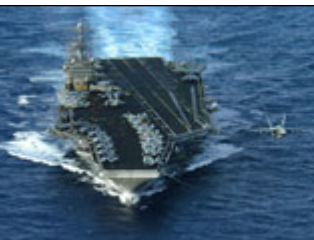


Incorporating a FOD Prevention matrix into our Management System

Jim Skaggs
FOD IPT Lead
801-775-1108
James.skaggs@atk.com
August 11th, 2009



- ATK Clearfield FOD program history
- Matrix development
- How we use this matrix at Clearfield
- Assessment criteria
- Overview of each element
- Conclusion

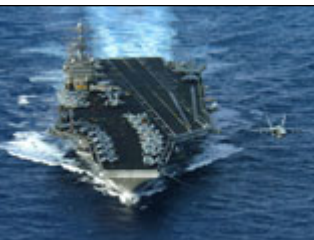


ATK Clearfield FOD Program History

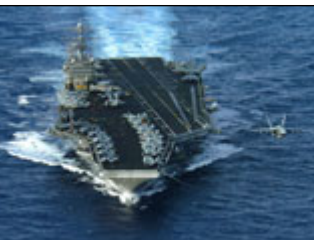


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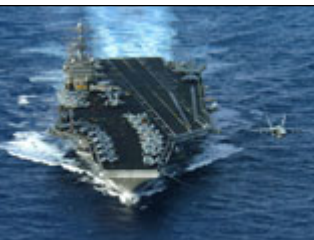
- Formal program started in mid 2006 by Operations
 - No formal process was in place for reduction or elimination
 - Operations recognized a need
- FOD focal point person
 - Position was created in mid 2007
 - Initially part time, the responsible person had to fit FOD in with other duties
 - The FOD IPT Lead position full time beginning in mid 2008
- ATK joins the Boeing GMD FOD Council
 - Joined in August 2008
 - ATK Hosted quarterly meeting Feb. 2009
 - Began using the enhanced matrix



- Developed by Boeing's GMD FOE office
- Began as a matrix for the major elements of NAS 412
- Developed as a tool for suppliers to enhance their FOD elimination programs
- FOD Council meetings
 - Quarterly face to face meetings
 - Supplier presentations given at these meetings
 - Open forum
 - Other suppliers are able to provide insight and help
 - Monthly telecons

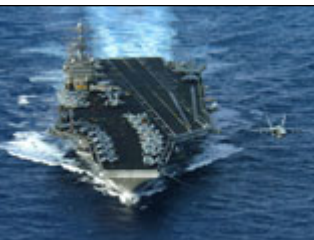


- Incorporate FOD elimination and the matrix as an integral part of our **management system**
- Performance Enterprise System (PES)
 - Based on Toyota Production System
 - 5S is the foundation
- Make problems visual
- People engaging in solutions
- Continuous Improvement



5S

- Gives everyone the ability to identify and define normal and abnormal conditions
- Engage everyone in improving the standard
- Abnormal is immediately apparent
- Escalation protocol to correct the abnormal



Items covered by NAS 412

- Metrics
- Training
- Incident reporting
- FOD Focal
- Handling of material
- Housekeeping
- Control of tools and personal items
- Employee Actions
- Design Considerations
- Production and Modification Operations
- Hardware accountability



