting system	Affirmation during base visits
Maintainers	Design reviews at bases prior to implementation. Participation in mockup installation.	Enthusiastic participation at bases during reviews, mockup installation, follow-up communication
Customer Engineering	Involvement in project selection. Frequent, regular communication. Full system lab test.	Strong support for project. Teamwork in decisions addressing challenges, regular communication.
Suppliers	Frequent communication, design reviews,– they were team members	Strong participation in developing design solutions. Commitment to schedule needs.

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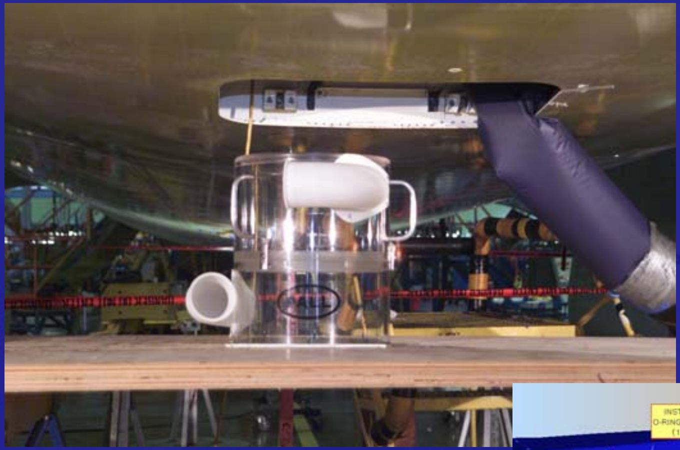

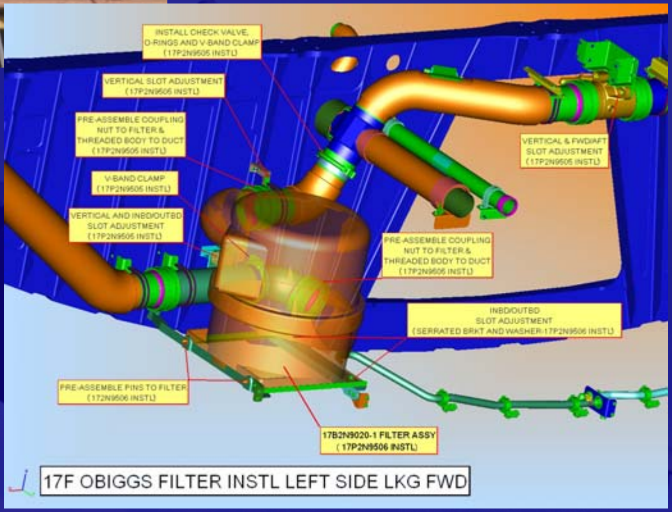

Stakeholder participation in design development

How Various Types of Resistance Were Identified and Addressed

Type	How Identified	How Addressed
Customer reluctance to fund project due to high cost	Customer feedback during negotiations	Detailed estimates, competitive pricing & life cycle cost analysis
Supplier not willing to control interfaces to requested tolerances	Interface Key Characteristic reviews	Negotiated compromise during weekly supplier coordination meetings
Production schedule impact from late parts	Feedback from production stakeholder on team	Established agreed-to lead times for parts
Production schedule impact from learning curve	Feedback from production stakeholder on team	Fit checks, dedicated engineering support
Production concern about part damage on installation	Feedback from production stakeholder on team	Assembly simulation and created protective covers
Cluttered production work space	Lean initiatives coordination meetings with Production	Created point-of-use carts to transport selected parts
Flight test airplane out of service too long	Customer feedback during flight test planning	Installed instrumentation in production
Resistance to Model Based Definition from QA	QA feedback at first article inspection	Generated 2D inspection sheets from 3D models

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Types of Tangible and Intangible Results That Were Realized

