



NTSB National Transportation Safety Board

Learning from Accidents

Pilatus PC-12 Accident
Butte, Montana

Earl F. Weener
NTSB Board Member



NBAA Single Pilot Safety
Standdown, October 9, 2011

Alfred Sheinwold

“Learn all you can from the mistakes of others. You won’t have time to make them all yourself”

History of Flight

- March 22, 2009
- 1432 mountain daylight time
- Butte, Montana
- Eagle Cap Leasing
- Departed Oroville, California
- Planned destination Bozeman, Montana

Debris Field



Fuselage Wreckage



No Survivors



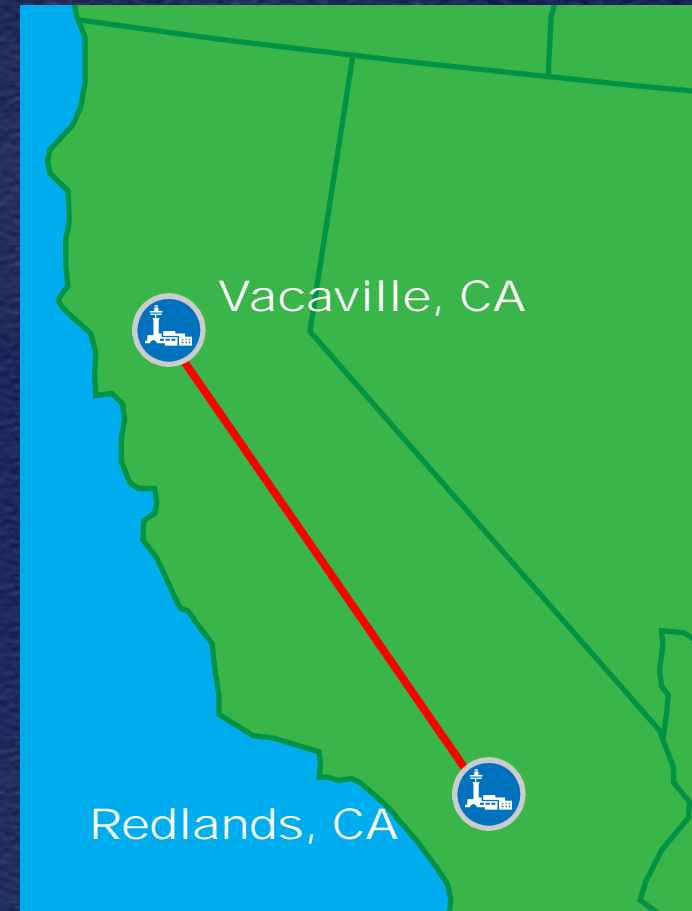
- Impact crater 23 ft wide, 9 ft long, 16 in deep
- Pilot and 13 passengers fatally injured

Preflight Activities

- Day before accident: pilot had airplane fueled to capacity
- Did not add fuel system icing inhibitor (FSII)
- Pilatus procedures require FSII for all operations below 0° C

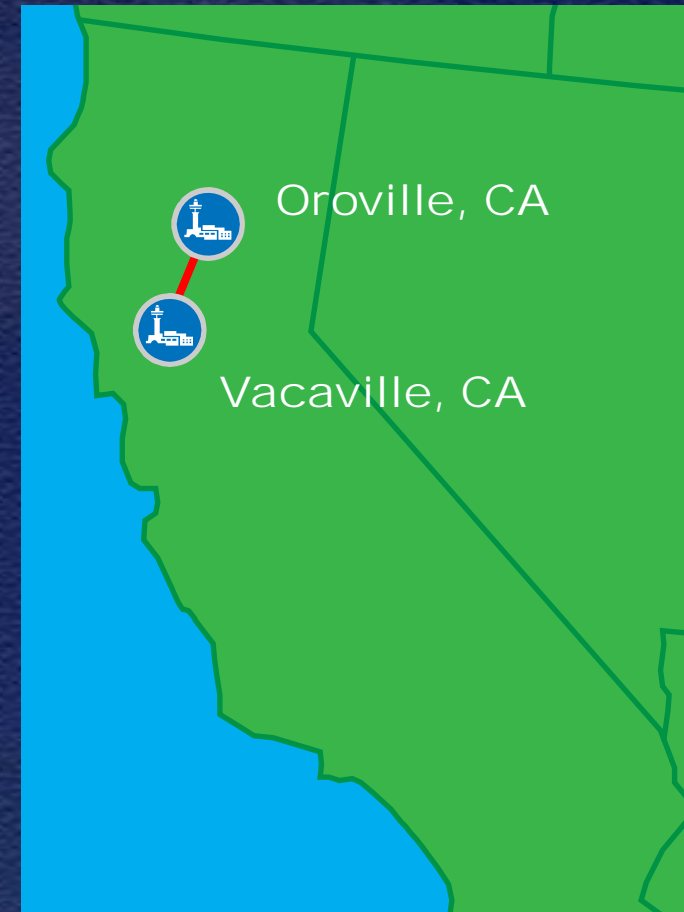
History of Flight

- First flight: Redlands to Vacaville, California
 - Airplane refueled
 - No FSII added
 - Nine passengers boarded



History of Flight

- Second flight:
Vacaville to
Oroville, California
 - Four additional
passengers boarded
 - 13 total passengers
 - Seating for nine
passengers



History of Flight

- Planned flight: Oroville to Bozeman

- Pilot diverted to Butte 1 hour 52 minutes into flight

- Pilot did not specify reason

- Accident occurred 30 min after divert



Investigation

- Pilot properly certified
- No known medical issues
- Airplane properly certified
- No pre-impact structural, engine, or system failures
- Weather not a factor
- Additional passengers not a factor