Matrix Element Example

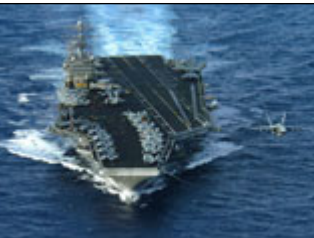
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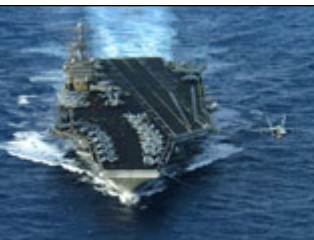
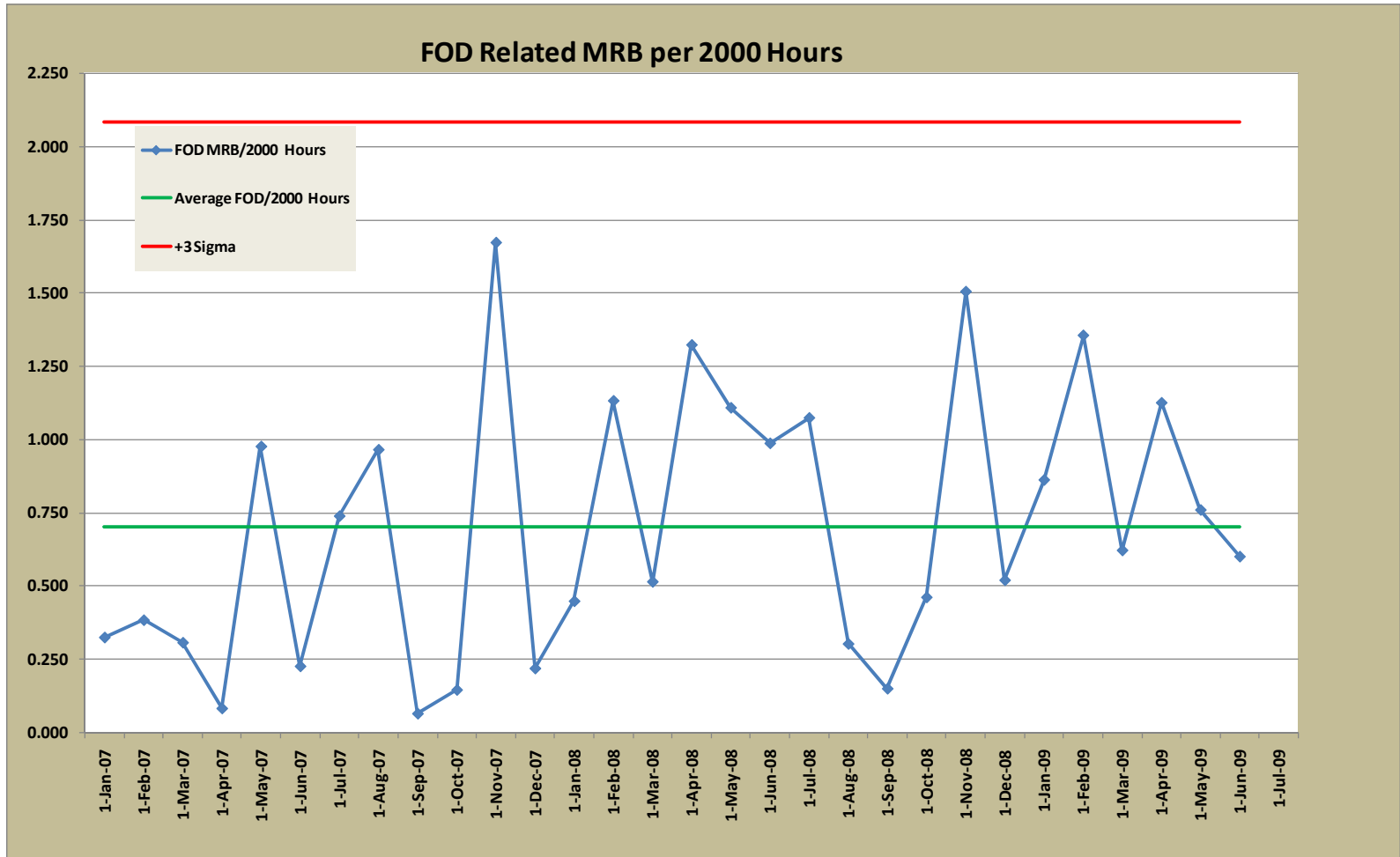
ELEMENT:	Training program with the primary objective of increasing employee awareness to the cause and effects of FOD, the promotion of active involvement through specific techniques, and the stressing of good work habits through work disciplines	X=Yes Blank=No
Level 1 Performed Informally	General "one time" FOD information training.	x
Level 2 Planned & Tracked	"One time" FOD training that includes: The control of personal items, equipment and consumables. The care and protection of end items, and quality workmanship ("Clean as you Go") work practices. Accountability/Control of tools or hardware, and general housekeeping principles.	x
Level 3 Well Defined	Periodic FOD Training that includes: The control of personal items, equipment and consumables. The care and protection of end items, and quality workmanship ("Clean as you Go") work practices. Accountability/Control of tools or hardware, and general housekeeping principles.	x
Level 4 Quantitatively Controlled	<i>Periodic (Minimum Annual) FOD Training that includes: The control of personal items, equipment and consumables. The care and protection of end items, and quality workmanship ("Clean as you Go") work practices. Accountability/Control of tools or hardware, and general housekeeping principles. <u>FOD Prevention training is supported by visual media in the work place, and employees are trained in how to report FOD incidents.</u></i>	x
4.1	FOD Prevention training aids are displayed throughout the work areas.	
4.2	Training includes housekeeping principles.	
4.3	Employees are trained on how to report actual or potential FOD incidents.	x
4.4	Training is reviewed and updated based on data and trends from FOD assessments.	
4.5	Formal FOD training is available in a computer based format.	x
4.6	FOD training is supported and emphasized by leadership and management.	x
4.7	Training uses applicable products and hardware to emphasize proper storage, containment, and handling.	
4.8	Training is required for all managers, suppliers and customers that require unescorted work areas	x
4.9	Initial and annual training provided.	x
5	Training course's completion is monitored and tracked.	x
Level 5 Continuously Improving	<u>Annual (Minimum Annual) FOD Training that includes: ... housekeeping principles. The proper storage, shipping, and handling of material, components, and equipment. FOD Prevention training is supported by visual media in the work place, and employees are trained in how to report actual or potential FOD incidents. The Training is reviewed and updated based on data and trends obtained from FOD assessments.</u>	4.6

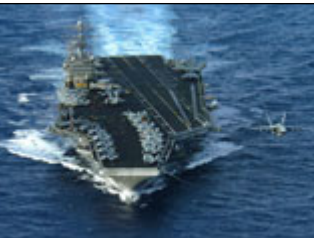
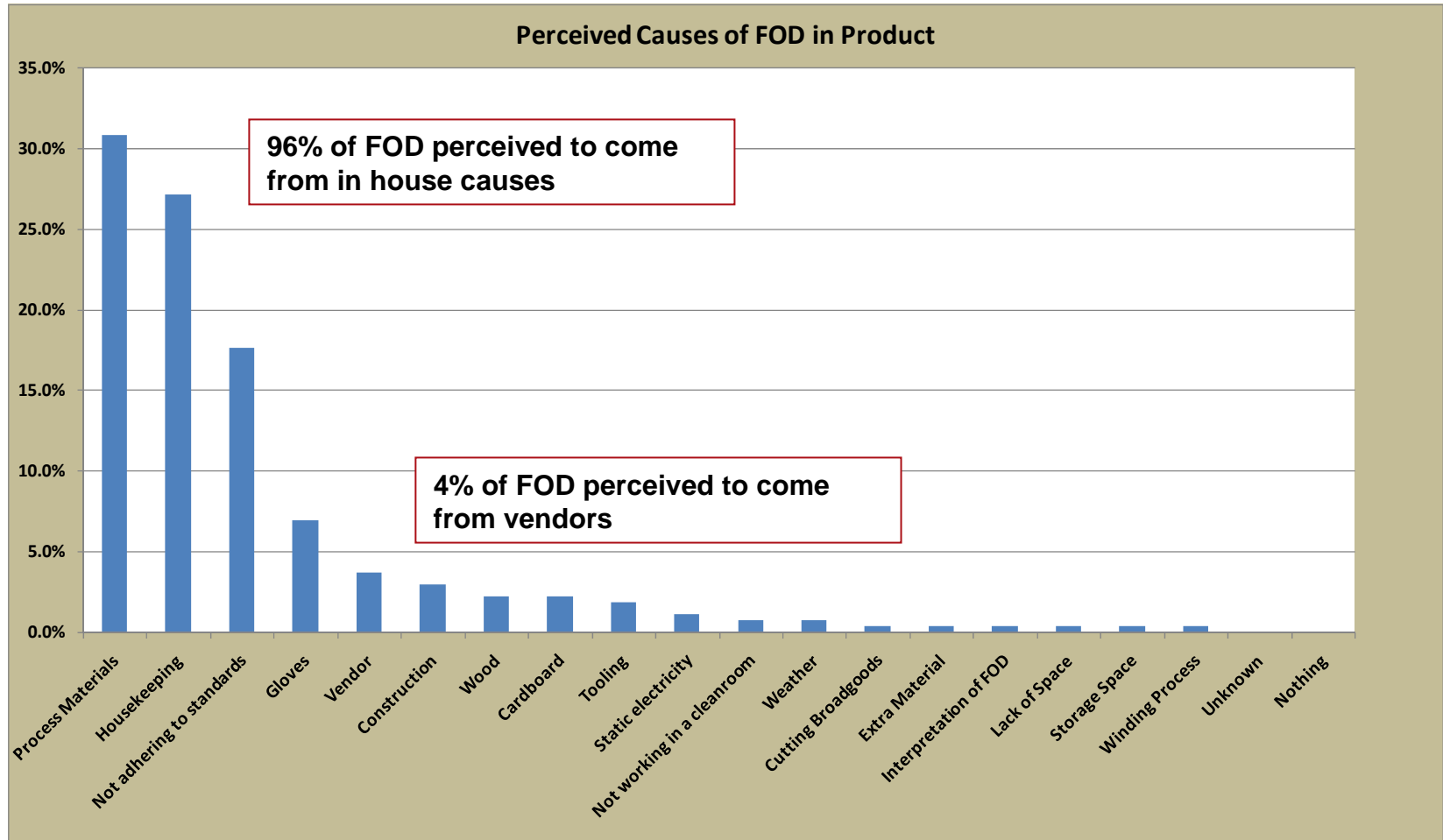