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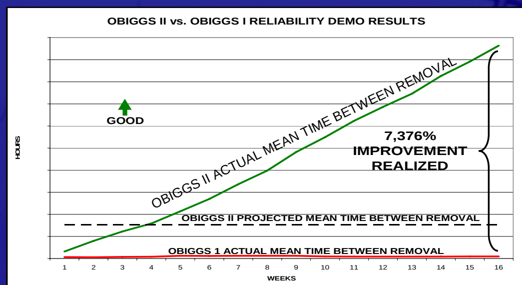
Tangible Benefits



Achieved 7400% Increase in system reliability vs. 1100%

Reduced Initialization Time by a factor of 11 vs. 5

Reduced weight by 517 lbs. vs. 475 lbs. allowing for increased cargo capability

20% system and 3:1 life cycle cost savings as predicted

How Results Link with Organization Goals, Performance Measures and Strategies

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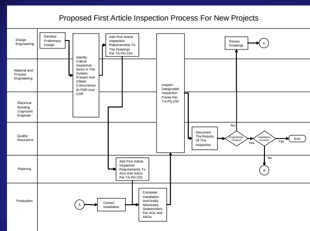


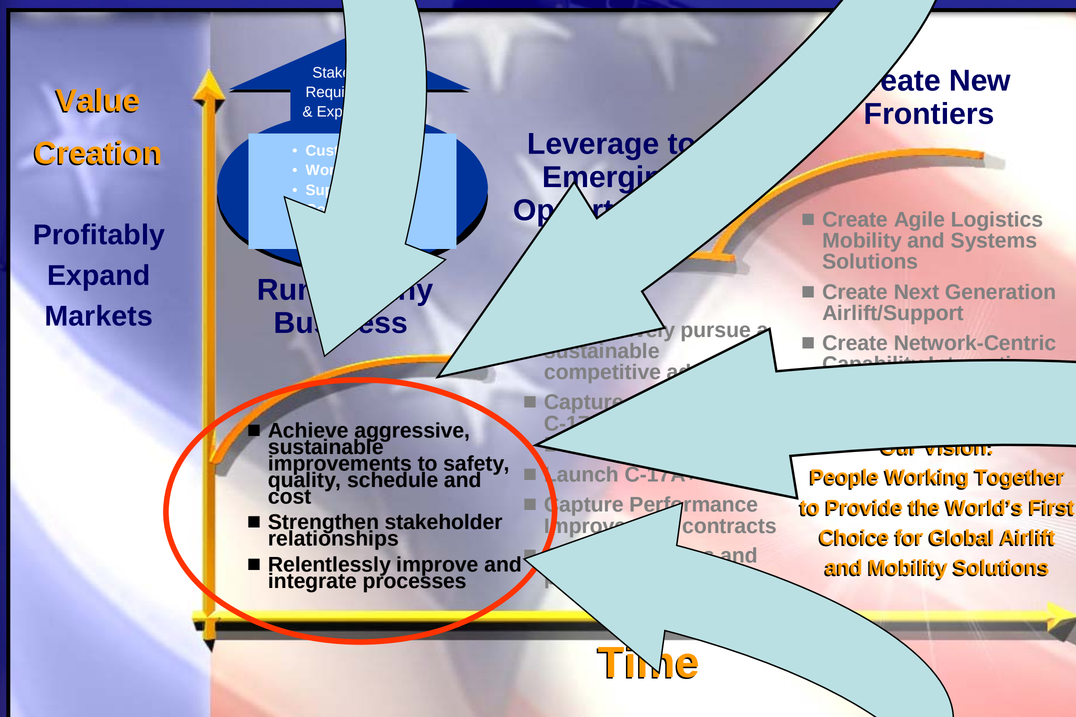
Process Improvements

- Four different processes

Reduced Initialization Time

- Improved by a factor of 11


(US Air Force Photo)



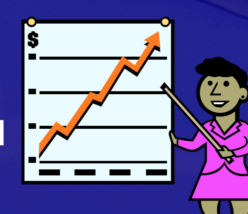

(US Air Force Photo)

Improved Reliability

- Improved by a factor of 74

Increased Revenue

- Captured excellent rating for every award fee period throughout the project



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Thank You!

(US Air Force Photo)