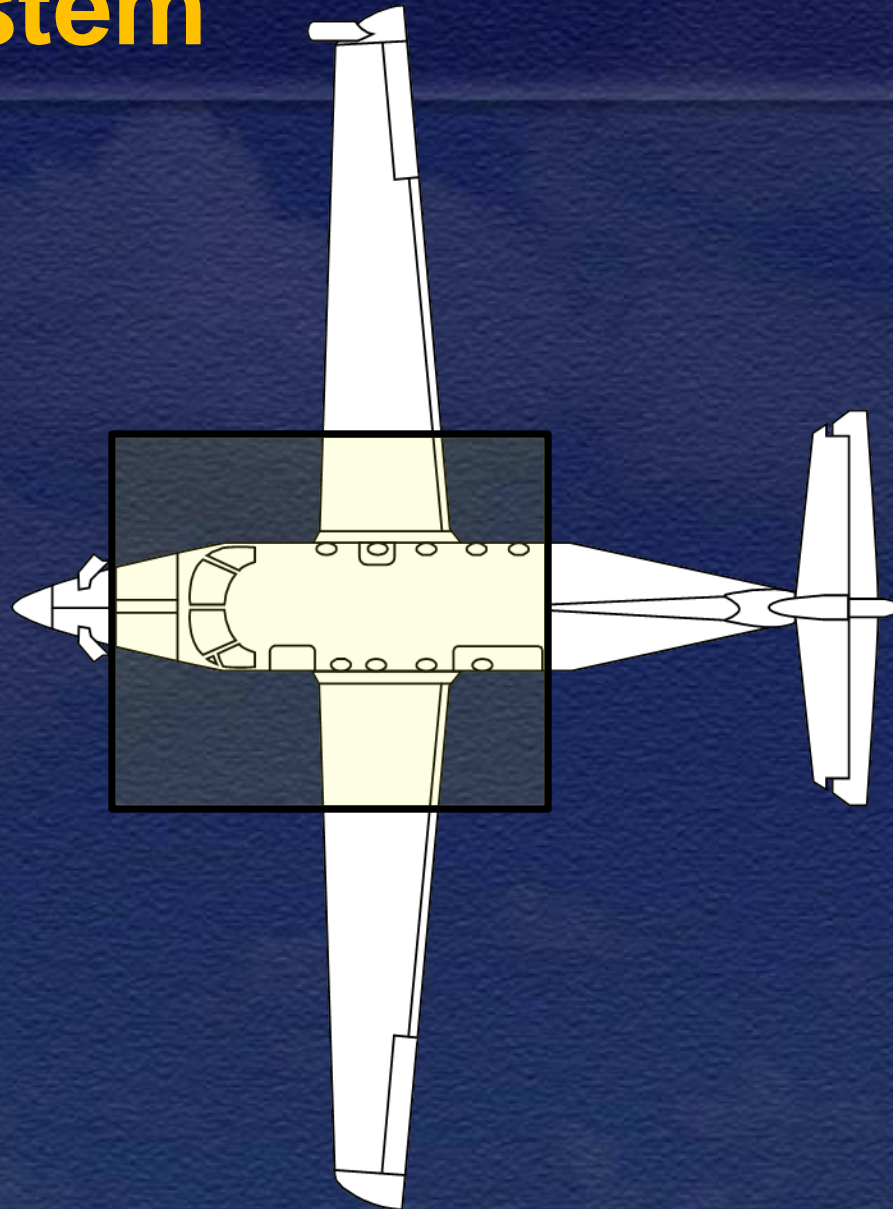
Investigation

- Low fuel pressure state
- Lateral fuel imbalance
- Lack of FSII
- Delayed diversion to another airport

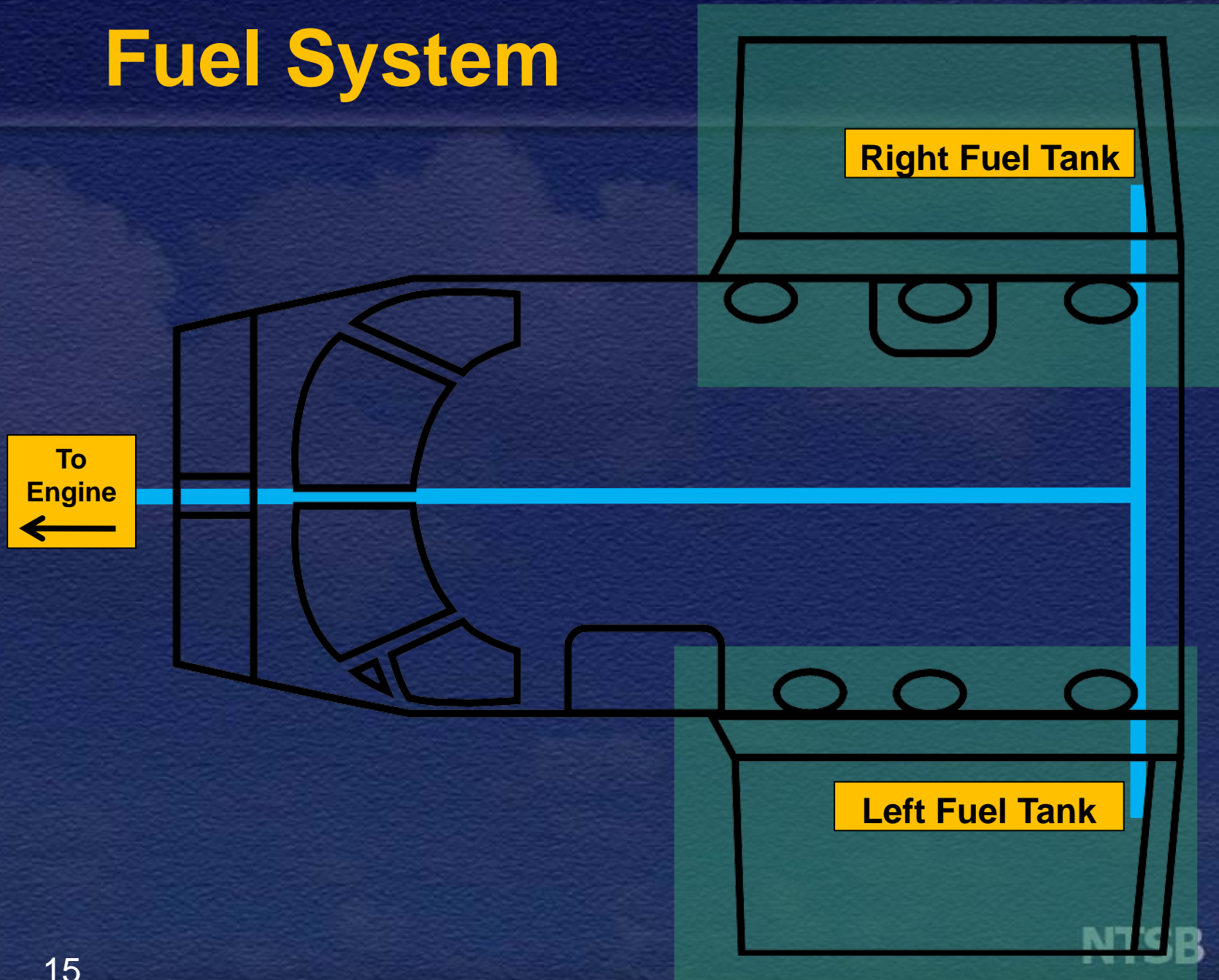
Safety Issues

- Fuel system icing prevention
- Crash protection for airplane occupants
- Flight recorder systems