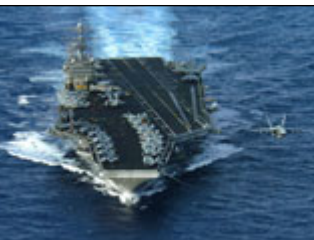
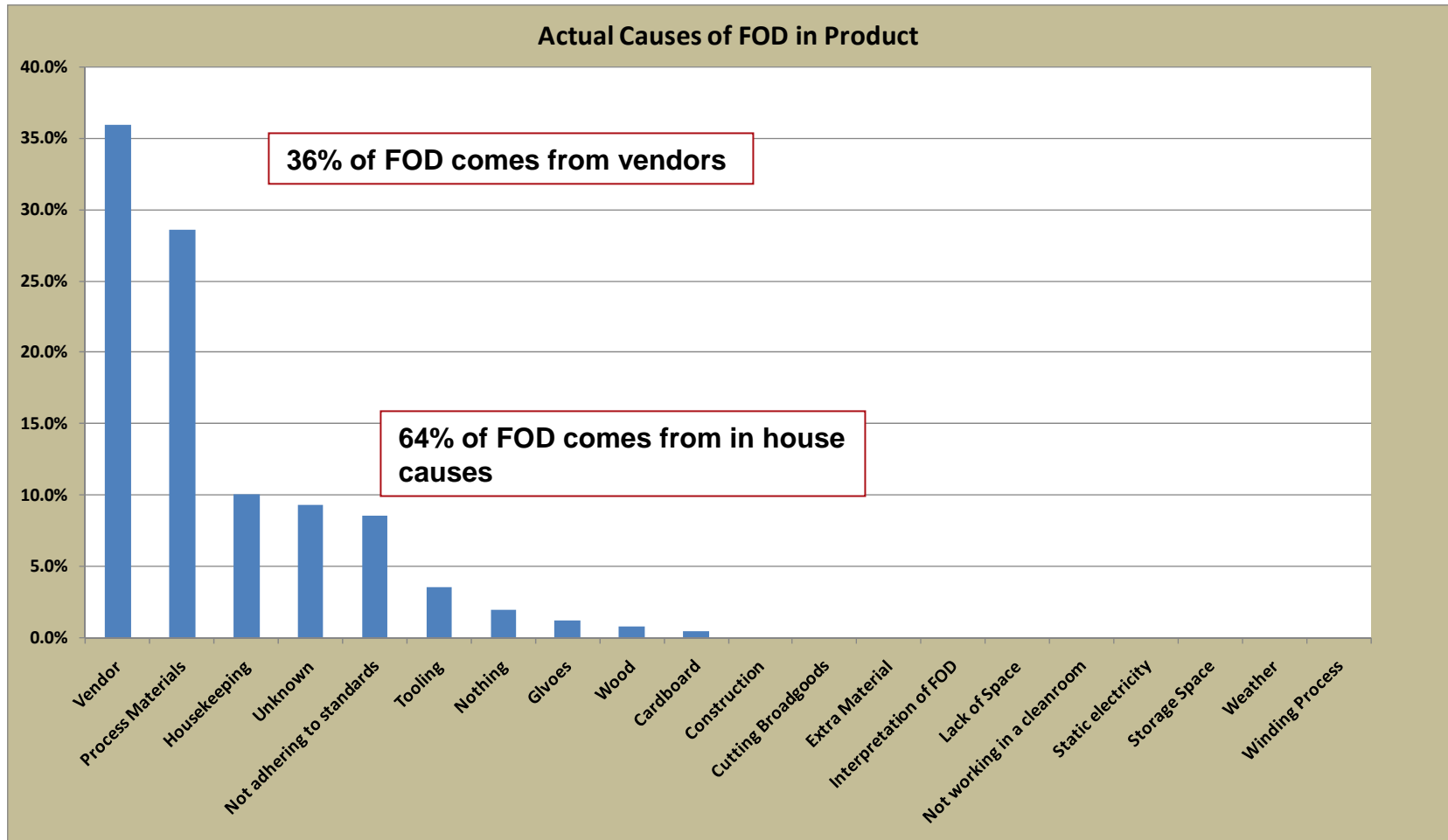
“Management uses the metrics to measure and manage performance including implementation of preventative action.”