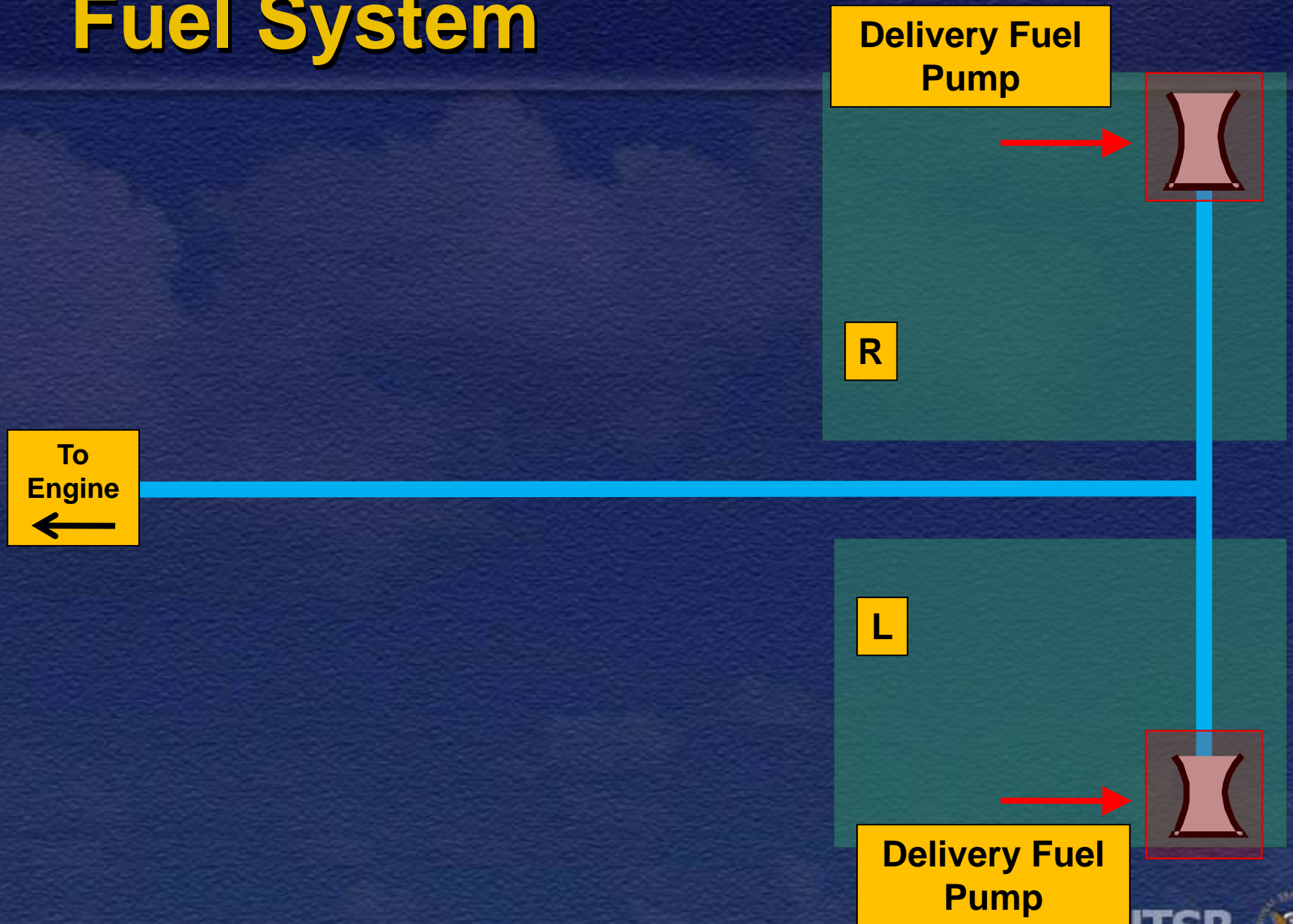
Fuel System



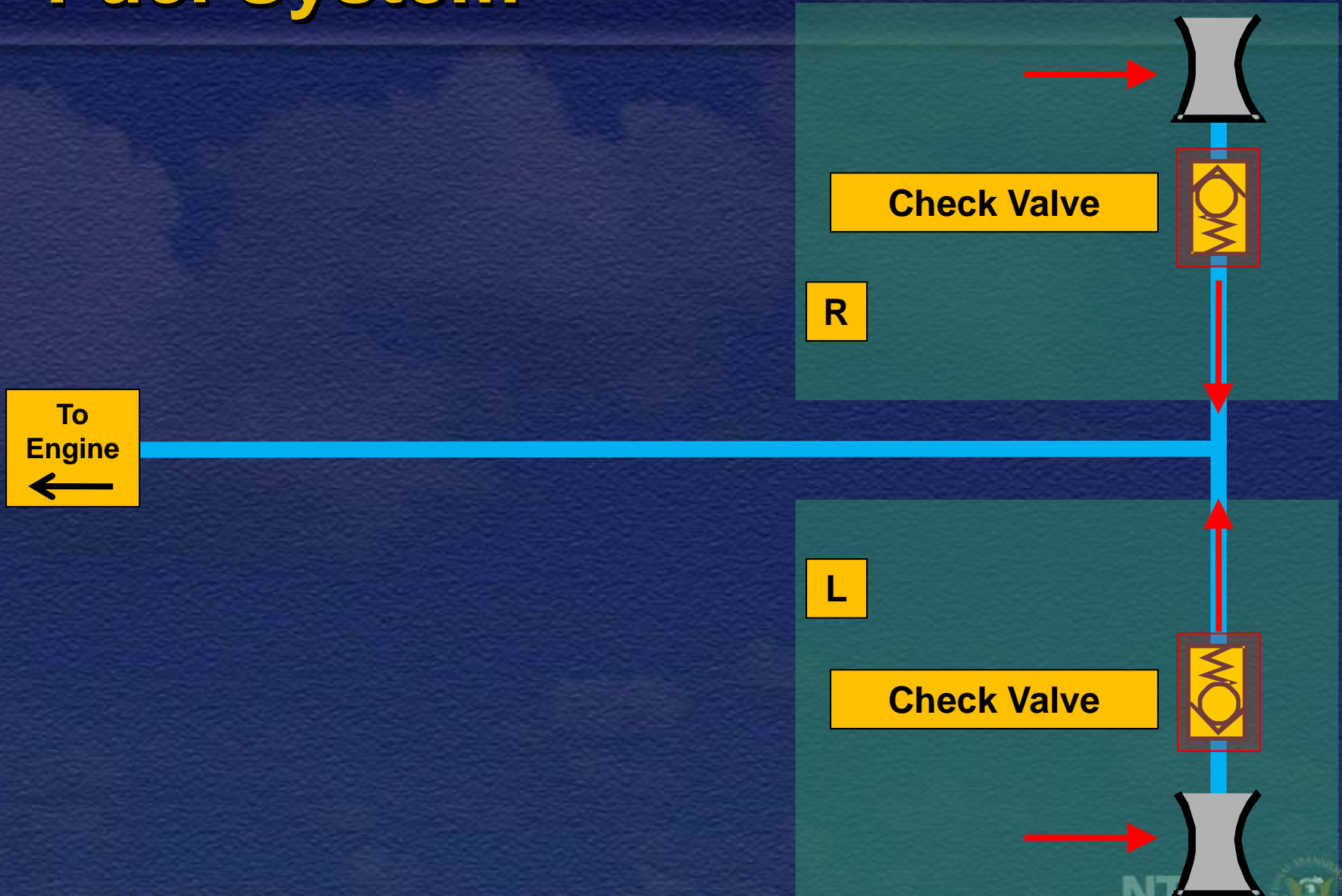
Fuel System



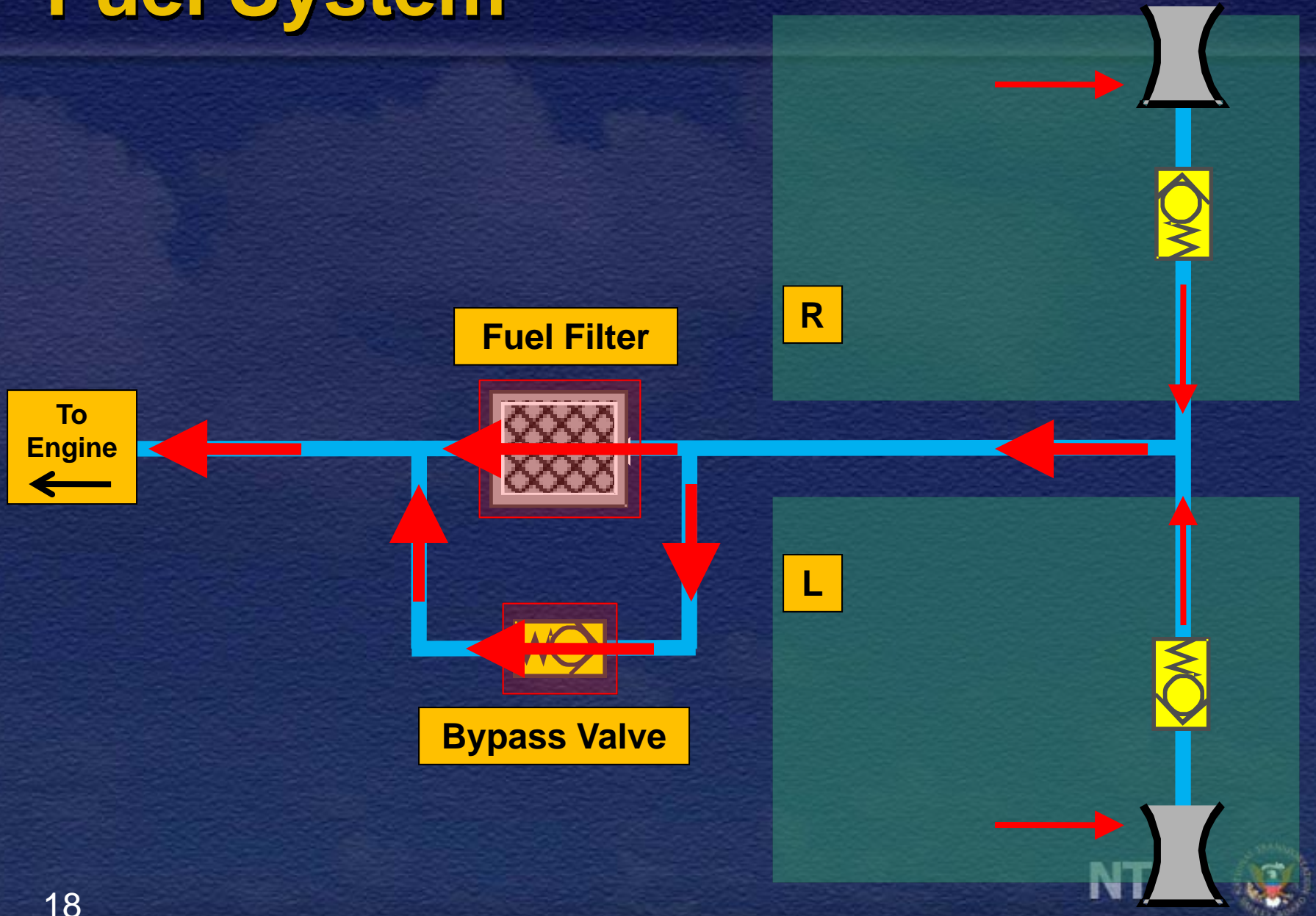
Fuel System



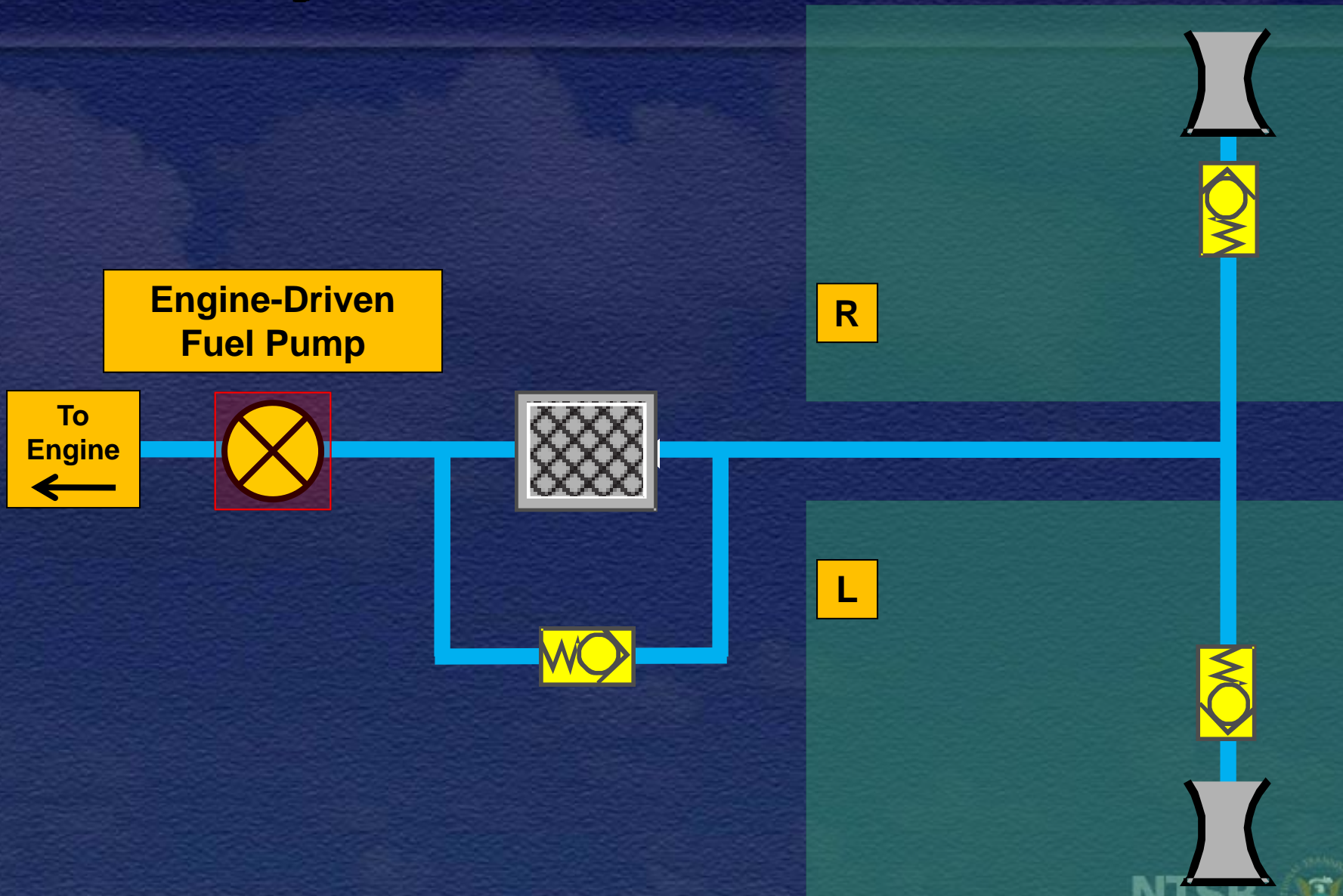
Fuel System



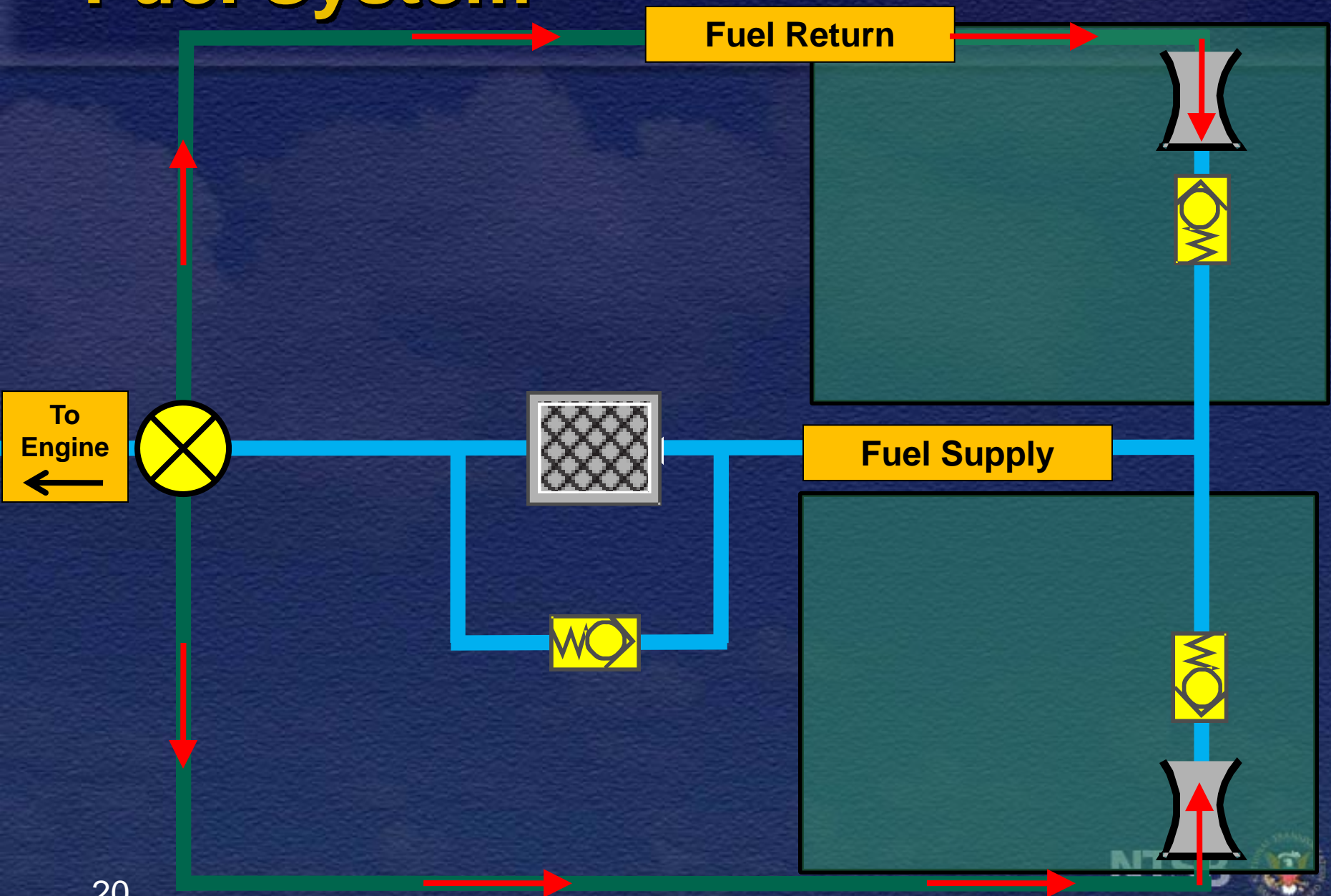
Fuel System



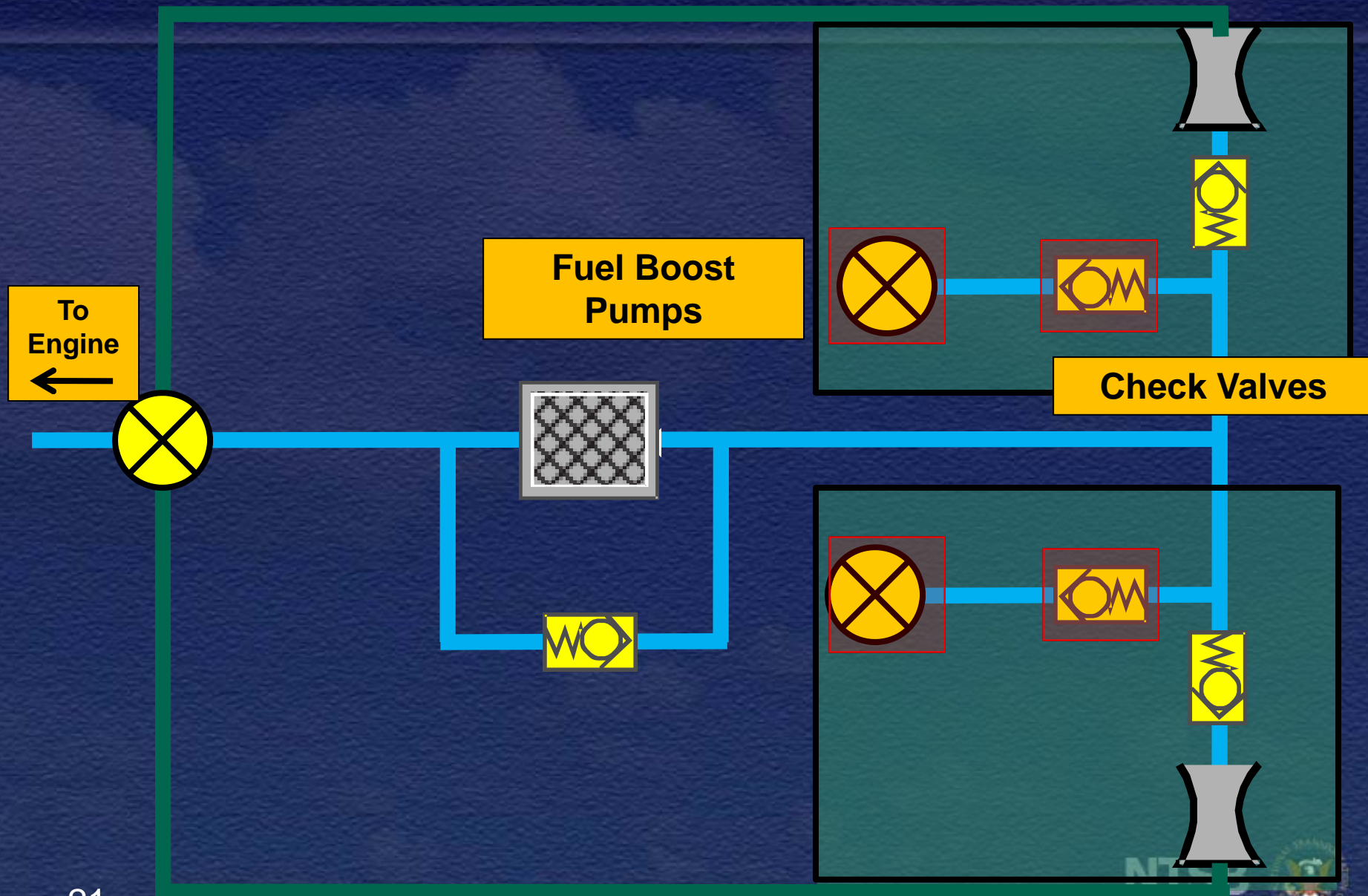