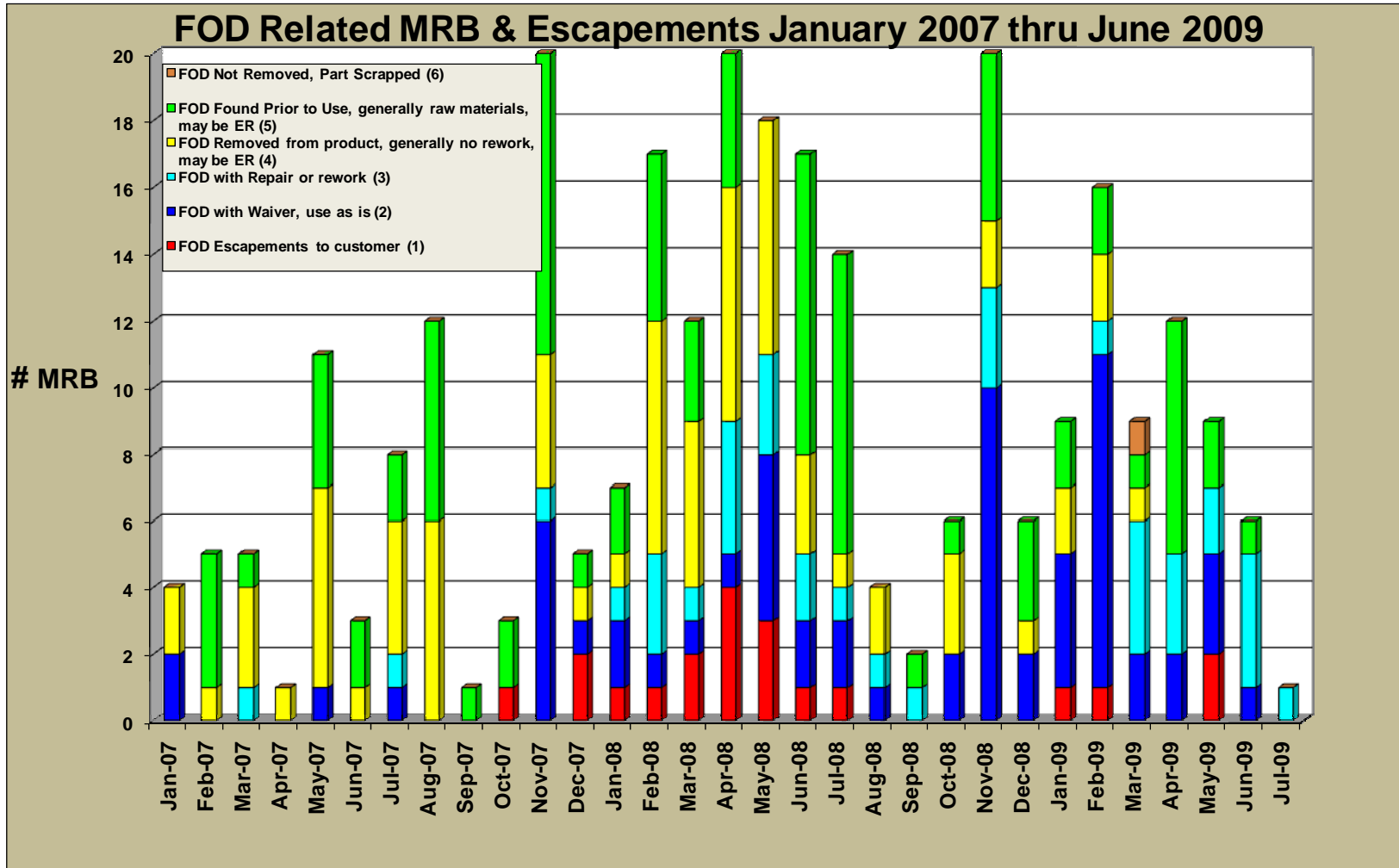
- ATK tracks FOD several ways
- FOD flash reports
- FOD related MRB
- Driving towards a visual workplace











“Periodic (Minimum Annual) FOD Training that includes: The control of personal items, equipment and consumables. The care and protection of end items, and quality workmanship (“Clean as you Go”) work practices. Accountability/Control of tools or hardware, and general housekeeping principles. FOD Prevention training is supported by visual media in the work place, and employees are trained in how to report FOD incidents.

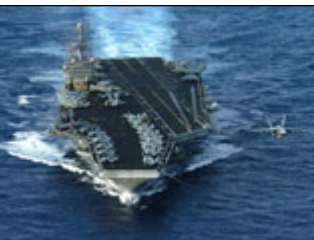
- ATK conducts FOD training for all new hires
- Annual training to the FOD Control Procedure required for all employees
- Use FOD incidents as a way to train “lessons learned”
- Going beyond –
 - 5S training – Visual workplace, making problems visible, continuous improvement
 - Plantwide from site manager on down
 - Engaging employees in finding solutions

Weekly 5S audit checklist

Category	Item	Yes= 1 No = 0	Comments
Sort	Is the area clearly tied to a map showing who is responsible? Is the map posted?		
	Have unneeded items in the area such as equipment, tools, Supplies, documents and furniture been eliminated?		
	Are the supplies, tools, and materials needed to perform the job in the area? Ask an operator if they have everything they need for their job.		
Set In Order	Have Distinct, Visual locations been designated for all items such as equipment, machines, tools, supplies, and documentation?		
	Are all items placed at the point of use or as close as possible? This is availability		
	Are all items easily accessible? Does an operator have to perform an unsafe action to obtain any item. (safety/ergonomics)		
	Are all 5S paint and footprint standards in adherence to the standard? (Clearfield Site Paint Standard; posted at 5S storage center)		
	Are Standards created that indicate Abnormal at a Glance? (daily checklist, standard work, pictures)		
	Are the posted Standards being followed up on? (Daily checklist current, does the area look like the posted pictures, for example)		
Shine	Is the work cell / station clear or free of FOD,dirt, dust, oil, and grease?		
	Have countermeasures been put in place to control / prevent recurrent cleaning problems? Are we fixing recurring cleaning problems.		
	Are all cleaning tools and materials stored in a designated area?		
	All are cleaning tools and materials readily available? Is everything needed for cleaning available.		
	Are line, labels, signs etc...clean and unbroken?		
Notes to auditor: 1. Only audit the area on the map. 2. Go see, audits are hands-on. 3. Gear comments towards potential improvements. 4. Use the audit as a teaching and coaching tool.			Area audited:
			Auditor name and phone:
Additional comments:			

Reporting and investigating procedures exist for FOD, requiring the immediate cessation of work, root cause determination, implementation of corrective action, and the sharing of lessons learned is implemented. In addition metrics on FOD incidents are tracked by senior manufacturing management.

- FOD Flash Reports
 - Informal - Flash reports sent by e-mail to all employees
 - “lessons learned” message
 - Corrective action can be taken
- FOD MRB
 - Formal – Requires investigation and C & CA
 - 5 why’s
 - Fishbone
 - Other investigative tools
 - May affect design requirements
- Any FOD incidents are discussed in daily startup meetings

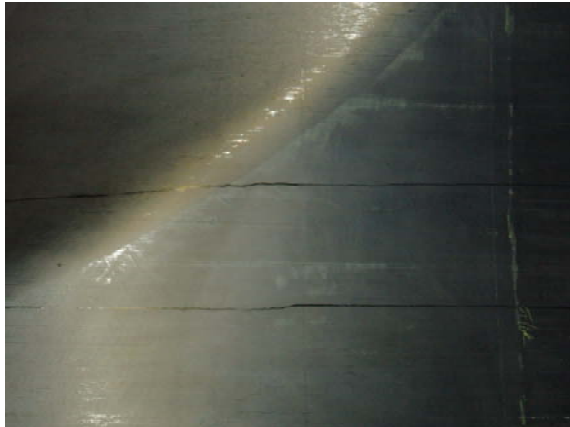


Incident Reporting



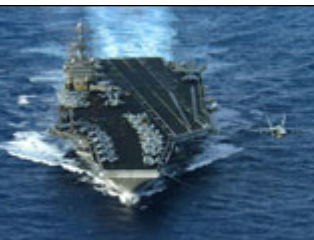
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- Flash Report
- Informal
- Lessons Learned
- Plantwide

Site Distribution: <input type="checkbox"/> All; <input type="checkbox"/> CLF; <input type="checkbox"/> DAY; <input type="checkbox"/> HOP; <input type="checkbox"/> IUK; <input type="checkbox"/> LAF; <input type="checkbox"/> LGH; <input type="checkbox"/> LOG; <input type="checkbox"/> RNB																
<h1 style="margin: 0;">ALERT</h1> <p style="margin: 0;">Alert Number: FOD07222009A</p> <h1 style="margin: 0;">NOTIFICATION</h1>		<p style="text-align: center; margin: 0;">Alert Type</p> <table border="0" style="width: 100%;"> <tr> <td><input type="checkbox"/> Safety (SAF)</td> <td><input type="checkbox"/> Handling (HND)</td> </tr> <tr> <td><input type="checkbox"/> Environmental (ENV)</td> <td><input type="checkbox"/> Technical (TEC)</td> </tr> <tr> <td><input type="checkbox"/> Quality (OAL)</td> <td><input type="checkbox"/> Escapement (ESC)</td> </tr> <tr> <td><input checked="" type="checkbox"/> FOD (FOD)</td> <td><input type="checkbox"/> Property (PRP)</td> </tr> <tr> <td><input type="checkbox"/> Facilities (FAC)</td> <td><input type="checkbox"/> Configuration (CFG)</td> </tr> <tr> <td><input type="checkbox"/> Materials (MAT)</td> <td><input type="checkbox"/> GIDEP (GID)</td> </tr> <tr> <td><input type="checkbox"/> Tooling (TOL)</td> <td><input type="checkbox"/> Other</td> </tr> </table>	<input type="checkbox"/> Safety (SAF)	<input type="checkbox"/> Handling (HND)	<input type="checkbox"/> Environmental (ENV)	<input type="checkbox"/> Technical (TEC)	<input type="checkbox"/> Quality (OAL)	<input type="checkbox"/> Escapement (ESC)	<input checked="" type="checkbox"/> FOD (FOD)	<input type="checkbox"/> Property (PRP)	<input type="checkbox"/> Facilities (FAC)	<input type="checkbox"/> Configuration (CFG)	<input type="checkbox"/> Materials (MAT)	<input type="checkbox"/> GIDEP (GID)	<input type="checkbox"/> Tooling (TOL)	<input type="checkbox"/> Other
<input type="checkbox"/> Safety (SAF)	<input type="checkbox"/> Handling (HND)															
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<input type="checkbox"/> Materials (MAT)	<input type="checkbox"/> GIDEP (GID)															
<input type="checkbox"/> Tooling (TOL)	<input type="checkbox"/> Other															
<input type="checkbox"/> Suspect Condition - <i>Feedback Required</i> <input checked="" type="checkbox"/> General Information - <i>Feedback Not Required</i>																
ORIGINATOR Jan	DATE OF INITIATION 8 July 2009	ORGANIZATION Operations														
PART NUMBER (if applicable)	SERIAL NUMBER (if applicable) ATB 0031	PROGRAM (if applicable)														
<p>The following condition(s) has been noted. If this condition exists in your organization or program, immediately initiate the appropriate steps to correct it.</p> <p>During an investigation of FOD on ATB0030, ATB0031 was inspected. An unknown substance was found on the ID of this case as well. MRB was initiated and samples were sent to the Lab. The substance was determined to be gear oil.</p> <p>This may have come from an overhead crane.</p> <p>The crane in involved has a gear box located at the outer edge of the crane. The hoist was not over the crane but the gear box may have been. All personnel need to remember to ensure overhead cranes are never parked over parts. Pay special attention cranes that have a gear box that is located away from the hoist.</p>																
																
GENERAL	FEEDBACK REQUIRED FROM:															
		Date Feedback Is Due:														
PROVIDE FEEDBACK HERE																
NAME	DATE	RETURN TO														
FORM # CS-1100-0052 17APR2008																
A L E R T N O T I F I C A T I O N																

A FOD focal point has an active FOD prevention plan in place, and has sufficient authority and freedom.

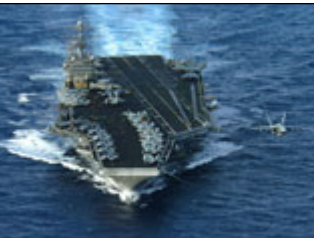
- Full time FOD IPT lead
- Team includes members from Management, Engineering, Quality, Operations, Materials
- Team has full backing and encouragement of plant management
- Meets monthly
- Sets FOD policy and procedures
- Leads plant 5S program



Employees are trained in compliance requirement, and materials/accessories used in Production, Housekeeping, Shipping, & Stores are clean and free of contamination. Parts and assemblies are packaged to preclude FOD issue, and protective devices (that do not cause FOD) are installed.

All containers are visually inspected for Foreign objects.