Fuel System



Fuel System



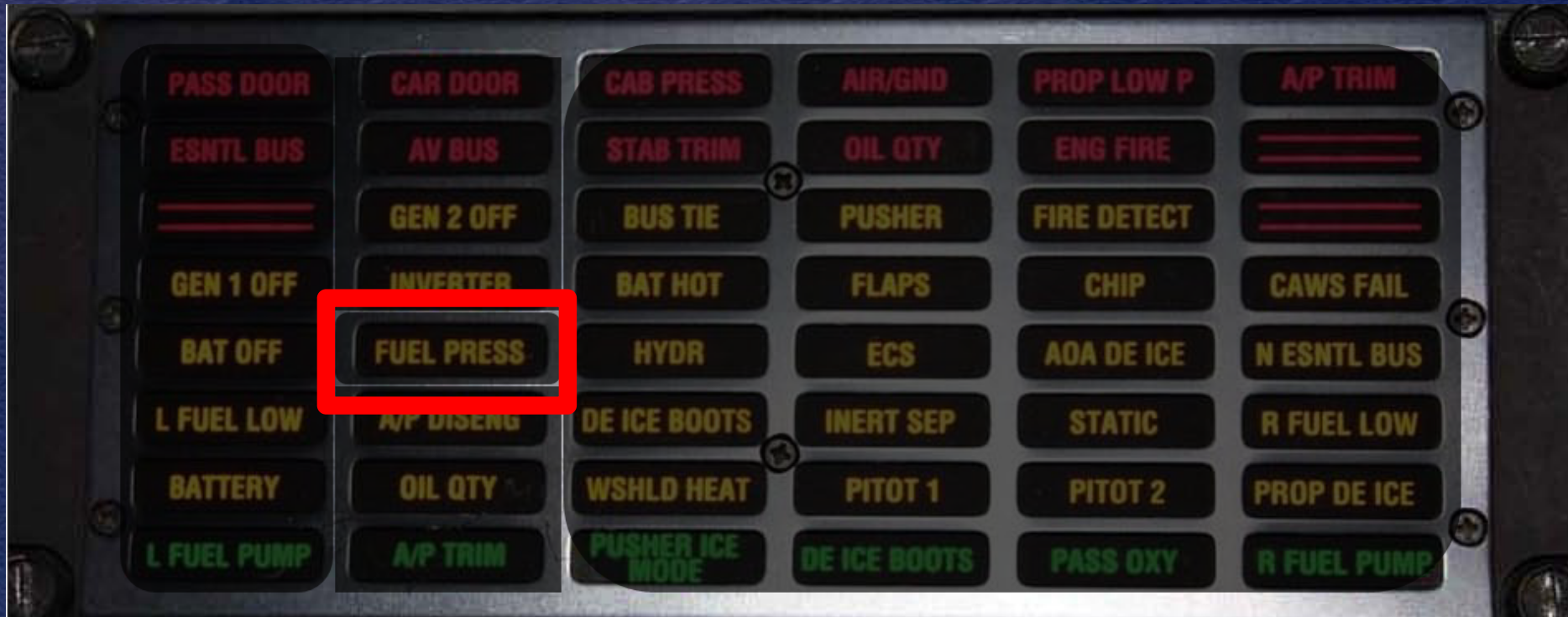
Fuel System



Boost Pump Annunciation



Fuel Low Pressure



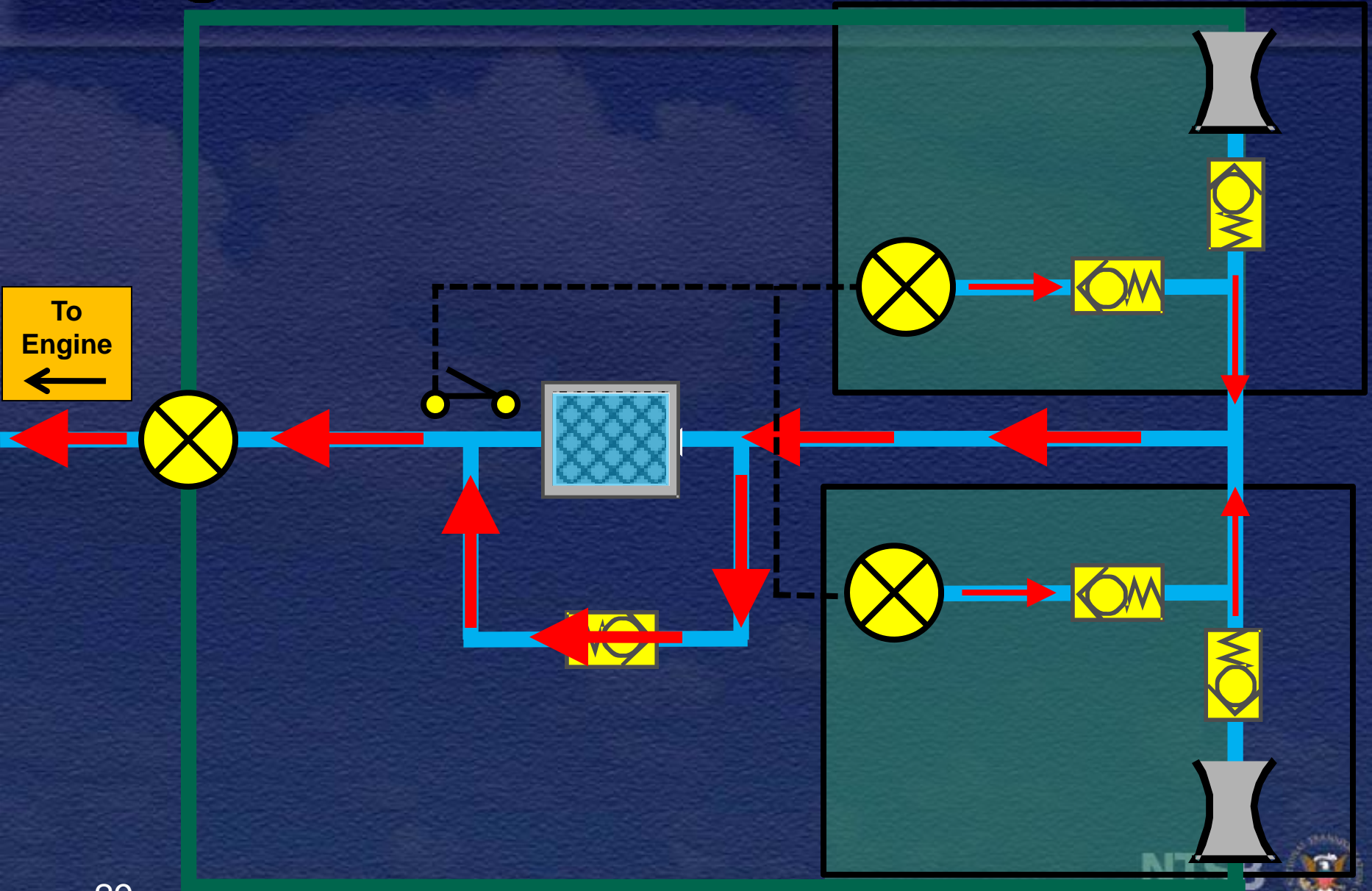
Accident Scenario

- Low fuel pressure 1 hour 13 minutes into flight
- Corrected through fuel boost pump operation
- Annunciators first indications of anomaly