- All material handling is done by procedure
- Process materials are contrasting colors
- Kitting of subassemblies
- Eliminating items such as wood pallets

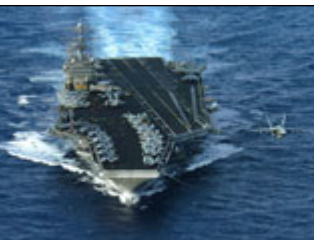




Clear Teflon Tape vs. Red Teflon Tape



Mandrel segments with red Teflon tape

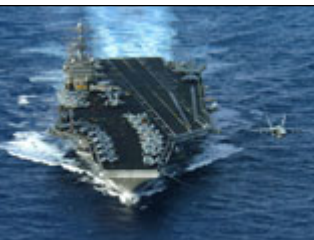


Housekeeping (5S, not housekeeping)

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A formalized housekeeping program is in place. External contractors are fully briefed, and maintain FOD control while on site. "Clean As You Go" is fully instilled throughout the facility. Level of control is clearly posted / identified. FOD Awareness, FOD Controlled or FOD Sensitive /

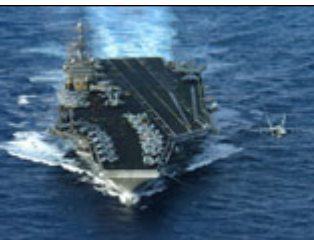
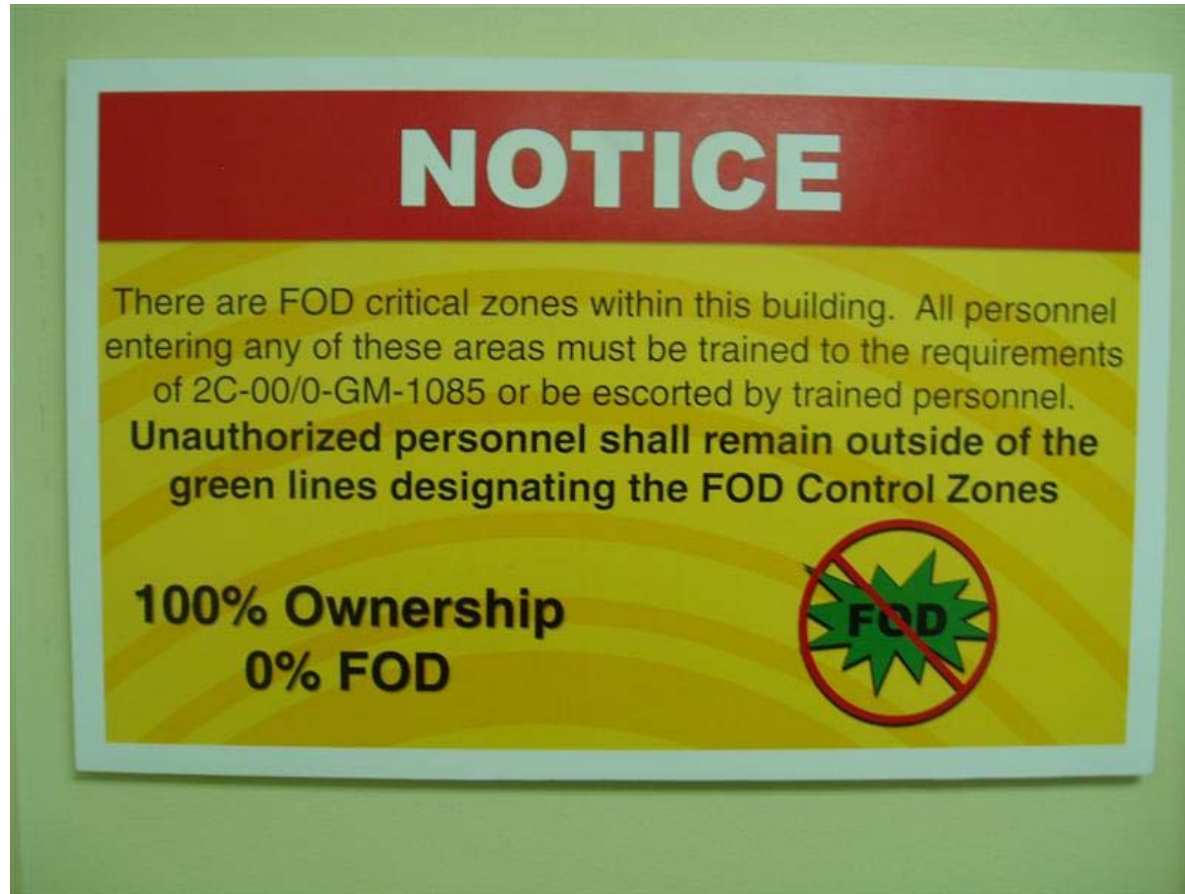
- 5S an integral part of our management system
- Daily, weekly checklists
 - Posted in work area
 - Visual, easily determine if task has been completed
 - Follow-up by management
 - Standard work
- "Clean as you go" is emphasized throughout the plant
- FOD Control Zone requirements posted at each zone
- Active/inactive posted at each zone



Housekeeping (5S, not housekeeping)



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Housekeeping (5S, not housekeeping)



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Tool accountability and tool control exist in appropriate areas of the facility. Tool containment includes such methods as the use of tool control trays/shadow boxing, bar coding, chit system, or consolidated tool kits. Tools and equipment are tethered or suitably restrained when required. Loose tools are carried or stored in a tray or other container. A system of accountability is in place for consumable/expendable

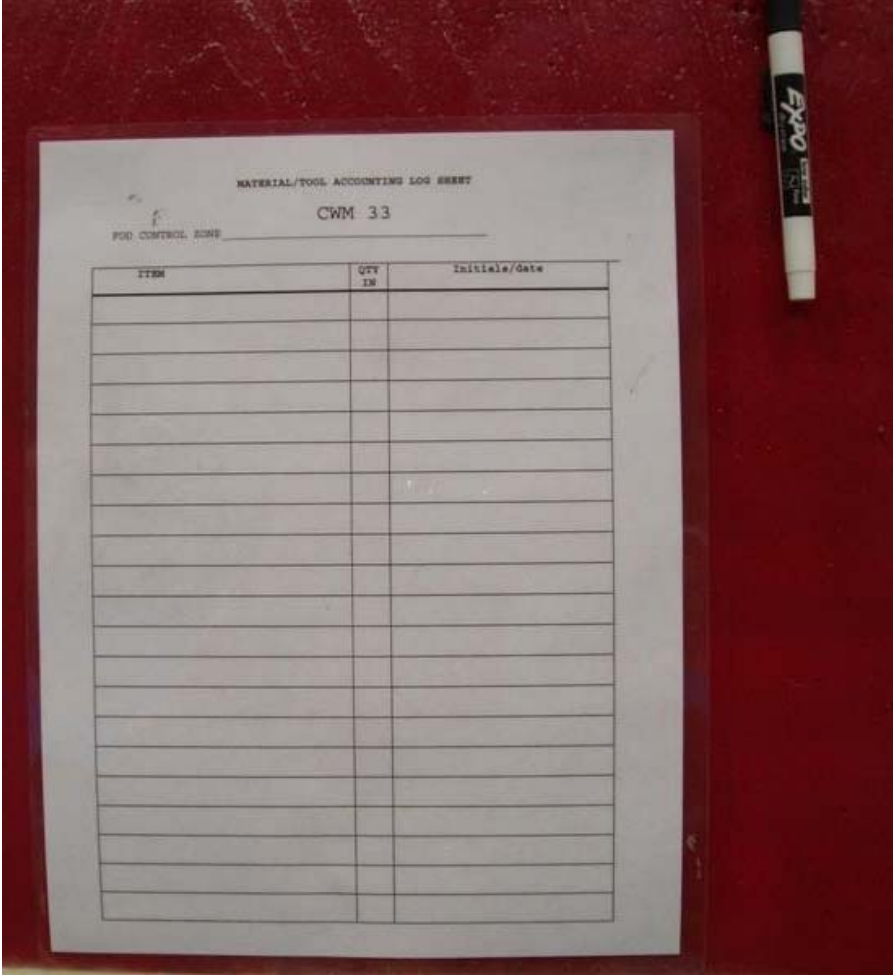
- A shadow board standard is in place
- ATK working to implement across the plant
- Tools within FOD zones are shadowed
- Tools brought into FOD zone require log in/out
- Visual, can easily determine if something is missing
- Kanban system in place for consumables

Tool Accountability



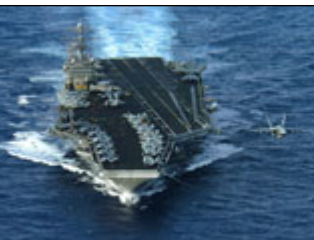
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Material/Tool Accounting Log Sheet



A photograph of a 'MATERIAL/TOOL ACCOUNTING LOG SHEET' on a red clipboard. The sheet is titled 'MATERIAL/TOOL ACCOUNTING LOG SHEET' and 'CWM 33'. It has a 'FOU CONTROL ZONE' field. The main body is a table with three columns: 'ITEM', 'QTY IN', and 'Initials/Date'. The table has 15 rows. A black Expo marker is visible on the right side of the clipboard.

ITEM	QTY IN	Initials/Date



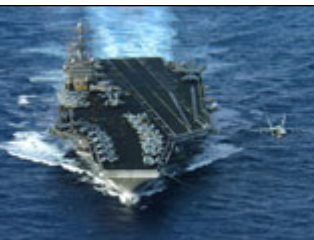
Tool Accountability

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Tools color coded

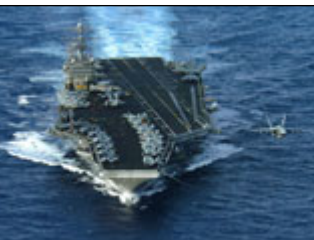
Missing torque wrench

Make it visual

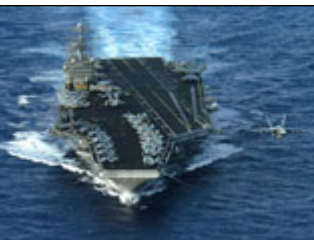


These FOD prevention methods are in place in the facility. Employees initiate the search & recovery process. Personal items are minimized and effectively contained.

- Recognition for outstanding catches
- Escalation protocol for missing items
- FOD Control procedure details what is allowed within a FOD control zone
- Material/Tool accounting log sheet
- Operations develops area standards



- Going beyond –
- Ongoing 5S program
 - Weekly 5S audits
 - Management follow-up
 - Goal of continuous improvement
 - 5S an integral part of ATK's management system
- Kaizen program
 - Goal of continuous improvement and visual factory
 - Ongoing, not just “events”
 - Separate “FOD” kaizen cards
 - Operations team decides to implement a kaizen suggestion
 - Tracked – 2119 suggestions since 4/1/09



Employee Actions



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A white Kaizen Suggestion Card (Form A-3) with a grid layout. It includes fields for Name, Date, and 7 Deadly Wastes (Waiting, Processing, Overproduction, Inventory, Defect, Conveyance, Motion). The card is numbered 12907 in red at the bottom right.

Regular Kaizen Suggestion Card

An orange Kaizen Suggestion Card (Form A-3) with a grid layout. It includes fields for Name, Date, and 7 Deadly Wastes. The card is labeled 'FOD' in large black letters on the right side.

FOD Kaizen Suggestion Card



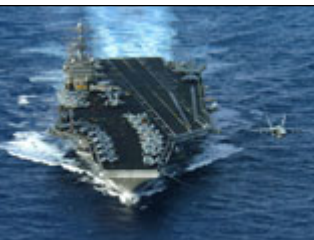
Employee Actions



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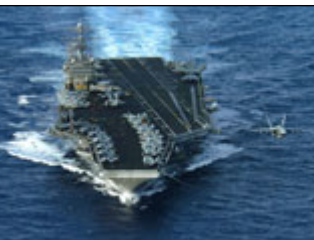