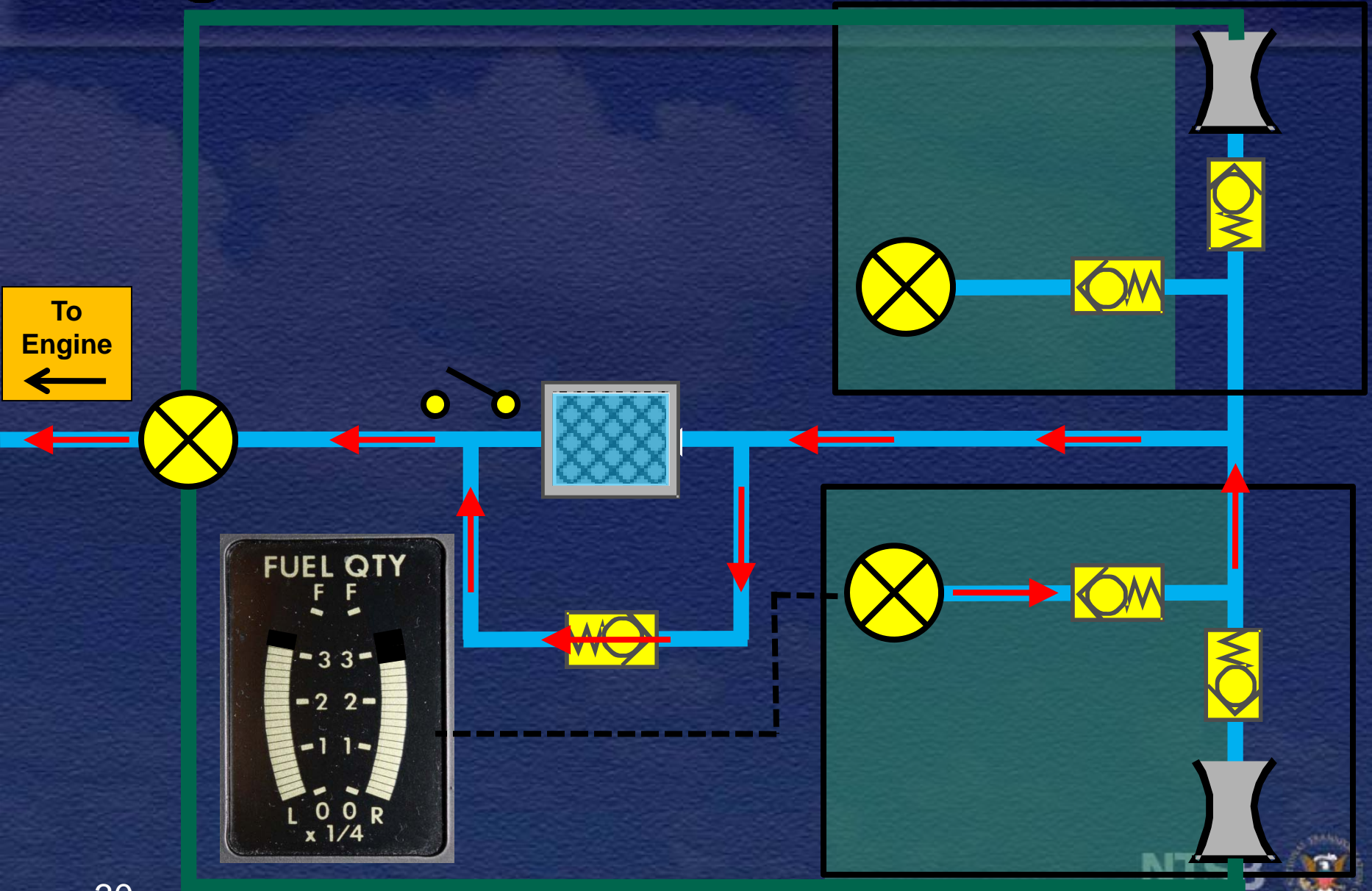
Accident Scenario

- Low pressure state
- Described in checklist
- Occurred on previous flights
- Ice accumulation
- Ice/water might have been found if pilot performed preflight inspection