Kaizen Board

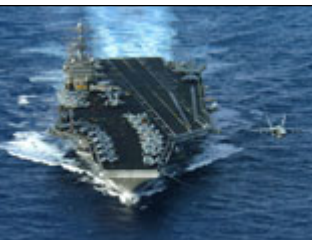
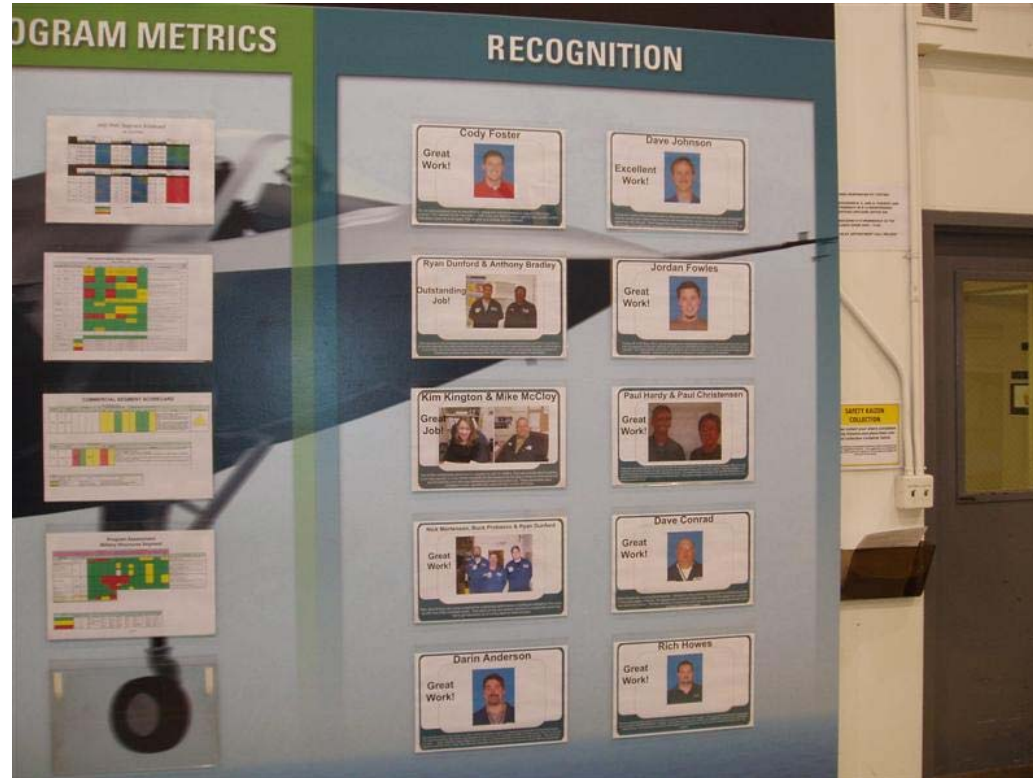


SQDEC Board

- Safety
- Quality
- Delivery
- Employee Involvement
- Cost



Employee Recognition



Employees involved in the design process understand FOD principles as they apply to how flight hardware is stored, transported, processed, or maintained.

- Tool and fixture designs are reviewed for FOD sources or entrapment areas
- Tooling check sheets (design)



FOD inspection checks are planned and sequenced into the manufacturing tasks. Processes exist to verify that required protective devices are properly installed, and that production tooling is inspected to minimize potential FOD. Evidence exist of the use of FOD barriers in assembly process. Sensitive areas, and FOD entrapment areas are fully protected.

- Long term goal –
 - PFMEA conducted on manufacturing processes
 - Safety
 - FOD
 - Completeness
- One countermeasure for FOD prevention –
 - Production procedures throughout the plant contain numerous FOD and contamination checks

Production Operations



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FMEA Work Sheet

Program: All

Team Lead: Walker

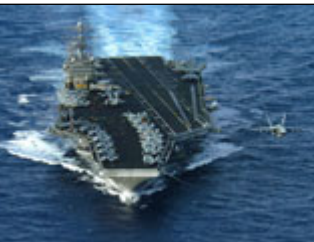
Date: 2/13/2008

Process: Fiber Placement

Rev: -

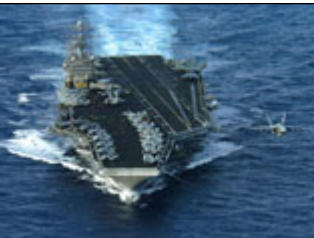
#	Process Function (Step)	Potential Failure Modes (process defects or X's)	Potential Failure Effects (Y's)	SEV	Potential Causes of Failure (X's)	OC	Current Process Controls	ILD	R P N	Recommend Actions	Responsible Person & Target Date	Required before continued operation	Status
Team: Mike McCloy, George Walker, Brad Spainhower, Brent Wiebke													
Put any comments here													
	facility	ceiling tiles	dirt, paint chips	8	FOD on part	2	PMS, daily, weekly monthly & semi annual cleaning Inspections, 5S inspections	2	32	None	NA	No	Complete, 5S inspection check sheets, sustaining
		flooding	Dirt, moisture	2	FOD on part	2	PMS, daily, weekly monthly & semi annual cleaning Inspections, 5S inspections	1	4	Improve outside drainage system	Facilities	No	On FY09 forecast
		dust	Dirt	2	FOD on part	4	PMS, daily, weekly monthly & semi annual cleaning Inspections, 5S inspections	9	72	None	NA	No	Complete, 5S inspection check sheets, sustaining
		floor	Dirt, FOD	2	FOD on part	4	PMS, daily, weekly monthly & semi annual cleaning Inspections, 5S inspections	9	72	None	NA	No	Complete, 5S inspection check sheets, sustaining
		Crane over the part, oil drips, paint chips, dust falling drop moving crane	FOD - Oil, dirt, paint chips	8	FOD, voids, strength reduction	3	PMS, semi annual cleaning Inspections, Visual inspection during FP of each ply, diapering	2	48	None	NA	No	Complete, 5S inspection check sheets, sustaining
	Creel	Interleave not removed from the tow, or small pieces left behind	FOD in part, Interweave	8	FOD, voids, strength reduction	4	Visual inspection during FP of each ply	3	96	None	NA	No	Complete, 5S inspection check sheets, sustaining
		splicing tape used to hold tow ends together at suppliers	FOD in part	8	FOD, voids, strength reduction	3	Not allowed per material specification	3	72	None	NA	No	Complete, 5S inspection check sheets, sustaining
		fuzz, stringers & resin build up	Mark off in part	6	out of plane waves in fibers	6	Visual inspection during FP of each ply	6	216	None	NA	No	Complete, 5S inspection check sheets, sustaining

Process FMEA Example



Approved procedures are utilized. Appropriate areas of the facility utilize approved methods of hardware accountability containment.

- Any process involving ATK production assets utilizes approved procedures and methods
- Approval requires signatures of
 - Engineering
 - Quality
 - Operations
 - Safety



- Incorporate elements into our management system (PES)
- Make the factory visual – set a standard
 - Abnormal becomes very apparent
 - Abnormal can be corrected quickly
- Helps to provide focus on areas that need improvement
- 5S is the key tool driven by management to eliminate FOD
- Opens discussion on how the FOE program can be improved



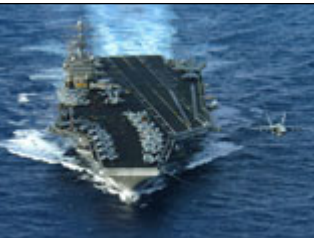
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Questions??