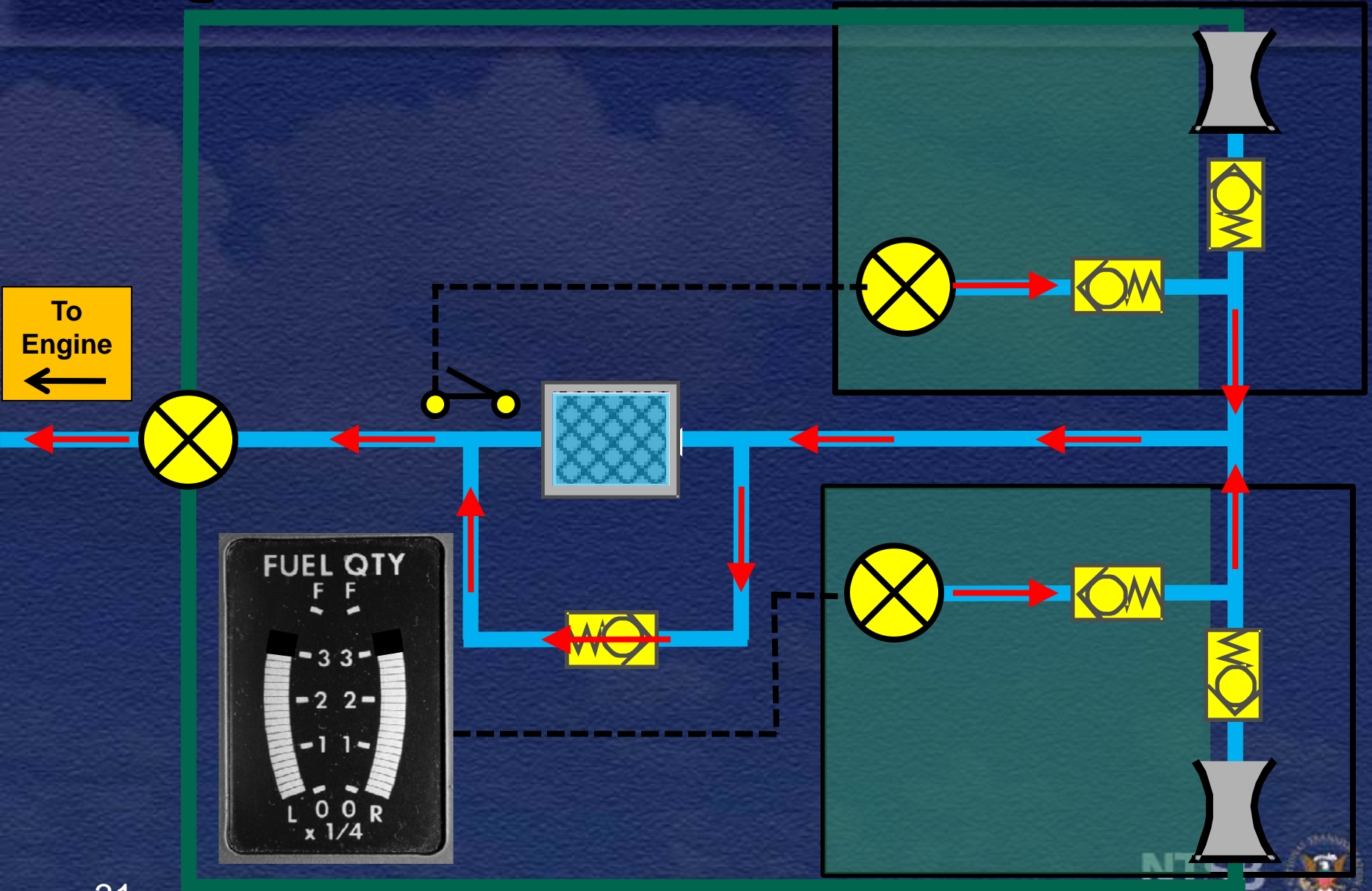
Flight Time - 1 Hour 13 Minutes



Flight Time – 1 Hour 18 Minutes



Flight Time - 1 Hour 21 Minutes



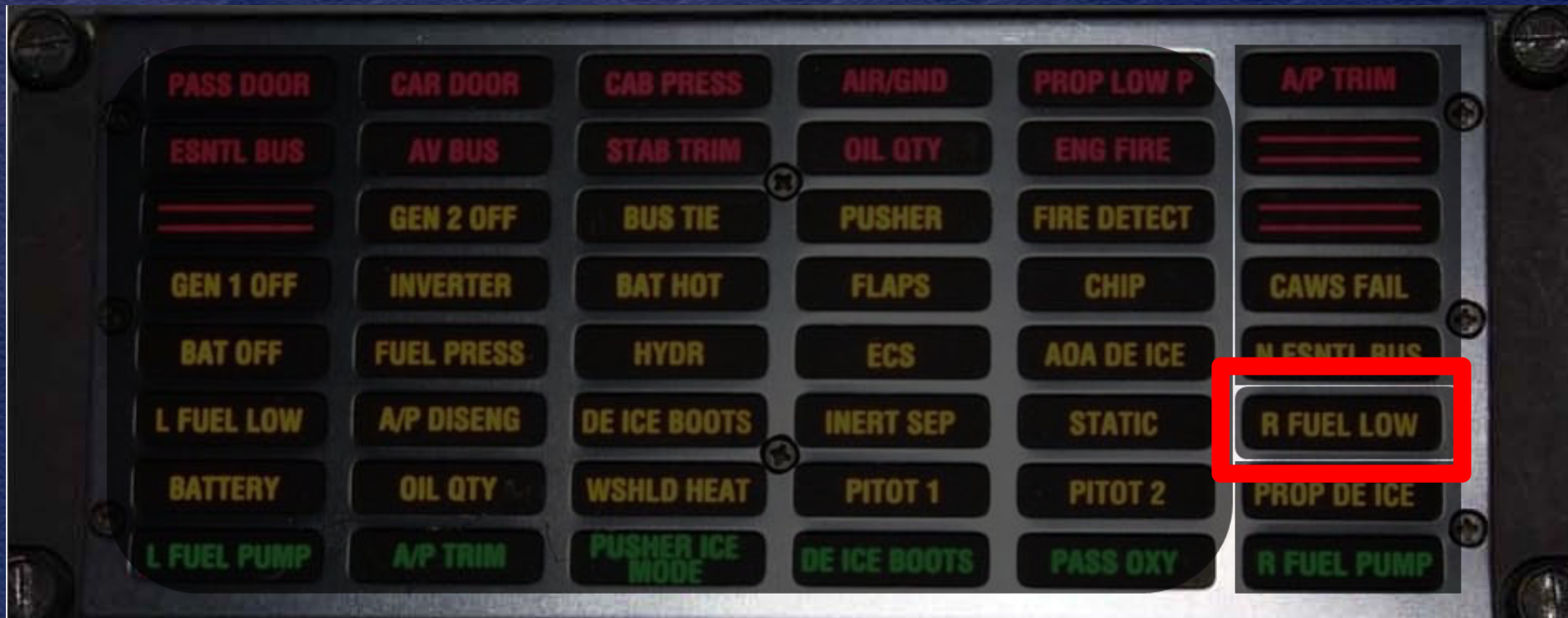
Accident Scenario

- Performance of fuel system degraded over time, resulting in significant fuel imbalance
- If pilot had added FSII, low pressure state and subsequent imbalance would not have developed

Accident Scenario

- By 1 hour 52 minutes, imbalance about 25% of one tank's capacity
- Pilot likely recognized fuel imbalance before this point
- Pilot attempted to manually balance fuel through activation of left boost pump
- Similar actions observed later in flight

Flight Time - 2 Hours 17 Minutes



Safety Issues

- Fuel filler placards not required to advise necessity for FSII
- FAA guidance on fuel system icing prevention does not include information on need for FSII

Fuel Quantity Indicator



Fuel Imbalance

AFM: land as soon as practical when fuel imbalance reaches three-bar differential and difference cannot be balanced



Fuel Imbalance



- Three-bar differential exceeded by 1 hour 25 minutes into flight
 - Fuel pumps cycling
 - Left tank filling
 - Right tank emptying rapidly

Fuel Imbalance



- Divert to Butte occurred 25 minutes later
- 15-bar differential

Fuel Imbalance



- 27-bar differential on arrival at Butte
- Left tank completely full
- Right tank almost empty

Possible Diversion Airports

- At time maximum allowable fuel imbalance exceeded
 - Boise, Idaho
 - Twin Falls, Idaho
 - Challis, Idaho
- At time of diversion to Butte
 - Challis, Idaho
 - Dillon, Montana

1 Hour 25 Minutes



BTM – Butte, MT



BZN – Bozeman, MT



LLJ - Challis, ID



BOI - Boise, ID



TWF - Twin Falls, ID



1 Hour 52 Minutes

BTM – Butte, MT

BZN – Bozeman, MT

LLJ - Challis, ID

DLN - Dillon, MT



2 Hours 7 Minutes

BTM – Butte, MT

BZN – Bozeman, MT

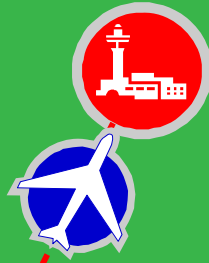
DLN - Dillon, MT



2 Hours 20 Minutes

BTM – Butte, MT

BZN – Bozeman, MT



Decision to Divert

- If pilot had diverted earlier to another airport, outcome of flight would have been different
 - Airplane would have had less severe fuel imbalance
 - Pilot would not have had to contend with deteriorating airplane handling qualities

Decision to Divert

- Should have landed at first opportunity
- Continued to Bozeman and condition worsened
- Did not divert to suitable airport
- Downplayed initial warnings

Descent Into Butte

- Pilot reported airport in sight
 - 8 miles southwest of airport
 - 5,550 feet above runway
- Last recorded radar target
 - 1.8 miles southwest of runway threshold
 - 3,550 feet above runway
- Excessive descent rate

Witness Information

- Witnesses reported that airplane
 - Approached runway at high altitude
 - Flew northwest away from runway
 - Made sharp left turn at 300 feet
 - Entered steep bank and pitched down

Loss of Control

- Maneuvers near runway resulted in increasing left roll angle and steep descent
- Pulling back on control wheel exacerbated rolling moment
- Airplane controllable with left-wing-heavy condition
- Pilot did not maintain control while maneuvering

Data Recorder Information

- No FDR or CVR on-board
- Obtained significant fuel system data from CAWS
- Pilatus now making add-in independent recorders available
- Industry standards for light weight recorder (EUROCAE MOPS)
 - Video/audio/flight parameters



NTSB - Probable Cause

- Failure to use FSII
- Failure to take appropriate actions after a low fuel pressure state
- Loss of control while maneuvering a left-wing-heavy airplane

Accident Prevention Strategies

Accidents are generally the result of a chain of events

Links in the Chain - Decisions

- Did not use FSII in fueling at Redlands
- Did not use FSII in fueling at Vacaville
- Did not check fuel sumps at Vacaville

Links in the Chain - Decisions

- Ignored CAWS fuel pump advisories
- Did not troubleshoot frequent boost pump cycling during first flight leg
- Passed up 3 suitable airports following the point of max allowable fuel imbalance

Links in the Chain - Decisions

- Diversion decision made 30 minutes after max allowable imbalance – to an airport 30 minutes away
- Passed up several closer suitable airports after deciding to divert

Accident Prevention Strategies

Accidents are generally the result of a chain of events

Break a link in the chain

Douglas Adams

Human beings, who are almost unique in having ability to learn from the experience of others, are also remarkable for their apparent disinclination to do so.”



NTSB

Pilot Professionalism

- Filed 2 IFR flight plans with wrong fuel load & number of passengers
- Made 2 overweight takeoffs
- Initiated turn and descent to Butte prior to getting clearance from ATC